LAKE OKEECHOBEE PROTECTION PROGRAM

February 23, 2007

Lake Okeechobee Protection Plan Evaluation Report

South Florida Water Management District

Florida Department of Environmental Protection

Florida Department of Agriculture and Consumer Services

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Evaluation Report

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Acronym	Definition
ARC	Florida's Acquisition and Restoration Council
BAT	Best Available Technologies
BMP	Best Management Practice
C	Canal
CAFO	Concentrated Animal Feeding Operation
CERP	Comprehensive Everglades Restoration Plan
EAA	Everglades Agricultural Areas
ECP	Everglades Construction Project
EIS	Environmental Impact Statement
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
F.S.	Florida Statutes
FRESP	Florida Ranchlands Environmental Services Projects
FWC	Florida Wildlife Conservation Commission
GIS	Geographic Information Systems
IFAS	Institute of Food and Agriculture Sciences
KRR	Kissimmee River Restoration
LOCP	Lake Okeechobee Construction Project
LOER	Lake Okeechobee and Estuary Recovery
LOFT	Lake Okeechobee Fast Track
LOOP	Lake Okeechobee Operating Permit
LOPA	Lake Okeechobee Protection Act
LOPP	Lake Okeechobee Protection Plan
LOWP	Lake Okeechobee Watershed Project
NEP	National Estuary Program
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
P	Phosphorus
PIR	Project Implementation Report
PPP	Public/Private Partnership
QA/QC	Quality Assurance/Quality Control
RaSTA	Reservoir-assisted Stormwater Treatment Area
S	Structure
SFWMD	South Florida Water Management District
SRF	State Revolving Fund loan program
STA	Stormwater Treatment Area
SWIM	Surface Water Improvement and Management

Acronym	Definition
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
UF	University of Florida
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
USGS	United States Geologic Survey
WAM	Watershed Assessment Model
WOD	Works of the District
WRAC	Water Resources Advisory Committee

SUMMARY

Lake Okeechobee is the largest lake in the southeastern United States and covers a surface area of 427,500 acres (1730 km^2) with an average depth of 8.9 ft (2.7m). The watershed of the Lake stretches from just south of Orlando to areas that border the lake on the south, east, and west and covers approximately 3.45 million acres (1.40 million ha). Lake Okeechobee functions as the central part of a large interconnected aquatic ecosystem in south Florida and is the major surface water body of the Central and Southern Florida Flood Control Project. The lake provides a number of values to society and nature including water supply for agriculture, urban areas and the environment, flood protection, a multi-million dollar sport and commercial fishery, and habitat for wading birds, migratory waterfowl, and the federally endangered Everglade Snail Kite. These values of the lake have been threatened in recent decades by excessive phosphorus (P) loading, harmful high water levels, and rapid expansion of exotic plants.

The Lake Okeechobee Protection Act (LOPA, Section 373.4595, F.S.) was passed by the 2000 Legislature to establish a restoration and protection program for the Lake. This will be accomplished by achieving and maintaining compliance with State water quality standards in Lake Okeechobee and its tributary waters, through a watershed-based, phased, comprehensive and innovative protection program designed to reduce P loads and implement long-term solutions, to meet the Total Maximum Daily Load (TMDL) for Lake Okeechobee and the proposed TMDLs for the tributaries. This Program set forth a series of activities and deliverables for the coordinating agencies - the South Florida Water Management District (SFWMD), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS). Elements specifically required by the legislation include a formal Lake Okeechobee Protection Plan (LOPP) and annual reports, implementation of the Lake Okeechobee Construction Project (LOCP), a watershed P source control program, a research and water quality monitoring program, in-lake P management evaluation, an exotic species control program, and associated permits.

The initial LOPP was delivered to the Governor and Legislature in 2004 (SFWMD et al., 2004). Since excessive loads of P to the lake originate from agricultural and urban activities that dominate land use in the watershed, the LOPP contained an integrated management strategy based on the implementation of P source control programs, including Best Management Practices (BMPs) at the parcel level; sub-basin and regional P control and flow attenuation projects; and in-lake remediation activities. In addition, it contained the required elements of exotic species control and research and monitoring, as specified by the Act.

The LOPA requires that the LOPP be reevaluated every three years to identify if further P load reductions are necessary to achieve compliance with the Lake Okeechobee P TMDL established pursuant to Section 403.067. This report evaluates the P load reduction goals achievable for each activity so that the TMDL will be met by 2015. This plan evaluation also defines current and proposed P reduction projects that require future funding, the lead agency responsible for implementing the activities and the

estimated total P load reduction. The load reductions under both current and future activities are estimated based on the best available information and data. The actual load reductions, as measured at the lake inflow structures, will be delayed due to P that has accumulated in soils and tributaries over time. Long-term assessment will continue through the life of the activities to quantify project performance.

In the plan reevaluation process, certain assumptions used in the development of the original plan were revisited. Items included P reduction estimates (project and BMP performance and implementation rates), the amount of water that could be retained on various agricultural land uses, lag effects, and overall schedules and funding. Several uncertainties exist in estimating project and BMP performance. Some of the uncertainties associated with the performance of BMPs include the impacts of different soils and hydrologic conditions, residual P in the soils, land use changes, and the rate of implementation of the BMPs. Because of these uncertainties, conservative estimates were used for the P reductions associated with the implementation of BMPs. The BMP performance estimates were based on best professional judgment and take into account the uncertainties described above and information available from literature as well as actual performance data observed in this watershed.

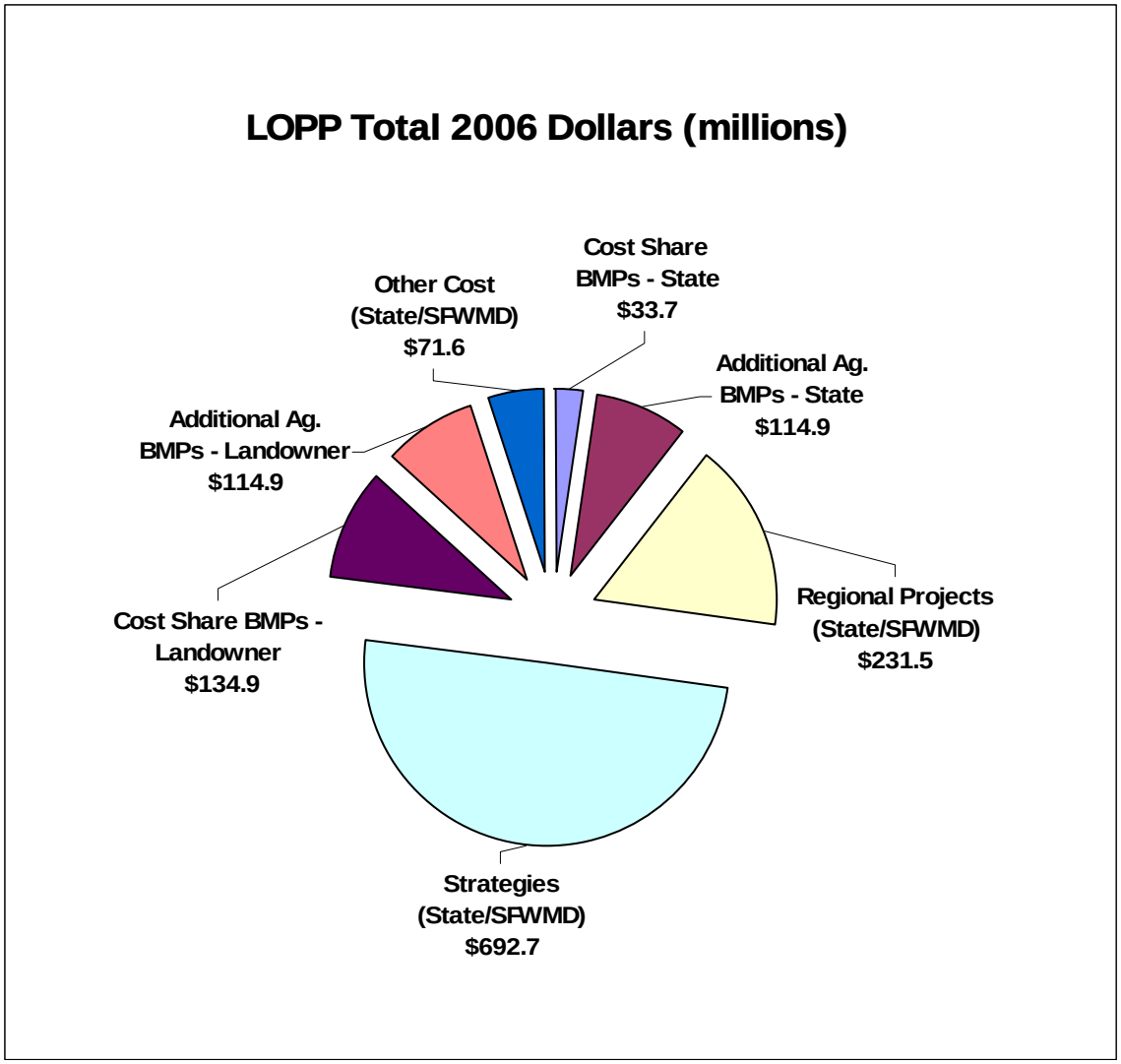
It is recognized that rainfall affects the flows into the lake, and that this factor has large inter-annual variability. The lake and its watershed were directly impacted by three hurricanes (Frances, Jeanne, and Wilma) and indirectly affected by two additional hurricanes (Charley and Ivan) in 2004 and 2005. The impacts of Frances and Jeanne, which struck the lake in September of 2004, and Wilma, which struck in October 2005, include increased suspended solids, total and soluble P, total and inorganic nitrogen, and significant reductions in water column transparency and submerged aquatic vegetation (SAV). For the period from 2001-2005, average TP loads were 709 metric tons (t) per year. These loads are higher than the baseline period (1991-2000) P load of 468 t per year and are more than five times higher than the TMDL of 140 t per year (five-year average). The original 10 year baseline (1991-2000) was used for initial planning and design purposes. In light of the increased loads experienced over the past five years, more P reduction strategies have been identified. These strategies will be evaluated for feasibility and cost-effectiveness and could be implemented if determined necessary due to the increased P loading to the lake.

