Special Publication SJ97-SP17

WATER SUPPLY NEEDS AND SOURCES ASSESSMENT
ALTERNATIVE WATER SUPPLY STRATEGIES INVESTIGATION
PLANNING LEVEL ASSESSMENT OF THE FEASIBILITY OF A REGIONALLY INTERCONNECTED REUSE SYSTEM IN BREVARD AND INDIAN RIVER COUNTIES

by

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1997

EXECUTIVE SUMMARY

In Brevard and Indian River counties, local ground water and surface water resources are used to meet both domestic and agricultural water demands or needs. Traditionally, the sources of supply for agriculture have been either ground water or surface water. In some cases agricultural users have constructed surface water reservoirs for the storage of rainfall and surface water runoff to supplement the water needs of their crops. However, with the seasonal variability of rainfall in Brevard and Indian River counties, surface-water and ground-water sources may be unreliable in some areas during portions of the year. Therefore, to maintain the current level or increase agricultural productivity in these two counties, new water supply strategies should be developed.

Reclaimed water is an alternative source that can be reused for beneficial purposes. Traditionally, treated wastewater has been perceived as a disposal problem with the solution being the least cost mechanism, such as, surface water discharge or deep well injection along the coast. In recent years, many have recognized that reclaimed water can be a valuable resource and beneficially reused to supply needs that were formerly served by the public potable water systems. Although many communities have developed beneficial reuse systems, in most cases, they have had to maintain some alternate systems of reuse or disposal during wet weather conditions.

Presently, the primary disposal mechanisms for treated wastewater effluent in Brevard and Indian River counties are deep injection wells or surface water discharges via rivers or lagoons. Chapter 90-262 Laws of Florida requires the elimination of surface water discharge of effluent to the Indian River Lagoon. In addition, the future permittability of deep injection wells is somewhat uncertain. Therefore, wastewater generators in the area are actively seeking cost effective and beneficial means of reusing the reclaimed water generated by their systems.

Law Engineering and Environmental Services, Inc., and SJRWMD entered into an agreement (SJRWMD Contract No. 95W166A) to investigate the feasibility of interconnecting water supply facilities and wastewater facilities. Task C of the agreement provides for a preliminary assessment of the feasibility of a regionally interconnected reuse system in Brevard and Indian River counties. The specific purpose of the task is to estimate the costs associated with interconnecting treated wastewater facilities in Brevard and Indian

River counties to form a regional reuse system and transporting this reclaimed water to locations in Brevard and Indian River counties for use in irrigating citrus or other reasonable beneficial uses. This technical memorandum, Technical Memorandum C.5., is a summary of the activities performed in investigating this interconnection feasibility. This assessment evaluates potential regional interconnections and does not specifically address potential local interconnected systems. The assessment includes a review of water resource needs and provides several potentially viable scenarios to link or interconnect available reclaimed water with agricultural users. Associated planning level costs for these scenarios are also presented.

Based on information concerning available sources and potential uses of reclaimed water in Brevard and Indian River counties, three scenarios for interconnecting treated wastewater facilities and delivering the treated wastewater to locations where it can be used for reasonable beneficial purposes were developed. Several versions of each scenario were evaluated. These versions are described as follows:

Version a: Includes all major wastewater treatment facilities from Titusville to Vero Beach.

Version b: Includes all major wastewater treatment facilities from the Brevard County Sykes Creek Regional plant to Vero Beach.

Version c: Includes all major wastewater treatment facilities from the Brevard County Sykes Creek Regional plant to Vero Beach except for Cocoa Beach.

Version d: Includes all major wastewater treatment facilities from the Melbourne David B. Lee plant to Vero Beach.

Scenario 1 provides for a pipeline connecting the major reclaimed water source along the coastal area and transporting the water to the southern part of Indian River County for use by agricultural or other users at any point along the pipeline. This scenario relies on surface water discharge of any surplus water because storage is not included. Scenario 1a is the most expensive version at $125,000,000 and a potential capacity of 22 million gallons per day (mgd), whereas Scenario 1d has a potential capacity of 13 mgd, and, at $90,300,000, is the least expensive due to the distance covered.

Scenario 2 also requires a major pipeline to collect reclaimed water and transport it to the southern part of Indian River County, but two combined reservoir/wetland areas were considered. The

reservoir/wetland areas would be used for the storage of reclaimed water during wet weather and withdrawal of the water during dry weather high demand periods. The wetlands provide treatment for nutrient removal. Both the reservoir/wetland areas are interconnected with appropriate size pipeline and pump stations. As versions b through d do not extend as far north, the cost is reduced, but the available supply capacity and operational flexibility also decreases. However, the storage tends to enhance reuse availability. Scenario 2a is the most expensive version at $103,200,000 with a potential capacity of 12.5 mgd. Scenario 2d is the least expensive version at $59,300,000 with a potential 7.6 mgd.

Scenario 3 is a combination of pipeline, wetland treatment, and storage reservoirs that is built on a more local basis and does not incorporate all the available reclaimed water within the areas of Brevard and Indian River counties. Scenario 3 is very similar to Scenario 2, except that the reservoir/wetland areas are not interconnected between Brevard and Indian River counties. Because they are not interconnected, this scenario does not take advantage of the reclaimed water available in Brevard County to meet Indian River County's agricultural needs. However, this scenario may provide an opportunity to incorporate the use of storm water from the Surface Water Improvement and Management (SWIM) Program in Indian River County to supplement the source of water. Chapter 90-262 Laws of Florida require the prioritization of the water quality improvement of the Indian River Lagoon. The reservoir/wetland areas could provide treatment for SWIM program storm water projects as well as a supplemental source of water.

The least expensive scenario is Scenario 3d at $40,000,000. This scenario does not interconnect Brevard and Indian River counties but it does interconnect the utilities within the respective counties. While this scenario would limit the initial operational flexibility of the system, the major project components would be provided and the system could be extended to be an interconnected system.

An alternative interconnection could be considered in conjunction with Scenario 3 to create a limited interconnected regional or subregional system. For example, an interconnection along a U.S. Highway 1 corridor could be developed to interconnect Brevard and Indian River counties. This interconnection would provide the resources to meet some of the local reclaimed water needs without creating a fully interconnected regional system. While this interconnection would limit the capacity of reclaimed water that can be exchanged between Brevard and Indian River counties, it could be an initial phase of an

interconnected regional system. The capital cost associated with an interconnection with a capacity of approximately 2 or 3 mgd is approximately $15,500,000. This cost combined with the costs associated with Scenario 3 creates an alternative which is less costly than the fully interconnected regional scenarios while accomplishing some of the goals of the fully interconnected system.

All the scenarios require substantial facility construction. However, these facilities can also provide potential benefits beyond meeting only irrigation demand because:

- beneficial reuse is more effectively accomplished, and
- water quality can be enhanced through additional treatment.

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INTRODUCTION

BACKGROUND

In Brevard and Indian River counties, local ground water and surface water resources are used to meet both domestic and agricultural water demands or needs. The agricultural needs are for those portions of the year when rainfall is not sufficient to meet the irrigation requirements of agriculture.

Brevard and Indian River counties are home to substantial agricultural activity, including citrus farming. Traditionally, the sources of supply for agricultural irrigation have been either ground water or surface water. In some cases agricultural users have constructed surface water reservoirs for the storage of rainfall and surface water runoff to supplement the water needs of their crops. While there are some months of the year when the citrus areas have excess water that is removed from the areas through drainage systems, supplemental irrigation is required during dry times. However, with the seasonal variability of rainfall in Florida, surface water sources and, to some degree, the ground water sources may be unreliable during portions of the year. The amount of water available for agricultural use may not meet needs in the foreseeable future. Therefore, to maintain the current level of agricultural activity or to increase productivity in these two counties, new water supply strategies should be developed. Reclaimed water could be used as an alternate source of supply for agricultural irrigation during periods of lower rainfall.

Most of the communities in Brevard and Indian River counties provide centralized wastewater collection and treatment to the residents of their respective cities and towns. In many communities, the effluent generated from the treatment of the wastewater is still a disposal issue which is resolved largely through surface water discharge or deep well injection. Chapter 90-262 Laws of Florida requires the elimination of surface water discharge of effluent to the Indian River Lagoon. Exceptions may be considered if no other practical alternative exists and the reclaimed water is treated to advanced wastewater treatment (AWT) or higher standards. If disposal to the St. Johns River is sought, the discharge would have to be considered within the goals of the Upper St. Johns River Basin Project. This "is a multipurpose project designed to balance the multiple uses of the river and to provide for major environmental habitat restoration and water quality benefits" (Sterling 1995). Although the water quality standards for the project

have not been established, tentative discharge standards are being imposed on certain agricultural interests at this time. These standards cannot be met by AWT reclaimed water, normally defined as 1 part per million of phosphorus. Therefore, without additional treatment beyond AWT, reclaimed water could not be discharged into the Upper St. Johns River Basin Project.

The other primary disposal mechanism is deep injection wells. Deep injection wells have been an issue in the State of Florida for the past several years, and the future permittability of deep injection wells is somewhat uncertain. Communities using injection wells as their alternate disposal mechanism for reclaimed water may find that they will have to phase out this alternative in the near future or find it difficult if not prohibitive to permit new facilities to meet their future needs. Therefore, wastewater generators in the area are actively seeking cost effective and beneficial means of reusing the effluent generated by their systems.

When beneficially used, effluent is termed reclaimed water and the application is called reuse. Through reuse, many communities have been able to reduce or lessen the demand on the public potable water supply systems. However, because many of the communities are already established, the cost to retrofit them by installing a secondary distribution system for reuse may be too great to justify the benefits in reduction of potable demand. Alternative reuse systems that provide beneficial reuse without creating the financial and administrative hardships generally associated with implementation of new utility systems are desirable. The preferred strategy would be to find a small number of large users who need the available reclaimed water generated from wastewater treatment systems.

PURPOSE AND SCOPE

Law Engineering and Environmental Services, Inc., and SJRWMD entered into an agreement (SJRWMD Contract No. 95W166A) to investigate the feasibility of interconnecting water supply facilities and wastewater facilities. Task C of the agreement provides for a preliminary assessment of the feasibility of a regionally interconnected reuse system in Brevard and Indian River counties. The specific purpose of the task is to estimate the costs associated with interconnecting treated wastewater facilities in Brevard County and Indian River County to form a regional reuse system and transporting this reclaimed water to locations in Brevard and Indian River counties for use in irrigating citrus or other reasonable beneficial uses. This

technical memorandum, Technical Memorandum (TM) C.5., is a summary of this investigation. This assessment evaluates potential regional interconnections and does not specifically address potential local interconnected systems. The assessment includes a review of water resource needs and provides several potentially viable scenarios to link or interconnect available reclaimed water sources with potential agricultural or other large users. Associated costs are also presented, at a conceptual planning level.

METHODS

This investigation was conducted by gathering information concerning available sources of reclaimed water in Brevard and Indian River counties and potential users of reclaimed water with particular focus on the use of reclaimed water for agricultural irrigation in Indian River County. The major generators of treated wastewater, in general facilities with a permitted capacity of greater than 1 mgd, in Brevard and Indian River counties are as follows:

- City of Titusville
- City of Cocoa
- City of Melbourne
- City of Rockledge
- City of Palm Bay
- Brevard County
- City of Vero Beach
- Indian River County

Personal interviews were conducted with the utility directors or appropriate designees of each of these utilities to obtain information, such as, wastewater flow, plant capacities, future expansion plans, treated wastewater disposal strategies, and reuse trends. The utilities were asked if they were implementing a major reuse program or if they had established goals to have a targeted percent reuse within a certain time frame. This question was posed to determine if the utility desired an alternate user for the reclaimed water either in connection with or in lieu of a reuse system expansion within its service area.

After the potential available source of supply was established, the water needs of large users in the area were determined from existing reports (Vergara 1994) and through interviews with SJRWMD personnel and Indian River Citrus League members.

With the potential needs and sources determined, scenarios were developed to assess the options that may be available to link the source of supply with the need for additional water resources. Criteria used to develop the scenarios include:

- Flow characteristics
- Availability of supply capacity
- Availability of facility capacity

- Water quality compatibility
- Projected deficits in meeting water needs
- Location of needs and reclaimed water sources

Once the scenarios were developed, the preliminary costs are estimated. The cost of the elements for each scenario was established from the water and wastewater facility cost component analysis of TM B.2.b., (Law 1996) and other appropriate references (Law 1995). The proposed scenarios are not optimized, but represent a conceptual level of planning to establish whether or not there may be potential alternative interconnections of sources of supply to meet future regional water needs.

DISCUSSION

The main purpose of this investigation is to develop scenarios that integrate the potential reclaimed water sources with potential large water users within Brevard and Indian River counties. Scenarios developed for consideration are outlined in this sub section.

POTENTIAL SCENARIOS

Based on information concerning available sources and potential uses of reclaimed water in Brevard and Indian River counties, three scenarios for interconnecting treated wastewater facilities and delivering the treated wastewater to locations where it can be used for reasonable beneficial purposes were developed.

Four versions for each of the three scenarios were evaluated to allow for variation in the facilities that were interconnected into the reuse system. The versions differed regarding which facilities were included in the interconnection evaluation depending on the amount of reclaimed water that the facilities had available and the length of pipe required to interconnect the facilities. The following is a description of the versions:

Version a: Includes all major facilities from Titusville to Vero Beach.

Version b: Includes all major facilities from the Brevard County Sykes Creek Regional plant to Vero Beach.

Version c: Includes all major facilities from the Brevard County Sykes Creek Regional plant to Vero Beach except for Cocoa Beach.

Version d: Includes all major facilities from the Melbourne David B. Lee plant to Vero Beach.

Scenario 1

Scenario 1 provides for a pipeline, as presented schematically in Figure 1a, connecting the major reclaimed water sources along the coastal area and transporting that water to the southern part of Indian River County for use by agricultural or other interests. Agricultural interests anywhere along the pipeline could also be potential users. Several sub-scenarios (versions) will be reviewed based on Scenario 1, including shorter pipelines that begin south of Titusville and convey reclaimed water to interests along the pipeline route to Indian River

County, as presented in Figures 1b through 1d. The basic premise of this pipeline alternative is that water can be conveyed to the agricultural or other interests and used as needed. However, during times of wet weather it is difficult for agriculture to use all the reclaimed water generated. This is similar to the current problem that reuse systems experience, that is, the ability to maintain a demand during seasonal high rainfall periods and to store significant quantities of reclaimed water during periods of low usage.

