Special Publication SJ2004-SP26

East Central Florida Water Supply Initiative
St. Johns River Water Supply Project

Surface Water Treatment Plant Siting Study
Level 3 Analysis:
Detailed Site-Specific Screening

TECHNICAL MEMORANDUM D2B

EAST CENTRAL FLORIDA WATER SUPPLY INITIATIVE
ST. JOHNS RIVER WATER SUPPLY PROJECT

SURFACE WATER TREATMENT PLANT SITING STUDY

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INTRODUCTION

St. Johns River Water Management District (SJRWMD) implemented an interactive program with utilities, citizens and other interested parties to develop the District's Water Supply Plan (DWSP) through the Water 2020 planning process. The need for alternative water supplies from the traditional use of groundwater became apparent through this process. The St. Johns River Water Supply Project of the East Central Florida Water Supply Initiative comprises five projects, including the St. Johns River Treatability and Demineralized Concentrate Management Study, the Surface Water Treatment Plant Siting Study, the Demand Projection and Affordability Study, the USGS Water Quality Study, and Middle St. Johns River Minimum Flows and Levels Work. These projects focus on the evaluation of surface water withdrawn from the St. Johns River as an alternative or supplemental source of supply for portions of Seminole and Volusia Counties, Florida. Three individual projects, the Surface Water Treatment Plant Siting Study, the St. Johns River Treatability Study, and the Demand Projection and Affordability Study, will help to facilitate design, location, and costing of a complete surface water treatment facility, intake structure, and connecting pipelines on a reach of the St. Johns River between the southern end of Lake Monroe and DeLand, Florida.

The Water Treatment Plant Siting Study involved three levels of analysis and includes the following project components:

- River intake structure location
- Treatment plant location
- Demineralized concentrate disposal area
- Pipeline corridors

Through the Level 1 Analysis, a preliminary screening of the study area was conducted to identify potential areas for the development of a water treatment plant. Through this process, eleven potential areas were identified. In the Level 2 Analysis, a preliminary site specific screening of these areas was conducted to refine the area boundaries into smaller site boundaries and to identify the five most feasible locations for a water treatment plant. In addition, through the Level 2 Analysis, raw water and finished water pipeline corridors, river intake locations and concentrate management options were identified. A

summary of these two levels of analysis is provided in Technical Memorandum D.2.A (HDR, October 2003).

The purpose of this technical memorandum (TM) is to present the methods, analysis, and results of the Level 3 Analysis, Detailed Site-Specific Screening. The Level 3 Analysis included conducting more detailed site-specific evaluation of the treatment plant sites, the proposed river intake locations, the inter-connecting pipelines and concentrate management options.

METHODS

WATER TREATMENT PLANT SITES

In the Level 3 Analysis, a more detailed analysis of the five water treatment plant sites short-listed through the Level 2 Analysis was conducted. The purpose of this more detailed analysis was to refine the data obtained through the GIS databases based on field and aerial reviews of the sites.

Property Owner Coordination

Through the Level 2 Analysis public involvement process, an initial attempt at contacting the property owners for the water treatment plant sites and river intake sites was made. In the Level 3 Analysis, further attempts were made to contact and coordinate with the property owners of the potential water treatment plant sites. Property owners were identified through property appraiser information for each of the counties. Letters explaining the siting process and requesting access to the property were sent to each of the property owners. Follow-up attempts to contact the property owners via the telephone were made to further explain the project and to obtain permission for access to the property.

Environmental Assessment

Site reviews were conducted at each of the five candidate sites. Pedestrian surveys were completed at sites where properties were accessible to characterize each site and identify any substantial constraints such as protected species, habitat, potential contamination or on-site hazardous materials, and land use. Sites not accessible due to lack of consent by the landowner or due to dense vegetative cover were reviewed from the roadside and aerial photographs. Sites reviewed from the roadside include Site B and Site G. In addition, information gathered during previous project phases was reviewed and considered in this assessment.

Land Use/Zoning Evaluation

The future land use and existing zoning classifications were evaluated for each of the five short-listed sites to determine if a water treatment plant would be an allowable use on the property or if additional

coordination would be required to approve the use as a special exception. This information was obtained from the Seminole County, Volusia County, City of DeBary, and Lake County property appraiser's offices and planning and growth management offices.

The future land use classification was also evaluated for the surrounding uses to determine if the development of a water treatment plant was consistent with the character of the anticipated future growth and development in the area. Future land use classifications were used for this comparison because they are less likely to be amended in comparison to zoning classifications.

Land Valuation

Through the Level 2 Analysis, land values from the property appraiser's databases were utilized to compare the potential costs associated with each of the potential water treatment plant sites. As a part of the more detailed evaluation conducted through the Level 3 Analysis, a land valuation process was conducted. This process included evaluating the land use and zoning and parcel size of the five short-listed water treatment plant sites and evaluating comparable land sales in the area of these sites with similar size, land use and zoning. Based on these comparable land sales, ranges of per acre land costs were developed for the sites in Seminole, Volusia and Lake Counties. These per acre costs were then applied to the five sites to develop a potential land acquisition cost for these sites based on the anticipated acreage to be acquired for the water treatment plant site.

The report that summarizes this land valuation process is provided in Appendix A.

PIPELINE ROUTES

During previous project phases, potential raw water and finished water pipeline routes were identified using a GIS based least-cost path analysis. Parameters considered included length, potential impacts to wetlands and floodplains, existing linear corridors (e. g. roads and power lines), and land acquisition. Pipeline routes are required from the intake to the treatment plant, from the treatment plant to a finished water delivery point and from the water treatment plant to the potential concentrate disposal locations. These pipeline routes were reviewed in the field by the project team and revised as necessary to reflect more feasible pipeline corridors. In the case of the finished

water pipeline corridors, the end points or delivery points were municipal water treatment plants serving areas of the greatest projected water demand in the study area. These areas of water demand were identified through the Demand Projection and Affordability Study. The finished water delivery points are referred to as Points of Connection.

INTAKE SITES

Potential intake sites were identified through a review of land use/land cover mapping and color infrared digital orthographic quarterquad (DOQQ) aerial maps. During the site identification process, consideration was given to potential environmental and social impacts as well as proximity to the proposed water treatment plant sites. Upland sites adjacent to the river channel or contiguous lakes (e.g. Lake Beresford) were preferred in an effort to minimize wetland impacts. A total of eight (8) sites were identified.

Six (6) of the eight (8) sites identified through this process were then reviewed in the field both from the land and by boat. Due to access constraints, Sites 2 and 6 were examined by boat only. During the field review process, an additional intake site was identified near Site 5, bringing the total number of intake sites to nine (9). Site reviews were completed to characterize each site and identify any substantial constraints such as protected species, habitat, potential contamination or on-site hazardous materials, and land use.

CONCENTRATE MANAGEMENT OPTIONS

As a part of the siting process, potential concentrate management options were identified for each of the water treatment plant locations. The concentrate contains the salts removed from the brackish feed water, as well as some of the chemicals that may have been added during the treatment and reverse osmosis processes. The disposal of the concentrate in an environmentally appropriate manner is an important part of this feasibility study. A series of technical memorandums related to concentrate management in the District were previously prepared as a part of the other project for SJRWMD. These technical memorandums reviewed the regulatory requirements for the various concentrate management options and the feasibility of utilizing the options in the District. As a part of the Level 3 Siting Analysis, these technical memorandums were reviewed and options specific to each of the five water treatment plant sites were identified and evaluated.

Surface Water

Due to the close proximity to the source water, the St. Johns River, discharging the concentrate from the surface water treatment plant into the river was one of the concentrate management options being considered as a part of this study. Several criteria were used in evaluating the feasibility of the surface water discharge option for each of the five water treatment plant sites. A list of the criteria is presented and described below:

- Total dissolved solids (TDS) concentration of the concentrate and in the St. Johns River
- Proximity to the receiving body and capacity (capability of having adequate mixing zone)
- Pipeline route alternatives from the water treatment plant to the proposed discharge location
- Classification of the receiving water body at the discharge location
- Permitting process

Based on information from the Surface Water Treatability and Demineralization Study, the TDS concentration of the St. Johns River in the study area is between 386 mg/l and 1260 mg/l depending on the flow, with an average value of 858 mg/l. The results of the pilot study conducted by CH2MHill indicated that the concentrate TDS concentration is on average 2,900 mg/l or approximately three and a half times the initial raw water TDS. Based on the pilot study, the concentrate quantity was estimated at 5 mgd, corresponding to 75% recovery from the proposed 20 mgd surface water treatment plant.

In identifying the most feasible route to the St. Johns River, efforts were made to avoid the portions of the river designated Outstanding Florida Waters (OFW), and any other conservations areas were of utmost consideration. Since a small portion of the river in the study area is not classified as an OFW, the preferred routes were not always the shortest routes to the river. According to the Florida Department of Environmental Protection, in an OFW a surface discharge can result in no degradation of the natural background water quality. In addition, zones are not allowed in OFW's, except the case for toxicity resulting from an imbalance. As a result of these permitting limitations the OFW portions were avoided for the concentrate disposal options evaluated as a part of this study.

Obtaining a permit to discharge brine into the St. Johns River is an important part of the evaluation of the potential sites. A detailed overview of the permitting entities and requirements was previously prepared for SJRWMD (Reiss Environmental, 2001). In this analysis, only the required NPDES permit as it relates to discharging concentrate into surface waters will be considered. Figure 1 presents a process flow chart, which outlines a typical permitting process for concentrate discharge to a surface water body. The supporting documentation for the permit application may have to include results from toxicity tests, detailed mass balance analysis, definitions of the mixing zone, and other information showing that the natural environment at the discharge point will not be adversely affected. Permitting for each of the five sites is discussed in the individual site evaluation.

