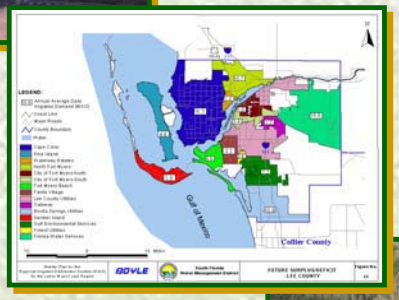
Feasibility Study for the Regional Irrigation Distribution System (RIDS) Sub-Region 2 For the Lower West Coast Region Project C-12368

South Florida Water Management District



December 2004

BOYLE

Master Plan for the
Regional Irrigation Distribution System (RIDS)
Sub-Region 2
For the Lower West Coast Region
Project C-12368

South Florida Water Management District
(SFWMD)

December 2004

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EXECUTIVE SUMMARY

The objective of the Regional Irrigation Distribution System (RIDS) Feasibility Study for the Lower West Coast Region is to develop the preliminary design information for the preferred alternative to supply enough water to meet all or a portion of the projected (year 2020) urban irrigation demand associated with Subregion I. Although the area has been progressive in developing alternative supply sources including reclaimed water, these sources will not be adequate to meet future demands. Also, because utilities in this subregion have their own discrete infrastructure, there has been no optimization of the resource on a regional basis.

The RIDS project was one of the recommendations identified in the District's *Lower West Coast Water Supply Plan* (Water Supply Plan) completed in April 2000. The Water Supply Plan recommended the RIDS to evaluate the "feasibility of constructing regional irrigation water distribution system(s) and other options to meet the growing urban irrigation demands of this area".

The RIDS Master Plan was completed in 2002. The Master Plan study area comprised the coastal area (western portion) of the Lower West Coast Region. It included the service areas of the Cities of Cape Coral, Fort Myers, and Naples, and the franchise areas for Lee County Utilities, Collier County Utilities, Florida Water Services, Gulf Environmental Services, and Bonita Springs Utilities.

The completion of the RIDS Master Plan resulted in the recommendation to develop a feasibility report for each sub-region to enhance the existing information, refine the recommended projects, provide more detailed cost estimates and develop basis of design information.

This feasibility study covers the Cape Coral / North Fort Myers area.

To determine the amount of water from alternative sources that will be necessary for future urban irrigation water, an evaluation of water demands was performed. The demand analysis was determined on a temporal basis. The current average demand for this subregion is approximately 23.4 MGD. Urban irrigation demand for the Year 2020 was projected at 74.2 MGD. Currently, the stakeholder utilities provide 6.2 MGD of reclaimed water for urban irrigation to this sub-region.

Alternative sources of supply were determined to address the urban irrigation demands. Additional allocations from resources that are currently stretched, such as groundwater, will be minimized. Therefore, an inventory of potential sources of supply was conducted and prioritized to address future irrigation water needs in the study area. These potential sources of supply are:

- Reclaimed wastewater from municipal wastewater treatment plants
- Water recovered during the dry season from reclaimed water aquifer storage and recovery (ASR) systems recharged during the wet season
- Surface water from streams, rivers, abandoned borrow pits, and canal systems having salinity control structures
- Water recovered during the dry season from surface water ASR systems recharged during the wet season
- Groundwater withdrawal adjacent to surface water sources such as mining pits

These sources provided a total future flow of 55.5 MGD to offset potable water demands and future groundwater withdrawals.

In order to develop a preliminary cost estimate associated with the projects, various potential projects were analyzed on a subregional basis. The costs consider the cost of financing the initial project capital costs, including assumptions about potential grant funding, and annual operations and maintenance expenses. These costs are then divided by the expected production of irrigation water resources for the identified projects to determine the unit cost of the irrigation water resources for each subregion. In order to calculate the cost per gallon, it was assumed that the total annual production of each project would be approximately equal to 180 days of production based on the project capacity measured on an average daily basis. The unit costs for the development of the irrigation water resources as identified herein range from $1.06 to $4.28 per one thousand gallons depending on the project.

It was determined that the preferred alternative is eligible for several different funding options including:

- EPA Grants - $2M/Year
- District Grants - $1M/Year
- Governor's Program Grants - $500K/Year
- SRF Loan - Balance of Capital

It was determined through consensus that individual interlocal agreements on a project-by-project basis, rather than focusing on the RIDS projects as a whole (i.e., Authority or regional utility), would be utilized as an institutional framework.

Implementation of the RIDS will require additional phases to design, finance and construct the improvements. Assuming Phase 1 included the Master Plan and Phase 2 includes the Feasibility Study, subsequent phases include the following:

- **Phase 3 Engineering Design –** Includes design, permitting and bidding of projects.
- **Phase 4 Construction –** Construction and startup of projects.

INTRODUCTION

The objective of the Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region is to develop a program to supply enough water to meet the projected (year 2020) urban irrigation demand for future growth in Lee and Collier counties. Although the area has been progressive in developing alternative supply sources including reclaimed water, these sources will not be adequate to meet future demands. Also, because many of the utilities in the service area have their own discrete infrastructure, there has been no optimization of the resource on a regional basis. Therefore, it was determined by the South Florida Water Management District (District) that a master plan was required to evaluate these needs.

The RIDS project was one of the recommendations identified in the District's *Lower West Coast Water Supply Plan* (Water Supply Plan) completed in April 2000. The Water Supply Plan recommended the RIDS to evaluate the "feasibility of constructing regional irrigation water distribution system(s) and other options to meet the growing urban irrigation demands of this area".

The purpose of this report is to present the results of the RIDS Master Plan Project.

A series of memoranda were submitted throughout the course of the study in order to ensure that all utilities, local government agencies, project team members, the District and other stakeholders were aware of and involved in the progress of the project.

STUDY AREA DEFINITION

The RIDS Sub-Region 2 study area was developed from the following sources:

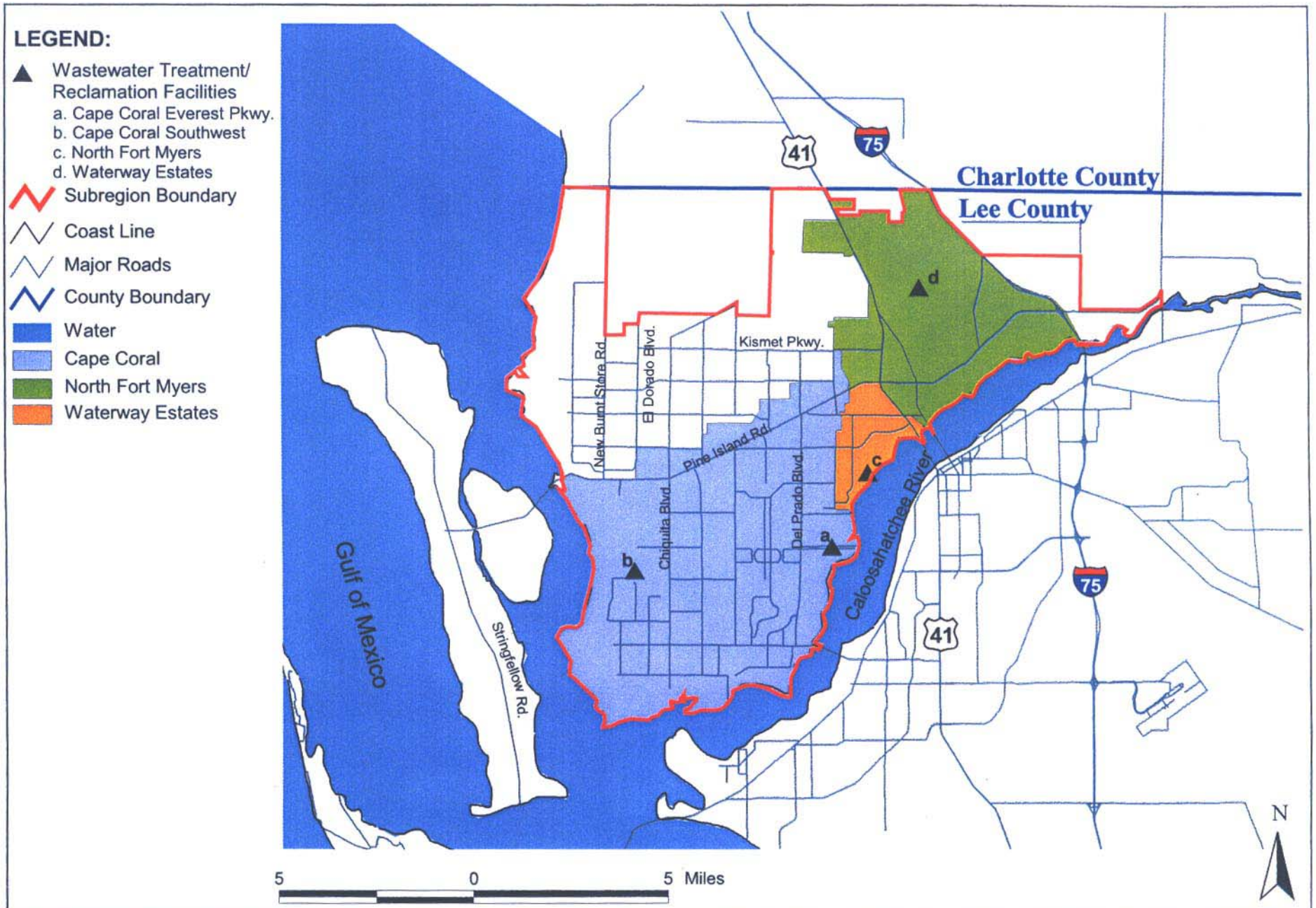
- Master plans
- Comprehensive land use plans
- Future growth areas (large developments)

The study area comprises the coastal area (western portion) of the Lower West Coast Region; land use is primarily residential and commercial. The limits follow the year 2020 projected service areas for the City of Cape Coral, North Ft. Myers and Waterway Estates. There are approximately 103,000 acres in the study area of this sub-region, of which approximately 67,000 acres are currently served by one of these Utilities. It is expected that for the year 2020, the entire population will be served. These are summarized in Table 1.

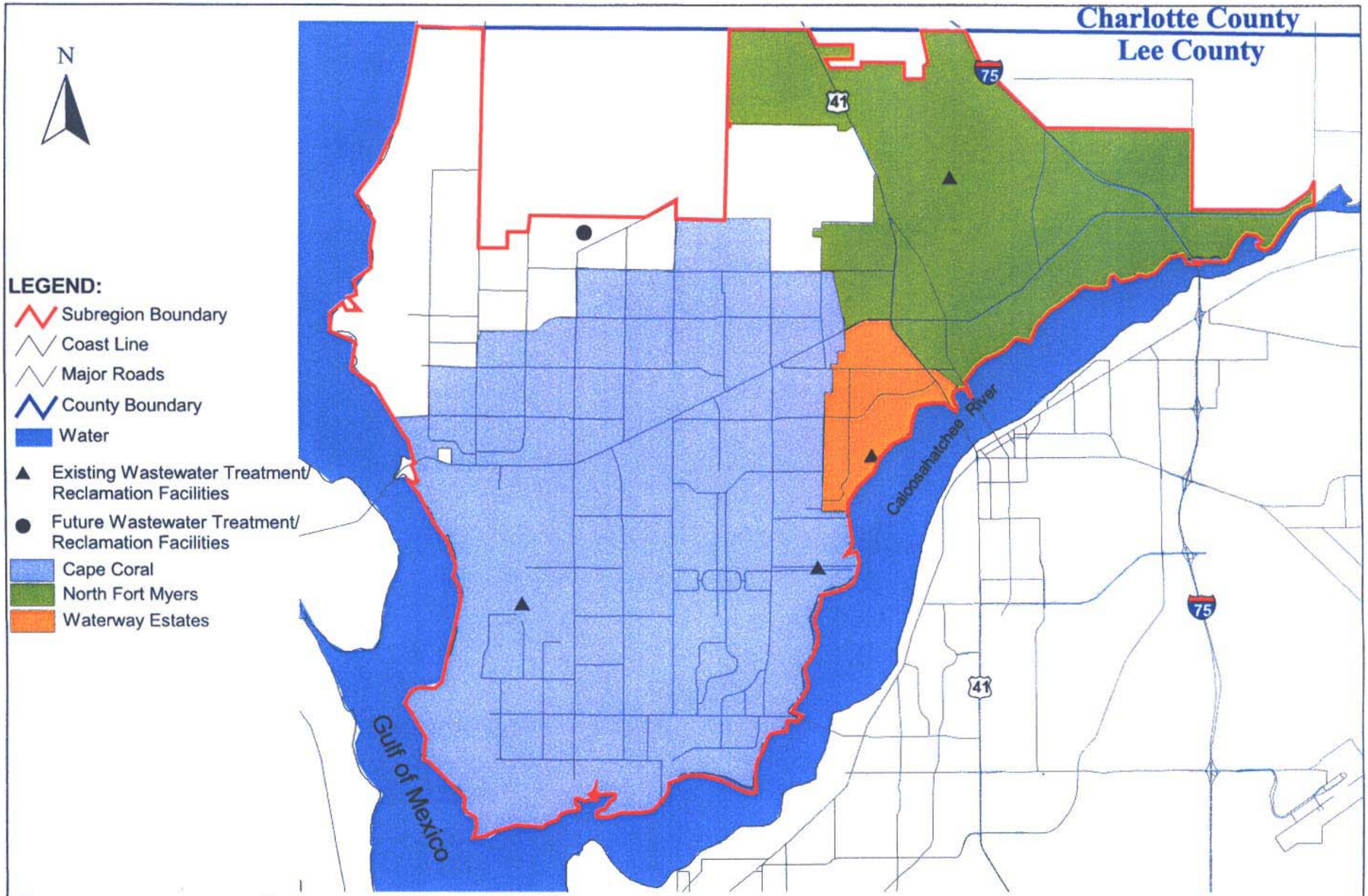
Table 1
Service Area Summary

Utility	Existing Service Area (Ac)	Projected Year 2020 Service Area (Ac)
Cape Coral	42,670	54,929
North Ft. Myers	20,653	25,470
Waterway Estates	3,716	3,716
Total	**67,040**	**102,640**

Figure 1 shows the study area and existing service areas. Figure 2 identifies the projected year 2020 service areas.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	SUBREGION 2 Study Area	Figure 1



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	SUBREGION 2 FUTURE (2020) WASTEWATER SERVICE AREAS	Figure 2

FACILITIES INVENTORY

Existing and future, year 2000 and year 2020, respectively, wastewater treatment/reclamation facilities and associated infrastructure within the study area were inventoried. The purpose of the inventory was to,

- Identify existing treatment facilities and infrastructure
- Identify reclaimed water transmission infrastructure
- Determine current wastewater flows
- Determine existing reuse and disposal mechanisms and how much reclaimed water/effluent is distributed to each

Flows were generated from Monthly Operating Reports (MORs) submitted for each facility to FDEP in accordance with their permits and from monitoring data provided by the facilities. Flow data included range from October 2002 through October 2003 as denoted in Attachment A.

Wastewater Treatment/Reclamation Facilities

There are five wastewater treatment plants/reclamation facilities of significance in the study area. Effluent from the wastewater treatment/reclamation facilities is reused for urban irrigation, commercial uses, and groundwater recharge, or disposed of via surface water. Tables 2 and 3 presents recent reuse and disposal information from the facilities. Table 4 displays the existing reclaimed water demands for the study area.

Table 2
Wastewater Treatment/Reclamation 2003 Facility Summary

Facility Name	Stakeholder	Permitted Capacity (MGD)	Annual Average Daily Flow (MGD)	Maximum Monthly Flow (MGD)	Minimum Monthly Flow (MGD)
Everest WRF	Cape Coral Utilities	8.50	6.78	9.72	5.48
Southwest WRF	Cape Coral Utilities	6.60	5.36	8.34	4.28
North Fort Myers	North Ft. Myers Utilities	2.00	2.07	2.94	1.43
Waterway Estates	Lee County Utilities	1.25	0.95	1.38	0.70
Total		**18.35**	**15.16**	**N/A**	**N/A**

(1)Permitted capacity and Annual Average Daily Flow take from DEP publication. Maximum and Minimum Monthly Flow were calculated based on Waterway Estates factors.

Table 3
Reuse and Disposal 2003 Summary

Utility	Disposal Method	Annual Average Daily Flow (MGD)	Maximum Monthly Flow (MGD)	Minimum Monthly Flow (MGD)
Cape Coral Utilities (1)	Irrigation Water	4.96	6.04	4.28
	Surface Water	1.07	6.13	-
	Deep Well Injection	-	-	-
North Ft. Myers	Irrigation Water	1.20	1.64	0.23
	Surface Water	-	-	-
	Deep Well Injection	0.87	1.58	0.28
Waterway Estates	Irrigation Water	-	-	-
	Surface Water	0.95	1.38	0.70
	Deep Well Injection	-	-	-
Total	Irrigation Water	6.16	7.68	4.51
	Surface Water	2.02	7.51	0.70
	Deep Well Injection	0.87	1.58	0.28

Notes:
Irrigation includes water pump by the Canal Pump Station, in Cape Coral, and all irrigation flow provided to the current customers.
Surface Water includes river discharge.
(1) Includes Reclaimed and Canal Pump Station (CPS)
Note: Any discrepancies seen in the figures are due to rounding.

Table 4
Existing Reclaimed Water Users

Utility	Existing User	Average Annual Reuse Demand (MGD)
Cape Coral Utilities	109 Metered Accounts (Current) and 33,215 Unmetered Residential Accounts	22.2
North Ft. Myers [(1)]	Riverbend Golf Course, Six Lakes, Sabal Springs	1.7
Waterway Estates	Golf Course	0
Total Current Reuse Demand =		23.4

[(1)]Permitted capacity

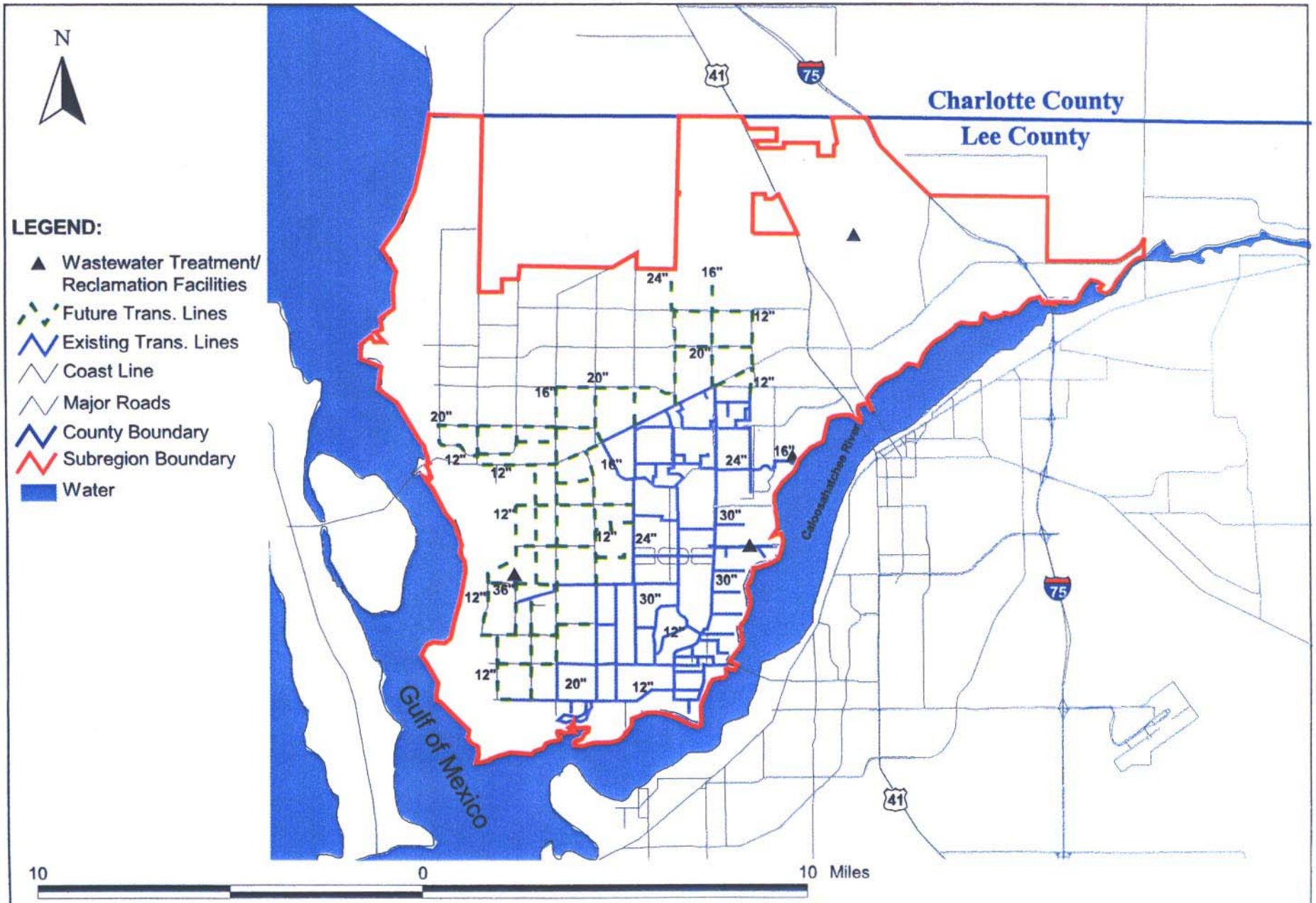
The current facility locations are shown in Figures 1 and 2. A list of potential end users for the RIDS has been determined based on information received from the local governments to determine future infrastructure needs. This will include existing and planned new golf courses, large green space areas, and future large planned residential developments. Table 5 presents the list of potential type of users and the potential major irrigation users.

Table 5
Potential Major Reclaimed Water Users

Utility	Projected Annual Average Reuse Demand (MGD)
Cape Coral	56.0
North Ft. Myers	17.6
Waterway Estates	2.8
Total Potential Reuse Demand	76.3

Reclaimed Water Transmission Facilities

Existing reclaimed water transmission facilities were identified. The focus was primarily on larger pipelines; therefore, distribution systems and smaller lines may not be shown on the maps. Figure 3 presents the existing reclaimed water transmission facilities and large users.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	EXISTING & FUTURE RECLAIMED WATER TRANSMISSION LINES	Figure 3

URBAN IRRIGATION WATER DEMANDS

In order to determine the amount of water that will be necessary for future urban irrigation, components such as population served, irrigable acres, seasonality factors were evaluated. It is assumed that for the year 2020 there will be 100 percent service of reclaimed water for the project area.

Population Projections

Permanent population projections for each service area were developed from a variety of sources including franchise or utility-supplied data. The majority is based on permanent population and does not reflect seasonal variability. Most of the population projections extended through 2020, but for those that did not, a linear regression was performed using the available data. Table 6 presents an estimate of the current serviced and future population projections and the source of information for each service area.

Table 6
Population Projections

Facility/Service Area	Current Serviced Population '99/'00	Projected Serviced Population 2020	Source
Cape Coral Utilities	73,840	166,934 [(1)]	City of Cape Coral Utility Water Use Permit
North Ft. Myers	50,301	55,764	Lee County Planning Community Web Map
Waterway Estates	7,768	8,603	Lee County Regional Water Supply Authority Update to Water Supply Master Plan 2000-2030
Total	**131,910**	**240,950**	

[(1)]Based on Water Use Permit irrigation population. Extrapolated using the average population growth of 3.14%, for the period between 2003 and 2019.

Irrigation Water Demands

The urban irrigation water demands were developed using both actual demand data and the modified Blaney-Criddle (B-C) model, provided by the District. The actual demand determined the seasonability factors, while the B-C methodology determined the total annual average demand.

The B-C methodology is explained in Attachment B. The demands were generated for the 1-in-10 year drought event, meaning there is a probability of such a drought occurring once in every ten years. The B-C modeling analysis and results are included in Attachment C. The following input variables were used in the model, to determine the B-C urban irrigation water demands:

- Rainfall Station: Ft. Myers
- Irrigation System: Sprinkler
- Crop: Turf Grass
- Irrigable Acreage: Calculated for each service area

- Soil Type: Lee, 0.8 (based on Figures C-8 and C-4 from the Management of Water Use Permitting Information Manual, Vol. III).

Table 7 presents the 1-in-10 Year Drought Rainfall, which was used to estimate the demand for irrigation along with the irrigable area.

Table 7
1-in-10 Year Drought Rainfall Values (inches)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lee Rainfall Station (in)	1.3	1.7	0.3	0.7	2.9	7.2	6.8	7.4	8.0	2.4	1.2	1.3

The irrigable acreage for each service area was estimated based on two main components;

- Developed Irrigable Acres includes residential and to a lesser extent, commercial. Based on experience in Cape Coral and other reuse systems, a factor of 0.075 irrigable acres per capita was used for the developed areas.
- Open space typically includes golf courses. Open space areas were determined from utility-supplied data, where possible; and were projected using historical golf course acreages from the Lower West Coast Water Supply Plan (2000), when other information could not be found.

The open space irrigable areas were then added to the developed irrigable acreage. The results indicated the total irrigable acreage for each service area. On a percentage basis, this amounted to an irrigable acreage per total acreage of approximately 15 to 20 percent, depending on the service area. This is a realistic percentage for a mixed-use area that has a higher residential coverage, but also includes non-developable coverage, which does not require any significant irrigation needs such as wetlands, surface water, and retail/commercial areas. Tables 8 and 9 present the irrigable acreage used to determine the service area irrigation demands. It is important to note that future water conservation efforts such as Xeriscape^{TM} landscaping, irrigation hours, and other mandatory ordinances may decrease the demand projections displayed here. These factors were not taken into consideration for this analysis.

Table 8
Irrigable Acreage – Current

Facility Inventory	Total Acreage	Developed Irrigable Acreage	Open Space Irrigable Acreage	Total Irrigable Acreage
Cape Coral Utilities	42,670	5,538	1,191	6,729
North Ft. Myers	20,653	3,773	581	4,354
Waterway Estates	3,716	583	103	686
Total	**67,039**	**9,894**	**1,875**	**11,769**

Table 9
Irrigable Acreage – Future (2020)

Facility Inventory	Estimate Future Acreage	Developed Irrigable Acreage	Open Space Irrigable Acreage	Total Irrigable Acreage
Cape Coral Utilities	54,929	11,316	1,902	13,218
North Ft. Myers	25,470	4,182	581	4,763
Waterway Estates	3,716	645	103	748
Total	**84,115**	**16,143**	**2,586**	**18,729**

Table 10 presents the future annual average estimated irrigation demand results from the B-C method model for the current and future scenario. Since it was determined that the B-C method alone does not realistically predict the seasonal irrigation demand, seasonal reuse factors were established using actual recent reuse demands. This ratio was calculated by dividing the monthly annual average daily reuse flow by the annual average daily flow. Table 11 presents the resulting seasonal factors. For certain service areas that did not show an appropriate distribution, factors from another representative service area were used. These factors were then applied to the annual average demand supplied by the B-C model to create future demand projections. The reuse factors described above are included in the methodology for Attachment B.

Table 10
Annual Average Irrigation Demand
From the Blaney-Criddle Model

Utilities	2020 Demand (MG)
Cape Coral	19,600
North Ft. Myers	6,500
Waterway Estates	1,100

Table 11
Seasonal Reuse Factors

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cape Coral	1.00	1.14	0.99	1.08	1.25	0.95	0.81	0.63	0.67	1.04	1.24	1.18
N. Ft. Myers	1.09	0.96	1.10	0.86	0.92	1.03	1.15	1.42	0.78	0.69	0.78	1.21
Waterway Estates	1.00	1.14	0.99	1.08	1.25	0.95	0.81	0.63	0.67	1.04	1.24	1.18

Tables 12 shows the actual current reclaimed water flows. These flows reflect the current irrigation demand for the year 2002 and 2003. The annual average current average demand for the study area is approximately 15.9 MGD. The future demand analysis determined on a temporal basis for each service area using the B-C method and the seasonal factors (explained above) is presented on Table 13. A greater than 300% increase is projected between 2000 and 2020. Taking into consideration the anticipated growth in the region, this estimate appears to be reasonable. The current and future demands are presented geographically in Figures 4 and 5 respectively.

Table 12
Urban Irrigation Demand Analysis – Current

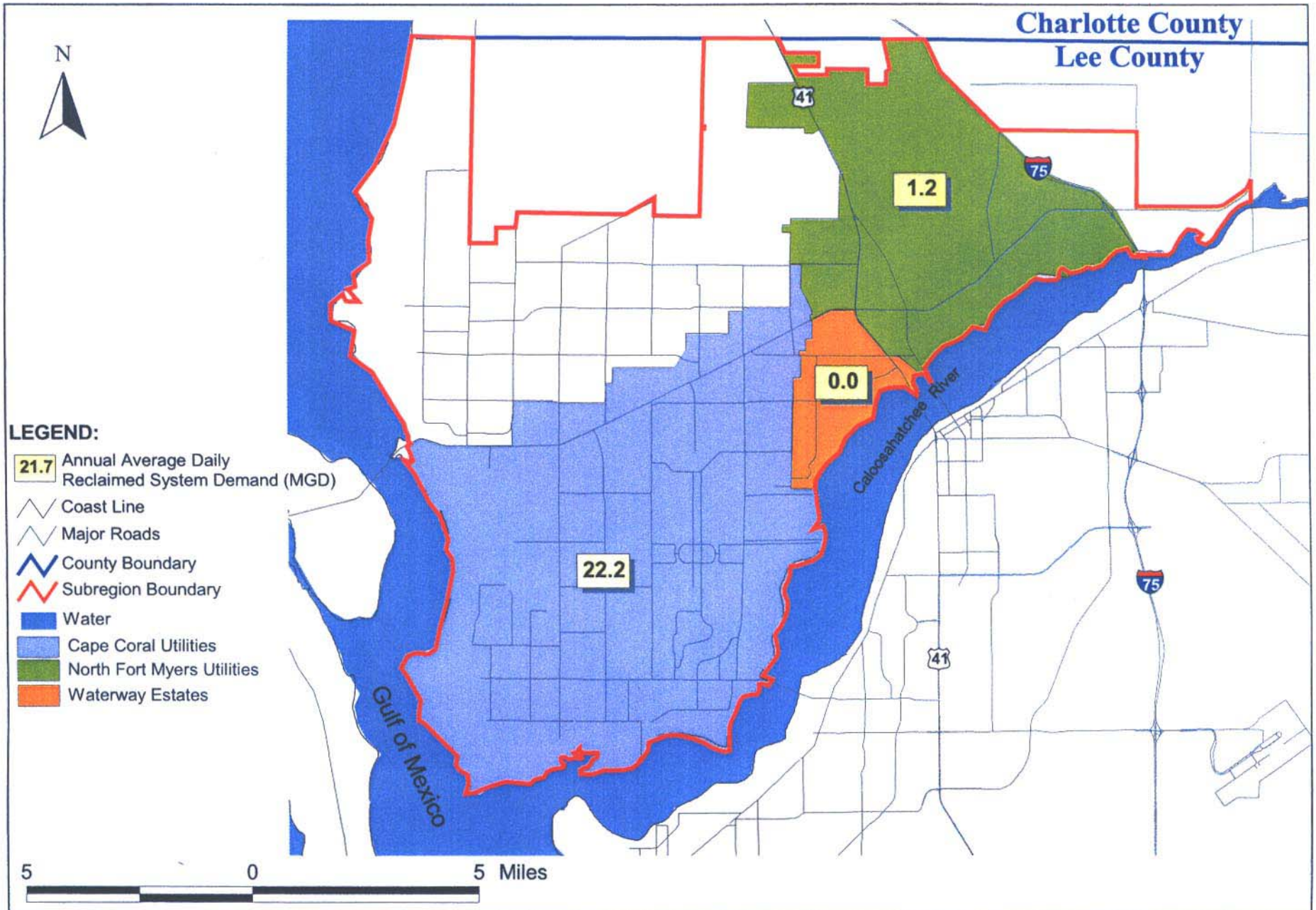
	Actual Irrigation System Demand* (MGD)												Annual Average (MGD)	Annual Total (MGD)
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**		
Cape Coral Utilities	22.3	25.4	22.0	24.0	27.9	21.2	17.9	14.1	14.8	23.1	27.7	26.3	22.2	266.7
North Ft. Myers	1.5	1.4	1.5	1.2	1.4	1.0	1.4	1.4	0.2	1.2	0.7	1.6	1.2	14.4
Waterway Estates	0	0	0	0	0	0	0	0	0	0	0	0	-	0
Total Monthly Flow (MGD)	**14.2**	**15.0**	**15.9**	**15.1**	**15.6**	**16.7**	**15.7**	**17.6**	**16.3**	**16.3**	**15.8**	**16.5**	**15.9**	**281.1**

Table 13
Urban Irrigation Demand Analysis – Year 2020

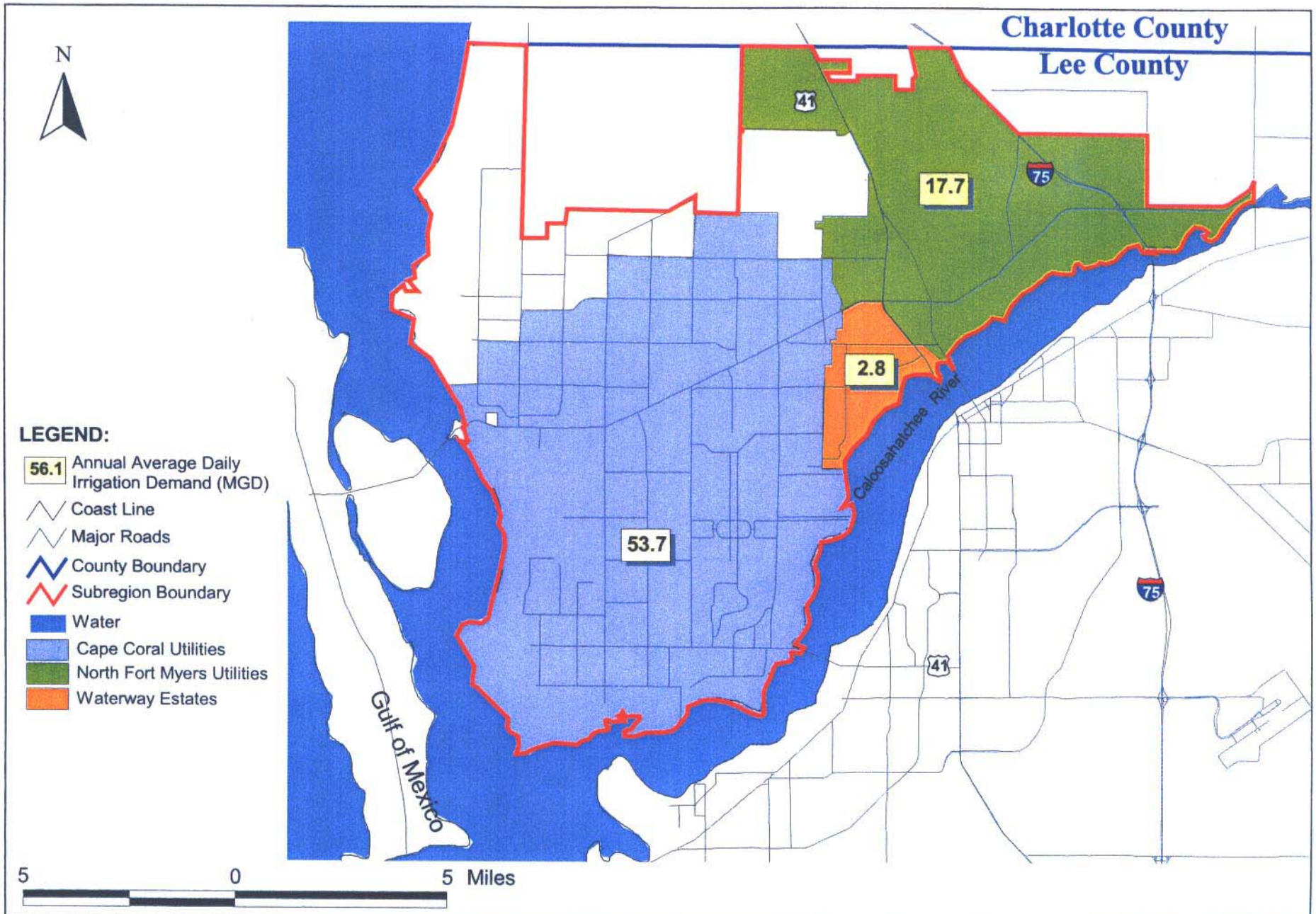
	Normalized Modified Blaney-Criddle Demand (MGD)												Annual Average (MGD)	Annual Total (MGY)
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**		
Cape Coral Utilities	53.9	61.3	53.2	58.0	67.3	51.1	43.3	34.1	35.8	55.9	66.8	63.6	53.7	644
North Ft. Myers	19.4	17.0	19.5	15.3	16.2	18.3	20.4	25.2	13.8	12.2	13.8	21.5	17.7	213
Waterway Estates	2.8	3.2	2.8	3.0	3.5	2.7	2.2	1.8	1.9	2.9	3.5	3.3	2.8	33
Total Monthly Flow (MGD)	**76.1**	**81.6**	**75.5**	**76.3**	**87.0**	**72.1**	**66.0**	**61.0**	**51.4**	**71.0**	**84.1**	**88.4**	**74.2**	**890**

* These figures represent calculated values for the year 2020, based on a normalized version of a modified Blaney-Criddle Method.

The demands estimated above were more significant than predicted by the Water Supply Plan. It is clear a variety of alternative sources will be necessary to satisfy these projected irrigation demands and to minimize impacts to other stretched resources, such as groundwater.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	CURRENT RECLAIMED WATER SYSTEM DEMAND	Figure 4



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	FUTURE RECLAIMED WATER SYSTEM DEMAND	Figure 5

POTENTIAL URBAN IRRIGATION WATER SOURCES

An evaluation of potential sources of supply was conducted to address future irrigation water needs in the Cape Coral/Waterway Estates/North Fort Myers sub-region. These potential sources of supply are:

- Reclaimed water from municipal wastewater treatment plants
- Water recovered during the dry season from reclaimed water aquifer storage and recovery (ASR) systems recharged during the wet season
- Surface water from streams, rivers, abandoned borrow pits, and canal systems having salinity control structures
- Water recovered during the dry season from surface water ASR systems recharged during the wet season
- Groundwater from irrigation supply wells

Reclaimed Water

It was assumed reclaimed water supply was equivalent to the projected influent wastewater flow. The assumption was also made that the entire population within each service area was connected. While this is not the case, this is a goal that the implementation of the RIDS will help to achieve. The projected reclaimed water supply was calculated by taking the current wastewater flows and dividing by the service area population. This resulted in a per capita wastewater generation factor of 112 gpd/capita (presented in Phase 1); this factor was multiplied by the projected 2020 population. This allowed the temporal variability to be accounted for in the future projections. Table 14 shows the existing monthly Water Reclamation Facility flows. Table 15 displays the projected (Year 2020) Water Reclamation Facility flows.

Table 14
Monthly Average Wastewater FLows – Current

Facility	Monthly Flows (MGD)												Annual Average (MGD)	Annual Total (MGY)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec		
Cape Coral Everest[b]	5.53	5.48	6.19	5.92	5.61	7.87	7.40	9.72	9.27	6.47	5.72	6.15	6.78	2,476
Cape Coral Southwest[b]	4.55	4.46	5.21	4.28	6.33	5.38	4.36	5.43	8.34	4.95	6.04	5.00	5.36	1,957
North Ft. Myers[a]	2.3	2.0	2.3	1.8	1.9	2.1	2.4	2.9	1.6	1.4	1.6	2.5	2.07	756
Waterway Estates[c]	0.9	0.8	0.7	0.7	0.7	0.8	1.2	1.4	1.3	1	0.9	0.9	0.95	346
Total Monthly Average Daily Flow (MGD)	**13.4**	**12.9**	**14.6**	**12.9**	**12.8**	**16.3**	**15.5**	**19.7**	**17.9**	**14**	**13.4**	**14.7**	**15.1**	**5,535**

a. This data was taken from Monthly Operating Reports submitted to the Dept. of Environmental Protection (Jan - Sept '01, Oct - Dec '00)

b. FY 03 data

c. 2000 data

Table 15
Projected Monthly Average Wastewater Flows - Year 2020

Facility	Monthly Flows (MGD)												Average (MGD)	Annual Total (MGY)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec		
Cape Coral Utilities	22.5	23.3	23.8	22.8	24.4	28.3	26.0	29.2	34.7	23.9	25.9	23.9	25.7	9,390
North Ft. Myers	2.5	2.2	2.5	2.0	2.1	2.4	2.6	3.3	1.8	1.6	1.8	2.8	2.3	838
Waterway Estates	1.0	0.9	0.8	0.8	0.8	0.8	1.4	1.5	1.5	1.1	1.0	1.0	1.1	383
Total Monthly Flow (MGD)	**26.0**	**26.4**	**27.1**	**25.6**	**27.3**	**31.5**	**30.0**	**34.0**	**38.0**	**26.6**	**28.7**	**27.7**	**29.1**	**10,611**

*Future supply was calculated using per capita usage for current supply data and 2020 projected populations.

Reclaimed Water ASR Systems

Reclaimed water ASR is becoming more accepted with established regulations for obtaining the necessary permits throughout Florida. There are several reclaimed water ASR systems currently permitted and in some stage of startup and testing. Because of its ability to store large volumes, reclaimed water ASR is considered the best method for optimizing wet-season reclaimed water surpluses, thus balancing storage needs.

To estimate the dry season recovery rate from reclaimed water ASR systems, it was assumed the entire wet season wastewater flow would be injected into the ASR storage zone. For the City of Cape Coral, this means that the fresh water canal system would be utilized to provide wet season irrigation needs. This is a resource conservation method in that it utilizes fresh water that would otherwise be discharged to tidal water bodies, reduces unnaturally high wet season discharges of fresh water to estuaries, and eliminates discharges of reclaimed wastewater to the Caloosahatchee River. This wet season 'recharge' period would therefore last approximately 120 days during the months of July, August, September and October. As discussed in the Phase I report, there is a lag of approximately one month between when high rainfall starts in the wet season to when flow rates in streams increases significantly. Therefore, while the wet season as determined by rainfall extends from June through September; the wet season as determined by stream flows occurs from July through October.

Recovery was assumed to occur during the dry season (December 1 through May 31) at an efficiency of 75% reflecting an estimated loss of 25% of the injected water to diffusion and dispersion with native groundwater in the storage zone. This is based on recovery criteria of a maximum of 250 mg/l dissolved chloride concentration. With a 75% recovery volume and a recovery period of 60 days longer than the injection period, the net result is an estimated dry season 'recovery' rate equal to 50% of the mean wet season 'injection' rate.

As discussed in the Phase I report, the Upper Floridan Aquifer (UFA), which contains brackish native groundwater, would be used as the storage aquifer. It is possible that the SFWMD would permit recovery to a dissolved chloride concentration of 350 mg/l. This would result in higher recovery efficiency and a slight reduction in the number of ASR wells.

Furthermore, reclaimed water would be injected directly into the reclaimed water distribution system, with no additional treatment. The estimated Year 2020 mean dry season reclaimed water ASR recovery rate for the study area is 14.2 MGD.

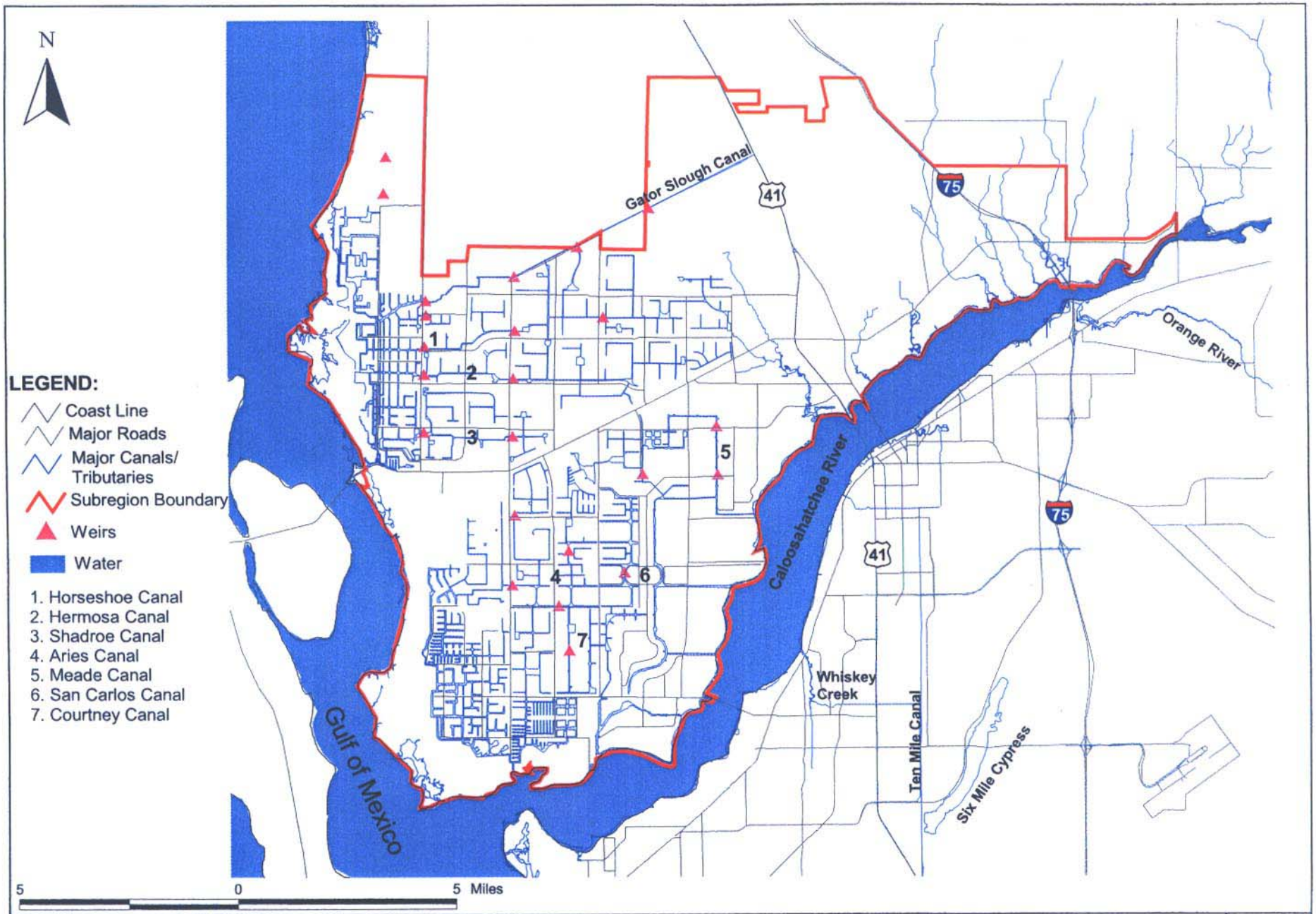
Surface Water

Table 16 is an inventory of 8 streams, rivers and canals in the study area. Figure 6 shows these surface water bodies and control structures. Flow for the eight surface water bodies is measured and recorded by either the United States Geological Survey (USGS) or the District. These are the only streams in the study area for which flows are measured. They were selected for flow measurement by governmental agencies because they have the highest flows in the study area. All eight surface water bodies inventoried have salinity control structures. Therefore, these water bodies could be used as dry season sources of supply if flow rates are sufficient. Available period of record flow data were tabulated and analyzed for the surface water bodies. Summaries of these tabulations and analyses are provided in Attachment D.

Table 16
Summary of USGS and SFWMD Stream Flow Data[1]

Water Body	Gauge Location	Period of Record	Mean Wet Season Flow (MGD)	Mean Dry Season Flow (MGD)	1-in-10 Year Dry Season Flow (MGD)	Utility Service Area
Gator Slough	Near SR 765	1984-2000	67	8	0	Cape Coral
Aries Canal	SW 28th St	1989-2000	20	3	1	Cape Coral
Hermosa Canal	Near SR 765	1987-2000	26	5	0	Cape Coral
Courtney Canal	Mohawk Pkwy	1986-2000	11	3	0	Cape Coral
Horseshoe Canal	Near SR 765	1987-2000	31	6	0	Cape Coral
Shadroe Canal	Embers Pkwy	1987-2000	13	3	1	Cape Coral
Meade Canal	Viscaya Pkwy	1986-2000	6	1	0	Cape Coral
San Carlos Canal	SE 26th Terrace	1986-2000	6	1	0	Cape Coral
TOTAL			**180**	**30**	**13**	

Similar to the ASR system, in the analyses of the surface water flow data for this study, the wet season is considered to be July through October, and the dry season is considered to be the six-month period of December through May. The months of November and June are considered transitional and were not integrated into the analyses.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	SURFACE WATER BODIES & CONTROL STRUCTURES	Figure 6

In other sub-regions of the RIDS, the potential surface water systems have a main criterion requirement of a minimum mean dry season flow rate of 20 MGD (see RIDS Phase I report). However, for Sub-Region 2, this criterion doesn't apply because the City of Cape Coral is already using a freshwater canal system to supplement the source of irrigation water during the dry season. This includes Gator Slough and the Aries, Hermosa, Courtney, Horseshoe, Meade, and San Carlos Canals. The permitted withdrawal rate from this source is approximately 25 MGD for annual average monthly flows, and 45 MGD for maximum monthly flow. Also, ongoing improvements to the control structures for this system will provide an incremental future increase in permitted withdrawal capacity. Measured dry season flow rates in the canal system have been influenced by these withdrawals since the City's reuse system became operational in 1994.

Surface Water ASR Systems

To provide drought condition reliability for surface water sources with supplemental irrigation water, surface water ASR systems may be constructed. These surface water ASR systems would inject partially treated (filtered and disinfected) water withdrawn from the surface water sources mentioned during the wet season (July through October). It is anticipated that up to three-log cycle removal of pathogens would be obtained from a properly constructed surface water intake system. If it is determined that additional pretreatment is required, such pretreatment may include ultraviolet disinfection.

The water would be recovered at an estimated efficiency of 75% during the dry season (December through May). Using the criterion of a minimum wet season flow of 20 MGD three potential surface water ASR systems were identified in the study area. The Aries Canal was not included because it is located within the 2-mile limit of the Reverse Osmosis supply wells and currently does not have a pump station. By only withdrawing from the surface water source during the wet season, impacts to the source during the dry season would be avoided. Assuming a diversion of 20% of the wet season flow would be permittable, the potential dry season recovery rates are presented in Table 17. The basis for the 20% diversion criteria was discussed in the RIDS Phase I report.

Table 17
Summary of Potential Surface Water ASR Systems

Irrigation Supply Source	Pumping Station Location	Mean Wet Season Flow[1] (MGD)	Mean Wet Season Diversion Rate[2] (MGD)	Mean Dry Season Recovery Rate[3] (MGD)	Utility Service Area
Gator Slough	Near SR 765	67	13.4	6.7	Cape Coral
Hermosa Canal	Near SR 765	26	5.2	2.6	Cape Coral
Horseshoe Canal	Near SR 765	31	6.2	3.1	Cape Coral
TOTAL		124	24.8	12.4	

[1] Mean measured flow during the months of July through October.
[2] Estimated as 20% of the mean wet season flow.
[3] Based on 75% recovery efficiency for 180 days during the dry season months of December through May.

It was assumed the storage aquifer for surface water ASR systems would be the Upper Floridan Aquifer (UFA), the same as for reclaimed water ASR systems. The City of Cape Coral currently has several proposed surface water ASR well locations listed in its SFWMD water use permit modification application. Additionally, a minimum distance of two miles from existing and permitted municipal reverse osmosis (RO) supply wells and potable water ASR systems was used in the site selection

process. In most cases the location selected for a surface water ASR system was adjacent to a control structure or canal pumping station.

Groundwater

The City of Cape Coral uses groundwater as a supplemental irrigation source for reuse water. This is accomplished with horizontal wells in the water-table aquifer. The wells supplement the reclaimed water and freshwater canal sources. There is potential for additional use of water-table aquifer horizontal well systems in road rights-of-way, at golf courses and other locations for Floridan aquifer ASR wells. This may serve to more efficiently utilize a resource that would otherwise be pumped from wet areas and stormwater systems and ultimately discharged to tidal water bodies during the wet season.

