U.S. Exhibit 2248

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF FLORIDA
CASE NO. 88-1886-CIV-MORENO

UNITED STATES OF AMERICA,	)
	)
Plaintiff,	)
	)
v.	)
	)
SOUTH FLORIDA WATER MANAGEMENT DISTRICT, et al.,	)
	)
Defendants.	)

INITIAL REMEDIES REPORT OF WILLIAM W. WALKER, Ph.D.

I, William Walker, submit the following report for the remedies hearing before the Special Master currently scheduled for February 14-18, 2011. This report addresses the issues raised either by the Plaintiff United States and/or the Plaintiff-intervenor Miccosukee Tribe of Indians regarding remedies sufficient to achieve compliance with the Consent Decree Appendix B levels in the Refuge, while also achieving the Class III numeric criterion throughout the Refuge.

Qualifications

1. My curriculum vitae, which summarizes my academic background and experience as an environmental engineer providing technical assistance to various private-sector, municipal, state, and federal clients since 1972, appears in U.S. Exhibit 2249. My participation in this case and implementation of the ensuing Consent Decree started in 1989 and has continued since then. While most of my involvement has been financially supported

by the U.S. Departments of Justice and Interior, specific tasks have been funded by the South Florida Water Management District ("SFWMD"), the Florida Department of Environmental Protection ("DEP), U.S. Environmental Protection Agency ("USEPA"), and U.S. Army Corps of Engineers ("Corps"). Most of the documents that I have prepared for the federal agencies are posted at my web site (http://www.wwwalker.net/doi/index.htm). I have had major or supporting roles in the following areas:

- Development of testimony to support the federal position in the instant action, United States v. South Florida Water Management District, No. 88-1886 (S. D. Fla.), specifically documenting increasing trends in phosphorus concentration at Everglades National Park ("ENP") inflow structures between 1978 and 1991;
- Participation in technical negotiations leading to the 1992 Consent Decree;
- Development of statistical models underlying Consent Decree compliance tests, including Refuge Marsh Phosphorus Levels and ENP Inflow Limits (Levels and Limits);
- Data analysis and modeling to support implementation of the Consent Decree, as an advisor to federal TOC representatives;
- Participation in technical mediation leading to the 1994 Conceptual Plan to achieve an interim goal of phosphorus concentration levels not exceeding 50 parts-per-billion ("ppb") at inflow points to the Everglades Protection Area and subsequently to the 1995 motions by the United States, the SFWMD, and FDEP ("settling parties") to modify the Consent Decree (granted by the Court in 2001);
- Development of a model for sizing stormwater treatment areas ("STAs") to achieve discharge concentrations that do not exceed 50 ppb;
- Development of a model (DMSTA, Dynamic Model for Stormwater Treatment Areas) used by the DEP and SFWMD (collectively "State Parties" or "State") to optimize STAs for achieving compliance with the 10 ppb phosphorus criterion under the State's Long-Term Plan;
- Development of software to assist the state parties in tracking compliance with the Consent Decree;
- Development of compliance tests and software used by the DEP to determine STA compliance with DEP permits containing 50 ppb discharge limits and for

tracking the performance of Best Management Practices ("BMPs") in agricultural areas ((Everglades Agricultural Area ("EAA") and C139) that discharge run-off into the Everglades Protection Area, including the Refuge and the Park;

- Participation on a technical panel convened by DEP to establish a phosphorus concentration goal for control of nuisance algal blooms in Lake Okeechobee and to estimate the maximum phosphorus load consistent with achieving that goal;

- Evaluation of Comprehensive Everglades Restoration Plan ("CERP") alternatives being considered by the U.S. Army Corps of Engineers ("Corps") as of 1998, with respect to their impacts on STA performance and phosphorus loads to the Everglades;

- Estimation of flow and nutrient loads discharged into Florida Bay to support water quality modeling by the Corps of Engineers;

- Participation in various technical workgroups focusing on STA design, the State of Florida's numerical interpretation of the Class III phosphorus standard, and development/implementation of the State's Long-Term Plan.

- Technical support to federal representatives of the Everglades Technical Oversight Committee.

- Review of Long-Term Restoration Alternatives under the River of Grass Initiative.

- Expert Testimony for the U.S. Department of Justice and U.S. Department of the Interior - March 2006 Hearings for Special Master on Exceedances of the Interim Levels of Appendix B (Consent Decree) in the Refuge

- Technical support to the U.S. Environmental Protection Agency in developing water-quality based effluent limits for STA discharges (EPA AD, Attachment G) and evaluating regional phosphorus control alternatives for achieving those limits (USEPA AD, Attachment H).

In October 2010, I testified on issues related to liability associated with the United States' July 15, 2010 Motion to Resolve Liability Issues and the Miccosukee Tribe of Indians' October 15, 2009 Violations Motion. My testimony in this report focuses on appropriate remedies for achieving Consent Decree requirements for restoration and protection of water quality in the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge). A list of articles and studies that I have authored and co-authored appears in U.S. Exhibit 2249.

Basis for Remedy Design

2. In the January 4, 2011 Report and Recommendation, the Special Master interpreted the Settlement Agreement (entered as a Consent Decree) to require achievement of both the Appendix B levels for the interior marsh and the Class III Criterion for the entire marsh. I interpret that to mean that the ultimate remedy must necessarily be sufficient to address both requirements. To the extent that this hearing focuses exclusively on remedies for violation of the Appendix B levels, I would like to explain the rationale for my broader testimony that addresses both Appendix B and Class III.

3. My testimony describes remedies that will decrease the risk of future Appendix B violations while at the same time addressing the requirements to achieve Class III compliance throughout the Refuge marsh (USEPA-AD-G (U.S. Exhibit 2259)). The remedies are also described in a report that I prepared for the USEPA (AD-H (U.S. Exhibit 2218)) following seven months of technical collaboration with the State Parties (collectively, the "State" or "State Parties") and other stakeholders. The time frame for full implementation of the base alternative for the Refuge selected by the USEPA is approximately 2019, as compared with the December 2006 time frame required in the Consent Decree.