NPDES/Wastewater

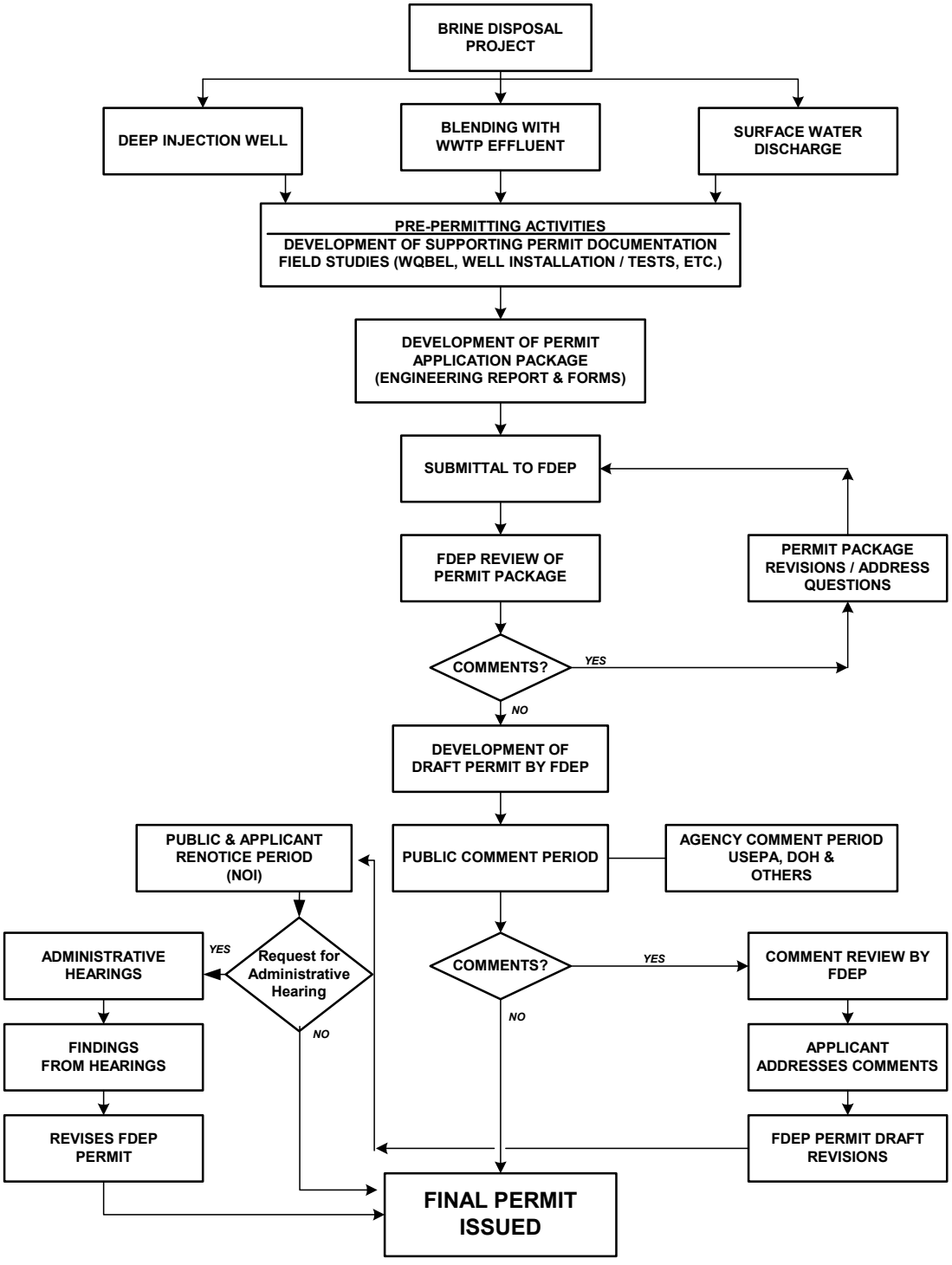
Discharge to wastewater treatment facilities was also evaluated as a concentrate management option. This option involves two scenarios: 1) the introduction of the concentrate to the influent of an existing wastewater treatment facility, whether into the collection system or at the headworks of the plant, and 2) the introduction of the concentrate to the effluent of an existing facility for surface discharge, subsurface injection, or reuse. In both cases the applicable permitting requirements were reviewed. Information on existing facilities was obtained from EPA's Envirofacts Data Warehouse, FDEP's Wastewater Treatment Facilities Reports, and FDEP's 2002 Reuse Inventory Report.

Deep Well Injection

The third concentrate management option considered as a part of this study was deep well injection. The feasibility of underground injection as a concentrate disposal option was included as a part of an investigation conducted by the SJRWMD in 2002 (Reiss Environmental, 2002). Based on this study, the ability to use deep well injection is dependent on the following criteria:

- Water Quality – TDS Concentrations in Aquifer
- Aquifer Confinement
- Transmissivity

SURFACE WATER DISCHARGE
BRINE DISPOSAL PERMITTING
PROCESS FLOW CHART



HDR Engineering, Inc.

East Central Florida Water Supply Initiative
St. Johns River Water Supply Project
Surface Water Treatment Plant Siting Study
Surface Water Discharge
Brine Disposal Permitting Process Flow

FIGURE 1

- Setbacks
- Site Suitability
- Permitting

There are two possible wells that can be utilized for concentrate disposal – Class I and Class V wells. Based on Chapter 62-528, F.A.C., Class I wells have to be completed to a depth where the TDS concentration in the aquifer exceeds 10,000 mg/l. Class V wells are usually used to inject fluids into or above underground sources of drinking water. Since the anticipated TDS of the concentrate exceeds the TDS of common underground drinking water sources, only Class I wells will be considered in this evaluation. Additionally, the TDS concentration of the concentrate is considerably greater than that of the Surficial and Upper Floridan Aquifer. Therefore, it was assumed that the Lower Floridan Aquifer is the portion of the Floridan Aquifer that is suitable for a Class I deep well injection construction.

Suitability of a site for deep injection for concentrate disposal is dependent upon the injection zone water quality, injection zone transmissivity, and the presence of adequate confinement to prohibit the upward migration of injected fluids. An investigation of subsurface injection in support of demineralized concentrate management was performed for the District by Reiss Environmental (2002). The investigation concluded that areas within the Lower Floridan Aquifer along the coast and along the St. Johns River exceeded the minimum 10,000 mg/l TDS concentration. The study also concluded that the entire area with Lower Florida Aquifer TDS concentrations greater than 10,000 mg/l had adequate transmissivity and confinement to merit further consideration and site-specific investigations of the feasibility for demineralized concentrate injection.

Setback distance from wells, springs, and faults was evaluated as part of the SJRWMD investigation as a regulatory criteria. Chapter 62-521, F.A.C. requires a minimum of 500 feet horizontal separation between a Class I injection well and a potable supply well. Public supply wells were identified and suitable areas for Class I wells identified as those at least 500 feet away. Domestic supply wells will need to be identified during site-specific investigations.

Concentrate disposal permitting can involve federal, state and local regulatory agencies. The Florida Department of Environmental Protection (FDEP), however, is the primary regulatory agency responsible for permitting concentrate disposal. The FDEP has

received federal delegation of the underground injection control (UIC) permitting program.

ALTERNATIVE DEVELOPMENT

Alternative combinations of water treatment plant sites, intake locations and points of connection were developed. These alternatives were developed to be consistent with the scenarios being costed in the St. Johns River Treatability Study and being evaluated in the Demand Projection and Affordability Study. These alternatives were developed to consider the scenarios of one water treatment plant in each of the three counties serving the needs of the county or a single water treatment plant serving multiple counties' water supply needs.

RESULTS

Water Treatment Plant Sites

The Level 3 Analysis involved a detailed site specific analysis of the five proposed water treatment plant sites. Through this analysis a field review, where possible, was conducted of each site and a more detailed analysis of the land use and anticipated land values was conducted. The finding of this analysis is presented below on a site-by-site basis.

Site B

General Site Description

Site B is approximately 51 acres in size and is located between Lake Monroe and SR 46 and west of SR 415 in Seminole County. Figure 2 presents an aerial of Site B. Site B consists of six parcels and involves three property owners. This site is currently active agricultural land.

Environmental Assessment

The environmental assessment for Site B was conducted from the roadside. The property owner indicated to the Project Team that access to the Site for field personnel was not permitted at the time of this study. Site B consists primarily of hayfields and pasture intersected by forested wind-rows crossing the site. Soils on the site are poorly drained and experience a high water table during the growing season. Wetlands on the site include shallow ditches constructed to improve site drainage. Wildlife utilization and the potential for protected species occurrences are minimal due to the agricultural improvements on the site and general absence of natural habitat. The site is bordered by mixed hardwood forest and rangeland.

Land Use/Zoning

The future land use for Site B is designated as "Suburban Estates" (SE). This future land use classification is characterized by primarily residential land uses with a minimum of one-acre residential development. This is a transitional land use between urban development and rural uses. Water treatment plants are listed as special exception uses under this future land use classification.

The zoning of the parcels within Site B is A-1, which is agricultural. Water treatment plants are not identified as a permitted use under this zoning classification. However, both public utility and service structures and water plants are considered conditional uses. As a

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site B

Figure 2

conditional use, the use as a water treatment plant would need to be reviewed by the zoning board of adjustment and a public hearing would be required before a determination is made as to whether or not the plant can be located on this site.

The future land use surrounding Site B is primarily "Suburban Estates" (SE). Directly adjacent to the east of Site B along the river, the future land use classification is Low Density Residential (LDR). Most of these parcels already have residential homes on them.

The future land use of Site B and the surrounding land uses indicate that residential development is anticipated throughout this area. Discussions with Seminole County staff have also indicated residential development is planned for this area. A water treatment plant on Site B, although allowable as a special exception in this area, is not completely consistent with the future land use plan for this area. Therefore, a water treatment plant within Site B would have some additional costs in meeting the architectural and aesthetics desirable for a residential area.

Land Valuation

Site B is currently agricultural land and the future land use is designated to be residential. Based on the current and anticipated future land use, the estimated cost for Site B is $25,000 per acre. Based on the refined site boundary and a site size of approximately 51 acres, the total estimated land cost for Site B is $1.3 million.

