QUESTION 14 - WATER

NOTE: The information contained in the responses to Question 14 is for the entire Area 6 property; however, development order approval is only being requested for the Charlotte County portion of the property at this time. The Lee County property within area 6 will be developed at a later time. At this time, no changes to the existing land uses in Lee County are proposed.

A. Describe the existing hydrologic conditions (both ground and surface water) on and abutting the site, including identification and discussion of any potential aquifer recharge areas. Please identify and describe any Outstanding Florida Waters, Wild and Scenic Rivers, Florida Aquatic Preserves or Florida Class I or II Waters that occur within, abutting or downstream of the site.

The existing hydrologic conditions of the 17,787.83 acre Babcock Ranch Community are varied. Within the site, there are approximately 4,063 acres of connected and isolated wetlands. There are three primary aquifer systems underlying the property that could be considered for potable and irrigation uses.

Surface Water

Water flows through or is stored in agricultural ditches, cattle ponds, wetland sloughs and incised natural channels. Water enters the north end of the Babcock Ranch Community from the state lands via overland flow and agricultural ditches. Although not directly through Area 6, the surface water continues south into Curry Lake, which is on state-owned property also. The water then flows back into the Babcock Ranch Community where it is conveyed by a ditch and Curry Lake Canal to Trout Creek, where it is conveyed to the south property line. Beyond the property, Trout Creek flows south to the Caloosahatchee. Both the creek and that portion of the Caloosahatchee are Class III waters. The other streams leaving the Babcock Ranch Community are also Class III waters. None of the streams on the site or the Caloosahatchee, which is the receiving water, are Outstanding Florida Waters, Wild or Scenic Rivers, Florida Aquatic Preserves or Florida Class I Waters. Water from the northeast portion of the Babcock Ranch Community flows east into Telegraph Swamp. Water in the swamp flows south and reaches the Caloosahatchee River through Telegraph Creek, Fichters Creek, Hall's Gully and Cypress Creek. The first two creeks contribute to a portion of the river that is a Class III water. Hall's Gully is a tributary to Cypress Creek, which flows into a portion of the Caloosahatchee that is a Class II water.

Wetlands

The on-site wetlands are located across the site and generally connected in a north to south direction with the exception of those in the northeast portion of the Babcock Ranch Community. Wetlands in this area convey water in an easterly direction towards Telegraph Swamp, which then directs water in a southerly direction.

The hydroperiod of wetlands on and abutting the site is dependent upon seasonal rainfall conditions. There has been alteration of some of the wetland hydroperiods by the use of shallow ditches. Some of these ditches are only about a foot deep, and the affect on the drainage of the site is minimal. Many of these shallow swales are impacted by trees, shrubs and herbaceous growth that limit their effectiveness. Typically, the highest wetland water levels occur near the end of the traditional June-September wet season, and the lowest

water levels occur at the end of the dry season in late May or early June. During extended dry periods, water levels within the wetlands may fall two to four feet below the base of the wetland. During extended wet periods, portions of the site may be subject to sheet flow conditions. Regional topography and drainage modifications completed in the upland agricultural areas of the site facilitate surface water drainage to the south. Ground elevations vary from about 37 feet NGVD to 9 feet NGVD from the north end of the Babcock Ranch Community to the south end.

Surface Water Monitoring

The data and information collected will be used to enhance maps showing watershed divides, conveyance courses, control structures, storage areas, and flow direction in addition to the elevations shown on the topographic map for the Ranch. Cross sections for the conveyances within the Babcock Ranch Community will be shown in graphical form in a variety of typical locations. Detailed sections will be provided in the computer models for the backwater profiles.

Baseline water quality will be provided at 15 locations across the Ranch. The sites are focused on the Babcock Ranch Community, but will also include each of the major streams that are on the Ranch. Each location will have the following items tested on a monthly basis from grab samples: total nitrogen, nitrite, nitrate, ammonia, Total Kjeldahl Nitrogen (TKN), total phosphorous, Ortho phosphorous, pH, specific conductance, salinity, dissolved oxygen, temperature, turbidity, total suspended solids, and chlorophyll-a. Pesticides will be tested on a quarterly basis along the perimeter from water sampling and annually for sediment sampling. Enterococci, and fecal coliform will also be tested quarterly. The pesticide, enterococci, and fecal coliform will be sampled at three locations. These will be the inflow along SR 31 to Telegraph Creek, its outflow location at the south end of the Ranch, and the outflow location of Trout Creek at the south end of the Ranch.

Flow measurements will also be done at the 15 water quality sample locations in conjunction with the wet chemistry and biological sampling. This will be done utilizing standard Price Open Cup rotating flow meters and determining cross sectional flowing areas at each location for each event, and utilizing flow measuring methodologies and techniques acceptable to SFWMD criteria for flow measurements, or other suitable techniques adapted to unique field conditions and deemed acceptable by the engineer of record. Summaries of the flow and sampling events will be provided as requested, following appropriate quality assurance procedures.

All testing will be evaluated annually. The list of pesticides will be reduced to those found in the previous year's sampling and those currently being used on the site. The review agencies will be able to audit the field sampling to assure that the methodologies and protocols are being followed.

Groundwater

Three main aquifer systems compose the groundwater resources beneath the project site: the Surficial (water table) Aquifer System, the Intermediate Aquifer System, composed of the Sandstone and the Mid-Hawthorn aquifers, and the Floridan Aquifer System. The Floridan aquifer system encompasses several distinct water-bearing units, among them the Lower Hawthorn (Upper Floridan), Suwannee, Avon Park and Ocala formations (Figure 14-1). The surficial, Sandstone and Floridan aquifers constitute the three main water-bearing units used

in this area. Wells penetrating the Floridan aquifer typically flow at land surface. The surficial and Sandstone aquifers both contain fresh groundwater, with chloride concentrations less than 250 milligrams per liter (mg/l), which is the secondary maximum contaminant level for drinking water. The Floridan aquifer typically contains brackish groundwater with chloride concentrations exceeding 250 mg/l. Chloride concentrations generally increase with depth, both among the aquifers and within the Floridan aquifer.

