SALTWATER INTRUSION IN THE FLORIDAN AQUIFER IN WALTON, OKALOOSA AND SANTA ROSA COUNTIES, FLORIDA

EASTERN MODEL DOMAIN

FINAL REPORT

Submitted To:

Northwest Florida Water Management District
81 Water Management Drive
Havana, FL 32333

Submitted By:

HydroGeoLogic, Inc.
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Reston, VA 20190

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FINAL REPORT
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1.0 INTRODUCTION

The Northwest Florida Water Management District (NWFWMD or the District) has the primary objective of protecting its water resources within the framework of consistently increasing demands for potable water since pre-development times. Among the concerns is the increased likelihood for induced intrusion of saltwater in the Floridan Aquifer caused by withdrawals from the Floridan Aquifer System. The potential processes of deterioration of water quality in the Upper Floridan Aquifer include: 1) inland movement of saline water from parts of the aquifer underlying the Gulf of Mexico; 2) upward movement of saline water from the lower limestone of the Floridan Aquifer through or around the Bucatunna Clay confining bed; 3) downward movement of saline water in coastal areas or bays, through the Intermediate System; 4) upconing of poor quality water from the base of the Upper Floridan Aquifer; and 5) combinations of the above. Saltwater intrusion models of the Floridan Aquifer System in the region were therefore developed in this work to help quantify the effects of pumping on the saltwater / fresh-water regime and guide withdrawal operations that protect the resource.

The District's existing groundwater flow model encompassing Escambia, Santa Rosa, Okaloosa, Walton, parts of Bay, Washington, and Holmes Counties was taken as the starting point for developing the saltwater intrusion models of the region (Figure 1.1). An associated modeling report (HydroGeoLogic, 2000) details the flow model conceptualization, site geology and hydrogeology, calibration and predictive simulation results, and sensitivity analysis. For the current work, groundwater flow and saltwater transport within the Floridan Aquifer System were examined to develop a conceptualization of the dynamics of the system. The conceptual model was then used to develop numerical models for saltwater intrusion within the system. Owing to computational concerns, two models were developed for the region. The first model encompasses coastal Escambia, Santa Rosa and Okaloosa Counties and is referred to as the Western Model. The second model encompasses coastal Okaloosa, Walton, and parts of Bay and Washington Counties and is referred to as the Eastern Model (Figure 1.2). Details relating to the Western Model have been documented in a separate report (HydroGeoLogic, 2005). This report focuses on the development of the Eastern Model. The conceptualization of the region is presented and discussed in Section 2 of this report. In Section 3, details of the development of the Eastern Model are presented. Section 4 addresses the calibration of the Eastern Model based on pre- and post-development conditions. Section 5 reports on the results of sensitivity analyses for saltwater intrusion in the Eastern Model domain. A summary is provided in Section 6.

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2.0 MODEL CONCEPTUALIZATION

Groundwater in coastal aquifers flows towards the coast from higher potentiometric elevations that occur inland. Saltwater, however, with higher density than fresh-water, has the tendency to intrude inland and creates a wedge of saltwater in the lower portion of these aquifers. Pumping of a coastal aquifer further induces saltwater intrusion from the coast and can also cause upconing of saline waters from the underlying wedge of salt water. The interplay of forces governing fresh-water flow and saltwater intrusion may be examined by conducting an analysis of saltwater intrusion using a density-dependent flow and transport model. The flow model accounts for groundwater flow subject to additional density effects due to salinity of water. The transport model for saltwater addresses the movement and location of chlorides within the system subject to pumping stresses. The movement and location of chlorides affect the density term in the flow model, thereby creating a coupling between flow and salt transport, which is solved by a density-dependent flow and transport model.

A density-dependent flow and transport model needs to be initiated via a set of assumptions regarding the state of the system before pumping was initiated in the aquifer. This is the pre-development state of the system whereby aquifer heads reflect the potentiometric surface prior to any withdrawals from the aquifer, and aquifer chloride concentrations reflect the saltwater present in the domain prior to any pumping of the system. To allow for a reproducible initial condition that does not reflect saltwater movement resulting from applied boundary conditions (aside from the pumping stresses), it is assumed that the saltwater is in an equilibrium state prior to development of the aquifer. Thus, it is conceptualized that the pre-development state is at equilibrium conditions with the existing saltwater within the domain. Pumping is then applied to this system in a transient mode, to reflect the pumping that occurred in the aquifer from pre-development conditions, to the current time. The model then simulates the changes in head and in chloride concentration through the simulation domain to provide the post-development state of the system which reflects the current conditions. A calibrated post-development model may then be used to examine the sensitivity of the model to unknown or uncertain parameters, and to conduct predictive simulations that reflect anticipated development of the water resource, or reflect managed development of the aquifer.

Groundwater flow and saltwater intrusion in coastal Escambia, Santa Rosa, Okaloosa, Walton and Bay Counties are examined further in this Section, to determine the conceptual model of the Floridan Aquifer in the region.

2.1 FLOW REGIME OF THE FLORIDAN AQUIFER SYSTEM

Several studies have been conducted since the early 1960s that examine the geology and hydrogeology of the study region and that examine the flow behavior within the aquifer systems via numerical modeling of groundwater flow. The District's existing model for groundwater flow in the region is reported in HydroGeoLogic (2000), which details the conceptualized hydrogeology, stratigraphy, potentiometric and recharge conditions of the aquifers in the study area. This model was used as the basis for further conceptualizing the saltwater system. A general location map of the study area is provided in Figure 1.1. Flow regime conceptualization is described in Section 3.2.

Barraclough and Marsh (1962) provide an early description of water quality and subsurface hydrology within the region. Even then, there were concerns of the possibility of deterioration of water quality within the system caused by water level declines within the Floridan Aquifer – by as much as 95 ft in the Fort Walton Beach coastal area between 1936 and 1957.

Trapp et al. (1977) and Barr et al. (1985) show the estimated generalized pre-development potentiometric surface for the upper limestone of the Floridan Aquifer in Okaloosa and Walton Counties. Water that recharges the aquifer in the northern regions of these counties (and further north where the Floridan Aquifer outcrops in Alabama), flows generally southwards to discharge points near the coast. A tongue of hard water extending south from central Okaloosa County between Crestview and Destin is coincident with a zone of higher transmissivities along which relatively more flushing occurred in pre-development times. In Santa Rosa and southwestern Okaloosa Counties, water contains mainly sodium-bicarbonate-chloride resulting from ion exchange with clay minerals that are more abundant to the west (with associated reduced transmissivities) and the Bucatunna Clay unit that subdivides the Floridan Aquifer into its upper and lower limestones. The Floridan Aquifer ultimately discharges into Choctawhatchee River, Choctawhatchee Bay and the Gulf of Mexico. Water levels during pre-development conditions within the Floridan Aquifer System were above land surface in coastal regions, with most coastal wells being artesian. The Intermediate System confining unit overlying the Floridan Aquifer thickens from east to west with vertical hydraulic conductivities decreasing from east to west along the coastal regions. This causes greater confinement with associated increased heads towards the west and relatively lower heads in coastal Walton and Bay Counties, where the potential for discharge is greater. Thus, there was a general southeastward direction of flow within the Floridan Aquifer System across Choctawhatchee Bay during pre-development conditions. In Santa Rosa and southwestern Okaloosa Counties, the pre-development head gradient was generally southwards towards the Gulf of Mexico.

Trapp et al. (1977) and Barr et al. (1985) also show the post-development water levels, and the net water level declines from pre-development conditions. Pumping centers around the Fort Walton Beach metropolitan area caused water level declines of greater than 100 ft from pre-development conditions by 1978. Flow of water from recharge areas to the north is still in a southerly direction. However, the large cone of depression in the Fort Walton Beach area for post-development conditions changes the flow patterns in coastal regions, with westward gradients across Choctawhatchee Bay and landward gradients from the Gulf of Mexico. The (slightly south-) westward direction of flow across Choctawhatchee Bay caused by the cone of depression induces fresh-water flow from upland regions, while the landward gradients create a potential for lateral intrusion of saltwater from the Gulf of Mexico. Furthermore, water levels in coastal regions are now below sea level, with potential for saltwater entering the Floridan Aquifer System from the relatively leaky Intermediate System under Choctawhatchee Bay or under the Gulf of Mexico in eastern regions of the domain adjacent to Walton and Bay Counties. Ryan et al. (1998) shows the progression of water level declines below sea level from 1974 through 1995. Water level declines around the center of depression are asymmetric, with larger declines to the west where the transmissivity of the upper limestone of the Floridan Aquifer is lower due to extensive presence of clays. Furthermore, the Intermediate System is leakier to the east, which facilitates relatively greater energy dissipation into Choctawhatchee Bay and the Gulf of Mexico.

The lower portions of the Floridan Aquifer behave in a hydraulically similar manner to the upper limestone in the eastern regions of the domain, where the Bucatunna Clay unit is absent. In Santa Rosa and western Okaloosa Counties, however, the Bucatunna Clay unit is thick and the hydraulic connection between the underlying Lower Floridan Aquifer and the Upper Floridan Aquifer is very weak. Deep well injection sites in Santa Rosa County have created a potentiometric mound within the Lower Floridan Aquifer with flow gradients out towards the Gulf of Mexico for post-development conditions. Thus landward movement of saltwater in the Lower Floridan Aquifer is hydraulically not possible in the western portions of the domain.

2.2 WATER QUALITY OF THE LOWER FLORIDAN AQUIFER

The chloride content of the lower limestone of the Floridan Aquifer has been interpreted by Barr et al. (1985) for Okaloosa and Walton Counties, based on limited sampling of the Lower Floridan Aquifer. The 250-ppm isochlor is as much as 10 miles inland (north) of Fort Walton Beach and south of Valparaiso and Niceville in Okaloosa County. Chlorides in the Lower Floridan Aquifer are least inland near the Okaloosa/Walton County line, with the 250-ppm isochlor probably underlying Choctawhatchee Bay. Further east in Walton County, the chlorides are more inland with the 250-ppm isochlor lying south of Freeport. The 3,000-ppm isochlor is interpreted to be inland in southeastern regions of Walton County and in southwestern regions of Okaloosa County. Further west in Santa Rosa County, the chloride trend within the Lower Floridan Aquifer continues inland with chlorides of about 3,200 ppm at the Yellow River Lower Floridan well and about 6,000 ppm at the Monsanto North Monitoring well. Saline and fresh water are presumed to be in equilibrium within the Lower Floridan Aquifer. However, pumping could upset this equilibrium. The salinity in the aquifer reflects the existence of residual seawater that has not been completely flushed from the aquifer by fresh water, which forms a wedge above the saline water due to its lower density. Available data are insufficient to determine the detailed areal or temporal changes in water quality. However, these chloride levels should be similar between pre- and post-development conditions.

2.3 WATER QUALITY OF THE UPPER FLORIDAN AQUIFER

The chloride content of water in the upper limestone of the Floridan Aquifer as interpreted by Barraclough and Marsh (1962) ranges from 2 to over 2,000 ppm across the area. Trapp et al. (1977) and Barr et al. (1981) show a similar increasing trend of chlorides inland towards the coast. A long-term chloride analysis of the upper limestone indicates slight changes in chloride levels throughout the domain (Trapp et al., 1977; Barr et al., 1985) and current chloride levels generally remain pre-development conditions. Saline water occurs in the upper limestone beneath the mainland in a large portion of coastal Walton County and in portions of coastal Santa Rosa County. Chloride content is low between Crestview, DeFuniak Springs, Freeport and Valparaiso, and increases in a southwesterly direction towards the coast. The 250-ppm isochlor underlies Escambia Bay and East Bay in the upper limestone, with concentrations up to 2,000 ppm near Pensacola Beach. Eastward along the coastline in Santa Rosa County, chloride levels decrease. Navarre Beach wells show between 100 and 200 ppm of chlorides. The southwesterly decrease in transmissivity along the coastline and distance from recharge areas to the north affect the degree of flushing. Further east of the Santa Rosa/Okaloosa County line, the chloride content shoreward of the Gulf of Mexico is below drinking water standards.

The high chlorides in the upper limestone under the eastern portions of Choctawhatchee Bay probably represent pre-development conditions. The Intermediate Confining unit in the region is extremely leaky, allowing hydraulic connection of water between the upper limestone and the Bay or the Gulf of Mexico. Furthermore, the transmissivity of the upper limestone in the region is relatively low, allowing little movement of water from the region, with associated minimal flushing. North of Choctawhatchee Bay, chloride concentrations are low. Pratt et al. (1996) provides a closer examination of spatial trends of chloride behavior in the vicinity of Choctawhatchee Bay. Between Destin and the vicinity of Morris Lake, chloride concentrations are low. In fact, the area from central Okaloosa County through Destin and Moreno Point has the lowest sodium, chloride and dissolved solids concentrations of any area along the coastline. This coincides with the high transmissivity zone, which, presumptively, facilitates significant flushing. Chloride concentrations are the highest between Morris Lake and Seagrove Beach, with sodium to chloride ratios representing diluted seawater conditions. Flushing of seawater in this region was minimal probably due to the lower transmissivity of the upper limestone in the vicinity. East of Seagrove Beach, towards Inlet Beach, chloride content in the upper limestone decreases.

2.4 WATER QUALITY CHANGES IN THE UPPER FLORIDAN AQUIFER FROM PRE-DEVELOPMENT CONDITIONS

Regionally, water quality in the area has not changed significantly since pre-development times. McKinnon and Pratt (1998) have compiled water quality variation information for all significant wells in the domain, indicating negligible changes in most wells. Trapp et al. (1977) and Barr et al. (1985) show changes of chloride concentration with time at various wells within Walton and Okaloosa Counties to be small over decades. Consistent trends in chloride level changes are, however, noted at several locations. The Selma Madara well to the south of Freeport, on the northern edge of Choctawhatchee Bay shows a decreasing trend in chlorides from 237 ppm in 1968 to 150 ppm in 1978 to 110 ppm in 1979 to about 100 ppm by 1988. This decline may be due to induced bulk motion of Floridan Aquifer water into the southern Okaloosa County cone of depression, which transports higher quality water to the south and west, from areas hydraulically up-gradient. Similarly decreasing temporal trends for chloride concentrations are noted for wells along the northern shore of Choctawhatchee Bay in Walton County (Barr et al., 1985) and for the Point Washington well. The Bridgetender well on the east side of Choctawhatchee Bay shows an increasing temporal trend, probably caused by induced leakage through the Intermediate System or by lateral motion induced as a result of depression of water levels in the Floridan Aquifer due to pumping. South of the eastern portions of Choctawhatchee Bay, wells show an increasing trend in chlorides over time (FCSC #4, #10, #11). This is most likely caused by upconing of saltwater that lies in the Floridan Aquifer at depth. Further west, the Destin wells DWU #2, #3, and #4 also show slight increases in chloride from 1993 through 1998. Further west along the coastline are the Eglin Air Force Base wells where chloride concentrations sampled recently by the District show no significant changes compared to data from the 1960s. These wells are furthest south in Okaloosa County and are situated between the deepest part of the potentiometric surface depression and the Gulf of Mexico. Thus, they would likely be first affected by lateral migration of saline water from the south. The lack of chloride increase in these wells indicates that the saltwater resides sufficiently far offshore in this region so as to not have an immediate impact on withdrawal wells. The high transmissivity zone of hard water in upland regions likely causes a larger degree of flushing in the vicinity, with larger fluxes from the north than from the south of the cone of depression. The FWB #6, #7 and #10 wells in Ocean City show a decreasing trend in chlorides over time. These wells also reside within the high transmissivity zone, but are landward of the cone of depression. The higher flow caused by pumping likely creates a larger degree of flushing in the vicinity, causing the noted decrease in chlorides. Further west, the Navarre Beach wells #1, #2, and #3 show increasing chloride trends with time, probably caused by upconing and the bulk motion of more saline water as a result of pumping.

2.5 WATER QUALITY VARIATIONS WITH DEPTH WITHIN THE FLORIDAN AQUIFER SYSTEM

Water quality variations with depth within the region have been presented by Pratt et al. (1996) and Barr et al. (1985). The DWU #5 Lower Floridan test well in Destin shows chloride concentrations of about 50 ppm above the Bucatunna Clay (depth of around 825 ft). Concentrations increase to over 660 ppm beneath the Bucatunna Clay at a depth of 911 ft, further increasing to almost 2,000 ppm at a depth of 1,123 ft. A regression line fitted to these samples for sodium to chloride ratio shows their proximity to the seawater dilution line. Water in the Lower Floridan Aquifer is most likely relic seawater. This relationship to seawater is also noted at the NWFWMD 331-98 test well where the Bucatunna Clay is absent. At NWFWMD 331-98 test well, chloride concentrations are around 550 ppm in the upper portions and around 3,100 ppm in the lower portions of the Floridan Aquifer. The EAFB Field 4 Lower Floridan well shows chloride contents of 8.7 and 410 ppm for sampling intervals of 940-1,015 ft and 940-1,380 ft, respectively. Dissolved solids content and sodium concentrations also increase with depth indicating the stratification of fresh water over saline water. No Bucatunna Clay is present at this location. The Beal Cemetery Lower Floridan well in Fort Walton Beach shows chlorides of 810 ppm and 1,600 ppm from intervals of 1,020-1,060 ft and 1,020-1,200 ft, respectively, within the Lower Floridan Aquifer, with associated increases in total dissolved solids content and sodium concentrations. The Camp Rucker Floridan well in Walton County shows dissolved chloride contents of 28 ppm from intervals of 201-900 ft, showing the water from the lower portions of the Floridan Aquifer in this region to be potable.

More detailed vertical sampling of water quality from the lower limestone is provided for the Freeport Remote Observation well (Table 2.1), for the WRP Lower Floridan test well (Table 2.2), and for the NWFWMD Tiger Point well (open to the upper limestone and the top of the Bucatunna Clay) in Table 2.3 (Pratt, personal communication). The locations of these wells are presented in Figure 1.1. The Freeport Remote Observation well shows minimal chloride levels to a depth of 600 ft. Further below, chlorides increase rapidly with increasing depth, up to 9,000 ppm at the bottom of the well (777 ft below land surface). Thus, high chlorides are noted in the base of the Floridan Aquifer System. The WRP Lower Floridan test well in Destin, sampled only within the lower limestone at discrete intervals, shows chlorides increasing with depth from 1,200 ppm at a depth of about 930 ft to 16,900 ppm at a depth of around 1,400 ft. The chloride sampling discussed above indicates that considerable stratification of chlorides lies within the Floridan Aquifer System in Walton and Okaloosa Counties. The Bucatunna Clay (where it exists) enhances the stratification by restricting movement of saline water from the deeper regions. Finally, the NWFWMD Tiger Point well, with samples from the lower portions of the upper limestone and the top of the Bucatunna Clay, shows chlorides increasing from around 350 ppm at a depth of 1,200 ft to around 600 ppm at a depth of 1,300 ft below land surface. Thus, the chloride stratification in the upper limestone in the west is not as significant as that in the Lower Floridan Aquifer or in the undifferentiated Floridan Aquifer in the east.

3.0 NUMERICAL MODEL DEVELOPMENT FOR THE EASTERN MODEL

3.1 CODE SELECTION

The DSTRAM code was selected for this study. DSTRAM is an acronym for Density-dependent Solute Transport Analysis finite-element Model (Huyakorn and Panday, 1994), which simulates density-dependent flow of water and solute transport in porous media. The code is designed specifically for complex situations where the flow of groundwater is influenced significantly by variations in solute concentration. The groundwater flow equation is therefore coupled with the solute transport equation for saltwater that accounts for advection and anisotropic dispersion. DSTRAM allows for complex hydrostratigraphy and heterogeneity in defining the aquifer materials, and provides several options for applying boundary conditions for flow and salt transport suitable for coastal systems including steady and transient prescribed heads, prescribed concentrations, prescribed fluid and solute fluxes, and spring, river, drain, and other general head boundary conditions with associated mass-flux solute transport boundary conditions. In addition, DSTRAM provides output for equivalent fresh-water heads (that includes the density effects of saltwater and is therefore the horizontal driving force for flow), environmental heads (the driving force for vertical flow), chloride concentrations, chloride isochlor elevations, velocity vectors and component fluid and solute mass balance fluxes which are useful in investigating saline intrusion characteristics and simulation convergence and accuracy. Therefore, DSTRAM possesses all the capabilities necessary for the current modeling effort.

3.2 CONCEPTUAL MODELING FRAMEWORK

The conceptual model adopted for quantitative analysis of groundwater flow and salt transport in eastern Okaloosa and western Walton Counties is illustrated in Figure 3.1, where the saltwater intrusion model comprises the Upper and Lower Floridan Aquifer units separated by the Bucatunna Clay, and overlain by the Intermediate System, and underlain by the Sub-Floridan System. In eastern Walton and Bay Counties, the Bucatunna Clay pinches out and the Floridan Aquifer becomes undifferentiated.

Prescribed heads in the Surficial Aquifer System drive flow into or out of the Upper Floridan Aquifer through the Intermediate System as the top boundary condition. These heads were obtained from the District’s MODFLOW groundwater flow model study (HydroGeoLogic, 2000) in landward portions of the domain, where the inflow of water was assumed to be free of chlorides. Lateral boundary conditions in upland regions were also obtained from the District’s groundwater flow model to drive fresh water into the Upper and Lower Floridan aquifers across the local saltwater intrusion model’s northern, eastern and western landward boundaries. Off the coast, and in the Gulf of Mexico, the lateral boundary was assumed to be at hydrostatic equilibrium, with chloride concentrations of seawater. The increasing weight of seawater with depth causes saltwater to intrude landward, in deeper regions of the aquifers. The Sub-Floridan System was included as a bottom confining unit with prescribed heads and seawater chloride concentrations which may intrude into the Upper and Lower Floridan Aquifers. This system was not included in the MODFLOW model because of its insignificance to the flow field, but was included in the density-dependent solute transport model in order to increase saltwater intrusion in the domain, which was otherwise significantly under-predicted as compared to field data, in preliminary simulations that neglected its presence. The model was assumed to be at equilibrium for pre-development conditions, where saltwater intrusion is a consequence of higher potential of fresh-water from upland regions balancing the larger weight forces of saltwater from the Gulf. Pumping was then applied to this system in a transient manner, to estimate the changes in chloride concentrations throughout the domain for post-development conditions. Transient post-development boundary conditions for the lateral upland boundaries were extracted from the MODFLOW transient groundwater flow model which is of more regional extent, to account for effects of pumping that are outside of the current saltwater intrusion model boundaries.

3.3 MODEL DOMAIN

The saltwater intrusion model domain, shown in Figure 3.2, was selected after careful considerations of the groundwater flow system within the region of interest, the modeling objectives, and the computational requirements of the DSTRAM computer code. In general, an optimal mix of the following objectives and constraints was sought:

- The model boundaries should correspond to the degree possible under naturally occurring, known boundary conditions.

- Computational time for various simulation scenarios, and therefore the number of active model nodes, had to be commensurate with the available computational resources and data.

The final model domain used in the analysis encompasses the southern half of Okaloosa and Walton Counties and the westernmost part of Bay and Washington Counties. In general, the model extends in an east-west direction from the western portions of Bay County, covering southern Walton County, and up to the western boundary of Okaloosa County. In the north-south direction, the domain extends approximately 19 miles landward and 19 miles into the Gulf of Mexico, from the mouth of Choctawatchee Bay. In UTM (Projection: UTM Zone 16, Datum NAD83) coordinates, the lower-left-hand corner of the model grid is located at x = 529,700 m and y = 3,328,000 m.

3.4 FINITE-ELEMENT MESH DESIGN

The major hydrogeologic units modeled for the saltwater intrusion study include the Intermediate System, the Upper Floridan Aquifer, the Bucatunna Clay confining unit, the Lower Floridan Aquifer, and the Sub-Floridan System. Each unit had to be discretized into multiple layers to simulate density-dependent groundwater flow and solute transport processes that occur in the vertical and horizontal directions. In the horizontal (x-y) plane, the grid is rectangular with 138 columns and 82 rows of elements (139 columns and 83 rows of nodes) for a total of 11,316 elements per layer and 11,537 nodes per layer. The discretization is at a maximum of 2,185 m near the boundaries of the model, and at a minimum of 402 m in areas of interest north of Choctawhatchee Bay. The finest discretization was used where the largest variations in chloride concentrations were expected, and larger cells sizes were used in the corners of the domain where concentration variation was expected to be relatively small (Figure 3.2).

The DSTRAM orthogonal curvilinear mesh option was used to discretize the model domain on the vertical (z) dimension. A curvilinear mesh is one where the gridline columns and/or rows do not remain parallel over their entire length. This option permits a grid to conform to the changing geometry of the various hydrogeological units. This option was invoked because there are significant dips and variations in the thicknesses of all hydrogeological units within the domain, and slopes of the various hydrogeological units could influence the density-dependent groundwater flow field. The vertical grid along cross-section x = 569,764.0 m Easting is illustrated in Figure 3.3. Vertically, the domain is discretized into 20 elemental (21 nodal) layers with three elemental layers representing the sub-Floridan System (layers 1 – 3), six elemental layers for the Lower Floridan Aquifer (layers 4 – 9), three elemental layers for the Bucatunna Clay (layers 10 – 12), five elemental layers for the Upper Floridan Aquifer (layers 13 – 17), and three elemental layers for the Intermediate System (layers 18 – 20). The grid contains a total of 226,320 elements and 242,277 nodes. The vertical grid spacing varies from 7 ft to 300 ft to accommodate the varying thicknesses of the hydrogeological units.

3.5 MODEL BOUNDARY CONDITIONS

This section describes the boundary conditions that were used for both groundwater flow and chloride concentrations at the bottom, top and sides of the three-dimensional model. A conceptual diagram of the boundary conditions applied along a typical north-south section is presented in Figure 3.4.

In this section, reference is frequently made to a normalized concentration. Normalized concentration is a dimensionless number that varies from 0 to 1. It is the ratio of a given concentration to the maximum concentration in the system. For example, if the maximum concentration in the model domain is 19,000 mg/L, and at some point a concentration of 5,000 mg/L occurs, then the normalized concentration at that point would be 5,000 mg/L / 19,000 mg/L = 0.263. In this study, the maximum concentration of chloride was assumed to be 19,000 mg/L (equal to that of seawater).

3.5.1 Bottom Boundary

The bottom boundary (nodal layer 1) of the model corresponds to the base of the Sub-Floridan System that contains deep brines which may potentially up-cone into the Floridan Aquifer. Little is known about this aquifer at this depth. This boundary was therefore assigned with a prescribed head condition such that an upward gradient exists for underlying saltwater to intrude into the domain of interest through the overlying low conductivity Sub-Floridan System in coastal and offshore regions. The chloride concentrations were supplied along the bottom to represent seawater concentrations beneath the Gulf of Mexico, with values declining northwestward in inland regions of the domain. Both specified concentrations and heads were subject to change during calibration. The final concentrations and heads of the Sub-Floridan Aquifer are discussed in Section 4.1.1 (see also Figures 4.1a and 4.1b referred to in that section).

3.5.2 Top Boundary

The top boundary of the model (nodal layer 21) corresponds to the top of the Intermediate System (MODFLOW layer 1). The area beneath the bay or gulf was assigned constant heads equal to 0.025*Z (where Z is the depth of the top of the Intermediate System below sea level) to allow equivalent freshwater heads (due to density considerations) to drive water in/out across the Intermediate Confining Unit. In other areas, the prescribed heads were extracted from the pre-development steady-state MODFLOW model for pre-development simulations or from the transient regional MODFLOW flow model for post-development simulations. The top concentration boundary beneath the bay or gulf was assigned a constant normalized concentration equal to 1.0 (equal to that of seawater). Otherwise, the prescribed normalized concentrations in the top layer were set to zero, which represents fresh-water in the Sand-and-Gravel Aquifer. Note that the chloride concentration boundary condition was applied to all inflow nodes, and DSTRAM provides a zero-concentration-gradient boundary condition (to allow for a natural outflow boundary) at outflow nodes.

3.5.3 Lateral Boundary Conditions

Flow boundary conditions along the lateral boundaries of the Upper and Lower Floridan Aquifers are prescribed head boundaries. On three of the four lateral boundaries (i.e., the north, east and west), prescribed heads were interpolated from the regional MODFLOW flow model. For pre-development conditions, the pre-development steady-state MODFLOW model was used, while for post-development conditions, these heads were obtained from a transient simulation of the regional MODFLOW groundwater flow model. The southern boundary was assigned constant heads equal to 0.025*Z (where Z is the depth below sea level) to allow for a vertical gradation of the equivalent freshwater heads due to density considerations. The multiplying factor of 0.025 assumes that a uniform normalized chloride concentration of C=1 exists from top to bottom along the southern boundary. No-flow boundary conditions were assigned along the boundaries of the Intermediate System (nodal layers 19 and 20), the Bucatunna Clay confining unit (nodal layers 11 and 12) and the upper portion of the Sub-Floridan System (nodal layers 2 and 3).

Prescribed normalized concentration boundary conditions were assigned along the lateral boundaries of the Upper and Lower Floridan Aquifers. Figure 3.5 shows the prescribed normalized concentrations along the lateral boundaries within the Upper and Lower Floridan Aquifers. The northern boundary conditions represent freshwater in the Floridan aquifer system, while the southern boundary conditions represent seawater in the gulf. The eastern boundary conditions in the Floridan Aquifers were prescribed as freshwater (normalized concentration = 0.0) from the northernmost inland area to West Bay (Bay County), and from West Bay to the southern boundary the normalized concentration was linearly increased from 0.0 to 1.0 (seawater). The western concentration boundary conditions were extracted from the pre-development steady-state Western Domain DSTRAM model (HydroGeoLogic, 2005). These chloride distributions were assumed to prevail from pre-development to current conditions.

3.5.4 River Boundary Conditions

The Upper Floridan Aquifer is in direct connection with the Choctawhatchee River and Holmes Creek in portions of the study domain. These locations were provided with river type boundary conditions in the MODFLOW regional groundwater flow model that encompasses the current domain, and were prescribed as spring nodes in the DSTRAM model. A spring node acts as a drain allowing for water to leave the system under prescribed spring head conditions. Spring head values were extracted from the MODFLOW model with a unit spring conductance of 250 day^{-1} per unit length of spring. The length of spring within each element was then computed within a GIS framework such that total spring conductance is the same as that used in the MODFLOW model. These spring nodes were placed in nodal layer 17 of the model to represent the top part of the Upper Floridan Aquifer. Figure 3.6 shows the location of river (spring) boundary conditions within nodal layer 17 of the model and associated spring head values.

3.6 MODEL PARAMETERIZATION

The flow domain of the DSTRAM saltwater intrusion model for the Eastern Model was initially parameterized from the pre-development regional MODFLOW groundwater flow model. Horizontal hydraulic conductivity values for the Upper and Lower Floridan aquifers were obtained from the associated transmissivity divided by the thickness of the respective units of the MODFLOW model, as depicted in Figures 3.7 and 3.8, respectively. Horizontal hydraulic conductivity values for the Bucatunna Clay and for the Intermediate System were also obtained from the associated transmissivity divided by the thickness of the respective units of the MODFLOW model. The Bucatunna Clay horizontal conductivity value thus obtained is on the order of 10^{-5} ft/day.

The Sub-Floridan System consists of Claiborne Group (Middle Eocene) sediments (Chen, 1965). Analyses of well logs show that the upper portion of the Sub-Floridan System directly beneath the Lower Floridan Aquifer, consisting of relatively permeable sandy carbonates, appears to be significantly less permeable than the Lower Floridan aquifer but significantly more permeable than a typical confining unit. Underlying this relatively permeable interval is a layer of very low hydraulic conductivity sediments. Therefore the Sub-Floridan System was parameterized as uniform values of 0.0003 ft/day for the bottom layer and 0.5 ft/day for the overlying Sub-Floridan model layers 2 and 3. A horizontal to vertical anisotropy of 35:1 was assigned to all units.

After model parameterization, a flow simulation was first conducted to ensure that the data transfer was correct. Head values obtained from the flow simulation were in close agreement with the MODFLOW model ensuring the integrity of the data. Density-dependent transport was then turned on within DSTRAM with the appropriate transport boundary conditions as conceptualized earlier. Preliminary sensitivity simulations were used to determine transport parameters that simulated realistic chloride distributions. Effective porosity was set to 0.25. The longitudinal dispersivity was set to 100 ft. The transverse dispersivity was set to 20 ft. The vertical longitudinal dispersivity was set to 10 ft and the vertical transverse dispersivity was set to 1 ft. The molecular diffusion was set to 0.001 ft^2/day for the bottom layer of the Sub-Floridan System and for the Bucatunna Clay confining unit. In the remaining parts of the model, the molecular diffusion was set to 0.0 ft^2/day.

4.0 MODEL CALIBRATION

The density-dependent saltwater intrusion model was calibrated in two phases corresponding to the pre-development and post-development conceptualizations. For the pre-development phase, the saltwater intrusion model parameterization and boundary conditions were first developed from the associated pre-development regional MODFLOW groundwater flow model (HydroGeoLogic, 2000), and initial tests were conducted on transport parameter values and on the conceptualization of the Sub-Floridan model boundary to note saltwater intrusion behavior. Flow parameter values were also adjusted in the process to note saltwater intrusion effects. However, the flow field was altered minimally as noted by head distributions of the saltwater intrusion model as compared to the District's regional MODFLOW flow model. Once the estimated pre-development chloride distribution was achieved by the model, transient post-development simulations were conducted to simulate head and chloride concentrations from year 1942 (approximate time of the pre-development state) through 2004. The simulated hydraulic heads and chloride concentrations were compared to field data measured in more recent times.

4.1 PRE-DEVELOPMENT MODEL CALIBRATION

The pre-development saltwater intrusion model approximates steady-state groundwater flow and chloride transport prior to 1942. The preliminary pre-development DSTRAM model was constructed from the pre-development regional MODFLOW model and the Western Domain DSTRAM model as described in Sections 3.5 and 3.6. The preliminary DSTRAM model was used to simulate transient conditions until steady-state conditions were obtained.

The preliminary pre-development DSTRAM model was modified and calibrated to give a satisfactory chloride distribution in the Lower Floridan Aquifer and Upper Floridan Aquifer. In order to represent saltwater within the model more appropriately, the Sub-Floridan boundary heads and concentrations were adjusted, and the hydraulic conductivities in the Lower Floridan Aquifer, Bucatunna Clay confining unit and the Intermediate System were modified.

4.1.1 Boundary Conditions

The preliminary pre-development model was modified along portions of the western, and southern boundaries to correspond with results from the Western Domain model in regions of overlap (see Figure 1.2). Thus, boundary conditions for equivalent freshwater head and chlorides along these overlapping regions were extracted from the Western Domain model pre-development steady-state simulation results.

The specified concentration at the bottom of the model domain was adjusted during the pre-development model calibration process. Lower boundary concentrations offshore increase to a normalized value equal to that of seawater. The boundary concentrations generally decrease to 10 percent of seawater just inland from the coast and decrease to near zero further inland. Under the eastern parts of Choctawhatchee Bay and under the Choctawhatchee River, the boundary concentration was set to a normalized value of 0.85 (representing approximately 16,000 ppm of chlorides) (Figure 4.1a).

Data were not available for the head in or below the Sub-Floridan System. The specified head values were based on the conceptual model of the flow system and the Western Domain DSTRAM model (HydroGeoLogic, 2005). In the coastal area of Okaloosa and Walton Counties an upward gradient is expected to exist, thus allowing for limited flow of saline groundwater through the Claiborne Group into the Lower Floridan Aquifer. The DSTRAM model applies this specified head beneath the lowermost model layer which represents a 30 ft thick confining unit. The initial specified freshwater head was set to the simulated Lower Floridan Aquifer head plus 8 ft. The head difference was adjusted during the pre-development model calibration process. The bottom head gradient is upward and the freshwater head difference, between slice 1 (the top layer of Sub-Floridan System) and slice 4 (the bottom layer of Lower Floridan Aquifer) varies between 5 ft and 15 ft. The final specified bottom freshwater head boundary condition is depicted in Figure 4.1b.

4.1.2 Hydraulic Conductivities

4.1.2.1 Lower Floridan Aquifer and Sub-Floridan System

Field data support a vertical concentration gradient across the Lower Floridan Aquifer. Even though the Sub-Floridan System saltwater source leads to higher chloride concentrations in the Lower Floridan Aquifer, the preliminary model did not simulate significant vertical concentration gradients which are known to exist. In order to increase the vertical concentration gradients, the following changes were made to the preliminary pre-development DSTRAM model. These changes are consistent with alterations incorporated into the Western Domain model.

- The Sub-Floridan System hydraulic conductivity was set at 0.0003 ft/day for the lowermost layer, and at 0.5 ft/day for the other two elemental layers that represent the Sub-Floridan System. A horizontal to vertical anisotropy of 35:1 was applied to these layers.

- The Lower Floridan Aquifer horizontal hydraulic conductivity (K_h) was decreased in the lower portion of the aquifer and increased in the upper portion of the aquifer so that the overall transmissivity was not changed since all the layers of the Lower Floridan Aquifer have the same thickness. The six elemental layer K_h values were set equal to the preliminary K_h (Figure 3.8) scaled by 0.2, 0.4, 0.8, 1.2, 1.6, and 1.8 from bottom to top. The existence of significantly higher hydraulic conductivity in the upper portion of the Lower Floridan Aquifer has been demonstrated at several locations (Merritt, 1984).

- The Lower Floridan Aquifer vertical hydraulic conductivity was set equal to the preliminary K_h (Figure 3.8) divided by 1000.

4.1.2.2 Bucatunna Clay Confining Unit

The vertical hydraulic conductivity values of the Bucatunna Clay based on laboratory analyses range from $2x10^{-7}$ ft/day to $3x10^{-5}$ ft/day (Merritt, 1984; Ehrlich et al, 1979). Both the MODFLOW model and the preliminary pre-development DSTRAM model were assigned vertical hydraulic conductivity values ranging from $7x10^{-6}$ ft/day to $2x10^{-7}$ ft/day. As was done in the Western Domain, the Bucatunna Clay confining unit hydraulic conductivity was increased by a factor of 10 from the preliminary pre-development DSTRAM model. These updated values are more representative of mean values obtained from laboratory analyses. In areas well offshore (generally more than 4 or 5 miles offshore) the hydraulic conductivity was increased by an additional order of magnitude. The K_h assigned to the Bucatunna Clay generally ranged from $7x10^{-4}$ ft/day to $7x10^{-5}$ ft/day and the horizontal to vertical anisotropy was set to 35:1. Further, in the southeastern portion of Choctawhatchee Bay and adjacent coastal area the vertical hydraulic conductivity of the middle portion of the undifferentiated Floridan Aquifer (Bucatunna Clay equivalent layers) was reduced to $2.45x10^{-3}$ ft/day representing some confinement though not as significant as for the Bucatunna Clay (Figure 4.2a). These changes in hydraulic conductivities of the Bucatunna Clay and the equivalent undifferentiated Floridan Aquifer layers allow for appropriate intrusion of saline water into the Upper Floridan Aquifer while having essentially no effect on the simulated heads.

4.1.2.3 Intermediate System

The vertical hydraulic conductivity of the Intermediate System was lowered from $3x10^{-3}$ to $1x10^{-3}$ in the eastern Choctawhatchee Bay and lower Choctawhatchee River area (Figure 4.2b). This alteration had the desired result of increasing the simulated chlorides in the eastern Choctawhatchee Bay area.

4.1.3 Transport Parameters

Preliminary sensitivity simulations were used to determine transport parameters that simulated realistic chloride distributions. The longitudinal dispersivity was set to 100 ft. The transverse dispersivity was set to 20 ft. The vertical longitudinal dispersivity was set to 10 ft and the vertical transverse dispersivity was set to 1 ft. The molecular diffusion coefficient was set to $0.001ft^2/d$ for the bottom layer of the Sub-Floridan System and for the Bucatunna Clay confining unit. In the remaining parts of the model, the molecular diffusion was set to 0.0 ft^2/d. These transport parameters remain un-changed during the calibration and are consistent with parameters applied to the Western Domain model.

4.1.4 Pre-Development Simulation Results

The pre-development equivalent freshwater heads are similar to the pre-development regional MODFLOW model heads except in the south-west portions of the model domain where the boundary heads were input from the Western Domain DSTRAM model. Figures 4.3a and 4.3b present the pre-development equivalent freshwater heads in the Upper Floridan Aquifer and Lower Floridan Aquifer, respectively. The groundwater generally flows southeast across the model domain. Higher groundwater heads are seen in the northwestern inland portion of the model domain, the central portion of the eastern boundary and east of the Choctawhatchee River. In the northeastern portion of the model domain it is noted that groundwater in the Floridan Aquifer flows towards the Choctawhatchee River. Figures 4.4, 4.5, and 4.6 present the pre-development environmental heads for three north-south vertical cross-sections. The groundwater generally flows south in the Upper Floridan Aquifer, Lower Floridan Aquifer and Sub-Floridan System, and upward through the Bucatunna Clay confining unit (where it exists). Flow is generally upward through the Intermediate System except in the north where the Upper Floridan

Aquifer is recharged through the Intermediate System. The pre-development chloride concentrations in the Upper Floridan Aquifer and Lower Floridan Aquifer are shown in Figures 4.7 and 4.8, respectively. Chloride intrusion is noted in both Upper and Lower Floridan Aquifers along the Choctawhatchee River. Figures 4.9, 4.10, and 4.11 present the pre-development chloride concentrations for three north-south vertical cross-sections. These figures show the highest chloride concentrations in the Sub-Floridan System and indicate large vertical concentration gradients across the Bucatunna Clay confining unit where it exists, and in the lower portions of the Floridan Aquifer where the Bucatunna Clay confining unit is absent. A lens of freshwater is also noted in the Seagrove area in Figure 4.11.

The pre-development Darcy velocities in the Upper Floridan Aquifer and Lower Floridan Aquifer are shown in Figures 4.12 and 4.13, respectively. The Darcy flow directions are approximately perpendicular to the equivalent freshwater head contours shown in Figures 4.3a and 4.3b. The northeast corner of the Upper Floridan Aquifer and Lower Floridan Aquifer contains the highest Darcy velocities. High Darcy velocities are also observed in the western portions of Choctawhatchee bay region in the Upper Floridan Aquifer. These high velocities are associated with areas of high hydraulic conductivity (Figures 3.7 and 3.8). The lowest horizontal Darcy velocities are noted offshore in both Upper and Lower Floridan Aquifers. Figures 4.14, 4.15, and 4.16 present the pre-development vertical Darcy velocities in the Intermediate System, Bucatunna Clay confining unit, and Sub-Floridan System, respectively. Flow through the Intermediate System is mainly downwards north of Choctawhatchee Bay, and upwards, south of Choctawhatchee Bay. Flow through the Intermediate System and the middle portion of the undifferentiated Floridan Aquifer is upward under Choctawhatchee River. Flow through the Bucatunna Clay and Sub-Floridan System is mainly upward though the magnitude is small. Figures 4.17, 4.18, and 4.19 present the pre-development Darcy velocities for three north-south vertical cross-sections. The figures show the groundwater flowing south in the inland areas of the Upper Floridan Aquifer and Lower Floridan Aquifer, and flowing upward in the Bucatunna Clay confining unit and Sub-Floridan System.

The pre-development water balance is shown in Table 4.1. Most of the inward water flow enters the eastern, northern and top boundaries of the domain. Approximately 55 percent of the total inward water flow enters the eastern boundary. Smaller amounts of water enter the southern, western, bottom and river boundaries. Most of the outward water flow (80 percent) exits the eastern and river boundaries. Approximately 17 percent of the total outward water flow exits the northern and top boundaries. Smaller amounts of water exit the model along the southern, western and bottom boundaries.

The pre-development chloride balance is shown in Table 4.2. Most of the inward advective flux enters the southern boundary, followed by the eastern boundary. Approximately 7 percent of the total inward advective flux enters from the bottom boundary. Most of the outward advective flux exits the southern, eastern, and top boundaries. Smaller advective flux exits the northern, western, bottom, and river boundaries. Most of the inward and outward dispersive flux occurs across the bottom boundary. This is consistent with the relatively low vertical hydraulic conductivity within the Sub-Floridan System where molecular diffusion is significant.

4.1.5 Grid Sensitivity

A finer-grid model was constructed from the pre-development DSTRAM model to verify the numerical accuracy of the solutions of the flow and transport equations. Each element in the model was divided into four elements in the horizontal (x-y) plane. The finer-grid model is rectangular with 276 columns and 164 rows of elements (277 columns and 165 rows of nodes) in the horizontal plane for a total of 45,264 elements per layer. The grid of this model has 20 elemental layers, which are identical to the pre-development model.

Figures 4.20 and 4.21 compare the pre-development equivalent freshwater heads for coarse and fine grids in the Upper Floridan Aquifer, and the Lower Floridan Aquifer, respectively. The equivalent freshwater heads are very similar throughout the model domain. Figures 4.22 and 4.23 compare the pre-development chloride concentrations in the Upper Floridan Aquifer and Lower Floridan Aquifer, respectively. In general, the finer-grid model exhibits a slightly less disperse chloride distribution. The finer-grid model simulates lower concentrations in the fresher portions of the model domain and higher concentrations in the saltier portion of the domain. The pre-development chloride concentrations are slightly lower for the fine grid simulation in landward portions of the domain. The grid sensitivity shows that grid refinement has a small effect on the accuracy of the pre-development results.

To delineate the effects of the upstream weighting scheme in producing numerical dispersion, the refined grid was used in a simulation wherein the upstream weighting parameters were reduced. The upstream weighting parameters for previous simulations were an upstream factor of 1 and a critical Peclet number of 2. (The Peclet number of a cell in any direction is the cell size in that direction divided by the dispersivity). Thus, full upstream weighting begins to be applied within any grid cell when the Peclet number of that cell is greater than 2. The current sensitivity uses an upstream weighting factor of 0.5 and a critical Peclet number of 3 (Figures 4.22 and 4.23). Thus, only half upstream factor is applied in this simulation, and it begins to be applied when the Peclet number of any cell is larger than 3. Figures 4.24 through 4.29 show the vertical chloride concentration profiles for the base case, the finer grid, and finer grid with reduced upstream parameters simulations, for well locations at Seagrove, Destin, Lisa Jackson Park, Beal Cemetery, Freeport, and EAFB Field 4, respectively. All sensitivities show the same chloride distributions at these locations and hence the upstream effects and grid effects on chloride distributions appear to be very small.

4.2 POST-DEVELOPMENT SIMULATION FROM 1942 TO 2004

The post-development transient saltwater intrusion model approximates groundwater flow and chloride transport from 1942 to 2004. The post-development simulation incorporated 153 wells. Tables 4.3a, 4.3b, 4.3c, 4.3d, and 4.3e list the wells and the annual average daily rate of pumping from 1942 to 1958, from 1959 to 1969, from 1970 to 1982, from 1983 to 1998, and from 1999 to 2004, respectively. Figure 4.30 presents a plot of the total pumping withdrawals within both the total Flow Model domain and the Eastern Domain model areas. Between the late 1980’s and 2002 the increase in withdrawals slowed dramatically. The leveling off of withdrawals is attributed to conservation measures, and alternative supply development such as reuse. The significant reduction in withdrawals noted after 2002 is due to a reduction in withdrawals in Bay

County where Panama City Beach eliminated the use of their Floridan Aquifer wells and replaced that portion of their supply with surface water from Deer Point Lake.

Transient flux boundary conditions were assigned to 441 nodes of the DSTRAM model on nodal layers 8 to 18 to represent the transient buildup of pumping in these wells. Transient specified head boundary conditions were assigned to the western, northern and eastern lateral boundaries. Transient specified head boundary conditions were also assigned to the top layer except where beneath the bay or gulf was assigned constant heads equal to 0.025*Z (where Z is the depth below sea level of the Intermediate System top). These specified heads were changed at the beginning of each year to match the heads in the post-development regional MODFLOW simulation (discussed in the next section). The bottom and southern boundary conditions were the same as those in the pre-development model. Pre-development conditions were used as initial conditions. Effective porosity was set to 0.25, and specific storage was set equal to the regional MODFLOW model storativity (10^{-4}) divided by the MODFLOW cell thickness. The range of specific storage in the final model was from $1.46x10^{-7}$ 1/ft to $5x10^{-6}$ 1/ft. The post-development simulation used 776 time steps with a maximum time step of 30 days. The initial time step size was one day.

4.2.1 Post-Development Regional MODFLOW Simulation

The post-development regional MODFLOW model simulates transient groundwater flow conditions from 1942 to 2004. The pre-development regional MODFLOW model results were utilized as initial conditions. Post-development conditions were simulated using 63 one-year stress periods. The District provided well injection/extraction boundary conditions for each stress period. The specified head, recharge, river, drain, and general-head boundary conditions were identical to the pre-development regional MODFLOW model. Each stress period used an initial time step size of one day and a maximum time step size of 30 days. The specific yield was 0.25 and the storativity value was 10^{-4}. Results of this simulation provide transient lateral landward boundary conditions for the DSTRAM model.

4.2.2 Post-Development DSTRAM Simulation

The post-development simulation considers transient flow and chloride transport from 1942 to 2004. The pre-development regional DSTRAM model results for equivalent freshwater heads and normalized chloride concentrations were utilized as initial conditions for the post-development simulation. The regional MODFLOW model results provided transient lateral boundary head conditions in 63 one-year increments along the top, northern, western, and eastern boundaries for the Eastern Domain DSTRAM model. Chloride boundary conditions were identical to the pre-development model along all boundary locations.

4.2.2.1 Simulated Water Levels and Darcy Velocities

The 2004 post-development equivalent freshwater heads in the Upper Floridan Aquifer and Lower Floridan Aquifer are shown in Figures 4.31 and 4.32, respectively. The groundwater flows inland from the Gulf of Mexico towards the cone of depression created by the extraction wells. Figures 4.33, 4.34, and 4.35 present the 2004 post-development environmental heads for three north-south vertical cross-sections. Compared to the pre-development simulation (Figures

4.4, 4.5, and 4.6), groundwater flow reversed direction in the Upper Floridan Aquifer, Lower Floridan Aquifer and in the Intermediate System for cross-sections A-A' and B-B' in offshore areas. Groundwater flow direction for cross-section C-C' did not change significantly as compared to the pre-development simulation. Locations near and east of cross-section C-C' are more influenced by the Choctawhatchee River than by the post-development pumping. Further, the Choctawhatchee River itself acts as a dividing line with locations to the east having a fairly separate flow system from the major post-development cone of depression to its west.

The 2004 post-development Darcy velocities in the Upper Floridan Aquifer and Lower Floridan Aquifer are shown in Figures 4.36 and 4.37, respectively. The Darcy flow directions are approximately perpendicular to the equivalent freshwater head contours in Figures 4.31 and 4.32. The Darcy velocities are higher than the pre-development Darcy velocities (Figures 4.12 and 4.13). Compared to the pre-development simulation, the post-development groundwater flow reverses direction in the Upper and Lower Floridan Aquifers in the offshore area in the western half of the model domain and around Choctawhatchee Bay. Figures 4.38, 4.39 and 4.40 present the 2004 post-development vertical Darcy velocities in the Intermediate System, Bucatunna Clay confining unit, and Sub-Floridan System, respectively. Compared to the pre-development simulation (Figures 4.14, 4.15 and 4.16), groundwater flow reverses direction in the Intermediate System in the western half of the model domain but changes insignificantly in the eastern half of the model domain. Darcy velocities increase in the Bucatunna Clay confining unit and Sub-Floridan System in the north and western portions of the model domain whereas southeast regions of the model domain change marginally. Figures 4.41, 4.42 and 4.43 present the 2004 post-development Darcy velocities for three north-south vertical cross-sections. Figures 4.41 and 4.42 for cross-sections A-A' and B-B' respectively also show the reversed flow direction in the Intermediate System compared to pre-development conditions as well as higher Darcy velocities in the Bucatunna Clay confining unit and the Sub-Floridan System when compared to the pre-development simulation. Figure 4.43 for cross-section C-C' shows nominal changes.

The post-development water balance is shown in Table 4.4. Compared to the pre-development simulation water balance in Table 4.1, the flow of water through the model increases by 15 percent. The eastern boundary has the highest inward as well as outward water flow rate (54 percent and 42 percent of the total respectively). Approximately 43 percent of the total inward water flow enters the northern and top boundaries. Beside the eastern boundary, river boundary has the highest outward flow rate (35 percent of the total). Pumping accounts for less than 8 percent of the total boundary flows. Smaller amounts of water exit the model along the southern, western and bottom boundaries.

Table 4.5 provides the net boundary flow for both the pre-development and post-development simulations, and the change in flow rate for each of the boundaries. Outflow in the river boundary is reduced by around 2 percent due to the post-development pumping stress. The top boundary provided for 63 percent of additional flow and is the largest term for change in flow between pre- and post-development conditions. The river boundary provided 9 percent of the pumping-induced flow. The change in flow from eastern and western boundaries was marginal. The northern, southern and bottom boundaries provide for the remainder of the pumping induced inflow.

The simulated heads were compared to observed water levels at twelve wells. Locations of these wells are shown in Figure 4.44. Figures 4.45a through 4.45l compare both the MODFLOW and DSTRAM simulated heads to observed water levels from 1942 to 2004. Most simulated heads decrease from 1942 to 2004 and are consistent with observed water level trends. In general, the DSTRAM simulated heads are similar to but slightly higher than the MODFLOW simulated heads. The maximum differences between the two heads are on the order of 5 to 10 ft. The observed water levels are in general consistent with simulated heads. At the following wells: Okaloosa County School Board, Selma Madara/USGS, FAF #2/USGS Monitor, and EAFB – Postil Point, the observed water levels show significant fluctuation and the simulated heads are higher than observed water levels. However, the general temporal trends at the wells are favorably captured by both the MODFLOW and DSTRAM models.

4.2.2.2 Simulated Chloride Concentrations

The 2004 post-development chloride concentrations in the Upper Floridan Aquifer and the Lower Floridan Aquifer are shown in Figures 4.46a and 4.46b, respectively. Chloride concentrations are very similar to the pre-development concentrations (Figures 4.7 and 4.8). Comparisons between the pre-development chloride concentrations and the 2004 post-development chloride concentrations in the Upper Floridan and Lower Floridan Aquifers are shown in Figures 4.47a and 4.47b, respectively. The largest changes are noted in the Lower Floridan Aquifer in the Fort Walton Beach area. Figures 4.48, 4.49, and 4.50 present the 2004 post-development chloride concentrations for three north-south vertical cross-sections. The figures show that the pumping induced inward flow from the top model boundary has caused higher chloride concentrations in the top nodal layers within the Intermediate System.

The post-development chloride balance is shown in Table 4.6. Flux rates into the domain from the boundaries are larger than pre-development flux rates. Most of the inward advective flux enters the top and southern boundaries. Approximately 13 percent of the total inward advective flux enters the bottom boundary. Smaller advective flux enters the northern and river boundaries. Most of the outward advective flux exits the western and top boundaries. Smaller advective flux exits the northern, bottom, and river boundaries. Most of the inward and outward dispersive fluxes occur across the top boundary.

Mean observed chloride concentrations from 1998 to 2000 for Okaloosa and Walton Counties in the Upper Floridan Aquifer or the upper portion of the undifferentiated Floridan Aquifer are presented in Figures 4.51a, and 4.51b, respectively. Shown in Figure 4.51c is a comparison between the concentration data shown in Figures 4.51a and 4.51b and chloride concentration contours for the Upper Floridan Aquifer or the upper portion of the undifferentiated Floridan Aquifer (also shown in Figure 4.46a). The same contours are also compared against another set of data between 1951 and 2003 in Figure 4.51d. Note that, owing to the lack of observed data across the model domain at the same time, data observed at different times were used to represent chloride concentration in 2004. Owing to the fact that chloride tends to migrate very slowly, a snapshot of chloride distribution could be approximated using a composite of chloride observed at different times. In Figures 4.51c and 4.51d, it is observed that the simulated spatial distribution of chloride concentration, in general, is in favorable agreement with the observed data throughout the model domain. However, in a small region around the eastern end of the Choctawhatchee Bay, the model shows relatively significant deviation from the available data.

This region corresponds to the area where distributions of hydraulic properties are relatively complex (see Figures 3.7 and 3.8).

Figures 4.52 through 4.57 show the vertical chloride concentration profiles for the pre-development and 2004 conditions at the Seagrove, Destin, Lisa Jackson Park, Beal Cemetery, Freeport and EAFB Field 4 wells, respectively. The locations of these wells are shown in Figure 4.51e. Figures 4.52 to 4.57 show negligible simulated change in chloride profiles between the pre-development and 2004 conditions at these locations.

DSTRAM-simulated chloride concentrations from 1942 to 2004 were compared against observed concentrations at five wells as shown in Figures 4.58 through 4.62. The locations of these wells are presented in Figure 4.44. Three of the five wells are located around the eastern perimeter of the Choctawhatchee Bay. Comparisons between the simulated chloride concentration versus time curves and the observed chloride data for the Point Washington, the Van Butler, and the DWU #1 wells are shown in Figures 4.58 to 4.60, respectively. No significant change in concentration is noted in either the observations or simulated values in these wells. The model conservatively predicts chloride concentration at the Point Washington and Van Butler wells and slightly underpredicts chloride concentration at the DWU#1 well. At the Selma Madera and S. Matthews wells which are located along the eastern perimeter of the Choctawhatchee Bay, the model underpredicts chloride concentration (Figures 4.61 and 4.62, respectively). In addition, the model does not mimic the relative change in chloride concentration over the simulation period. The discrepancies encountered at these two wells may be attributable to uncertainty associated with parameters that govern vertical/lateral fluxes.

The parameters found to influence the distribution of chloride in the area around the eastern region of the Choctawhatchee Bay include: the vertical hydraulic conductivities in the Intermediate System and the Bucatunna Clay pinchout. The effects of these parameters are described in Chapter 5 and presented in Appendix A (Sensitivity Cases 3a, 3b, 5a, and 5b). Other factors include: variability of hydraulic conductivities and effective porosities (local heterogeneity) in the area. Transient concentration and head responses at the S. Matthew well suggest uneven horizontal pathways in the vicinity of, and between, this well and the down-gradient pumping area. If the model is to be utilized for evaluating saltwater intrusion potential in this area, it will be necessary to improve the agreement between the model and the area's local observations.

5.0 MODEL SENSITIVITY ANALYSIS

Parameter sensitivity analysis was conducted to quantify uncertainty in the calibrated model resulting from uncertainty in the estimates of aquifer parameters, stresses and boundary conditions. The analysis established the effect of model parameter uncertainty on both the model calibration and results. The effects of parameter changes were categorized in a manner that could be used to evaluate the predictive capability of the calibrated model. The effects of various model parameters on the calibrated model were examined by comparing observed head and chloride values to the simulated values resulting from a specific parameter change. Parameters to be investigated and their associated range of variation were selected based on input from the District and were considered important parameters governing saltwater intrusion within the domain.

The sensitivity analysis helps identify intrusion characteristics critical to the water supply system of the region and is used to assess model uncertainty. The ASTM (1994) guidelines were applied to categorize parameter sensitivity in a qualitative manner into one of four categories or types. Type I parameter sensitivities are those which cause insignificant changes in calibration residuals and model predictions. Type I parameter sensitivity is of no concern because, irrespective of the parameter value (within the range tested), the model prediction remains the same. Type II parameter sensitivities are those which cause a significant change in model calibration but do not result in significant changes in the model predictions. Type II parameter sensitivity is also of no concern because, regardless of the change in model parameter, the model prediction remains the same. Type III parameter sensitivities are those which result in both significant changes in calibration residuals and to model predictions. Type III parameter sensitivity is of no concern because even though the model's conclusions change as a result of variation of model input, the resultant model with changed parameter becomes un-calibrated. Type IV parameter sensitivities are those which cause insignificant changes in the model calibration and yet significant changes in the model's conclusions. Type IV parameter sensitivities exhibit greater uncertainty because the model predictions change over the range of parameter values in which the model can be considered calibrated. Additional data collection and model calibrations efforts are required to reduce uncertainty related to parameters of this type. In the analysis documented herein, changes were considered significant when their absolute values were greater than 30 percent of the base case for head, and 100 percent of the base case for chloride concentration. The criterion for concentration is larger than that for head because the range of concentration sensitivity is much larger than the range of head sensitivity.

A total of 15 sensitivity simulations were performed. Each sensitivity simulation consisted of applying a specified parameter change to the calibrated model input file and running this modified model to steady-state conditions. Each simulation contributed to establishing the effect of the parameter change on the pre-development distributions of heads and chlorides. Subsequently, transient pumpage was applied to the modified model, establishing the effect of the parameter change on the post-development (1998) head and chloride distribution. Table 5.1 includes a list of parameter changes applied in the 15 sensitivity simulations and the resulting calibration statistics. The conclusions assessed include: chloride concentration changes from pre-development to 1998 for the Upper Floridan Aquifer; groundwater seepage velocities in areas where saline water is known to exist; chloride concentrations for up-gradient saltwater interface areas; and total chloride mass contained within the model domain. The results below are divided into two parts: pre-development sensitivities and post-development sensitivities, and reported in Subsections 5.1 and 5.2, respectively.

5.1 PRE-DEVELOPMENT MODEL SENSITIVITIES

Figure 5.1 presents the root mean square (RMS) and the mean head difference $(\mu_{\text{sim. pre-dev. hd}} - \mu_{\text{sim. sensitivity hd}})$ calculated using the pre-development base case and each of the respective sensitivity simulations. Model error was not calculated for the pre-development sensitivities due to the very limited availability of pre-development observations. Instead, the RMS and mean head change from the base case pre-development model were calculated. The change was calculated at the model nodes specified in Tables 5.2 and 5.3, which are critical locations for the system in terms of drawdown. These are the same nodes used to calculate the post-development (1998) head errors and for the error statistics in Table 5.1. For the range of parameter variations selected for this study, the vertical hydraulic conductivity of the Intermediate System is the most sensitive with respect to pre-development head statistics. Increasing the Intermediate System vertical hydraulic conductivity by an order-of-magnitude (Case 3b) results in a mean head decline of 4.90 ft (RMS = 11.35 ft) from base-case results. Decreasing it by an order-of-magnitude (Case 3a) results in a mean head increase of 8.07 ft (RMS = 10.97 ft). For the remainder of the parameter variations, simulated pre-development heads are relatively insensitive.

Aquifer specific values of RMS and mean chloride difference $(\mu_{\text{sim. pre-dev. Cl}} - \mu_{\text{sim. sensitivity Cl}})$ for the pre-development sensitivity simulations are presented in Figure 5.2 (Upper Floridan Aquifer) and Figure 5.3 (Lower Floridan Aquifer). In calculating the RMS and mean chloride change from the base case pre-development model, model nodes specified in Tables 5.4 and 5.5 were used which are critical locations for the system in terms of chloride intrusion. These are the same nodes used to calculate the post-development (1998) chloride errors and the calibration statistics in Table 5.1. Increasing the vertical hydraulic conductivity of the Intermediate System by an order of magnitude (Case 3b) causes the largest deviation from base case results for both Upper and Lower Floridan aquifer statistics. The next largest effect on chlorides within the Upper and Lower Floridan aquifers results from lowering the aquifer material permeabilities by half (Case 2a), and from increasing the vertical hydraulic conductivity of the Sub-Floridan System by an order of magnitude (Case 5b). Case 5b yields greater solute fluxes in the domain, with increases in attendant concentration. These increases in concentration propagate into the Upper Floridan Aquifer. Case 2a yields a more sluggish flow system and greater solute retention, compared to the base case.

Specific model conclusions that were examined include pre-development chloride concentrations for selected Upper Floridan and Lower Floridan Aquifer areas in the vicinity of the saltwater interface. These areas are of interest because saline water is known to occur within the Floridan Aquifer at these general locations and under current conditions these areas are up-gradient of withdrawal wells.

The locations selected to represent the up-gradient interface areas for the Upper Floridan Aquifer and for the Lower Floridan Aquifer are shown in Figure 5.15. The specific model node numbers and layer numbers are presented in Tables 5.6 and 5.7, respectively. These areas are included here to assess the significance of the model predictions at these specific locations. Figure 5.4 presents the variation of RMS and mean chloride difference between the pre-development base case and each of the respective sensitivity simulations for the selected Upper Floridan Aquifer interface areas. Figure 5.5 presents the variation of RMS and mean chloride difference for the selected Lower Floridan Aquifer interface areas.

Chlorides concentrations for the Upper Floridan Aquifer interface areas are most sensitive to an order-of-magnitude increase in the Intermediate System vertical hydraulic conductivity (Case 3b) (Figure 5.4). Increasing the Intermediate System vertical hydraulic conductivity lowers head in the Upper Floridan Aquifer moving the saltwater interface closer to shore. Case 3b results in a significant change in the model conclusions, predicting that the saltwater is closer to shore, compared to the base case. However, the simulation also results in a significant change in the head calibration statistics (Table 5.1), indicating a Type III sensitivity. According to the ASTM (1994) guidelines, a Type III sensitivity is of no concern because, even though the model's conclusions change as a result of the variation of the input, the parameters used in the simulation cause the model to become un-calibrated. The next largest effect on chloride concentrations for the Upper Floridan Aquifer interface areas results from lowering the aquifer material permeabilities by half (Case 2a). However, the simulation also results in a significant change in the chloride calibration statistics (Table 5.1), indicating a Type III sensitivity.

From Figure 5.5, it is noted that increasing the Intermediate System vertical hydraulic conductivity by an order of magnitude (Case 3b) causes the greatest change in chloride concentrations for the Lower Floridan Aquifer interface area. However, this is a Type III sensitivity due to the significant effect of the parameter change on the head and chloride concentration calibration statistics (Table 5.1).

5.2 POST-DEVELOPMENT MODEL SENSITIVITIES

Figure 5.6 presents the RMS and mean head error ($\mu=\sum[hd_{1998obs}-hd_{1998sim}]/n_{obs}$) variation in the Upper and Lower Floridan aquifers for the base-case 1998 simulation and the various sensitivity simulations. Head observations for 1998 are given in Tables 5.2 and 5.3. Figure 5.7 presents the RMS and mean head difference between the post-development base case and each of the respective sensitivity simulations. Horizontal hydraulic conductivity of the Upper and Lower Floridan aquifers is the most sensitive parameter with respect to system head (Case 2). Decreasing Floridan aquifer conductivities by half (Case 2a) yields a simulated 1998 mean head change from the base case of 11.19 ft (RMS = 17.59 ft) lower than the base case, and increasing Floridan aquifer conductivities by a factor of 1.5 (Case 2b) gives a simulated change of -4.75 ft for the mean head (RMS = 6.97 ft). Other cases with fairly high head sensitivities include the Intermediate System vertical hydraulic conductivity (Cases 3a and 3b), and increasing Sub-Floridan System vertical hydraulic conductivities (Case 5b).

Figures 5.8 and 5.9 present the RMS and mean chloride error for the base-case 1998 simulation and all sensitivity simulations in the Upper and Lower Floridan Aquifers, respectively. Post-development chloride observations are provided in Tables 5.4 and 5.5. Figures 5.10 and 5.11 present the difference in RMS and mean chloride concentrations between the base-case 1998 simulation and each of the respective sensitivity simulations. The largest concentration error for both Upper and Lower Floridan aquifers occurs for Case 3b, whereby the Intermediate System vertical hydraulic conductivity value is increased by an order of magnitude. Figures 5.8 and 5.9 indicate relatively insignificant changes in the simulated chloride error for several of the sensitivity simulations. The sensitivity responses in Figures 5.10 and Figure 5.11 are similar to the respective pre-development cases of Figures 5.2 and 5.3, indicating that the chloride distribution at pre-development is the key factor to minimizing the post-development chloride error, as opposed to chloride movement from pre-development to post-development.

The RMS and simulated mean drawdowns ($\mu= \sum[hd_{pre\text{-}dev.sim}-hd_{1998sim}]/n_{obs}$) of the Floridan Aquifer System are given in Figure 5.12, for the base case and all sensitivity simulations. The calculated RMS and mean drawdowns incorporate both the Upper and Lower Floridan aquifers. Drawdowns were calculated at the nodes used to calculate post-development (1998) head errors. Node locations are given in Tables 5.2 and 5.3. The least amount of drawdown is noted for an increase in the Intermediate System vertical hydraulic conductivity by an order of magnitude (Case 3b). This sensitivity more effectively dissipates pumping stress into the overlying boundary condition, resulting in less aquifer drawdown. The most drawdown is noted for a decrease in the Intermediate System vertical hydraulic conductivity by an order of magnitude (Case 3a), and for a decrease in the horizontal hydraulic conductivity of the aquifers (Case 2a).

For the base case and the sensitivity simulations, the changes in RMS and mean chloride concentrations from pre- to post-development conditions for the Upper and Lower Floridan aquifers are shown in Figures 5.13 and 5.14, respectively. These figures show the degree of intrusion that occurs as a result of the transient pumping history from pre- to post-development at the locations given in Tables 5.4 and 5.5. For both the Upper and Lower Floridan Aquifers, the transient pumping history imparts very little increase in the simulated chloride concentrations at the observation points. This is consistent with existing observations which show little chloride change with time. It is important, however, to note the limited number of historical chloride observations, and more importantly, that the existing chloride observations are biased, in that they represent the freshest portion of the flow system. Considering these chloride sensitivity simulations for the Upper Floridan Aquifer, all 15 sensitivities may be categorized as Type I and therefore chloride intrusion from pre- to post-development conditions is insensitive to the parameter changes.

Specific post-development model conclusions that were examined include seepage velocities, head and chloride values for the Upper Floridan Aquifer saltwater interface areas; seepage velocities, head and chloride values for the Lower Floridan Aquifer saltwater interface areas; and seepage velocities within the Intermediate System beneath the Choctawhatchee Bay and the near shore Gulf of Mexico. Model sensitivities were calculated at selected nodes or elements as shown in Figure 5.15. Additional node information is provided in Tables 5.6 and 5.7. Additional element information is provided in Tables 5.8, 5.9 and 5.10. Table 5.11 provides a summary of these model results.

The simulated groundwater seepage velocities essentially represent the rate of saltwater intrusion at these specific locations. The seepage velocities are important conclusions of the model and are specifically examined here since the velocities directly influence the sustainability of current and future groundwater withdrawal rates. Table 5.12 shows the sensitivity of the Upper Floridan

Aquifer horizontal groundwater seepage velocity and bearing at selected interface areas to the various parameters, along with ASTM sensitivity type, as determined for the mean seepage velocity. The largest sensitivity results from the change in the vertical hydraulic conductivity of the Intermediate System (Case 3b). An order of magnitude of change in the vertical hydraulic conductivity resulted in a 184 percent increase in seepage velocity. However, this parameter change significantly affects calibration statistics, therefore exhibiting a Type III sensitivity. The second largest sensitivity results from the change in porosity (Case 1) which resulted in a 67 percent increase in seepage velocity. All other sensitivity cases resulted in seepage velocity changes of less than 35 percent. In Table 5.12, changes were considered significant when their absolute values were greater than 30 percent of the base case for head and groundwater velocity, and 100 percent of the base case for chloride concentration.

Table 5.13 shows the sensitivity of Lower Floridan Aquifer horizontal groundwater seepage velocity and bearing at selected interface areas to the various parameters, along with ASTM sensitivity type as determined for the mean seepage velocity. The largest sensitivity is to the vertical hydraulic conductivity of the Intermediate System (Case 3b). One order of magnitude of change in the vertical hydraulic conductivity resulted in a 167 percent increase in seepage velocity. The second largest sensitivities are to the cases of increased contrast among Lower Floridan aquifer (Cases 8 and 9) which resulted in a 58 to 69 percent increase in seepage velocity. These large increases in average velocity can be attributed to the two elements situated in relatively leaky areas adjacent to a model boundary (Choctawhatchee River). The simulation is also sensitive to the porosity, showing a 58 percent increase in seepage velocity. All other sensitivity cases resulted in seepage velocity changes of less than 37 percent.

Table 5.14 shows the sensitivity of vertical groundwater seepage velocity through the Intermediate System in the bay and near-shore Gulf of Mexico, along with ASTM sensitivity type, as determined for the mean seepage velocity. It was noted that the direction of seepage velocity in one element is different from the others. Therefore, the averages of absolute seepage velocities were used in the analysis. The vertical groundwater seepage velocity is most sensitive to the Intermediate System vertical hydraulic conductivity. The largest absolute seepage rate occurs when the Intermediate System vertical conductivity is increased by a factor of 10 (Case 3b). The absolute seepage velocity is the smallest for the case where the vertical conductivity is decreased by a factor of 0.1 (Case 3a). However, Cases 3a and 3b result in a significant change in the head and chloride distributions (Figures 5.6, 5.8, and 5.9) and a significant change in the conclusion (vertical seepage velocity lower (3a), higher (3b) than the base case simulation), indicating a Type III sensitivity.

In Table 5.14, the seepage velocity through the Intermediate System is also sensitive to a decrease in aquifer horizontal hydraulic conductivity (Case 2a). The reduction of the hydraulic conductivity results in additional drawdown (Figure 5.12) and an increase in gradients and seepage velocities. Case 2a results in a moderate change to the chloride calibration statistics (Table 5.1), indicating a Type III sensitivity.

It is important to note that a porosity change from 25 percent to 15 percent results in a 67 percent increase in the seepage velocity (rate of saltwater intrusion) at each of the three locations identified above while producing an insignificant change in the model calibration. Thus the model exhibits a Type IV sensitivity to porosity, indicating uncertainty in the actual rate of intrusion. Case 1 demonstrates the actual rate of intrusion predicted by the base-case model may be up to 1.67 times the rate predicted by the base case model. However, Figure 5.13 shows that no significant simulated chloride change occurred from pre-development to 1998 as a result of the lower porosity and associated change in seepage velocity.

6.0 SUMMARY AND CONCLUSIONS

The construction and calibration of the Eastern Domain saltwater model provide significant insight into the dynamics of groundwater flow and saltwater transport within the Floridan Aquifer System in the area encompassing coastal Okaloosa and Walton Counties. The model helps to fill gaps in the database regarding the likely location of saltwater in the subsurface and to quantify rates of saltwater intrusion. The following bulleted items summarize the key points and findings from this study.

- Significant development of the Floridan Aquifer as a source of water supply for Okaloosa and Walton Counties began in the 1940s.

- Prior to 1940, Floridan Aquifer water levels were in the range of 60 ft in coastal Okaloosa County to 25 ft in coastal Walton County, above sea level. Fresh groundwater flowed in a generally southerly to south-southeasterly direction to discharge points near the coast.

- During the late 1950s, as the water supply for this area was developed, groundwater levels within the Floridan Aquifer in the Fort Walton Beach coastal area declined by as much as 95 ft. Because of this decline, groundwater flow along the coast has reversed. Groundwater now flows from offshore areas northward in the direction of coastal withdrawal wells.

- By 2004, Floridan Aquifer groundwater withdrawals in Okaloosa and Walton Counties had risen to an average of 34 Mgal/day. The increase in groundwater withdrawal from the 1940s to 2004 has caused Floridan Aquifer water levels along the coast to decline to more than 100 ft below sea level.

- Simulated river discharge accounts for approximately 40 percent of the total outward flow during the pre-development period. Because of pumping during the post-development period, the simulated discharge rate decreased to 35 percent in 2004. Discharge from the Choctawhatchee River plays a significant role within the hydrologic system of the eastern domain. The Choctawhatchee River appears to act as a major discharge water body and, as a consequence, a dividing line with locations to the east having a fairly separate flow system from the major post-development cone of depression to its west. Discharge rate through the Intermediate System from the Upper Floridan Aquifer is significant in the vicinity of the Choctawhatchee River.

- The developed model shows that the existing water quality monitoring system is not sufficient for detecting intrusion. Most of the monitoring points are either water supply wells or monitoring wells located too far inland to experience any water quality degradation in the near future.

- Upper Floridan Aquifer water with chlorides below the secondary drinking water standard of 250 mg/L is known to exist onshore in coastal Okaloosa County. Model simulations predict that water of similar quality (<250 mg/L) extends approximately five miles to the south of Fort Walton Beach.

- Model simulations indicate the principal pathways of saltwater intrusion are: lateral intrusion within the Upper Floridan Aquifer from beneath the Gulf, lateral intrusion within the Lower Floridan Aquifer with vertical migration into the Upper Floridan Aquifer where the Bucatunna Clay confining unit is absent, and downward vertical leakage through the Intermediate System.

- Although the response of water levels to a change in pumping or development is relatively fast (on the order of years or decades) the response of saltwater movement is much slower (on the order of decades or centuries). Therefore, saltwater will continue to move inland even though water levels may have stabilized following development of water supplies.

- The pre-development chloride distribution for onshore areas is most sensitive to the increase of the Intermediate System hydraulic conductivity. However, this parameter is of no concern because it belongs to the ASTM Type III sensitivity category. The pre-development model is also sensitive, to a lesser degree, to: decrease in the Floridan Aquifer horizontal hydraulic conductivity, increase in the Sub-Floridan System vertical hydraulic conductivity, and increase in the hydraulic head applied to the Sub-Floridan System.

- Seepage velocities are important since they directly influence the rate of saltwater intrusion, and consequently the sustainability of current and future groundwater withdrawal rates. The simulated seepage velocities during the pre- to post-development periods are particularly sensitive to the porosity of the Floridan Aquifer. Floridan Aquifer porosity is not determinable by direct measurement, and thus, is subject to significant uncertainty. For predictive analyses, special attention must be given to this parameter.

- Simulated post-development rates of saltwater intrusion within the Upper Floridan Aquifer are on the order of 4 to 8 ft per year. Simulated post-development rates of saltwater intrusion in the Lower Floridan Aquifer are on the order of 8-22 ft per year. Model sensitivity to porosity shows the actual rate of intrusion may be significantly greater than simulated.

- Although not specifically addressed in this report, leakage of saline water into the Floridan Aquifer via leaky, abandoned well casings can significantly shorten the timescales associated with noticeable water quality degradation. The model also cannot address localized saltwater intrusion problems that may result from undetected pockets of saltwater, multi-scale heterogeneities that serve as uneven conduits for saltwater flow, well construction problems, or improperly plugged boreholes which penetrate the Bucatunna Clay.

- All entities with responsibility related to the use and/or management of this resource need to continue and improve the monitoring of the Floridan Aquifer System for evidence of saltwater intrusion. This information will be critical for future efforts to refine this model and is necessary to timely adapt to the inevitable deterioration in water quality that will come as a result of continued resource utilization at or near current levels.

- The model has demonstrated that, based on the currently available data, it can be used to simulate migration of seawater within the eastern model domain. However, the current model has displayed deviation from the observed data in a small area in the vicinity of the eastern perimeter of the Choctawhatchee Bay. It is recommended that the model's parameters local to this area be further refined to improve the agreement between the model and observed data in the eastern portion of the Choctawhatchee Bay. Future site investigation in this area may be necessary to better characterize the area's hydraulic and transport properties and conditions.

- In order to utilize the developed model as a predictive and management tool on a long-term basis, it is recommended that an annual post-audit program be implemented for the model. Such a program would allow the model to be continually verified with future observations so as to maintain the model's predictive capability and to identify areas where the model needs to be updated in the future.

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TABLES

Table 2.1
Variation of Chloride Content with Depth for the FREEPORT REMOTE OBS (7233) Well

Freeport Remote Observation Well	
estimated chloride concentration (mg/L)	**point sample interval (ft below land surface)**
0	250
0	350
0	450
0	530
0	575
21	595
500	610
4300	650
5300	700
7100	750
8900	770

Note: Chloride concentrations estimated from fluid resistivity logs.

Table 2.2
Variation of Chloride Content with Depth for the WRP LOWER FLRD TEST (7260) Well

WRP Lower Floridan Monitor Well	
measured chloride concentration (mg/L)	**midpoint of sampled interval (ft below land surface)**
1200	948
1590	980
2240	1020
2930	1060
3860	1075
6370	1110
7280	1150
7790	1185
8600	1220
9580	1320
16900	1402

Note: Chloride concentrations obtained from packer samples.

Table 2.3
Variation of Chloride Content with Depth for the NWFWMD TIGER POINT (7686) Well

NWFWMD Tiger Point Upper Floridan Monitor Well	
measured chloride concentration (mg/L)	**depth of penetration at time of sample collection (ft below land surface)**
340	1200
390	1220
410	1240
420	1260
520	1280
590	1300

Note: Chloride concentrations obtained from drill stem samples.