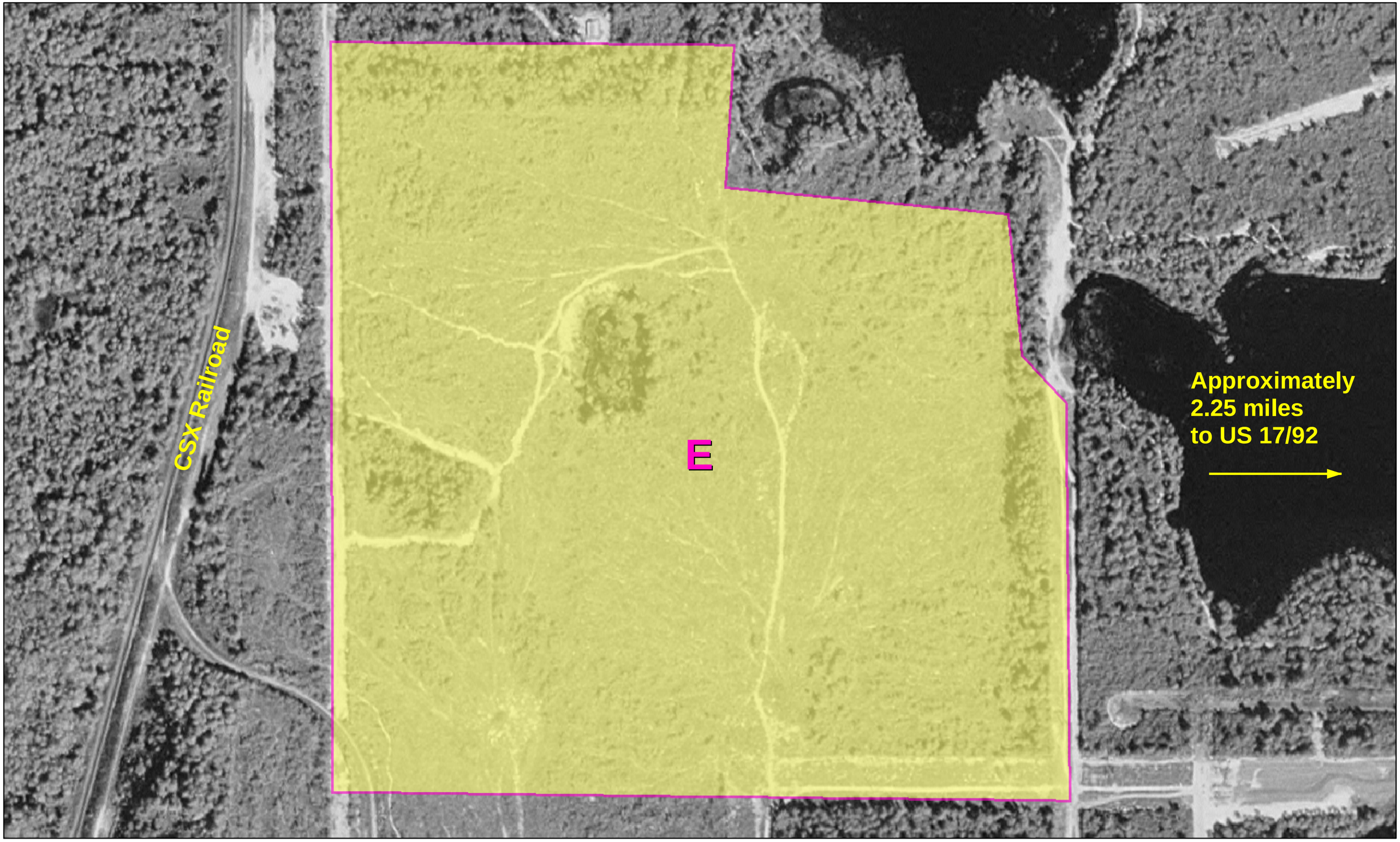
Site E

General Site Description

Site E is approximately 160 acres in size and is owned by Progress Energy. Site E is located between US 17/92 and the CSX railroad, north of Highbanks Road in Volusia County. Figure 3 presents an aerial of Site E. This site consists primarily of disturbed upland areas.

Environmental Assessment

A field review of this site was conducted with Mr. Thomas Trocheck, Director of Land Management for Progress Energy. Mr. Trocheck indicated the property was timbered in 1995. The site can be described as cutover sandpine scrub. Vegetation is extremely dense and supports a variety of shrub species including myrtle oak (*Quercus myrtifolia*), Chapman's oak (*Q chapmanii*), scrub live oak (*Q. geminata*), silkybay (*Persea humilis*), saw palmetto (*Serenoa repens*), and sandpine (*Pinus clausa*). Oak species are approximately 15 feet in height while the sandpine are approximately 30 feet in height.



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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site E

Figure 3

According to Mr. Trocheck, a survey was recently conducted and four to six Florida scrub jay (*Aphelocoma coerulescens*) colonies were found to exist onsite. However, as the habitat succeeds, and in the absence of fire or timbering, the quality of the habitat for continued support of scrub jays will deteriorate. The U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FFWCC) list the Florida scrub jay as Threatened. Gopher tortoises (*Gopherus polyphemus*) were observed on the site and are listed as a species of special concern by the FFWCC. Other listed species potentially occurring onsite include the Eastern indigo snake (*Drymarchon corais coperi*) (Threatened); Florida scrub lizard (*Sceloporous woodii*) (under review by the USFWS); short-tailed snake (*Stilosoma extenuatum*) (Threatened, FFWCC); and the Florida mouse (*Podomys floridanus*) (species of special concern, FFWCC).

There is a potential that some degree of mitigation would be required to offset impacts to wildlife and habitat associated with development of this site. Progress Energy owns approximately 2,200 acres of land in the vicinity, of which a portion could potentially provide opportunities for mitigation if required for impacts to protected species.

Land Use/Zoning

The future land use classification for Site E is "Industrial/Utilities". Because this property is owned by Progress Energy, this land use classification is specific to providing for the major electric power generation and distribution facilities within the City of DeBary. In addition to power production uses, limited development of uses not directly associated with the production of power may be permitted. The examples given include office and employment uses and conference and training centers. Although it is not specifically addressed in the City's Comprehensive Plan, the characteristics of this future land use classification and the existing land use are consistent with a water treatment facility.

The zoning classification for Site E is "Industrial Planned Unit" (IPUD). This zoning classification is consistent with the water treatment plant because it allows for "essential utility services" and "public utility uses and structures".

The surrounding future land use classifications include "Rural" uses to the north and east of the property, "Environmentally Sensitive Lands" to the west of the property, and "Industrial Planned Unit" south of the property. The "Rural" land use classification includes areas that are a

mixture of agriculture and low-density residential development. In the vicinity of Site E, there is a wastewater treatment plant as well as several Progress Energy facilities. Because of the industrial nature of this area, the placement of a water treatment plant on Site E is consistent with the future land use plans for both the City of DeBary and Volusia County.

Land Valuation

Based on its potential industrial use, the estimated cost for Site E is $15,000 per acre. The refined boundary presented for Site E included one parcel that is approximately 160 acres in size. Typically, the entire parcel would be acquired so as not to subdivide an existing parcel. However, the lands surrounding Site E are all owned by Progress Energy and therefore, it may be feasible to acquire only a portion of this parcel. The total land acquisition cost for this site is estimated to be $750,000 based on the acquisition of 50 acres for the proposed water treatment plant.

SITE G

General Site Description

Site G is approximately 138 acres in size and is located between Spring Garden Avenue and the CSX railroad just south of McGregor Road in Volusia County. Figure 4 presents an aerial of Site G. Site G is primarily comprised of disturbed upland areas. Site G consists of two parcels owned by two separate property owners.

Environmental Assessment

This site was assessed using existing mapping, aerial photography, and roadside field inspection. The majority of the site was inaccessible to field personnel as a result of heavy vegetation on the site. Soils onsite (Apopka fine sand and Paola fine sand) typically support sandpine and oak scrub. The site is undeveloped but shows evidence of past timbering. Common species include myrtle oak, Chapman's oak, scrub live oak, silkybay saw palmetto and sandpine. The shrub layer is very dense with minimal ground cover. There are no wetlands onsite.

Potential listed species onsite include the Florida scrub jay, Florida mouse, Florida scrub lizard, eastern indigo snake, short-tailed snake, and gopher tortoise. However, due to the density of the scrub vegetation and paucity of ground cover, the potential for listed species occurrences is diminished compared to undisturbed sandpine scrub communities. Should any of these species occur onsite, mitigation may be required in response to site development.

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site G

Figure 4

Land Use/Zoning

The future land use classification for Site G is "Rural". This classification includes an area characterized by a mixture of agriculture and low density residential. Specific types of land uses falling within this classification are not provided in the Volusia County Comprehensive Plan.

The zoning classification for Site G is "Rural Agriculture" (A-2). Under this zoning classification, "essential utility services" are allowable. Also, "Public Utility Uses and Structures" are listed under the special exceptions portion of this classification.

Surrounding future land use classifications include "Rural" classifications primarily to the north and east and "Conservation" classifications to the west. The railroad is located directly adjacent to the western boundary of Site G, separating it from the "Conservation" land use areas. The rural nature of the area and the future land use classifications surrounding Site G make a water treatment plant consistent with Volusia County's future land use plan for this area.

Land Valuation

The future land use for Site G is classified as rural, which includes a mixture of agriculture and low density residential. Based on this land use, the estimated land cost for Site G is $7,500 per acre. The refined site boundary for Site G consists of approximately 138 acres comprised of two equally sized parcels. While both parcels are feasible for the development of a water treatment plant, the acquisition of only one parcel is necessary to meet the needs of the proposed water treatment plant. As such, the total land acquisition cost for Site G is estimated to be $510,000 based on the acquisition of approximately 68 acres.

SITE I

General Site Description

Site I is approximately 60 acres in size and is located in Lake County at the southeast corner of the SR 44 bridge on the St. Johns River. Figure 5 presents an aerial of Site I. This site is primarily improved pastureland that has been drained by a series of shallow swales. This site is comprised of one parcel.

Environmental Assessment

Site I was reviewed with the landowner, who currently grazes beef cattle there. Improvements onsite include planting of pasture grass and a series of wet ditches used for onsite water management.

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site I

Figure 5

The site provides foraging habitat for sandhill cranes and ibis. No nesting sites suitable for sandhill cranes (marsh wetlands) are present within the proposed footprint.

Land Use/Zoning

The future land use classification for Site I is "Rural" (RU). The land use classification is a mixture of agriculture and low-density residential with development restrictions of one dwelling unit per five acres. In addition, allowable uses include neighborhood commercial and industrial uses.