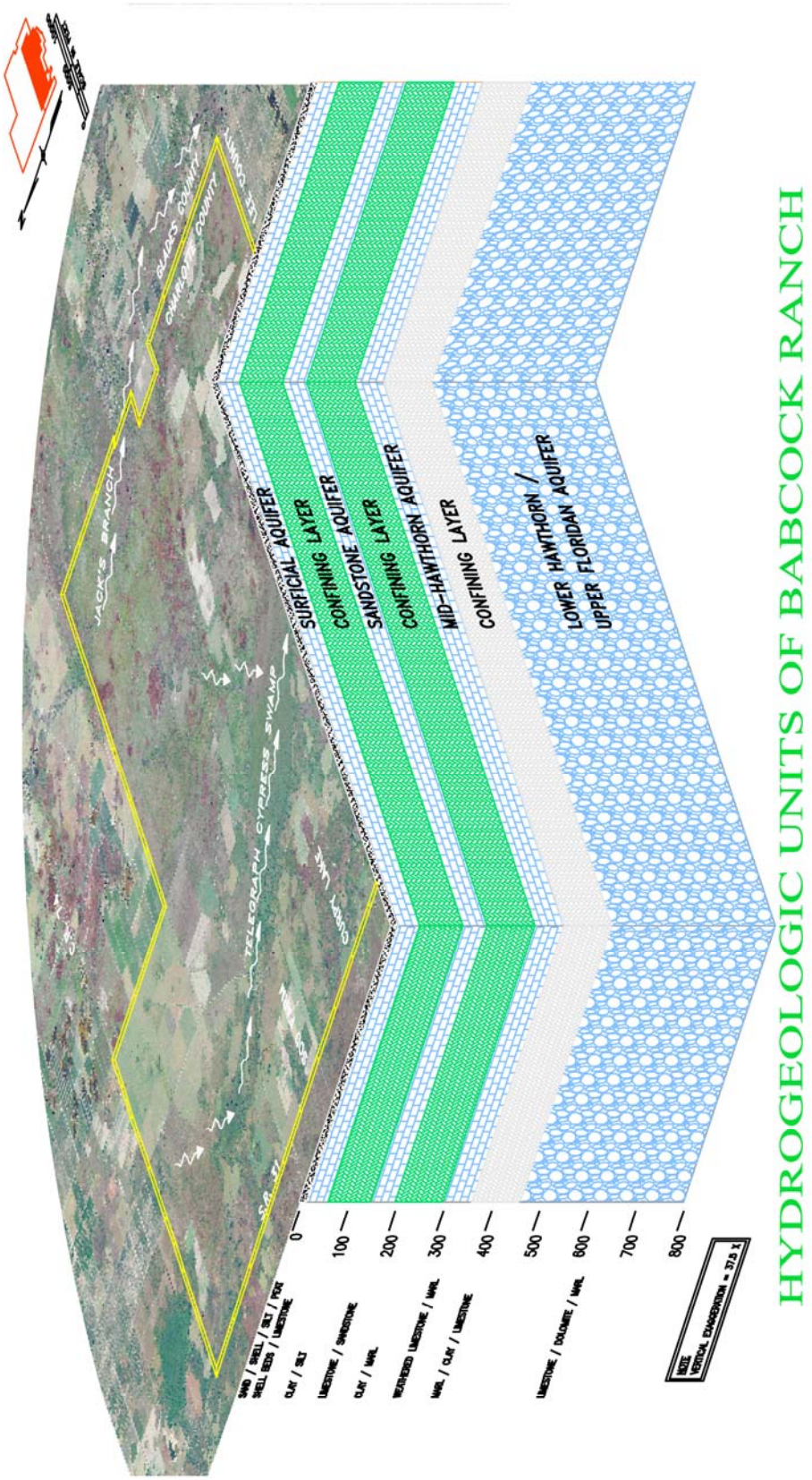

Figure 14-1: Hydrogeology of the Babcock Ranch Community site

In 2001, Johnson Engineering constructed a total of twelve (12) test wells in three locations at the site. Five wells were installed in Section 29, Township 41 South, Range 26 East approximately ½ mile northwest of the Babcock Ranch Headquarters. Six wells were installed in Section 28, Township 45 South, Range 26 East approximately 1 mile east of Earthsource Mine. One well was installed in Section 34, Township 43 South, Range 26 East approximately 2 miles north of County Road 78 entrance and 3 miles east of State Road 31. Four wells are completed in the surficial aquifer (MW-1, 3, 6 & 7) two in the shallow surficial aquifer (MW-2 & 11), four in the Sandstone aquifer (MW-4, 8, 9 & 12) and two in the Lower Hawthorn aquifer (MW-5 & 10). (Figure 14-2)

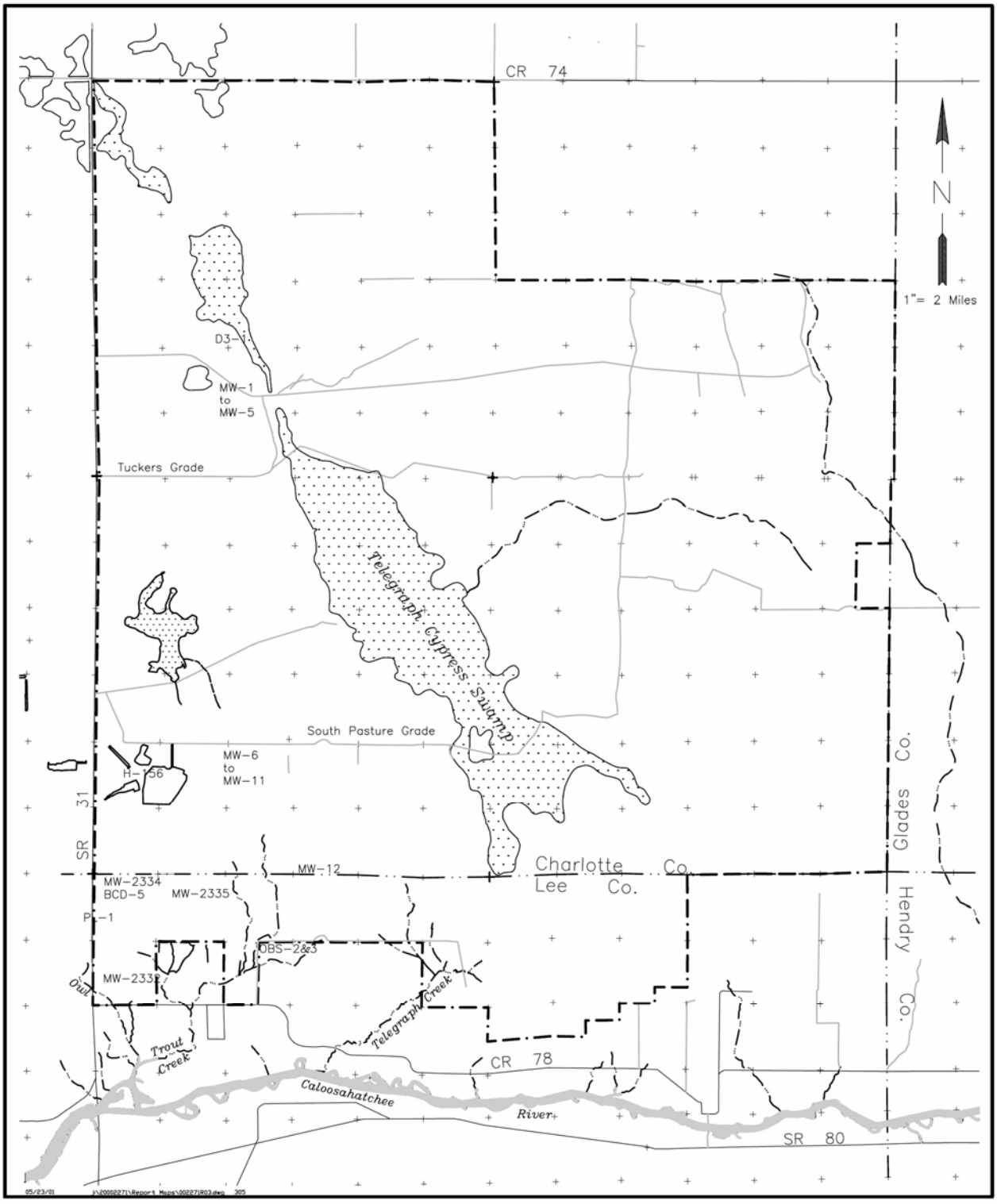

Figure 14-2: Test well locations

Surficial Aquifer

The surficial aquifer system is the uppermost system, comprised of sediments extending from land surface to the upper confining zone of the intermediate aquifer system. This aquifer system is usually unconfined or sometimes semi-confined. There are two zones in the surficial aquifer system at the project site. The upper zone is comprised of fine sand, and the lower zone is made up of limestone, shells and sand. The two zones are separated by a clayey sand which acts as an extremely leaky confining unit.

On-site test boring show that Pleistocene age terrace deposits consisting predominantly of quartz sand extend approximately 10 feet bls, followed by a Pliocene age shell bed. The thickness of the shell beds (where present) varies across the site. The shell beds consist of predominantly loose shell and sand to a mixture of limestone, shell and sand. The shell beds are thickest near the Ranch Headquarters, as seen at drilling location (MW-5) where they extend to 90 feet bls. This unit tapers off to the south, as evidenced at the Earthsource Mine drilling location (MW-10), where they terminate to 50 feet bls. The shell beds completely pinch out farther to the south and are not present at MW-12, which is located slightly north of the Lee County line.

In early 2006, Johnson Engineering constructed a total of 62 water table piezometers across the Babcock Ranch Community project site, 18 of which are located in Lee County. On July 19, 2006, Johnson Engineering measured water levels in distributed across the project site. Water level data measured at the piezometers was compared to water level data collected at United States Geological Survey (USGS) surficial aquifer well L-2217, located near the intersection of SR 31 and the Lee-Charlotte County line. Periodic water level data have been measured at this well from 1975 to 2006. Water levels have ranged from 19.00 to 26.75 feet NGVD throughout the period of record. Water level data collected from the piezometers located near the Lee-Charlotte County line in the vicinity of SR 31 averaged 25 feet-NGVD, slightly higher than the average annual surficial aquifer water level recorded at L-2217 of 24.3 feet-NGVD for the period of record (Figure 14-3). See Figure 14-4 for monitoring site locations. Therefore, the water level data collected on July 19, 2006 should approximate average water levels and hydraulic gradients at the Babcock Ranch Community site. A potentiometric surface map produced from the water level data shows a hydraulic gradient of approximately 8 feet per mile near SR 31 south of the county line, which is consistent with the numerous streams and relatively steep topography characterizing this area (Figure 14-5).