4. The Consent Decree envisioned a two-phase control program to restore the Refuge marsh by December 2006. The first phase, designed to achieve an STA discharge concentration of 50 ppb, was relatively successful because of conservative assumptions made in forecasting the performance of agricultural BMPs and STA phosphorus removal efficiency. The second phase has been unsuccessful in achieving Class III compliance (ref. Aumen Expert Report, U.S. Exh.

1201, October 1, 2010) because it relied upon an optimistic assumption that STAs designed to achieve 50 ppb could be coaxed into achieving the Class III numeric criterion for phosphorus (long-term geometric mean (LTGM) of 10 ppb) in areas of the Refuge marsh adjacent to the STA discharges without expanding the STAs or implementing additional source controls, as envisioned in the Settlement Agreement (ref. Settlement Agreement, Appendix B, Page B-2). As described in my testimony below, the ultimate remedies for the Refuge most recently proposed by the state (EAA Regional Feasibility Study, ADA, Inc, 2005, US Exhibit 2250) have not been implemented, are already out-dated because of recent increases in source TP concentrations, are projected to fall far short of achieving Class III compliance in the marsh adjacent to the STA discharges, and risk adverse hydrologic impacts by diverting flow away from the Refuge. Implementing yet another iteration of incremental measures designed only to achieve Appendix B requirements, and not integrated with a comprehensive plan to also achieve Class III compliance throughout the Refuge marsh, may (1) limit future options for the ultimate remedy, (2) not take full advantage immediate opportunities to make the best long-term uses of land in the S5A basin recently purchased from U.S. Sugar Corporation and proposed improvements to the basin water-management infrastructure (C51 Rockpit, Kugler, 2010; U.S. Exhibit 2251), (3) increase ultimate costs, and (4) further extend the time frame for achieving compliance with the Consent Decree. It may also anomalously sacrifice water quality in the exterior marsh areas of the Refuge to protect water quality only at the 14 interior Refuge stations.

5. There are signs of improvement in the Refuge interior marsh (area represented by the 14 Appendix B stations) since 1999, when the interior marsh geometric mean TP concentrations were above the Appendix B Interim Levels in 5 out of 12 months (Ref. 2005 U.S. Exhibit 60, Figure 2). Because of the complexity of the hydrodynamics and P transport mechanisms in the

marsh, however, there is a great deal of uncertainty associated with distinguishing and quantifying the mechanisms responsible for those apparent improvements. Potential mechanisms include reductions in external phosphorus load, changes in water management operations implemented to reduce intrusion from the rim canal into the interior marsh, refinements to the marsh sampling protocol, climatologic variations, and other factors (ref. Harwell testimony). While we can safely assume that continuing to reduce external P loads will decrease the risk of exceeding the Appendix B levels, we cannot reliably quantify the relationship between that risk and the external inflow concentrations. Without differentiating mechanisms, there will always be a risk that recent observed improvements will be reversed in the future to the extent that they are linked to short-term variations in climate and/or temporary changes in other causal factors.

6. Operational remedies implemented thus far to reduce intrusion into the interior marsh shunt the excessive phosphorus loads around the Refuge rim canal and into Water Conservation Area - 2A ("WCA-2A"). This essentially displaces the phosphorus loading impacts. While attenuated, a portion of the loads diverted to WCA-2A are transported further downstream to Water Conservation Area ("WCA-3A") and Everglades National Park ("ENP"). To the extent that they rely on operational changes to reduce intrusion into the marsh, remedies designed exclusively to achieve the Appendix B levels would be sufficient only if one accepts the uncertainties regarding causal mechanisms and the adverse impacts on the other WCAs. Pinning the remedy to changes in operation also reduces the flexibility for adjusting Refuge water levels to manage vegetation and wildlife habitat, as well as to support other uses of Refuge for water supply and flood control. The interim remedy for overloading of STA-1E (sending more runoff from the C51 West basin to the East (Harwell, Jan. 26, 2011 Report, U.S. Exhibit 2205) may have also contributed to reduction in the interior marsh TP concentrations, but that measure is

inadequate as a long-term remedy for the Appendix B violations because it decreases the total inflow the Refuge relative to that expected under the 1994 Conceptual Plan (Burns & McDonnell, 1994; US Exhibit 2252) and has adverse water quality impacts on the Lake Worth Estuary.

7. Implementing a remedy that is barely sufficient to achieve the Appendix B levels would allow the exterior marsh of the Refuge to continue functioning as a wetland treatment marsh for removing phosphorus analogous to a Stormwater Treatment Area (STA). Those exterior portions of the Refuge are already impacted by excess phosphorus and have been determined by Florida to be impaired under the Clean Water Act. The engineering objective in designing a remedy limited to the admitted Appendix B violation would be to reduce the inflow concentrations to the exterior marsh of the Refuge sufficiently to achieve the interior marsh Appendix B levels at the 14 stations. Especially given the ultimate requirement to restore the entire marsh, it makes better sense to focus the remedy-design efforts on modeling phosphorus removal in STA-1W and STA-1E instead of modeling phosphorus removal in the exterior marsh and allowing that portion of the Refuge to continue functioning as an STA to protect the interior marsh represented by the 14 stations in Appendix B.

8. For the above reasons, the remedies described in my testimony below are designed to take the best advantage of current opportunities to address both Appendix B and Class III compliance by reducing the Refuge inflow concentrations from STA-1W and STA-1E to a long-term geometric mean (LTGM) of 10 ppb. That degree of treatment is required to achieve the Class III numeric criterion in the marsh areas closest to the STA outflow. For modeling purposes and to provide a margin of safety, this treatment objective is translated into a long-term flow-weighted mean (LTFWM) discharge concentration of 11.5 ppb (USEPA AD). The

LTFWM target is appropriate for engineering design purposes because it can be predicted more accurately than the LTGM or yearly FWM values.

