FWF
TRIAL EXHIBIT
94

CHEMICALLY DISTINCT: BACKPUMPING POLLUTED CANAL WATER INTO LAKE OKEECHOBEE HARMS THE LAKE

This exhibit demonstrates that the water in the canals is chemically distinct from that of the Lake in that the canal water is highly polluted. In fact, the back pumping of water from the canals into the Lake harms the Lake by adding these pollutants.

The water chemistry tables from Plaintiff's Exhibit 94 show that the water backpumped into Lake Okeechobee from pumping station S-2 is much more polluted than the water in the Lake. S-2 backpumps water from the North New River Canal into the Lake The tables in this exhibit show the pollution levels in the North New River Canal (designated "NNR Basin" in table 7.4.3.1-3) compared to those in Lake Okeechobee (designated "LOK_{NNR}") near where the back pumping takes place. The North New River Canal has a dissolved oxygen level less than half than the legally allowable minimum (2.47 mg/L vs. state standard of 5 mg/L) as compared to 6.57 mg/L in Lake Okeechobee. Total nitrogen is 5.50 mg/L in the North New River Canal compared to 2.00 mg/L in the Lake. Total phosphorus is .150 mg/L in that canal compared to .077 mg/L in the Lake. Fish and oxygen dependent organisms need dissolved oxygen to survive in water, while phosphorus and nitrogen are nutrients that cause algae blooms and contaminate drinking water sources.

CENTRAL AND SOUTHERN FLORIDA PROJECT
EVERGLADES AGRICULTURAL AREA STORAGE RESERVOIRS

DRAFT
INTEGRATED PROJECT IMPLEMENTATION REPORT
ENVIRONMENTAL IMPACT STATEMENT

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

SEPTEMBER 2005

This Report Contains 2 Volumes

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structures into STA 3/4. The total capacity for these structures is approximately 6,000 cfs. These structures are double-barreled stop log riser structures. For the EAA Storage Reservoirs Project these structures will continue to function as the STA 3/4 inflow structures. These structures are located along the northern boundary of STA 3/4.

Canals

Perimeter Canal

The functions of perimeter canals, C-601 and C-602, are for seepage collection and conveyance of reservoir outlet flows. The canals are also required as a borrow source for construction of levees. The new perimeter canals will capture seepage to the western, northern, and eastern boundaries. Seepage along the reservoirs southern boundary will be captured by the existing STA 3/4 supply canal.

C-601 Canal

Canal C-601 is the Cell 1 perimeter seepage/conveyance canal. The canal is located along the Cell 1 northern and eastern boundaries. The north section of C-601 is used for both seepage collection and conveyance of Cell 2 discharge through the S-607 structure. The eastern reach of C-601 is used for seepage collection. Seepage flows in the canal are collected by the S-610 pump station and returned to the reservoir.

C-602 Canal

Canal C-602 is the Cell 2 perimeter seepage canal. The canal is located along the Cell 2 northern and western boundaries. The north section of C-601 is used for both seepage collection and conveyance of Cell 2 discharge through the S-607 structure. The eastern reach of C-601 is used for seepage collection.

Canal Modifications

Miami Canal

The design capacity of the Miami Canal is 3,000 cfs. The conveyance capacity of the Miami Canal would have to be increased by approximately 50% as determined by the hydraulic analysis. The increase in capacity requirements necessitated an enlargement of an approximate 9 mile section of canal. All of this work will be performed within the existing SFWMD right of way of the Miami Canal.

North New River Canal

The design capacity of the North New River Canal is 4,000 cfs. The conveyance capacity of the North New River Canal would have to be increased by approximately 150% as determined by the hydraulic analysis. The increase in capacity requirements necessitated an enlargement of an approximate 22.5 mile section of canal between the reservoir and Lake Okeechobee. The North New River Canal channel improvement is constrained by U.S. 27 on the west bank. All of this work will be performed within the existing SFWMD right of way of the North New River Canal.

Bolles and Cross Canals

Improvements to the Bolles and Cross Canals will allow water from Lake Okeechobee and the northern portion of the EAA to be more effectively routed to the south. The design capacity determined for these canals is 1,500 cfs. The existing capacities of these canals are severely limited due to their shallowness. The increase in capacity requirements necessitated an enlargement of the entire reach of both canals. The length of Bolles and Cross Canals are approximately 7.7 and 8.8 miles, respectively. All of this work will be performed within the existing SFWMD right of way of the Bolles and Cross Canals. The location of the Bolles and Cross Canals are shown on Figure 6-3.