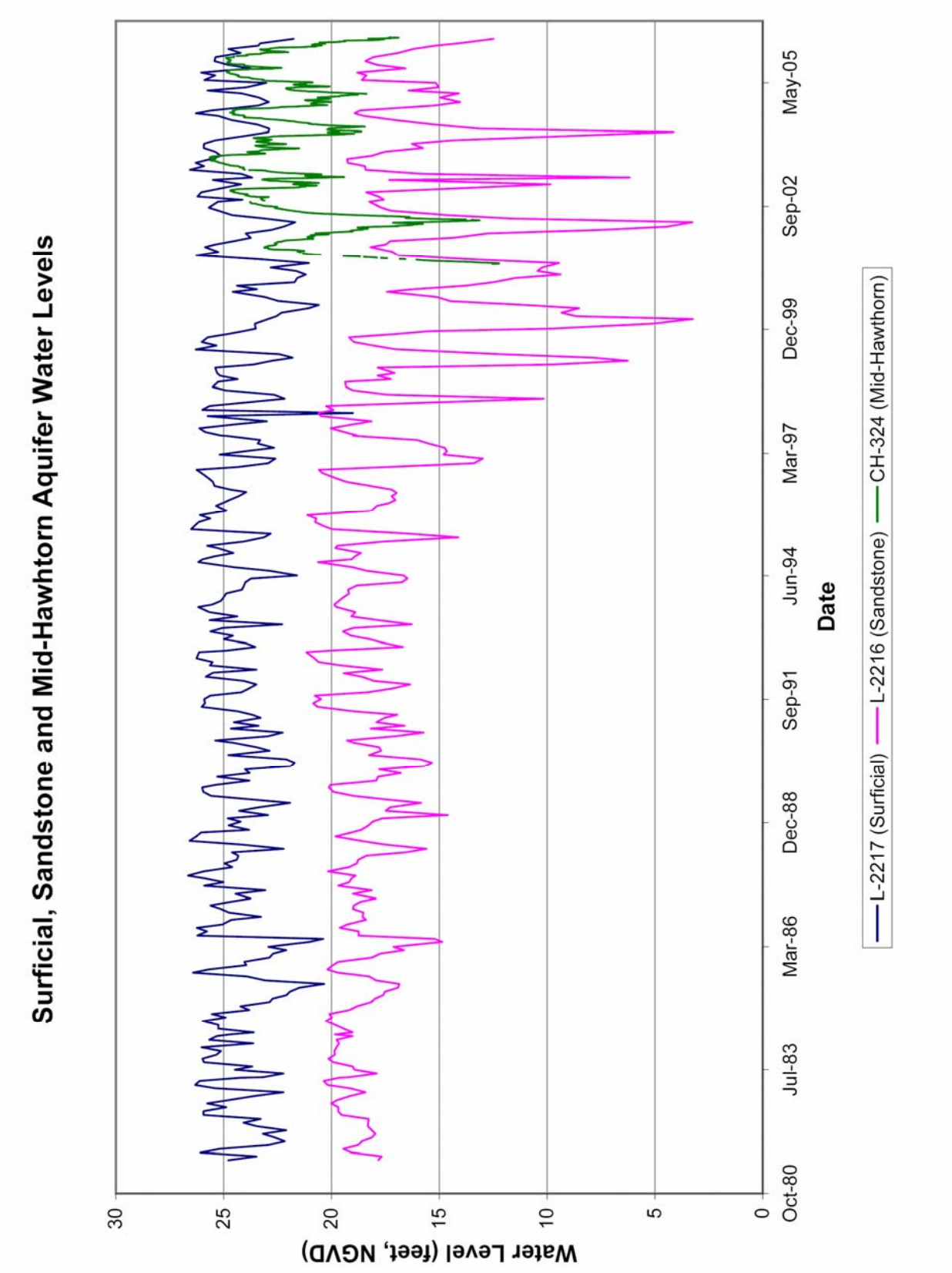

Figure 14-3: USGS wells L-2216, L-2217 and CH-324 hydrographs

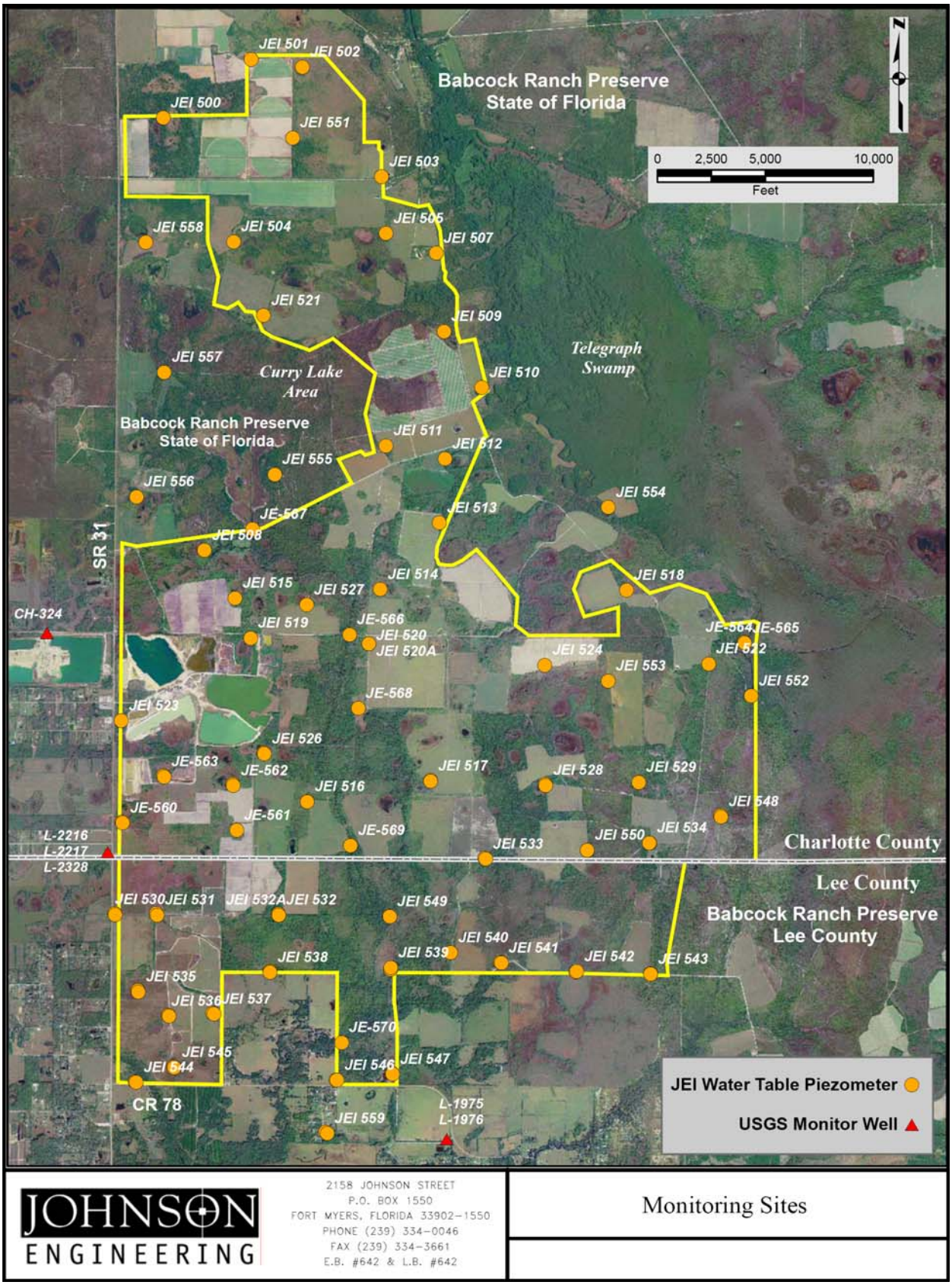

Figure 14-4: Monitor well locations

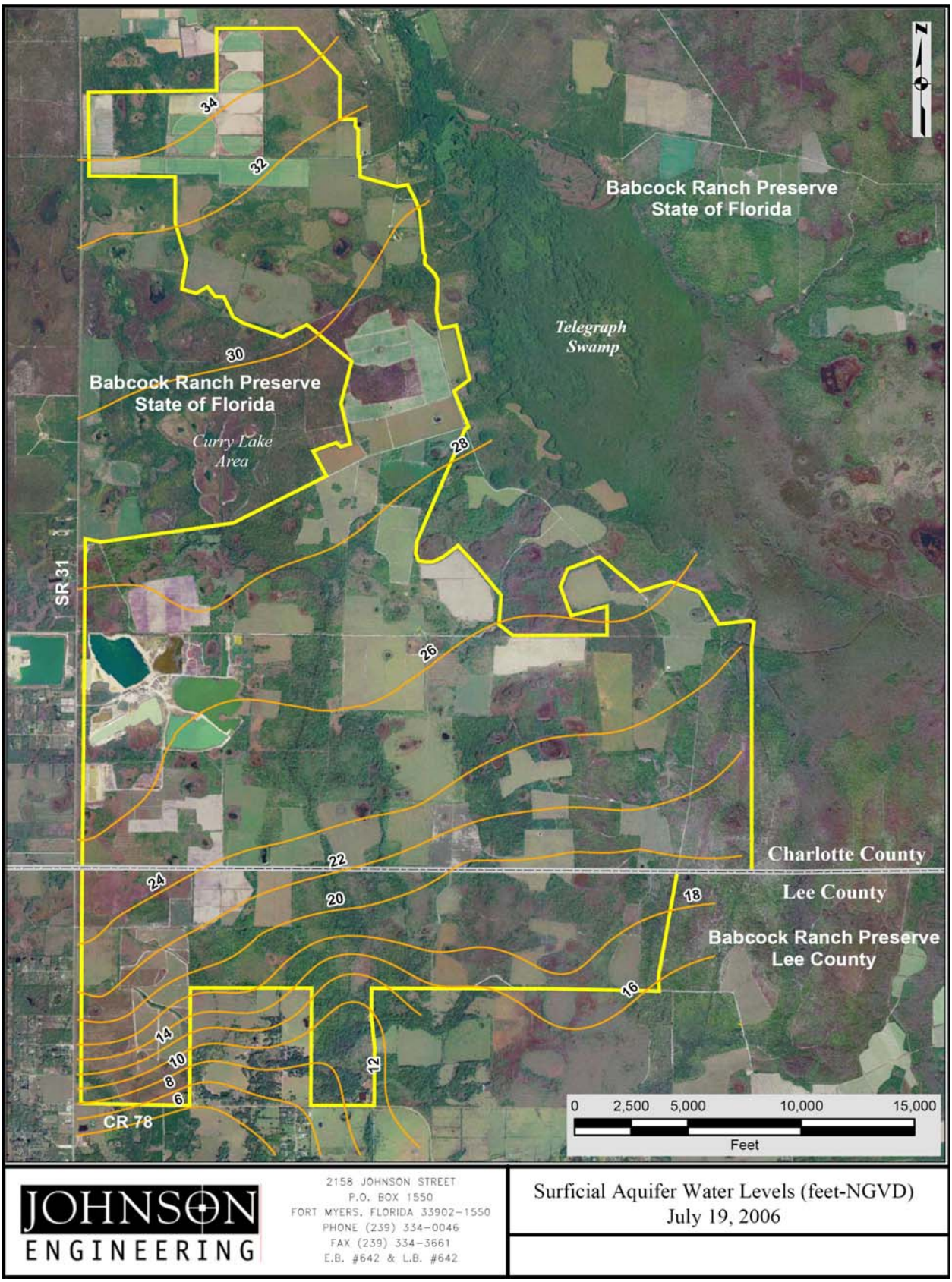

Figure 14-5: July 19, 2006 surficial aquifer water levels

In 2001, Johnson Engineering analyzed constant rate pump test data from three surficial aquifer wells (MW-2332, 2333 and 2334) located across the western portion of the Lee County Babcock Ranch Community site, and conducted constant rate pump tests on wells MW-3 and MW-6. The northernmost transmissivity value calculated at MW-2334 was 32,600 gpd/ft, and the southernmost value calculated at MW-2332 was 7,600 gpd/ft. Surficial aquifer transmissivity values generally decrease from north to south across the Babcock Ranch Community project site. Test data from MW-3 and MW-6 indicated transmissivity values of 33,100 and 38,800 gpd/ft, respectively, on the Charlotte County portion of the site. Storage coefficient values based on data from constant rate pump tests performed on MW-3, MW-6, MW-2332, MW-2333 and MW-2334 range from $1.7e^{-1}$ to $3.6e^{-4}$. Leakage values range from 26 to 180 feet.

The surficial aquifer is recharged directly from rainfall, and as a result, the water contained in this aquifer is fresh and of good quality. Following construction, water quality samples were collected from wells MW-3 and 6 after fully developing the well. MW-3 & 6 had chloride concentrations of 24 mg/l and 32 mg/l, respectively. These results are below the State secondary maximum contaminant levels for chloride concentration of 250 mg/l.

Rule 9J-5.003(1)(g)(77) of the Florida Administrative Code states, “Natural groundwater aquifer recharge areas” or “natural groundwater recharge areas” or “groundwater recharge areas” means areas contributing to or providing volumes of water which make a contribution to the storage or regional flow of an aquifer. Since the surficial aquifer within the Babcock Ranch Community is unconfined with a phreatic surface connected to atmospheric pressure, anywhere precipitation can fall on the land surface during the dry-season could be considered a groundwater recharge area by the above definition. What is important to note is that the storage is temporal due to natural uptake from vegetation, and the regional flow component within the surficial aquifer is very small compared to the other hydrologic inputs (rainfall) and outputs (runoff and evapotranspiration). This concept is clearly indicated by a water budget for the Babcock Ranch Community site.

Review of the SFWMD Lower West Coast Water Supply Plan Appendix B – Rainfall Analysis and National Climatic Data Center rainfall data indicates the Babcock Ranch Community receives approximately 53 inches of average annual rainfall. Approximately 40 inches is returned to the atmosphere annually through evapotranspiration (Florida Water Resources Atlas of Florida, 1985). Based upon long-term discharge records for nearby watersheds, approximately 12 inches of runoff is generated on an annual average leaving approximately only 1 inch available for net recharge to the surficial aquifer. This amount of recharge is considered low and does not warrant special protection.