The final plan reevaluation contained in this document has the following components: owner-implemented BMPs (primarily operational changes), cost-share BMPs (primarily structural changes), additional agricultural BMPs focused on entire site stormwater management, regional scale projects, the Comprehensive Everglades Restoration Plan (CERP) Lake Okeechobee Watershed Project (LOWP) and additional P reduction strategies.

Costs have been updated to reflect modifications in projects and adjusted for inflation. The total estimated additional cost to implement the plan through 2015 is $1,394.0 million in 2006 dollars, or $1,558.6 million, adjusted for inflation (2% annual rate). The

total State (including SFWMD) contribution is $1,116.9 million in 2006 dollars and $1,247.0 million adjusted for inflation.

Throughout this reevaluation process, uncertainties have been addressed by using best available estimates of P load reductions. The LOPP will continue to be reevaluated every three years to incorporate any new or updated information. Another aspect of the LOPA addresses BMP performance. If actual BMP performance does not meet initial expectations, the LOPA requires that BMPs be appropriately modified to improve their effectiveness. Should there be a significant deviation from the assumptions and performance expectations of the plan, the plan will be modified accordingly. As noted, the TMDL itself is expected to be re-evaluated, and should that target change, this could increase or decrease the scale of this plan.



1.0 INTRODUCTION

Lake Okeechobee (located at 27^{o} N latitude and 81^{o} W longitude) is an important resource for the interconnected South Florida aquatic ecosystem and the US Army Corps of Engineers (USACE) regional flood control project. The lake has a surface area in excess of 427,500 acres (1,730 km^{2}) and it is extremely shallow, with a mean depth of 8.9 ft (2.7 m) and maximal depth of 18 ft (5.5 m) (James et al., 1995). Lake Okeechobee receives water from a 5,400 square mile (mi^{2}) (14,000 km^{2}) watershed that includes the Upper Kissimmee Chain of Lakes, the Kissimmee River, Lake Istokpoga, Fisheating Creek, and other sub-basins (**Figure 1**). Lake waters flow south, east and west to the Everglades Protection Area, the St. Lucie River (C-44 Canal), and the Caloosahatchee River (C-43 Canal), respectively.

Lake Okeechobee has a diversity of roles. It provides water supply to urban areas, agriculture, and downstream ecosystems; it supports a multimillion-dollar sport fishery (Furse and Fox, 1994), a commercial fishery, and various recreational activities, and provides habitat for migratory waterfowl, wading birds, alligators, and the Everglade Snail Kite (Aumen, 1995). The lake also is used for flood control during the summer wet season. The lake faces three major environmental challenges: (1) excessive total phosphorus (TP) loads, (2) unnaturally high and low water levels, and (3) rapid spread of exotic and nuisance plants. In addition, the lake has been directly impacted by three hurricanes in 2004 and 2005 (Frances, Jeanne, and Wilma) that have affected the water levels and water quality of the lake.

This document provides an evaluation/update to the 2004 Lake Okeechobee Protection Plan (SFWMD et al., 2004), focusing on phosphorus (P) management activities, strategies, and associated costs. Results of recently completed projects are presented, as well as status updates for ongoing watershed and in-lake restoration projects. Project time lines, information about funding sources, and other aspects of project planning are also included. The recommendations included in this plan are based on best available information to date and are subject to modification as additional data and understanding of the dynamics of the watershed and lake are developed, thus allowing maximum flexibility to embrace new technologies, processes and procedures. The philosophies and programs described in the Plan reflect the collective efforts of the Interagency Team, representing federal, state, regional and local stakeholders from the public and private sectors. The performance goals and effectiveness estimates detailed in the plan are based on current data and best professional judgment. Program performance and effectiveness may vary from the originally established goals and estimates and will be revisited to determine whether any further reductions are necessary to achieve the TMDL. Those who have participated in the development of this planning document are dedicated to the success of the Lake Okeechobee Protection Program. This plan is respectfully submitted in an effort to secure long-term support for the successful restoration and protection of Lake Okeechobee.