In Scenario 1, no storage is available within the pipeline system. To accommodate disposal during wet weather conditions, we make the assumption that the reclaimed water will be treated to AWT standards to facilitate a direct discharge to surface water if it becomes necessary.

Scenario 2

Scenario 2 includes a major pipeline to transport reclaimed water to the southern part of Indian River County, but two reservoir/wetland areas will be considered as presented in Figures 2a through 2d. One area will be mid-point between Palm Bay and Vero Beach, and one will be in the general area of Interstate Highway 95 north of State Road 60. These reservoir/wetland areas would be included for both the storage of reclaimed water during wet weather occasions and withdrawal during the high demand periods. Wetland treatment would be required to meet standards and to provide the ability to discharge the reclaimed water when necessary either into a stream system which transports it to the Indian River Lagoon or to transport this water to the Upper St. Johns River Basin water management areas for additional storage and treatment prior to being discharged to the Upper St. Johns River Basin project area. The wetland treatment system and reservoirs will have the following general conceptual characteristics:

Wetlands

- Retention time - 10 days
- Wetland variable depth 0.5 - 2 feet
- Treatment of either inflow prior to reservoir or outflow from reservoir

Reservoirs

- Depth at high water level 6 feet
- Allows for 75 percent usage
- Consistent with pipeline hydraulics
- Necessary to provide 120 days of dry season needs
- Allows for storage of excess water during wet season

Scenario 3

Scenario 3 is also a combination of pipeline, land treatment, and storage alternatives that are built on a more local basis. The collection and transportation of reclaimed water will be within the county where the flow is generated, and there is no interconnection between Brevard and Indian River counties. However, two reservoir/wetland areas will be considered. One area will be south of Palm Bay, as presented in Figures 3a.1, 3b.1, 3c.1, and 3d.1, and one in the general area of Interstate Highway 95 and north of state road 60, as presented in Figures 3a.2, 3b.2, 3c.2 and 3d.2. These reservoir/wetland areas would be included for both the storage of reclaimed water during wet weather occasions and withdrawal during the high demand periods. Wetland treatment would be required to meet standards and to provide the ability to discharge the reclaimed water when necessary either into a stream system which transports it to the Indian River Lagoon or by transporting this water to the Upper St. Johns River Basin water management areas for additional storage and treatment prior to being discharged to the Upper St. Johns River Basin Project area. The conceptual characteristics of the wetlands treatment systems and reservoirs are the same outlined in Scenario 2 and are presented below:

Wetlands

- Retention time - 10 days
- Wetland variable depth 0.5 - 2 feet
- Treatment of either inflow prior to reservoir or outflow from reservoir

Reservoirs

- Depth at high water level 6 feet
- Allows for 75 percent usage
- Consistent with pipeline hydraulics
- Necessary to provide 120 days of dry season needs
- Allows for storage of excess water during wet season

SCENARIO COST INFORMATION

The cost component information for pipeline reuse systems developed in Technical Memorandum B.2.b. is used to develop the costs for each scenario. This information is summarized in the Conclusions section of the report.

CONCLUSIONS

SUMMARY OF NEEDS

The potential annual average day agricultural needs in the study area for 2010 (Vergara 1994) are:

Brevard County	101 million gallons per day
Indian River County	166 million gallons per day

Of the above estimated agricultural need, those portions of the Brevard and Indian River counties within the Upper St. Johns River Basin will account for approximately 240 mgd of that need in 2010 (Ritter 1994).

The actual water used for citrus irrigation in 1994 (Florence 1996) was 13.8 million gallons per day (mgd) in Brevard County and 155.7 mgd in Indian River County. Currently the actual needs are being met through the use of ground water and surface water sources. However, seasonally both water quality and quantity problems exist in portions of the two county area.

During an interview with representatives of the Indian River Citrus League in September, 1996, the water needs of the citrus growers and the potential use of reclaimed water for those needs were discussed. The following are the major conclusions of the meeting:

- There are seasonal needs for additional sources of supply.
- In some areas existing quality of irrigation water is marginal and potentially a problem.
- Seasonally, excess water from rainfall is discharged from citrus areas and additional sources of supply could not be assimilated during that time.
- The most feasible areas to consider for use of reclaimed water for citrus irrigation are east of Interstate Highway 95.

SUMMARY OF SOURCES

During the course of this investigation the major utilities with a potential of available reclaimed water were contacted and interviewed. The major conclusions of those discussions were as follows:

- All of the utilities interviewed have developed a reuse program.
- A few of the reuse programs have been able, or will be able in the near future, to assimilate all the reclaimed water generated except during wet weather conditions.
- All utilities are continuing to expand their reuse systems.
- Large single user customers are preferred to the retrofit of single family residential neighborhoods mainly because of relative cost and some utilities believe that the fiscal and administrative demands of a reuse system detracts from their main focus of providing water and wastewater service to their communities mainly because of the related costs.
- Installation of reuse systems concurrent with the construction of new developments is also a preferred alternative.
- The reduction of potable water needs, as a result of reuse projects, are varied among the various systems.
- The continued viability of alternate reuse methods such as surface water discharge and deep well injection is a major concern.

A summary of the approximate amounts of reclaimed water available from the major sources are presented in Table 1. Reuse sources, in addition to the major sources, may be available in Brevard County and could be considered for inclusion in follow-up activities. As indicated, some of the reuse systems have accomplished 100 percent reuse except in wet weather conditions. Thus flow under these conditions is presented in the table as annualized available flow. Most of the available reclaimed water is in the northern portion of the study area with only a minor amount, during wet weather, available in the Vero Beach area or southern portion of the study area.

EVALUATION OF SCENARIOS

The cost estimates associated with the implementation of each scenario are presented in Table 2. Additional detailed cost information is presented in Appendices A, B, and C.

Scenario 1

Scenario 1 as previously discussed describes the interconnection of the reclaimed water sources within the study area. Schematics of this scenario are presented in Figures 1a through 1d. This scenario includes the cost of the pipeline required to interconnect the sources of supply and the necessary upgrade of treatment to AWT in lieu of reservoir storage and wetland treatment.

Scenario 1a provides a full interconnection of all major reuse facilities in Brevard and Indian River counties. It is also the most expensive alternative and relies on surface water discharge of any reclaimed water flows (that meet AWT standards) in excess of use since this scenario does not include storage. The b through d versions of Scenario 1 correspondingly do not extend as far north to connect reuse facilities and thus each successive version decreases in cost. However, along with the cost decrease, the available reuse capacity and operational flexibility also decrease. Scenario 1d is the least costly of the Scenario 1 versions, beginning at Melbourne and extending to the agriculture areas in the Vero Beach area. This version of Scenario 1 is still more costly than any versions of Scenarios 2 and 3 and does not provide the potential for the storage and retention of the reclaimed water. Consequently, the availability of water during dry periods is restricted.

Scenario 2

Scenario 2 describes the interconnection of the reclaimed water sources of supply within the study area and provides reservoir storage and wetland treatment. Schematics of this scenario are presented in Figures 2a through 2d. Two reservoir/wetland areas were included as a part of this scenario. The first reservoir/wetland area is located midway between Palm Bay and Vero Beach and the second reservoir /wetland area is located near the general area of Interstate Highway 95 north or State Road 60. The reservoirs and wetlands will provide additional treatment and wet weather storage for the reclaimed water.

This scenario is characterized by the addition of two reservoir/ wetland areas and the corresponding change in interconnecting pipeline hydraulic conditions. These areas also provide for additional nutrient removal treatment of the reclaimed water and the elimination of the proposed AWT treatment as proposed in Scenario 1. The combination of the proposed storage and wetland acreage will decrease the need for wet weather discharges. In Scenario 2 both of the reservoir/wetland areas are interconnected with appropriate size pipeline and pump stations. The b through d versions of Scenario 2 correspondingly do not extend as far north to connect reuse facilities and thus each successive version decreases in cost (all versions include both reservoir/wetland areas). However, the available reuse capacity and operational flexibility also decrease but the storage tends to offset the reduction of total reclaimed water availability. Scenario 2d is the least costly of the Scenario 2 versions, beginning at Melbourne and extending to the agricultural areas in the Vero Beach area.

Scenario 3

Scenario 3 describes the interconnection of the reclaimed water sources of supply on a more local basis. The reuse system for this scenario is basically divided into two sections. Schematics of this scenario are presented in Figure 3a through 3d. The first section interconnects the major facilities as far south as Palm Bay. The reclaimed water is pumped to a reservoir/wetland area directly west of Palm Bay and is later discharged to a canal that serves to transport the water to agricultural areas. The second section interconnects the Vero Beach and Indian River County facilities. Vero Beach is connected to the existing Indian River pipeline and the combined reclaimed water from these two areas is sent to a reservoir/wetland area. The reclaimed water can be used in seasonally dry times for the general area of the reservoir/wetland area.

Scenario 3 is similar to Scenario 2 except the reservoir/wetland areas are not interconnected. Thus, Scenario 3 does not provide interconnection of the two counties and will not be able to take advantage of available reclaimed water from Brevard County to meet needs in Indian River County. This may result in more frequent discharges of reclaimed water from the proposed reservoir/wetland area in Brevard County if the supply exceeds demand. The opposite may be the case in the southern system where less than adequate amounts of reclaimed water could be available to supply the proposed reservoir/wetland area in Indian River County. As presented in the previous scenarios, Versions b through d represent successive omission of reuse facilities north of Melbourne. Although this decreases operational flexibility and available reclaimed water, the facilities that would not be connected have plans for the implementation of reuse programs that should provide for 100 percent reuse within their systems. The major issue with this scenario is the likely lack of available reclaimed water for the reservoir/wetland area in the Vero Beach area. However, public supply demand in Indian River County is projected to increase by 190 percent between the years 1990 and 2010. A corresponding increase in reclaimed water will also occur over this period.

The need to supplement the water necessary to maintain the viability of the reservoir/wetland area in the Vero Beach area may provide an opportunity to incorporate another emerging program. The State legislature, Chapter 90-262 Laws of Florida, has requested that priority be given to the clean up of the Indian River Lagoon through the SJRWMD Surface Water Improvement Management Program (SWIM). The reservoir/wetland area in the Vero Beach area would be available

to store storm water from a SWIM project. The water stored during wet weather conditions could then be used later to meet irrigation needs. The reservoir/wetland area would also provide treatment of the storm water, thus improving the quality of any necessary surface water discharges.

SUMMARY OF CONCLUSIONS

Significant quantities of reclaimed water are available in Brevard and Indian River counties. This reclaimed water can be made available to meet a portion of the agriculture demands of the area. Unfortunately the largest quantities of available reclaimed water are in Brevard County and the greatest potential need for supplemental irrigation water is in the Vero Beach area of Indian River County. Thus, the cost to pipe the reclaimed water between those points becomes a major project consideration. All the scenarios require substantial facility construction. However, these facilities can also provide potential benefits beyond meeting only irrigation demand because:

- beneficial reuse is more effectively accomplished;
- water quality is enhanced through additional treatment, and
- the reservoir/wetland components could also provide storm water collection and treatment.

The estimated cost for a fully interconnected reuse system without reservoir/wetland areas (but with AWT), Scenario 1a, is approximately $125,000,000. The least expensive Scenario 3d, at approximately $40,000,000, does not provide full interconnection of the proposed reuse facilities and the reservoir/wetland areas. Brevard County and Indian River County would not be interconnected. This would limit the initial operational flexibility and provide less than optimal use of the reclaimed water from the Brevard County area. An alternative interconnection could be considered in conjunction with Scenario 3 to create a limited interconnected regional or subregional system. For example, an interconnection along a U.S. Highway 1 corridor could be developed to interconnect Brevard and Indian River counties. This interconnection would provide the resources to meet some of the local reclaimed water needs without creating a fully interconnected regional system. While this interconnection would limit the capacity of reclaimed water that can be exchanged between Brevard and Indian River counties, it could be an initial phase of an interconnected regional system. The capital cost associated with an interconnection with a capacity of approximately 2 or 3 mgd is approximately $15,500,000. This cost combined with the costs

associated with Scenario 3 creates an alternative which is less costly than the fully interconnected regional scenarios while accomplishing some of the goals of the fully interconnected system.

However, Scenario 3 would provide the initial major project components and could be extended to be an interconnected system. This scenario also provides the opportunity to integrate other existing SJRWMD programs, such as, Upper St. Johns River Basin Project and Indian River Lagoon SWIM.

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TABLES

Table1. Potential Available Reclaimed Water From Facilities in Brevard and Indian River Counties

Utility	Plant Capacity (mgd) (1)	Average Day Flow (mgd) (1)	Reuse (mgd) (1)	Alternative Disposal (2)	Available Reclaimed Water (mgd) (3)	Projected Flow 2015 (mgd) (4)	Net Available Reclaimed Water 2015 (mgd) (5)
Titusville	4.75	4.40	2.00	SD	2.40	7.00	0.00
Palm Bay	5.20	2.61	0.94	UGI	1.67	10.30	9.36
Cocoa Beach	6.00	4.20	4.20	SD	0.00	6.00	0.00
Cocoa	4.50	2.76	1.09	SD	1.67	4.50	0.00
Brevard County	18.00	12.19	2.53	P/UGI	9.66	20.50	17.97
Rockledge	4.50	1.54	0.54	UGI	1.00	4.50	3.96
Melbourne	10.10	7.73	1.88	UGI	5.85	10.10	8.22
SUBTOTAL	53.05	35.42	13.18		22.25	62.90	39.51
Indian River County	3.45	1.76	1.76	WT	0.00	8.00	6.25
Vero Beach	4.50	3.13	1.91	SD	1.22	4.50	2.59
SUBTOTAL	7.95	4.88	3.67		1.22	12.50	8.84
TOTAL	61.00	40.31	16.84		23.47	75.40	48.35

(1). Plant capacities and flow information from SJRWMD (Brandes 1995)

(2). P=Evaporation/Percolation Ponds, OF=Overland Flow, SF=Spray Field, SD=Surface Discharge, UGI=Underground Injection, WT=Wetlands

(3). This is calculated based on average annual daily flow and actual reuse water may only be available in wet weather conditions for some facilities.