Table 4.1
Water Balance for Pre-Development Conditions

	Flow In (Mgal/day)	Percent of Total	Flow Out (Mgal/day)	Percent of Total
Northern Boundary	41.58	15.78	16.76	6.36
Southern Boundary	1.36	0.52	0.84	0.32
Eastern Boundary	144.35	54.78	107.84	40.93
Western Boundary	3.30	1.25	2.86	1.09
Top Boundary	72.16	27.38	26.93	10.22
Bottom Boundary	0.77	0.29	0.00	0.00
Spring/River Boundary	0.00	0.00	108.28	41.09
Total	263.52	100.00	263.51	100.00

Table 4.2
Chloride Balance for Pre-Development Conditions

	Advective Flux				Dispersive Flux			
	Flow In (Kg/day)	Percent of Total	Flow Out (Kg/day)	Percent of Total	Flow In (Kg/day)	Percent of Total	Flow Out (Kg/day)	Percent of Total
Northern Boundary	0	0.00	0	0.00	4	0.05	25	0.74
Southern Boundary	98845	30.89	49317	15.79	1407	19.51	11	0.31
Eastern Boundary	56274	17.59	69589	22.27	123	1.71	28	0.80
Western Boundary	115480	36.09	143133	45.82	2715	37.65	99	2.86
Top Boundary	24752	7.73	48505	15.53	53	0.73	612	17.73
Bottom Boundary	24655	7.70	5	0.00	2911	40.35	2675	77.56
Spring/River Boundary	0	0.00	1866	0.60	0	0.00	0	0.00
Total	320006	100.00	312415	100.00	7213	100.00	3449	100.00

Table 4.3a
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
681	PANAMA CITY BCH #11	0	0	0	0	0	0	0	0	0
684	PANAMA CITY BCH #5	0	0	0	0	0	-125000	-150000	-175000	-133333.3
685	PANAMA CITY BCH #6	0	0	0	0	0	0	0	0	0
739	PANAMA CITY BCH #1	0	0	0	0	0	0	0	0	0
743	PANAMA CITY BCH #9	0	0	0	0	0	0	0	0	0
745	PANAMA CITY BCH #4	0	0	0	0	0	0	0	0	0
747	PANAMA CITY BCH #2	0	0	0	0	0	0	0	0	0
756	PANAMA CITY BCH #3	0	0	0	0	0	0	0	0	0
765	PANAMA CITY BCH #13	0	0	0	0	0	0	0	0	0
768	PANAMA CITY BCH #10	0	0	0	0	0	0	0	0	0
794	PANAMA CITY BCH #12	0	0	0	0	0	0	0	0	0
863	INLET BEACH #2	0	0	0	0	0	0	0	0	0
891	SANDCLIFFS	0	0	0	0	0	0	0	0	0
909	CAMP CREEK S/D #1	0	0	0	0	0	0	0	0	0
922	FCSC #5A	0	0	0	0	0	0	0	0	0
1000	FCSC #3	0	0	0	0	0	0	0	0	0
1011	SEAGROVE #2	0	0	0	0	0	0	0	0	0
1018	SEAGROVE #1	0	0	0	0	0	0	0	0	0
1043	FCSC #10	0	0	0	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0	0	0	0
1074	VAN BUTLER	0	0	0	0	0	0	0	0	0
1136	FCSC #12	0	0	0	0	0	0	0	0	0
1430	SWU #1	0	0	0	0	0	0	0	0	0
1431	SWU #4	0	0	0	0	0	0	0	0	0
1445	SWU #5	0	0	0	0	0	0	0	0	0
1453	SWU #2	0	0	0	0	0	0	0	0	0
1476	SWU #3	0	0	0	0	0	0	0	0	0
1481	SWU #6	0	0	0	0	0	0	0	0	0
1586	DWU #7	0	0	0	0	0	0	0	0	0

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
1601	DWU #2	0	0	0	0	0	0	0	0	0
1604	US COAST GUARD #1	0	0	0	0	0	0	0	0	0
1611	DWU #8	0	0	0	0	0	0	0	0	0
1654	DWU #3	0	0	0	0	0	0	0	0	0
1661	DWU #9	0	0	0	0	0	0	0	0	0
1687	DWU #1	0	0	0	0	0	0	0	0	0
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	0	0	0	0	0
1710	ISL-2 (EAST TANK)	0	0	0	0	0	0	0	0	0
1714	ISL-4 (TREAT PLANT)	0	0	0	0	0	0	0	0	0
1736	EAFB A-6 BLDG 8552	0	0	0	0	0	0	0	0	0
1742	ISL-6 (EL MATADOR)	0	0	0	0	0	0	0	0	0
1796	DWU #5	0	0	0	0	0	0	0	0	0
1838	DWU #4	0	0	0	0	0	0	0	0	0
1901	FWB #1	0	0	0	0	0	0	0	0	-101666.7
1940	MARY ESTHER #3	0	0	0	0	0	0	0	0	0
2023	MARY ESTHER #1	0	0	0	0	0	0	0	0	0
2031	MARY ESTHER #4	0	0	0	0	0	0	0	0	0
2035	MARY ESTHER #2	0	0	0	0	0	0	0	0	0
2085	FWB #5	0	0	0	0	-70500	-91000	-111500	-132000	-101666.7
2093	FWB #2	-50000	-67000	-83000	-100000	-70500	-91000	-111500	-132000	-101666.7
2099	FWB #3	0	0	0	0	0	0	0	0	0
2108	FWB #8	0	0	0	0	0	0	0	0	0
2139	FWB #9	0	0	0	0	0	0	0	0	0
2146	FWB #11	0	0	0	0	0	0	0	0	0
2168	EAFB HURL #7 #91136	0	0	0	0	0	0	0	0	0
2236	OC-9 (NORTHGATE)	0	0	0	0	0	0	0	0	0
2365	FCSC #11	0	0	0	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-100000	-124000	-148000	-172000	-196000	-220000	-244000	-268000	-292000

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
2463	OC-10 (LOWERY)	0	0	0	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	0	0	0	0	0	0	0	0	0
2508	OC-4 (GREEN STREET)	0	0	0	0	0	0	0	0	0
2554	OC-6 (HAWKINS ROAD)	0	0	0	0	0	0	0	0	0
2581	OC-5 (SHALIMAR)	-100000	-124000	-148000	-172000	-196000	-220000	-244000	-268000	-292000
2584	OC-7(SHALIMAR ANNEX)	0	0	0	0	0	0	0	0	0
2651	MOODY KELLY #1	0	0	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	0	0	0	0	0	0	0	0	0
2750	EAFB HOUS #12 #2829	0	0	0	0	0	0	0	0	0
2758	FWB #7	0	0	0	0	0	0	0	0	0
2759	OC-8 (GREEN ACRES)	0	0	0	0	0	0	0	0	0
2762	EAFB HOUS #16 #2755	0	0	0	0	0	0	0	0	0
2787	EAFB HOUS #11 #10634	0	0	0	0	0	0	0	0	0
2792	FWB #10	0	0	0	0	0	0	0	0	0
2807	FWB #6	0	0	0	0	0	0	0	0	0
2814	BLUEWATER #4	0	0	0	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	0	0	0	0	0	0	0	0	0
2825	EAFB HOUS #8 #2594	0	0	0	0	0	0	0	0	0
2860	EAFB HOUS #9 #10000	0	0	0	0	0	0	0	0	0
2874	OC-2 (LONGWOOD)	-100000	-124000	-148000	-172000	-196000	-220000	-244000	-268000	-292000
2884	EAFB HOUS #7 #2590	0	0	0	0	0	-301400	-321600	-342000	-362200
2891	BLUEWATER #2	0	0	0	0	0	0	0	0	0
2909	SOUTH GOLF COURSE	0	0	0	0	0	0	0	0	0
2953	SEMINOLE #5	0	0	0	0	0	0	0	0	0
2958	EAFB HOUS #14 #1308	0	0	0	0	0	0	0	0	0
2971	SEMINOLE #1	0	0	0	0	0	0	0	0	0
2972	SEMINOLE #6	0	0	0	0	0	0	0	0	0
2973	WELL #6	0	0	0	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	0	0	0	0	0	0	0	0	0
2985	EAFB MAIN #4 #303	-250000	-275250	-300750	-326000	-351250	-301400	-321600	-342000	-362200

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
3004	EAFB HOUS #15 #1320	0	0	0	0	0	0	0	0	0
3012	EAFB MAIN #3 #31	-250000	-275250	-300750	-326000	-351250	-301400	-321600	-342000	-362200
3015	EAFB MAIN #6 #62	0	0	0	0	0	0	0	0	0
3026	OLD GOLF COURSE #1	0	0	0	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	-250000	-275250	-300750	-326000	-351250	-301400	-321600	-342000	-362200
3049	SEMINOLE #2	0	0	0	0	0	0	0	0	0
3057	SEMINOLE #3	0	0	0	0	0	0	0	0	0
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-250000	-275250	-300750	-326000	-351250	-301400	-321600	-342000	-362200
3091	BLUEWATER #3	0	0	0	0	0	0	0	0	0
3095	FREEPORT #2	-20000	-21000	-22000	-22000	-23000	-24000	-25000	-26000	-26000
3126	VALPARAISO #4	0	0	0	0	0	0	0	0	0
3231	NICEVILLE #8	0	0	0	0	0	0	0	0	0
3240	VALPARAISO #2	0	0	0	0	0	0	0	0	0
3256	NICEVILLE #2	0	0	0	0	0	0	0	0	0
3258	VALPARAISO #1	0	0	0	-30000	-35000	-39000	-44000	-48000	-53000
3295	VALPARAISO #3	0	0	0	0	0	0	0	0	0
3304	REDBAY GOLF #1	0	0	0	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0	0	0	0
3326	NICEVILLE #6	0	0	0	0	0	0	0	0	0
3350	NICEVILLE #1	0	0	0	0	0	0	0	0	-100000
3367	NICEVILLE #3	0	0	0	0	0	0	0	0	0
3432	NICEVILLE #10	0	0	0	0	0	0	0	0	0
3457	NICEVILLE #5	0	0	0	0	0	0	0	0	0
3482	NICEVILLE #4	0	0	0	0	0	0	0	0	0
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-50000	-24500	-24500	-24000	-24000	-23500	-23500	-23000	-23000
4376	EAFB FLD#3 BLDG#3102	0	-24500	-24500	-24000	-24000	-23500	-23500	-23000	-23000

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
5837	FCSC #2A	0	0	0	0	0	0	0	0	0
5838	FCSC #1	0	0	0	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	0	0	0	0	0
5886	FREEPORT #4	0	0	0	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0	0	0	0
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0	0	0	0
6023	VILLA TASSO #1	0	0	0	0	0	0	0	0	0
6024	VILLA TASSO #2	0	0	0	0	0	0	0	0	0
6796	CHOCTAW BCH #2	0	0	0	0	0	0	0	0	0
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0	0	0	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	0	0	0	0	0	0	0	0	0
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	0	0	0	0
8225	VALPARAISO #5	0	0	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0	0	0

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1942 Pumping (gpd)	1943 Pumping (gpd)	1944 Pumping (gpd)	1945 Pumping (gpd)	1946 Pumping (gpd)	1947 Pumping (gpd)	1948 Pumping (gpd)	1949 Pumping (gpd)	1950 Pumping (gpd)
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0	0	0
	Total	-1420000	-1610000	-1801000	-2020000	-2240000	-2584000	-2829000	-3073000	-3350333.4

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
681	PANAMA CITY BCH #11	0	0	0	0	0	0	0	0
684	PANAMA CITY BCH #5	-150333	-167000	-183667	-200333	-217000	-233667	-250333	-267000
685	PANAMA CITY BCH #6	0	0	0	0	0	0	0	0
739	PANAMA CITY BCH #1	0	0	0	0	0	0	0	0
743	PANAMA CITY BCH #9	0	0	0	0	0	0	0	0
745	PANAMA CITY BCH #4	0	0	0	0	0	0	0	0
747	PANAMA CITY BCH #2	0	0	0	0	0	0	0	0
756	PANAMA CITY BCH #3	0	0	0	0	0	0	0	0
765	PANAMA CITY BCH #13	0	0	0	0	0	0	0	0
768	PANAMA CITY BCH #10	0	0	0	0	0	0	0	0
794	PANAMA CITY BCH #12	0	0	0	0	0	0	0	0
863	INLET BEACH #2	0	0	0	0	0	0	0	0
891	SANDCLIFFS	0	0	0	0	0	0	0	0
909	CAMP CREEK S/D #1	0	0	0	0	0	0	0	0
922	FCSC #5A	0	0	0	0	0	0	0	0
1000	FCSC #3	0	0	0	0	0	0	0	0
1011	SEAGROVE #2	0	0	0	-10000	-11000	-12000	-13000	-14000
1018	SEAGROVE #1	0	0	0	0	0	0	0	0
1043	FCSC #10	0	0	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0	0	0
1074	VAN BUTLER	0	0	0	0	0	0	0	0
1136	FCSC #12	0	0	0	0	0	0	0	0
1430	SWU #1	0	0	0	0	0	0	0	0
1431	SWU #4	0	0	0	0	0	0	0	0
1445	SWU #5	0	0	0	0	0	0	0	0
1453	SWU #2	0	0	0	0	0	0	0	0
1476	SWU #3	0	0	0	0	0	0	0	0
1481	SWU #6	0	0	0	0	0	0	0	0
1586	DWU #7	0	0	0	0	0	0	0	0

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
1601	DWU #2	0	0	0	0	0	0	0	0
1604	US COAST GUARD #1	0	0	0	0	0	0	0	0
1611	DWU #8	0	0	0	0	0	0	0	0
1654	DWU #3	0	0	0	0	0	0	0	0
1661	DWU #9	0	0	0	0	0	0	0	0
1687	DWU #1	0	0	0	0	0	0	0	0
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	0	0	0	0
1710	ISL-2 (EAST TANK)	0	0	0	0	0	0	0	0
1714	ISL-4 (TREAT PLANT)	0	0	0	0	-100000	-112500	-125000	-137500
1736	EAFB A-6 BLDG 8552	0	0	0	0	0	0	-33333.3	-36000
1742	ISL-6 (EL MATADOR)	0	0	0	0	0	0	0	0
1796	DWU #5	0	0	0	0	0	0	0	0
1838	DWU #4	0	0	0	0	0	0	0	0
1901	FWB #1	-115000	-128667	-142333	-156000	-169667	-183333	-186000	-234500
1940	MARY ESTHER #3	0	0	0	0	0	0	0	0
2023	MARY ESTHER #1	0	0	0	0	0	0	0	-150000
2031	MARY ESTHER #4	0	0	0	0	0	0	0	0
2035	MARY ESTHER #2	0	0	0	0	0	0	0	0
2085	FWB #5	-115000	-128667	-142333	-156000	-169667	-183333	-186000	-234500
2093	FWB #2	-115000	-128667	-142333	-156000	-169667	-183333	-186000	-234500
2099	FWB #3	0	0	0	0	0	0	-186000	-234500
2108	FWB #8	0	0	0	0	0	0	0	0
2139	FWB #9	0	0	0	0	0	0	0	0
2146	FWB #11	0	0	0	0	0	0	0	0
2168	EAFB HURL #7 #91136	0	0	0	0	0	0	0	0
2236	OC-9 (NORTHGATE)	0	0	0	0	0	0	0	0
2365	FCSC #11	0	0	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-316000	-339667	-363667	-387667	-411667	-435667	-459667	-483667

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
2463	OC-10 (LOWERY)	0	0	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	0	0	0	0	0	0	0	0
2508	OC-4 (GREEN STREET)	0	0	0	0	0	0	0	0
2554	OC-6 (HAWKINS ROAD)	0	0	0	0	0	0	0	0
2581	OC-5 (SHALIMAR)	-316000	-339667	-363667	-387667	-411667	-435667	-459667	-483667
2584	OC-7(SHALIMAR ANNEX)	0	0	0	0	0	0	0	0
2651	MOODY KELLY #1	0	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	0	0	0	0	0	0	0	0
2750	EAFB HOUS #12 #2829	0	0	0	0	0	0	0	0
2758	FWB #7	0	0	0	0	0	0	0	0
2759	OC-8 (GREEN ACRES)	0	0	0	0	0	0	0	0
2762	EAFB HOUS #16 #2755	0	0	0	0	0	0	0	0
2787	EAFB HOUS #11 #10634	0	0	0	0	0	0	0	0
2792	FWB #10	0	0	0	0	0	0	0	0
2807	FWB #6	0	0	0	0	0	0	0	0
2814	BLUEWATER #4	0	0	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
2825	EAFB HOUS #8 #2594	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
2860	EAFB HOUS #9 #10000	0	0	0	0	0	0	-252000	-238364
2874	OC-2 (LONGWOOD)	-316000	-339667	-363667	-387667	-411667	-435667	-459667	-483667
2884	EAFB HOUS #7 #2590	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
2891	BLUEWATER #2	0	0	0	0	0	0	0	0
2909	SOUTH GOLF COURSE	0	0	0	0	0	0	0	0
2953	SEMINOLE #5	0	0	0	0	0	0	0	0
2958	EAFB HOUS #14 #1308	0	0	0	0	0	0	0	0
2971	SEMINOLE #1	0	0	0	0	0	0	0	0
2972	SEMINOLE #6	0	0	0	0	0	0	0	0
2973	WELL #6	0	0	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	0	0	0	0	0	0	-252000	-238364
2985	EAFB MAIN #4 #303	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
3004	EAFB HOUS #15 #1320	0	0	0	0	0	0	0	-238364
3012	EAFB MAIN #3 #31	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
3015	EAFB MAIN #6 #62	0	0	0	0	0	0	-252000	-238364
3026	OLD GOLF COURSE #1	0	0	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
3049	SEMINOLE #2	0	0	0	0	0	0	0	0
3057	SEMINOLE #3	0	0	0	0	0	0	0	0
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-273143	-287714	-302143	-316571	-331143	-345571	-252000	-238364
3091	BLUEWATER #3	0	0	0	0	0	0	0	0
3095	FREEPORT #2	-27000	-28000	-29000	-29000	-30000	-31000	-32000	-33000
3126	VALPARAISO #4	0	0	0	0	0	0	0	0
3231	NICEVILLE #8	0	0	0	0	0	0	0	0
3240	VALPARAISO #2	0	0	0	0	0	0	0	0
3256	NICEVILLE #2	0	0	0	0	0	0	0	0
3258	VALPARAISO #1	-57000	-62000	-66000	-71000	-75000	-80000	-95000	-111000
3295	VALPARAISO #3	0	0	0	0	0	0	0	0
3304	REDBAY GOLF #1	0	0	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0	0	0
3326	NICEVILLE #6	0	0	0	0	0	0	0	0
3350	NICEVILLE #1	-62500	-75000	-87500	-100000	-112500	-125000	-144500	-164000
3367	NICEVILLE #3	0	0	0	0	0	0	0	0
3432	NICEVILLE #10	0	0	0	0	0	0	0	0
3457	NICEVILLE #5	0	0	0	0	0	0	0	0
3482	NICEVILLE #4	-62500	-75000	-87500	-100000	-112500	-125000	-144500	-164000
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-22500	-22500	-22000	-22000	-21500	-21500	-21000	-21000
4376	EAFB FLD#3 BLDG#3102	-22500	-22500	-22000	-22000	-21500	-21500	-21000	-21000

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
5837	FCSC #2A	0	0	0	0	0	0	0	0
5838	FCSC #1	0	0	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	0	0	0	0
5886	FREEPORT #4	0	0	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0	0	0
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0	0	0
6023	VILLA TASSO #1	0	0	0	0	0	0	0	0
6024	VILLA TASSO #2	0	0	0	0	0	0	0	0
6796	CHOCTAW BCH #2	0	0	0	0	0	0	0	0
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0	0	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	0	0	0	0	-100000	-112500	-125000	-137500
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	0	0	0
8225	VALPARAISO #5	0	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0	0

Table 4.3a (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1942–1958

NWF_ID	Well Name	1951 Pumping (gpd)	1952 Pumping (gpd)	1953 Pumping (gpd)	1954 Pumping (gpd)	1955 Pumping (gpd)	1956 Pumping (gpd)	1957 Pumping (gpd)	1958 Pumping (gpd)
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0	0
	Total	-3609333	-3871000	-4130666	-4401333	-4863001	-5150667	-5647667	-6267000

Table 4.3b
Pumping for the Transient Post-Development DSTRAM Simulation 1959–1969

NWF_ID	Well Name	1959 Pumping (gpd)	1960 Pumping (gpd)	1961 Pumping (gpd)	1962 Pumping (gpd)	1963 Pumping (gpd)	1964 Pumping (gpd)	1965 Pumping (gpd)	1966 Pumping (gpd)	1967 Pumping (gpd)	1968 Pumping (gpd)	1969 Pumping (gpd)
681	PANAMA CITY BCH #11	0	0	0	0	0	0	0	0	0	0	0
684	PANAMA CITY BCH #5	-284000	-300667	-238000	-250500	-263000	-220400	-230400	-240400	-208833	-217167	-193286
685	PANAMA CITY BCH #6	0	0	0	0	0	0	0	0	0	0	0
739	PANAMA CITY BCH #1	0	0	-238000	-250500	-263000	-220400	-230400	-240400	-208833	-217167	-193286
743	PANAMA CITY BCH #9	0	0	0	0	0	0	0	0	0	0	0
745	PANAMA CITY BCH #4	0	0	0	0	0	0	0	0	0	0	-193286
747	PANAMA CITY BCH #2	0	0	0	0	0	-220400	-230400	-240400	-208833	-217167	-193286
756	PANAMA CITY BCH #3	0	0	0	0	0	0	0	0	-208833	-217167	-193286
765	PANAMA CITY BCH #13	0	0	0	0	0	0	0	0	0	0	0
768	PANAMA CITY BCH #10	0	0	0	0	0	0	0	0	0	0	0
794	PANAMA CITY BCH #12	0	0	0	0	0	0	0	0	0	0	0
863	INLET BEACH #2	0	0	0	0	0	0	0	0	0	0	0
891	SANDCLIFFS	0	0	0	0	0	0	0	0	0	0	0
909	CAMP CREEK S/D #1	0	0	0	0	0	0	0	0	0	0	0
922	FCSC #5A	0	0	0	0	0	0	0	0	0	0	0
1000	FCSC #3	0	0	0	0	0	0	0	0	0	0	0
1011	SEAGROVE #2	-7500	-8000	-8500	-9000	-9000	-9500	-10000	-10500	-11000	-11500	-12000
1018	SEAGROVE #1	-7500	-8000	-8500	-9000	-9000	-9500	-10000	-10500	-11000	-11500	-12000
1043	FCSC #10	0	0	0	0	0	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0	0	0	0	0	0
1074	VAN BUTLER	0	-5000	-5000	-6000	-6000	-6000	-7000	-7000	-7000	-8000	-8000
1136	FCSC #12	0	0	0	0	0	0	0	0	0	0	0
1430	SWU #1	0	0	0	0	0	0	0	0	0	0	-40000
1431	SWU #4	0	0	0	0	0	0	0	0	0	0	0
1445	SWU #5	0	0	0	0	0	0	0	0	0	0	0
1453	SWU #2	0	0	0	0	0	0	0	0	0	0	0
1476	SWU #3	0	0	0	0	0	0	0	0	0	0	0
1481	SWU #6	0	0	0	0	0	0	0	0	0	0	0
1586	DWU #7	0	0	0	0	0	0	0	0	0	0	0
1601	DWU #2	0	0	0	0	0	0	0	0	0	0	0
1604	US COAST GUARD #1	0	0	0	0	0	0	0	0	0	0	0
1611	DWU #8	0	0	0	0	0	0	0	0	0	0	0
1654	DWU #3	0	0	0	0	0	0	0	0	0	0	0
1661	DWU #9	0	0	0	0	0	0	0	0	0	0	0
1687	DWU #1	0	0	0	0	0	-200000	-274000	-348000	-422000	-496000	-570000
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	0	0	0	0	0	0	0
1710	ISL-2 (EAST TANK)	0	0	0	-125000	-133333	-141667	-150000	-158333	-125000	-131250	-137500

Table 4.3b (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1959–1969

NWF_ID	Well Name	1959 Pumping (gpd)	1960 Pumping (gpd)	1961 Pumping (gpd)	1962 Pumping (gpd)	1963 Pumping (gpd)	1964 Pumping (gpd)	1965 Pumping (gpd)	1966 Pumping (gpd)	1967 Pumping (gpd)	1968 Pumping (gpd)	1969 Pumping (gpd)
1714	ISL-4 (TREAT PLANT)	-150000	-162500	-175000	-125000	-133333	-141667	-150000	-158333	-125000	-131250	-137500
1736	EAFB A-6 BLDG 8552	-38333.3	-40666.7	-43333.3	-30000	-26666.7	-26666.7	-23333.3	-23333.3	-20000	-20000	-19333.3
1742	ISL-6 (EL MATADOR)	0	0	0	0	0	0	0	0	-125000	-131250	-137500
1796	DWU #5	0	0	0	0	0	0	0	0	0	0	0
1838	DWU #4	0	0	0	0	0	0	0	0	0	0	0
1901	FWB #1	-282750	-331250	-379750	-342400	-381200	-420000	-385000	-396667	-436667	-465714	-391429
1940	MARY ESTHER #3	0	0	0	0	0	0	0	0	0	0	0
2023	MARY ESTHER #1	-171000	-192000	-214000	-235000	-256000	-139000	-149500	-160000	-170000	-190000	-180000
2031	MARY ESTHER #4	0	0	0	0	0	0	0	0	0	0	0
2035	MARY ESTHER #2	0	0	0	0	0	-139000	-149500	-160000	-170000	-190000	-180000
2085	FWB #5	-282750	-331250	-379750	-342400	-381200	-420000	-385000	-396667	-436667	-465714	-391429
2093	FWB #2	-282750	-331250	-379750	-342400	-381200	-420000	-385000	-396667	-436667	-465714	-391429
2099	FWB #3	-282750	-331250	-379750	-342400	-381200	-420000	-385000	-396667	-436667	-465714	-391429
2108	FWB #8	0	0	0	0	0	0	0	0	0	-465714	-391429
2139	FWB #9	0	0	0	0	0	0	0	0	0	0	0
2146	FWB #11	0	0	0	0	0	0	0	0	0	0	0
2168	EAFB HURL #7 #91136	0	0	0	0	0	0	0	0	0	0	0
2236	OC-9 (NORTHGATE)	0	-398750	-416750	-434750	-452750	-470750	-488750	-506750	-524750	-542750	-560750
2365	FCSC #11	0	0	0	0	0	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-507667	-398750	-416750	-434750	-452750	-470750	-488750	-506750	-524750	-542750	-560750
2463	OC-10 (LOWERY)	0	0	0	0	0	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	0	0	0	0	0	0	0	0	0	0	0
2508	OC-4 (GREEN STREET)	0	0	0	0	0	0	0	0	0	0	0
2554	OC-6 (HAWKINS ROAD)	0	0	0	0	0	0	0	0	0	0	0
2581	OC-5 (SHALIMAR)	-507667	-398750	-416750	-434750	-452750	-470750	-488750	-506750	-524750	-542750	-560750
2584	OC-7(SHALIMAR ANNEX)	0	0	0	0	0	0	0	0	0	0	0
2651	MOODY KELLY #1	0	0	0	0	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	0	0	0	0	0	0	0	0	0	-265385	-246429
2750	EAFB HOUS #12 #2829	0	0	0	0	0	0	-256667	-291667	-317500	-265385	-246429
2758	FWB #7	0	0	0	0	0	0	-385000	-396667	-436667	-465714	-391429
2759	OC-8 (GREEN ACRES)	0	0	0	0	0	0	0	0	0	0	0
2762	EAFB HOUS #16 #2755	0	0	0	0	0	0	0	0	0	0	0
2787	EAFB HOUS #11 #10634	0	0	0	0	0	0	0	0	0	0	0
2792	FWB #10	0	0	0	0	0	0	0	0	0	0	0
2807	FWB #6	0	0	0	-342400	-381200	-420000	-385000	-396667	-436667	-465714	-391429
2814	BLUEWATER #4	0	0	0	0	0	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
2825	EAFB HOUS #8 #2594	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
2860	EAFB HOUS #9 #10000	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
2874	OC-2 (LONGWOOD)	-507667	-398750	-416750	-434750	-452750	-470750	-488750	-506750	-524750	-542750	-560750

Table 4.3b (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1959–1969

NWF_ID	Well Name	1959 Pumping (gpd)	1960 Pumping (gpd)	1961 Pumping (gpd)	1962 Pumping (gpd)	1963 Pumping (gpd)	1964 Pumping (gpd)	1965 Pumping (gpd)	1966 Pumping (gpd)	1967 Pumping (gpd)	1968 Pumping (gpd)	1969 Pumping (gpd)
2884	EAFB HOUS #7 #2590	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
2891	BLUEWATER #2	0	0	0	0	0	0	0	0	0	0	0
2909	SOUTH GOLF COURSE	0	0	0	0	0	0	0	0	0	0	0
2953	SEMINOLE #5	0	0	0	0	0	0	0	0	0	0	0
2958	EAFB HOUS #14 #1308	0	0	0	0	0	0	0	0	0	0	-246429
2971	SEMINOLE #1	0	-15000	-16000	-17500	-18500	-19500	-21000	-22000	-23000	-24500	-25500
2972	SEMINOLE #6	0	0	0	0	0	0	0	0	0	0	0
2973	WELL #6	0	0	0	0	0	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
2985	EAFB MAIN #4 #303	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3004	EAFB HOUS #15 #1320	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3012	EAFB MAIN #3 #31	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3015	EAFB MAIN #6 #62	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3026	OLD GOLF COURSE #1	0	0	0	0	0	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3049	SEMINOLE #2	0	-15000	-16000	-17500	-18500	-19500	-21000	-22000	-23000	-24500	-25500
3057	SEMINOLE #3	0	0	0	0	0	0	0	0	0	0	0
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-247546	-256818	-266000	-275182	-284455	-293636	-256667	-291667	-317500	-265385	-246429
3091	BLUEWATER #3	0	0	0	0	0	0	0	0	0	0	0
3095	FREEPORT #2	-33000	-34000	-35000	-36000	-37000	-37000	-38000	-39000	-40000	-40000	-41000
3126	VALPARAISO #4	0	0	0	0	0	0	0	0	0	0	0
3231	NICEVILLE #8	0	0	0	0	0	0	0	0	0	0	0
3240	VALPARAISO #2	-63000	-70500	-78500	-86000	-62333.3	-67666.7	-72666.7	-77666.7	-83000	-88000	-93000
3256	NICEVILLE #2	0	0	0	0	0	0	-200000	-206667	-213333	-220000	-226667
3258	VALPARAISO #1	-63000	-70500	-78500	-86000	-62333.3	-67666.7	-72666.7	-77666.7	-83000	-88000	-93000
3295	VALPARAISO #3	0	0	0	0	-62333.3	-67666.7	-72666.7	-77666.7	-83000	-88000	-93000
3304	REDBAY GOLF #1	0	0	0	0	0	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0	0	0	0	0	0
3326	NICEVILLE #6	0	0	0	0	0	0	0	0	0	0	0
3350	NICEVILLE #1	-183500	-203000	-222000	-241500	-261000	-280500	-200000	-206667	-213333	-220000	-226667
3367	NICEVILLE #3	0	0	0	0	0	0	0	0	0	0	0
3432	NICEVILLE #10	0	0	0	0	0	0	0	0	0	0	0
3457	NICEVILLE #5	0	0	0	0	0	0	0	0	0	0	0
3482	NICEVILLE #4	-183500	-203000	-222000	-241500	-261000	-280500	-200000	-206667	-213333	-220000	-226667
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-20500	-20500	-20000	-25000	-30000	-45000	-45000	-30000	-40000	-50000	-49500
4376	EAFB FLD#3 BLDG#3102	-20500	-20500	-20000	-25000	-30000	-45000	-45000	-30000	-40000	-50000	-49500
5837	FCSC #2A	0	0	0	0	0	0	0	0	0	0	0

Table 4.3b (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1959–1969

NWF_ID	Well Name	1959 Pumping (gpd)	1960 Pumping (gpd)	1961 Pumping (gpd)	1962 Pumping (gpd)	1963 Pumping (gpd)	1964 Pumping (gpd)	1965 Pumping (gpd)	1966 Pumping (gpd)	1967 Pumping (gpd)	1968 Pumping (gpd)	1969 Pumping (gpd)
5838	FCSC #1	0	0	0	0	0	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	0	0	0	0	0	0	0
5886	FREEPORT #4	0	0	0	0	0	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0	0	0	0	0	0
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0	0	0	0	0	0
6023	VILLA TASSO #1	0	0	0	0	0	0	0	0	0	0	0
6024	VILLA TASSO #2	0	-10000	-11000	-12000	-12000	-13000	-14000	-15000	-16000	-16000	-17000
6796	CHOCTAW BCH #2	0	-10000	-11000	-11000	-12000	-12000	-13000	-14000	-14000	-15000	-15000
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0	0	0	0	0	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	-150000	-162500	-175000	-125000	-133333	-141667	-150000	-158333	-125000	-131250	-137500
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	0	0	0	0	0	0
8225	VALPARAISO #5	0	0	0	0	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0	0	0	0	0
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0	0	0	0	0
	Total	-6752334	-7296334	-7947333	-8442000	-8945666	-9783867	-1E+07	-1.1E+07	-1.2E+07	-1.2E+07	-1.2E+07

Table 4.3c
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
681	PANAMA CITY BCH #11	0	0	0	0	0	0	0
684	PANAMA CITY BCH #5	-200429	-207571	-187875	-194125	-200375	-206750	-170400
685	PANAMA CITY BCH #6	0	0	-187875	-194125	-200375	-206750	-170400
739	PANAMA CITY BCH #1	-200429	-207571	-187875	-194125	-200375	-206750	-170400
743	PANAMA CITY BCH #9	0	0	0	0	0	0	-170400
745	PANAMA CITY BCH #4	-200429	-207571	-187875	-194125	-200375	-206750	-170400
747	PANAMA CITY BCH #2	-200429	-207571	-187875	-194125	-200375	-206750	-170400
756	PANAMA CITY BCH #3	-200429	-207571	-187875	-194125	-200375	-206750	-170400
765	PANAMA CITY BCH #13	0	0	0	0	0	0	0
768	PANAMA CITY BCH #10	0	0	0	0	0	0	-170400
794	PANAMA CITY BCH #12	0	0	0	0	0	0	0
863	INLET BEACH #2	0	0	0	0	0	0	0
891	SANDCLIFFS	0	0	0	-12000	-13000	-14000	-15000
909	CAMP CREEK S/D #1	0	0	0	0	0	0	0
922	FCSC #5A	0	0	0	0	0	0	0
1000	FCSC #3	0	0	0	0	0	0	0
1011	SEAGROVE #2	-12500	-12500	-13000	-13000	-13500	-13500	-14000
1018	SEAGROVE #1	-12500	-12500	-13000	-13000	-13500	-13500	-14000
1043	FCSC #10	0	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0	0
1074	VAN BUTLER	-8000	-9000	-9000	-9000	-10000	-10000	-10000
1136	FCSC #12	0	0	0	0	0	0	0
1430	SWU #1	-44000	-48000	-52000	-57000	-30500	-32500	-55000
1431	SWU #4	0	0	0	0	0	0	0
1445	SWU #5	0	0	0	0	0	0	0
1453	SWU #2	0	0	0	0	-30500	-32500	-55000
1476	SWU #3	0	0	0	0	0	0	0
1481	SWU #6	0	0	0	0	0	0	0
1586	DWU #7	0	0	0	0	0	0	0

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
1601	DWU #2	0	-359000	-396000	-433000	-313333	-290000	-350000
1604	US COAST GUARD #1	0	0	0	0	0	0	-5000
1611	DWU #8	0	0	0	0	0	0	0
1654	DWU #3	0	0	0	0	-313333	-290000	-350000
1661	DWU #9	0	0	0	0	0	0	0
1687	DWU #1	-644000	-359000	-396000	-433000	-313333	-290000	-350000
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	-112500	-116667	-120833
1710	ISL-2 (EAST TANK)	-143750	-150000	-156250	-130000	-112500	-116667	-120833
1714	ISL-4 (TREAT PLANT)	-143750	-150000	-156250	-130000	-112500	-116667	-120833
1736	EAFB A-6 BLDG 8552	-18666.7	-18333.3	-17666.7	-17000	-16333.3	-15666.7	-15333.3
1742	ISL-6 (EL MATADOR)	-143750	-150000	-156250	-130000	-112500	-116667	-120833
1796	DWU #5	0	0	0	0	0	0	0
1838	DWU #4	0	0	0	0	0	0	0
1901	FWB #1	-343750	-366250	-341889	-331667	-343333	-321111	-340000
1940	MARY ESTHER #3	0	0	0	0	0	0	0
2023	MARY ESTHER #1	-196000	-175000	-182000	-150000	-168000	-168000	-225000
2031	MARY ESTHER #4	0	0	0	0	0	0	0
2035	MARY ESTHER #2	-196000	-175000	-182000	-150000	-168000	-168000	-225000
2085	FWB #5	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2093	FWB #2	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2099	FWB #3	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2108	FWB #8	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2139	FWB #9	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2146	FWB #11	0	0	0	0	0	0	0
2168	EAFB HURL #7 #91136	0	0	0	0	0	0	0
2236	OC-9 (NORTHGATE)	-462800	-477200	-409667	-421667	-433667	-445667	-457667
2365	FCSC #11	0	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-462800	-477200	-409667	-421667	-433667	-445667	-457667

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
2463	OC-10 (LOWERY)	0	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	-462800	-477200	-409667	-421667	-433667	-445667	-457667
2508	OC-4 (GREEN STREET)	0	0	-409667	-421667	-433667	-445667	-457667
2554	OC-6 (HAWKINS ROAD)	0	0	0	0	0	0	0
2581	OC-5 (SHALIMAR)	-462800	-477200	-409667	-421667	-433667	-445667	-457667
2584	OC-7(SHALIMAR ANNEX)	0	0	0	0	0	0	0
2651	MOODY KELLY #1	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2750	EAFB HOUS #12 #2829	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2758	FWB #7	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2759	OC-8 (GREEN ACRES)	0	0	0	0	0	0	0
2762	EAFB HOUS #16 #2755	0	-250000	-322667	-305333	-286667	-295333	-266667
2787	EAFB HOUS #11 #10634	0	0	0	0	0	0	0
2792	FWB #10	0	0	-341889	-331667	-343333	-321111	-340000
2807	FWB #6	-343750	-366250	-341889	-331667	-343333	-321111	-340000
2814	BLUEWATER #4	0	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2825	EAFB HOUS #8 #2594	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2860	EAFB HOUS #9 #10000	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2874	OC-2 (LONGWOOD)	-462800	-477200	-409667	-421667	-433667	-445667	-457667
2884	EAFB HOUS #7 #2590	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2891	BLUEWATER #2	0	0	0	0	0	0	-200000
2909	SOUTH GOLF COURSE	0	0	0	0	0	0	0
2953	SEMINOLE #5	0	0	0	0	0	0	0
2958	EAFB HOUS #14 #1308	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2971	SEMINOLE #1	-27000	-28000	-29000	-30500	-31500	-32500	-34000
2972	SEMINOLE #6	0	0	0	0	0	0	0
2973	WELL #6	0	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	-251429	-250000	-322667	-305333	-286667	-295333	-266667
2985	EAFB MAIN #4 #303	-251429	-250000	-322667	-305333	-286667	-295333	-266667

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
3004	EAFB HOUS #15 #1320	-251429	-250000	-322667	-305333	-286667	-295333	-266667
3012	EAFB MAIN #3 #31	-251429	-250000	-322667	-305333	-286667	-295333	-266667
3015	EAFB MAIN #6 #62	-251429	-250000	-322667	-305333	-286667	-295333	-266667
3026	OLD GOLF COURSE #1	0	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	-251429	-250000	-322667	-305333	-286667	-295333	-266667
3049	SEMINOLE #2	-27000	-28000	-29000	-30500	-31500	-32500	-34000
3057	SEMINOLE #3	0	0	0	0	0	0	0
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-251429	-250000	-322667	-305333	-286667	-295333	-266667
3091	BLUEWATER #3	0	0	0	0	0	0	0
3095	FREEPORT #2	-42000	-43000	-44000	-44000	-45000	-46000	-53000
3126	VALPARAISO #4	0	0	0	0	0	0	0
3231	NICEVILLE #8	0	0	0	0	0	0	0
3240	VALPARAISO #2	-98333.3	-103333	-123333	-100000	-133333	-130000	-150000
3256	NICEVILLE #2	-233333	-246667	-326667	-305000	-227000	-207250	-268750
3258	VALPARAISO #1	-98333.3	-103333	-123333	-100000	-133333	-130000	-150000
3295	VALPARAISO #3	-98333.3	-103333	-123333	-100000	-133333	-130000	-150000
3304	REDBAY GOLF #1	0	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0	0
3326	NICEVILLE #6	0	0	0	0	0	0	0
3350	NICEVILLE #1	-233333	-246667	-326667	-305000	-227000	-207250	-268750
3367	NICEVILLE #3	0	0	0	-305000	-227000	-207250	-268750
3432	NICEVILLE #10	0	0	0	0	0	0	0
3457	NICEVILLE #5	0	0	0	0	0	0	0
3482	NICEVILLE #4	-233333	-246667	-326667	-305000	-227000	-207250	-268750
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-49000	-48500	-48000	-47500	-47000	-46500	-45500
4376	EAFB FLD#3 BLDG#3102	-49000	-48500	-48000	-47500	-47000	-46500	-45500

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
5837	FCSC #2A	0	0	0	0	0	0	0
5838	FCSC #1	0	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	0	0	0
5886	FREEPORT #4	0	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0	0
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0	0
6023	VILLA TASSO #1	0	0	0	0	0	-11000	-11000
6024	VILLA TASSO #2	-18000	-19000	-20000	-20000	-21000	-11000	-11000
6796	CHOCTAW BCH #2	-16000	-17000	-17000	-18000	-18000	-19000	-21000
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	-130000	-112500	-116667	-120833
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	-143750	-150000	-156250	-130000	-112500	-116667	-120833
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	0	0
8225	VALPARAISO #5	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1970 Pumping (gpd)	1971 Pumping (gpd)	1972 Pumping (gpd)	1973 Pumping (gpd)	1974 Pumping (gpd)	1975 Pumping (gpd)	1976 Pumping (gpd)
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0
	Total	-1.3E+07	-1.3E+07	-1.5E+07	-1.5E+07	-1.5E+07	-1.5E+07	-1.6E+07

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1977 Pumping (gpd)	1978 Pumping (gpd)	1979 Pumping (gpd)	1980 Pumping (gpd)	1981 Pumping (gpd)	1982 Pumping (gpd)
681	PANAMA CITY BCH #11	0	0	-174500	-198667	-222833	-246917
684	PANAMA CITY BCH #5	-175400	-180400	-174500	-198667	-222833	-246917
685	PANAMA CITY BCH #6	-175400	-180400	-174500	-198667	-222833	-246917
739	PANAMA CITY BCH #1	-175400	-180400	-174500	-198667	-222833	-246917
743	PANAMA CITY BCH #9	-175400	-180400	-174500	-198667	-222833	-246917
745	PANAMA CITY BCH #4	-175400	-180400	-174500	-198667	-222833	-246917
747	PANAMA CITY BCH #2	-175400	-180400	-174500	-198667	-222833	-246917
756	PANAMA CITY BCH #3	-175400	-180400	-174500	-198667	-222833	-246917
765	PANAMA CITY BCH #13	0	0	0	0	0	0
768	PANAMA CITY BCH #10	-175400	-180400	-174500	-198667	-222833	-246917
794	PANAMA CITY BCH #12	0	0	-174500	-198667	-222833	-246917
863	INLET BEACH #2	0	0	0	0	0	0
891	SANDCLIFFS	-17000	-18000	-19000	-20000	-20000	-20000
909	CAMP CREEK S/D #1	0	-25000	-28000	-31000	-34000	-37000
922	FCSC #5A	0	0	0	0	0	0
1000	FCSC #3	0	0	0	0	-60000	-65500
1011	SEAGROVE #2	-14500	-14500	-15000	-15000	0	0
1018	SEAGROVE #1	-14500	-14500	-15000	-15000	0	0
1043	FCSC #10	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0
1074	VAN BUTLER	-10000	-13000	-17000	-20000	-20000	-20000
1136	FCSC #12	0	0	0	0	0	0
1430	SWU #1	-77500	-100500	-123000	-145500	-231000	-211000
1431	SWU #4	0	0	0	0	0	0
1445	SWU #5	0	0	0	0	0	0
1453	SWU #2	-77500	-100500	-123000	-145500	-231000	-211000
1476	SWU #3	0	0	0	0	0	-211000
1481	SWU #6	0	0	0	0	0	0
1586	DWU #7	0	0	0	0	0	0
1601	DWU #2	-400000	-453333	-462000	-353000	-393000	-433250
1604	US COAST GUARD #1	-5000	-5000	-6000	-6000	-6000	-6000
1611	DWU #8	0	0	0	0	0	0
1654	DWU #3	-400000	-453333	-462000	-353000	-393000	-433250
1661	DWU #9	0	0	0	0	0	0
1687	DWU #1	-400000	-453333	-462000	-353000	-393000	-433250
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	-125000	-129167	-133333	-125000	-116500	0
1710	ISL-2 (EAST TANK)	-125000	-129167	-133333	-125000	-116500	-52104.1

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1977 Pumping (gpd)	1978 Pumping (gpd)	1979 Pumping (gpd)	1980 Pumping (gpd)	1981 Pumping (gpd)	1982 Pumping (gpd)
1714	ISL-4 (TREAT PLANT)	-125000	-129167	-133333	-125000	-116500	-134107
1736	EAFB A-6 BLDG 8552	-14666.7	-14000	-13333.3	-12666.7	-12333.3	-11666.7
1742	ISL-6 (EL MATADOR)	-125000	-129167	-133333	-125000	-116500	-168181
1796	DWU #5	0	0	0	0	0	0
1838	DWU #4	0	0	0	-353000	-393000	-433250
1901	FWB #1	-353333	-347778	-371556	-349333	-355889	0
1940	MARY ESTHER #3	0	0	0	0	0	0
2023	MARY ESTHER #1	-255000	-259000	-263000	-267000	-278000	-289000
2031	MARY ESTHER #4	0	0	0	0	0	0
2035	MARY ESTHER #2	-255000	-259000	-263000	-267000	-278000	-289000
2085	FWB #5	-353333	-347778	-371556	-349333	-355889	-362333
2093	FWB #2	-353333	-347778	-371556	-349333	-355889	-362333
2099	FWB #3	-353333	-347778	-371556	-349333	-355889	-362333
2108	FWB #8	-353333	-347778	-371556	-349333	-355889	-362333
2139	FWB #9	-353333	-347778	-371556	-349333	-355889	-362333
2146	FWB #11	0	0	0	0	0	-362333
2168	EAFB HURL #7 #91136	0	0	0	0	0	0
2236	OC-9 (NORTHGATE)	-469667	-481667	-423143	-445143	-467286	-428125
2365	FCSC #11	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-469667	-481667	-423143	-445143	-467286	-428125
2463	OC-10 (LOWERY)	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	-469667	-481667	-423143	-445143	-467286	-428125
2508	OC-4 (GREEN STREET)	-469667	-481667	-423143	-445143	-467286	-428125
2554	OC-6 (HAWKINS ROAD)	0	0	-423143	-445143	-467286	-428125
2581	OC-5 (SHALIMAR)	-469667	-481667	-423143	-445143	-467286	-428125
2584	OC-7(SHALIMAR ANNEX)	0	0	0	0	0	-428125
2651	MOODY KELLY #1	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	-250000	-209333	-227667	-246000	-261733	-277467
2750	EAFB HOUS #12 #2829	-250000	-209333	-227667	-246000	-261733	-277467
2758	FWB #7	-353333	-347778	-371556	-349333	-355889	-362333
2759	OC-8 (GREEN ACRES)	0	0	0	0	0	0
2762	EAFB HOUS #16 #2755	-250000	-209333	-227667	-246000	-261733	-277467
2787	EAFB HOUS #11 #10634	0	0	0	0	0	0
2792	FWB #10	-353333	-347778	-371556	-349333	-355889	-362333
2807	FWB #6	-353333	-347778	-371556	-349333	-355889	-362333
2814	BLUEWATER #4	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	-250000	-209333	-227667	-246000	-261733	-277467
2825	EAFB HOUS #8 #2594	-250000	-209333	-227667	-246000	-261733	-277467
2860	EAFB HOUS #9 #10000	-250000	-209333	-227667	-246000	-261733	-277467
2874	OC-2 (LONGWOOD)	-469667	-481667	-423143	-445143	-467286	-428125

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1977 Pumping (gpd)	1978 Pumping (gpd)	1979 Pumping (gpd)	1980 Pumping (gpd)	1981 Pumping (gpd)	1982 Pumping (gpd)
2884	EAFB HOUS #7 #2590	-250000	-209333	-227667	-246000	-261733	-277467
2891	BLUEWATER #2	-248000	-148500	-172500	-197000	-221000	-245500
2909	SOUTH GOLF COURSE	0	0	0	0	0	0
2953	SEMINOLE #5	0	0	0	-19750	-21000	-22250
2958	EAFB HOUS #14 #1308	-250000	-209333	-227667	-246000	-261733	-277467
2971	SEMINOLE #1	-35000	-35000	-37500	-19750	-21000	-22250
2972	SEMINOLE #6	0	0	0	-19750	-21000	-22250
2973	WELL #6	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	-250000	-209333	-227667	-246000	-261733	-277467
2985	EAFB MAIN #4 #303	-250000	-209333	-227667	-246000	-261733	-277467
3004	EAFB HOUS #15 #1320	-250000	-209333	-227667	-246000	-261733	-277467
3012	EAFB MAIN #3 #31	-250000	-209333	-227667	-246000	-261733	-277467
3015	EAFB MAIN #6 #62	-250000	-209333	-227667	-246000	-261733	-277467
3026	OLD GOLF COURSE #1	0	0	0	-20000	-22000	-25000
3033	EAFB MAIN #2 #82	-250000	-209333	-227667	-246000	-261733	-277467
3049	SEMINOLE #2	-35000	-35000	-37500	-19750	-21000	-22250
3057	SEMINOLE #3	0	0	0	0	0	0
3063	BLUEWATER #1 (AUX)	0	-148500	-172500	-197000	-221000	-245500
3071	EAFB MAIN #1 #859	-250000	-209333	-227667	-246000	-261733	-277467
3091	BLUEWATER #3	0	0	0	0	0	0
3095	FREEPORT #2	-60000	-68000	-77000	-85000	-92000	-99000
3126	VALPARAISO #4	0	0	0	0	0	0
3231	NICEVILLE #8	0	0	0	0	0	0
3240	VALPARAISO #2	-199333	-183333	-169000	-170333	-170000	-169333
3256	NICEVILLE #2	-229800	-264200	-281800	-207333	-225000	-242667
3258	VALPARAISO #1	-199333	-183333	-169000	-170333	-170000	-169333
3295	VALPARAISO #3	-199333	-183333	-169000	-170333	-170000	-169333
3304	REDBAY GOLF #1	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0
3326	NICEVILLE #6	0	0	0	-207333	-225000	-242667
3350	NICEVILLE #1	-229800	-264200	-281800	-207333	-225000	-242667
3367	NICEVILLE #3	-229800	-264200	-281800	-207333	-225000	-242667
3432	NICEVILLE #10	0	0	0	0	0	0
3457	NICEVILLE #5	-229800	-264200	-281800	-207333	-225000	-242667
3482	NICEVILLE #4	-229800	-264200	-281800	-207333	-225000	-242667
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-45000	-44500	-44000	-43500	-43000	-42500
4376	EAFB FLD#3 BLDG#3102	-45000	-44500	-44000	-43500	-43000	-42500
5837	FCSC #2A	0	0	0	0	0	0

Table 4.3c (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1970–1982

NWF_ID	Well Name	1977 Pumping (gpd)	1978 Pumping (gpd)	1979 Pumping (gpd)	1980 Pumping (gpd)	1981 Pumping (gpd)	1982 Pumping (gpd)
5838	FCSC #1	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	-60000	-65500
5886	FREEPORT #4	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0
6023	VILLA TASSO #1	-11000	-11000	-11000	-11000	-13500	-16000
6024	VILLA TASSO #2	-11000	-11000	-11000	-11000	-13500	-16000
6796	CHOCTAW BCH #2	-23000	-26000	-28000	-30000	-33000	-36000
6797	CHOCTAW BCH #1	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	-125000	-129167	-133333	-125000	-116500	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	-125000	-129167	-133333	-125000	-116500	-294140
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	-10000
8225	VALPARAISO #5	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0
	Total	-1.6E+07	-1.6E+07	-1.7E+07	-1.8E+07	-1.9E+07	-2E+07

Table 4.3d
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
681	PANAMA CITY BCH #11	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
684	PANAMA CITY BCH #5	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
685	PANAMA CITY BCH #6	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
739	PANAMA CITY BCH #1	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
743	PANAMA CITY BCH #9	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
745	PANAMA CITY BCH #4	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
747	PANAMA CITY BCH #2	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
756	PANAMA CITY BCH #3	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
765	PANAMA CITY BCH #13	0	0	0	0	-382462	-375923	-342692	-393077
768	PANAMA CITY BCH #10	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
794	PANAMA CITY BCH #12	-271083	-295250	-319417	-390083	-382462	-375923	-342692	-393077
863	INLET BEACH #2	-25000	-27000	-28000	-30000	-48000	-36000	-34000	-34000
891	SANDCLIFFS	-21000	-21000	-21000	-45000	-34000	-36000	-33000	-45000
909	CAMP CREEK S/D #1	-40000	-43000	-23000	-24500	-26000	-27500	-28000	-29000
922	FCSC #5A	0	0	-23000	-24500	-26000	-27500	-28000	-29000
1000	FCSC #3	-71500	-77000	-83000	-83500	-43500	-61500	-48250	-76200
1011	SEAGROVE #2	0	0	0	0	0	0	0	0
1018	SEAGROVE #1	0	0	0	0	0	0	0	0
1043	FCSC #10	0	0	0	0	-43500	-61500	-48250	-76200
1044	FCSC #4	0	0	0	0	-43500	-61500	-48250	-76200
1074	VAN BUTLER	-20000	-20000	-20000	0	0	0	0	0
1136	FCSC #12	0	0	0	0	0	0	0	0
1430	SWU #1	-201000	-243750	-286500	-324750	-290400	-250600	-268400	-308400
1431	SWU #4	-201000	-243750	-286500	-324750	-290400	-250600	-268400	-308400
1445	SWU #5	0	0	0	0	-290400	-250600	-268400	-308400
1453	SWU #2	-201000	-243750	-286500	-324750	-290400	-250600	-268400	-308400
1476	SWU #3	-201000	-243750	-286500	-324750	-290400	-250600	-268400	-308400
1481	SWU #6	0	0	0	0	0	0	0	0
1586	DWU #7	0	0	0	-389167	-336000	-344000	-295625	-321000

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
1601	DWU #2	-473250	-410800	-442800	-389167	-336000	-344000	-295625	-321000
1604	US COAST GUARD #1	-7000	-7000	-7000	-7000	-7000	-7000	-7000	-7000
1611	DWU #8	0	0	0	0	-336000	-344000	-295625	-321000
1654	DWU #3	-473250	-410800	-442800	-389167	-336000	-344000	-295625	-321000
1661	DWU #9	0	0	0	0	0	0	-295625	-321000
1687	DWU #1	-473250	-410800	-442800	-389167	-336000	-344000	-295625	-321000
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	-167975	-210918	-92200	-16805.5
1696	ISL-1 (MONITOR)	0	0	0	0	0	0	-92200	0
1710	ISL-2 (EAST TANK)	-42904.1	0	0	0	0	0	0	0
1714	ISL-4 (TREAT PLANT)	-108107	-123532	0	0	0	0	0	0
1736	EAFB A-6 BLDG 8552	-11000	-10333.3	-9666.7	-9333.3	-8666.7	-8000	-7333.3	-6666.7
1742	ISL-6 (EL MATADOR)	-220660	-255060	-276614	-240515	-217219	-207408	-92200	-119304
1796	DWU #5	0	-410800	-442800	-389167	-336000	-344000	-295625	-321000
1838	DWU #4	-473250	-410800	-442800	-389167	-336000	-344000	-295625	-321000
1901	FWB #1	0	0	0	0	0	0	0	0
1940	MARY ESTHER #3	0	0	-215000	-245000	-234667	-227333	-235000	-233333
2023	MARY ESTHER #1	-300500	-311500	-215000	-245000	-234667	-227333	-235000	-233333
2031	MARY ESTHER #4	0	0	0	0	0	0	0	0
2035	MARY ESTHER #2	-300500	-311500	-215000	-245000	-234667	-227333	-235000	-233333
2085	FWB #5	-368889	-391111	-431111	-439889	-426889	-163885	-174093	-73087.7
2093	FWB #2	-368889	-391111	-431111	-439889	-426889	-75874	-63454.8	-40284.9
2099	FWB #3	-368889	-391111	-431111	-439889	-426889	-308526	-81961.6	-72684.9
2108	FWB #8	-368889	-391111	-431111	-439889	-426889	-38706.8	0	-52000
2139	FWB #9	-368889	-391111	-431111	-439889	-426889	-175948	-946134	-909206
2146	FWB #11	-368889	-391111	-431111	-439889	-426889	-712553	-563904	-576274
2168	EAFB HURL #7 #91136	0	0	0	0	-195500	-188750	-182000	-175250
2236	OC-9 (NORTHGATE)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-270795
2365	FCSC #11	0	0	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-765573

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
2463	OC-10 (LOWERY)	0	0	0	0	0	0	0	0
2506	OC-3 (NEWCASTLE)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-210622
2508	OC-4 (GREEN STREET)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-663189
2554	OC-6 (HAWKINS ROAD)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-597816
2581	OC-5 (SHALIMAR)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-482452
2584	OC-7(SHALIMAR ANNEX)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-640312
2651	MOODY KELLY #1	0	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2750	EAFB HOUS #12 #2829	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2758	FWB #7	-368889	-391111	-431111	-439889	-426889	-833438	-667170	-1071329
2759	OC-8 (GREEN ACRES)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-661863
2762	EAFB HOUS #16 #2755	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2787	EAFB HOUS #11 #10634	0	0	-304375	-306875	-309375	-311875	-314375	-316875
2792	FWB #10	-368889	-391111	-431111	-439889	-426889	-743606	-290836	-412521
2807	FWB #6	-368889	-391111	-431111	-439889	-426889	-814036	-960290	-645690
2814	BLUEWATER #4	0	0	0	0	0	0	0	0
2815	EAFB HOUS #10 #10941	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2825	EAFB HOUS #8 #2594	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2860	EAFB HOUS #9 #10000	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2874	OC-2 (LONGWOOD)	-397667	-414889	-432000	-449222	-466333	-488111	-507667	-452940
2884	EAFB HOUS #7 #2590	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2891	BLUEWATER #2	-179667	-195667	-212000	-228000	-244333	-260333	-276667	-129370
2909	SOUTH GOLF COURSE	0	0	0	-11333.3	-12333.3	-13000	-13666.7	-14666.7
2953	SEMINOLE #5	-23250	-24500	-25750	-20000	-22200	-21200	-20000	-21200
2958	EAFB HOUS #14 #1308	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2971	SEMINOLE #1	-23250	-24500	-25750	-20000	-22200	-21200	-20000	-21200
2972	SEMINOLE #6	-23250	-24500	-25750	-20000	-22200	-21200	-20000	-21200
2973	WELL #6	0	0	0	-11333.3	-12333.3	-13000	-13666.7	-14666.7
2984	EAFB MAIN #5 #616	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
2985	EAFB MAIN #4 #303	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
3004	EAFB HOUS #15 #1320	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
3012	EAFB MAIN #3 #31	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
3015	EAFB MAIN #6 #62	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
3026	OLD GOLF COURSE #1	-27000	-29000	-32000	-11333.3	-12333.3	-13000	-13666.7	-14666.7
3033	EAFB MAIN #2 #82	-293200	-308933	-304375	-306875	-309375	-311875	0	0
3049	SEMINOLE #2	-23250	-24500	-25750	-20000	-22200	-21200	-20000	-21200
3057	SEMINOLE #3	0	0	0	-20000	-22200	-21200	-20000	-21200
3063	BLUEWATER #1 (AUX)	-179667	-195667	-212000	-228000	-244333	-260333	-276667	0
3071	EAFB MAIN #1 #859	-293200	-308933	-304375	-306875	-309375	-311875	-314375	-316875
3091	BLUEWATER #3	-179667	-195667	-212000	-228000	-244333	-260333	-276667	-748614
3095	FREEPORT #2	-106000	-113000	-120000	-162000	-142000	-155000	-139000	-153000
3126	VALPARAISO #4	0	0	0	0	-113750	-150000	-23619.2	-79389
3231	NICEVILLE #8	0	0	-253286	-297429	-312000	-309143	-124910	-171104
3240	VALPARAISO #2	-216047	-183000	-196667	-170000	-113750	-150000	-243321	-235269
3256	NICEVILLE #2	-260167	-277833	-253286	-297429	-312000	-309143	-421499	-360296
3258	VALPARAISO #1	-80501.4	-183000	-196667	-170000	-113750	-150000	-94600	-75780.8
3295	VALPARAISO #3	-209973	-183000	-196667	-170000	-113750	-150000	-206132	-216206
3304	REDBAY GOLF #1	0	0	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0	0	0
3315	FREEPORT #3	0	0	0	0	0	0	0	0
3326	NICEVILLE #6	-260167	-277833	-253286	-297429	-312000	-309143	-157537	-211200
3350	NICEVILLE #1	-260167	-277833	-253286	-297429	-312000	-309143	-381315	-377660
3367	NICEVILLE #3	-260167	-277833	-253286	-297429	-312000	-309143	-390855	-377022
3432	NICEVILLE #10	0	0	0	0	0	0	0	-333619
3457	NICEVILLE #5	-260167	-277833	-253286	-297429	-312000	-309143	-684652	-640189
3482	NICEVILLE #4	-260167	-277833	-253286	-297429	-312000	-309143	-43698.6	-42517.8
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-42000	-41500	-41000	-40500	-40000	-39500	-39000	-38500
4376	EAFB FLD#3 BLDG#3102	-42000	-41500	-41000	-40500	-40000	-39500	-39000	-38500

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
5837	FCSC #2A	0	0	0	0	0	0	0	-76200
5838	FCSC #1	0	0	0	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0	0	0
5840	FCSC #13	0	0	0	0	0	0	0	0
5841	FCSC #14	0	0	0	0	0	0	0	0
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	0	0
5852	SADDLEBROOK DOWNS	-71500	-77000	-83000	-83500	-43500	-61500	-48250	-76200
5886	FREEPORT #4	0	0	0	0	0	0	0	0
6006	EAFB MAIN #2A BLDG82	0	0	0	0	0	0	-314375	-316875
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	0	0	0
6023	VILLA TASSO #1	-18000	-20500	-23000	-24000	-25000	-26000	-27000	-28000
6024	VILLA TASSO #2	-18000	-20500	-23000	-24000	-25000	-26000	-27000	-28000
6796	CHOCTAW BCH #2	-38000	-41000	-44000	-47000	-50000	-52000	-55000	-58000
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0	0
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0	-92200	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	-353156	-447493	-460052	-427170	-358814	-273756	-92200	-93145.2
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	-10000	-10000	-11000	-11000	-11000	-11000	-12000	-12000
8225	VALPARAISO #5	0	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0	0

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1983 Pumping (gpd)	1984 Pumping (gpd)	1985 Pumping (gpd)	1986 Pumping (gpd)	1987 Pumping (gpd)	1988 Pumping (gpd)	1989 Pumping (gpd)	1990 Pumping (gpd)
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0	0
	Total	-2.1E+07	-2.3E+07	-2.4E+07	-2.6E+07	-2.7E+07	-2.7E+07	-2.7E+07	-2.8E+07

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
681	PANAMA CITY BCH #11	-327308	-348539	-308595	-281518	-203885	-62698.6	-129710	-64937
684	PANAMA CITY BCH #5	-327308	-348539	-440055	-332836	-213269	-111814	-256340	-208107
685	PANAMA CITY BCH #6	-327308	-348539	-216480	-192340	-131567	-66602.7	-121208	-115241
739	PANAMA CITY BCH #1	-327308	-348539	-340504	-182392	-335200	-350786	-284723	-298660
743	PANAMA CITY BCH #9	-327308	-348539	-484411	-421841	-268622	-380611	-474181	-435219
745	PANAMA CITY BCH #4	-327308	-348539	-355890	-325233	-334967	-350351	-289348	-375521
747	PANAMA CITY BCH #2	-327308	-348539	-381808	-291789	-294104	-217395	-237543	-282721
756	PANAMA CITY BCH #3	-327308	-348539	-457669	-290011	-320723	-209540	-285047	-371236
765	PANAMA CITY BCH #13	-327308	-348539	-519247	-424014	-302882	-358633	-289143	-274496
768	PANAMA CITY BCH #10	-327308	-348539	-471619	-387937	-262962	-257934	-407710	-509307
794	PANAMA CITY BCH #12	-327308	-348539	-401153	-299241	-342937	-428943	-309767	-396118
863	INLET BEACH #2	-38000	-40000	-44000	-56000	-46000	-40000	-47308.8	-79569
891	SANDCLIFFS	-28000	-31616.4	-48742.5	-39084.9	-31561.6	-45764.4	-80550.7	-73249.3
909	CAMP CREEK S/D #1	-20333.3	0	0	0	0	0	0	0
922	FCSC #5A	-20333.3	-30934.2	-36035.6	-33145.2	-42769.9	-52961.6	-67227.4	-54630.1
1000	FCSC #3	-83600	-219682	-213712	-177970	-158247	-134512	-89602.7	-105832
1011	SEAGROVE #2	0	0	0	0	0	0	0	0
1018	SEAGROVE #1	0	0	0	0	0	0	0	0
1043	FCSC #10	-83600	-103447	-67838.4	-81035.6	-59120.5	-45643.8	-27868.5	-21446.6
1044	FCSC #4	-83600	-103584	-67838.4	-80295.9	-59120.5	-45520.5	-27868.5	-21446.6
1074	VAN BUTLER	0	0	0	0	0	0	0	0
1136	FCSC #12	0	0	-118825	-113370	-113732	-122030	-116975	-168447
1430	SWU #1	-250200	-152874	-145167	-171200	-152699	-131326	-115885	-125299
1431	SWU #4	-250200	-327192	-444156	-341307	-308285	-431038	-384669	-357658
1445	SWU #5	-250200	-252329	-386921	-425211	-304953	-84797.3	-290260	-264277
1453	SWU #2	-250200	-184367	-234959	-189384	-445145	-565622	-416638	-452277
1476	SWU #3	-250200	-173806	-156671	-96583.6	-93265.8	-182285	-314943	-311436
1481	SWU #6	0	-369107	-371688	-555811	-495027	-406364	-352575	-502159
1586	DWU #7	-316125	-317125	-381571	-505923	-570567	-549797	-394326	-574189

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
1601	DWU #2	-316125	-317125	-381571	-789211	-839296	-820989	-869800	-769600
1604	US COAST GUARD #1	-9693.2	-12000	-14000	-15000	-16578.1	-15306.8	-31827.4	-20191.8
1611	DWU #8	-316125	-317125	-381571	-712.3	-13.7	-106715	-368027	-313488
1654	DWU #3	-316125	-317125	-381571	-607816	-572093	-691953	-610266	-685055
1661	DWU #9	-316125	-317125	-381571	-13241.1	-61019.2	-154923	-171096	-351474
1687	DWU #1	-316125	-317125	0	0	0	0	0	0
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	0	0	0	0
1710	ISL-2 (EAST TANK)	0	0	0	0	0	0	0	0
1714	ISL-4 (TREAT PLANT)	0	0	0	0	0	0	0	0
1736	EAFB A-6 BLDG 8552	-6333.3	-5666.7	-5000	-4333.3	-3666.7	-3333.3	-2666.7	-2000
1742	ISL-6 (EL MATADOR)	-114592	-86679.5	-2690.4	0	0	0	0	0
1796	DWU #5	-316125	-317125	-381571	-379751	-251192	-132353	-341304	-139526
1838	DWU #4	-316125	-317125	-381571	-457425	-526877	-463406	-166000	-291343
1901	FWB #1	0	0	0	0	0	0	0	0
1940	MARY ESTHER #3	-254378	-256373	-192775	-126822	-189126	-168633	-165112	-164690
2023	MARY ESTHER #1	-194806	-169348	-200463	-102096	-7698.6	-35049.3	-140814	-35643.8
2031	MARY ESTHER #4	0	0	0	-198008	-319274	-355389	-325759	-264436
2035	MARY ESTHER #2	-251011	-277899	-383937	-368419	-268093	-204299	-74139.7	-246353
2085	FWB #5	-4400	-20109.6	-65695.9	-12232.9	-201885	-66512.3	-93808.2	-43682.2
2093	FWB #2	-235.6	-51852.1	-203556	-229715	-318016	-345745	-295567	-24071.2
2099	FWB #3	-125934	0	0	0	-13569.9	-70980.8	-109074	-152006
2108	FWB #8	-66150.7	-291504	-207871	-311660	-455871	-286386	-113863	-178822
2139	FWB #9	-558501	-50137	-216033	-95671.2	-286343	-432049	-127471	-248419
2146	FWB #11	-568288	-757090	-673466	-693107	-703214	-413589	-826655	-918781
2168	EAFB HURL #7 #91136	-168500	-161750	-155000	-148250	-107222	-213458	-180750	-251326
2236	OC-9 (NORTHGATE)	-313863	-325893	-359123	-489743	-378370	-391016	-223756	-361701
2365	FCSC #11	0	0	-1484.9	-50668.5	-110625	-80479.5	-37663	-8827.4
2390	QUAIL RUN ESTATES	0	0	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-725279	-556266	-330986	-350751	-299743	-383737	-272921	-39219.2

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
2463	OC-10 (LOWERY)	0	-70230.1	-488679	-580307	-486929	-548792	-584660	-599258
2506	OC-3 (NEWCASTLE)	-331529	-172784	-281192	-328762	-184775	-221115	-275301	-275485
2508	OC-4 (GREEN STREET)	-522984	-577452	-776466	-320732	-674356	-688093	-564181	-499699
2554	OC-6 (HAWKINS ROAD)	-328110	-532499	-599112	-644279	-636016	-737816	-897019	-770611
2581	OC-5 (SHALIMAR)	-676474	-794844	-739244	-518356	-532838	-265236	-476208	-361975
2584	OC-7(SHALIMAR ANNEX)	-749115	-635584	-662784	-664953	-643304	-627997	-407910	-540493
2651	MOODY KELLY #1	0	0	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-109893
2750	EAFB HOUS #12 #2829	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-92687.7
2758	FWB #7	-716203	-868452	-901077	-825030	-844296	-614184	-746255	-109841
2759	OC-8 (GREEN ACRES)	-344151	-625564	-714279	-714041	-730507	-738293	-927732	-855260
2762	EAFB HOUS #16 #2755	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-249112
2787	EAFB HOUS #11 #10634	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-375186
2792	FWB #10	-720644	-576967	-512008	-449003	0	-468838	-662197	-862992
2807	FWB #6	-723671	-958677	-760499	-733490	-466392	-651978	-218293	-713197
2814	BLUEWATER #4	0	0	-82.2	-404743	-370134	-409471	-524019	-402433
2815	EAFB HOUS #10 #10941	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-198332
2825	EAFB HOUS #8 #2594	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-155107
2860	EAFB HOUS #9 #10000	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-440677
2874	OC-2 (LONGWOOD)	-553885	-680030	-447921	-389940	-633326	-518011	-477937	-496132
2884	EAFB HOUS #7 #2590	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-218756
2891	BLUEWATER #2	-172759	-475500	-266663	-104170	-236427	-127743	-217647	-215890
2909	SOUTH GOLF COURSE	-24463	-21542.5	-34528.8	-104052	-53476.7	-24446.6	-18315.1	-31720.5
2953	SEMINOLE #5	-17600	-19000	-20564.4	-19200	-34515.1	-31575.3	-26364.4	-19695.9
2958	EAFB HOUS #14 #1308	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-73805.5
2971	SEMINOLE #1	-17600	-19000	-11597.3	-19200	-13123.3	-10221.9	-13011	-19695.9
2972	SEMINOLE #6	-17600	-19000	-18367.1	-19200	-11720.5	-14684.9	-15342.5	-19695.9
2973	WELL #6	-22843.8	-17758.9	-10526	-1517.8	-1331.5	-939.7	-1131.5	0
2984	EAFB MAIN #5 #616	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-35386.3
2985	EAFB MAIN #4 #303	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-77775.3

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
3004	EAFB HOUS #15 #1320	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-83304.1
3012	EAFB MAIN #3 #31	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-261866
3015	EAFB MAIN #6 #62	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-52682.2
3026	OLD GOLF COURSE #1	0	0	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	0	0	0	0	0	0	0	0
3049	SEMINOLE #2	-17600	-19000	-24016.4	-19200	-28857.5	-23849.3	-23542.5	-19695.9
3057	SEMINOLE #3	-17600	-19000	-27589	-19200	-22860.3	-25778.1	-24934.2	-19695.9
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-316677
3091	BLUEWATER #3	-667466	-475500	-750773	-484463	-420570	-489077	-318562	-431321
3095	FREEPORT #2	-172000	-178000	-87500	-104000	-97666.7	-105667	-160667	-323652
3126	VALPARAISO #4	-103934	-121984	-113178	-181855	-177241	-215049	-241504	-255348
3231	NICEVILLE #8	-125170	-179280	-196559	-215786	-353411	-373863	-275362	-269504
3240	VALPARAISO #2	-186534	-221767	-166274	-160052	-146732	-125474	-108899	-124074
3256	NICEVILLE #2	-290816	-201288	-380167	-354299	-407425	-349493	-247419	-550137
3258	VALPARAISO #1	-92824.7	-169477	-140170	-120786	-124710	-101655	-96383.6	-139411
3295	VALPARAISO #3	-173838	-69800	-196540	-145893	-162099	-175014	-178945	-139825
3304	REDBAY GOLF #1	0	0	0	-30000	-32000	-34000	-36500	-29937
3305	REDBAY GOLF #2	0	0	0	-30000	-32000	-34000	-36500	-46624.7
3315	FREEPORT #3	0	0	-87500	-104000	-97666.7	-105667	-160667	-323652
3326	NICEVILLE #6	-154666	-195406	-211669	-199233	-278679	-562912	-545025	-356600
3350	NICEVILLE #1	-358203	-343063	-337907	-315036	-365329	-352071	-388910	-414934
3367	NICEVILLE #3	-350726	-342896	-337208	-318789	-356523	-346501	-369266	-318397
3432	NICEVILLE #10	-461874	-456945	-475953	-437964	-494797	-489214	-553984	-274852
3457	NICEVILLE #5	-333825	-611063	-545989	-541195	-519036	-521134	-597616	-604085
3482	NICEVILLE #4	-56589	-43306.8	-51605.5	-42706.8	-37457.5	-26558.9	-30241.1	-33112.3
3665	OWL'S HEAD #3/FAF #6	0	0	0	0	0	0	0	0
3731	OWL'S HEAD #2/FAF #3	0	0	0	0	0	0	0	0
4368	EAFB FLD#3 BLDG#3204	-37500	-37000	-36500	-36000	-35500	-23333.3	-23000	-3643.8
4376	EAFB FLD#3 BLDG#3102	-37500	-37000	-36500	-36000	-35500	-23333.3	-23000	-59147.9

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
5837	FCSC #2A	-83600	-58194.5	-73391.8	-67123.3	-55923.3	-59027.4	-76268.5	-39657.5
5838	FCSC #1	0	-58194.5	-73391.8	-67123.3	-55923.3	-59027.4	-76268.5	-39657.5
5839	FCSC #6	-20333.3	-30934.2	-36032.9	-33147.9	-42758.9	-52961.6	-67227.4	-54621.9
5840	FCSC #13	0	0	0	0	0	-76739.5	-101096	-105915
5841	FCSC #14	0	0	0	0	0	-62309.6	-52082.2	-42408.2
5847	FCSC #15/GRAYTON #12	0	0	0	0	0	0	-52429.6	-18852.1
5852	SADDLEBROOK DOWNS	-83600	0	0	0	-660.3	-6232.9	-5969.9	-4369.9
5886	FREEPORT #4	0	0	0	0	-97666.7	-105667	-160667	0
6006	EAFB MAIN #2A BLDG82	-300875	-284875	-268875	-252875	-236875	-223125	-209438	-414592
6010	EAFB FLD#3 BLDG#3043	0	0	0	0	0	-23333.3	-23000	-5427.4
6023	VILLA TASSO #1	-21500	-22000	-25000	-27500	-29500	-29500	-36515.1	-34320.5
6024	VILLA TASSO #2	-21500	-22000	-25000	-27500	-29500	-29500	-26695.9	-34320.5
6796	CHOCTAW BCH #2	-55000	-55000	-70000	-56000	-65000	-65000	0	0
6797	CHOCTAW BCH #1	0	0	0	0	0	0	0	0
7176	SWU #9	0	0	0	0	0	0	0	0
7209	OC-11 (FOREST)	0	0	0	0	0	0	0	-151912
7267	NICEVILLE #11/COLLEG	0	0	0	0	0	0	0	0
7306	SWU #7	0	0	0	0	0	0	0	0
7924	SWU #8	0	0	0	0	0	0	0	0
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0	0	0
8005	RU OWL'S HEAD #1	0	0	0	0	0	0	0	0
8006	ISL-3 (AMUSEMENT PK)	-137778	-114800	0	-48101.4	0	-219.2	-95.9	0
8008	EAFB HURLBURT #8 #91	0	0	0	0	0	0	0	0
8127	EAFB HOUSING #16A	0	0	0	0	0	0	0	0
8209	CEMEX FLD @ DESTIN	-12000	-12000	-12000	-13000	-13000	-12857.5	-13928.8	-16819.2
8225	VALPARAISO #5	0	0	0	0	0	0	0	0
8231	RU OWL'S HEAD #2	0	0	0	0	0	0	0	0
8283	FREEPORT #5/HIGH SCH	0	0	0	0	0	0	0	0
8314	SEMINOLE #8	0	0	0	0	0	0	0	0
8375	SEMINOLE #7	0	0	0	0	0	0	0	0

Table 4.3d (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1983–1998

NWF_ID	Well Name	1991 Pumping (gpd)	1992 Pumping (gpd)	1993 Pumping (gpd)	1994 Pumping (gpd)	1995 Pumping (gpd)	1996 Pumping (gpd)	1997 Pumping (gpd)	1998 Pumping (gpd)
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	0	0	0
8928	SWU #10	0	0	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	0	0	0
	Total	-2.6E+07	-2.7E+07	-2.8E+07	-2.7E+07	-2.7E+07	-2.7E+07	-2.7E+07	-2.7E+07

Table 4.3e
Pumping for the Transient Post-Development DSTRAM Simulation 1999–2004

NWF_ID	Well Name	1999 Pumping (gpd)	2000 Pumping (gpd)	2001 Pumping (gpd)	2002 Pumping (gpd)	2003 Pumping (gpd)	2004 Pumping (gpd)
681	PANAMA CITY BCH #11	-100882	-138885	-135216	0	0	0
684	PANAMA CITY BCH #5	-227564	-344710	-325384	0	0	0
685	PANAMA CITY BCH #6	-107669	-146723	-120088	0	0	0
739	PANAMA CITY BCH #1	-326488	-296496	-26587.4	0	0	0
743	PANAMA CITY BCH #9	-399630	-509499	-47098.9	0	0	0
745	PANAMA CITY BCH #4	-409269	-446173	-255227	0	0	0
747	PANAMA CITY BCH #2	-316871	-327027	-281510	0	0	0
756	PANAMA CITY BCH #3	-347770	-408948	-362471	0	0	0
765	PANAMA CITY BCH #13	-301704	-378753	-282852	0	0	0
768	PANAMA CITY BCH #10	-457455	-511132	-409584	0	0	0
794	PANAMA CITY BCH #12	-278252	-401499	-35781.1	0	0	0
863	INLET BEACH #2	-25545.2	-54246.6	-37017.5	-37019.2	-13564.4	-7710.2
891	SANDCLIFFS	-73835.6	-77972.1	-41379.1	0	0	0
909	CAMP CREEK S/D #1	0	0	0	0	0	0
922	FCSC #5A	-43684.9	-16514.5	-26131.5	0	0	0
1000	FCSC #3	-36808.2	-22921.4	-2321.6	0	0	0
1011	SEAGROVE #2	0	0	0	0	0	0
1018	SEAGROVE #1	0	0	0	0	0	0
1043	FCSC #10	0	0	0	0	0	0
1044	FCSC #4	0	0	0	0	0	0
1074	VAN BUTLER	0	0	0	0	0	0
1136	FCSC #12	-68179.7	-11670.3	-63196.2	0	0	0
1430	SWU #1	-119685	-133485	-102186	-146378	-189219	-25471.2
1431	SWU #4	-343159	-378625	-34541.1	-197206	-277521	-327764
1445	SWU #5	-237181	-280756	-298304	-161378	-190822	-147775
1453	SWU #2	-427808	-479896	-481422	-263803	-42807.4	-517827
1476	SWU #3	-350488	-393348	-333395	-34081.1	-260480	-407244
1481	SWU #6	-440148	-324060	-423581	-460619	-483430	-588501
1586	DWU #7	-800518	-716164	-628759	-627504	-741449	-972523
1601	DWU #2	-541438	-731940	-983855	-726239	-606334	-729606
1604	US COAST GUARD #1	0	0	0	0	0	0
1611	DWU #8	-349288	-328501	-338951	-356619	-371896	-37627.4
1654	DWU #3	-389496	-418962	-357518	-528356	-465373	-556353
1661	DWU #9	-374488	-34981.1	-398008	-530104	-49333.7	0
1687	DWU #1	0	0	0	0	0	0
1688	ISL-7 (JOHN BEASLEY)	0	0	0	0	0	0
1696	ISL-1 (MONITOR)	0	0	0	0	0	0
1710	ISL-2 (EAST TANK)	0	0	0	0	0	0

Table 4.3e (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1999–2004

NWF_ID	Well Name	1999 Pumping (gpd)	2000 Pumping (gpd)	2001 Pumping (gpd)	2002 Pumping (gpd)	2003 Pumping (gpd)	2004 Pumping (gpd)
1714	ISL-4 (TREAT PLANT)	0	0	0	0	0	0
1736	EAFB A-6 BLDG 8552	0	0	0	0	0	0
1742	ISL-6 (EL MATADOR)	0	0	0	0	0	0
1796	DWU #5	-123345	-164699	-242671	-9241.1	-170044	-18660
1838	DWU #4	-711869	-693340	-383918	-396403	-405277	-937112
1901	FWB #1	0	0	0	0	0	0
1940	MARY ESTHER #3	-169715	-150466	-132841	-18116.3	-157912	-121573
2023	MARY ESTHER #1	-32046.3	-79350.1	-23917.3	-147424	-246827	-250222
2031	MARY ESTHER #4	-238666	-177378	-149718	-133541	-175285	-233148
2035	MARY ESTHER #2	-210485	-250553	-289847	-153792	0	0
2085	FWB #5	-19509.6	-12915.8	-33849.3	-31394.5	-44435.6	-53230.1
2093	FWB #2	-204066	-170071	-209003	-170071	-245006	-231115
2099	FWB #3	-176588	-65995.8	-226573	-234303	-173833	-11378.9
2108	FWB #8	-227134	-189562	-250899	-220748	-17032.6	-171392
2139	FWB #9	-206553	-412592	-341044	-435814	-406260	-405214
2146	FWB #11	-788236	-77409.7	-617230	-483808	-471107	-499458
2168	EAFB HURL #7 #91136	-154425	-243816	-239595	-155586	-212093	-193671
2236	OC-9 (NORTHGATE)	-461518	-448186	-452340	-475512	-426079	-416241
2365	FCSC #11	0	0	0	0	0	0
2390	QUAIL RUN ESTATES	0	0	0	0	0	0
2404	OC-1 (OFFICE)	-171069	-50398.9	-281575	-20941.1	-219940	-275296
2463	OC-10 (LOWERY)	-494332	-841553	-723907	-632466	-565806	-59392.6
2506	OC-3 (NEWCASTLE)	-218748	-226266	-22232.6	-266934	-257241	-227164
2508	OC-4 (GREEN STREET)	-385967	-535948	-531890	-637575	-577753	-591090
2554	OC-6 (HAWKINS ROAD)	-539164	-635759	-656438	-68472.6	-664586	-666923
2581	OC-5 (SHALIMAR)	-410756	-229680	-288885	-336677	-350343	-435055
2584	OC-7(SHALIMAR ANNEX)	-405241	-41900	-433364	0	0	-147334
2651	MOODY KELLY #1	0	0	0	0	0	0
2735	EAFB HOUS#13 #2985	-219019	-127816	-179466	-117282	-71649.3	-39758.9
2750	EAFB HOUS #12 #2829	-96624.7	-90358.9	-72983.6	-81852.1	-61424.7	-61967.1
2758	FWB #7	-370466	-548715	-323592	-39887.4	-429156	-549455
2759	OC-8 (GREEN ACRES)	-587622	-617740	-600041	-653671	-712803	-712482
2762	EAFB HOUS #16 #2755	-142806	-372784	-75306.9	0	0	0
2787	EAFB HOUS #11 #10634	-173140	-216586	-86350.7	-63468.5	-55819.2	-10706.3
2792	FWB #10	-668923	-613436	-655910	-503753	-457066	-468630
2807	FWB #6	-546753	-465427	-352559	-457732	-40720	-428334
2814	BLUEWATER #4	-444877	-470770	-431699	-50906.3	-213395	-461397
2815	EAFB HOUS #10 #10941	-293633	-337718	-165460	-21318.9	-95720.5	-163359
2825	EAFB HOUS #8 #2594	-187203	-240444	-194482	-198715	-26760	-138282
2860	EAFB HOUS #9 #10000	-193680	-159178	-629129	-406348	-344436	-395447
2874	OC-2 (LONGWOOD)	-62187.4	-335734	-420836	-432047	-318395	-402658

Table 4.3e (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1999–2004

NWF_ID	Well Name	1999 Pumping (gpd)	2000 Pumping (gpd)	2001 Pumping (gpd)	2002 Pumping (gpd)	2003 Pumping (gpd)	2004 Pumping (gpd)
2884	EAFB HOUS #7 #2590	-249690	-88293.1	-204312	-197680	-225858	-32147.9
2891	BLUEWATER #2	-274304	-255944	-22478.9	-21653.7	-313658	-243573
2909	SOUTH GOLF COURSE	0	0	0	0	0	0
2953	SEMINOLE #5	-18201.6	-49946.3	-35995.1	-37690.4	-31213.7	-35342.5
2958	EAFB HOUS #14 #1308	-38482.2	-100567	-8827.4	-2545.2	-2460.3	-15761.6
2971	SEMINOLE #1	0	0	0	0	0	0
2972	SEMINOLE #6	-18201.6	-7811.2	-8265.8	0	-4712.3	0
2973	WELL #6	0	0	0	0	0	0
2984	EAFB MAIN #5 #616	-27479.5	-31791.8	-109978	-2132.6	-16980.8	-204882
2985	EAFB MAIN #4 #303	-221904	-161419	-151515	-6052.6	-29619.2	-318723
3004	EAFB HOUS #15 #1320	-94205.5	-99054.8	-116871	-58468.5	-87169.9	-72531.5
3012	EAFB MAIN #3 #31	-426438	-326932	-356332	-93479.5	-165781	0
3015	EAFB MAIN #6 #62	-22627.4	-306956	-291296	-474107	-316362	-171751
3026	OLD GOLF COURSE #1	0	0	0	0	0	0
3033	EAFB MAIN #2 #82	0	0	0	0	0	0
3049	SEMINOLE #2	-18201.6	-12304.1	-20858.1	-25076.7	-2347.4	-29575.3
3057	SEMINOLE #3	-18201.6	-14182.7	-12650.7	-10539.7	-6931.5	-3684.9
3063	BLUEWATER #1 (AUX)	0	0	0	0	0	0
3071	EAFB MAIN #1 #859	-214392	-173827	-137548	-186222	-183701	0
3091	BLUEWATER #3	-371310	-408877	-397019	-353940	-553595	-47360
3095	FREEPORT #2	-459170	-370090	-259164	-196748	-86205.5	-120271
3126	VALPARAISO #4	-274830	-283145	-290392	-283233	-23820	-273658
3231	NICEVILLE #8	-180419	-141797	-134107	-192255	-217036	-278584
3240	VALPARAISO #2	-137381	-132660	-169115	-143162	-141058	-13293.7
3256	NICEVILLE #2	-44893.7	-410389	-400370	-310433	-279359	-392910
3258	VALPARAISO #1	-165181	-151964	-23309.6	0	0	0
3295	VALPARAISO #3	-114244	-144452	-186669	-181756	-177036	-173729
3304	REDBAY GOLF #1	0	0	0	0	0	0
3305	REDBAY GOLF #2	0	0	0	0	0	0
3315	FREEPORT #3	-445069	-585953	-481290	-523318	-95734.3	-110786
3326	NICEVILLE #6	-257227	-313143	-225756	-155967	-156132	-130186
3350	NICEVILLE #1	-345482	-306781	-30487.4	-330970	-178956	-222844
3367	NICEVILLE #3	-403710	-382564	-362934	-373836	-345186	-388060
3432	NICEVILLE #10	-459123	-433184	-417699	-430504	-426899	-473290
3457	NICEVILLE #5	-441003	-463107	-467584	-470564	-397406	-422852
3482	NICEVILLE #4	-2187.4	-4578.1	0	0	0	0
3665	OWL'S HEAD #3/FAF #6	0	-230721	-183301	-142266	-109784	-125433
3731	OWL'S HEAD #2/FAF #3	0	-10001.1	-151493	-10978.9	-9738.9	-12380
4368	EAFB FLD#3 BLDG#3204	-30931.5	-30931.5	-880	-4895.9	-2969.4	-32109.6
4376	EAFB FLD#3 BLDG#3102	-18539.7	-18539.7	-32231.6	-33545.2	-12264.1	-40180.8
5837	FCSC #2A	-13419.2	-39782.5	-2215.1	0	0	0

Table 4.3e (continued)
Pumping for the Transient Post-Development DSTRAM Simulation 1999–2004

NWF_ID	Well Name	1999 Pumping (gpd)	2000 Pumping (gpd)	2001 Pumping (gpd)	2002 Pumping (gpd)	2003 Pumping (gpd)	2004 Pumping (gpd)
5838	FCSC #1	-13419.2	0	0	0	0	0
5839	FCSC #6	0	0	0	0	0	0
5840	FCSC #13	-96449.3	-10914.6	-132606	-32516.2	0	0
5841	FCSC #14	-60030.1	-79206.9	-42909.6	0	0	0
5847	FCSC #15/GRAYTON #12	-6884.9	0	0	0	0	0
5852	SADDLEBROOK DOWNS	0	0	0	0	0	0
5886	FREEPORT #4	-199151	-390241	-431019	-465608	-428748	-499564
6006	EAFB MAIN #2A BLDG82	-408449	-176225	-33273.7	-86041.1	-87221.9	-268869
6010	EAFB FLD#3 BLDG#3043	-4917.8	-4917.8	0	-10711.8	-1782.2	-3816.4
6023	VILLA TASSO #1	-36232.9	-29767.1	-920	-1833.7	-18340.7	-38561.6
6024	VILLA TASSO #2	-27630.1	-36643.8	-45616.4	-51920.5	-30161.2	-37331.5
6796	CHOCTAW BCH #2	-30178.1	-51134.2	-54156.2	-28649.3	-26754.5	-27145.2
6797	CHOCTAW BCH #1	-36545.2	-21142.5	-11753.4	-39016.4	-33871.3	-34378.1
7176	SWU #9	0	0	-128088	-553545	-318981	-393397
7209	OC-11 (FOREST)	-631416	-552627	-59767.4	-67247.4	-715981	-742236
7267	NICEVILLE #11/COLLEG	-291025	-465090	-456553	-39132.6	-454101	-497981
7306	SWU #7	-216885	-425225	-270145	-397833	-361315	-461258
7924	SWU #8	0	0	-116422	-566310	-329288	-40258.9
7998	ISL-5 (CAROUSEL)	0	0	0	0	0	0
8005	RU OWL'S HEAD #1	0	0	-386693	-620318	-221099	-238529
8006	ISL-3 (AMUSEMENT PK)	0	0	-934.2	0	0	0
8008	EAFB HURLBURT #8 #91	0	0	-68764.4	-91643.8	-104715	-88175.3
8127	EAFB HOUSING #16A	0	0	0	-9490.4	-15065.8	-290844
8209	CEMEX FLD @ DESTIN	0	0	0	0	0	0
8225	VALPARAISO #5	0	0	0	0	-14605.5	-37301.4
8231	RU OWL'S HEAD #2	0	0	0	-329.6	-199819	-375066
8283	FREEPORT #5/HIGH SCH	0	0	0	-171444	-1406071	-1241907
8314	SEMINOLE #8	0	0	0	0	0	-14652.1
8375	SEMINOLE #7	-18201.6	-12015.1	-12858.4	-1758.9	-15309.6	-11619.2
8579	FREEPORT #6/PORTLAND	0	0	0	0	0	-80501.4
8928	SWU #10	0	0	0	0	0	0
8997	RU OWL'S HEAD #3	0	0	0	0	0	0
9142	FREEPORT/NORTH BAY #	0	0	0	0	0	-148669
	Total	-2.6E+07	-2.7E+07	-2.5E+07	-2.1E+07	-2.2E+07	-2.4E+07

Table 4.4
Water Balance for Post-Development (2004) Conditions

	Flow In (Mgal/day)	Percent of Total	Flow Out (Mgal/Day)	Percent of Total
Northern Boundary	49.30	16.24	22.89	7.53
Southern Boundary	2.71	0.89	0.91	0.30
Eastern Boundary	162.56	53.54	126.15	41.48
Western Boundary	5.01	1.65	4.12	1.36
Top Boundary	79.98	26.34	19.82	6.52
Bottom Boundary	4.06	1.34	0.00	0.00
Pumping	0.00	0.00	24.05	7.91
Spring/River Boundary	0.00	0.00	106.18	34.91
Total	303.62	100.00	304.13	100.00

Table 4.5
Net Fluid Flux for Pre-Development and 2004 Conditions

	Pre-Development	Post Development (2004)	Change in Boundary Flow (2004) – (Pre-Dev)	
	Net Flow In (out) (Mgal/day)	Net Flow In (out) (Mgal/day)	(Mgal/day)	Percent of Total
Northern Boundary	24.82	26.41	1.59	6.72
Southern Boundary	0.52	1.80	1.28	5.41
Eastern Boundary	36.51	36.41	(0.10)	(0.41)
Western Boundary	0.44	0.88	0.44	1.86
Top Boundary	45.23	60.16	14.93	63.20
Bottom Boundary	0.77	4.06	3. 29	13.92
Spring/River Boundary	(108.28)	(106.18)	2.10	8.90
Wells	0.00	(24.05)	(24.05)	(99.59)

Note: Number in parentheses indicates net outward flux.