Levees

The reservoir has perimeter levees, L-601 and L-602, with a minimum height of 23 feet above average ground for both earthen and RCC designs. The height of the internal levee L-601i is 21 and 19.2 feet above average ground for the earthen and RCC designs, respectively.

Cut-off walls will be installed as part of the levee or embankment construction. For earthen embankments, the estimated depth of the cut-off wall is 35 feet along the east, north, west, and STA 3/4 sides of the reservoir. A 50-foot deep cut-off wall will be installed along the Holey Land area. For RCC embankments, a 50-foot deep cut-off wall will be installed along the perimeter of the reservoir embankment.

Bridges

The S-609 box culvert structure will be constructed underneath U.S. Highway 27. This structure will serve as a hydraulic connection between the EAA reservoir and the North New River Canal.

Bridge relocations will be required due to channel improvements in the Miami, North New River, Bolles and Cross Canals.

The estimated cost for the EAA Storage Reservoir selected plan is $912,895,089. The breakdown of the estimated cost is shown in Table 1.

TABLE 1 TOTAL COSTS (AUGUST 2005)
EAA RESERVOIR ALTERNATIVE 4

Borrow and Canal	**$261,957,593**
Levee construction	**$191,732,312**
Cutoff Wall	**$86,086,678**
Utility Relocations	**$323,857**
Bridges	**$5,636,497**
NNR Canal Improvements	**$35,443,519**
Miami Canal Improvements	**$16,682,354**
Bolles & Cross Improvements	**$20,745,203**
Pump Stations	**$122,520,842**
Structures	**$14,714,934**
Manatee Gates	**$5,325,000**
Recreation	**$342,300**
Total Construction Cost	**$761,511,089**
Real Estate	**$80,134,000**
S&A	**$33,750,000**
PED	**$37,500,000**
Total Estimated Cost	**$912,895,089**

The average annual operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs are estimated to be $2,423,508. The average annual water quality monitoring costs are estimated to be $350,000.

BENEFITS OF THE PLAN

Alternative 4, the selected alternative plan and preferred plan for purposes of NEPA, would meet all of the project-specific objectives established for the EAA Storage Reservoir. It is expected to provide an ensure eventual compliance within the EPA. A long-term plan for achieving this compliance was published by SFWMD in October 2003 (Burns & McDonnell, 2003).

2.2.11 WATER QUALITY

Overview

Water quality information focuses upon the EAA as the area of expected primary impacts. However, the water quality of the larger area is dependent on Lake Okeechobee water quality to the extent that these waters are released to the various receiving waters. Lake Okeechobee water is conveyed to receiving water bodies by canals and primary and secondary tributaries. Receiving waters are St. Lucie and Caloosahatchee River Estuaries, including Indian River Lagoon and Charlotte Harbor, and the northern WCAs.

Nutrients such as phosphorous and nitrogen compounds are a concern in the WCAs and EPA. When there are sufficient levels of both nutrients present, cattails and other invasive species displace native sawgrass. There are many natural and human sources of nitrogen compounds. However, vegetation growth is limited by the comparative lack of phosphorous compounds. These come primarily from agricultural fertilizers and decomposition of the peat soils in the area. Decomposition of peat soils in the EAA is accelerated by continued agricultural use. Thus, phosphorous is a parameter of particular concern regarding water from Lake Okeechobee and the EAA.

Agricultural BMPs were implemented in the EAA in 2000, with the result of improving water quality. However, this area remains a primary source of pollutants for the WCAs. The WCAs form the remnant wetland communities for the northern section of the Everglades system. These areas have been isolated from contiguous lands by a series of levees and pump stations. Water moving south from the lake and EAA is pumped through the WCAs, thereby making these areas nutrient filters for downstream basins. A highly altered hydroperiod results from the presence of various levees and pumping schedules. These factors may worsen water quality conditions in the WCAs and are consistent with the general degradation of water quality in areas along the canals and pump stations when compared to conditions in the central portions of the basins. Construction of STAs upstream of the WCAs will serve to improve water quality conditions through time; however, other problems may persist.