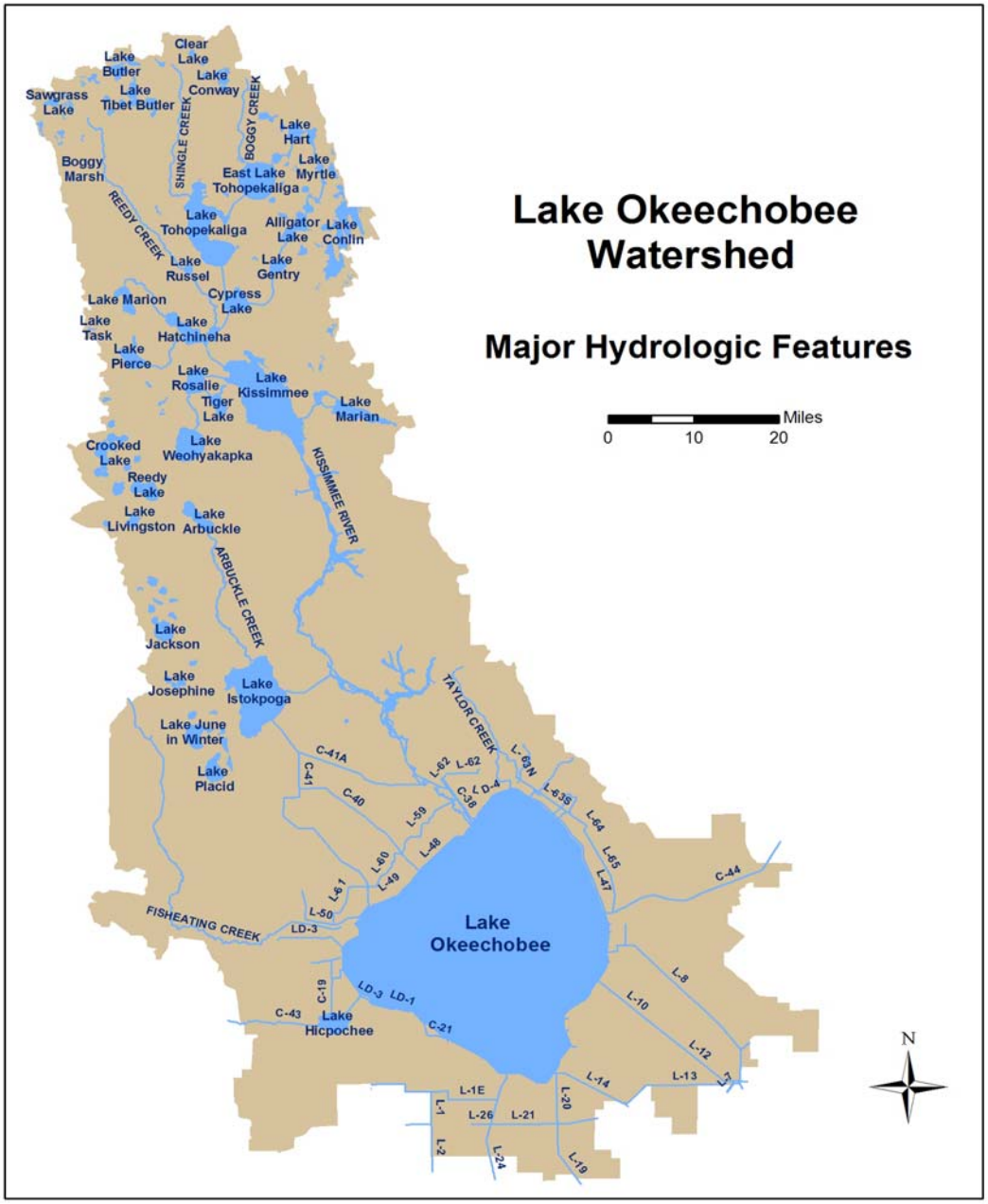


Figure 1. Major hydrologic features of the Lake Okeechobee watershed (L = levee, C = canal).

2.0 LAKE OKEECHOBEE AND WATERSHED STATUS

2.1 Lake Okeechobee

Surface water discharges and P loading rates into Lake Okeechobee have varied over time as a result of a combination of climatic conditions, land use changes and changes in land management practices. During the baseline period (1991-2000), the annual average P load to Lake Okeechobee was 468 metric tons (t) per year. In 2005 (from January to December), the annual measured P load was 822 t, including an atmospheric load of 35 t per year. The five-year average measured load from 2001 to 2005 was 709 t (including the atmospheric load of 35 t per year), which exceeded the Lake Okeechobee TMDL by 569 t (**Table 1**). This five-year average included two of the wettest years on record (2004 and 2005) that included the impacts of four hurricanes (Charley, Frances and Jeanne in 2004 and Wilma in 2005). These extremes document the reason that the TMDL is based on a five-year average, to account for variations in water flow and loads.

Table 1. Total phosphorus loads to Lake Okeechobee 1991-2005.

Year	Measured Load [a] (t)	Long-term Load (5-yr moving average) [a] (t)	Long-term Over-target Load (5-yr moving average) [ab] (t)
1991	445	415	257
1992	388	393	253
1993	296	375	235
1994	580	421	281
1995	683	478	338
1996	200	430	290
1997	470	446	306
1998	780	543	403
1999	670	561	421
2000 [c]	169	458	318
2001	609	540	400
2002	561	558	418
2003	614	525	385
2004	938	578	438
2005	822	709	569

[a] Includes an atmospheric load of 35 t per year based on the Lake Okeechobee TMDL (FDEP, 2001)
[b] Target is the Lake Okeechobee TMDL of 140 t compared to a five-year moving average
[c] Period of record for baseline load estimate in LOPP update is 1991-2000

2.2 Watershed Description

The Lake Okeechobee watershed spans from just south of Orlando to areas bordering the lake on the south, east, and west. This watershed, known as the LOPP area, includes 61 drainage basins and six regions with a drainage area of 5,400 square miles

(13,859 km^2) (**Figure 2**). The continuous urban and agricultural development in South Florida and consequent rapid land use changes in the watershed call for periodic land use updates to support planning and management activities. The most recent land use data were updated in May 2006 (**Figure 3**). The major land use change was an increase of urban areas that have occurred throughout the watershed (**Table 2**). Another major update was in the Lake Istokpoga drainage basins, where many areas previously listed as "other" have been changed to the "citrus" category.

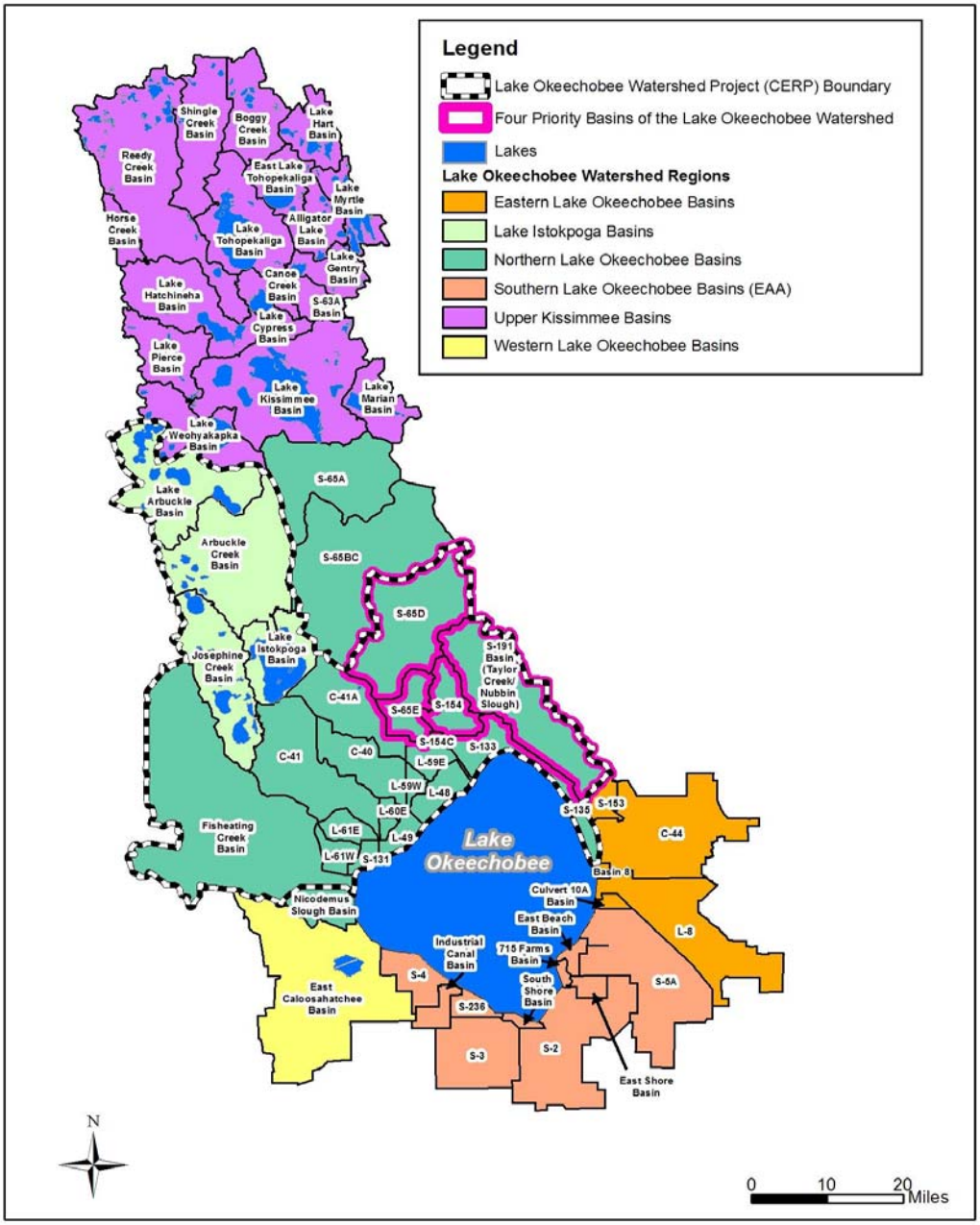


Figure 2. Lake Okeechobee watershed basins, regions, and priority basins.