9. As explained in the September 3, 2010 USEPA Amended Determination ("AD"), Attachment H ("AD Att. H") (U.S. Exhibit 2218), a LTFWM target in the range of 11 to 12 ppb is appropriate for designing STAs to achieve Class III requirements. Previous WQBEL derivations (FDEP, 2010; US Exhibit 2253) indicated that a LTFWM of 12 ppb was statistically equivalent to a LGTM of 10 ppb in the STA discharges. That was later confirmed in USEPA's WQBEL derivation (AD Att. G, Figure 8; U.S. Exhibit 2259). LTFWMs computed from historical STA data (rescaled to a LTGM of 10 ppb) averaged 12.0 ppb and ranged from 10.8 to 13.3 ppb for the individual STAs. The rescaled LTFWM was 11.4 ppb for STA-3/4, which had the best performance record and represented the best prototype for an STA operating in the remedy design range. The USEPA ultimately selected a LTFWM of 11.5 ppb as a design basis for the AD alternatives in order to provide a margin of safety and greater assurance that the WQBEL would be met.

10. The Water Quality Based Effluent Limit (USEPA, AD Att. G) was discussed extensively in the October 2010 hearing. The WQBEL is a convenient means to measure compliance on an annual basis, but it is not a design target for the STAs. Although the STA design target and WQBEL derivation to achieve Class III compliance in the STA discharges are each based upon the assumption that the discharge concentration would be distributed around a LTGM of 10 ppb, they are not the same. The STA design target is at center of the distribution and is independent of the WQBEL, which is at the 90^{th} percentile (USEPA AD-G). Because the STA design target is independent of the WQBEL, it can be used as a basis for establishing remedies to address Appendix B levels and Class III water quality requirements of the Consent Decree, in advance of

the TOC, DEP, or judicial determination of what the maximum annual discharge limit ("MADL") of Appendix B of the Consent Decree must be for discharges into the Refuge from STA 1W and 1E, and without knowing what that MADL will ultimately be.

Collaboration with State to Develop Class III Remedies in 2010

11. Following the filing of the Tribe's October 2009 motion, the State acknowledged the Appendix B violation and the need for the Florida DEP to enforce more stringent inflow discharge limits to achieve long term concentration levels in the Refuge. D.E. 2100 at 4-5. The state and federal parties initiated a joint effort in January 2010 to develop alternative remedies for consideration by the decision-makers. As a consultant to the Department of the Interior, I participated in a series of meetings and provided technical support in areas related to development of source flow and load datasets, modeling framework, design assumptions, and initial screening-level analysis of alternatives for the Refuge.

12. Collaboration with state and federal experts produced a framework for developing and evaluating alternative remedies starting with several fundamental assumptions (US Exhibits 2225 and 2226). The key assumptions included the following:

- The remedies would be designed to achieve a long-term geometric mean (LTGM) of 10 ppb in the STA outflows. For modeling purposes, this was translated into a long-term flow-weighted mean (LTFWM) in the range of 11-12 ppb.
- The remedies would cause no net decrease in flow to the Refuge or have adverse impacts on Refuge stage management objectives.
- Phosphorus loads from each source would be estimated based upon a 40-year time series of daily flows from the District's regional hydrologic simulation model (2x2) and source concentrations derived from the 2005-2009 period of record for all basins. The alternatives would be designed to treat all source flows in the 40-year period of record.

- No additional regional water management projects beyond those prescribed in the remedy (e.g., L8 basin projects) would be assumed.

- The Dynamic Model for Stormwater Treatment Areas (DMSTA, Walker & Kadlec, 2005, 2010, US Exhibit 2254) would be used for simulating the STAs. Despite acknowledged uncertainties and limitations, it was agreed that DMSTA was the best available tool for use in design.

Sensitivities to design assumptions were explored in the process of reaching a consensus on the assumptions and in evaluating alternatives.

13. On April 14, 2010, in Miccosukee Tribe of Indians v. United States, No. 04-21448 (S.D. Fla.), U.S. District Judge Alan Gold issued an order directing USEPA to issue an Amended Determination to identify specific steps that must be undertaken by DEP to comply with the Clean Water Act (CWA) requirement to achieve Class III water quality standards in the Everglades Protection Area, and required USEPA to issue the Amended Determination no later than September 3, 2010. Following Judge Gold's April 14, 2010 order, the federal-state collaborative process shifted from devising alternatives to address the exceedances of the Refuge Appendix B levels to devising alternatives to achieve the Class III criterion throughout the EvPA (which incorporates the Refuge), including all of the EvPA source basins treated under the 1994 Conceptual Plan (Burns & McDonnell, 1994; U.S. Exhibit 2252). This broader consideration of all basins was appropriate because some of the potential alternatives involved inter-basin transfers. The federal-state collaborative framework established for the Refuge provided a good foundation for addressing the other basins. I participated in that expanded design process as a consultant to the USEPA.

14. The federal and state technical representatives, now working collaboratively with representatives from the agricultural industry and environmental groups on more expansive remedies to achieve Class III water quality throughout the EvPA to comply with Judge Gold's

order, reached consensus on methodology and design datasets for all of the source basins (EAA, C139[1], C51W, L8, Chapter 298 Districts, and Lake Okeechobee) that are currently discharging to STAs 1W, 1E, 2, 3/4, 5, and 6, as well as to Compartments B and C once they are completed. District technical staff and I independently performed a series of DMSTA simulations to evaluate potential treatment area expansion requirements for each STA under various assumptions with respect to design target, source controls, flow-equalization basins (FEBs), and diversions (U.S. Exhibit 2229). Federal and State technical staff discussed the preliminary results of these simulations in further state/federal meetings, but these discussions did not culminate in development of any further refined set of alternatives.