The Lee County Babcock Ranch Community lands are not significant with respect to recharge of the surficial aquifer, although they carry the Density Reduction/Groundwater Recharge (DR/GR) designation. This area constitutes a discharge area due to the presence of some of the steepest regional natural slopes in Lee County. Land elevations slope from above 25 feet-NGVD at the Lee-Charlotte County line to below 10 feet-NGVD at the southern end of the Babcock Ranch Community. This slope of 7.5 feet per mile accounts for the creeks discharging from this area, including Owl Creek, Trout Creek, and Telegraph Creek and the general flow of water within the surficial aquifer to the south (Figure 14-5).

Once the site is developed, wet season and dry season water levels of the water table will be maintained through surface water management facilities. Through the use of best management practices such as water control structures and detention systems, predevelopment hydrology will be maintained for new development within the Babcock Ranch Community, as required by SFWMD rules and regulations. As discussed above, the Babcock Ranch Community site does not currently provide appreciable recharge to the surficial aquifer, as evidenced by the lack of a recharge component to the water budget, and the location's steep natural slopes and numerous streams. The creation of a storm water management system would enable the site to retain more surface water for a greater duration, enhancing the opportunity for infiltration into the surficial aquifer. The addition of fill to raise site elevations would also increase the storage capacity of the surficial aquifer by increasing the distance from land surface to the water table.

Sandstone Aquifer

The intermediate aquifer system includes all water-bearing units and confining units between the overlying surficial aquifer and the underlying Floridan aquifer systems. The Sandstone and Mid-Hawthorn aquifers compose the intermediate aquifer system at the project site. The water-bearing formations of the intermediate aquifer generally consist of quartz sand, shell, limestone, and dolostone. The intermediate aquifer system is approximately 350 feet thick at the project site.

The Sandstone aquifer is the first water bearing unit encountered in the intermediate aquifer system. This aquifer underlies the upper hawthorn confining unit separating the surficial aquifer system from the intermediate aquifer system. Johnson Engineering conducted an aquifer testing program that included the Sandstone aquifer at the project site in 2001. This investigation revealed that the top of the Sandstone aquifer varies from approximately 160 feet below land surface (bls) near the northern limit of the project site to 80 feet bls at the southern limit. The aquifer consists of sandstone, shell, and hard to marly weathered limerock separated from the overlying surficial aquifer by up to 80 feet of soft to stiff white, green and grey clay. Up to 60 feet of clay and marl separate the Sandstone aquifer from the underlying Mid-Hawthorn aquifer.

Data recorded by USGS monitor well L-2216, located on SR-31 at the western project boundary show water table levels have ranged between 3.24 and 21.16 feet, NGVD for the period of record from 1981 to 2006. Water levels averaged 17 feet NGVD from 1980 to 1997 and approximately 15 feet NGVD from 1997 to 2006 (Figure 14-3). Water level data collected at L-1975, located 0.6 miles south of the project site, show water levels ranging between 4.17 and 16.57 feet, NGVD for the same period of record. Water levels averaged 13 feet NGVD from 1980 to 1994 and 11 feet NGVD from 1997 to 2006 (Figure 14-6).These water levels reflect historical irrigation and domestic supply withdrawals in the area.