The zoning classification for this site is agricultural. The purpose of this zoning district is to provide a method to preserve land most suited for agriculture, a major industry in the County. The allowable uses in this zoning classification do not include public utilities, such as water treatment plants. According to the County's land development ordinances, these uses are primarily allowable in the "Community Facility" zoning classification.

Surrounding future land use is also "Rural". The rural nature of the site and the surrounding area, along with the future land use classification, indicate that a water treatment plant is a consistent use in this area. Whether or not it is consistent with the existing zoning classification will have to be determined by Lake County.

Land Valuation

The future land use for Site I is classified as rural and includes a mixture of agriculture and low-density residential. Based on this land use, the estimated land cost for Site I is approximately $7,500 per acre. The refined site boundary for Site I consists of approximately 60 acres. The total estimated land acquisition cost for this site is $450,000.

SITE K

General Site Description

Site K is approximately 40 acres in size. This site is located in northwestern Seminole County north of SR 46, between Orange Boulevard and the St. Johns River. Figure 6 presents an aerial of Site K. This site is owned by Seminole County and is adjacent to the County's wastewater treatment facility.

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site K

Figure 6

Environmental Assessment

This site is underlain by Astatula fine sand which is excessively drained and has a water table more than eighty inches below the surface. The site is entirely upland and consists of clear-cut sandpine scrub. Saw palmetto is the dominant cover. One gopher tortoise burrow was observed onsite and complete surveys for gopher tortoise should be completed prior to site development. Florida black bear have been observed onsite utilizing adjacent forested wetland for forage and refuge (personal communication, Seminole County). A Florida scrub jay management and mitigation area is located just west of the site. The proposed treatment plant site, in its current condition, is not suitable for the support of scrub jays.

Land Use/Zoning

The future land use classification for Site K is "Public/Quasi-Public" (PUBC). This land use classification specifically includes public uses such as transportation, communication and utilities. Water facilities are listed under the allowable uses for this future land use code.

The zoning for Site K is A-1, which is primarily agricultural. Water treatment plants are not identified as a permitted use under this zoning classification. However, both public utility and service structures and water plants are considered conditional uses. As a conditional use, this use would need to be reviewed by the zoning board of adjustment and a public hearing would be required before a determination is made as to whether or not the plant can be located on this site.

The land use adjacent to the east boundary of Site K is an existing residential subdivision. The future land use classification for this adjacent area is "Suburban Estates" (SE). However, because of the future land use classification of Site K and the presence of an existing wastewater treatment plant in this area, a water treatment plant is consistent with the future land use plan for this property. The residential nature of the adjacent property should be considered in the treatment plant design should Site K be selected as the location of a water treatment plant.

Land Valuation

Site K is currently owned by Seminole County and is being used for utility purposes. As a result, it is assumed at this time that there are no land acquisition costs associated with Site K. If a utility other than

Seminole County develops a water treatment plant at this site, there may be land acquisition costs associated with this site at that time.

PIPELINE ROUTES

The pipeline routes identified through the least costs path evaluation in the Level 2 Analysis were refined based on field review and further development of the alternative scenarios. The pipeline routes for each of the alternatives are further discussed below.

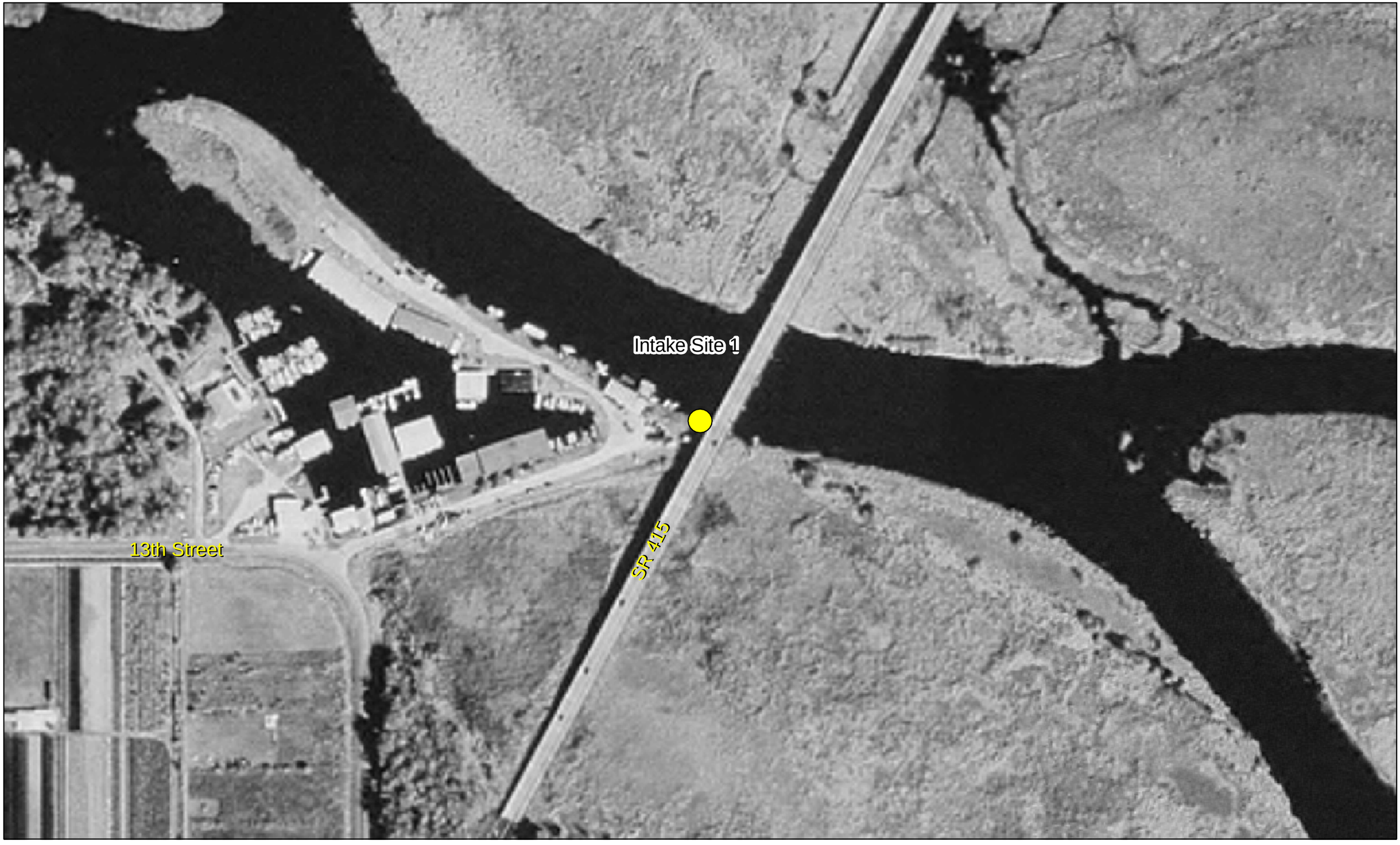
INTAKE SITES

Site 1

Site 1 is located at the southwest quadrant of the SR 415 crossing of the St. Johns River in Seminole County. Currently this upland site is developed with a riverside restaurant and associated parking. Relocation of the restaurant and parking may be required to develop an intake structure at this site. Marsh wetlands associated with the St. Johns River floodplain are located adjacent to the proposed site. Due to the developed nature of the site, habitat suitable for the support of wildlife is minimal. Figure 7 presents the aerial photograph of Intake Site 1.

Site 2

Site 2 is located coincident with high voltage power lines that cross the St. Johns River south of Konomac Lake. These power lines extend to the south through Seminole County property and abut treatment plant Site K. Wetlands at this site are abundant, supporting marsh and scrub shrub communities. Common species include bald cypress (*Taxodium distichum*), cattail (*Typha latifolia*), southern bayberry (*Myrica cerifera*), salt bush (*Baccharis halimifolia*), common reed (*Phragmites australis)*, and maidencane (*Panicum* spp.). These wetlands appear to be an artifact of cleared forested wetlands under the power lines. Other constraints at this site include the power lines themselves as well as a buried gas pipeline. Florida black bear have been documented onsite and likely traverse the powerline as they move throughout extensive forested wetlands in the area. The marsh wetlands provide forage for a variety of wading birds, including great blue herons, which were observed along the river shoreline. Figure 8 presents an aerial photograph of Intake Site 2.



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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 1
Figure 7

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ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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N

Feet

0 2,000 4,000 6,000 8,000

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 2
Figure 8

Site 3

Site 3 is located on the north side of the St. Johns River just south of Konomac Lake. Herbaceous and forested wetlands dominate the water's edge and extend landward approximately 100 ft. Dominant species include common reed and red maple (*Acer rubrum*). Uplands landward of the river edge consist of turf grass shaded by large live oaks (*Quercus virginiana*). This area is used by residents of the Meadowlea on the River residential community for passive recreation. A fenced RV and boat storage complex is located adjacent to the proposed intake site. Due to the developed nature of the site, wildlife utilization is minimal and generally limited to the river edge. Figure 9 presents an aerial photograph of Intake to Site 3.

Site 4

Site 4 is located on the St. Johns River just west of Konomac Lake. The shoreline is comprised of a narrow sandy beach supporting a variety of prostrate herbs, which quickly transition to a bluff and uplands. The bluff is roughly 10 feet above the river edge. Uplands onsite are comprised of cleared pasture dotted with scrub live oak (*Quercus geminata*) and laurel oak (*Quercus laurifolia*) near the water's edge. Impacts to wetlands at this location would be minor and limited due to the bluff. Land use on the site is upland improved pasture. Figure 10 presents an aerial photograph of Intake to Site 4.

Site 5A

Site 5A is located northwest of the northwest corner of Konomac Lake. A series of small private boat docks line the shoreline, which serves the Traders Cove residential community. Shrub and marsh wetland dominate the shoreline upstream of the boat docks. Dominant species include common reed, salt bush, southern bayberry, Carolina willow (*Salix caroliniana*), and red maple. Spatter-dock (*Nuphar* spp.), a floating aquatic plant, is common along the water's edge. Oak-dominated uplands lie landward of the wetland. Impacts associated with this site include wetland marsh, scrub shrub wetlands and upland forest. These wetlands provide foraging and roosting habitat for wading birds. Figure 11 presents an aerial photograph of Intake to Site 5A.