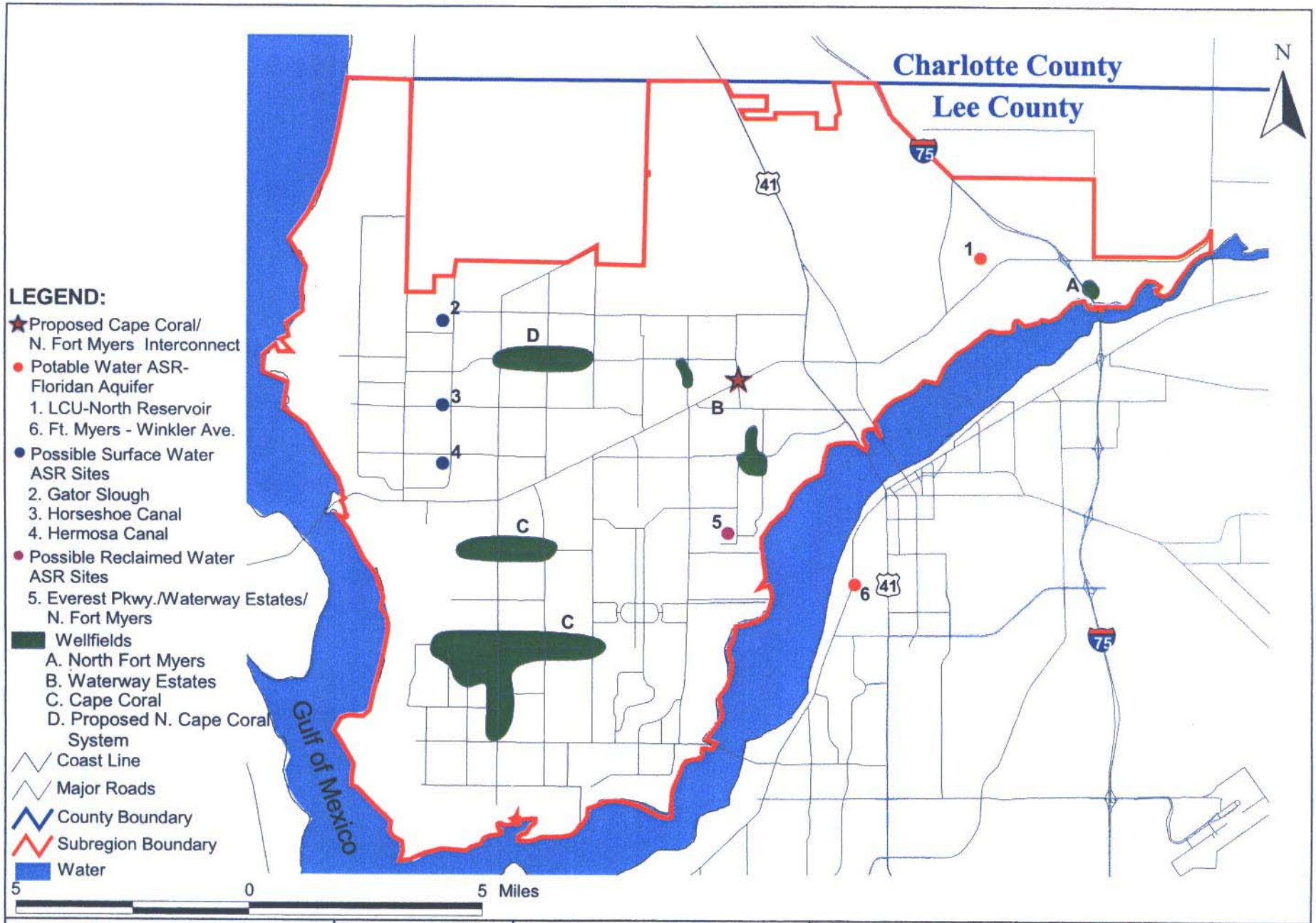
Table 18 presents a summary of the potential sources as discussed above.

Table 18
Potential Urban Irrigation Water Sources

	Monthly Flows (MGD)												Average
Source Type	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**(MGD)**
Reclaimed Water Total	31.6	35.6	31.3	31.7	37.0	29.7	25.9	22.2	18.9	28.2	35.3	38.8	30.5
Reclaimed Water ASR	14.2	14.2	14.2	14.2	14.2	0.0	0.0	0.0	0.0	0.0	0.0	14.2	14.2
Surface Water	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3
Surface Water ASR	12.4	12.4	12.4	12.4	12.4	0.0	0.0	0.0	0.0	0.0	0.0	12.4	12.4
TOTAL SUPPLY	**83.5**	**87.5**	**83.2**	**83.6**	**88.9**	**55**	**51.2**	**47.5**	**44.2**	**53.5**	**60.6**	**90.7**	**82.4**

Priority of Construction of Potential Surface Water and Reclaimed Water ASR Alternatives

Storage is the most critical part of the RIDS to optimize current sources and to balance supply and demand. ASR systems are considered an integral part of any potential storage solution. Using the siting criterion of two miles from existing and permitted future municipal reverse osmosis (RO) supply wells and potable water ASR systems, locations of these potential systems are shown on Figure 7.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	CURRENT AND POTENTIAL ASR AND WELLFIELD LOCATIONS	Figure 7

Ranking of Potential ASR Systems

There are eight potential surface water ASR systems and one reclaimed water source listed in Table 19. In this Table, the potential ASR systems are presented along with the proposed total depth, the rate of injection expected and the rate of recovery (reclaimed water supply). The potential ASR systems were prioritized based on capacity, proximity to existing infrastructure, and potential for success as discussed below.

Table 19
Summary of Ranked Potential Surface Water and Reclaimed Water ASR Systems

ASR Site No.	Description	Type	PTD	Recovery Capacity (MGD)	Ultimate Number of Wells	Potential Storage Zones	Overall Rank
1	Gator Slough	Surface Water	1100	14.0	20	SU II, III, IV	2
2	Horseshoe Canal	Surface Water	1100	6.0	9	SU II, III, IV	5
3	Hermosa Canal	Surface Water	1100	6.0	9	SU III, IV	6
4	North-South Transfer Station	Surface Water*	1050	10.0	14	SU II-V	3
5	Canal Pumping Station No. 8	Surface Water*	1200	5.0	7	SU III, IV; OC I	4
6	Everest Parkway	Reclaimed Water	950	12.2	17	SU I-V	1

PTD = Proposed Total Depth
LH = Lower Hawthorn portion of Upper Floridan Aquifer System
SU = Suwannee portion of Upper Floridan Aquifer System
I, II, III, IV, V = Zone Numbers
* From Canal Pump Station

Data Collection

The data used in this investigation comes from several sources, including Water Resource Solutions (WRS) in-house database; South Florida Water Management District; Florida Geological Survey; Florida Department of Environmental Protection; Bureau of Geology; consultant reports; and publications.

Because of its extensive use in coastal areas of the region, the study did not consider the Mid-Hawthorn aquifer system (MHA) as a potential ASR storage interval, but rather was focused on the UFA, starting from the Lower Hawthorn Aquifer (LHA) down through the Ocala. Data from existing ASR Systems, existing reverse osmosis (RO) systems, and other available wells which provide some information about the UFA were evaluated and used to delineate locations for potential surface water and reclaimed water ASR systems.

A total of 191 deep wells were inventoried in the area. Wells with either lithological or geophysical log information were reviewed to delineate the hydrostratigraphy of the area. A hydrostratigraphic database was compiled. Information for 117 of the 191 wells was obtained from the recently completed SFWMD "Lower West Coast Potentiometric Mapping Project" (Water Resource Solutions, 2003).

Four cross-sections showing the hydrostratigraphy of the area were generated. A map showing lines of cross-section and the cross-sections are provided in the Attachment E. The cross-sections were used as

a framework for correlation of other wells in the study areas for which lithologic and/or geophysical log data is available. A tabulation of formation tops for these wells was also conducted and a subsurface structure contour map on top of Suwannee Formation was created.

As indicated on the cross-sections some zones of the UFA may be suitable for ASR. Criteria for selecting potential ASR zones included confinement above and below, a thickness of between 40 and 100 feet, and a lack of nearby users of the zone. Site-specific subsurface testing will be needed to demonstrate the feasibility of the potential aquifer zones at each location.

Existing ASR Systems

One existing UFA ASR system in the area and another existing ASR system proximal to the boundary of the sub-region were inventoried as shown in Figure 7. The Lee County North Reservoir potable water ASR System, located in North Fort Myers, uses one existing ASR well completed in the Lower Hawthorn Aquifer, with the ASR storage interval between 542 and 640 feet below land surface (BLS).

The City of Fort Myers Winkler Avenue potable water ASR System is located south of the Caloosahatchee River in the City of Fort Myers. It consists of one ASR well completed in the LHA (520 – 645 feet BLS).

Proposed ASR Systems

The City of Cape Coral has eight permitted proposed surface water ASR wells located in five different sites in the sub-region. The proposed wells should be completed in the Upper Florida Aquifer with the storage zones between 900 to 1,000 feet BLS.

Existing RO Systems

Two RO systems were inventoried in the area and two other additional systems located in the vicinity of this sub-region were also included, as shown on Figure 7. City of Cape Coral has three wellfield alignments, which supply water from the UFA to its RO Water Treatment Plant, located in southwest Cape Coral. These wellfields consist of 25 existing production wells completed in the basal MHA / LHA and the uppermost part of the Suwannee portion of the UFA. Production zones ranges from approximately 350 to 800 feet BLS.

A new Water Treatment Plant and wellfield is planned in North Cape Coral. Three existing production wells, which are not equipped with pumps or discharge piping are present but are not in use at this time. The wells are completed in the LHA / UFA with production zones ranging from 500 to 1,100 feet BLS. There are also 10 permitted proposed wells included in this RO North Cape System. Charlotte County Utilities Burnt Store RO system is located in the southwestern most area of Charlotte County near the northwest boundary of the sub-region. It consists of four existing and two planned production wells completed in the MHA / LHA (300 – 600 feet BLS).

The City of Fort Myers RO System is located in the northeastern portion of the City of Fort Myers. It consists of seven existing production wells completed in the LHA / UFA (445 – 837 feet BLS) and five proposed permitted wells.

SUPPLY AND DEMAND ANALYSIS

To determine the quantity of alternative water sources required to meet projected irrigation demands, future urban irrigation supply was compare to projected demand. The demands presented above in Tables 12 and 13 were compared to the existing and projected reclaimed water. Tables 20 and 21 present the surplus/deficit summary for the current and future conditions, demonstrating the need for the water sources. Cape Coral demands will be mitigated by the alternative supply source and a contribution from North Ft. Myers through the interconnect. Figure 8 and Figure 9 displays the surplus and deficit for the current and future scenario respectively.

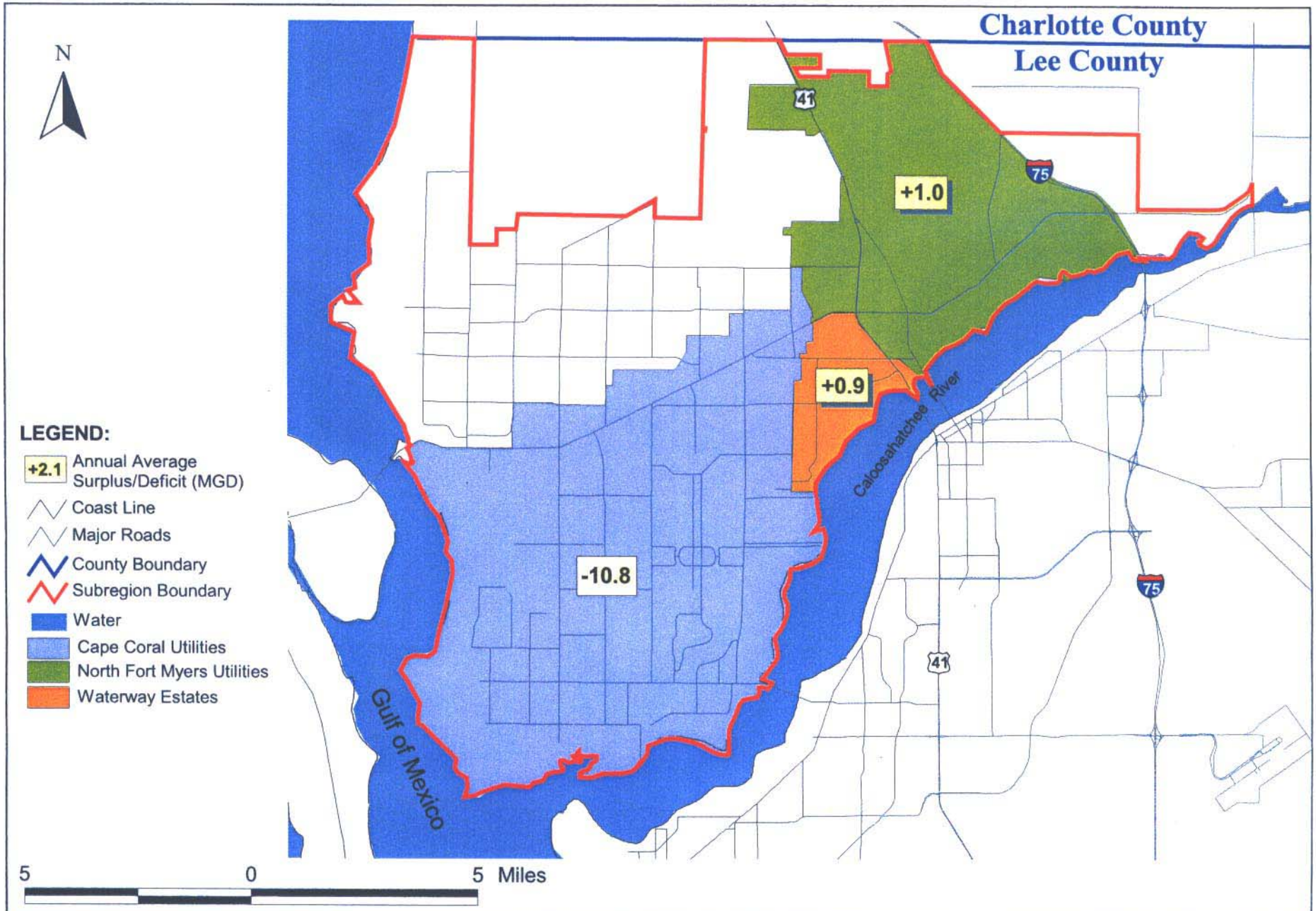
Table 20
Surplus/Deficit Analysis – Current (2003)

Facility	Monthly Surplus/Deficit (MGD)												Annual Average
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	(MGD)
Cape Coral	(12.3)	(15.1)	(11.5)	(13.9)	(17.1)	(8.7)	(6.4)	(1.2)	0.6	(12.5)	(16.2)	(15.7)	(10.8)
North Ft. Myers	0.8	0.6	0.8	0.6	0.5	1.2	1.0	1.6	1.4	0.3	0.9	0.9	0.9
Waterway Estates	0.9	0.8	0.7	0.7	0.7	0.8	1.2	1.4	1.6	1.0	0.9	0.9	1.0
Total Monthly Flow (MGD)	**(12.3)**	**(15.1)**	**(11.5)**	**(13.9)**	**(17.1)**	**(8.7)**	**(6.4)**	**(1.2)**	**0.6**	**(12.5)**	**(16.2)**	**(15.7)**	**(10.8)**

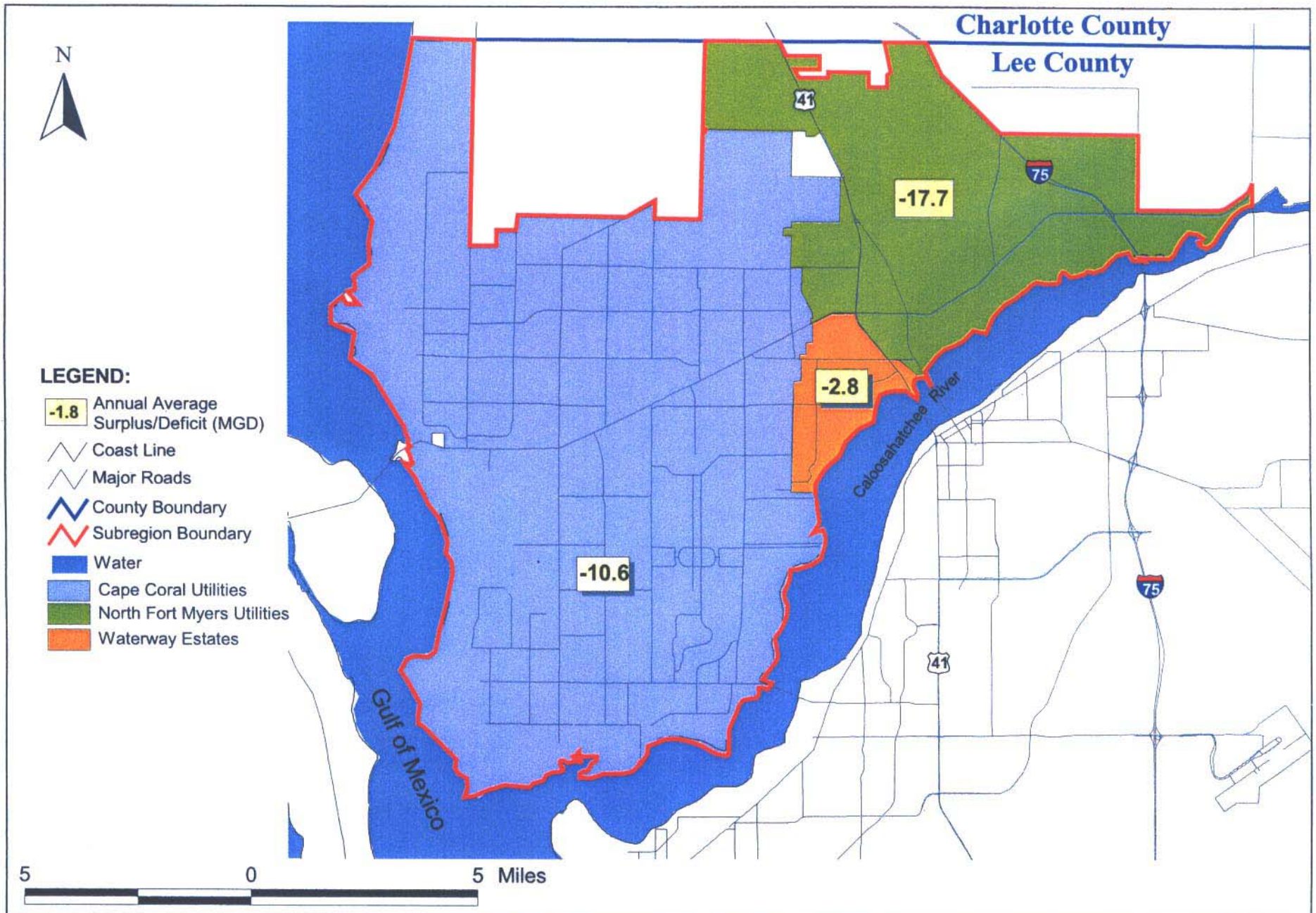
Table 21
Surplus/Deficit Analysis – Future (2020)

Facility	Monthly Surplus/Deficit (MGD)												Annual Average
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	(MGD)
Cape Coral	20.5	13.8	22.5	16.6	9.0	2.4	7.9	20.5	24.2	(6.7)	(15.6)	12.1	10.6
North Ft. Myers	(19.4)	(17.0)	(19.5)	(15.3)	(16.2)	(18.3)	(20.4)	(25.2)	(13.8)	(12.2)	(13.8)	(21.5)	(17.7)
Waterway Estates	(2.8)	(3.2)	(2.8)	(3.0)	(3.5)	(2.7)	(2.2)	(1.8)	(1.9)	(2.9)	(3.5)	(3.3)	(2.8)
Total Monthly Flow (MGD)	**(1.7)**	**(6.4)**	**0.2**	**(1.7)**	**(10.7)**	**(18.5)**	**(14.7)**	**(6.5)**	**8.6**	**(21.9)**	**(32.9)**	**(12.7)**	**(9.9)**

Note: Wet months are July, August, September, and October. The transitional months are June and November.



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	CURRENT SURPLUS/DEFICIT	Figure 8



Feasibility Study for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	FUTURE SURPLUS/DEFICIT	Figure 9

DESIGN ALTERNATIVES

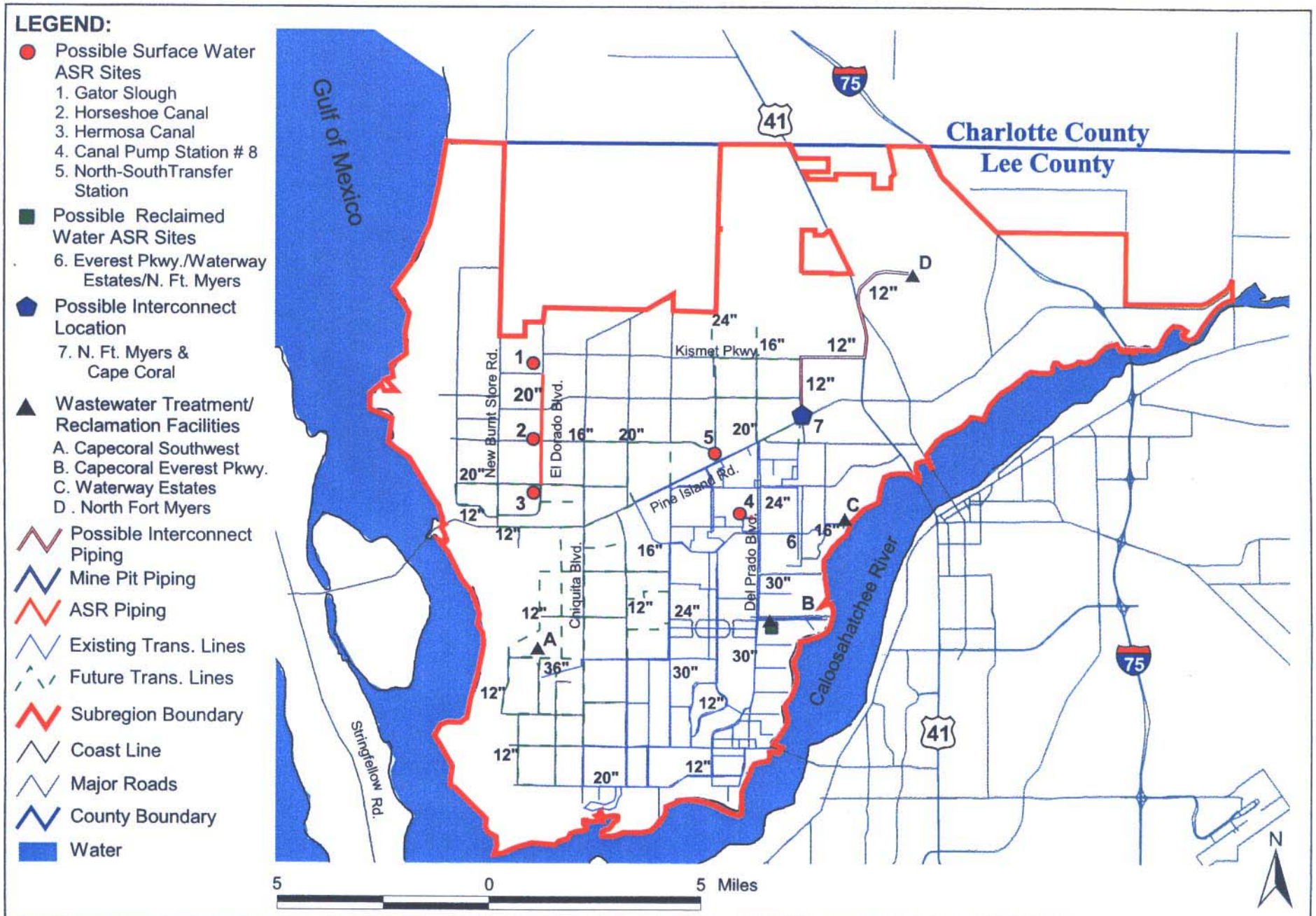
Design alternatives were developed to provide an alternative source of supply of irrigation water and to store it to maximize its use. The design alternatives included:

- Surface water source and ASR storage
- Reclaimed water source and ASR storage
- Interconnects between utilities

All alternatives within the sub-region have been generally located and are shown in Figure 10. Table 22 is a description of the sub-regional alternatives. Together, these options complement the reclaimed/reuse water and may generate up to 55.5 MGD of additional irrigation water resources for the area, during the dry season. This supply needs to meet a total estimated annual average demand of 74.2 MGD, as presented in Technical Memorandum No. 1 (Table 13). Each of the type of supply listed above has particular requirements for infrastructure and treatment as described below.

Table 22
Sub-regional Alternatives Summary

Alternatives	Benefit or Recovery Capacity (MGD)	No. of Wells
1A. Gator Slough-Intake and Pump Station		
1B. Gator Slough-Wells and Pipelines		
1C. Gator Slough-Transmission Lines	14.0	20
2A. Horseshoe Canal-Intake and Pump Station		
2B. Horseshoe Canal-Wells and Pipelines		
2C. Horseshoe Canal-Transmission Lines	6.0	9
3A. Hermosa Canal-Intake and Pump Station		
3B. Hermosa Canal-Wells and Pipelines		
3C. Hermosa Canal-Transmission Lines	6.0	9
4A. Everest Parkway-Intake and Pump Station		
4B. Everest Parkway-Wells and Pipelines		
4D. Everest Parkway-Transmission Lines	12.2	17
5. North Ft. Myers & Cape Coral	2.3	0
6A. North-South Transfer Station-Intake and Pump Station		
6B. North-South Transfer Station-Wells and Pipelines		
6A. North-South Transfer Station-Transmission Lines	10.0	14
7A. Canal Pumping Station #8-Intake and Pumping Station		
7A. Canal Pumping Station #8-Intake and Pumping Station		
7C. Canal Pumping Station #8-Transmission Lines	5.0	7
Total Benefit or Recovery Capacity	**55.5**	**76**



Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Design Alternatives Subregion 2	Figure 10

Surface Water Systems and ASR storage

This type of system focus on several potential surface water supply sources such as rivers, abandoned borrow pits, and canal system (with saline control structures) to be collected and stored in ASR wells for future use during the dry season.

Intake and Well Geology

The geology of the site for each of the proposed surface water system and ASR storage alternatives plays an important roll in selecting the type of the infrastructure, construction cost, and supply recovery potential. The geology information was obtained from the data compiled for the SFWMD Lower West Coast Potentiometric Mapping Project (WRS, 2003). Available data regarding the expected site-specific geology was gathered and evaluated. In cases where no information was available; data of the nearest well site available was used to determine the most likely geology for that location.

According to the data compiled, three likely shallow geology scenarios are as follows:

1. The first one represents sites with a thickness of the Holocene – Pleistocene sand greater than 20 feet. This type of scenario is likely to be found in the potential surface water ASR sites. However, the existence of heterogeneity in the shallow sediments within short distances in these areas suggests the possibility of the existence of two other scenarios.

2. The second possible shallow geology scenario occurs when the Holocene – Pleistocene sand thickness is less than 5 feet and overlies a section of the Tamiami Limestone that could be as thick as 30 feet.

3. The third scenario is one where the Holocene-Pleistocene sand section is between 5 and 20 feet thick. The Holocene

These geologic scenarios in turn, determined the four types of intake systems described below:

- Horizontal well (Type I). This type of extraction system is applicable to the first geological scenario and the exact depth and construction details would be based on site-specific geology. A cross-sectional view of this type of intake system is provided as Figure 11.

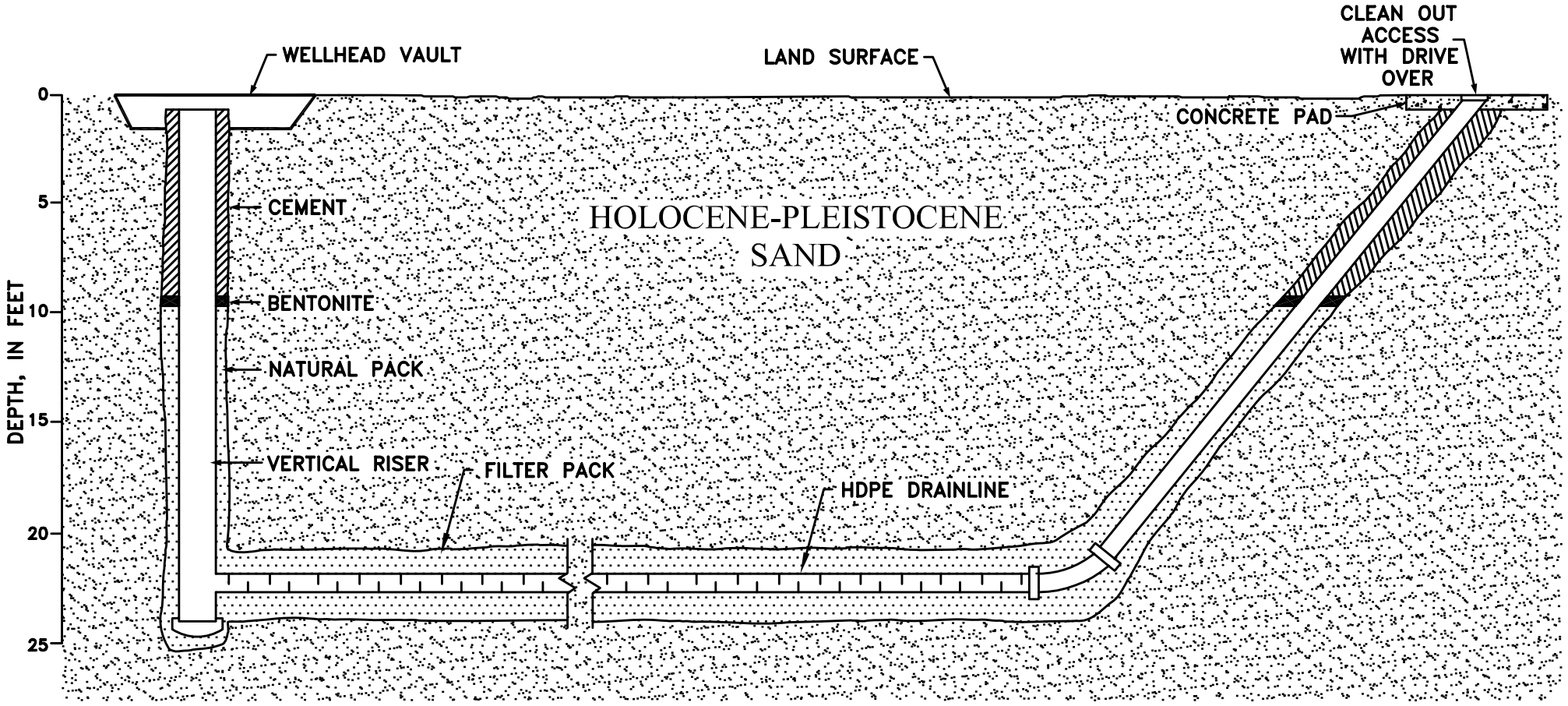
- Shallow vertical well alignment (Type II) completed in the Tamiami Limestone. This system applied to the second geological scenario. The collection wells in this alignment would have to be manifolded together and connected to a centrifugal pumping withdrawal system. A cross-sectional view of this intake system is provided as Figure 12.

- Open trench with screen covering (Type III). This system applies to the second and third geological scenarios. Site-specific geology and the expected extraction volume requirements will determine the trench dimensions. A cross-sectional view of this intake system is provided as Figure 13.

- Trench with infiltration gallery and sand filter pack material (Type IV). This system also applies to the second and third geological scenarios. Site-specific geology and the expected extraction volume requirements will determine the trench dimensions. A cross-sectional view of this intake system is provided as Figure 14.

Based on the information above, the following is a summary of the data available for each proposed alternative including the proposed preliminary intake type.

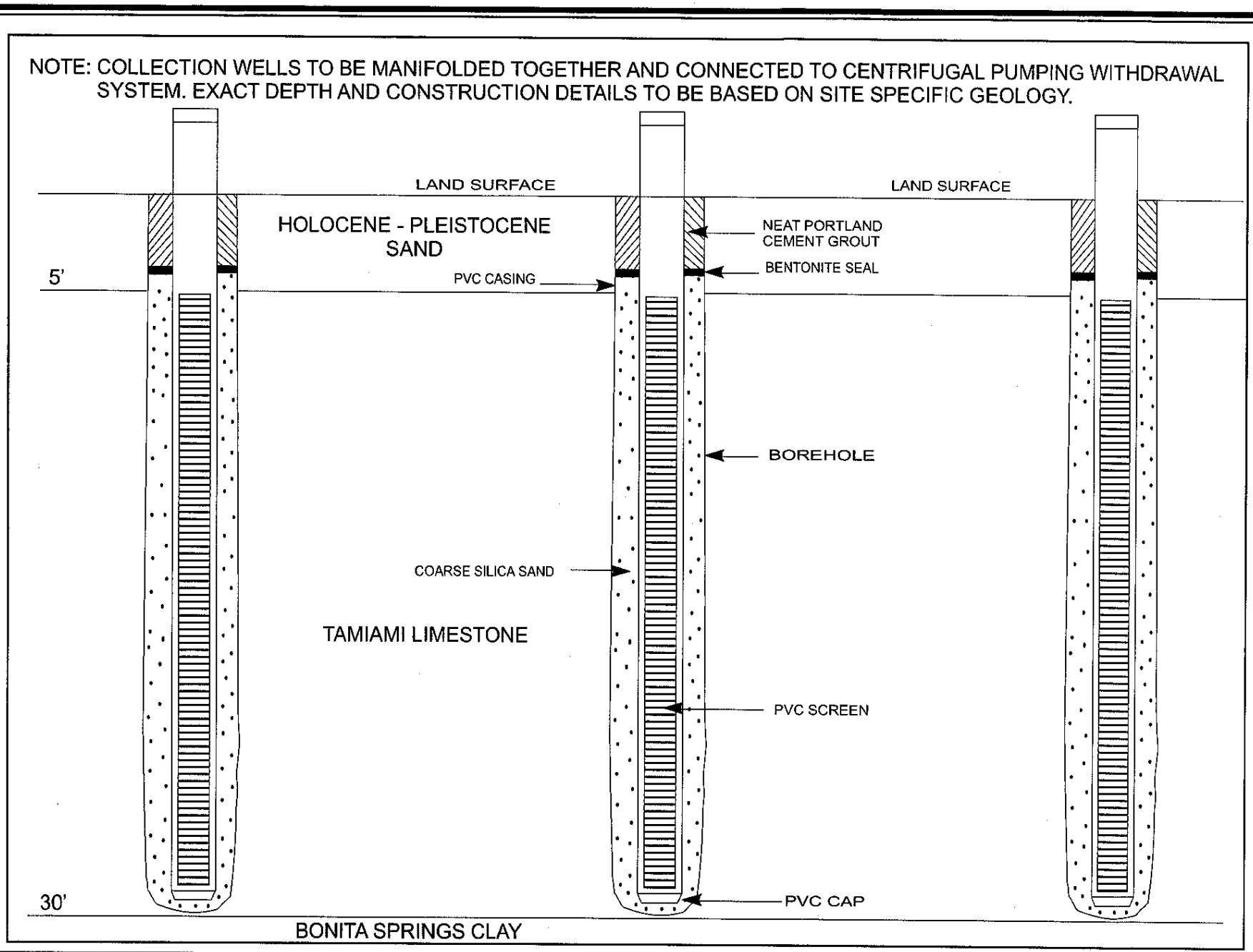
Potential ASR System	Holocene-Pleistocene Sand Thickness (ft)	Intake Type
Gator Slough ASR	25	I
Horseshoe Canal ASR	20	II
Hermosa Canal ASR	20	II
North-South Transfer Station	30	I
Canal Pumping Station #8	40	I



NOTE: EXACT DEPTH AND CONSTRUCTION DETAILS OF HORIZONTAL WELL SYSTEM TO BE BASED ON SITE-SPECIFIC GEOLOGY

Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445R1-1
	PROJECT NUMBER: 01-04445.HO	DATE: 10/03/03

FIGURE 11. CROSS-SECTIONAL VIEW OF HORIZONTAL WELL FOR INTAKE SYSTEM TYPE I.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
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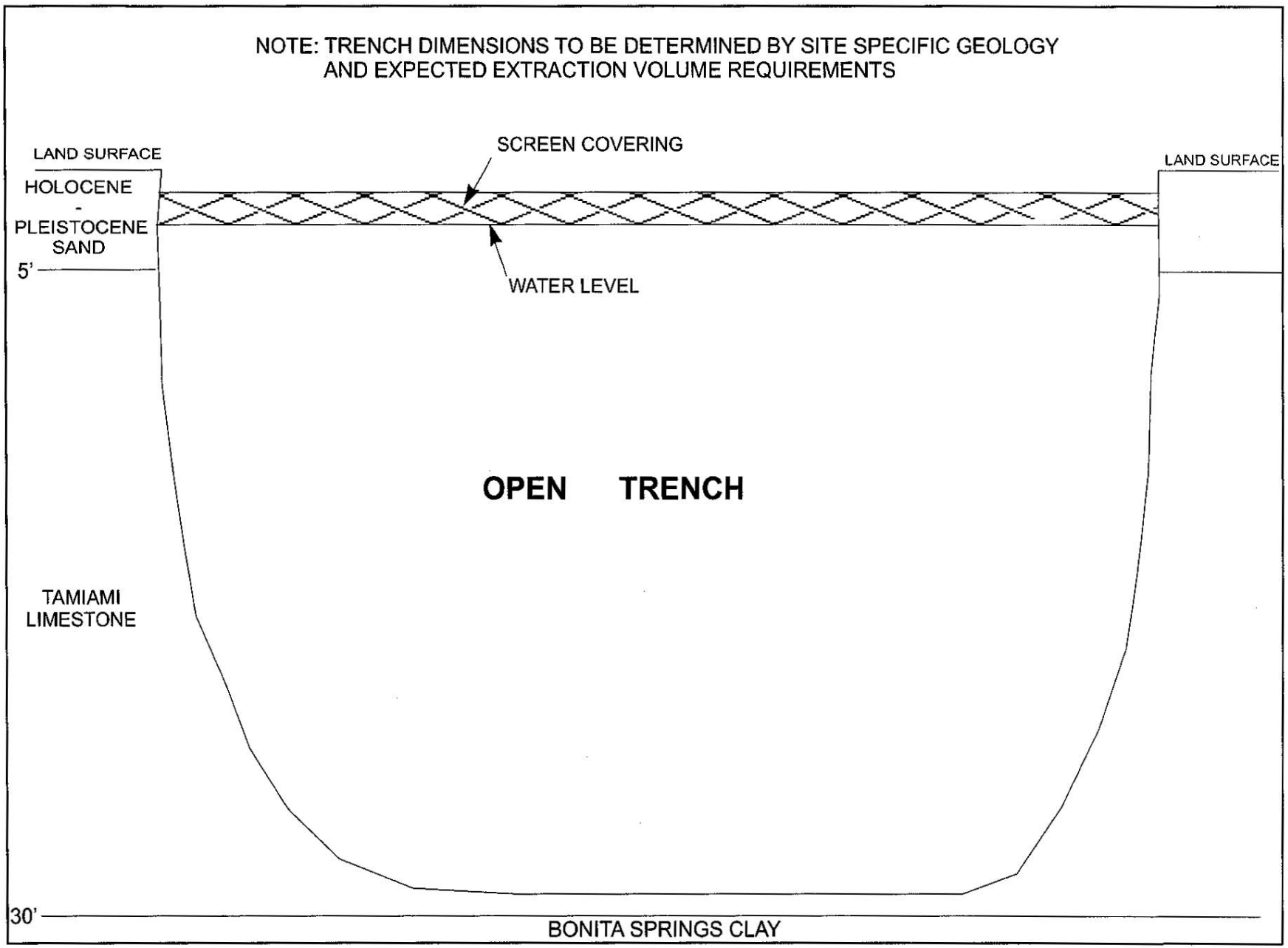
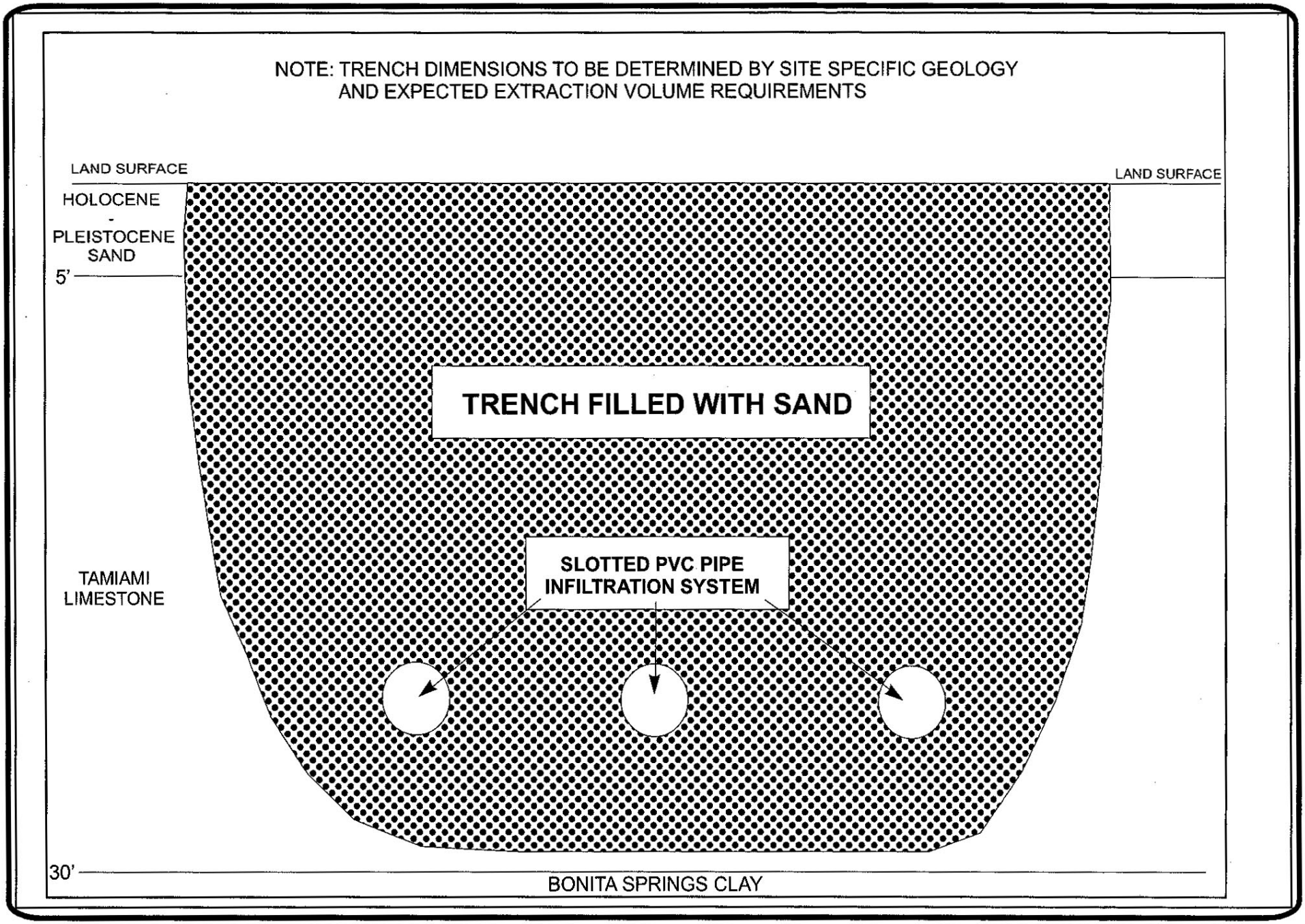
FIGURE 12- Cross sectional view of shallow vertical wells alignment for intake system Type II.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/3/03

FIGURE 13- Cross sectional view of open trench with screen covering for intake system Type III.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/3/03

FIGURE 14- Cross sectional view of trench with infiltration gallery and sand filter pack material for intake system Type IV.

Water Quality Background and Requirements

Water quality, as well as the regulations for ASR wells storage and recovery, also have a great importance in the selection of a supply.

The current water quality available was total suspended solids (TDS) for the period of October 2002 through March 2004. The average TDS for the surface water supply proposed are as follows:

Table 23

Surface Water System Average Water Quality Available

Proposed Surface Water	TDS mg/L
Gator Slough	302
Horseshoe Canal	277
Hermosa Canal	262
Canal P.S. #8	302

Water Quality Requirements

Currently, the surface water to be injected into an ASR well needs to meet the Primary and Secondary Drinking Water Standards of Treatment (FAC 62-550). Table 24 presents the basic water quality parameters to be met by treatment prior to injection. After recovery from the ASR wells the Reuse of Reclaimed Water and Land Application Rule FAC 62-610 dictates the water quality requirements.

Table 24
Primary Drinking Water Standards
(applicable to ASR Wells)

Parameter			**Limit (mg/L)**
Inorganics	Arsenic		<10 µg/L MCL
	Fluoride [(1)]		<4 mg/L MCL – Recommended optimum concentration
	Sulfate		<250 mg/L MCL
Organics	Volatile Organic Compounds		Below MCLs at all times.
	Synthetic Organic Compounds		Below MCLs at all times.
Microbials and Turbidity	Disinfection		Surface water – 4-log Virus, 3-log Giardia, 2.5-log Cryptosporidium.
	Turbidity		Surface water - 95th percentile <0.25, always < 3 NTU
Secondary	Color		Maintain Finished Water 15 color units at all times.
Other	Regulated Disinfection-By-Products (DBPs):	THMs / HAAs	Below Stage I (<80 µg/L/ <60 µg/L).
	PH		Maintain Finished Water pH within range needed for corrosion control (approximately 7.6 to 7.9).
	TDS		Below secondary MCL of 500 mg/L.
	Chloride		Below secondary MCL of 250 mg/L.
	Turbidity		<0.3 NTU in Finished Water: Remove colloidal iron.

MCL = Maximum Contaminant Level

[(1)]Fluoride is also a Secondary Parameter

Treatment Proposed

The treatment of surface water systems is highly dependant on raw water quality, but there are systems in operation, such as Collier County's Mule Pen Quarry which uses shallow wells adjacent to the quarry, which pump directly into the County's reclaimed water system. Also, the District is preparing to undertake a pilot study to evaluate the use of in-bank filtration of surface water as the primary means of treatment prior to ASR storage for the CERP. This study assumes the use of in-bank filtration through a variety of media systems, depending on geology, as the treatment system prior to injection. Therefore, the overall system includes in-bank filtration, pumping to the ASR, pH adjustment (acidification), disinfection, injection, recovery, disinfection, and pumping to the existing reclaimed water system.

This system will provide the necessary water quality for urban irrigation. It is anticipated that this treatment system will provide the following:

- Up to 3-log removal of pathogens,
- Minimal potential for disinfection by-product formation,
- Corrosion control, and
- Well plugging control.

Again, color is not treated to the required level with this type of system, but the FDEP has given exemptions in the past for this parameter.

ASR Recovery Standards

For recovery, the water needs to meet Rule 62-610.410, FAC. This rule provides that water for irrigation with public access shall not contain more than 5 mg/L of TSS, as well as meeting the secondary treatment standards and high–level disinfection. It is anticipated that disinfection with chlorine/chloramines after recovery is all that will be necessary to meet the reclaimed water rule.

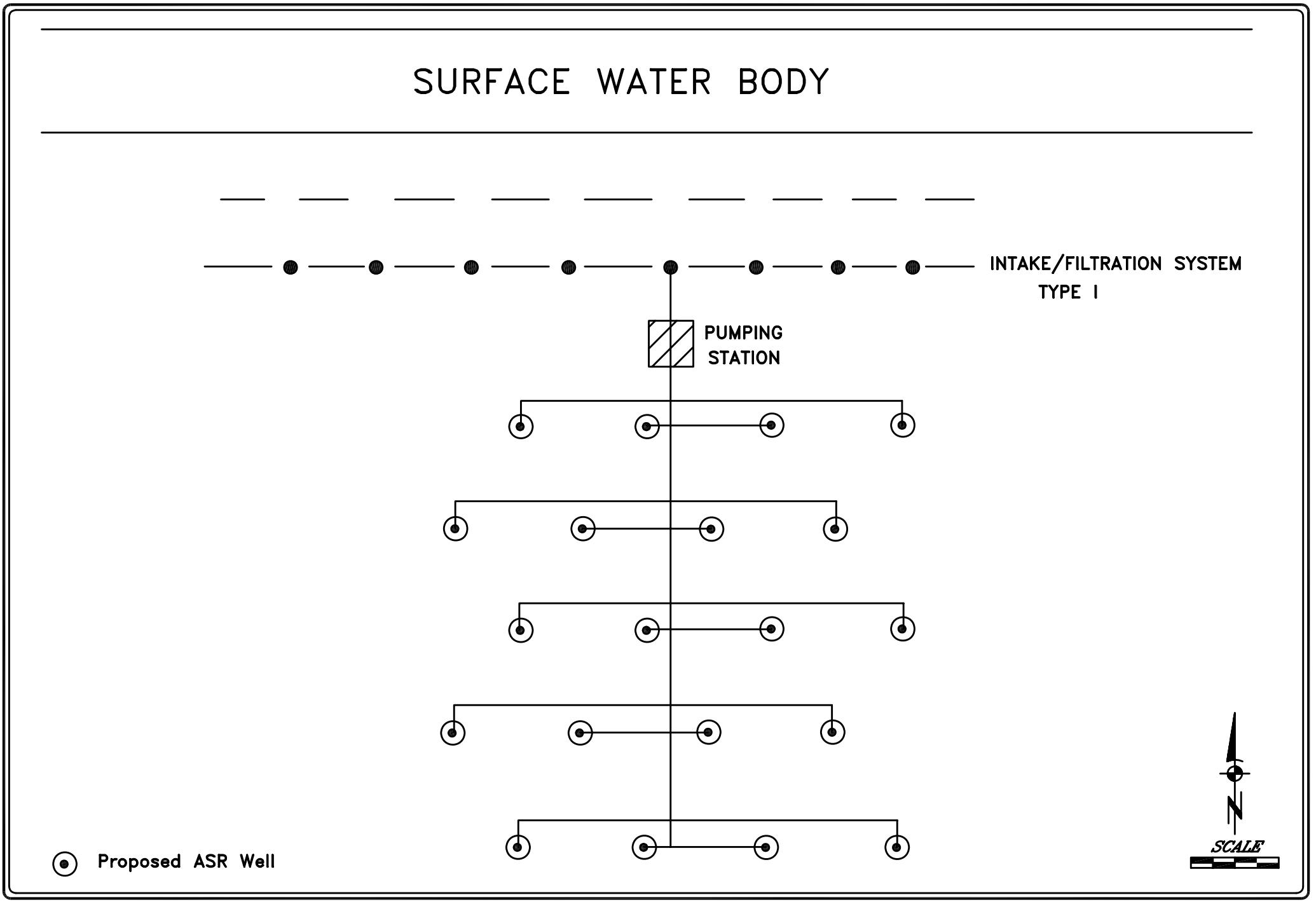
Typical System Configuration

A typical surface water ASR system will require, a diversion/intake structure (with filtration), pipelines, pumps, pH adjustment (prior to storage), disinfection and the ASR wells, as shown in Figure 5. The pH adjustment system will use either hydrochloric or carbonic acid. The storage capacity for the pH adjustment system chemicals will be dependent upon the number of ASR wells in each ASR wellfield.

Well Configuration

The configuration of the ASR systems was designed using the information described above and the optimum number of wells for each site. Each proposed configuration tried to achieve the best distribution of wells to optimize ASR recovery by concentrating the wells to reduce mixing between the injected water with the native water. The ASR system configurations for each potential alternative site are provided as Figures 15, 16, 17, 18, and 19.