(4). Based on interviews conducted with the utilities

(5). Utilities indicating no available reuse anticipate 100% reuse within their own system in the future.

Table 2. Summary of Interconnection Scenarios

(In Millions)

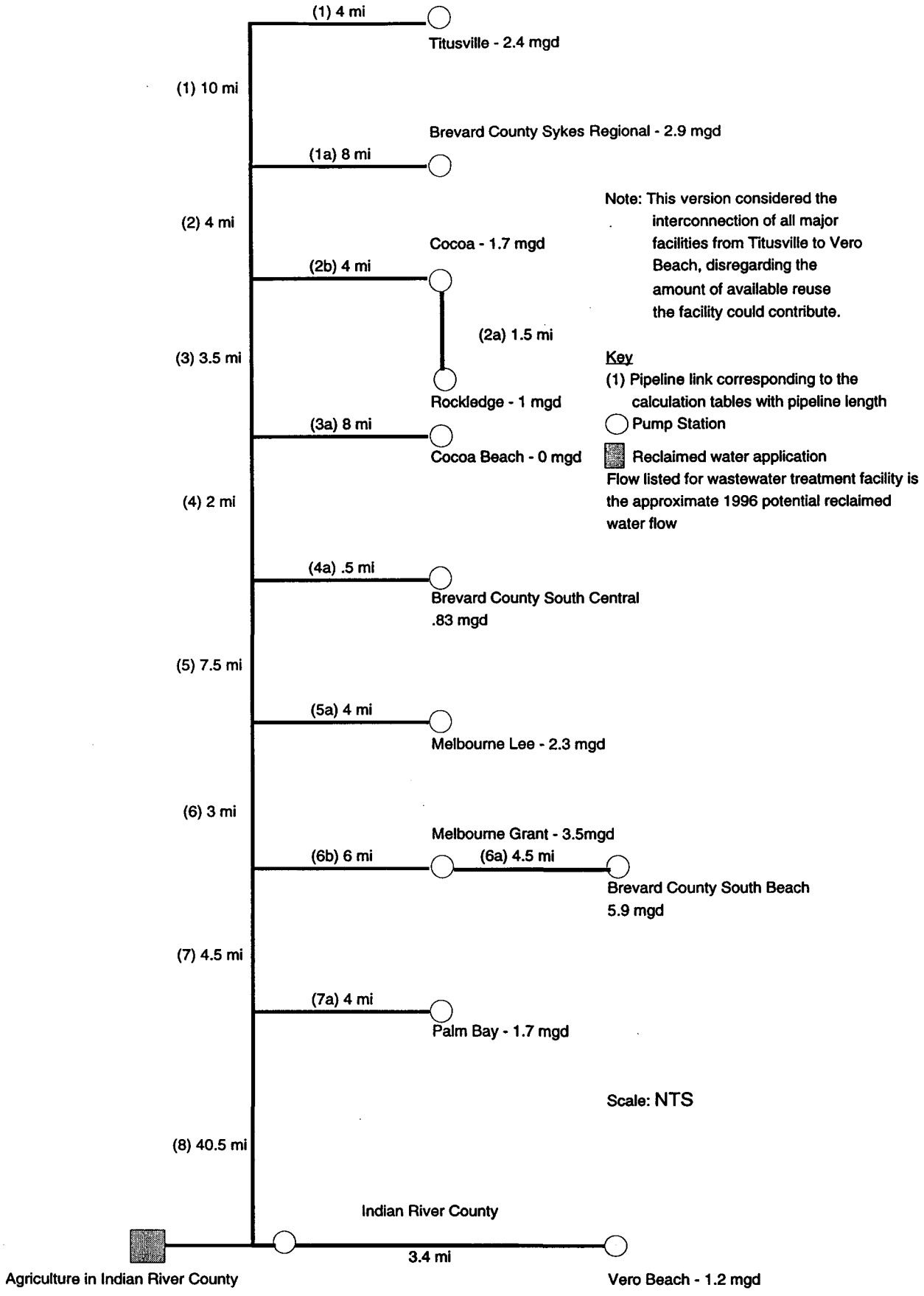
Scenario	Potential Capacity (mgd)[1]	Capital Pipeline & Pumping Costs	Additional Wastewater Treatment Costs	Wetland/Storage Costs	Total Capital Costs	Annual Capital Costs (2)	O&M/Power Costs	Total Annual Costs
1a	22.24 mgd	$125.0	$32.2	$0.0	$157.2	$12.6	$3.0	$15.7
1b	19.84 mgd	$116.9	$28.8	$0.0	$145.7	$11.7	$2.6	$14.2
1c	19.84 mgd	$115.6	$28.8	$0.0	$144.3	$11.6	$2.6	$14.1
1d	13.43 mgd	$90.3	$19.5	$0.0	$109.8	$8.7	$1.6	$10.3
2a	22.24 mgd into Res.1, 16.67 mgd into Res 2, 12.5 mgd Available	$103.2	$0.0	$15.5	$118.7	$9.3	$0.8	$10.1
2b	19.84 mgd into Res.1, 14.88 mgd into Res 2, 11.16 mgd Available	$92.7	$0.0	$15.5	$108.2	$8.5	$0.7	$9.2
2c	19.84 mgd into Res.1, 14.88 mgd into Res 2, 11.16 mgd Available	$86.6	$0.0	$15.5	$102.1	$8.0	$0.7	$8.7
2d	13.43 mgd into Res.1, 10.07 mgd into Res 2, 7.55 mgd Available	$59.3	$0.0	$15.5	$74.8	$5.9	$0.4	$6.3
3a	22.24 mgd into Res.1, 16.67 mgd Available from Res. 1, and 10 mgd from Res. 2	$73.5	$0.0	$15.5	$89.0	$7.1	$0.6	$7.8
3b	19.84 mgd into Res.1, 14.88 mgd Available from Res. 1, and 0 mgd from Res. 2	$63.3	$0.0	$15.5	$78.8	$6.3	$0.6	$6.9
3c	19.84 mgd into Res.1, 14.88 mgd Available from Res. 1, and 0 from Res 2	$62.0	$0.0	$15.5	$77.5	$6.2	$0.6	$6.8
3d	13.43 mgd into Res.1, 10.07 mgd Available from Res. 1, and 0 mgd from Res. 2	$40.0	$0.0	$15.5	$55.5	$4.5	$0.4	$4.9

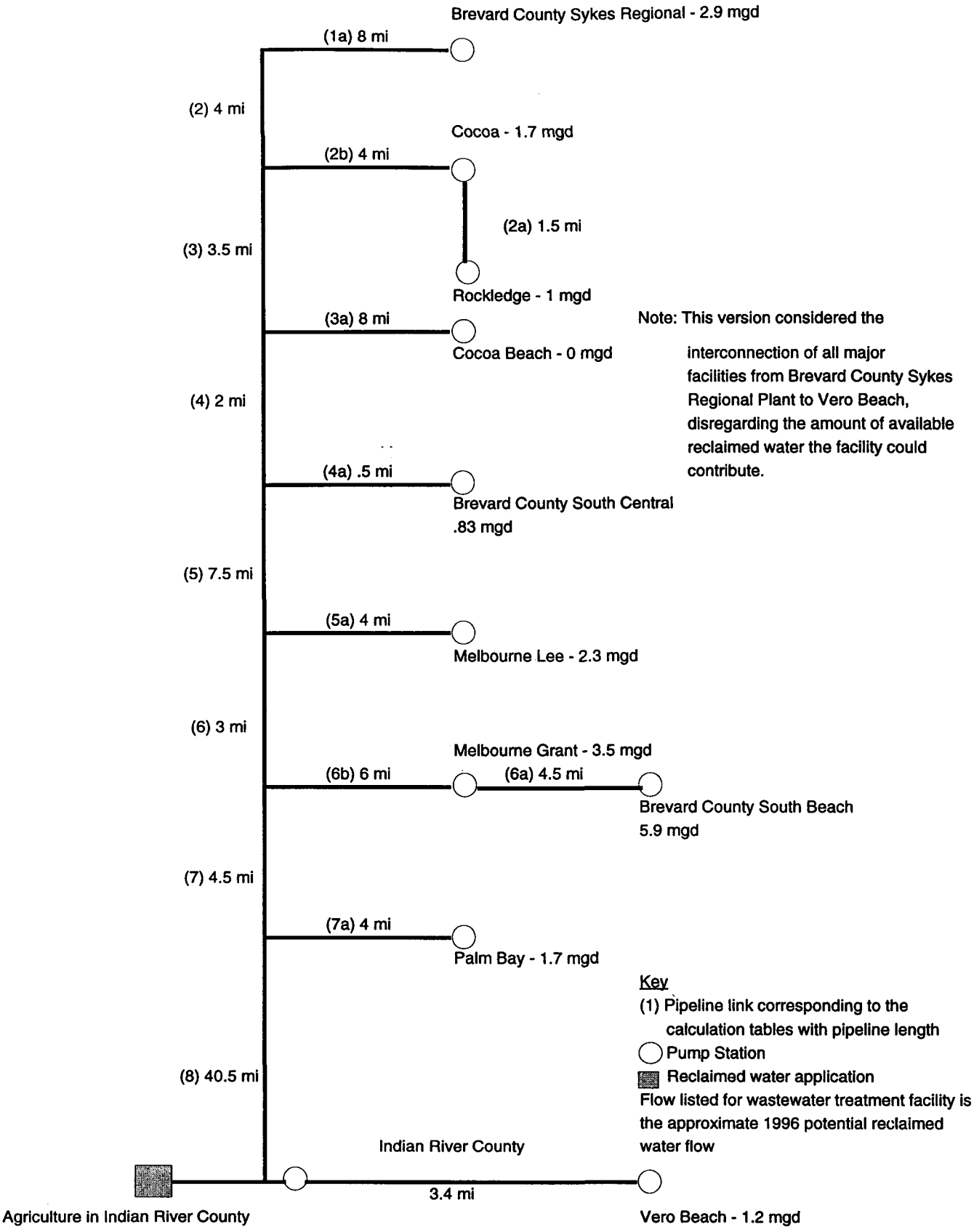
(1) Scenario 1 provides for a pipeline connecting the major reclaimed water source along the coastal area and transporting the water to the southern part of Indian River County for use by agricultural or other users at any point along the pipeline. This scenario relies on surface water discharge of any surplus water because storage is not included.
Scenario 2 also requires a major pipeline to collect reclaimed water and transport it to the southern part of Indian River County, but two combined reservoir/wetland areas were considered, one south of Palm Bay and the second in the area of Interstate Highway 95 north of State Road 60.
Scenario 3 is a combination of pipeline, wetland treatment, and storage reservoirs that is built on a more local basis and does not incorporate all the available reclaimed water within the areas of Brevard and Indian River counties. Scenarios 3 is very similar to Scenario 2, except that the reservoir/wetland areas are not interconnected between Brevard and Indian River Counties.
The definitions of the versions for Scenarios 1 and 2 are as follows:
Version a: Includes all major wastewater treatment facilities from Titusville to Vero Beach.
Version b: Includes all major wastewater treatment facilities form the Brevard County Sykes Creek Regional plant to Vero Beach.
Version c: Includes all major wastewater treatment facilities from the Brevard County Sykes Creek Regional plant to Vero Beach except for Cocoa Beach.
Version d: Includes all major wastewater treatment facilities from the Melbourne David B. Lee plant to Vero Beach.
The versions for Scenario 3 are the same as the other scenarios except there is no interconnection between the facilities in Brevard County and Indian River County.

(2) The potential capacity, to provide water to users, of scenarios 1 & 2 above were calculated with the maximum capacity of reclaimed water being transported to agriculture and other users along the pipeline.
Scenario 3 indicated a zero quantity available from Reservoir/Wetland 2 with only reclaimed water, generated in Indian River County, as a source of supply because the supply is only available in wet weather conditions and not sufficient to meet the anticipated needs unless supplemental water from other sources such as stormwater is routed to the reservoir/wetland.