Site 5B

Site 5B was added as a result of field reviews and serves as an alternate site to Site 5A which would potentially result in impacts to wetlands. Site 5B is located adjacent to a public boat ramp at the end of West Highbanks Road. The river shoreline rises quickly to oak hammock.

HDR

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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N

Feet

0 1,900 3,800 5,700 7,600

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 3
Figure 9

HDR

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

N

Feet

0 1,900 3,800 5,700 7,600

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 4
Figure 10

HDR

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

N

Feet

0 1,900 3,800 5,700 7,600

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 5A and Intake Site 5B
Figure 11

Impacts to wetlands would be limited due to the narrow shoreline. The intake pump station at this site would be located further inland to avoid impacts to the parking associated with the boat ramp and the adjacent residential property. Figure 11 presents an aerial photograph of Intake to Site 5B.

Site 6

Site 6 is located just west of treatment plant Site G and the CSX railroad on the eastern shore of Lake Beresford. The site is comprised of hardwood forest wetland extending landward approximately 450 feet to the railroad. Dominant species include Carolina willow, red maple elm (*Ulmus* spp.), buttonbush (*Cephalanthus occidentalis*), and bald cypress. Herbaceous cover extends into the water and includes smartweed (*Polygonum* spp.) and pennywort (*Hydrocotyl* spp.). Impacts associated with this site include forested wetland impacts and crossing of the CSX railroad. The wetlands onsite provide roosting and foraging habitat for wading birds. Figure 12 presents an aerial photograph of Intake to Site 6.

Site 7

Site 7 is located in Lake County on the northwest quadrant of the SR 44 crossing of the St. Johns River. A natural upland berm parallels the shoreline and is dominated by live oak (*Quercus virginiana*) and laurel oak (*Q. laurifolia*). Approximately 100 feet landward of the shoreline, the berm ends and transitions into forested wetland. Common tree species in this wetland include laurel oak, American elm (*Ulmus american*), water oak (*Q. nigra*), red maple (*Acer rubrum*), blue beech (*Carpinus caroliniana*), buttonbush (*Cephalanthus occidentalis*), bald cypress (*Taxodium distichum*) and Carolina ash (*Fraxinus caroliniana*). Ground cover consists of Virginia chain fern (*Woodwardia virginica*), poison ivy (*Toxicodendron radicans*), and catbriar (*Smilax* spp.). Although forested wetland will be impacted at this location, the site takes advantage of co-location with existing linear infrastructure being adjacent to SR 44. Figure 13 presents an aerial photograph of Intake to Site 7.

Site 8

Site 8 is located in Lake County approximately 1 mile south of SR 44 on the west bank of the St. Johns River near treatment plant Site I. This upland site consists of planted upland grass and is dotted by large live oak trees. Horses graze the site. The upland pasture slopes down towards the water's edge and can be characterized as a seepage slope, roughly 200 feet wide, and paralleling the shoreline. During site

reviews in August 2003, the ground was saturated and was dominated by a variety of sedges (*Cyperus* spp.), smartweed (*Polygonum* spp.), and pennywart (*Hydrocotyl umbellata*). This wet seepage slope provides limited habitat for wildlife due to its use as pasture. Figure 14 presents an aerial photograph of Intake to Site 8.

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ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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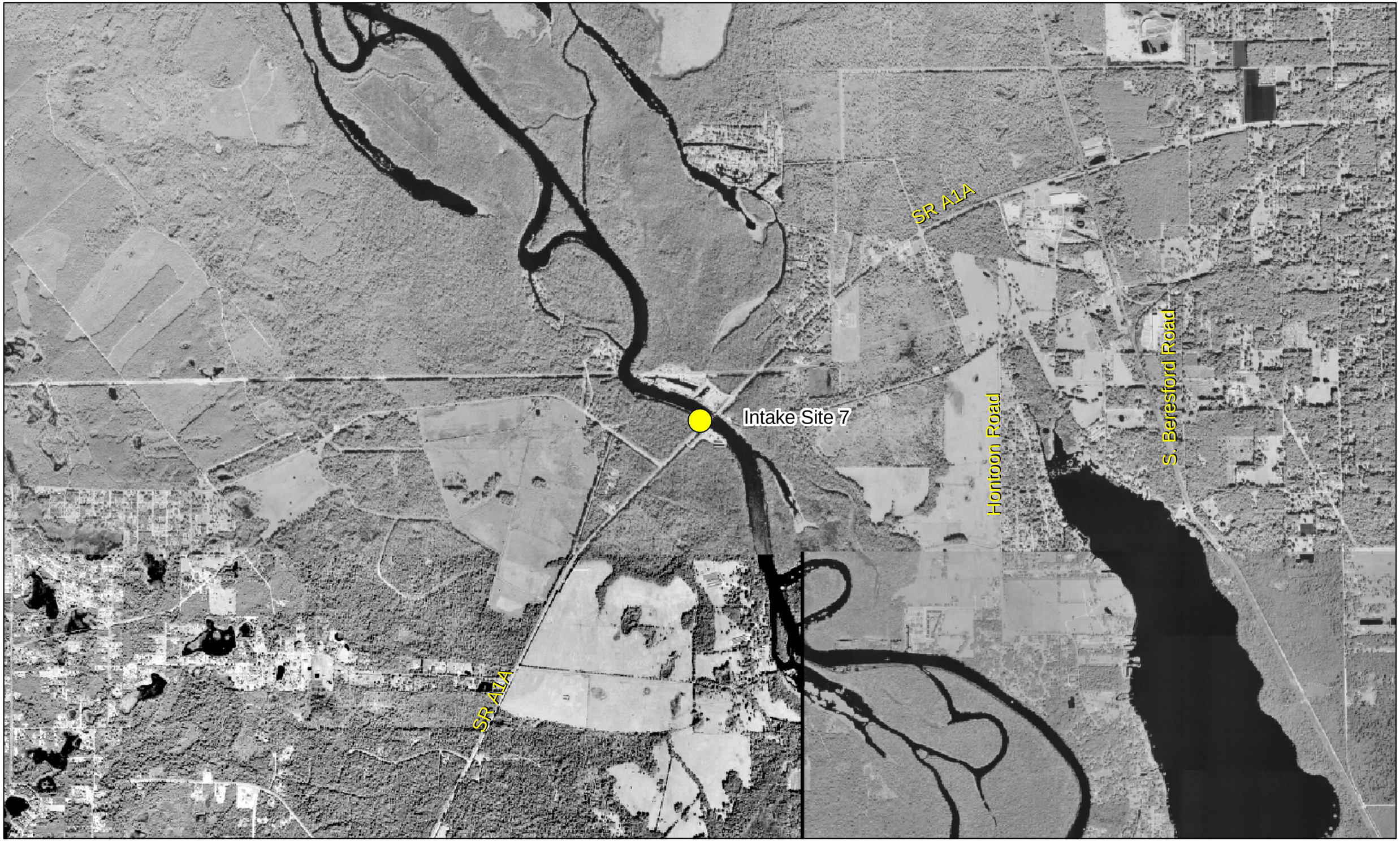
N

Feet

0 1,900 3,800 5,700 7,600

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 6
Figure 12



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ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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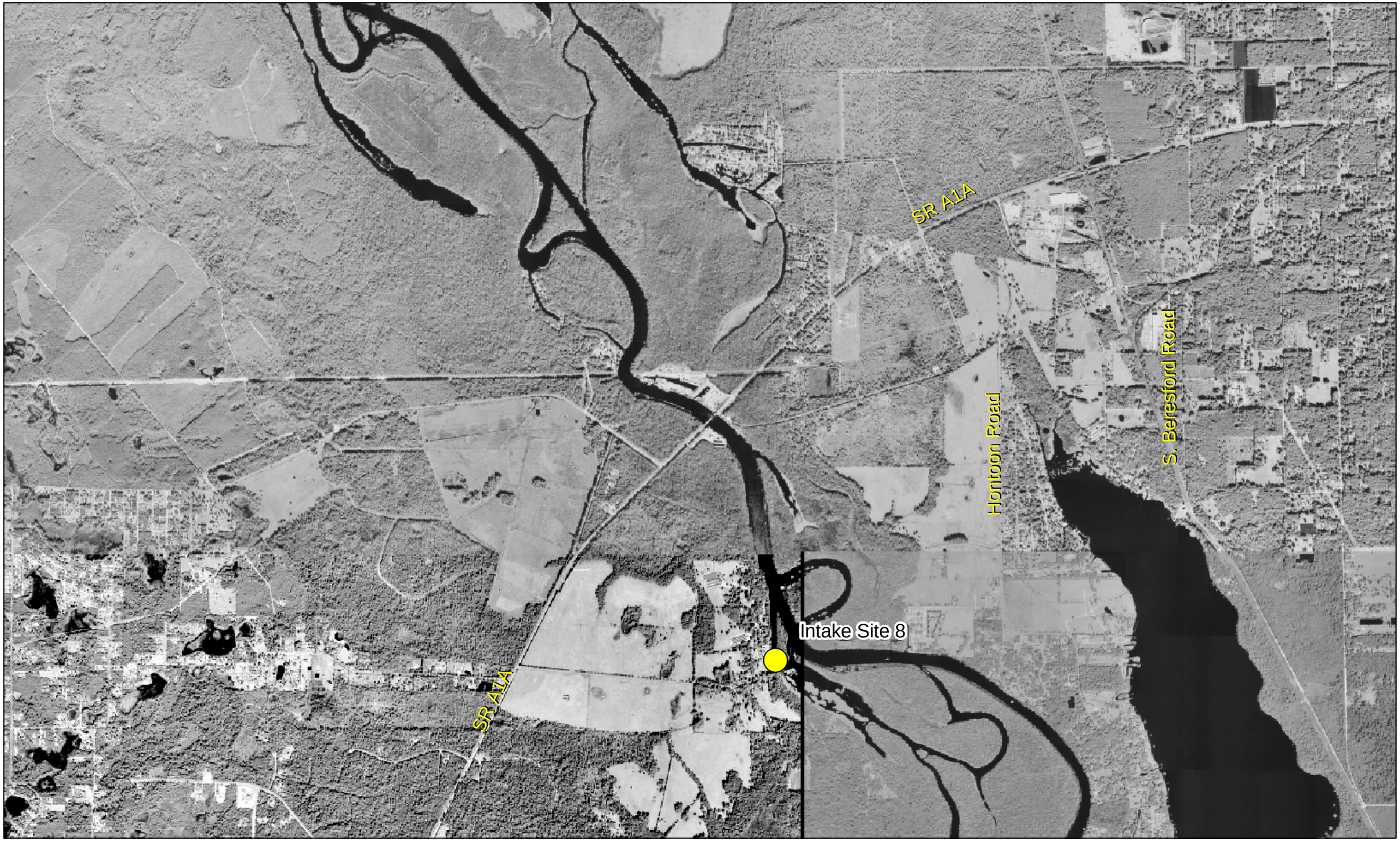
N

Feet

0 1,900 3,800 5,700 7,600

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 7
Figure 13



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ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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N

Feet

0 1,900 3,800 5,700 7,600

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Intake Site 8
Figure 14

CONCENTRATE MANAGEMENT OPTIONS

A summary of the three concentrate disposal options evaluated for the five surface water treatment plants is provided below. Each of these options will require significant analysis as a part of the permitting process.