15. As the September deadline for USEPA issuance of the Amended Determination (AD) approached, I worked independently with USEPA and DOI technical representatives to develop and evaluate specific alternatives for inclusion in the AD. The modeling assumptions followed primarily from those developed jointly with the state. The results are described in the AD Attachment H (AD-H, U.S. Exhibit 2218). The USEPA selected one alternative in each basin as a base case for the AD. USEPA also afforded the District the flexibility to develop its own proposal that would accomplish the same objectives in terms of performance and time frame based upon the same underlying modeling assumptions. To my knowledge, no such proposal has been put forth by the State. While the cooperative effort with the State to develop specific plans faded in August 2010 and has not resumed, the agreements on the source datasets, methodologies, and key design assumptions achieved before the collaborative process ended provide potential cornerstones to develop a technical consensus on promising alternatives to

[1] Differences of opinion remained with respect to the C139 basin runoff concentration. The state's base assumption was a 25% reduction in runoff concentration relative to 2005-2009. The federal assumption was that there be 0%

achieve the 11-12 ppb LTFWM treatment objective in each STA discharge. Selected alternatives could be refined in subsequent conceptual and detailed design phases.

USEPA AD Class III Remedies - Overview

16. Building upon assumptions and preliminary model runs developed with the State, I constructed eight modeling scenarios for evaluation in my report to the USEPA (AD-H). Each was based upon 2005-2009 source TP concentrations and 40-year simulated flows (AD-H, Table 1). My report to the USEPA summarizes modeling assumptions (AD-H, Table 2), scenario results (AD-H, Table 3, US Exhibit 2255), and STA simulation results (U.S. Exh. 2218; AD-H; Table 4). Attachments 1 and 2 to the AD-H contain yearly time series charts of the predicted FWM and GM concentrations for each STA and scenario. Attachment 3 to the AD-H contains detailed schematics and simulation results for each scenario. I refined DMSTA software to facilitate simulation of the entire regional network and exploration of alternatives. The associated model input and output files were provided to the State Parties on September 9, 2010, shortly after USEPA issued the AD on September 3, 2010.

17. The eight AD-H scenarios (U.S. Exhibit 2255) represent specific configurations for the three Everglades Flow-paths: the Western Flow-path (treated in STA-5, STA-6, and Comp-C), the Central Flow-path (STA-3/4, STA-2, and Comp-B), and the Eastern Flow-path (STA-1W, STA-1E). Under the two baseline scenarios (1 & 2), the predicted LTFWMs in the combined outflows from all basins were 30 ppb (Scenario 1) and 23 ppb (Scenario 2) with and without Comp-B and Comp-C (not yet operational), respectively. The other six scenarios were designed to meet a LTFWM of 11.5 ppb in the discharge from each STA using different combinations of

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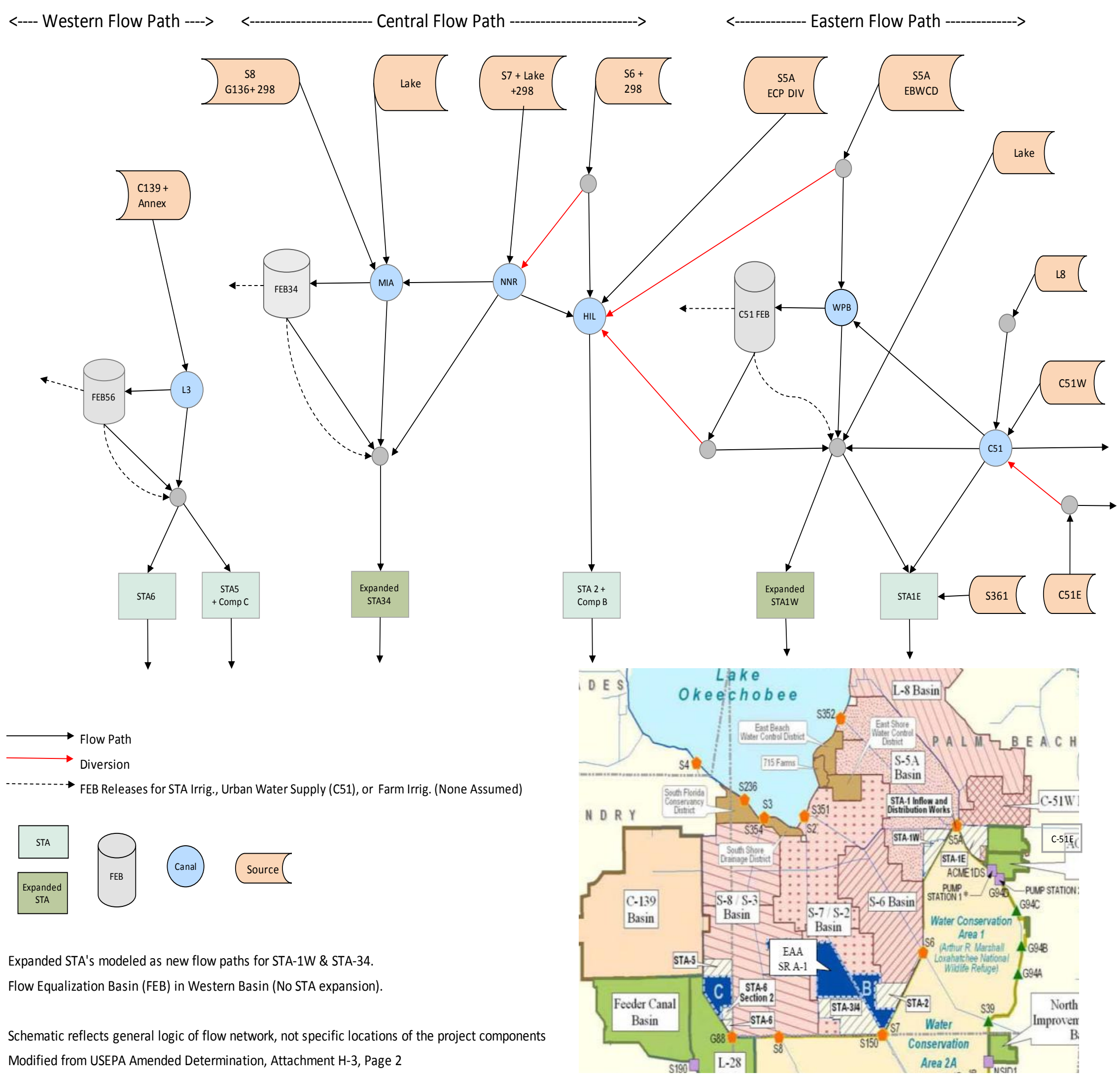
reduction, as reflected in the EPA-AD alternatives.