The L-8 (C-51), West Palm Beach, Hillsboro, North New River, and Miami Canals from Lake Okeechobee to the L-4, 5, 6, and 7 Canals, which roughly define the EAA, have poor water quality with extremely high nutrient and low dissolved oxygen levels. Other problems include pesticides, biological oxygen demand, bacteria, and suspended solids. Fish kills occur periodically in the West Palm Beach Canal after heavy rains drain from the Chemair Spray hazardous waste site.

Monitoring Programs

SFWMD maintains a water quality monitoring network for surface waters within and at the boundaries of the EAA. These surface water samples have been analyzed for multiple constituents. The samples have been acquired at various frequencies from a variety of sampling stations over the years. These water quality data are compiled in SFWMD's database DBHYDO and available through Internet search (http://www.sfwmd.gov/org/ema/dbhydro/). Additional data sources include: USEPA, the U.S. Geological Survey (USGS), FDEP, and numerous public and private research and monitoring efforts.

FDEP has defined most of the primary and secondary canals within the EAA (Miami, Hillsboro, North New River, West Palm Beach, Bolles and Cross Canals) as Class III Waters with a designated use of "recreation, propagation and maintenance of healthy, well-balanced population of fish and wildlife." Agricultural canals are regulated as Class IV Waters designated for "agricultural water supply." A summary of applicable water quality criteria for Class III and IV Waters of the state as defined in Section 62-302.530, FAC, may be found in Appendix C.

While most of the surface water quality monitoring has been performed by SFWMD, other agencies have cooperated in the monitoring effort, including USEPA, USGS, FDEP, and the USACE. Surface water samples and field measurement data were collected near the water surface. Samples and data generally were collected at routine frequencies so they were not biased by water management practices or season of the year. Analytical procedures were typically USEPA methods that were approved by CERP oversight.

Information in this sub-section is intended to be general summary data. It should be useful in providing a broad understanding of water quality in the various water bodies of interest. It must be noted that any monitoring program has limitations with regard to the detail to which data may be interpreted. For example, water samples and field measurement data were routinely collected near the water surface. Sampling at the surface of a water body may or may not yield analytical data that reflect the water quality of the entire water column. The water columns in some Florida canals have been seen to stratify, allowing substantial water quality (e.g., dissolved oxygen, nutrients) differences to develop in the near-surface water and water closer to the canal bottom. Please see Appendix C for more detail on water quality data.

Water Quality Parameters of Interest

Field measurement parameters include specific conductance, pH, and dissolved oxygen. Specific conductance, the ability of a water sample to carry an electrical current, provides a measure of the dissolved solids such as sodium chloride, calcium carbonate, and sulfate, which have an electrical charge when they dissolve. There are levels of salt that will adversely affect aquatic plants and animals. This level is different for each species. Measuring pH determines how acidic or basic the water is. Aquatic plants and animals are generally only able to tolerate a narrow range of pH values. Oxygen is necessary for aquatic plants and animals to live and either dissolves into water at the water-and-air interface or during photosynthesis by aquatic plants. Low dissolved oxygen may be an indicator of high organic loadings and is associated with foul smelling water.

Solids and chemical ions are determined during laboratory testing. These tests provide general water quality information. Suspended solids and turbidity are often related. The suspended solids test measures particulates that are in the water column at the time of sampling. These solids may be microscopic plants (algae), fine silt, and/or clay suspended by wave action or water movement. Turbidity measures the light scattering caused by particulates in the water column. Light scattering may limit the amount of light that bottom dwelling plants receive and may reduce the aesthetic appeal of a water body.

Major ions of interest are chloride, sulfate, calcium, sodium, and iron. These chemical constituents are normally present in natural surface waters, but may sometimes limit water use when present in excess, causing problems with water hardness, color and staining, and excessive saltiness. Alkalinity is important for measuring carbonate and other acid and base buffering ions in natural waters.