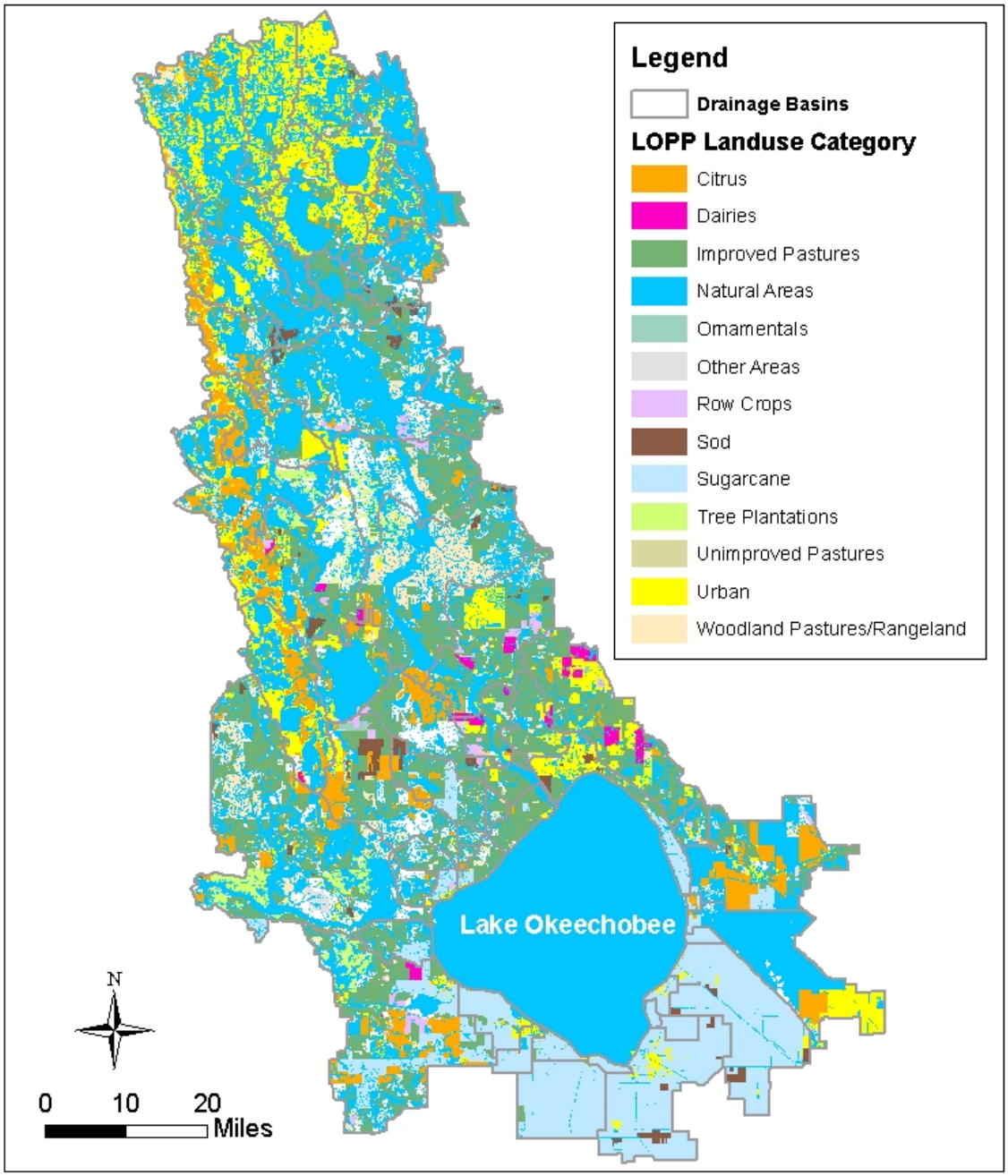


Figure 3. The 2006 land use map for the Lake Okeechobee watershed.

Table 2. Land use data for the Lake Okeechobee Protection Plan (LOPP) area.

Land Use	Area (acre)		Change
	2006	2003	
Citrus	234,629	209,961	12%
Dairies	22,432	28,121	-20%
Improved Pastures	674,356	693,480	-3%
Natural Areas	1,282,267	1,308,438	-2%
Ornamentals	4,687	4,687	0%
Other Areas	27,567	95,994	-73%
Row Crops	23,157	22,881	1%
Sod	39,081	32,867	19%
Sugarcane	399,710	400,318	0%
Tree Plantations	49,687	52,001	-4%
Unimproved Pastures/Rangeland	324,630	339,967	-5%
Urban	368,884	262,371	41%
LOPP Total Acreage	**3,451,086**	**3,451,086**	--

Note: Ornamentals were included in "Other Areas" in 2003.

Nutrient levels in surface runoff are directly related to land use and land management practices (Hiscock et al., 2003; Zhang et al., 2002). The major land use in the northern Lake Okeechobee basins is improved pasture for beef cattle grazing, while the major land use in the southern basins is sugarcane production. Citrus groves represent a large land use in the eastern basins and the Lake Istokpoga basins. The major land uses in the Upper Kissimmee Basins are natural areas and urban. Although dairy farms in the northern basins only cover one percent of the land use area, they represent a considerable source of P to some tributaries and up to 5 percent of the total external loading to the lake (Bottcher, 2006).

3.0 OVERVIEW OF LAKE OKEECHOBEE PROGRAMS

The Lake Okeechobee Protection Act (LOPA) (Section 373.4595, F.S.) was passed by the 2000 Florida legislature to establish a restoration and protection program for the lake. This program will be accomplished by achieving and maintaining compliance with water quality standards in the lake and its tributary waters. The approach is a watershed-based, phased, comprehensive, and innovative protection program designed to reduce P loads and implement long-term solutions based upon the Lake Okeechobee Total Maximum Daily Load (TMDL) for TP developed by the Florida Department of Environmental Protection (FDEP, 2001).

In October 2005, Governor Bush announced the Lake Okeechobee and Estuary Recovery (LOER) program to improve the ecological health of Lake Okeechobee and

the St. Lucie and Caloosahatchee Estuaries. The plan consists of a combination of capital projects and numerous interagency initiatives designed to provide measurable and meaningful improvements to water quality and water quantity in Lake Okeechobee and the St. Lucie and Caloosahatchee estuaries. Key state agencies charged with carrying out the plan include the South Florida Water Management District (SFWMD), the FDEP, the Florida Department of Agriculture and Consumer Services (FDACS), and the Florida Department of Community Affairs (FDCA).

3.1 Lake Okeechobee Protection Program

Elements of the Lake Okeechobee Protection Program include (1) the Lake Okeechobee Protection Plan (LOPP), (2) the Lake Okeechobee Construction Project, (3) the Watershed P Control Program, (4) the Research and Water Quality Monitoring Program, (5) the Internal P Management Program, (6) the Exotic Species Control Plan, and (7) an Annual Progress Report.

3.1.1 Lake Okeechobee Protection Plan

The SFWMD, in cooperation with the FDEP and FDACS, developed the Lake Okeechobee Protection Plan on January 1, 2004 (SFWMD et al., 2004). Since development of the plan, the coordinating agencies have focused their attention on implementation of the activities identified in the plan. This document provides an evaluation/update of the original 2004 plan, as well as the identification of additional phosphorous reduction strategies that may be necessary to meet the TMDL.

3.1.2 Lake Okeechobee Construction Project

The Lake Okeechobee Construction Project is being implemented in two phases. Phase I projects include two pilot stormwater treatment areas (STAs) in the Taylor Creek/Nubbin Slough (S-191) basin. Phase II, known as the Lake Okeechobee Watershed Project (LOWP) of CERP, will provide approximately 54 t of TP load reduction needed to meet the TMDL target of 140 t per year.

3.1.2.1 Phase I of the Lake Okeechobee Construction Project

Phase I of the Lake Okeechobee Construction Project is intended to bring immediate TP load reductions to Lake Okeechobee, consistent with the recommendations of the South Florida Ecosystem Restoration Working Group's Lake Okeechobee Action Plan (Harvey and Havens, 1999).

Construction is complete for the two Lake Okeechobee Critical Projects (Taylor Creek STA and Nubbin Slough STA) and start-up operations have begun. The reduction of P loads to Lake Okeechobee from these projects is estimated as 2.08 t of TP per year for the Taylor Creek STA and 6.5 t of TP per year for the Nubbin Slough STA. These estimates are based on model simulations using the DMSTA model (Walker and Kadlec, 2004) with lower inflow concentrations after BMPs are implemented.