Surface Water

Discharge to the St. Johns River is the concentrate disposal option that has been the most fully evaluated to date as a part of the St. Johns River Water Supply Project. A discussion of the potential for surface water discharge is presented on a site-by-site basis. Figure 15 presents the discharge locations and the proposed pipeline routes from the water treatment plant sites to these discharge locations.

Site B

Located within half a mile of Lake Monroe, Site B has a potential for surface water discharge of the concentrate. Lake Monroe is a flow-through water body, which may provide an adequate mixing velocity and mixing zone for the concentrate. A Risk Assessment was recently completed for the discharge of concentrate to Lake Monroe (CH2M Hill, 2002). As a part of this study, the preliminary indication was that the discharge of concentrate to Lake Monroe was potentially feasible. The pipeline route associated with the discharge location for Site B will be shorter than the pipeline routes associated with the other sites, due to the close proximity of Site B to Lake Monroe.

Site E

The potential concentrate disposal pipeline route to a surface discharge point for Site E is approximately 6.3 miles long and is designed to avoid discharge into OFW. Portions of this pipeline route pass through Progress Energy-owned property. Land use analysis indicates that this pipeline route will impact wetlands, agricultural lands, uplands, and pine forested areas.

Interstate
State/US Road
Local Road
Railroad Track
County Line

Outstanding Florida Waters
Conservation Lands
Proposed Conservation Lands
Candidate Site
Potential Concentrate Pipeline Routes

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
DeLand
Ocala National Forest
Lake Beresford
Hontoon Island State Park
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Lake Helen
Orange City
DeBary
Lydia Preserve
Deltona
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Wekiva Springs State Park
Lake Mary
Sanford
Orlando-Sanford Airport
Lake Jessup

15A
92
44
42
4
472
17
92
431
46
46A
415
417

G
E
K
B

HDR
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Concentrate Management
Figure 15

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Site G

The potential concentrate disposal pipeline route to a surface water discharge for Site G is approximately 4.8 miles and leads to a discharge location where the St. Johns River is not classified as an OFW. This route impacts residential and commercial areas, uplands, lakes, wetlands and wooded areas.

Site I

The preferred surface discharge pipeline route for Site I is approximately 1.4 miles and discharges into a portion of the St. Johns River that is not designated as an OFW. The route passes through a marina, agricultural lands, and wetlands.

Site K

The surface water discharge pipeline route for Site K is approximately 3 miles and passes through uplands, streams and wetlands. The discharge location is not in the area of OFW.

NPDES/Wastewater

The permitting process associated with the blending of demineralization concentrate with wastewater depends primarily on where the concentrate is introduced into the wastewater process. Permitting requirements associated with this concentrate management option were presented in "Technical Memorandum B.5, Applicable Rules and Regulations for Concentrate Management" by Reiss Environmental, Inc.

The potential for blending concentrate from the surface water treatment plant with wastewater is discussed below on a site-specific basis. Discharge to wastewater treatment plants was determined to be feasible if the site was located within 7 miles of an existing wastewater treatment plant (Figure 16) or within 6 miles of a possible irrigation location (Figure 17). For all of the sites, the discharge of concentrate to wastewater treatment plants is not recommended as the sole concentrate management option. However, the feasibility of a portion of the concentrate flow to be discharged to wastewater treatment plants does exist for some sites and recommendations for further studies are presented.

Discharge Facility
7 Mile Radius
Conservation Lands
Proposed Conservation Lands
Candidate Site
Interstate
State/US Road
Local Road
Railroad Track
County Line

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
DeLand
44
Ocala National Forest
44
42
Lake Beresford
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
17 92
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Lyonia Preserve
Deltona
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
431
Central Florida Zoo
4
46
415
17 92
415
Sanford
46A
Lake Mary
46
Wekiva Springs State Park
Orlando-Sanford Airport
417
Lake Jessup

Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
EPA Classified Major Discharge Facilities

Figure 16

map_b_p_fig_16.mxd - 1/16/04

Irrigation Locations
6 Mile Radius
Conservation Lands
Proposed Conservation Lands
Candidate Site
Interstate
State/US Road
Local Road
Railroad Track
County Line

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
DeLand
Ocala National Forest
Lake Beresford
Lake Helen
Hontoon Island State Park
Orange City
Lower Wekiva River State Reserve
Blue Spring State Park
Lyonia Preserve
Deltona
LAKE COUNTY
VOLUSIA COUNTY
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
Sanford
Lake Mary
Wekiva Springs State Park
Orlando-Sanford Airport
Lake Jessup

Miles
0 1 2 3 4

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Existing Irrigation Locations

Figure 17

map_b_p_fig_17.mxd - 2/04/04

Site B

Site B is located approximately 7 miles from the Sanford Municipal Water Treatment Plant (WTP) (FL0020141) as shown in Figure 16. This treatment facility has a permitted capacity of 7.3 mgd and an average annual flow of 4.21 mgd. Based on this apparent available capacity, the plant may be able to receive a portion of the concentrate in the collection system or at the headworks of the wastewater treatment facility. Further investigation into this concentrate management option would be required.

Effluent from this facility goes to reuse and during wet weather conditions is discharged to Lake Monroe. Specific information regarding reuse for Sanford is listed in Table 1.

Table 1. Sanford Reuse System Information

Reuse Type	Reuse	Capacity (mgd)	Flow (mgd)	Area (acres)
Agricultural Irrigation	Other Crops	2.59	1.25	669
Agricultural Irrigation	Edible Crops	2.13	0.15	300
Public Access Areas & Landscape Irrigation	Other Public Access Areas	2.55	0.31	15
Public Access Areas & Landscape Irrigation	Golf Course Irrigation	1.40	0.43	250
Industrial	At Treatment Plant	0.55	0.55	
Industrial	At Other Facilities	0.08	0.08	
Public Access Areas & Landscape Irrigation	Residential Irrigation	0.83	0.53	565

In order to blend concentrate with existing irrigation water, additional studies on the tolerance of the specific vegetative species to the blended water quality would have to be performed. The proximity to Site B would also have to be established.

The permitted capacity of discharge to Lake Monroe according to the NPDES is 1.00 mgd while the annual average flow is 0.90 mgd. The NPDES permit would have to be modified if concentrate was blended with this existing effluent.

Site E

Site E is located approximately 4.5 miles from the Florida Power and Light Sanford Power Plant (FL0001554) as shown in Figure 16. This treatment facility has a permitted capacity of 180 mgd. However, the cooling water process at this facility is a closed loop process and actual discharge from the facility is intermittent. In addition, treatment of the concentrate to reduce TDS levels would be required prior to blending the concentrate with the cooling water. For these reasons, the blending of concentrate with the cooling water is not a feasible concentrate management option for this site.

Site G

Site G is located approximately 4 miles from the Deland Regional Wastewater Treatment Facility (WWTF) (FL0020303) as shown in Figure 16. This treatment facility has a permitted capacity of 6.0 mgd and an average annual flow of 2.52 mgd. The permitted surface water discharge from this facility is 4.0 mgd. Based on this apparent available capacity, the plant may be able to receive a portion of the concentrate in the collection system or at the headworks of the wastewater treatment facility. Further investigation into this concentrate management option would be required.

Effluent from this facility goes to reuse and surface water discharge to the St. Johns River. Specific information regarding reuse for the Deland Regional WWTF is listed in Table 2.

Table 2. Deland Regional WWTF Reuse System Information

Reuse Type	Reuse	Capacity (mgd)	Flow (mgd)	Area (acres)
Public Access Areas & Landscape Irrigation	Other Public Access Areas	2.27	0.27	580
Industrial	At Treatment Plant	0.25	0.20	
Public Access Areas & Landscape Irrigation	Golf Course Irrigation	2.30	0.79	300
Public Access Areas & Landscape Irrigation	Residential Irrigation	0.45	0.03	70

In order to blend concentrate with existing irrigation water, additional studies on the tolerance of the specific vegetative species to the blended water quality would have to be performed. The proximity to Site G would also have to be established.

The permitted capacity of discharge to the St. Johns River according to the NPDES for the DeLand Regional WWTF is 6.00 mgd while the annual average flow is 1.24 mgd. The NPDES permit would have to be modified if concentrate was blended with this existing effluent.

Site I

Site I is not located within 7 miles of an existing wastewater treatment facility or within 6 miles of an existing irrigation location. Therefore, discharge to a wastewater treatment facility is not a feasible concentrate management option for this site.

Site K

Site K is located within a mile of the Northwest Regional Wastewater Treatment Plant (WWTP) (FL0042625) as shown in Figure 16. This treatment facility has a permitted capacity of 2.5 mgd and an average annual flow of 1.28 mgd. Based on this apparent available capacity, the plant may be able to receive a portion of the concentrate in the collection system or in the headworks of the wastewater treatment facility. Further investigation into this concentrate management option would be required.

Effluent from this facility goes to reuse. Specific information regarding reuse for the Northwest Regional WWTP is listed in Table 3.