(3) Based on the service lives presented in Technical Memorandum B.2.b (LAW 1996) and a time value of money of 7%

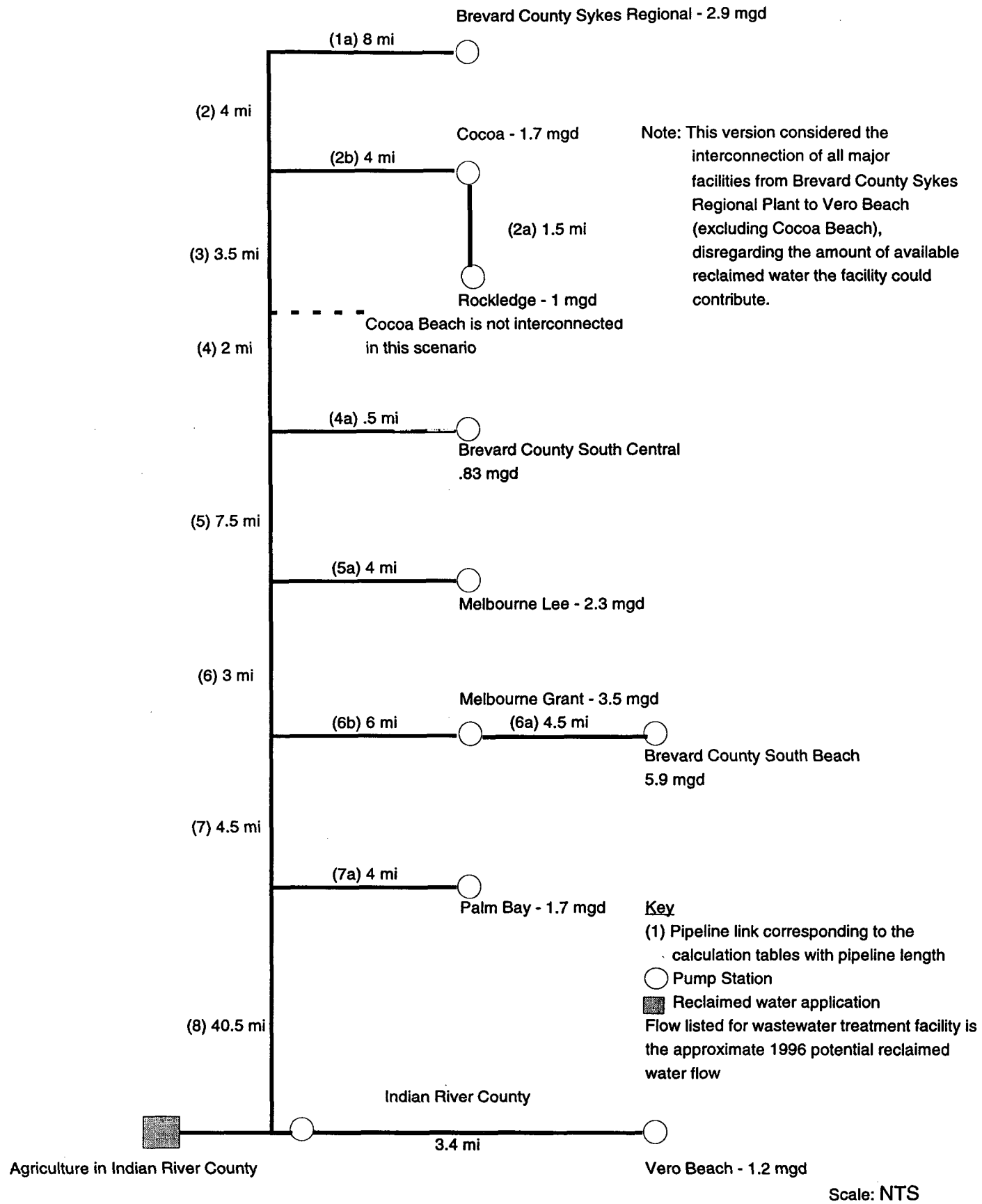
FIGURES


(1) 4 mi
Titusville - 2.4 mgd
(1) 10 mi
Brevard County Sykes Regional - 2.9 mgd
(1a) 8 mi
(2) 4 mi
Cocoa - 1.7 mgd
(2b) 4 mi
(2a) 1.5 mi
(3) 3.5 mi
Rockledge - 1 mgd
(3a) 8 mi
Cocoa Beach - 0 mgd
(4) 2 mi
(4a) .5 mi
Brevard County South Central
.83 mgd
(5) 7.5 mi
(5a) 4 mi
Melbourne Lee - 2.3 mgd
(6) 3 mi
Melbourne Grant - 3.5mgd
(6b) 6 mi
(6a) 4.5 mi
Brevard County South Beach
5.9 mgd
(7) 4.5 mi
(7a) 4 mi
Palm Bay - 1.7 mgd
(8) 40.5 mi
Indian River County
3.4 mi
Agriculture in Indian River County
Vero Beach - 1.2 mgd
Note: This version considered the interconnection of all major facilities from Titusville to Vero Beach, disregarding the amount of available reuse the facility could contribute.
Key
(1) Pipeline link corresponding to the calculation tables with pipeline length
Pump Station
Reclaimed water application
Flow listed for wastewater treatment facility is the approximate 1996 potential reclaimed water flow
Scale: NTS

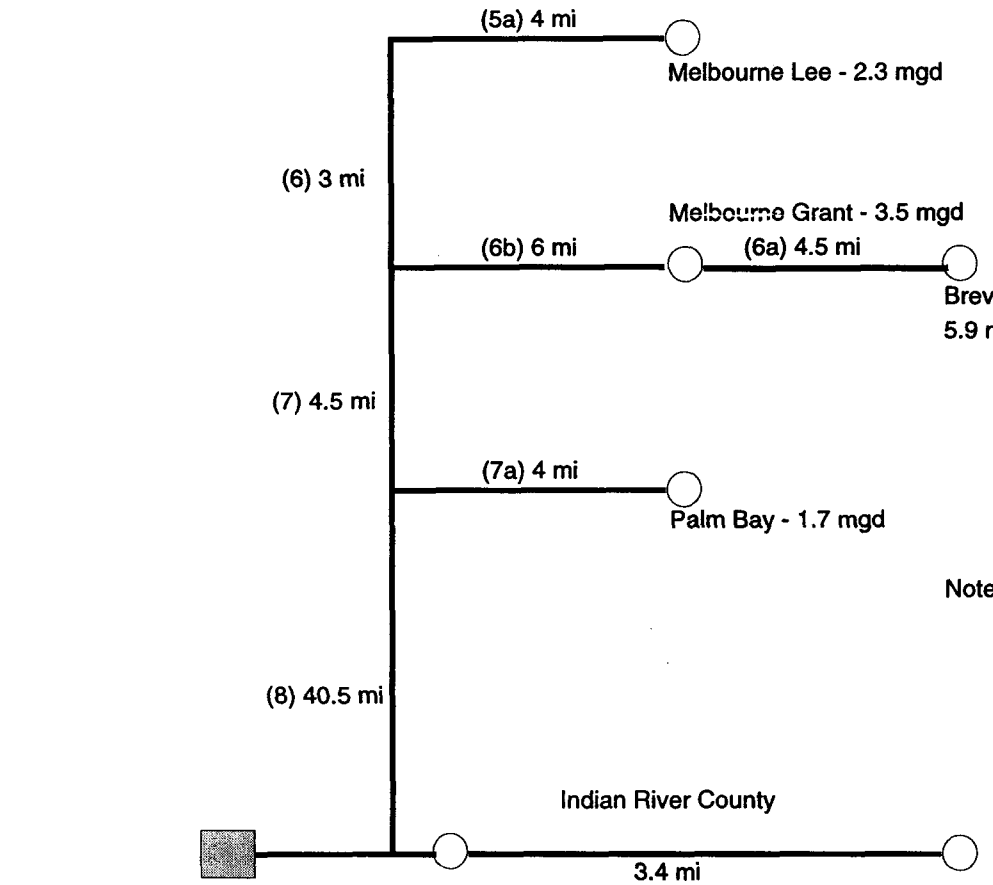


Scale: NTS

SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 19	Scenario 1b Pipeline Interconnecting Reuse from Brevard County (Sykes Regional) to Vero Beach Figure 1b



SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 20	Scenario 1c Pipeline Interconnecting Reuse from Brevard County(Sykes Regional) to Vero Beach (excluding Cocoa Beach) Figure 1c



Note: This version considered the interconnection of all major facilities from Melbourne to Vero Beach disregarding the amount of available reclaimed water the facility could contribute.

Key

(1) Pipeline link corresponding to the calculation tables with pipeline length

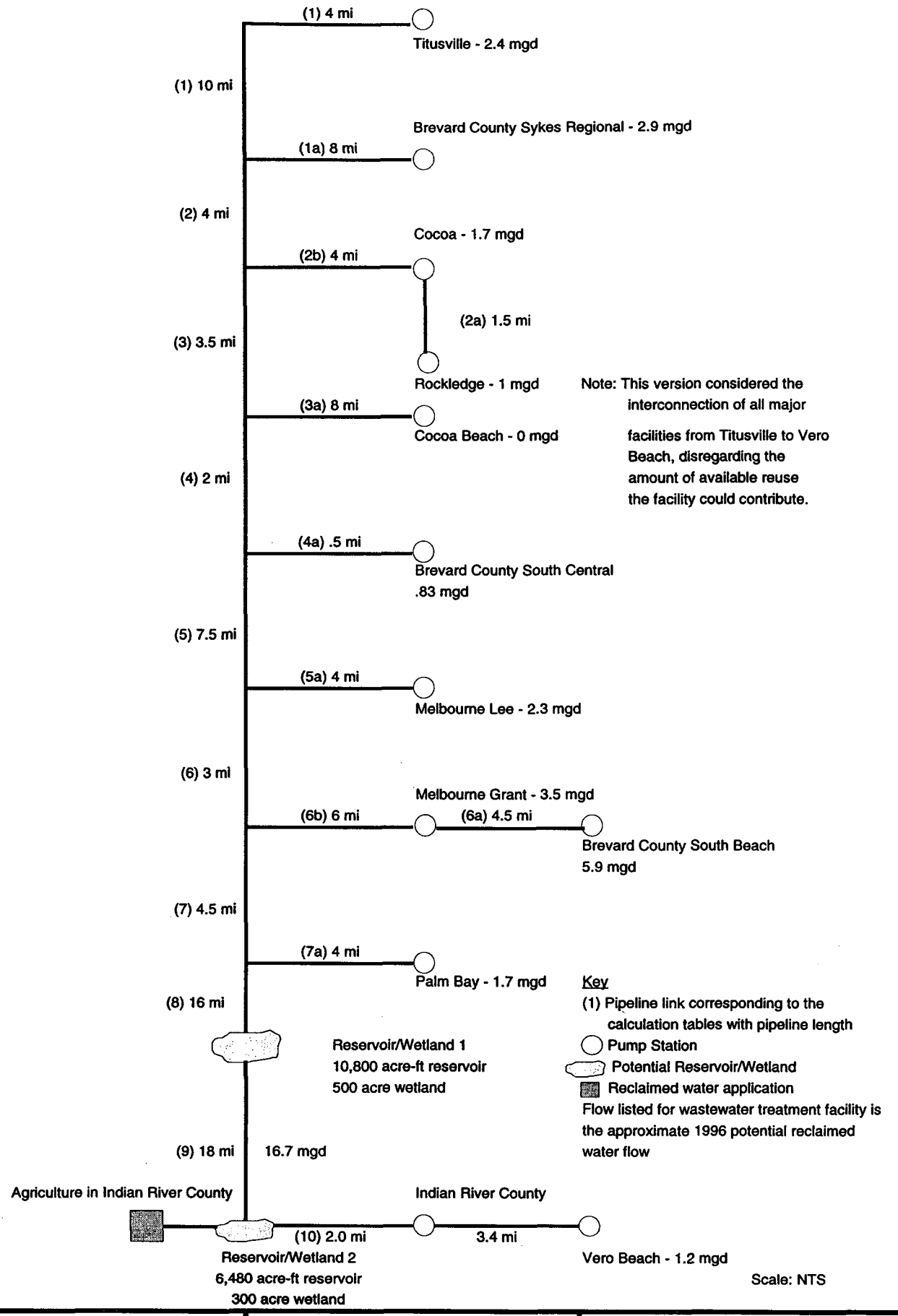
◯ Pump Station

▩ Reclaimed water application

Flow listed for wastewater treatment facility is the approximate 1996 potential reclaimed water flow

Scale: NTS

SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 21	Scenario 1d Pipeline Interconnecting Reuse from Melbourne to Vero Beach Figure 1d



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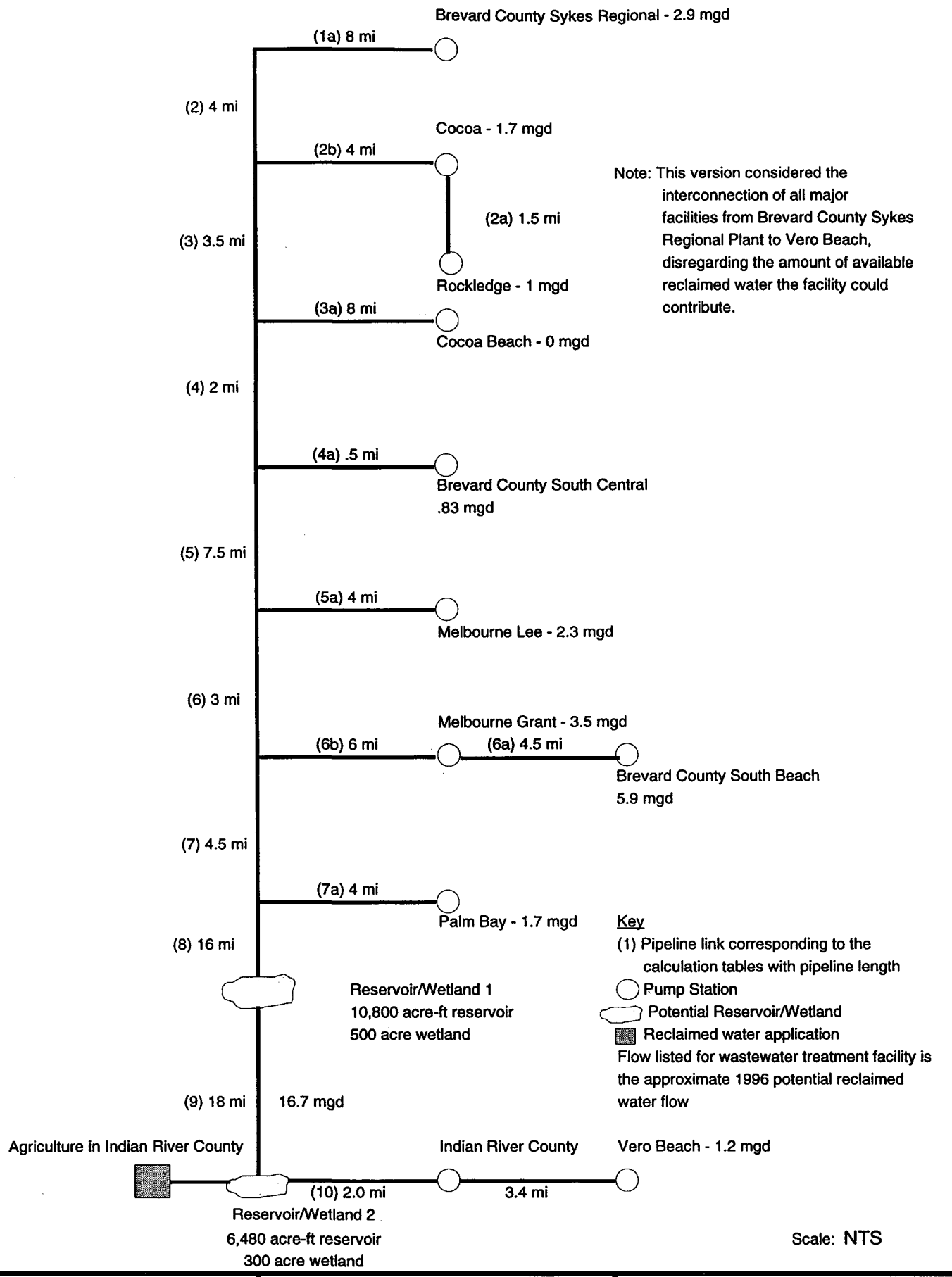
Technical Memorandum C.5.