Nitrogen and phosphorus are typically the most important nutrients with regard to aquatic plant growth. In water, excessive growth of plants cannot be sustained and may act to deplete dissolved oxygen. Nitrogen (N) in the forms of nitrate (NO_3) and nitrite (NO_2) are commonly analyzed together with a single test and the results are often identified as NOx-N. Ammonia and NOx-N are available for plant uptake. Total Kjeldahl nitrogen measures ammonia nitrogen and nitrogen incorporated into organic compounds and plant and animal cells but not NOx-N. Ortho phosphate (PO_4 or oP) and total dissolved phosphorus (TDP) are forms of phosphorus that are not bound in

ii. Submission of scoping letter to identified Project stakeholders providing a description of the EAA Storage Reservoir project and identifying points of contact for more information or registering concerns.
iii. Two public workshops were conducted in Spanish and English at Belle Glade in August 2001 and January 2003.
iv. A series of PDT meetings (that were open to the public) were held within 50 miles of the Study Area.

Many of the issues identified through this process are related to the conflict between encroaching human development and the natural environment. Public comments generally supported the Project's goals and objectives, but expressed concern over the length of the Project schedule. There was skepticism regarding the cost-effectiveness of storage reservoirs versus storing water in Lake Okeechobee or the WCAs due to increased evaporation and seepage from the reservoirs. Suggestions were put forth by the public to investigate alternate approaches to restoring historic flows and flow-ways. Many of the public comments were concerns regarding potential impact to jobs in the Study Area.

4.2 WATER QUALITY

4.2.1 Everglades and WCAs

Currently, the EAA has altered the frequency, duration, and magnitude of interannual wet and dry cycles, and introduced high nutrient loading. Water released from the EAA directly to the WCAs contains significant quantities of nutrients (most notably phosphorous derived from agricultural practices) relative to goals for such pollutants. The hydrology of the remaining Everglades has become altered by the operations of the C&SF Project. The resulting loss in spatial extent increased concentrations of pollutants in natural system surface waters, sediments, and wetlands.

4.2.2 Lake Okeechobee

Similar pollutants in the water are backpumped to Lake Okeechobee from the EAA. They contribute to the eutrophic state of the lake, although there are larger sources of nutrients to the lake - notably the Kissimmee River basin and the Taylor Creek/Nubbin Slough Basin. Lake Okeechobee is designated as a Class I waterbody according to the FAC. This means that it is used as a potable water supply source and must meet the most stringent surface water quality and pollution control criteria in Florida. However, in 1988, FDEP prepared a list of waterbody sites where water quality was not adequate to sustain its designated uses. Lake Okeechobee had eight different monitoring stations wherein excessive nutrients, low levels of

4.3.4 Opportunities

The EAA Storage Reservoir project, if properly designed, is an opportunity to smooth out the delivery of water to the WCAs and incrementally improve the ecosystems of the WCAs, Lake Okeechobee, and the two estuaries. This is accomplished by more complete treatment of water released to the WCAs, eliminating backpumping of water from the EAA to the lake, and providing an additional increment of storage volume to allow lowering of the lake's level.

During the wet season, storage within the EAA will help reduce ecologically damaging high water conditions in the WCAs and backpumping of agricultural runoff into Lake Okeechobee. Regional above-ground impoundments or storage areas within the EAA could capture and store EAA runoff or excess water from Lake Okeechobee during the wet season.

During the dry season reservoir releases could be made to the primary canals for agricultural irrigation and for restoration of the downstream Everglades ecosystem. Lake Okeechobee would then no longer serve as the only supplemental source for meeting EAA irrigation demands. During the periods when supplemental irrigation requirements could not be met by the EAA storage reservoirs, water supply releases from Lake Okeechobee could still be provided.

4.4 FISH AND WILDLIFE

4.4.1 Everglades and WCAs

Human-induced changes in and around the Study Area have resulted in a substantial reduction in habitat options for fish and wildlife. In the WCAs, the population of alligators has increased, but nesting success is affected by water levels. Colonial wading birds' feeding and breeding success is also affected by ponded, deep water areas, and altered timing of seasonal drying. During periods of extended high water, accumulation of dead plant material interferes with fish spawning and exerts a large oxygen demand causing fish kills. The fish community structure and abundance is highly dependent on water levels. The fish communities, in turn, provide a major food source for wading birds, alligators, and other carnivores.