expanded STAs, Flow Equalization Basins (FEBs), flow balancing across STAs, and construction sequences, as illustrated in Figure 1 (AD Att H-3, Page 2, U.S. Exhibit 2256)

Figure 1: Flowchart for USEPA AD Attachment H Alternatives, U.S. Exh. No. 2256



18. Two out of the six scenarios (US Exhibit 2255, 5 & 8) reflected interim configurations designed to expedite STA-3/4 performance improvements. The four remaining scenarios (US Exhibit 2255, 3, 4, 6, & 7) reflect different ultimate configurations of STAs and FEBs in each basin:

- Because of the relatively high variability in runoff and high seepage rates, a flow-equalization basin (FEB, 7 kac,[2] 12 ft. deep) would be more beneficial than STA expansion as a remedy for the Western Basin. The added feature would fit within the footprint of the C139 Annex recently purchased by SFWMD from the U.S. Sugar Corporation.

- The Central basin alternatives involved expansion of STA-3/4 (14 -22 kac) with and without a FEB (34 kac, 8 ft deep). Treatment objectives for STA-2 and Comp-B would be accomplished by diverting inflows to the expanded STA-3/4 and/or the FEB. While the designs were not attached to specific parcels, the added features would fit in the footprints of existing publicly owned lands (EAA Compartments A1 and A2).

- The Eastern basin (Refuge) alternatives involved expansion of STA-1W (8-15 kac) with and without a FEB (1.7 kac, 44 ft deep). Treatment objectives for the rehabilitated STA-1E would be accomplished by diverting inflows from the C51 West canal to the expanded STA-1W and/or FEB. The STA-1W expansion would range from 8 kac with the FEB to 15 kac without the FEB, as compared with 8.9 kac in the northern S5A basin recently purchased by SFWMD from the U.S. Sugar Corporation.

19. The total new effective treatment area (FEBs + STAs) varied from 38 to 40 kac beyond the existing 57 kac, including Compartments B and C. The total new project area (including an additional 10% for pump stations, levees, etc.) ranged from 41 to 44 kac. While the various alternatives were similar with respect to total land requirements, they differed with respect to other factors that would be considered in selecting final alternatives, such as feature locations, flow distribution, canal conveyance and pump capacities, schedule, cost, operational flexibility, and hydrologic benefits. While final designs could involve land exchanges to optimize the treatment area locations and/or to construct associated canals and pump stations, the preliminary evaluations indicated that project objectives could be accomplished without major new land purchases. The lone exception is the Refuge basin alternative without an FEB, which would require sufficient additional land in the S5A basin to accommodate approximately 7 kac of effective treatment area, above and beyond the 8.9 kac already purchased by the District.

[2] Kac = thousand acres of effective treatment area (excluding pumps, levees, etc..)

USEPA AD Class III Remedies - Refuge

20. The base assumptions for each of the Refuge alternatives developed jointly with the state and other stakeholders are listed in US. Exhibit 2226 and further described in the AD Att-H. Among these are that:

- STA-1E will be fully rehabilitated.
- There will be no additional water management projects in the L8 basin.
- Basin flows will be managed in a manner consistent with the SFWMD's 2x2 Model simulations.
- There will be no untreated bypass to the Refuge.
- There will be no discharge to the east from the C51 West and L8 basins, except during extreme storm events when such flows could be necessary to avoid untreated bypass deliveries to the Refuge or to avoid degrading Refuge STA performance.
|
- Source concentrations will not increase beyond those measured in 2005-2009.

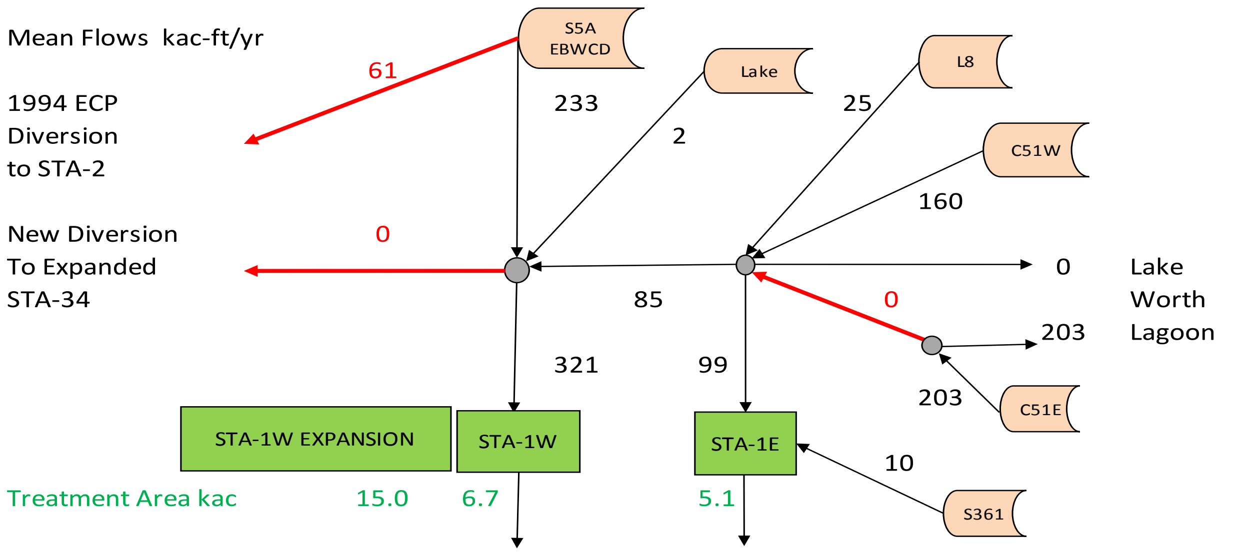
  The STAs will be operated and managed in a manner consistent with designs with respect to inflows, water depths, and vegetation.
- An excess treatment capacity of 5% will be provided in order to account for routine STA maintenance.
- There will be no additional net diversions from the S5A basin to the west beyond those contemplated under the 1994 Conceptual Plan (Burns & McDonnell, 1994, US 2252).
- The magnitude and timing of the inflows will be sufficient to achieve stage management objectives for the Refuge, as evaluated using the Refuge hydrologic model and performance measures (Waldon, 2010; U.S. Exhibit 2204).