Table 3. Northwest Regional WWTP Reuse System Information

Reuse Type	Reuse	Capacity (mgd)	Flow (mgd)	Area (acres)
Groundwater Recharge & Indirect Potable Reuse	Rapid Infiltration Basins	0.36	0.23	22
Public Access Areas & Landscape Irrigation	Other Public Access Areas	0.08	0.04	
Wetlands		2.50	0.87	
Agricultural Irrigation	Other Crops	0.35	0.14	73

In order to blend concentrate with existing irrigation water, additional studies on the tolerance of the specific vegetative species to the blended water quality would have to be performed. The proximity to Site K would also have to be established.

Deep Well Injection

The approximate location of each proposed water treatment plant site is shown on a map of areas meeting the regulatory and technical criteria for potential Lower Floridan Aquifer injection (Figure 18). The feasibility of underground injection is discussed below for each proposed water treatment plant site based on its location relative to the identified suitable areas in the SJRWMD investigation.

Class I wells would most likely be required for this project due to the location of the proposed treatment plant sites and anticipated TDS concentrations of the concentrate, which would exceed that of the Surficial and Upper Floridan Aquifer systems. The anticipated TDS of the concentrate from the proposed plant is estimated to be 4,300 mg/l on average. TDS concentration of the receiving formation must equal or exceed 10,000 mg/l for a Class I well. Areas in the Upper Floridan Aquifer exceeding a TDS of 10,000 mg/l in the SJRWMD are very limited. TDS concentration of the Upper Floridan Aquifer in the area of the five proposed treatment plant sites ranges from approximately <500 to 3,000 mg/l (Reiss Environmental, 2002; FGS, 1992), which makes the Upper Floridan Aquifer unsuitable for a Class I injection well in these areas. TDS concentration of the Lower Floridan Aquifer apparently exceeds 10,000 mg/l generally along the coast and along areas of the St. Johns River in the general area of the five proposed water treatment plant sites (Figure 1). Because it is deeply buried and contains poor quality water, the Lower Floridan Aquifer has not been intensively drilled or tested; therefore the character of the aquifer is not well known (Miller, 1986). The TDS of the proposed injection zone for any proposed water treatment plant site would require site-specific verification during drilling of a test injection well.

Site B

Site B appears to be located in an area that would meet regulatory and technical criteria for injection of concentrate into the Lower Floridan Aquifer. The site appears to be just north of a proposed offset area for faults that have been identified along the St. Johns River in this area (Reiss Environmental, 2002). More detailed site-specific investigation may be necessary to determine the potential impact of these features on a proposed injection well. A test well would be required during the permitting process to confirm the suitability of the site for a Class I injection well.

Site E

Site E appears to be located in an area that would meet regulatory and technical criteria for injection of concentrate into the Lower Floridan Aquifer. However, the site appears to be just west of a proposed offset area for faults and springs that have been identified along the St. Johns River in this area (Reiss Environmental, 2002). More detailed site-specific investigation may be necessary to determine the potential impact of these features on a potential injection well. A test well would be required during the permitting process to confirm the suitability of the site for a Class I injection well.

Site G

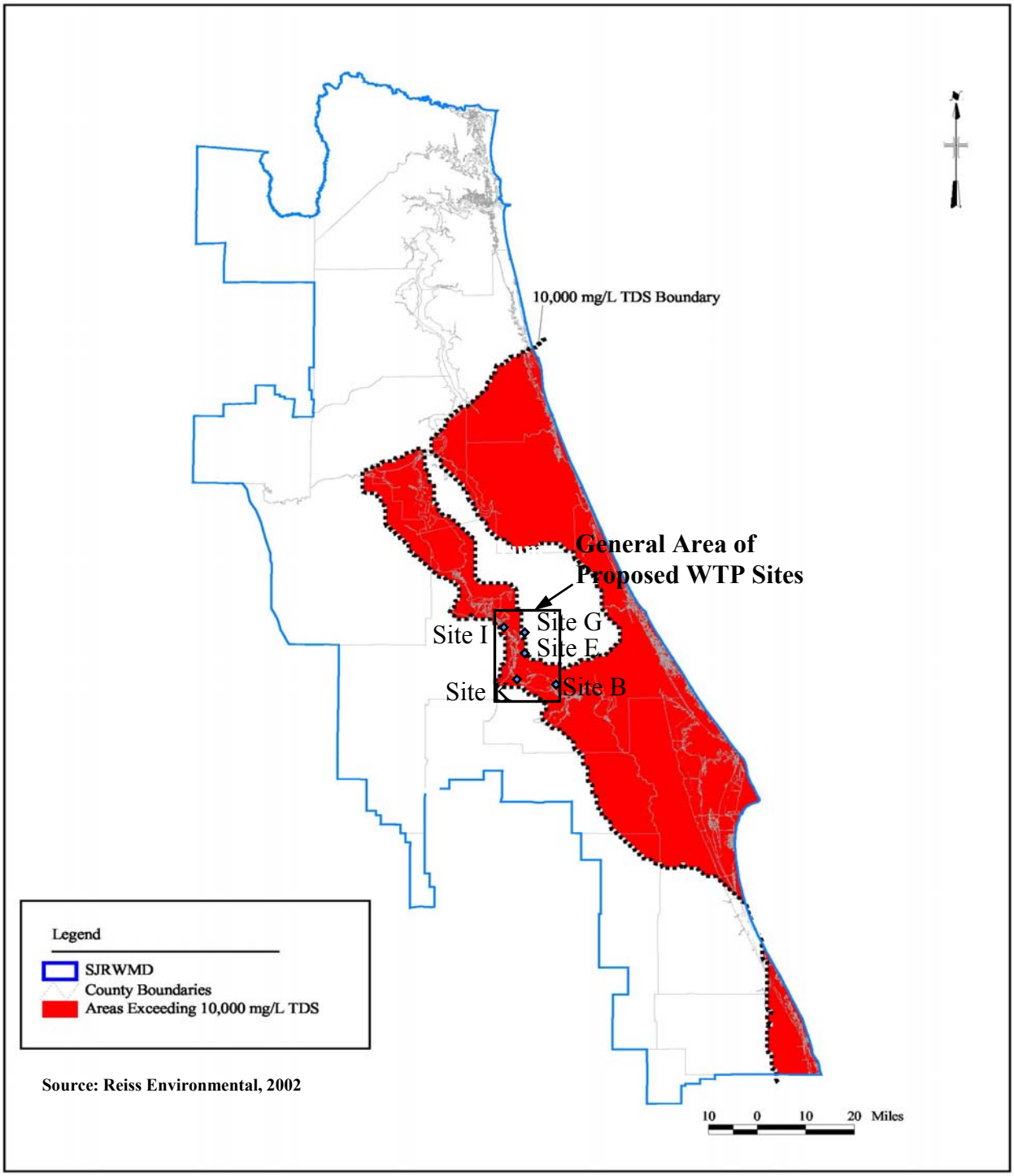
Site G appears to be located in an area that may not meet regulatory and technical criteria for injection of concentrate into the Lower Floridan Aquifer. The site appears to be located within an offset area for faults that have been identified along the St. Johns River in this area (Reiss Environmental, 2002). The site is also located close to the 10,000 mg/l TDS concentration boundary for the Lower Floridan Aquifer. More detailed site-specific investigation may be necessary to determine the potential impact of these geologic features on a potential injection well and to confirm the TDS of the Lower Floridan Aquifer in this area.

Site I

Site I appears to be located in an area that may not meet regulatory criteria for injection of concentrate into the Lower Floridan Aquifer. The site is located in close proximity to the 10,000 mg/l TDS concentration boundary for the Lower Floridan Aquifer. More detailed site-specific investigation may be necessary to confirm the TDS of the Lower Floridan Aquifer in this area.

Site K

Site K appears to be located in an area that may not meet regulatory criteria for injection of concentrate into the Lower Floridan Aquifer. The site is located in close proximity to the 10,000 mg/l TDS concentration boundary for the Lower Floridan Aquifer. More detailed site-specific investigation may be necessary to confirm the TDS of the Lower Floridan Aquifer in this area.



Areas Exceeding 10,000 mg/L TDS for the Lower Floridan Aquifer

HDR Engineering, Inc.	East Central Florida Water Supply Initiative St. Johns River Water Supply Project Surface Water Treatment Plant Siting Study	Figure 18

Interstate
State/US Road
Local Road
Railroad Track
County Line
Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
To Point of Connection in Daytona Beach Area
DeLand
Point of Connection 6
44
Ocala National Forest
Intake Site 7
Intake Site 8
42
Lake Beresford
Intake Site 6
C
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Point of Connection 5
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Lyonia Preserve
E
Deltona
Point of Connection 4
Intake Site 5B
Intake Site 5A
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Intake Site 4
St. Johns River
Intake Site 3
Lake Monroe
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
Intake Site 2
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
K
431
4
Wekiva River
46
415
B
Intake Site 1
17 92
415
Sanford
Point of Connection 2
46A
46
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
Point of Connection 3
Point of Connection1
417
Lake Jessup

HDR
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Miles
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N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Shortlisted Water Treatment Plant Sites
Figure 19

map_b_p_fig_19.mxd - 1/16/04

ALTERNATIVE DEVELOPMENT

Alternative combinations of water treatment plant sites, points of connection and intake locations were developed based on the scenarios being costed in the St. Johns River Treatability Study and evaluated in the Demand Projection and Affordability Study. A series of nine potential alternative combinations was developed. These alternatives are discussed below. Figure 19 presents all of the water treatment plant sites, raw water intake locations, points of connection and all of the interconnecting pipeline associated with these alternatives with the exception of the concentrate disposal pipelines.

Site E - Volusia County Alternative

This alternative presents the potential for one treatment plant located at Site E to serve all of western Volusia County. Potential raw water intakes for Site E are located at Intake Sites 3, 4, 5A and 5B. The finished water would be delivered to points of connection in DeLand, Deltona and DeBary (Points of Connection 4, 5 and 6). Approximately 7.2 miles of raw water intake pipeline and 18.4 miles of finished water pipeline would be required for this alternative. Figure 20 presents this alternative.