Table 4.6
Chloride Balance for Post-Development (2004) Conditions

	Advective Flux				Dispersive Flux			
	Flow In (Kg/day)	Percent of Total	Flow Out (Kg/day)	Percent of Total	Flow In (Kg/day)	Percent of Total	Flow Out (Kg/day)	Percent of Total
Northern Boundary	0	0.00	0	0.00	4	0.01	40	0.03
Southern Boundary	194898	23.52	65375	15.22	484	0.69	15	0.01
Eastern Boundary	55948	6.75	72799	16.95	1951	2.77	932	0.74
Western Boundary	101190	12.21	175439	40.85	5706	8.10	3208	2.56
Top Boundary	369114	44.54	111731	26.02	59568	84.58	118631	94.53
Bottom Boundary	107649	12.99	3	0.00	2719	3.86	2670	2.13
Pumping	0	0.00	2286	0.53	0	0.00	0	0.00
Spring/River Boundary	0	0.00	1812	0.42	0	0.00	0	0.00
Total	828798	100.00	429444	100.00	70431	100.00	125496	100.00

Table 5.1
Model Parameter Changes Applied to the Sensitivity Simulations and the Resulting Statistics

Sensitivity Run Number	Tested Parameter	Comments	Perturbation Applied	Total Mass (Equilibrated Pre-development Simulation) (Relative Units)	Total Mass (1998 simulation) (Relative Units)	Mean Head Error, 1998 (ft)	RMS Head Error, 1998 (ft)	Mean Chloride Error, 1998 (mg/L)	RMS Chloride Error, 1998 (mg/L)
0	Base Case	Porosity = 0.25	None	3.536E+12	3.932E+12	-14.1	18.4	68.1	490.0
1	Porosity	changed to 0.15 for all elements	Value = 0.15	2.118E+12	2.357E+12	-14.1	18.4	72.6	492.4
2a	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 0.5	4.137E+12	4.493E+12	-2.1	11.0	-212.2	635.9
2b	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 1.5	3.143E+12	3.566E+12	-18.8	24.5	179.7	561.7
3a	Kz	Intermediate System only	Factor by 0.1	2.012E+12	2.538E+12	-6.8	14.8	252.8	635.9
3b	Kz	Intermediate System only	Factor by 10.0	4.937E+12	5.193E+12	-25.1	31.0	-1274.4	3243.8
4a	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 0.1	3.541E+12	3.929E+12	-14.1	18.4	133.2	466.1
4b	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 10.0	3.891E+12	4.275E+12	-14.4	18.9	-10.3	633.2
5a	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 0.1	3.297E+12	3.694E+12	-12.5	17.1	150.6	552.9
5b	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 10.0	3.906E+12	4.296E+12	-22.6	27.0	-259.3	652.4
6a	Specified Head	Sub-Floridan System	head - 10 ft	2.807E+12	3.233E+12	-13.7	18.2	226.3	585.0
6b	Specified Head	Sub-Floridan System	head + 10 ft	3.994E+12	4.381E+12	-14.5	18.7	-152.6	678.1
7	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9	Kz = Kx/35	3.650E+12	4.040E+12	-14.5	18.9	-11.6	608.3

Table 5.1 (continued)
Model Parameter Changes Applied to the Sensitivity Simulations and the Resulting Statistics

Sensitivity Run Number	Tested Parameter	Comments	Perturbation Applied	Total Mass (Equilibrated Pre-development Simulation) (Relative Units)	Total Mass (1998 simulation) (Relative Units)	Mean Head Error, 1998 (ft)	RMS Head Error, 1998 (ft)	Mean Chloride Error, 1998 (mg/L)	RMS Chloride Error, 1998 (mg/L)
8	Kx and Ky	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9. Vary by factor, Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively	Kx = Kz * 1000 * Wi Ky = Kx	3.534E+12	3.931E+12	-14.2	18.5	98.4	526.2
9	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9: applied to material properties as used in Case 8	Kz = Kx/35	3.665E+12	4.059E+12	-14.5	18.9	17.8	567.7
10	Kx, Ky and Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx = 0.0007 ft/d (Area >5 mi offshore)	Kx =Kx*100 Ky =Ky*100 Reset Kz = Kx/35	3.893E+12	4.279E+12	-14.1	18.5	128.6	508.5

Table 5.2
1998 Head Observations, Upper/Undifferentiated Floridan Aquifer

Well Name	NWFID	OBS Type	Node# (slice 1)	Node#	WL MSL (ft)	Slice#
ARLEE DEFRIES	7195	ufld-head	5689	178744	13.93	16
BILL GRIGGS	7192	ufld-head	6089	179144	10.89	16
DEBBIE WARD	7188	ufld-head	6511	179566	23.49	16
DWU #5	1796	ufld-head	4335	177390	-75.19	16
EAFB CAMP RUCKER	2993	ufld-head	6605	179660	-5.07	16
EAFB FIELD 5 #2	3923	ufld-head	10015	183070	-15.32	16
EAFB FLD-3 #2 B-3204	4368	ufld-head	11282	184337	9.78	16
EAFB FLD-4 #2 #4204	3209	ufld-head	7381	180436	-50.32	16
EAFB POSTIL POINT	2994	ufld-head	6565	179620	-77.83	16
EAFB RANGE 63 #32	3820	ufld-head	9677	182732	29.94	16
FAF #2	3807	ufld-head	9695	182750	37.53	16
FAF #72	3485	ufld-head	8468	181523	24.50	16
FREEPORT #4	5886	ufld-head	7069	180124	31.40	16
HOWARD FORTNER	7196	ufld-head	4139	177194	2.82	16
M. FOUNTAIN	1408	ufld-head	3396	176451	-41.88	16
MARY ESTHER #2	2035	ufld-head	4590	177645	-154.12	16
NWFWMD WEST HEWETT FLD	1376	ufld-head	3411	176466	-12.95	16
OKALOOSA SCHOOL BRD	1894	ufld-head	4459	177514	-94.26	16
OLD COWFORD	2534	ufld-head	5693	178748	21.75	16
PANAMA CITY BCH #12	794	ufld-head	1522	174577	-49.82	16
PANAMA CITY BCH #13	765	ufld-head	1386	174441	-58.23	16
PINNACLE PORT OLD IRRIG	830	ufld-head	1656	174711	-5.02	16
POINT WASHINGTON	1371	ufld-head	3438	176493	11.49	16
PT WASH FLRD TEST	1062	ufld-head	2615	175670	21.19	16
R WRIGHT	2820	ufld-head	5892	178947	-28.65	16
R.E. LALONDE	2962	ufld-head	6461	179516	-10.60	16
RICHARD FARRINGTON	7191	ufld-head	6362	179417	13.28	16
ROD LUNA	7190	ufld-head	3569	176624	3.55	16
RU ROCKHILL PROD	7175	ufld-head	10944	183999	47.86	16
S. MATTHEWS	2034	ufld-head	4811	177866	0.02	16
SELMA MADARA	2738	ufld-head	5792	178847	9.53	16
SWU #6	1481	ufld-head	3665	176720	-47.21	16
SWU UPR FLRD MONITOR	7183	ufld-head	4083	177138	-48.69	16
THOMPSON	3293	ufld-head	7883	180938	15.23	16
USGS FREEPORT #17	3101	ufld-head	6770	179825	14.20	16
VAN BUTLER	1074	ufld-head	2596	175651	11.69	16
WAYSIDE PARK	1675	ufld-head	4045	177100	-82.78	16
WRIGHT ELEMENTARY	2394	ufld-head	5289	178344	-113.00	16
WRIGHT UPPER FLRD	2822	ufld-head	5844	178899	-102.30	16

Table 5.3
1998 Head Observations, Lower Floridan Aquifer

Well Name	NWFID	OBS Type	Node# (slice 1)	Node#	WL MSL (ft)	Slice#
BEAL CEM. LOWER FLRD	2173	lfld-head	5011	74233	-23.02	7
EAFB FLD 4 LOWER FLRD	3210	lfld-head	7381	76603	-49.67	7

Table 5.4
Post-Development Chloride Observations, Upper/Undifferentiated Floridan Aquifer

Well Name	NWFID	OBS Type	Node# (slice 1)	Node#	Chloride (mg/L)	Slice#
BRIDGETENDER	1763	ufld-cl	4402	188994	580	17
CHESTER DOMBROWSKI	4365	ufld-cl	11361	195953	2	17
D.D. CROSBY	8648	ufld-cl	5797	190389	100	17
DWU #1	1687	ufld-cl	4060	177115	55	16
EAFB CAMP RUCKER	2993	ufld-cl	6605	64290	28	6
EAFB FLD#8 #8776	3320	ufld-cl	7850	192442	2	17
EAFB RANGE 52 #8720	3847	ufld-cl	9798	194390	2	17
EAFB WHITE PT. #1628	2694	ufld-cl	5745	167263	250	15
ERIC SWANSON	8520	ufld-cl	5809	190401	2	17
FAF #98	3780	ufld-cl	9720	136627	50	12
FCSC #2A/AKA #7	5837	ufld-cl	2463	175518	107	16
FCSC #5A/AKA #13	922	ufld-cl	2062	186654	12	17
FOREST DAVIS	1439	ufld-cl	3571	176626	360	16
FREEPORT #2	3095	ufld-cl	7048	99344	1	9
FREEPORT #3	3315	ufld-cl	7744	157725	2	14
INLET BEACH #2	863	ufld-cl	1931	163449	56	15
J.A. HOLLEY FLORIDAN	1404	ufld-cl	3415	164933	550	15
J.D. MILLER	1545	ufld-cl	3843	165361	450	15
JACK ADAIR	2028	ufld-cl	4278	177333	66	16
M.T. FONTARN	1408	ufld-cl	3396	187988	10	17
MACK MORRISON	2042	ufld-cl	4851	189443	7	17
NWFWMD PT. WASHINGTON	1062	ufld-cl	2615	152596	10	14
NWFWMD SEAGROVE DEEP	7751	ufld-cl	3004	152985	840	14
NWFWMD SEAGROVE SHALLOW	7687	ufld-cl	3004	187596	10	17
NWFWMD WEST HEWETT FLD	1376	ufld-cl	3411	153392	153	14
OLD COWFORD	2534	ufld-cl	5693	178748	3	16
PINNACLE PORT OLD IRRIG	830	ufld-cl	1656	151637	107	14
POINT WASHINGTON/MCGEE	1371	ufld-cl	3438	176493	200	16
PT. WASHINGTON TOWER	1241	ufld-cl	3027	176082	37	16
R.A. MARSH	3040	ufld-cl	6753	191345	3	17
RU MONITOR/ELEMENTARY	8921	ufld-cl	7605	53753	49	5
S.L. MATTHEWS	2034	ufld-cl	4811	189403	1000	17
SELMA MADARA	2738	ufld-cl	5792	190384	86	17
SIDNEY LATIMER	2335	ufld-cl	5381	189973	422	17
ST. RITA'S MISSION	1380	ufld-cl	3418	188010	239	17
SWU #3	1476	ufld-cl	3669	176724	12	16
SWU #4	1431	ufld-cl	3543	153524	31	14
THOMAS MILLER	2961	ufld-cl	6504	191096	2	17
TOM HUGHES #2	3005	ufld-cl	6594	191186	12	17
VAN BUTLER	1074	ufld-cl	2596	164114	240	15

Table 5.5
Post-Development Chloride Observations, Lower Floridan Aquifer

Well Name	NWFID	OBS Type	Node# (slice 1)	Node#	Chloride (mg/L)	Slice#
NWFWMD 331-98 FLORIDAN	1413	lfld-cl	3566	84325	3100	8
WRP LOWER FLORIDAN	7174	lfld-cl	4340	85099	1700	8
NWFWMD-BEAL CEMETERY	2173	lfld-cl	5011	85770	1600	8

Table 5.6
Nodes Representing Upper Floridan Aquifer, Up-gradient Interface Areas

Area	Type	Reference #	Node #	Layer #
Offshore	ufld-node	2099	175170	16
Offshore	ufld-node	2415	175488	16
Bay	ufld-node	3945	177029	16
Bay	ufld-node	5068	178159	16
River	ufld-node	8274	181389	16

Table 5.7
Nodes Representing Lower Floridan Aquifer, Up-gradient Interface Areas

Area	Type	Reference #	Node #	Layer #
Buc pinchout	lfld-node	4490	96819	9
Buc pinchout	lfld-node	4858	97189	9
Bay	lfld-node	5060	97393	9
River	lfld-node	5371	97706	9
River	lfld-node	8274	100630	9

Table 5.8
Elements Representing Intermediate System, Near Shore Gulf of Mexico and Choctawhatchee Bay

Area	Type	Reference #	Element #	Layer #
Bay and Near Shore Gulf	is-element	3086	206774	19
Bay and Near Shore Gulf	is-element	4205	207893	19
Bay and Near Shore Gulf	is-element	4355	208043	19
Bay and Near Shore Gulf	is-element	4861	208549	19
Bay and Near Shore Gulf	is-element	5064	208752	19

Table 5.9
Elements Representing Upper Floridan Aquifer, Up-gradient Interface Areas

Area	Type	Reference #	Element #	Layer #
offshore	ufld-element	2099	171839	16
offshore	ufld-element	2415	172155	16
Bay	ufld-element	3945	173685	16
Bay	ufld-element	5068	174808	16
River	ufld-element	8274	178014	16

Table 5.10
Elements Representing Lower Floridan Aquifer, Up-gradient Interface Areas

Area	Type	Reference #	Element #	Layer #
buc pinchout	lfld-element	4490	83702	8
buc pinchout	lfld-element	4858	84070	8
Bay	lfld-element	5060	84272	8
River	lfld-element	5371	84583	8
River	lfld-element	8274	87486	8

Table 5.11
Summary of 1998 Model Sensitivity Results for Up-gradient Saltwater Interface Areas
(Locations provided in Figure 5.15)

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Upper Floridan Aquifer (Up-gradient Interface Areas)			Low Floridan Aquifer (Up-gradient Interface Areas)			Intermediate System (bay and near shore Gulf of Mexico)
				Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean absolute vertical seepage velocity (ft/year)
0	Base Case	Porosity = 0.25	None	7.0	194.3	24.36	9.0	264.0	36.62	0.12
1	Porosity	changed to 0.15 for all elements	Value = 0.15	7.0	179.9	40.60	9.0	266.2	61.04	0.20
2a	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 0.5	6.7	2158.4	17.02	3.4	567.7	28.17	0.17
2b	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 1.5	7.8	47.7	30.71	11.8	131.7	42.96	0.11
3a	Kz	Intermediate System only	Factor by 0.1	-6.0	12.2	15.97	4.9	68.2	23.62	0.02
3b	Kz	Intermediate System only	Factor by 10.0	13.9	6564.9	69.28	12.3	2026.4	97.72	0.38
4a	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 0.1	7.1	202.1	24.44	9.5	291.6	36.46	0.12

Table 5.11 (continued)
Summary of 1998 Model Sensitivity Results for Up-gradient Saltwater Interface Areas
(Locations provided in Figure 5.15)

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Upper Floridan Aquifer (Up-gradient Interface Areas)			Low Floridan Aquifer (Up-gradient Interface Areas)			Intermediate System (bay and near shore Gulf of Mexico)
				Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean absolute vertical seepage velocity (ft/year)
4b	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 10.0	7.4	219.3	24.24	7.9	157.2	36.87	0.12
5a	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 0.1	6.1	74.0	24.41	6.0	118.1	36.51	0.13
5b	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 10.0	11.1	498.2	24.62	22.2	894.6	37.76	0.11
6a	Specified Head	Sub-Floridan System	head - 10 ft	6.6	28.7	24.26	8.4	41.8	36.53	0.12
6b	Specified Head	Sub-Floridan System	head + 10 ft	7.3	365.9	24.45	9.6	500.1	36.73	0.12
7	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9	Kz = Kx/35	7.1	175.9	23.45	8.5	238.8	39.38	0.12

Table 5.11 (continued)
Summary of 1998 Model Sensitivity Results for Up-gradient Saltwater Interface Areas
(Locations provided in Figure 5.15)

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Upper Floridan Aquifer (Up-gradient Interface Areas)			Low Floridan Aquifer (Up-gradient Interface Areas)			Intermediate System (bay and near shore Gulf of Mexico)
				Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean head (ft msl)	Mean chloride (mg/L)	Mean horizontal seepage velocity (ft/year)	Mean absolute vertical seepage velocity (ft/year)
8	Kx and Ky	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9. Vary by factor, Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively	Kx = Kz * 1000 * Wi Ky = Kx	7.0	172.3	24.04	8.8	191.4	57.52	0.12
9	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9: applied to material properties as used in Case 8	Kz = Kx/35	7.0	160.1	23.42	8.4	238.1	61.79	0.12
10	Kx, Ky and Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx = 0.0007 ft/d (area > 5 mi offshore)	Kx = Kx * 100 Ky = Ky * 100 Reset Kz = Kx/35	7.5	292.2	24.50	8.8	163.4	36.50	0.12

Note:
1 Bearing is given in degrees measured counter-clockwise relative to the positive x-direction.
2 Average velocity is the average of the specified elements.

Table 5.12
Sensitivity of Upper Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 171839 [3] (2099)		Element 172155[3] (2415)		Element 173685[3] (3945)		Element 174808[3] (5068)		Element 178014[3] (8274)		Average Velocity[2] (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]		
0	Base Case	Porosity = 0.25	None	7.63	87.72	5.25	123.01	4.22	186.36	4.51	251.76	100.19	4.10	24.36	N/A
1	Porosity	changed to 0.15 for all elements	Value = 0.15	12.72	87.71	8.73	122.94	7.04	186.34	7.53	251.72	166.99	4.10	40.60	IV
2a	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 0.5	5.28	85.10	3.51	117.32	2.52	162.20	2.71	253.29	71.07	7.67	17.02	III
2b	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 1.5	8.90	90.85	5.89	127.70	5.96	200.12	6.09	251.58	126.72	2.17	30.71	II/III
3a	Kz	Intermediate System only	Factor by 0.1	8.63	84.40	7.59	132.55	8.29	207.67	3.69	214.21	51.63	351.31	15.97	III
3b	Kz	Intermediate System only	Factor by 10.0	2.45	100.59	1.02	96.31	3.41	97.14	8.01	267.97	331.53	15.00	69.28	III
4a	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 0.1	7.77	88.01	5.36	122.47	4.24	185.77	4.61	252.36	100.22	4.11	24.44	I

Table 5.12 (continued)
Sensitivity of Upper Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 171839 (3) (2099)		Element 172155(3) (2415)		Element 173685(3) (3945)		Element 174808(3) (5068)		Element 178014(3) (8274)		Average Velocity(2) (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)		
4b	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 10.0	7.46	87.49	5.11	122.15	4.11	185.28	4.35	250.75	100.17	4.10	24.24	II
5a	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 0.1	7.95	87.37	5.55	122.66	4.42	176.56	4.49	245.68	99.66	4.07	24.41	II
5b	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 10.0	6.03	89.96	3.77	125.19	4.71	229.63	5.26	274.38	103.35	4.27	24.62	II
6a	Specified Head	Sub-Floridan System	head - 10 ft	7.63	87.49	5.16	123.34	4.25	184.34	4.45	249.97	99.84	4.08	24.26	II
6b	Specified Head	Sub-Floridan System	head + 10 ft	7.64	87.92	5.18	122.38	4.21	188.47	4.62	253.71	100.59	4.13	24.45	II
7	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9	Kz = Kx/35	7.60	87.78	5.21	122.85	4.19	186.44	4.32	250.30	95.94	2.48	23.45	II

Table 5.12 (continued)
Sensitivity of Upper Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 171839 (3) (2099)		Element 172155(3) (2415)		Element 173685(3) (3945)		Element 174808(3) (5068)		Element 178014(3) (8274)		Average Velocity(2) (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)		
8	Kx and Ky	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9. Vary by factor, Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively	Kx = Kz * 1000 * Wi Ky = Kx	7.61	87.72	5.23	122.92	4.22	186.29	4.44	251.11	98.72	3.75	24.04	I
9	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9: applied to material properties as used in Case 8	Kz = Kx/35	7.57	87.75	5.20	123.09	4.19	186.32	4.31	250.11	95.85	2.44	23.42	I
10	Kx, Ky and Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx = 0.0007 ft/d (area > 5 mi. offshore)	Kx = Kx * 100 Ky = Ky * 100 Reset Kz = Kx/35	8.28	87.14	5.32	120.81	4.21	186.18	4.51	251.59	100.19	4.10	24.50	I

Note:
(1) Bearing is given in degrees measured counter-clockwise relative to the positive x-direction.
(2) Average velocity is the average of the specified elements.
(3) Its location (identified by the number in parentheses) is shown in Figure 5.15. The number in parentheses is element number local to a given layer.

Table 5.13
Sensitivity of Lower Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 83702(3) (4490)		Element 84070(3) (4858)		Element 84272(3) (5060)		Element 84583(3) (5371)		Element 87486(3) (8274)		Average Velocity(2) (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)	Velocity (ft/yr)	Bearing(1)		
0	Base Case	Porosity = 0.25	None	7.79	169.42	22.63	99.93	5.44	227.26	8.99	285.07	138.26	0.99	36.62	N/A
1	Porosity	changed to 0.15 for all elements	Value = 0.15	12.98	169.43	37.71	99.93	9.07	227.29	14.99	285.07	230.44	0.99	61.04	IV
2a	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 0.5	5.64	162.65	19.48	95.88	2.62	227.29	8.60	285.62	104.51	4.62	28.17	II
2b	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 1.5	9.69	175.17	25.44	105.10	7.93	227.37	8.65	285.28	163.08	359.70	42.96	II
3a	Kz	Intermediate System only	Factor by 0.1	9.59	162.06	25.00	91.31	8.73	207.50	1.27	216.99	73.52	351.87	23.62	III
3b	Kz	Intermediate System only	Factor by 10.0	2.02	171.60	17.25	114.82	4.45	268.52	37.90	284.32	426.99	7.78	97.72	III
4a	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 0.1	7.73	168.30	22.33	99.26	4.93	222.43	8.98	285.32	138.30	0.99	36.46	I
4b	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 10.0	8.32	175.08	22.73	103.00	6.08	231.81	8.99	284.88	138.23	0.99	36.87	II

Table 5.13 (continued)
Sensitivity of Lower Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 83702[3] (4490)		Element 84070[3] (4858)		Element 84272[3] (5060)		Element 84583[3] (5371)		Element 87486[3] (8274)		Average Velocity[2] (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]		
5a	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 0.1	9.35	181.94	20.28	99.16	6.43	222.46	9.00	283.13	137.49	0.93	36.51	II
5b	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 10.0	5.20	92.63	27.79	98.75	3.83	280.94	8.97	294.13	142.98	1.34	37.76	II
6a	Specified Head	Sub-Floridan System	head - 10 ft	7.88	172.75	22.22	99.49	5.72	227.14	9.05	284.11	137.78	0.94	36.53	II
6b	Specified Head	Sub-Floridan System	head + 10 ft	7.73	165.81	23.11	100.32	5.14	226.84	8.86	286.40	138.79	1.04	36.73	II
7	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9	Kz = Kx/35	8.01	169.71	23.45	100.32	5.81	232.60	10.09	288.06	149.55	1.11	39.38	II
8	Kx and Ky	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9. Vary by factor, Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively	Kx = Kz*1000*Wi Ky = Kx	12.32	170.02	35.60	99.95	8.51	227.10	13.92	285.03	217.24	0.47	57.52	IV

Table 5.13 (continued)
Sensitivity of Lower Floridan Aquifer Groundwater Seepage Velocity, Up-gradient Interface Areas

Horizontal Ground Water Seepage Velocity and Bearing for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Element 83702[3] (4490)		Element 84070[3] (4858)		Element 84272[3] (5060)		Element 84583[3] (5371)		Element 87486[3] (8274)		Average Velocity[2] (ft/yr)	ASTM Sensitivity Type
				Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]	Velocity (ft/yr)	Bearing[1]		
9	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9: applied to material properties as used in Case 8	Kz = Kx/35	12.58	170.45	36.49	100.29	9.14	232.74	15.77	287.98	234.96	1.12	61.79	IV
10	Kx, Ky and Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx = 0.0007 ft/d (area > 5 mi offshore)	Kx = Kx*100 Ky = Ky*100 Reset Kz = Kx/35	7.90	170.69	21.85	100.73	5.49	227.43	8.99	285.03	138.26	0.99	36.50	I

Note:
(1) Bearing is given in degrees measured counter-clockwise relative to the positive x-direction.
(2) Average velocity is the average of the specified elements.
(3) Its location (identified by the number in parentheses) is shown in Figure 5.15. The number in parentheses is element number local to a given layer.

Table 5.14

Sensitivity of Intermediate System Groundwater Seepage Velocity for the Bay and Near Shore Gulf of Mexico Areas

Vertical Ground Water Seepage Velocity for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Velocity for element number (ft/yr)(1)					Mean Absolute Velocity(2) (ft/yr)	ASTM Sensitivity Type
				206774(3) (3086)	207893(3) (4205)	208043(3) (4355)	208549(3) (4861)	208752(3) (5064)		
0	Base Case	Porosity = 0.25	None	-0.243	-0.121	-0.005	-0.092	0.149	0.122	N/A
1	Porosity	changed to 0.15 for all elements	Value = 0.15	-0.405	-0.202	-0.008	-0.154	0.249	0.204	IV
2a	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 0.5	-0.346	-0.190	-0.037	-0.143	0.114	0.166	III
2b	Kx and Ky	aquifers only - slices 10, 11 and 12 where Kx and Ky ≥ 1.0 ft/d	Factor by 1.5	-0.189	-0.084	0.018	-0.071	0.170	0.106	II
3a	Kz	Intermediate System only	Factor by 0.1	-0.044	-0.024	-0.012	-0.013	0.014	0.021	III
3b	Kz	Intermediate System only	Factor by 10.0	-0.497	-0.073	0.303	-0.349	0.685	0.381	III
4a	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 0.1	-0.244	-0.122	-0.006	-0.093	0.150	0.123	I
4b	Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx< 1.0 ft/d	Factor by 10.0	-0.234	-0.116	-0.002	-0.089	0.149	0.118	II
5a	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 0.1	-0.258	-0.136	-0.024	-0.098	0.135	0.130	II
5b	Kz	Sub-Floridan System - slices 1, 2 and 3	Factor by 10.0	-0.165	-0.049	0.079	-0.061	0.207	0.112	II
6a	Specified Head	Sub-Floridan System	hd - 10 ft	-0.246	-0.124	-0.009	-0.093	0.145	0.124	II
6b	Specified Head	Sub-Floridan System	hd + 10 ft	-0.240	-0.118	-0.001	-0.092	0.153	0.121	II
7	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9	Kz = Kx/35	-0.240	-0.119	-0.004	-0.091	0.150	0.121	II

Table 5.14
Sensitivity of Intermediate System Groundwater Seepage Velocity for the Bay and Near Shore Gulf of Mexico Areas

Vertical Ground Water Seepage Velocity for 1998 for the Listed Elements

Sensitivity Run Number	Tested Parameter	Comments	Perturbation applied	Velocity for element number (ft/yr)[1]					Mean Absolute Velocity[2] (ft/yr)	ASTM Sensitivity Type
				206774[3] (3086)	207893[3] (4205)	208043[3] (4355)	208549[3] (4861)	208752[3] (5064)		
8	Kx and Ky	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9. Vary by factor, Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively	Kx = Kz*1000*Wi Ky = Kx	-0.242	-0.121	-0.005	-0.092	0.149	0.122	I
9	Kz	Lower Floridan Aquifer - slices 4, 5, 6, 7, 8, 9: applied to material properties as used in Case 8	Kz = Kx/35	-0.240	-0.120	-0.004	-0.091	0.150	0.122	I
10	Kx, Ky and Kz	Bucatunna Clay only - slices 10, 11 and 12 where Kx = 0.0007 ft/d (area > 5 mi offshore)	Kx = Kx*100 Ky = Ky*100 Reset Kz = Kx/35	-0.240	-0.121	-0.005	-0.092	0.149	0.121	I

Note:
(1) Negative velocity is downward movement.
(2) Mean absolute velocity is the average of the absolute velocities at the specified elements.
(3) Its location (identified by the number in parentheses) is shown in Figure 5.15. The number in parentheses is element number local to a given layer.

FIGURES

Filename: X:\NWF002\003-07\General_Loc_Map.cdr
Project: NWF006-001-04
Revised: 11/16/06 TB
Source: HydroGeoLogic, Inc.

Figure 1.1
General Location Map with Reference Wells in Region II

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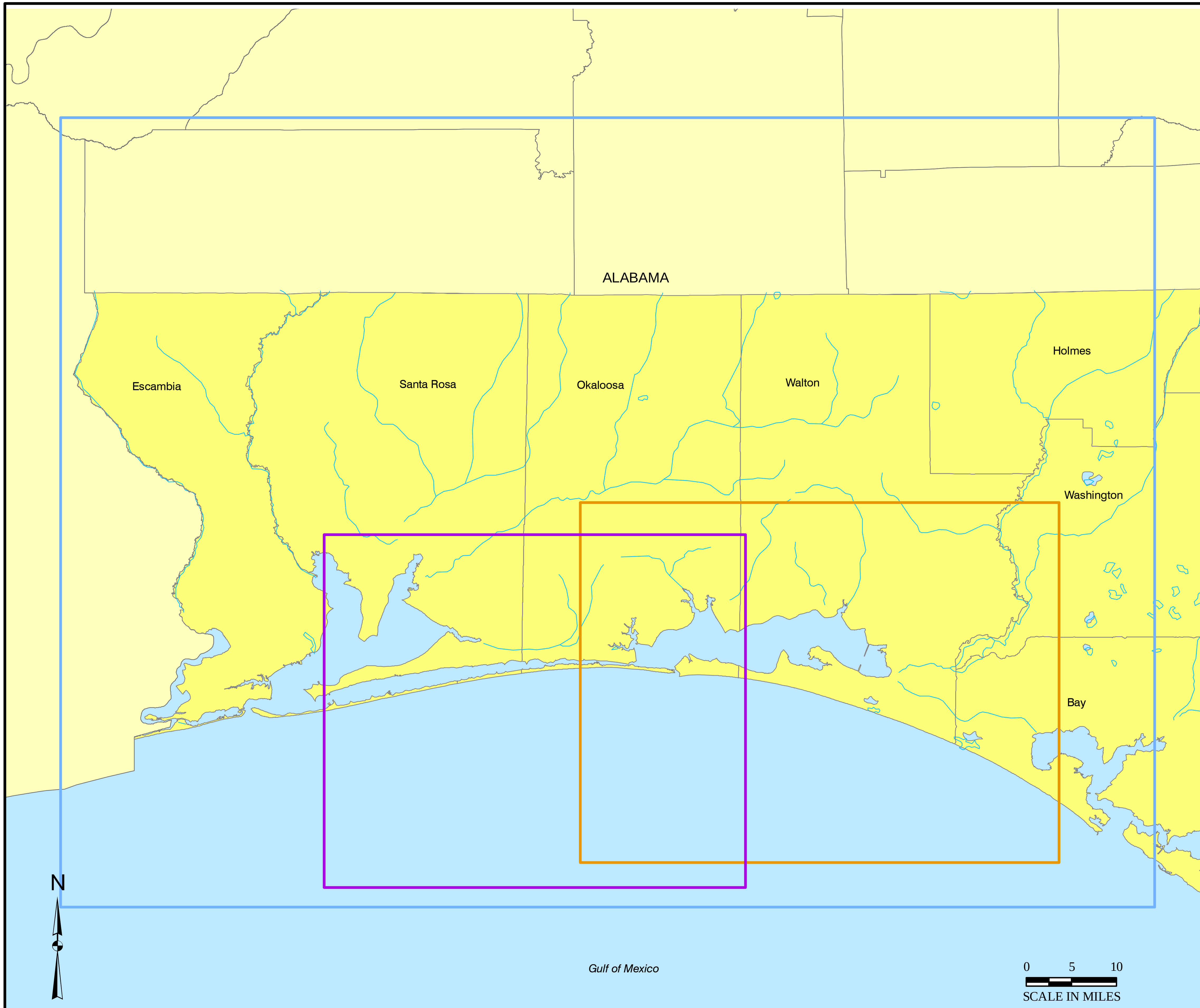
Figure 1.2
Domain Extents for MODFLOW Model, Western Domain DSTRAM Model and Eastern Domain DSTRAM Model

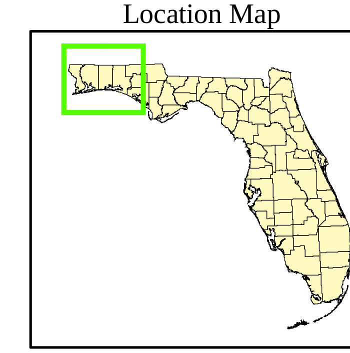
Northwest Florida Water Management District



Legend

- County Boundary
- Hydrology
- Western Domain Model Boundary
- Eastern Domain Model Boundary
- Regional Groundwater Flow Model Boundary

Location Map



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Revised: 11/16/06 TB
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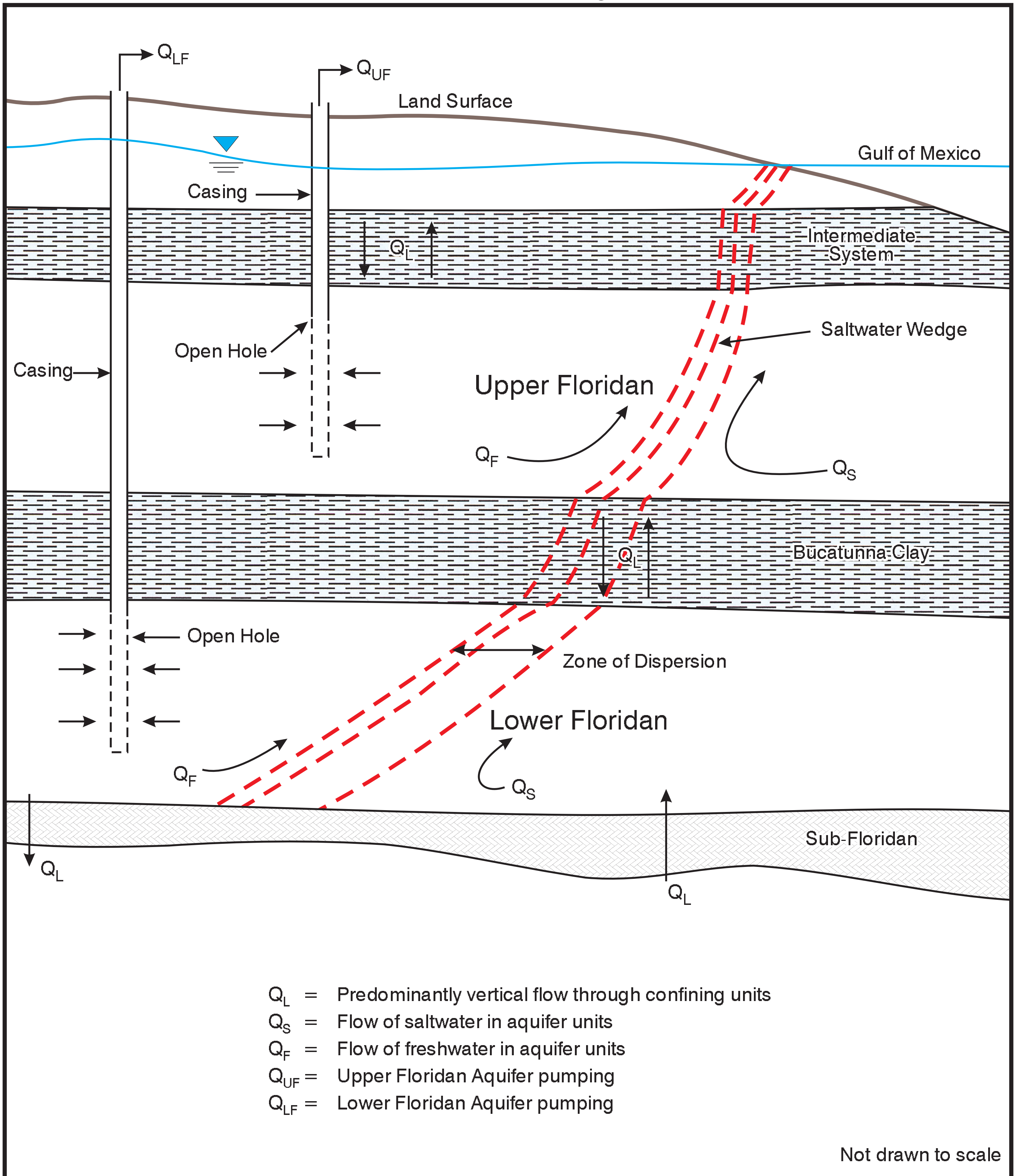

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Revised: 11/16/06 TB
Source: HydroGeoLogic, Inc.

Figure 3.1
Conceptual Model for Groundwater Flow and Solute Transport

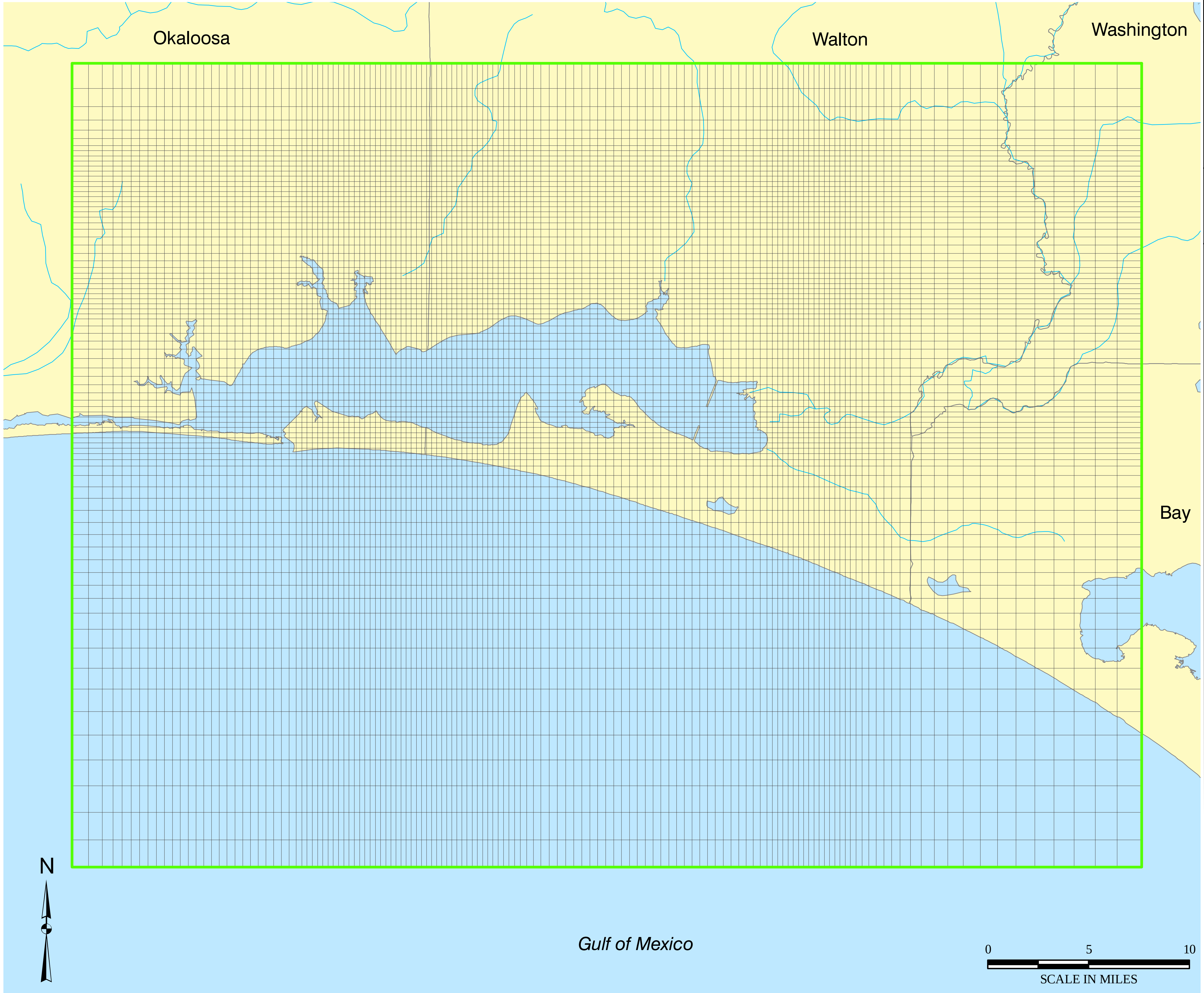

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Figure 3.2
Modeling Domain and
Finite Element Mesh for
Chloride Intrusion Simulation
of the Eastern Model

Northwest Florida
Water Management District

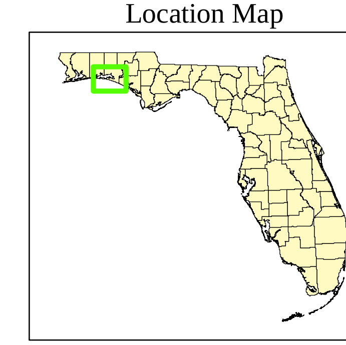
Legend

County Boundary

Hydrology

Model Boundary

Finite Element Mesh


Location Map

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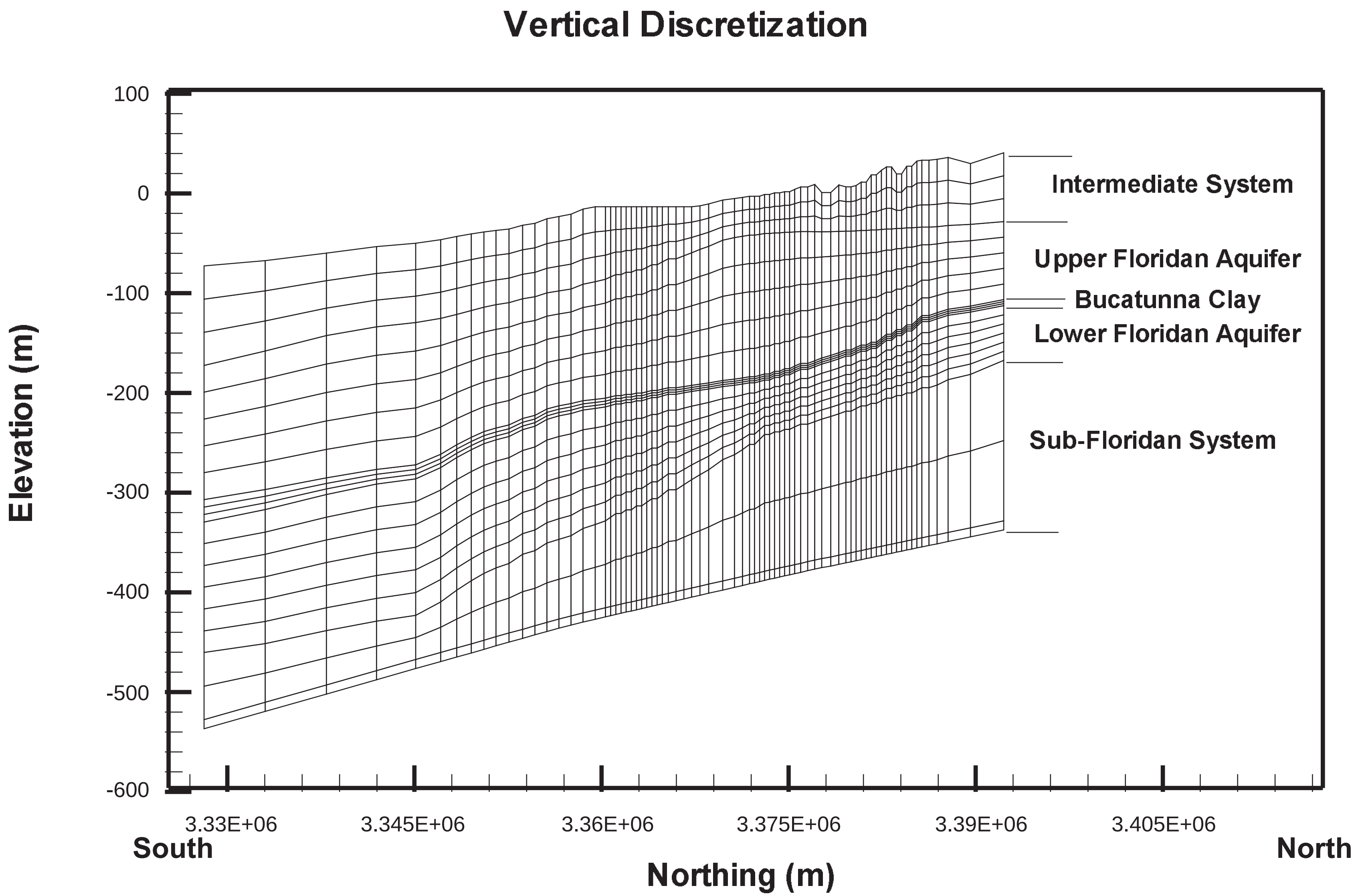
Revised: 11/16/06 TB
Map Source: HydroGeoLogic GIS
Database 2002



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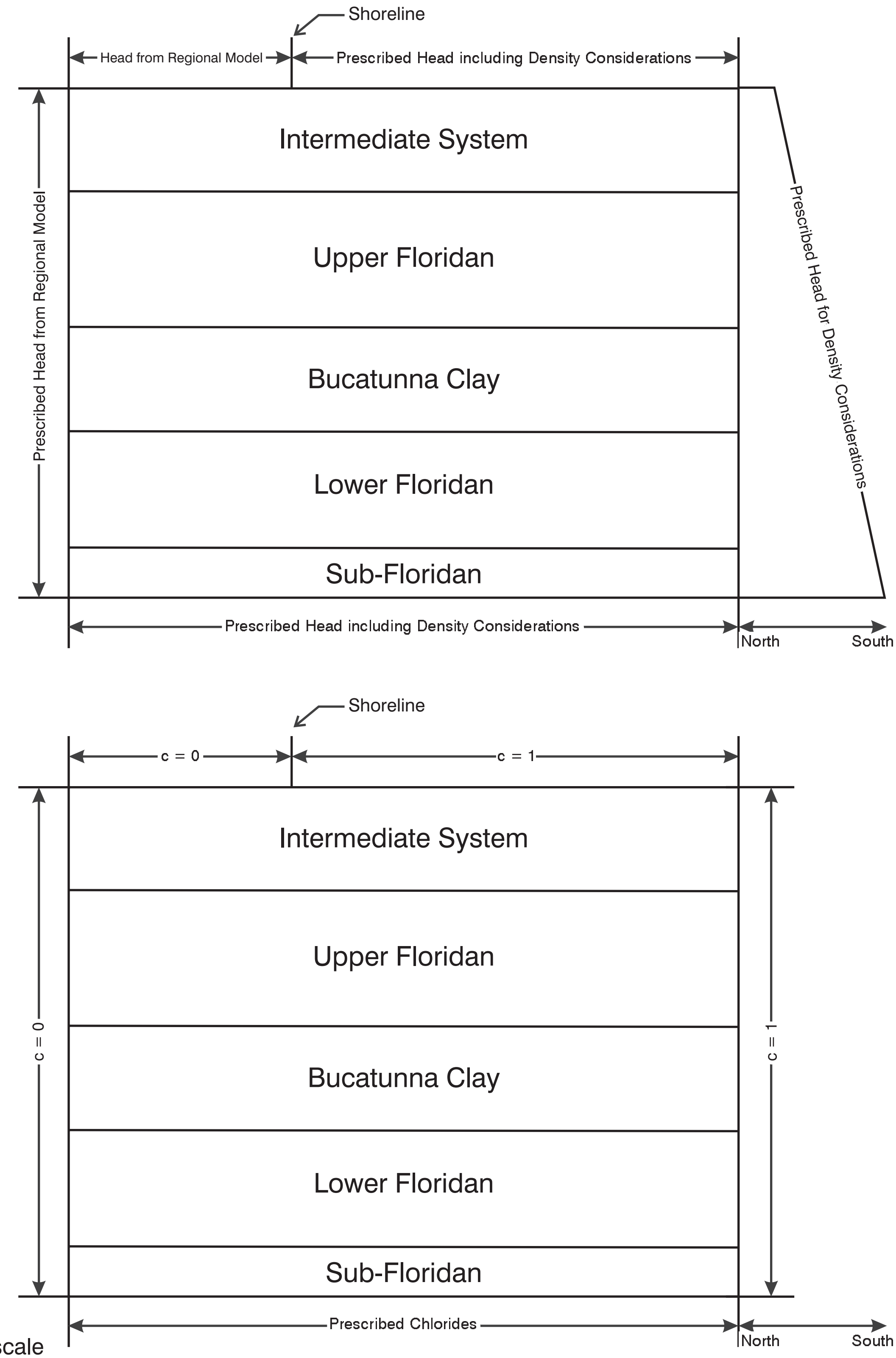
Revised: 11/16/06 TB
Source: HydroGeoLogic, Inc.

Figure 3.3
Vertical Discretization Along
y-z Cross-Section at x=569764m



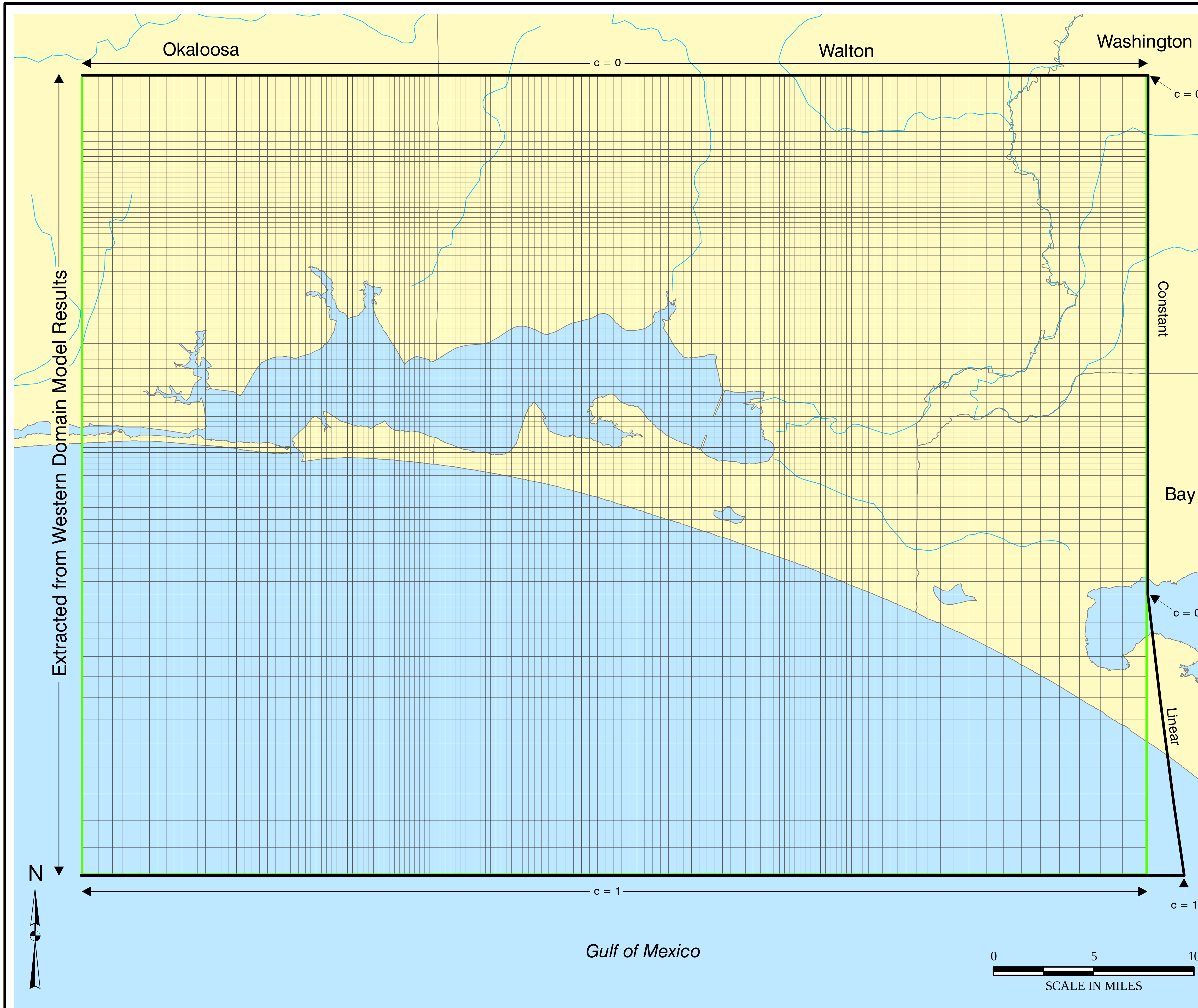
Not drawn to scale

Filename: X:\NWF006\001-04\Diagram.cdr
Project: NWF006-001-04
Revised: 11/16/06 TB
Source: HydroGeoLogic, Inc.

Figure 3.4
Conceptual Diagram of Boundary Conditions Applied along a Typical North-South Section

Figure 3.5
Prescribed Normalized Concentrations along Lateral Boundaries in the Upper and Lower Floridan Aquifers for the Eastern Model

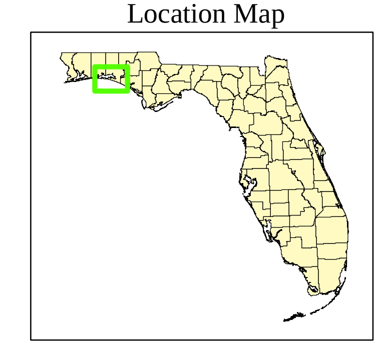
Northwest Florida Water Management District



Legend

- County Boundary
- Hydrology
- Model Boundary
- Finite Element Mesh

Location Map



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Revised: 11/17/06 TB
Map Source: HydroGeoLogic GIS Database 2006

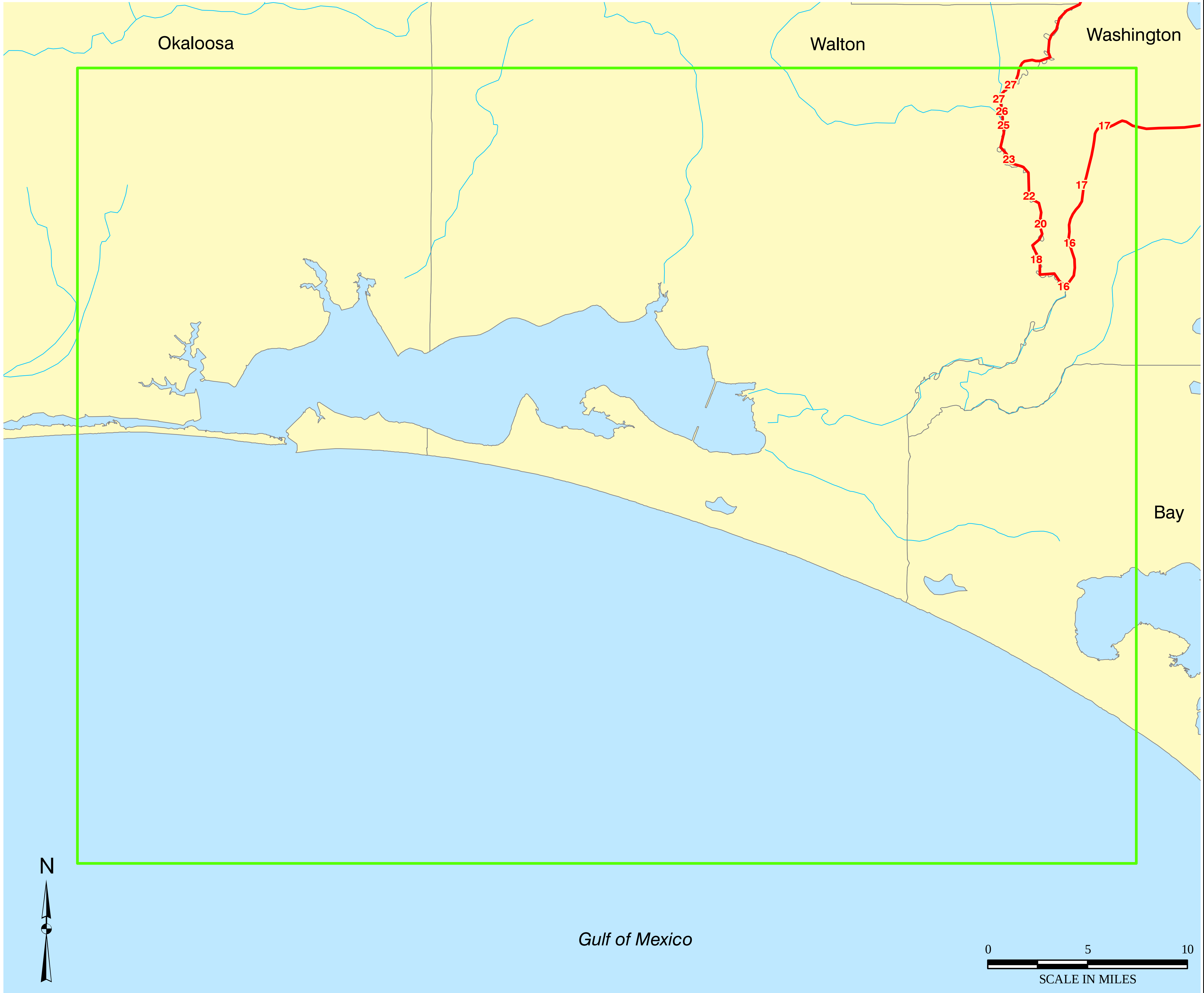

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Figure 3.6
Location of River Nodes within the Upper Floridan Aquifer and Associated River Head Values

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- River Boundary
- 22 River Head (ft)

Location Map

Filename: X:/NWF006/001-04/Maps/River_Head.mxd
Project: NWF006-001-04
Revised: 11/17/06 TB
Map Source: HydroGeoLogic GIS Database 2006

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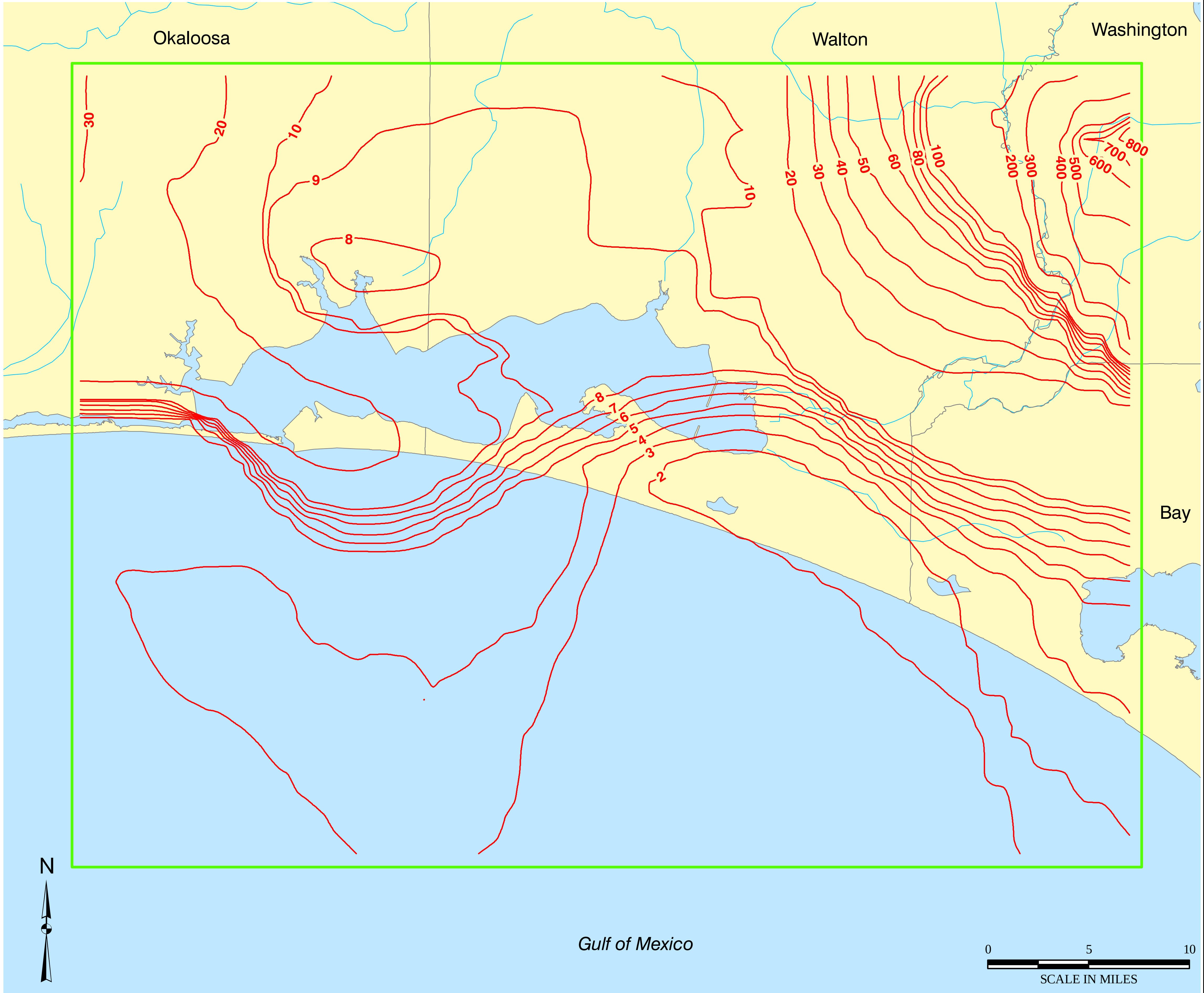
Figure 3.7
Horizontal Hydraulic Conductivity of the Upper Floridan Aquifer as Obtained from the District's Regional MODFLOW Groundwater Flow Model

Northwest Florida Water Management District



Legend

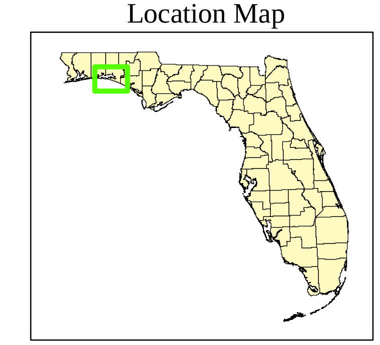
County Boundary

Hydrology

Model Boundary

—10— Hydraulic Conductivity (ft/d)

Location Map



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Project: NWF006-001-04
Revised: 11/16/06 TB
Map Source: HydroGeoLogic GIS Database 2002

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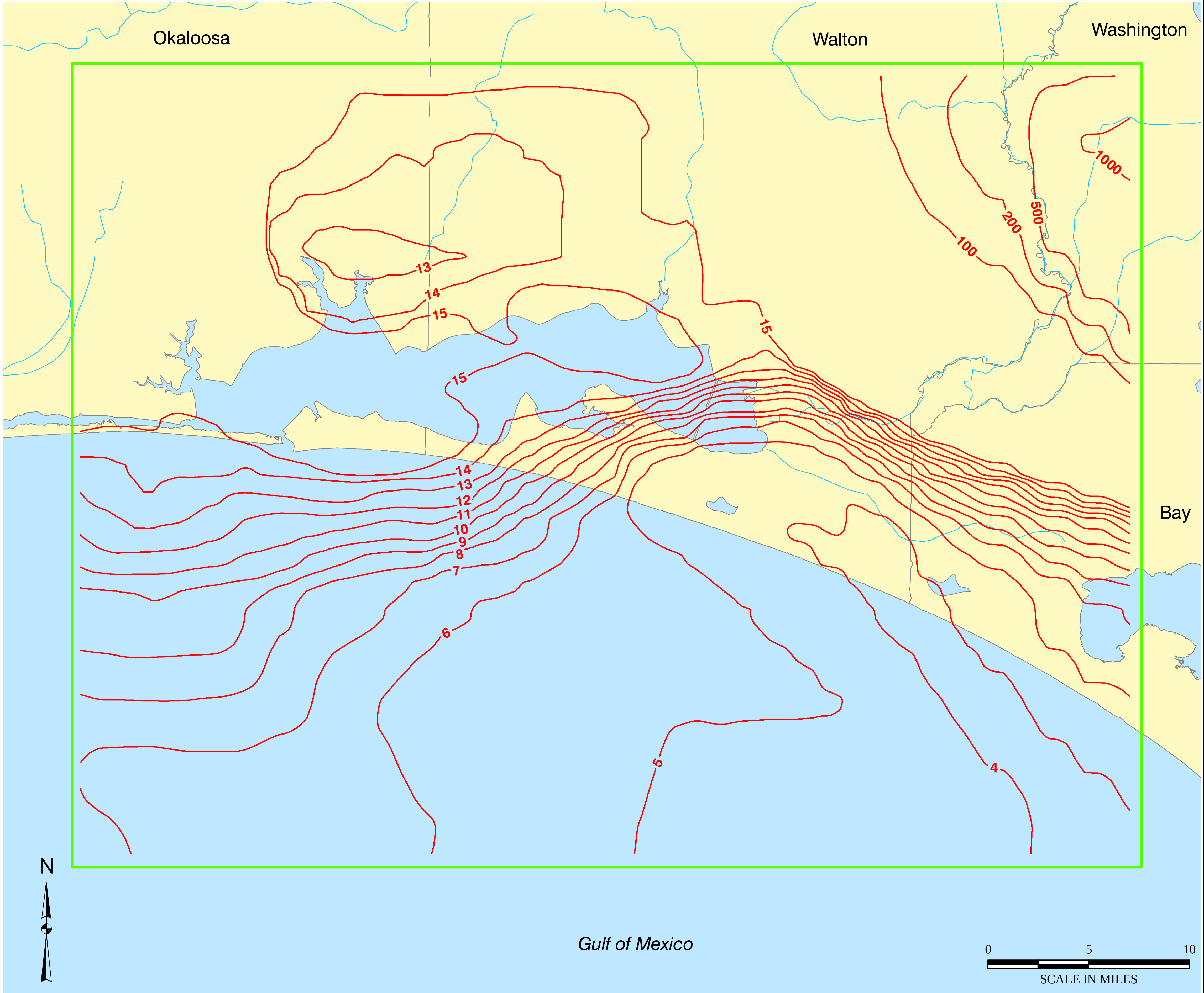
Figure 3.8
Horizontal Hydraulic Conductivity of the Lower Floridan Aquifer as Obtained from the District's Regional MODFLOW Groundwater Flow Model

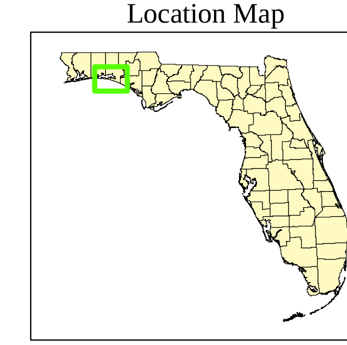
Northwest Florida Water Management District



Legend

- County Boundary
- Hydrology
- Model Boundary
- —10— Hydraulic Conductivity (ft/d)

Location Map



Filename: X:/NWF006/001-04/Maps/Kx_Lay8_LowerFloridan.mxd
Project: NWF006-001-04
Revised: 11/16/06 TB
Map Source: HydroGeoLogic GIS Database 2006

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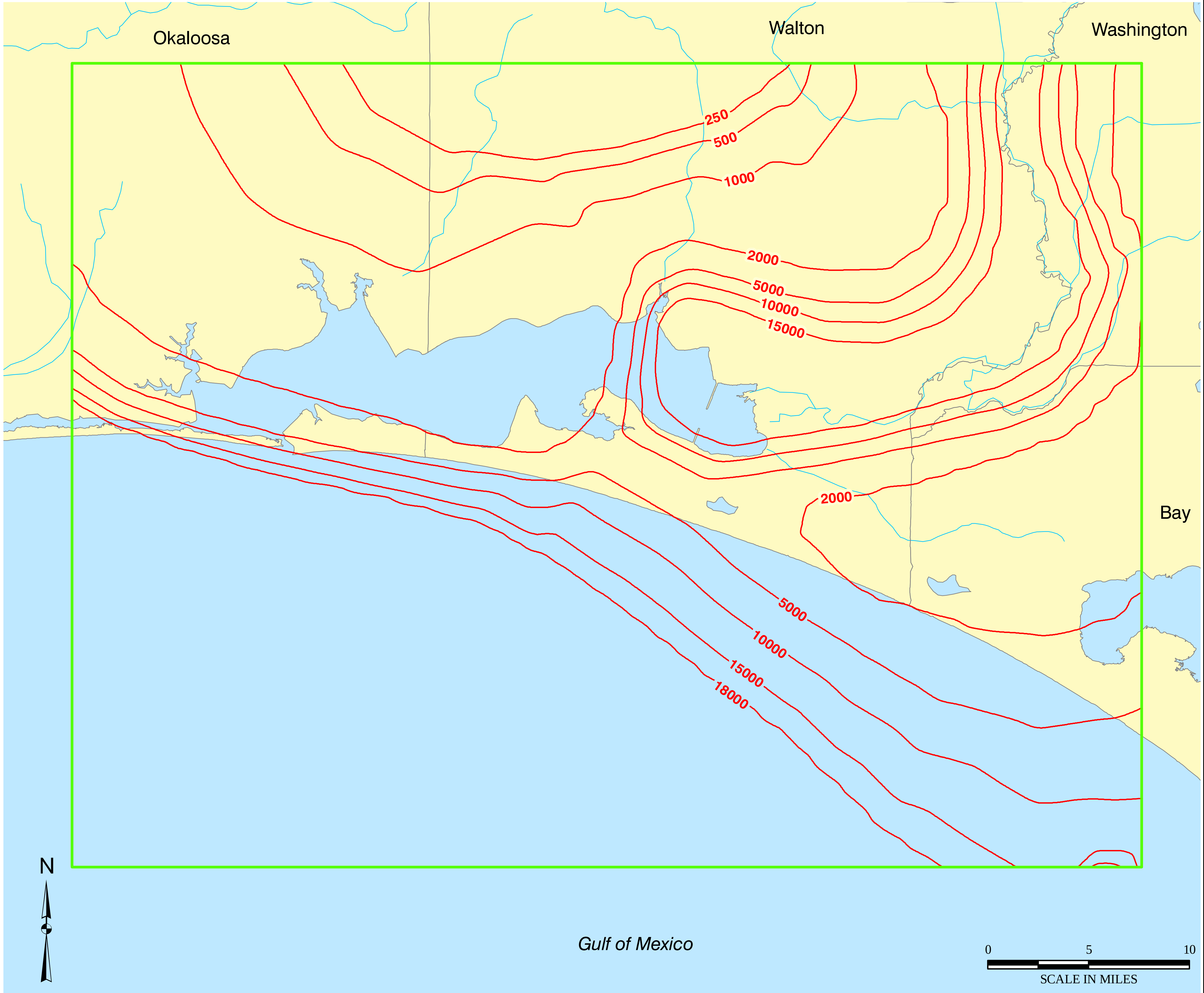
Figure 4.1a
Chloride Concentration Conditions along the Bottom of the Model Domain

Northwest Florida Water Management District



Legend

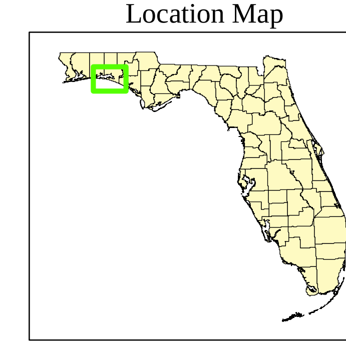
County Boundary

Hydrology

Model Boundary

–1000– Chloride Concentration (mg/L)

Location Map



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Map Source: HydroGeoLogic GIS Database 2006

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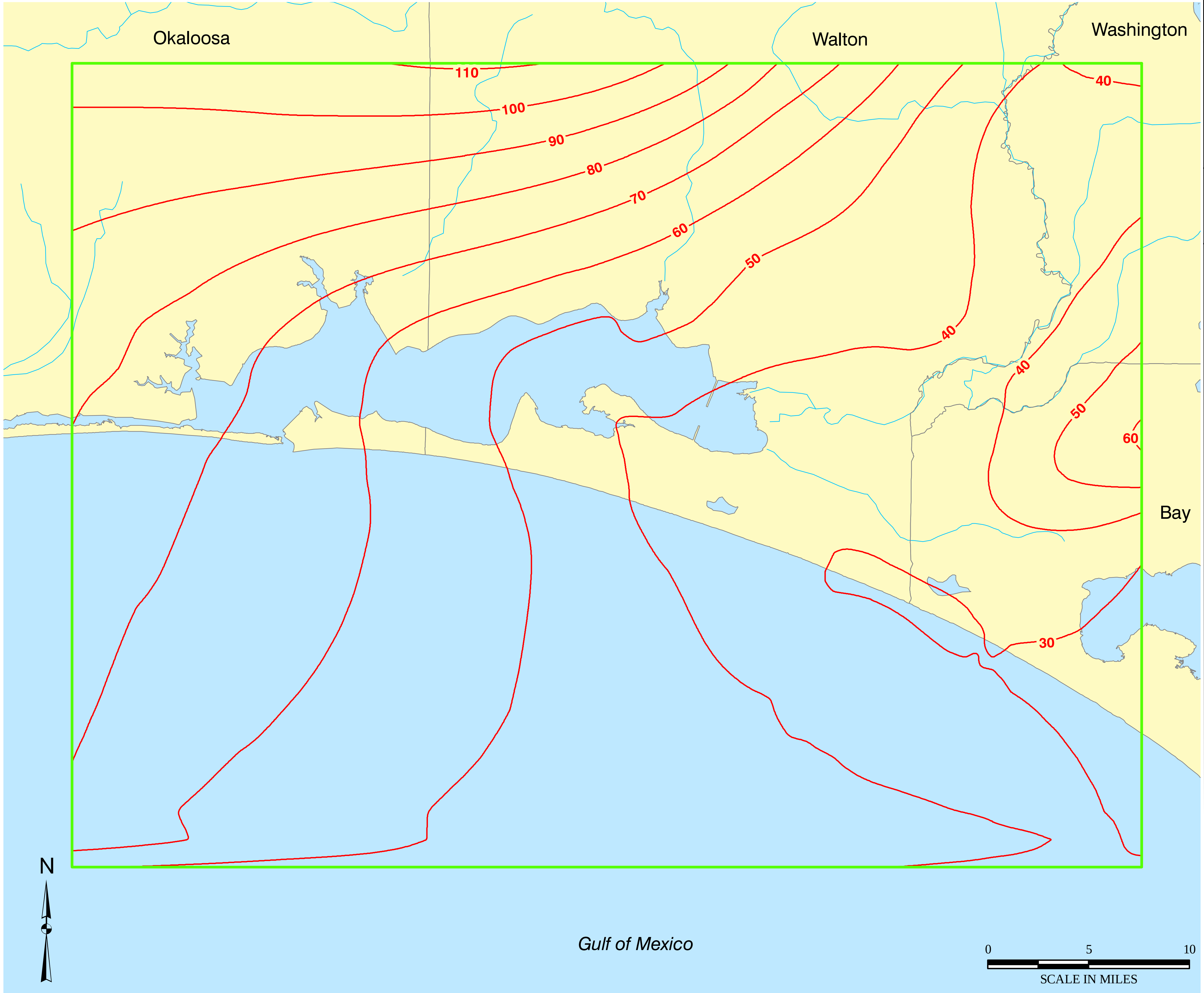

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Figure 4.1b
Equivalent Freshwater Head Boundary Conditions along the Bottom of the Model Domain

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Equivalent Freshwater Head (ft)

Location Map

Filename: X:/NWF006/001-04/Maps/SS_Lay1BC_FEH.mxd
Project: NWF006-001-04
Revised: 11/17/06 TB
Map Source: HydroGeoLogic GIS Database 2006

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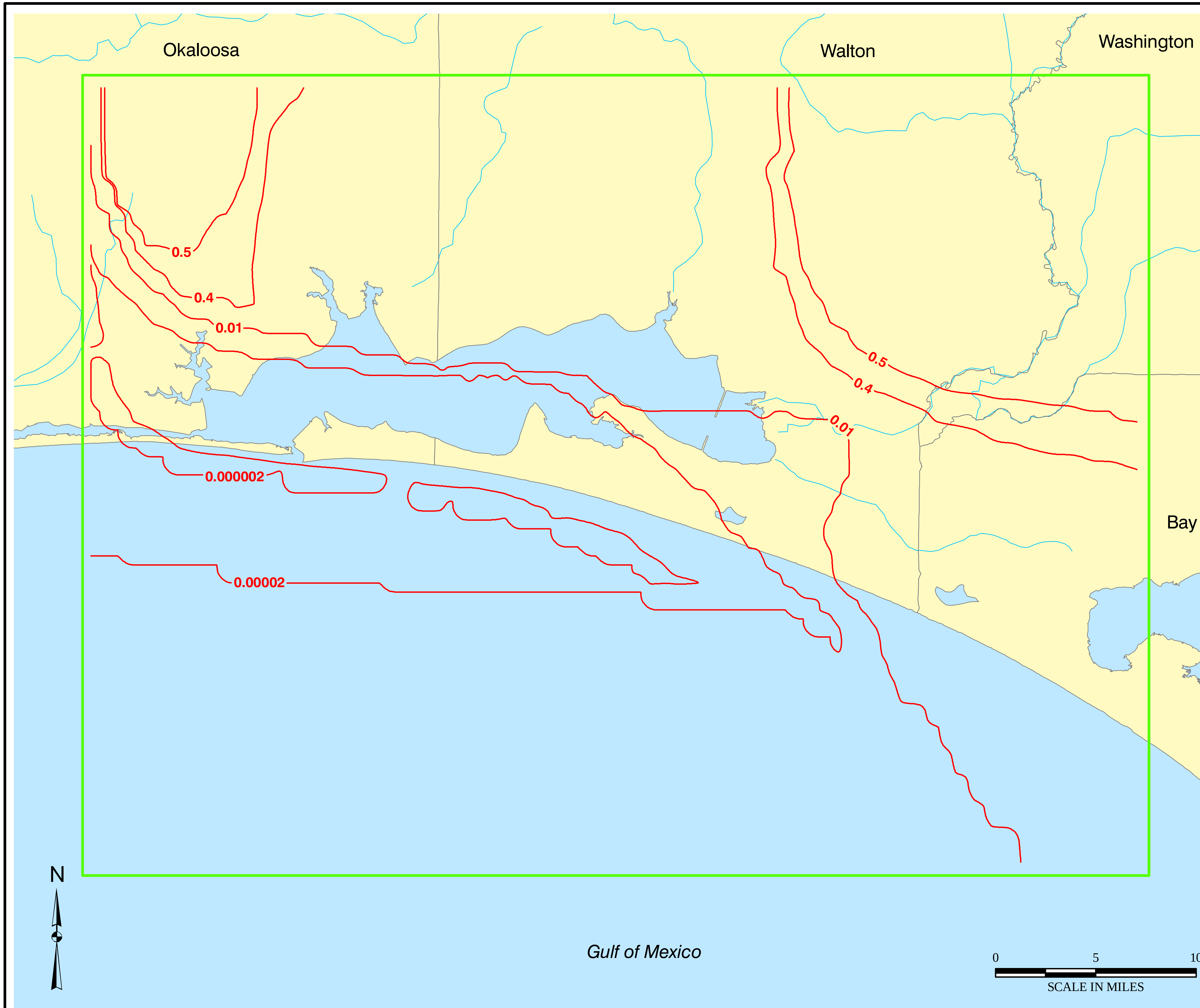
Figure 4.2a
Vertical Hydraulic Conductivity
of the Bucatunna Clay Model Layer
(Elemental Layer 11)

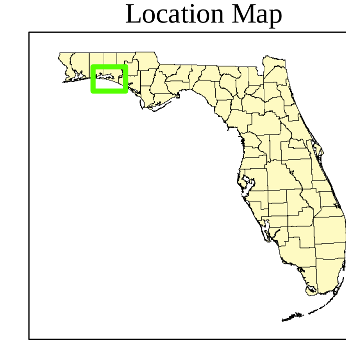


Northwest Florida
Water Management District

Legend

County Boundary
Hydrology
Model Boundary
10 Hydraulic Conductivity (ft/d)

Location Map



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Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS
Database 2006

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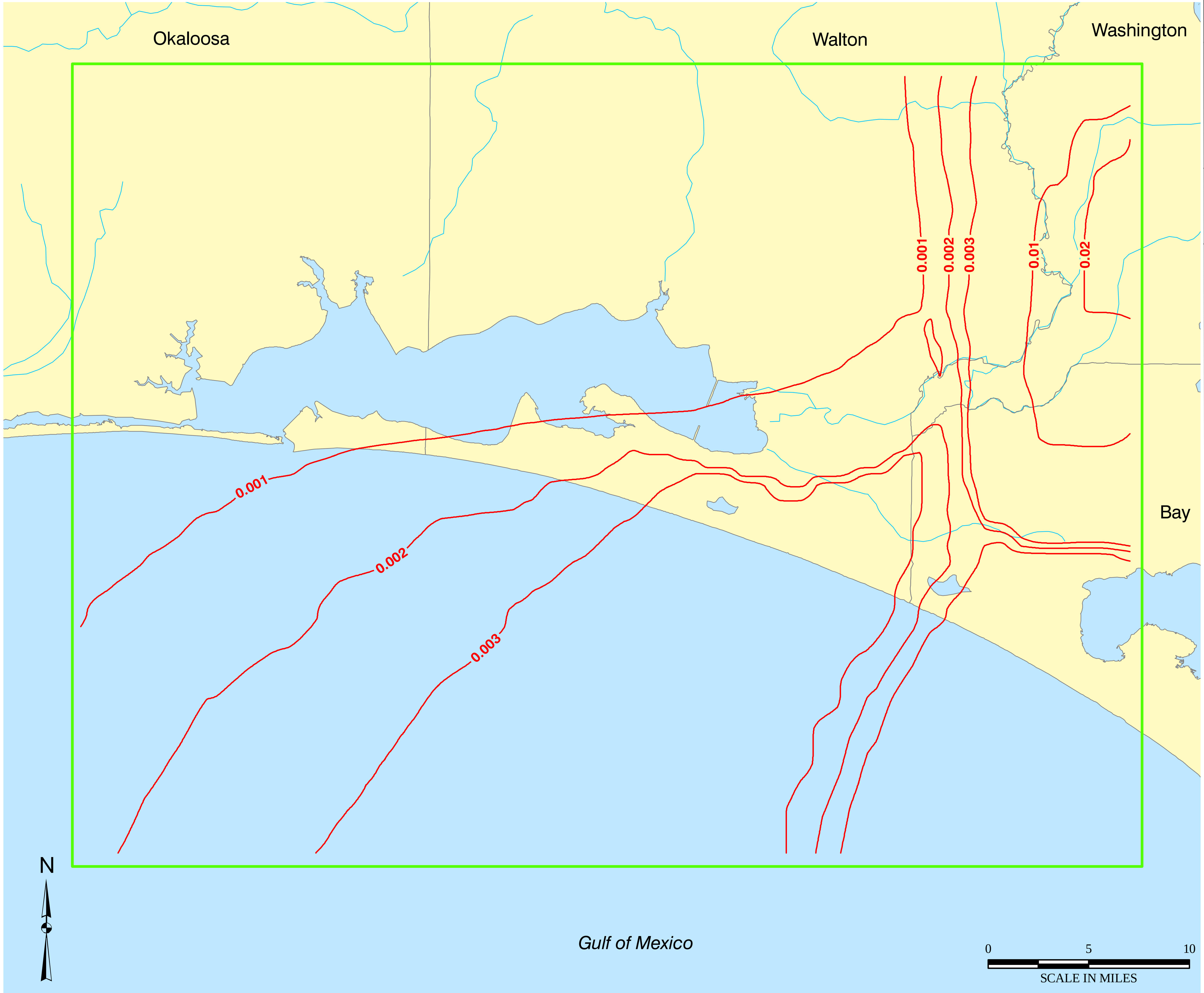