A typical ASR wellhead configuration plan view is shown on Figure 20 and a typical ASR subsurface sectional view (prior to installing submersible pump equipment) is shown on Figure 21.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
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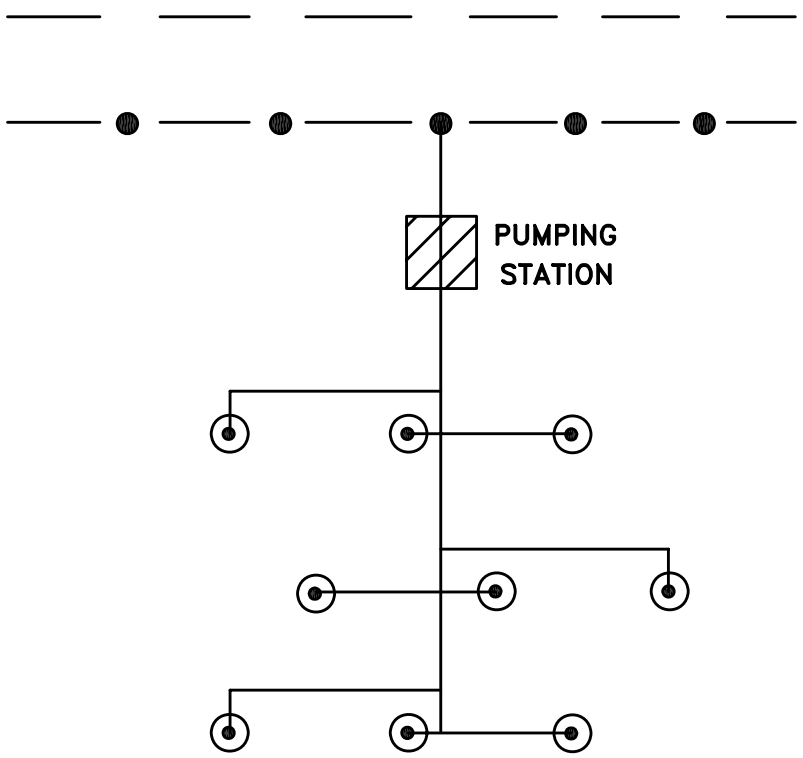
FIGURE 15– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR GATOR SLOUGH

SURFACE WATER BODY



INTAKE/FILTRATION SYSTEM
TYPE I

⊙ Proposed ASR Well

N

SCALE

Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
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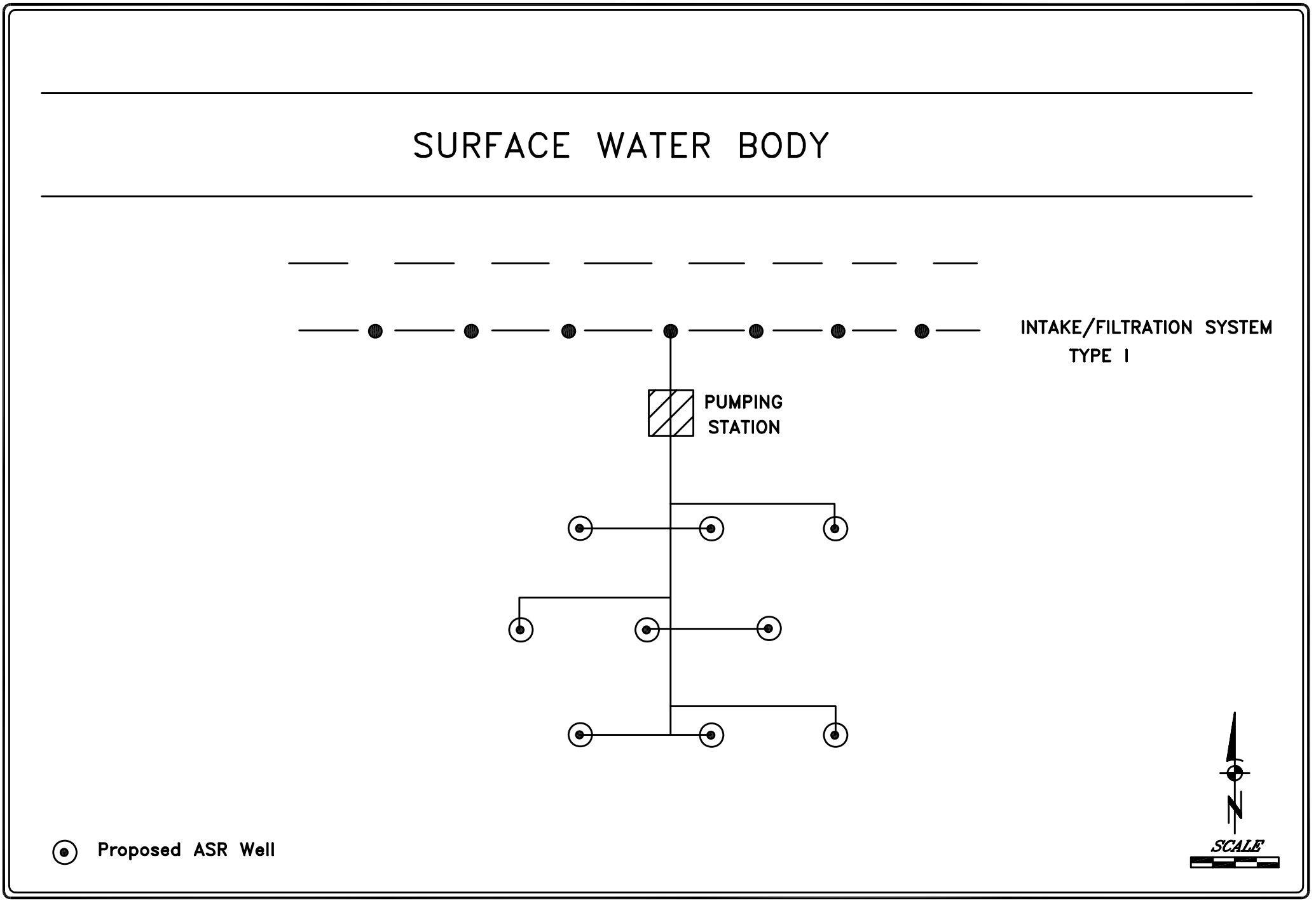
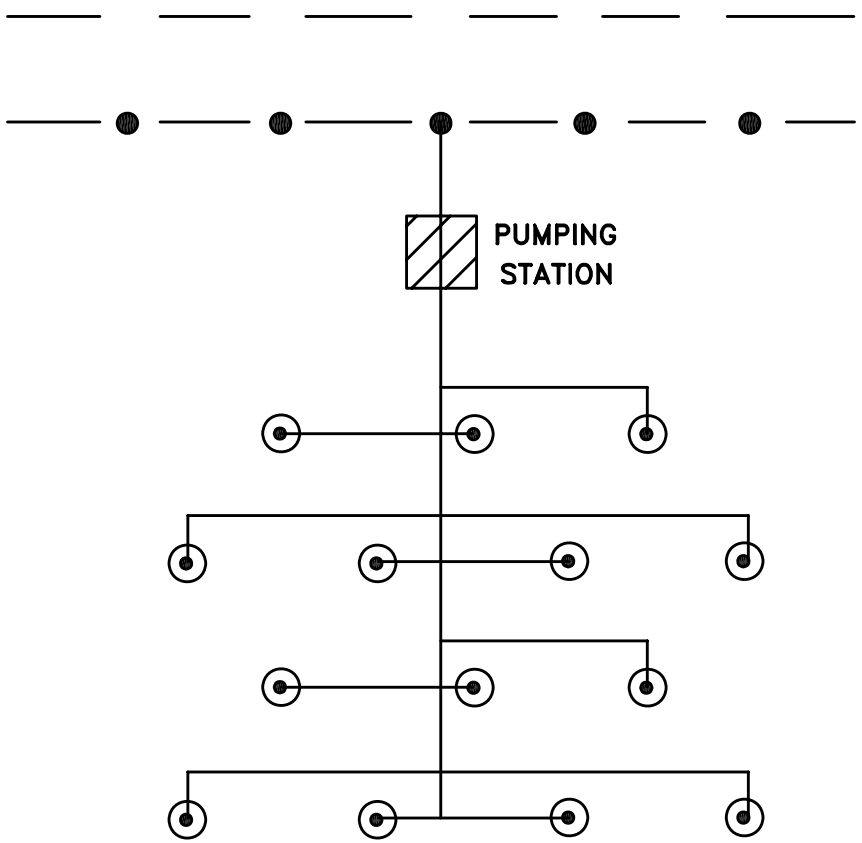
FIGURE 16– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR HORSESHOE CANAL



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 17- PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR HERMOSA CANAL

SURFACE WATER BODY



INTAKE/FILTRATION SYSTEM
TYPE I

⊙ Proposed ASR Well

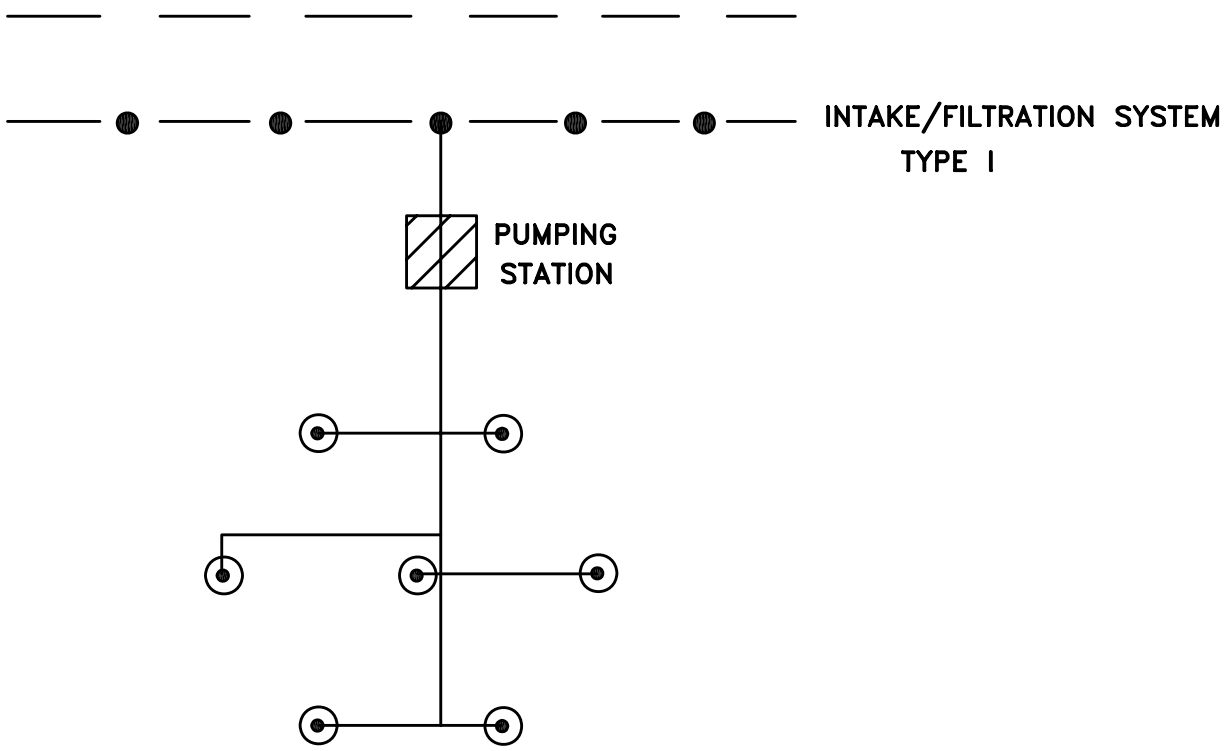
N

SCALE

Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 18– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR NORTH–SOUTH TRANSFER STATION

SURFACE WATER BODY



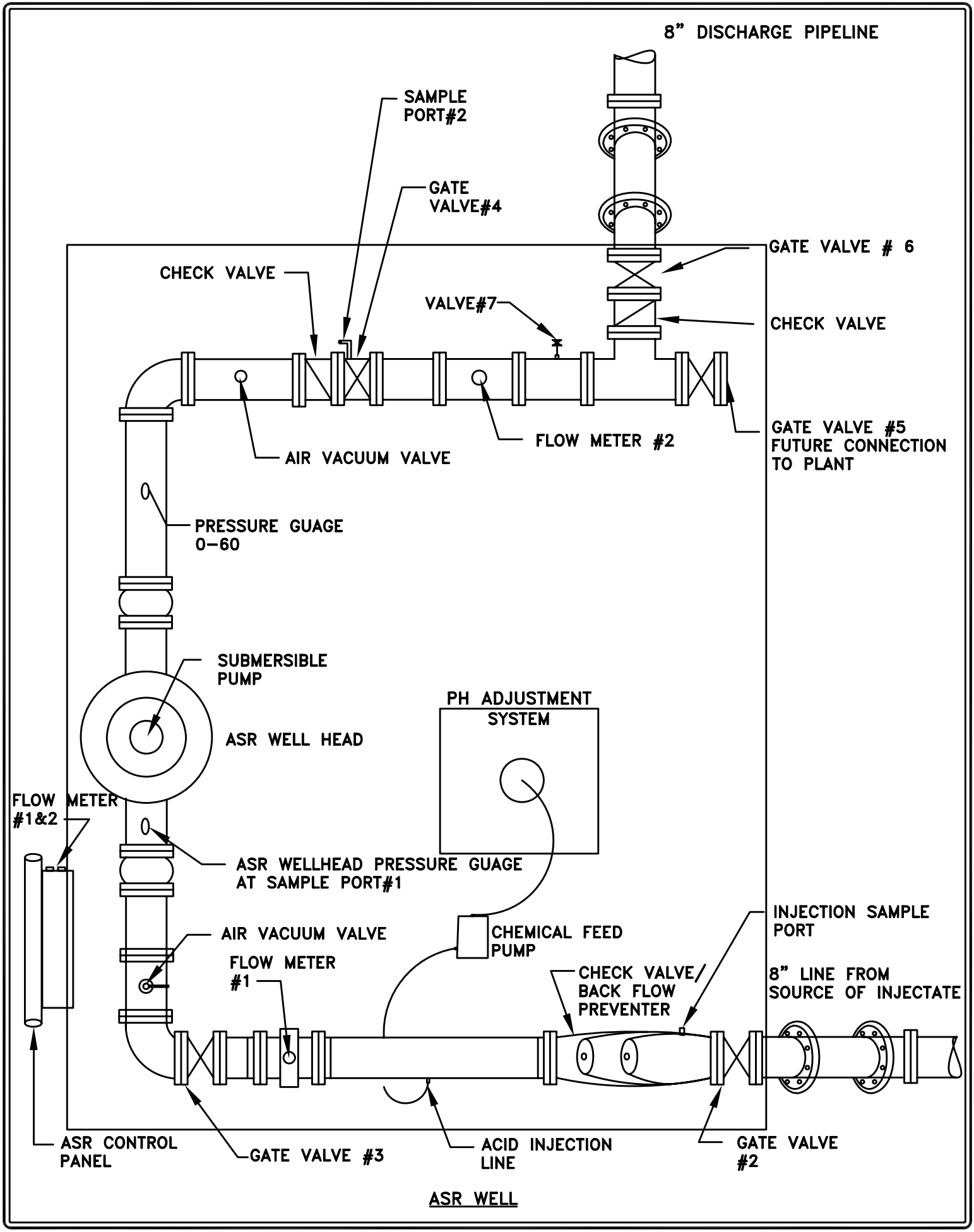
Proposed ASR Well

N

SCALE

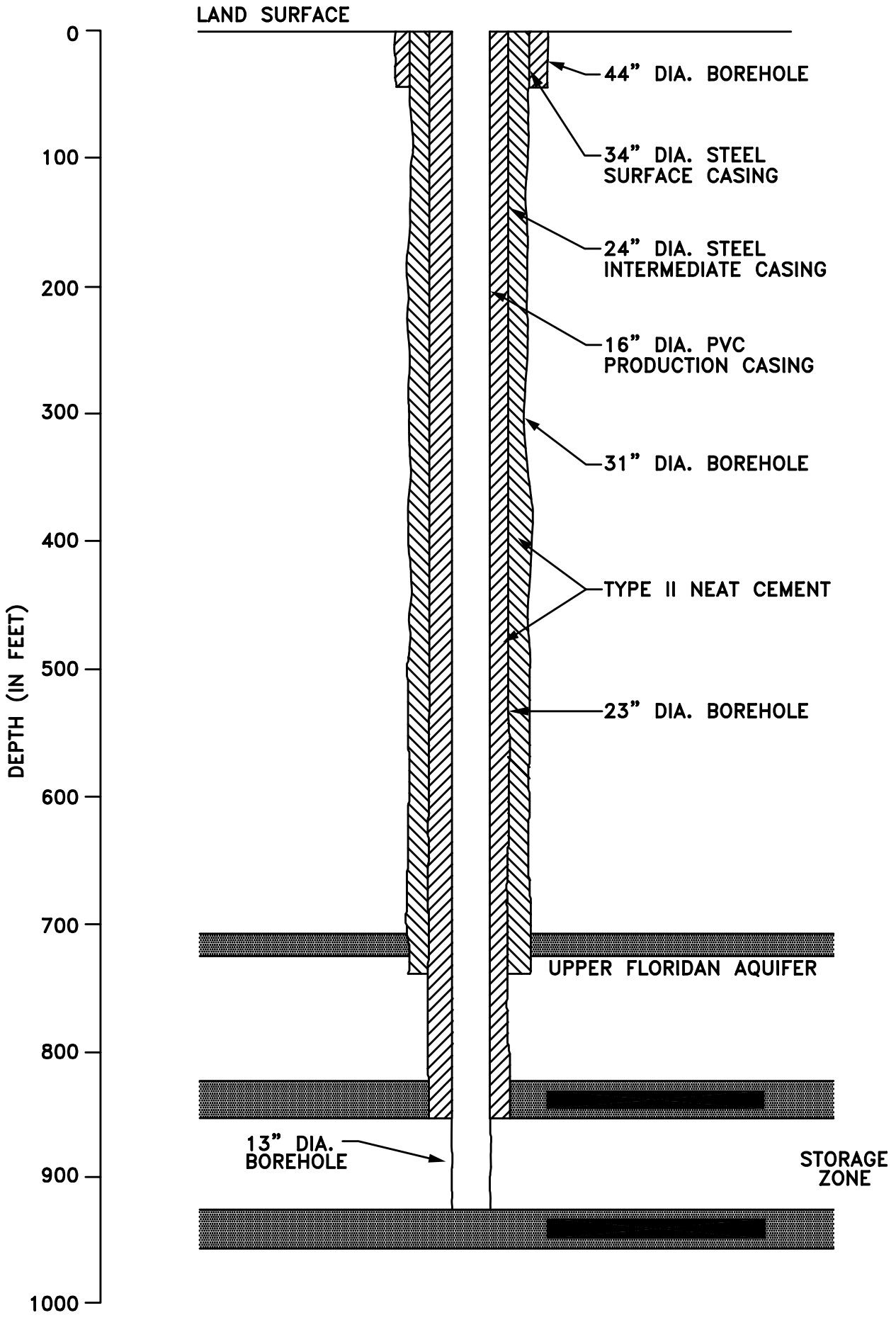
Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 19– PLAN VIEW OF CONCEPTUAL SURFACE WATER ASR SYSTEM FOR CANAL PUMPING STATION #8.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445R10-1
	PROJECT NUMBER: 01-04445.HO	DATE: 10/22/03

FIGURE 20. PLAN VIEW OF ASR WELL PAD.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445R11-1
	PROJECT NUMBER: 01-04445.HO	DATE: 10/22/03

FIGURE 21. GENERAL ILLUSTRATION OF CONSTRUCTION DETAILS FOR ASR WELL.

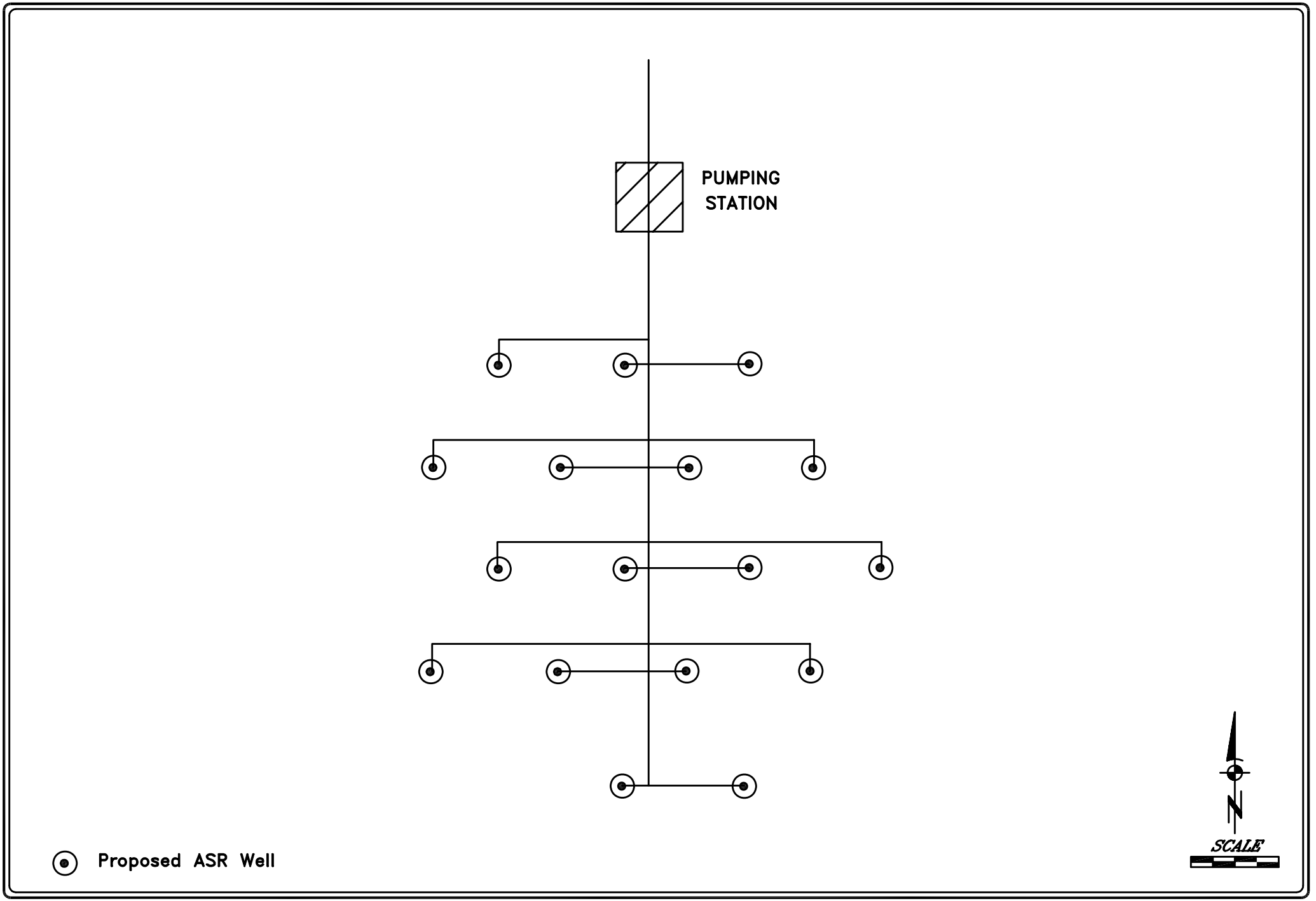
Reclaimed Water Systems

There is a great deal of opportunity to maximize the use of reclaimed water in a RIDS program. The stakeholder utilities have growing reuse programs and plan to continue to expand. In order to offset the disposal of highly treated water during the wet season; ASR storage will be used to store the water during the wet season for use during the dry period of the year.

The reclaimed water ASR systems were configured with the optimum number of wells for each site. Configurations were selected to optimize ASR recovery by concentrating wells to reduce mixing between the injected water and the native water. The ASR wellfield configuration for the reclaimed water ASR system for Everest Parkway is shown in Figure 22.

Quantity

As presented previously on TM No. 1, the expected flow from the WWTPs was estimated based on the projected population and wastewater generation factor of 112 gpd/capita. As a result, a total of 13.7 MGD could be use to meet the future reuse demands.



Water Resource Solutions	PROJECT NAME: RIDS PHASE II	
	PROJECT NUMBER: 01-04445.HO	DATE: 10/1/03

FIGURE 22- PLAN VIEW OF CONCEPTUAL RECLAIMED WATER ASR SYSTEM FOR EVEREST PARKWAY

Water Quality Requirements

As is the case with the surface water systems, several sections of Chapter 62 of the Florida Administrative Code (FAC) have some control over reuse ASR. The more important sections are 62-610.560 (Ground Water Recharge by Injection) and 62-528.600 (Criteria for Class V Wells).

Section 62-610.560 FAC requires reclaimed water injected into class G-II aquifers (any aquifer containing groundwater quality with a total dissolved solids concentration of less than 10,000 milligrams per liter) with groundwater quality of less than 3,000 milligrams per liter (mg/l) of total dissolved solids (TDS) must meet full treatment and disinfection regulations. These regulation require total suspended solids (TSS) concentrations to be less than 5.0 mg/l before disinfection, filtration for TSS control, total nitrogen less than 10.0 mg/l, Primary and Secondary Drinking Water Standards must be met, total organic carbon (TOC) less than 3.0 mg/l, total organic halogen (TOX) less than 0.2 mg/l, no potable water supply wells drawing from the aquifer within one of the ASR well unless those wells are owned and operated by the ASR well owner.

For aquifers containing groundwater with TDS concentrations greater than 3,000 mg/l but less than 10,000 mg/l, the reclaimed water must meet principal treatment and disinfection requirements. Principal treatment includes (TSS) concentrations to be less than 5.0 mg/l before disinfection, filtration for TSS control, total nitrogen less than 10.0 mg/l Compliance with Secondary Drinking Water Standards and for sodium limitations for the reclaimed water is not required.

Section 62-610.466 FAC requires that water recovered from a reclaimed water ASR well must be treated to high level disinfection standards before it enters a reuse distribution system. This section also requires an engineering report with the initial permit application, which evaluates any anticipated changes in characteristics of the reclaimed water during injection, storage, and recovery. Further details about all the regulations applicable to these projects are presented, below, in the portion of this Technical Memorandum entitled, “Assessment Of Current Policies, Procedures, And Regulations”.

Interconnects / Transmission Lines

The concept of interconnects between utilities was developed in the Master Plan. These interconnects are the key to providing a system with a regional benefit, not just water for a local utility. There are also transmission lines necessary to bring water from supply sources to the existing distribution system. Interconnected systems do have water quality issues due to treatment types, disinfection types, piping materials, etc. This will be considered prior to the actual installation of the interconnects so that the utilities can proactively address the issue.

Interconnects / transmission lines were located based on several criteria including:

- Existing reuse transmission system locations
- Geographic proximity between systems
- Potential piping routes or corridors
- Areas of demand
- The conceptual location of and costing for the interconnect included piping, booster pump stations and ASR storage.

Within this Region, there is an interconnect between Waterway Estates and Cape Coral.

Water Quality Requirements

Recovery prior to transmission shall meet the Reuse of Reclaimed Water and Land Application Rule FAC 62-610.

COST ANALYSIS

Preliminary cost estimates for the identified alternatives were developed including capital as well as operation and maintenance (O&M) costs. Table 25 presents these costs for each of the alternatives. The costs consider financing the initial project capital costs, including assumptions about potential funding sources, and annual operations and maintenance expenses. Projected annual costs were divided by the projected annual benefits to obtain unit costs for each alternative. The range of costs was $0.85 (for 414 million gallons per year) to $1.56 (for 1.1 billion gallons per year) per thousand gallons. The unit cost for the overall alternatives would be approximately $1.27 per thousand gallons. These costs was based on FDEP's State Revolving Fund (SRF) loan structures and assumed no grant funding. These cost estimates include estimated construction costs for the various wells, pumping stations and pipelines that make up the projects, including engineering and contingencies. The cost summary is included as Attachment F.

Table 25
Sub-regional Alternatives Cost Summary

No.	Alternatives	Capital Cost	Annual O&M Cost	Annual Benefit (1,000 gal)[1]	Unit Cost ($/1,000 gal)[2]
1.	Gator Slough ASR	$26,855,004	$588,000	2,520,000	$1.29
2.	Horseshoe Canal ASR	$14,029,882	$252,000	1,080,000	$1.48
3.	Hermosa Canal ASR	$14,828,218	$252,000	1,080,000	$1.56
4.	Everest Parkway/Waterway Estates/N. Ft. Myers	$22,110,750	$352,600	2,196,000	$1.20
5.	Cape Coral / North Ft. Myers Interconnect	$2,646,396	$96,000	414,000	$0.85
6.	North-South Transfer Station	$19,374,000	$420,000	1,800,000	$1.27
7.	Canal Pumping Station #8	$11,720,750	$210,000	900,000	$1.49

[1] Annualized Benefit in 1,000 gallons = is the total estimated benefit of the project multiplied by the number of day of withdrawal (180 days).

[2] Unit costs divide the sum of Annualized Capital Costs and Annual O & M costs by the Annual Benefit.

To estimate the debt service for each project the following assumptions and considerations were used:

- The initial project costs will be financed over a twenty (20) year period at a rate of 3.5%;
- The cost to be financed includes administrative fees equal to two percent (2%) of the initial project capital costs as required by the terms and conditions of the SRF Loan Program;
- The cost to be financed includes funding of a loan repayment reserve equal to three percent (3%) of the initial project capital costs being borrowed as required by the terms and conditions of the SRF Loan Program, and
- The cost to be financed includes thirty-six (36) months of capitalized interest based upon construction funding draws during the assumed project engineering and construction period.
- Total capital costs for each subregion include debt service and an allowance for debt service coverage equal to 25% of the annual debt service.
- The allowance for debt service coverage is based upon the SRF Loan Program's minimum debt service coverage requirement of 15% adjusted upward to also reflect the need for funding capital renewals and replacements that may occur during the term of the loan agreement.

The annual operations and maintenance costs for each alternative included:

- The cost of electricity for pumping;
- General maintenance of the facilities;
- Submersible pump maintenance;
- Adjustment of injection rates and measurement of water quality;
- Weekly water sample procurement for laboratory analysis;
- Semiannual calibration of flowmeters and gauges;
- Preparation of monthly regulatory reports; and
- Cost for chemicals, pretreatment, and filtration prior to injection.

The annual operations and maintenance costs were added to the annual capital related financing costs to estimate the total costs for each project and subregion. The cost per thousand gallons for each subregion was divided by the total annual production of each alternative to obtain unit costs. It was assumed alternatives would serve provide an irrigation water benefit for only 180 days per year.

It is important to note preexisting deficiencies at the treatment plants considered in this study were not included in the analysis. It was assumed all plants would be providing the appropriate treatment to meet primary and secondary standards.

INSTITUTIONAL FRAMEWORK

The decision was made during the Master Plan to utilize interlocal agreements to oversee design, construction, development, funding and operation of systems resulting from the RIDS program. In practice, various types of interlocal agreements have been used to own, operate, and govern regional utility water supply and wastewater treatment projects. These range from the formation of a separate and distinct entity such as a utility authority to arrangements where one party is the prime sponsor with respect to financing and operations and the other regional participants are enjoined through a contractually binding bulk sales agreement or capacity entitlement and cost sharing arrangement.

There is one primary interlocal agreement that is anticipated:

- Waterway Estates to Cape Coral

The advantages of the project-by-project or subregional approach is that individual arrangements can be developed that are flexible in dealing with ownership and operating issues in a way that satisfies all of the jurisdictions involved. This type of institutional approach may ensure more active and better participation among the involved parties. Also, it is anticipated that the project cost would be lower because there would be very little redundant administrative and operating costs. The utility representatives that are participating in developing the Master Plan strongly favor a project-by-project or subregional approach to the development of irrigation water resources.

FUNDING SOURCES AND OPTIONS

Introduction

As a regional project with far reaching impact, the RIDS program requires concerted efforts by all parties involved for funding. The project stakeholders currently have substantial, ongoing programs to implement water, wastewater and reclaimed water programs; therefore, they have incurred significant debt service. With estimated costs of more than $300 Million, the stakeholders are expecting funding assistance in order to implement the program.

This document will emphasize the steps necessary to get the priority projects funded, and will serve as a guideline for future RIDS efforts.

Critical Issues

- **Program Identity:** As funding is sought for these projects, it is imperative that the program be accurately and consistently identified to image it appropriately. IT should be imaged as an Alternative Water Supply Program with regional benefits. Also, projects within stakeholder Capital Improvement Plans often fail to identify the project as pertaining to RIDS. Projects listed on the District alternative water supply list, the Florida Department of Environmental Protection (FDEP) State Revolving Fund (SRF) Fundable List, and the State and Federal Government budgets should be integrated and identified as RIDS to create an identity for the program.

- **Uniform Approach:** To date, Federal and State funding efforts have been minimal, primarily due to the lack of a uniform approach. Stakeholders and the District must coordinate together to achieve the type of funding support the program requires.

- **Detailed Schedule:** The timing of funding cycles and legislative opportunities must be identified for all parties.

Proposed Resolutions

- An identity for the program must be created. To achieve this, a point person should be identified by the District and given the support required to move the program forward. Identification of the program as a major initiative by the District both in the media and on the website would aid in recognition.

- A unified approach must be taken. A project team or steering committee should be set up consisting of the District point person and a representative from each of the stakeholders. Other members would include the federal and state lobbyists; a representative of the District's funding department, the consulting engineer, and the funding specialist.

- A presentation package is required to assist in the timing and uniformity of the project team's actions. The project team should utilize this document for all discussions and funding requests.

This section lists the available sources of funding for the RIDS program.

Florida Department of Environmental Protection (FDEP) State Revolving Fund Loan Program – Wastewater and Stormwater

The State Revolving Fund Loan Program (SRF) provides low-interest loans for planning, designing, and constructing water pollution control facilities. Federal Capitalization Grants and State match appropriations of 20% have funded the SRF. It is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The FDEP solicits project information each year. The information is used to establish project priorities for the following annual cycle. Funds are made available for Pre-construction Loans and Construction Loans. The loan terms include a 20-year amortization and low interest rates, which represent a 40% discount off bond rates.

Pre-construction loans are available to all communities and provide up-front disbursements for administrative services, project planning and project design.

Construction loans are also available to all communities and provide for construction costs and technical services during construction.

Approximately $120M/yr is available. The current interest rate is approximately 3.00%.

FDEP State Revolving Fund Loan Program – Drinking Water

The Drinking Water State Revolving Fund (SRF) Program provides low-interest loans for planning, designing, and constructing public water facilities. Federal Capitalization Grants and State match appropriations of 20% have funded the SRF. It is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The Department solicits project information each year from January 1 to February 15. The information is used to establish the project priority list for the following annual cycle. Funds are made available for Pre-construction Loans to rate-based public water systems, Construction Loans of $75,000 minimum or more, and Pre-construction Grants and Construction Grants to financially disadvantaged communities.

The loan terms include a 20-year (30-year for financially disadvantaged communities) amortization and low interest rates, which represent a 40% discount off bond rates. Small community assistance is available for communities having populations less than 10,000. Each year 15% of the funds are reserved exclusively for their use. In addition, small communities may qualify for loans from the unreserved 85% of the funds.

Approximately $40M/yr is available. The current interest rate is approximately 3.00%.

SFWMD Alternative Water Supply Grant Program

In 1995, the Florida Legislature enacted the Alternative Water Supply Grant Program to increase the potential for the development of alternative water supplies in the state and to help utilities develop cost-effective reclaimed water supplies.

The Program is a cost share program that provides a portion of funding for alternative water supply projects built by local, county, or private water purveyors. To be considered for the program, a project must be consistent with the local government plan and must be located in a Water Resource Caution Area. Funding support is limited to capital or infrastructure costs for alternative water supply systems.

The available funds vary annually as determined during the District's budget process.

SFWMD Water Resource Development Program

Water resource development projects are generally regional in nature and are primarily the responsibility of the District. Each water management district is required to include in its annual budget the amount needed for the fiscal year to implement water resource development projects as prioritized in its regional water supply plans.

The traditional source of funding has been ad valorem taxes. Projects are ranked and prioritized along with projects in all other regional water supply plans during annual District budget preparation and funded, as money is available. Priority considerations for a project include availability of a cost-share partner and if a project makes 'new' water available. Sustainability of the regional system is also an important consideration.

State Funds - The Water Quality Improvement and Water Restoration Grant Program (Section 403.885 F.S.)

Amount of funds available will vary by year. In 2003, no projects were funded. In 2004, $100M worth of projects were funded.

Projects eligible for the funding must address such criteria as resolving violations of state water quality standards, preventing drainage and flood control problems, resolving public health threats and protecting the environment. Financial capability of the local government is also a deciding factor.

The program includes grants covering wastewater, stormwater, surface water restoration and water management projects.

Currently, funds are requested through a Community Budget Issue Request/Special Appropriation Process. The FDEP will review the request and make recommendations as to appropriateness of the project to the program.

Federal Funds – EPA State and Tribal Assistance Grants

The United States Environmental Protection Agency makes funds available for special water supply projects through its State and Tribal Assistance Grant (STAG) program.

The projects must be included in an appropriation bill passed by the Senate and House.

Approximately $2M/yr per project in grant funds is typically available for projects the size of RIDS.

Local Funds – Developer Contributions/Impact Fees/User Fees (Rates)

Revenue derived from the collection of impact fees could be used to fund portions of the project. Additionally, requirements could be placed on developers to provide or construct portions of the system within particular developments reducing the total cost of the distribution system.

Revenue generated through rates is normally used for O&M costs.

Bonds

Issuance of bonds could provide for project funding; however, due to the costs of issuance, interest rates, coverage and other financial considerations, this would be a last resort option.

Funding Strategy

As depicted in Figure 4-1, it is recommended that the base funding for the RIDS project be the FDEP SRF program loans. The low interest rates (approximately 3.00%) and repayment terms (20 years) make them the most attractive form of overall financing.

The SRF program provides for the flexibility to draw funds only when needed and allows for application of grant funds when received. Unlike bond funds, there is no arbitrage or pre-payment penalties.

After this base funding is secured, it is recommended that district, state, and federal grant funds be sought and secured to negate the use of borrowed funds where possible.

A significant increase in the District's Water Management and Planning budget would be required to support further development of the program as well as dedication of revenues to provide grants for construction funding.

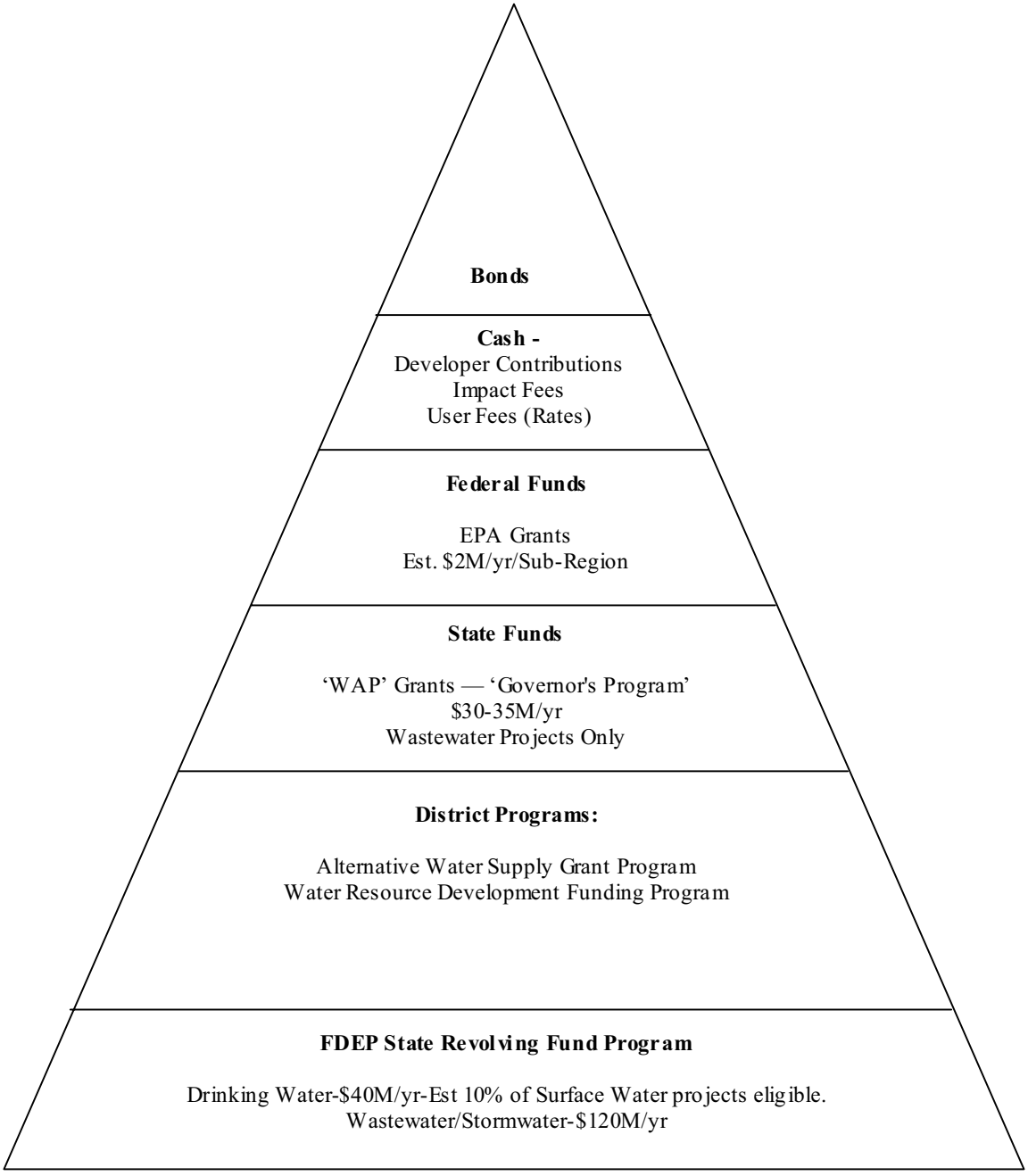
Cash reserves in the form of Developer Contributions and Impact Fees would be considered the third level of funding with bond proceeds considered the least attractive form of funding due to financing costs.

It is assumed that user fees (rates) will pay for Operating and Maintenance costs.

Project Timing and Phasing

It is assumed that the project would be phased to provide system resources based on need. Consideration should also be given to phasing of the service areas as individual areas' economics/demographics may allow them to better "compete" for funding versus other areas or the total project as a whole.

Funding Strategy



Priority Projects

In order to meet the critical issues presented previously, a funding workshop was held with all of the stakeholders and the District. It was determined that "Priority Projects" would be necessary to initiate momentum for the program and to properly image it amongst the legislators, funding agencies regulators. The following table presents a summary of the priority projects as agreed to by the stakeholders and the potential funding sources for them.

RIDS Priority Projects

Project Name	Capital Cost	Typical Funding Sources			
		EPA (STAG)	SFWMD	State (CBIR)	SRF
Sub Region 1 (Collier County, Naples and Bonita Springs)					
BSU - Kehl Canal Surface Water ASR	$ 23,000,000	$ 2,300,000	$ 2,300,000	$ 1,150,000	$ 17,250,000
Collier - BSU Interconnect	$ 3,000,000	$ 300,000	$ 300,000	$ 150,000	$ 2,250,000
Collier - BSU Reclaimed Water ASR	$ 20,000,000	$ 2,000,000	$ 2,000,000	$ 1,000,000	$ 15,000,000
Subtotal	$ 46,000,000	$ 4,600,000	$ 4,600,000	$ 2,300,000	$ 34,500,000
Sub Region 2 (Cape Coral, North Ft. Myers and Waterway Estates)					
Cape Coral - Gator Slough Surface Water ASR	$ 27,000,000	$ 2,700,000	$ 2,700,000	$ 1,350,000	$ 20,250,000
Cape Coral - Everest Pkwy Reclaimed Water ASR	$ 22,000,000	$ 2,200,000	$ 2,200,000	$ 1,100,000	$ 16,500,000
Cape Coral - North South Transfer Station Surface Water ASR	$ 19,000,000	$ 1,900,000	$ 1,900,000	$ 950,000	$ 14,250,000
Subtotal	$ 68,000,000	$ 6,800,000	$ 6,800,000	$ 3,400,000	$ 51,000,000
Sub Region 3 (City of Ft. Myers and Lee County)					
Ft Myers - Central WWTP and South WWTP Interconnect	$ 19,500,000	$ 1,950,000	$ 1,950,000	$ 975,000	$ 14,625,000
Ft Myers - Reclaimed Water Pipeline East of I-75	$ 6,500,000	$ 650,000	$ 650,000	$ 325,000	$ 4,875,000
Lee - Ft. Myers Beach/ Ft. Myers Village ASR system	$ 14,000,000	$ 1,400,000	$ 1,400,000	$ 700,000	$ 10,500,000
Subtotal	$ 40,000,000	$ 4,000,000	$ 4,000,000	$ 2,000,000	$ 30,000,000
TOTAL	$ 154,000,000	$ 15,400,000	$ 15,400,000	$ 7,700,000	$ 115,500,000

Notes:

1. Project Costs are from the Boyle Engineering Funding Report for SFWMD, dated 12/14/04.
2. EPA Participation through STAG requests is dependant upon adequate preparation. $2 million per project is typical for projects of similar scope.
3. SFWMD (AWS) participation has typically been maximized at $200,000, and is considered to be included in applicable projects.
4. Future funds availability from EPA, State, and WMD are uncertain. All funding options will be utilized in order to minimize Stakeholder funds required.
5. Initial funding estimates have been broken down as 10% Federal, 10% SFWMD, and 5% State.

Funding Examples

Shown below are project funding examples from other Districts. The dollar amounts shown for Federal, State, and District sources provided to indicate the type of funding that might be available.

Funding Examples

Project Name	Project Type	Year	Total Project Cost	Total Federal Funding	Total District Cost	Total Basin Cost	Total Governing Board Cost
Tampa Water Resource Recovery	New Water Sources Initiative	FY 2005	4,392,000	3,642,000	750,000	375,000	375,000
Peace River Option	New Water Sources Initiative	FY 2005	65,989,692	574,000	20,755,155	10,377,578	10,377,577
Manatee Agricultural Reuse Supply (MARS)	New Water Sources Initiative	FY 2005	30,821,940	7,256,000	11,981,145	5,990,660	5,990,485
Hillsborough County Central Reuse System	New Water Sources Initiative	FY 2005	7,000,000		3,294,841	1,584,390	1,710,451
Hillsborough Co Northwest Reuse System Ph 1	New Water Sources Initiative	FY 2005	11,100,000		5,406,232	2,685,232	2,721,000
Peace River Regional Reservoir Expansion	New Water Sources Initiative	FY 2005	29,800,000		14,900,000	7,453,980	7,446,020
Peace River Facility Expansion	New Water Sources Initiative	FY 2005	76,200,000	9,000,000	24,200,000	12,225,000	11,975,000
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2005	10,072,312		4,965,712	2,486,268	2,479,444
Facilitating Agricultural Resource Mgmt Systems	Water Supply & Resource Development	FY 2005	6,453,039		6,353,039	4,295,089	2,057,950
Charlotte Co Regional Reclm Wtr Expansion	Water Supply & Resource Development	FY 2005	5,803,245		2,903,745	1,451,898	1,451,847
Manatee Co FPL / Piney Point MARS Storage	Water Supply & Resource Development	FY 2005	8,000,000		4,000,000	2,000,000	2,000,000
TBRRAP-N, Tampa Reclaimed Wtr Pipeline - Ph I	Water Supply & Resource Development	FY 2005	42,774,874	12,372,750	21,406,098	10,703,440	10,702,658
TBRRAP-N, Tampa Reclaimed Wtr Pipeline - Ph II	Water Supply & Resource Development	FY 2005	42,300,000		21,150,000	10,575,000	10,575,000
Central Sarasota Co Regional Reuse Sys Project	New Water Sources Initiative	FY 2004	4,008,608		2,004,304	1,002,152	1,002,152
North Pinellas Reuse Interconnections	New Water Sources Initiative	FY 2004	3,172,300		1,586,150	793,075	793,075
W. Pasco Infrastructure Improvement-Starkey/N. Pasco	Water Supply & Resource Development	FY 2004	30,000,000		15,000,000	7,500,000	7,500,000
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2004	10,067,144		4,960,544	2,480,894	2,479,650
Facilitating Agricultural Resource Mgmt Systems	Water Supply & Resource Development	FY 2004	3,267,271		3,167,271	2,304,016	863,255
Central Sarasota Reuse	New Water Sources Initiative	FY 2003	4,008,608		2,004,304	1,002,152	1,002,152
NW Reuse Expansion	New Water Sources Initiative	FY 2003	10,884,000		5,442,000	272,100	272,100
Largo/Clearwater/Pasco - ASR / Interconnect	Water Supply & Resource Development	FY 2003	9,564,786		4,708,186	2,353,536	2,354,650
Tampa's Howard Curren WWTP Regional Reclaimed to New Tampa	Water Supply & Resource Development	FY 2003	15,000,000		7,500,000	3,750,000	3,750,000
Tampa's Howard Curren WWTP Regional Reclaimed to Pasco	Water Supply & Resource Development	FY 2003	15,000,000		5,000,500	2,481,000	2,500,000

Below shows various projects identified from this District in its "Alternative Water Supply" (AWS) program, which could hopefully be a source for some of the projects identified in the RIDS Engineering document. The SFWMD Budget for Major Projects includes an additional $21,687,996.

Alternative Water Supply (AWS) Identified Projects

Applicant	Project Title	SFWMD Funding	Total Project Cost	% Funded by SFWMD
City of Pahokee	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
City of South Bay	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
City of Belle Glade	Lake Region Water Treatment Plant Project	$200,000	$675,000	30%
City of Clewiston*	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
South Shore Water Association*	Lake Region Water Treatment Plant Project	$200,000	$499,000	40%
Palm Beach County	Century Village Reuse	$200,000	$1,065,000	19%
Town of Manalapan	Floridan Aquifer Wells	$100,000	$842,242	12%
Village of Wellington	Village Park & Water Reclamation Facility #2	$100,000	$672,000	15%
South Central Regional Wastewater Treatment & Disposal Board	Reuse Plant Expansion (phased project)	$100,000	$12,600,000	1%
Jupiter Utilities	RO Treatment Plant Expansion	$100,000	$3,500,000	3%
Jupiter Utilities	Floridan Aquifer Wells	$100,000	$2,742,000	4%
Village of Tequesta	RO Expansion	$100,000	$1,120,000	9%
City of Hollywood*	Reclaimed Water System Expansion	$100,000	$480,000	21%
City of Miami Beach	Normandy Shores Golf Club	$200,000	$935,000	21%
City of North Miami Beach	Nanofiltration Concentrate Treatment	$100,000	$634,000	16%
Miami-Dade Water and Sewer Dept.	Ultra Violet Disinfection – West Wellfield	$200,000	$2,053,000	10%
Miami-Dade Water and Sewer Dept.	Ultra Violet Disinfection – Southwest Wellfield	$100,000	$2,149,000	5%
Florida Keys Aqueduct Authority	Blending ASR Well	$200,000	$1,334,715	15%
City of Fort Myers	Central WWTF Reclaimed Water Extension	$200,000	$3,127,000	6%
City of Fort Myers	RO Expansion	$100,000	$9,800,000	1%
Cape Coral	Reclaimed Water Supplemental Source	$100,000	$998,000	10%
City of Naples	Reclaimed Water System Expansion	$100,000	$13,600,000	1%
Collier County	ASR Expansion	$100,000	$1,260,100	8%
Bonita Springs	San Carlos ASR Wells	$100,000	$974,199	10%
Bonita Springs	New RO Wellfield	$100,000	$2,800,000	4%
Bonita Springs	RO Treatment	$100,000	$24,000,000	0%
Martin County Utilities	North Reclaimed Water System Expansion	$100,000	$570,000	18%
Martin County Utilities	Tropical Farms RO Wellhead	$100,000	$750,000	13%
South Martin Regional Utility	Reclaimed Water System Expansion	$100,000	$540,000	19%
Fort Pierce Utility Authority	Reclaimed Water System	$100,000	$3,150,000	3%
Port St. Lucie Westport Reuse	Westport Reclaimed Water System	$100,000	$1,202,760	8%
City of Kissimmee	Stormwater Reuse	$200,000	$5,200,000	4%
Orange County Utilities Department	Ginn Property Reuse	$100,000	$816,248	12%
City of St. Cloud	Reclaimed Water System Expansion	$100,000	$758,898	13%
Total		$4,500,000	$102,345,162	4%

Shown below is the funding that was obtained for the Manatee County Agricultural Reuse System project.