21. Without further remedial measures, the predicted LTFWM concentration in the inflows to the Refuge is 34 ppb, which is equivalent to a LTGM concentration of approximately 28 ppb, nearly three times the 10 ppb Class III Criterion (U.S. Exhibit 2255, Scenario 2). The predicted LTFWM for the Refuge is substantially higher than those predicted for the other basins without

expansion (34 ppb vs. 16-20 ppb). This disparity between the Refuge and other basins reflects the fact that the current plans for the Refuge basin do not provide additional treatment capacity analogous to Compartments B and C. Basic features of the two AD-H alternatives for the Refuge are summarized in Figure 2 (STA-1W Expansion without FEB, AD-H Scenario 3, U.S. Exhibit 2257) and Figure 3 (STA-1W expansion with FEB, AD-H Scenario 7, U.S. Exhibit 2258). The flow charts illustrate the components, logic, and flow distribution. Water and mass balances are summarized at the bottom of each figure.

22. The remedy previously proposed by SFWMD for improving water quality in the Refuge basin involved additional diversion of S5A runoff to STA-2 and Compartment B, as opposed to STA expansion or additional BMPs within the S5A basin (ADA, 2005, EAA Regional Feasibility Study, EAARFS Alternative-1, U.S. Exhibit 2250, Table 5.3). That strategy would be inconsistent with the design assumptions developed jointly with the State in 2010 because it was forecasted to provide LTFWMs of 13 and 19 ppb in the discharges from STA-1E and STA-1W, respectively, as compared with the AD design target of 11.5 ppb. The predicted outflow concentrations (13 and 19 ppb) would have been higher had they been based upon 2005-2009 source concentrations assumed in simulating the AD alternatives. The EAARFS plan would also be inconsistent with the AD design assumptions because it would decrease the average inflow volume to the Refuge by 27% relative to an alternative that did not include diversion (EAARFS Alternative 2, Table 5.10). Because the EAARFS proposed diversions were limited to low and moderate flows, most of the high flows would remain in the Refuge basin and overload STA-1W during peak runoff periods when STA discharges into the Refuge rim canal are most likely to penetrate the marsh. The selective diversion of low flows would also make it more difficult to manage water levels in the STAs and Refuge.

Figure 2: Refuge Basin Flowchart for the STA-1W Expansion Alternative, U.S Exhibit 2257



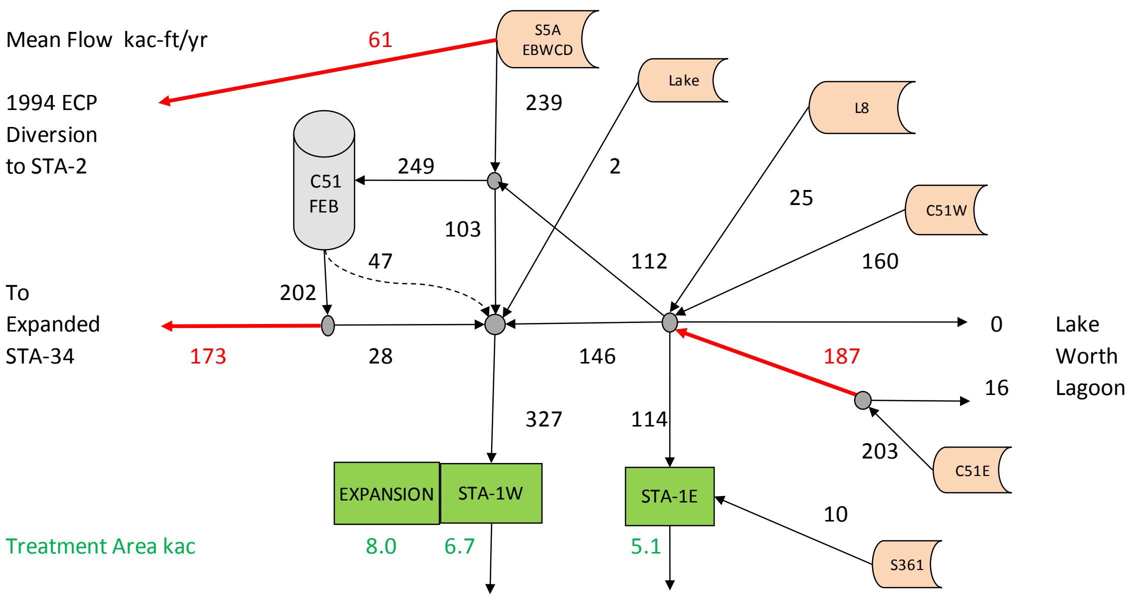
To Refuge	Total	STA1W Out	STA1E Out
Flow kac-ft/yr	429	327	102
Load mt/yr	6.0	4.6	1.5
Conc ppb	11.4	11.3	11.6

Source	Flow kac	Load mt	Conc pp
S5A to STA2	61.0	16.0	213
S5A Runoff	208.9	47.0	182
EBWCD Runoff	24.2	14.7	492
Lake to S5A	2.3	0.3	103
L8 Runoff	25.0	4.2	135
C51 West	159.7	32.2	163
S361	9.7	0.9	73
C51 East	202.6	23.9	96
Total Sources	693.4	139.2	163
To Refuge Basin	429.7	99.3	187
To Estuary	202.6	23.9	96
To West	61.0	16.0	213

Source	Flow kac	Load mt	Conc pp
C51 to STA1E	99.2	19.5	159
C51 to STA1W	85.5	16.9	160
STA1E Inflow	108.9	20.4	152
STA1E Outflow	102.0	1.5	11.6
STA 1W Inflow	320.8	78.9	199
STA1W Outflow	326.8	4.6	11.3
Refuge Inflow	428.8	6.0	11.4

Derived from USEPA AD-H, Scenario 3.