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Figure 4.2b
Vertical Hydraulic Conductivity of the Intermediate System (Elemental Layer 19)

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 0.01 Hydraulic Conductivity (ft/d)

Location Map

Filename: X:/NWF006/001-04/Maps/Kz_Lay19_Int.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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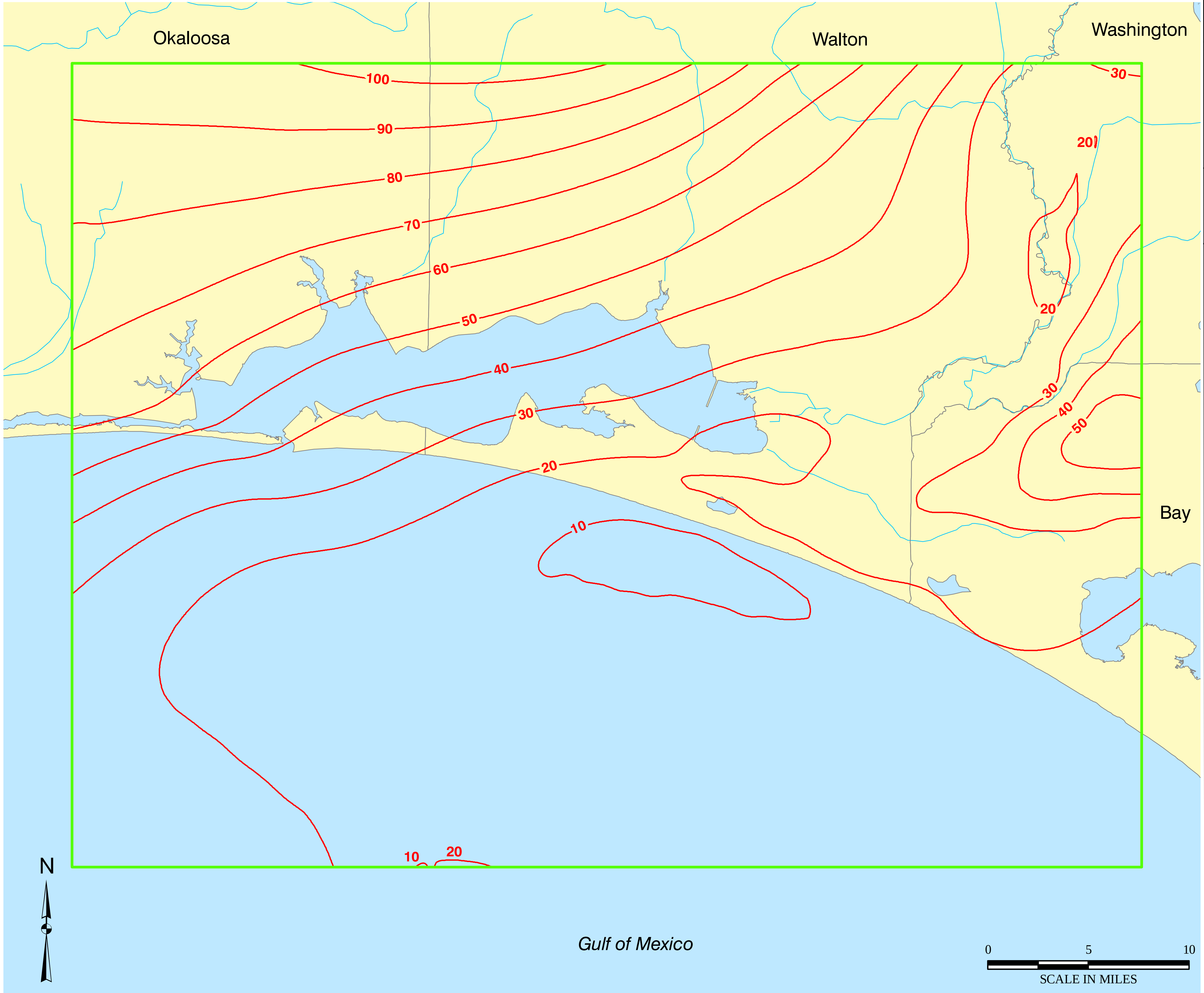
Figure 4.3a
Pre-Development Equivalent Freshwater Head for the Upper Floridan Aquifer (Nodal Layer 16, mid-aquifer)

Northwest Florida Water Management District



Legend

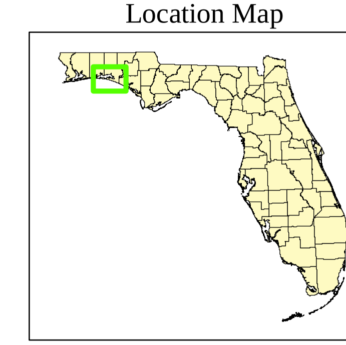
County Boundary

Hydrology

Model Boundary

50 Equivalent Freshwater Head (ft)

Location Map



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Revised: 11/16/06 TB
Map Source: HydroGeoLogic GIS Database 2002

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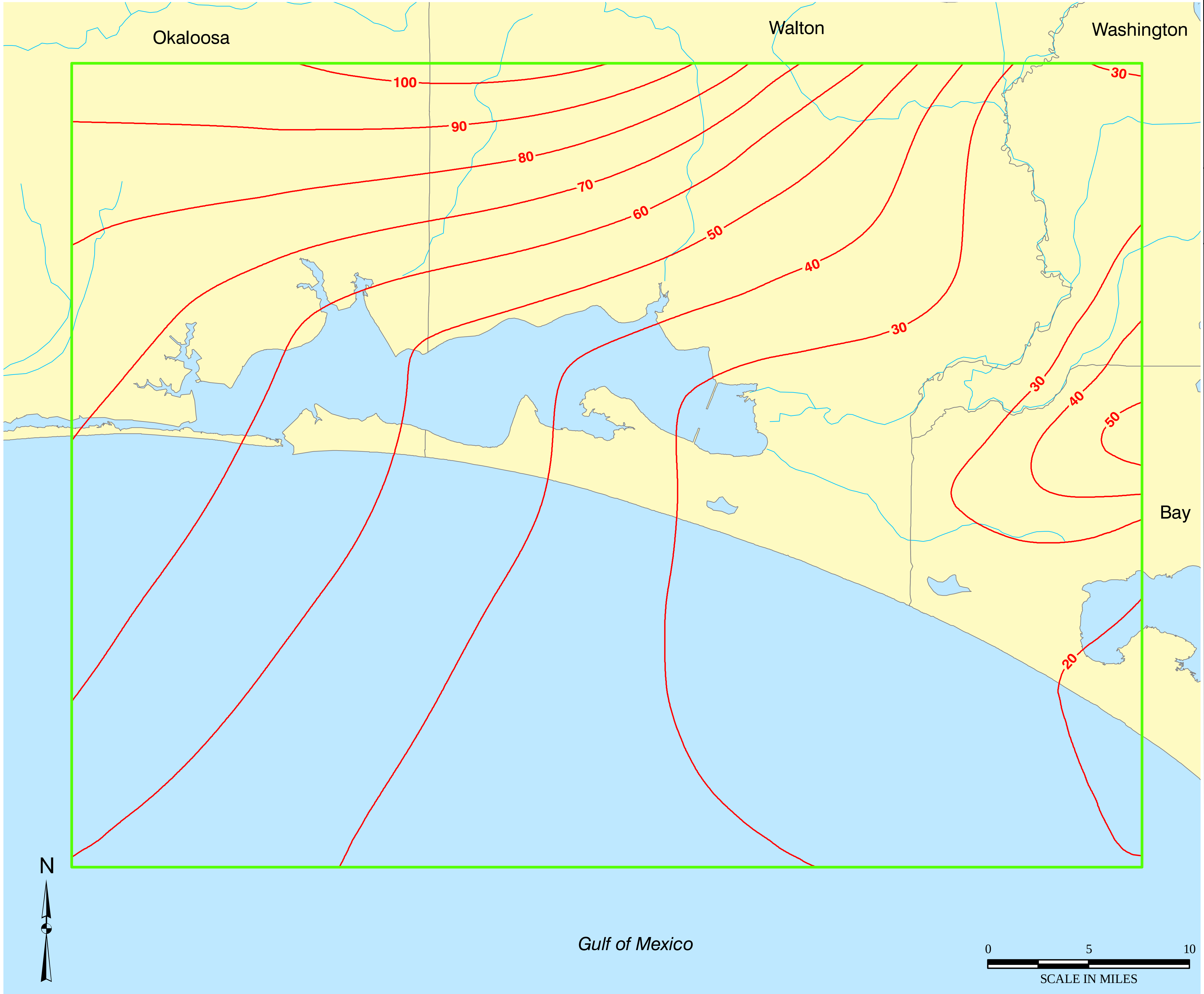

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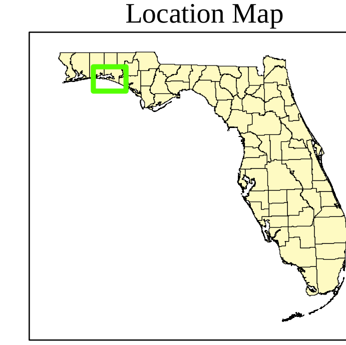
Figure 4.3b
Pre-Development Equivalent Freshwater Head for the Lower Floridan Aquifer (Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Equivalent Freshwater Head (ft)

Location Map



Filename: X:/NWF006/001-04/Maps/SS_EFH_Lay7.mxd
Project: NWF006-001-04
Revised: 11/16/06 TB
Map Source: HydroGeoLogic GIS Database 2002

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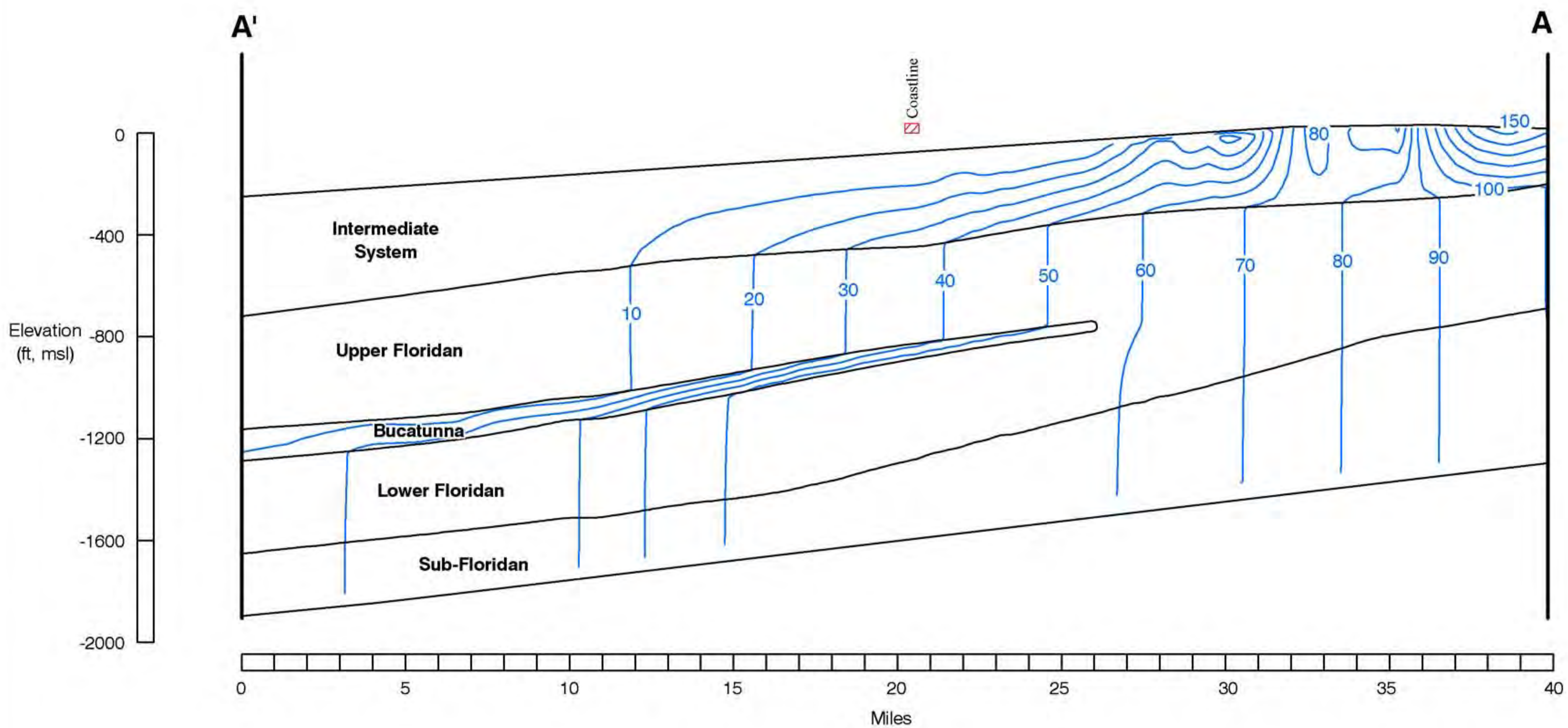
Figure 4.4
Pre-Development Environmental Head for Cross-Section A-A'

Northwest Florida Water Management District



Legend

—20— Environmental Head (ft)

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_AAprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

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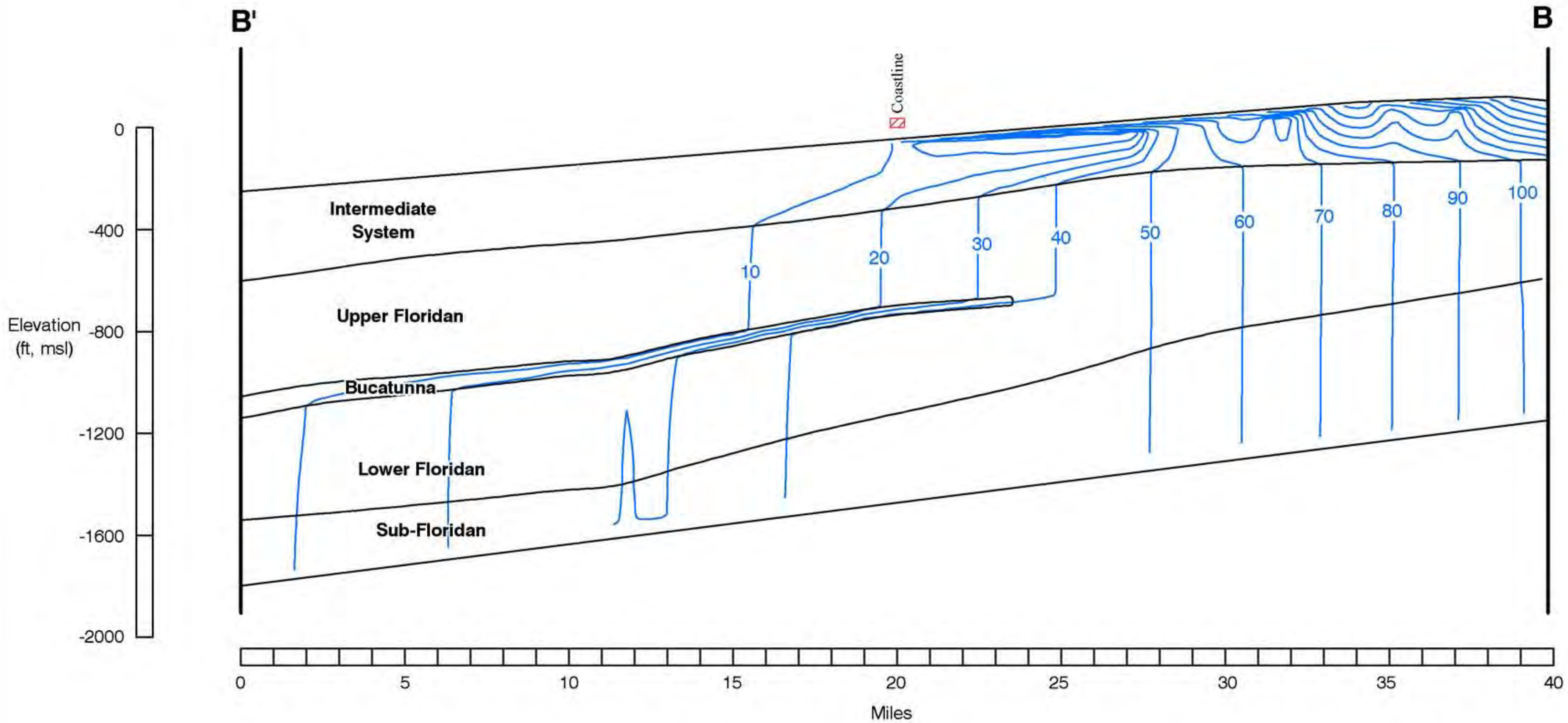
Figure 4.5
Pre-Development Environmental Head for Cross-Section B-B'

Northwest Florida Water Management District



Legend

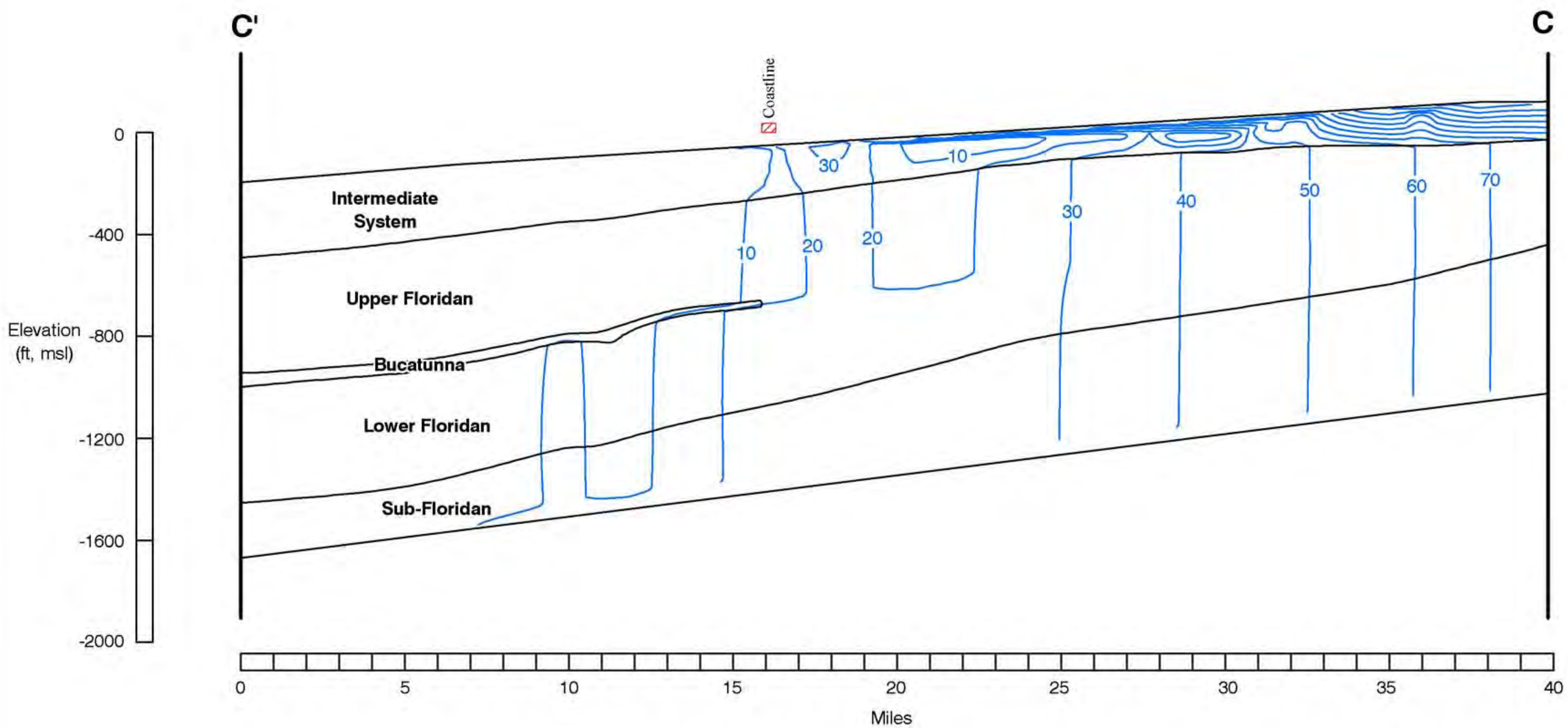
—20— Environmental Head (ft)

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_BBprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.6
Pre-Development Environmental Head for Cross-Section C-C'

Northwest Florida Water Management District

Legend

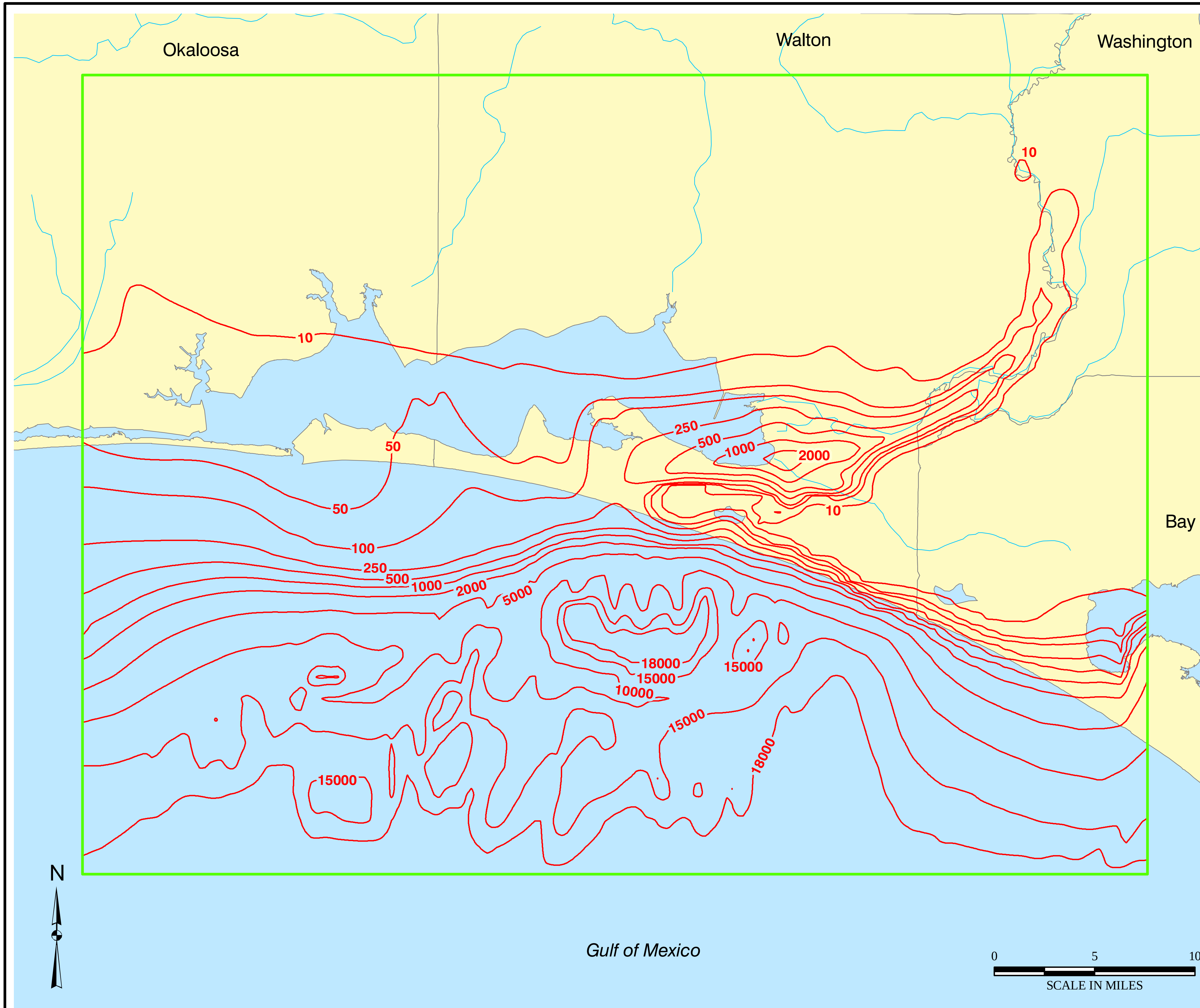
—20— Environmental Head (ft)

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_CCprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc



HGL—Northwest Florida
Water Management District

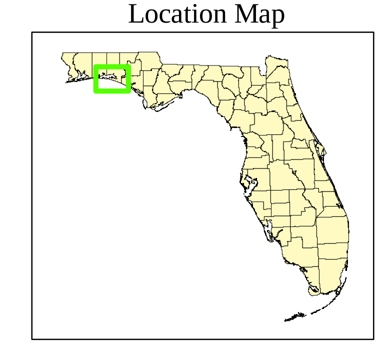
Figure 4.7
Pre-Development Chloride Concentrations for the Upper Floridan Aquifer (Nodal Layer 16, mid-aquifer)

Northwest Florida Water Management District

Legend

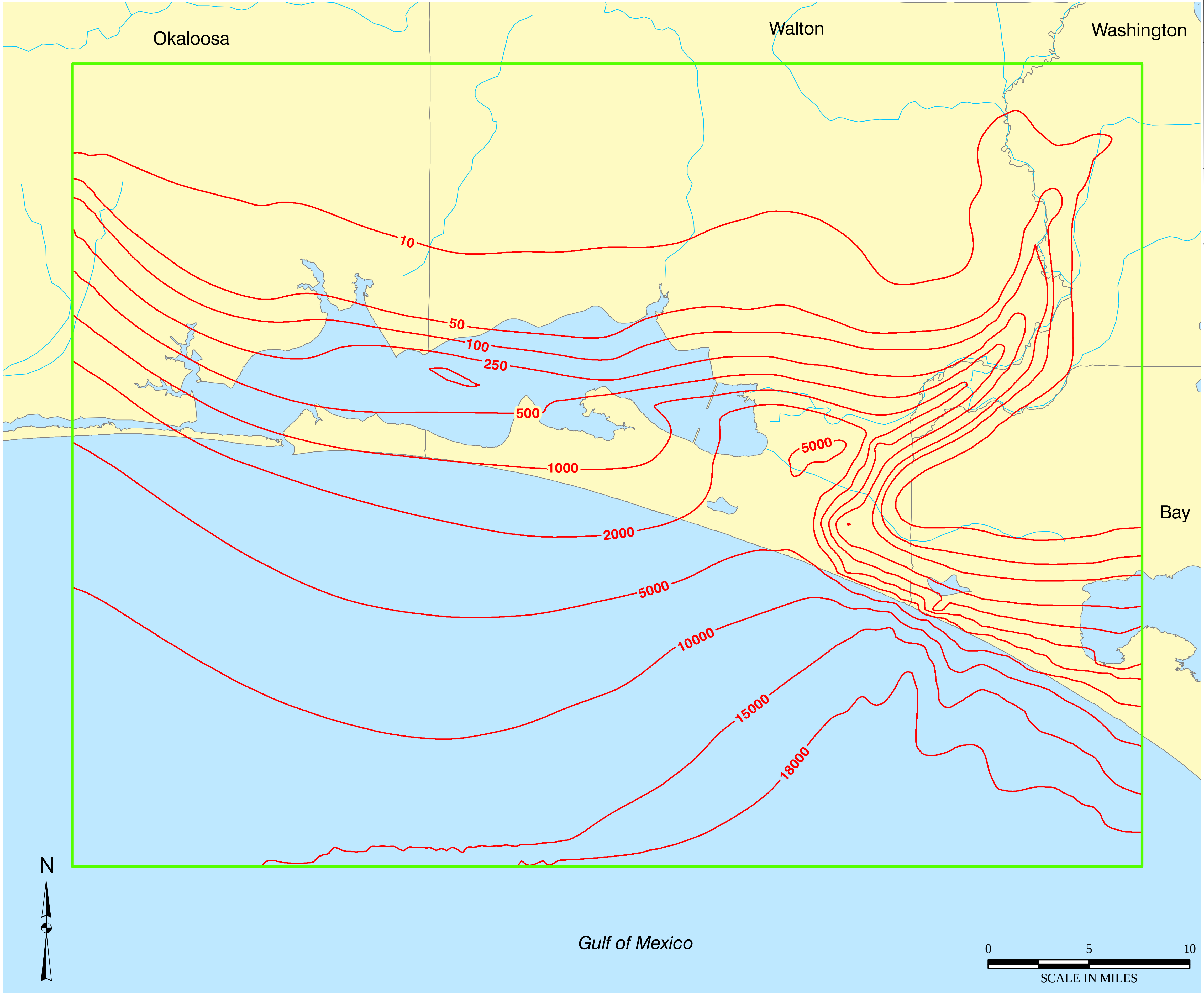
- County Boundary
- Hydrology
- Model Boundary
- 50 Chloride Concentration (mg/L)

Location Map



Filename: X:/NWF006/001-04/SS_C_Lay16.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.8
Pre-Development Chloride Concentrations for the Lower Floridan Aquifer (Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District

Legend

County Boundary
Hydrology
Model Boundary
50 Chloride Concentration (mg/L)

Location Map

Filename: X:/NWF006/001-04/SS_C_Lay7.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

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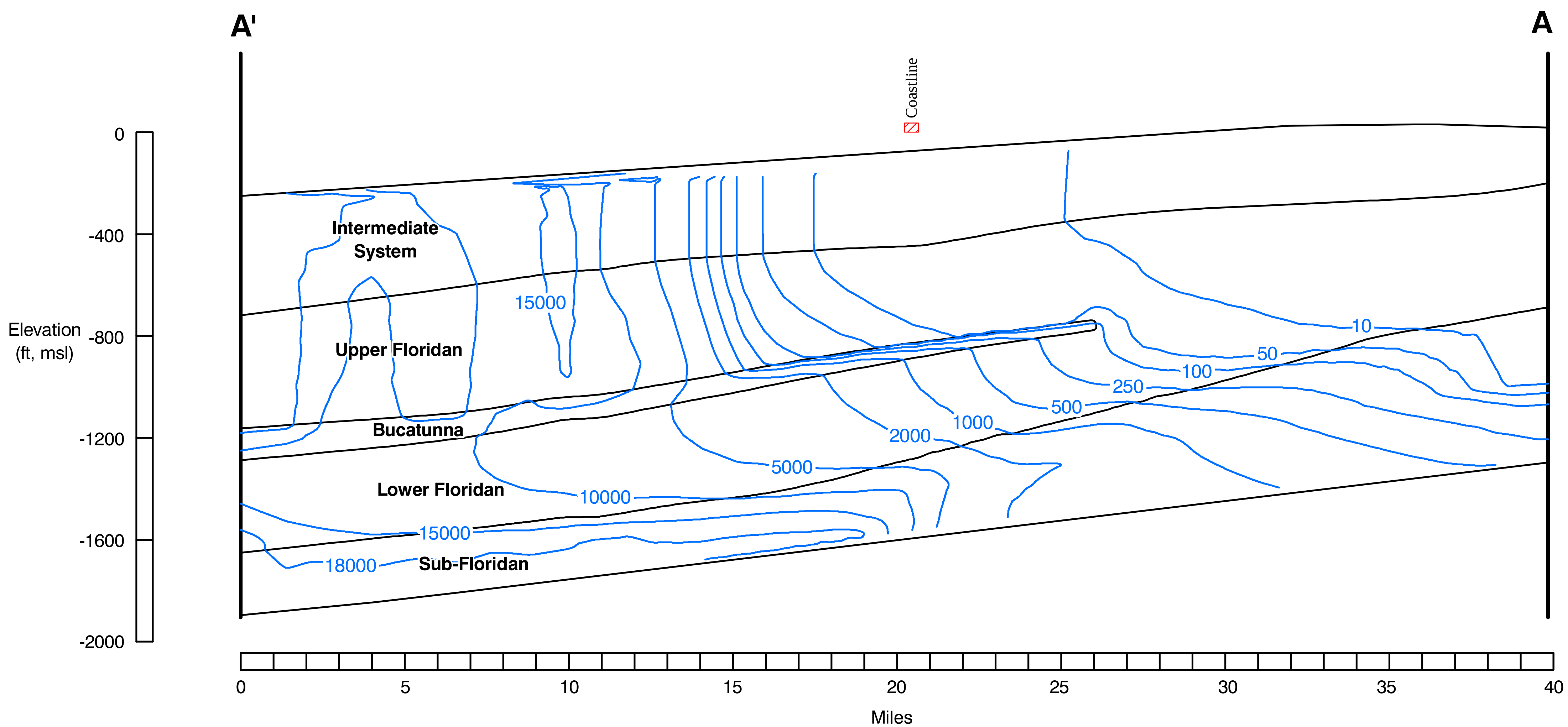
Figure 4.9
Pre-Development Chloride Concentrations for Cross-Section A-A'

Northwest Florida Water Management District

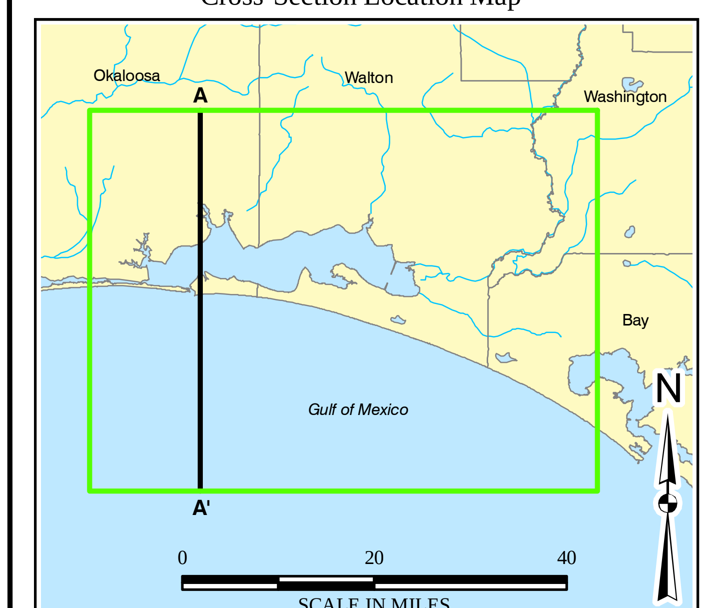


Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1

Cross-Section Location Map



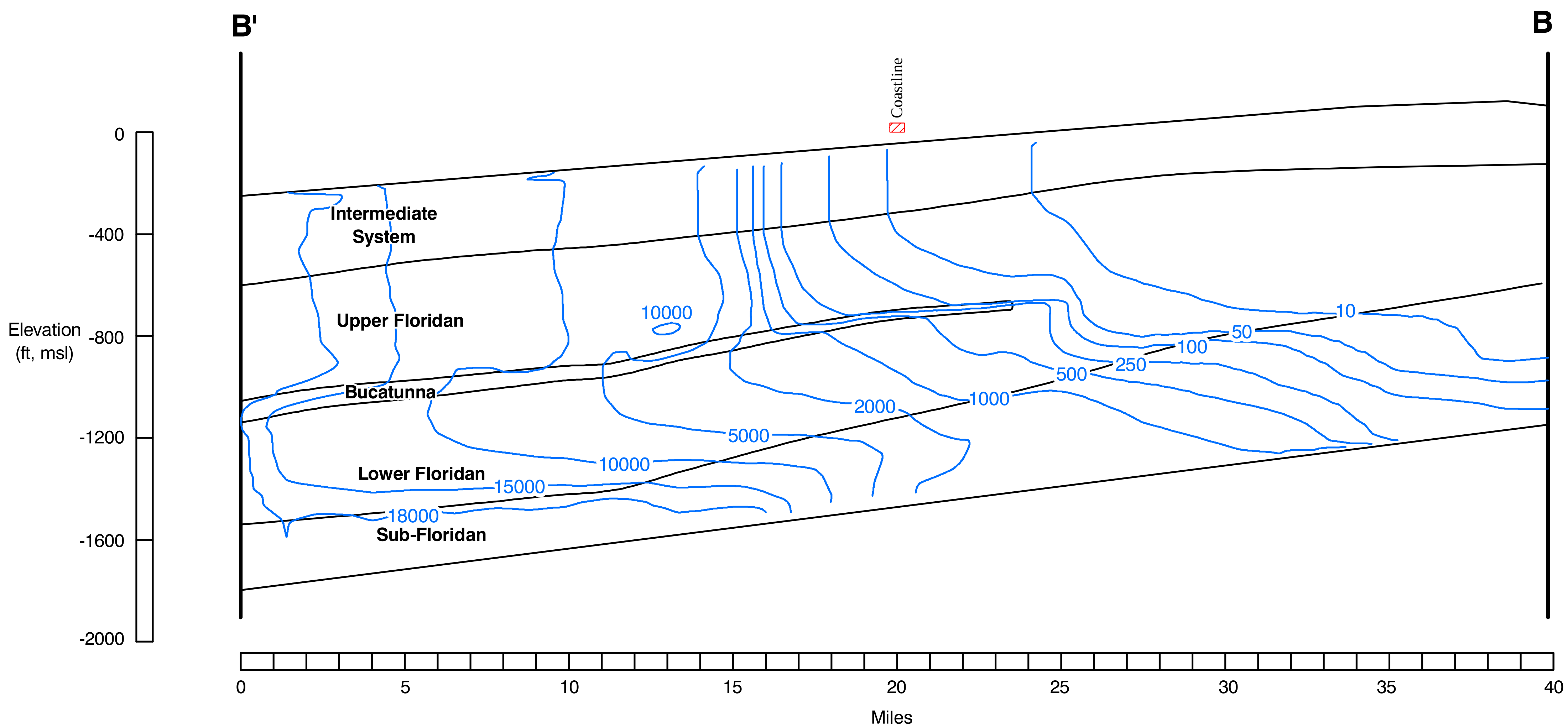
Filename: X:/NWF006/001-04/SS_AAprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida Water Management District

Figure 4.10
Pre-Development
Chloride Concentrations for
Cross-Section B-B'

Northwest Florida Water Management District



Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_BBprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2005

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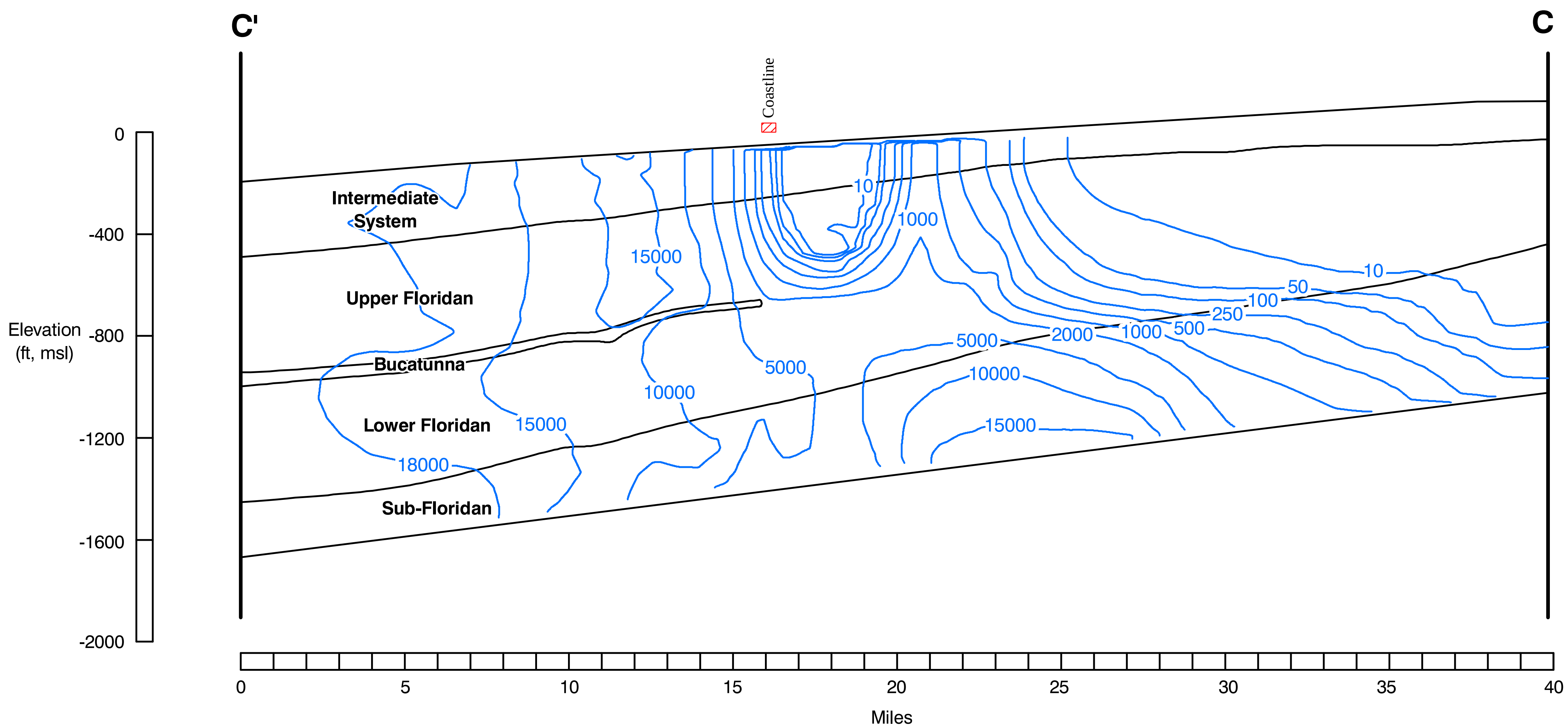
Water Management District

Figure 4.11
Pre-Development
Chloride Concentrations for
Cross-Section C-C'

Northwest Florida
Water Management District

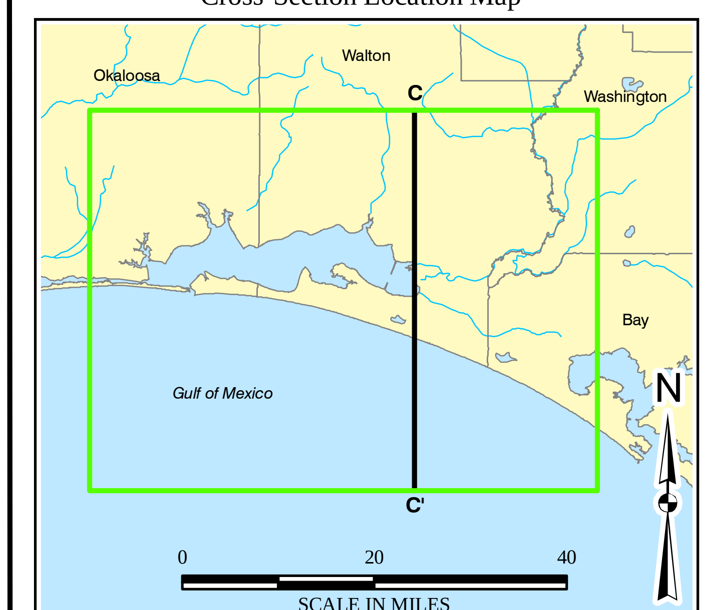


Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1

Cross-Section Location Map



Filename: X:/NWF006/001-03/SS_CCprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

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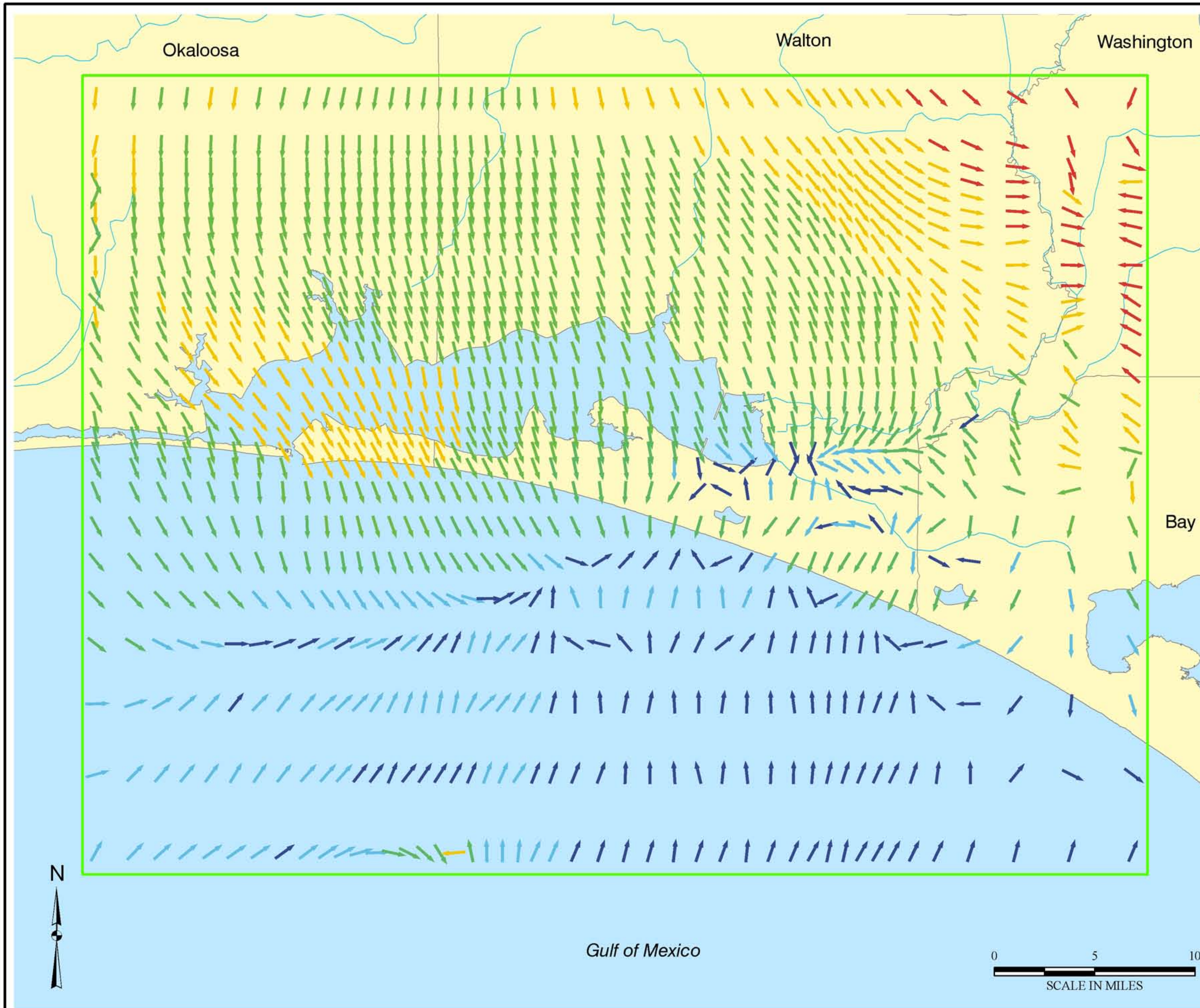
Figure 4.12
Pre-Development Darcy Velocities for the Upper Floridan Aquifer (Elemental Layer 15)



Northwest Florida Water Management District

Legend

County Boundary

Hydrology

Model Boundary

Velocities (ft/d)

0.05
0.01
0.005
0.001
0.0005

Location Map

Filename: X:/NWF006/001-04/SS_Lay15_wmf.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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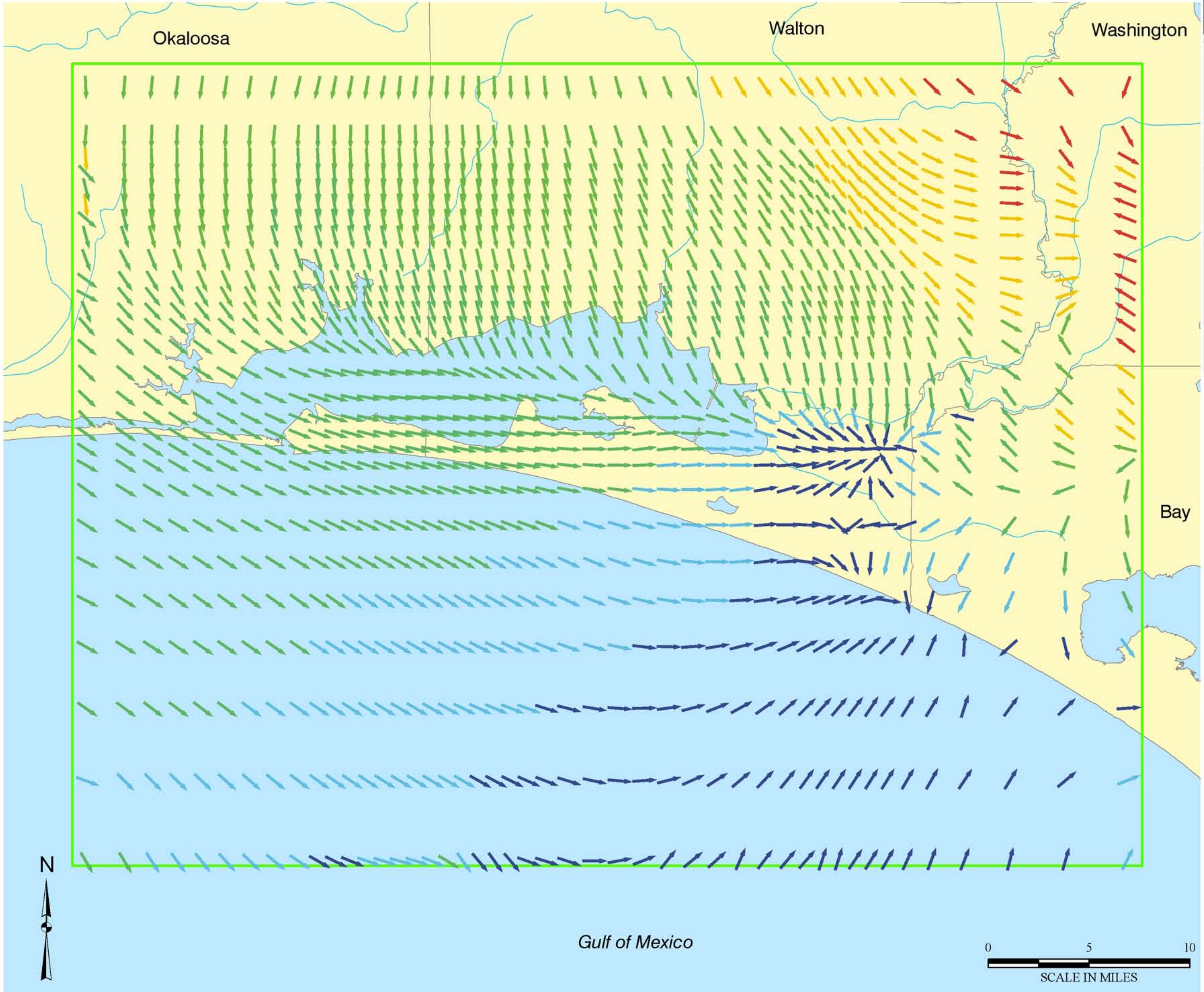


HGL—Northwest Florida
Water Management District

Figure 4.13
Pre-Development
Darcy Velocities for the
Lower Floridan Aquifer
(Elemental Layer 6)

Northwest Florida
Water Management District

Legend

County Boundary

Hydrology

Model Boundary

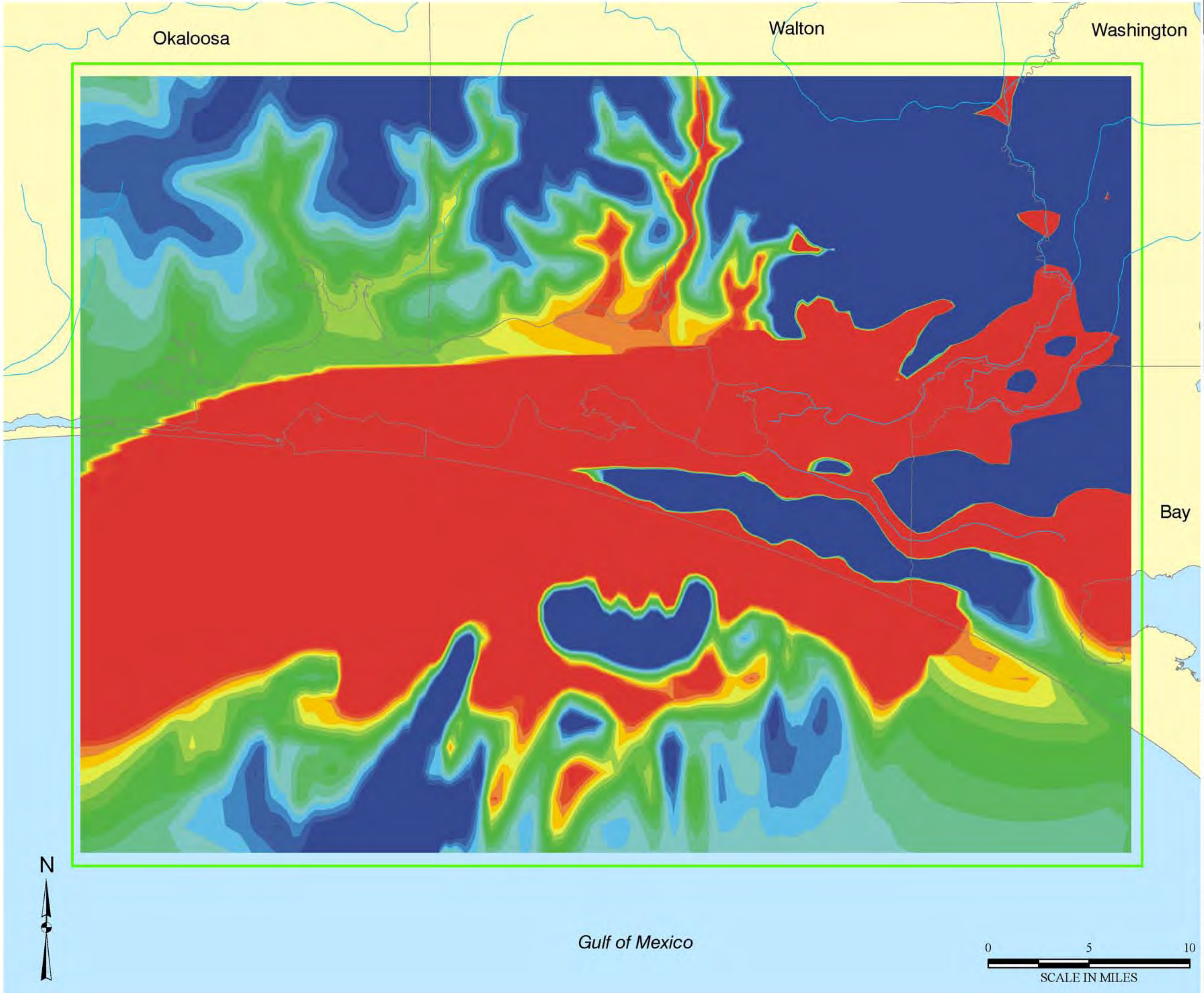
Velocities (ft/d)

0.05
0.01
0.005
0.001
0.0005

Location Map

Filename: X:/NWF006/001-04/SS_Lay6_wmf.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.14
Pre-Development Vertical Darcy Velocities for the Intermediate System (Elemental Layer 19)

Northwest Florida Water Management District

Legend

County Boundary

Hydrology

Model Boundary

Velocities (ft/d)

1.6E-05
1.5E-05
1.3E-05
1.1E-05
9.8E-06
8.2E-06
6.6E-06
4.9E-06
3.3E-06
1.7E-06
7.0E-08
-1.6E-06
-3.2E-06
-4.8E-06
-6.4E-06

Note: Negative velocity indicates downward flow

Location Map

Filename: X:/NWF006/001-04/SS-velz19.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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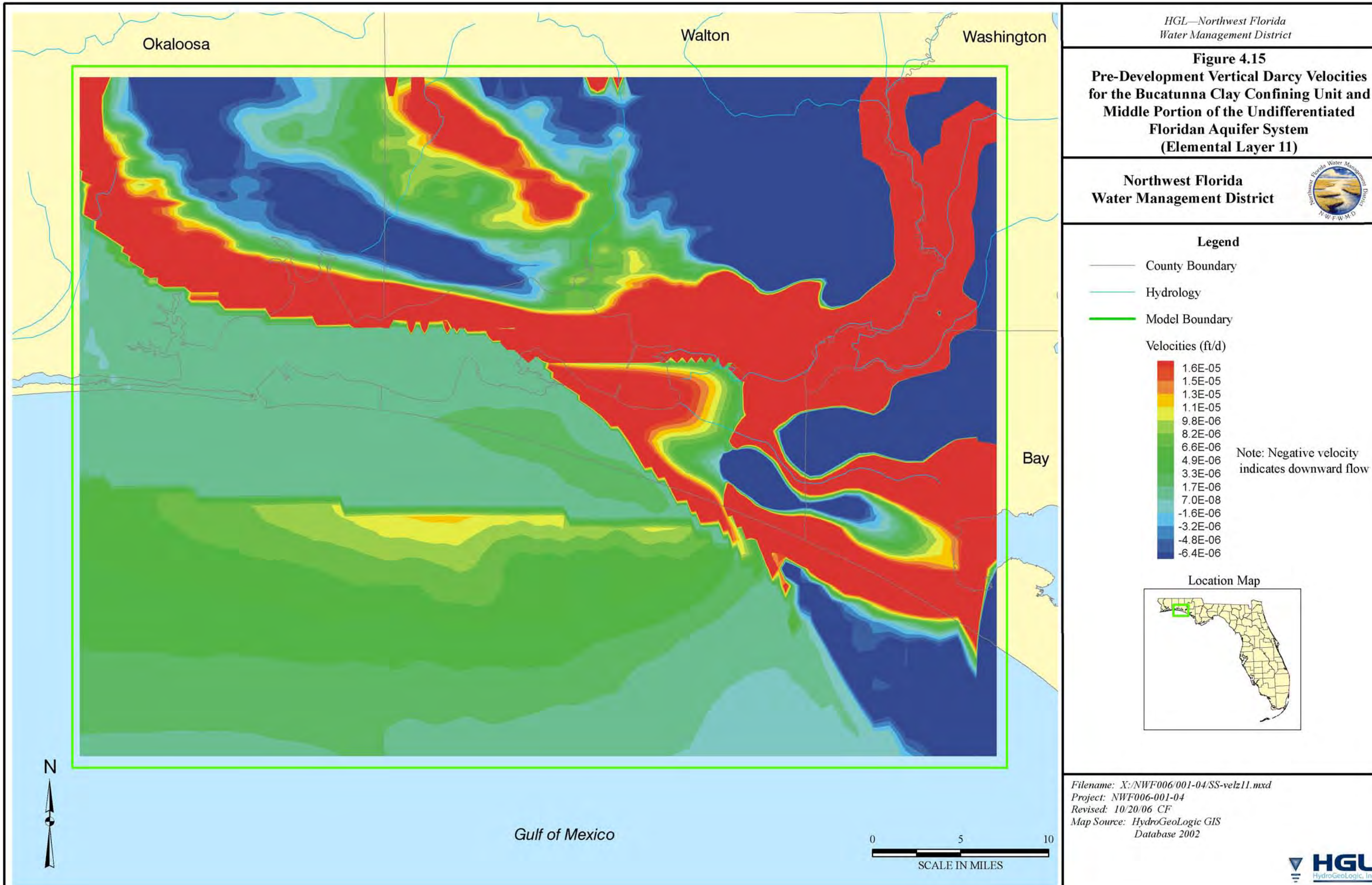
Figure 4.15
Pre-Development Vertical Darcy Velocities for the Bucatunna Clay Confining Unit and Middle Portion of the Undifferentiated Floridan Aquifer System (Elemental Layer 11)

Northwest Florida Water Management District



Filename: X:/NWF006/001-04/SS-velz11.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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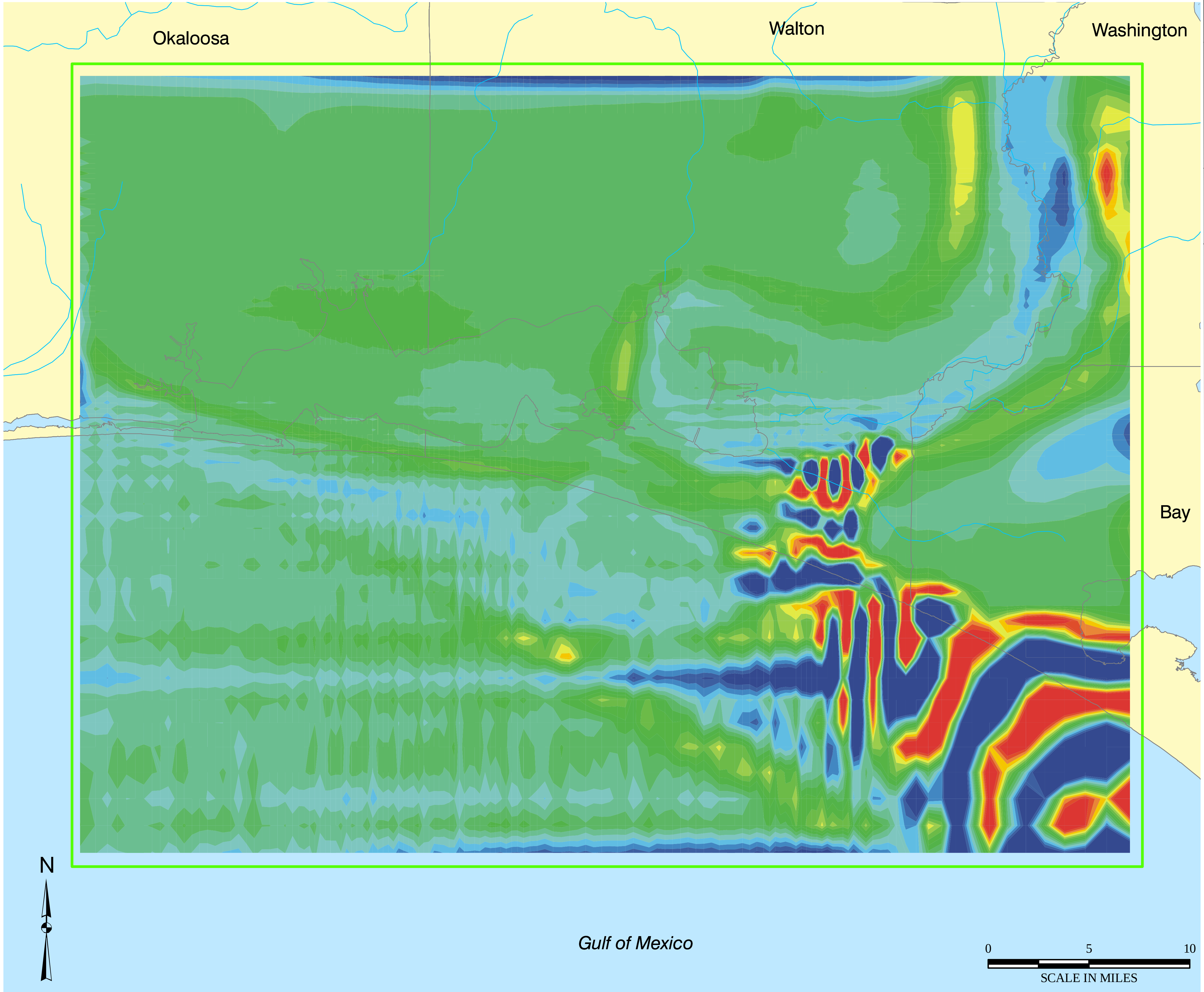
Figure 4.16
Pre-Development
Vertical Darcy Velocities
for the Sub-Floridan System
(Elemental Layer 2)

Northwest Florida
Water Management District



Legend

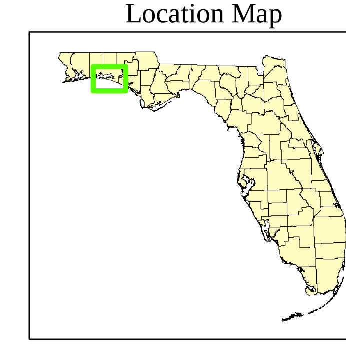
County Boundary
Hydrology
Model Boundary

Velocities (ft/d)

1.6E-05
1.5E-05
1.3E-05
1.1E-05
9.8E-06
8.2E-06
6.6E-06
4.9E-06
3.3E-06
1.7E-06
7.0E-08
-1.6E-06
-3.2E-06
-4.8E-06
-6.4E-06

Note: Negative velocity indicates downward flow

Location Map



Filename: X:/NWF006/001-04/SS-velz2.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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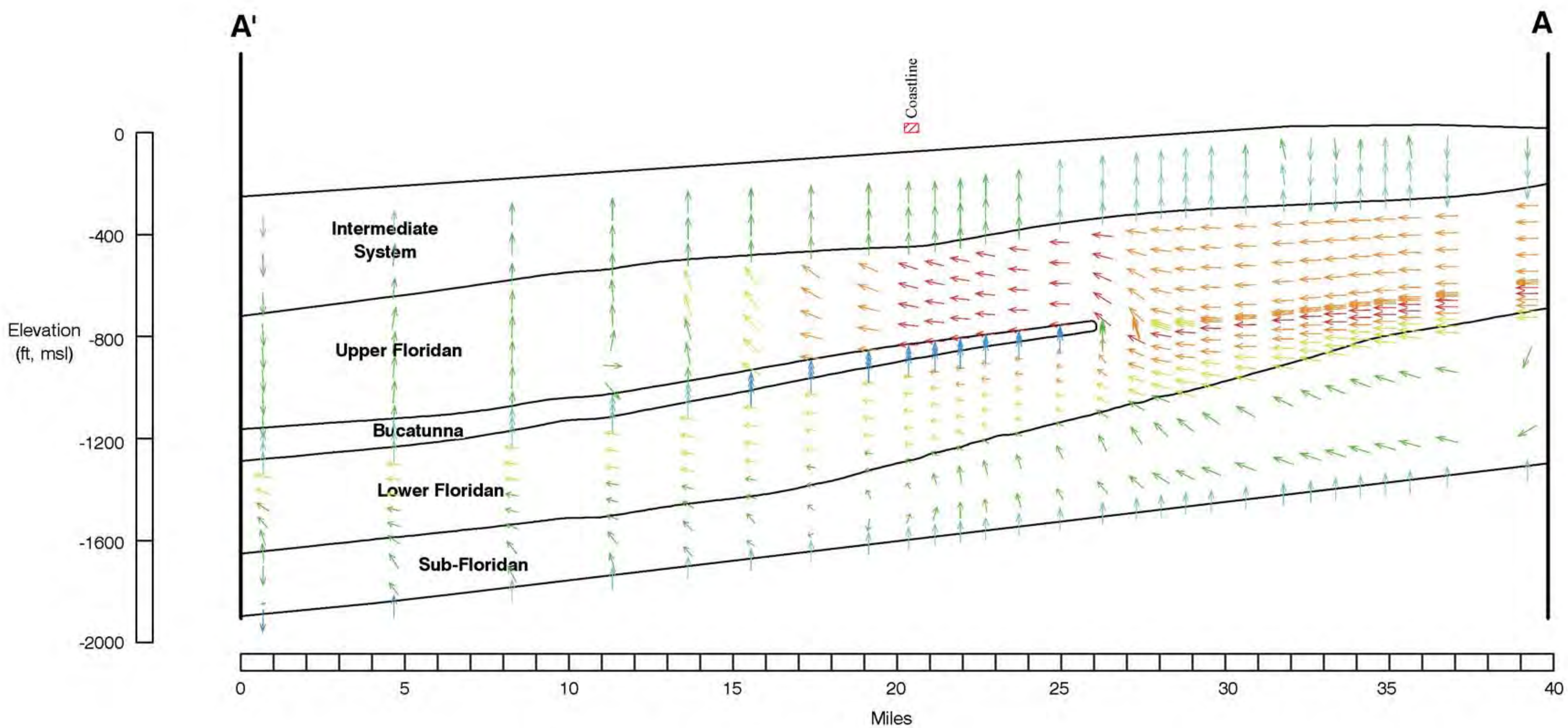
Water Management District

Figure 4.17
Pre-Development
Darcy Velocities for
Cross-Section A-A'

Northwest Florida
Water Management District



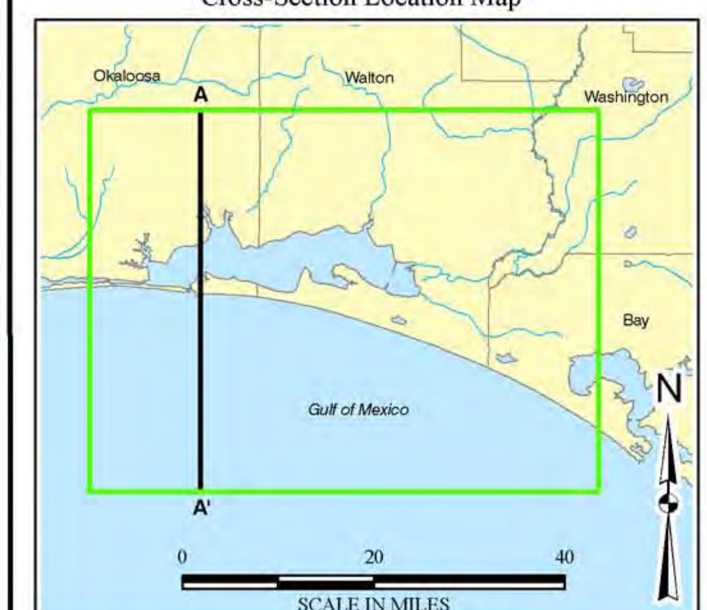
Legend

Velocities (ft/d)

- 0.009
- 0.005
- 0.001
- 0.0001
- 1E-05
- 1E-06
- 1E-07

Vertical Exaggeration 41:1

Cross-Section Location Map



Filename: X:/NWF006/001-04/SS_YZ-28-AA.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

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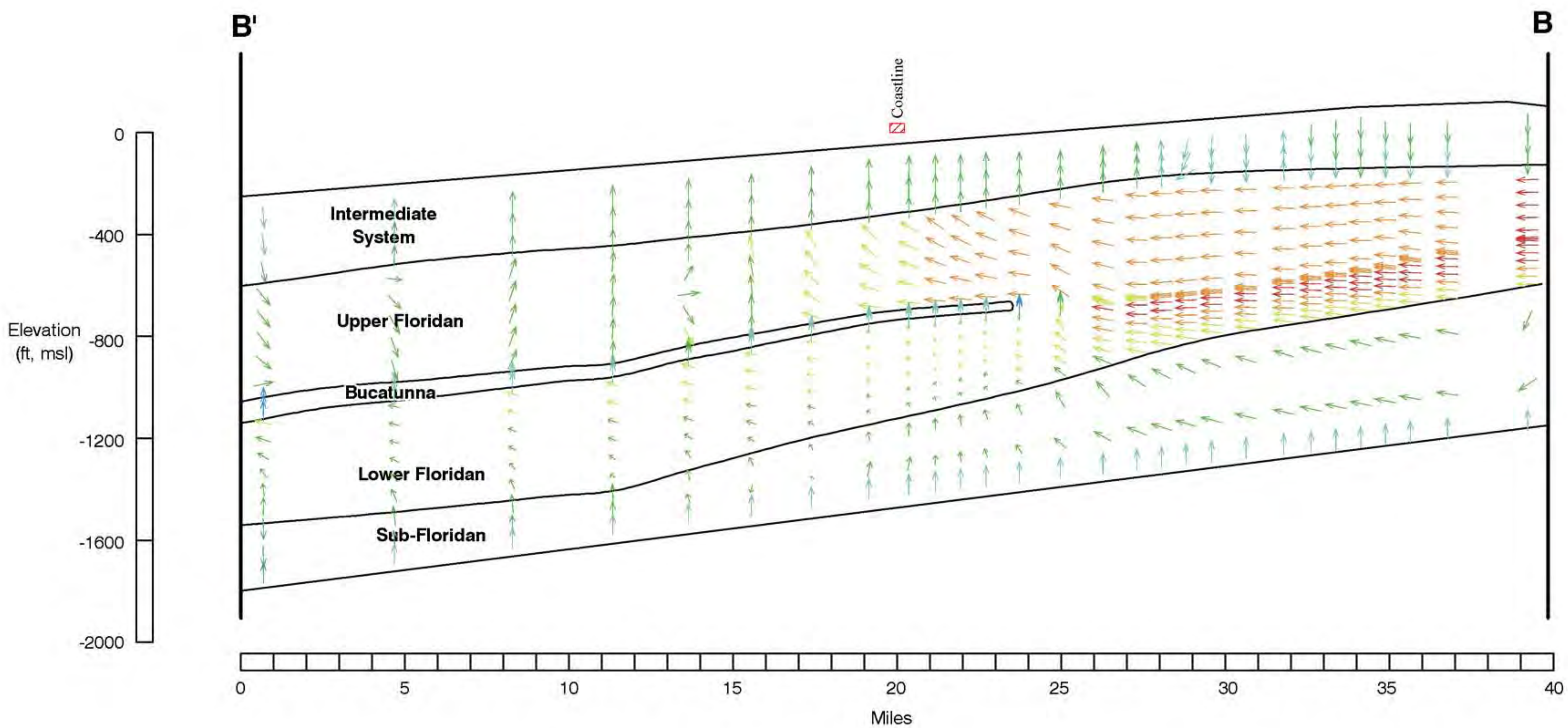
Figure 4.18 Pre-Development Darcy Velocities for Cross-Section B-B'

Northwest Florida Water Management District



Legend

Velocities (ft/d)

- 0.009
- 0.005
- 0.001
- 0.0001
- 1E-05
- 1E-06
- 1E-07

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_YZ-28-BB.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

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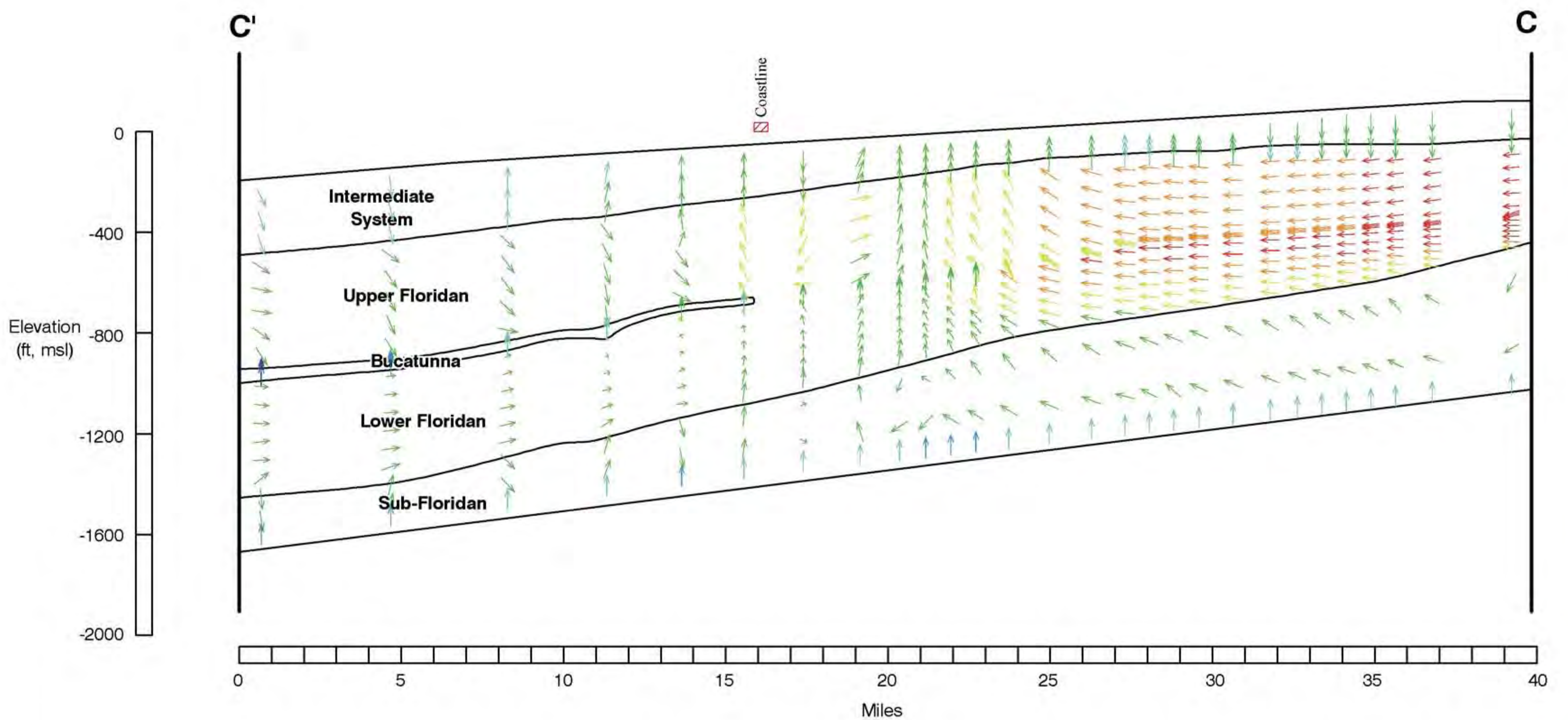
Figure 4.19
Pre-Development Darcy Velocities for Cross-Section C-C'

Northwest Florida Water Management District



Legend

Velocities (ft/d)

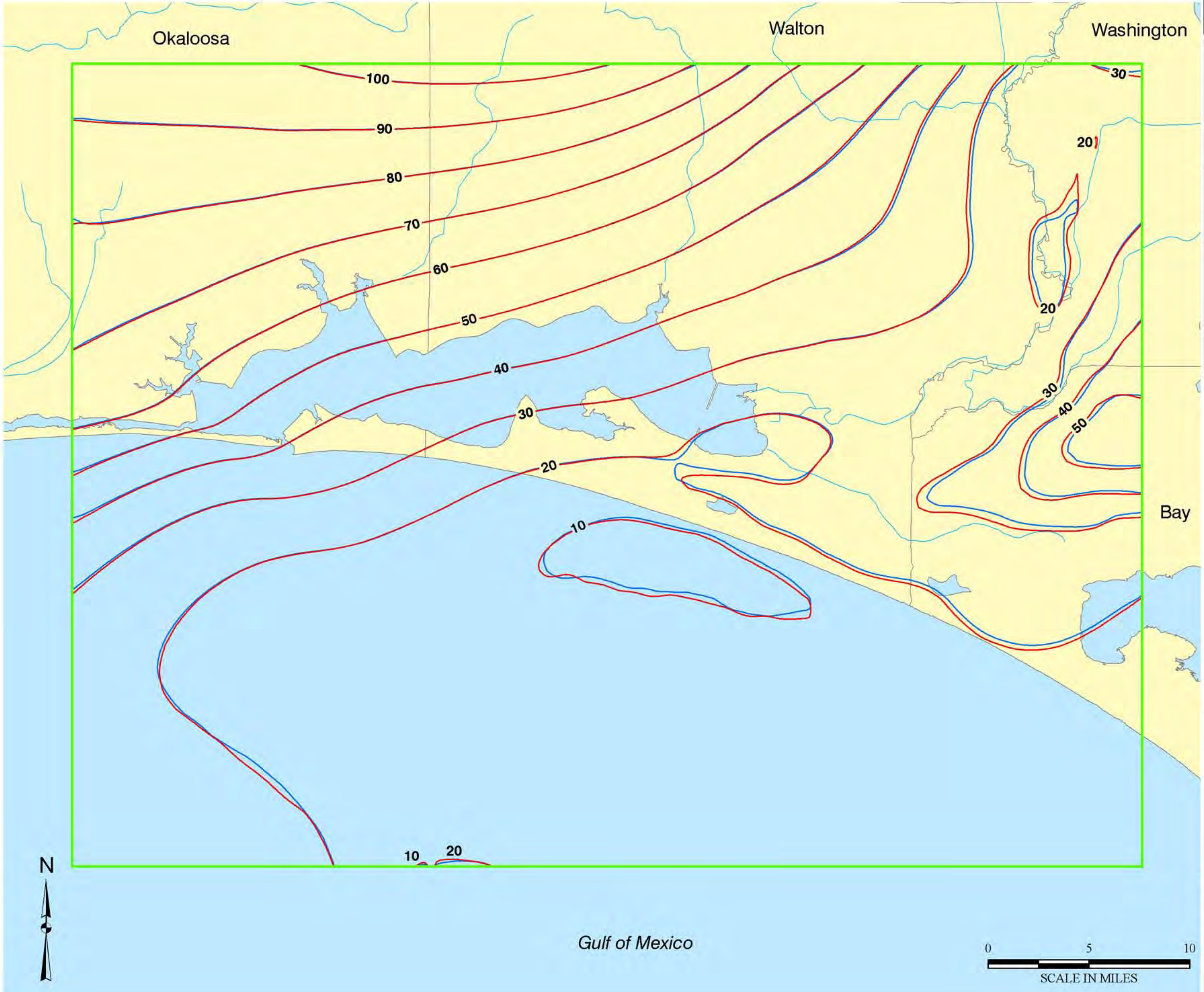
0.009
0.005
0.001
0.0001
1E-05
1E-06
1E-07

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/SS_YZ-28-CC.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.20
Pre-Development Equivalent Freshwater Head for the Upper Floridan Aquifer Grid Sensitivity (Nodal Layer 16, mid-aquifer)

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Freshwater Head (ft) (nx,ny,nz) = (139,83,21)
- 50 Freshwater Head (ft) (nx,ny,nz) = (277,165,21)

Location Map

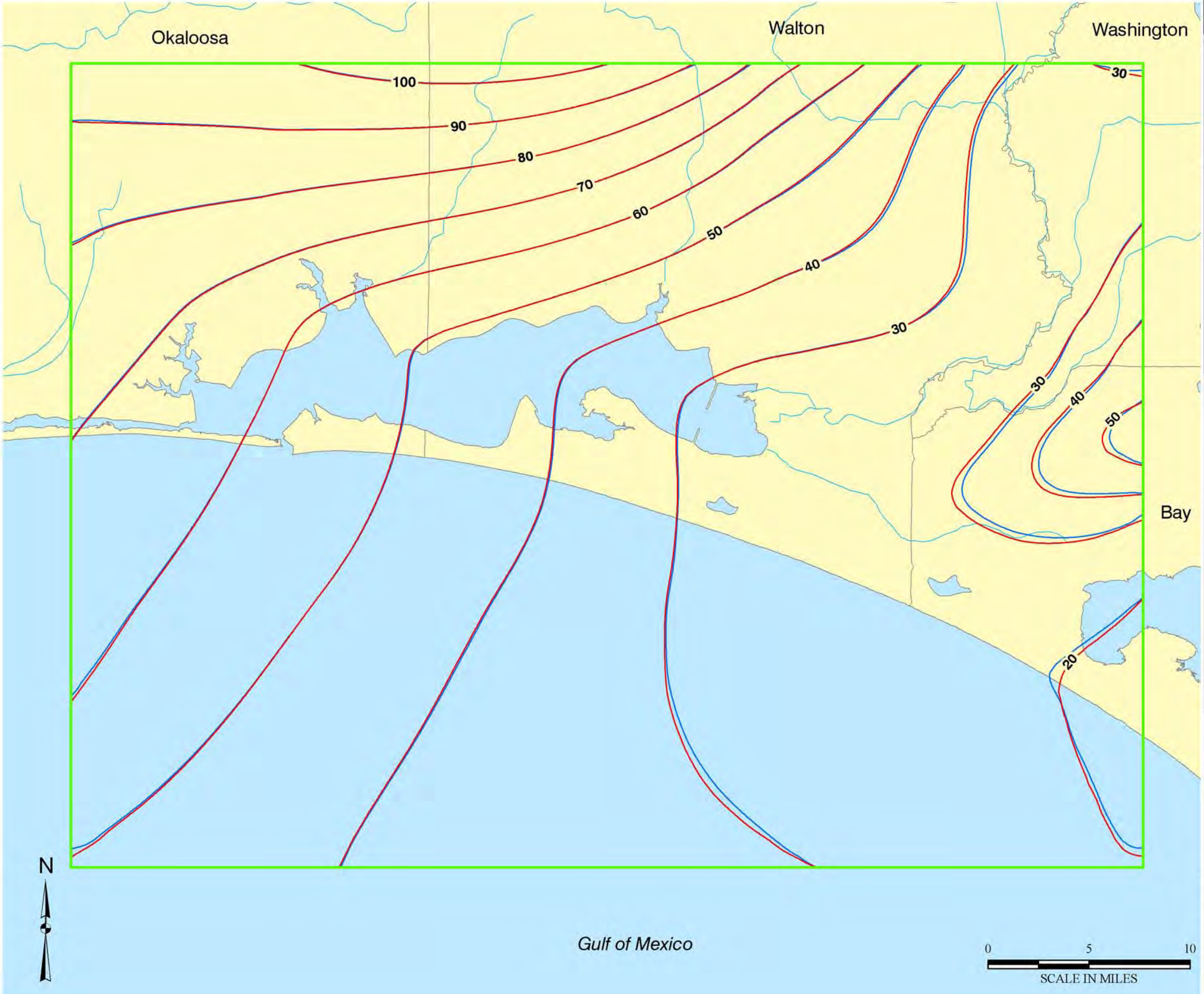
Filename: X:/NWF006/001-04/EFH_UFA_Lay16.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida Water Management District