4.4.2 Lake Okeechobee

In the littoral zone of Lake Okeechobee, the more constant high water levels do not allow for the periodic wetting and drying necessary for the germination of several plant communities, such as willows, which provide

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ANNEXES AND APPENDICES

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

SEPTEMBER 2005

APPENDIX F

DRAFT WATER QUALITY ASSESSMENT REPORT

Prepared for

U.S. Army Corps of Engineers
Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207-8175

Prepared by

Water & Air Research, Inc.
6821 S.W. Archer Road
Gainesville, Florida 32608

Table 7.3.6.2-2. Average Depths as a Percent of Planned Maximum Depth

Configuration	C1	C2
Alt1R	84%	49%
Alt2R	76%	44%
Alt3R	73%	44%
Alt4R	74%	43%
Original Alt. 3	50%	50%

The simulated depths for the five SFWMM alternatives can be compared to the 37 comparables shown in Table 7.3.2.3-2. Lakes and reservoirs in this database have average stages ranging from 48 to 89% of their maximum stages with an average of 71.6%. Interestingly, the operating ranges are similar for the other control categories. By comparison, C2 is operated at a relatively low mean depth and is similar to the Pre-existing Wetlands category in Table 7.3.2.3-2.

The alternative design depths for the EAASR are 6, 10, 12, and 14 feet, or 183, 305, 366, and 427 cm, respectively. The mean design depth for the 15 lakes and reservoirs is shown in Table 7.3.2.3-2 and was found to be 293 cm with a range from 187 to 457 cm. Thus, the four selected depths fall within a reasonable range for this area.

7.4 *Influent Water Quality*

7.4.1 Parameters of Interest

The following fifteen water quality parameters have been recommended to represent the impacts of the Everglades Agricultural Area Storage Reservoir (EAASR) on the surrounding system.

1. Dissolved Oxygen (DO)
2. Specific Conductivity
3. pH
4. Turbidity
5. Total Suspended Solids (TSS)
6. Alkalinity
7. Iron
8. Calcium
9. Sulfate
10. Chloride
11. Sodium
12. Total Nitrogen (TN)
13. Total Phosphorous (TP)
14. Pesticides/Herbicides
15. Mercury

The influent quality of these parameters was determined by data analysis using the methodology described below.

7.4.2 Water Quality Methodology

To examine the influent water quality for the EAASR, it was necessary to examine the sources of inflows to the reservoir. Inflows to the EAASR in each alternative configuration provided were conveyed by the Miami and NNR Canals from four sources. S2 is the pump station located at the NNR Canal on LOK that both backpumps and releases water from LOK. S3 is the pump station located at the Miami Canal that backpumps and releases water from LOK. Water was assumed to be released from LOK through pump stations S2 and S3 and was routed directly to the reservoir, without water quality changes in the canals. The assumption of water exiting LOK being equivalent to water entering the EAASR was used because a method to estimate changes in the canals was not readily available.

Water quantity and quality data were collected for S2 and S3 from DBHYDRO, the SFWMD database (SFWMD 2005e). Measurements for pump stations S2 and S3 were downloaded for both flow and surface water quality for the periods of record. The earliest water quality measurement was taken on June 4, 1973, and the latest reported water quality measurement was on January 18, 2005. Flow data were available for the entire period of water quality measurements. The data were then imported into Excel for manipulation. Each water quality record was matched with the flow record corresponding to the sampling day. Samples occurring with positive flows represented those out of LOK and negative flows represented backpumping from the EAA to LOK (Raymond 2005). Only the measurements taken by grab sampling were used in analysis. Auto sampler measurements were not used, because they potentially included samples from LOK water and waters backpumped from the EAA. Thus, they could not be assigned a source with certainty. All concentrations measured on zero flow days were ignored because they did not necessarily represent the quality of water that would be delivered in either direction. The number of water quality measurements available for each parameter varied from zero to 227 and is presented by parameter and source in Tables 7.4.2-1 and 7.4.2-2.