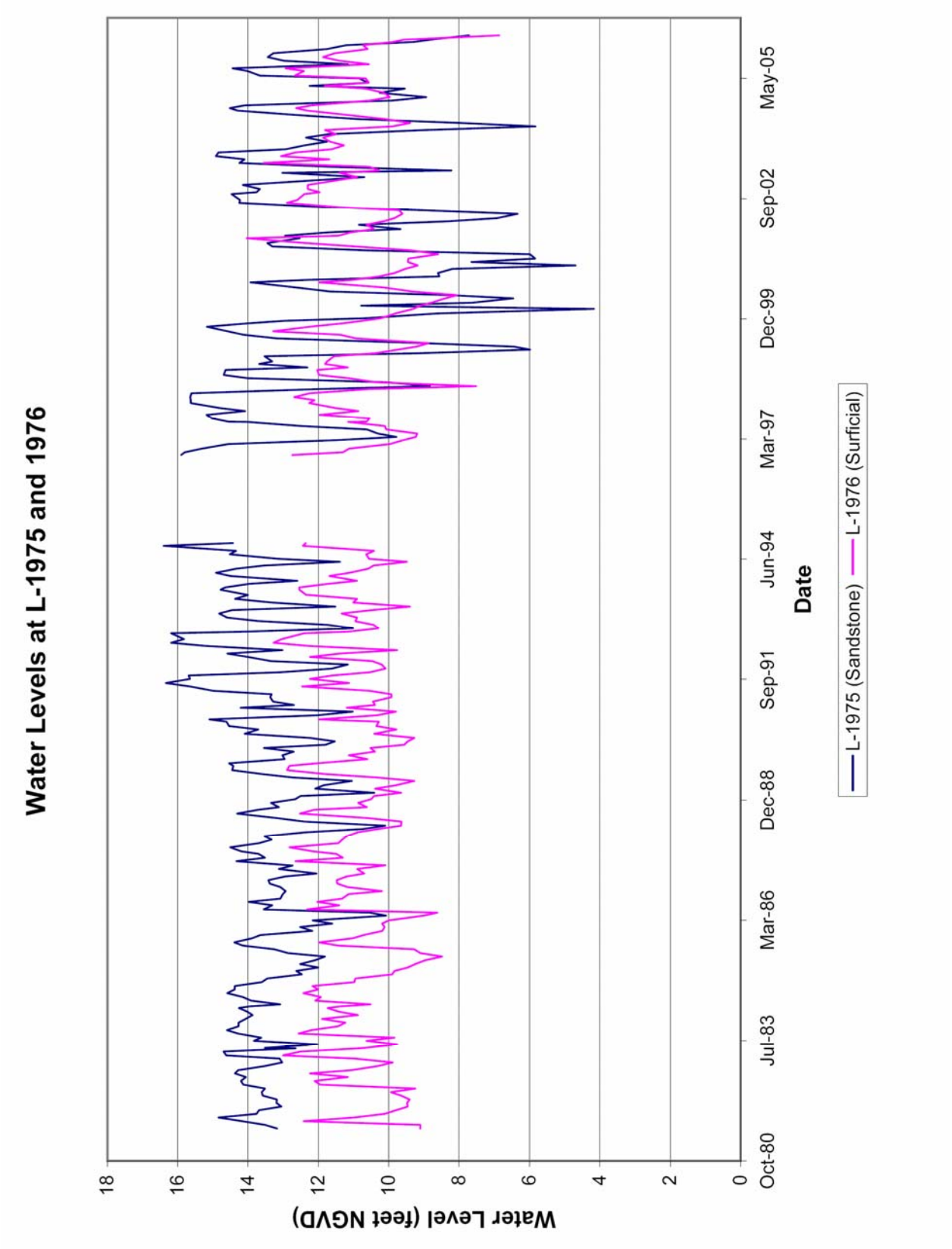

Figure 14-6: USGS wells L-1975 and L-1976 hydrographs

In 2001, Johnson Engineering analyzed specific capacity and constant rate pump testing data from four Sandstone aquifer wells located on or south of the county line within 4 miles east of SR 31. Transmissivity values at this location ranged from 81,525 to 93,725 gpd/ft, based on constant rate pump testing performed on a test production well with two observation wells. Specific capacity testing at MW-4 and MW-8, located near the Ranch headquarters and EarthSource Mine, respectively, reported estimated transmissivity values of 20,420 and 122,100 gpd/ft. A constant rate pump test conducted at MW-8 produced a transmissivity value of 192,340 gpd/ft and a storage coefficient of $2.45e^{-4}$. Constant rate pump testing performed on a Sandstone aquifer well located on the Lee County portion of the project reported storage coefficient values of $1.04e^{-4}$ to $2.05e^{-4}$, and leakance values ranging from 0.0006 to 0.00083 gpd/ft^3.

Water quality samples obtained from MW-4, 8 and 12 had chloride concentrations of 110 mg/l, 127 mg/l, and 133 mg/l, respectively. These results fall below the State secondary maximum contaminant levels for chloride concentration of 250 mg/l. The sandstone aquifer is recharged by leakage from both the overlying surficial aquifer and the underlying Mid-Hawthorn aquifer and contains fresh water of excellent quality.

The Sandstone aquifer does not out-crop on or near the project site, minimizing the potential for direct recharge. The only substantial Sandstone aquifer recharge areas in the vicinity of the project are those areas surrounding major water-table or Sandstone aquifer wellfields, where recharge is induced rather than naturally occurring. In Lee County, these areas are defined by Wellfield Protection Zones and are protected by the Lee County Wellfield Protection Ordinance. The recharge areas for Lee County's existing and proposed wellfields are neither part of nor proximate to the Babcock Ranch Community. No part of the Babcock Ranch Community lies within the Lee County Wellfield Protection Zones specified in the Lee County Wellfield Protection Ordinance.

Water level data indicate that the hydraulic gradient between the surficial and Sandstone aquifers changes across the project site, with a small component of recharge occurring in the most northerly portion and discharge dominating to the south. The annual water budget for the surficial aquifer discussed above shows that less than one inch of water remains for recharge to both the surficial and Sandstone aquifers combined, after accounting for naturally occurring ET and runoff losses. Given the limitations of the water budget and the hydraulic gradient across the site, this area does not represent an area of significant recharge for either the surficial or Sandstone aquifer.

Constant rate pump testing performed on a Sandstone aquifer well located on the Lee County portion of the project reported leakance values ranging from 0.0006 to 0.00083 gpd/ft^3, which are relatively low values that further minimize the potential for substantial recharge. Based on these leakance values, the Sandstone aquifer may receive 0.9 inches of annual recharge from the surficial aquifer at most. However, the confinement between the surficial aquifer and Sandstone aquifer is much greater than that between the Sandstone aquifer and the underlying Mid-Hawthorn aquifer, as shown by lithologic logs from test wells constructed at the Babcock Ranch Community site. Additionally, chloride concentrations in the Sandstone aquifer would be closer to those of the surficial aquifer if most of the recharge originated from the fresher surface water. Finally, Mid-Hawthorn aquifer water levels measured at CH-324, located 0.65 miles west of the Babcock Ranch Community and 2 miles north of L-2216, constantly exceed, but closely imitate, those of the Sandstone aquifer (Figure 14-3). This water level data suggests

good hydraulic connection between the two aquifers and an upward recharge component from the Mid-Hawthorn to the Sandstone aquifer.

Mid-Hawthorn Aquifer

The Mid-Hawthorn aquifer underlies the Mid-Hawthorn confining zone within the Intermediate Aquifer System. Interbedded weathered limestone, marl and clay characterize this aquifer. It is a relatively thin aquifer, and due to the abundance of the low permeability layers, not highly productive. This aquifer generally occurs at depths between 300 and 400 feet bls, although the thickness varies across the project site.

No site specific data exists for the Mid-Hawthorn aquifer. Water level data from the closest Mid-Hawthorn aquifer well, USGS well CH-324, ranged from approximately 3 to 21 feet NGVD for the period of record from 1980 to 2006 (Figure 14-3). Due to the lack of productivity, few uses of the Mid-Hawthorn aquifer exist near the project site.

The Mid-Hawthorn aquifer does not outcrop on or near the project site, precluding the possibility of direct rainfall recharge. Mid-Hawthorn aquifer water levels typically exceed those of the overlying Sandstone aquifer, thereby minimizing the potential for recharge from above. However, Floridan aquifer water levels exceed those of the Mid-Hawthorn, which indicates that the Mid-Hawthorn aquifer receives recharge from the deeper, brackish aquifer.

Floridan Aquifer

The Floridan aquifer system underlies all of Florida and contains several distinct producing zones. However, since the water quality generally deteriorates with depth, only the top of the Floridan aquifer system was explored at the project site. This system generally consists of a porous, fractured, and faulted limestone and dolostone formation, the top of which is under artesian conditions in this area. The Lower-Hawthorn aquifer is the first water bearing unit encountered in the Floridan aquifer system. The top of the aquifer occurs at approximately 500 feet bls at the project site. This aquifer underlies the lower hawthorn confining unit separating the intermediate aquifer system from the Floridan aquifer system. The aquifer consists of porous limestone and dolostone formations, with some interbedded marl present in the uppermost Lower Hawthorn unit. Approximately 50 to 100 feet of interbedded marl, clay and limestone stringers separate the Lower Hawthorn from the overlying Mid-Hawthorn aquifer. The aquifer generally displays greater productivity in the northern portion of the project site located in Charlotte County, as well as fresher water quality.