Figure 4.21
Pre-Development Equivalent Freshwater Head for the Lower Floridan Aquifer Grid Sensitivity (Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District



Legend

County Boundary

Hydrology

Model Boundary

Freshwater Head (ft) (nx,ny,nz) = (139,83,21)

Freshwater Head (ft) (nx,ny,nz) = (277,165,21)

Location Map

Filename: X:/NWF006/001-04/EFH_LFA_Lay7.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

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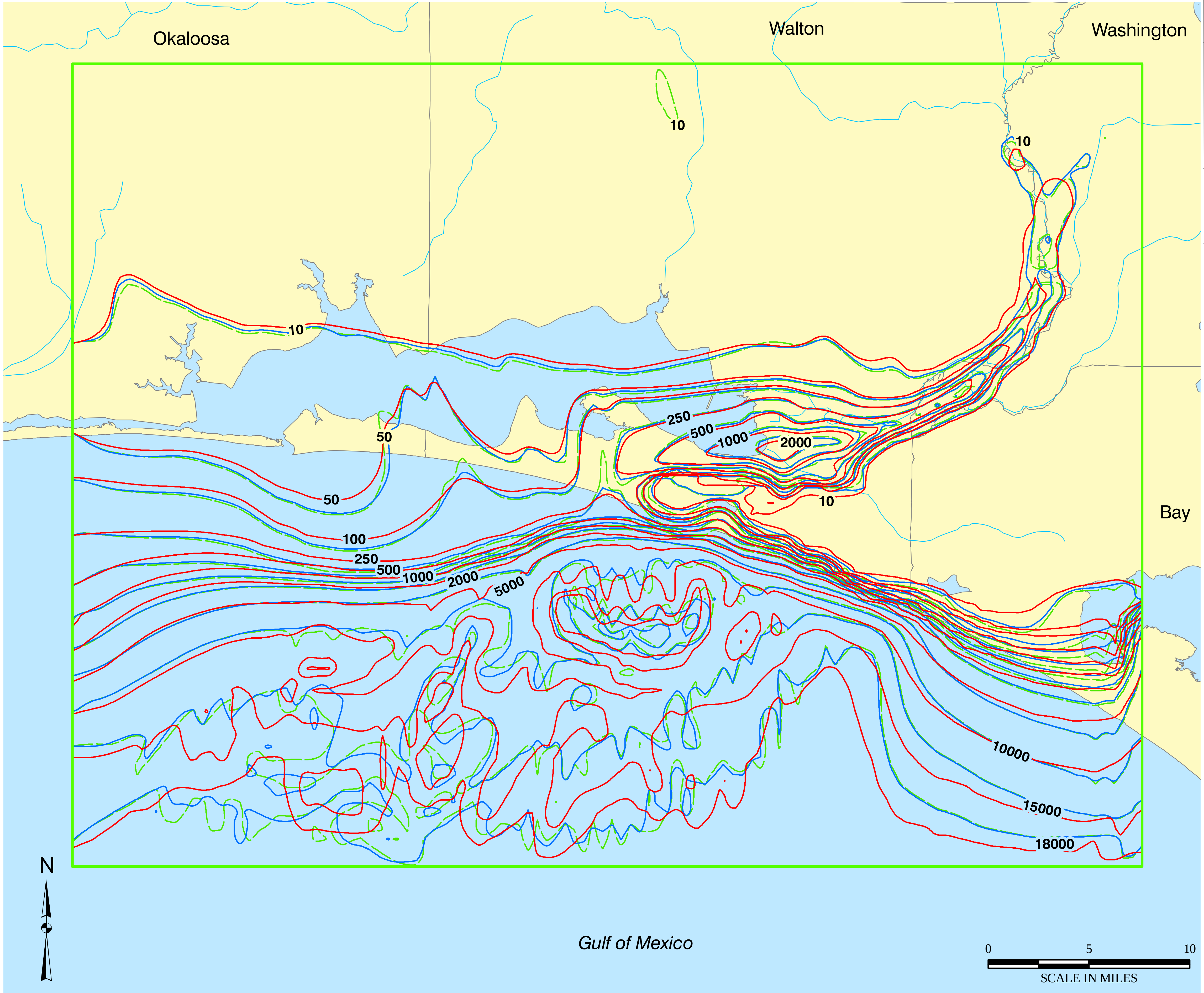
HGL—Northwest Florida
Water Management District

Figure 4.22
Pre-Development Chloride Concentrations for the Upper Floridan Aquifer Grid Sensitivities (Nodal Layer 16, mid-aquifer)

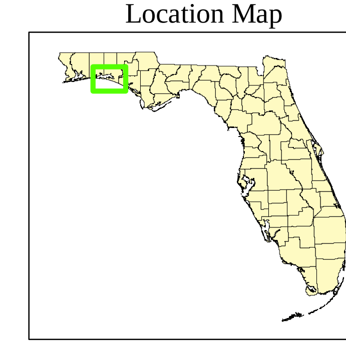


Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 — Chloride Concentration Contour (mg/L) (nx,ny,nz) = (139,83,21)
- 50 — Chloride Concentration Contour (mg/L) (nx,ny,nz) = (277,165,21)
- 50 - - Chloride Concentration Contour (mg/L) (nx,ny,nz) = (277,165,21) and Reduced Upstream Parameters

Location Map



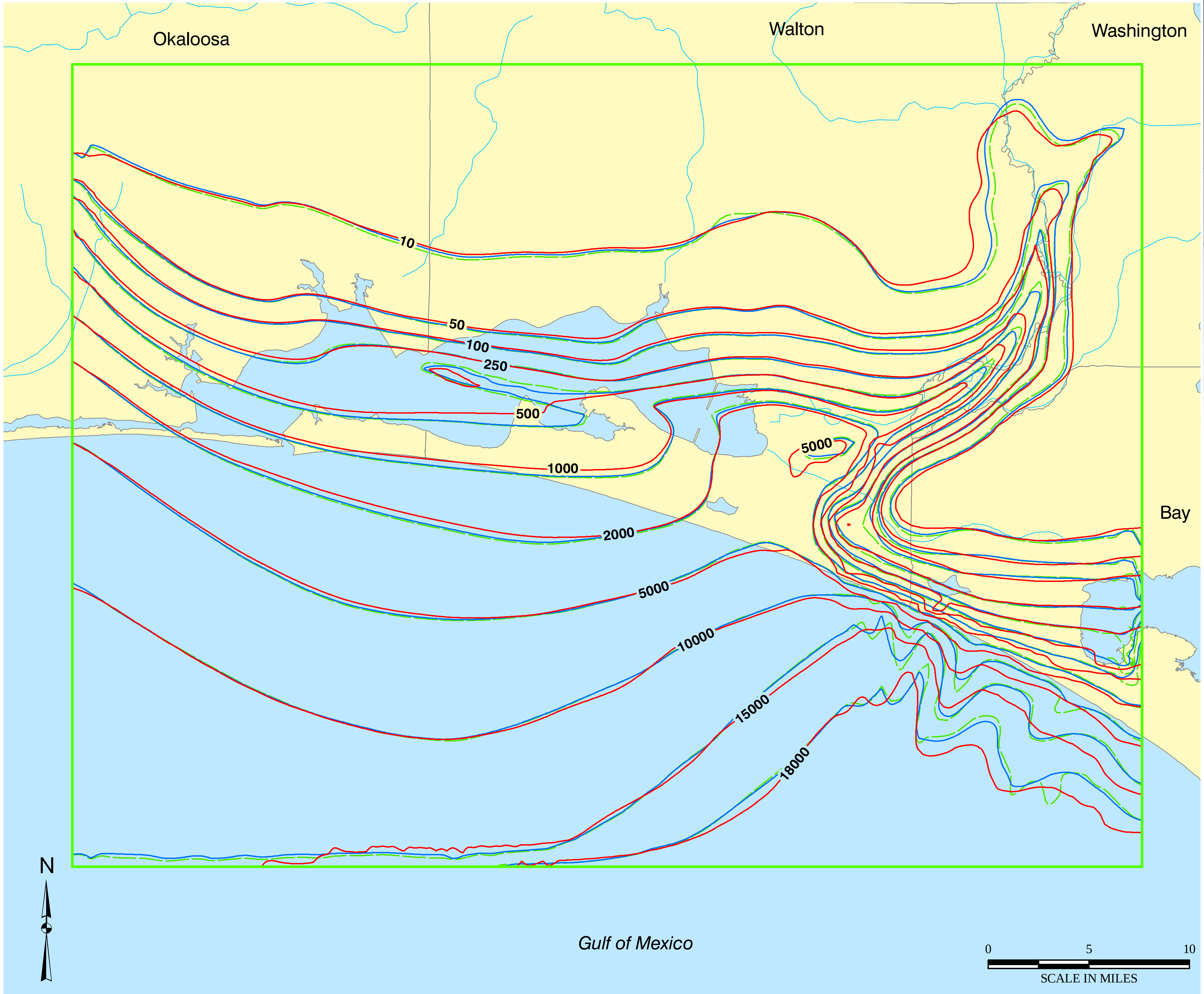
Filename: X:/NWF006/001-04/CC_UFA_Lay16.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.23
Pre-Development Chloride Concentrations for the Lower Floridan Aquifer Grid Sensitivities (Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District



Legend

County Boundary

Hydrology

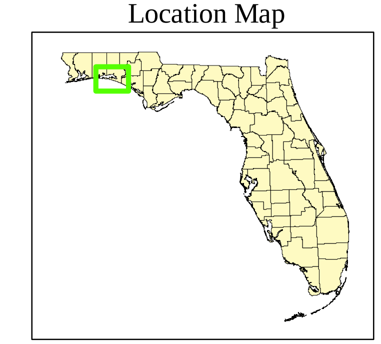
Model Boundary

50 Chloride Concentration Contour (mg/L) (nx,ny,nz) = (139,83,21)

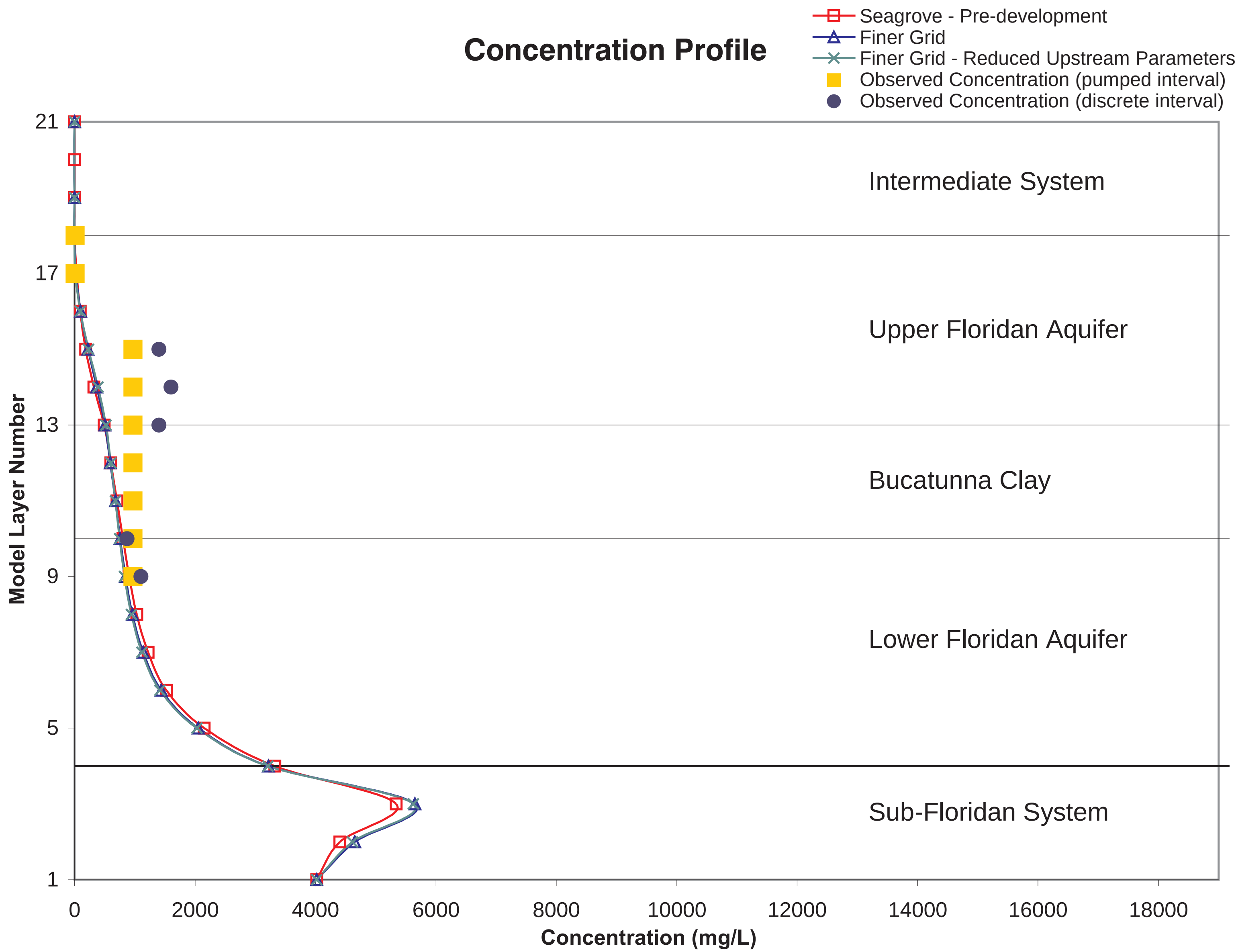
50 Chloride Concentration Contour (mg/L) (nx,ny,nz) = (277,165,21)

50 Chloride Concentration Contour (mg/L) (nx,ny,nz) = (277,165,21) Lower Dispersivity With Finer Grid

Location Map

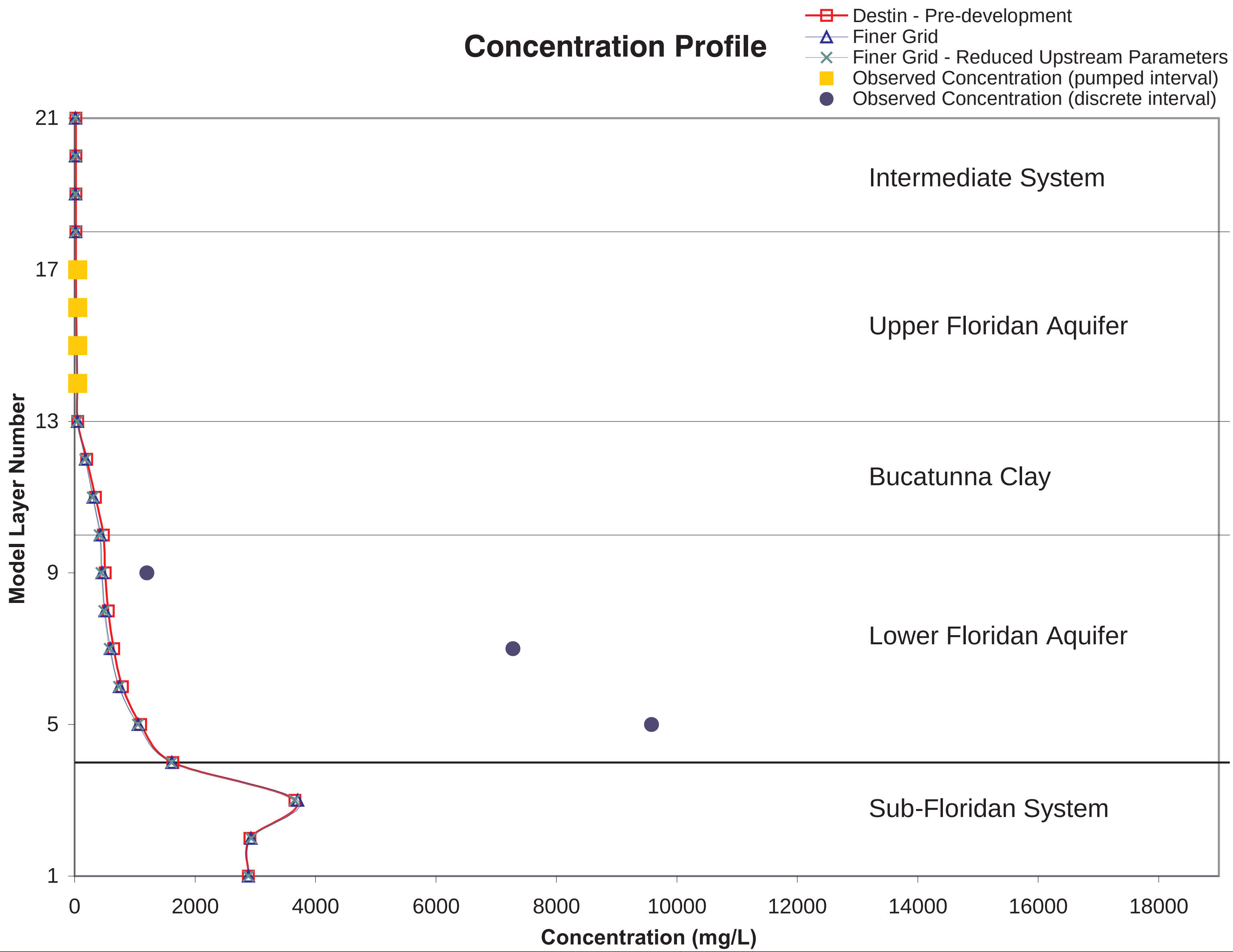


Filename: X:/NWF006/001-04/CC_LFA_Lay7.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002



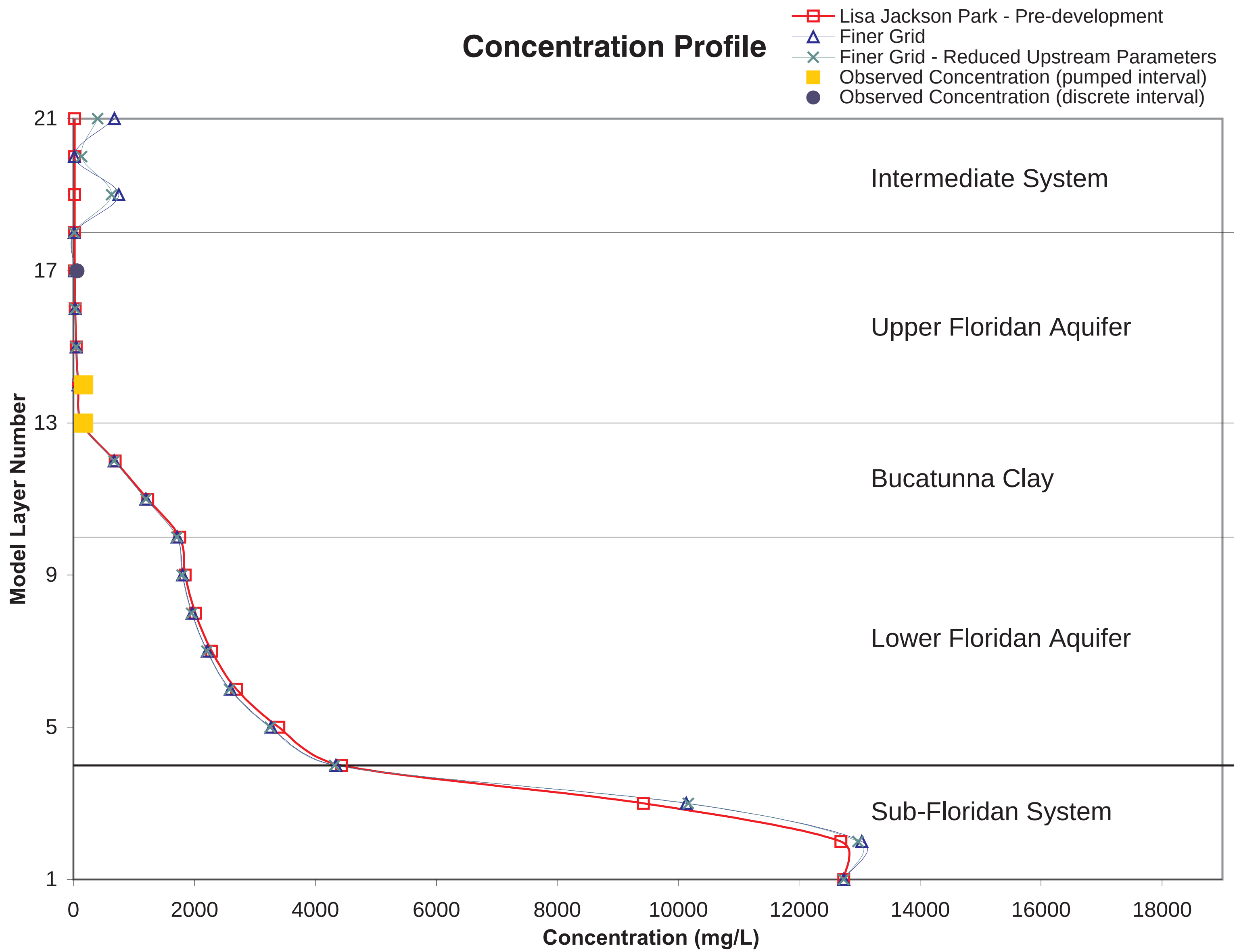
Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.24
Concentration Profiles at Seagrove
for Pre-Development and Grid Sensitivity Simulations



Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

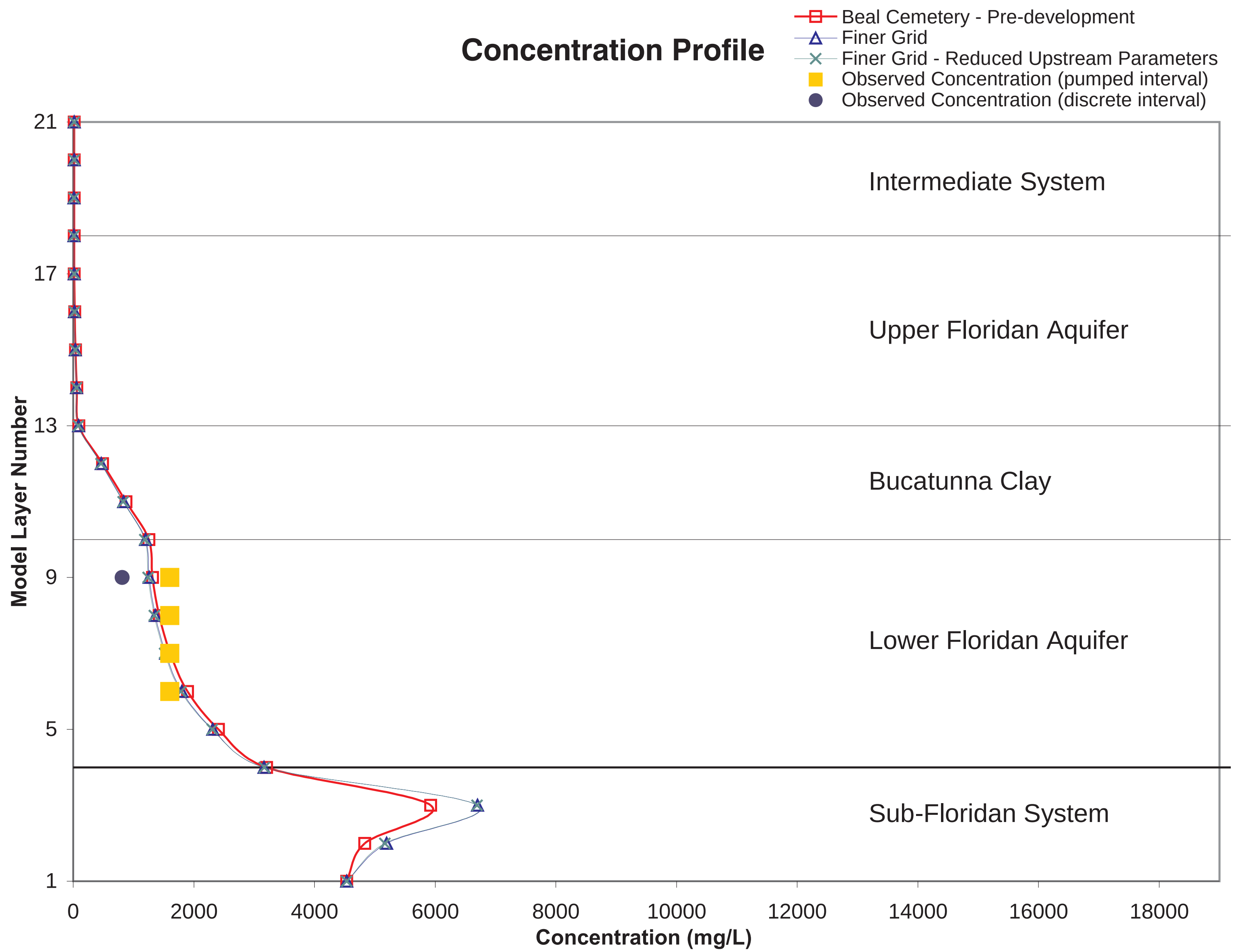
Figure 4.25
Concentration Profiles at Destin
for Pre-Development and Grid Sensitivity Simulations



HGL—Northwest Florida Water Management District

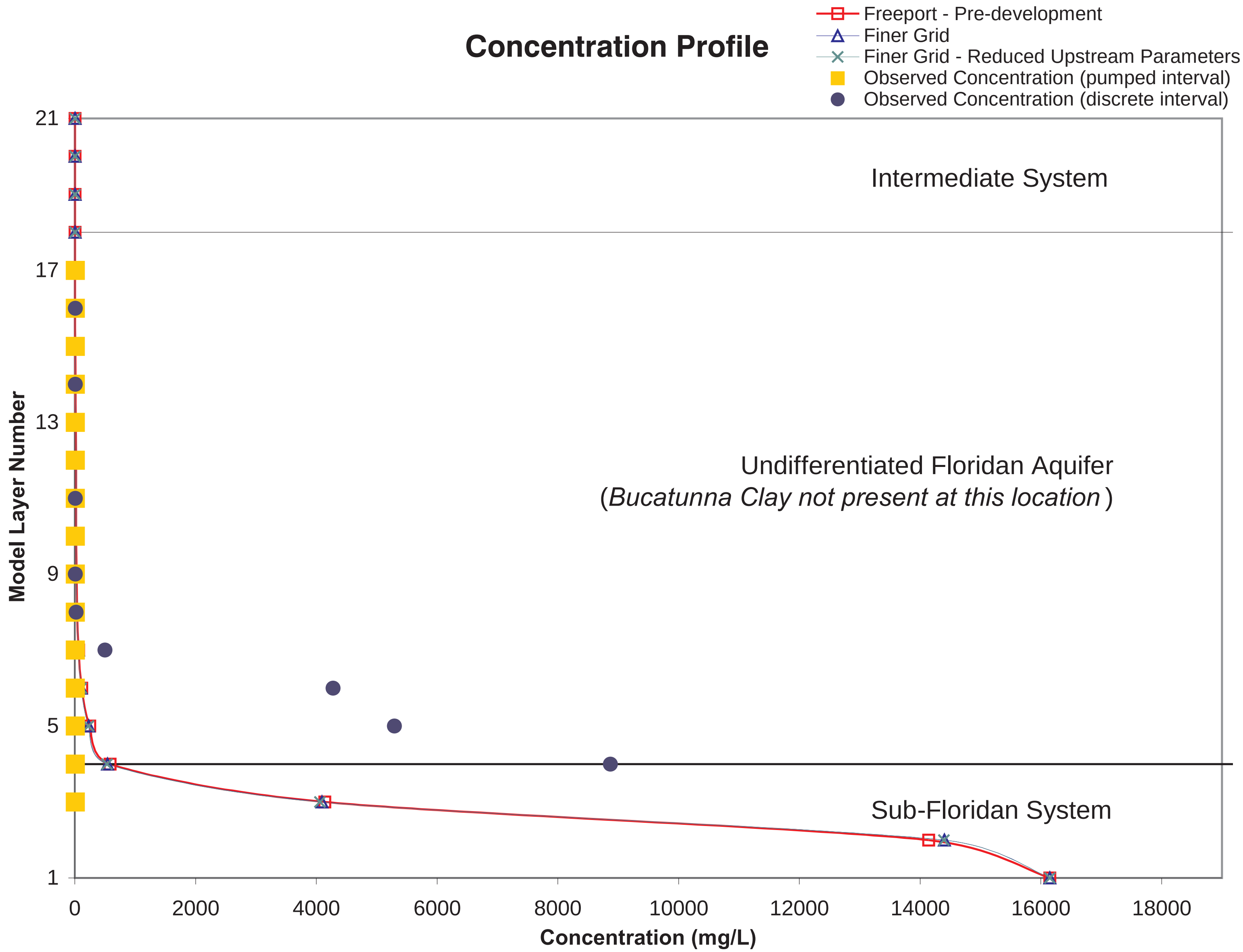
Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.26
Concentration Profiles at Lisa Jackson Park for Pre-Development and Grid Sensitivity Simulations



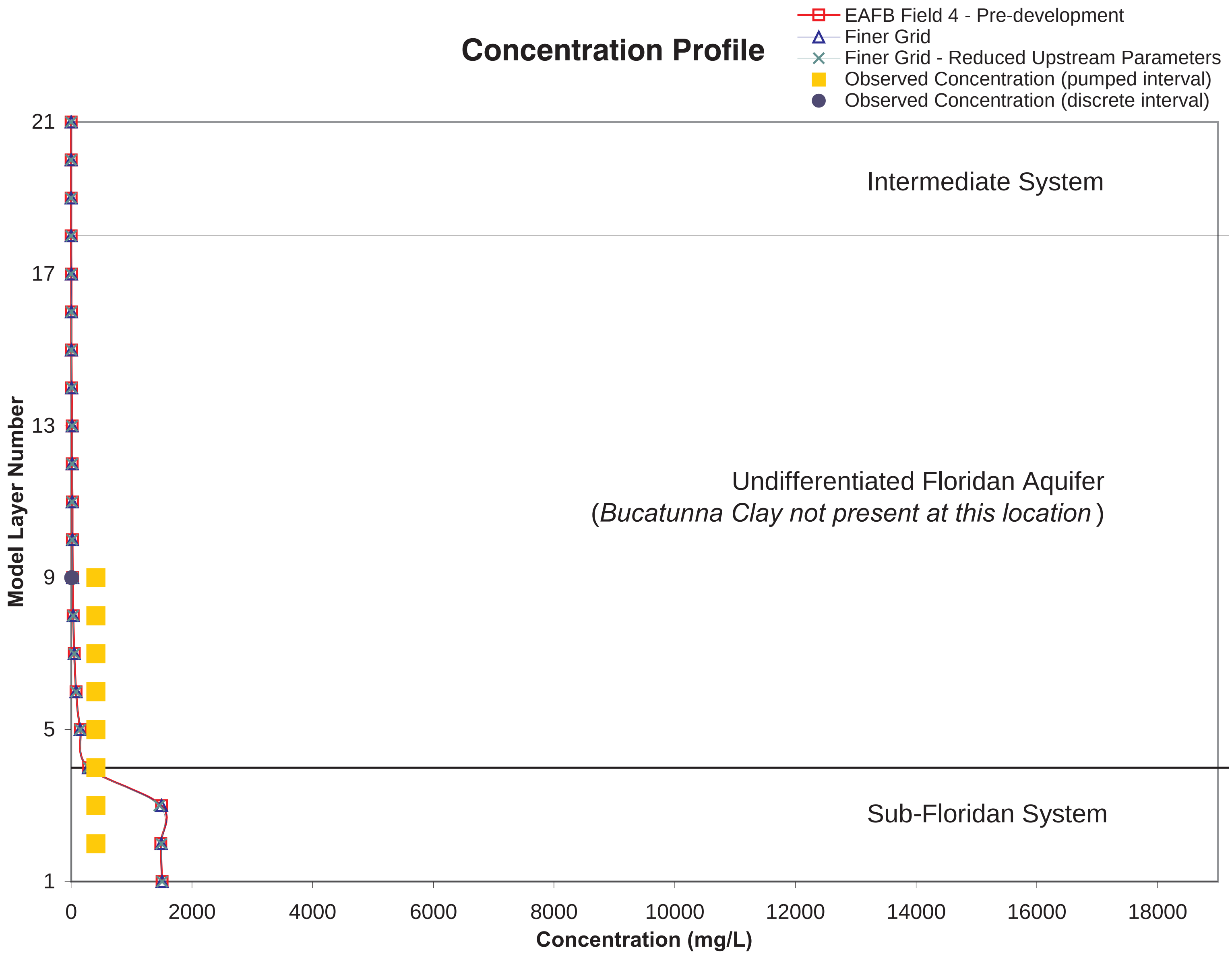
Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.27
Concentration Profiles at Beal Cemetery for Pre-Development and Grid Sensitivity Simulations



Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

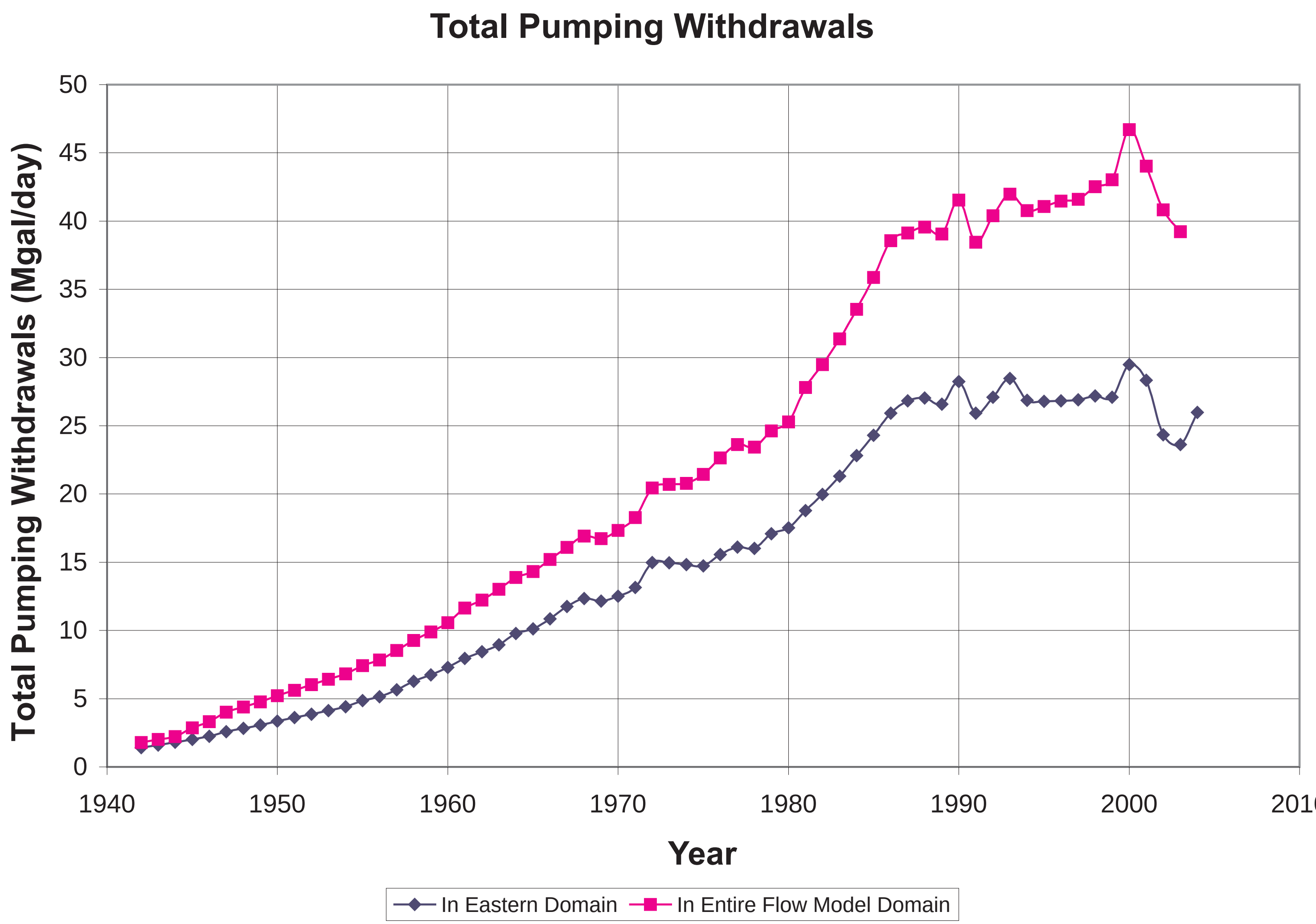
Figure 4.28
Concentration Profiles at Freeport
for Pre-Development and Grid Sensitivity Simulations



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.29
Concentration Profiles at EAFB Field 4
for Pre-Development and Grid Sensitivity Simulations



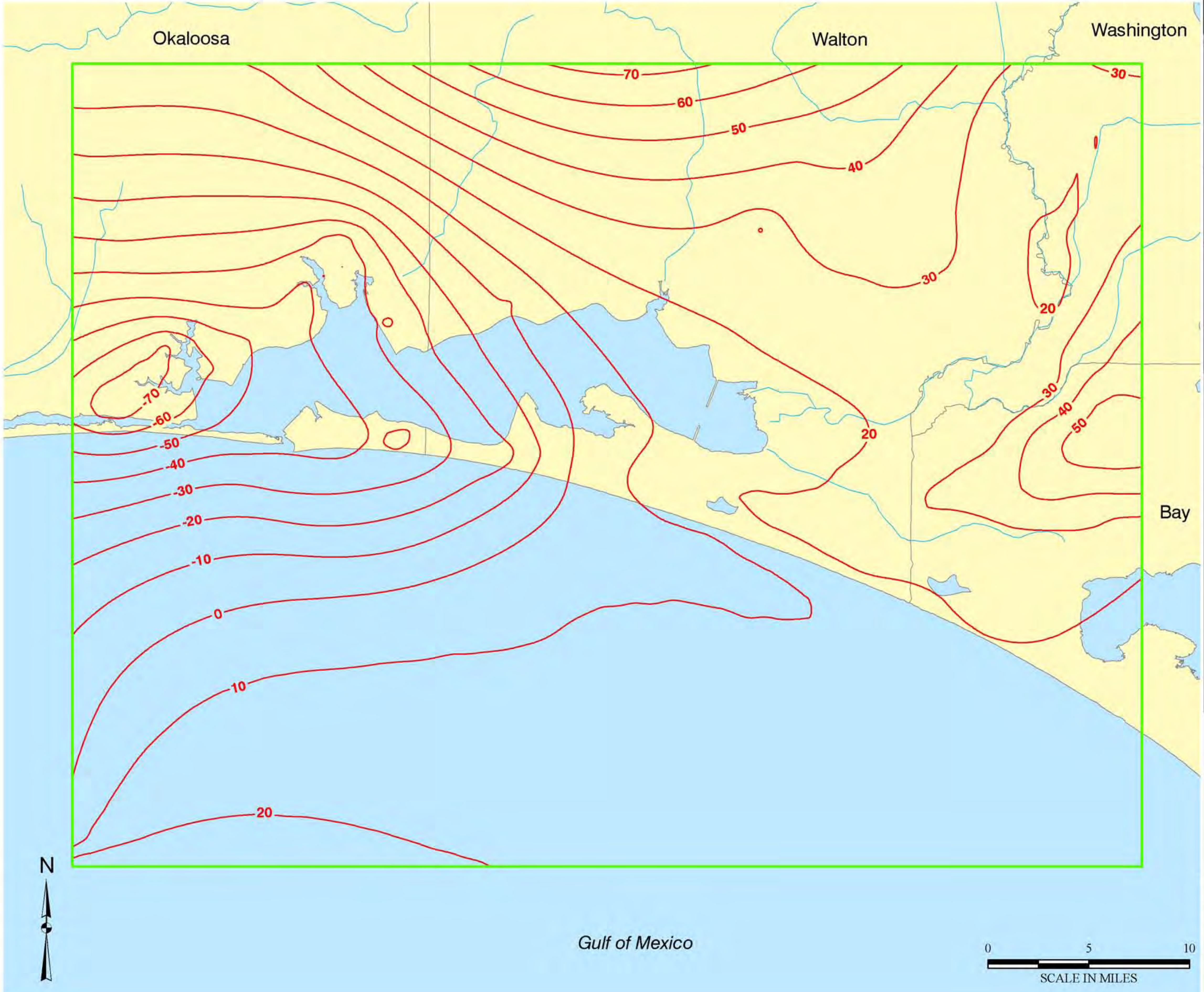
Filename: X:\NWF006\001-04\(4-24_4-30)Conc_profiles.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.30
Total Withdrawals Applied to the Post-development Simulations in the Eastern Model Domain and the Entire Flow Model Domain

HGL—Northwest Florida
Water Management District

Figure 4.31
2004 Equivalent Freshwater Head for the Upper Floridan Aquifer (Nodal Layer 16, mid-aquifer)

Northwest Florida Water Management District



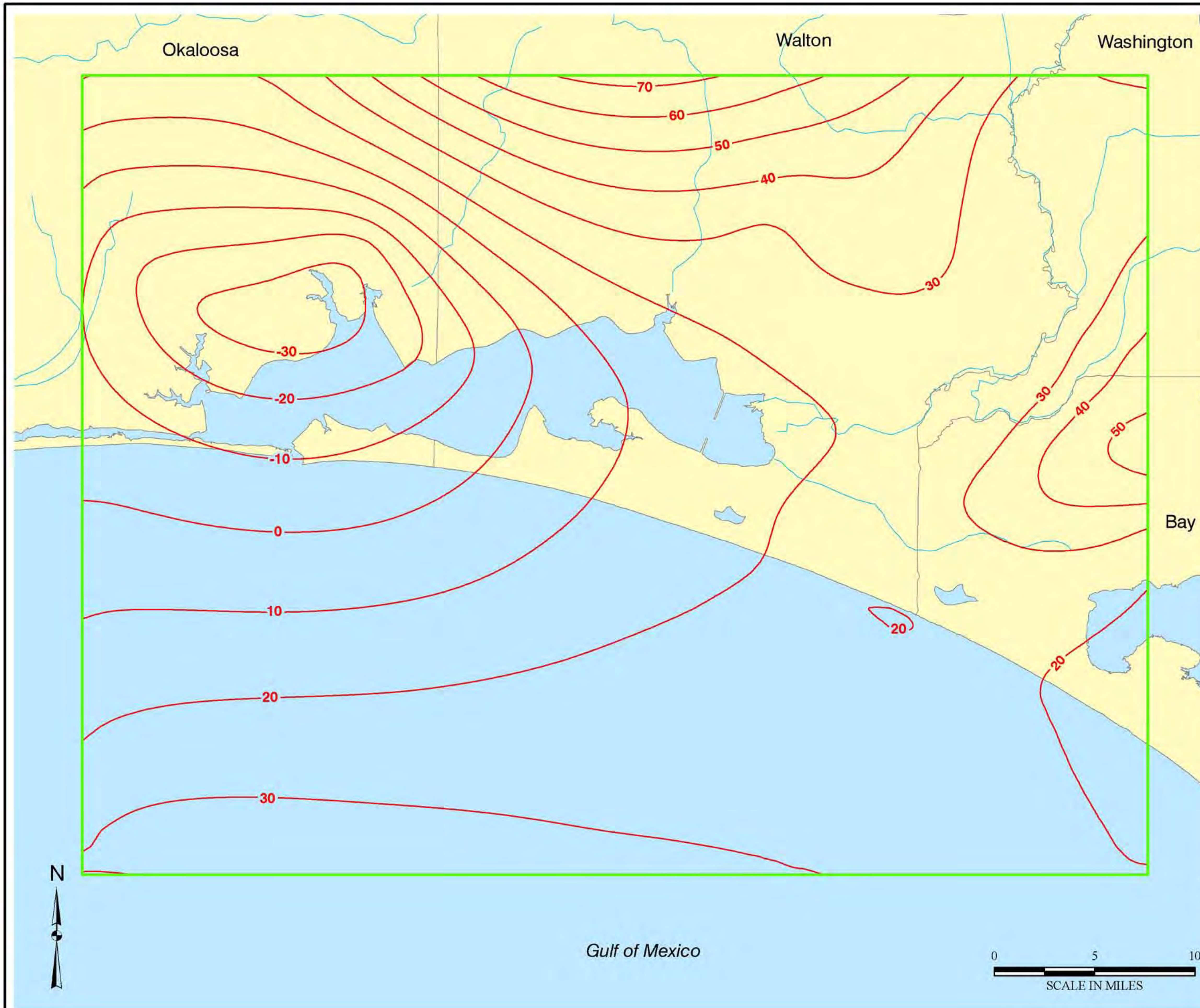
Legend

County Boundary
Hydrology
Model Boundary
50 Equivalent Freshwater Head (ft)

Location Map

Filename: X:/NWF006/001-04/PostDev_TECN-2004_Lay16.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.32
2004 Equivalent Freshwater Head for the Lower Floridan Aquifer (Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Equivalent Freshwater Head (ft)

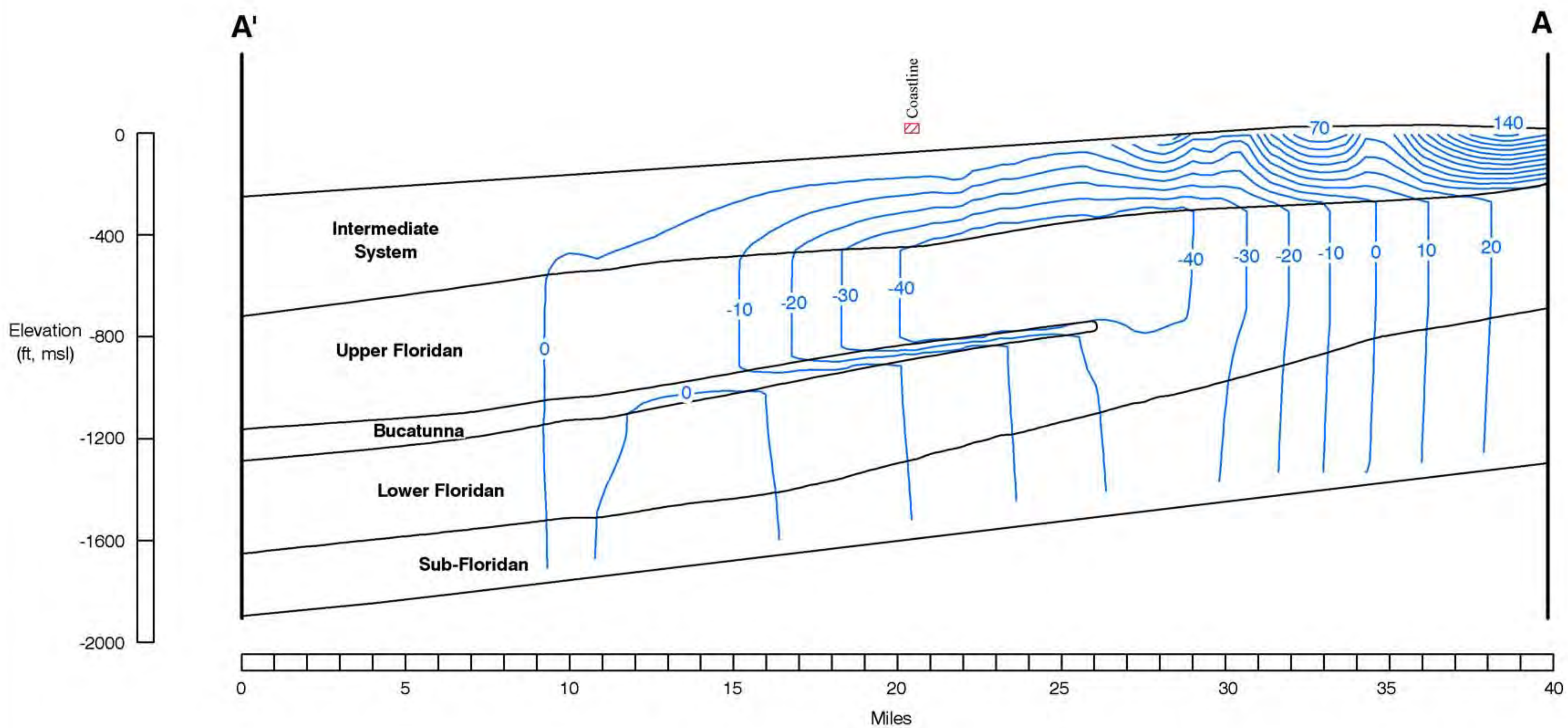
Location Map

Filename: X:/NWF006/001-04/PostDev_TECN-2004_Lay7_FEH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL—Northwest Florida Water Management District

Figure 4.33
2004 Environmental Head
for Cross-Section A-A'

Northwest Florida Water Management District



Legend

—20— Environmental Head (ft)

Vertical Exaggeration 41:1

Cross-Section Location Map

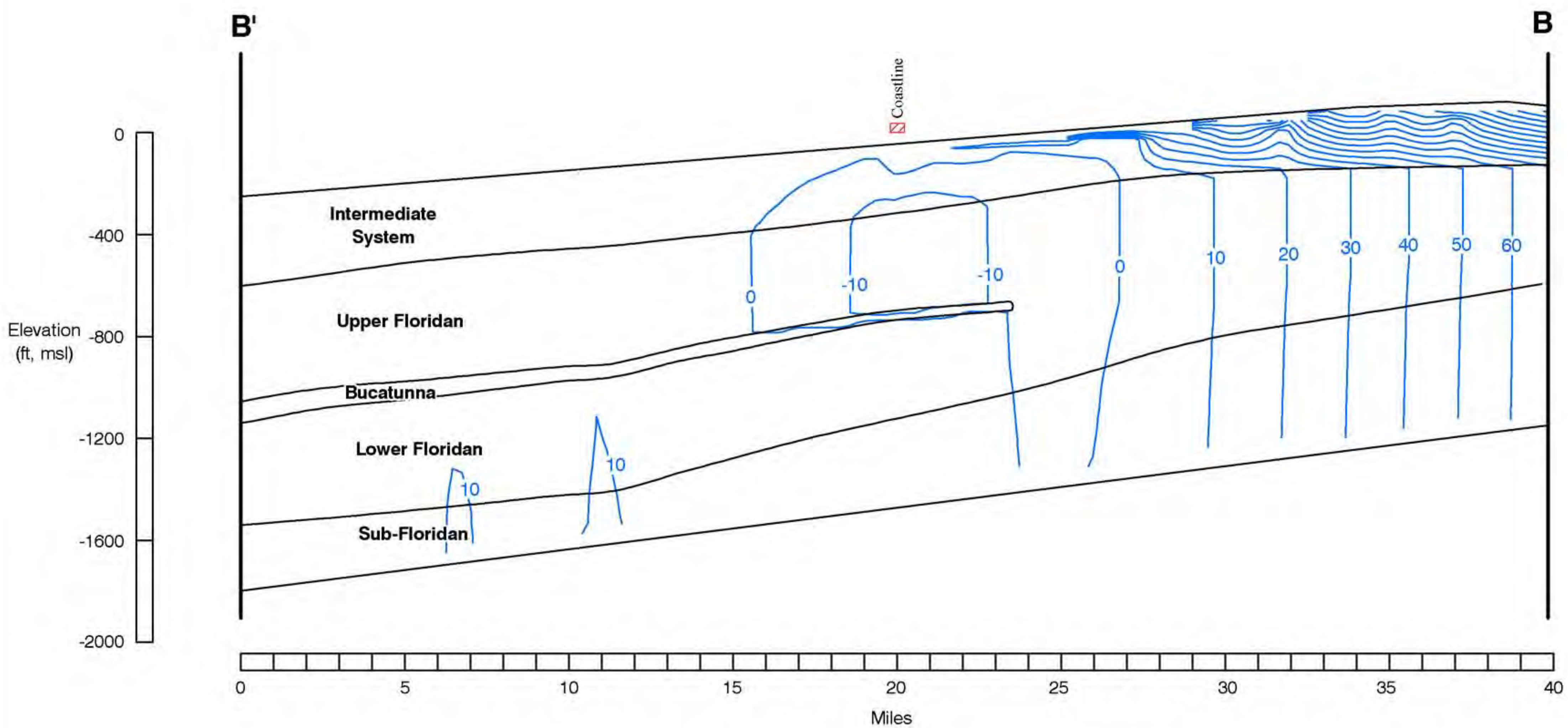
Filename: X:/NWF006/001-04/PostDev_AAprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida Water Management District

Figure 4.34
2004 Environmental Head for Cross-Section B-B'

Northwest Florida Water Management District



Legend

—20— Environmental Head (ft)

Vertical Exaggeration 41:1

Cross-Section Location Map

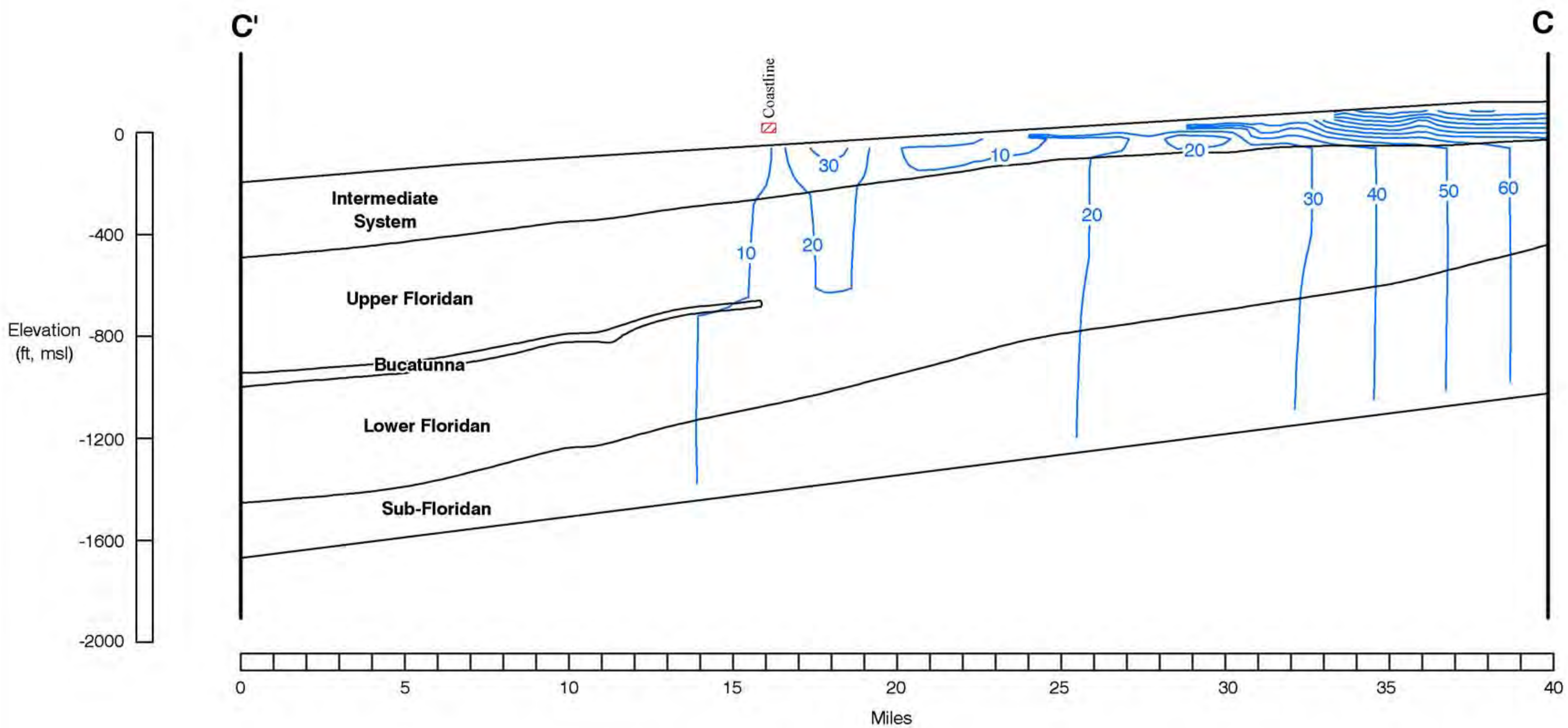
Filename: X:/NWF006/001-04/PostDev_BBprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc.

HGL—Northwest Florida Water Management District

Figure 4.35
2004 Environmental Head for Cross-Section C-C'

Northwest Florida Water Management District

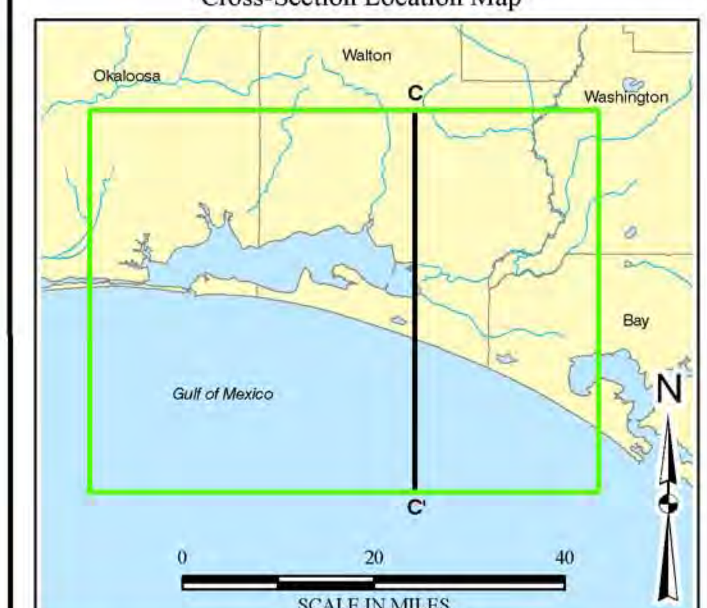


Legend

—20— Environmental Head (ft)

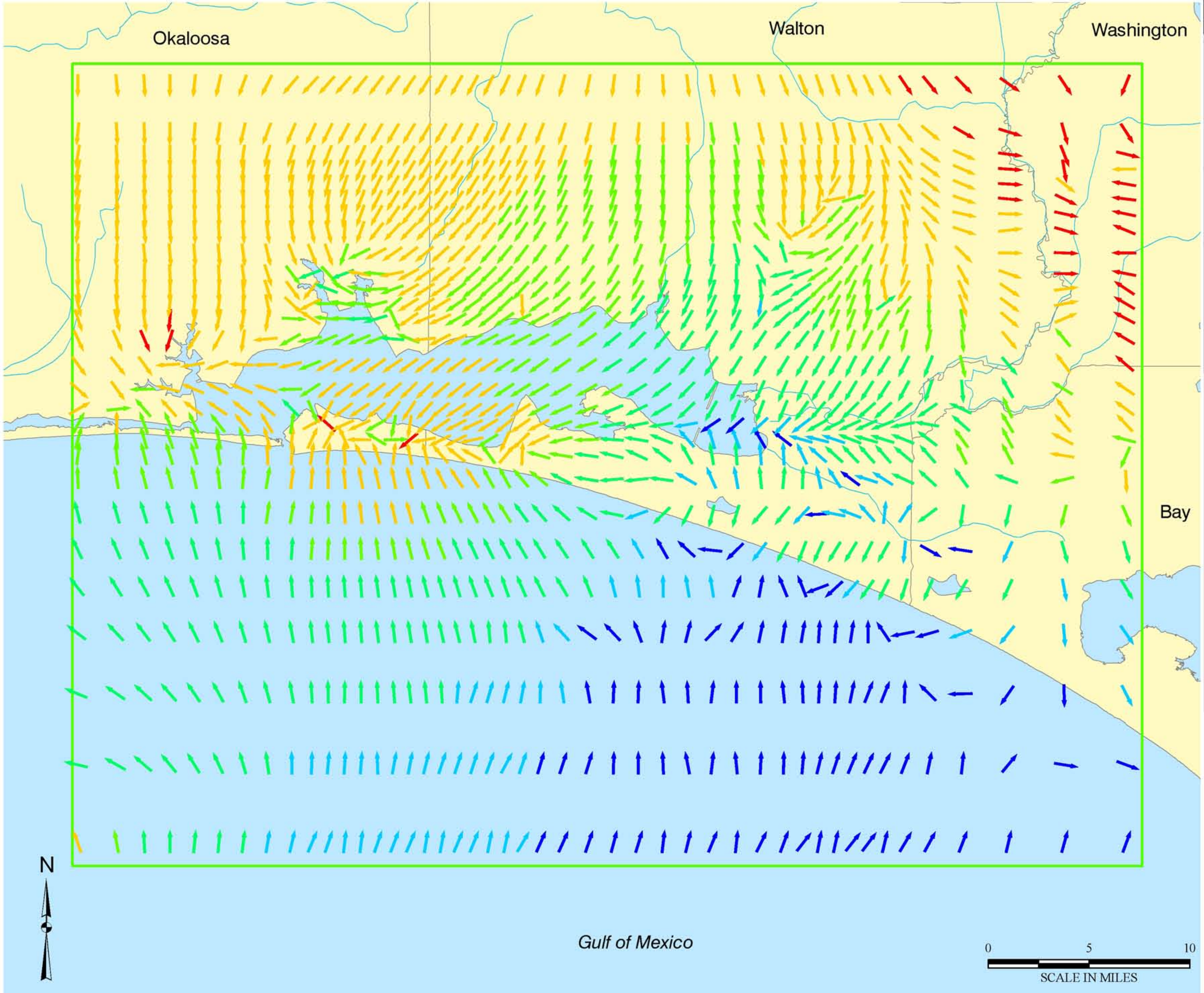
Vertical Exaggeration 41:1

Cross-Section Location Map



Filename: X:/NWF006/001-04/PostDev_CCprime_EH.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc



HGL—Northwest Florida
Water Management District

Figure 4.36
2004 Darcy Velocities for the Upper Floridan Aquifer (Elemental Layer 15)

Northwest Florida Water Management District

Legend

County Boundary
Hydrology
Model Boundary

Velocities (ft/d)
0.05
0.01
0.005
0.001
0.0005

Location Map

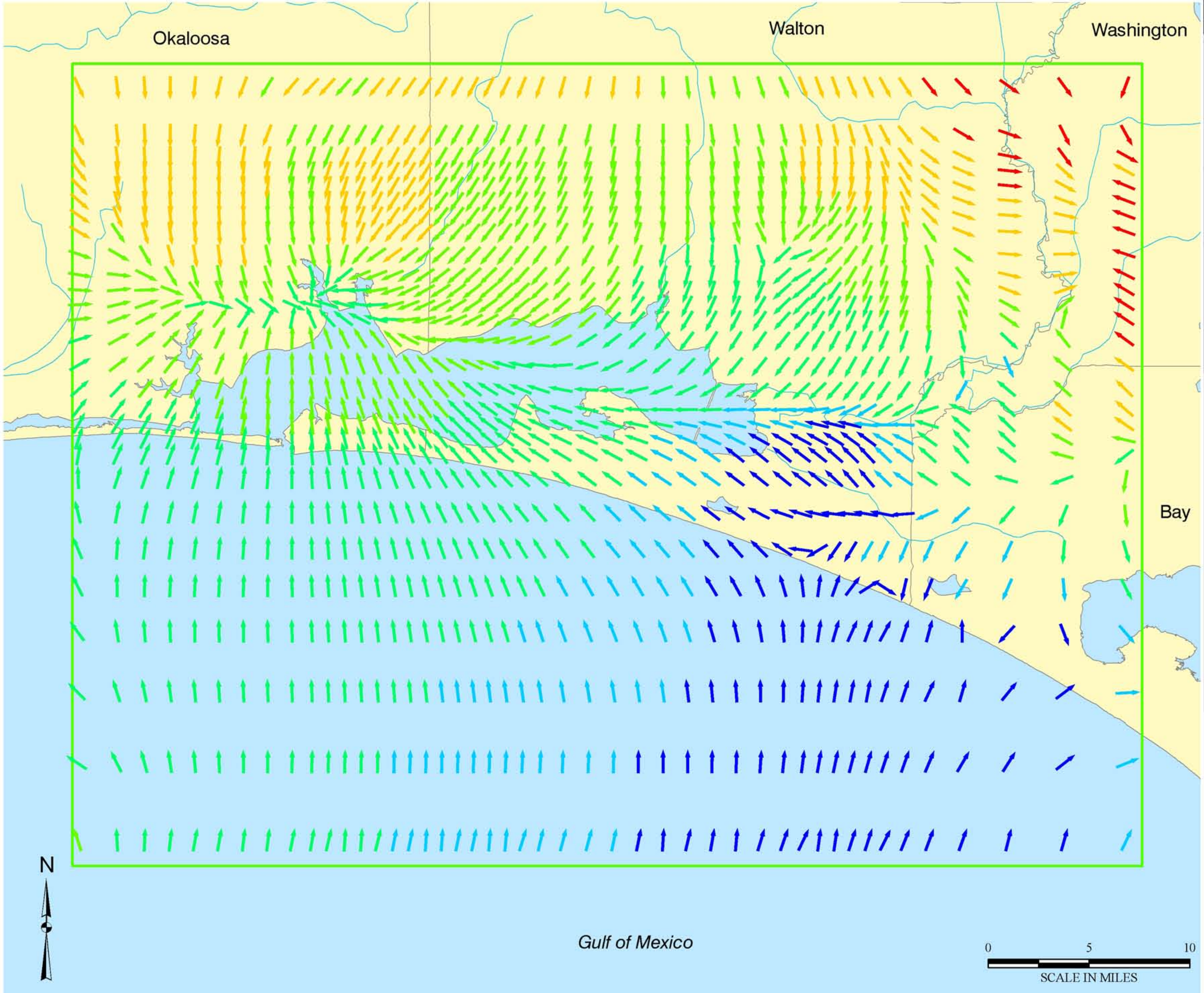
Filename: X:/NWF006/001-04/PostDev_Velxy_Lay15.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.37
2004 Darcy Velocities for the Lower Floridan Aquifer (Elemental Layer 6)

Northwest Florida Water Management District



Legend

- County Boundary
- Hydrology
- Model Boundary

Velocities (ft/d)

- 0.05
- 0.01
- 0.005
- 0.001
- 0.0005

Location Map

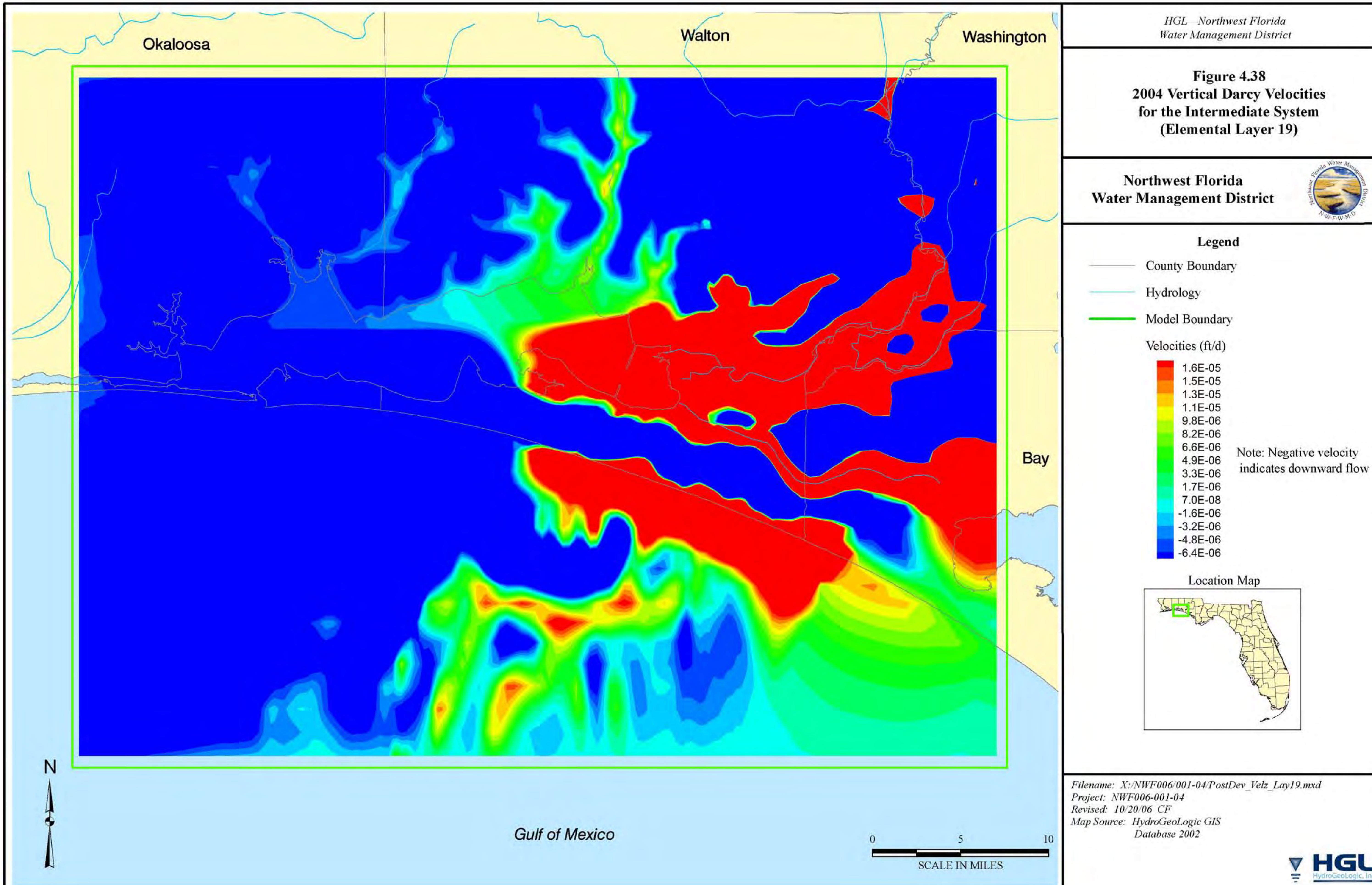
Filename: X:/NWF006/001-04/PostDev_Velxy_Lay6.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida Water Management District

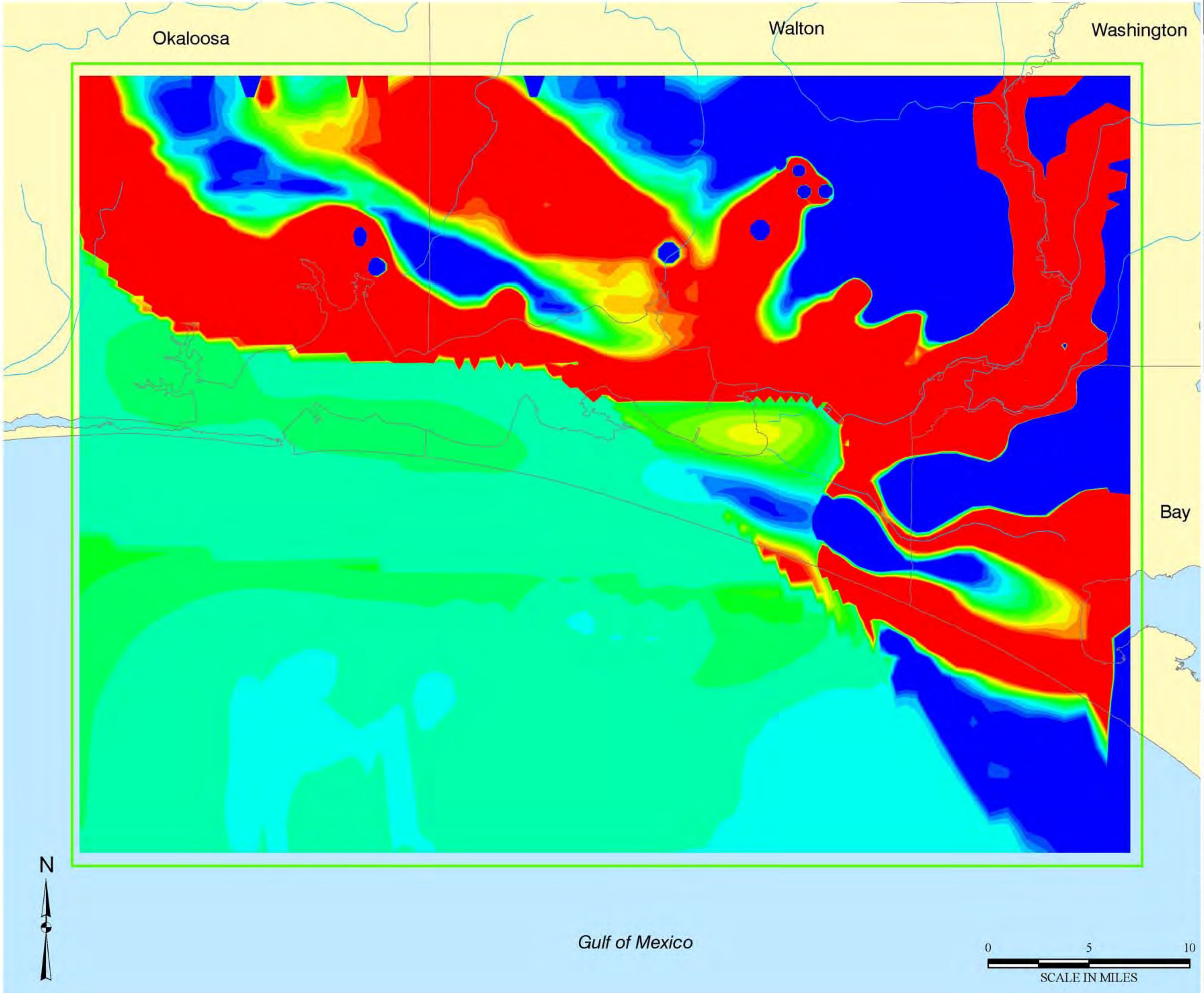
Figure 4.38
2004 Vertical Darcy Velocities for the Intermediate System (Elemental Layer 19)

Northwest Florida Water Management District



Filename: X:/NWF006/001-04/PostDev_Velz_Lay19.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.39
2004 Vertical Darcy Velocities for the Bucatunna Clay Confining Unit and Middle Portion of the Undifferentiated Floridan Aquifer System (Elemental Layer 11)

Northwest Florida Water Management District

Legend

County Boundary
Hydrology
Model Boundary

Velocities (ft/d)

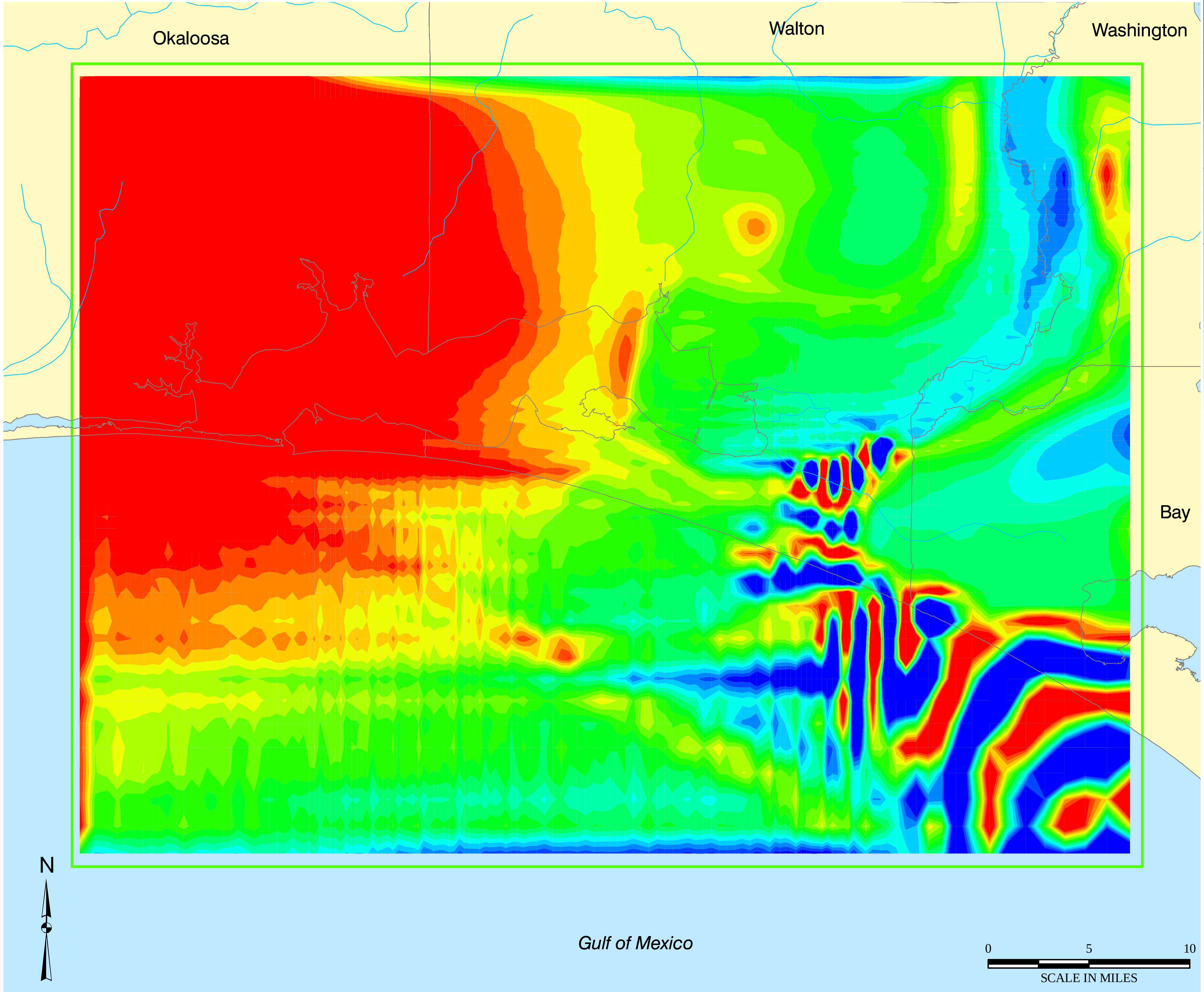
1.6E-05
1.5E-05
1.3E-05
1.1E-05
9.8E-06
8.2E-06
6.6E-06
4.9E-06
3.3E-06
1.7E-06
7.0E-08
-1.6E-06
-3.2E-06
-4.8E-06
-6.4E-06

Note: Negative velocity indicates downward flow

Location Map

Filename: X:/NWF006/001-04/PostDev_Velz_Lay11.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc



HGL—Northwest Florida Water Management District

Figure 4.40
2004 Vertical Darcy Velocities for the Sub-Floridan System (Elemental Layer 2)

Northwest Florida Water Management District

Legend

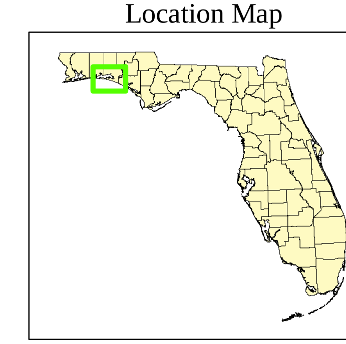
- County Boundary
- Hydrology
- Model Boundary

Velocities (ft/d)

- 1.6E-05
- 1.5E-05
- 1.3E-05
- 1.1E-05
- 9.8E-06
- 8.2E-06
- 6.6E-06
- 4.9E-06
- 3.3E-06
- 1.7E-06
- 7.0E-08
- -1.6E-06
- -3.2E-06
- -4.8E-06
- -6.4E-06

Note: Negative velocity indicates downward flow

Location Map



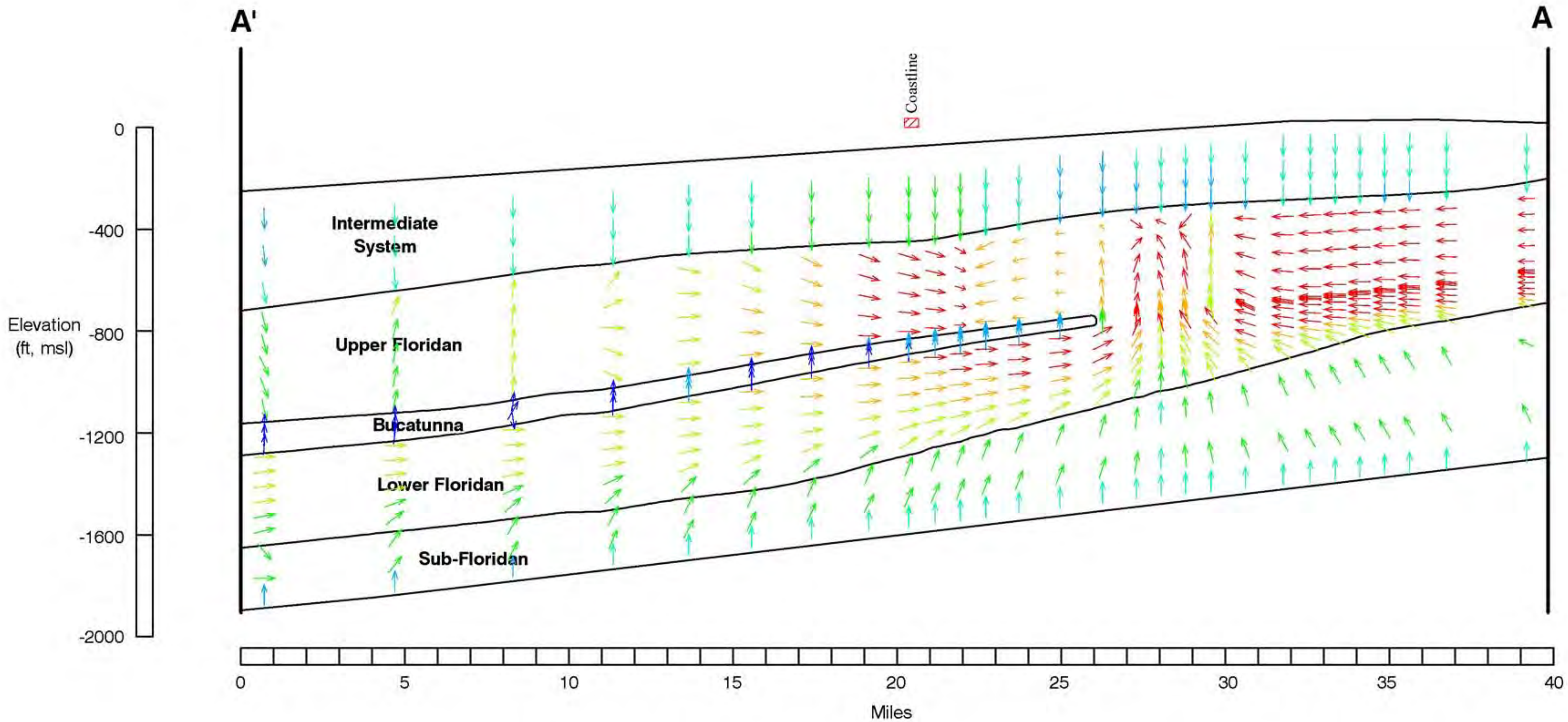
Filename: X:/NWF006/001-04/PostDev_Velz_Lay2.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.41
2004 Darcy Velocities
for Cross-Section A-A'

Northwest Florida
Water Management District



Legend

Velocities (ft/d)

- 0.01
- 0.005
- 0.001
- 0.0001
- 1E-05
- 1E-06

Vertical Exaggeration 41:1

Cross-Section Location Map

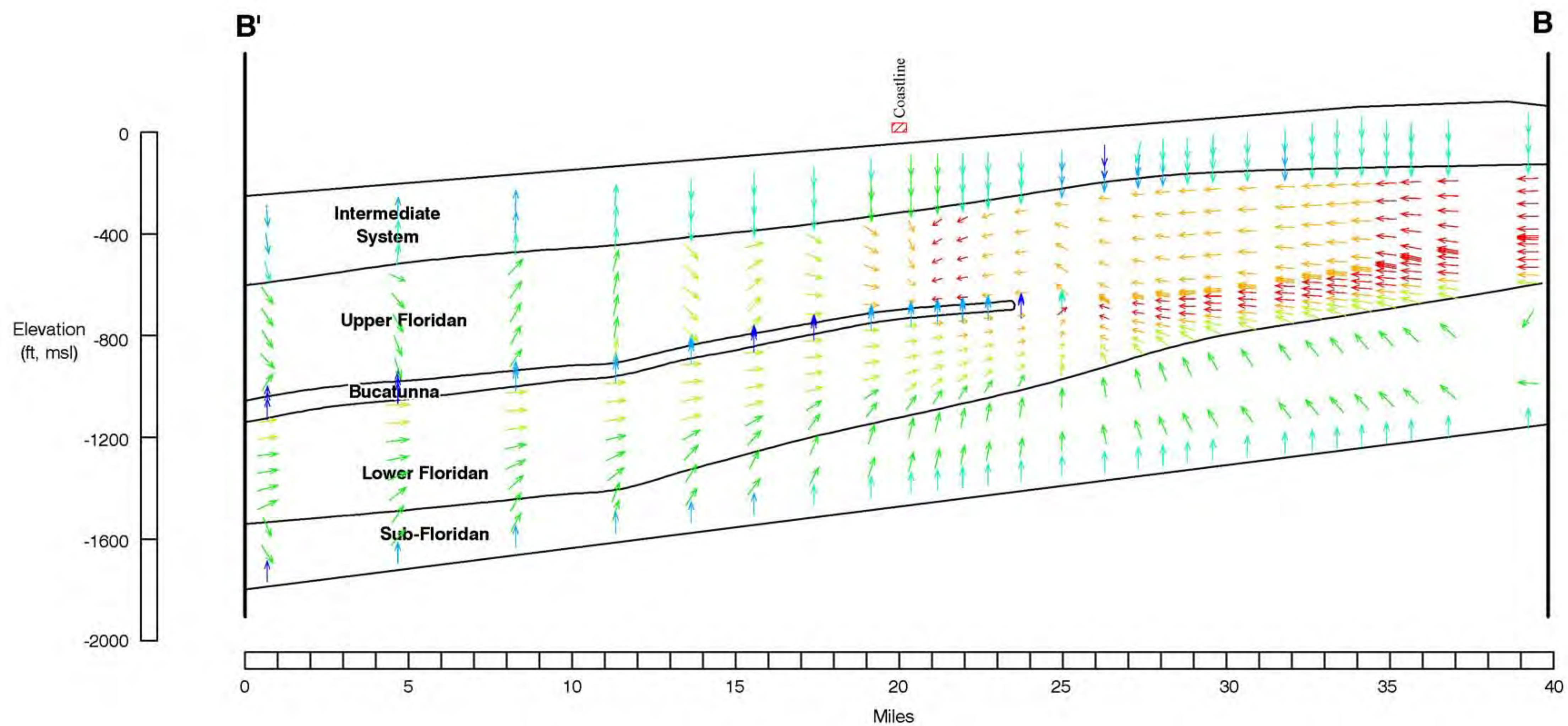
Filename: X:/NWF006/001-04/PostDev_Velyz_28.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.42
2004 Darcy Velocities
for Cross-Section B-B'