Project 40141-5-0635

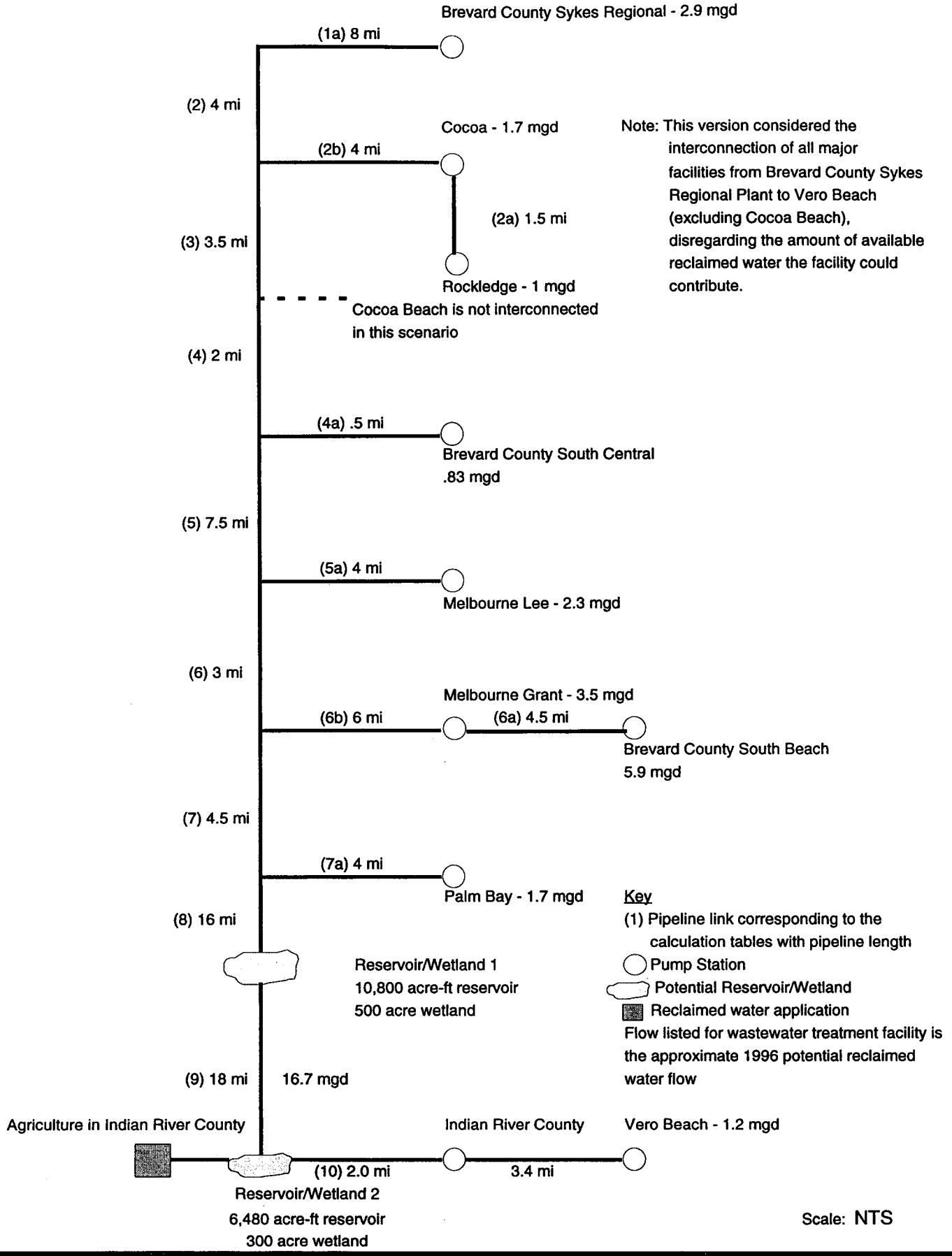
LAW
Engineering and Environmental Services

Scenario 2a
Pipeline & Reservoirs/Wetlands Interconnecting Reuse from Titusville to Vero Beach

Figure 2a



SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 23	Scenario 2b Pipeline & Reservoirs/Wetlands Interconnecting Reuse Brevard County (Sykes Regional) to Vero Beach Figure 2b



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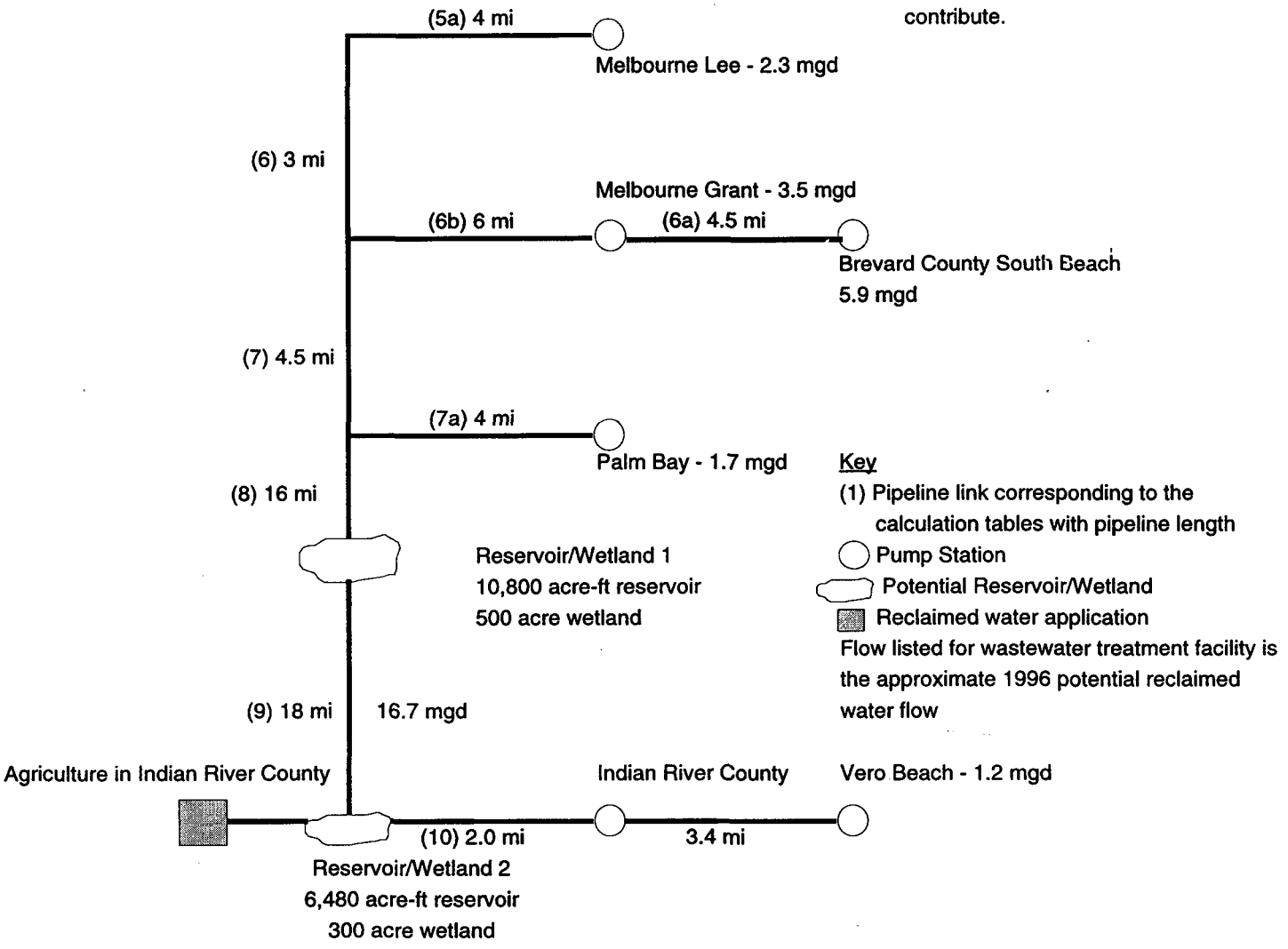
Project 40141-5-0635

LAW
Engineering and Environmental Services

Scenario 2c
Pipeline & Reservoirs/Wetlands Interconnecting Reuse from Brevard County(Sykes Regional) to Vero Beach (excluding Cocoa Beach)

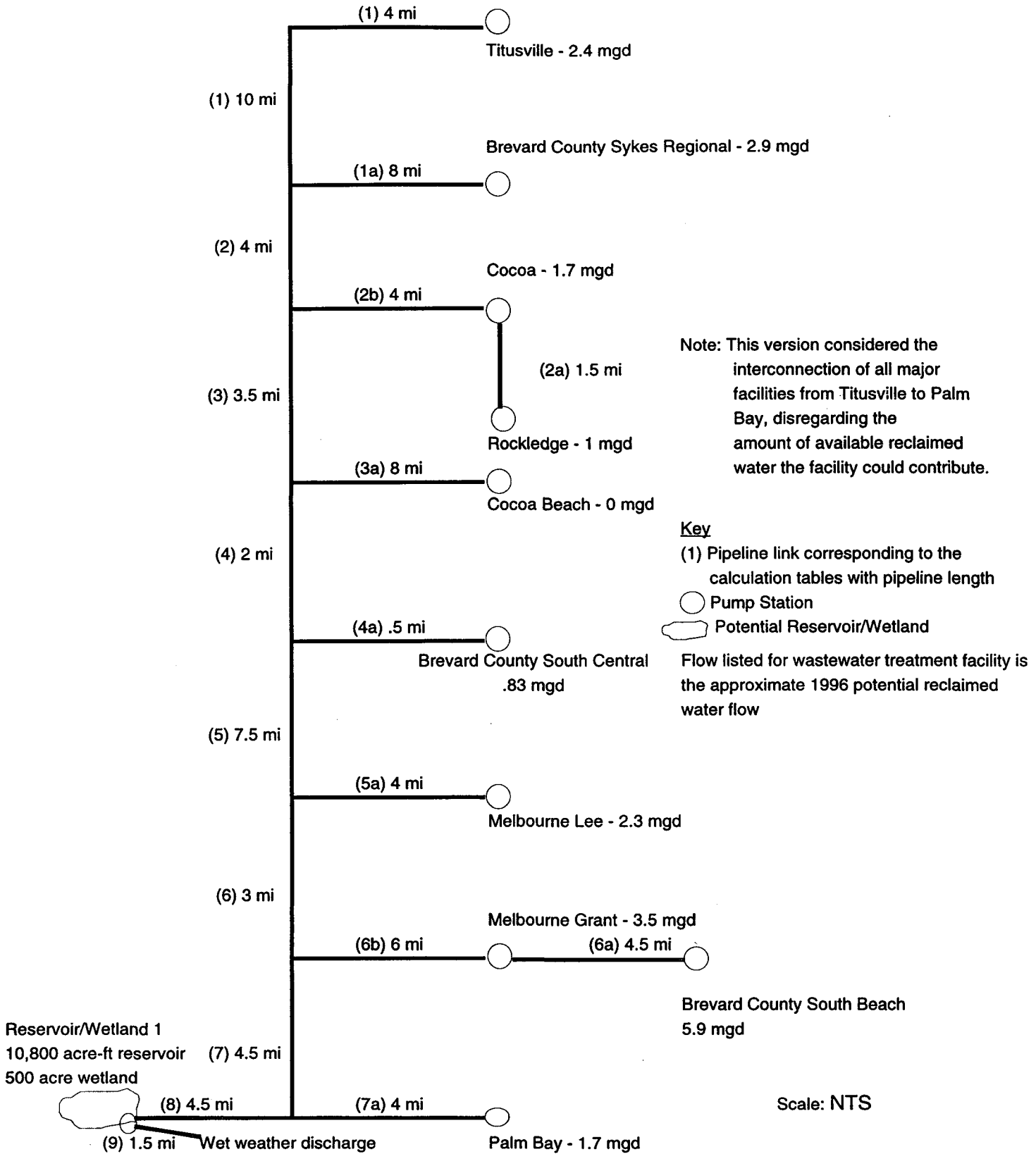
Figure 2c

Note: This version considered the interconnection of all major facilities from Melbourne to Vero Beach disregarding the amount of available reclaimed water the facility could contribute.



Scale: NTS

SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 25	Scenario 2d Pipeline & Reservoirs/Wetlands Interconnecting Reuse from Melbourne to Vero Beach Figure 2d



SJRWMD
Technical Memorandum C.5.