3.1.2.2 Phase II of the Lake Okeechobee Construction Project

The objectives of LOWP of CERP are to reduce P loading to Lake Okeechobee, attenuate peak flows from the watershed, provide more natural water level fluctuations in the lake, and restore wetland habitat. These goals will be accomplished by constructing reservoir storage approaching 273,000 ac-ft (33,674 ha-m) in volume and constructing stormwater treatment facilities capable of removing approximately 54 t of P from the tributary flows prior to release to Lake Okeechobee not accounted for through other projects. Although this project was to have provided 130 t of P removal, no acceptable component was found for the Fisheating Creek Basin, for which the initial P removal goal was 50 t. The Lake Okeechobee Fast Track (LOFT) projects under the LOER program, which provide about 26 t TP load reduction, continue to be a part of the LOWP of CERP. However, the 26 t TP reduction provided by LOFT is not included in the 54 t TP removal attributed to the LOWP. The project will also select about 3,500 acres (1,416 ha) of watershed land for wetland and habitat restoration. The draft Lake Okeechobee Project Implementation Report (PIR) is scheduled for completion in March, 2008. Detailed information about LOWP is available on the CERP web site at www.evergladesplan.org/pm/projects/proj_01_lake_o_watershed.cfm.

3.1.3 Watershed Phosphorus Control Program

The Lake Okeechobee watershed P control program includes (1) continued implementation of existing regulations and voluntary agricultural and non-agricultural BMPs, (2) development and implementation of improved BMPs, (3) improvement and restoration of hydrologic function of natural and managed wetland systems, and (4) use of alternative technologies for nutrient reduction. In February 2001, the SFWMD, FDEP, and FDACS entered into an interagency agreement to address how to implement the programs and coordinate with existing regulatory programs, including Lake Okeechobee Works of the District (LOWOD) permitting program [Chapter 40E-61 Florida Administrative Code (F.A.C.)], Dairy Rule, and Everglades Forever Act (EFA). Under the LOPA (Section 373.4595, F.S.), the FDACS is charged with implementing a voluntary BMP program (Rule 5M-3) on all agricultural lands within the Lake Okeechobee watershed. In general, farmers are eligible to receive between 75 percent and 87.5 percent cost share, either through FDACS or a combination of FDACS and the Natural Resources Conservation Service (NRCS) funds. FDEP is responsible for developing non-agricultural non-point source BMPs. The implementation of P reduction projects and large-scale regional projects, research and monitoring, existing regulations, and exotic plant control is the responsibility of the SFWMD.

3.1.3.1 FDACS Agricultural Programs

Since 2002, considerable effort has been expended on the implementation of agricultural BMPs and water-quality improvement projects to immediately reduce the discharge of P from the watershed to the lake. Initially, the FDACS BMP program consisted of two phases: 1) the implementation of interim BMPs selected from existing cow/calf and citrus water-quality BMP manuals via the manuals' assessment checklists; 2) the development of more comprehensive, site-specific plans containing BMPs to

address nutrient and stormwater management. Experience has shown that it is more efficient to proceed directly to the comprehensive planning stage; therefore, the interim assessment and BMP selection are no longer being conducted.

Agricultural Nutrient Management Plans (AgNMPs) for the 22 active dairies in the four priority basins (S-191, S-154, S-65D, and S-65E) were completed in 2002, covering more than 31,000 acres (12,545 ha). Collectively, the completed AgNMPs indicated that it would cost a total of $140 million to achieve our water quality goals. The interagency team concluded that funds should first be expended on the stormwater component of the AgNMPs, aimed at lowering phosphorus concentrations at the edge-of-farm discharge point. Presently, all 22 dairies have signed Notices of Intent to implement their AgNMPs. Detailed planning, engineering, and design for implementing the stormwater component of the AgNMPs, at four of the dairies, will be completed by June 2007. Implementation of all of the dairy AgNMPs is expected to be completed by FY 2015.

Because the implementation of planned agricultural BMPs is expected to improve water quality substantially in the watershed, the FDACS and NRCS have executed an interagency Memorandum of Agreement that commits available federal resources to expedite BMP-based planning for the remaining acres in the watershed. In support of this agreement, the FDACS contracted with the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), in conjunction with NRCS, to provide training for private-sector third-party vendors who wish to assist in plan development.

To date, the FDACS and the NRCS have obtained $950,000 in federal appropriations, which has been used to identify, train, and contract with private-sector technical service providers to develop BMP-based plans for cow/calf, citrus, row crop, and other agricultural operations. This effort has significantly increased plan development and implementation, including the engineering and design of planned water control structures.

A critical component in the success of the agricultural BMP program is the collection and analysis of data to determine whether the BMPs are working as anticipated. The interagency team is committed to continue funding on-farm BMP demonstration projects at representative sites that, over time, will provide both BMP effectiveness data and insight into what new or modified BMPs may be necessary to reach the P reduction goals required to achieve lake and tributary restoration. In cooperation with UF/IFAS, FDACS is conducting BMP demonstration and evaluation projects at representative sites for all agricultural land uses in the watershed, including dairies, beef cattle, citrus, and vegetable production. This effort incorporates regional and sub-regional water quality monitoring in collaboration with the SFWMD and the United States Geological Survey (USGS), which can help identify where to focus plan development and implementation, and BMP effectiveness studies.

Completed plans now cover approximately 278,000 acres (112,500 ha) in the watershed, and BMPs are in various stages of implementation. The majority of this acreage lies within the four priority basins. Plans are being developed for an additional

634,000 acres (256,564 ha) of agricultural operations. These figures reveal that more than half of the agricultural acreage in the entire watershed is currently under voluntary FDACS programs to plan and implement practices to control offsite movement of P. At the current rate of participation, FDACS is on schedule to complete BMP-based plans for the remainder of the agricultural acreage in the watershed by July 2010, and fully implement BMPs by 2015, as required by the Lake Okeechobee Protection Plan.

One of the challenges in implementing agricultural BMP programs in the watershed, and throughout the state, is attrition in producer participation due to development pressure and the sale of agricultural land for other uses. Considerable amounts of agricultural acreage are undergoing land use changes, and the trend is expected to continue. In 2006, approximately 13,046 acres (5,280 ha) of land under plan development or BMP implementation in the watershed were sold and are no longer active under a BMP program. This creates at least two complexities: 1) The disappearance and fragmentation of large agricultural holdings lead to increased expenditure of staff and financial resources to enroll a greater number of smaller parcels in BMP programs; 2) Conversion of agricultural lands to developed uses places additional responsibility on the SFWMD to ensure that associated stormwater discharges are at or below the levels prior to conversion.

3.1.3.2 FDEP Non-Agricultural Programs

A phased approach is being used to reduce P loadings to Lake Okeechobee from non-agricultural areas in the Lake Okeechobee watershed. The largest contributors of P loading from non-agricultural areas to Lake Okeechobee are animal feed and fertilizer distributors, golf courses, and failing wastewater systems (septic tanks and package plants). Efforts since the inception of the LOPA include implementation of BMPs, master planning for stormwater and wastewater, implementation of stormwater retrofits, the designing of larger urban stormwater projects, and public education.

Interim measures in the first phase include BMPs identified in the Florida Land Development Manual, UF/IFAS lawn fertilization rates, and UF/IFAS turfgrass BMPs. These nonstructural BMPs primarily target homeowners and businesses. UF/IFAS extension agents are working with homeowners, as well as lawn maintenance companies, on better lawn management. The implementation of these BMPs follows a non-regulatory incentive-based approach.

The next phase is to develop more detailed plans for addressing P loading to Lake Okeechobee from stormwater and wastewater sources in the watershed's urbanized areas. Stormwater master plans have been developed for two of the urban areas surrounding Lake Okeechobee – the City of Okeechobee/Okeechobee County and the City of Moore Haven/Glades County. The Okeechobee Service Center of SFWMD is working cooperatively with Okeechobee County and the city of Okeechobee to expand the plans. Stormwater master plans are being developed for other urban areas within the Lake Okeechobee watershed. Because a majority of the urban areas were developed prior to the adoption of state stormwater regulations, the existing infrastructure is typically inadequate to properly deal with stormwater. Stormwater

retrofits, such as detention/retention facilities and swales, are needed to improve the water quality of urban stormwater runoff.