Northwest Florida
Water Management District



Legend

Velocities (ft/d)

0.01
0.005
0.001
0.0001
1E-05
1E-06

Vertical Exaggeration 41:1

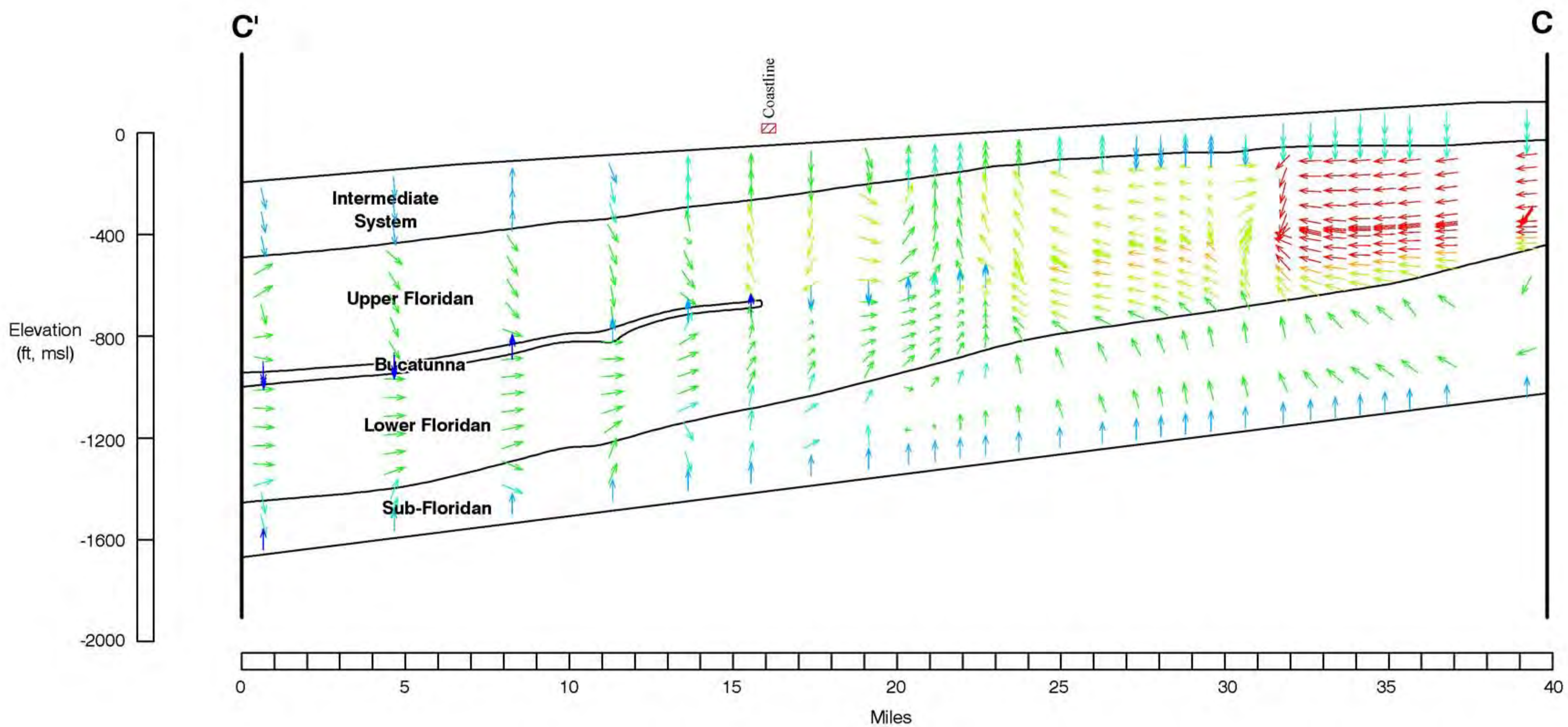
Cross-Section Location Map

Filename: X:/NWF006/001-04/PostDev_Velyz_70.mxd
Project: NWF006-001-04
Revised: 10/20/06 CF
Map Source: HydroGeoLogic GIS
Database 2005

HGL—Northwest Florida
Water Management District

**Figure 4.43
2004 Darcy Velocities
for Cross-Section C-C'**

**Northwest Florida
Water Management District**



Legend

Velocities (ft/d)

0.01
0.005
0.001
0.0001
1E-05
1E-06

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/PostDev_Velyz_100.mxd
Project: NWF006-001-04
Revised: 10/23/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.44
Water Level
Location Map

Northwest Florida
Water Management District

Legend

County Boundary

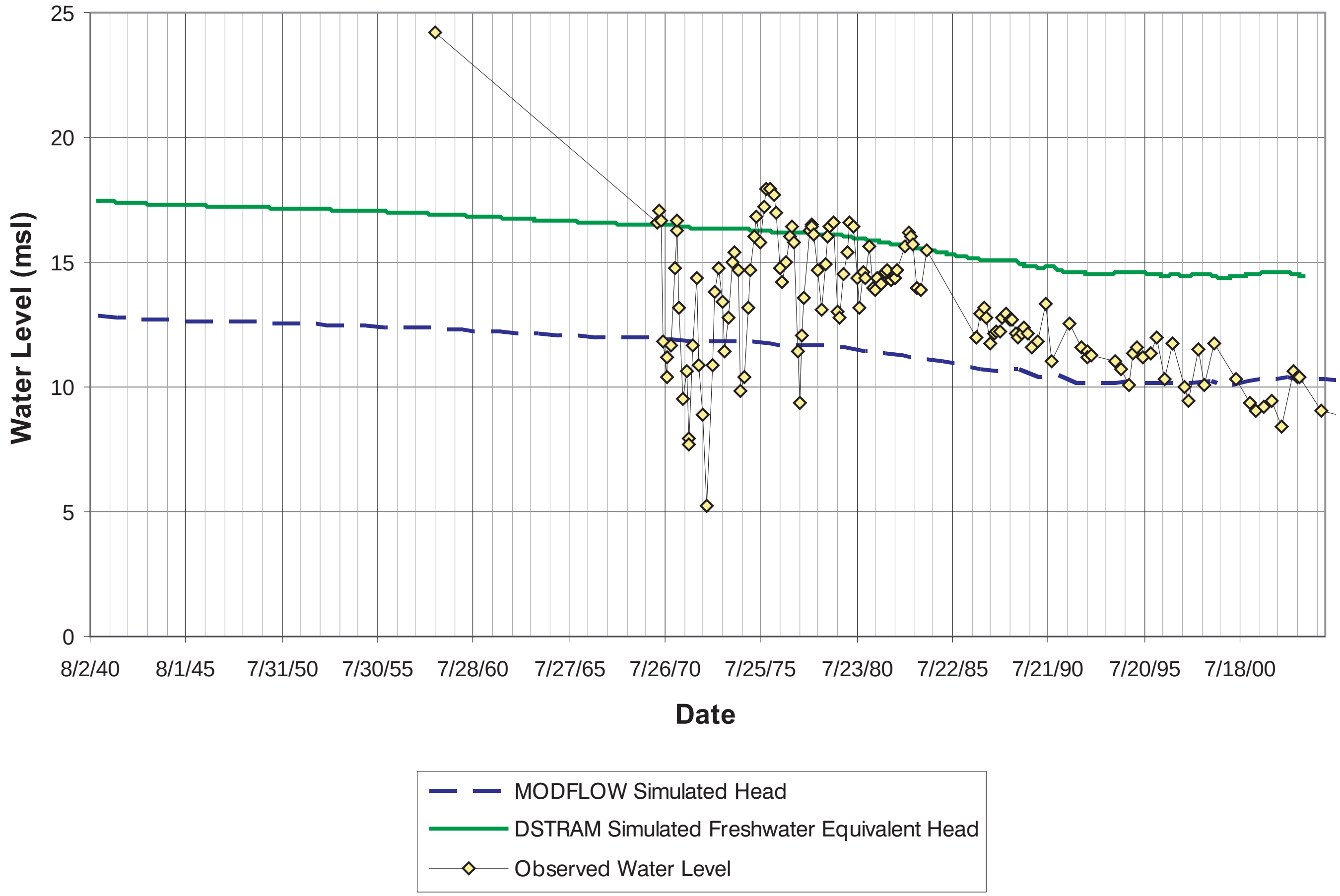
Hydrology

Model Boundary

Water Level Location

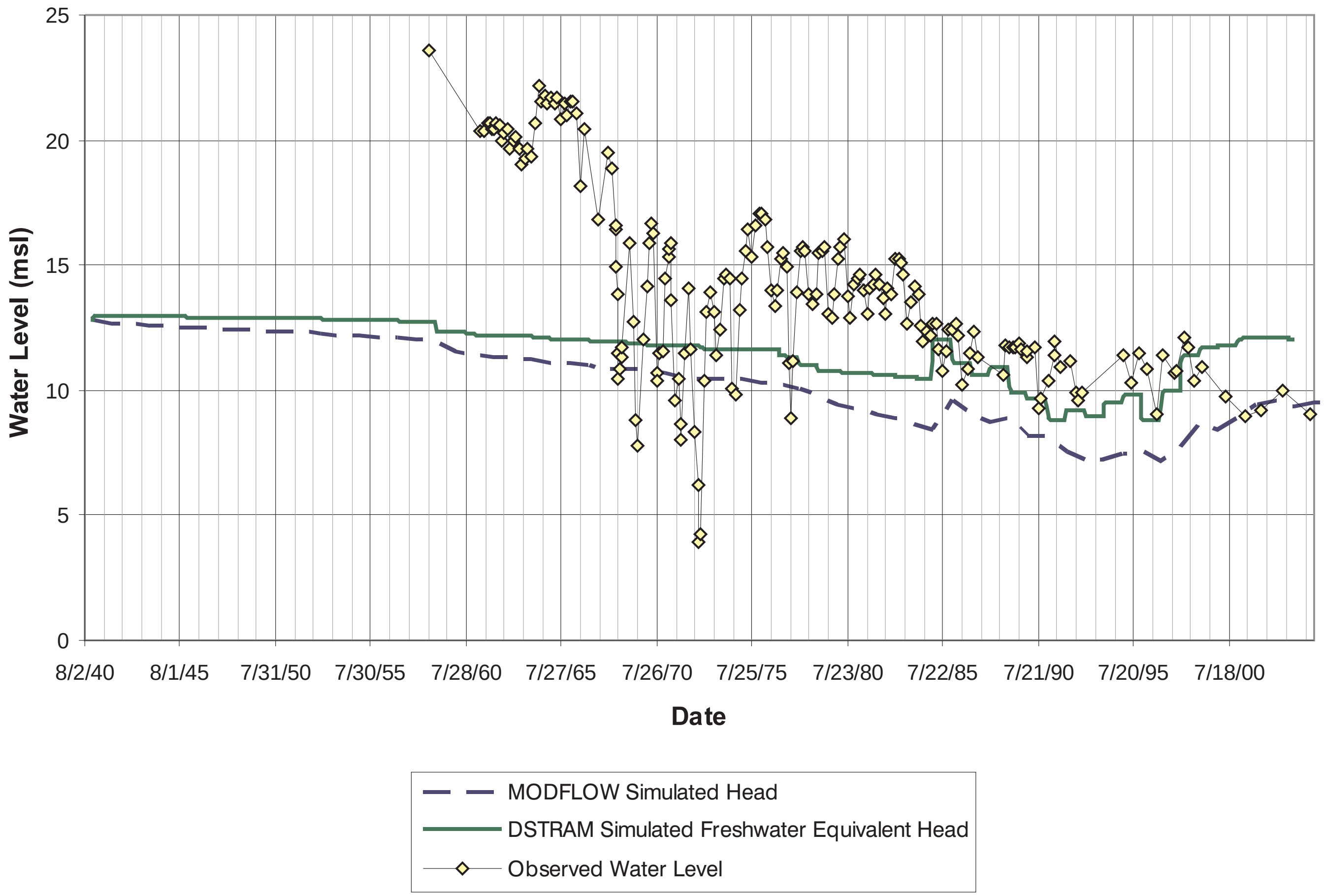
Location Map

Filename: X:/NWF006/001-04/
Water_Lvl_Loc.mxd
Project: NWF006-001-04
Revised: 03/09/07 TB
Map Source: HydroGeoLogic GIS
Database 2006



Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

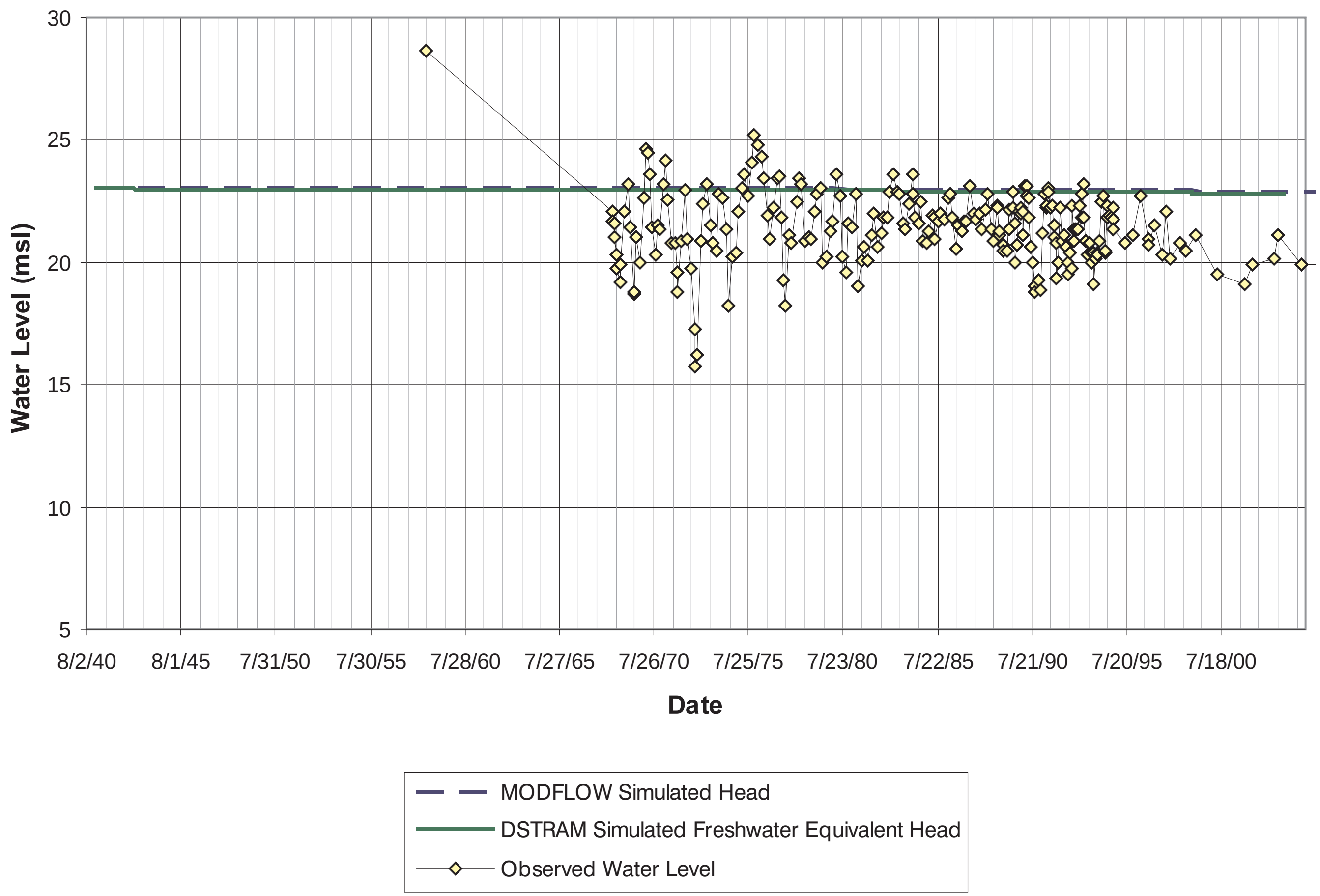
Figure 4.45a
Point Washington/McGee NWF ID 1371
Water Level



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

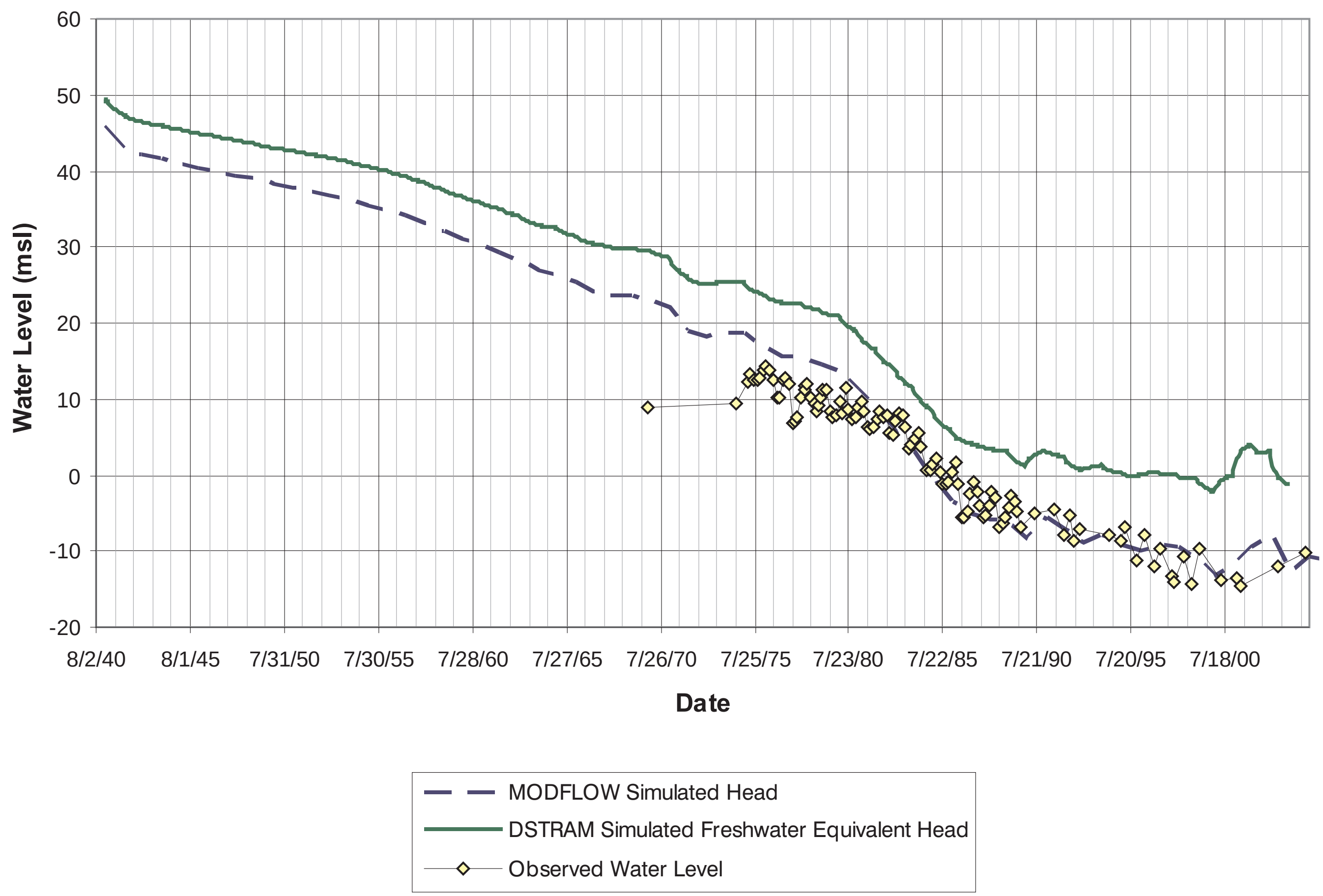
Figure 4.45b
Van Butler/USGS NWF ID 1074
Water Level



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

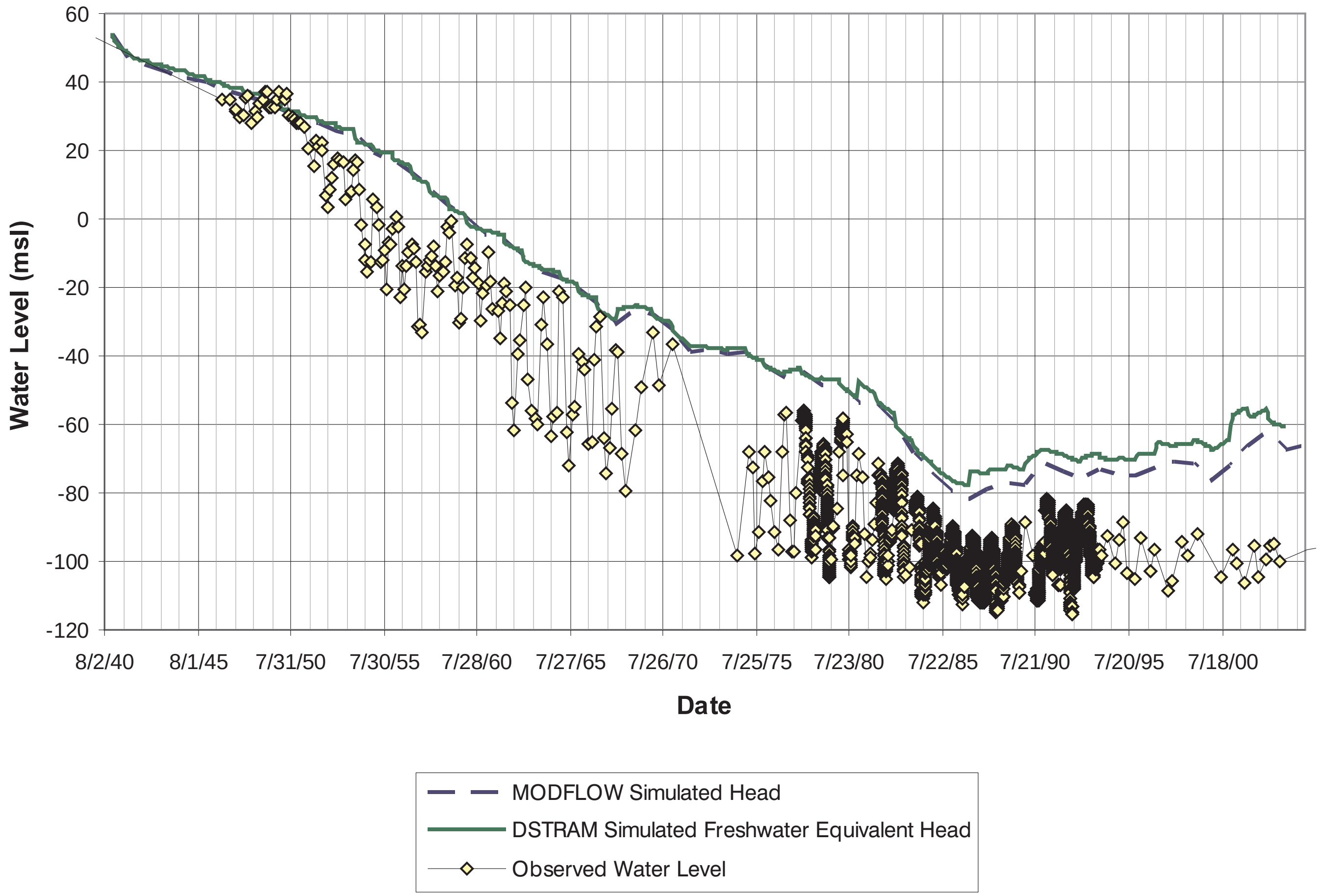
Figure 4.45c
Old Cowford NWF ID 2534
Water Level



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

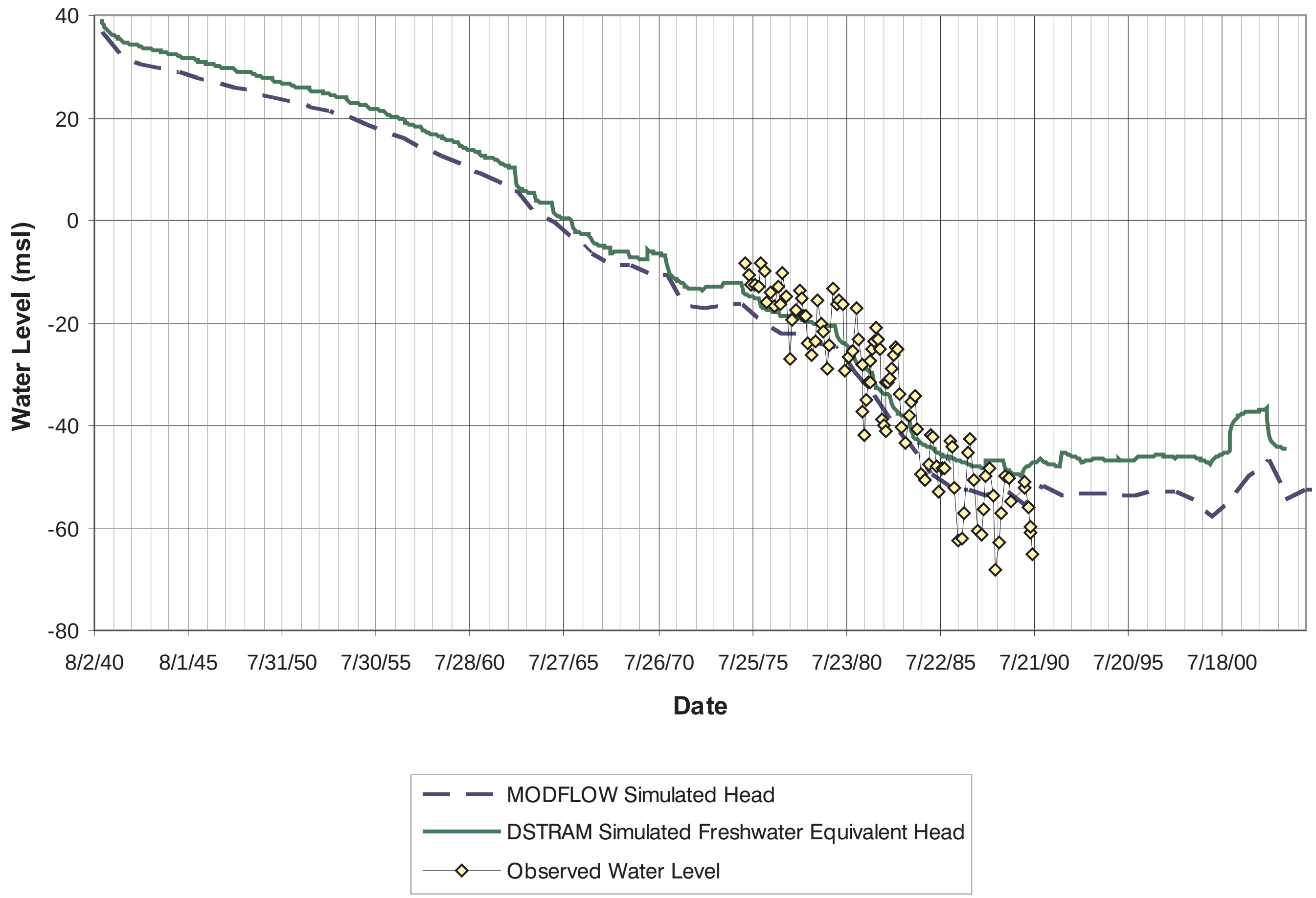
Figure 4.45d
FGS-Lalonde #1 NWF ID 2962
Water Level



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

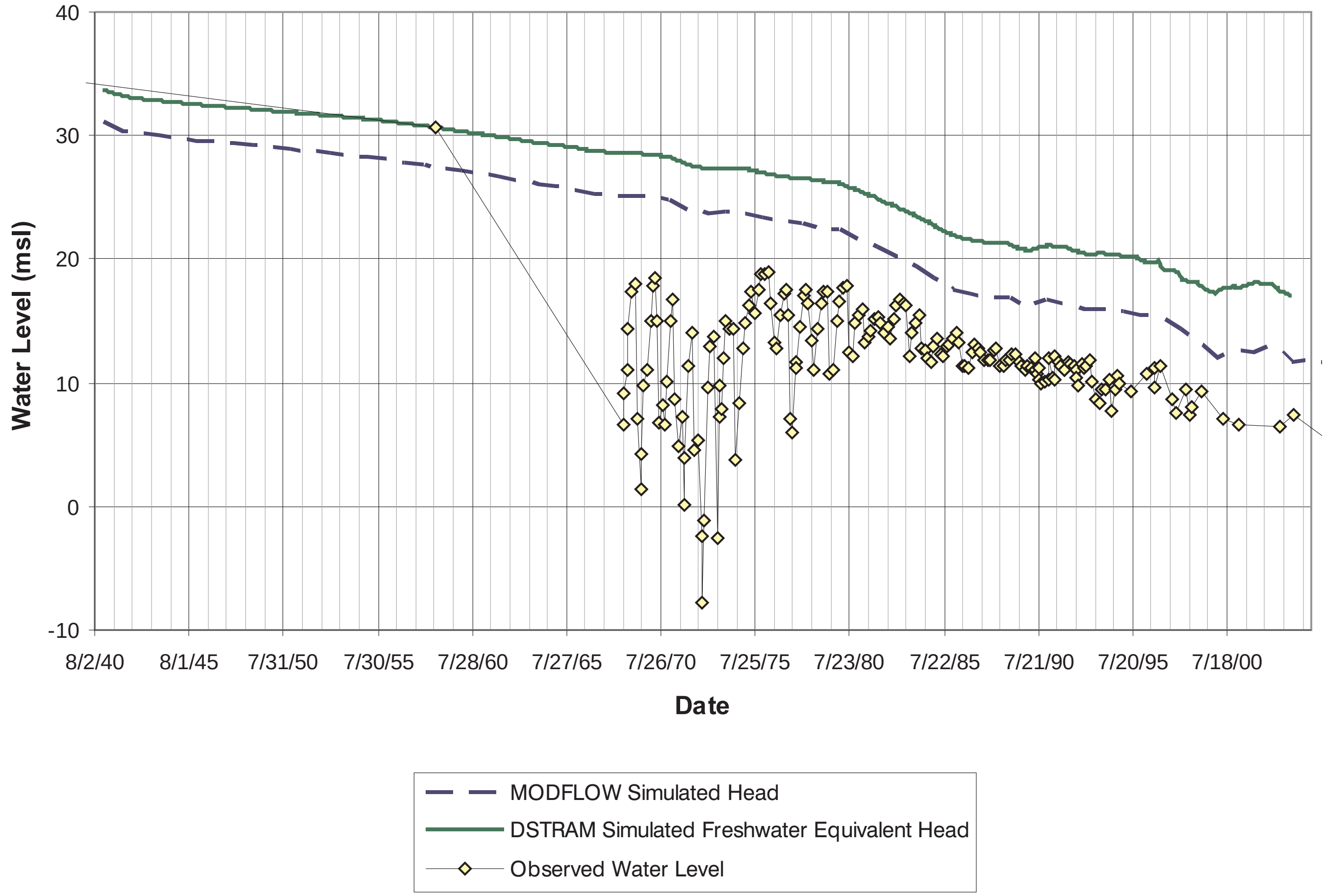
Figure 4.45e
Okaloosa School Board NWF ID 1894
Water Level



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

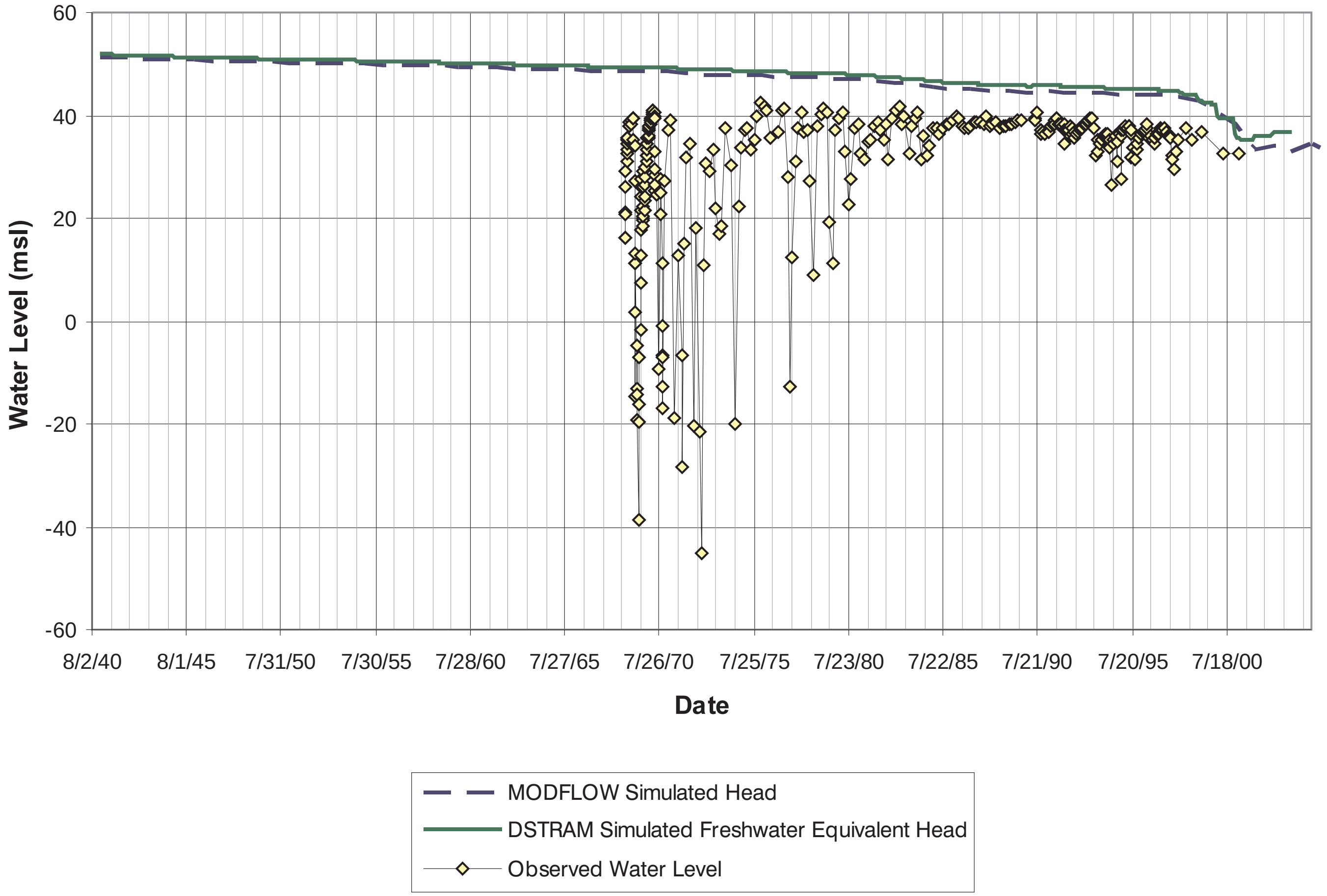
Figure 4.45f
DWU #1 NWF ID 1687
Water Level



HGL—Northwest Florida Water Management District

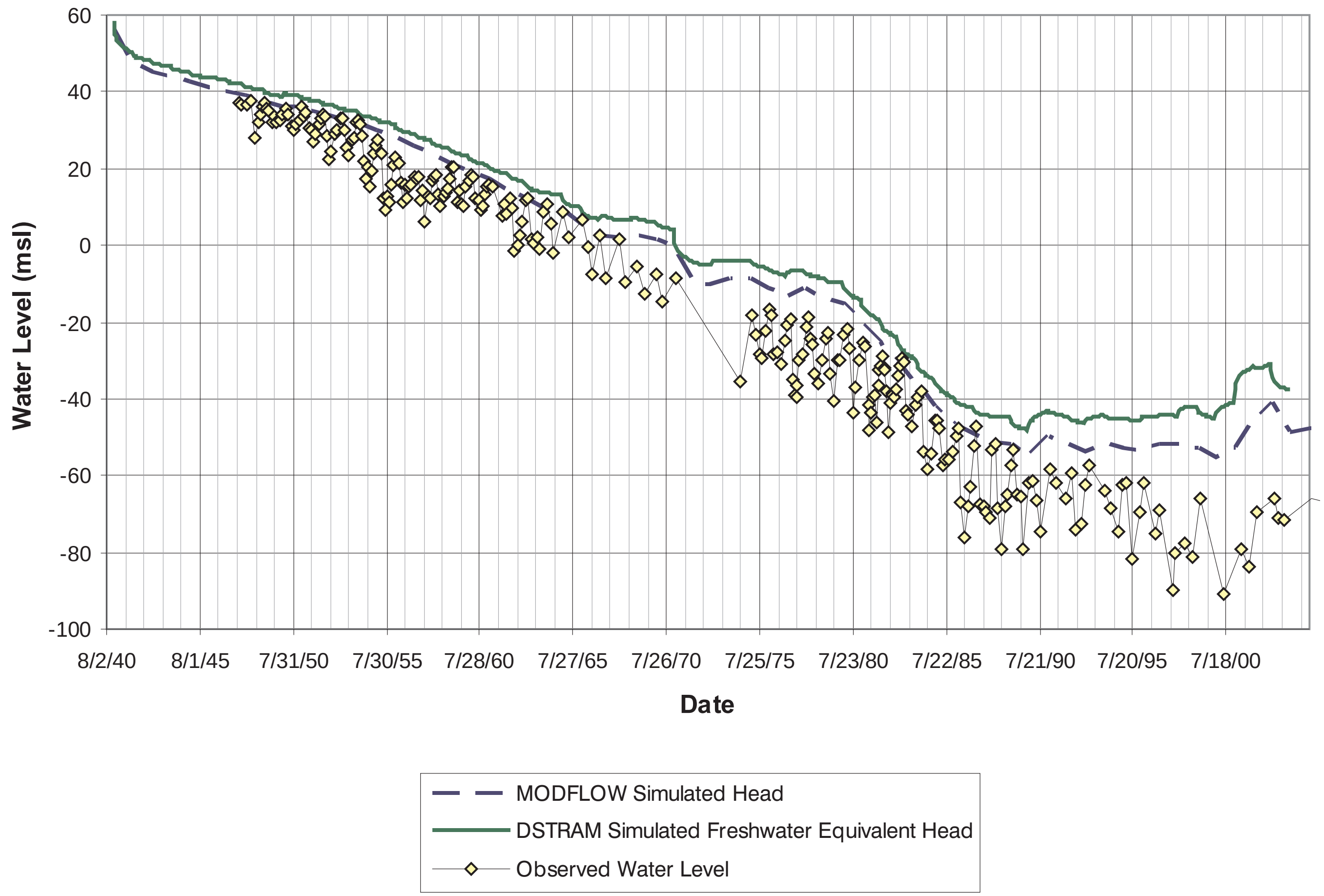
Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.45g
Selma Madara/USGS NWF ID 2738
Water Level



Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

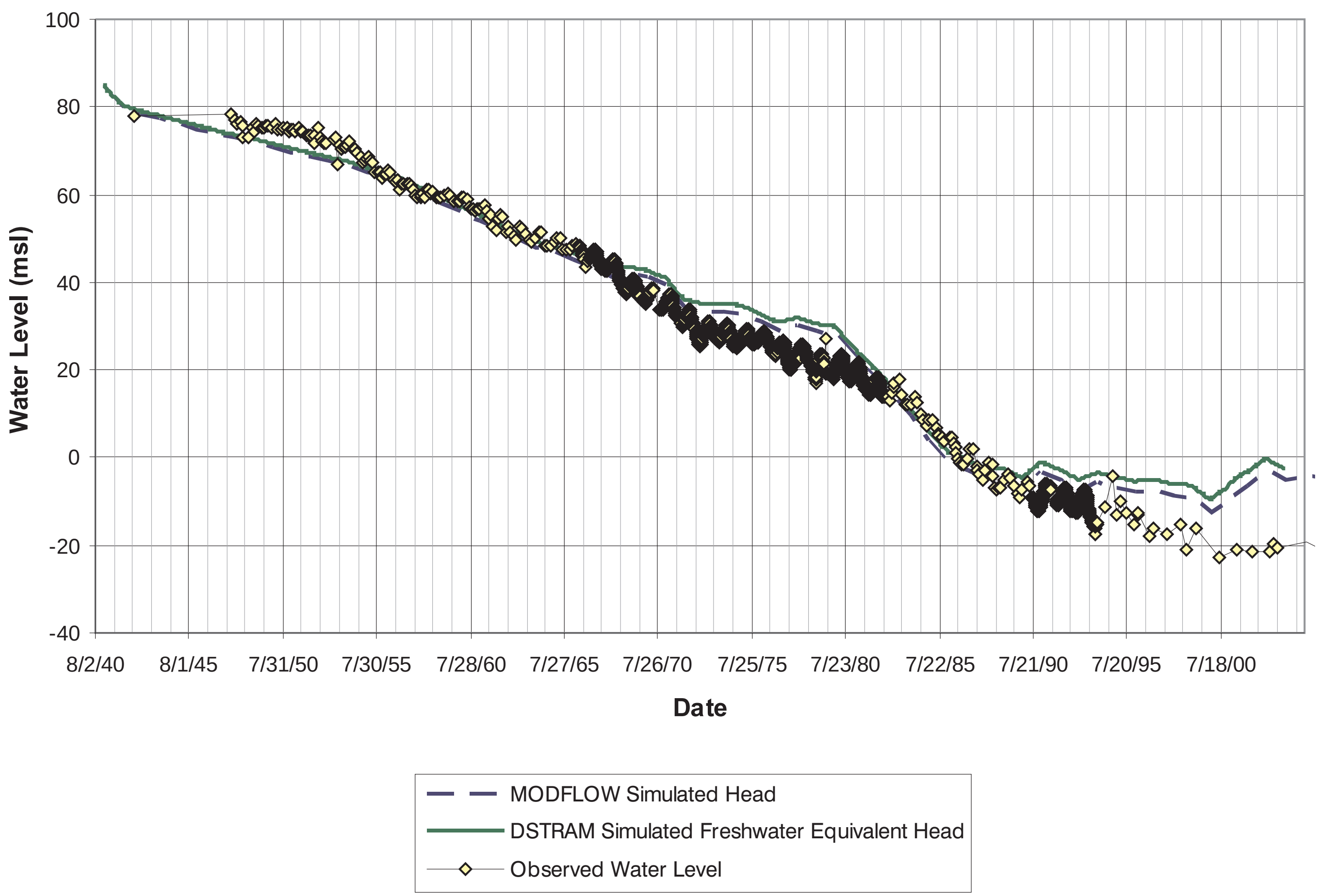
Figure 4.45h
FAF #2/USGS Monitor NWF ID 3807
Water Level



HGL—Northwest Florida Water Management District

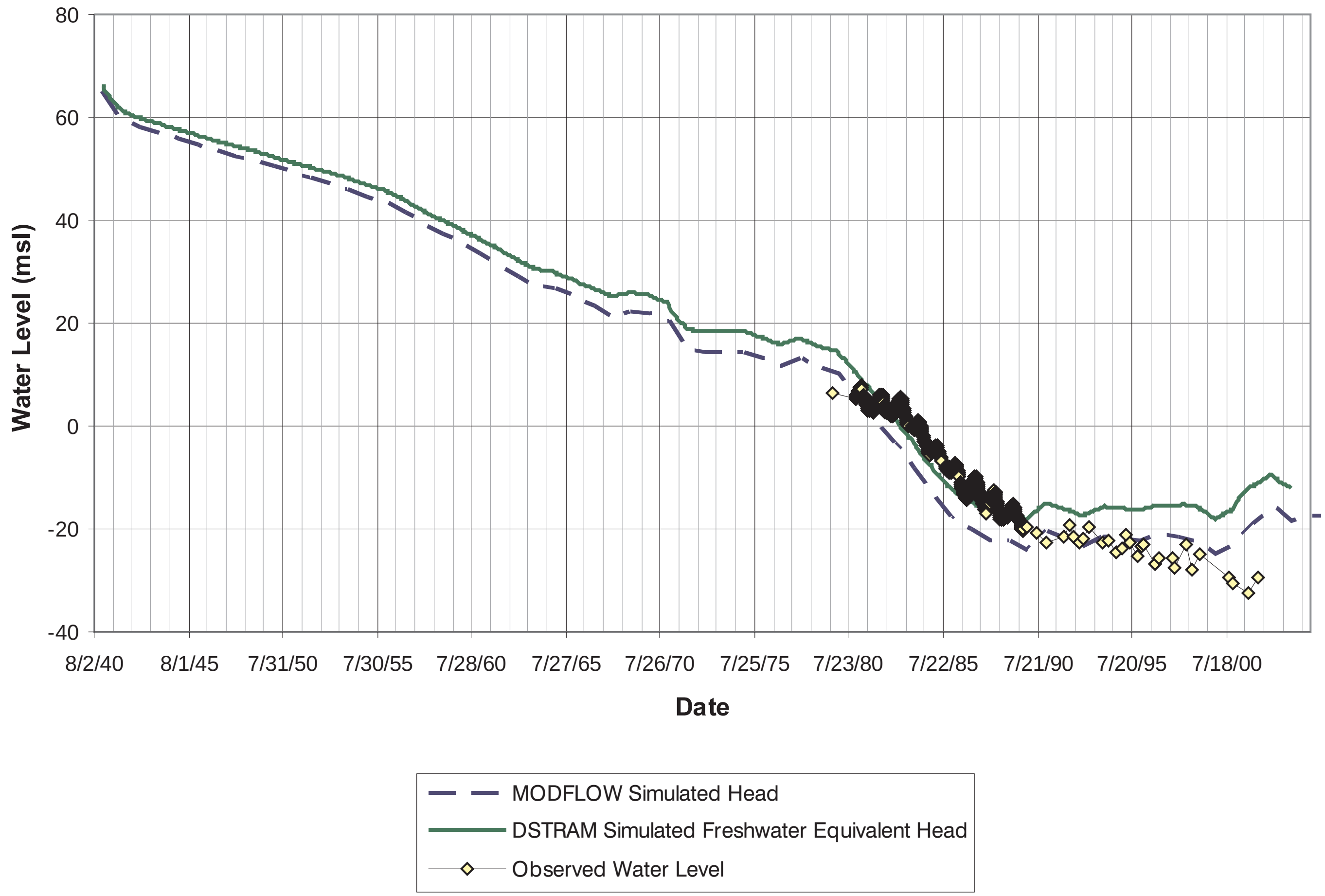
Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.45i
EAFB Postil Point NWF ID 2994
Water Level



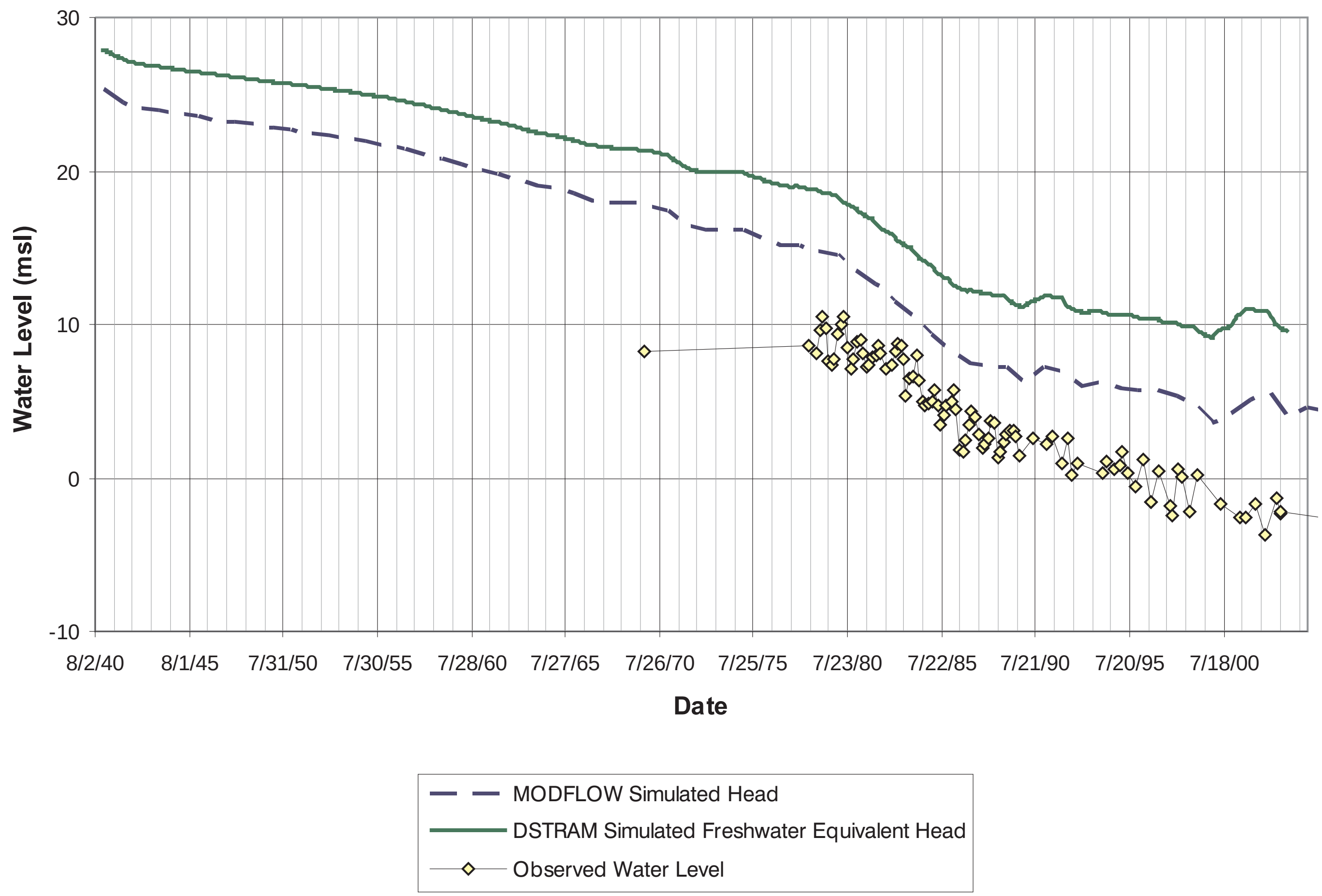
Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.45j
EAFB FLD #5 Well #2 NWF ID 3923
Water Level



Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.45k
Beal Cemetery Lower NWF ID 2173
Water level



HGL—Northwest Florida Water Management District

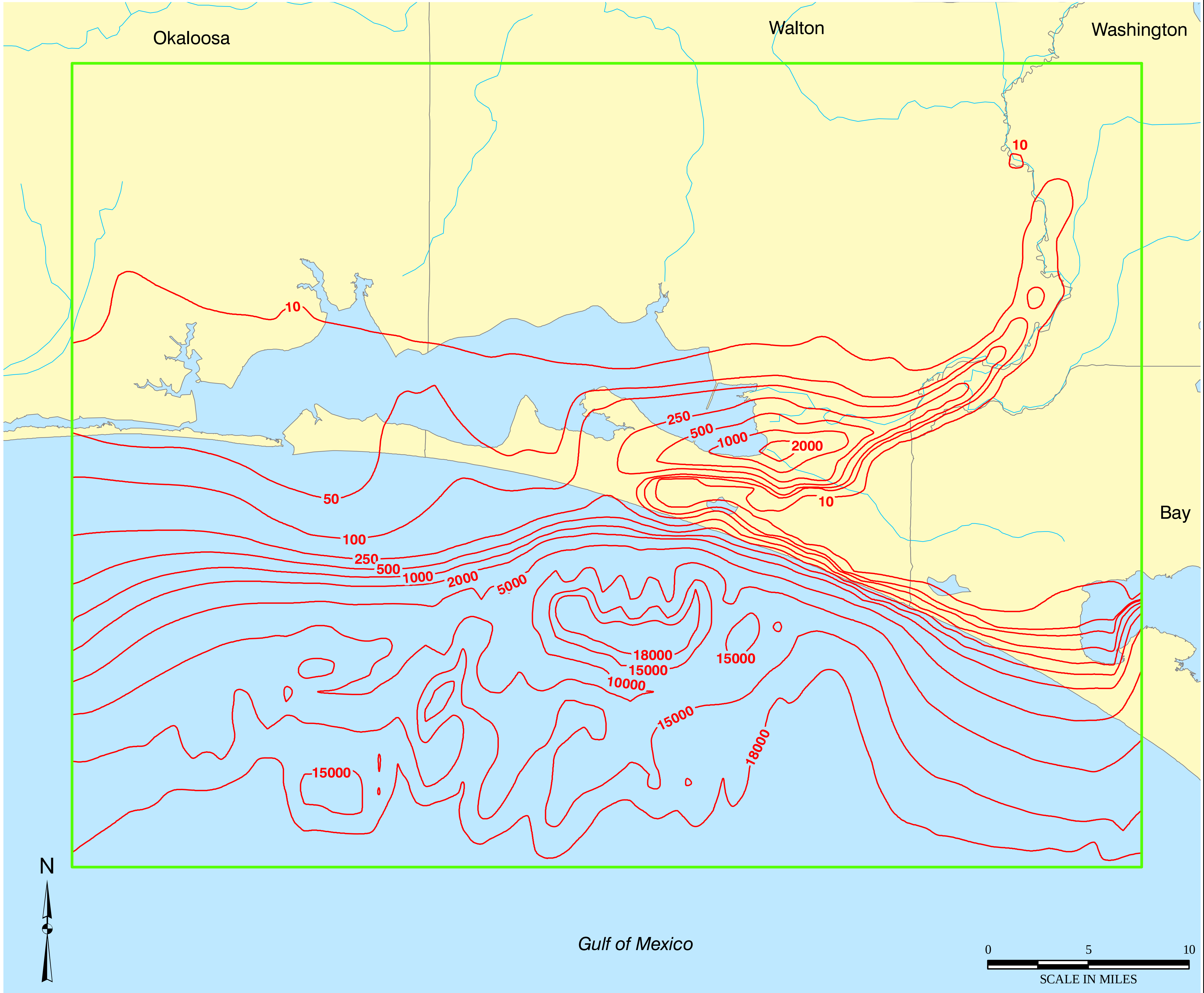
Filename: X:\NWF006\001-04
\Water_Levels.cdr
Project: NWF006-001-04
Revised: 07/27/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.45l
S. Matthews NWF ID 2034
Water Level

HGL—Northwest Florida
Water Management District

Figure 4.46a
2004 Chloride Concentrations
for the Upper Floridan Aquifer
(Nodal Layer 16, mid-aquifer)

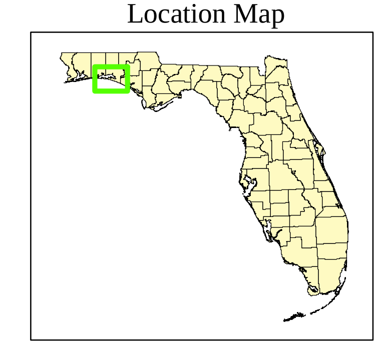
Northwest Florida
Water Management District



Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Chloride Concentration (mg/L)

Location Map



Filename: X:/NWF006/001-04/PostDev_TECN-2004_Lay16.mxd
Project: NWF006-001-04
Revised: 03/09/07 TB
Map Source: HydroGeoLogic GIS
Database 2002

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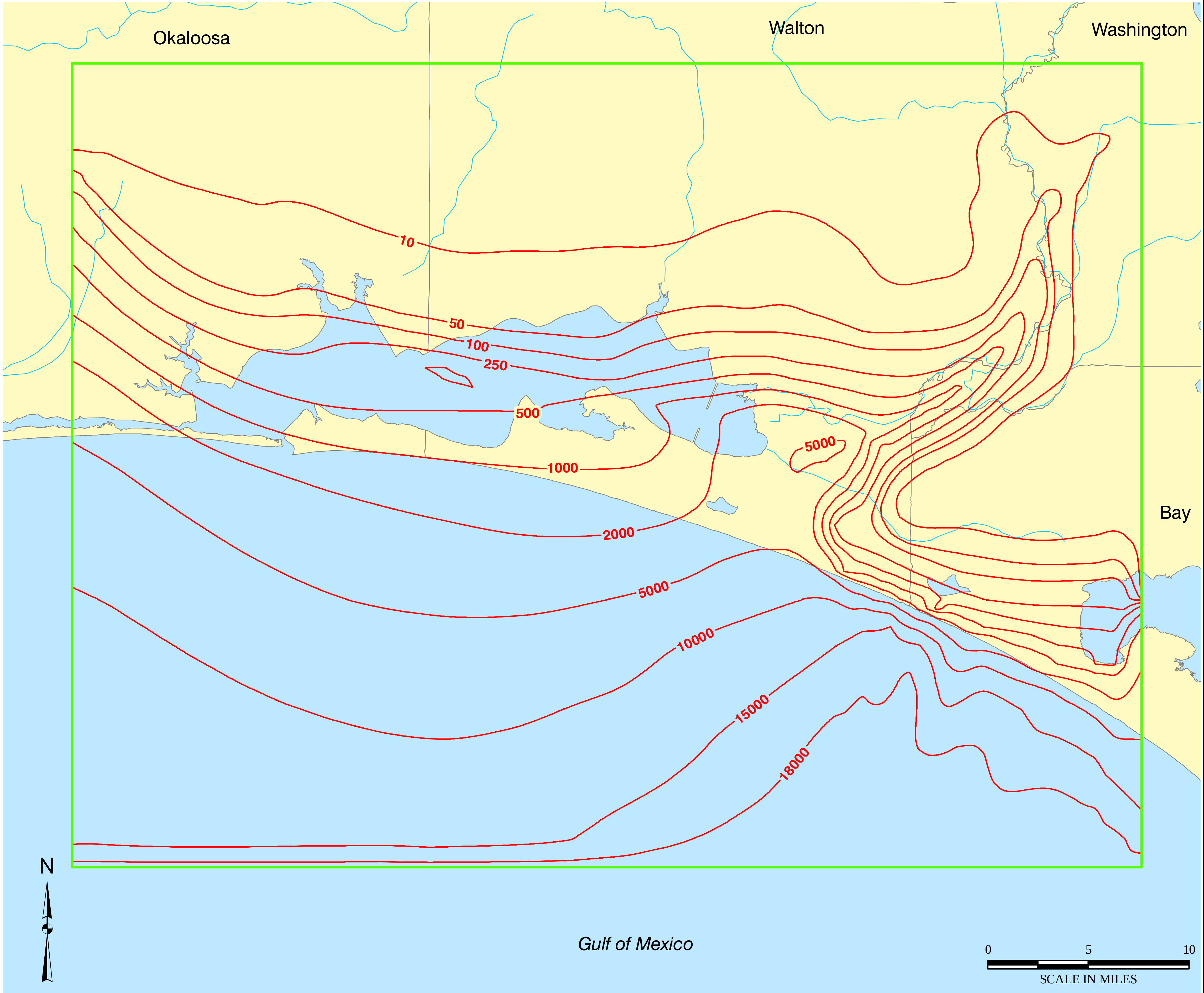
HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.46b
2004 Chloride Concentrations
for the Lower Floridan Aquifer
(Nodal Layer 7, mid-aquifer)

Northwest Florida Water Management District



Legend

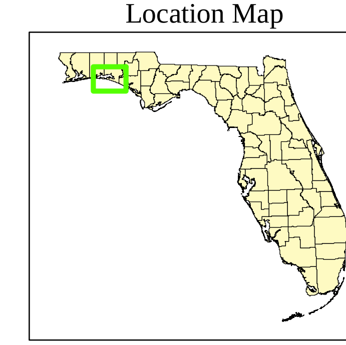
County Boundary

Hydrology

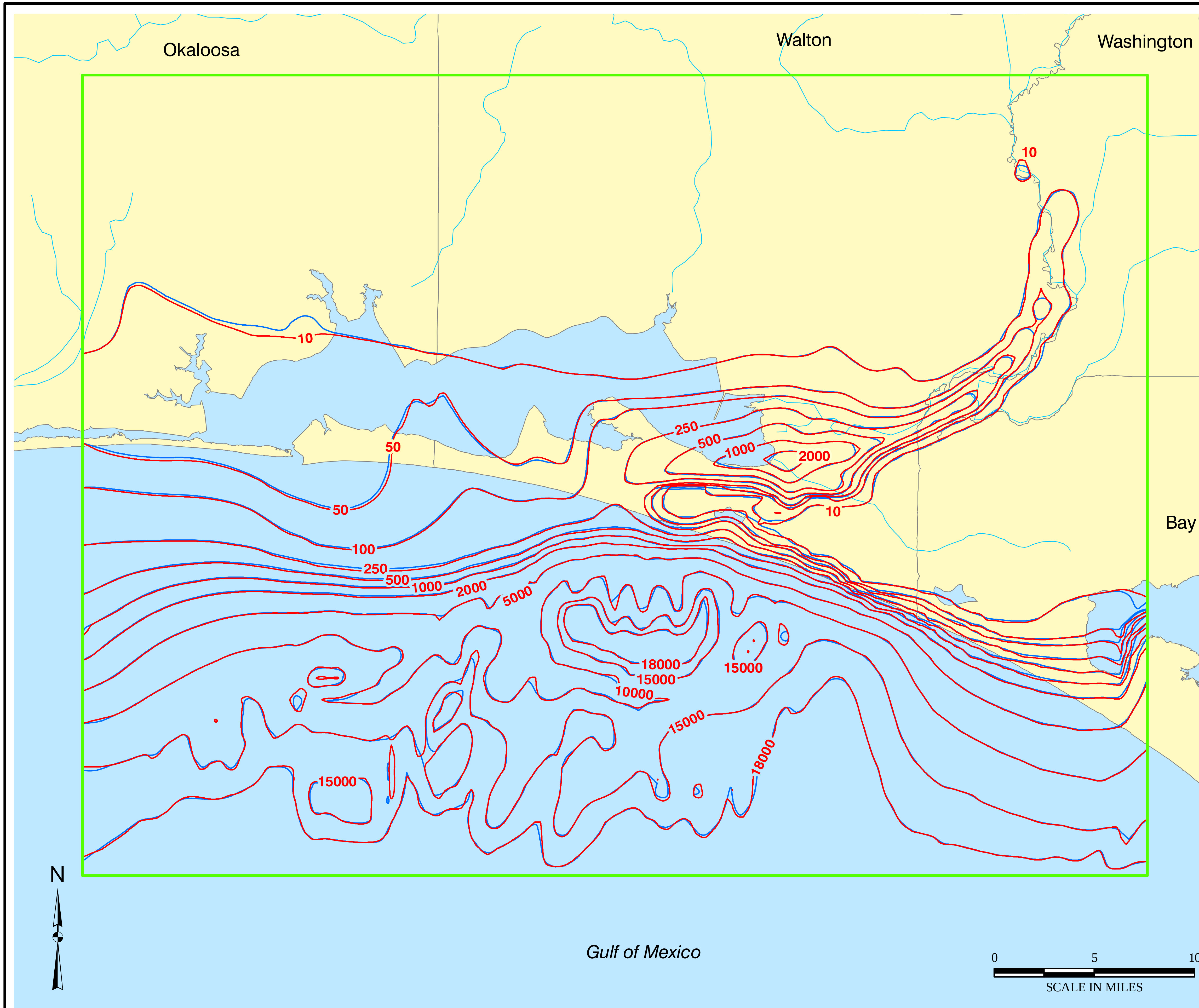
Model Boundary

—50— Chloride Concentration (mg/L)

Location Map



Filename: X:/NWF006/001-04/PostDev_TECN-2004_Lay7.mxd
Project: NWF006-001-04
Revised: 03/09/07 TB
Map Source: HydroGeoLogic GIS Database 2002



HGL—Northwest Florida Water Management District

Figure 4.47a
Pre-Development and 2004 Chloride Concentrations for the Upper Floridan Aquifer (Nodal Layer 16, mid-aquifer)

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Pre-Development Chloride Concentration (mg/L)
- 2004 Chloride Concentration (mg/L)

Location Map

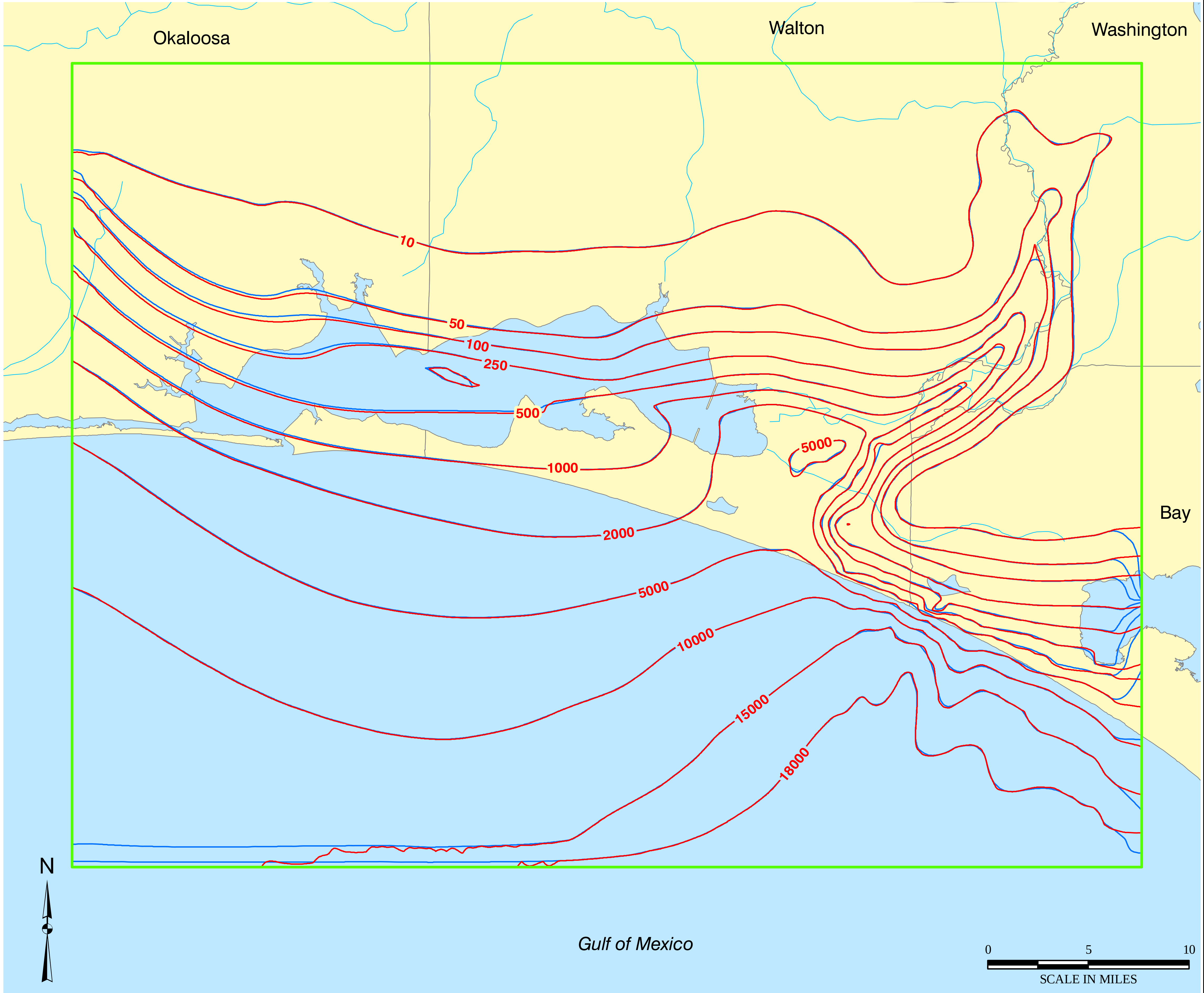
Filename: X:/NWF006/001-04/SS_C-PostDevTECN04_Lay16.mxd
Project: NWF006-001-04
Revised: 03/09/07 TB
Map Source: HydroGeoLogic GIS Database 2002

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.47b
Pre-Development and
2004 Chloride Concentrations
for the Lower Floridan Aquifer
(Nodal Layer 7, mid-aquifer)

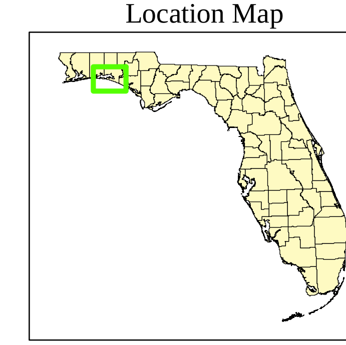
Northwest Florida
Water Management District



Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Pre-Development Chloride Concentration (mg/L)
- 2004 Chloride Concentration (mg/L)

Location Map



Filename: X:/NWF006/001-04/SS_C-PostDevTECN04_Lay7.mxd
Project: NWF006-001-04
Revised: 03/09/07 TB
Map Source: HydroGeoLogic GIS Database 2002

HGL
HydroGeoLogic, Inc

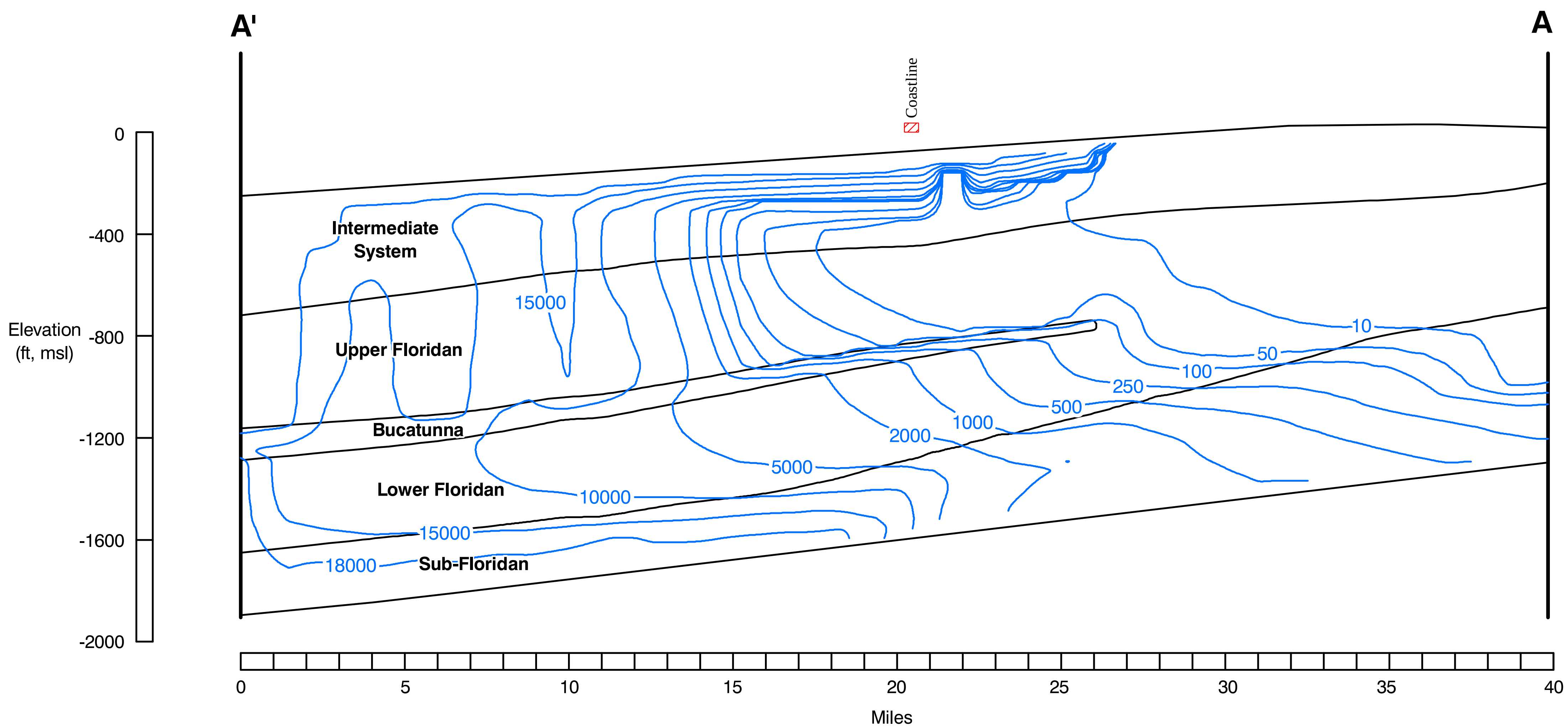
Figure 4.48
2004 Chloride Concentrations
for Cross-Section A-A'

Northwest Florida
Water Management District

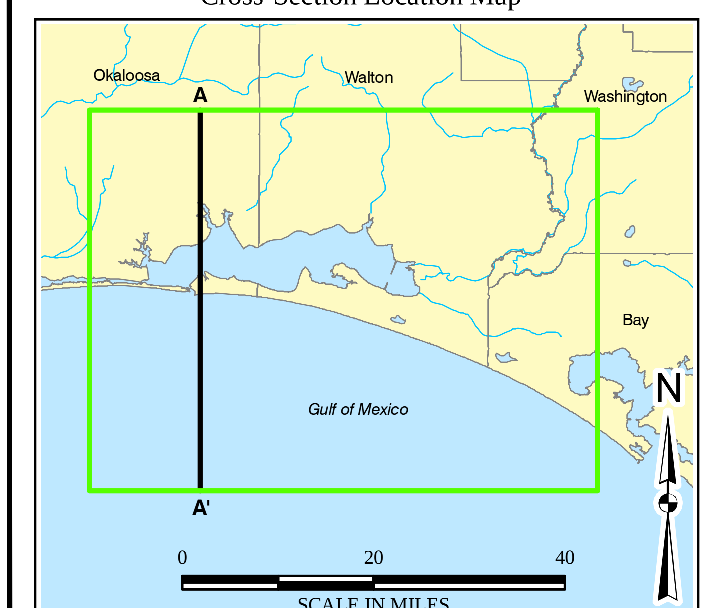
Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1



Cross-Section Location Map



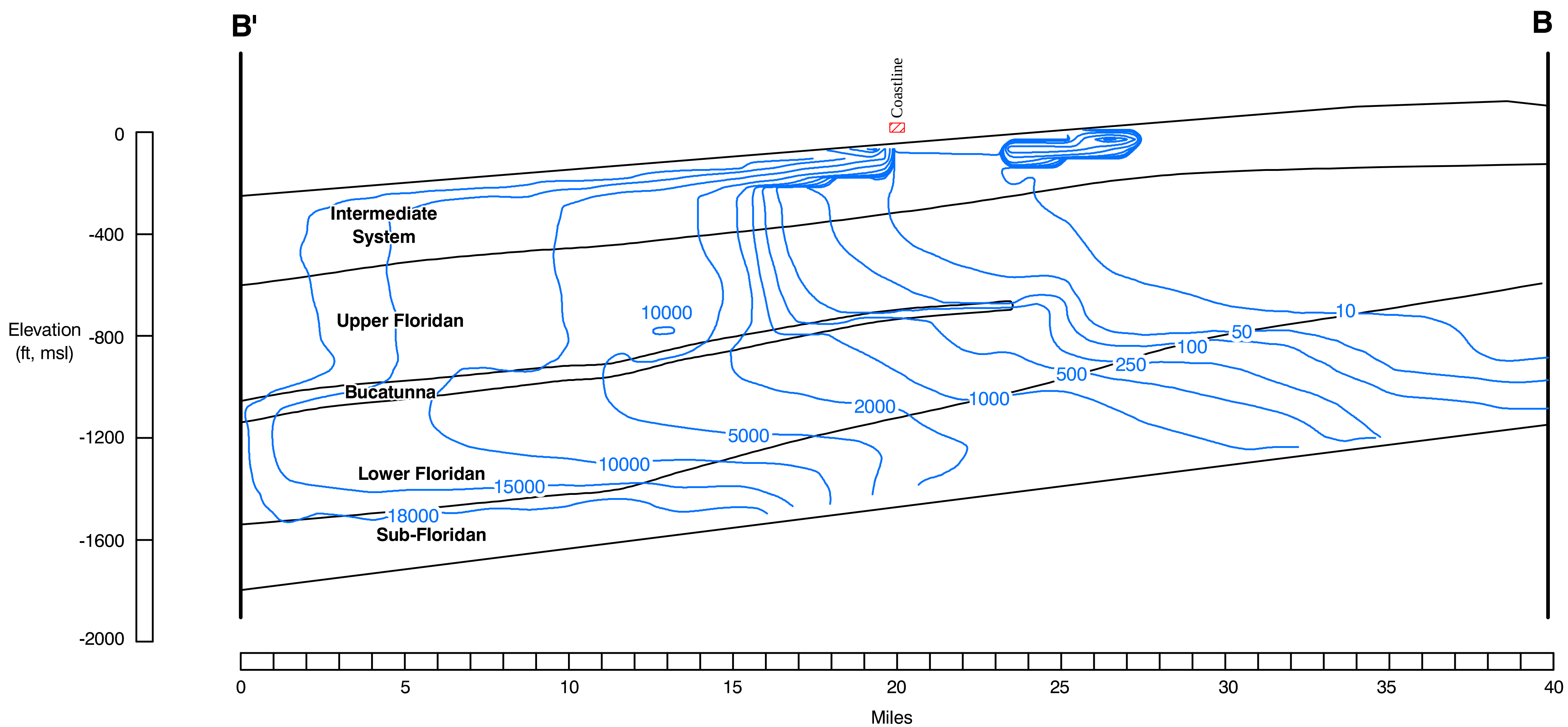
Filename: X:/NWF006/001-04/PostDev_AAprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS
Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.49
2004 Chloride Concentrations
for Cross-Section B-B'

Northwest Florida
Water Management District



Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1

Cross-Section Location Map

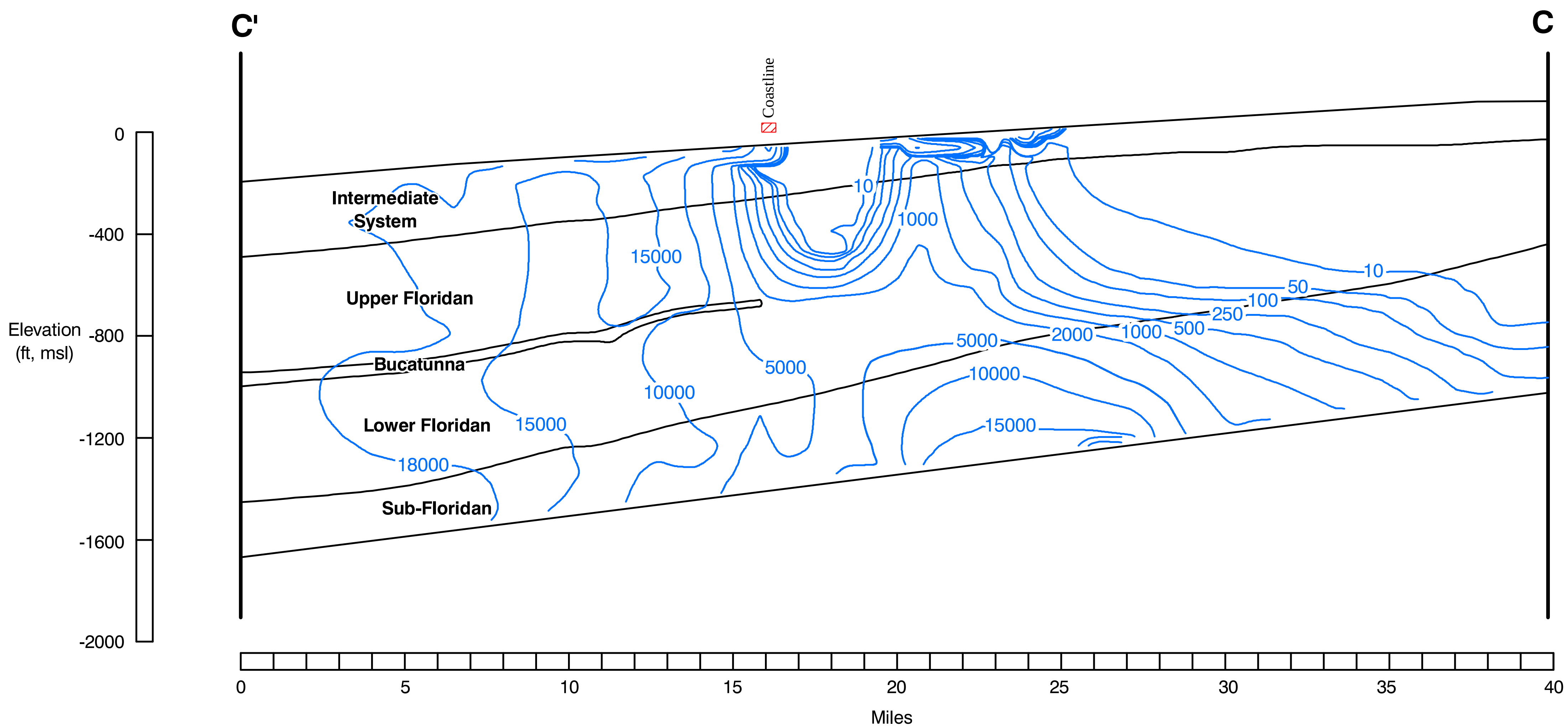
Filename: X:/NWF006/001-04/PostDev_BBprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS Database 2005

HGL HydroGeoLogic, Inc

HGL—Northwest Florida
Water Management District

Figure 4.50
2004 Chloride Concentrations
for Cross-Section C-C'

Northwest Florida
Water Management District



Legend

—50— Chloride Concentration (mg/L)

Vertical Exaggeration 41:1

Cross-Section Location Map

Filename: X:/NWF006/001-04/PostDev_CCprime_C.mxd
Project: NWF006-001-04
Revised: 12/18/06 CF
Map Source: HydroGeoLogic GIS
Database 2005

HGL
HydroGeoLogic, Inc

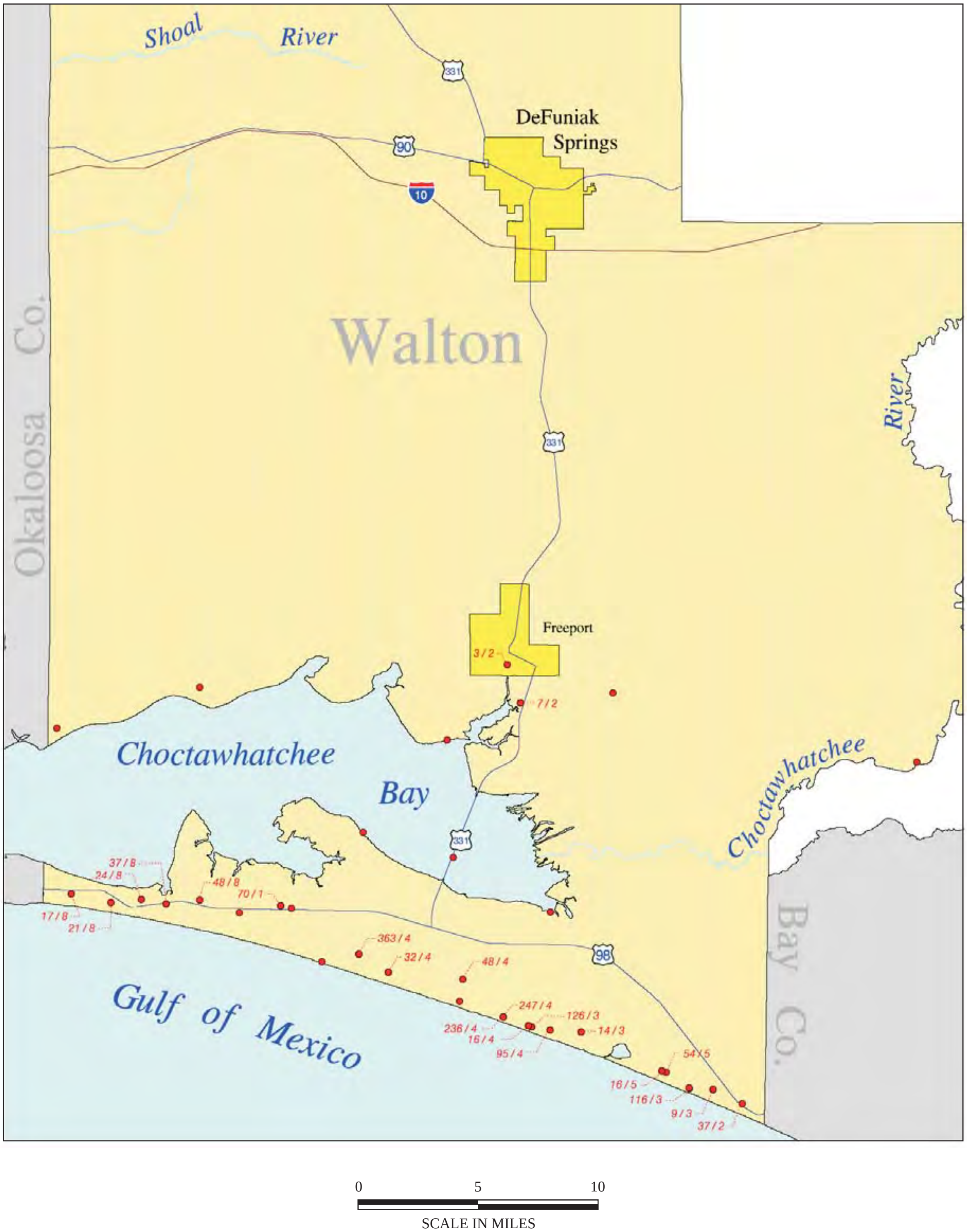
Filename: X:\NWF006\001-04\ Okaloosa_Mean_Chloride.cdr
Project: NWF006-001-04
Revised: 05/11/07 TH

Legend

- Mean Chloride Concentration in mg/L / Number of Samples
- Wells Open to Lower Floridan Aquifer
- Major City
- U. S. Highway
- Interstate Highway

N

Figure 4.51a
Okaloosa County
Mean Chloride Concentration
in the Floridan Aquifer
(or the Upper Portion of the
Undifferentiated Floridan Aquifer)
1998 - 2000



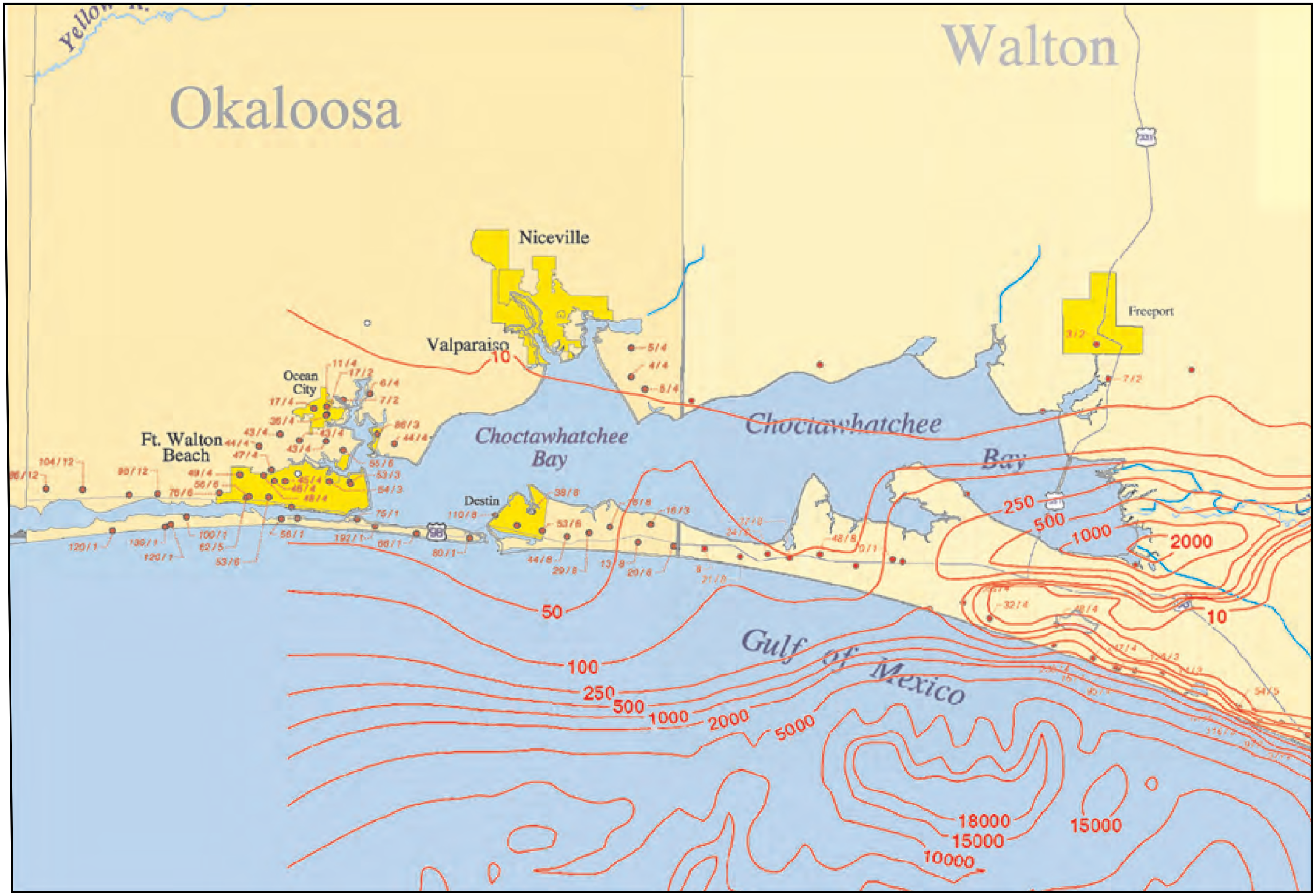
Filename: X:\NWF006\001-04
\Walton_Mean_Chloride.cdr
Project: NWF006-001-04
Revised: 05/11/07 TH
Source: NWFWMD

Legend

- ● Mean Chloride Concentration in mg/L / Number of Samples
- ○ Wells Open to Lower Floridan Aquifer
- Major City
- U. S. Highway
- Interstate Highway

N

Figure 4.51b
Walton County
Mean Chloride Concentration
in the Floridan Aquifer
(or the Upper Portion of the
Undifferentiated Floridan Aquifer)
1998 - 2000



Filename: X:\NWF006\001-04\Contours_1998-2000.cdr
Project: NWF006-001-04
Revised: 05/11/07 CF
Source: HydroGeoLogic, Inc.