Data recorded by USGS monitor well L-2328, west of the project at SR-31, show Floridan aquifer water levels have ranged between 46.1 and 54.7 feet-NGVD for the period of reco rd from 1984 to 2006. Water level data collected at ROMP-5, located 6.4 miles northwest of the project site, show water levels ranging between 47.4 and 52.4 feet-NGVD for the period of record from 2001 to 2006 (Figure 14-7). These water levels reflect historical withdrawals in the area. Monitor data from ROMP-5 show that the Lower Hawthorn aquifer and Suwannee aquifer are hydraulically connected.

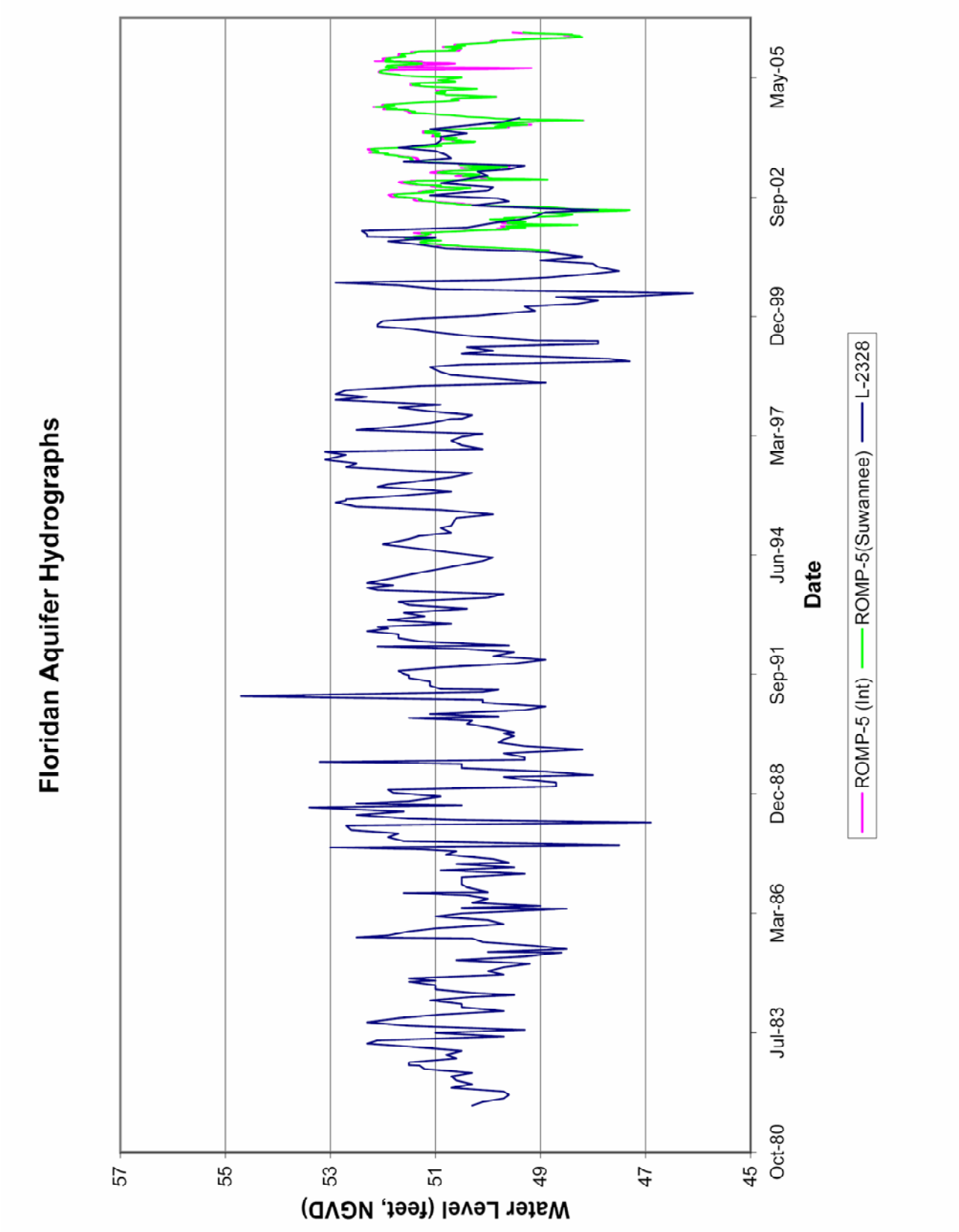

Figure 14-7: Hydrographs from Floridan aquifer wells

In 2006, Johnson Engineering performed constant rate 72-hour aquifer performance tests (APTs) on wells MW-5 and MW-10. Results from the APT data analyses indicate that the Floridan aquifer has an approximate transmissivity of 1,500 ft^2/day at the project site. Aquifer parameter values have also been reported in publications based on the field testing conducted in the area, including at ROMP 5, the North Lee County Water Treatment Plant, the Florida Power and Light power plant site, and the North Reservoir ASR site. Based on this testing, storage coefficient values ranged from 0.001 to $3.1e^{-4}$; and leakance values ranged from 0.0024 to $7.33e^{-4}$/day (Table 14-1).

Site Name	Latitude	Longitude	Top (ft. bls)	Bottom (ft. bls)	T (ft^2/day)	S	L (1/day)	Q (gpm)	SC (gpm/ft)
ROMP 5	26 56 44	81 48 29	450	600	2,970	-	0.002	930	49
NLCWTP	26 43 45	81 47 30	478	700	9,960	0.00031	0.0024	788	6
FPL	26 41 44	81 46 50	470	935	10,840	0.001	-	240	38
North Res ASR	26 42 39	81 50 18	540	642	8,290	0.000327	0.000733	379	-

Table 14-1: Floridan aquifer hydraulic parameters from selected test data

The Floridan aquifer has reported chloride concentrations of approximately 280 mg/L approximately two miles north of the county line, based on data collected from a 720-foot deep test well in 2001. USGS well L-2328, which has an open hole interval from 300 to 600 feet bls has reported chloride concentrations ranging from 1,040 to 1,180 mg/l. Water quality generally becomes fresher heading north across the Babcock Ranch Community site.

Water samples were collected on April 30, 2001 from MW-10 while drilling out the open interval using water as the drilling fluid. Three samples were collected at 580 feet, 660 feet and 720 feet. At each depth, the formation was allowed to flow to obtain a native water sample. The chloride concentrations for these samples averaged 213 mg/l. MW-10 was sampled again on May 1 and 10, 2001 after the well was allowed to flow. These water samples represent a mixture of formation water from the entire open interval. The chloride concentrations from these samples were 273 mg/l and 277 mg/l, respectively. During APT testing in 2006, Johnson Engineering re-sampled wells MW-5 and MW-10 for chloride concentrations. The results showed concentrations of 72 mg/L for MW-5 and 229 mg/L for MW-10.

The South Florida Water Management District (SFWMD) has not designated any high or prime aquifer recharge areas for any aquifers within the Babcock Ranch Community. The Babcock Ranch Community acts as a discharge area for the Floridan Aquifer System, as wells constructed in this aquifer flow naturally at land surface across the project site. Water levels within the Lower Hawthorn/Upper Floridan Aquifer are at an approximate elevation of 50 ft-NGVD (approximately 20 feet above land surface), allowing wells completed in that aquifer to free-flow at land surface. The Floridan aquifer does not outcrop on or near the project site, precluding the possibility of direct rainfall recharge. Floridan aquifer water levels exceed those of all overlying shallower aquifers across the site, which means the Floridan aquifer provides, rather than receives, recharge to these aquifers.

B. Describe, in terms of appropriate water quality parameters, the existing ground and surface water quality conditions on and abutting the site. (The appropriate parameters and methodology should be agreed to by the regional planning council and other reviewing agencies at the preapplication conference state.)

Surface Water Monitoring

The historic and existing drainage patterns will be reviewed based on the same aerial base as described in the comments above on Wetlands Methodology, which will be provided for the entire Ranch. A narrative explanation of the historic, existing and post construction conditions will be provided.

Stormwater Management: Water Quality Monitoring Program

The data and information collected will be used to produce maps showing watershed divides, conveyance courses, control structures, storage areas, and flow direction in addition to the elevations shown on the topographic map for the Ranch. Cross sections for the conveyances within the Babcock Ranch Community will be shown in graphical form in a variety of typical locations. Detailed sections will be provided in the computer models for the backwater profiles.