Public education offers a means to promote measures for reducing P entering stormwater in the urbanized areas. The UF/IFAS, through the Florida Yards and Neighborhoods Program, provides weekly newspaper articles in the Okeechobee newspapers that address proper lawn maintenance practices. Additionally, a brochure has been developed in conjunction with the fertilizer industry to promote the use of low-P fertilizers and the use of appropriate BMPs when applying such chemicals. This brochure is available at retail stores in the city of Okeechobee where fertilizers are sold. UF/IFAS monitors the number of people requesting assistance information regarding this program.

3.1.3.3 SFWMD Phosphorus Control Programs

An extensive effort was expended on P control project implementation in the LOPP area to reduce P loads to the lake. The SFWMD, in coordination with the FDACS and FDEP, has developed and implemented more than 30 P reduction projects (**Figure 4**). These projects have been implemented under programs such as the P Source Control Grants, Isolated Wetland Restoration, Dairy Best Available Technologies (BATs), Public/Private Partnerships, Former Dairy Remediation, and Alternate Water Storage and Treatment. All of these projects have some level of performance monitoring to facilitate the evaluation and potential future use of these types of technologies.

3.1.3.3.1 Phosphorus Source Control Grants

The intent of the Lake Okeechobee P Source Control Grant (PSCG) program is to fund the early implementation of projects that have the potential for reducing P exports to Lake Okeechobee from the watershed. The program consists of 13 projects (**Figure 4**) with a total cost of $7.5 million. An interagency team evaluated the projects and ranked them using established evaluation criteria. The funded projects range in size and complexity, and grant recipients consist of landowners, public facilities, and private corporations.

3.1.3.3.2 Dairy Best Available Technologies

In October 2000, the SFWMD initiated the Dairy BATs projects to identify, select, and implement various technologies to significantly reduce TP discharge from dairy operations in the Lake Okeechobee watershed. After a thorough evaluation of alternatives by an interagency project team, edge-of-farm stormwater treatment was selected for implementation on three dairy properties in the Lake Okeechobee watershed. These projects consist of capturing stormwater runoff (especially from all of the high-nutrient pasture areas), reusing the runoff on site in current operations if possible, and if offsite discharge is necessary, chemically treating the stormwater prior to its release. The three Dairy BATs projects are fully constructed, and performance monitoring was initiated in May 2004. TP load monitoring is a component of the project so that performance can be accurately determined. Project performance is being

evaluated at various TP discharge concentration goals ranging from 150 ppb to 40 ppb. Annual TP load reductions could range from 27 to 78 percent. The FDEP provided funds from the 2002–2003 state general revenue funds designated for TMDL implementation projects to be used for the design and implementation of a fourth BAT site, the Milking “R” Dairy. The fourth site was completed in December 2005 and is in the performance monitoring phase.

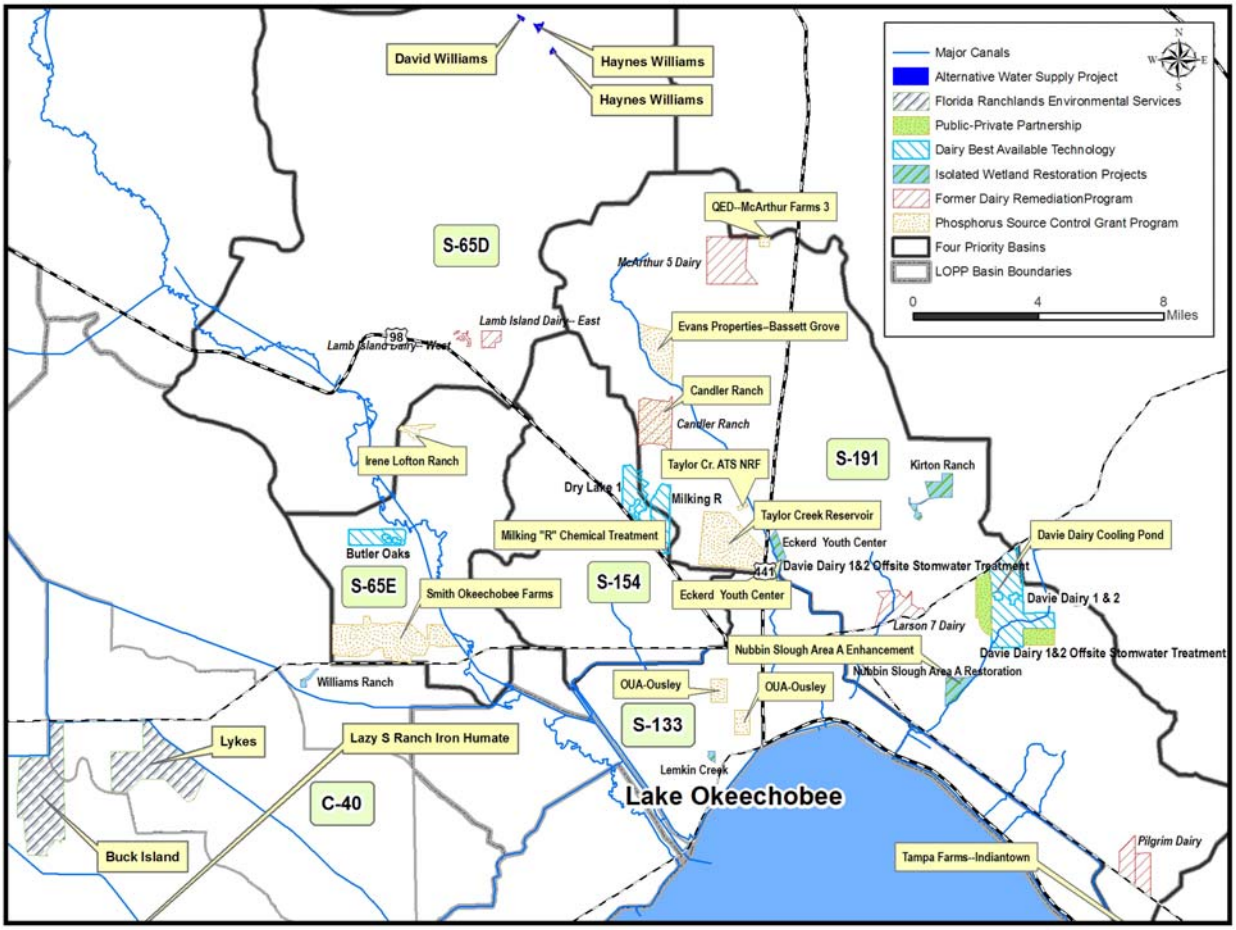


Figure 4. SFWMD project locations under Lake Okeechobee watershed phosphorus control programs.

3.1.3.3.3 Isolated Wetland Restoration

The Lake Okeechobee Isolated Wetland Restoration Program (LOIWRP) is designed to enhance and restore wetlands, reduce P loads, and retain stormwater flows by increasing regional water storage in the Lake Okeechobee watershed. Historically, isolated wetlands covered a considerable percentage of land area in the four priority basins, capturing stormwater runoff and helping to retain P in the watershed. However, many of these wetlands have been drained to increase the amount of land in agricultural production, allowing more P to reach Lake Okeechobee.

As a cost-share program, the LOIWRP pays for all wetland restoration costs including land survey, design, permits, construction, initial exotic and nuisance plant removal, fencing and monitoring, as well as the value of the easement. The landowner is responsible for paying property taxes and for the operation and maintenance of the restored area. Landowners have the choice of entering into a 30-year or perpetual easement agreement for the portion of their property that is enrolled in the program. The SFWMD is administering the LOIWRP with the cooperation of a multi-agency team that includes the FDACS, FDEP, NRCS, U.S. Fish and Wildlife Service (USFWS), and UF/IFAS. The four projects under the program are (1) Kirton Ranch, completed in March 2004; (2) Lemkin Creek, a state-owned property in the design phase; (3) Eckerd Youth Center, a state-owned property in planning phase; and (4) Nubbin Slough Area A restoration.

3.1.3.3.4 Former Dairy Remediation

Five former dairy remediation projects are in various stages of implementation for the privately owned former dairies that are now cow/calf operations. Planned remediation practices include retaining runoff from old high intensity areas, rehydrating onsite wetlands, amending high-P soils, and reducing the flow of storm water offsite. Design and construction were completed on three farms and the construction for other two will be completed by July 2007. Water-quality monitoring for P concentration reductions during flow events will be conducted for one year following construction completion.