Legend

- Mean Chloride Concentration in mg/L /Number of Samples
- Wells Open to Lower Floridan Aquifer
- 50 — Chloride Concentration (mg/L)
- Major City
- U. S. Highway
- Interstate Highway

N

Figure 4.51c
Simulated Concentration Contours vs. Mean Chloride Concentrations in the Upper Floridan Aquifer (or the Upper Portion of the Undifferentiated Floridan Aquifer)
1998 – 2000

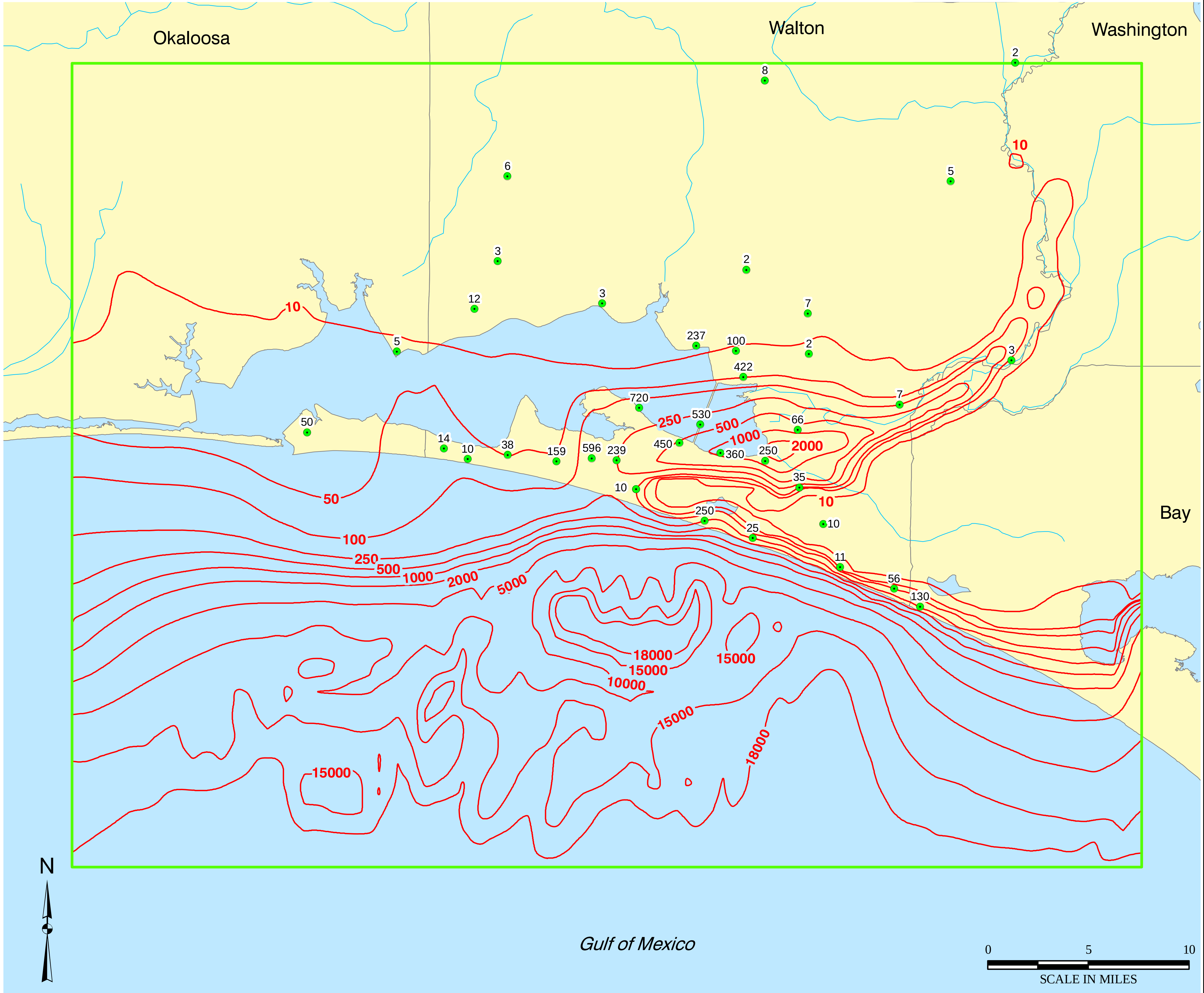


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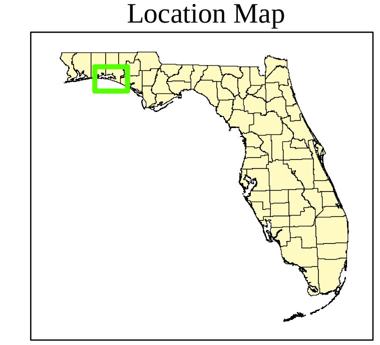
Figure 4.51d
Simulated Concentration Contours vs. Observed Chloride Concentrations in the Upper Floridan Aquifer (or the Upper Portion of the Undifferentiated Floridan Aquifer)
1951 – 2003

Northwest Florida Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- 50 Chloride Concentration (mg/L)
- Observed Chloride Concentration (mg/L)

Location Map



Filename: X:/NWF006/001-04/Sim_conc_vs_observed_Chl.mxd
Project: NWF006-001-04
Revised: 05/11/07 TH
Map Source: HydroGeoLogic GIS Database 2002

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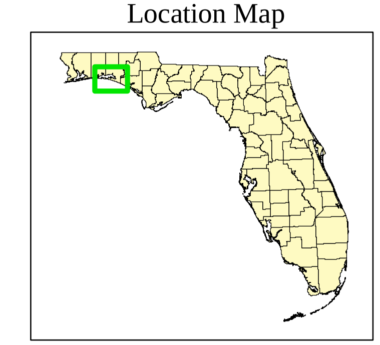
Figure 4.51e
Chloride Concentration
Profile Location Map

Northwest Florida
Water Management District

Legend

- County Boundary
- Hydrology
- Model Boundary
- Chloride Concentration Profile Location

Location Map



Filename: X:/NWF006/001-04/
Chlor_Conc_Prof_Loc.mxd
Project: NWF006-001-04
Revised: 05/10/07 TH
Map Source: HydroGeoLogic GIS
Database 2006

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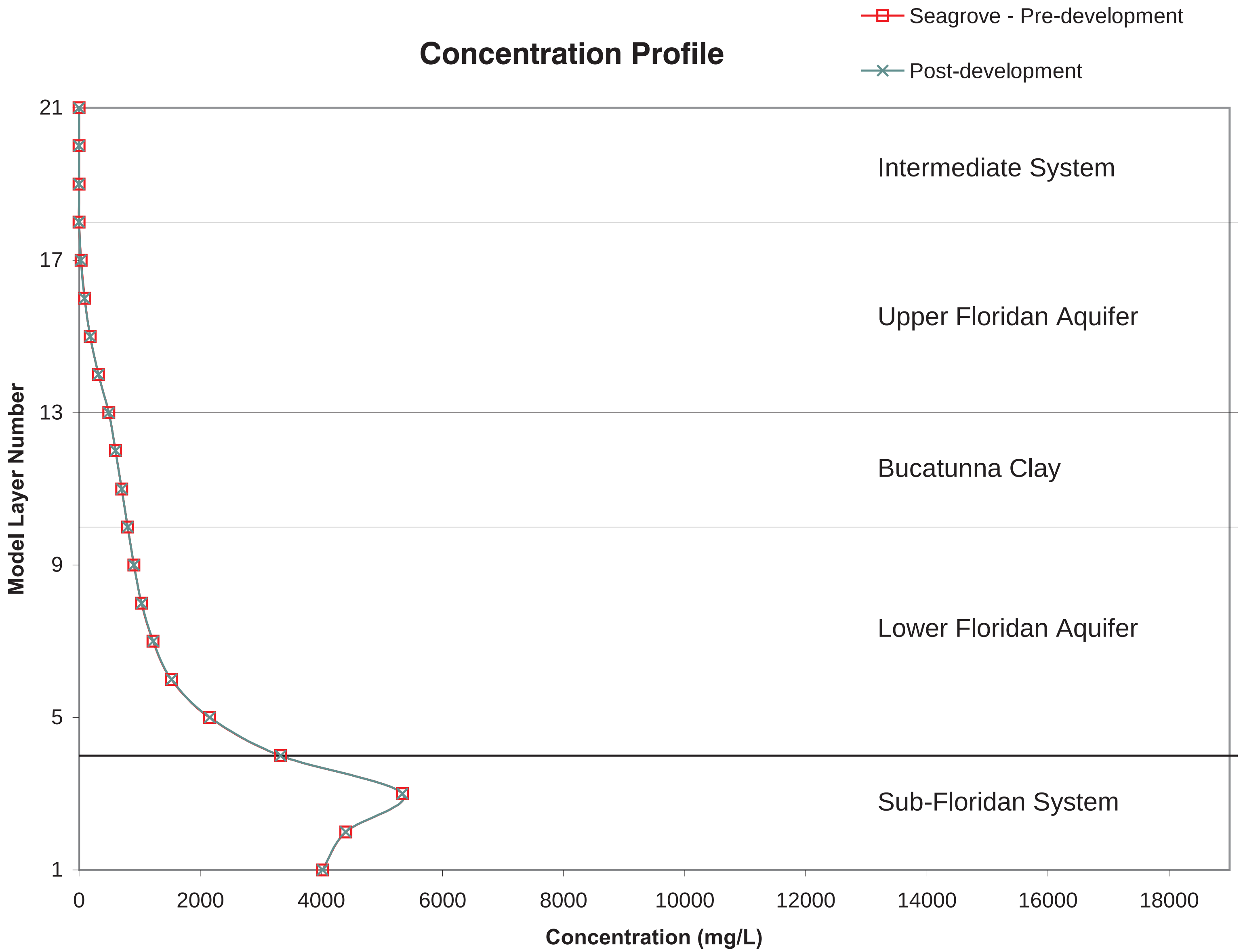
HydroGeoLogic, Inc



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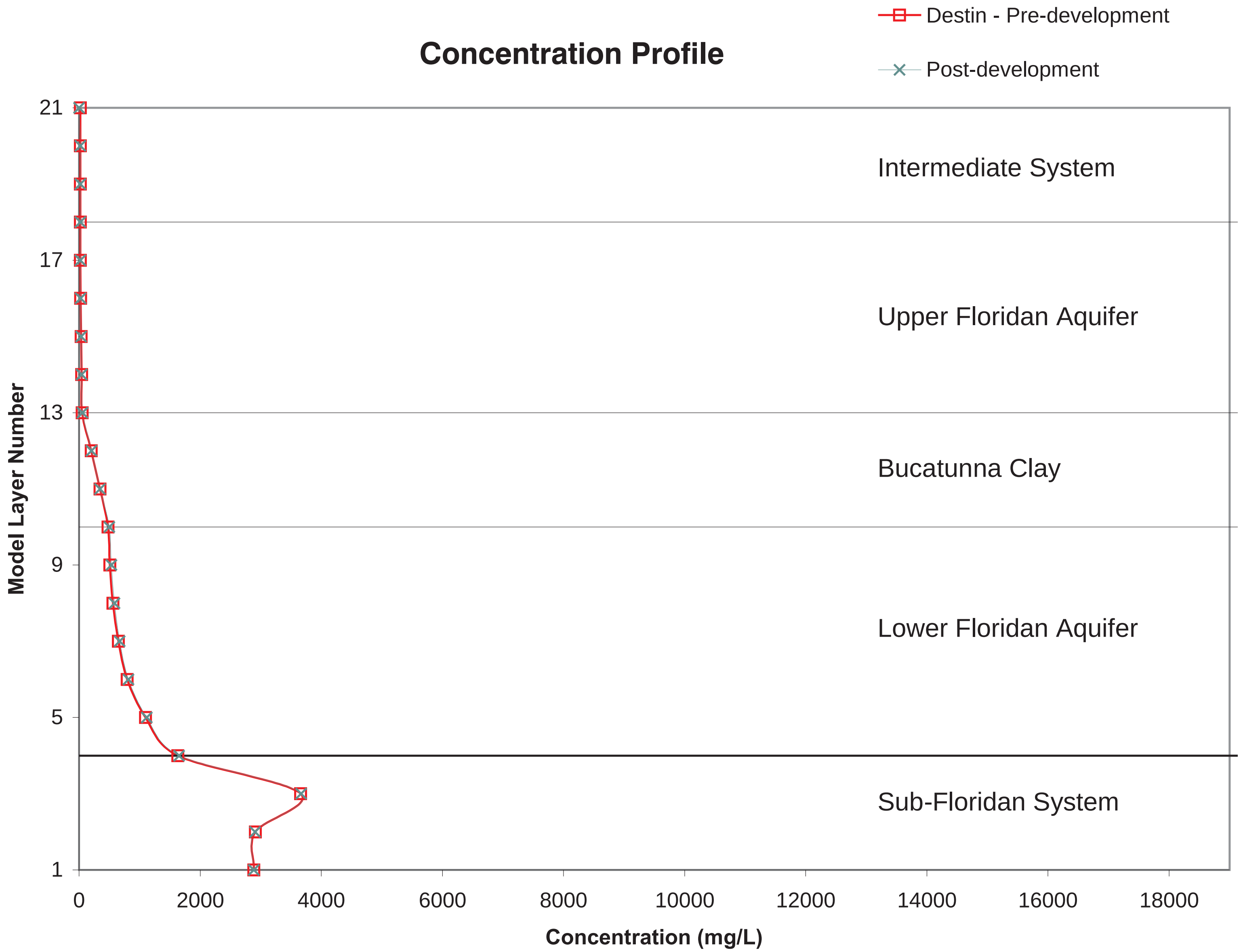
Filename: X:\NWF006\001-04\(4-52_4-57)
Conc_Profile_Sims.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.52
Concentration Profiles at Seagrove
for Pre-Development and 2004 Simulations



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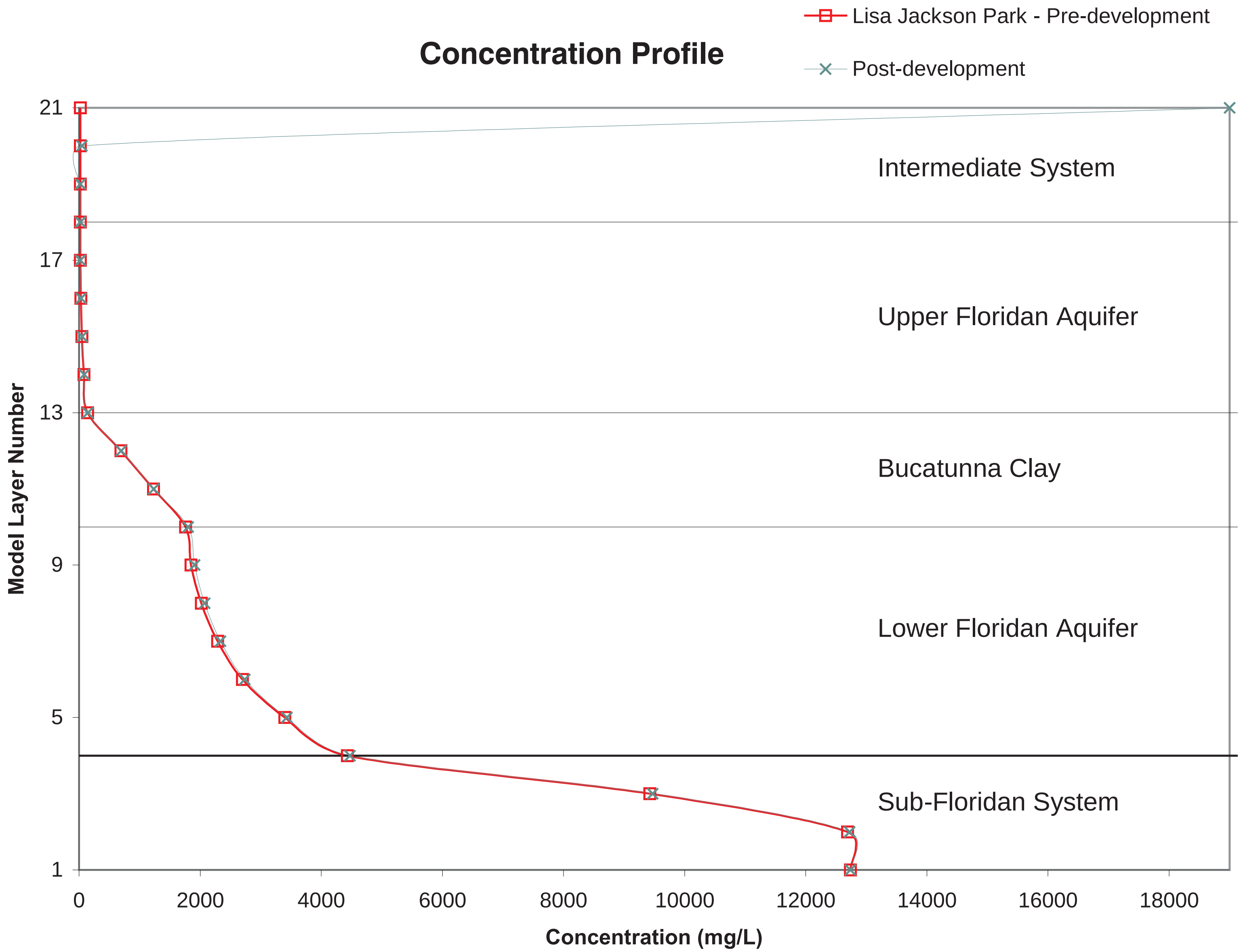
Conc_Profile_Sims.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.53
Concentration Profiles at Destin
for Pre-Development and 2004 Simulations



HGL—Northwest Florida Water Management District

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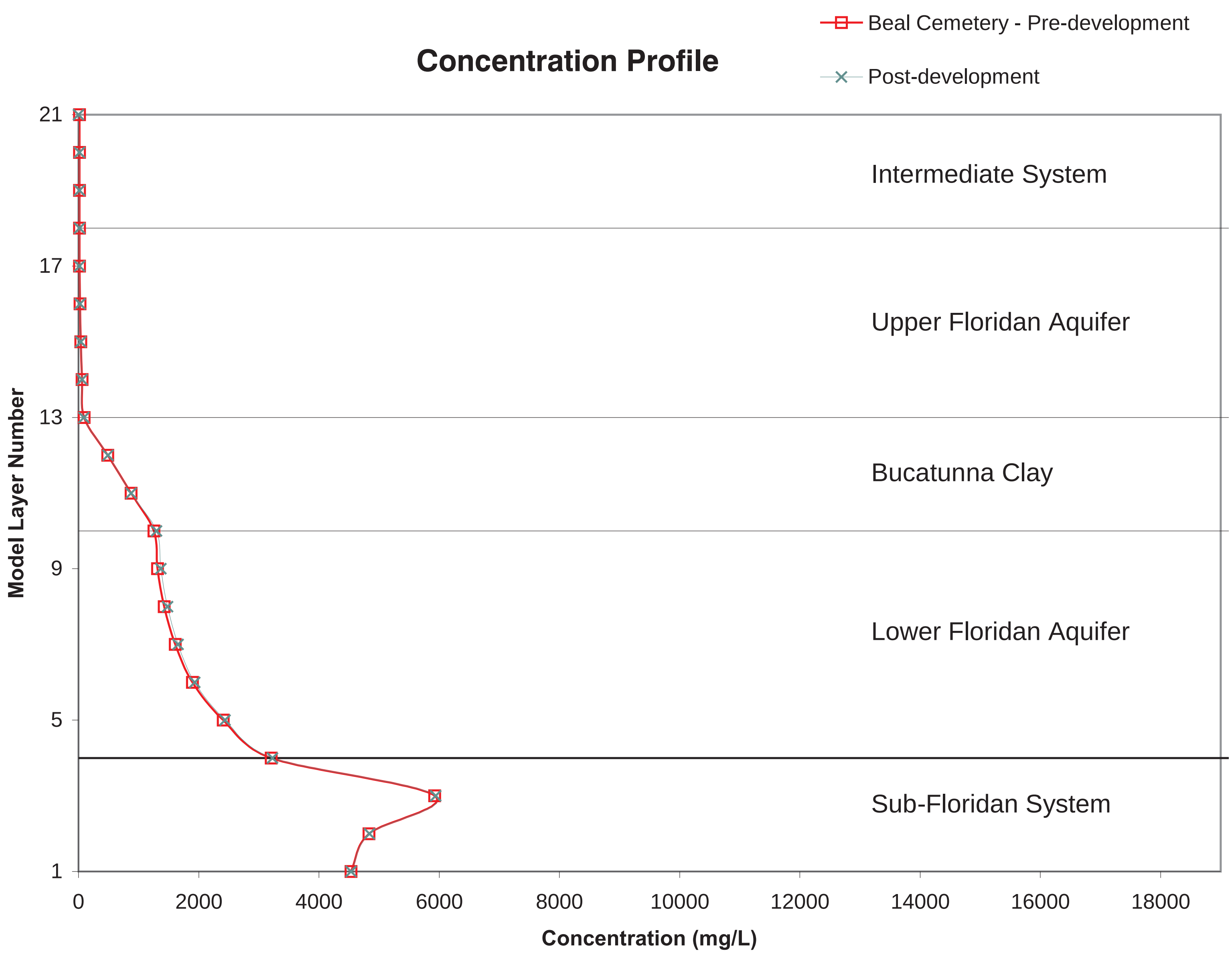
Conc_Profile_Sims.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.54
Concentration Profiles at Lisa Jackson Park for Pre-Development and 2004 Simulations



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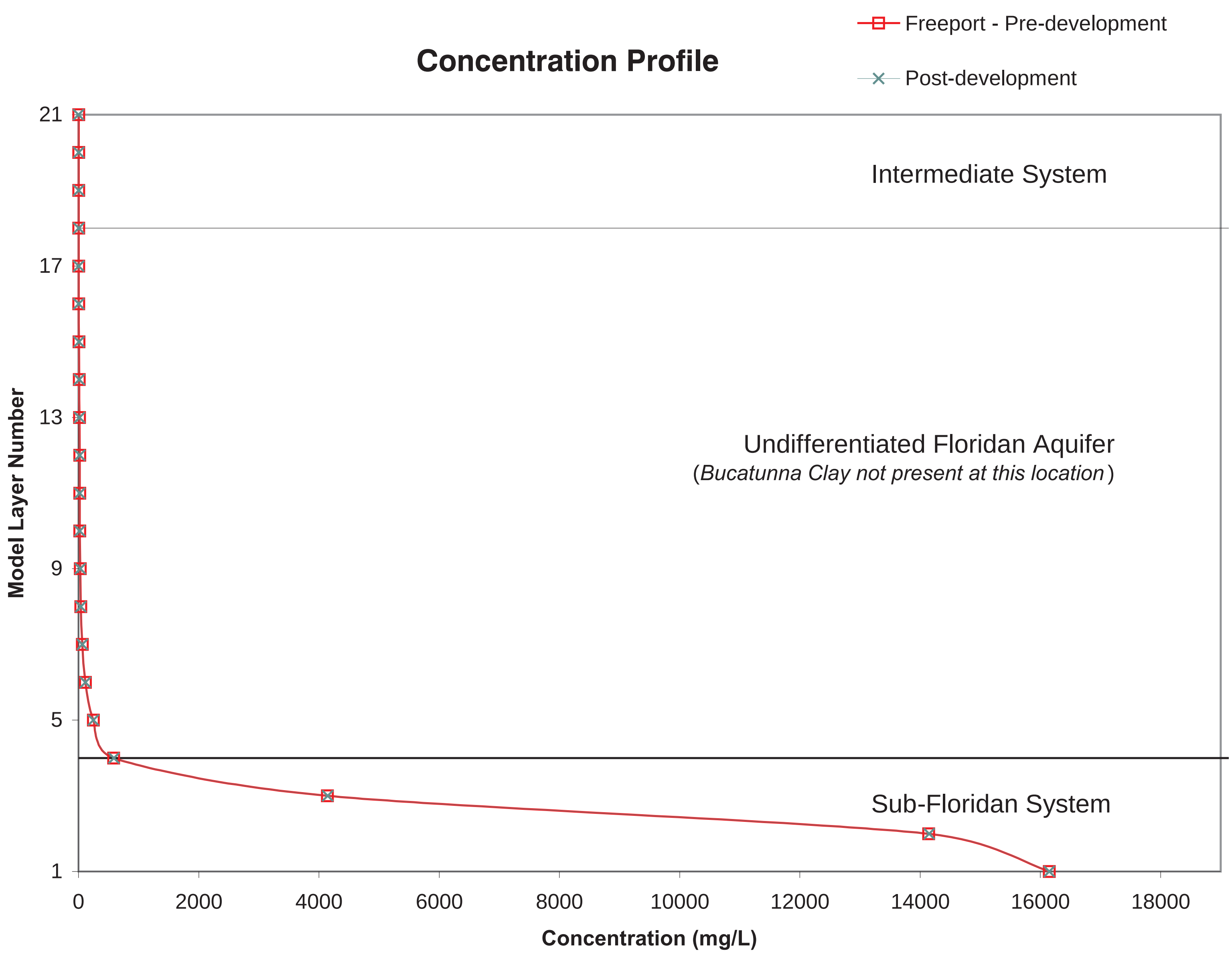
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

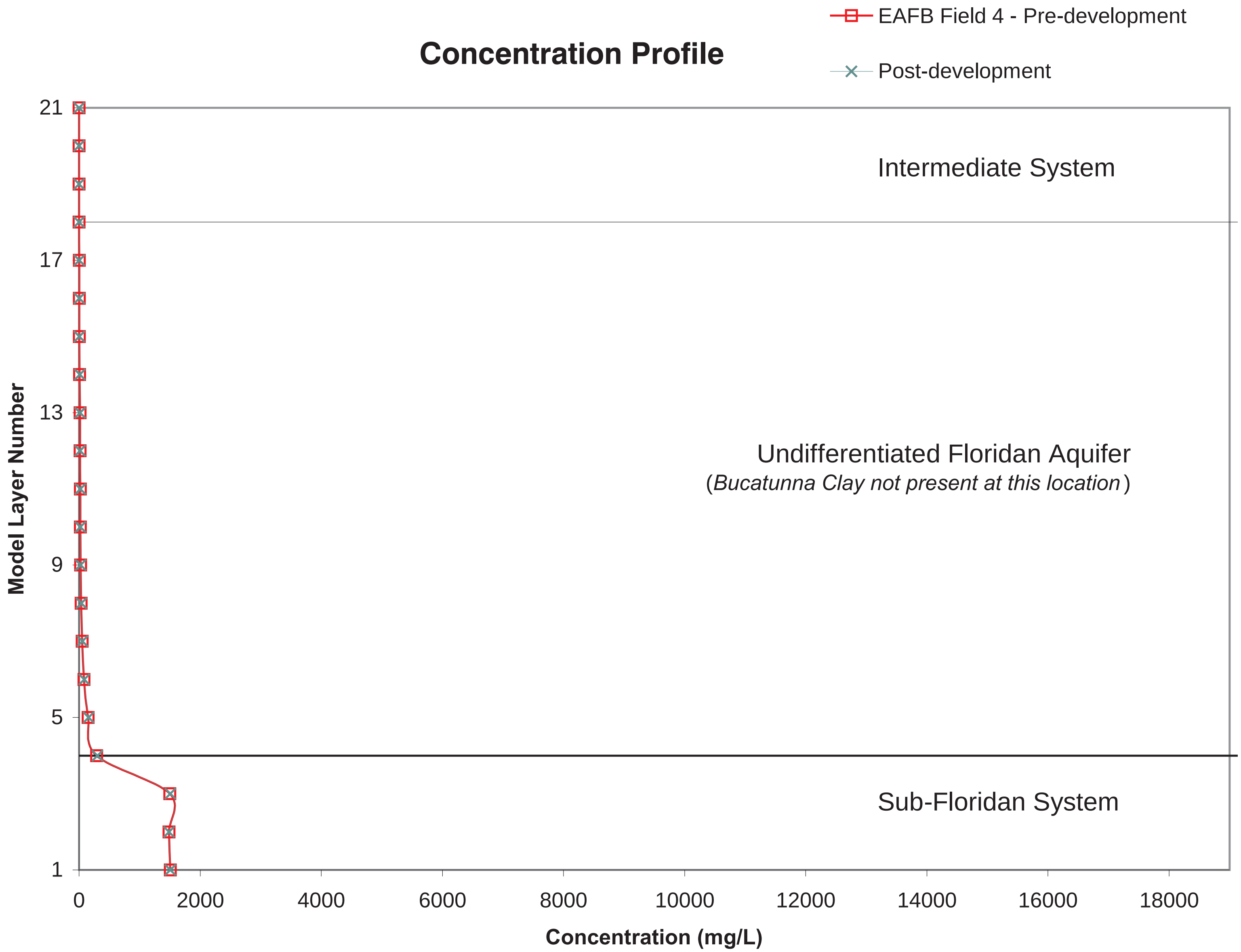
Figure 4.55
Concentration Profiles at Beal Cemetery for Pre-Development and 2004 Simulations



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\(4-52_4-57)
Conc_Profile_Sims.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

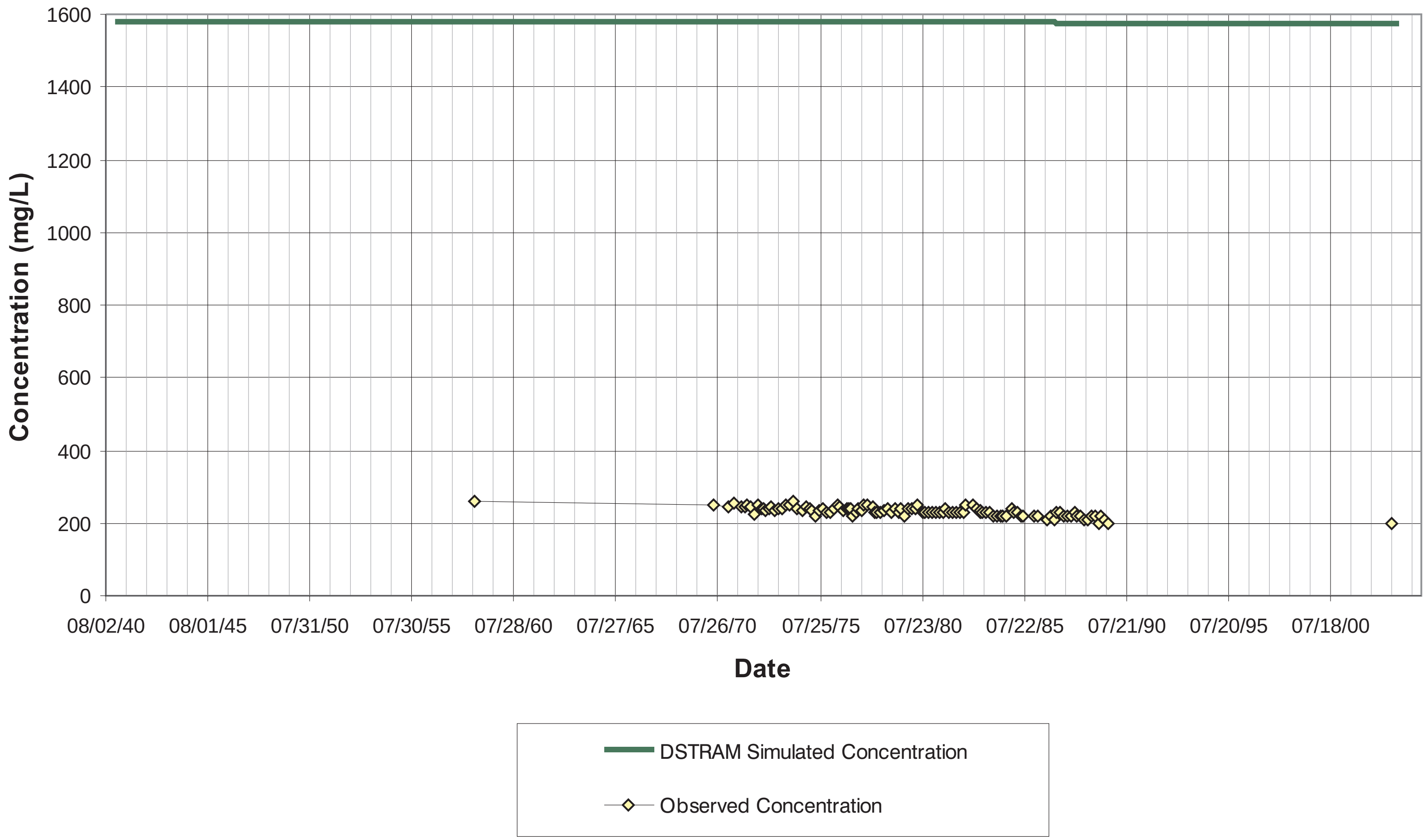
Figure 4.56
Concentration Profiles at Freeport
for Pre-Development and 2004 Simulations



HGL—Northwest Florida Water Management District

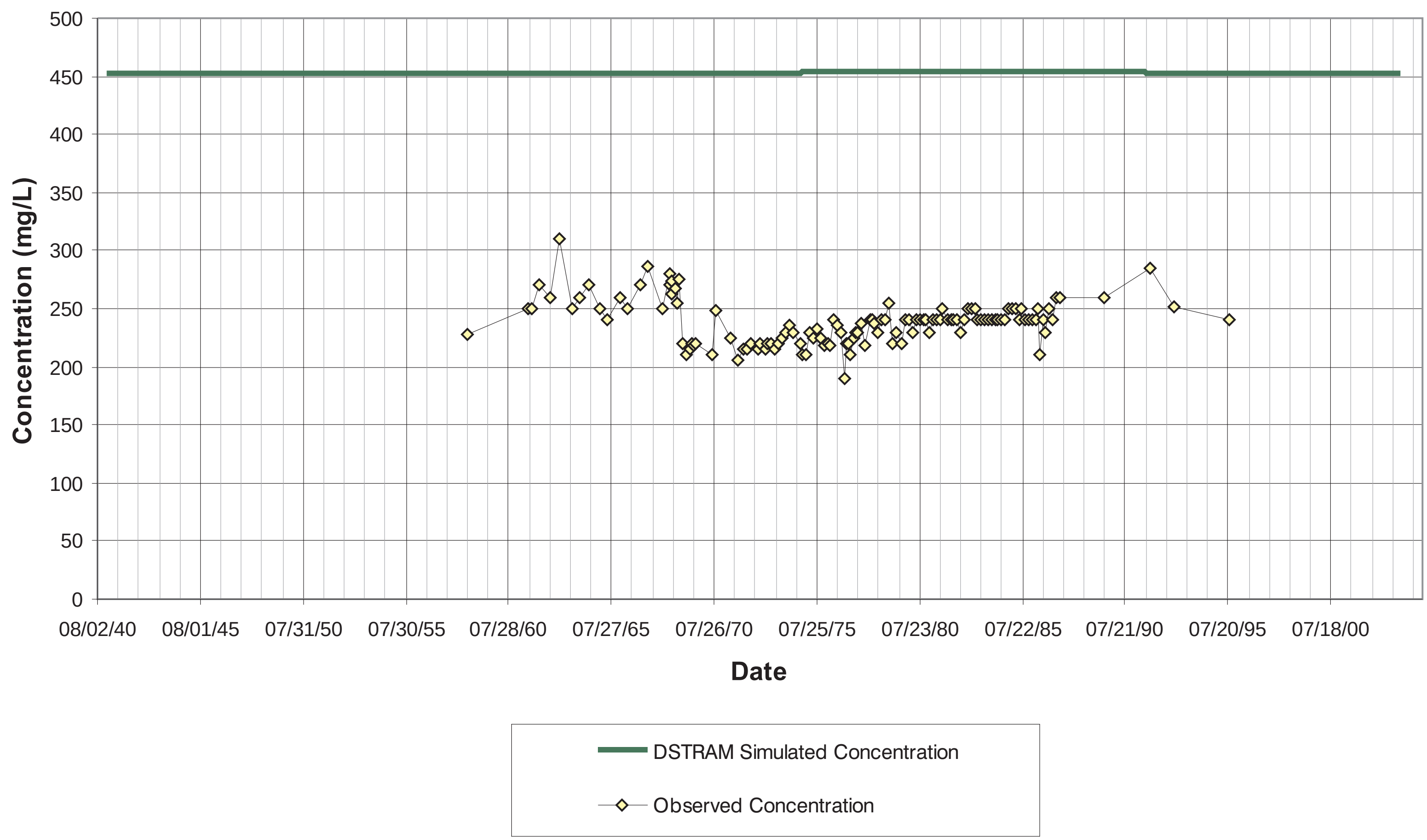
Filename: X:\NWF006\001-04\(4-52_4-57)
Conc_Profile_Sims.cdr
Project: NWF006-001-04
Revised: ganthony 12/19/06
Source: HydroGeoLogic, Inc.

Figure 4.57
Concentration Profiles at EAFB Field 4
for Pre-Development and 2004 Simulations



Filename: X:\NWF006\001-04
\Concentrations.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

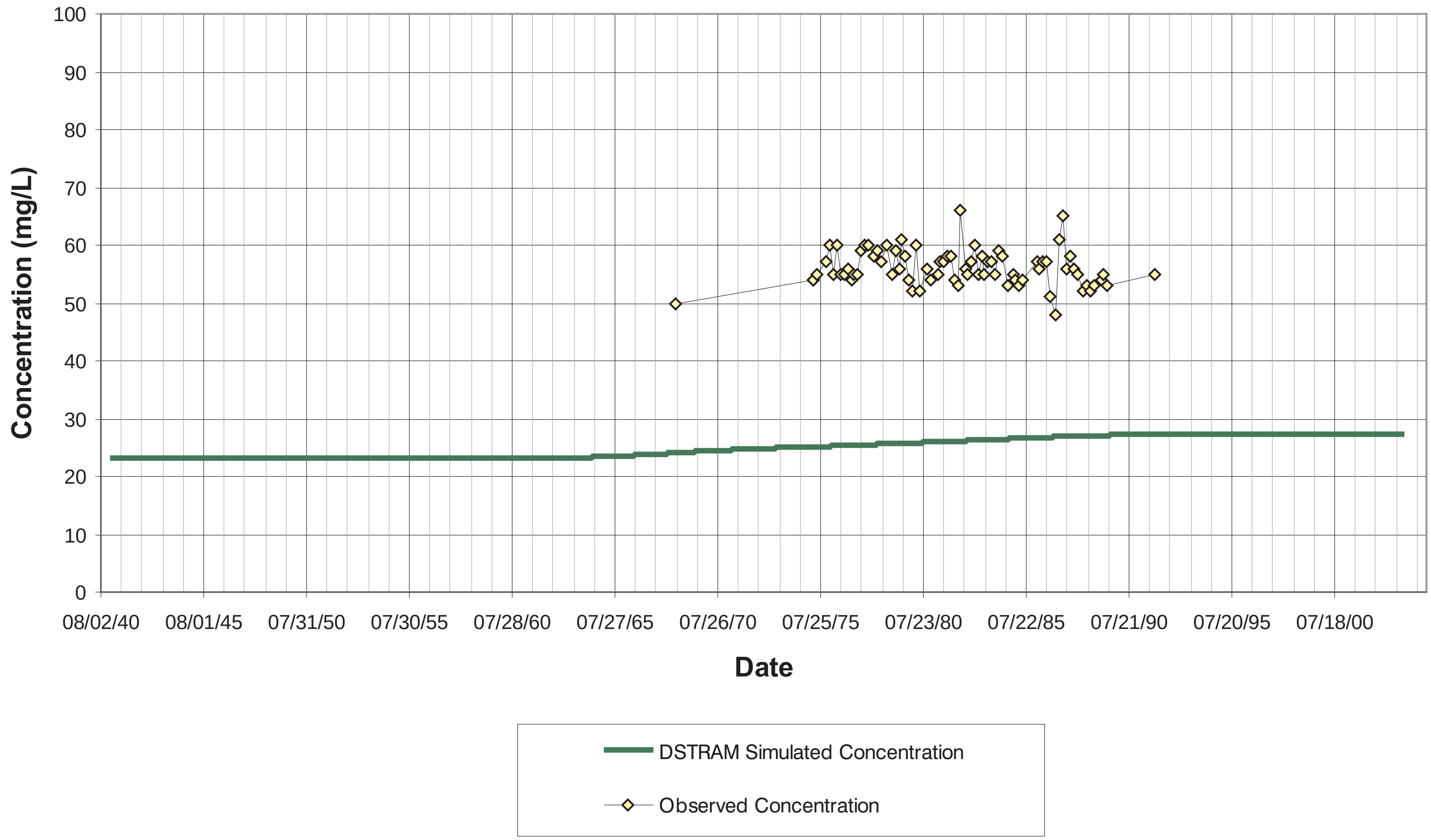
Figure 4.58
Point Washington/McGee NWF ID 1371
Concentration



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04
\Concentrations.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.59
Van Butler/USGS Walton #21 NWF ID 1074
Concentration



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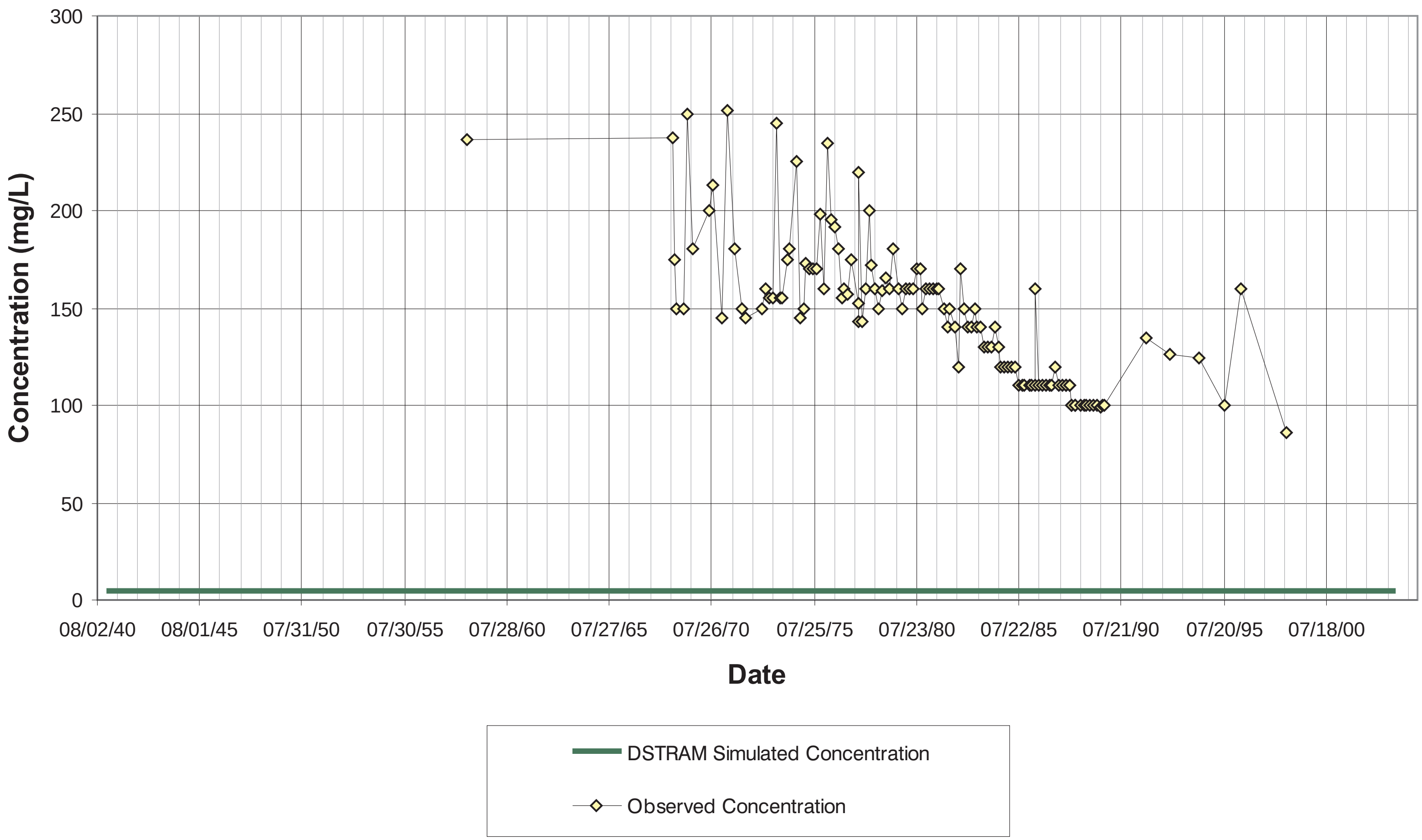
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.60
DWU #1 NWF ID 1687
Concentration



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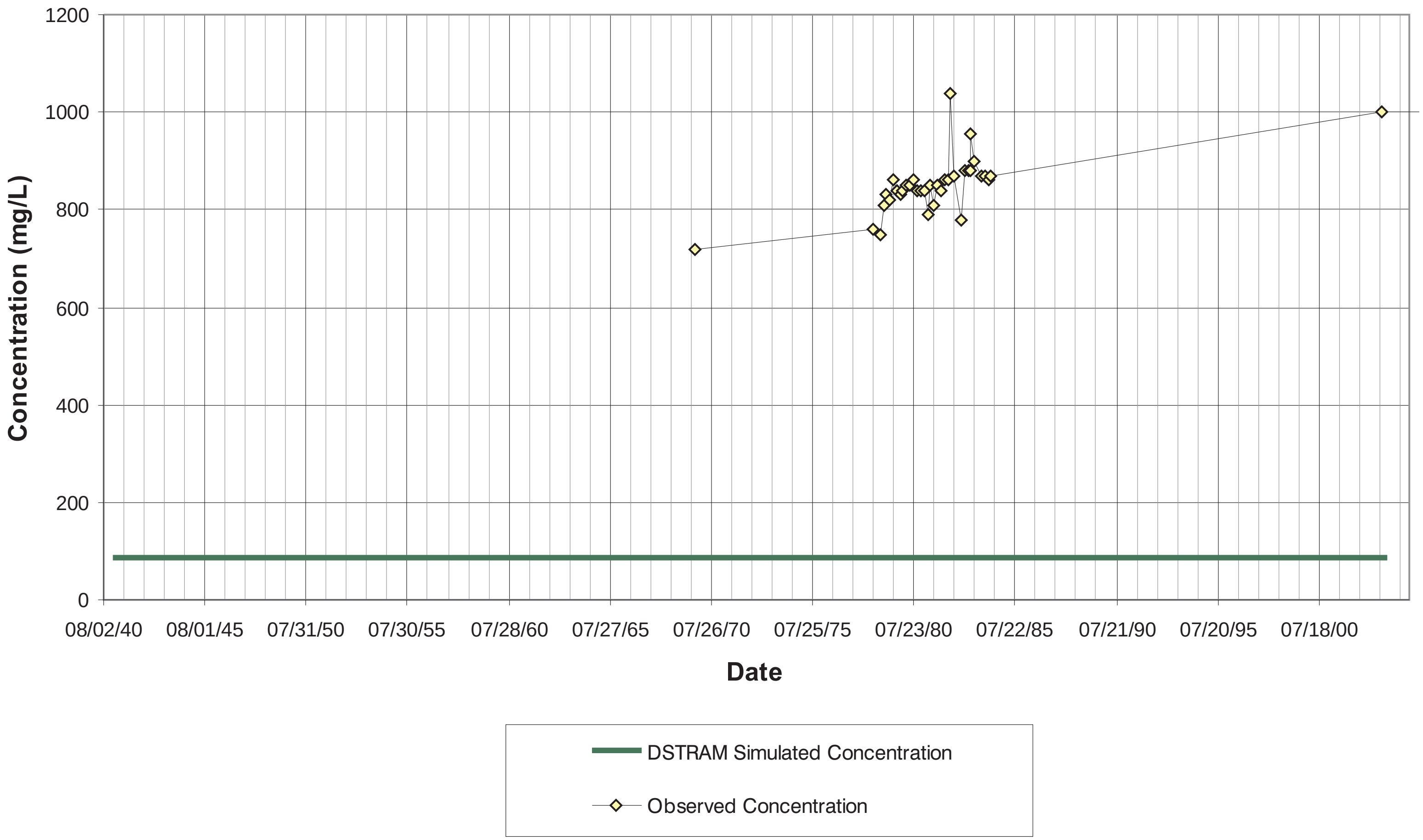
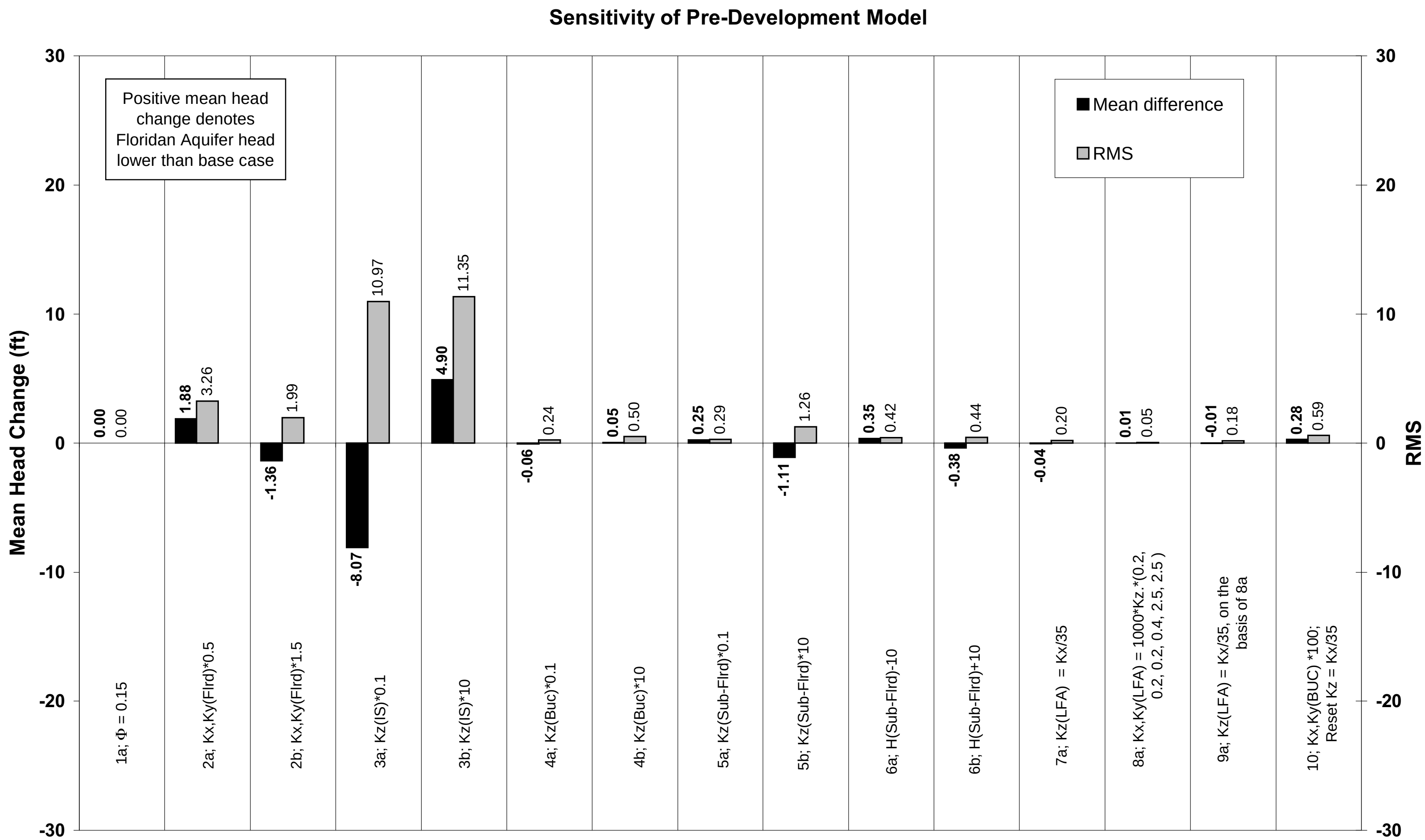
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.61
Selma Madara/USGS Walton #9 NWF ID 2738
Concentration



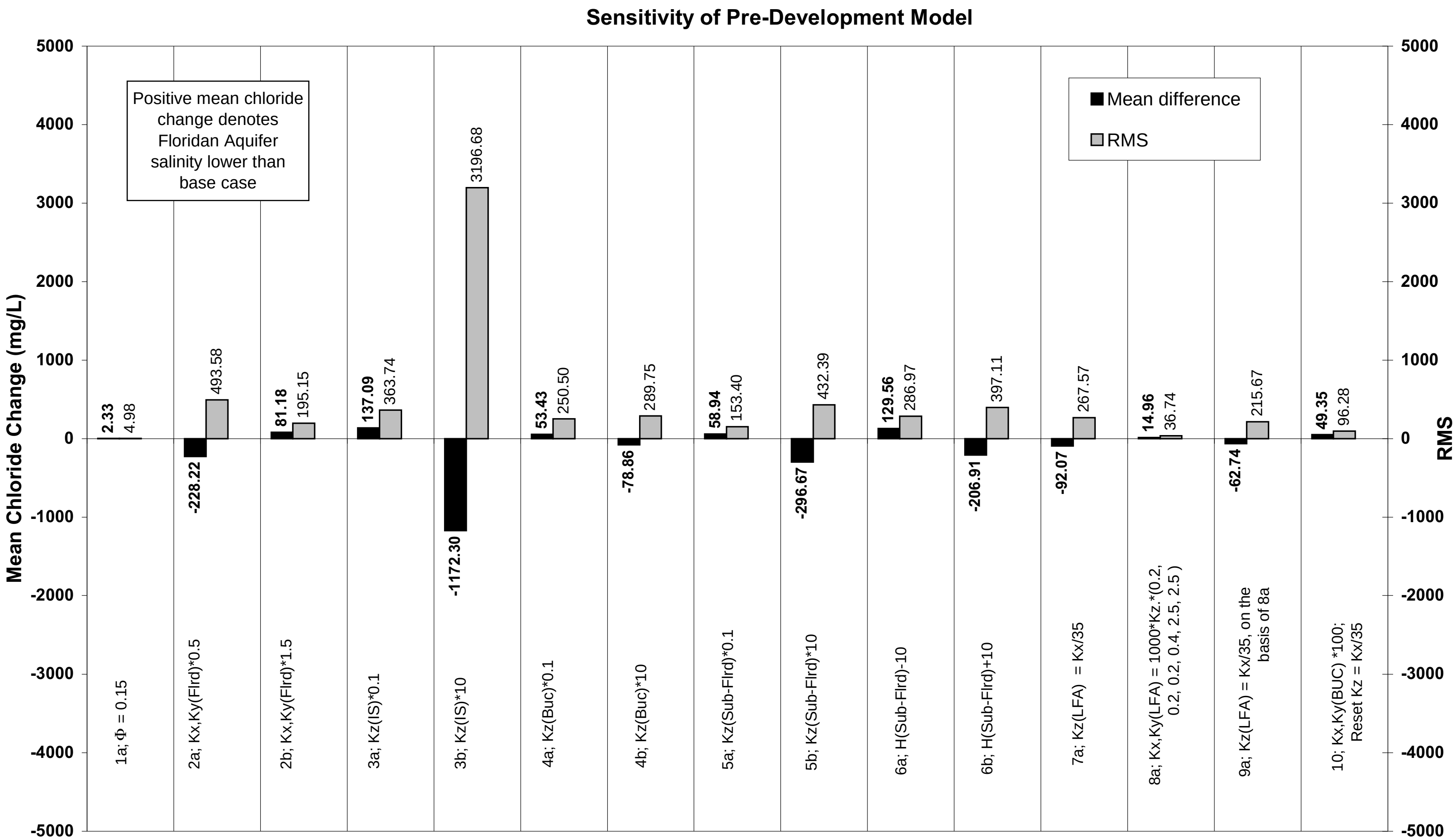
Filename: X:\NWF006\001-04
\Concentrations.cdr
Project: NWF006-001-04
Revised: 03/22/07 CF
Source: HydroGeoLogic, Inc.

Figure 4.62
S. Matthews NWF ID 2034
Concentration



Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.1
RMS and Mean Head Change from Pre-Development Base Case (Upper and Lower Floridan Aquifers Combined)



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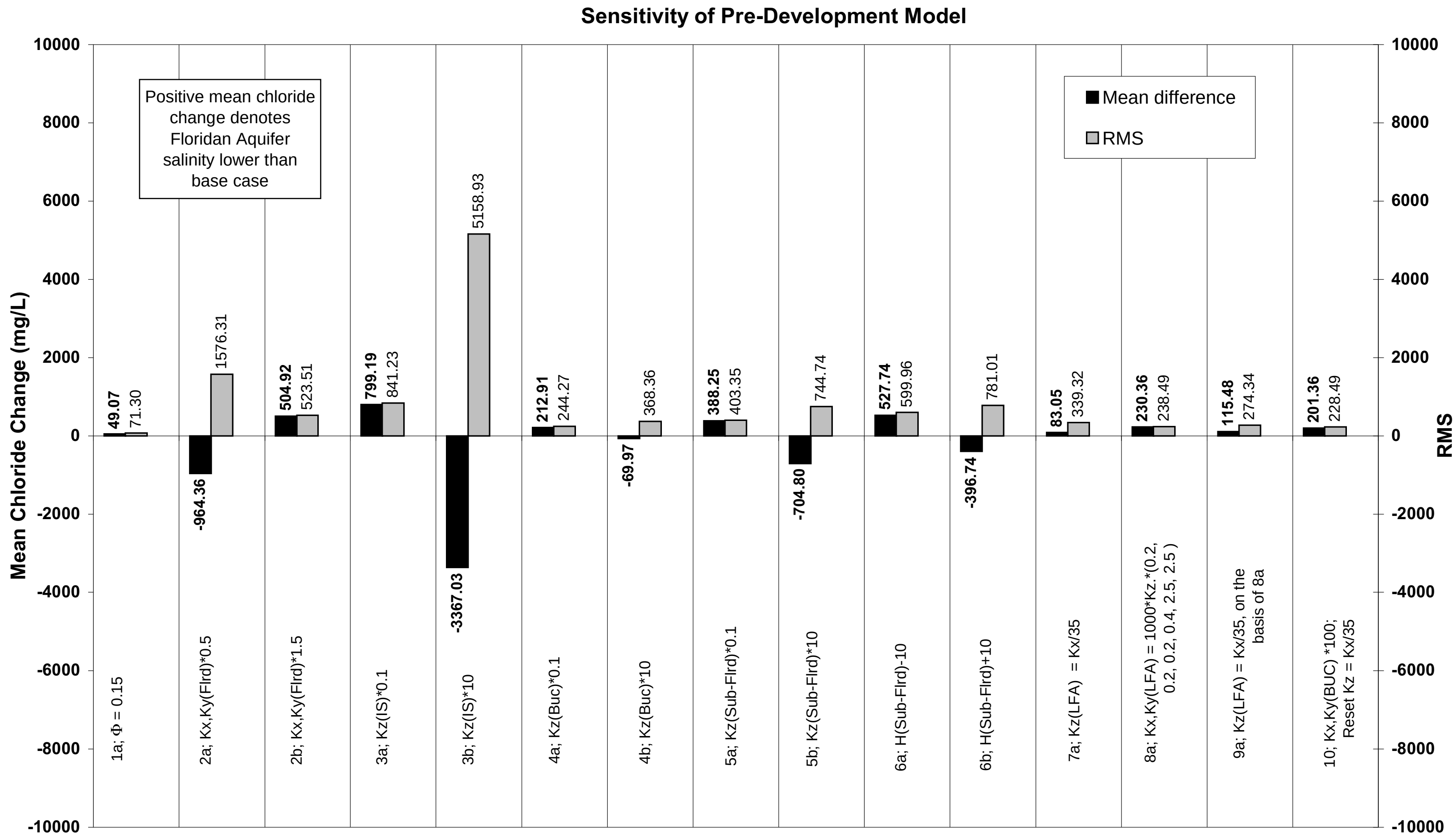
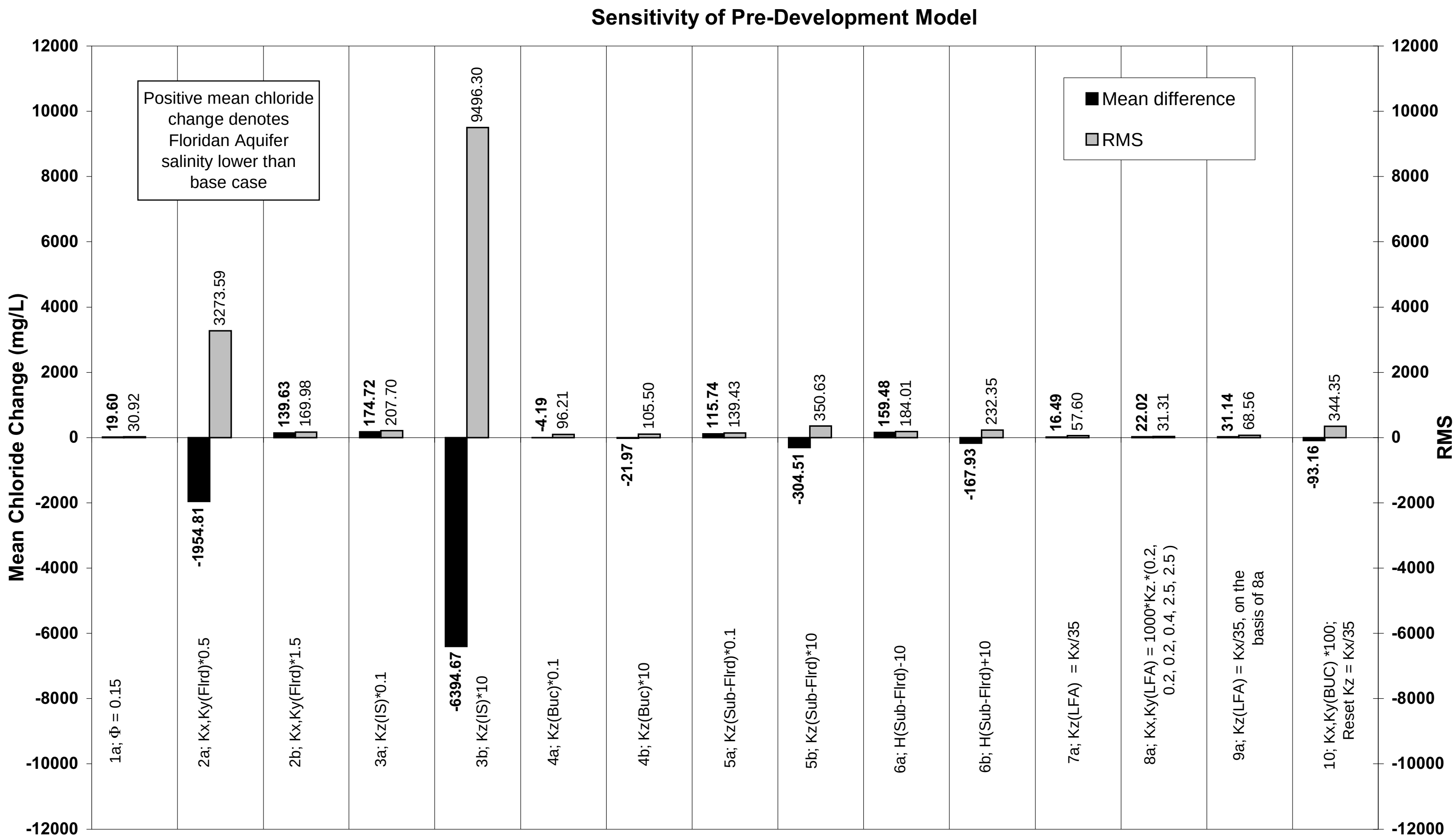
Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.2
RMS and Mean Chloride Change from Pre-Development Base Case (Upper Floridan Aquifer Only)



Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.3
RMS and Mean Chloride Change from Pre-Development Base Case (Lower Floridan Aquifer Only)



Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Northwest Florida Water Management District N·W·F·W·M·D

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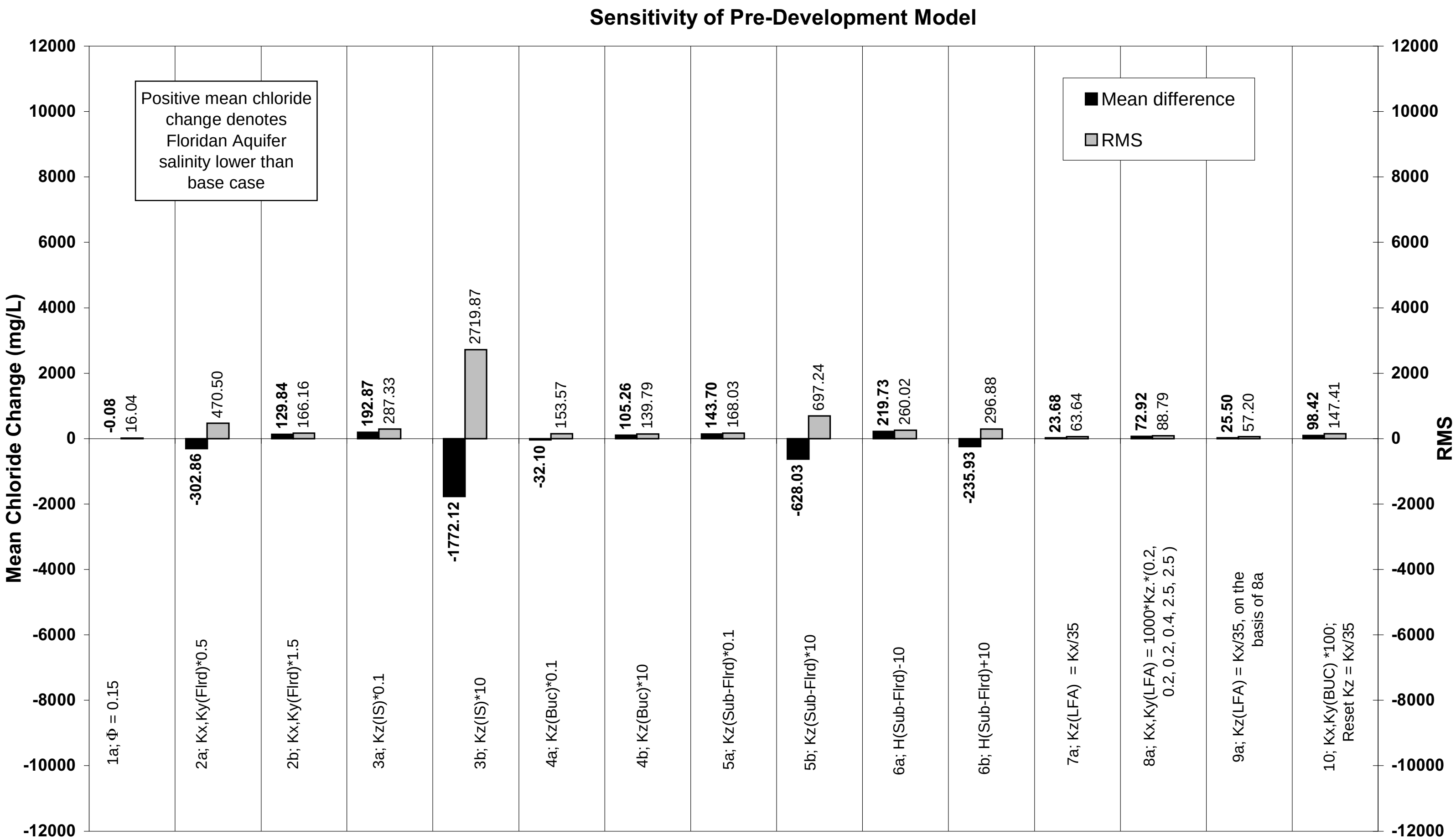
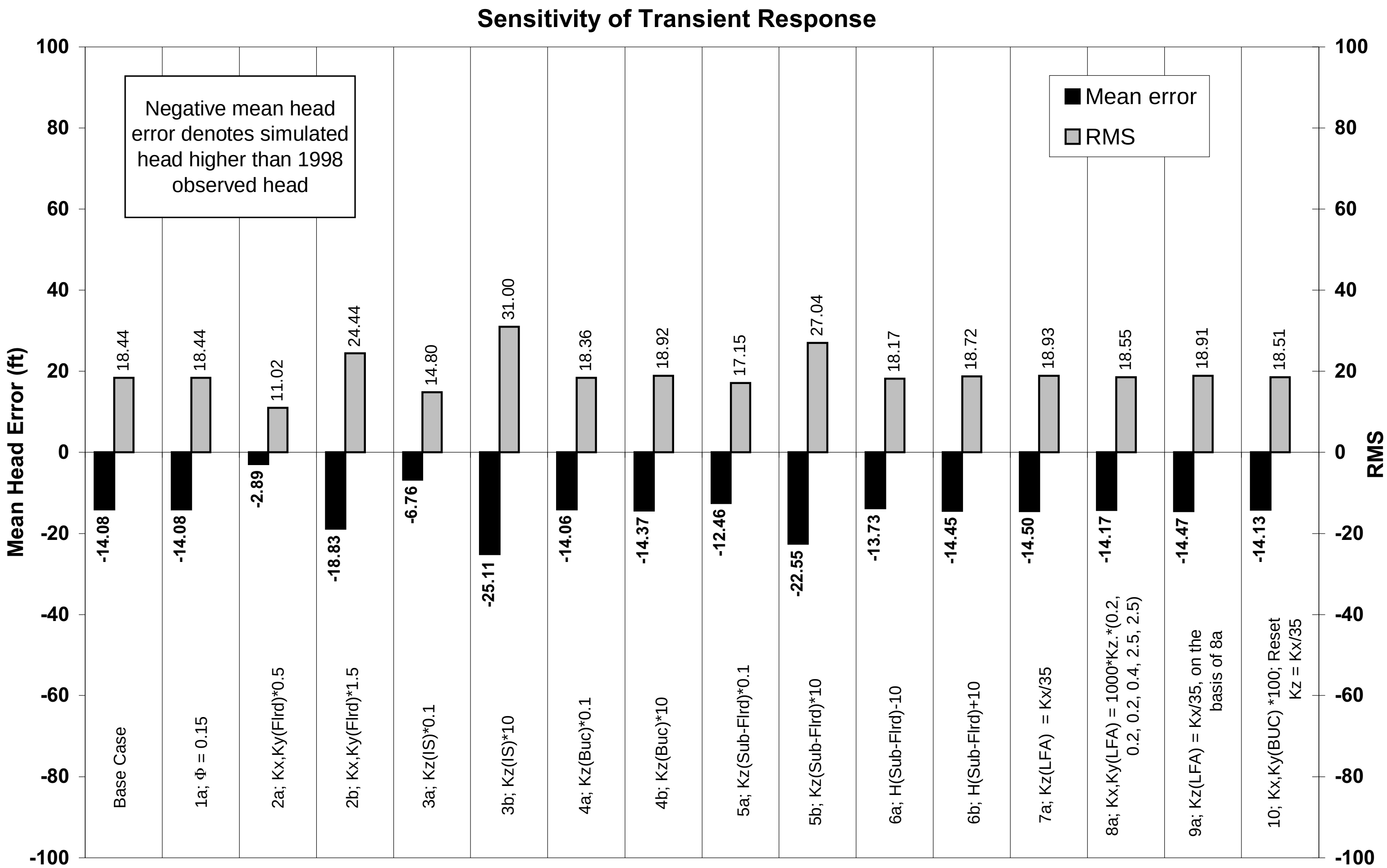
Figure 5.4
RMS and Mean Chloride Change from Pre-Development Base Case (Upper Floridan Aquifer, Up-Gradient Interface Node Set)



Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

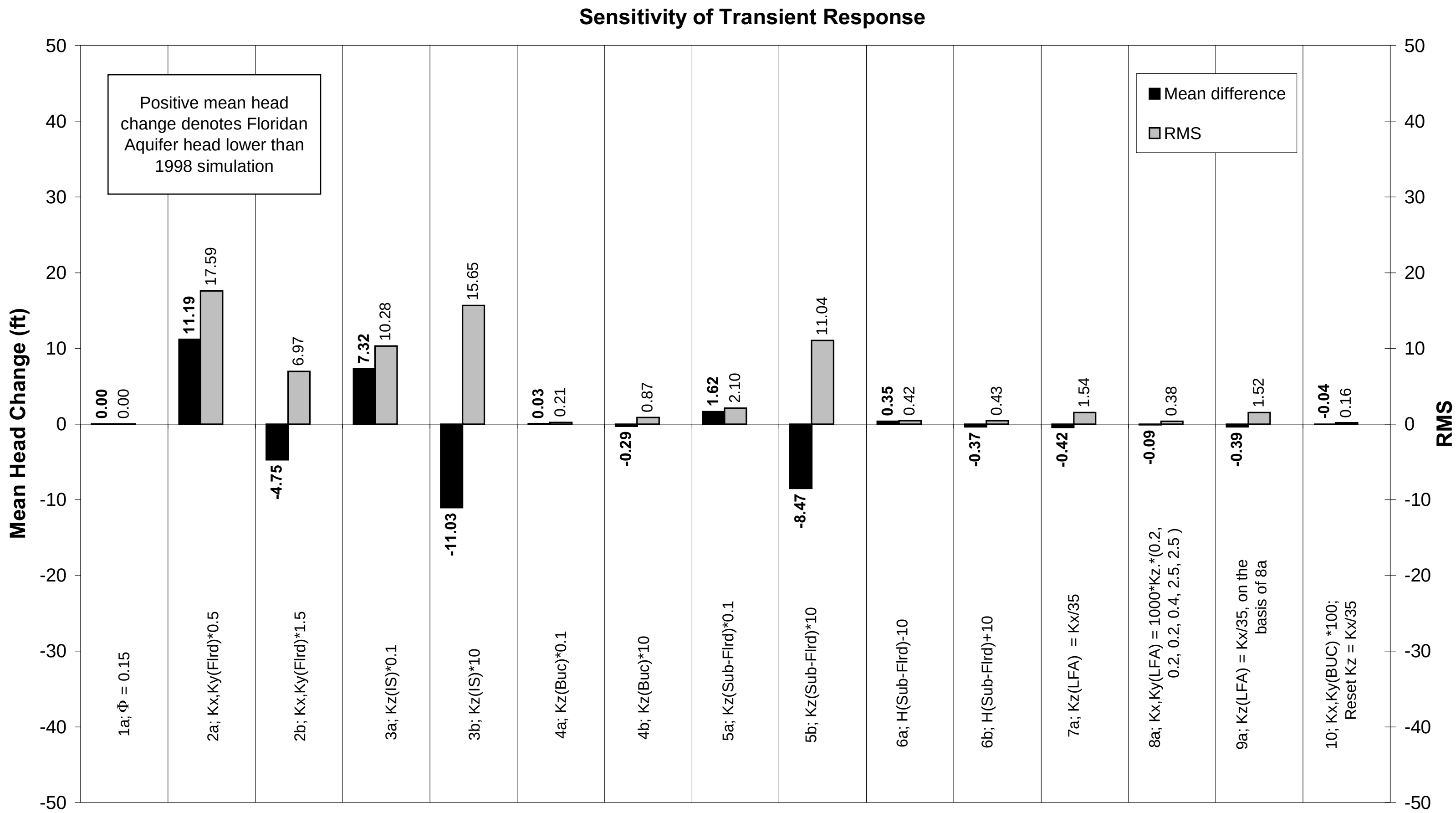
Figure 5.5
RMS and Mean Chloride Change from Pre-Development Base Case (Lower Floridan Aquifer, Up-Gradient Interface Node Set)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

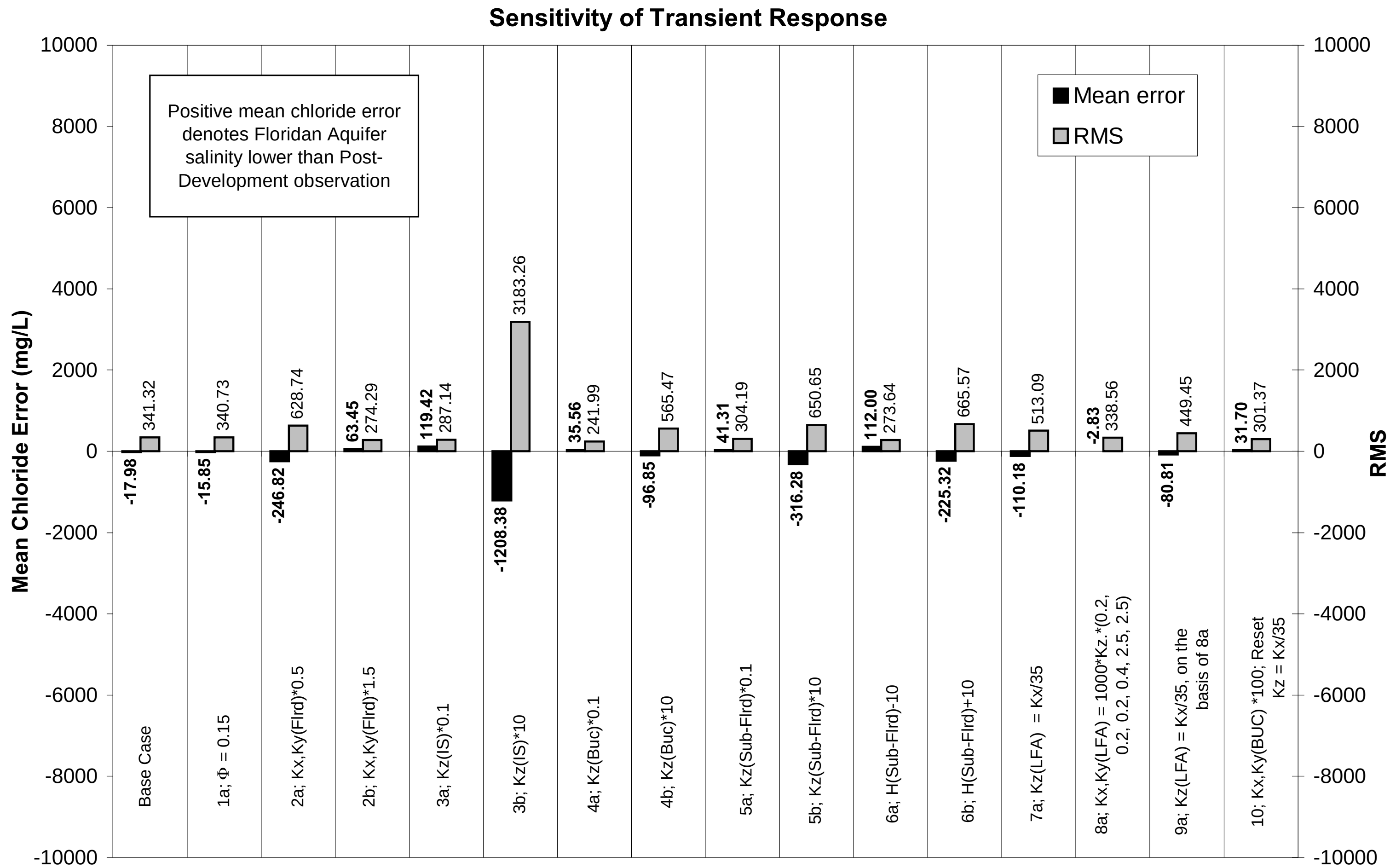
Figure 5.6
RMS and Mean Head Error
(Upper and Lower Floridan Aquifers Combined)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