Project 40141-5-0635

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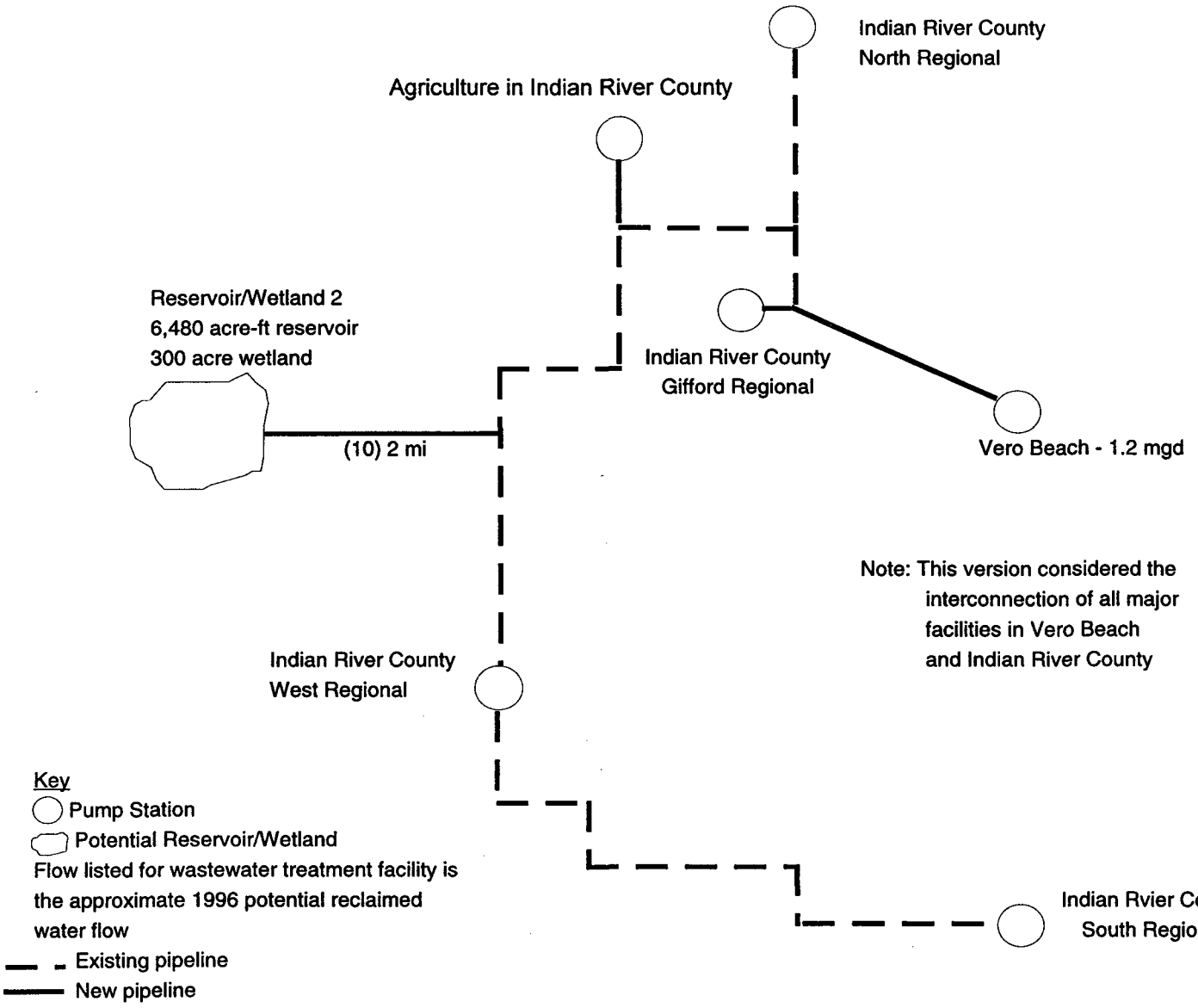
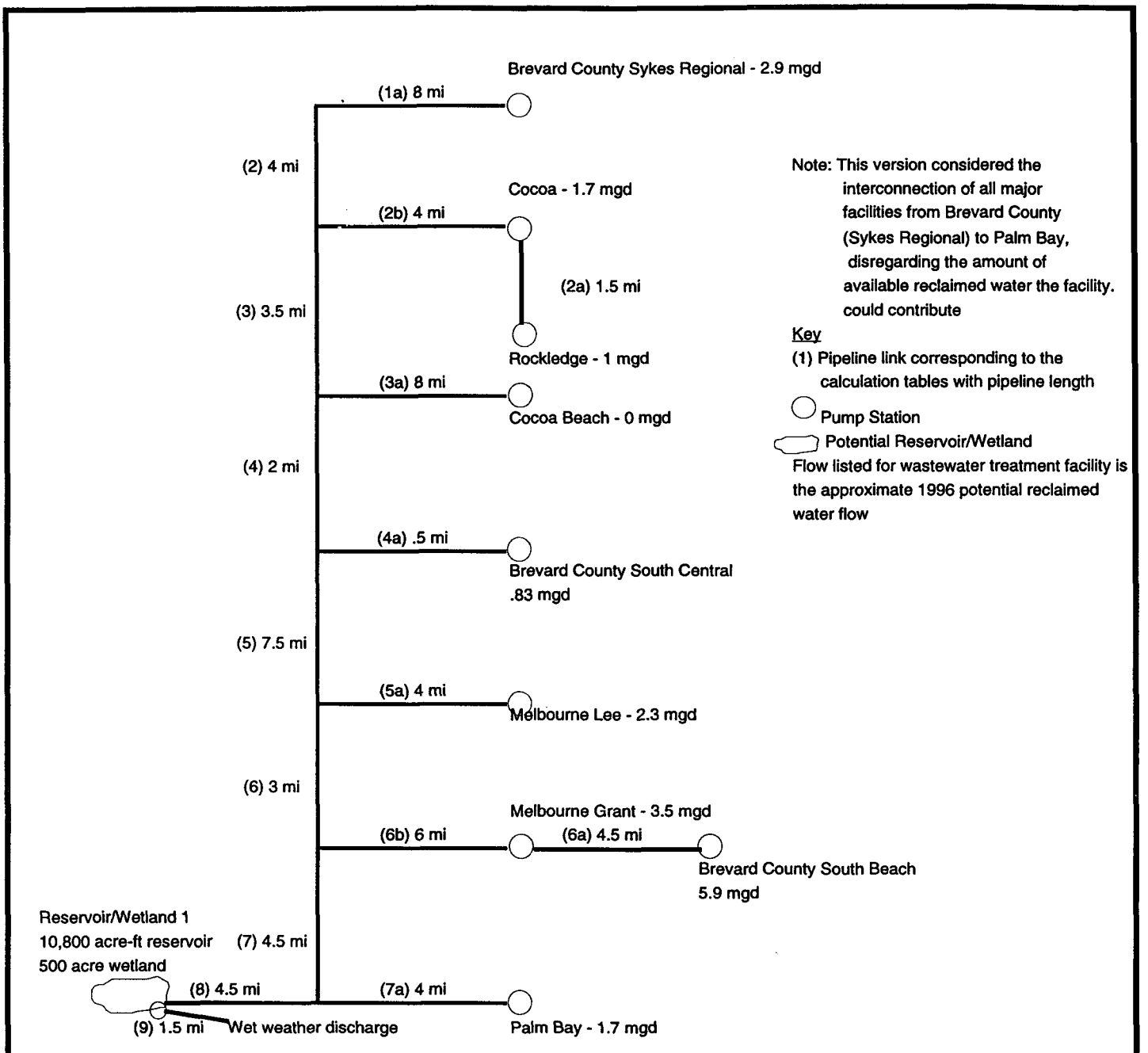
Scenario 3a
Pipeline & Reservoir/Wetland Interconnecting Reuse from Titusville to Palm Bay

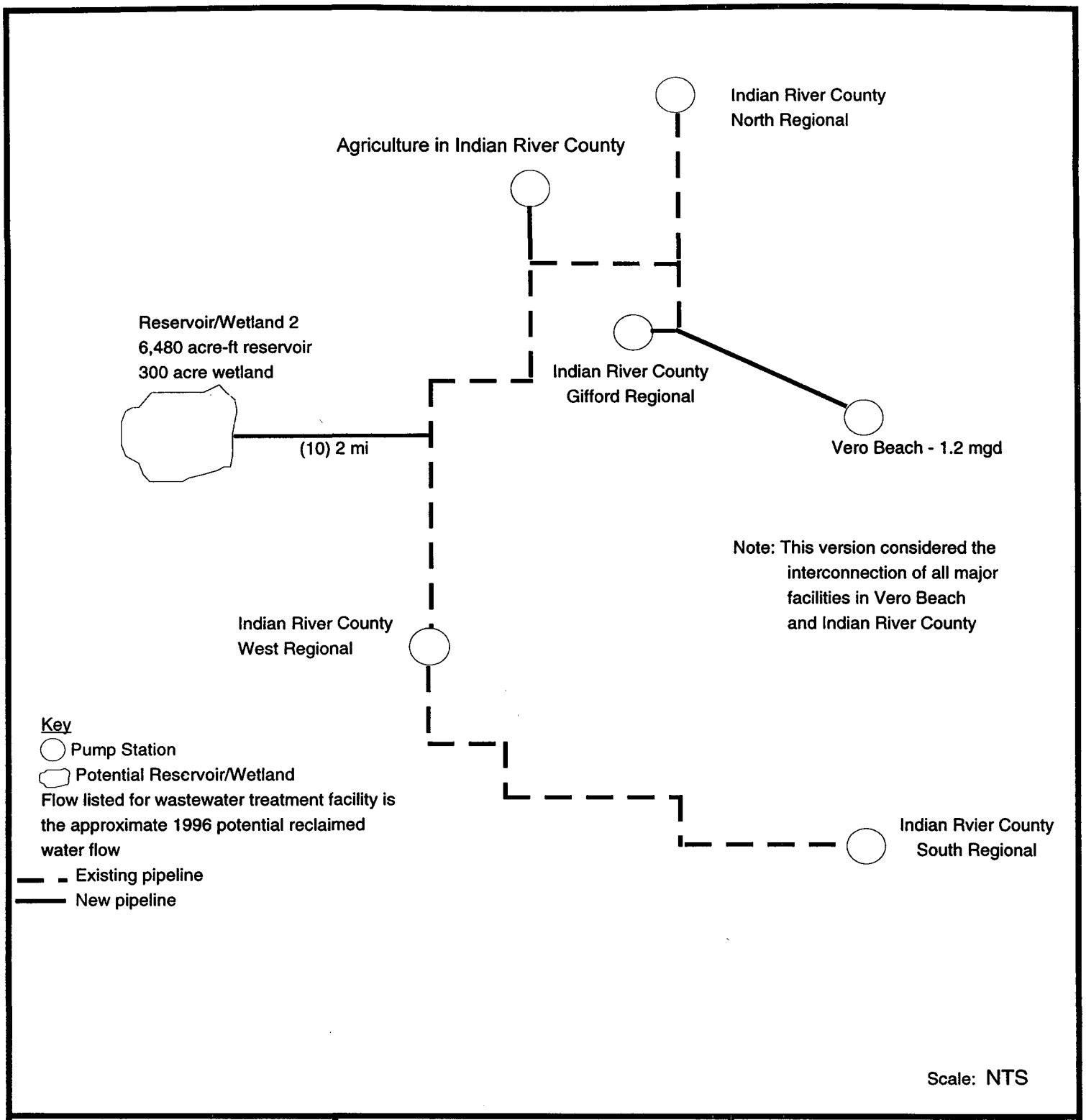
Figure 3a.1



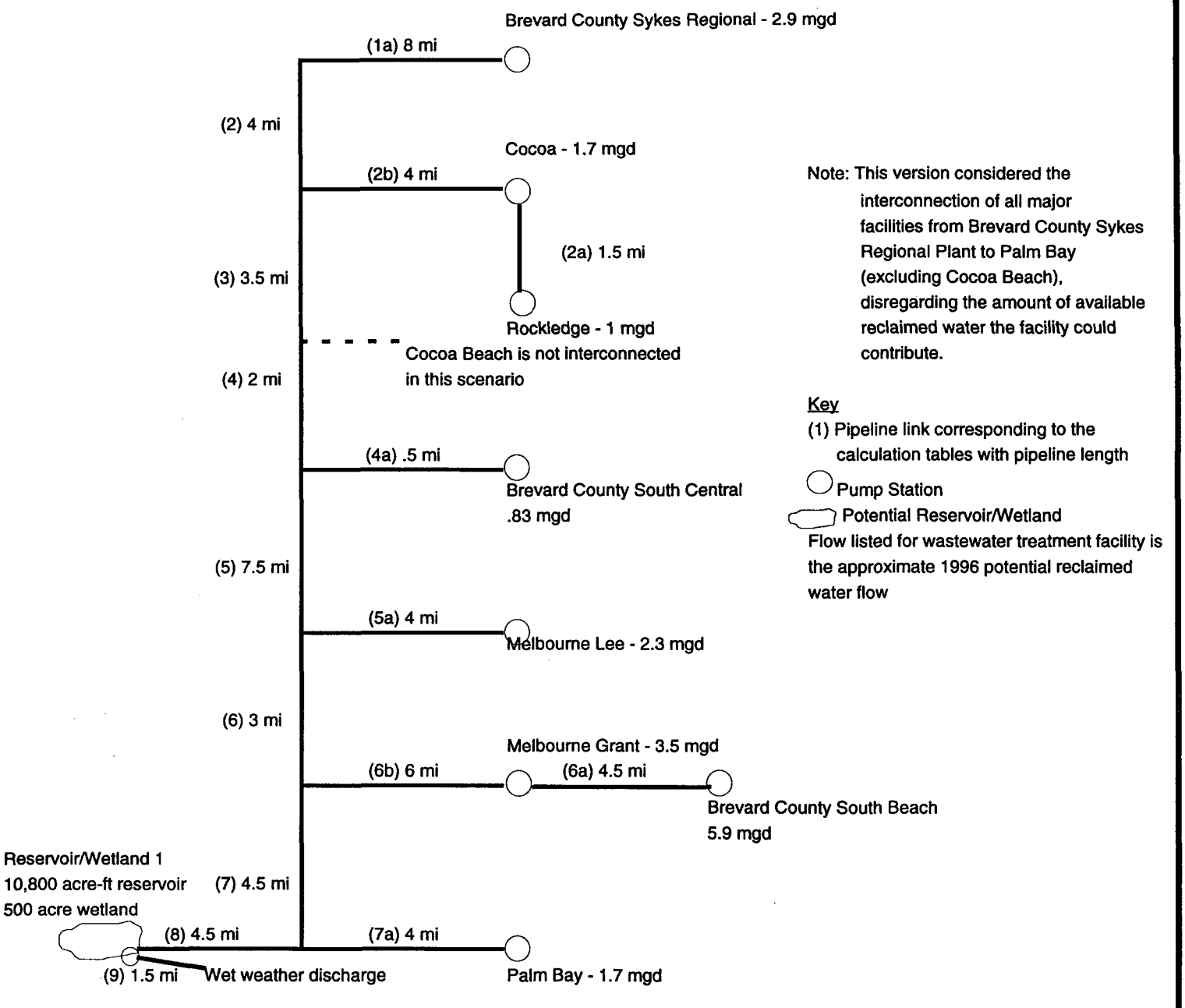
SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 27	Scenario 3a Reuse Interconnection & Reservoir/Wetland for Vero Beach and Indian River County Figure 3a.2