Baseline water quality will be provided at 15 locations across the Ranch. The sites are focused on the Babcock Ranch Community, but will also include each of the major streams that are on the Ranch. A map depicting the water quality location sampling sites is provided as Attachment 3 of this Environmental Methodology Supplement. Each location will have the following items tested on a monthly basis from grab samples:

Total nitrogen
Nitrate
Total Kjeldahl nitrogen (TKN)
Ortho phosphorous
Specific conductance
Dissolved oxygen
Turbidity
Chlorophyll-a
Nitrite
Ammonia
Total phosphorous
pH
Salinity
Temperature
Total suspended solids

Water samples collected along the perimeter will be tested for pesticides on a quarterly basis, and sediment samples will be tested annually. Enterococci, and fecal coliform will also be tested quarterly. The pesticides, enterococci, and fecal coliform will be sampled at three locations. These will be the inflow along SR 31 to Telegraph Creek, its outflow location at the south end of the Ranch, and the outflow location of Trout Creek at the south end of the Ranch.

Flows will also be measured at the 15 water quality sample locations in conjunction with the wet chemistry and biological sampling. This will be performed utilizing standard Price Open Cup rotating flow meters and by determining cross sectional flowing areas at each location for each event, and utilizing flow measuring methodologies and techniques acceptable to SFWMD criteria for flow measurements, or other suitable techniques adapted to unique field conditions and deemed acceptable by the engineer of record. Summaries of the flow and sampling events will be provided as requested, following appropriate quality assurance procedures.

All testing will be evaluated annually. The list of pesticides will be reduced to those found in the previous year's sampling and those currently being used on the site. The review agencies will be able to audit the field sampling to assure that the methodologies and protocols are being followed.

Fish and Aquatic Macroinvertebrate Sampling

Fifteen (15) sites within the Ranch will be sampled for fish and aquatic macroinvertebrates. The sampling locations include the major flow-ways leading into and out of the property and were located to include upstream, mid-stream, and outfall locations of the Ranch flow-ways. Each site will be sampled once during each sampling period when standing water is present in order to establish a representative baseline of resident fauna. Sampling periods are defined as July-August, October-November, and January-February. This sampling regime is based on the baseline aquatic fauna assessments currently being conducted for the Picayune Strand Restoration Project (PSRP). The PSRP is a Comprehensive Everglades Restoration Project (CERP) and also part of the State of Florida ACCELER-8 project (Ceilley et al. 2005).

Methods: Fish

Trained biologists will conduct sampling for freshwater fish. Fish will be sampled in July - August, October - November, and January – February to determine species presence/absence, relative abundance, size, approximate age, and plant community associations. Samples will be collected from major plant communities in the vicinity of each monitoring site when water is present. Ten (10) clear plastic Breder traps will be placed in those study sites flooded to a sufficient depth to permit effective sampling. Fish traps will be placed in a stratified manor throughout the circular plot to sample all available microhabitats and to maximize capture efficiency (Ceilley et al. 2005) Fish (10 Breder traps) and invertebrate sampling (20 samples) will be divided proportionally among vegetation/habitat zones present (Lane et al. 2003. Bob Rutter, personal communication).

Submergence time for the Breder traps will be one hour. All fish collected will be identified. Dip net sweeps, as described below for the aquatic macro-invertebrates, will also be utilized. Dip net samples of fish will be recorded separately along with their relative abundance at each site. Any species of fish that cannot be field identified will be preserved and returned to the laboratory for positive identification. In addition, several voucher specimens of each fish species will be preserved in formalin. An experienced fisheries biologist will be consulted with for these identifications and for the preparation of voucher specimens.

Methods: Aquatic Macroinvertebrates

Biologists will sample invertebrates with a 30-mesh D-frame dip-net which is an effective sampling method for wetland macroinvertebrates (Cheal et al. 1993, Rader and Richardson 1994, Stansly et al. 1997). Sampling will continue until the peak (asymptote) of the taxa accumulation curve is reached or no additional taxa are observed in replicate dip net samples for approximately 10 minutes. This typically requires about one hour of intensive sampling by a trained and experienced biologist in all major habitats within the wetland. Samples will be field-sorted using forceps, eyedroppers and sorting pans along with hand picking of natural substrates. Not all individuals of an abundant species will be collected for preservation; however; each species observed in the pan will be collected in proportion to its relative abundance in the field. This allows for calculation of biometric scoring and some statistical analyses that are useful in comparative wetland studies. Sorted field samples are

preserved in 80% ethanol, and delivered to the taxonomic expert at Florida Gulf Coast University (FGCU) for identification and preparation of voucher specimens.

Groundwater Monitoring

Ground water monitoring will be performed using 28 wells in the surficial aquifer. The parameters measured will include pH, conductance, temperature, dissolved oxygen, BOD, color, sulfate, chloride, totaled dissolved solids, nitrate, ammonia, water table elevation. Samples will be collected from the wells and analyzed semi-annually and reported annually.

Johnson Engineering collected water quality samples from all the test wells constructed in 2001 and re-sampled selected wells in 2006. As described below, some water samples were collected during drilling in order to assess water quality from a discreet zone, while other wells were sampled following development to obtain an average water quality from the open-hole interval. Additionally, Johnson Engineering collected water quality samples from dozens of existing wells located throughout the project site during 2006. All water quality samples were analyzed for chloride concentrations. These existing, primarily agricultural wells, generally tap the surficial aquifer, although some are constructed in the Sandstone, or less commonly, Lower Hawthorn aquifers (Figure 14-8).

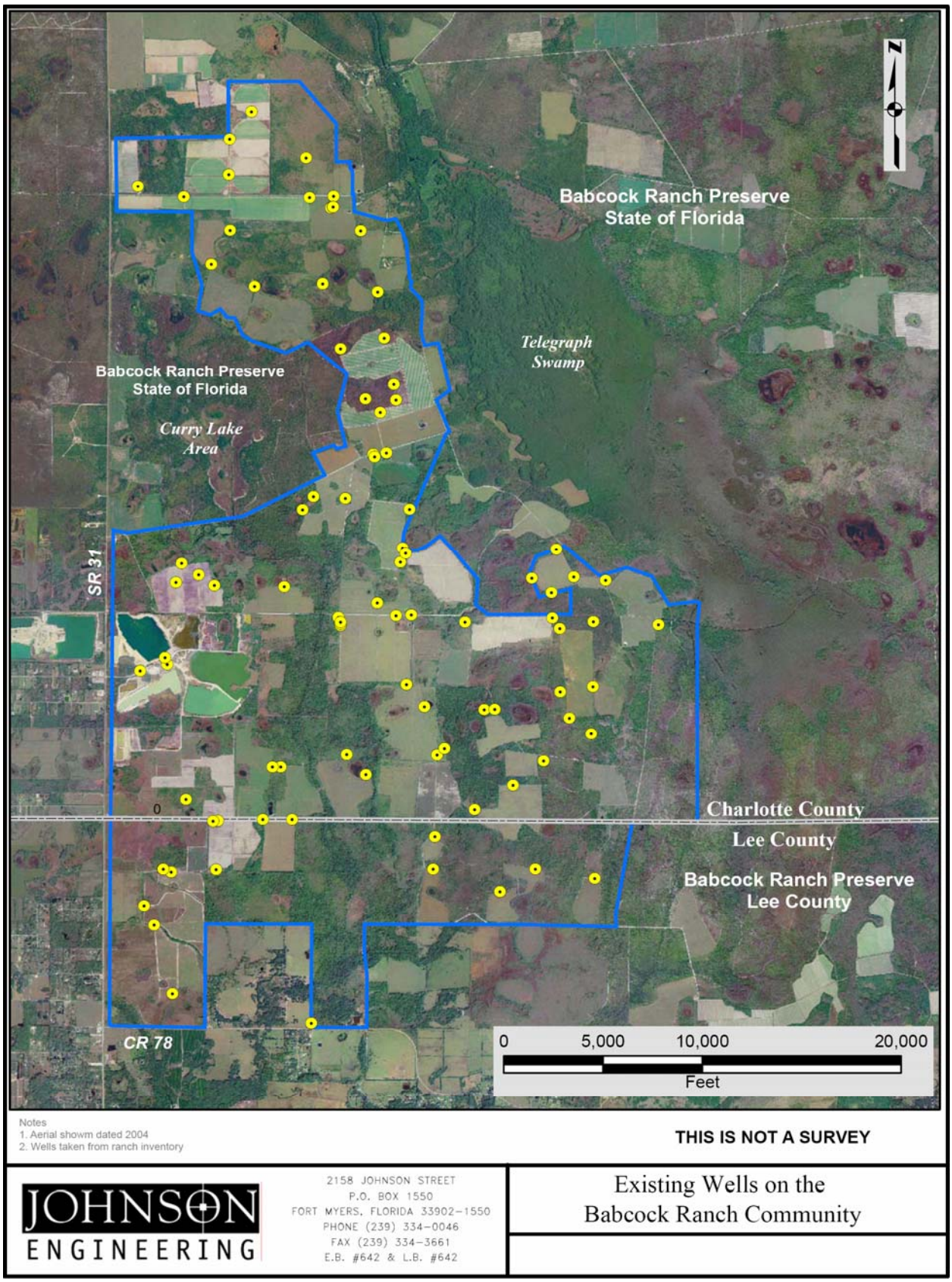

Figure 14-8: Existing wells on Babcock Ranch Community site

The surficial aquifer is recharged directly from rainfall, and as a result, the water contained in this aquifer is fresh and of good quality. Following construction, water quality samples were collected from wells MW-3 and 6 after fully developing the wells. MW-3 & 6 had chloride concentrations of 24 mg/l and 32 mg/l, respectively. Chloride concentrations from existing agricultural wells ranged from 14 to 95 mg/l. These results are below the State secondary maximum contaminant levels for chloride concentration of 250 mg/l. See Table 14-2 for a listing of chloride data by aquifer.