Manatee County ASR/Reuse Demonstration Program Funding Worksheet

Manatee County ASR/Reuse Demonstration Program
Funding Worksheet

	Total	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	Total
Project Cost	14,824,724	4,295,000	2,632,431	2,632,431	2,632,431	2,632,431	14,824,724
EPA (Original)	4,295,000	2,093,383	1,283,047	918,571	-	-	4,295,000
SWFWMD (Ag. Reuse)	6,740,970	1,670,395	1,267,644	1,267,644	1,267,644	1,267,644	6,740,970
SWFWMD (ASR)	325,000	325,000	-	-	-	-	325,000
Subtotal	11,360,970	4,088,778	2,550,691	2,186,214	1,267,644	1,267,644	11,360,970
Balance of Project Costs	3,463,754	206,222	81,740	446,217	1,364,787	1,364,787	3,463,754
EPA (Amendment)	1,900,000	-	-	446,217	1,364,787	88,996	1,900,000
County Funds (Required)	1,563,754	206,222	81,740	0	0	1,275,791	1,563,754
Subtotal	3,463,754	206,222	81,740	446,217	1,364,787	1,364,787	3,463,754
Grand Total	**14,824,724**	**4,295,000**	**2,632,431**	**2,632,431**	**2,632,431**	**2,632,431**	**14,824,724**

Notes:
1. Project Costs were utilized from the SWFWMD Grant Agreements dated 12/6/94.
2. EPA Participation through the Original Agreement is 48.74% of $8,812,147 up to a maximum of $4,295,000.
3. SWFWMD (Ag. Reuse) participation is 50% of $14,024,724 up to a maximum of $6,740,970.
4. SWMWMD (ASR) participation is 50% of $650,000 (of the $800,000 project) up to a maximum of $325,000.
5. The project EPA Amendment amount is based on discussions with Mario Machado of EPA. Participation is expected to be 95%.
6. Future funds availability from EPA is uncertain. All funds will be utilized in order to minimize County funds required.

Similar results are possible for the RIDS program.

Funding Schedule

A proposed funding schedule is below. This schedule is typical of the annual funding cycles. For State and Federal appropriations, it is imperative that efforts be started now.

The funding consultant is prepared to initiate a CBIR for the District to help get the first funding success with the State and to initiate the entire program.

Specific Recommendations/Summary

Leadership from the District will ensure success of the RIDS Program. This has been the key to the successes of other District's efforts around the state. The immediate assignment of a high-level person from the District, perhaps a board member, is critical to funding successes.

All stakeholders need direction and support from the District. They need to buy into the funding plan for the program and to be certain their actions are consistent with those of the District in attempts to secure funding.

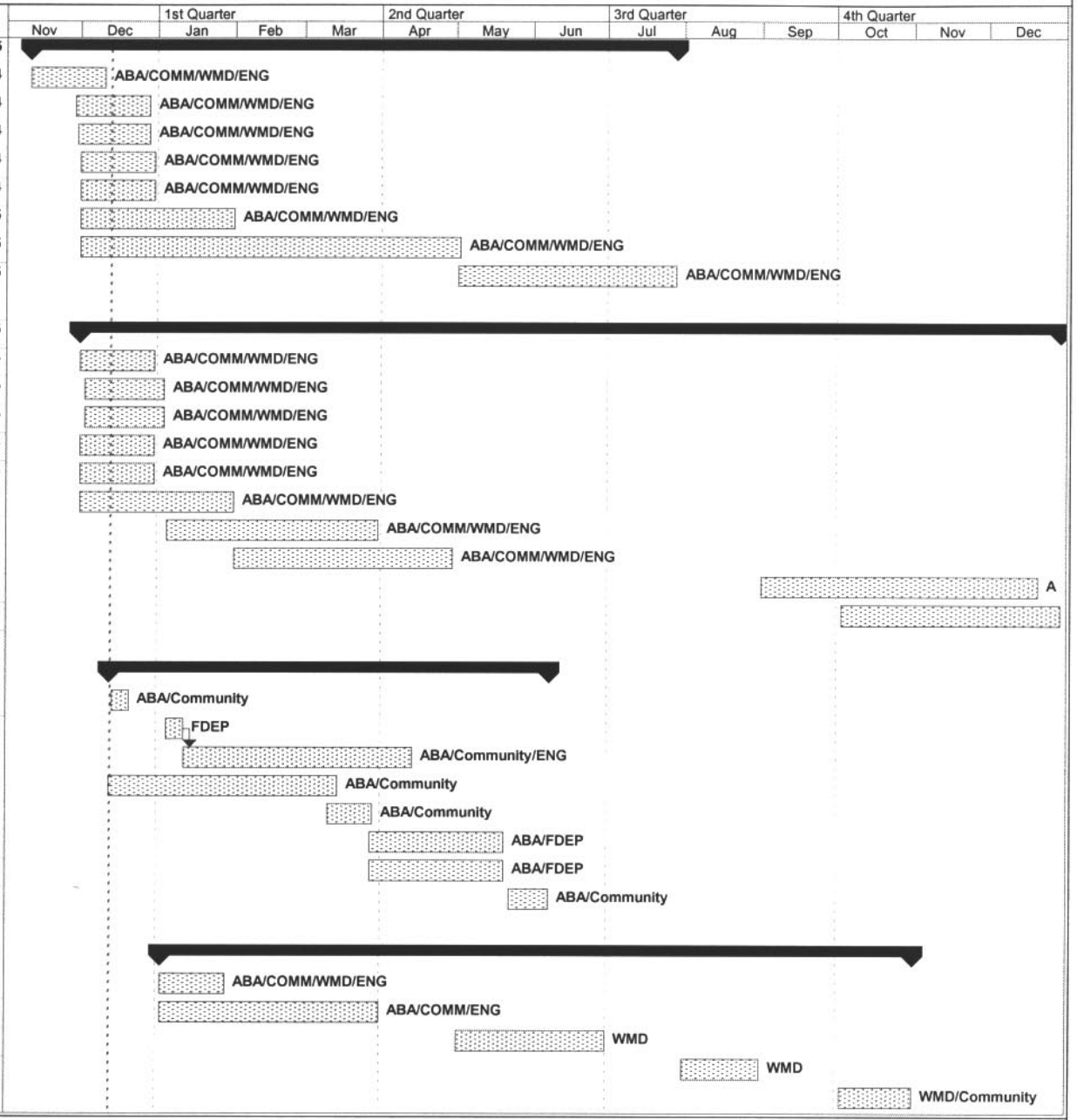
The process must be identified for all concerned in sufficient detail to allow any party to take advantage of funding opportunities when they arise.

The program must be given a high profile within the District in all actions and publications. This will reinforce the intent to implement the program.

RIDS is a worthwhile program that can address water supply needs in a multi-jurisdictional area for years to come. These issues cannot be ignored by any of the interested parties. With the leadership of the South Florida Water Management District, this program can succeed in addressing these needs.

Table 26

Task Name	Start	Finish
STATE APPROPRIATIONS	**Thu 11/11/04**	**Thu 7/28/05**
Information Document	Thu 11/11/04	Fri 12/10/04
Legislative Discussions	Mon 11/29/04	Tue 12/28/04
Prep Required Documents	Tue 11/30/04	Tue 12/28/04
CBIR Senate	Wed 12/1/04	Thu 12/30/04
CBIR House	Wed 12/1/04	Thu 12/30/04
DEP Review Period	Wed 12/1/04	Mon 1/31/05
Lobby Effort	Wed 12/1/04	Mon 5/2/05
Follow Up	Mon 5/2/05	Thu 7/28/05
FEDERAL APPROPRIATIONS	**Wed 12/1/04**	**Thu 12/29/05**
Information Document	Wed 12/1/04	Thu 12/30/04
Legislative Discussions	Fri 12/3/04	Mon 1/3/05
Prep Required Documents	Fri 12/3/04	Mon 1/3/05
CBIR Senate	Wed 12/1/04	Thu 12/30/04
CBIR House	Wed 12/1/04	Thu 12/30/04
EPA Review Period	Wed 12/1/04	Mon 1/31/05
Lobby Effort 1st Session	Wed 1/5/05	Wed 3/30/05
Follow Up	Tue 2/1/05	Fri 4/29/05
Lobby Effort 2nd Session	Thu 9/1/05	Tue 12/20/05
Follow Up	Mon 10/3/05	Thu 12/29/05
SRF CYCLE	**Mon 12/13/04**	**Tue 6/7/05**
RFI	Tue 12/14/04	Mon 12/20/04
FDEP Hearing	Wed 1/5/05	Tue 1/11/05
Facilities Plan	Wed 1/12/05	Wed 4/13/05
Capital Financing Plan	Mon 12/13/04	Mon 3/14/05
Public/Dedicated Revenue Meeting & Approvals	Fri 3/11/05	Mon 3/28/05
State Environmental Review & Approval Process	Mon 3/28/05	Fri 5/20/05
FFONSI/CEN	Mon 3/28/05	Fri 5/20/05
Site Planning	Mon 5/23/05	Tue 6/7/05
SFWMD FUNDING	**Mon 1/3/05**	**Mon 10/31/05**
Identify Source	Mon 1/3/05	Fri 1/28/05
Request Funding	Mon 1/3/05	Thu 3/31/05
SFWMD Ranks Eligibility	Mon 5/2/05	Thu 6/30/05
District Board Reviews list	Mon 8/1/05	Wed 8/31/05
Agreements Executed	Mon 10/3/05	Mon 10/31/05



Project: Table 26 RIDS Schedule draft
Date: Mon 12/13/04

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

ASSESSMENT OF CURRENT POLICIES, PROCEDURES, AND REGULATIONS

There are numerous regulatory issues that apply to the RIDS program. Emerging policies and regulations are evolving for projects like ASR and surface water withdrawals. The RIDS is on the leading edge of some of these applications, so it is appropriate to assess how specific regulations may affect this initiative.

Surface water ASR is currently being evaluated for the Comprehensive Everglades Restoration Program (CERP). There will ultimately need to be a determination made by FDEP on the water quality criteria for the injection of surface water into ASR wells. The difference between the degree of treatment to meet Primary and Secondary drinking water quality as defined by the Safe Drinking Water Act and incorporated into FAC 62-550, and the minimum criteria for injection wells, is substantial in terms of costs to the overall program. The USEPA has indicated a willingness to allow recharge water that contains Coliform bacteria for the CERP ASR demonstration program. It may not be unreasonable for them to also consider a water quality criterion that slightly exceeds the primary standards for turbidity as long as fundamentally, the turbidity and resulting particles are not a clogging problem for the wells.

Further, there is the need to allow for natural attenuation of bacteria and other microbiota (viruses and protozoa) within the ASR storage zone such that discrepancies between the Safe Drinking Water Act (SDWA) and the EPA underground injection control program requirements are reconciled. With these water quality issues resolved there is great potential for lower technology processes to meet water quality goals within a more reasonable expectation of costs and complexity of the systems.

In this manner, the main criteria would be turbidity and/or particle size consistent with protection of the ASR well and disinfection to meet a Coliform reduction based on daily sampling in which no more than one sample is positive for Total Coliform and no single sample exceeds 4 total Coliforms per 100 mL.

If there is agreement for relaxed treatment requirements for disinfection, wherein the water quality requirements are only to meet a Coliform level of not more than 4 colonies/100mL sample, then the following will suffice:

- A treatment system to meet particulate removals consistent with protecting the injection system (not plugging the well).
- Corrosion control to prevent the injected water causing a corrosive atmosphere to the receiving formation will be sufficient.

However, the concern of disinfecting minimally for Coliforms while preventing Disinfection By-Products remain a concern; therefore, the following methods may be appropriate:

- Bankfiltration systems followed by either a UV disinfection or a low tech solid chemical chlorine/ammonia feed system to provide some limited free chlorine for bacteria and virus inactivation followed by chloramines for further disinfection contact time without a major production of DBPs.
- Slow-sand filtration systems followed by the same level of disinfection as described above (chlorine/ammonia).

The RIDS has assumed the use of bankfiltration systems for source water for ASR in lieu of more costly technologies, such as membranes.

The following is a brief overview of the regulations that will apply to the RIDS projects; it is not intended to be an exhaustive list or comprehensive discussion, but rather to provide a summary of the regulatory environment in which the RIDS will be developed:

Florida Department of Environmental Protection (FDEP) Regulations

Relevant FDEP regulations, as published in the Florida Administrative Code (FAC), were summarized for their relevance to the RIDS project.

Chapter 62-40, FAC – Water Resource Implementation Rule

Chapter 62-40, FAC, contains FDEP policies on water resources in Florida and establishes a cooperative relationship with the Water Management Districts in water resource issues. Under the general water policy provisions, reclaimed water is specifically identified as an integral part of water management programs. FDEP also encourages the use of water of the lowest acceptable quality for the purpose intended. Under the water use guidelines, it is stated that no water use permit shall be granted by the Water Management District unless the applicant demonstrates a reasonable beneficial use for that water.

Chapters 62-520 & 522, FAC – Ground Water

The relevant chapters on the subject of ground water focus on protecting the present and future most beneficial uses of ground waters of the state. To ensure their protection, classifications for ground waters of the State have been established. Appropriate water quality designations are outlined in these chapters.

Chapter 62-520, FAC, contains the minimum criteria for ground water and classification descriptions ranging from G-1 (which has the most stringent regulations), to G-IV (the least stringent). This chapter also includes a list of exemptions for each class of ground water.

Chapter 62-522, FAC, discusses ground water monitoring and permitting. This includes recharging aquifers with surface water and reclaimed water ASR. An allowable zone of discharge is expressed for each classification, and monitoring requirements and exemptions are also discussed.

Chapter 62-528, FAC – Underground Injection Control

The Underground Injection Control Program (UIC) is a delegated federal program authorized under the EPA Safe Drinking Water Act. It is under this program that ASR wells are permitted. All wells included in the RIDS would fall under the Class V category, and would most likely be in Group 7 (Aquifer Storage and Recovery System Wells).

Aquifer Storage and Recovery

As indicated above, FDEP rules contained in Chapter 62, Section 528 of the Florida Administrative Code (FAC), govern the permitting and operation of ASR wells. Subsection 300 is of special interest in the permitting of surface water and reclaimed water ASR wells. This portion of the regulations deals with aquifer exemptions. Such exemptions may be needed for certain injection water quality

parameters, such as color, which do not meet Secondary Drinking Water Standards. Minor exemptions are fairly straightforward for aquifers, which have total dissolved solids (TDS) concentrations between 3,000 and 10,000 milligrams per liter (mg/L).

Well Construction

Regulations regarding construction and testing of ASR wells are contained in FAC Chapter 62, Section 528. In addition to obtaining an FDEP Class V well construction permit, a well construction permit must also be obtained from the agency that permits wells in a particular jurisdiction. In portions of Lee County, it is the Lee County Water Resources Department, which permits small diameter wells. In other parts of Lee County, it is a local government, such as the City of Cape Coral., which permits small diameter wells. However, all of the ASR wells contemplated will have final casing diameters greater than six inches and will therefore be permitted through the SFWMD, as well as the FDEP*Chapter 62-600, FAC – Wastewater Facilities*

Chapter 62-600, FAC, discusses planning for wastewater facilities design and expansion and goes into some detail discussing minimum treatment standards, disinfection, pH, and other design and operational criteria. It also details the required treatment levels for all types of disposal, including discharge to surface waters, reuse and land application, and disposal by underground injection. It is expected this chapter will govern many aspects of the design and construction of RIDS infrastructure.

Chapter 62-604, FAC – Collection Systems and Transmission Facilities

This chapter imparts information on basic design principles that should be upheld, including details on fencing, siting, and special crossings. A requirement for uninterrupted service and a procedural outline for abnormal events are also included in this chapter.

Chapter 62-610, FAC, Part I – Reuse of Reclaimed Water and Land Application

The first part of this rule provides design, operation, and maintenance criteria for land application systems, surface water discharge projects involving reuse for ground water discharge, indirect potable use, or other beneficial purposes. For all new or expanded reuse or land application projects, a preliminary design report must be submitted to FDEP. Any exceptions to this are noted in this rule.

South Florida Water Management District (SFWMD) Regulations

Formed by Florida State Legislature in 1949, the Central and Southern Florida Flood Control District (FCD) resulted from the need to respond to drought and flood conditions in south Florida. The main responsibility of the FCD through 1972 was to act as local sponsor for the U.S. Army Corps of Engineers construction project.

In accordance with South Florida's changing demand for, and perception of, water resources management, the Florida State Legislature enacted the Water Resources Act in 1972. This act divided the state into five regional districts, naming one of them as the South Florida Water Management District (SFWMD). This act (Chapter 373, Florida Statutes) also greatly expanded the previous responsibilities of the FCD. Watersheds and other natural, hydrologic, and geographic features determine the districts' boundaries.

Today, the SFWMD operates and maintains the structures and conveyances built by the FCD. These consist of 1,800 miles of canals and levees, 25 major pumping stations, and about 200 large and 2,000 small water control structures.

The SFWMD spans 16 counties and includes vast areas of agricultural lands, water conservation areas, and areas of rapid urban growth and development.

Consumptive Use Permitting

After construction of a viable ASR pilot project and conducting cycle testing, a water use permit for the established system and any planned expansion must be obtained from the SFWMD. This may be a modification of any existing permit for a particular utility, or a new permit for either an existing utility or for a new subregional entity. The main purpose for obtaining a water use permit for an ASR system is the same as that for obtaining any other water use permit in the State; namely it establishes the prior rights of the permittee to those applicants which may want to use an aquifer in the area in the future.

U.S. Army Corps of Engineers (ACOE)

The ACOE regulatory program includes the review of dredge and fill activities in waters of the United States, construction in navigable waters and the disposal of dredge material in offshore locations. Section 404 of the Clean Water Act requires that permits be received for the deposition of fill in waters or adjacent wetlands of the United States, the construction of revetments, groynes, levees, dams or weirs, and the placement of riprap. Section 10 of the Rivers and Harbors Act of 1899 requires that permits be obtained for activities that affect navigable waters. The ACOE also has Memorandums of Agreement (MOA) with other federal agencies such as the U.S. Fish and Wildlife Service (FWS) and the U.S. Department of Environmental Protection. These agreements allow for the agencies to provide input during the review process on issues such as federally listed wildlife species and wetland impacts associated with the projects under review. In determining whether to issue a permit, the ACOE must also comply with other requirements, including Section 7 of the Endangered Species Act of 1973 (50 CFR Part 402), the National Environmental Policy Act of 1969, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act and other applicable federal laws.

Illustrated in Table 27 are the possible constraints by federal and state regulations broken down by RIDS alternative.

Table 27
Regulatory Constraints by Alternative

Source	Regulatory Agency	Constraint
Surface Water	FDEP	Safe Drinking Water Act – Disinfection Byproducts (DBPs), Surface Water Treatment Rules, Primary and Secondary Drinking Water Standards; Permitting and Construction of Public Water System; Regulation of Wells
	SFWMD	Water Use Permit (WUP) Minimum Flows and Levels (MFLs) Reservations
Surface Water ASR	FDEP	Safe Drinking Water Act – Disinfection Byproducts (DBPs), Surface Water Treatment Rules, Primary and Secondary Drinking Water Standards; Permitting and Construction of Public Water System; Regulation of Wells; Underground Injection Control (UIC)
	SFWMD	WUP MFLs Reservations
Reclaimed Water	FDEP	Wastewater Facilities, Collection Systems and Transmission Facilities, Reuse of Reclaimed Water and Land Application
Reclaimed Water ASR	FDEP	Wastewater Facilities, Collection Systems and Transmission Facilities, Reuse of Reclaimed Water and Land Application, Primary and Secondary Drinking Water Standards, Regulation of Wells, UIC
	SFWMD	WUP

Lee County Regulations

Lee County does not have a basin board; therefore, the majority of water rules and regulations are determined by the District, FDEP, or federal rules. However, Lee County is proactive in that both existing and new developments must use reclaimed water for irrigation over potable wherever feasible and within the utility service area.

Lee County Municipal Code, Sec. 10-354 -Reuse Water System

This portion of the Municipal Code states that, wherever feasible, the irrigation of grassed or landscaped areas must be provided for through the use of a second water distribution system supplying treated wastewater effluent or reuse water. All proposed developments should be designed to maximize the use of reclaimed water whether located in the utility service area or from an on-site wastewater treatment facility.

For other information on Lee County regulations, refer to the Lee County Municipal Code, SFWMD, and FDEP regulations.

Cape Coral

As per City of Cape Coral's personnel, the water and wastewater hook up fee is currently mandatory as is an assessment for irrigation with reclaimed water; however, the hook up fee for reclaimed water irrigation is not mandatory. Cost of the assessment depends on property footage. New and renewal of permits for groundwater wells are still available. If a well fails, the homeowner is required to connect to the City's irrigation system as required by the ordinance.

BENEFITS AND INCENTIVES

The benefits of the RIDS program are very positive in terms of additional water sources in a high growth area such as the lower west coast of Florida. Overall, the RIDS optimizes existing reclaimed water supplies, maximizes surface water use, diversifies supply sources, reduces water shortage declarations, offsets potable water usage, reduces disposal volumes, and offsets groundwater withdrawals. Along with these obvious benefits, Table 28 summarizes incentives for this sub-region.

Table 28
Benefits and Incentives

1. Meet increasing demands
2. Will allow water to be shared between utilities for beneficial reuse
3. Promote reduction of on-site septic systems, increasing reclaimed water supply
4. Allow growth to continue in the region by providing a supplemental supply of irrigation water
5. Reduce reliance on surface water discharge
6. Will allow expansion of reclaimed water systems and infrastructure
7. The region will be able to utilize or store close to 100% of reclaimed water on an annual basis
8. Incrementally reduce unnaturally high freshwater discharges to estuaries during the wet season
9. Rather than disposing of it in a deep injection well, beneficially reuse North Ft. Myers' excess reclaimed water in Cape Coral
10. Reduce reclaimed water discharges to the Caloosahatchee River

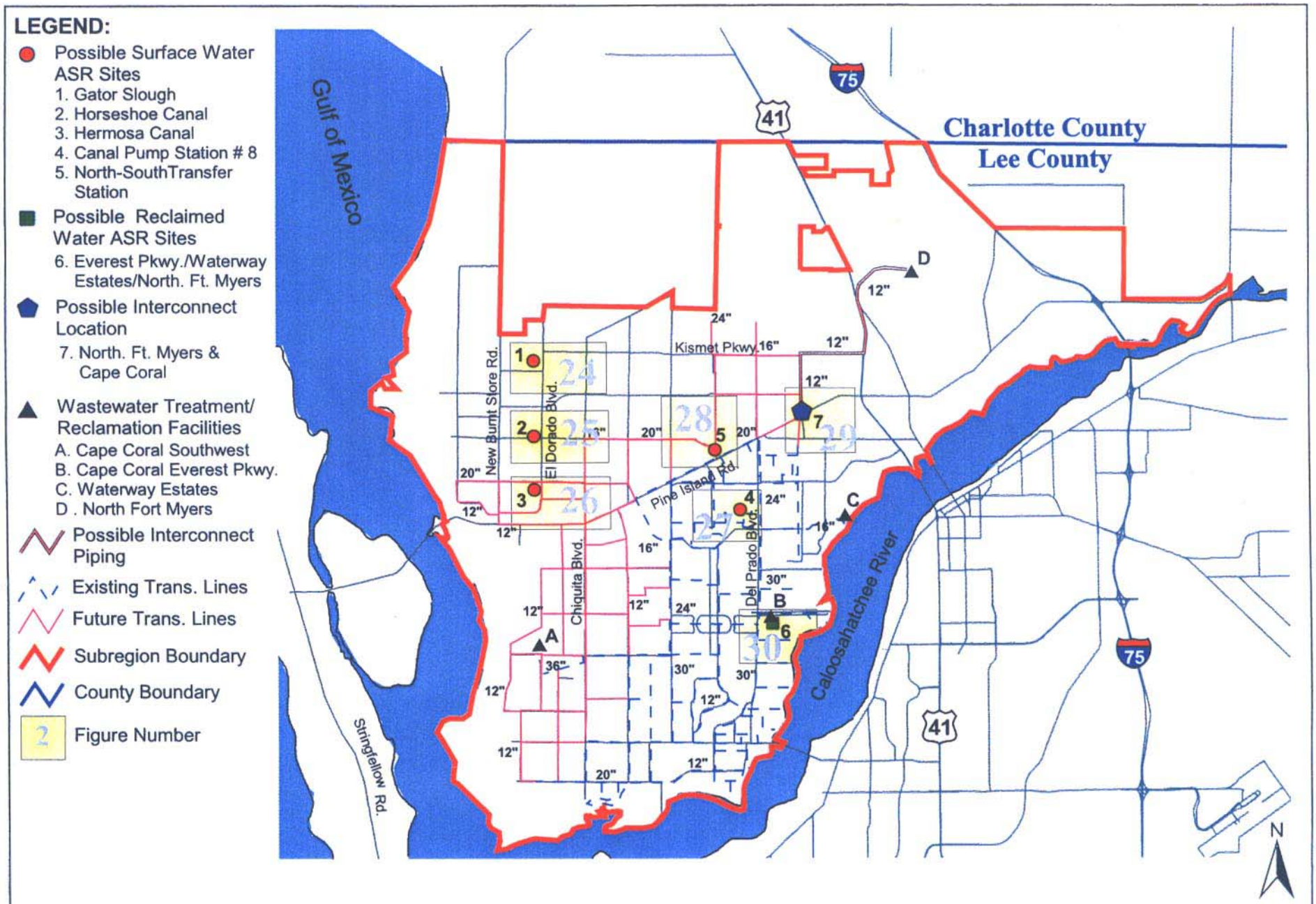
PREFERRED ALTERNATIVE

As presented in TM 2, Table 29 presents the preferred alternative and describes alternative benefit and number of wells needed. The projects include surface water ASR, reclaimed water ASR, interconnects, and using water from mine pits. Table 29 also presents the supply benefit that each project is estimated to provide. Figure 23 presents the ASR system locations and interconnect routes**.**

Table 29
Sub-regional Alternatives Capacity

Alternatives	Benefit or Recovery Capacity (MGD)
1A. Gator Slough-Intake and Pump Station	14
1B. Gator Slough-Wells (including well piping)	
1C. Gator Slough-Transmission Lines	
2A. Horseshoe Canal-Intake and Pump Station	6
2B. Horseshoe Canal-Wells (including well piping)	
2C. Horseshoe Canal-Transmission Lines	
3A. Hermosa Canal-Intake and Pump Station	6
3B. Hermosa Canal-Wells (including well piping)	
3C. Hermosa Canal-Transmission Lines	
4A. Canal Pumping Station #8-Intake and Pumping Station	5
4B. Canal Pumping Station #8-Intake and Pumping Station	
4C. Canal Pumping Station #8-Transmission Lines	
5A. North-South Transfer Station-Intake and Pump Station	10
5B. North-South Transfer Station-Wells (including well piping)	
5C. North-South Transfer Station-Transmission Lines	
6A. Everest Parkway-Intake and Pump Station	12.2
6B. Everest Parkway-Wells (including well piping)	
6C. Everest Parkway-Transmission Lines	
7. North Ft.Myers & Cape Coral	2.3
Total	**55.5**

(1) Capacity / Benefit based on estimated North Ft. Myers supply for the Year 2020.



Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	ALTERNATIVE PROJECTS INDEX SHEET SUBREGION 2	Figure 23

ALTERNATIVE SELECTION

In order to better allocate funds for the alternative supply projects presented in TM No. 2, the projects have been divided in sub-project base on the type of project, as shown in Table 22 and 29. Each of the projects shown in Table 29 were evaluated to best meet the supply needs of this sub-region and to determine the feasibility of its implementation using the criteria described below:

- Capacity Benefit
- Permittability
- Proximity to Existing Infrastructure
- Unit Cost
- Participation Interest
- Funding Ability
- Consistency with Master Plan

These selection criteria are scored between 1 and 5, with the higher score resulting in a higher priority for implementation. The summary of the scoring is shown on Table 31. The prioritized projects will then be used in the implementation strategy.

Capacity Benefit

This criterion evaluates the amount of supplemental water (benefit) that each project will provide to offset total potable water use for urban irrigation. Table 29 summarizes the benefit per alternative. The benefit is estimated in million of gallons per day. The capacity benefit scoring was based on the range of supply provided as shown below:

From 1 MGD to 3 MGD Score = 1

From 4 MGD to 6 MGD Score = 2

From 7 MGD to 10 MGD Score = 3

From 11 MGD to 14 MGD Score = 4

Greater than 15 MGD Score = 5

Permittability

All of the projects included in the recommended alternative are permittable and there are several precedents for each in the region and throughout the State. Some projects, such as interconnects are much easier to permit than the others, which is reflected in the scoring.

For surface and reclaimed water ASR systems the score is 3 and for interconnects the score is 5 expecting it to be the least difficult to be permitted.

Proximity to Existing Infrastructure

There is an extensive network of existing infrastructure throughout the sub-region that will provide a means of transmission from the new sources of supply to the areas of need. Some projects are closer to the transmission system, making implementation more economical.

Unit Cost

A unit cost was calculated for each of the projects, as shown in Table 30. The unit cost includes the construction of the project, engineering, pilot testing and operation and maintenance (O&M). Currently, the proposed technology for surface water ASR includes bank-filtration, pH adjustment, and chlorine/chloramines disinfection.

Cost Includes:

- Wells: $550,000 per well.
- Pump Station Cost was derived from Pumping Station Design, second Edition, Robert Sanks.
- Intake cost: For capacity equal or less than 5 MGD the cost is $1M. For capacity greater than 5 MGD the cost is $ 100k per MGD.
- Land Acquisition: $100k for site work + $150k for land acquisition. Land estimate is based on a site less than 3 acres.
- Pipes: $4/diameter per lf.
- Engineering = 25% of capital cost +15% contingency
- O & M for Surface ASR= 0.14 cents/1000 gals X10 months X 30 days/month
- O & M Reclaimed ASR or Mine Pits = $1,5000* # wells +$8,000 * Estimated benefit (MGD)

Shown below is the scoring range of the unit cost based on price ranges. The final scoring is presented in Table 30.

From $0.45-$1.00 Score = 5

From $1.01-$1.20 Score = 4

From $1.21-$1.49 Score = 3

From $1.50-$2.00 Score = 2

Greater than $2.00 = 1

Table 30
Project Unit Cost

Project	Cost per 1000 gallons
1A. Gator Slough-Intake and Pump Station	1.27
1B. Gator Slough-Wells (including well piping)	
1C. Gator Slough-Transmission Lines	
2A. Horseshoe Canal-Intake and Pump Station	1.48
2B. Horseshoe Canal-Wells (including well piping)	
2C. Horseshoe Canal-Transmission Lines	
3A. Hermosa Canal-Intake and Pump Station	1.56
3B. Hermosa Canal-Wells (including well piping)	
3C. Hermosa Canal-Transmission Lines	
4A. Canal Pumping Station #8-Intake and Pumping Station	1.49
4B. Canal Pumping Station #8-Intake and Pumping Station	
4C. Canal Pumping Station #8-Transmission Lines	
5A. North-South Transfer Station-Intake and Pump Station	1.27
5B. North-South Transfer Station-Wells (including well piping)	
5C. North-South Transfer Station-Transmission Lines	
6A. Everest Parkway-Intake and Pump Station	1.20
6B. Everest Parkway-Wells (including well piping)	
6C. Everest Parkway-Transmission Lines	
7. North Ft.Myers & Cape Coral	0.85

Participation Interest

Some of the stakeholders in the RIDS have expressed more interest and participated more extensively than others. As this is primarily a voluntary program for the stakeholders, their anticipated participation is scored accordingly.

Funding Ability

The projects included in the preferred alternative are fundable through SRF loans and should be eligible for a number of state and federal grants. Funding has been directed towards projects with regional benefits and those that offset potable use and groundwater pumpage, i.e., alternative sources of supply. The availability of state and federal grant programs has been based on legislative and congressional approval; therefore, a funding strategy based on the latest programs will be provided for the preferred alternative in the final report.

Consistency with Master Plan

The stakeholders have developed or are developing master plans to improve and expand their individual system. The development of the RIDS has integrated the plans of the stakeholders. Therefore, this criterion evaluates how each of the projects could be integrated to the improvements planned.

Table 31
Project and Criteria Evaluation

Supply Projects	Capacity Benefit	Permit-ability	Proximity to Existing Infrastructure	Unit Cost	Participation Interest	Funding Ability	Consistency with Master Plans	Total Points	Rank
1A. Gator Slough-Intake and Pump Station	5	3	3	3	5	5	5	29	5
1B. Gator Slough-Wells (including piping)	5	3	3	3	5	5	5	29	5
1C. Gator Slough-Transmission Lines	5	5	3	3	5	5	5	31	3
2A. Horseshoe Canal-Intake and Pump Station	3	3	3	3	5	5	5	27	7
2B. Horseshoe Canal-Wells (including piping)	3	3	3	3	5	5	5	27	7
2C. Horseshoe Canal-Transmission Lines	3	5	3	3	5	5	5	29	5
3A. Hermosa Canal-Intake and Pump Station	3	3	5	2	5	5	5	28	6
3B. Hermosa Canal-Wells (including piping)	3	3	5	2	5	5	5	28	6
3C. Hermosa Canal-Transmission Lines	3	5	5	2	5	5	5	30	4
4A. Canal Pumping Station #8-Intake and Pumping Station	2	3	5	3	5	5	5	28	6
4B. Canal Pumping Station #8-Intake and Pumping Station	2	3	5	3	5	5	5	28	6
4C. Canal Pumping Station #8-Transmission Lines	2	5	5	3	5	5	5	30	4
5A. North-South Transfer Station-Intake and Pump Station	4	3	5	3	5	5	5	30	4
5B. North-South Transfer Station-Wells (including piping)	4	3	5	3	5	5	5	30	4
5C. North-South Transfer Station-Transmission Lines	4	5	5	3	5	5	5	32	2
6A. Everest Parkway-Intake and Pump Station	5	3	4	4	5	5	5	31	3
6B. Everest Parkway-Wells (including piping)	5	3	4	4	5	5	5	31	3
6C. Everest Parkway-Transmission Lines	5	5	4	4	5	5	5	33	1
7. North Ft. Myers & Cape Coral Interconnect	1	5	5	5	3	5	3	27	7
8. Limerock /Jay Rock/Babcock	2	2	1	1	1	4	1	12	8

RECOMMENDED IMPLEMENTATION STRATEGY

The supply projects presented in Table 31 were prioritized based on the project criteria evaluation. The implementation strategy for the projects was based on the following:

- Funding availability – Assume an approximate maximum funding of $20 million per year
- Program horizon of 2020
- Regulatory approval
- Design, bidding, construction and testing schedules
    - Two (2) years for interconnects
    - Four (4) years for ASR systems except for Faka Union (5 years)

Table 32 presents the proposed implementation for the projects starting in 2005. The project implementation is started in the order of scoring.

Table 32
Implementation

Project Name	Est. Implementation Time (Yrs.)	Total Proj. Cost ($M)	Construction Yearly Cost ($M)															
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
5C. North-South Transfer Station-Transmission Lines	1	$ 180,000	$ 180,000															
5A. North-South Transfer Station-Intake and Pump Station	2	$ 4,425,000		$ 2,212,500	$ 2,212,500													
5B. North-South Transfer Station-Wells (including piping)	4	$ 14,769,000	$ 3,692,250	$ 3,692,250	$ 3,692,250	$ 3,692,250												
7. North Ft. Myers & Cape Coral Interconnect	2	$ 2,646,396	$ 1,323,198	$ 1,323,198														
1C. Gator Slough-Transmission Lines	1	$ 1,197,504			$ 1,197,504													
2C. Horseshoe Canal-Transmission Lines	1	$ 709,632				$ 709,632												
3C. Hermosa Canal-Transmission Lines	1	$ 1,507,968					$ 1,507,968											
1A. Gator Slough-Intake and Pump Station	2	$ 5,550,000						$ 2,775,000	$ 2,775,000									
1B. Gator Slough-Wells (including piping)	4	$ 20,107,500					$ 5,026,875	$ 5,026,875	$ 5,026,875	$ 5,026,875								
6C. Everest Parkway-Transmission Lines	1	$ 180,000						$ 180,000										
6A. Everest Parkway-Intake and Pump Station	2	$ 5,055,000							$ 2,527,500	$ 2,527,500								
6B. Everest Parkway-Wells (including piping)	4	$ 16,875,750						$ 4,218,938	$ 4,218,938	$ 4,218,938	$ 4,218,938							
2A. Horseshoe Canal-Intake and Pump Station	2	$ 3,000,000									$ 1,500,000	$ 1,500,000						
2B. Horseshoe Canal-Wells (including piping)	4	$ 10,320,250								$ 2,580,063	$ 2,580,063	$ 2,580,063	$ 2,580,063					
3A. Hermosa Canal-Intake and Pump Station	2	$ 3,000,000										$ 1,500,000	$ 1,500,000					
3B. Hermosa Canal-Wells (including piping)	4	$ 10,320,250									$ 2,580,063	$ 2,580,063	$ 2,580,063	$ 2,580,063				
4C. Canal Pumping Station #8-Transmission Lines	1	$ 180,000										$ 180,000						
4A. Canal Pumping Station #8-Intake and Pumping Station	2	$ 3,000,000											$ 1,500,000	$ 1,500,000				
4B. Canal Pumping Station #8-Wells (including piping)	4	$ 8,540,750												$ 2,135,188	$ 2,135,188	$ 2,135,188	$ 2,135,188	
8. Limerock /Jay Rock/Babcock	5	$ -											$ -	$ -	$ -	$ -	$ -	
		$ 111,565,000	**$ 5,195,448**	**$ 7,227,948**	**$ 7,102,254**	**$ 4,401,882**	**$ 6,534,843**	**$ 12,200,813**	**$ 14,548,313**	**$ 14,353,375**	**$ 10,879,063**	**$ 8,340,125**	**$ 8,160,125**	**$ 6,215,250**	**$ 2,135,188**	**$ 2,135,188**	**$ 2,135,188**	**$ -**

DESIGN STANDARDS

The design and implementation of the projects contained in the preferred alternative will be performed in accordance with industry standards, regulatory requirements and local government standards. This section presents the accepted industry resources and which elements apply to the proposed projects.

American Water Works Association (AWWA)

The following are AWWA standards that will be applicable to the facilities in the proposed projects:

- A97-100 - Groundwater and Wells
- C104, C105, C110, C111, C115, C116, C150, C151, and C153 - Ductile Iron Pipe and Fittings
- C200, C203, C205, C205, C206, C207, C208 - Steel Pipe
- C500, C501, C504, C540 - Valves and Hydrants
- C600s - Disinfection Facilities
- C900s - Plastic Pipe
- C901, C906 - HDPE Pipes

Florida Department Of Environmental Protection (FDEP)

The following arethe FDEP regulations (Florida Administrative Code) applicable to the facilities under consideration:

- 62-40 - Water Policy
- 62-520 - Ground Water Classes, Standards, and Exemptions
- 62-521 - Wellhead Protection
- 62-522 - Ground Water permitting and Monitoring Requirements
- 62-524 - New Potable Water Well Permitting in Delineated Areas
- 62-528 - Underground Injection Control
- 62-531 - Water Well Contractors
- 62-532 - Water Well Permitting and Construction Requirements
- 62-550 - Drinking Water Standards, Monitoring, and Reporting
- 62-600 - Domestic Wastewater Facilities (Reuse requirements)
- 62-610 – Reuse of Reclaimed Water and Land Application
- 62-650 - Water Quality Based Effluent Limitations
- 62-520 - Ground Water Classes, Standards, and Exemptions

Class I reliability, as defined by the US EPA and stated in FDEP's regulations refers to reliability of mechanical, electrical, and fluid systems. For major equipment items (pumps, blowers, etc.), the capacity and operations should be designed for the maximum design flows with the largest unit out of service.

United States Environmental Protection Agency (US EPA)

The Class V - Underground Injection Control Study, Volume 21-Aquifer Recharge and Aquifer Storage and Recovery Well, September 1999. This document presents best management practices for aquifer storage and recovery (ASR) wells.

Ten States Standards / Recommended Standards for Water Works Great Lakes-Upper Mississippi River Board (2003 Edition)

These standards include design guidelines for :

- Treatment – Part 4
- Pumping Facilities – Part 6
- Finished Water Storage – Part 7
- Distribution System Piping and Appurtenances – Part 8

ASR WELL STANDARDS

Criteria and standards for Class V wells are addressed in Chapter 62-528 FAC. ASR systems are categorized Class V Group 7. For these wells, there are standards of design and construction required for any construction permit application. In order to operate the well, it must be demonstrated that the well operation will not adversely affect underground sources of drinking water (USDW). Approval to operate the system by the FDEP will be subject to operating and reporting requirements, such as meeting drinking water standards for the injectate.

Surface water sources are a major part of the RIDS program. Therefore, ASR wells receiving surface water are a Under Direct Influence (UDI) of surface water, which will require more extensive sampling and monitoring requirements. This needs to be considered from a cost and operations standpoint.

Siting and Construction Requirements

Specific construction standards for Class V wells have not been enacted by Florida because of the variety of Class V wells and their uses. Instead, the state requires the well to be designed and constructed for its intended use, in accordance with good engineering practices, and approves the design and construction through a permit. The state can apply any of the criteria for Class I wells to the permitting of Class V wells, if it determines that without such criteria the Class V well may cause or allow fluids to migrate into a USDW and cause a violation of the state's primary or secondary drinking water standards, which are contained in Chapter 62-550 of the FAC. However, if the injectate meets the primary and secondary drinking water quality standards and the minimum criteria contained in Rule 62-520-400 of the FAC, Class I injection well permitting standards will not be required.

Class V wells are required to be constructed so that their intended use does not violate the water quality standards in Chapter 62-520 FAC at the point of discharge, provided that the drinking water standards of 40 CFR Part 42 (1994) are met at the point of discharge.

Water Quality

The following are federal rules and programs that regulate ASR well water quality:

- Total Trihalomethane Rule (TTHMs)
- Surface Water Treatment Rule
- Total Coliform Rule
- Interim Enhanced Surface Water Treatment
- Stage 1 Disinfection Byproducts Rule
- Radon Rule
- Ground Water Rule

Siting and Construction

In order to determine the location and spacing of the ASR wells, the following should be considered:

- Proposed storage zone background water quality, permeability, and confinement characteristics
- Background hydrogeology
- Projected withdrawal rates
- For surface water ASR system, discharge locations
- Nearby users of potential storage zones

Florida has enacted specific regulation requirements for Class V wells that include:

- Calibration of pressure gauges and flow meters every six months
- Monitoring of the storage zone and the next overlying permeate zone
- Monthly and annual reports of injected and recovered water qualities and quantities

Water injected into the ASR wells must meet water quality requirements such as the following:

- Primary and Secondary Drinking Water Quality Standards (Chapter 62-550 FAC)
- Minimum criteria in Rule 62-520-400 of FAC- Ground Water Classes, Standards, and Exemptions/ Minimum Criteria for Ground Water

Operation requirements

Class V wells are required to operate in a manner that does not present a hazard to an USDW and to meet the water quality standards presented in Rule 62-520 FAC. The following operating and maintenance practices are recommended for successful operations of ASR wells:

- Periodic change in operating mode
- Periodic back-flushing to waste during recharge

Monitoring

Only wells with injectate being treated by a permitted drinking water facility in accordance with rules 62-528.615(1)(a)2 FAC do not require monitoring. None of the well injectate in the proposed projects in this Sub-Region is expected to originate from a drinking water treatment facility; thus, monitoring requirements will be included in the Class V use permit.

PROPOSED PROJECTS DESCRIPTION AND EXISTING INFRASTRUCTURE

As described on previous technical memoranda, a group of projects for urban irrigation were evaluated and selected to mitigate the irrigation demand. Table 33 shows the list of theses proposed projects and the expected facilities needed. The amount of benefit or recovery will determine the capacity necessary for the pipes and pumps.

Table 33
Proposed Sub-Regional Project Summary

No.	Alternatives	Benefit or Recovery Capacity (MGD)	No. of ASR Wells	Infrastructure Needed
1	Gator Slough	14.0	20	Intake system, pumping station, ASR wells and chemical treatment system
2	Horseshoe Canal	6.0	9	Intake system, pumping station, ASR wells and chemical treatment system
3	Hermosa Canal	6.0	9	Intake system, pumping station, ASR wells and chemical treatment system
4	Canal Pumping Station #8	5.0	7	ASR wells, chemical treatment system and pump station
5	North-South Transfer Station	10.0	14	ASR wells, chemical treatment system and pump station
6	Everest Parkway / Waterway Estates / N.Ft.Myers	12.2	17	ASR wells, pump station, connection, and Chemical treatment.
7	North Ft. Myers & Cape Coral	2.3	0	Pumping station, ASR wells, chemical treatment system and interconnection.
Total Benefit or Recovery Capacity		**55.5**		

The locations of the projects listed above are presented in a series of figures, which are located in Figure No. 23. The Index figure shows a general map of the Sub-Region 2 projects. This figure serves as an index to locate the figure number where the proposed projects are shown. Proposed locations are based on general locations and do not include land use, survey, property assessment or any other property-specific resources.

Figure 24 shows the general location of Project No. 1, GATOR SLOUGH project. This ASR project will be located west of El Dorado Boulevard, north of Van Buren Parkway, east of NW 26th Place and south of NW 24TH Street. A 20-inch pipeline will be constructed to covey the supply from this project to the City's future secondary water system.

Figure 25 illustrates the location of Project No. 2, HORSESHOE CANAL. The propose location of this ASR surface water project is west of El Dorado Boulevard North, north of NW 6th Terrace, east of NW 26TH Court and just south of the Horseshoe Canal. Shown on this figure, also is the 20-inch pipeline to the future secondary water system, at Embers Parkway.

Figure 26 presents Project No. 3, the HERMOSA CANAL project. This ASR surface project is going to be located south of Embers Parkway West, west of El Dorado Boulevard, near the Hermosa Canal. The supply obtained from this project will be conveyed to a 20-inch pipeline along El Dorado Boulevard.

Figure 27 presents Project No. 4, CANAL PUMP STATION #8. This surface water project is located near the existing Canal Pump Station No. 8. The proposed project location is west of Del Prado Boulevard, south of 4th Street and east of 13th Place.

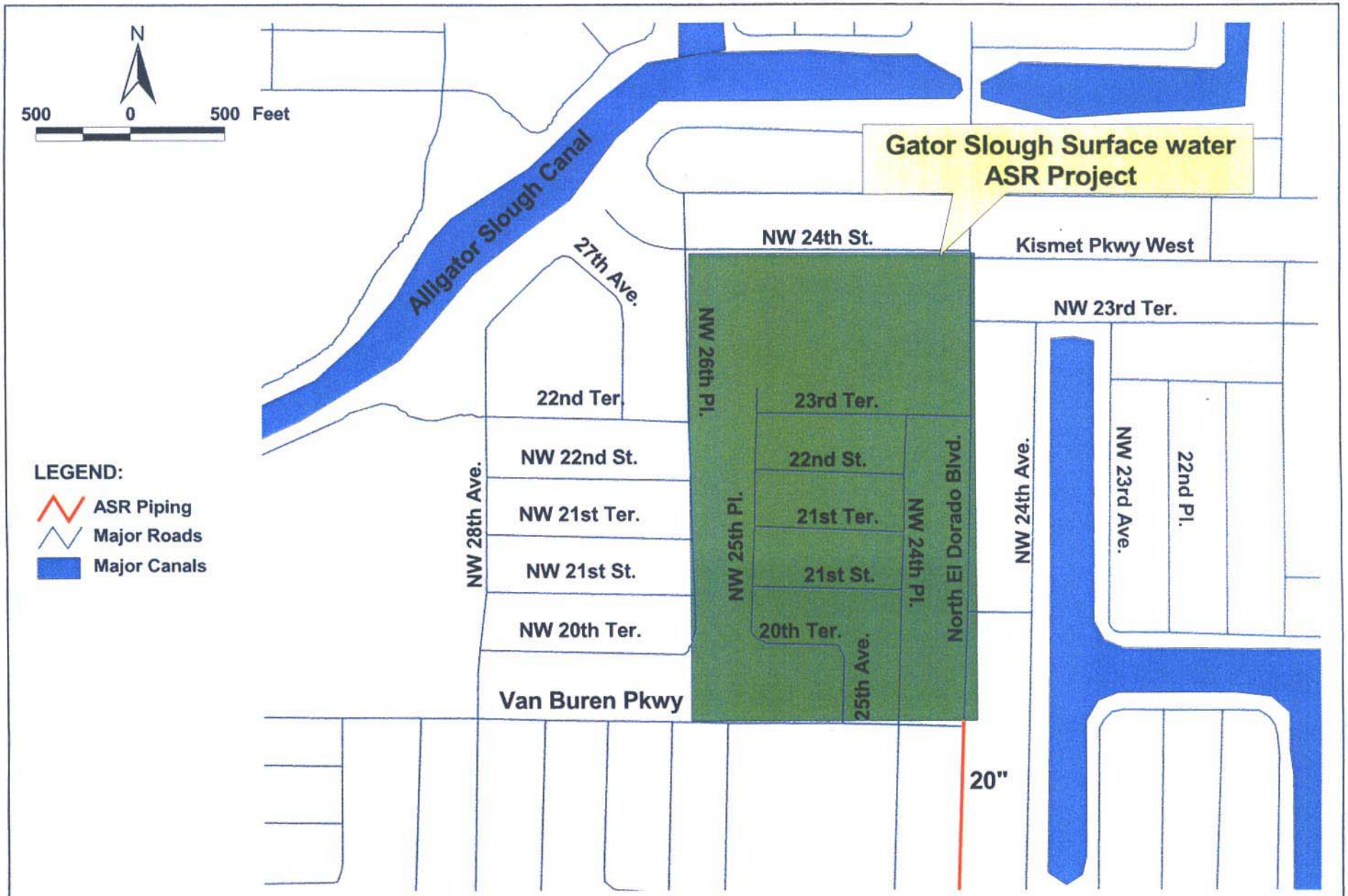
Figure 28 shows Project No. 5, NORTH-SOUTH TRANSFER STATION. The location of this project is north of Pine Island Road, east of NE 7th Street, perpendicular to Andalusia Boulevard, south of Tropicana Parkway, NE 7th Street and west of NE 10th Place. The proposed location is next to the existing North-South Transfer Station.

Figure 29 presents the alignment of Project No. 7, the NORTH FT. MYERS AND CAPE CORAL CANAL interconnect. The interconnect is anticipated to be a 12-inch transmission line and will start near the intersection of Pine Island Road and Garden Boulevard, continue north on Garden Boulevard to Littleton Road, where it turns east to US Highway 41, along Highway 41 until it turns east to Heritage Golf Course to the North Fort Myers Wastewater Treatment Facility.