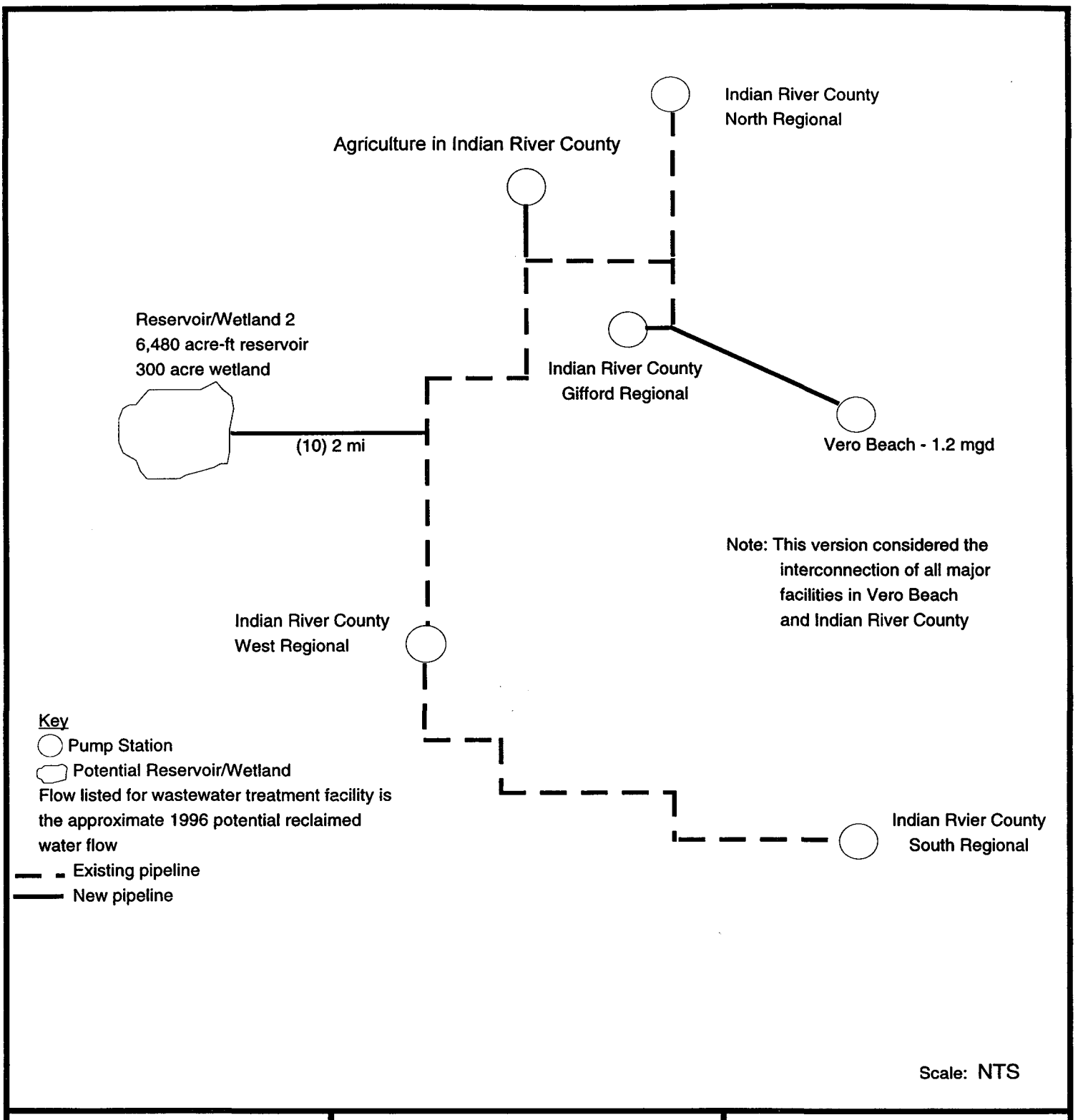
SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 28	Scenario 3b Pipeline & Reservoir/Wetland Interconnecting Reuse from Brevard County(Sykes Regional) to Palm Bay Figure 3b.1



SJRWMD Technical Memorandum C.5. Project 40141-5-0635	**LAW** Engineering and Environmental Services *29*	Scenario 3b Reuse Interconnection & Reservoir/Wetland for Vero Beach and Indian River County Figure 3b.2

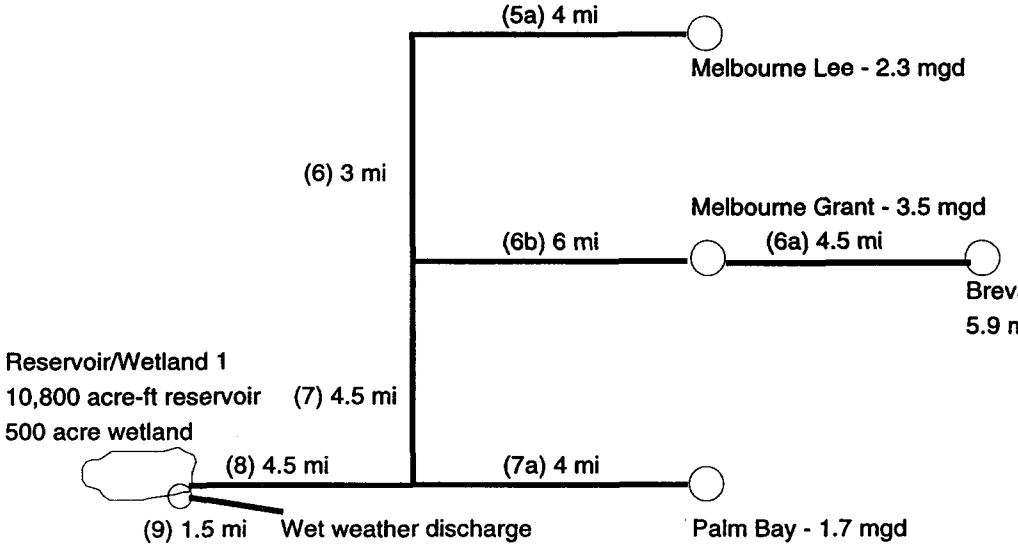


SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 30	Scenario 3c Pipeline & Reservoir/Wetland Interconnecting ReuseBrevard County (Sykes Regional) to Palm Bay (excluding Cocoa Beach) Figure 3c.1



SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 31	Scenario 3c Reuse Interconnection & Reservoir/Wetland for Vero Beach and Indian River County Figure 3c.2

Note: This version considered the interconnection of all major facilities from Melbourne to Palm Bay disregarding the amount of available reclaimed water the facility could contribute.



Key

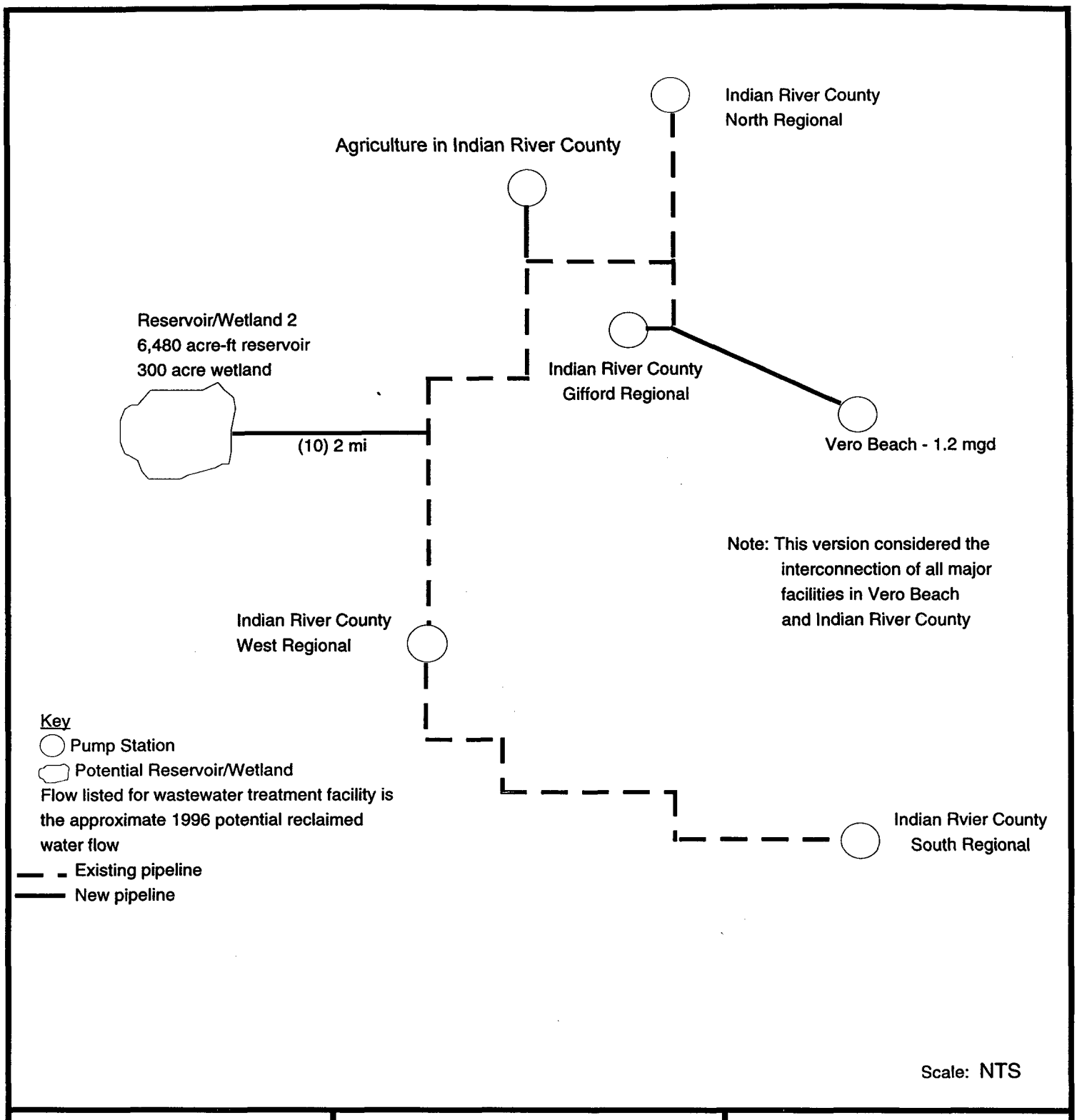
(1) Pipeline link corresponding to the calculation tables with pipeline length

○ Pump Station

Potential Reservoir/Wetland

Flow listed for wastewater treatment facility is the approximate 1996 potential reclaimed water flow

SJRWMD Technical Memorandum C.5. Project 40141-5-0635	LAW Engineering and Environmental Services 32	Scenario 3d Pipeline & Reservoir/Wetland Interconnecting Reuse from Melbourne to Palm Bay Figure 3d.1



SJRWMD Technical Memorandum C.5. Project 40141-5-0635	**LAW** Engineering and Environmental Services *33*	Scenario 3d Reuse Interconnection & Reservoir/Wetland for Vero Beach and Indian River County Figure 3d.2

APPENDIX A

Scenario 1
Additional Information

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 1a

Pipeline interconnecting reuse from Titusville to Palm Bay for agriculture and other users along pipeline.

Flow (mgd) 22.24 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	15	20	$4,831,200
1a	8	24	$3,168,000
2	4	24	$1,584,000
2a	1.5	12	$261,360
2b	4	24	$1,584,000
3	3.5	30	$1,774,080
3a	8	8	$929,280
4	2	30	$1,013,760
4a	0.5	12	$87,120
5	7.5	36	$4,672,800
5a	4	20	$1,288,320
6	3	36	$1,869,120
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	40.5	54	$45,120,240

PIPELINE CAPITAL COST	$78,476,640
PIPELINE CAPITAL COST plus 45% contin.	$113,791,128
AWT CAPITAL COSTS	$32,246,968
PUMP STATION CAPITAL	$9,996,560
DISINFECTION SYSTEM	$0
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$157,235,256**
ANNUAL POWER COST	$434,181
ADMINISTRATIVE COSTS	$0
ANNUAL O&M COST	**$2,605,666**
ANNUAL COST PIPELINE (capital)	8,535,375
AWT ANNUAL COSTS	$3,043,886
PS ANNUAL COST	$943,605
ANNUAL COST DISINFECTION SYSTEM (capital)	$0
INTERCONNECT ANNUAL COST	$90,056
TOTAL ANNUAL COST	**$15,652,767**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 1b

Pipeline interconnecting reuse from the Brevard County - Sykes Regional plant to Palm Bay for agriculture and other users along pipeline.