Table 7.4.2-1. NNR Basin Mean, Coefficient of Variation, and Count of Water Quality Parameters

Parameters	NNR Basin Mean	NNR Basin Coefficient of Variation	NNR Basin Number of Records
Dissolved Oxygen (mg/L)	2.47	1.00	125
Specific Conductivity (uS/cm)	1191.29	0.21	124
pH (Standard Units)	7.19	0.05	133
Turbidity (NTU)	10.68	1.34	106
Total Suspended Solids (mg/L)	18.13	1.45	94
Alkalinity (mg/L as CaCO3)	317.35	0.27	113
Iron (mg/L)	267.00	0.89	113
Calcium (mg/L)	109.22	0.22	55
Sulfate (mg/L)	101.86	0.41	54
Chloride (mg/L)	137.05	0.28	125
Sodium (mg/L)	97.83	0.29	55
Total Nitrogen (mg/L)	5.50	0.46	141
Total Phosphorus (mg/L)	0.150	0.529	148
Atrazine (ug/L)	0.67	0.97	8
Ametryn (ug/L)	0.06	0.36	15
Total Mercury (ng/L)	2.82	0.50	9

Table 7.4.2-2. LOK_{NNR} Canal Mean, Coefficient of Variation, and Count of Water Quality Parameters

Parameters	LOK_{NNR} Mean	LOK_{NNR} Coefficient of Variation	LOK_{NNR} Number of Records
Dissolved Oxygen (mg/L)	6.57	0.26	98
Specific Conductivity (uS/cm)	625.17	0.25	100
pH (Standard Units)	7.78	0.04	99
Turbidity (NTU)	11.72	0.87	103
Total Suspended Solids (mg/L)	12.94	0.96	97
Alkalinity (mg/L as CaCO3)	137.82	0.33	105
Iron (mg/L)	170.43	0.70	105
Calcium (mg/L)	48.64	0.23	32
Sulfate (mg/L)	49.42	0.27	37
Chloride (mg/L)	81.96	0.25	105
Sodium (mg/L)	52.63	0.30	32
Total Nitrogen (mg/L)	2.00	0.45	97
Total Phosphorus (mg/L)	0.077	0.463	105
Atrazine (ug/L)	0.28	0.54	13
Ametryn (ug/L)	0.03	0.78	13
Total Mercury (ng/L)	NA	NA	0

Inflows to the reservoir were simulated separately by canal with the arithmetic average concentration representing the expected influent concentration to the reservoir. A schematic of the region with inflow destinations is shown in Figure 7.4.2-1 where flows from the left side of the schematic are conveyed by the Miami Canal and flows on the right are conveyed by the NNR Canal.

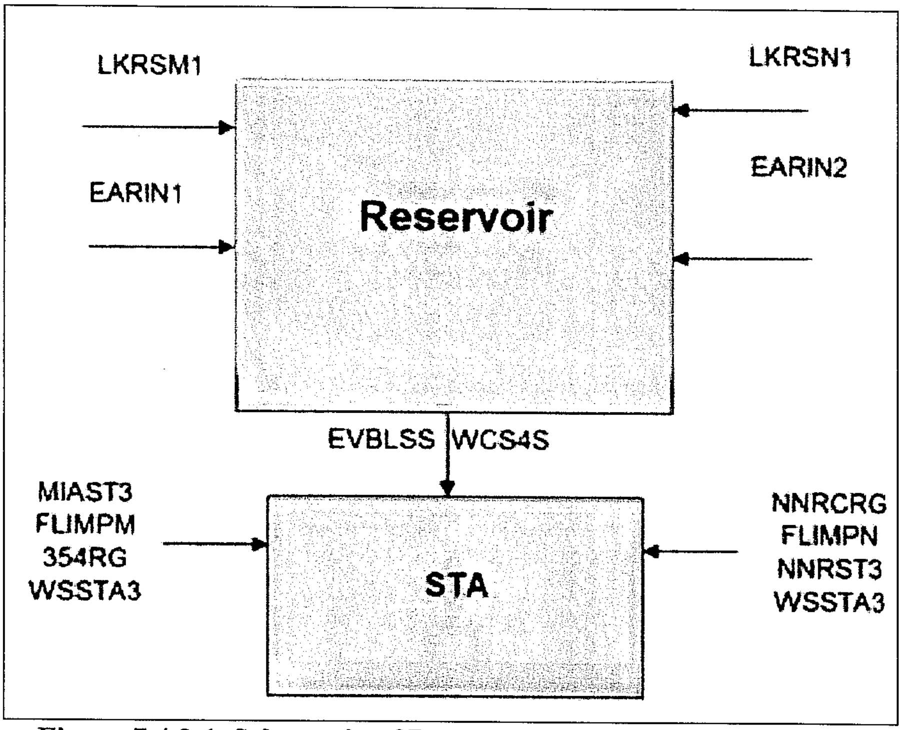

Figure 7.4.2-1. Schematic of Reservoir/STA System and Inflows

Flows LKRSM1 and LKRSN1 were simulated by examining positive flows. All of these flows are derived from LOK and were released via S2 or S3 to the STA. Flows EARIN1 and EARIN2 are comprised of water received from the NNR Canal Basin and the Miami Basin. These flows were simulated using the negative flows from the S2 and S3 dataset. It was assumed that these values would accurately predict water quality from the basin that would be directed to the reservoir and STA.