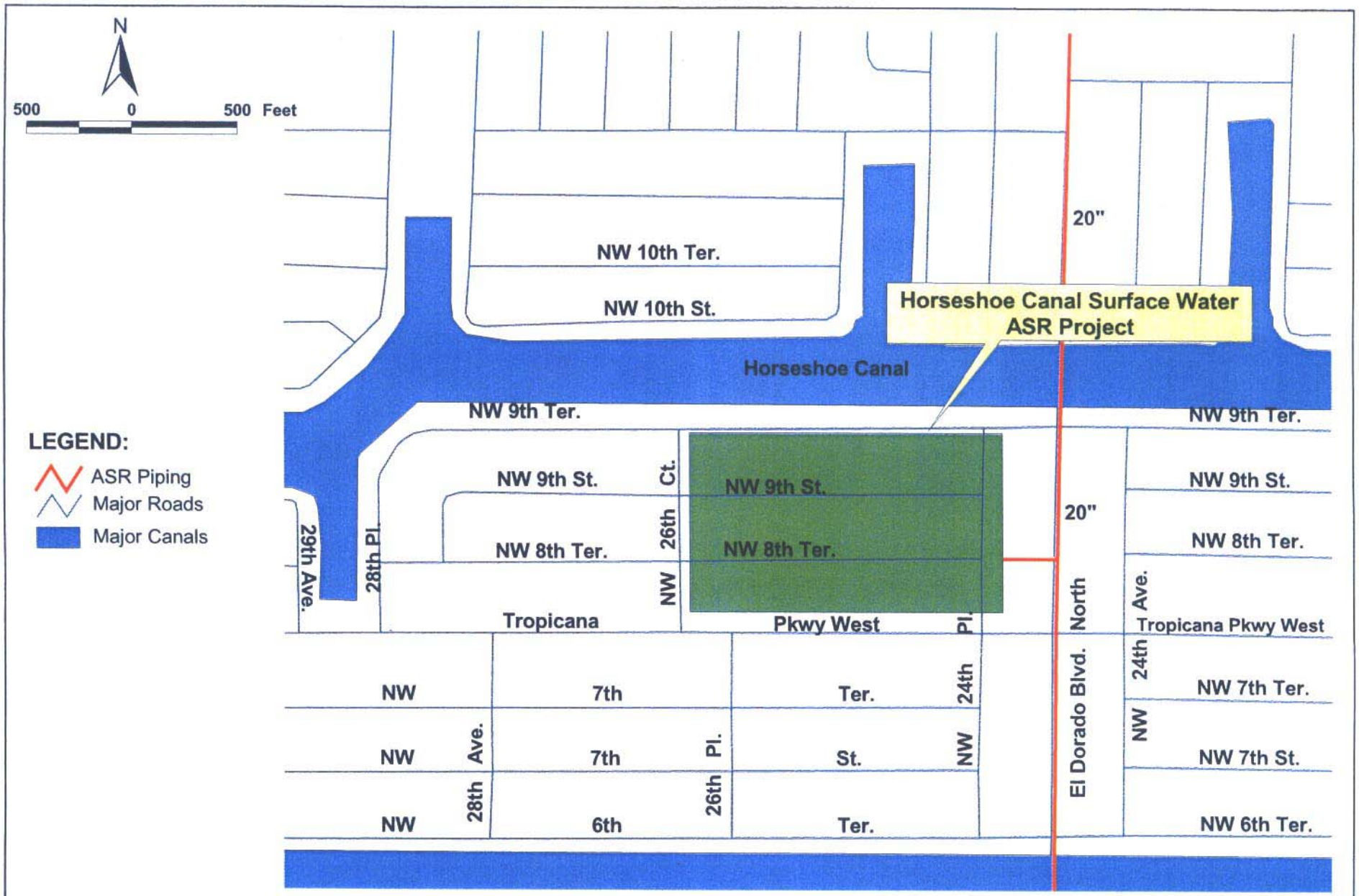
Figure 30 shows Project No. 6, the EVEREST PARKWAY/WATERWAY ESTATES. This Reclaimed water project will be located south of Everest Parkway (25th Street) east of Del Prado Boulevard, north of SE 26th Terrace, east of 19th Place. The supply from the ASR project will be transmitted to the distribution system via an existing line as shown on the figure.

Existing Infrastructure

Currently Cape Coral, Waterway Estates and North Ft. Myers have some existing reclaimed water distribution systems. The proposed projects will use the existing and proposed infrastructure as much as practically possible. Figures 23 through 31 show the existing and planned infrastructure near each of the proposed projects.

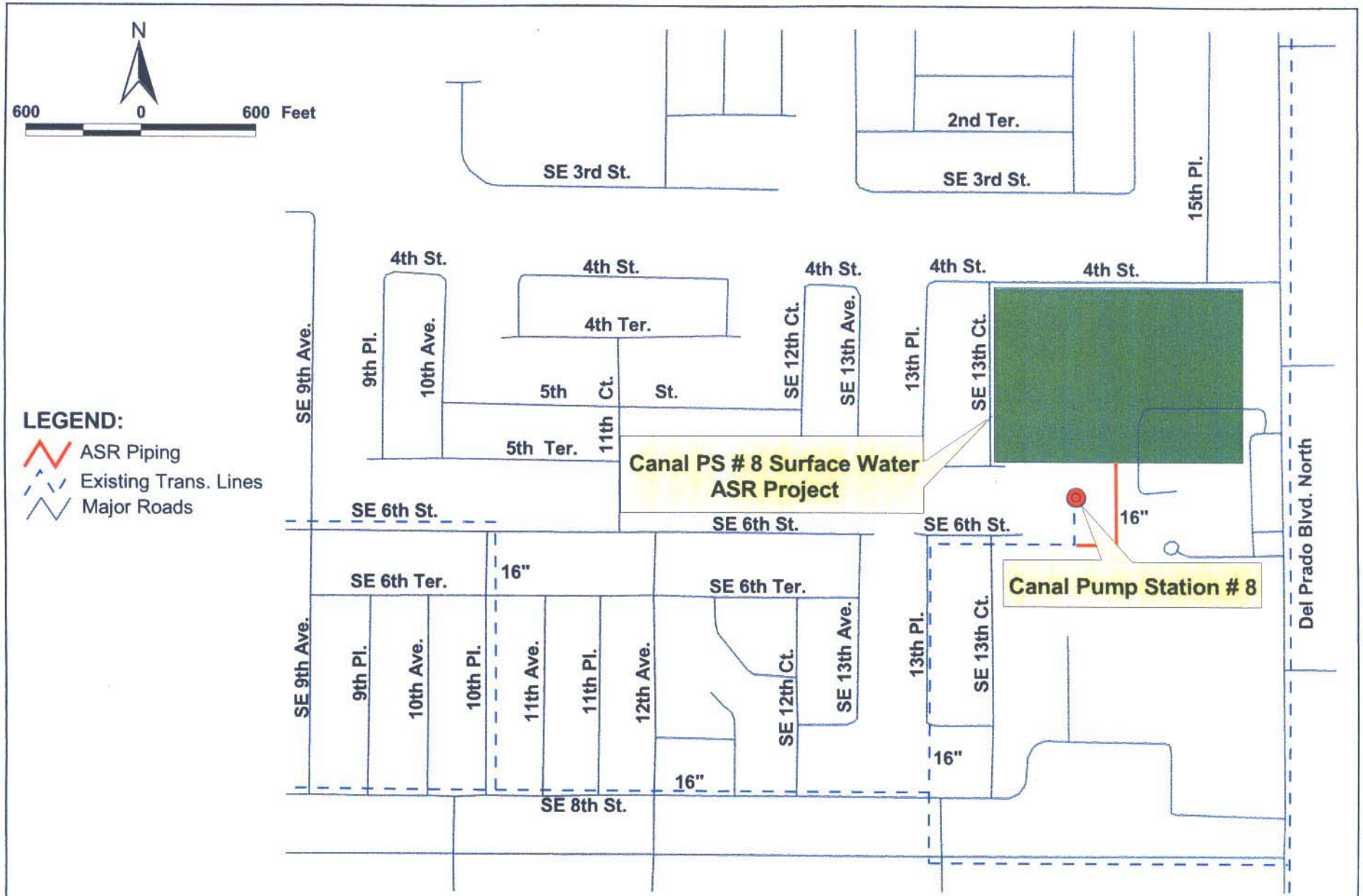


Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Gator Slough Surface Water ASR Project Subregion 2	Figure 24



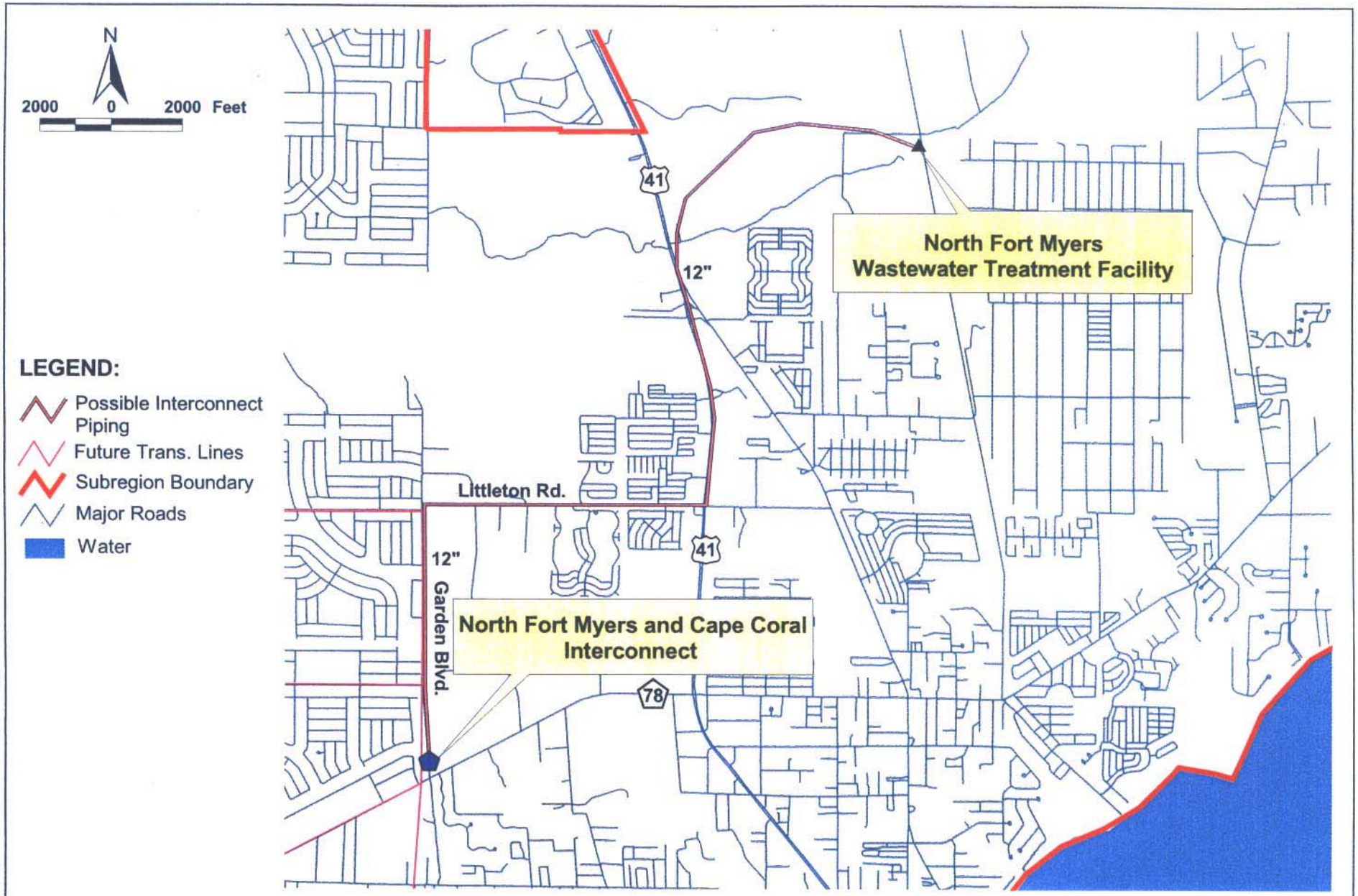
Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Horseshoe Canal Surface Water ASR Project Subregion 2	Figure 25

Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Hermosa Canal Surface water ASR Project Subregion 2	Figure 26

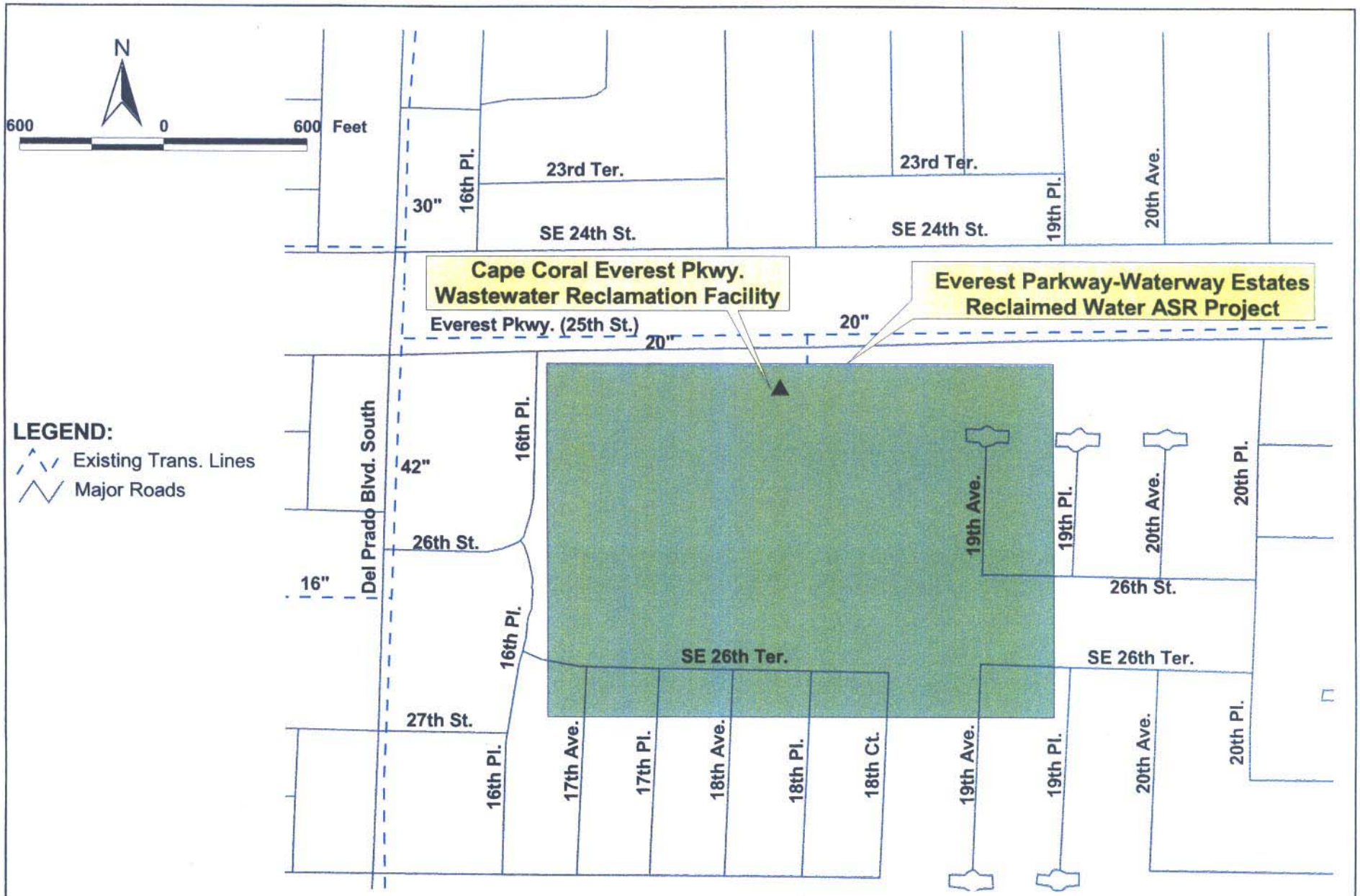


Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Canal Pump Station # 8 Surface Water ASR Project - Subregion 2	Figure 27

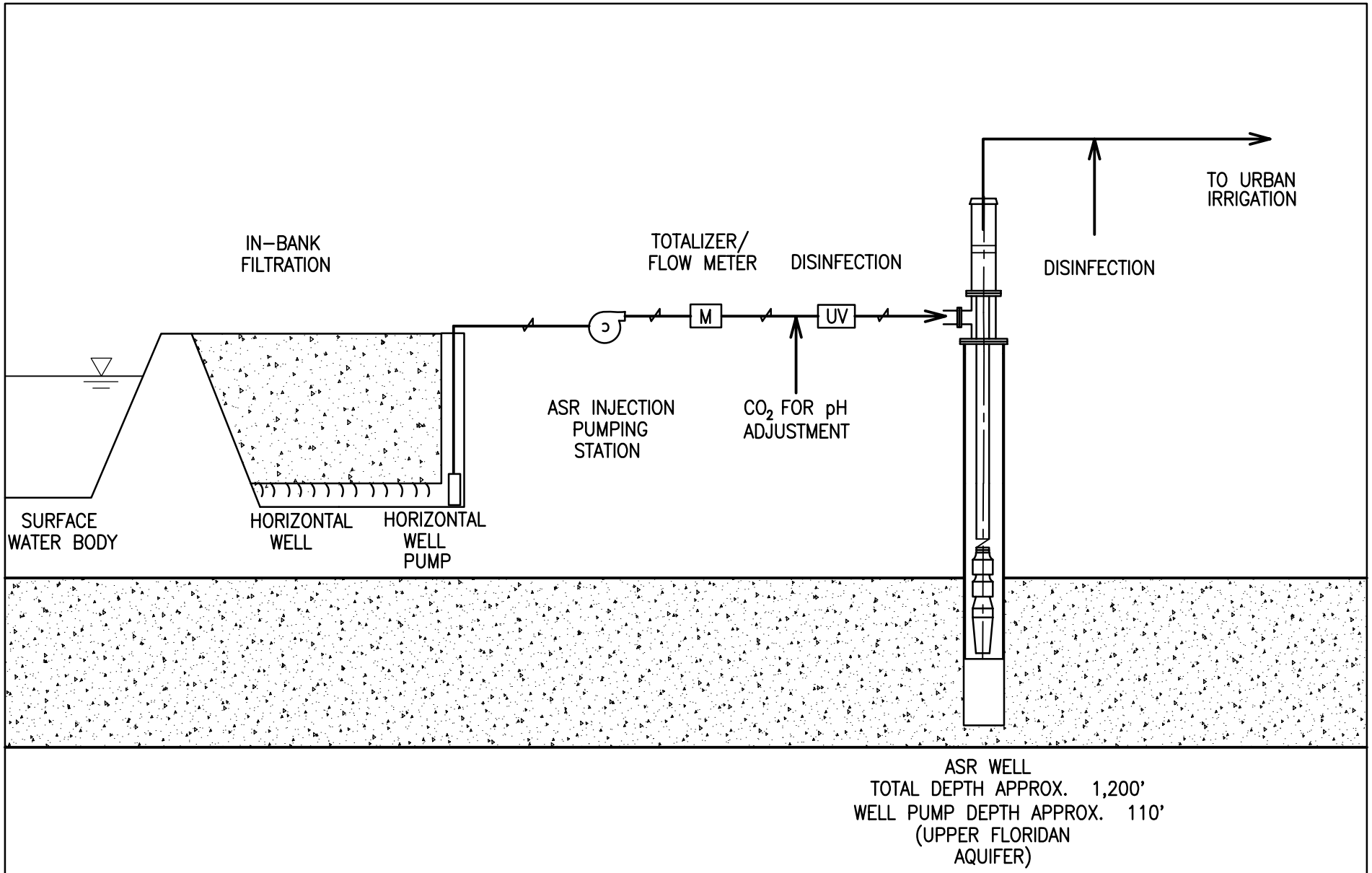
Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	North-South Transfer Station Surface Water ASR Project - Subregion 2	Figure 28



Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	North Fort Myers and Cape Coral Interconnect - Subregion 2	Figure 29



Master Plan for the Regional Irrigation Distribution System (RIDS) for the Lower West Coast Region	BOYLE	South Florida Water Management District	Everest Parkway/Waterway Estates Reclaimed Water ASR Project - Subregion 2	Figure 30



Not to Scale
For Conceptual Purposes Only

Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Surface Water ASR System Process Flow Schematic	Figure 31

PROPOSED INFRASTRUCTURE

Surface Water Projects Design Criteria

The proposed surface water ASR projects are Gator Slough, Horseshoe Canal, Hermosa Canal, Canal Pump Station No. 8, and North-South Transfer Station. The typical facilities for this type of projects are as follows:

- Horizontal well to provide in-bank filtration,
- Pump stations,
- pH adjustment, and
- Pre- and post- ASR well disinfection.

The typical process flow schematic for these facilities is shown on Figure 31. This figure conceptually presents the horizontal well, which will be constructed near the surface water source. From this point, the pH is adjusted with CO_2, prior to disinfection and injection into the ASR well. Water recovered from the well will then be disinfected before it is sent to the irrigation system.

Figure 32 illustrates how the horizontal wells and injection pumping are located in relation to one another.

Figure 33 presents how the injection well pump station will be configured. A minimum of two pumps will be used at each pump station. Piping size depends on each projects capacity requirement. This figure also shows the anticipated locations of power pole connections, meters, valves, and sample taps.

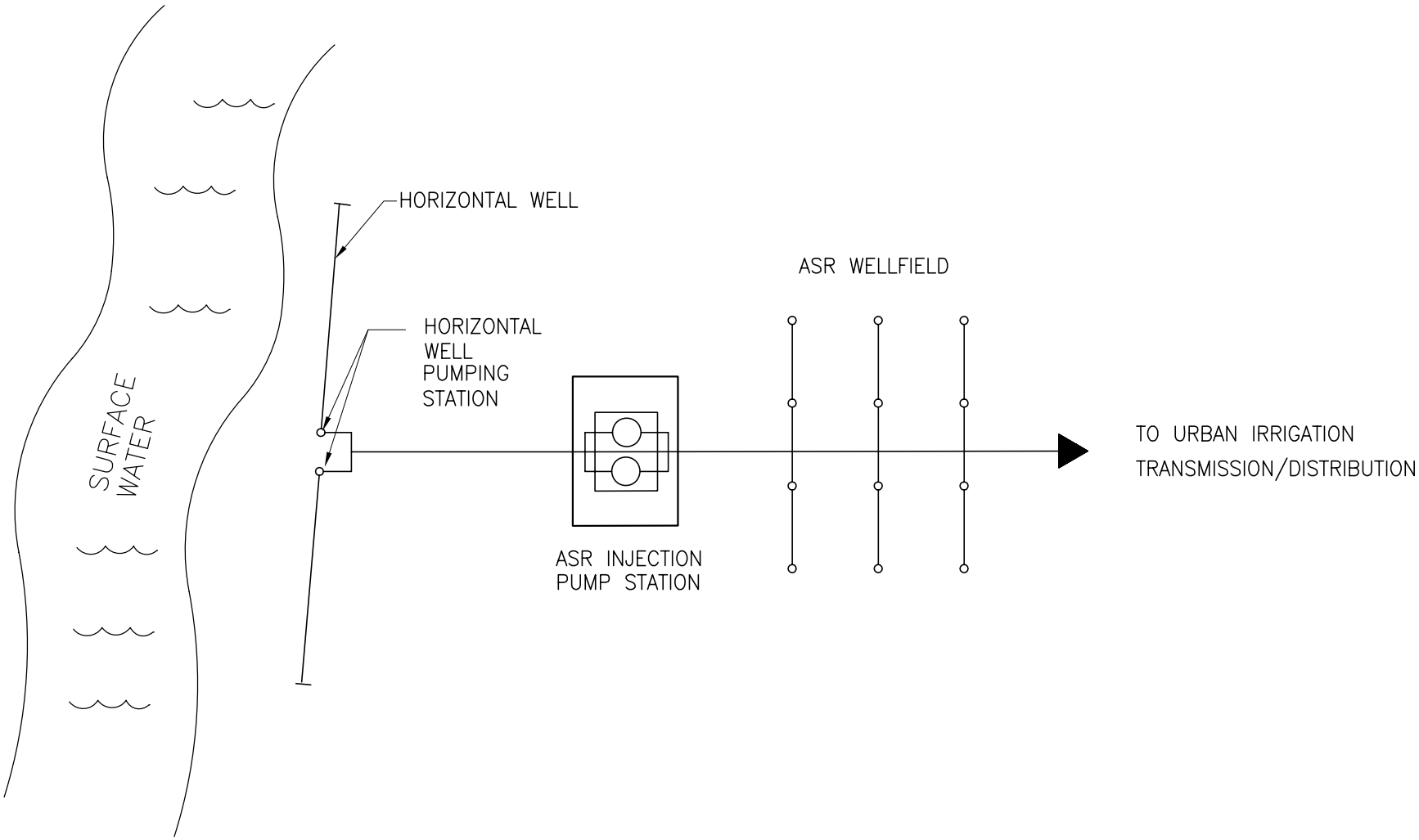
Figure 34 presents the layout of a typical ASR well. Figures 35 and 36 show horizontal well installation methods. The specific method used will depend on subsurface conditions at each project location.

Reclaimed Water Projects Design Criteria

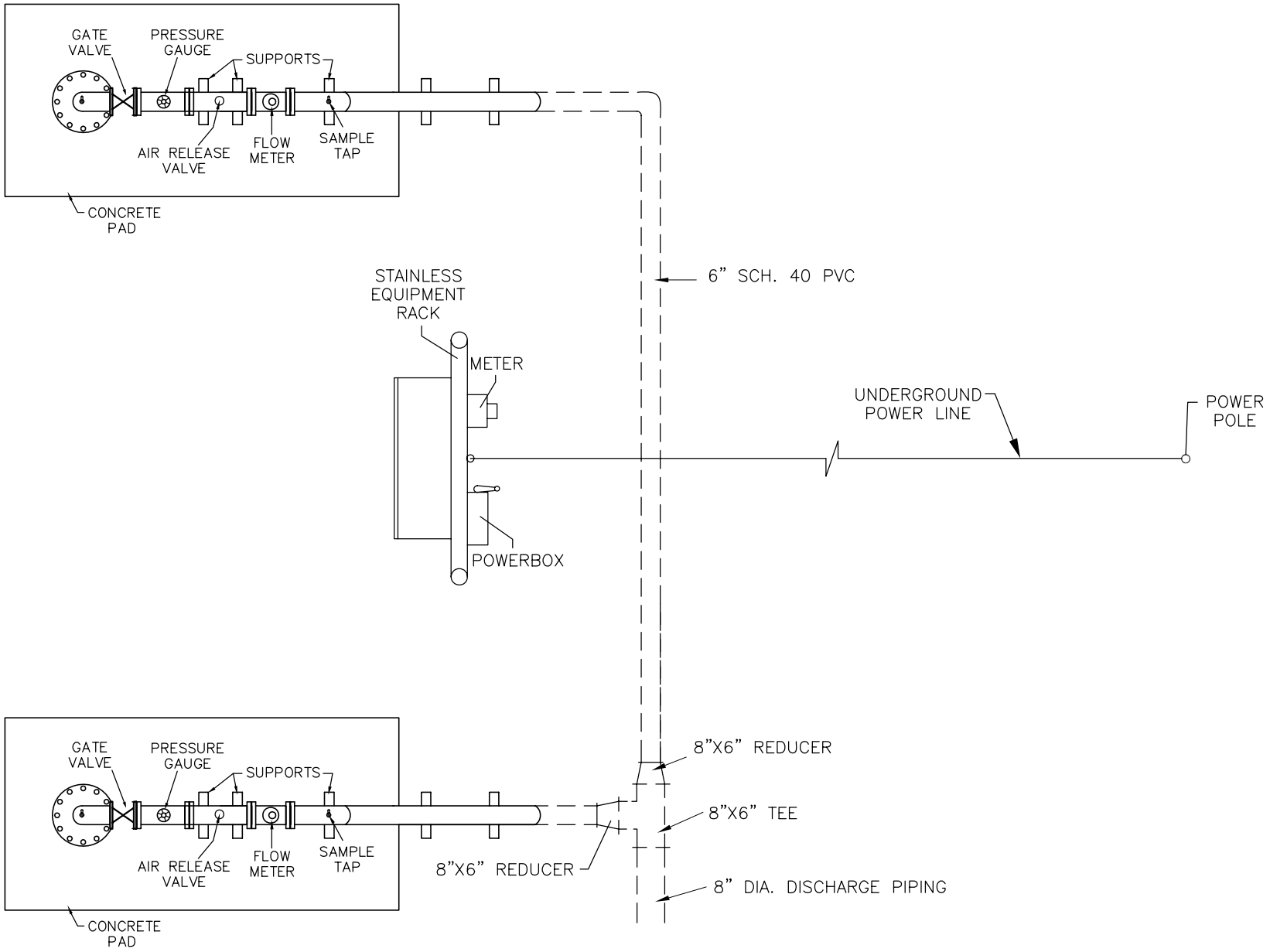
The reclaimed water ASR project is the Everest Parkway. The typical facilities for this type of project are similar to the surface water ASR projects, except for the horizontal well and the need for additional disinfection facilities (if the WWTP meets AWT). The reclaimed water will be treated effluent from the wastewater treatment plant, however, prior to injection, the pH will be adjusted with CO_2 and disinfected. High service pumps from the treatment plant could be used to transport the injectate to the ASR Well. This system is presented in Figure 37**.**

Interconnects

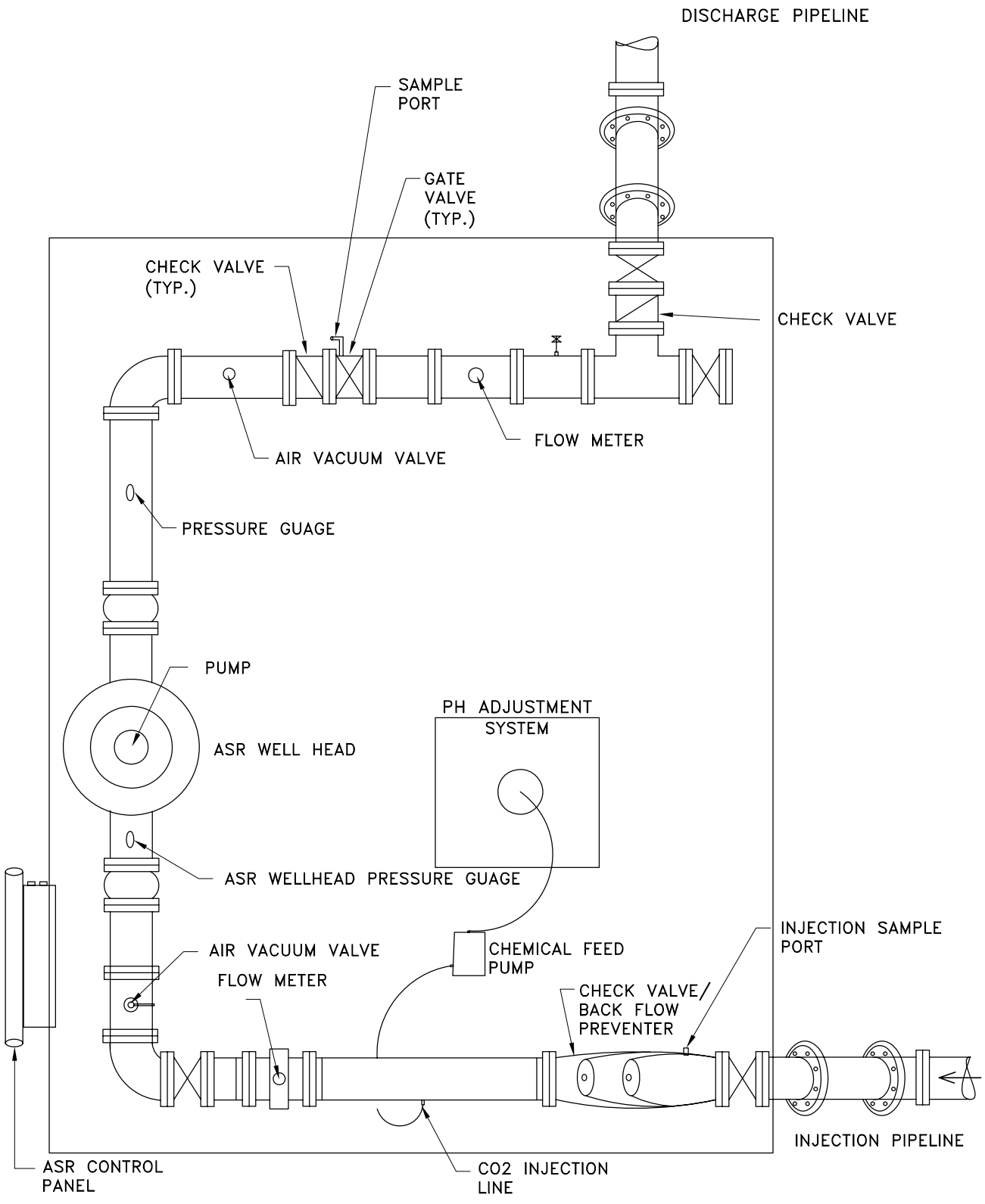
Interconnects will supplement the irrigation needs through resources available in either side of the connection. The proposed interconnect project is between the North Fort Myers and Cape Coral, shown on Figure 29.



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Surface Water ASR System Layout	Figure 32



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Withdrawal Pumping Station	Figure 33



ASR WELL

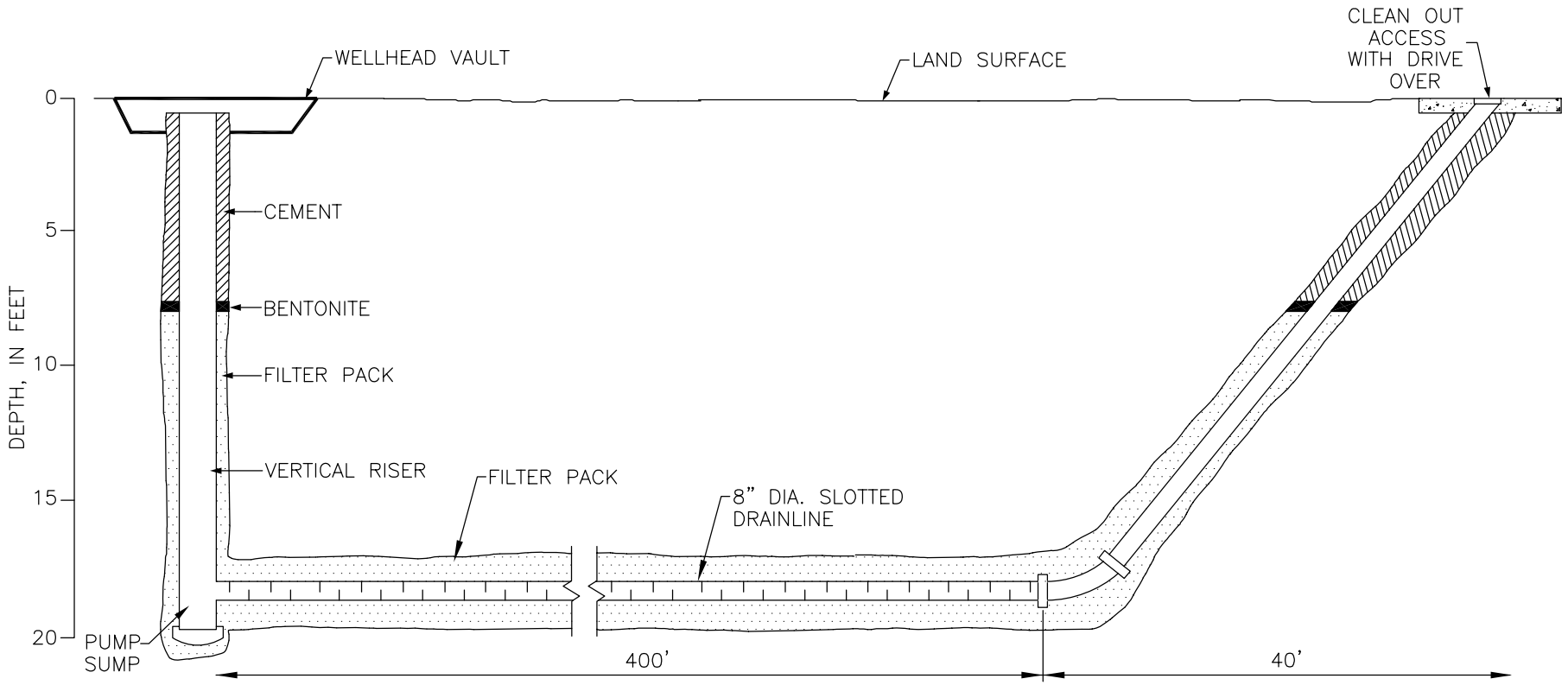
Figure 34

Typical ASR Well Layout

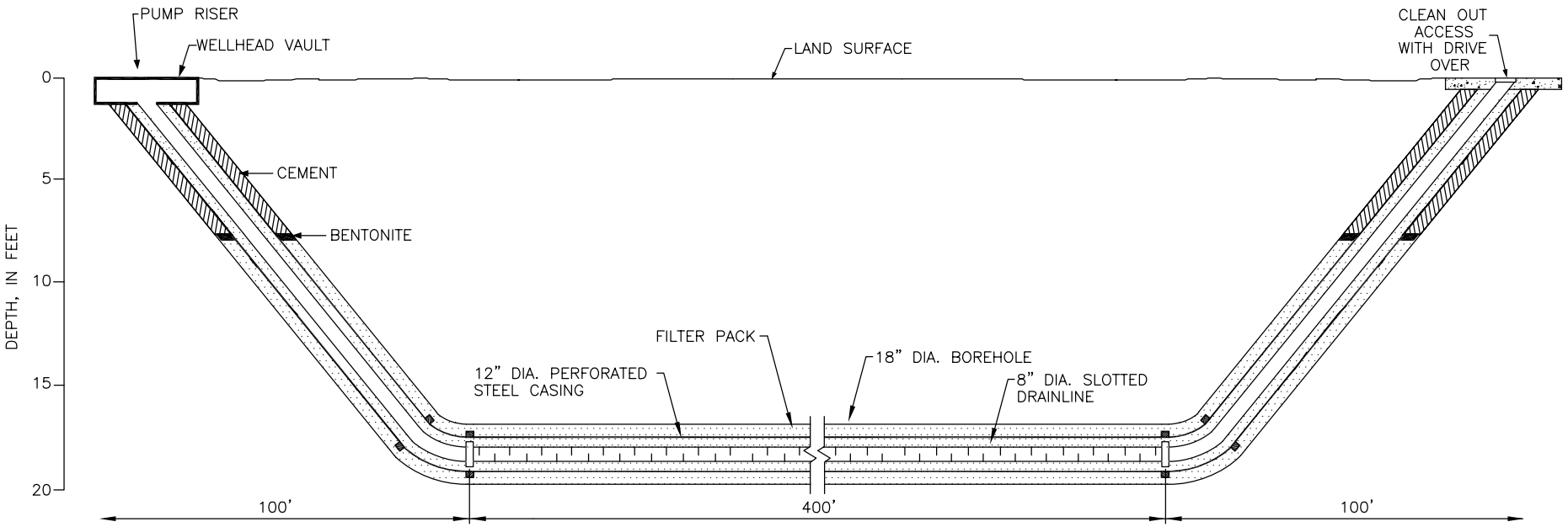
South Florida Water Management District

BOYLE

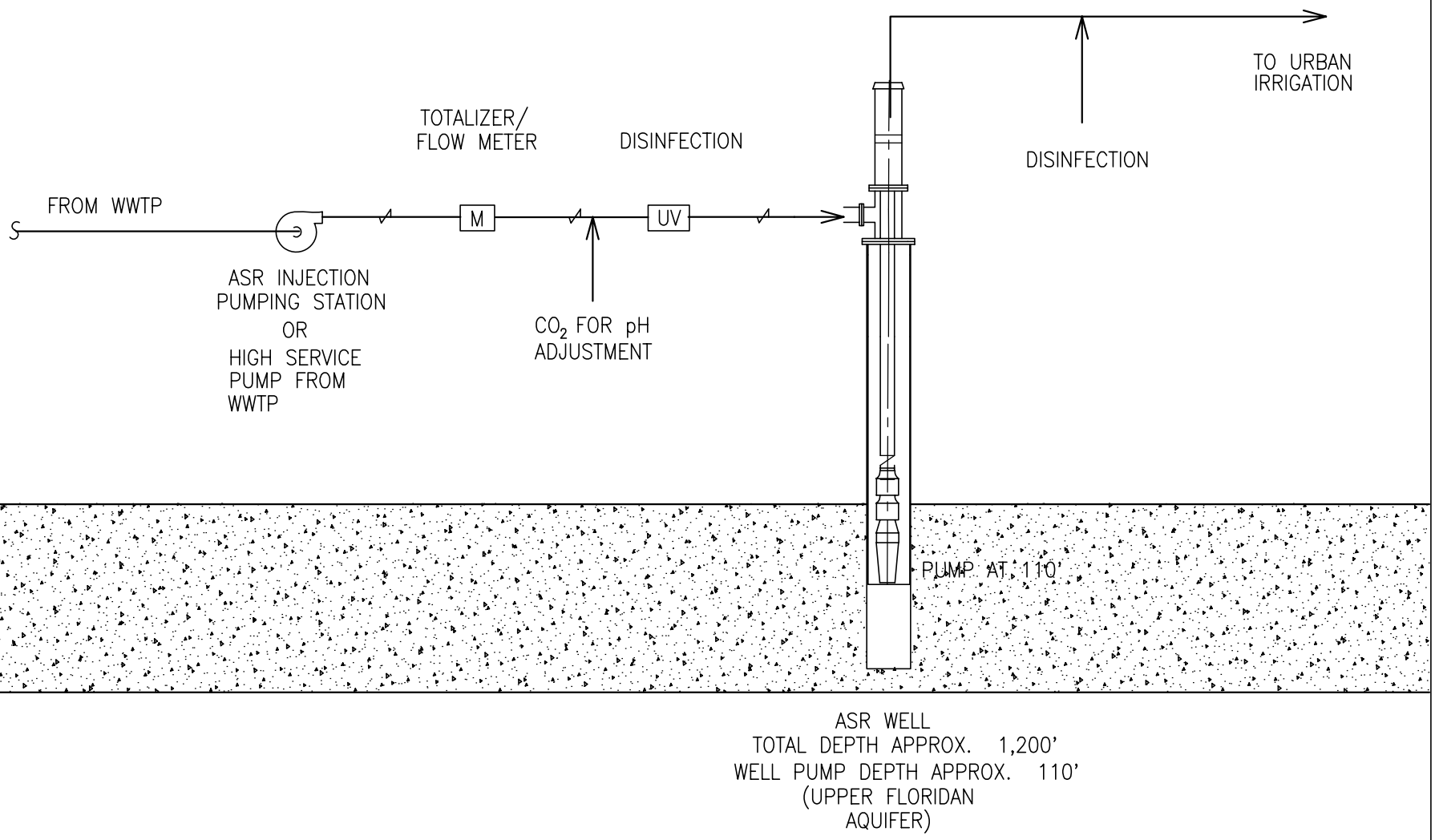
Regional Irrigation Distribution System (RIDS) Feasibility Study



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Cross-Section Installation Method A (Directional Drilled)	Figure 35



Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE		South Florida Water Management District	Typical Horizontal Well Cross-Section Installation Method B	Figure 36



Not to Scale
For Conceptual Purposes Only

Regional Irrigation Distribution System (RIDS) Feasibility Study	BOYLE	South Florida Water Management District	Typical Reclaimed Water ASR System Process Flow Schematic	Figure 37

PIPELINE DIAMETERS AND MATERIALS

Preliminary piping arrangements for the ASR well system are shown in Figure 33. Piping and valving arrangements allow for isolation, directing of flow for recharge/injection, or recovery, flow measurements, and control of recharge and recovery flow rates. Typical piping and valve sizes are presented in Figures 23 through 30 projects.

The pipe materials anticipated for the ASR systems infrastructure will be as follows:

- For Horizontal Wells - slotted high-density polyethylene (HDPE) and Ductile Iron Pipe (DIP)
- For Injection pumping stations- Ductile Iron Pipe (DIP) and polyvinyl chloride (PVC)
- For the ASR wells- Ductile Iron Pipe (DIP) and polyvinyl chloride (PVC)
- For the recovery pumping stations- polyvinyl chloride (PVC) and Ductile Iron Pipe (DIP)

PUMPS AND TREATMENT EQUIPMENT DESCRIPTIONS

The typical ASR well system will include pumps, pipes, valves, meters, instrumentation, and disinfection equipment. This section includes a preliminary selection of each type of equipment, which will be confirmed during the design phase.

Pumps

For reliability, all pumping systems will be designed for firm capacity, meaning that the capacity is met with the largest pump out of service. For the surface water projects, there will be three types of pumps. As shown in Figures 31, 32, 33 and 34, the system includes the horizontal well pumps, the injection pumps, and recovery pumps. For reclaimed water projects, the horizontal well pumps will not be necessary. In addition, the injection well pumps may not be necessary if it is determined that the WWTP's effluent pumps can be used for this purpose. For the preliminary selection of equipment for this Feasibility Study, the capacities needed are estimated based on the typical layout and pressure requirements from other ASR wells.

Horizontal well pumps

As shown on Figures 35 and 36 the horizontal well will require a submersible pump to extract the filtered surface water. Table 34 presents the ASR well projects for surface water sources and the anticipated pump capacities. Pump capacities are based on potential of withdrawal benefit from the source. The depth of the sump will vary depending on the conditions of the project site. A typical depth is about one foot above the invert of the pipe, about 20 feet below ground. The total discharge head (TDH) required is calculated based on this depth and approximately 5 feet for minor losses. Thus, the TDH for this type of well will be 25 feet. This type of pump is typically recommended for minimal turbulence and the entrance velocity should not be greater than 3.5 ft/s. The horizontal well layout allows the surface water to be filtered through the shallow soils. The pumps will operate based on a pressure tranducer on the slotted high-density polyethylene (HDPE). Sample pump curves are included in Appendix A for the above list of pumps.

Table 34
Horizontal Well Pump Characteristics

No.	Project	Type of ASR Project	Benefit and Pump Capacity (MGD)	Benefit and Pump Capacity (GPM)
1	Gator Slough	Surface Water	14	9,722
2	Horseshoe Canal	Surface Water	6	4,167
3	Hermosa Canal	Surface Water	6	4,167
4	Canal Pumping Station #8	Surface Water	5	3,472
5	North-South Transfer Station	Surface Water	10	6,944
6	Everest Parkway / Waterway Estates / N.Ft.Myers	Reclaimed Water	12.2	8,472

Injection Pumps

In some cases, the high service pumps from the advanced water treatment plants (AWTs), for the reclaimed water projects, might be used to inject the flows into the ASR well, injection pumps will be necessary for others. In situations in which injection pumps are necessary, vertical turbine pumps will be used. The vertical turbine pumps will be installed in a wet well. TM No. 1 presented an estimate of the depth of each ASR well, but the final depth will be evaluated based on conditions at each site. The TDH for the pump is based on the anticipated pressure of injection plus some headloss. Using an estimated injection pressure of 60 psi, the TDH for these pumps will be 63 psi. The total flow for the surface water ASR systems is the same amount that was withdrawn from the horizontal wells. For the injection pump stations, multiple pumps will be used to assure reliability, still using the firm capacity concept for selection. Table 35 presents the list of projects, and their associated injection pumps capacities/characteristics.

Table 35
Injection Pump Characteristics

No.	Project	Type of ASR Project	Benefit (MGD)	No. of Wells	Pump Capacity (GPM)	No. of Pumps	Proposed Well Depth (ft)
1	Gator Slough	Surface Water	14	20	9,722	2	1100
2	Horseshoe Canal	Surface Water	6	9	4,167	2	1100
3	Hermosa Canal	Surface Water	6	9	4,167	2	1100
4	Canal Pumping Station #8	Surface Water	5	7	3,472	2	1200
5	North-South Transfer Station	Surface Water	10	14	6,944	2	1050
6	Everest Parkway / Waterway Estates / N.Ft.Myers	Reclaimed Water	12.2	17	8,472	2	950

For the injection pumps, sample pump curves are included in Appendix B.

Recovery Pumps

Each well will have its own recovery pump system. For all the projects, the estimated flow for each well will be 0.75 MGD (521 GPM). It is anticipated that the TDH of the well will be 110 feet (depth of the pump) plus approximately 10 feet of head from friction losses. Thus, the total TDH will be 120 feet. Table 36 presents the projects and the anticipated characteristics of the pumps. Each pump must be constructed of 316 stainless steel since it will be used to pump water from an aquifer zone, which contains background brackish water quality.

Table 36
Recovery Well Pump

No.	Project	Type of ASR Project	Benefit (MGD)	No. of Wells	Proposed Well Depth (ft)
1	Gator Slough	Surface Water	14	20	1100
2	Horseshoe Canal	Surface Water	6	9	1100
3	Hermosa Canal	Surface Water	6	9	1100
4	Canal Pumping Station #8	Surface Water	5	7	1200
5	North-South Transfer Station	Surface Water	10	14	1050
6	Everest Parkway / Waterway Estates / N.Ft.Myers	Reclaimed Water	12.2	17	950

Appendix C presents pre-selected pump curves that can meet capacity requirements for the horizontal wells, injection and recovery pumps.

Treatment

Ultraviolet Disinfection (UV)

In order to meet the Primary Drinking Water Standards, UV disinfection has been selected. This type of disinfection is considered operator friendly as it has no residual, no chemicals to store, minimal contact time, and requires a smaller footprint than other disinfection methods. The recommended UV system will be a closed vessel, medium pressure, and high intensity type system.

According to the Recommended Standards from Water Works (2003 Edition), the Policy Statement on UV Light for treatment of Public Water Supplies states that the UV system shall meet the Class A criteria under ANSI/NSF Standard 55 (See Appendix D).

Chlorine Disinfection

Chlorine disinfection may be considered, but current and emerging disinfection byproduct regulations may result in chlorine not being viable. Chlorine disinfection can be evaluated to develop site-specific information related to microbial inactivation and disinfection by-product formation similar to that done for ozone and UV. In view of the organic content of the project source water, chlorine demand and subsequent disinfection by-product formation will be high. Chloramination may be able to reduce demand and disinfection by-product formation, however significantly greater contact time will be necessary to achieve disinfection comparable to free chlorine. Because chlorine disinfection has not been tested, it cannot be stated at this time whether or not it is a viable disinfection process. Once the appropriate evaluations have been performed, chlorine disinfection can be compared and contrasted with ozone and UV. If chlorine disinfection is able to meet water quality objectives (and this level varies

depending on requirements mandated by EPA or FDEP), this process may have a competitive advantage in that disinfection could be achieved via a solid (tablet type) chemical feed/contact system. Such a system would be relatively simple to maintain and operate.

It is of importance to note that chloramination has been tested on highly colored surface water and found to be suitable for meeting the coliform standard. This procedure was evaluated for disinfection for another ASR project in South Florida that proposed to store highly colored surface water.

CONTROL REQUIREMENTS

The permit will require proper system operation and monitoring. The operation and control of the ASR well system needs to be monitored for the following parameters:

- Pressure at the wellhead during injection
- Pressure at the wellhead during recovery
- Water level
- Flow rates during injection and recovery
- Conductivity during recovery (to estimate TDS)
- Pump motor status (on/off)
- Open/close position of each motor operated valve
- Abnormal conditions alarm (high motor temperature, high/low pressure, high/low flow)

Control panels for the well should be free standing within a NEMA 4X cabinet to include the following:

- Local Off Remote switch
- Lock out Stop switch
- Indicator light for pump/motor status
- Indicator of monitored hydraulic parameters
- PLC and auxiliary hardware

If remote control of the ASR well is needed, a remote telemetry unit (RTU) can transmit an operator directive or provide information about the selected parameters.

GENERAL CIVIL REQUIREMENTS

Structures

Local codes and requirements - Standard Florida Building Code (Wind Speed = 150 Mile per Hour).

Electrical

Final design also will be performed in coordination and communication with Florida Power & Light Company (FPL). Electrical service will be extended from the existing electrical distribution system that currently serves nearby systems. The electrical power needs will be estimated to include motor horsepower (HP), motor operated valves, lighting, and instrumentation controls. Emergency power will be provided by a back-up generators located either at the treatment plants (for reclaimed water projects) or on-site for surface water projects). Each well will have a control panel. All electrical equipment will have nameplates to identify each item with its respective service or function. The nameplates will include the name of the equipment being served and its associated component number.