Flow (mgd) 19.84 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	24	$3,168,000
2	4	24	$1,584,000
2a	1.5	12	$261,360
2b	4	24	$1,584,000
3	3.5	30	$1,774,080
3a	8	8	$929,280
4	2	30	$1,013,760
4a	0.5	12	$87,120
5	7.5	36	$4,672,800
5a	4	20	$1,288,320
6	3	36	$1,869,120
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	40.5	54	$45,120,240

PIPELINE CAPITAL COST	$73,645,440
PIPELINE CAPITAL COST plus 45% contin.	$106,785,888
AWT CAPITAL COSTS	$28,766,863
PUMP STATION CAPITAL	$8,917,728
DISINFECTION SYSTEM	$0
INTERCONNECT VERO TO INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$145,671,079**
ANNUAL POWER COST	$249,401
ADMINISTRATIVE COSTS	$0
ANNUAL O&M COST	**$2,324,462**
ANNUAL COST PIPELINE (capital)	$8,009,918
AWT ANNUAL COSTS	$2,715,388
PS ANNUAL COST	$841,770
ANNUAL COST DISINFECTION SYSTEM (capital)	$0
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$14,230,995**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 1c

Pipeline interconnecting reuse from the Brevard County - Sykes Regional plant to Palm Bay (excluding Cocoa Beach) for agriculture and other users along pipeli

Flow (mgd) 19.84 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	24	$3,168,000
2	4	24	$1,584,000
2a	1.5	12	$261,360
2b	4	24	$1,584,000
3	3.5	30	$1,774,080
3a	0	8	$0
4	2	30	$1,013,760
4a	0.5	12	$87,120
5	7.5	36	$4,672,800
5a	4	20	$1,288,320
6	3	36	$1,869,120
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	40.5	54	$45,120,240

PIPELINE CAPITAL COST	$72,716,160
PIPELINE CAPITAL COST plus 45% contin.	$105,438,432
AWT CAPITAL COSTS	$28,766,863
PUMP STATION CAPITAL	$8,917,728
DISINFECTION SYSTEM	$0
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$144,323,623**
ANNUAL POWER COST	$249,401
ADMINISTRATIVE COSTS	$0
ANNUAL O&M COST	**$2,324,462**
ANNUAL COST PIPELINE (capital)	$7,908,846
AWT ANNUAL COSTS	$2,715,388
PUMP STATION ANNUAL COSTS	$841,770
ANNUAL COST DISINFECTION SYSTEM (capital)	$0
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$14,129,924**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 1d

Pipeline interconnecting reuse from the Melbourne - Lee plant to Palm Bay for agriculture and other users along pipeline.

Flow (mgd) 13.43 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	0	24	$0
2	0	24	$0
2a	0	12	$0
2b	0	24	$0
3	0	30	$0
3a	0	8	$0
4	0	30	$0
4a	0	12	$0
5	0	36	$0
5a	4	20	$1,288,320
6	3	36	$1,869,120
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	40.5	54	$45,120,240

PIPELINE CAPITAL COST	$58,571,040
PIPELINE CAPITAL COST plus 45% contin.	$84,928,008
AWT CAPITAL COSTS	$19,472,363
PUMP STATION CAPITAL	$4,163,057
DISINFECTION SYSTEM	$0
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$109,764,028**
ANNUAL POWER COST	$47,782
ADMINISTRATIVE COSTS	$0
ANNUAL O&M COST	**$1,573,434**
ANNUAL COST PIPELINE (capital)	$6,370,377
AWT ANNUAL COSTS	$1,838,053
PUMP STATION ANNUAL COSTS	$392,963
ANNUAL COST DISINFECTION SYSTEM (capital)	$0
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$10,312,666**

APPENDIX B

Scenario 2
Additional Information

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 2a

Pipeline & reservoirs interconnecting reuse from Titusville to Palm Bay for agriculture and other users.

Flow (mgd) 16.67 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	15	20	$4,831,200
1a	8	20	$2,576,640
2	4	24	$1,584,000
2a	1.5	12	$261,360
2b	4	16	$971,520
3	3.5	30	$1,774,080
3a	8	8	$929,280
4	2	30	$1,013,760
4a	0.5	12	$87,120
5	7.5	30	$3,801,600
5a	4	16	$971,520
6	3	30	$1,520,640
6a	4.5	24	$1,782,000
6b	6	30	$3,041,280
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	16	48	$15,037,440
9	18	36	$11,214,720
10	2	16	$485,760

PIPELINE CAPITAL COST plus 45% contin.	$81,429,216
PUMP STATION CAPITAL	$20,528,208
RESERVOIR CAPITAL	$10,282,080
WETLAND CAPITAL	$5,220,000
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$118,660,104**
ANNUAL O&M COST	**$406,463**
ANNUAL POWER COST	$407,529
ANNUAL COST PIPELINE (capital)	$6,107,935
RESERVOIR ANNUAL COST	$794,126
WETLAND ANNUAL COST	$403,161
PUMP STATION ANNUAL COST	$1,937,718
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$10,146,988**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 2b

Pipeline & reservoirs interconnecting reuse from Brevard County - Sykes Regional plant to Palm Bay for agriculture and other users.

Flow (mgd) 14.88 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	20	$2,576,640
2	4	20	$1,288,320
2a	1.5	12	$261,360
2b	4	20	$1,288,320
3	3.5	24	$1,386,000
3a	8	8	$929,280
4	2	24	$792,000
4a	0.5	12	$87,120
5	7.5	30	$3,801,600
5a	4	16	$971,520
6	3	30	$1,520,640
6a	4.5	24	$1,782,000
6b	6	30	$3,041,280
7	4.5	42	$3,302,640
7a	4	12	$696,960
8	16	48	$15,037,440
9	18	36	$11,214,720
10	2	16	$485,760

PIPELINE CAPITAL COST plus 45% contin.	$73,172,220
PUMP STATION CAPITAL	$18,374,568
RESERVOIR COSTS	$10,282,080
WETLAND COSTS	$5,220,000
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$108,249,468**
ANNUAL O&M COST	**$388,066**
ANNUAL POWER COST	$263,316
ANNUAL COST PIPELINE (capital)	$5,488,585
RESERVOIR ANNUAL COSTS	$794,126
WETLAND ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COSTS	$1,734,429
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$9,161,740**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 2c

Pipeline & reservoirs interconnecting reuse from Brevard County - Sykes Regional plant to Palm Bay (excluding Cocoa Beach) for agriculture and other users.

Flow (mgd) 14.88 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	20	$0
2	4	20	$1,288,320
2a	1.5	12	$1,393,920
2b	4	20	$483,120
3	3.5	24	$1,386,000
3a	0	8	$464,640
4	2	24	$792,000
4a	0.5	12	$0
5	7.5	30	$3,801,600
5a	4	16	$121,440
6	3	30	$1,520,640
6a	4.5	24	$1,584,000
6b	6	30	$2,280,960
7	4.5	42	$3,302,640
7a	4	12	$1,045,440
8	16	48	$15,037,440
9	18	36	$11,214,720
10	2	16	$485,760

PIPELINE CAPITAL COST plus 45% contin.	$66,993,828
PUMP STATION CAPITAL	$18,374,568
RESERVOIR CAPITAL	$10,282,080
WETLANDS CAPITAL	$5,220,000
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$102,071,076**
ANNUAL O&M COST	**$388,066**
ANNUAL POWER COST	$263,316
ANNUAL COST PIPELINE (capital)	$5,025,149
RESERVOIR ANNUAL COSTS	$794,126
WETLANDS ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COSTS	$1,734,429
INTERCONNECT ANNUAL COST	$90,056
TOTAL ANNUAL COST	**$8,698,304**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 2d

Pipeline & reservoirs interconnecting reuse from Melbourne - Lee plant to Palm Bay for agriculture and other users.

Flow (mgd) 10.07 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	0	24	$0
2	0	24	$0
2a	0	12	$0
2b	0	24	$0
3	0	30	$0
3a	0	8	$0
4	0	30	$0
4a	0	12	$0
5	0	36	$0
5a	4	20	$1,288,320
6	3	16	$728,640
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	36	$2,803,680
7a	4	16	$971,520
8	16	36	$9,968,640
9	18	30	$9,123,840
10	2	16	$485,760

PIPELINE CAPITAL COST plus 45% contin.	$45,514,920
PUMP STATION CAPITAL	$12,612,153
RESERVOIR CAPITAL	$10,282,080
WETLANDS CAPITAL	$5,220,000
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
TOTAL CAPITAL COST	**$74,829,753**
ANNUAL O&M COST	**$313,200**
ANNUAL POWER COST	$93,193
ANNUAL COST PIPELINE (capital)	$3,414,035
RESERVOIR ANNUAL COSTS	$794,126
WETLANDS ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COST	$1,190,498
INTERCONNECT ANNUAL COSTS	$90,056
TOTAL ANNUAL COST	**$6,298,269**

APPENDIX C

Scenario 3
Additional Information

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 3a

Pipeline interconnecting reuse from Titusville to Palm Bay which is pumped to a reservoir west of Palm Bay.

Flow (mgd) 10.00 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	15	20	$4,831,200
1a	8	20	$2,576,640
2	4	24	$1,584,000
2a	1.5	12	$261,360
2b	4	16	$971,520
3	3.5	30	$1,774,080
3a	8	8	$929,280
4	2	30	$1,013,760
4a	0.5	12	$87,120
5	7.5	30	$3,801,600
5a	4	16	$971,520
6	3	30	$1,520,640
6a	4.5	24	$1,782,000
6b	6	30	$3,041,280
7	4.5	42	$3,302,640
7a	4	16	$971,520
8	4.5	42	$3,302,640
9	1.5	36	$934,560
10	2	30	$1,013,760

PIPELINE CAPITAL COST plus 45% contin.	$50,273,124
PUMP STATION CAPITAL	$21,984,660
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
RESERVOIR CAPITAL	$10,282,080
WETLAND CAPITAL	$5,220,000
TOTAL CAPITAL COST	**$88,960,464**
ANNUAL O&M COST	**$406,673**
ANNUAL POWER COST	$221,510
ANNUAL COST PIPELINE (capital)	$3,770,944
INTERCONNECT ANNUAL	$90,056
RESERVOIR ANNUAL COST	$794,126
WETLAND ANNUAL COST	$403,161
PUMP STATION ANNUAL COST	$2,075,196
TOTAL ANNUAL COST	**$7,761,666**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 3b

Pipeline interconnecting reuse from Brevard County - Sykes Regional plant to Palm Bay which is pumped to a reservoir west of Palm Bay.

Flow (mgd) 10.00 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	20	$2,576,640
2	4	20	$1,288,320
2a	1.5	12	$261,360
2b	4	20	$1,288,320
3	3.5	24	$1,386,000
3a	8	8	$929,280
4	2	24	$792,000
4a	0.5	12	$87,120
5	7.5	30	$3,801,600
5a	4	16	$971,520
6	3	30	$1,520,640
6a	4.5	24	$1,782,000
6b	6	30	$3,041,280
7	4.5	42	$3,302,640
7a	4	12	$696,960
8	4.5	42	$3,302,640
9	1.5	36	$934,560
10	2	30	$1,013,760

PIPELINE CAPITAL COST plus 45% contin.	$42,016,128
PUMP STATION CAPITAL	$20,100,773
INTERCONNECT VERO TO INDIAN RIVER	$1,200,600
RESERVOIR COSTS	$10,282,080
WETLAND COSTS	$5,220,000
TOTAL CAPITAL COST	**$78,819,581**
ANNUAL O&M COST	**$388,276**
ANNUAL POWER COST	$162,679
ANNUAL COST PIPELINE (capital)	$3,151,594
INTERCONNECT ANNUAL COST	$90,056
RESERVOIR ANNUAL COSTS	$794,126
WETLAND ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COSTS	$1,897,371
TOTAL ANNUAL COST	**$6,887,263**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 3c

Pipeline interconnecting reuse from Brevard County - Sykes Regional plant to Palm Bay (excluding Cocoa Beach) which is pumped to a reservoir west of Palm Ba

Flow (mgd) 10.00 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	8	20	$2,576,640
2	4	20	$1,288,320
2a	1.5	12	$261,360
2b	4	20	$1,288,320
3	3.5	24	$1,386,000
3a	0	8	$0
4	2	24	$792,000
4a	0.5	12	$87,120
5	7.5	30	$3,801,600
5a	4	16	$971,520
6	3	30	$1,520,640
6a	4.5	24	$1,782,000
6b	6	30	$3,041,280
7	4.5	42	$3,302,640
7a	4	12	$696,960
8	4.5	42	$3,302,640
9	1.5	36	$934,560
10	2	30	$1,013,760

PIPELINE CAPITAL COST plus 45% contin.	$40,668,672
PUMP STATION CAPITAL	$20,100,773
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
RESERVOIR CAPITAL	$10,282,080
WETLANDS CAPITAL	$5,220,000
TOTAL CAPITAL COST	**$77,472,125**
ANNUAL O&M COST	**$388,276**
ANNUAL POWER COST	$162,679
ANNUAL COST PIPELINE (capital)	$3,050,522
INTERCONNECT ANNUAL COST	$90,056
RESERVOIR ANNUAL COSTS	$794,126
WETLANDS ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COSTS	$1,897,371
TOTAL ANNUAL COST	**$6,786,191**

REUSE INTERCONNECTION MASTER CALCULATION SHEET

SCENARIO 3d

Pipeline interconnecting reuse from Melbourne -Lee plant to Palm Bay which is pumped to a reservoir west of Palm Bay.

Flow (mgd) 10.00 ADF

PIPELINE SEGMENT NUMBER	PIPELINE LENGTH (miles)	PIPE DIAMETER (inches)	PIPELINE COST
1	0	20	$0
1a	0	24	$0
2	0	24	$0
2a	0	12	$0
2b	0	24	$0
3	0	30	$0
3a	0	8	$0
4	0	30	$0
4a	0	12	$0
5	0	36	$0
5a	4	20	$1,288,320
6	3	16	$728,640
6a	4.5	30	$2,280,960
6b	6	36	$3,738,240
7	4.5	36	$2,803,680
7a	4	16	$971,520
8	4.5	36	$2,803,680
9	1.5	30	$760,320
10	2	30	$1,013,760

PIPELINE CAPITAL COST plus 45% contin.	$23,764,224
PUMP STATION CAPITAL	$15,058,619
INTERCONNECT VERO WITH INDIAN RIVER	$1,200,600
RESERVOIR CAPITAL	$10,282,080
WETLANDS CAPITAL	$5,220,000
TOTAL CAPITAL COST	**$55,525,523**
ANNUAL O&M COST	**$339,144**
ANNUAL POWER COST	$67,142
ANNUAL COST PIPELINE (capital)	$1,782,534
INTERCONNECT ANNUAL COSTS	$90,056
RESERVOIR ANNUAL COSTS	$794,126
WETLANDS ANNUAL COSTS	$403,161
PUMP STATION ANNUAL COST	$1,421,427
TOTAL ANNUAL COST	**$4,897,590**