Figure 3: Refuge Basin Flowchart for the C51 FEB Rockpit + STA-1W Expansion Alternative, U.S. Exhibit 2258



To Refuge	Total	STA1W Out	STA1E Out
Flow kac-ft/yr	444	328	116
Load mt/yr	6.3	4.7	1.6
Conc ppb	11.5	11.5	11.5

Flow Path
Diversion
FEB Release to STA1W for STA Irrigation, Refuge Stage Management & Urban Water Supply

Source
STA

Terms	Flow kac	Load mt	Conc ppb	Terms	Flow kac	Load mt	Conc ppb
S5A to STA2	61.0	16.0	213	C51W to STA1E	113.6	17.8	127
S5A Runoff	215.3	48.5	182	C51W to STA1W	146.1	23.0	127
EBWCD Runoff	24.2	14.7	492	C51W to FEB	112.1	17.7	128
Lake to S5A	2.3	0.3	103				
L8 Runoff	25.0	4.2	135	FEB Bypass to S5A	103.0	23.2	182
S361	9.7	0.9	73	FEB Inflow	248.6	57.7	188
C51 West	159.7	32.2	163	FEB Release to STA	47.0	10.5	181
C51E Total	202.6	23.9	96	FEB Outflow	201.7	45.1	181
C51E Div to C51W	187.1	22.1	96	FEB Out to STA1W	28.5	6.3	179
C51E to East	15.6	1.9	96	FEB Out to West	173.2	38.8	181
Total Sources	699.8	140.7	163	STA1E Inflow	123.3	18.7	123
To Refuge Basin	450.1	84.0	151	STA1E Outflow	115.8	1.6	11.5
To West	234.2	54.8	190	STA1W Inflow	326.9	63.2	157
To Estuary	15.6	1.9	96	STA1W Outflow	328.2	4.7	11.5
				Refuge Inflow	444.0	6.3	11.5

Derived from USEPA AD-H, Scenario 7.

23. The 15 kac STA expansion to achieve 11.5 ppb without the FEB (Figure 2) is consistent with SFWMD's 2010 modeling results (13 kac for 12 ppb, 16 kac for 11 ppb, U.S. Exhibit 2227). The FEB alternative (Figure 3) requires substantially less STA expansion (8 kac vs. 15 kac), but was not specifically included in modeling results provided by the SFWMD. Each of the Refuge alternatives takes full advantage of the 8.9 kac of land in the northern S5A basin (about 15 miles north of STA-1W) recently purchased from the U.S. Sugar Corporation. The preliminary simulations assume that the expanded treatment area will operate in parallel with the existing STA-1W and discharge directly into the Refuge. Options that would allow utilization of the U.S. Sugar acquisition in place without exchanging it for areas adjacent to STA-1W may be feasible but require further evaluation. Subject to uncertainties regarding the land exchanges, it is possible that no further major land purchases would be required if the FEB feature were included in the project (Figure 3). Without the FEB (Figure 2), approximately 7 kac of additional farmland beyond that already purchased from U.S. Sugar would have to be identified and acquired.

24. In the 2010 collaborative process, there was a technical consensus that FEBs should be considered as potential components of the Class III remedy in each basin, as reflected in the AD-H alternatives (US Exhibit 2255). Their primary functions are to improve STA performance by storing and attenuating peak flow during wet periods and by releasing flow during dry periods to help maintain STA water levels and vegetation. FEBs provide operational flexibility for real-time regional water management (e.g. balancing flows across STAs; maintaining STA water levels, and facilitating STA maintenance). These benefits provide an additional margin of safety that is not reflected in the STA simulations. Optimization of the FEB and conveyance

parameters in subsequent design studies may improve performance and provide additional operational flexibility.

25. The FEB alternative for the Refuge basin ("Rockpit Alternative," Figure 3, U.S. Exhibit 2258) can accommodate a pre-existing proposal, conceptual design, and funding offered by regional water utilities and miners to excavate a 44-foot deep, 1.7 kac rock-pit north of the S5A pump station (Kugler, 2010; U.S. Exhibit 2251). This concept has been discussed with the District and Refuge management and technical staff over the past few years. The facility has already been designed, and, if implemented, would provide multiple-use benefits with respect to STA performance, urban water supply, urban flood control, and a source of limerock for urban development. The proposed project could be constructed in phases over a 7 year period and portions of the facility could provide treatment benefits within 3 years. One potential configuration and operational scheme is depicted in Figure 3 (U.S. Exhibit 2258).

26. On the inflow side, the Rockpit Alternative would be operated to capture peak runoff flows from the S5A and other source basins. The Rockpit Alternative would also involve diversion of approximately 187 kac-ft/yr runoff from the C51 East basin into the Refuge basin via the C51 West canal (Figure 3, US Exhibit 2258). The diversion would benefit the Refuge because C51 East runoff has relatively low P concentrations (~96 ppb, Figure 3) as compared with runoff from the other source basins, which average 187 ppb and range from 73 to 492 ppb. The C51E runoff also has lower mineral content that is more representative of the interior of the Refuge marsh. Diversion of C51 E runoff away from the Lake Worth estuary would be beneficial because the estuary is currently adversely impacted by freshwater inflows. The C51E diversion associated with the Rockpit Alternative would provide a net increase in the total treated

flow to the Everglades from 1416 kac-ft/yr to 1574 kac-ft/yr (US Exhibit 2255, Scenarios 3 vs. 7).

27. Figure 3 (U.S. Exhibit 2258) depicts one of a range of potential configurations that could be evaluated in subsequent designs for integrating the C51 Rockpit FEB into the treatment scheme. Flows diverted from C51 East basin would be routed through the C51 West canal and distributed to the Rockpit FEB, STA-1W, and STA-1E in a manner that optimizes treatment and water-supply benefits. An equivalent volume would be discharged from the Rockpit FEB to the west for treatment in an expanded STA-3/4. As a consequence of the diversion, the STA-3/4 expansion would be increased from 16 to 22 kac, but that expansion would be offset by a decrease in the amount of STA-1W expansion from 15 kac to 8 kac (US Exhibit 2255, Scenario 3 vs. 6). The remaining Rockpit FEB releases would enter the expanded STA-1W. The releases generally would occur during dry periods and be timed to provide treatment benefits (maintain STA water levels), facilitate Refuge stage management, and provide the desired urban water supply.