The Sandstone aquifer receives minor amounts of recharge from the surficial aquifer and more predominantly from the deeper, more saline Mid-Hawthorn aquifer. As a result Sandstone aquifer chloride concentrations typically exceed those of the surficial aquifer, but remain fresher than those of the Floridan aquifer. Water quality samples obtained from MW-4, 8 and 12 in 2001 had chloride concentrations of 110 mg/l, 127 mg/l, and 133 mg/l, respectively. Existing agricultural wells reported chloride concentrations of 94 to 233 mg/l. These results are below the State secondary maximum contaminant levels for chloride concentration of 250 mg/l.

Water quality data collected from Floridan aquifer wells at the project site in 2001 and in the immediate vicinity reported chloride concentrations ranging from 100 to over 1,000 milligrams per liter (mg/l). Water quality in this aquifer system generally deteriorates with depth and generally becomes fresher heading north across the project site.

Well MW-10, located approximately 1.5 miles north of the Lee-Charlotte County line and 2.25 miles east of SR-31, has consistently reported chloride concentrations greater than 200 mg/l. Water samples were collected on April 30, 2001 from MW-10 while drilling out the open interval using water as the drilling fluid. Three samples were collected at 580 feet, 660 feet and 720 feet. At each depth, the formation was allowed to flow to obtain a native water sample. The chloride concentrations for these samples averaged 213 mg/l. MW-10 was sampled again on May 1 and 10, 2001 after the well was allowed to flow. These water samples represent a mixture of formation water from the entire open interval. The chloride concentrations from these samples were 273 mg/l and 277 mg/l, respectively. During aquifer performance testing in 2004, the well had a measured chloride concentration of 229 mg/L.

Water quality samples collected at MW-5 in the northern area of the project site, north of Tucker's Grade and approximately two miles east of SR-31, reported chloride concentrations below 150 mg/l for the interval from 463 to 720 feet bls. Water samples were collected on February 2 and 3, 2001 at intervals of approximately 40 feet during reverse-air drilling operations on MW-5, in order to provide a generalized profile of water quality changes with respect to depth. Chloride concentrations ranged from 71 to 121 mg/l, generally increasing with depth. MW-5 was sampled again on February 3 and May 9, 2001 after allowing the well to flow. The resulting chloride concentrations were 76 and 71 mg/l, respectively, and represent a mixture of formation water from the entire open interval. Water samples obtained during aquifer performance testing in 2006 reported concentrations of 72 mg/L. Water quality typically deteriorates with depth within this aquifer, which generally contains water with chloride concentrations exceeding 600 mg/l. However, at this well location, water quality has remained below the State chloride concentration standards of 250 mg/l.

Other wells in the general area have reported higher chloride concentrations. USGS well L-2328, which has an open hole interval from 300 to 600 feet bls has reported chloride concentrations ranging from 1,040 to 1,180 mg/L. Water level data from ROMP-5, with monitoring intervals from 440 to 600 feet bls (labeled as the Intermediate zone in SWFWMD publications) and 720-970 feet bls (Suwannee), show that the Lower Hawthorn aquifer is

hydraulically connected with the Suwannee, which typically contains higher chloride concentrations.

Well	Chloride Concentration (mg/l)
Surficial Aquifer	
MW-3	24
MW-6	32
Existing agricultural wells	14-95
Sandstone Aquifer	
MW-4	110
MW-8	127
MW-12	133
Existing agricultural wells	94-233
Floridan Aquifer	
MW-5 (depth profile during drilling)	71-121
MW-5 (Feb. 3 & May 9, 2001)	76 & 71
MW-10 (average during drilling)	213
MW-10 (May 1 & May 10, 2001)	273 & 277

Table 14-2: Table of chloride data by aquifer

C. Describe the measures which will be used to mitigate (or avoid where possible) potential adverse effects upon ground and surface water quality, including any resources identified in Subquestion A.

A storm water pollution prevention plan will be established and implemented to be proactive with water quality of the site. Potential adverse effects upon ground and surface water quality will be mitigated by using specially selected Best Management Practices (BMPs) during and after site construction. During construction special attention will be given to the minimization of soil erosion to protect the site's vegetated areas whether upland or wetland. The following will be implemented during planning and construction at the Babcock Ranch Community and include: avoiding the generation of pollutants, reducing and redirecting pollutants and capturing and treating pollutants. Both nonstructural and structural BMPs will be implemented.

Nonstructural BMPs will include conservation, recycling and source controls, maintenance and operational procedures, education and outreach programs. Some these will come from the onsite research center. Conservation measures will include minimal lawn irrigation, adoption of xeriscape landscape principals, installation of low volume sprinklers, implementation of leak detection programs and public education. Source control measures include erosion and sediment controls during construction, collection and proper disposal of solid, yard and animal wastes, proper collection, disposal and recycling of toxic wastes and petroleum products, modified use of fertilizers as agreed in one or more documents, herbicides and pesticides and the safe storage, handling and disposal of hazardous household wastes. Maintenance and operational procedures that will be implemented include turf and landscape management, street cleaning, catch basin cleaning, road maintenance and storm water detention maintenance.

Structural BMPs for controlling potential pollutants within stormwater run-off will include two main mechanisms, retention systems and detention systems. Retention systems rely on absorption, biological activity and filtration to remove pollutants. Retention BMPs include dry retention basins, exfiltration trenches, concrete grid pavers, vegetated filter strips and grassed swales. Detention systems include dry and wet detention ponds and wetlands. Systems that will be used in conjunction with wet and dry retention systems include water quality inlets that provide for settling of solids before discharge into the stormwater sewer system. In addition, other devices such as sediment basins will be used for pretreatment by separating heavy grit and floating debris from the run-off prior to discharge.

To preclude the direct discharge of sediment and other possible pollutants into the ground water system, the applicant will grout all existing agricultural wells, other than those intended for future use, to land surface as required by SFWMD. And, as necessary in those areas of the site utilized for public water supply withdrawals, the applicant will follow applicable wellfield protection practices as detailed in the Lee County Wellfield Ordinance and the Charlotte County Wellfield Ordinance.

List of Terms

Alternative Water Supply:	By SFWMD definition, a supply of water that has been reclaimed after one or more public supply, municipal, industrial, commercial or agricultural uses, or a supply of stormwater, or brackish or salt water, that has been treated in accordance with applicable rules and standards sufficient to supply the intended use.
Aquifer Storage and Recovery (ASR):	Projects involving approved Class V injection wells for the injection and recovery of fresh water into a ground water reservoir.
Blaney-Criddle Model:	Equation used by the SFWMD to determine supplemental irrigation needs of a project based on, among other things, rainfall, hours of daylight, average monthly temperature, soil characteristics, crop type, and irrigation method.
Confining Unit/Confinement:	A body of significantly less permeable material than the aquifer, or aquifers, that it stratigraphically separates.
Evapotranspiration:	The total loss of water to the atmosphere by evaporation from land and water surfaces and by transpiration from plants.
Hydraulic Conductivity (K):	A measure of the ease with which a porous medium, such as an aquifer, can transmit a fluid, such as water.
Hydraulic Gradient:	Change in head (water level) with change in distance.
Leakance (L or leakage = B):	Represents the vertical movement of water from one aquifer to another across a confining zone due to differences in hydraulic head.
Reclaimed Water:	Water that has received at least secondary treatment and is reused after flowing out of a wastewater treatment facility (reclaimed water used in the BRC will have tertiary treatment).
Runoff:	That component of rainfall not absorbed by soil, intercepted and stored by surface water bodies, evaporated to the atmosphere, transpired and stored by plants, or infiltrated to ground water, but which flows to a watercourse as surface water flow.
Storage Coefficient (S):	Coefficient describing the volume of water an aquifer can release per unit change in head.
Specific Capacity:	Describes productivity of a well = pumping rate/drawdown.
Transmissivity (T):	Rate at which an aquifer can transmit water under a unit hydraulic gradient per unit width of aquifer. Transmissivity (T) = Hydraulic Conductivity (K) x Aquifer Thickness (b).
Upconing:	Upward migration of saline water as a result of pressure variation caused by withdrawal of groundwater from a well.