3.1.3.3.5 Alternate Water Storage and Treatment

In October 2005, the SFWMD in cooperation with Alderman-DeLoney Ranch, Buck Island Ranch (McArthur Agro-Ecology Research Center), Lykes Bros. Inc., Williamson Cattle Company, World Wildlife Fund, FDACS, and FDEP, started a three-year pilot project titled “Florida Ranchlands Environmental Services Projects (FRESP)” under the LOER program. The purpose of the pilot project is to design, field test and evaluate a market-based program to pay for environmental services on ranchlands, specifically water storage, P retention, and wetland habitat enhancement. The goal of the program is to produce measurable benefits to the environment, be profitable for ranchers, cost-effective for tax payers, easily administered, and replicable in other regions and watersheds. Additional project sites are being considered utilizing State funds. The P reduction total from these additional project sites is under evaluation.

3.1.3.3.6 Other Regional Projects

Through a coordinated effort by FDEP, City of Okeechobee, Okeechobee County, and the SFWMD, the Lemkin Creek urban STA project is designed to treat urban stormwater runoff from southwest Okeechobee County and reduce P loading to the lake. Phase I of the project included water storage and wetland re-hydration. Phase II consisted of land acquisition for approximately 135 acres (55 ha) of agricultural and abandoned mining lands. The project is currently in the design phase. It is expected that approximately 50 percent of the urban runoff from the City of Okeechobee would be captured and treated by the STA.

The Brighton Seminole Reservation reservoir is another regional project. The main objective of the project is to design and construct a shallow reservoir for storing and treating excess water in the Indian Prairie Basin. In 2006, the project was in the planning and design phase.

3.1.3.3.7 Regulatory

While revisions to the LOWOD permitting program (Chapter 40E-61, F.A.C.) remain under development with SFWMD staff, the program is being administered to support voluntary BMP implementation throughout the watershed. The SFWMD evaluates permit applications from those operations that are not participating in a BMP program and new urban developments within the watershed. In addition, revisions are being proposed through the ERP criteria that deal specifically with land use changes occurring throughout the Lake Okeechobee watershed. The LOPA requires that "Prior to authorizing a discharge into Works of the District, the SFWMD shall require responsible parties to demonstrate that proposed changes in land use will not result in increased P loading over that of existing land uses." These revisions target a zero net increase in P loads to the watershed through land use changes and require the implementation of BMPs and stormwater management systems that further reductions of P loads in new developments.

3.1.4 Research and Water Quality Monitoring Program

The SFWMD, in cooperation with the FDEP and FDACS, has implemented a comprehensive research and water quality monitoring program for the lake and watershed. Several other agencies and interested parties participate in the monthly interagency team meetings and various project teams. Watershed research and assessment studies are reviewed and prioritized each year by the interagency team to ensure that information needs are addressed and watershed projects have been designed and implemented successfully. The data obtained will fill information gaps that have been identified by the interagency participants, assist in focusing on areas of concern, and determine performance of watershed management efforts.

In July 2006, the SFWMD worked with the consultant to update a letter report titled Phosphorus Reduction Performance and Implementation Costs under BMPs and Technologies in the Lake Okeechobee Protection Plan Area. The appropriate values for existing and BMPs practices for each agricultural land use were updated based on group consensus (Bottcher, 2006). The group consists of professors from UF/IFAS and staff from Soil & Water Engineering Technology (SWET) and SFWMD. It is anticipated that the implementation of owner and typical cost share BMPs in the urban and agricultural sectors will provide approximately a 25 percent reduction in P loads into the tributaries within the Lake Okeechobee watershed. Additional reductions could be achieved by a more aggressive BMP implementation program within the basin. The reductions shown are for a "typical" BMP implementation level under a moderately aggressive program that assumes a limited amount of cost share support will be available for agricultural landowners.

Water quality monitoring is conducted through the LOWP of CERP, the Lake Okeechobee Watershed Assessment (LOWA) micro-basin monitoring, and through the SFWMD's ambient water quality monitoring program. Through the LOWP, the USGS monitors 16 sub-basin sites within the LOWP boundary north of Lake Okeechobee for stream flow, P, nitrogen, and total suspended solids. Continuous flow and weekly water quality samplings are collected at these stations. Additional information can be found on the CERP web site.

In 2004, the SFWMD restructured the LOWOD farm-level concentration monitoring network to the LOWA micro-basin level monitoring network, moving sampling sites throughout the watershed to develop baseline data. These data are used by the coordinating agencies, specifically FDACS, to direct technical service providers to areas exhibiting poor water quality. The site data collected under the program, along with data collected from the SFWMD's ambient monitoring network, the LOWP monitoring network, and the Lake Okeechobee inflow sites, are used by LOWA staff to evaluate changes in P concentrations throughout the watershed. If changes are observed, the SFWMD can perform more intensive monitoring within the basin and micro-basins to identify P sources. If high P source areas are detected and P discharges within a basin do not improve, the coordinating agencies can require the implementation of additional BMPs or regional projects.

3.1.5 Internal Phosphorus Management Program

3.1.5.1 Bloom and Toxin Monitoring

Excessive nutrient loading has resulted in a major change in the phytoplankton community in Lake Okeechobee. The phytoplankton has shifted from being dominated by desirable diatoms to being dominated by noxious bloom-forming and potentially toxin forming cyanobacteria (Havens et al., 2003). Large algal blooms and the associated toxins can cause taste and odor problems in drinking water, can cause skin irritations in humans, and can impact aquatic biota, including fish, macro-invertebrates, alligators, wading birds, and other wildlife that make use of the ecosystem (Pearl, 1988). The Lake Okeechobee Division of SFWMD monitors the biomass, taxonomic composition, and toxin production of bloom-forming blue-green algae in Lake Okeechobee on a monthly basis at 10 shoreline stations where blooms historically have been known to occur. These analyses will provide insight into factors controlling the occurrence of algal blooms and toxins in the lake ecosystem.

3.1.5.2 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) plays a key role in shallow lakes, providing critical habitat for fish, wading birds, and other wildlife, supporting epiphyton that can be an important source of carbon and energy in the lake food web, and directly affecting water quality. SAV influences the biomass of phytoplankton and the transparency of water through a number of processes. These include stabilization of sediments by roots, reduction of shearing stress to sediment surfaces, uptake of nutrients by periphyton

(algae which grows on plants and benthic substrates) attached to SAV, and precipitation of P with calcium when intense photosynthesis results in high water column pH.

SFWMD scientists have been documenting the abundance and distribution of SAV in the Lake by conducting monthly and annual surveys (Havens et al., 2002; Havens, 2003). On a yearly basis, the entire submerged plant community of the Lake is mapped with an intensive program that includes over 600 sites around the shoreline. These maps allow SFWMD to determine the total number of acres of each dominant plant species (eelgrass, peppergrass, *Hydrilla*, and *Chara*), and how this acreage changes from year-to-year with variations in lake stage and other conditions. Sampling is conducted in August at the height of SAV growth. On a monthly basis, surveys are conducted at stations located along 17 fixed transects encompassing the Lake's south and west shoreline. This covers a region where SAV beds historically have occurred. The sampling includes measurements of plant biomass, water chemistry, clarity of the water, and underwater light penetration. The August 2006 mapping indicated a total of 2,965 acres of SAV.

The SAV monitoring program has been in place in Lake Okeechobee since the spring of 1999 so the database for this component encompasses over seven years of biological data collected over a wide range of hydrological and environmental conditions. Additionally, historical SAV biomass and distribution data exists from a study conducted in the late 1980s and early 1990s (Zimba et al., 1995) that can be used to compare the current SAV distribution and abundance during comparable historic lake stages.

3.1.5.3 Sediment Dredging Study

The Eagle Bay Island Habitat Enhancement Dredging Project is being conducted to provide habitat restoration benefits and to evaluate technologies for effectiveness in removing mud sediments, utilization of cost-effective disposal options, and sediment stabilization. The Habitat Enhancement Dredging Project is located in the near shore region of Lake Okeechobee, east of Eagle Bay Island. Currently, sediment mapping and analysis are underway and the SFWMD is seeking proposals for the design of innovative disposal and sediment stabilization technologies. The results of this project are anticipated to have both benefits for the local ecology of the area around Eagle Bay Island and will serve as a model for potential future similar dredging projects within the lake.