7.4.3 Influent Water Quality Values

7.4.3.1 Canal Water Quality

The water passing through pump stations S2 (NNR) and S3 (Miami) was divided into two types: to LOK from the EAA (backpumping), and from LOK to the EAA. These were designated in all further discussion as Basin and LOK_{Canal}, respectively. The mean, coefficient of variation (standard deviation divided by mean), and count of data for each parameter and divided by flow direction are presented for S2 in Tables 7.4.2-1 and 7.4.2-2 and for S3 in Tables 7.4.3.1-1 and 7.4.3.1-2.

Table 7.4.3.1-1. Miami Basin Mean, Coefficient of Variation, and Count of Water Quality Parameters

Parameters	Miami Basin Mean	Miami Basin Coefficient of Variation	Miami Basin Number of Records
Dissolved Oxygen (mg/L)	3.45	0.42	176
Specific Conductivity (uS/cm)	961.96	0.27	177
pH (Standard Units)	7.23	0.05	191
Turbidity (NTU)	8.24	0.82	160
Total Suspended Solids (mg/L)	12.92	1.10	140
Alkalinity (mg/L as CaCO3)	248.09	0.24	188
Iron (mg/L)	192.32	0.49	188
Calcium (mg/L)	106.67	0.29	88
Sulfate (mg/L)	72.81	0.43	67
Chloride (mg/L)	112.23	0.37	205
Sodium (mg/L)	70.42	0.30	88
Total Nitrogen (mg/L)	5.04	0.47	227
Total Phosphorus (mg/L)	0.112	0.726	236
Atrazine (ug/L)	0.47	1.26	16
Ametryn (ug/L)	0.06	0.34	16
Total Mercury (ng/L)	2.20	0.33	11

Table 7.4.3.1-2. LOK_{Miami} Mean, Coefficient of Variation, and Count of Water Quality Parameters

Parameters	LOK_{Miami} Mean	LOK_{Miami} Coefficient of Variation	LOK_{Miami} Number of Records
Dissolved Oxygen (mg/L)	6.35	0.30	70
Specific Conductivity (uS/cm)	766.52	0.42	72
pH (Standard Units)	7.80	0.06	72
Turbidity (NTU)	6.88	0.84	71
Total Suspended Solids (mg/L)	8.21	0.70	67
Alkalinity (mg/L as CaCO3)	163.71	0.44	75
Iron (mg/L)	148.35	0.93	75
Calcium (mg/L)	64.02	0.44	22
Sulfate (mg/L)	69.54	0.74	29
Chloride (mg/L)	101.02	0.45	74
Sodium (mg/L)	71.52	0.64	22
Total Nitrogen (mg/L)	2.14	0.50	72
Total Phosphorus (mg/L)	0.060	0.50	76
Atrazine (ug/L)	0.28	2.01	26
Ametryn (ug/L)	0.05	1.38	11
Total Mercury (ng/L)	NA	NA	0

In both S2 and S3, water quality exiting LOK was of higher quality than water entering LOK. The mean water quality coming to LOK from the EAA was higher quality in the Miami Canal than in the NNR Canal. The coefficients of variation for concentrations to

LOK were similar, with the exception of iron, turbidity, and dissolved oxygen. The reverse is true for flows from LOK to the EAA, where S2 had better water quality than S3, with the exception of iron and phosphorous. The coefficients of variation for the flows from LOK are similar with the exception of sodium.

The relationship between concentration and flow was investigated for all the water quality parameters. A linear regression was used to evaluate the relationship. For the NNR Canal, flows for total iron to LOK showed a weak relationship with an R^2 of 0.36. All other parameters did not show a significant relationship. Thus, concentration will be assumed to be independent of flow for all constituents.