The Following are the electrical standards and codes that will be used to design and construct the proposed facilities:

- National Electrical Code (NEC)
- American National Standards Institute (ANSI)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)
- Occupational Safety and Health Administration (OSHA)
- American Society for Testing Material (ASTM)
- Underwriters' Laboratories, Inc. (UL)
- Local codes and standards

TECHNICAL SPECIFICATIONS

Division 1 – General Requirements

01025	MEASUREMENT AND PAYMENT
01040	CONSTRUCTION COORDINATION
01065	PERMITS AND FEES
01070	GENERAL ABBREVIATIONS
01200	PROJECT MEETINGS
01300	SUBMITTALS
01326	SCHEDULE (CPM)

01370 SCHEDULE OF VALUES

01380 CONSTRUCTION PHOTOGRAPHS

01410 TESTING LABORATORY SERVICES

01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01600 MATERIAL AND EQUIPMENT

01667 SYSTEM START UP AND TESTING

01700 CONTRACT CLOSEOUT

01730 OPERATION AND MAINTENANCE MANUALS

Division 2 – Site Work

02210 SAND CEMENT RIP-RAP

02221 EXCAVATING, BACKFILLING AND COMPACTION

02232 LIME ROCK BASE

02270 EROSION AND SEDIMENT CONTROL

02486 FINISH GRADING AND GRASS

02822 CHAIN LINK FENCE AND GATES

Division 3 - Concrete

03100 CONCRETE FORMWORK

03201 CONCRETE REINFORCEMENT

03260 CONCRETE JOINTS AND WATERSTOPS

03300 CONCRETE

03345 CONCRETE FINISHING AND CURING

03800 LEAKAGE TESTING OF HYDRAULIC STRUCTURES

Division 5 - Metals

05050 BOLTS, WASHERS, DRILLED ANCHORS, AND EYEBOLTS

05121 MISCELLANEOUS STRUCTURAL STEEL AND ALUMINUM

05515 LADDERS, STAIRS, AND STAIR NOSINGS

05520 HANDRAILS AND SAFETY CHAINS

05530 GRATING, COVER PLATES, AND ACCESS HATCHES

Division 9 - Finishes

09900 PAINTING AND COATING

Division 11 - Equipment

11210 HORIZONTAL END SUCTION CENTRIFUGAL PUMPS
11214 VERTICAL TURBINE PUMPS
11215 VERTICAL TURBINE PUMPS-WATER WELLS
11240 CO_2 FEED SYSTEM
11281 FABRICATED STAINLESS-STEEL SLIDE GATES
11375 ULTRAVIOLET DISINFECTION SYSTEM

Division 13 – Special Construction

13226 UNDERDRAIN AND COLLECTION SYSTEM

Division 15 – Mechanical

15000 PIPING SCHEDULE & GENERAL PIPING REQUIREMENTS
15041 DISINFECTION OF PIPING AND STRUCTURES
15044 PRESSURE TESTING OF PIPING
15056 DUCTILE-IRON PIPE
15064 PVC DISTRIBUTION PIPE (AWWA C900)
15100 MANUAL, CHECK, AND PROCESS VALVES
15108 AIR-RELEASE AND VACUUM-RELIEF VALVES
15121 MISCELLANEOUS PIPE FITTINGS AND ACCESSORIES
15122 FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS
15132 PRESSURE GAUGES
15142 WALL PIPES, SEEP RINGS, AND PENETRATIONS
15155 MAGNETIC FLOWMETER
15190 EQUIPMENT, PIPING, DUCT & VALVE IDENTIFICATION

Division 16 - Electrical

16015 ELECTRICAL REFERENCE SYMBOLS
16020 WORK INCLUDED
16025 CODES, FEES, & STANDARDS
16035 ACCEPTANCE TESTING
16040 IDENTIFICATION
16050 SPECIAL REQUIREMENTS
16110 RACEWAYS AND CONDUITS

16120 WIRES AND CABLES
16130 OUTLET BOXES
16134 PANEL BOARDS
16140 WIRING DEVICES
16150 ELECTRIC MOTORS
16160 MOTOR CONTROLS
16170 DISCONNECTS
16180 OVERCURRENT PROTECTIVE DEVICES
16190 SUPPORTING DEVICES
16410 ELECTRIC SERVICE
16450 GROUNDING
16460 TRANSFORMERS
16501 LIGHTING FIXTURES
16709 SURGE SUPPRESSION EQUIPMENT
16850 INSTRUMENTATION, CONTROL AND TELEMETRY SYSTEM
16910 CONTROL PANELS

Reference:

1. Pumping station Design Robert Sanks, Second Edition, 1998.
2. Wastewater Technology Fact Sheet Ultraviolet Disinfection, EPA September 1999.
3. Water Ten State Standards

CONCLUSIONS AND RECOMMENDATIONS

The RIDS Master Plan concludes developing improvements on a subregional basis would be the most beneficial way to develop alternative water supplies to offset potable water demands. Table 37 presents a summary of the selected alternatives for each subregion. Figure 23 illustrates the RIDS alternative options for the lower west coast study area.

Table 37
Subregional Alternative Summary

Alternatives	Benefit (MGD)	Capital Cost ($)	Unit Cost ($ / 1,000 gal) [1]
Gator Slough	14	26,855,004	1.27
Horseshoe Canal	6	14,029,882	1.48
Hermosa Canal	6	14,828,218	1.56
Canal Pumping Station #8	5	11,720,750	1.49
North-South Transfer Station	10	19,374,000	1.27
Everest Parkway	12.2	22,110,750	1.20
North Fort Myers & Cape Coral	2.3	2,646,396	0.85
Total	55.5	111,565,000	1.32

[1]Unit costs assume grant funding assistance

Implementation of the RIDS will require additional phases to plan, design, finance and construct the improvements. Assuming Phase 1 included the Master Plan, and Phase 2 included the Feasibility Study, subsequent phases include the following:

- **Phase 3 Engineering Design –** Includes design, permitting and bidding of projects.
- **Phase 4 Construction –** Construction and startup of projects.

Project phases will be implemented on a subregional basis as developed in the RIDS Master Plan.

ATTACHMENT A

The B-C methodology

ATTACHMENT A
BLANEY-CRIDDLE METHODOLOGY

The basic B-C formula states that the consumptive use (U) is equal to a seasonal consumptive use factor coefficient (k), times a monthly consumptive use factor (f), therefore U=k*f. F is a function of the mean monthly temperature in degrees Fahrenheit (t) times the monthly percent of daytime hours (p), divided by 100, expressed as f=t*p/100. K is a factor relating the plant water usage for a specific species. K factors are generated under experimental conditions where F and U are measured under tightly controlled conditions. This analysis uses a modified B-C method beginning with a modified (k) factor, explained in Appendix B.

Here, the coefficient (k) is equal to a climatic coefficient, which is related to the mean air temperature (kt), times a coefficient reflecting the growth stage of the crop (kc), (k=kt x kc). In order to approximate evapotranspiration, the following calculations must first be completed:

$f(m) = (t(m) \times p(m))/100,$
$kt(m) = (0.0173 \times t(m)) - 0.314,$
$kt\ f\ (m) = f(m) \times kt(m),$
$U(m) = kt\ f\ (m) \times kc\ (m),$ where,

m = month of year
f(m) = monthly evapotranspiration factor
r(m) = average monthly temperature, (provided)
p(m) = monthly percentage of annual daylight hours, (provided)
kt(m) = kt
U(m) = monthly evapotranspiration
kc(m) = monthly crop coefficient, (provided)

The effective rainfall for crop evapotranspiration is calculated as a function of the 1-in-10 year drought rainfall as:

$Rt(1) = (0.70917 \times (Rt(m)^{(0.82416)})) - 0.11556,$
$U1(m) = 10^{(0.01226 \times U(m))}$
$F1 = 0.531747 + (0.295154 \times D) - (0.057697 \times D^2) + (0.003804 \times D^3)$
$Re(m) = Rt1(m) \times U1(m) \times F1,$ where

Rt1(m) = monthly effective rainfall factor considering 1-in-10 monthly rainfall
Rt(m) = 1-in-10 monthly rainfall, (provided)
U1(m) = monthly effective rainfall factor considering monthly evapotranspiration
F1 = soil factor
D = net depth of application
Re(m) = monthly effective rainfall

After the monthly evapotranspiration, U(m), and the monthly 1-in-10 effective rainfall, Re(m), have been determined, the monthly supplemental crop requirement, Sup(m), is calculated as:

Sup(m) = U(m) – Re (m) for each month of the year

Finally, the irrigation quantity needed to supply the supplemental crop requirement Sup(m) is determined by:

Q(m) = Sup(m) x Ka x A, where

Ka = allocation coefficient multiplier for the irrigation system specified
A = irrigated acreage for the crop

ATTACHMENT B

The B-C Models Results

North Ft. Myers - Future

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Ft. Myers
Irrigation System:	Sprinkler
Irrigated Acreage:	4763.00
Crop:	Turf Grass
Soil Type:	0.80
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.90	2.00	1.50	1.90	4.10	9.40	8.70	8.60	8.40	3.50	1.50	1.50	53.00
Evapotranspiration (inches)	1.86	2.14	3.70	5.11	6.83	7.60	8.05	7.72	6.48	4.92	3.07	2.15	59.63
Average Effective Rainfall (inches)	0.88	0.94	0.79	1.06	2.31	4.91	4.71	4.58	4.19	1.81	0.76	0.72	27.66
1-in-10 Effective Rainfall (inches)	0.62	0.81	0.13	0.40	1.71	3.91	3.82	4.03	4.02	1.30	0.62	0.63	22.00
Average Irrigation (inches)	0.98	1.20	2.91	4.05	4.52	2.69	3.34	3.14	2.29	3.11	2.31	1.43	31.97
1-in-10 Irrigation (inches)	1.24	1.33	3.57	4.71	5.12	3.69	4.23	3.69	2.46	3.62	2.45	1.52	37.63

1-in-10 Annual Supplemental Crop Requirement = 37.63 inches

Annual Supplemental Crop Water Use:

37.63 inches X 4763 Acres X 1.33 X 0.02715 MG/AC-IN = 6471.97 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.12 inches

Maximum Monthly Supplemental Crop Water Use:

5.12 inches X 4763 Acres X 1.33 X 0.02715 MG/AC-IN = 880.59 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

Waterway Estates - Future

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Ft. Myers
Irrigation System:	Sprinkler
Irrigated Acreage:	748.00
Crop:	Turf Grass
Soil Type:	0.80
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.90	2.00	1.50	1.90	4.10	9.40	8.70	8.60	8.40	3.50	1.50	1.50	53.00
Evapotranspiration (inches)	1.86	2.14	3.70	5.11	6.83	7.60	8.05	7.72	6.48	4.92	3.07	2.15	59.63
Average Effective Rainfall (inches)	0.88	0.94	0.79	1.06	2.31	4.91	4.71	4.58	4.19	1.81	0.76	0.72	27.66
1-in-10 Effective Rainfall (inches)	0.62	0.81	0.13	0.40	1.71	3.91	3.82	4.03	4.02	1.30	0.62	0.63	22.00
Average Irrigation (inches)	0.98	1.20	2.91	4.05	4.52	2.69	3.34	3.14	2.29	3.11	2.31	1.43	31.97
1-in-10 Irrigation (inches)	1.24	1.33	3.57	4.71	5.12	3.69	4.23	3.69	2.46	3.62	2.45	1.52	37.63

1-in-10 Annual Supplemental Crop Requirement = 37.63 inches

Annual Supplemental Crop Water Use:

37.63 inches X 748 Acres X 1.33 X 0.02715 MG/AC-IN = 1016.38 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.12 inches

Maximum Monthly Supplemental Crop Water Use:

5.12 inches X 748 Acres X 1.33 X 0.02715 MG/AC-IN = 138.29 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

Cape Coral Utilities - Future

Calculations Of Irrigation Requirements (1-in-10)

Rainfall Station:	Ft. Myers
Irrigation System:	Sprinkler
Irrigated Acreage:	15146.00
Crop:	Turf Grass
Soil Type:	0.80
Multiplier	1.33
Efficiency	0.75

Calculations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Rainfall (inches)	1.90	2.00	1.50	1.90	4.10	9.40	8.70	8.60	8.40	3.50	1.50	1.50	53.00
Evapotranspiration (inches)	1.86	2.14	3.70	5.11	6.83	7.60	8.05	7.72	6.48	4.92	3.07	2.15	59.63
Average Effective Rainfall (inches)	0.88	0.94	0.79	1.06	2.31	4.91	4.71	4.58	4.19	1.81	0.76	0.72	27.66
1-in-10 Effective Rainfall (inches)	0.62	0.81	0.13	0.40	1.71	3.91	3.82	4.03	4.02	1.30	0.62	0.63	22.00
Average Irrigation (inches)	0.98	1.20	2.91	4.05	4.52	2.69	3.34	3.14	2.29	3.11	2.31	1.43	31.97
1-in-10 Irrigation (inches)	1.24	1.33	3.57	4.71	5.12	3.69	4.23	3.69	2.46	3.62	2.45	1.52	37.63

1-in-10 Annual Supplemental Crop Requirement = 37.63 Inches

Annual Supplemental Crop Water Use:

37.63 inches X15146 Acres X 1.33 X 0.02715 MG/AC-IN = 20580.39 MG

1-in-10 Maximum Monthly Supplemental Crop Requirement = 5.12 inches

Maximum Monthly Supplemental Crop Water Use:

5.12 inches X 15146 Acres X 1.33 X 0.02715 MG/AC-IN = 2800.20 MG

Notes:
Evapotranspiration was calculated using a modified Blaney-Criddle method.
Average effective rainfall is the amount that is useful to crops in an average year.
2-in-10 drought rainfall is the rainfall minimum expected with a probability of 2 year in 10.
2-in-10 effective rainfall is the amount that is useful to crops in a 2-in-10 drought rainfall.
Average irrigation is the net amount that should be required for maximum yields during an average year.
2-in-10 irrigation is the net amount that should be required for maximum yields during a 2-in-10 drought year.

ATTACHMENT C

USGS and SFWMD Stream Flow Data

SURFACE WATER BODY: SAN CARLOS CANAL
GAGE STATION LOCATION SE 1/4 NE 1/4 SEC. 36 T 44S R 23E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986												0.49
1987	1.93	3.46	3.65	2.03	2.13	6.29	11.0	7.01	2.40	9.75	3.19	1.02
1988	1.61	0.85	2.21	0.27	0	0.07	3.60	10.3	6.59	1.57	2.08	1.79
1989	0.84	0.69	1.30	0.01	0	1.55	9.59	6.32	10.9	4.82	1.62	1.83
1990	0.93	0.09	0.09	0	0	3.84	6.10	8.25	3.92	4.06	0.34	0
1991	7.10	0.98	0.33	0.68	0.99	2.80	8.74	10.4	11.9	8.83	0.44	0.14
1992	0.41	2.52	2.07	1.90	0.08	17.5	13.9	11.2	12.7	2.43	0.69	1.61
1993	2.45	2.86	4.27	1.22	0.19	2.62	10.2	8.07	11.8	14.1	4.55	1.43
1994	1.35	1.08	0.63	0.01	0	1.40	5.80	5.77	7.95	3.74	2.70	1.09
1995	2.07	0.39	0	0.14	0.33	34.1	33.8	20.3	39.5	19.8	2.26	0
1996	2.17	0	0.01	0.10	3.63	17.6	5.50	11.8	7.51	7.15	0.01	0
1997	0	0	0	0.95	0.67	1.24	0.04	12.1	6.31	2.74	0.64	9.42
1998	9.77	12.7	5.60	0	0	2.32	19.7	13.8	5.17	0	5.46	4.48
1999	9.17	0.77	0	0	0	20.5	7.23	4.48	19.6	7.13	0.84	0.39
2000	3.32	0.20	0	0	0	2.34	7.09	11.2	14.7			
MEAN	3.08	1.90	1.44	0.52	0.57	8.16	10	10	11	6.62	1.91	1.69

DRY SEASON: 1.53
WET SEASON: 9.59

SURFACE WATER BODY: MEADE CANAL
GAGE STATION LOCATION NW 1/4 NE 1/4 SEC. 20 T 44S R 24 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986												1.46
1987	2.32	3.05	4.08	4.33	3.44	4.95	10.4	6.64	4.27	8.15	5.19	2.06
1988	0.93	1.74	3.00	0.79	0.50	1.27	6.07	16.6	4.69	0	1.07	0.88
1989	0.82	0.29	0.75	0.15	0.35	2.77	22.3	21.5	19.8			
1990	0.67	0.51	0.57	0	1.00	12.8	18.7	7.87	8.75	4.87	1.40	0.42
1991	7.86	1.32	0.83	1.45	4.53	14.1	13.1	3.20	8.33	5.41	1.31	0.45
1992	0.89	3.91	4.47	2.71	0.42	12.0	8.14	7.28	4.14	0.32	0.79	1.08
1993	4.49	2.17	2.33	1.19	0.01	2.97	3.83	3.58	4.62	7.01	1.88	0.31
1994	2.46	0.11	0.29	2.23	2.36	1.98	4.44	4.23	4.79	3.18	0.88	1.26
1995	2.15	2.16	0.17	0.49	1.93	24.8	29.0	38.3	22.9	13.4	1.11	0.30
1996	8.38	2.55	2.27	0.89	0.74	9.06	1.59	8.03	4.30	1.95	0.11	0.52
1997	0.44	2.06	1.32	4.48	5.05	9.84	3.41	22.5	9.12	5.61	3.83	9.69
1998	8.45	16.3	5.80	0.64	0.43	8.84	19.1	23.0	10.2	1.95	0.11	0.52
1999	0.44	2.06	1.32	4.48	5.05	9.84	4.06	15.5	11.6	7.40	2.32	2.99
2000	4.17	2.30	1.71	0.61	0.74	1.48	11.4	8.54	16.9			
MEAN	3.18	2.90	2.07	1.75	1.90	8.33	11.1	13.3	9.60	4.94	1.67	1.69

DRY SEASON: 1.69
WET SEASON: 9.75

SURFACE WATER BODY: SHADROE CANAL
GAGE STATION LOCATION SE 1/4 SW 1/4 SEC. 8 T 44 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1987		8.11	9.87	7.98	14.4	20.0	25.8	35.9	27.6	29.3	12.9	8.69
1988	5.43	4.90	4.69	1.61	0.26	0.01	3.35	9.19	19.6	2.56	8.92	2.42
1989	3.88	2.61	2.47	0.66	0.12	2.87	3.35	3.43	13.0	6.45	1.24	1.92
1990	1.13	1.82	0.37	0.07	2.23	7.28	9.85	7.95	3.77	2.67	0.50	0
1991	10.1	2.69	4.02	2.29	5.57	5.70	14.5	13.2	13.7	10.3	1.58	2.10
1992	1.34	4.06	2.49	1.97	0.36	22.3	41.7	39.8	17.3	5.68	1.67	1.56
1993	2.84	3.78	8.69	2.71	1.37	9.24	7.81	9.39	11.6	16.6	5.94	1.76
1994	3.30	2.79	0.85	2.59	0.54	0.32	8.64	8.93	28.1	8.86	5.04	3.08
1995	3.86	3.13	2.58	2.23	3.63	20.2	63.6	68.4	75.8	114	17.1	3.00
1996	15.7	2.82	2.91	2.40	5.19	15.4	12.4	11.0	9.44	19.4	3.98	1.85
1997	1.16	1.66	0.92	2.86	3.06	3.19	4.70	13.6	20.7	6.08	5.26	15.5
1998	19.3	38.2	13.1	3.19	1.17	0.02	17.5	10.1	12.4	2.87	7.76	3.67
1999	4.01	2.89	1.15	0.12	0	6.39	20.3	10.3	30.1	14.3	3.63	2.26
2000	2.84	1.81	0.48	0.30	0	1.25	12.3	22.8	50.4			
MEAN	5.76	5.81	3.90	2.21	2.71	8.15	17.6	18.9	23.8	18.4	5.81	3.68

DRY SEASON: 4.01
WET SEASON: 19.7

SURFACE WATER BODY: HORSESHOE CANAL
GAGE STATION LOCATION NW 1/4 NW 1/4 SEC. 5 T 44 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1987		13.4	28.7	27.8	33.1	50.1	70.6	39.3	32.2	59.4	17.9	3.58
1988	1.77	1.51	5.70	4.19	1.07	0.51	36.6	66.6	46.0	7.74	7.11	2.52
1989	2.25	2.04	2.82	0.86	1.88	14.5	34.6	37.2	15.7	4.41	1.86	3.25
1990	4.57	3.90	2.81	0.93	12.8	40.4	31.0	27.9	12.7	17.9	4.81	1.46
1991	22.1	11.2	17.9	14.6	43.4	71.9	115	62.8	41.1	29.0	2.95	1.70
1992	0.73	5.03	5.97	4.71	1.20	59.6	65.3	62.5	41.7	12.5	4.02	3.44
1993	8.97	7.75	16.2	7.20	3.49	57.9	54.9	48.4	53.7	28.1	18.9	3.22
1994	4.15	4.34	3.00	8.76	4.24	4.17	34.3	29.8	58.8	18.6	8.26	4.23
1995	5.22	6.66	3.49	3.47	4.84	88.0	97.2	134	102	93.0	23.6	7.33
1996	20.3	3.48	3.12	1.84	5.43	45.2	41.0	32.8	43.0	45.0	3.63	0.89
1997	0.24	0.31	0.03	1.19	4.78	10.9	47.8	63.2	43.1	29.7	17.3	60.5
1998	62.4	130	72.9	13.2	1.14	4.61	66.8	50.4	98.1	16.5	27.4	7.59
1999	6.46	3.03	0.32	0	0	61.5	76.5	49.4	65.9	26.5	3.83	3.02
2000	3.77	1.06	0.06	0	0	2.48	8.90	27.5	73.7			

MEAN	11.0	13.8	11.6	6.34	8.38	36.6	55.7	52.3	52.0	29.9	10.9	7.90

DRY SEASON: 9.85
WET SEASON: 47.5

SURFACE WATER BODY: COURTNEY CANAL
GAGE STATION LOCATION SE 1/4 SW 1/4 SEC. 2 T 45 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986												0.27
1987	3.97	4.01	8.37	3.61	2.21	12.9	24.1	12.8	4.02	13.6	3.03	0
1988	0.01	0	0.90	0	0	0	0.68	17.20	6.36	0	0	0
1989	0	0	0	0	0	0.01	15.2	14.8	24.9	11.0	0	0
1990	0.29	0	0	0.03	0	12.3	23.0	20.3	6.87	1.88	0	0
1991	8.89	0.59	0.26	0	2.64	8.21	16.90	14.6	18.1	4.49	4.18	4.04
1992	3.85	4.14	4.33	4.32	4.02		4.71	4.61	4.57	4.38	4.29	4.29
1993	4.41	4.46	4.45	4.13	3.65	3.94	4.61	4.55	4.59	4.59		
1994	4.30	4.35	4.13	3.64	3.01	2.49			4.80	4.58	4.51	4.40
1995	4.67	4.62			4.37	5.01	5.15			28.7	2.62	0.45
1996	12.0	0	0	0	1.77	31.5	31.3	22.6	11.1	19.2	0	0
1997	0	0.02	0	1.40	0.54	7.43	30.20	50.9	19.4	9.82	8.08	34.2
1998	44.0	66.7	39.3	5.09	0.36	3.29	72.2	35.0	21.6	0.38	29.9	15.9
1999	14.5	5.62	0	0	0	59.7	17.2	0.60	29.1	16.4	0.61	0.80
2000	11.3	10.7	0.21	0.02	0	1.74	11.70	57.3	50.0			
MEAN	8.01	7.52	4.77	1.71	1.61	11.4	19.8	21.3	15.8	9.15	4.77	5.34

DRY SEASON: 4.83
WET SEASON: 16.5

SURFACE WATER BODY: HERMOSA CANAL
GAGE STATION LOCATION SW 1/4 SW 1/4 SEC. 5 T 44 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1987		2.16	2.78	1.16	4.44	34.6	29.6	21.5	7.21	85.1	47.0	13.9
1988	7.36	9.90	12.5	4.26	1.17	1.58	41.9	58.4	34.3	7.51	6.34	1.47
1989	5.40	4.38	9.59	4.14	1.82	21.0	55.0	62.0	43.7	23.3	11.4	9.75
1990	7.47	5.51	3.40	1.05	11.2	27.0	18.1	18.5	15.2	9.93	2.52	1.78
1991	19.3	5.87	6.33	5.28	25.6	45.8	79.0	28.3	31.6	37.3	6.08	3.71
1992	2.01	9.66	11.8	8.54	2.96	35.4	50.1	51.3	30.2	12.6	5.28	4.26
1993	9.14	11.4	16.2	8.97	5.35	35.0	50.9	26.7	30.8	32.9	22.3	6.53
1994	4.19	5.19	3.55	12.0	5.66	8.38	35.3	18.8	47.8	24.5	16.7	12.7
1995	12.1	6.94	6.64	6.05	10.1	79.5	92.9	114	85.4	88.1	17.7	3.75
1996	7.81	0.80	3.00	1.74	8.26	48.2	31.5	26.0	31.7	43.5	6.33	1.00
1997	0.23	0.55	0.09	2.00	5.94	9.46	38.5	76.7	49.9	21.4	9.68	53.5
1998	59.6	98.3	41.1	2.10	0.01	0.28	27.4	30.0	56.0	13.0	25.9	8.88
1999	4.79	1.43	0.07	0	0	37.2	33.3	16.4	44.5	42.6	12.8	4.31
2000	0.99	0	0	0	0	0.65	8.93	52.0	85.1			
MEAN	10.8	11.6	8.36	4.09	5.89	27.4	42.3	42.9	42.4	34.0	14.6	9.66

DRY SEASON: 8.40
WET SEASON: 40.4

SURFACE WATER BODY: ARIES CANAL
GAGE STATION LOCATION SW 1/4 NE 1/4 SEC. 34 T 44 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1989										6.75	0.79	0.99
1990	1.25	0.80	0.54	0.97	0.34	7.68	11.4	16.6	21.1	13.3	2.52	0.40
1991	18.2	7.79	4.47	3.51	7.27	16.5	45.2	37.7	43.9	33.2	5.85	1.90
1992	2.23	5.09	9.75	8.56	1.22	60.0	34.9	41.3	34.2	9.55	5.00	4.57
1993	7.04	8.33	10.4	5.76	1.22	9.42	40.7	26.4	17.9	25.3	5.57	1.12
1994	1.29	1.25	0.97	0.71	0.00	0.92	7.92	6.02	24.0	5.20	3.67	2.99
1995	5.45	3.32	1.64	2.83	4.35	19.1	42.6	36.9	74.6	31.0	7.29	2.20
1996	10.3	2.78	2.17	1.88	8.67	25.1	20.4	18.1	13.6	10.9	0.02	1.45
1997	1.55	1.28	0.23	4.06	2.61	3.60	15.9	23.7	18.8	10.5	5.48	20.6
1998	22.1	31.6	11.8	1.60	0.50	6.51	50.3	21.4	15.3	2.52	15.3	6.86
1999	22.3	5.16	0.75	0	0	39.9	127	41.8	71.8	31.9	3.95	2.47
2000	5.33	2.78	0.54	0	0	3.24	34.3	57.9	110			
MEAN	8.82	6.38	3.93	2.72	2.38	17.5	39.1	29.8	40.5	16.4	5.04	4.14

DRY SEASON: 4.73
WET SEASON: 31.4

SURFACE WATER BODY: GATOR SLOUGH
GAGE STATION LOCATION NE 1/4 NW 1/4 SEC. 32 T 43 S R 23 E
FLOW (CFS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986										29.4	14.9	13.2
1987	38.1	16.3	41.6	43.2	40.8	63.5	150	74.5	47.2	95.3	38.6	18.9
1988	7.09	6.50	17.6	9.22	3.06	1.40	96.90	159	125	17.4	16.9	5.80
1989	4.56	4.33	9.40	1.65	0.72	17.1				32.4	10.8	7.81
1990	3.99	4.15	2.90	1.25	13.7	46.7	47.1	64.5	23.3	17.6	4.87	2.10
1991	33.4	14.1	10.2	8.70	58.0	133	192	87.0	56.8	605	7.72	4.89
1992	2.45	10.3	14.6	13.9	4.30	135	157	136	87.5	31.0	6.47	5.45
1993	16.9	20.1	37.9	20.7	9.92	60.1	88.6	55.3	78.0	56.5	41.0	9.56
1994	10.5	14.7	12.6	26.2	14.8	11.8	51.1	56.5	147	54.4	19.5	11.5
1995	14.6	10.8	10.4	7.62	26.3	215	284	278	175	253	33.6	0.50
1996	23.4	2.94	4.22	4.62	13.3	79.7	84.3	116	119	188	42.2	4.91
1997	0.03	0	0	3.06	7.50	16.4	83.3	359	112	4.4	4.61	14.7
1998	15.1	23.8	18.6	4.38	0.96	2.57	1.66	3.96	24.3	4.14	4.56	2.47
1999	2.15	1.20	0.29	0.01	0.74	20.4	18.1	17.3	13.2			
2000						8.27	9.15	76.7	194			
MEAN	13.3	9.94	13.9	11.1	14.9	57.9	97.2	114	92.5	107	18.9	7.83

DRY SEASON: 11.8
WET SEASON: 103

ATTACHMENT D

Hydrostratigraphy Assessment of Inventoried Wells

TABLE 7 - SUMMARY OF INVENTORIED WELL DATA
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBE	BOG #	FDS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft	CASED DEPTH (ft	DIS. CHLOR. (MG/L)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
CH-314		W-17357				SW SW 32-42S-23E	422332	3268	2528	677		1207-1287' Ocala Ls	OLDS	INJ	FWS Burnt Store	WRS
										19,800		1832-1868' A. Park Fm				
CH-378						SW SW 32-42S-23E	422332	600	304	985		Permit # 203522	MH/LH	P.S	Burnt Store	WRS
CH-379						SW SW 32-42S-23E	422332	596	300	895		Permit # 203522	MH/LH	P.S	Burnt Store	WRS
CH-437						SW SW 32-42S-23E	422332	596	300			Permit # 203522	MH/LH	P.S	Burnt Store	WRS
CH-438						SE SW 32-42S-23E	422332	600	304			Permit # 203522	MH/LH	P.S	Burnt Store	WRS
CH-439						SW SW 32-42S-23E	422332	602	313	835		Permit # 203522	MH/LH	P.S	Burnt Store	WRS
LM-3366				L-6434		SE NE 24-43S-22E	432224	720	485	680		City of Cape Coral, Site N	LH	TEST		WRS
LM-3480				L-6437		NE NE 24-43S-22E	432224	1205	800	3,360		City of Cape Coral, Site N	SU/OC			WRS
LM-1277				L-2526		NE NE 07-43S-23E	432307	605	300	540	2,150			TEST		USGS
LM-5281						NE SW 08-43S-23E	432308					PERMIT # 36-00518-W	LH	AQU		SFWMD
LM-3231			WA-206			NE SE 17-43S-23E	432317	748	170	812	3,050					SFWMD
LM-3232		W-16918	WA-127			NE NE 19-43S-23E	432319	675	181	1,513	4,500	P&A 4/29/82				SFWMD
LM-3233			WA-495			NW SE 30-43S-23E	432330	601	254	787	2,126	P&A 4/8/85				SFWMD
LM-3247				L-6431		NW NW 33-43S-23E	432333	740	455	750			LH	TEST	City of Cape Coral Site P	WRS
LM-3249					RO-1N	NW NW 33-43S-23E	432333	735	500	820	2,800	PERMIT # 36-00046-W	LH	TEST	TEST/PRODUCTION WELL RO-1N	WRS
LM-3482				L-6438		NE NE 35-43S-23E	432335	780	494	580			LH		City of Cape Coral Site Q	WRS
LM-5923				L-5802		SW SE 14-43S-24E	432414	2600	2335	3,300	3,700	AP (1,479 - 1,489')			N. FT. MYERS'86 IW-1	USGS
										7,150	20,000	AP (1,559 - 1,569')				
LM-6964		W-16098		L-5803		NW SE 14-43S-24E	432414	2600	1950	555	2,600	OCA (1,318 - 1422')		MONITOR	N. FT. MYERS'86 MW	USGS
										18,600	49,900	AP (1,930 - 2,004')				
LM-3226			WA-96			SW SW 15-43S-24E	432415	712		808	3,250	P&A 4/13/82				SFWMD
LM-3483				L-6439		NW NE 17-43S-24E	432417	760	505	800			LH		City of Cape Coral, Site R	WRS
LM-854				L-1957		NW SW 22-43S-24E	432422	726	346	780			MH/LH	DOM		USGS
LM-855				L-1962		NW NE 26-43S-24E	432426	796	310	745	2,300		MH/LH	IRR		USGS
LM-3273				L-6432	RO-2N	SE NE 31-43S-24E	432431	800	560	580	2,220	PERMIT # 36-00046-W	LH	TEST	TEST/PRODUCTION WELL RO-2N	WRS
LM-3508					RO-3N	SE NE 31-43S-24E	432431	1100	785	720	3,120	PERMIT # 36-00046-W	SU	TEST	TEST/PRODUCTION WELL RO-3N	WRS
LM-3509						NE SE 31-43S-24E	432431	1585	785	640	2,570	SUW (900 - 1020')	SU/OC/A	MONITOR	CITY OF CAPE CORAL'90 SITEV	WRS
										740	2,910	SUW (1080')				
										860	3,220	OCA (1150')				
										1,960	6,200	OCA (1220')				
										10,040	27,100	AP (1585')				
LM-2285						NW NE 33-43S-24E	432433	550		740	3,149		LH	IRR	PERMIT # 36-03674-W	WRS
LM-2286						NE NE 33-43S-24E	432433	550		700	3,130		LH	IRR	PERMIT # 36-03674-W	WRS
LM-2287						SE NE 33-43S-24E	432433	550		760	3,190		LH	IRR	PERMIT # 36-03674-W	WRS
LM-4783			WA-11	L-3290		SE NE 33-43S-24E	432433	590	162	583		P&A 8/12/82				SFWMD
LM-5099			WA-321	L-102		SW SW 35-43S-24E	432435	672	152	628	2,950	P&A 6/22/83				SFWMD
LM-5854			WA-439	L-5611		NE SW 35-43S-24E	432435	860	302	1,150	3,490		MH/LH/SU		P&A 9/14/84	SFWMD
LM-5464				L-2328		NE NE 01-43S-25E	432501	600	300	1,000	4,150		MH/LH			USGS
LM-3052			W-40	L-2341		NW NW 07-43S-25E	432507	585	300	840	3,380		MH			USGS
LM-809				L-278		NE NW 18-43S-25E	432518	880						IND		USGS
LM-5086			WA-297			SE SE 19-43S-25E	432519	730	140	845	3,450	P&A 4/25/83				SFWMD
LM-6208						SW SW 20-43S-25E	432520	980	537	890	3,230	LH II (480 - 518')	LH/SU	MONITOR	LEE COUNTY UTILS ASR- N. RES.	WRS
										700	2,640	LH III (529 - 619')				
										740	2,710	SUW I (640 - 703')				
										720	2,450	SUW III (808 - 890')				
										1,000	3,244	OCA I (904 - 977')				
LM-5860			WA-373			NE NE 24-43S-25E	432524	732	86			P&A 7/26/84				SFWMD
LM-7338						NW NW 29-43S-25E	432529	600	280			Permit # 36-03726-W	MH/LH	IRR	Faith Assembly of God Inc.	SFWMD
LM-7339						NW NW 29-43S-25E	432529	600	280			Permit # 36-03726-W	MH/LH	IRR	Faith Assembly of God Inc.	SFWMD
LM-7340						NW NW 29-43S-25E	432529	600	280			Permit # 36-03726-W	MH/LH	IRR	Faith Assembly of God Inc.	SFWMD
LM-2660						NW NE 35-43S-25E	432535	935								WRS
LM-5395						NE NE 35-43S-25E	432535	800	500			PERMIT # 36-00595-W	LH/SU	IND		SFWMD
LM-5396						NW NE 35-43S-25E	432535	800	500			PERMIT # 36-00595-W	LH/SU	IND		SFWMD
LM-5397						SW NE 35-43S-25E	432535	800	500			PERMIT # 36-00595-W	LH/SU	IND		SFWMD
LM-3485				L-6441		SW SW 03-44S-23E	442303	750	395	1,040			MH/LH	P.S	City of Cape Coral, Site T	WRS
LM-3051				L-2528		SW SW 11-44S-23E	442311	625	420	940			MH/LH			USGS
LM-3484				L-6440		NW NE 12-44S-23E	442312	760	520	640			LH	P.S	City of Cape Coral, Site S	WRS
LM-1625				L-1473		SE SW 17-44S-23E	442317	970	800	1,244			SU	P.S		USGS
LM-7635				L-2201		SE SW 17-44S-23E	442317	850	625	960	3,730		LH/SU			USGS

TABLE 7 - SUMMARY OF INVENTORIED WELL DATA

CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBE	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft	CASED DEPTH (ft	DIS. CHLOR. (MG/L)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
LM-3353				L-6433		NW NW 18-44S-23E	442318	640	488	1,450			LH		City of Cape Coral Site M	WRS
LM-3479				L-6436		NW NW 18-44S-23E	442318	1080	898	1,420			SUW	P.S	City of Cape Coral Site M	WRS
LM-2213						NE SW 20-44S-23E	442320	863	360	540		PERMIT # 36-00451	MH/LH/SU	IRR	ROYAL TEE	WRS
LM-5077			WA-283	L-4879		NW NW 21-44S-23E	442321	838	100	881						SFWMD
LM-2434						NE NE 22-44S-23E	442322	660	595	600				TEST		WRS
LM-3970					RO-24	SW SW 23-44S-23E	442323	709	389	618		PERMIT # 36-00046-W		P.S	CITY OF CAPE CORAL'94 RO-24	WRS
LM-2432						SE NE 24-44S-23E	442324	610		730				MONITOR		WRS
LM-2426					RO-13	NE NW 27-44S-23E	442327	765	590	750		PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL RO-13	WRS
LM-2427					RO-14	NE NW 27-44S-23E	442327	702	520	650	2,320	PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL RO-14	WRS
LM-2428					RO-15	NW NE 27-44S-23E	442327	782	558	570		PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL RO-15	WRS
LM-3515					RO-23	NE NE 27-44S-23E	442327	580	420	630		PERMIT # 36-00046-W	MH	P.S	CITY OF CAPE CORAL RO-23	WRS
LM-2424					RO-11	NW NE 28-44S-23E	442328	762	599			PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL RO-11	WRS
LM-2425					RO-12	NE NE 28-44S-23E	442328	742	599	464	2,000	PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL RO-12	WRS
LM-2411						NW SE 32-44S-23E	442332	800	445	220			LH	TEST		WRS
LM-2433						NW NW 34-44S-23E	442334	880	838	500			LH	TEST		WRS
LM-2326		W-17419				SE SW 36-44S-23E	442336	720	583	520	2,240		LH	TEST		WRS
LM-5308						SW NE 09-44S-24E	442409	680	400			PERMIT # 36-01897-W	MH/LH	IRR	N. FT. MYERS HIGH SCHOOL	SFWMD
LM-5879			WA-447			NE SW 13-44S-24E	442413	938	234			P&A 4/4/85				SFWMD
LM-5110			WA-339			NW SW 15-44S-24E	442415	898	176	994	3,000	P&A 8/30/84				SFWMD
LM-343				L-2403		NE NE 16-44S-24E	442416	629	124	860	2,670		SS/MH/LH	IRR		USGS
LM-5881			WA-512	L-5612		NW SE 19-44S-24E	442419	669	360	634	1,480		MH/LH		P&A 9/19/85	SFWMD
LM-5884			WA-423			SE SE 23-44S-24E	442423	928	322			P&A 9/12/84				SFWMD
LM-7607						C 09-44S-24E	442409	600	300			PERMIT # 36-01899-W	MH/LH	IRR	Palm Island Phse I	SFWMD
LM-5383						SW SW 10-44S-24E	442410	803	302			PERMIT # 36-00319-W	MH/LH	IRR	MOODY EQUITIES	SFWMD
LM-5384						SW SW 10-44S-24E	442410	600	300			PERMIT # 36-00319-W	MH/LH	IRR	MOODY EQUITIES	SFWMD
LM-5385						SW SW 10-44S-24E	442410	604	304			PERMIT # 36-00319-W	MH/LH	IRR	MOODY EQUITIES	SFWMD
LM-7606						NW NE 15-44S-24E	442415	700	260			PERMIT # 36-02373-W	MH/LH	IRR	ELEMENTARY SCHOOL "E"	SFWMD
LM-5800					D-1	NE NW 16-44S-24E	442416	600	300	670		Permit # 36-00152-W	MH/LH	P.S	Waterway Estates	WRS
LM-5846					D-2	NE NW 16-44S-24E	442416	600	300	625		Permit # 36-00152-W	MH/LH	P.S	Waterway Estates	WRS
LM-5398						NE SE 18-44S-24E	442410	575	450			PERMIT # 36-00636-W	LH	IRR	CALOOSA MIDDLE SCHOOL/LEE COUNTY	SFWMD
LM-5030			WA-188	L-95		NE NE 24-44S-24E	442424	924	170	1,958	6,000	P&A 9/14/82				SFWMD
LM-5889			WA-375			SW SW 25-44S-24E	442425	908	150			P&A 6/13/84				SFWMD
LM-5891			WA-405	L-102		SW SE 26-44S-24E	442426	1008	242			P&A 6/27/84				SFWMD
LM-7634				L-470		NE NE 26-44S-24E	442426	843	427	675	2,840		MH/LH/SU		GRESHAM	USGS
LM-5072			WA-276			SE SE 34-44S-24E	442434	644	130	769	2,340	P&A 1/13/83				SFWMD
LM-6955						NE SW 35-44S-24E	442435	645	520				LH	ASR	CITY OF FT. MYERS ASR - WINKLER AVE.	FDEP
LM-7605						SE NE 01-44S-25E	442501	797	490	522		PERMIT # 36-01569-W	MH/LH	IRR	OASIS PALMS	SFWMD
LM-5010			WA-129	L-1318		NE SE 02-44S-25E	442502	814	80	1,396	4,760	P&A 5/3/82				SFWMD
LM-3447		W-9330				SW NE 03-44S-25E	442503	1130						TEST	STRAYHORN	FGS
LM-5903			WA-502			SW SW 04-44S-25E	442504	756	136			P&A 5/11/87				SFWMD
LM-5012			WA-136	L-773		SE SE 07-44S-25E	442507	740	130	1,120	4,240	P&A 8/25/81				SFWMD
LM-5908			WA-366			NW NW 10-44S-25E	442510	700	122			P&A 8/6/84				SFWMD
LM-5910			WA-361			NE NE 11-44S-25E	442511	1040	878			P&A 8/20/84				SFWMD
LM-5040			WA-205			NW NE 12-44S-25E	442512	890	190	894	3,075	P&A 7/1/82				SFWMD
LM-5913			WA-470			SW NE 16-44S-25E	442516	765	210			P&A 4/1/85				SFWMD
LM-5063			WA-260	L-2317		SW NE 18-44S-25E	442518	702	96	905	4,140	P&A 3/3/83				SFWMD
LM-7197					P-1	SE SE 20-44S-25E	442520	1150	462	680	2,790	Backplugged to 775'	MH/LH/SU	P.S	City of Fort Myers. Permit # 36-00035-W	MI
LM-7628					P-2	NE SE 20-44S-25E	442520	775	465	950	3,990	Permit # 36-00035-W	MH/LH/SU	P.S	City of Fort Myers.	SFWMD
LM-483			W-46	L-2292		SW NE 28-44S-25E	442528	616	302	900	3,500		MH/LH	TEST		USGS
LM-7629					P-3	NW NW 28-44S-25E	442528	837	510	910	3,770	Permit # 36-00035-W	LH/SU	P.S	City of Fort Myers.	SFWMD
LM-7630					P-4	SW NW 28-44S-25E	442528	825	510	920	3,180	Permit # 36-00035-W	LH/SU	P.S	City of Fort Myers.	SFWMD
LM-7631					P-5	NW SW 28-44S-25E	442528	832	480	880	3,530	Permit # 36-00035-W	LH/SU	P.S	City of Fort Myers.	SFWMD
LM-7632					P-6	NW SW 28-44S-25E	442528	805	445	780	3,500	Permit # 36-00035-W	MH/LH/SU	P.S	City of Fort Myers.	SFWMD
LM-7633					P-7	SW SW 28-44S-25E	442528	800	445	940	3,640	Permit # 36-00035-W	MH/LH/SU	P.S	City of Fort Myers.	SFWMD
LM-5916			WA-2303			NW SW 30-44S-25E	442530	718	132			PERMIT # 36-01861-W	SS/MH/LH	IRR	Britton Lease Farm	SFWMD
LM-3440		W-9332				NW NE 35-44S-25E	442535	1445						TEST	TRAVERS	FGS
LM-5000			WA-87	L-2197		NE NE 36-44S-25E	442536	604	132	811	3,750	LM-5000, P&A 9/2/81				SFWMD
LM-932				L-2525		SE SW 26-45S-22E	452226	650	405	400				TEST		USGS
LM-2431						SW SE 01-45S-23E	452301	620	418	550			MH/LH	MONITOR	CITY OF CAPE CORAL'85 SITE C	WRS
LM-2420					RO-19	NW NW 02-45S-23E	452302	710	490			PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'85 RO-19	WRS

TABLE 7 - SUMMARY OF INVENTORIED WELL DATA
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBE	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft	CASED DEPTH (ft	DIS. CHLOR. (MG/L)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
LM-2421					RO-20	NE NW 02-45S-23E	452302	720	508			PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL'85 RO-20	WRS
LM-2422					RO-21	NW NE 02-45S-23E	452302	720	510			PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL'85 RO-21	WRS
LM-2423					RO-22	NE NE 02-45S-23E	452302	642	515			PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL'85 RO-22	WRS
LM-2417					RO-16	NW NW 03-45S-23E	452303	707	450	430	1,840	PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'84 RO-16	WRS
LM-2418					RO-17	NE NW 03-45S-23E	452303	700	440	350	1,635	PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'84 RO-17	WRS
LM-2419					RO-18	NW NE 03-45S-23E	452303	722	495	400		PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'84 RO-18	WRS
LM-1345				L-2113	RO-1	NW NE 04-45S-23E	452304	900	362	401		PERMIT # 36-00046-W	MH/LH/SU	P.S	CITY OF CAPE CORAL'84 RO-1	USGS
LM-1346				L-2272	RO-5	NW NW 04-45S-23E	452304	700	350		1,100	PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'76 RO-5	WRS
LM-1347				L-2273	RO-6	NW NW 04-45S-23E	452304	765	345	242		PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'76 RO-6	WRS
LM-1348				L-2249	RO-2	NE NW 04-45S-23E	452304	745	362	440		PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'76 RO-2	WRS
LM-1349				L-2250	RO-3	NE NW 04-45S-23E	452304	685	347	502		PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'76 RO-3	WRS
LM-1350				L-2251	RO-4	NE NW 04-45S-23E	452304	705	345	350		PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'76 RO-4	WRS
LM-1822					RO-7	SE NE 04-45S-23E	452304	752	357			PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'81 RO-7	WRS
LM-1823					RO-8	SE SE 04-45S-23E	452304	752	345			PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'81 RO-8	WRS
LM-1918					RO-10	SE NW 04-45S-23E	452304	758	350			PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'81 RO-10	WRS
LM-6617					RO-10A	SE SW 04-45S-23E	452304	712	459	446	2,100	PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'01 RO-10A	WRS
LM-3969					RO-6R	NE NE 05-45S-23E	452305	800	564	336		PERMIT # 36-00046-W	LH	P.S	CITY OF CAPE CORAL'94 RO-6A	WRS
LM-3367				L-6435		SE NW 08-45S-23E	452308	1402	980	5,450	10,100	SUW (980 - 1,060')	SUW	TEST	City of Cape Coral, Site O	WRS
LM-1824					RO-9	SE NE 09-45S-23E	452309	744	480			PERMIT # 36-00046-W	MH/LH	P.S	CITY OF CAPE CORAL'81 RO-9	WRS
LM-3449		W-9342				C NW 10-45S-23E	452310	1490				L.W. Randell		CORE	Humble Oil & Ref Comp Core Test #1	BOG
LM-592				L-964		NW NE 13-45S-23E	452313	808	362	780	3,380					USGS
LM-2430						NE NE 15-45S-23E	452315	600	495	1,340			MH/LH	MONITOR	CITY OF CAPE CORAL'85 SITE B	WRS
LM-7608						SE SE 35-45S-23E	452335	780	376			PERMIT # 36-00073-W	MH/LH	IRR	Florida Investors'91	SFWMD
LM-1628			WA-85			NE SE 36-45S-23E	452336	916	162	771	3,400	LM-1882				SFWMD
LM-7034			WA-98	L-4901		SE SW 03-45S-24E	452403	920	114	902	3,440	P&A 6/22/82				SFWMD
LM-7636				L-2426		SW NW 05-45S-24E	452405	665	385	460	1,730		MH/LH			USGS
LM-3486				L-6442		NW NW 07-45S-24E	452407	740	430	560			LH		City of Cape Coral, Site U	WRS
LM-3487						NW NW 07-45S-24E	452407	930	700	1,000			SUW		City of Cape Coral, Site U	WRS
LM-3442		W-10120			F-1441	NW NW 07-45S-24E	452407	1200						PET TW	HUMBLE OIL CO. (HORC, FRANKLIN #1)	FGS
LM-7619						10-45S-24E	452410	640	260			Permit # 36-03783-W		IRR	Whiskey Creek Medians	SFWMD
LM-7637			WA-642	L-5613		SW NE 10-45S-24E	452410	760	750	730	2,180		SUW			USGS
LM-7016				L-1471		SW NW 11-45S-24E	452411	960	735							USGS
LM-7017				L-1445		12-45S-24E	452412	740								USGS
LM-7039	P-208	W-3368				NW NW 13-45S-24E	452413	5612				P&A 9/9/54		PET TW	SUNNILAND CONT. CO.'54 #1 Walton	BOG
LM-7616						SE NW 14-45S-24E	452414	600	300			Permit # 36-00693-W	MH/LH	IRR	Forestwood Apartments	SFWMD
LM-7617						SW NE 14-45S-24E	452414	600	320			Permit # 36-00693-W	MH/LH	IRR	Forestwood Apartments	SFWMD
LM-7618						SW SE 14-45S-24E	452414	620	480			Permit # 36-02095-W	MH/LH	IRR	World Plaza 11	SFWMD
LM-7626						NE SW 14-45S-24E	452414	600	320			Permit # 36-02989-W	MH/LH	IRR	Linden Place Professional Center	SFWMD
LM-7041		W-9327				NW NW 15-45S-24E	452415	1360						PET TW	HORC #1 Sanders	FGS
LM-7031				L-979		NE SW 16-45S-24E	452416	1350				P&A 10/70			CALUSA BAY VIEW'69	USGS
LM-1562				L-3000D		SE SE 17-45S-24E	452417	1200	595	800				IRR	LITH LOG W-LE018	USGS
LM-1440				L-2115		NW NW 21-45S-24E	452421	750	610	720	2,970					USGS
LM-7045			WA-111	L-1715		NE NE 22-45S-24E	452422	901	135	3,679	9,600	P&A 7/1/81				SFWMD
LM-3453		W-10739				SE NW 23-45S-24E	452423	930							SEVEN LAKES	FGS
LM-7023				L-1157		NE SE 23-45S-24E	452423	740	589	700	2,980					USGS
LM-7615						SW NE 23-45S-24E	452423	605	260			Permit # 36-00088-W	MH/LH	IRR	Seven Lakes Golf Course	SFWMD
LM-7043			LE-31			SW NE 31-45S-24E	452423	4900						PET TW	HORC'53	FGS
LM-7026			WA-2176	L-5696		SW SE 31-45S-24E	452431	905	385			Permit # 36-00052-W	MH/LH/SU	IRR	Black Diamond Potato Farm	USGS
LM-3435		W-9309				SE NW 33-45S-24E	452433	1360						TEST	HORC #1 Broughon	FGS
LM-7610			WA-2167			C SE 33-45S-24E	452433	900-1000				Permit # 36-00054-W		IRR	Black Diamond Potato Farm	SFWMD
LM-7611			WA-2168			SE NE 33-45S-24E	452433	900-1000				Permit # 36-00054-W		IRR	Black Diamond Potato Farm	SFWMD
LM-7612						SW NE 33-45S-24E	452433	804	400			Permit # 36-00054-W		IRR	Black Diamond Potato Farm	SFWMD
LM-7613						NE SE 33-45S-24E	452433	900	400			Permit # 36-00054-W		IRR	Black Diamond Potato Farm	SFWMD
LM-7614						SE NE 33-45S-24E	452433	800	400			Permit # 36-00054-W		IRR	Black Diamond Potato Farm	SFWMD
LM-6963			WA-363	L-335		SE NW 36-45S-24E	452436	631	148			P&A 8/20/84				SFWMD
LM-7201		W-9355				NW SW 05-45S-25E	452505	1558						TEST	HUMBLE OIL CO. (HORC CI #1)	FGS
LM-867			WA-2055	L-2003		NE NE 07-45S-25E	452507	685	240	1,300	4,650					USGS
LM-3438		W-9328				SE SW 15-45S-25E	452515	1290						TEST	HORC #1 Smith	FGS
LM-7623						NW NW 18-45S-25E	452518	600	300			Permit # 36-02506-W	MH/LH	IRR	Metropolitan Commercial Park	SFWMD
LM-3439		W-9331				NW SE 18-45S-25E	452518	1240						TEST	HORC #1 Travis	FGS