Site G - Volusia County Alternative

This alternative presents the potential for one treatment plant located at Site G to serve all of western Volusia County. A potential raw water intake for this alternative is located at Intake Site 6. The finished water would be delivered to points of connection in DeLand, Deltona and DeBary (Points of Connection 4, 5, and 6). Approximately 0.25 miles of raw water intake pipeline and 17.2 miles of finished water pipeline would be required for this alternative. Figure 21 presents this alternative.

Site B - Seminole County Alternative

This alternative presents the potential for one water treatment plant located at Site B to serve Seminole County. The potential raw water intake for Site B is located at Intake Site 1. The finished water would be delivered to points of connection in the Sanford and Lake Mary areas (Points of Connection 1, 2, and 3). Approximately 0.65 miles of raw water pipeline and 14.4 miles of finished water pipeline would be associated with this alternative. Figure 22 presents this alternative.

Site K - Seminole County Alternative

This alternative presents the potential for one treatment plant located at Site K to serve Seminole County. The potential raw water intake for Site K is located at Intake Site 2. The finished water would be delivered to points of connection in the Sanford and Lake Mary areas (Points of Connection 1, 2, and 3). Approximately 2.7 miles of raw water pipeline and 15.5 miles of finished water pipeline would be associated with this alternative. Figure 23 presents this alternative.

Site E - Seminole County and Southern Volusia County Alternative

This alternative presents the potential for one water treatment plant located at Site E to serve Seminole County and southern Volusia County. The potential raw water intakes for Site E are located at Intake Sites 3, 4, 5A and 5B. The finished water would be delivered to points of connection in Seminole County and southern Volusia County (Points of Connection 1, 2, 3, 4, and 5). The finished water pipeline would parallel the raw water lines from Site E to the St. Johns River and would cross the river in between proposed Intake Sites 2 and 3. Approximately 7.2 miles of raw water pipeline and 36.2 miles of finished water pipeline would be associated with this alternative. Figure 24 presents this alternative.

Site K - Seminole County and Southern Volusia County Alternative

This alternative presents the potential for one water treatment plant located at Site K to serve Seminole County and southern Volusia County. The potential raw water intake for Site K is located at Intake Site 2. The finished water would be delivered to points of connection in Seminole County and southern Volusia County (Points of Connection 1, 2, 3, 4, and 5). The finished water pipeline would parallel the raw water intake line from Site K across the St. Johns River to the approximate location of Site E. Approximately 2.7 miles of raw water pipeline and 36.2 miles of finished water pipeline would be associated with this alternative. Figure 25 presents this alternative.

Interstate
State/US Road
Local Road
Railroad Track
County Line
Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
To Point of Connection in Daytona Beach Area
DeLand
Point of Connection 6
44
Ocala National Forest
44
42
Lake Beresford
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Point of Connection 5
Lower Wekiva River State Reserve
Blue Spring State Park
Lyonia Preserve
LAKE COUNTY
VOLUSIA COUNTY
E
Deltona
Point of Connection 4
Intake Site 5B
Intake Site 5A
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Intake Site 4
St. Johns River
Intake Site 3
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
431
4
46
Wekiva River
415
17 92
415
Sanford
46A
46
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
417
Lake Jessup

Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site E - Volusia County Alternative

Figure 20

map_b_p_fig_20.mxd - 1/16/04

Interstate
State/US Road
Local Road
Railroad Track
County Line
Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
Ocala National Forest
DeLand Municipal Airport
DeLand
To Point of Connection in Daytona Beach Area
Point of Connection 6
Intake Site 6
Lake Beresford
Hontoon Island State Park
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Orange City
Point of Connection 5
Point of Connection 4
Lyonia Preserve
Deltona
Lake Helen
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Central Florida Zoo
Lake Monroe Conservation Area
Wekiva River
Wekiva Springs State Park
Lake Mary
Sanford
Orlando-Sanford Airport
Lake Jessup

92
15A
44
42
472
4
431
46
17
92
46A
415
417

Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site G - Volusia County Alternative

Figure 21

map_b_p_fig_21.mxd - 1/16/04

Interstate
State/US Road
Local Road
Railroad Track
County Line

Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
Ocala National Forest
DeLand Municipal Airport
DeLand
Lake Beresford
Hontoon Island State Park
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Konomac Lake
Orange City
Lake Helen
Lyonia Preserve
Deltona
DeBary
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
Wekiva River
Wekiva Springs State Park
Lake Mary
Sanford
Orlando-Sanford Airport
Lake Jessup
Intake Site 1
Point of Connection 2
Point of Connection 3
Point of Connection1

15A
92
44
42
472
4
431
46
46A
17
92
415
417

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Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site B - Seminole County Alternative

Figure 22

map_b_p_fig_22.mxd - 1/16/04

Interstate
State/US Road
Local Road
Railroad Track
County Line

Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
DeLand
44
Ocala National Forest
44
42
Lake Beresford
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Lyonia Preserve
Deltona
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
Intake Site 2
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
K
431
Central Florida Zoo
4
Wekiva River
46
415
17 92
415
Sanford
Point of Connection 2
46A
46
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
Point of Connection 3
Point of Connection1
417
Lake Jessup

Miles
0 1 2 3 4

N

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site K - Seminole County Alternative

Figure 23

map_b_p_fig_23.mxd - 1/16/04

Interstate
State/US Road
Local Road
Railroad Track
County Line

Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
DeLand
44
Ocala National Forest
44
42
Lake Beresford
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Point of Connection 5
Lower Wekiva River State Reserve
Blue Spring State Park
Lyonia Preserve
LAKE COUNTY
VOLUSIA COUNTY
E
Deltona
Point of Connection 4
Intake Site 5B
Intake Site 5A
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Intake Site 4
Intake Site 3
St. Johns River
Lake Monroe
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
Central Florida Zoo
431
4
46
415
17 92
Sanford
415
Point of Connection 2
46A
46
Wekiva River
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
Point of Connection 3
Point of Connection1
417
Lake Jessup

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Miles
0 1 2 3 4

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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site E - Seminole & Southern Volusia Counties' Alternative

Figure 24

map_b_p_fig_24.mxd - 02/04/04

Interstate
State/US Road
Local Road
Railroad Track
County Line

Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
Bereau of Transportation Statistics, 1994
Seminole County Stormwater Engineering, 1999
Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
DeLand
44
Ocala National Forest
44
42
Lake Beresford
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Point of Connection 5
Lower Wekiva River State Reserve
Blue Spring State Park
Lyonia Preserve
LAKE COUNTY
VOLUSIA COUNTY
Deltona
Point of Connection 4
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Lake Monroe
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Intake Site 2
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
K
431
Central Florida Zoo
4
46
415
17 92
415
Sanford
Point of Connection 2
46A
46
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
Point of Connection 3
Point of Connection1
417
Lake Jessup

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Miles
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St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site K - Seminole & Southern Volusia Counties' Alternative

Figure 25

map_b_p_fig_25.mxd - 02/04/04

Site I - Lake County Alternative

This alternative presents the potential for one water treatment plant to serve Lake County. The potential raw water intakes associated with this alternative are located at Intake Sites 7 and 8. Approximately 1 mile of raw water pipeline is associated with this alternative. As a part of this study and the other studies being conducted as a part of the St. Johns River Water Supply project, no demand centers or points of connection were identified. Therefore, only a proposed water treatment plant site, raw water intake locations and raw water pipeline corridors were identified as a part of this study. Figure 26 presents this alternative.

Interstate
State/US Road
Local Road
Railroad Track
County Line

Conservation Lands
Proposed Conservation Lands
Candidate Site
Raw Water Pipeline Corridor
Finished Water Pipeline Corridor

Sources: St. Johns River Water Management District, 2000
Florida Natural Areas Inventory, 2001
Florida Geographic Data Library, 2000
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Lake County Property Appraiser, 1998
Seminole County Property Appraiser, 2002
Volusia County Property Appraiser, 2002

Lake Woodruff National Wildlife Refuge
DeLand Municipal Airport
92
15A
DeLand
44
Ocala National Forest
44
Intake Site 7
Intake Site 8
Lake Beresford
42
4
Lake Helen
44
Hontoon Island State Park
472
Orange City
Lower Wekiva River State Reserve
Blue Spring State Park
LAKE COUNTY
VOLUSIA COUNTY
Lyonia Preserve
Deltona
17 92
DeBary
Konomac Lake
Water Cooling Facility
Gemini Springs Park
Seminole State Forest
LAKE COUNTY
SEMINOLE COUNTY
St. Johns River
Lake Monroe
VOLUSIA COUNTY
SEMINOLE COUNTY
Lake Monroe Conservation Area
431
4
Central Florida Zoo
46
415
17 92
415
Sanford
46A
46
Wekiva Springs State Park
Lake Mary
Orlando-Sanford Airport
417
Lake Jessup

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Miles
0 1 2 3 4

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map_b_p_fig_26.mxd - 02/04/04

St. Johns River Water Supply Project
Water Treatment Plant Siting Study Level 3 Analysis
Site I - Lake County Alternative

Figure 26

DISCUSSION

Based on the Level 3 Analysis, the five shortlisted water treatment plant sites appear to be feasible for the development of a surface water treatment plant that will treat water from the St. Johns River. The alternative combinations of raw water intakes, water treatment plant sites and finished water delivery points developed in this report correspond to those being evaluated in both the St. Johns River Treatability and Demineralized Concentrate Management Study and the Demand Projection and Affordability Study.

REFERENCES

CH2M Hill, 2004. Surface Water Treatability and Demineralization Study Final Report.

FGS, 1992. Florida's Ground-water Monitoring Program, Background Hydrochemistry," Florida Geological Survey Special Publication No. 34.

HDR Engineering, Inc., 2003. East Central Florida Water Supply Initiative St. Johns River Water Supply Project Surface Water Treatment Plant Siting Study Technical Memorandum D.2.A.

Miller, 1986, Hydrogeologic Framework of the Floridan Aquifer System in Florida and on Parts of Georgia, Alabama, and South Carolina, U.S. Geological Survey Professional Paper 1403-B.

Reiss Environmental, 2001. Technical Memorandum B.5. Applicable Rules and Regulations for Concentrate Management, for St. Johns River Water Management District.

Reiss Environmental, 2002. Investigation of Subsurface Injection in Support of the Demineralized Concentrate Management Plan- Task C.2, For the Investigation of Demineralized Concentrate Management Project, for St. Johns River Water Management District.