28. Since the urban water supply releases from the Rockpit FEB would be delivered to municipalities via STA-1W and the Refuge, the preliminary simulations indicate that water supply benefits could be provided without adversely impacting treatment or Refuge hydrology. While not included in the preliminary simulations, a portion of the Rockpit FEB outflow could be used for farm irrigation provided that it does not interfere with treatment and urban water supply benefits. That type of operation would essentially recycle farm runoff and its associated phosphorus load back to the farms, as well as decrease the volume of Lake Okeechobee releases required for farm irrigation. A full accounting of the net long-term costs of the project should

consider the funding provided by the miners and water utilities, as well as the economic benefits associated with providing additional flood storage (Kugler, 2010).

29. Despite the apparent advantages of the C51 FEB alternative, there are potential disadvantages that need to be considered before adopting a specific plan for the Refuge. There has been no regional experience with operating multi-purpose storage facilities in conjunction with the STAs to provide treatment, water supply, and flood control benefits. The configurations and simulations that I developed for the USEPA-AD have not had the benefits of brain-storming, review, or cross-checking with District staff. Preliminary versions of the model input files for evaluating the C51 FEB option were provided to the District in May 2010, but no feedback was received and the alternative was not included in the model runs presented by the District (U.S. Exhibit 2229). Further consideration of the Rockpit option would require significant efforts to develop agreements with the Rockpit miners and water utilities to ensure that the project is constructed and operated so as not to compromise the treatment and Refuge benefits, especially with respect to water supply (January 2011 Expert Report of Dr. Aumen, U.S. Exhibit 2201). Given these factors and despite the uncertainties associated with additional land acquisition, the USEPA recommended the 15 kac STA-1W expansion alternative as a base case for the AD (Figure 2), but provided flexibility for the District to develop the Rockpit FEB alternative (Figure 3) or others.

30. Each of the alternatives developed in AD Att. H is designed to provide a LTFWM discharge concentration of 11.5 ppb with an uncertainty band of approximately +/- 15%. While the predicted yearly outflow concentrations have greater uncertainty, they exceed the two-part WQBEL (USEPA-AD-G) in only 2 years out of the 40-year simulation period for each STA without the Rockpit FEB and in only 1 year for each STA with the Rockpit FEB (USEPA, AD-

H, Table 4, Scenarios 3 and 7). Subsequent comparison of the same outflow concentration time series with the SFWMD's proposed version of the WQBEL (20 ppb annual FWM limit, 10 ppb GM 5-year limit; District Post-Hearing Memorandum 24 November 2010, Page 1) indicate that the SFWMD's version is more stringent than the USEPA's version (18 ppb annual FWM limit, maximum of 2 consecutive years with GM exceeding 10 ppb). For the STA Expansion alternative (Figure 2), the SFWMD's WQBEL is exceeded in 5 out of 40 years for each STA vs. 2 years for each STA assuming the USEPA's WQBEL. Results for the Rockpit FEB with STA expansion alternative (Figure 3) are 4 years for STA-1W and 6 years for STA-1E vs. 1 year for each STA assuming the USEPA's WQBEL. The 5-year GM test in the SFWMD's version is far more stringent than the USEPA's [not >2] consecutive year GM test, even though it has a higher yearly FWM limit (19-21 ppb vs. 18 ppb). That factor can be considered by the TOC in seeking a consensus on the appropriate MADL (WQBEL) required by Appendix B of the Consent Decree, as recommended by the Special Master in his January 4, 2011 Report.

Conclusions and Recommendations

31. Collaborative efforts between the State and Federal technical representatives in 2010 indicate that there is sufficient experience, technology, and technical consensus to design a comprehensive plan to achieve a LTGM of 10 ppb in the STA discharges to the Refuge. Treatment to that level is necessary in order to achieve compliance with both the Appendix B and Class III requirements for the Refuge. The alternatives described in the USEPA-AD-H provide a basis for further collaboration and development of specific plans that can be implemented on expedient schedules. Focusing narrowly on remedies to achieve Appendix B long-term concentration levels at the 14 stations without integrating them with a comprehensive

plan that also achieves Class III standards in the STA discharges may limit future options, increase remedial costs, and is likely to extend the time frame ultimately required to achieve Consent Decree objectives and restore the Refuge marsh.

32. The uncertainties associated with STA performance forecasts were discussed extensively with State representatives in 2010, and should be considered in developing realistic expectations for the performance of any alternative. STA modeling uncertainty is estimated at ± 15% of the predicted outflow concentration. The total forecast uncertainty is likely to be greater because of variability in future climatologic conditions and uncertainty in the assumed source flows and phosphorus loads. In addition to the margin of safety inherent in the specified design target (11.5 ppb vs. 12 ppb equivalent to a LTGM of 10 ppb), additional measures could be taken to account for performance uncertainty and reduce the risk of exceeding the Class III numeric criterion in the marsh areas adjacent to the STA discharges (e.g., source controls, further optimization of STAs, optimization of FEB designs and operations, and integration of research results to improve treatment efficiency by implementing new technologies utilizing periphyton (including PSTA) or other biological communities). In any case, further remedial measures may be necessary to achieve the projected STA performance because of unforeseen circumstances and the unavoidable uncertainties. Those further measures could delay the time frame, but in my opinion, the treatment objectives are ultimately achievable if the remedial projects are constructed and operated according to the designs referenced in AD Att. H, U.S. Exhibit 2218.

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Pursuant to 28 U.S.C. § 1746, I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing statements are true and correct to the best of my knowledge, information, and belief.

Executed on: January 26, 2011

Dr. William W. Walker

Dr. William W. Walker