TABLE 7 - SUMMARY OF INVENTORIED WELL DATA
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBE	BOG #	FOS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	SORT CODE	TOTAL DEPTH (ft	CASED DEPTH (ft	DIS. CHLOR. (MG/L)	COND (umhos/cm)	COMMENTS	AQUIFER	USE	OWNER - WELL NAME	DATA SOURCE
LM-7621						SE NE 19-45S-25E	452519	660	330			Permit # 36-00660-W	MH/LH	IRR	Brookshire Bath & Tennis Club	SFWMD
LM-7624						NE SE 19-45S-25E	452519	660	280			Permit # 36-02846-W	MH/LH	IRR	Daniels Crossing	SFWMD
LM-7620						SW NE 20-45S-25E	452520	680	248			Permit # 36-00622-W	MH/LH	IRR	Cross Creek Country Club	SFWMD
LM-3437		W-9313				SW SW 21-45S-25E	452521	1205						TEST	HORC #1 Ft. Myers Land Co.	FGS
LM-7064			LE-26			SE NW 22-45S-25E	452522	748						TEST	L. BETTS	FGS
LM-7625						SW SE 28-45S-25E	452528	625	450			Permit # 36-03145-W	MH/LH	IRR	Thomas Property Golf Course	SFWMD
LM-7188		W-9329				SW NE 30-45S-25E	452530	1281				W.A. Smith		CORE	Humble Oil & Ref Comp Core Test #1	BOG
LM-7622						NE NE 32-45S-25E	452532	600	295			Permit # 36-1902-W		IRR	Glenn Abey	SFWMD
LM-1841				L-5641		SE NE 33-45S-25E	452533	1410	950	1,060				TEST		USGS
LM-1842				L-5801		SE NE 33-45S-25E	452533	635	450	1,160	4,380		MH/LH			USGS
LM-3436		W-9310				SW NW 35-45S-25E	452535	1126						TEST	HORC	FGS

ATTACHMENT E

Summary of TOPS of Geologic Units in Inventoried Wells

TABLE 8 - SUMMARY OF TOPS OF GEOLOGIC UNITS IN INVENTORIED WELLS.
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBER	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	Total Depth Ft.	Cased Depth Ft.	Hol/Pleist-Pinec. Ls Thickness	Bonita Springs Top	Ochopee Top	Peace River Top	Arcadia Top	Lower Hawthorn Top	Suwanee Top	Ocala Top	Avon Park Top	DATA SOURCE
CH-314		W-17357				SW SW 32-42S-23E	3268	2528	16	NP	16	25	209	542	714	1197	1532	WRS
LM-3366				L-6434		SE NE 24-43S-22E	720	485	47	NP	NP	47	205	525	NDE	NDE	NDE	WRS
LM-3480				L-6437		NE NE 24-43S-22E	1205	800	40	NP	NP	40	198	530	812	1075	NDE	WRS
LM-1277				L-2526		NE NE 07-43S-23E	605	300	20	NP	20	35	145	545	NDE	NDE	NDE	USGS
LM-3231			WA-206			NE SE 17-43S-23E	748	170	20?	NP?	20?	38?	204	504	NDE	NDE	NDE	SFWMD
LM-3232		W-16918	WA-127			NE NE 19-43S-23E	675	181	10	NP	10	30	194	514	NDE	NDE	NDE	SFWMD
LM-3233			WA-495			NW SE 30-43S-23E	601	254	35	35	45	57	148	530	NDE	NDE	NDE	SFWMD
LM-3247				L-6431		NW NW 33-43S-23E	740	455	34	NP	34	46	159	575	734	NDE	NDE	WRS
LM-3249					RO-1N	NW NW 33-43S-23E	735	500	30	NP	30	49	170	570	NDE	NDE	NDE	WRS
LM-3482				L-6438		NE NE 35-43S-23E	780	494	30	NP	NP	30	170	530	765	NDE	NDE	WRS
LM-5923				L-5802		SW SE 14-43S-24E	2600	2335	10	NP	10	38	237	553	740	1125	1485	USGS
LM-6964		W-16098		L-5803		NW SE 14-43S-24E	2600	1950	15	NP	15	45	240	560	730	1100	1465	USGS
LM-3226			WA-96			SW SW 15-43S-24E	712		NL	NL	NL	NL	NL	548	NDE	NDE	NDE	SFWMD
LM-3483				L-6439		NW NE 17-43S-24E	760	505	40	NP	NP	40	185	553	737	NDE	NDE	WRS
LM-854				L-1957		NW SW 22-43S-24E	726	346	27	NP	NP	27	140	539	NDE	NDE	NDE	USGS
LM-855				L-1962		NW NE 26-43S-24E	796	310	20	NP	20	40	235	485	635	NDE	NDE	USGS
LM-3273				L-6432	RO-2N	SE NE 31-43S-24E	800	560	30	NP	NP	30	224	561	774	NDE	NDE	WRS
LM-3508					RO-3N	SE NE 31-43S-24E	1100	785	30	NP	NP	30	224	561	760	NDE	NDE	WRS
LM-3509						NE SE 31-43S-24E	1585	785	30	NP	NP	30	220	560	770	1120	1495	WRS
LM-4783			WA-11	L-3290		SE NE 33-43S-24E	590	162	40	NP	NP	40	240	445	NDE	NDE	NDE	SFWMD
LM-5099			WA-321	L-102		SW SW 35-43S-24E	672	152	40	NP	NP	40	240	470	630	NDE	NDE	SFWMD
LM-5464				L-2328		NE NE 01-43S-25E	600	300	25	NP	25	50	245	500	NDE	NDE	NDE	USGS
LM-3052			W-40	L-2341		NW NW 07-43S-25E	585	300	45	NP	NP	45	180	455	NDE	NDE	NDE	USGS
LM-809				L-278		NE NW 18-43S-25E	880		80	NP	NP	80	180	460	700	NDE	NDE	USGS
LM-5086			WA-297			SE SE 19-43S-25E	730	140	30	NP	NP	30	166	508	712	NDE	NDE	SFWMD
LM-6208						SW SW 20-43S-25E	980	537	23	NP	23	40	230	450	640	904	NDE	WRS
LM-5860			WA-373			NE NE 24-43S-25E	732	86	10	NP	10	55	190	480	598	NDE	NDE	SFWMD
LM-2660						NW NE 35-43S-25E	935		8	NP	8	26	174	538	650	NDE	NDE	WRS
LM-3485				L-6441		SW SW 03-44S-23E	750	395	3	NP	NP	3	145	480	660	NDE	NDE	WRS
LM-3484				L-6440		NW NE 12-44S-23E	760	520	40	NP	NP	40	175	515	NDE	NDE	NDE	WRS
LM-1625				L-1473		SE SW 17-44S-23E	970	800	20	NP	NP	20	225	550	833	NDE	NDE	USGS
LM-3353				L-6433		NW NW 18-44S-23E	640	488	24	24	30	43	205	550	NDE	NDE	NDE	WRS
LM-3479				L-6436		NW NW 18-44S-23E	1080	898	45	NP	NP	45	225	585	710	1047	NDE	WRS
LM-2213						NE SW 20-44S-23E	863	360	25	25	45	50	229	545	800	NDE	NDE	WRS
LM-5077			WA-283	L-4879		NW NW 21-44S-23E	838	100	?	?	?	60?	228	566	752	NDE	NDE	SFWMD
LM-2434						NE NE 22-44S-23E	660	595	27	NP	27	55	195	600	NDE	NDE	NDE	WRS
LM-2432						SE NE 24-44S-23E	610		20	NP	NP	20	185	485	NDE	NDE	NDE	WRS
LM-2426					RO-13	NE NW 27-44S-23E	765	590	28	NP	28	34	220	564	705	NDE	NDE	WRS
LM-2427					RO-14	NE NW 27-44S-23E	702	520	35	NP	30	35	235	540	688	NDE	NDE	WRS
LM-2428					RO-15	NW NE 27-44S-23E	782	558	40	NP	NP	40	245	530	690	NDE	NDE	WRS
LM-3515					RO-23	NE NE 27-44S-23E	580	420	40	NP	NP	40	220	?	NDE	NDE	NDE	WRS
LM-2424					RO-11	NW NE 28-44S-23E	762	599	38	NP	NP	38	237	478	687	NDE	NDE	WRS
LM-2425					RO-12	NE NE 28-44S-23E	742	599	40	NP	NP	40	235	480	688	NDE	NDE	WRS
LM-2411						NW SE 32-44S-23E	800	445	25	NP	25	40	200	585	NDE	NDE	NDE	WRS
LM-2433						NW NW 34-44S-23E	880	838	30	NP	NP	30	155	477	625	NDE	NDE	WRS
LM-2326		W-17419				SE SW 36-44S-23E	720	583	22	NP	NP	22	246	450	715?	NDE	NDE	WRS
LM-5879			WA-447			NE SW 13-44S-24E	938	234	40	NP	NP	40	175	522	736	NDE	NDE	SFWMD
LM-5110			WA-339			NW SW 15-44S-24E	898	176	25	NP	NP	25	140	486	590	865	NDE	SFWMD
LM-343				L-2403		NE NE 16-44S-24E	629	124	?	?	?	?	170	490	NDE	NDE	NDE	USGS
LM-5884			WA-423			SE SE 23-44S-24E	928	322	20	NP	NP	20	195	550	785	NDE	NDE	SFWMD
LM-5030			WA-188	L-95		NE NE 24-44S-24E	924	170	40	NP	NP	40	180	540	758	NDE	NDE	SFWMD
LM-5889			WA-375			SW SW 25-44S-24E	908	150	40	NP	NP	40	218	584	800	NDE	NDE	SFWMD

TABLE 8 - SUMMARY OF TOPS OF GEOLOGIC UNITS IN INVENTORIED WELLS.
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

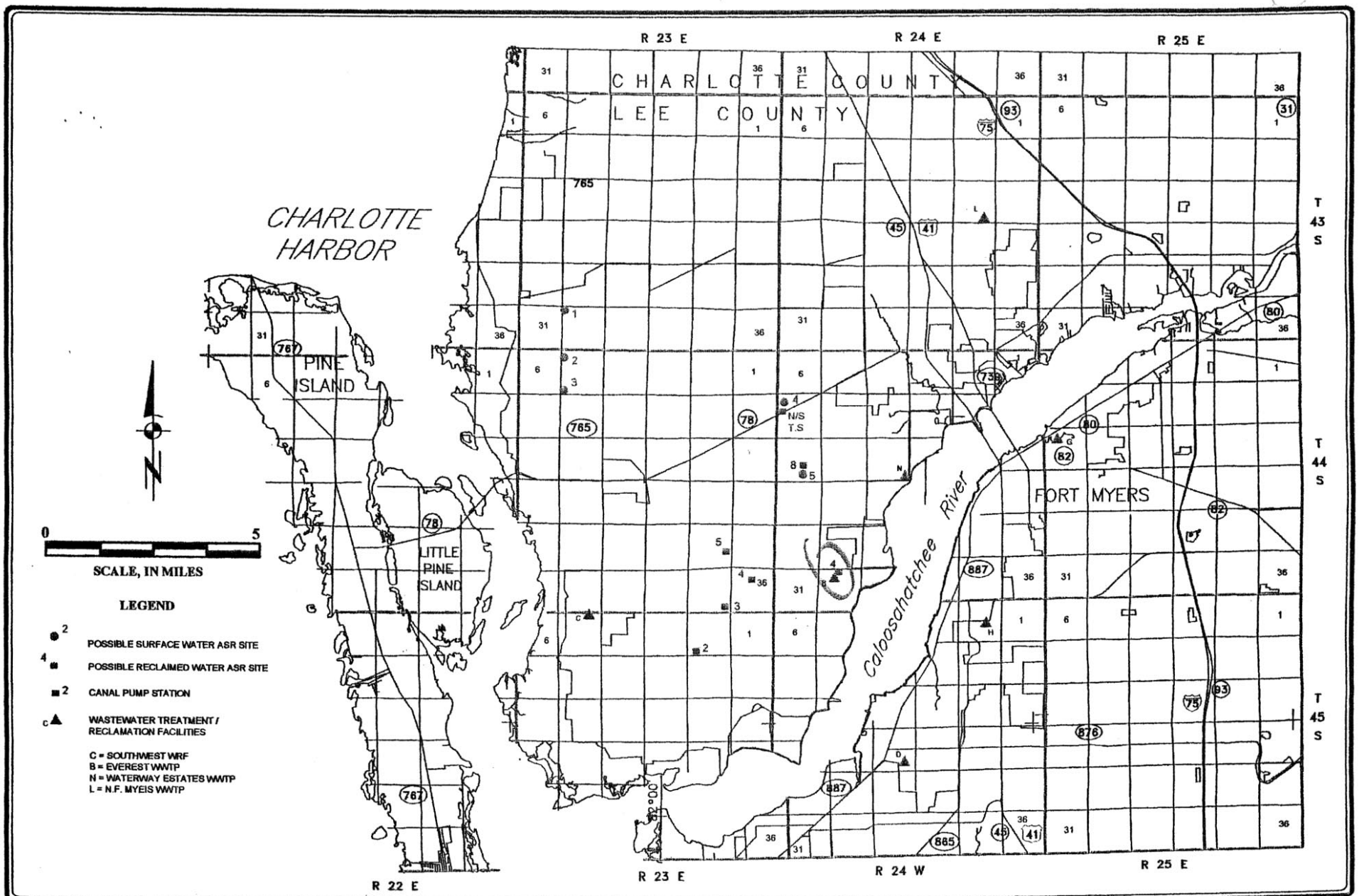
WRS NUMBER	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	Total Depth Ft.	Cased Depth Ft.	Hol/Pleist-Pinec. Ls Thickness	Bonita Springs Top	Ochopee Top	Peace River Top	Arcadia Top	Lower Hawthorn Top	Suwanee Top	Ocala Top	Avon Park Top	DATA SOURCE
LM-5891			WA-405	L-102		SW SE 26-44S-24E	1008	242	55	NP	NP	55	198	564	773	NDE	NDE	SFWMD
LM-5072			WA-276			SE SE 34-44S-24E	644	130	40	NP	NP	40	148	484	NDE	NDE	NDE	SFWMD
LM-6955						NE SW 35-44S-24E	645	520	60	NP	NP	60	165	490	NDE	NDE	NDE	FDEP
LM-5010			WA-129	L-1318		NE SE 02-44S-25E	814	80	35	NP	35	85	170	525	710	NDE	NDE	SFWMD
LM-3447		W-9330				SW NE 03-44S-25E	1130		40	NP	40	90	160	580	840	1110	NDE	FGS
LM-5903			WA-502			SW SW 04-44S-25E	756	136	64	NP	NP	64	150	402	652	NDE	NDE	SFWMD
LM-5012			WA-136	L-773		SE SE 07-44S-25E	740	130	50	NP	NP	50	132	374	654	NDE	NDE	SFWMD
LM-5908			WA-366			NW NW 10-44S-25E	700	122	60	NP	NP	60	186	550	NDE	NDE	NDE	SFWMD
LM-5910			WA-361			NE NE 11-44S-25E	1040	878	50	NP	NP	50	194	597	820	NDE	NDE	SFWMD
LM-5040			WA-205			NW NE 12-44S-25E	890	190	64	NP	NP	64	200	566	760	NDE	NDE	SFWMD
LM-5913			WA-470			SW NE 16-44S-25E	765	210	38	NP	38	70	160	510	NDE	NDE	NDE	SFWMD
LM-5063			WA-260	L-2317		SW NE 18-44S-25E	702	96	58	NP	NP	58	142	407	596	NDE	NDE	SFWMD
LM-7197					P-1	SE SE 20-44S-25E	1150	462	30	NP	NP	30	180	450	660	1010?	NDE	MI
LM-483			W-46	L-2292		SW NE 28-44S-25E	616	302	19	NP	NP	19	197	537	NDE	NDE	NDE	USGS
LM-7629					P-3	NW NW 28-44S-25E	837	510	30	NP	NP	30	200	480	700	NDE	NDE	SFWMD
LM-7630					P-4	SW NW 28-44S-25E	825	510	30	NP	NP	30	210	470	690	NDE	NDE	SFWMD
LM-7631					P-5	NW SW 28-44S-25E	832	480	30	NP	NP	30	180	470	640	NDE	NDE	SFWMD
LM-7632					P-6	NW SW 28-44S-25E	805	445	30	NP	NP	30	200	430	650	NDE	NDE	SFWMD
LM-7633					P-7	SW SW 28-44S-25E	800	445	30	NP	NP	30	200	450	650	NDE	NDE	SFWMD
LM-3440		W-9332				NW NE 35-44S-25E	1445		NP	NP	Surf	30	220	590	780?	1120?	NDE	FGS
LM-5000			WA-87	L-2197		NE NE 36-44S-25E	604	132	10	NP	10	44	210	490	NDE	NDE	NDE	SFWMD
LM-932				L-2525		SE SW 26-45S-22E	650	405	40	NP	NP	40	265	555	NDE	NDE	NDE	USGS
LM-2431						SW SE 01-45S-23E	620	418	23	NP	NP	23	107	550	NDE	NDE	NDE	WRS
LM-2420					RO-19	NW NW 02-45S-23E	710	490	29	NP	NP	29	98	540	NDE	NDE	NDE	WRS
LM-2421					RO-20	NE NW 02-45S-23E	720	508	10	NP	10	14	95	533	NDE	NDE	NDE	WRS
LM-2422					RO-21	NW NE 02-45S-23E	720	510	30	NP	NP	30	100	555	NDE	NDE	NDE	WRS
LM-2423					RO-22	NE NE 02-45S-23E	642	515	9	NP	9	16	100	535	NDE	NDE	NDE	WRS
LM-2417					RO-16	NW NW 03-45S-23E	707	450	25	NP	NP	25	95	540	NDE	NDE	NDE	WRS
LM-2418					RO-17	NE NW 03-45S-23E	700	440	28	NP	NP	28	100	510	NDE	NDE	NDE	WRS
LM-2419					RO-18	NW NE 03-45S-23E	722	495	30	NP	NP	30	100	582	NDE	NDE	NDE	WRS
LM-1345				L-2113	RO-1	NW NE 04-45S-23E	900	362	20	NP	NP	20	110	580	820	NDE	NDE	USGS
LM-1346				L-2272	RO-5	NW NW 04-45S-23E	700	350	20	NP	NP	20	120	560?	NDE	NDE	NDE	WRS
LM-1347				L-2273		NW NW 04-45S-23E	765	345	30	NP	NP	30	105	575	NDE	NDE	NDE	WRS
LM-1348				L-2249	RO-2	NE NW 04-45S-23E	745	362	25	NP	NP	25	95	555	NDE	NDE	NDE	WRS
LM-1349				L-2250	RO-3	NE NW 04-45S-23E	685	347	20	NP	NP	20	95	575	NDE	NDE	NDE	WRS
LM-1350				L-2251	RO-4	NE NW 04-45S-23E	705	345	25	NP	NP	25	100	530	NDE	NDE	NDE	WRS
LM-6617					RO-10A	SE SW 04-45S-23E	712	459	22	NP	NP	22	212	537	NDE	NDE	NDE	WRS
LM-3367				L-6435		SE NW 08-45S-23E	1402	980	50	NP	NP	50	180	542	856	1198	NDE	WRS
LM-3449		W-9342				C NW 10-45S-23E	1490		10	NP	10	40	120	590	794	1135	1380	BOG
LM-592				L-964		NW NE 13-45S-23E	808	362	20	NP	20	50	120	600	710	NDE	NDE	USGS
LM-2430						NE NE 15-45S-23E	600	495	25	NP	NP	25	123	560?	NDE	NDE	NDE	WRS
LM-1628			WA-85			NE SE 36-45S-23E	916	162	?	?	?	?	145	475	685	NDE	NDE	SFWMD
LM-7034			WA-98	L-4901		SE SW 03-45S-24E	920	114	?	?	?	40	206	527	685	NDE	NDE	SFWMD
LM-3486				L-6442		NW NW 07-45S-24E	740	430	40	NP	NP	40	128	500	700	NDE	NDE	WRS
LM-3487						NW NW 07-45S-24E	930	700	30	NP	NP	30	150	497	698	NDE	NDE	WRS
LM-3442		W-10120			F-1441	NW NW 07-45S-24E	1200		10	NP	10	40	130	500	720	1140	NDE	FGS
LM-7016				L-1471		SW NW 11-45S-24E	960	735	43	NP	NP	43	115	510	715	NDE	NDE	USGS
LM-7017				L-1445		12-45S-24E	740		30	NP	NP	30	135	540	710	NDE	NDE	USGS
LM-7039	P-208	W-3368				NW NW 13-45S-24E	5612		30	NP	NP	30	140	540	710	1020	1530	BOG
LM-7041		W-9327				NW NW 15-45S-24E	1360		40	NP	NP	40	120	580	?	1200?	NDE	FGS
LM-7031				L-979		NE SW 16-45S-24E	1350		?	?	?	40	160	470	636	NL	NL	USGS

TABLE 8 - SUMMARY OF TOPS OF GEOLOGIC UNITS IN INVENTORIED WELLS
CAPE CORAL / WATERWAY ESTATES / NORTH FORT MYERS SUBREGIONAL GROUP

WRS NUMBER	BOG #	FGS #	SFWMD #	USGS #	OTHER #	(QTR QTR S-T-R)	Total Depth Ft.	Cased Depth Ft.	Hol/Pleist-Pinec. Ls Thickness	Bonita Springs Top	Ochopee Top	Peace River Top	Arcadia Top	Lower Hawthorn Top	Suwanee Top	Ocala Top	Avon Park Top	DATA SOURCE
LM-1562				L-3000D		SE SE 17-45S-24E	1200	595	?	?	?	38	141	460	630	1060	NDE	USGS
LM-7045			WA-111	L-1715		NE NE 22-45S-24E	901	135	30	NP	NP	30	135	540	715	NDE	NDE	SFWMD
LM-3453		W-10739				SE NW 23-45S-24E	930		?	?	?	30	153	520	668	NDE	NDE	FGS
LM-7026			WA-2176	L-5696		SW SE 31-45S-24E	905	385	50	NP	NP	50	180	590	735	NDE	NDE	USGS
LM-3435		W-9309				SE NW 33-45S-24E	1360		50	NP	NP	50	150	520	?	1290?	NDE	FGS
LM-7201		W-9355				NW SW 05-45S-25E	1558		70	70	NP	100	190	NL	NL	NL	NL	FGS
LM-867			WA-2055	L-2003		NE NE 07-45S-25E	685	240	20	20	NP	40	175	575	NDE	NDE	NDE	USGS
LM-3438		W-9328				SE SW 15-45S-25E	1290		70	NP	NP	70	160	560	750?	1170	NDE	FGS
LM-3439		W-9331				NW SE 18-45S-25E	1240		NL	NL	NL	NL	NL	560?	700?	1180	NDE	FGS
LM-3437		W-9313				SW SW 21-45S-25E	1205		60	NP	NP	60	150	?	710?	1120	NDE	FGS
LM-7064			LE-26			SE NW 22-45S-25E	748		20?	20?	NP?	30?	165	510?	650?	NDE	NDE	FGS
LM-7188		W-9329				SW NE 30-45S-25E	1281		40	NP	NP	40	160	560?	710?	NL	NL	BOG
LM-1841				L-5641		SE NE 33-45S-25E	1410	950	5	NP	5	30	165	542	689	1110	1360	USGS
LM-3436		W-9310				SW NW 35-45S-25E	1126		55	NP	NP	55	180	560?	710	1110	NDE	FGS

ATTACHMENT F

Potential Surface and Reclaimed Water ASR Sites

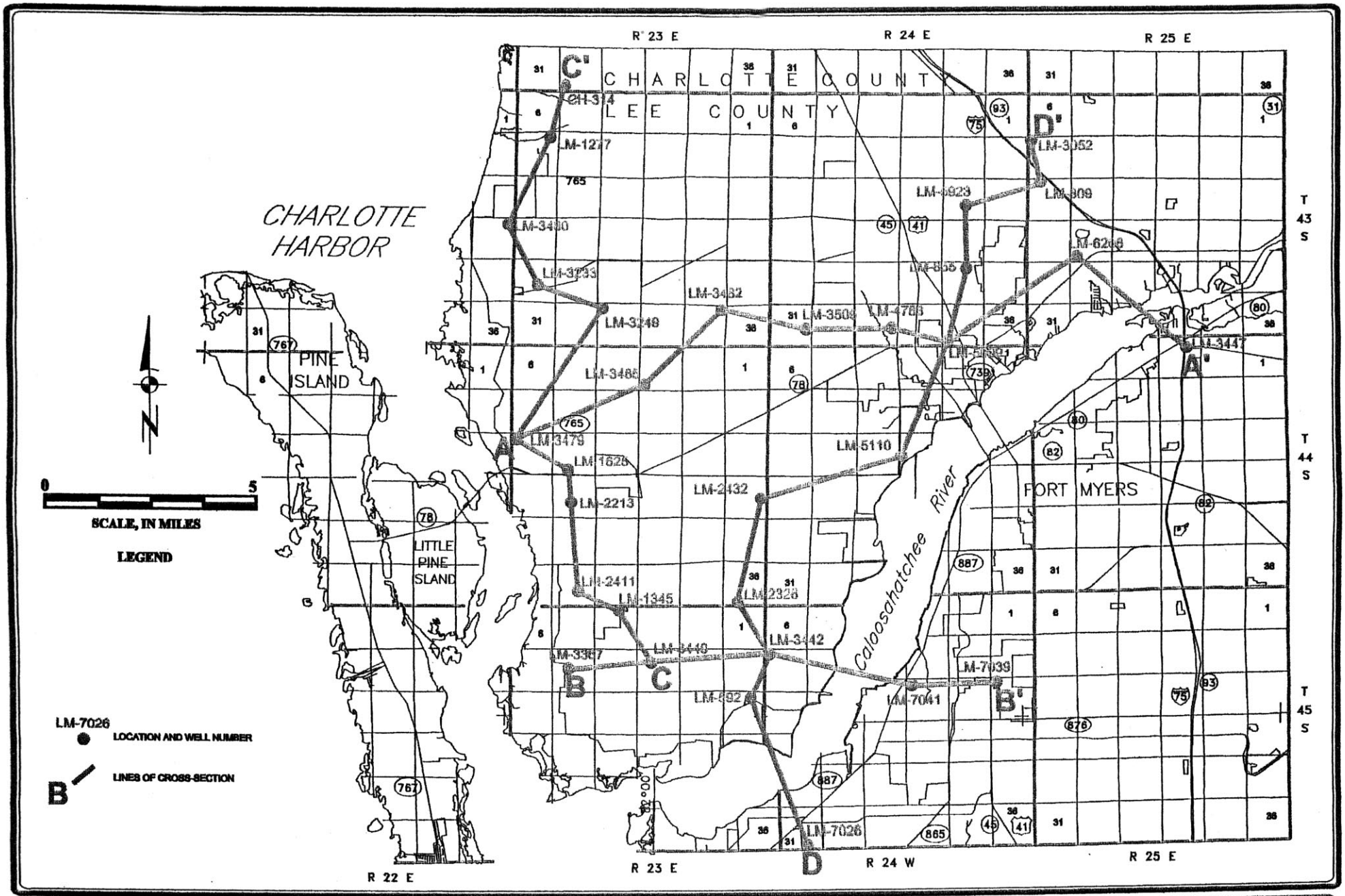


Water Resource Solutions	PROJECT NAME: RIDS PHASE II	DWG. NUMBER: A-014445P2-1
	PROJECT NUMBER: 01-04445.HO	DATE: 08/13/03

FIGURE 2. MAP SHOWING POTENTIAL SURFACE AND RECLAIMED WATER ASR SITES

ATTACHMENT G

Cross Section



Water Resource Solutions	PROJECT NAME: RIDS PHASE II
	PROJECT NUMBER: 01-04445.H0 DATE: 7/31/03

FIGURE 3. MAP SHOWING LINES OF CROSS SECTION

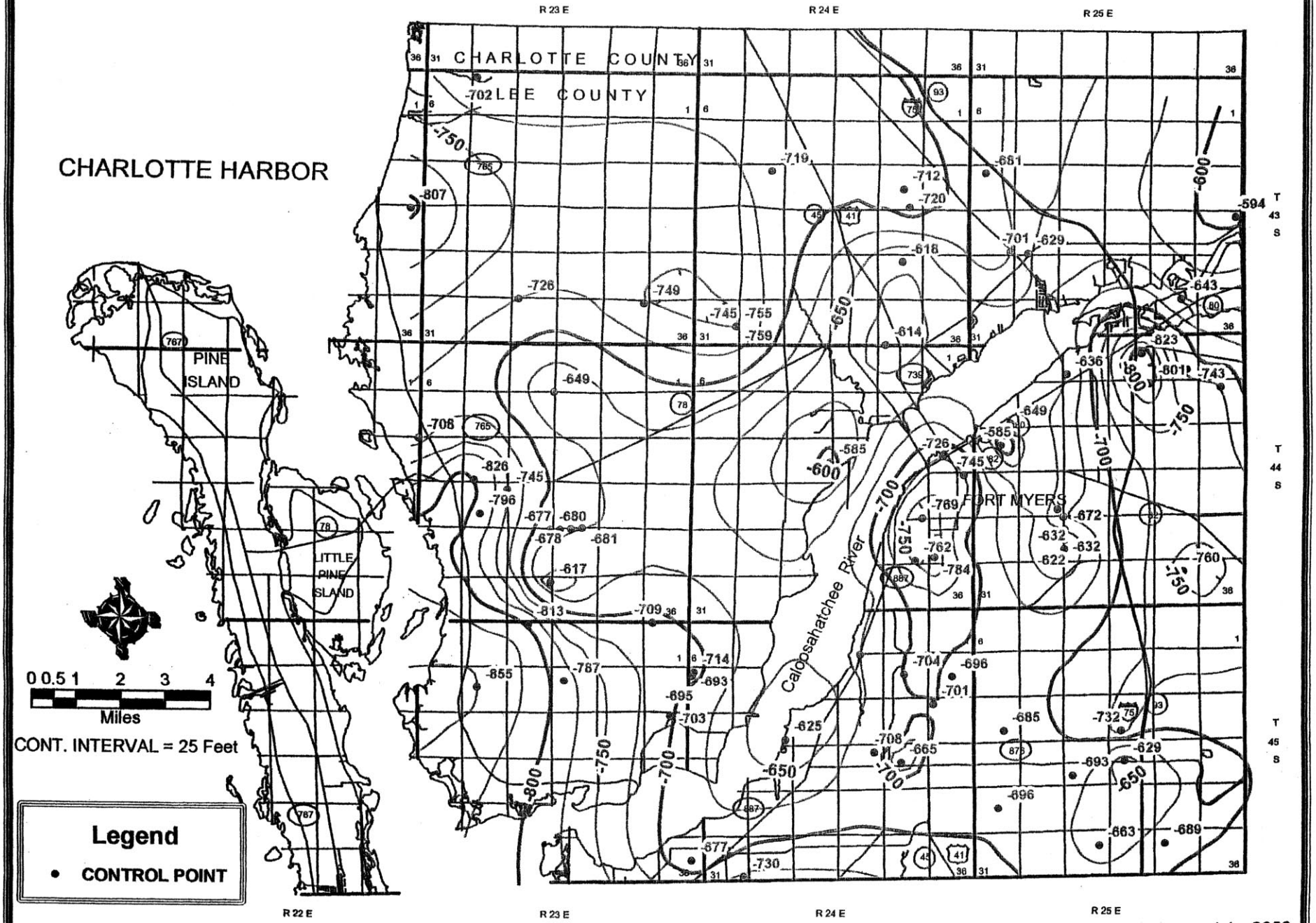
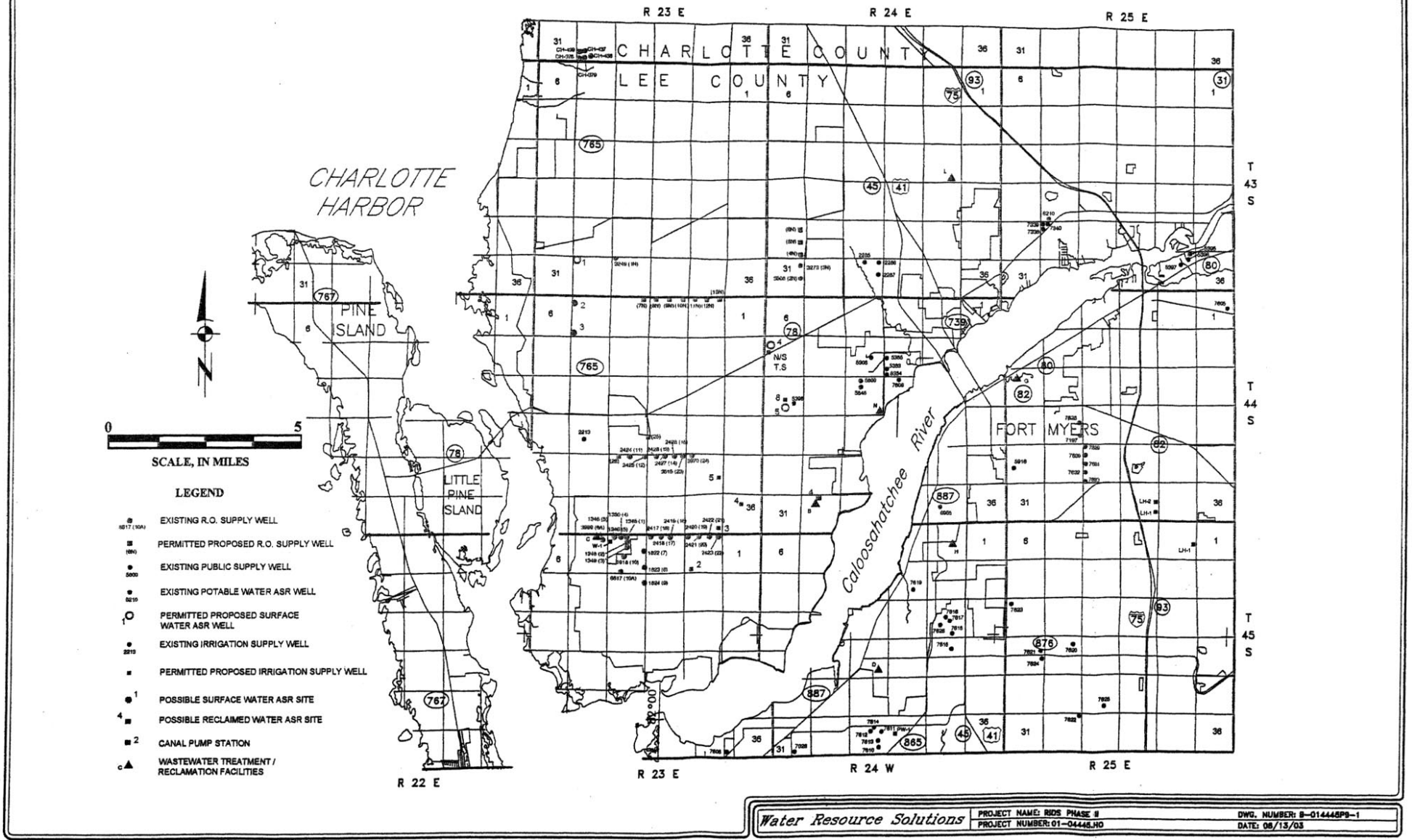


FIGURE 8- SUBSURFACE STRUCTURE CONTOUR MAP ON TOP OF SUWANNEE FORMATION

Water Resource Solutions July, 2003



Water Resource Solutions | PROJECT NAME: RIDS PHASE II | PROJECT NUMBER: 01-04446.HO | DWG. NUMBER: S-014446PS-1 | DATE: 06/13/03

FIGURE 9. MAP SHOWING EXISTING AND PERMITTED PROPOSED UPPER FLORIDAN AQUIFER WELLS

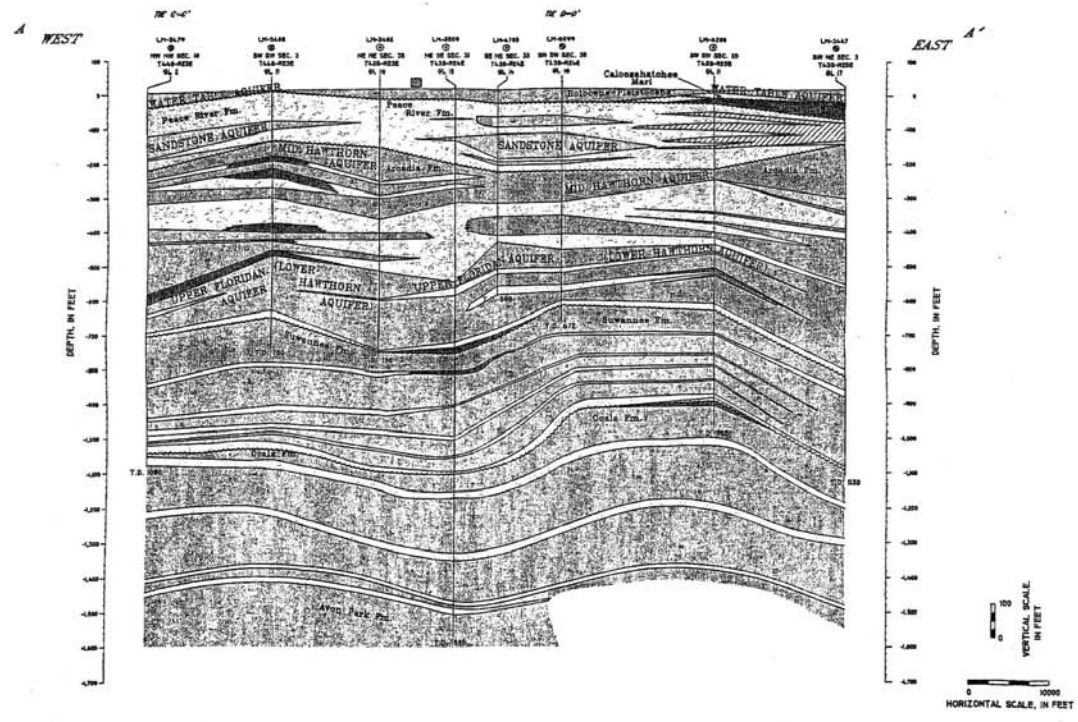
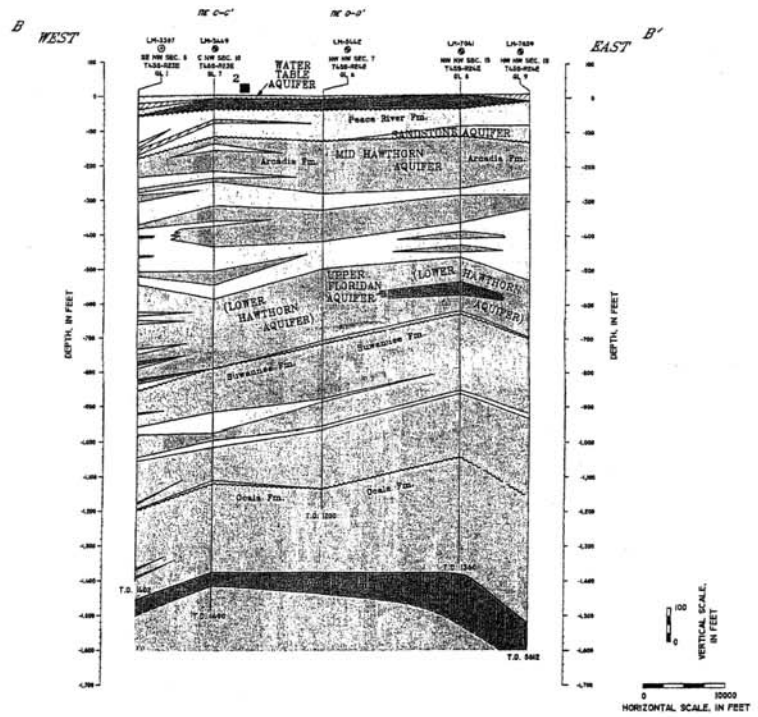


FIGURE 4
CROSS-SECTION A-A'
RIDS-PHASE II PROJECT



KEY:

- SAND
- SANDSTONE
- LIMESTONE
- CLAY/MARL
- CALCAREOUS SANDSTONE
- SANDY LIMESTONE
- UNCONFORMITY
- DOLOMITE
- CANAL PUMP STATION/ POTENTIAL SURFACE WATER ABS SITE
- OBSERVATION WELL
- SUPPLY WELL
- P & A WELL
- INJECTION WELL

FIGURE 5
CROSS-SECTION B-B'
RIDS-PHASE II PROJECT

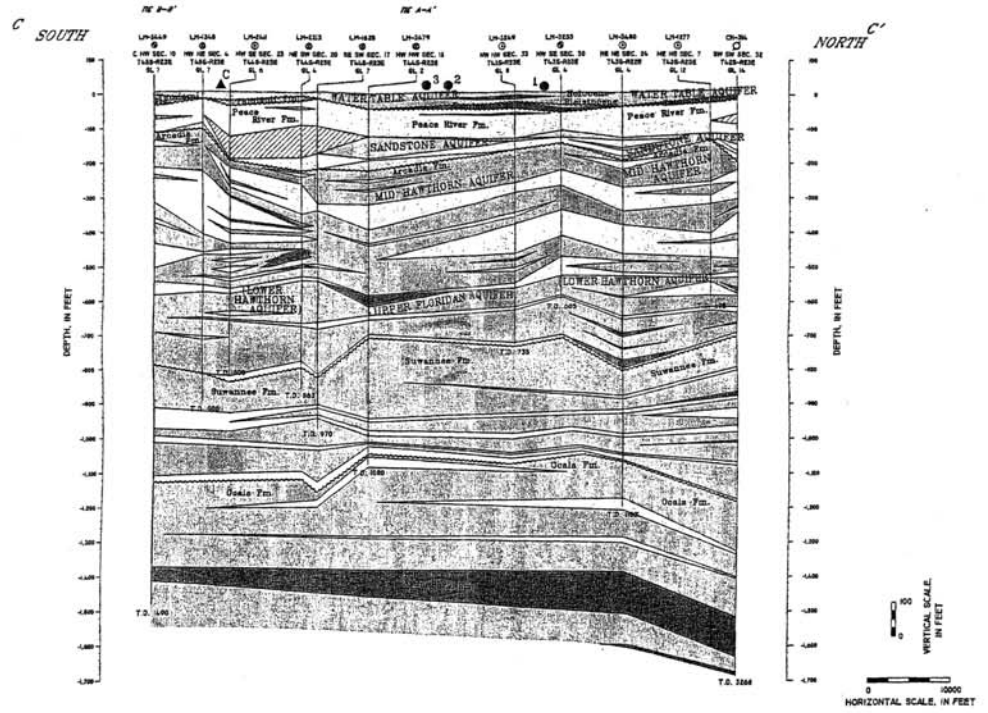


FIGURE 6
CROSS-SECTION C-C'
RIDS-PHASE II PROJECT

ATTACHMENT H
COST ANALYSIS

ATTACHMENT H
COST ANALYSIS

Itemized Capital Costs ($M)												
Name	**Type**	**Number of Wells**	**Wells**	**Pumping Station**	**Intake System Const. Cost**	**Land Acquisition Cost**	**Pipelines**	**Engineering, Administrative and Legal**	**Estimated Pilot Project Cost**	**Total**	**Annual Operations and Maintenance**	**Estimated Benefit (MGD)**
1A. Gator Slough-Intake and Pump Station	Surface Water ASR			$ 1,800,000.00	$1,900,000			$740,000		$ 5,550,000		
1B. Gator Slough-Wells (including well piping)	Surface Water ASR	20	$ 11,000,000.00			$1,000,000	$30,000	$2,206,000	$ 1,850,000	$ 20,107,500		
1C. Gator Slough-Transmission Lines	Surface Water ASR						$798,336	$159,867		$ 1,197,504		9,722
Gator Slough			**$ 11,000,000.00**	**$ 1,800,000.00**	**$ 1,900,000**	**$ 1,000,000**	**$ 828,336**	**$ 3,105,667**	**$ 1,850,000**	**$26,855,004**	**$588,000**	14.0
2A. Horseshoe Canal-Intake and Pump Station	Surface Water ASR			$ 900,000.00	$1,100,000			$400,000		$ 3,000,000		
2B. Horseshoe Canal-Wells (including well piping)	Surface Water ASR	9	$ 4,950,000.00			$450,000	$13,500	$992,700	$ 1,850,000	$ 10,320,250		
2C. Horseshoe Canal-Transmission Lines	Surface Water ASR						$473,088	$94,618		$ 709,632		4,167
Horseshoe Canal			**$ 4,950,000.00**	**$ 900,000.00**	**$ 1,100,000**	**$ 450,000**	**$ 486,588**	**$ 1,487,318**	**$ 1,850,000**	**$14,029,882**	**$252,000**	6.0
3A. Hermosa Canal-Intake and Pump Station	Surface Water ASR			$ 900,000.00	$1,100,000			$400,000		$ 3,000,000		
3B. Hermosa Canal-Wells (including well piping)	Surface Water ASR	9	$ 4,950,000.00			$450,000	$13,500	$992,700	$ 1,850,000	$ 10,320,250		
3C. Hermosa Canal-Transmission Lines	Surface Water ASR						$1,005,312	$201,062		$ 1,507,968		4,167
Hermosa Canal			**$ 4,950,000.00**	**$ 900,000.00**	**$ 1,100,000**	**$ 450,000**	**$ 1,018,812**	**$ 1,593,762**	**$ 1,850,000**	**$14,828,218**	**$252,000**	6.0
4A. Canal Pumping Station #8-Intake and Pumping Station	Surface Water ASR			$ 1,000,000.00	$1,000,000			$400,000		$ 3,000,000		
4B. Canal Pumping Station #8-Intake and Pumping Station	Surface Water ASR	7	$ 3,850,000.00			$350,000	$10,500	$772,100	$ 1,850,000	$ 8,540,750		
4C. Canal Pumping Station #8-Transmission Lines	Surface Water ASR						$120,000	$24,000		$ 180,000		3,472
Canal Station #8 Pumping Station			**$ 3,850,000.00**	**$ 1,000,000.00**	**$ 1,000,000**	**$ 350,000**	**$ 130,500**	**$ 1,196,100**	**$ 1,850,000**	**$11,720,750**	**$210,000**	5.0
5A. North-South Transfer Station-Intake and Pump Station	Surface Water ASR			$ 1,450,000.00	$1,500,000			$590,000		$ 4,425,000		
5B. North-South Transfer Station-Wells (including well piping)	Surface Water ASR	14	$ 7,700,000.00			$700,000	$21,000	$1,544,200	$ 1,850,000	$ 14,769,000		
5C. North-South Transfer Station-Transmission Lines	Surface Water ASR						$120,000	$24,000		$ 180,000		6,944
North-South Transfer Station			**$ 7,700,000.00**	**$ 1,450,000.00**	**$ 1,500,000**	**$ 700,000**	**$ 141,000**	**$ 2,158,200**	**$ 1,850,000**	**$19,374,000**	**$420,000**	10.0
6A. Everest Parkway-Intake and Pump Station	Reclaimed Water ASR			$ 1,650,000.00	$1,720,000			$674,000		$ 5,055,000		
6B. Everest Parkway-Wells (including well piping)	Reclaimed Water ASR	17	$ 9,350,000.00			$850,000	$25,500	$1,875,100	$ 1,400,000	$ 16,875,750		
6C. Everest Parkway-Transmission Lines	Reclaimed Water ASR						$120,000	$24,000		$ 180,000		8,472
Everest Parkway			**$ 9,350,000.00**	**$ 1,650,000.00**	**$ 1,720,000**	**$ 850,000**	**$ 145,500**	**$ 2,573,100**	**$ 1,400,000**	**$22,110,750**	**$512,400**	12.2
7. North Ft.Myers & Cape Coral	Interconnect	0	$ -	$ 345,000.00	$0		$1,419,264	$352,853	$ -	$ 2,646,396		1,597
North Ft.Myers & Cape Coral Interconnect			**$ -**	**$ 345,000.00**	**$ -**	**$ -**	**$ 1,419,264**	**$ 352,853**	**$ -**	**$2,646,396**	**$96,600**	2.3
TOTAL		**76**	**$ 41,800,000.00**	**$ 8,045,000.00**	**$8,320,000**	**$3,800,000**	**$4,170,000**	**$12,467,000**	**$10,650,000**	**$111,565,000**	**$2,331,000**	**55.5**
Notes:												
For systems 4, 6, and 7 pumping station costs are for upgrades only to existing pumping facilities												
Wells: $550,000 per well except for the pit wells that are shallow wells and are $150,000.												
Pump Station Cost: Derived from Construc. Cost of Service Water P.S. figure 29-6 from the Pumping Station Handbook.												
Intake cost: For the first 5 MGD the cost is $1M. For additional cost greater than 5 MGD the cost is $ 100k per MGD.												
Land Cost $50,000/well. 500 ft well separation minimum												
Pipes: $4/diameter.lf												
Engineering = 20% of capital cost. Doesn't include the land cost.												
Total has a contingency of 25%												
O & M for Surface ASR= 0.14cents/1000 gals X10 months X 30 days/month												
O & M Reclaimed ASR or Mine Pits = $1,5000* # wells +$8,000 * Estimated benefit (MGD)												

Worksheet 1

Subregion 2.
Financing Assumptions

Line No.	Description	Percent	Amount
	SRF Loan		
1	Total Projects Funded		111,565,000
2	Adjustment		0
3	Net Amount of Projects Funded from Loan		111,565,000
	Issuance and Surety Costs		
4	Loan Repayment Reserve	3.00%	3,346,950
5	Loan Service Fee	2.00%	2,231,300
6	Surety Costs (%)	0.00%	0
7	Underwriters Discount	0.00%	0
8	Total Issuance Costs		5,578,250
9	Capitalized Interest		5,857,000
10	Additional Proceeds		0
11	Principal Amount of Loan		123,000,250
	Level Debt Service Payment:		
12	Term-Years		20
13	Avg. Interest Rate		3.50%
14	First Year of Amortization		4
15	% First Year Payment		100.00%
16	Average Annual Payment		8,654,400

Loan Cap Int. Calculation

Fiscal Year	Annual Principal Draw	Cumulative Balance	% Total	Annual Interest
1	$ 27,891,250	27,891,250	25.0%	$ 488,000
2	55,782,500	83,673,750	50.0%	1,952,000
3	27,891,250	111,565,000	25.0%	3,417,000
4	0	111,565,000	0.0%	0
5	0	111,565,000	0.0%	0
				$ 5,857,000
	Total Capitalized Interest			$ 5,857,000

Loan Cap Int. Calculation

Fiscal Year	Annual Principal Draw	Cumulative Balance	% Total	Annual Interest
1	$ -	0	25.0%	$ -
2	0	0	50.0%	0
3	0	0	25.0%	0
4	0	0	0.0%	0
5	0	0	0.0%	0
				$ -
	Total Capitalized Interest			$ -

Line No.	Description	Percent	Amount
	Revenue Bonds		
17	Total Projects Funded		0
18	Adjustment		0
19	Net Amount of Projects Funded from Loan		0
	Issuance and Surety Costs		
20	Issuance Costs (%)	0.50%	0
21	Underwriters Discount	0.50%	0
22	Bond Insurance Premium	0.30%	0
23	Surety Costs (%)	3.00%	0
24	Total Issuance Costs		0
25	Capitalized Interest		0
26	Additional Proceeds		0
27	Principal Amount of Loan		0
	Level Debt Service Payment:		
28	Term-Years		30
29	Avg. Interest Rate		5.50%
30	First Year of Amortization		1
31	% First Year Payment		100.00%
32	Average Annual Payment		0

Summary of Annual Debt Service:	
SRF Loan	$8,654,400
Revenue Bonds	$0
Total	$8,654,400

33
34
35

Table 1. Summary of Total Costs For Subregion 2 Alternative.