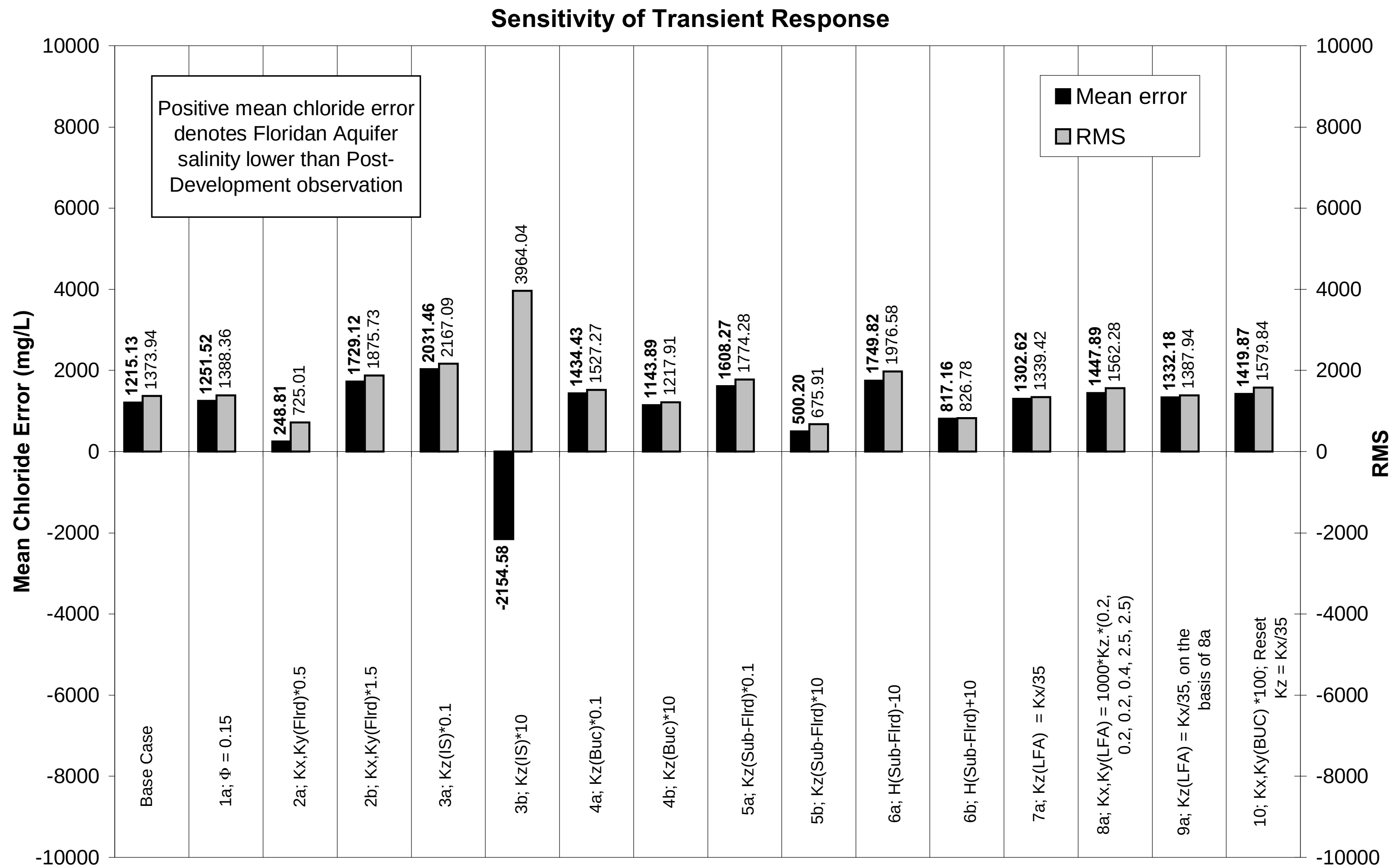
Figure 5.7
RMS and Mean Head Change from Post-Development Base Case (Upper and Lower Floridan Aquifers Combined)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

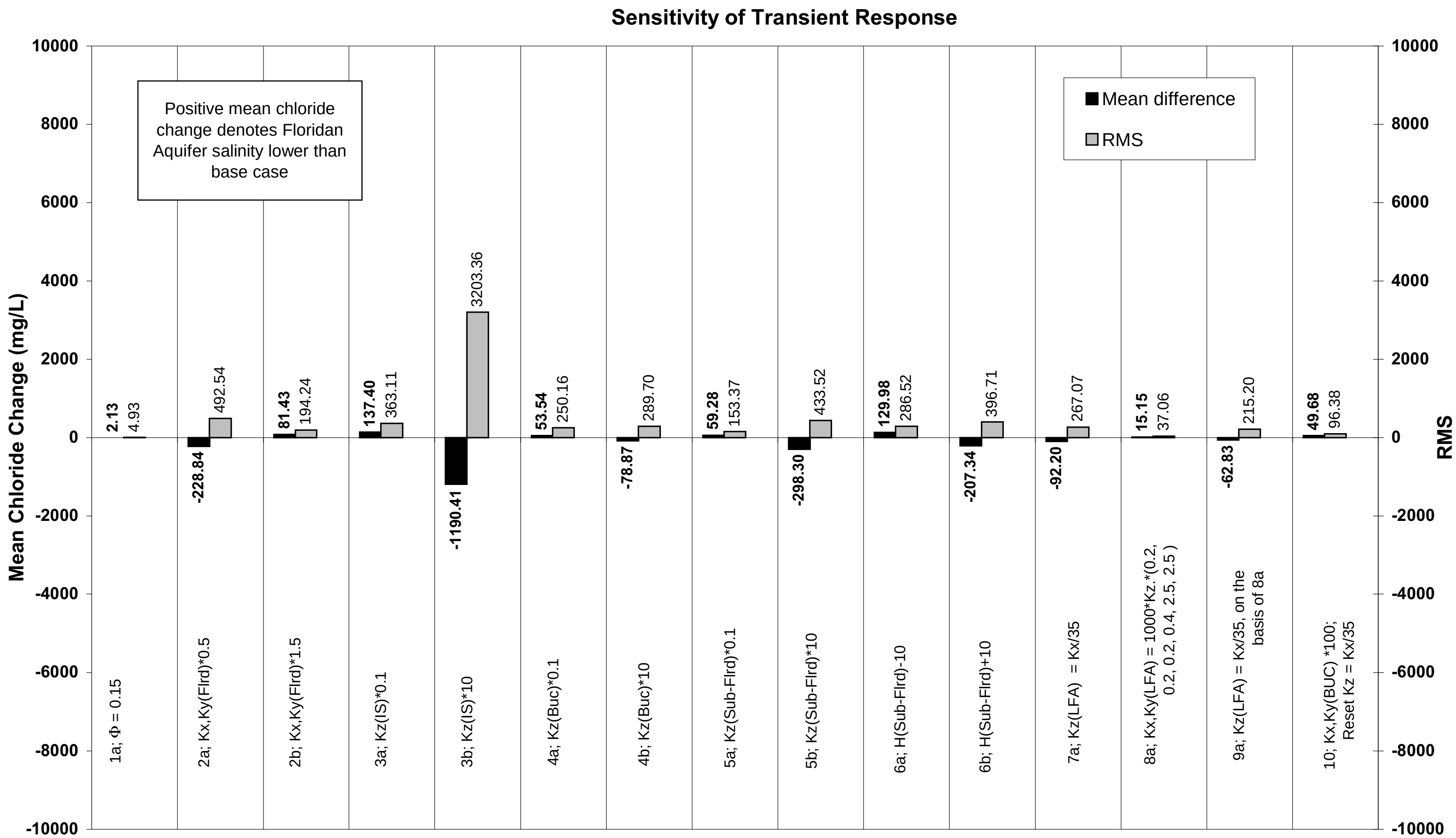
Figure 5.8
RMS and Mean Chloride Error
(Upper Floridan Aquifer Only)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.9
RMS and Mean Chloride Error
(Lower Floridan Aquifer Only)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

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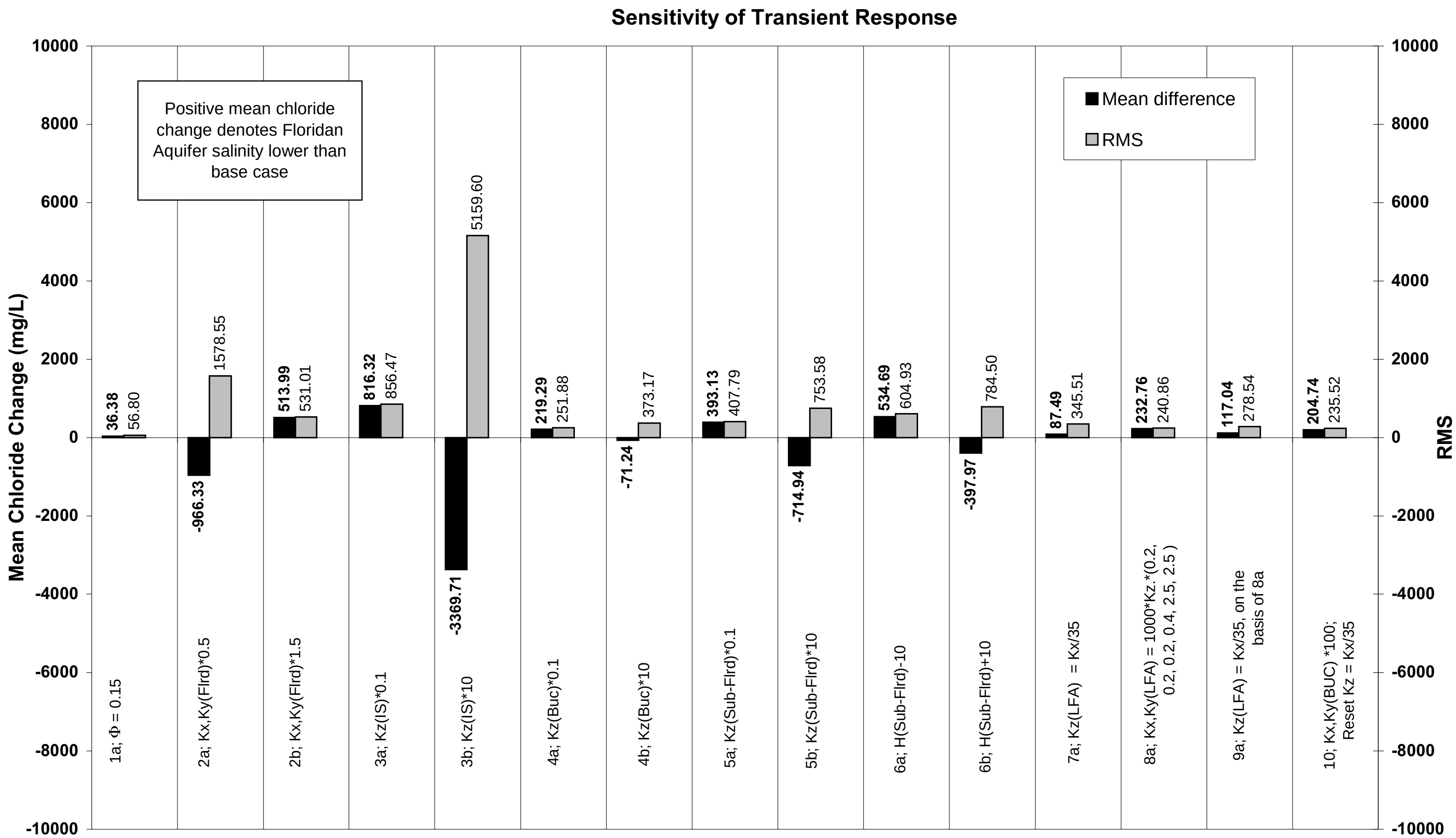
HGL HydroGeoLogic, Inc — Exceeding Expectations

Figure 5.10
RMS and Mean Chloride Change from Post-Development Base Case (Upper Floridan Aquifer Only)



Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

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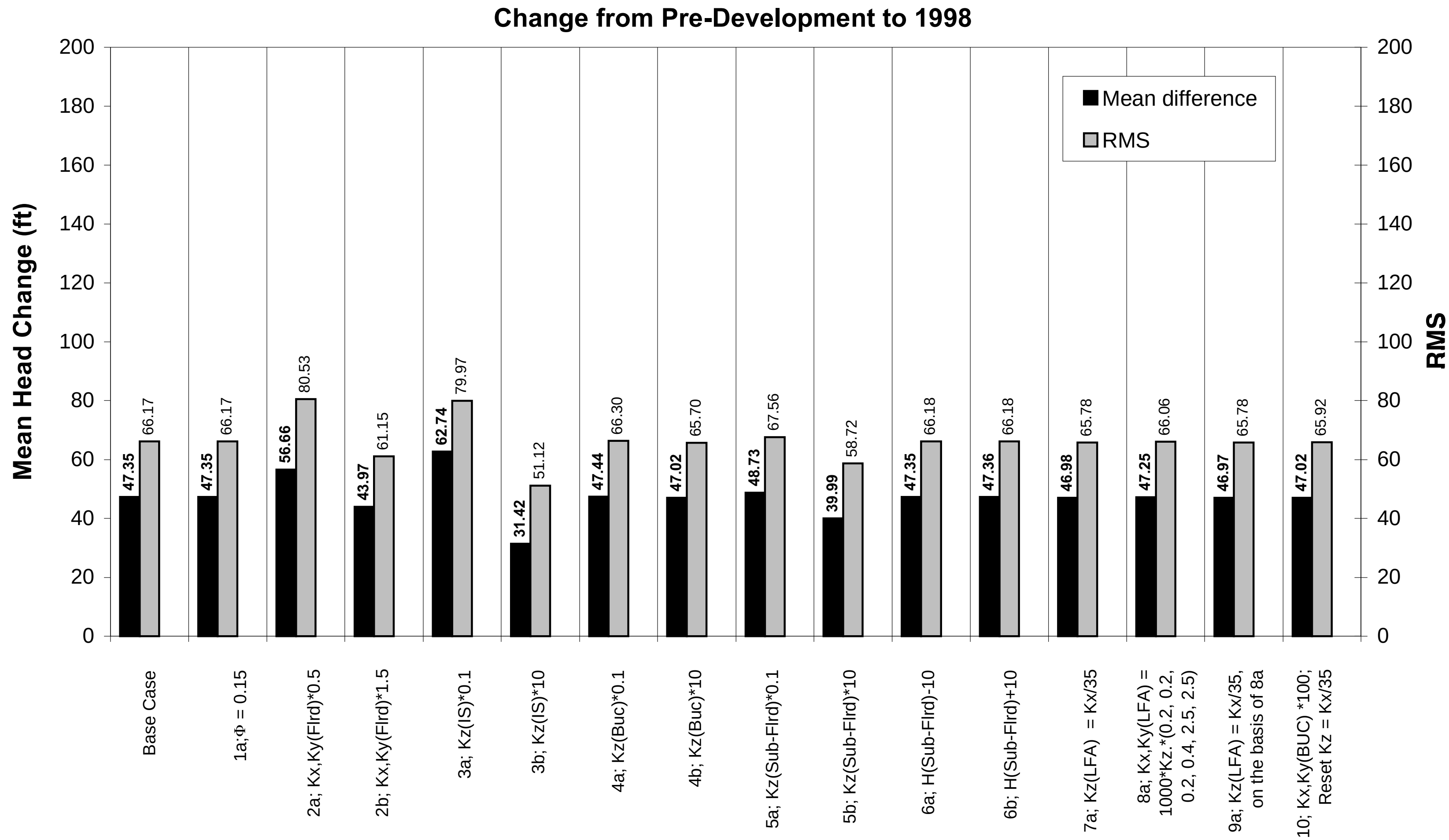
HGL HydroGeoLogic, Inc Exceeding Expectations

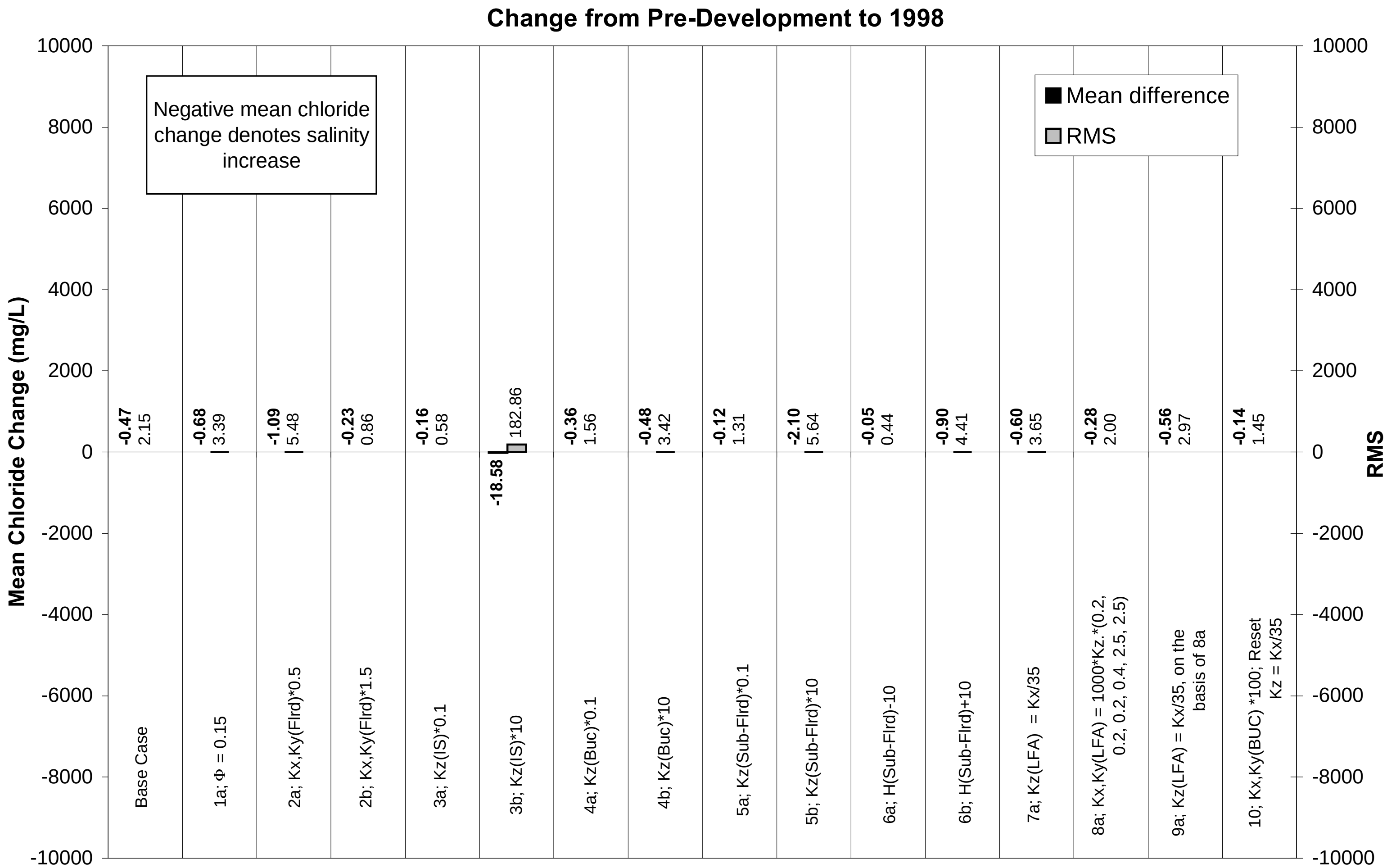
Figure 5.11
RMS and Mean Chloride Change from Post-Development Base Case (Lower Floridan Aquifer Only)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.12
RMS and Mean Drawdown from Pre-Development to 1998 (Upper and Lower Floridan Aquifers Combined)



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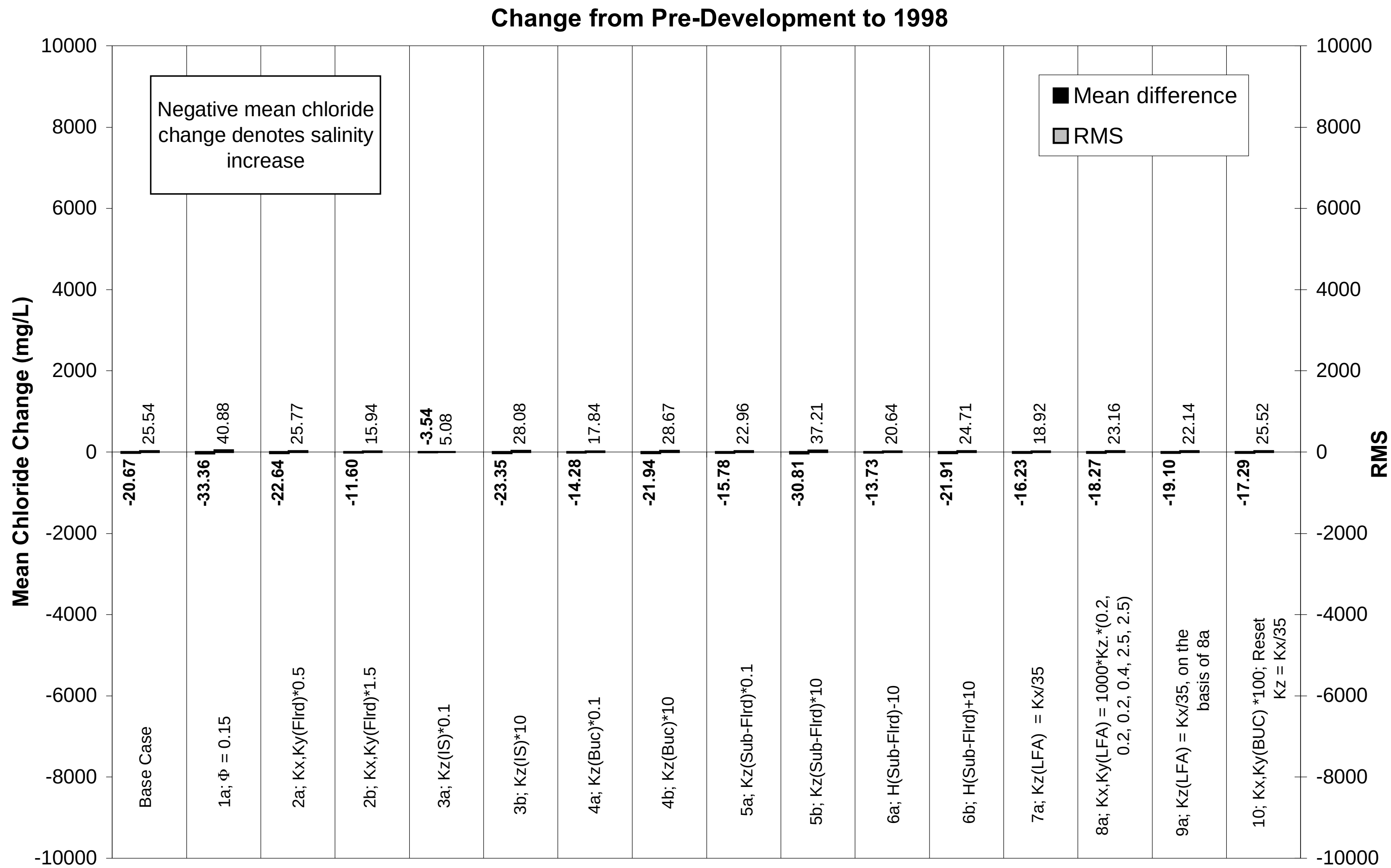
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.13
RMS and Mean Chloride Change from Pre-Development to 1998 (Upper Floridan Aquifer Only)



HGL—Northwest Florida Water Management District

Filename: X:\NWF006\001-04\Maps\Charts_1-14.cdr
Project: NWF006-001-04
Created by: cfarmer 06/22/06
Revised: 09/06/06 CF
Source: HydroGeoLogic, Inc.

Figure 5.14
RMS and Mean Chloride Change from Pre-Development to 1998 (Lower Floridan Aquifer Only)

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Figure 5.15
Selected Locations for Assessment of Model Results (with Location Reference Number)

Northwest Florida Water Management District

Filename: X:/NWF006/001-04/Model_Assess_locations_nonodes.mxd
Project: NWF006-001-04
Revised: 09/06/06 CF
Map Source: HydroGeoLogic GIS Database 2006

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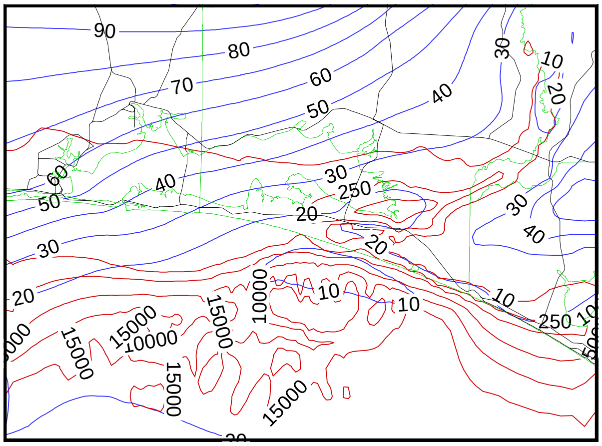
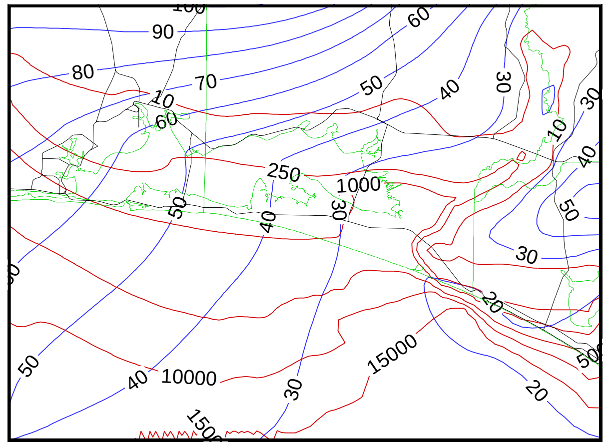
APPENDIX A

EQUIVALENT FRESHWATER HEAD AND CHLORIDE CONCENTRATION PLOTS

SIMULATED PREDEVELOPMENT CONDITIONS : base case calibrated model

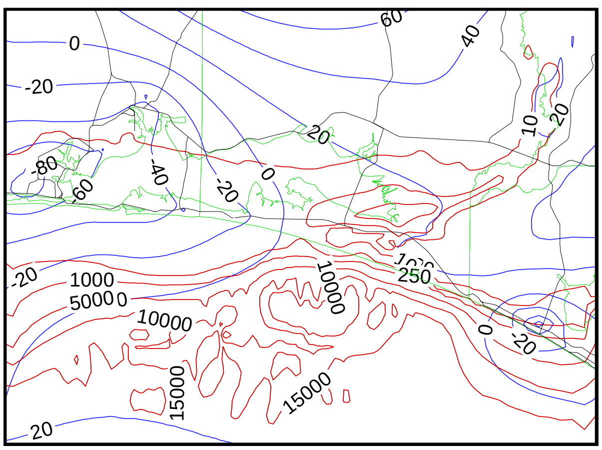


UPPER FLORIDAN AQUIFER

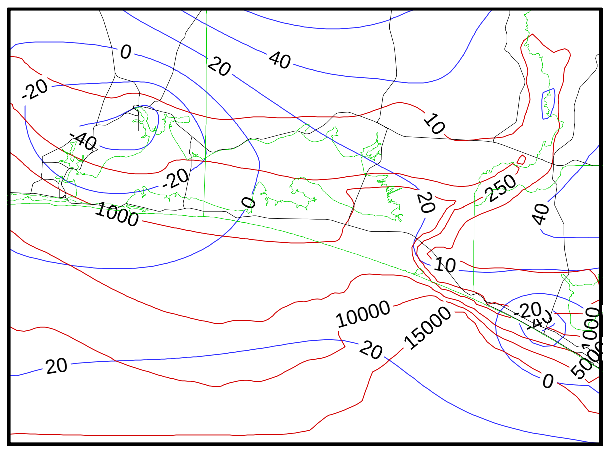


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : base case calibrated model



UPPER FLORIDAN AQUIFER



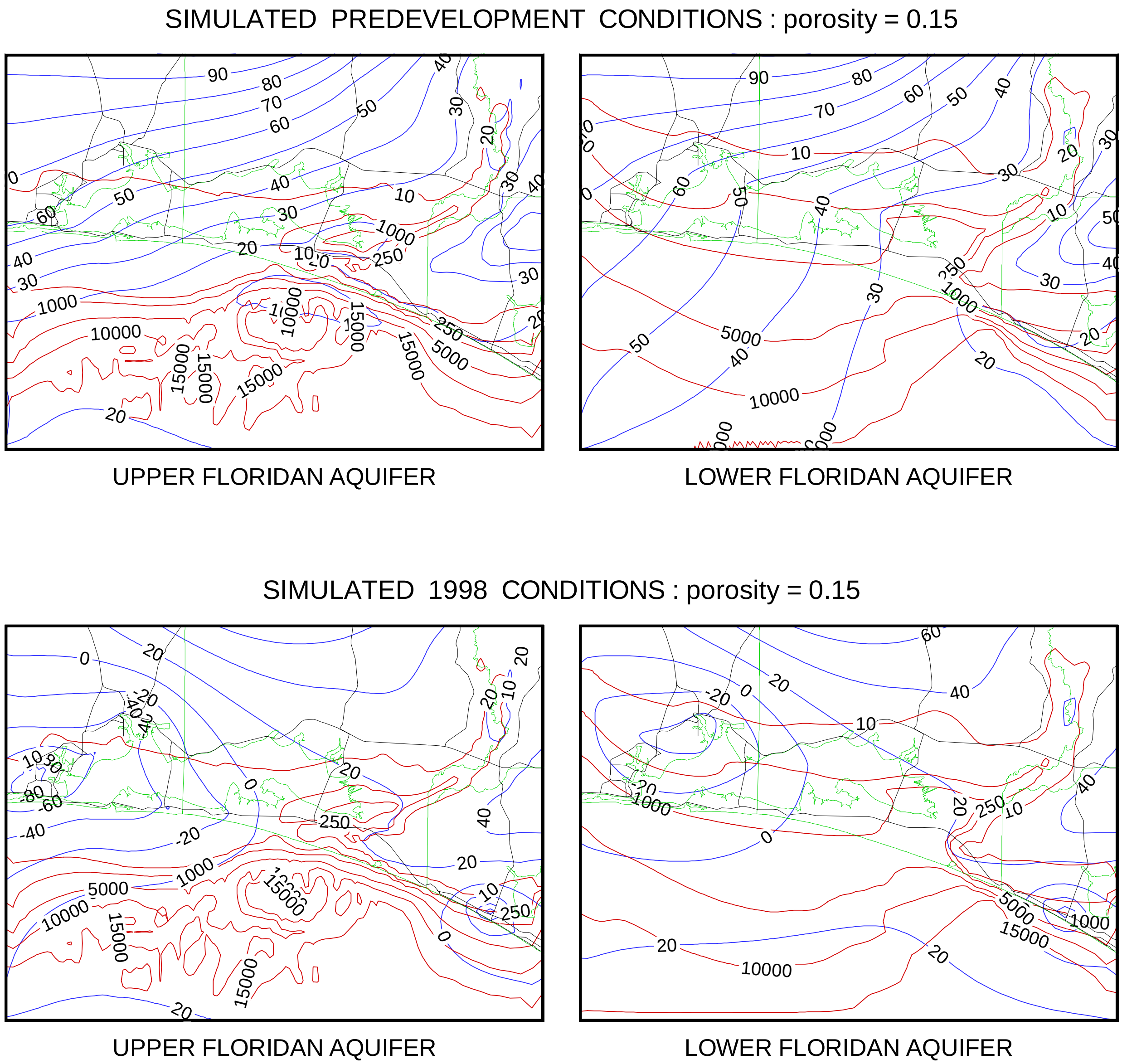
LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)
Blue contours: Water level elevation (ft msl)

Figure A.1

Eastern Domain Salt Water Intrusion Model Simulation: base case calibrated model

Simulation by HGL (base_case) - - Plot by NWFWMD - - 25 Aug 2006



Red contours: Chloride concentration (mg/l)

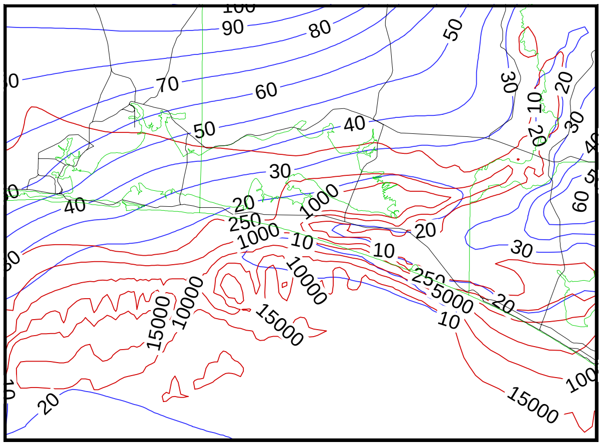
Blue contours: Water level elevation (ft msl)

Figure A.2

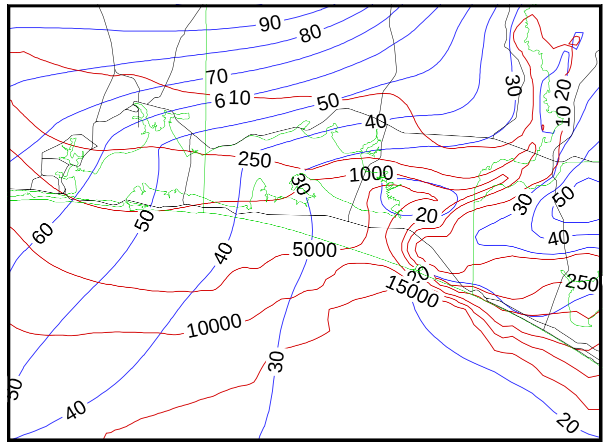
Eastern Domain Salt Water Intrusion Model Simulation: porosity = 0.15

Simulation by HGL (s1a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kx,Ky(Fld)*0.5

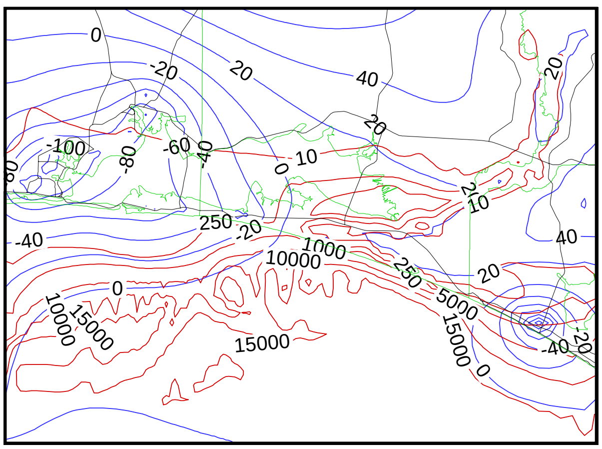


UPPER FLORIDAN AQUIFER

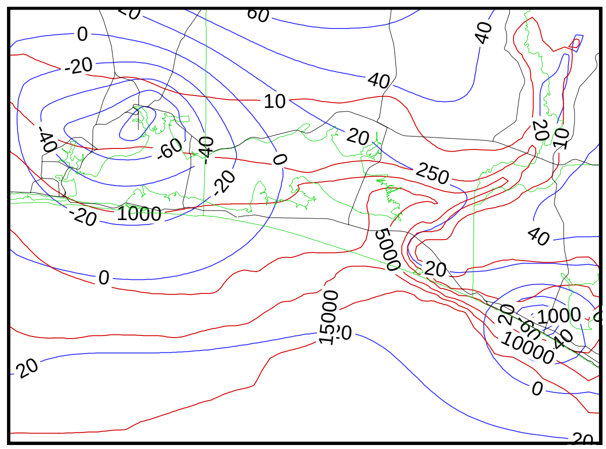


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kx,Ky(Fld)*0.5



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

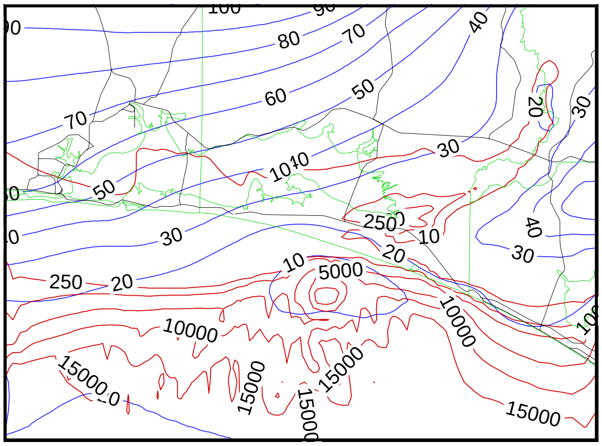
Blue contours: Water level elevation (ft msl)

Figure A.3

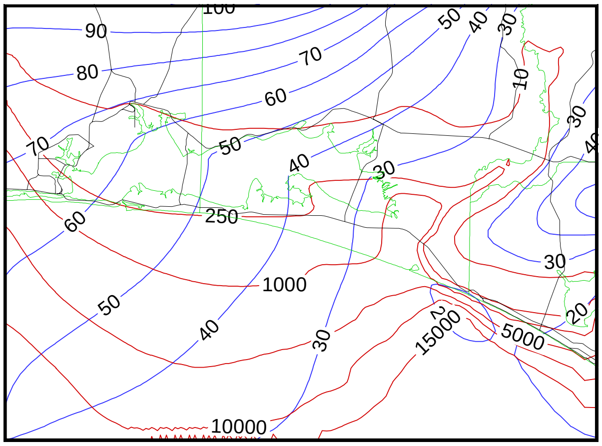
Eastern Domain Salt Water Intrusion Model Simulation: Kx,Ky(Fld)*0.5

Simulation by HGL (s2a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kx,Ky(Fld)*1.5

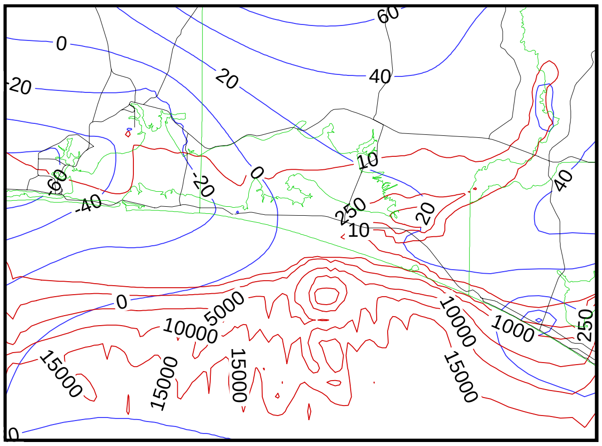


UPPER FLORIDAN AQUIFER

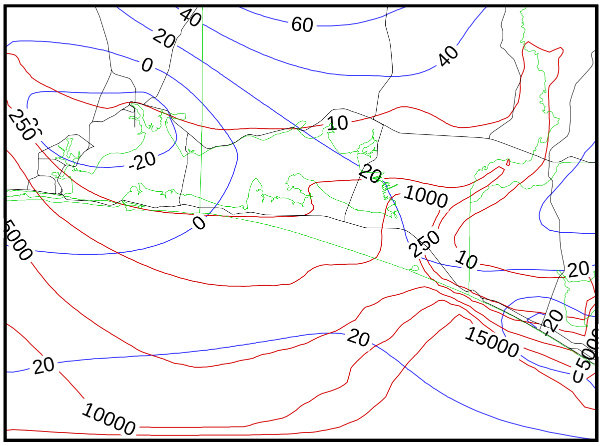


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kx,Ky(Fld)*1.5



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

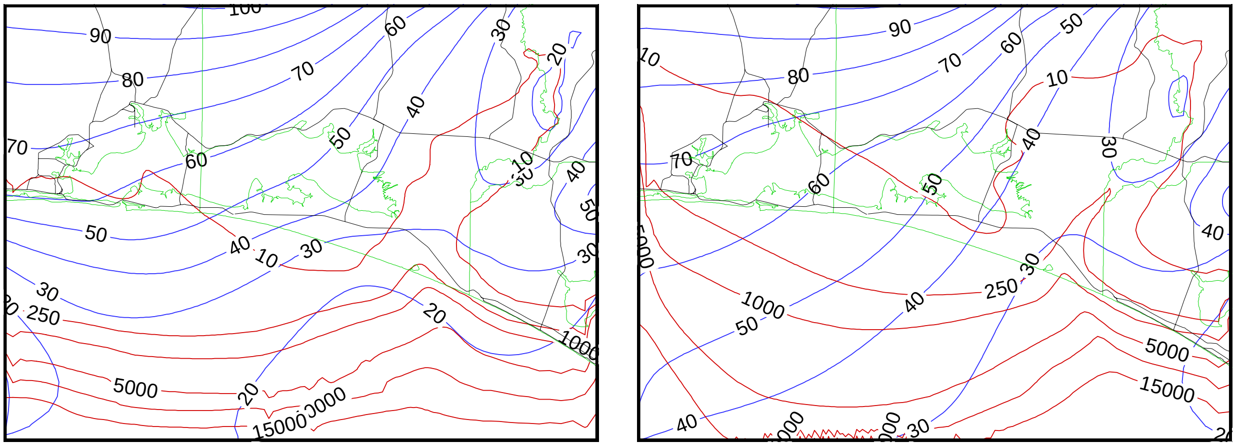
Blue contours: Water level elevation (ft msl)

Figure A.4

Eastern Domain Salt Water Intrusion Model Simulation: Kx,Ky(Fld)*1.5

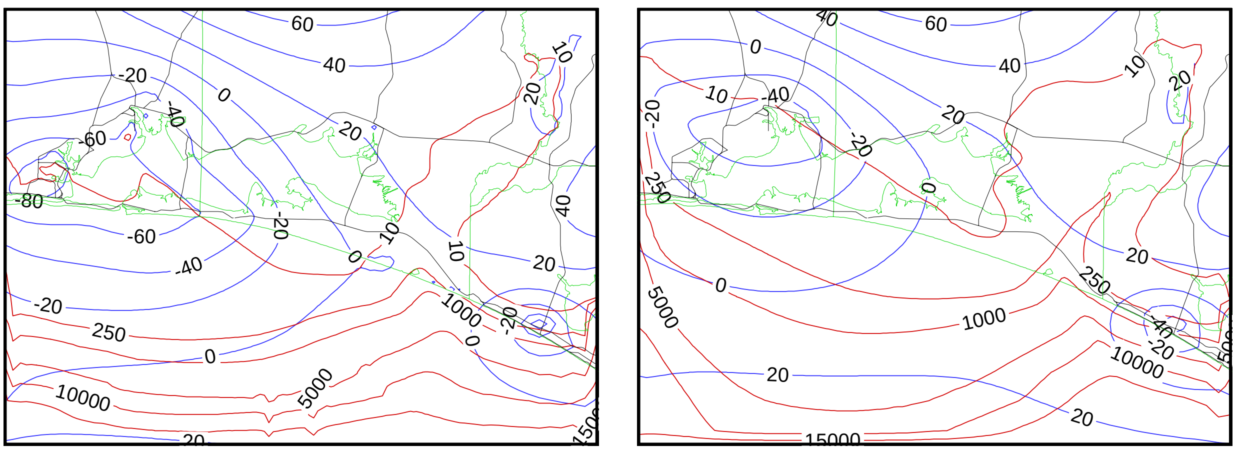
Simulation by HGL (s2b) -- Plot by NWFWMD -- 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(IS)*0.1



UPPER FLORIDAN AQUIFER | LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(IS)*0.1



UPPER FLORIDAN AQUIFER | LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

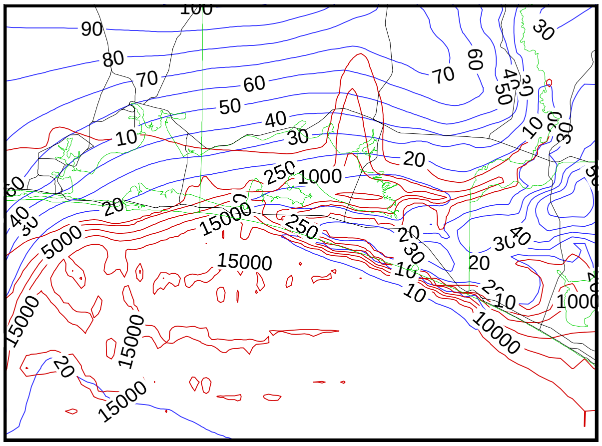
Blue contours: Water level elevation (ft msl)

Figure A.5

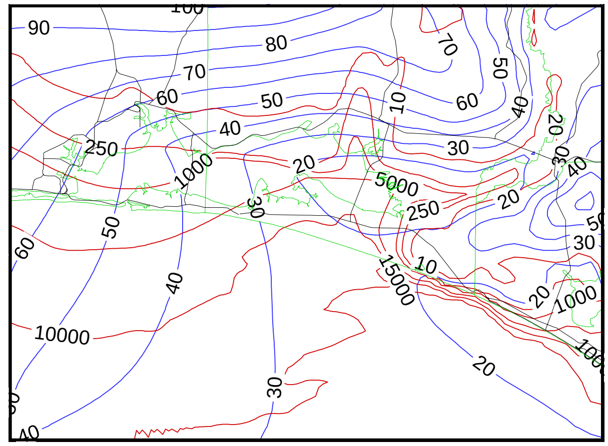
Eastern Domain Salt Water Intrusion Model Simulation: Kz(IS)*0.1

Simulation by HGL (s3a) -- Plot by NWFWMD -- 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(IS)*10

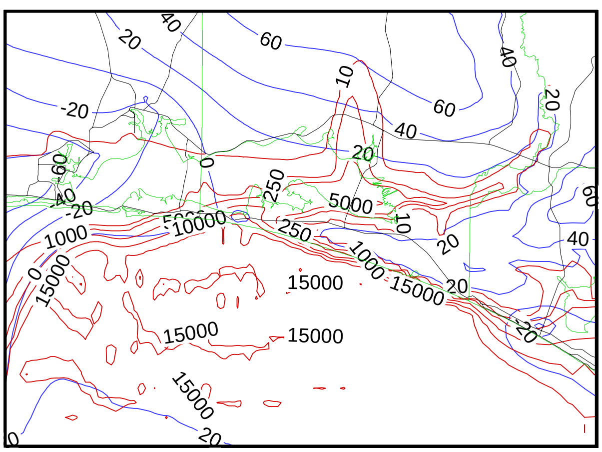


UPPER FLORIDAN AQUIFER

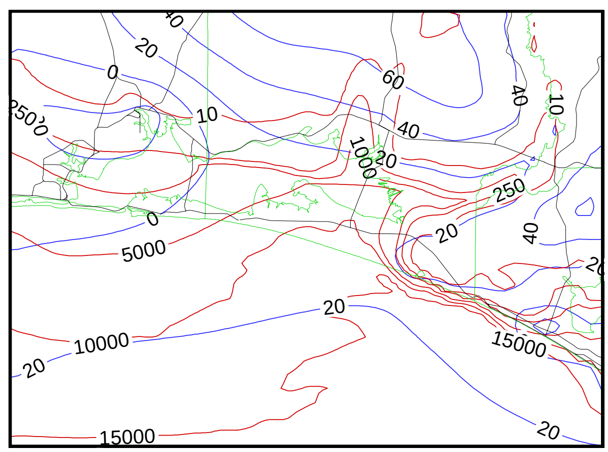


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(IS)*10



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

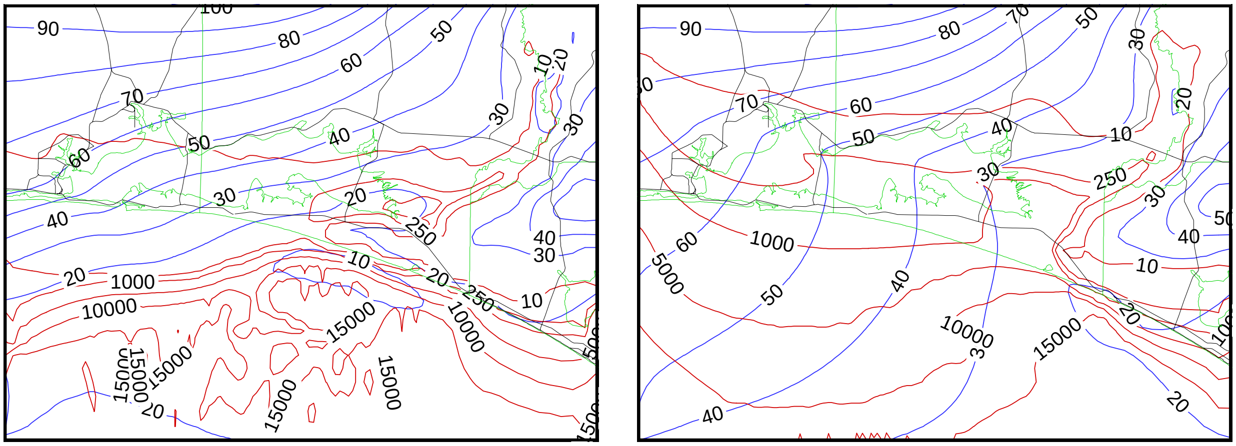
Blue contours: Water level elevation (ft msl)

Figure A.6

Eastern Domain Salt Water Intrusion Model Simulation: Kz(IS)*10

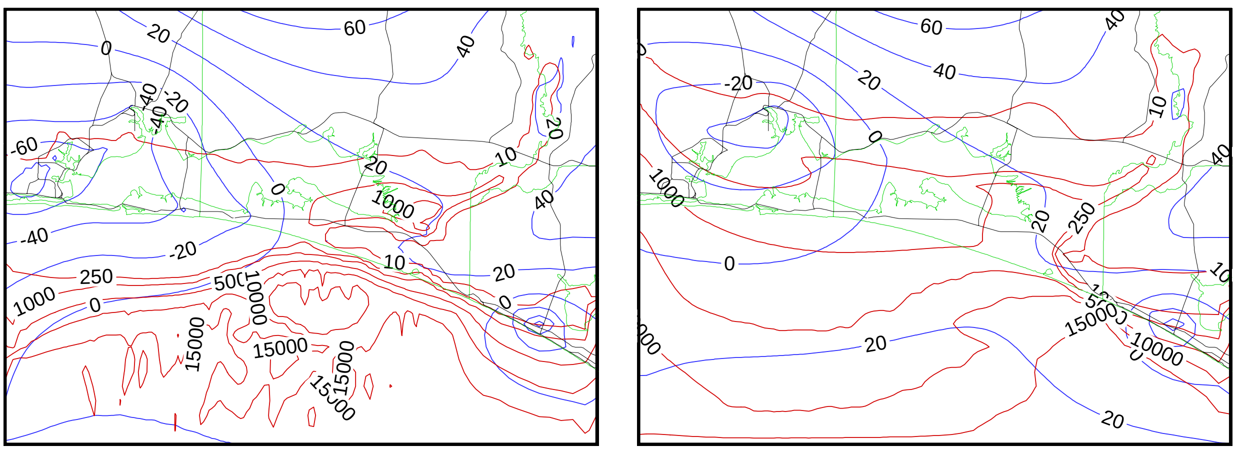
Simulation by HGL (s3b) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(Buc)*0.1



UPPER FLORIDAN AQUIFER   LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(Buc)*0.1



UPPER FLORIDAN AQUIFER   LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

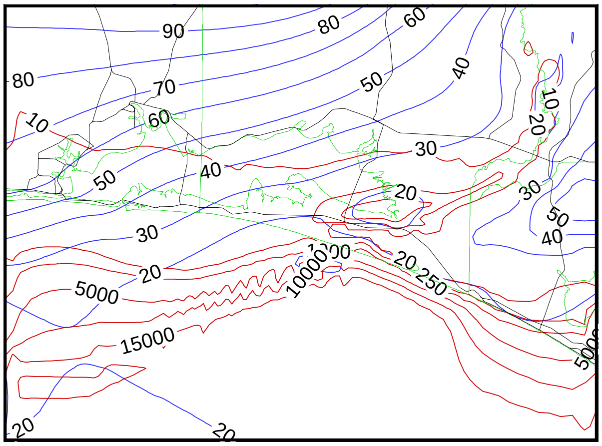
Blue contours: Water level elevation (ft msl)

Figure A.7

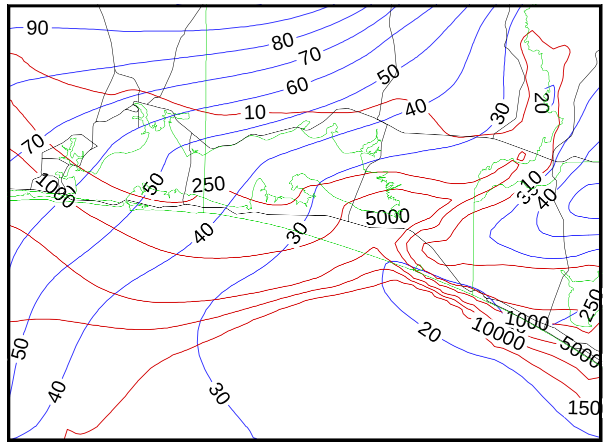
Eastern Domain Salt Water Intrusion Model Simulation: Kz(Buc)*0.1

Simulation by HGL (s4a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(Buc)*10

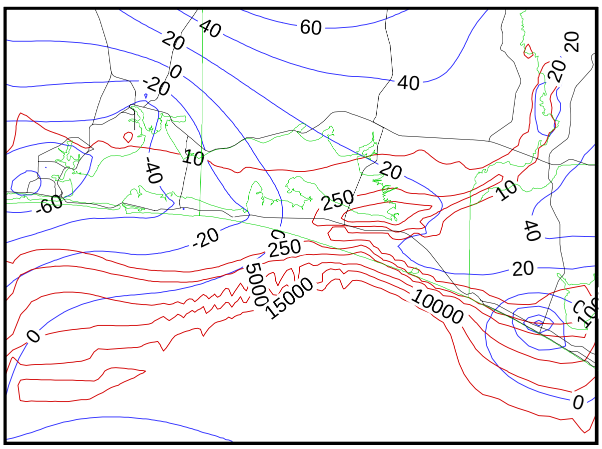


UPPER FLORIDAN AQUIFER

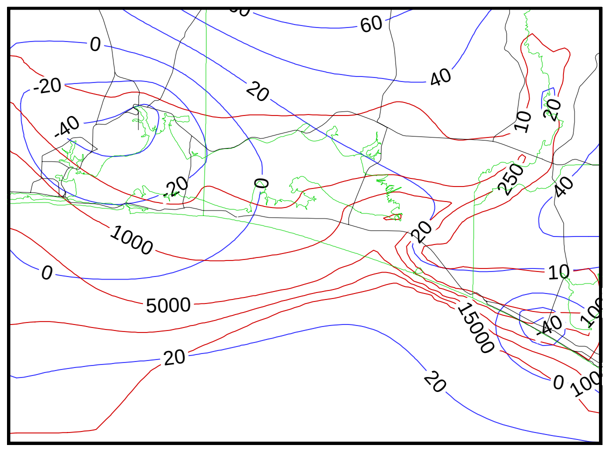


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(Buc)*10



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

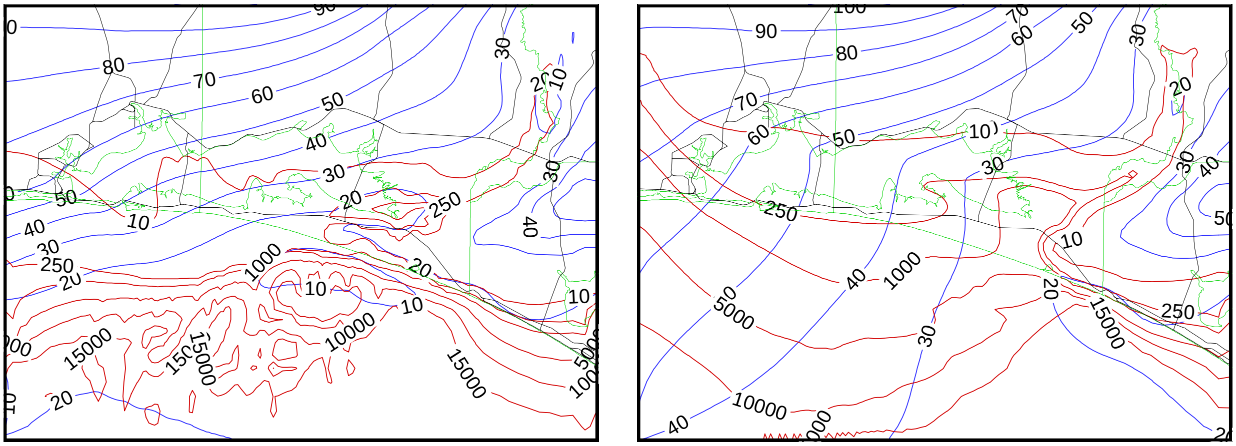
Blue contours: Water level elevation (ft msl)

Figure A.8

Eastern Domain Salt Water Intrusion Model Simulation: Kz(Buc)*10

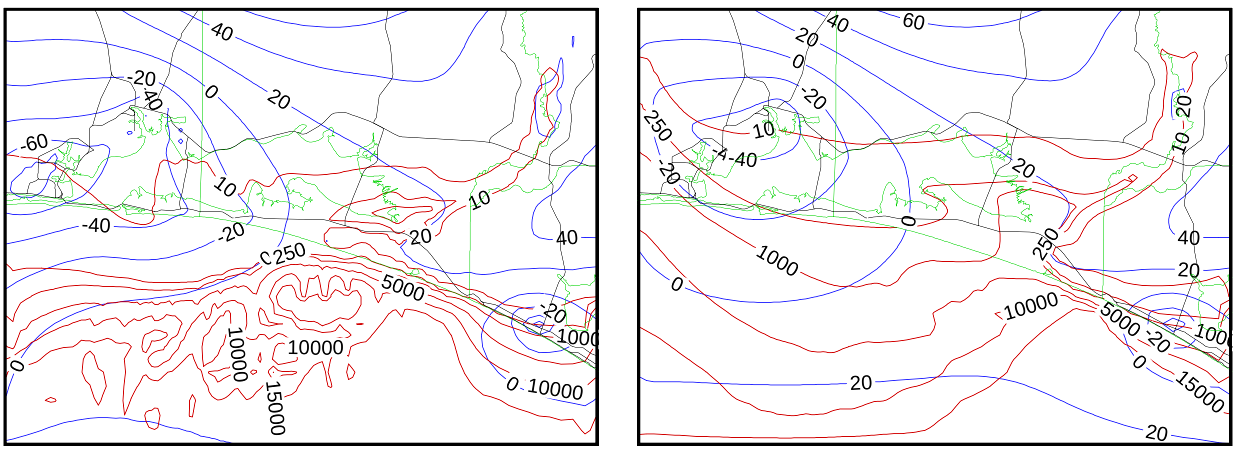
Simulation by HGL (s4b) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(Sub-Fld)*0.1



UPPER FLORIDAN AQUIFER | LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(Sub-Fld)*0.1



UPPER FLORIDAN AQUIFER | LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

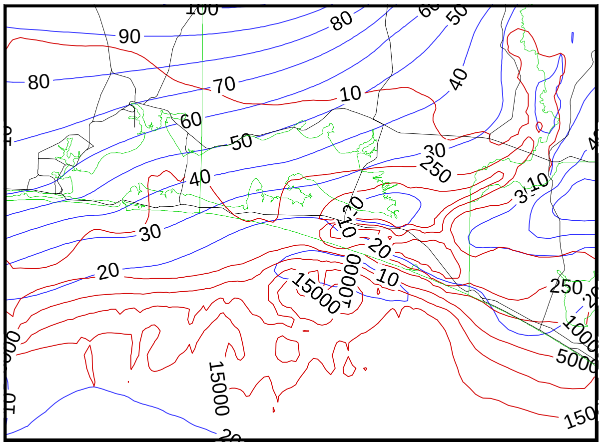
Blue contours: Water level elevation (ft msl)

Figure A.9

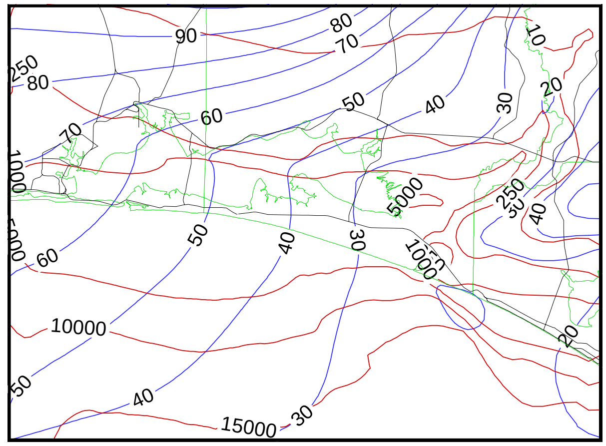
Eastern Domain Salt Water Intrusion Model Simulation: Kz(Sub-Fld)*0.1

Simulation by HGL (s5a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(Sub-Fld)*10

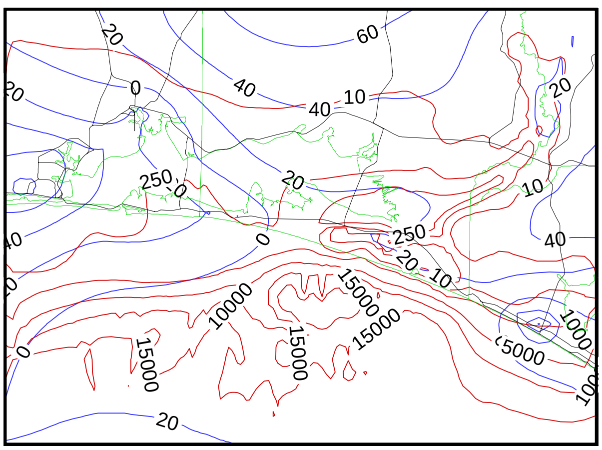


UPPER FLORIDAN AQUIFER

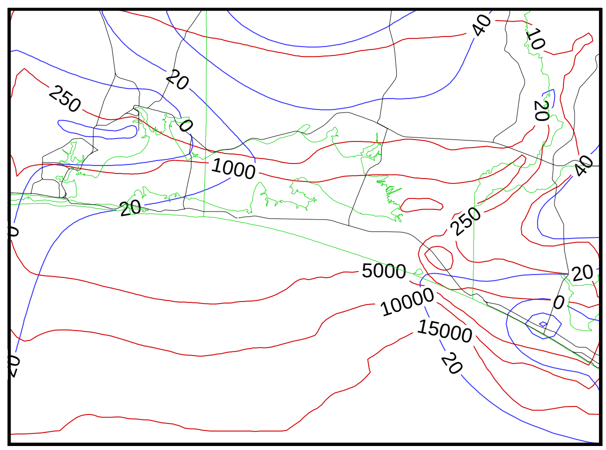


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(Sub-Fld)*10



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

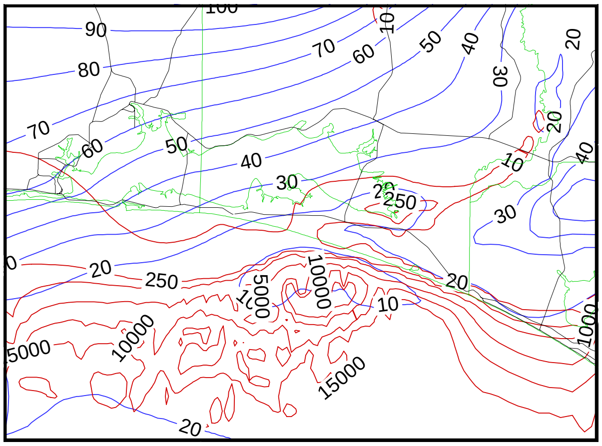
Red contours: Chloride concentration (mg/l)
Blue contours: Water level elevation (ft msl)

Figure A.10

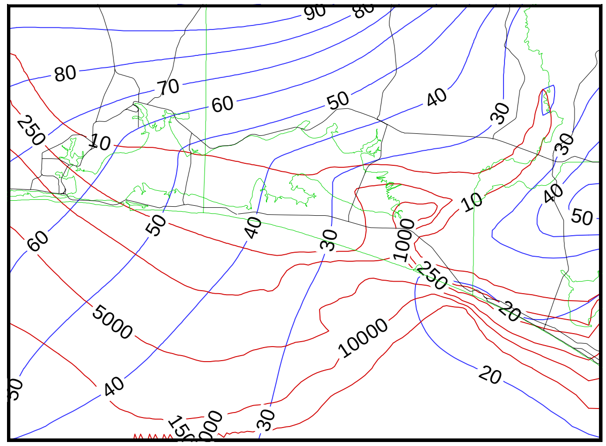
Eastern Domain Salt Water Intrusion Model Simulation: Kz(Sub-Fld)*10

Simulation by HGL (s5b) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Hd(Sub-Fld)-10

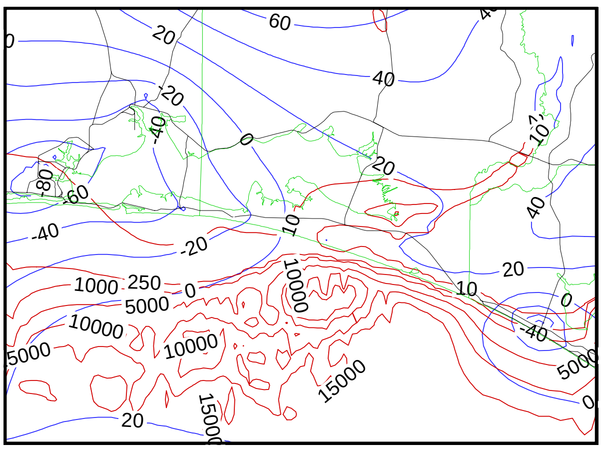


UPPER FLORIDAN AQUIFER

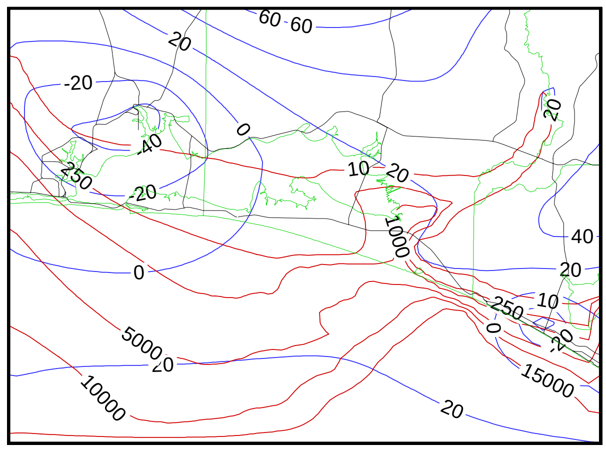


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Hd(Sub-Fld)-10



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

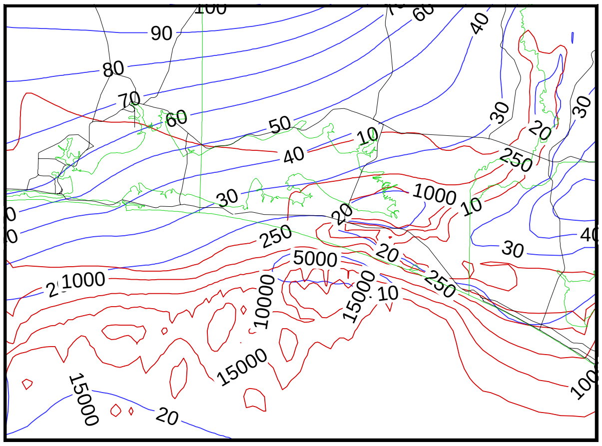
Red contours: Chloride concentration (mg/l)
Blue contours: Water level elevation (ft msl)

Figure A.11

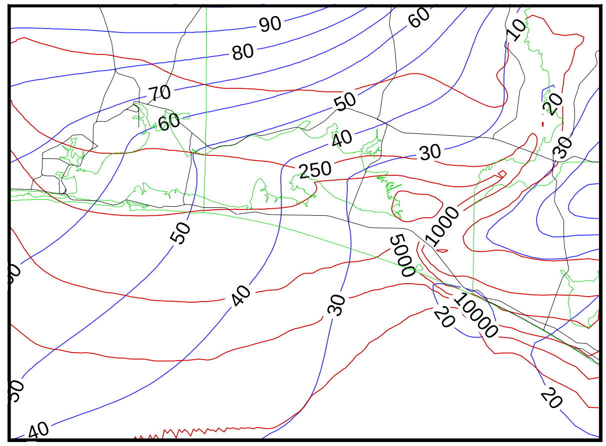
Eastern Domain Salt Water Intrusion Model Simulation: Hd(Sub-Fld)-10

Simulation by HGL (s6a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Hd(Sub-Fld)+10

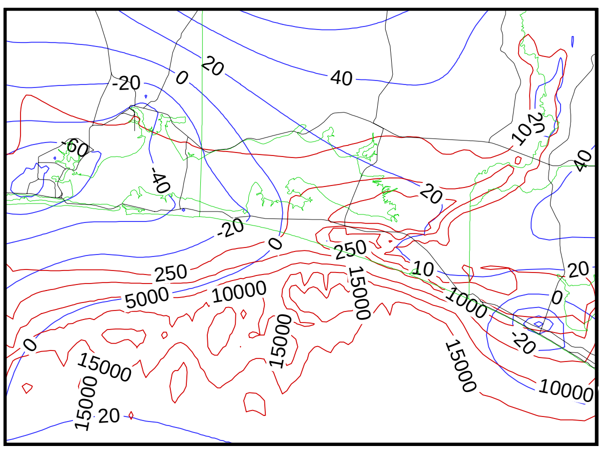


UPPER FLORIDAN AQUIFER

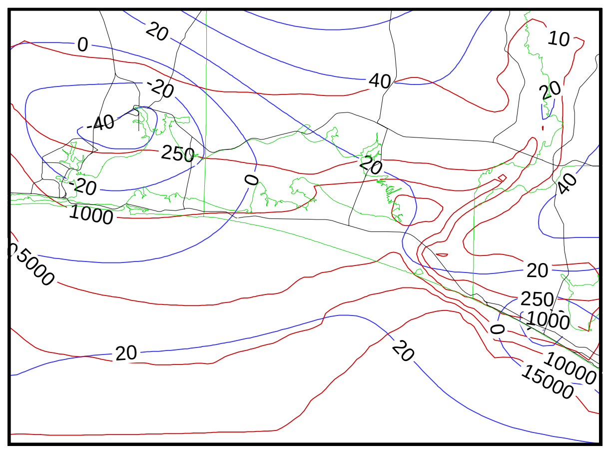


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Hd(Sub-Fld)+10



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

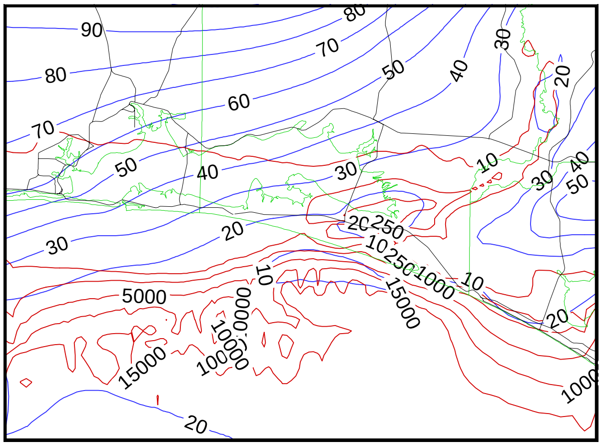
Blue contours: Water level elevation (ft msl)

Figure A.12

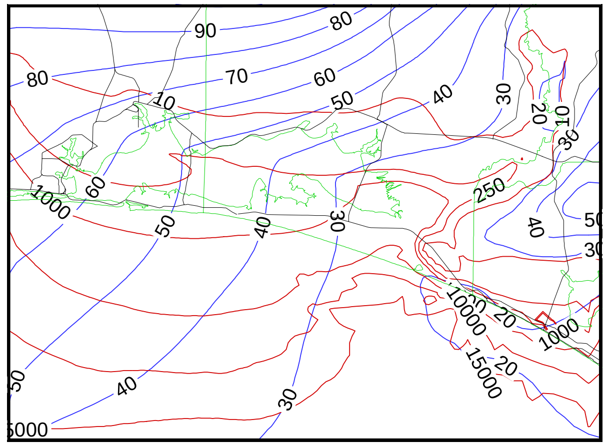
Eastern Domain Salt Water Intrusion Model Simulation: Hd(Sub-Fld)+10

Simulation by HGL (s6b) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kz(LFld)=Kx/35

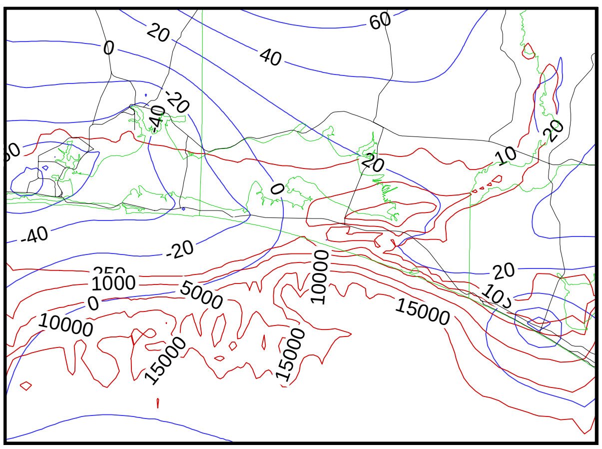


UPPER FLORIDAN AQUIFER

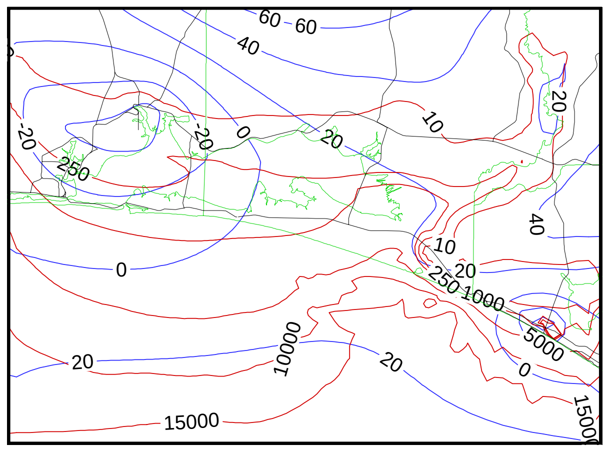


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kz(LFld)=Kx/35



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

Red contours: Chloride concentration (mg/l)

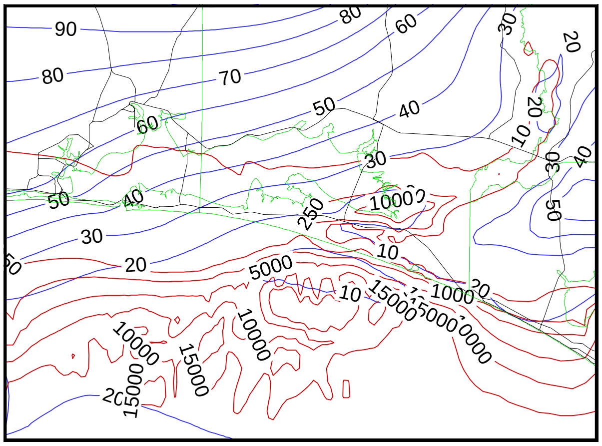
Blue contours: Water level elevation (ft msl)

Figure A.13

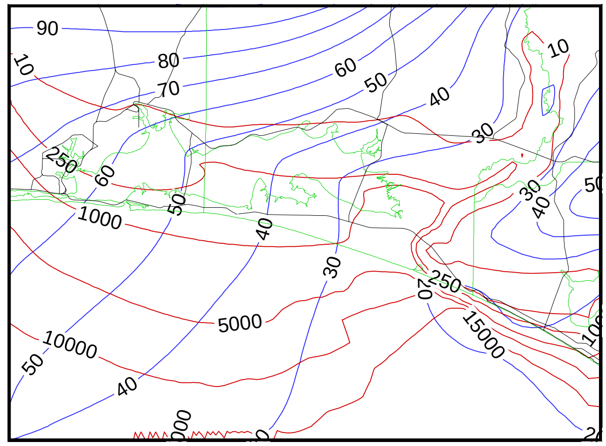
Eastern Domain Salt Water Intrusion Model Simulation: Kz(LFld)=Kx/35

Simulation by HGL (s7a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kx(LFld)=Kz*1000*Wi, Ky(LFLD)=Kx

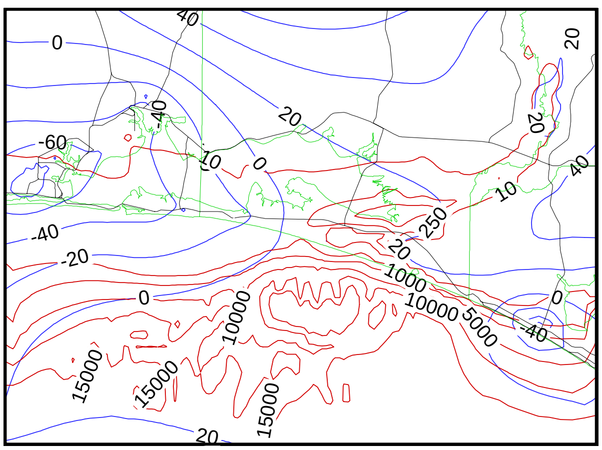


UPPER FLORIDAN AQUIFER

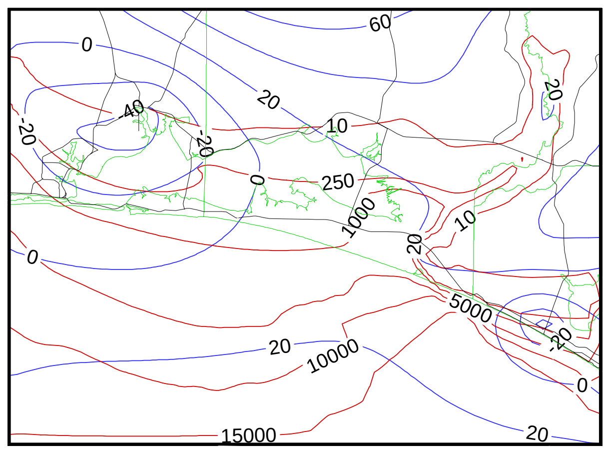


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kx(LFld)=Kz*1000*Wi, Ky(LFLD)=Kx



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

NOTE: Wi = (0.2, 0.2, 0.2, 0.4, 2.5, 2.5) for i= 4 to 9, respectively, where i is the slice.

Red contours: Chloride concentration (mg/l)

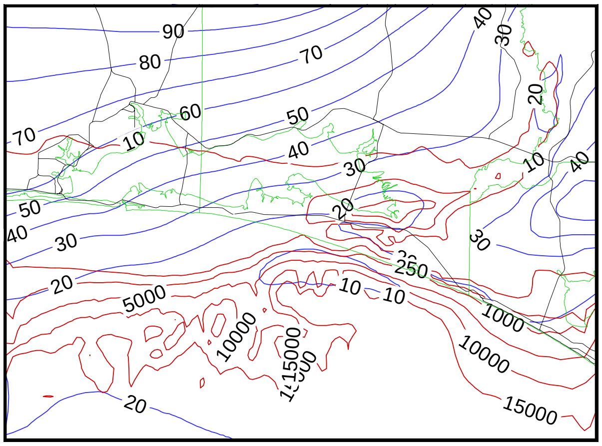
Blue contours: Water level elevation (ft msl)

Figure A.14

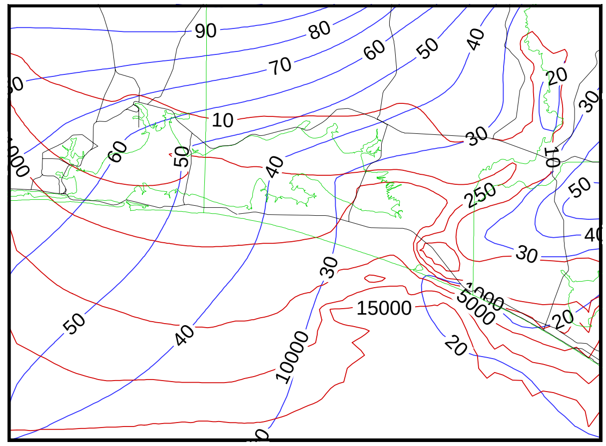
Eastern Domain Salt Water Intrusion Model Simulation: Kx(LFld)=Kz*1000*Wi, Ky(LFLD)=Kx

Simulation by HGL (s8a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : s8a + Kz(LFld)=Kx/35

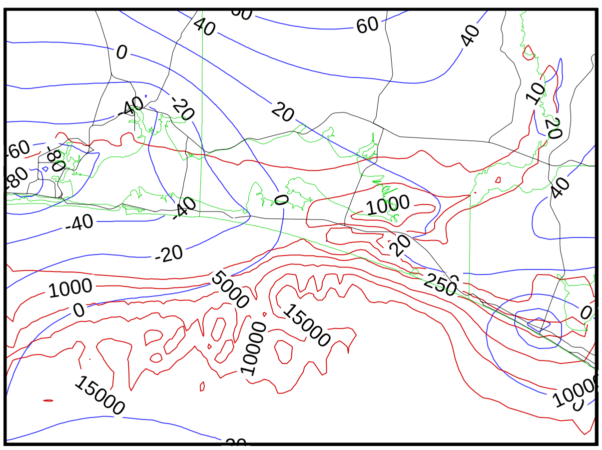


UPPER FLORIDAN AQUIFER

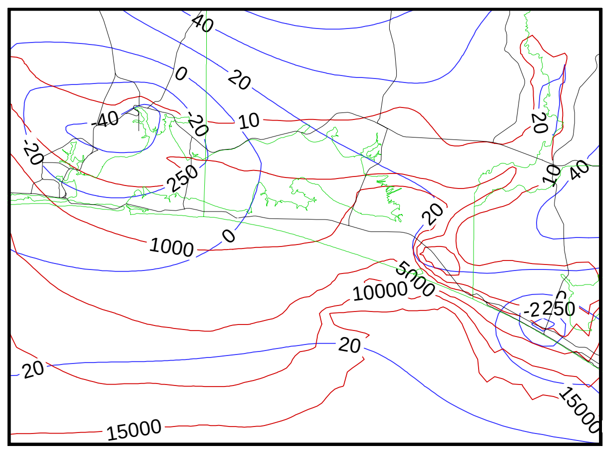


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : s8a + Kz(LFld)=Kx/35



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

NOTE: This simulation contains the attibutes of Case 8.

Red contours: Chloride concentration (mg/l)

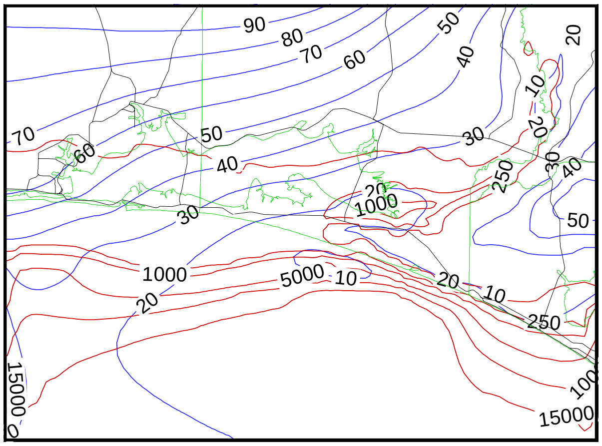
Blue contours: Water level elevation (ft msl)

Figure A.15

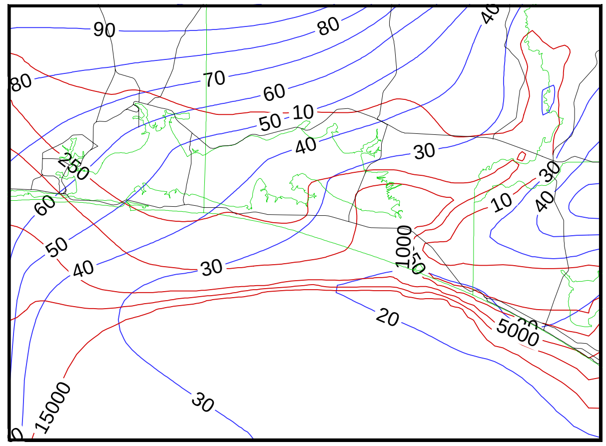
Eastern Domain Salt Water Intrusion Model Simulation: s8a + Kz(LFld)=Kx/35

Simulation by HGL (s9a) - - Plot by NWFWMD - - 24 Aug 2006

SIMULATED PREDEVELOPMENT CONDITIONS : Kx,Ky(Buc)*100 & Kz(Buc)=Kx/35

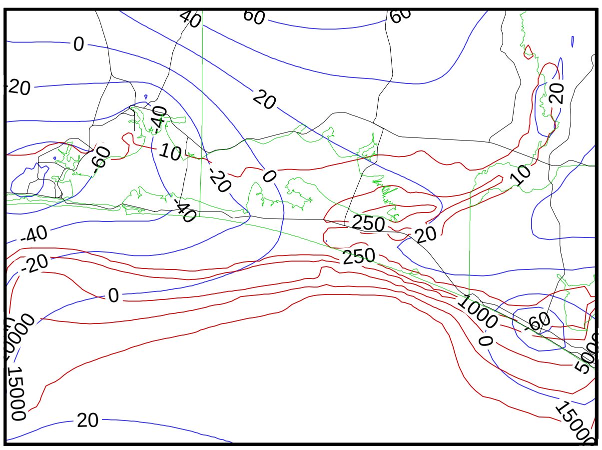


UPPER FLORIDAN AQUIFER

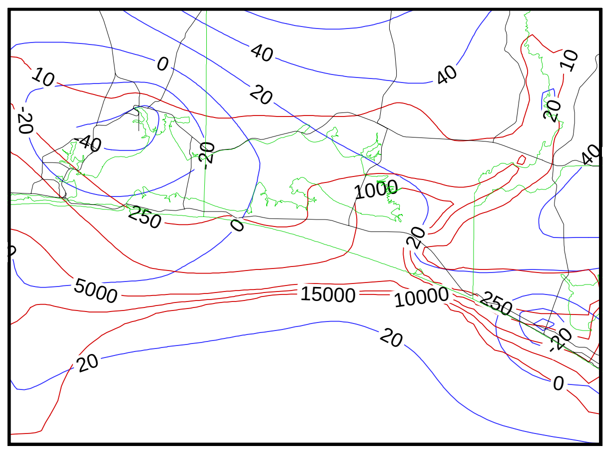


LOWER FLORIDAN AQUIFER

SIMULATED 1998 CONDITIONS : Kx,Ky(Buc)*100 & Kz(Buc)=Kx/35



UPPER FLORIDAN AQUIFER



LOWER FLORIDAN AQUIFER

NOTE: The Bucatunna was only perturbed in the area greater than 5 miles off shore.

Red contours: Chloride concentration (mg/l)
Blue contours: Water level elevation (ft msl)

Figure A.16

Eastern Domain Salt Water Intrusion Model Simulation: Kx,Ky(Buc)*100 & Kz(Buc)=Kx/35

Simulation by HGL (s10) - - Plot by NWFWMD - - 24 Aug 2006