The mean water quality concentrations for the S2 and S3 stations were compared to the values calculated in Section 2.2 of this document. These earlier numbers represented the mean of the current (post-2000) water quality conditions in the major canals of the EAA. The measurements were created regardless of flow direction in the canal. The mean water quality to and from the lake and the earlier inflow concentrations are presented in Table 7.4.3.1-3 for the NNR Canal and in Table 7.4.3.1-4 for the Miami Canal.

Table 7.4.3.1-3. NNR Canal Water Quality Estimates

Parameters	NNR Basin	LOK_{NNR}	Section 2.2 NNR
Dissolved Oxygen (mg/L)	2.47	6.57	5.40
Specific Conductivity (uS/cm)	1191	625	903
pH (Standard Units)	7.19	7.78	7.53
Turbidity (NTU)	10.68	11.72	10.40
Total Suspended Solids (mg/L)	18.13	12.94	16.90
Alkalinity (mg/L as CaCO3)	317.35	137.8	239.0
Iron (mg/L)	267.0	170.4	245.0
Calcium (mg/L)	109.2	48.64	86.40
Sulfate (mg/L0	101.9	49.42	63.80
Chloride (mg/L)	137.0	81.96	104.00
Sodium (mg/L)	97.83	52.63	65.30
Total Nitrogen (mg/L)	5.50	2.00	2.58
Total Phosphorus (mg/L)	0.150	0.077	0.092
Atrazine (ug/L)	0.673	0.276	1.080
Ametryn (ug/L)	0.058	0.032	0.049
Total Mercury (ng/L)	2.822	NA	1.870

Table 7.4.3.1-4. Miami Canal Water Quality Estimates

Parameters	Miami Basin	LOK_{Miami}	Section 2.2 Miami
Dissolved Oxygen (mg/L)	3.45	6.35	5.42
Specific Conductivity (uS/cm)	962	767	764
pH (Standard Units)	7.23	7.80	7.63
Turbidity (NTU)	8.24	6.88	6.70
Total Suspended Solids (mg/L)	12.92	8.21	7.69
Alkalinity (mg/L as CaCO3)	248.1	163.7	209.0
Iron (mg/L)	192.3	148.3	164.0
Calcium (mg/L)	106.7	64.0	86.4
Sulfate (mg/L)	72.8	69.5	61.7
Chloride (mg/L)	112.2	101.0	90.0
Sodium (mg/L)	70.42	71.52	59.10
Total Nitrogen (mg/L)	5.04	2.14	2.35
Total Phosphorus (mg/L)	0.112	0.060	0.043
Atrazine (ug/L)	0.474	0.276	0.686
Ametryn (ug/L)	0.060	0.046	0.043
Total Mercury (ng/L)	2.197	NA	1.760

A comparison of the earlier data and by source inflow concentrations show the earlier values generally falling between the Basin and LOK values. Turbidity values were estimated lower and the Atrazine values were higher for both canals. Additionally, parameter estimates for total suspended solids, sulfate, and Ametryn varied slightly from the reported range in the Miami Canal. Sodium values in the Miami Canal were 15.9 percent lower than the earlier data. Overall, the averages by source compared very well to the earlier averages.

7.4.4 Pollutant Removal Rates

7.4.4.1 Literature Search

Literature searches were performed to examine available pollutant removal data for systems similar to the EAASR. Several sources were chosen because of their description of similar systems and pollutant removal information for these systems. The sources used were, in order, the Water Quality Impact of Reservoirs Report-WQIR (Burns & McDonnell 2004), Water Quality Assessment Tool (WQAT) Report (WSI 2004), Dynamic Model for Stormwater Treatment Areas 2 Reservoir component (DMSTAR) (Walker 2005a), the International Best Management Practice Database (IBMSTAR) (ASCE and EPA 2005), the National Pollutant Discharge Elimination System Database (NPDES) (EPA 2005), the Evaluation of Alternative Stormwater Regulations for Southwest Florida (EASRSWF) (ERD 2003), and the CDM Report on Stormwater Best Management Practices (CDMBMP) (CDM 2002). The sources analyzed and the data available from each are provided in Table 7.4.4.1-1. The information is presented for k - the constituent removal rate, HRT - the hydraulic residence time, HLR - the hydraulic loading rate, and % - the percent removal.