Alternative		
Projects Included in Alternative	1. Gator Slough 2. Horseshoe Canal 3. Hermosa Canal 4. Everest Parkway 5. North Ft.Myers & Cape Coral 6. North-South Transfer Station 7. Canal Pumping Station #8	
Annual Debt Service	$	8,654,400
Debt Service Coverage(1)		2,163,600
Annual O & M Costs (2)		2,331,000
Total	$	13,149,000
Production:		
Daily Benefit (1000 gal /day)		55,500
Average Days Per Year		180
Annual Benefit (1000 gal)		9,990,000
Cost per 1000 gallons	$	1.32

(1) The debt service coverage funding amounts shown represent an allowance of 25% of the annual debt service based on the SRF Loan Program's minimum coverage requirement of 15% adjusted upward to also reflect the need for funding certain renewals and replacements that may occur during the term of the loans.

(2) Annual operations and maintenance (O & M) costs include:

1. Daily adjustment of injection rates, measurement of water quality
2. Weekly sample procurement for laboratory analyses
3. Calibration of flowmeters and gauges semi-annually
4. Preparation of monthly regulatory reports to FDEP.
5. Submersible pump maintenance
6. General Maintenance
7. Record keeping
8. Electricity for pumping

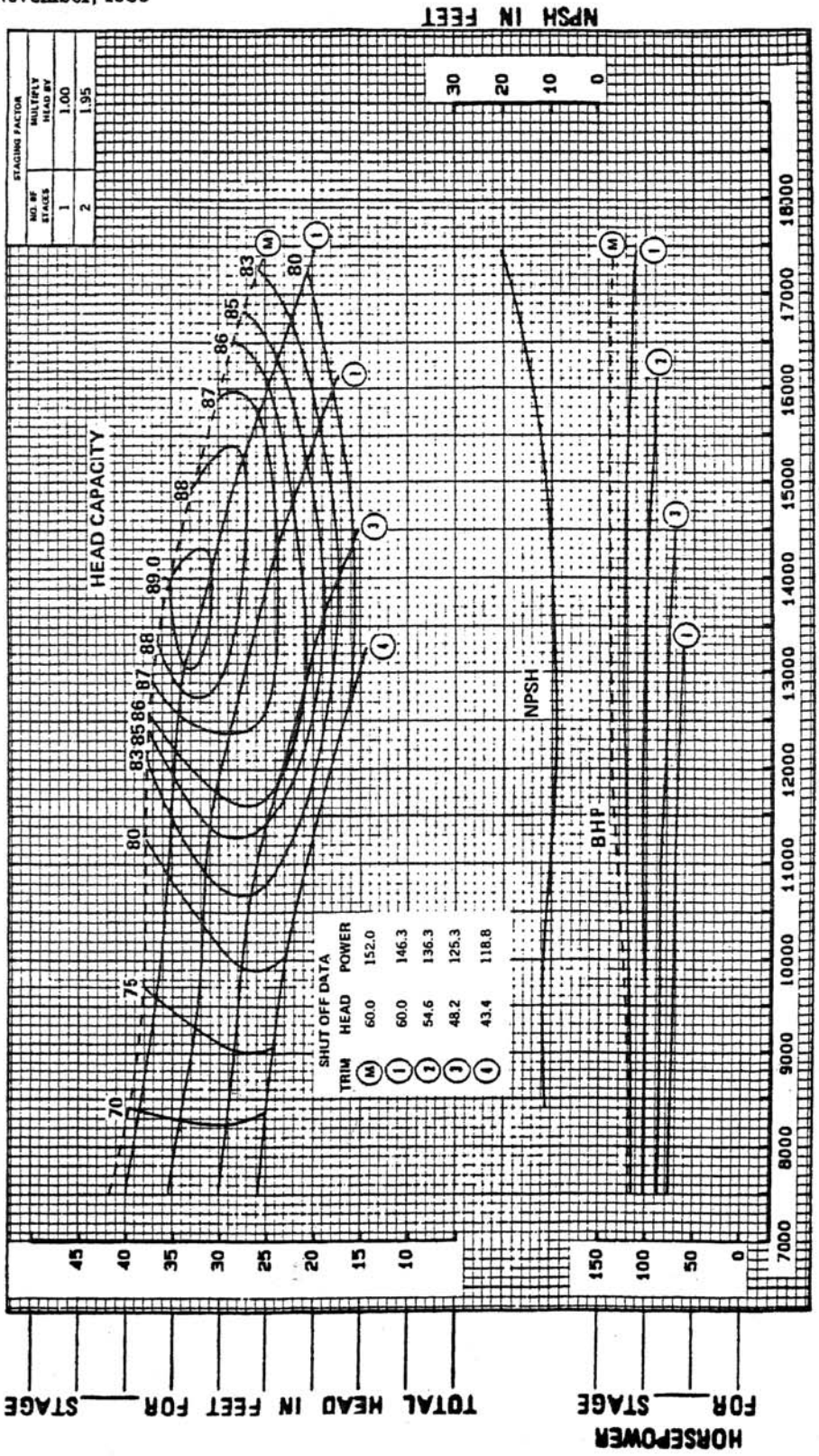
	Amount Funded by SRF	Loan Repayment Reserve	Loan Service Fee	Surety Costs (%)	Underwriters Discount	Fiscal Year 1	FY 2	FY 3	Principal Amount of Loan	Annual Debt Service	Debt Service Coverage[1]	Annual O & M Costs (2)	Total Annual Costs	Daily Benefit (1000 gal /day)	Average Days Per Year	Annual Benefit (1000 gal)	Cost per 1000 gallons
Gator Slough	$26,855,004	$805,650	805650.12	-	0.0	$117,000	$352,000	$470,000	$29,405,304	$2,069,000	$517,250	588,000	$3,174,250	14,000	180	2,520,000	$1.26
Horseshoe Canal	$14,029,882	$420,896	420896.46	-	0.0	$81,000	$184,000	$246,000	$15,362,675	$1,080,900	$270,225	252,000	$1,603,125	6,000	180	1,080,000	$1.48
Hermosa Canal	$14,828,218	$444,847	444846.54	-	0.0	$85,000	$195,000	$259,000	$16,236,911	$1,142,400	$285,600	252,000	$1,680,000	6,000	180	1,080,000	$1.56
Everest Parkway	$22,110,750	$663,323	663322.5	-	0.0	$97,000	$290,000	$387,000	$24,211,395	$1,703,500	$425,875	512,400	$2,641,775	12,200	180	2,196,000	$1.20
North Ft.Myers & Cape Coral Interconnect	$2,646,396	$79,392	79391.88	-	0.0	$12,000	$35,000	$46,000	$2,898,180	$203,900	$50,975	98,600	$351,475	2,300	180	414,000	$0.85
North-South Transfer Station	$19,374,000	$581,220	581220	-	0.0	$85,000	$254,000	$339,000	$21,214,440	$1,492,700	$373,175	420,000	$2,285,875	10,000	180	1,800,000	$1.27
Canal Station #8 Pumping Station	$11,720,750	$351,623	351622.5	-	0.0	$51,000	$154,000	$205,000	$12,833,995	$903,000	$225,750	210,000	$1,338,750	5,000	180	900,000	$1.49
$0	$0	$0	0	-	0.0	$0	$0	$0	$0	$0	$0	0	$0	0	180	0	#DIV/0!

ATTACHMENT I

Horizontal Well Pump - Sample Curves

VERTICAL TURBINE PUMPS
Model 30HH - 585 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026



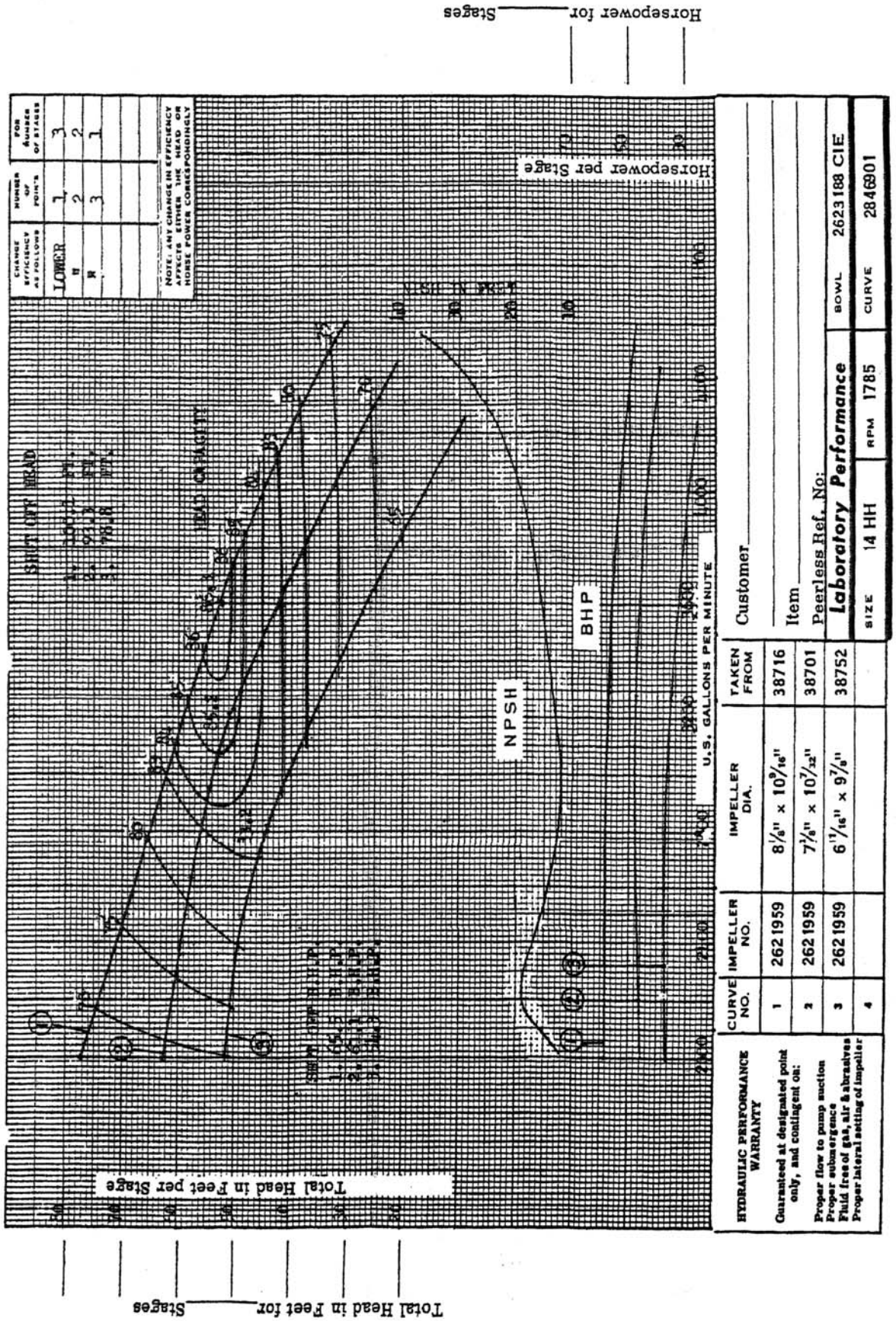
Head and Capacity Warranty Contingent on:	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
	1	2621978	18-5/8" x 24-3/16"	36758
	2	2621978	17" x 23-17/32"	36783
Proper flow to pump suction Proper submergence Fluid free of gas, air & abrasives Proper lateral setting of impeller	3	2621978	15-7/16" x 22-31/32"	36814
	4	2621978	14-1/32" x 22-15/32"	36837
	M	2621978	FULL DIAMETER EXTENDED PERFORMANCE	58320

Customer_____
Item_____
Peerless Ref. No:
Laboratory Performance
SIZE 30HH RPM 585 BOWL 2621979CI PLASTIC COATED
CURVE 4806306

PUMP DESCRIPTION: Driver_____; Head_____; Column_____
BOWL☐ PERFORMANCE: Capacity_____gpm; Head_____ft; Eff_____%; BHP_____
FIELD☐

VERTICAL TURBINE PUMPS
Model 14HH - 1785 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026



CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	262 1959	8⅛" × 10⁹/₁₆"	38716
2	262 1959	7⅞" × 10⁷/₃₂"	38701
3	262 1959	6¹¹/₁₆" × 9⅞"	38752
4			

HYDRAULIC PERFORMANCE WARRANTY

Guaranteed at designated point only, and contingent on:

Proper flow to pump suction
Proper submergence
Fluid free of gas, air & abrasives
Proper lateral setting of impeller

Customer _____

Item _____

Peerless Ref. No: **Laboratory Performance**

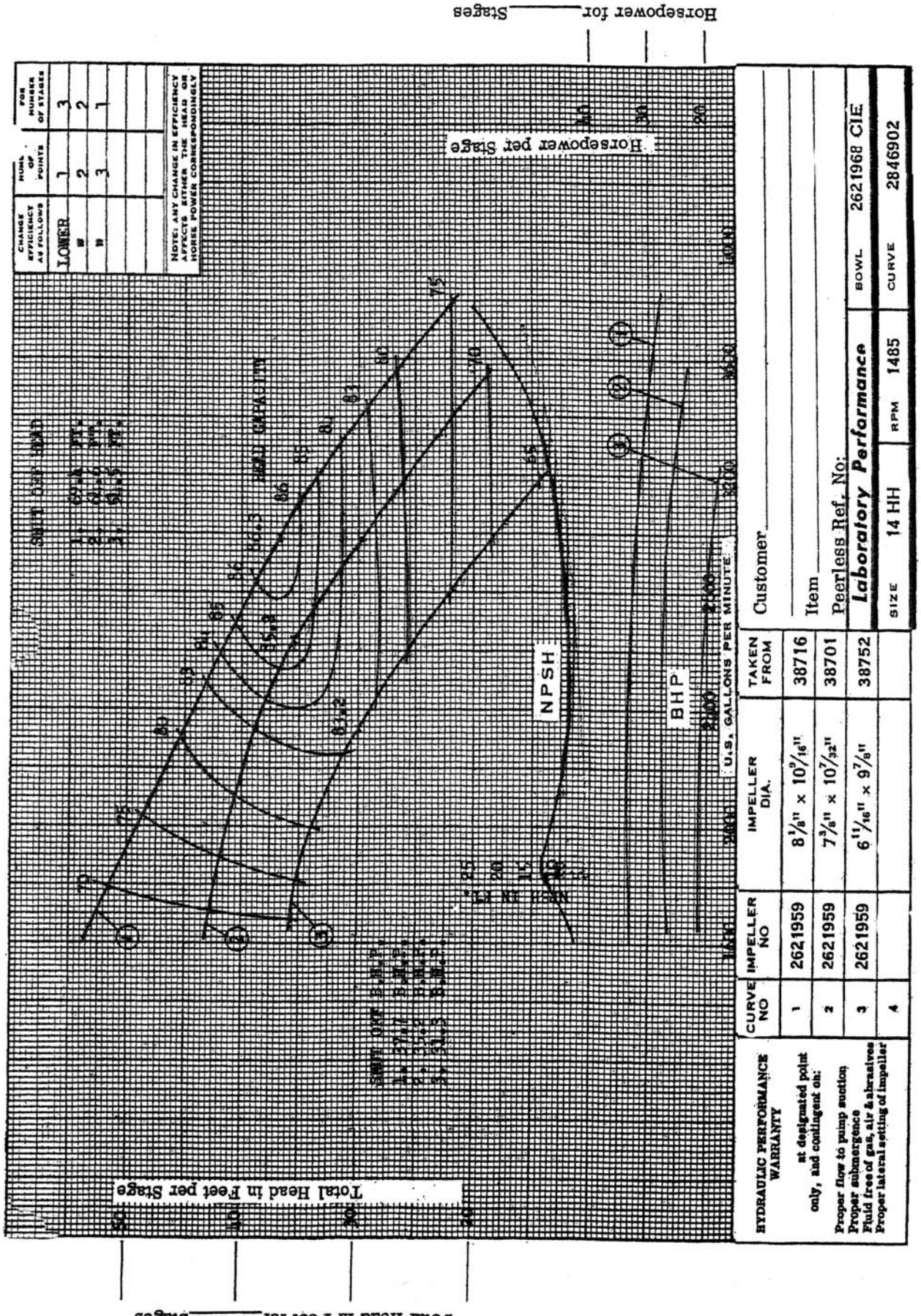
SIZE	14 HH	RPM	1785	BOWL	2623188 CIE
				CURVE	2846901

PUMP DESCRIPTION: Driver _____; Head _____; Column _____

GUARANTEED BOWL☐ FIELD☐ PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____%; BHP _____

VERTICAL TURBINE PUMPS

STERLING PEERLESS PUMP
Sterling Fluid Systems (USA), Inc.
Indianapolis, IN 46207-7026

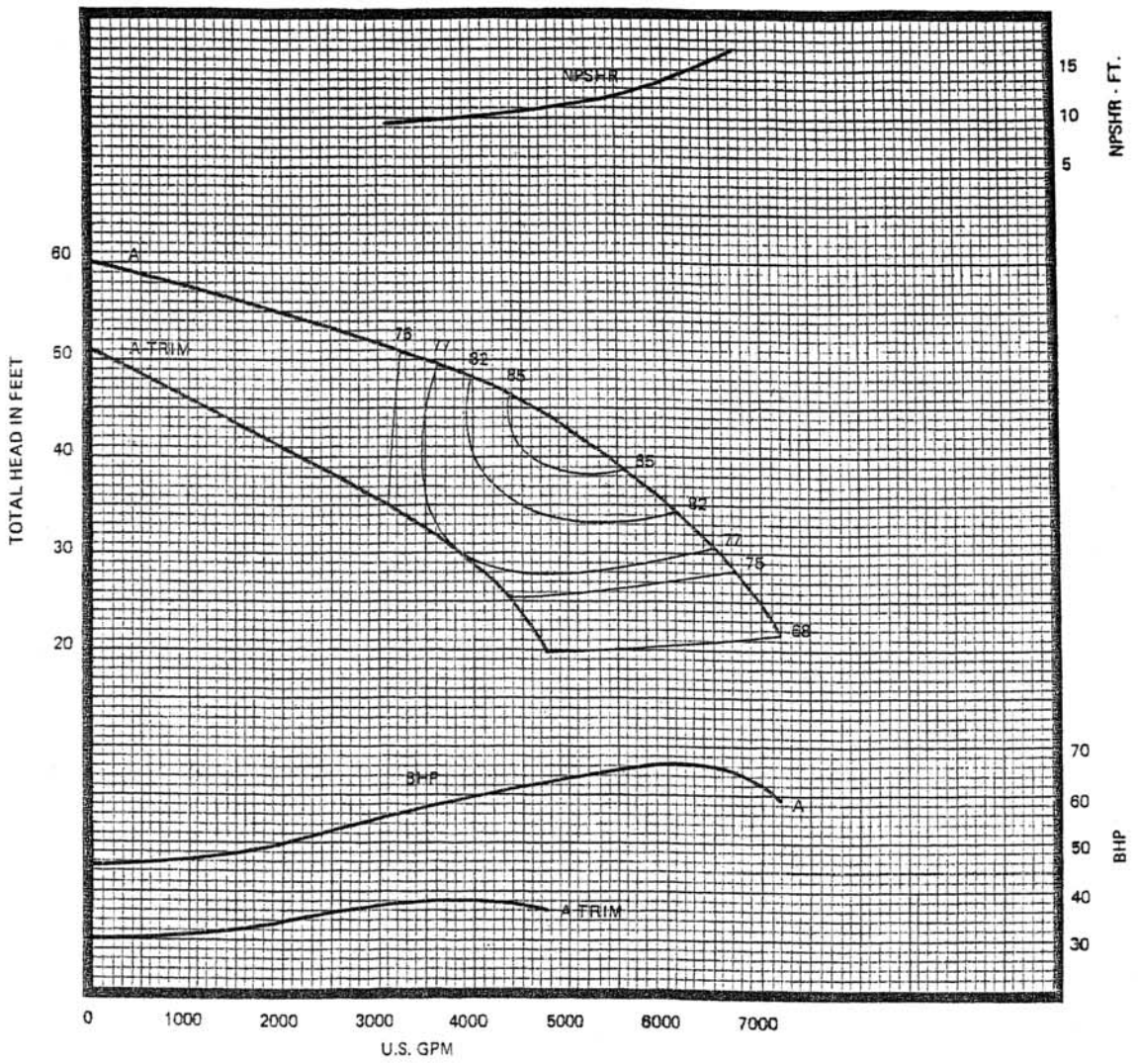


PUMP DESCRIPTION: Driver_____; Head_____; Column_____
BOWL☐ PERFORMANCE: Capacity_____gpm; Head_____ft; Eff_____%; BHP_____
FIELD☐

28MC 6970

705 RPM

SEMI-OPEN IMPELLER T4NA92



EFFICIENCY CORRECTIONS(1)

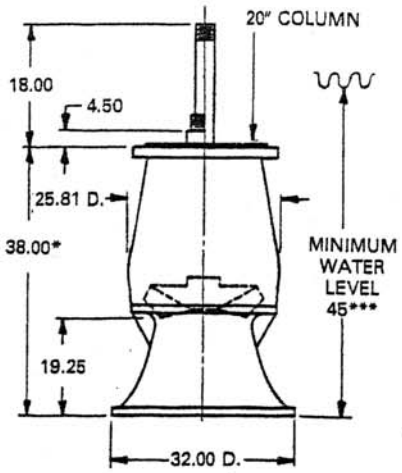
NUMBER OF STAGES	EFFICIENCY CHANGE
1	-3.0 POINTS
2	-2.0 POINTS
3	-1.0 POINTS
4	NO CHANGE
5	NO CHANGE
6 OR MORE	NO CHANGE

BOWL MATERIAL	EFFICIENCY CHANGE
CAST IRON	-1.0 POINTS
EPOXIED C.I.	NO CHANGE

IMPELLER MATERIAL	EFFICIENCY CHANGE
CAST IRON	-1.0 POINTS
BRONZE	NO CHANGE
EPOXIED C.I.	NA

(1) Refer to "Application and Reference Data" for head correction.

DIMENSIONS (Inches)



*Add 18.00 for each additional stage.

TECHNICAL DATA

DATA	VALUE
MAXIMUM OPERATING SPEED	900 RPM
MAXIMUM NUMBER OF STAGES	11**
PUMP SHAFT DIAMETER	3 7/16 IN.
IMPELLER EYE AREA	140 SQ. IN.
MAXIMUM SPHERE SIZE	1.56 IN.
K_t (THRUST FACTOR)	84 LBS./FT.
K_s (ROTOR WT. PER STAGE)	195 LBS.
BOWL WT. (FIRST STAGE)	1800 LBS.
BOWL WT. (EACH ADD'L. STAGE)	900 LBS.
ALLOWABLE SHAFT STRETCH	.63 IN.**
WK^2 (FIRST STAGE)	67.30 LBS.-FT.^{2}
WK^2 (EACH ADD'L. STAGE)	42.30 LBS.-FT.^{2}
BOWL RING CLEARANCE	NA

** These are nominal values. Refer to "Application and Reference Data" for information further limiting or extending these values.

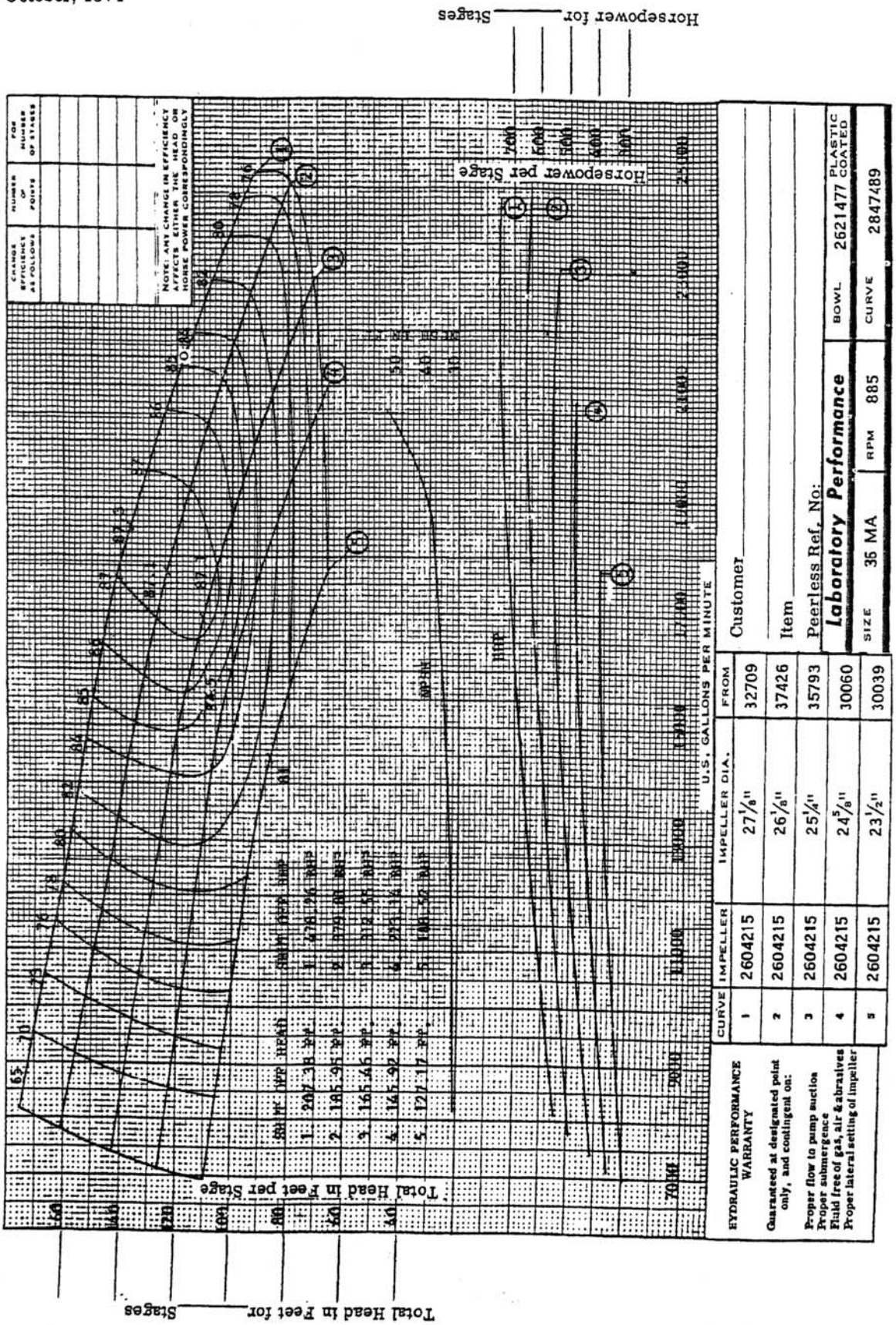
*** This value is the minimum submergence required to prevent vortexing only. This value may need to be increased to provide adequate NPSHA.

ATTACHMENT J

Injection Well Station - Sample Curves

VERTICAL TURBINE PUMPS
Model 36MA - 885 Rpm

Peerless Pump Company
Indianapolis, IN 46207-7026



CURVE	IMPELLER	IMPELLER DIA.	FROM
1	2604215	27 1/8"	32709
2	2604215	26 1/8"	37426
3	2604215	25 1/4"	35793
4	2604215	24 5/8"	30060
5	2604215	23 1/2"	30039

HYDRAULIC PERFORMANCE WARRANTY

Guaranteed at designated point only, and contingent on:

- Proper flow to pump suction
- Proper submergence
- Fluid free of gas, air & abrasives
- Proper lateral setting of impeller

Customer _____

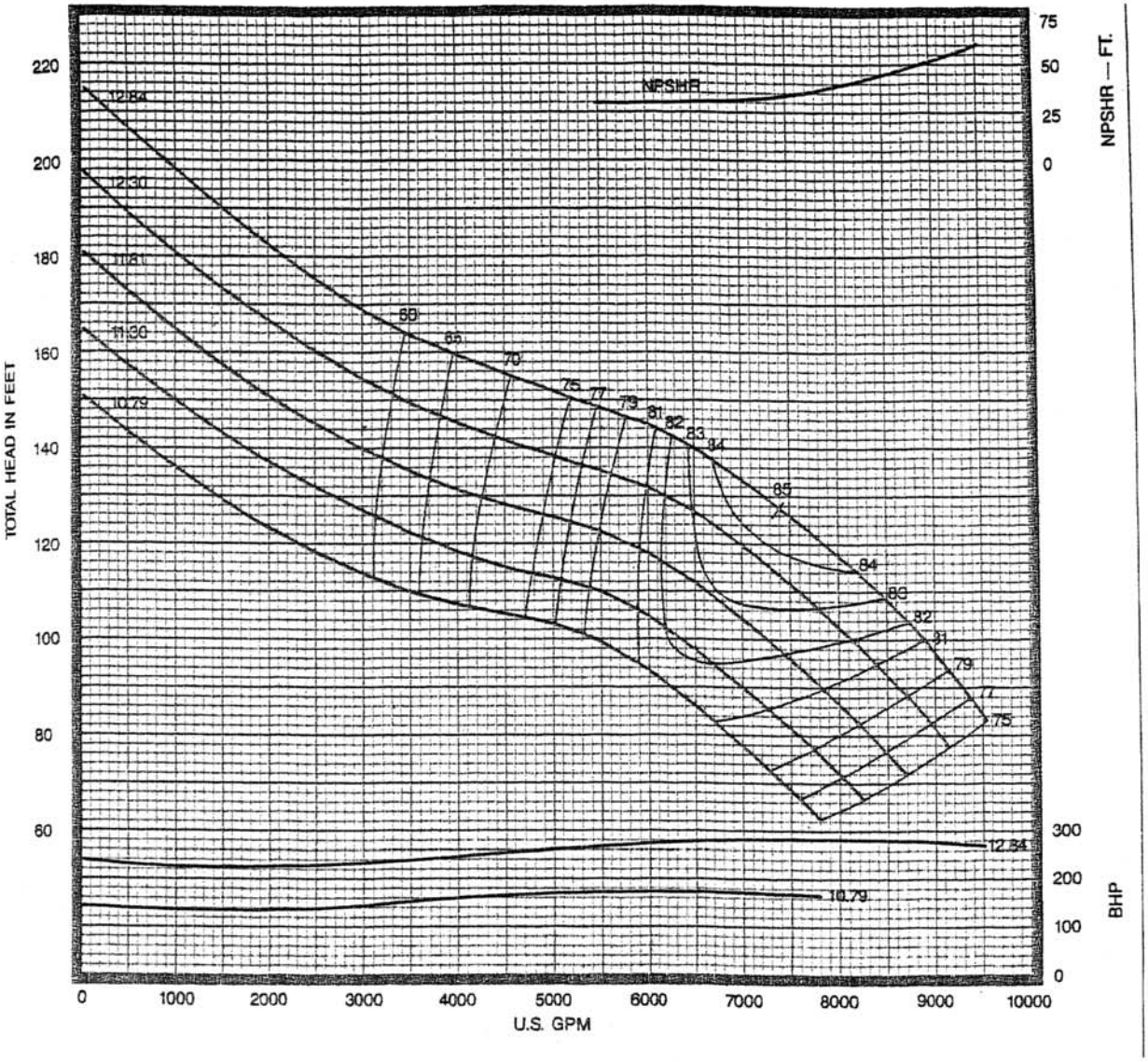
Item _____

Peerless Ref. No: **Laboratory Performance**

SIZE 36 MA | RPM 885 | BOWL 2621477 PLASTIC COATED | CURVE 2847489

PUMP DESCRIPTION: Driver_____; Head_____; Column_____

GUARANTEED BOWL☐ FIELD☐ PERFORMANCE: Capacity_____ gpm; Head_____ft; Eff_____%; BHP_____



21H 7000 1770 RPM

ENCLOSED IMPELLER T7LKB99

EFFICIENCY CORRECTIONS(1)

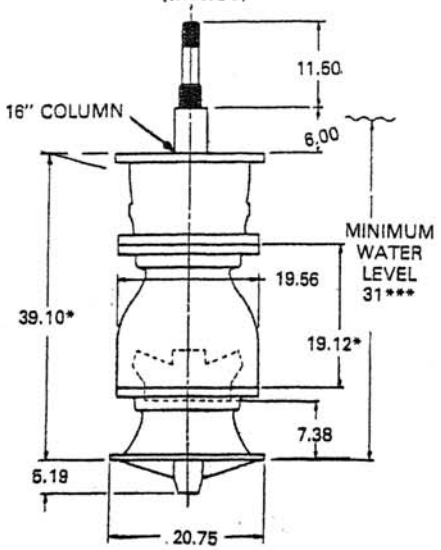
NUMBER OF STAGES	EFFICIENCY CHANGE
1	-2.5 POINTS
2	-1.5 POINTS
3	-0.5 POINTS
4	NO CHANGE
5	NO CHANGE
6	NA

BOWL MATERIAL	EFFICIENCY CHANGE
CAST IRON	-2.0 POINTS
ENAMELED C.I.	NO CHANGE

IMPELLER MATERIAL	EFFICIENCY CHANGE
CAST IRON	1.0 POINTS
BRONZE	NO CHANGE
ENAMELED C.I.	NO CHANGE

Refer to "Application and Reference Data" for head correction.

DIMENSIONS (Inches)



*Add 19.12 for each additional stage.

TECHNICAL DATA

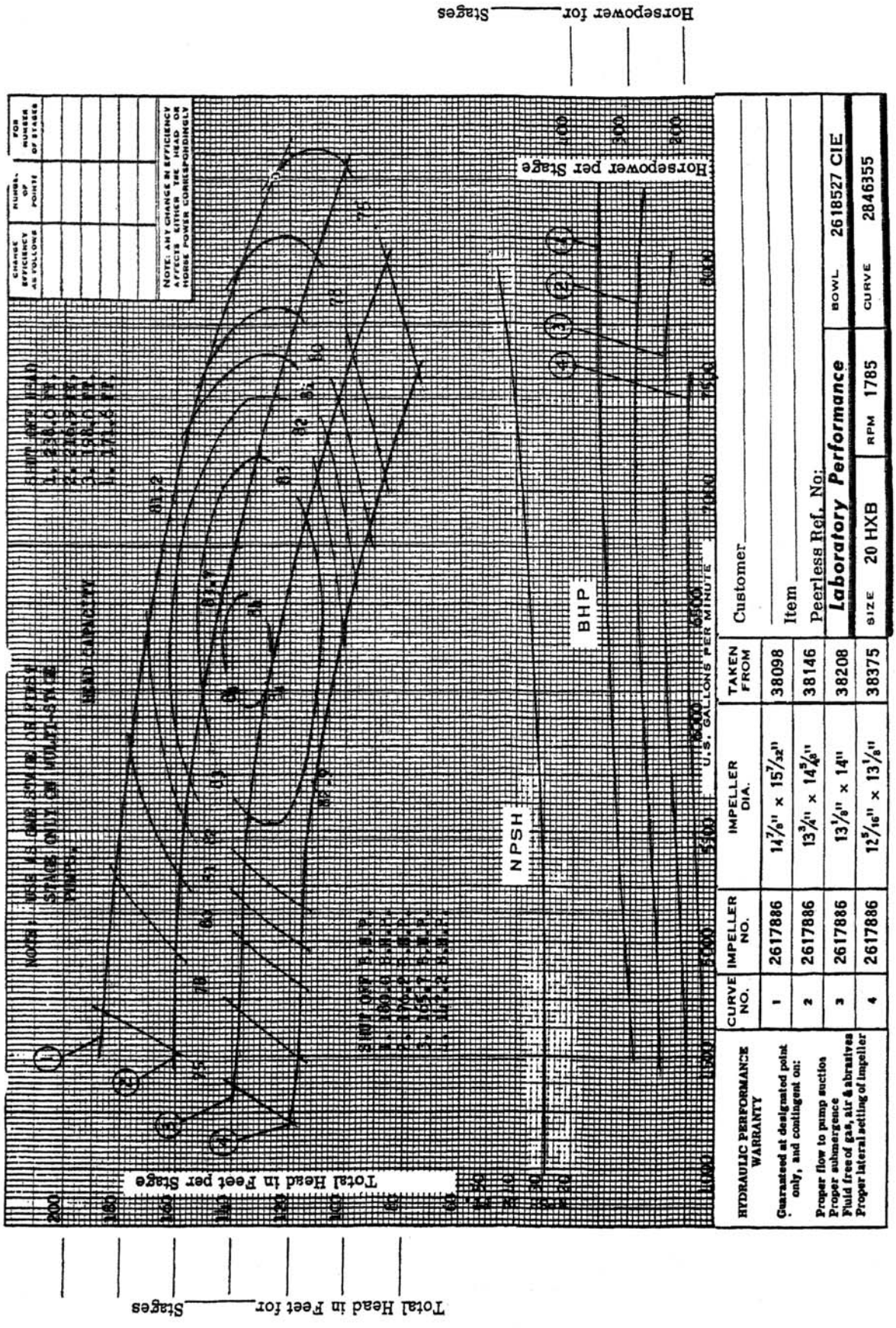
DATA	VALUE
MAXIMUM OPERATING SPEED	1800 RPM
MAXIMUM NUMBER OF STAGES	5 **
IMPELLER SHAFT DIAMETER	2 7/16 IN.
IMPELLER EYE AREA	77.5 SQ. IN.
MAXIMUM SPHERE SIZE	1.62 IN.
K_t (THRUST FACTOR)	28.49 LBS./FT.
K_s (ROTOR WT. PER STAGE)	88 LBS.
BOWL WT. (FIRST STAGE)	900 LBS.
BOWL WT. (EACH ADD'L. STAGE)	435 LBS.
ALLOWABLE SHAFT STRETCH	.94 IN.**
WK^2 (FIRST STAGE)	16.93 LBS.-FT.^{2}
WK^2 (EACH ADD'L. STAGE)	16.76 LBS.-FT.^{2}
BOWL RING CLEARANCE	.022/.028 IN.

** These are nominal values. Refer to "Application and Reference Data" for information further limiting or extending these values.

*** This value is the minimum submergence required to prevent vortexing only. This value may need to be increased to provide adequate NPSHA.

Peerless Pump Company
Indianapolis, IN 46207-7026

VERTICAL TURBINE PUMPS
Model 20HXB - 1785 Rpm



HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on:	1	2617886	$14^{7}/_{16}$" x $15^{7}/_{32}$"	38098
Proper flow to pump suction Proper submergence Fluid free of gas, air & abrasives Proper lateral setting of impeller	2	2617886	$13^{3}/_{4}$" x $14^{5}/_{8}$"	38146
	3	2617886	$13^{1}/_{8}$" x 14"	38208
	4	2617886	$12^{5}/_{16}$" x $13^{1}/_{8}$"	38375

Customer _____
Item _____
Peerless Ref. No:

Laboratory Performance

SIZE	20 HXB	RPM	1785	BOWL	2618527 CIE
				CURVE	2846355

PUMP DESCRIPTION: Driver _____; Head _____; Column _____
GUARANTEED PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____ %; BHP _____
BOWL☐ FIELD☐

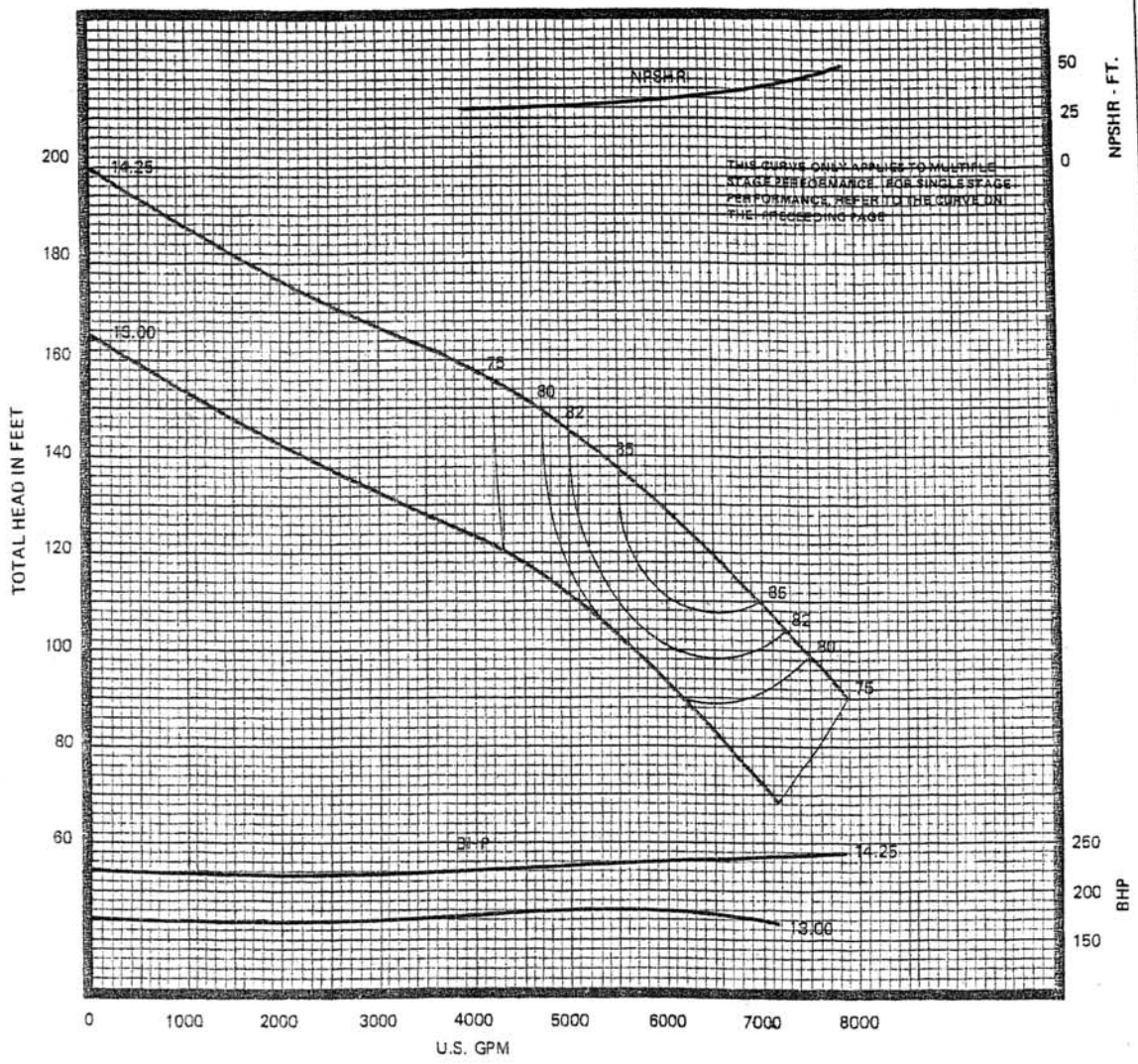
ATTACHMENT K

Recovery Pump - Sample Curves

18XHC
6920
1770 RPM

ENCLOSED IMPELLER
T5KA268

MULTI-STAGE



EFFICIENCY CORRECTIONS(1)

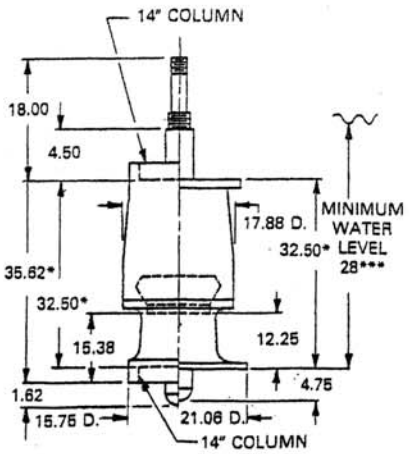
NUMBER OF STAGES	EFFICIENCY CHANGE
1	NA
2	-1.0 POINTS
3	NO CHANGE
4	NO CHANGE
5	NO CHANGE
6	NO CHANGE

BOWL MATERIAL	EFFICIENCY CHANGE
CAST IRON	-2.0 POINTS
EPOXIED C.I.	NO CHANGE

IMPELLER MATERIAL	EFFICIENCY CHANGE
CAST IRON	-1.0 POINTS
BRONZE	NO CHANGE
EPOXIED C.I.	NO CHANGE

(1) Refer to "Application and Reference Data" for head correction.

DIMENSIONS (Inches)



*Add 16.38 for each additional stage.

TECHNICAL DATA

DATA	VALUE
MAXIMUM OPERATING SPEED	1800 RPM
MAXIMUM NUMBER OF STAGES	6**
PUMP SHAFT DIAMETER	2 7/16 IN.
IMPELLER EYE AREA	86.1 SQ. IN.
MAXIMUM SPHERE SIZE	1.25 IN.
K_t (THRUST FACTOR)	33 LBS./FT.
K_s (ROTOR WT. PER STAGE)	50 LBS.
BOWL WT. (FIRST STAGE)	750 LBS.
BOWL WT. (EACH ADD'L. STAGE)	350 LBS.
ALLOWABLE SHAFT STRETCH	.94 IN.**
WK^2 (FIRST STAGE)	15.56 LBS.-FT.^{2}
WK^2 (EACH ADD'L. STAGE)	15.27 LBS.-FT.^{2}
BOWL RING CLEARANCE	.014/.020 IN.

** These are nominal values. Refer to "Application and Reference Data" for information further limiting or extending these values.

*** This value is the minimum submergence required to prevent vortexing only. This value may need to be increased to provide adequate NPSHA.

ATTACHMENT L

Public Statement On Ultraviolet (UV) Light For Treatment Of Public Water Supplies

Recommended Standards For Water Works

2003 Edition

Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers

Illinois Indiana Iowa Michigan Minnesota Missouri
New York Ohio Ontario Pennsylvania Wisconsin

POLICY STATEMENT
ON
ULTRA VIOLET LIGHT
FOR TREATMENT OF PUBLIC WATER SUPPLIES

Ultra Violet (UV) Light treatment devices may be used to treat bacteriologically unsafe groundwater from drinking water wells. However, reviewing authorities expect water system owners to take all steps possible to obtain a naturally safe water source before considering treatment. A naturally safe water source provides the best long-term public health protection and there is no reliance on a treatment device to assure safe water. There must be a determination that the bacteriologically unsafe water is not due to the influence of surface water.

Recent research has demonstrated the effectiveness of UV as a primary disinfectant. While this policy statement does not specifically cover UV treatment for surface water or groundwater under the direct influence of surface water, it is not the intent of this policy to discourage such use. Portions of this policy are applicable to the treatment of effectively filtered surface water. The reviewing authority shall be contacted regarding use of UV treatment for these applications.

When a naturally safe groundwater source is not available, or the system owner wishes to provide UV treatment for other reasons, the following criteria shall be considered. Supplemental disinfection to provide a residual in the water distribution system may be required by the approval authority. When UV light treatment devices are used for non-health related purposes the UV device may provide doses less than indicated in the following criteria.

A. CRITERIA FOR UV WATER TREATMENT DEVICES

1. UV water treatment devices must comply with criteria approved by the reviewing authority or Class A criteria under ANSI/NSF Standard 55 - Ultraviolet Microbiological Water Treatment Systems; each UV water treatment device shall meet the following standards;

    a. Ultraviolet radiation at a wavelength of 253.7 nanometers shall be applied at a minimum dose of 40 millijoules per square centimeter (mJ/cm^2) at the failsafe set point at the end of lamp life;

    b. The UV device shall be fitted with a light sensor to safely verify that UV light is being delivered into the reactor;

    c. The UV light assembly shall be insulated from direct contact with the influent water by a quartz (or high silica glass with similar optical and strength characteristics) lamp jacket to maintain proper operating lamp temperature;

    d. The design and installation of the UV reactor shall ensure that the manufacturer's maximum rated flow and pressure cannot be exceeded;

    e. The UV assemblies shall be accessible for visual observation, cleaning and replacement of the lamp, lamp jackets and sensor window/lens;

    f. A narrow band UV monitoring device shall be provided that is sensitive to germicidal UV light. It shall be accurately calibrated so that it indicates the true irradiance (mJ/cm^2) at 253.7 nanometers and be installed at the location critical for that unit. The device shall trigger an audible alarm in the event the sensor or lamp fails or if insufficient dosage is detected as defined in item "a" above;

g. An automatic shutdown valve shall be installed in the water supply line ahead of the UV treatment system that will be activated whenever the water treatment system loses power or is tripped by a monitoring device when the dosage is below its alarm point of 40 mJ/cm^2. When power is not being supplied to the UV unit the valve shall be in a closed (fail-safe) position.

h. The UV housing shall be stainless steel 304 or 316L;

2. A flow or time delay mechanism wired in series with the well or service pump shall be provided to permit a sufficient time for tube warm-up per manufacturer recommendations before water flows from the unit upon startup. Where there are extended no-flow periods and fixtures are located a short distance downstream of the UV unit, consideration should be given to UV unit shutdown between operating cycles to prevent heat build-up in the water due to the UV lamp:

3. A sufficient number (required number plus one) of parallel UV treatment systems shall be provided to assure a continuous water supply when one unit is out of service;

4. No bypasses shall be installed;

5. All water from the well shall be treated. The well owner may request a variance to treat only that portion of the water supply that is used for potable purposes provided that the daily average and peak water use is determined and signs are posted at all non-potable water supply outlets.

6. The well or booster pump(s) shall have adequate pressure capability to maintain minimum water system pressure after the water treatment devices;

B. PRETREATMENT

The reviewing authority will determine pre and post treatment on a specific case basis depending on raw water quality. See Section G for raw water quality limitations. If coliform bacteria or other microbiological organisms are present in the untreated water, a 5 micron filter shall be provided as minimum pretreatment.

C. PROCESS CONTROL WATER QUALITY MONITORING

Total coliform monitoring and other parameters required by the reviewing authority will be used to evaluate UV treatment effectiveness. The minimum monitoring frequency will be as follows:

Startup and 2 weeks after start up - one raw and one treated sample.
Monthly thereafter - raw and treated.

Monitoring for additional parameters or total coliform on an increased frequency may be required by the reviewing authority.

D. ONLINE MONITORING, REPLACEMENT PARTS

UV light intensity of each installed unit shall be monitored continuously. Treatment units and the water system shall automatically shutdown if the UV dosage falls below the required output of 40 mJ/cm^2. Water systems that have source water exceeding 5 NTU turbidity may be required to install an online turbidimeter ahead of the UV water treatment device. An automatic shutdown valve shall be installed and operated in conjunction with the turbidimeter. Each owner shall have available on site at least one replacement lamp, a 5 micron replacement filter and, where applicable, a replacement cyst reduction filter and any other components necessary to keep the treatment system in service.

E. SEASONAL OPERATIONS

UV water treatment devices that are operated on a seasonal basis shall be inspected and cleaned prior to use at the start of each operating season. The UV water treatment system including the filters shall be disinfected prior to placing the water treatment system back into operation. A procedure for shutting down and starting up the UV treatment system shall be developed for or by each owner based upon manufacturer recommendations and submitted in writing to the review authority.

F. RECORD KEEPING AND ACCESS

A record shall be kept of the water quality test data, dates of lamp replacement and cleaning, a record of when the device was shutdown and the reason for shutdown, and the dates of prefilter replacement.

The reviewing authority shall have access to the UV water treatment system and records.

Water system owners will be required to submit operating reports and required sample results on a monthly or quarterly basis as required by the reviewing authority.

G. RAW WATER QUALITY CHARACTERISTICS

The water supply shall be analyzed for the following water quality parameters and the results shall be included in the UV application. Pretreatment is required for UV installations if the water quality exceeds any of the following maximum limits. When an initial sample exceeds a maximum limit, a check sample shall be taken and analyzed.

Parameter	Maximum
UV 254nm Absorption	20 percent at 1 cm
Dissolved Iron	0.3 mg/L
Dissolved Manganese	0.05 mg/L
Hardness	120 mg/L*
Hydrogen sulfide (if odor is present)	Non-Detectable
Iron Bacteria	None
pH	6.5 to 9.5
Suspended Solids	10 mg/L
Turbidity	1.0 NTU
Total Coliform	1,000/100 ML
E. Coli	**
Cryptosporidium	**
Giardia	**

* A higher hardness may be acceptable to the reviewing authority if experience with similar water quality and reactors shows there are no treatment problems or excessive maintenance required.

** These organisms may indicate that the source is either a surface water or ground water under the direct influence of surface water and may require additional filtration pretreatment. Consult the reviewing authority for guidance.

Raw water quality shall be evaluated and pretreatment equipment shall be designed to handle water quality changes. Variable turbidity caused by rainfall events is of special concern.

Adopted April, 2003