3.1.6 Exotic Species Control Plan

The Exotic Species Control Program is required to identify the exotic species that threaten native flora and fauna within the Lake Okeechobee Watershed, and develop and implement measures to protect native species. The exotic plants and animals identified as threatening native species will require management of existing invasion, or in the case of some animal species, monitoring of possible future invasions.

Aerial and ground treatments of exotic and invasive emergent vegetation continued in 2005-06. Approximately 5,000 acres (2,023 ha) of torpedograss and 3,000 acres (1,214

ha) of cattail were treated in the Moore Haven and Indian Prairie regions of the marsh. This brings the total acres treated in Lake Okeechobee since 2000, to nearly 25,000 acres (10,117 ha) of torpedograss and 7,400 acres (2,995 ha) of cattail. Treatment efficacy has varied with torpedograss but generally a high level of control has been achieved. In some areas of the Moore Haven marsh, torpedograss has been controlled for more than four years following a single treatment. Native vegetation including spikerush and fragrant water lily has become established in many of the treatment sites. Treatment efficacy of cattail also has been high. Cattail treatments have been confined to interior marsh locations to preserve the remaining cattail wall that helps prevent nutrient rich pelagic water from entering the interior marsh. Many cattail treatment sites are now open and recent wild fires in some of the treated areas have helped reduce cattail wrack.

3.1.7 Annual Progress Report

Annual reports can be found in the South Florida Environmental Report (SFER). The 2007 annual report is included in Chapter 10 of the SFER and can be found at http://www.sfwmd.gov/sfer/.

3.2 Lake Okeechobee and Estuary Recovery Program

Components of the LOER program include the LOFT Projects, revisions to the Lake Okeechobee Regulation Schedule, establishment of TMDLs for Lake Okeechobee tributaries, implementation of mandatory fertilizer BMPs, revisions to Environmental Resource Permitting (ERP) criteria for new development, storage and/or disposal of excess surface water on public, private or tribal lands, implementation of growth management plans to encourage innovative land use planning, elimination of land application of residuals, and full implementation of the LOPP and LOWP. All LOER components are underway and once implemented collectively will improve water quality, expand water storage, facilitate land acquisition, and enhance lake and estuary health.

3.2.1 Lake Okeechobee Fast Track Projects

Initial funding has been provided for four LOER construction projects north of Lake Okeechobee identified as LOFT projects (**Figure 5**). These LOFT projects are specifically designed to provide water quality improvements and include a 24,000 ac-ft (2,960 ha-m) reservoir in association with the Taylor Creek STA, a 2,400-acre (971 ha) STA at Lakeside Ranch, and consideration of re-routing of flows from the S-133 and S-154 basins to the Lakeside Ranch STA in the S-135 basin.

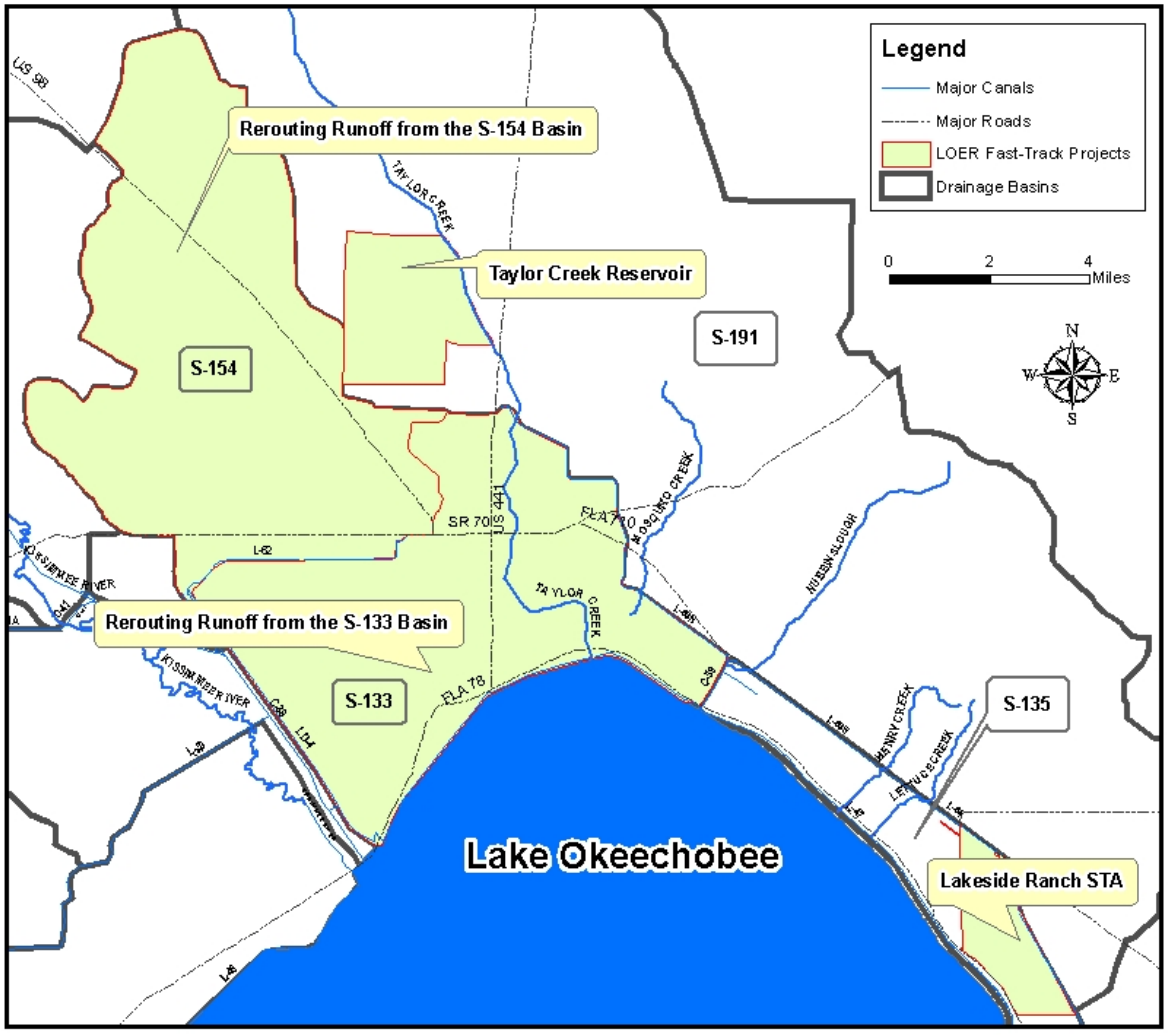


Figure 5. Lake Okeechobee Fast Track (LOFT) projects under the Lake Okeechobee and Estuary Recovery (LOER) Plan.

3.2.2 Revision of the Lake Okeechobee Operating Schedule

The current Lake Okeechobee Water Supply and Environmental (WSE) Operating Schedule can restrict water releases from the Lake, which results in lake stages higher than desirable for the ecosystem. This condition has been exacerbated by recent above-average rainfall years and the passage of four hurricanes over the lake or its northern watershed in 2004 and 2005, which caused rapid increases in lake stage, by more than 4.5 ft (1.4 m) during 2004 and 2.5 ft (0.8 m) during 2005.

The revision will optimize Lake Okeechobee's operating schedule within existing structural constraints to meet the diverse requirements of the lake, its receiving waters, and its users. This project is led by the USACE with Project Delivery Team (PDT) support from the SFWMD as the local sponsor, and input from the US Fish & Wildlife

Service (USFWS), the Wildlife Conservation Commission (FWC), the City of Sanibel, and Martin and Lee counties.

The goal of this revision is to bridge the gap until implementation of the Acceler8 and LOFT projects. Acceler8 is a major boost program for Everglades restoration by stepping up the pace on eight restoration projects. Alternative regulation schedules were evaluated against performance measures that were developed as part of the CERP RECOVER program. Each alternative evaluated includes temporary forward pumps as a component in the event of extreme low lake stages [<11 ft (< 3.4 m) NGVD]; similar to conditions that arose during the 2000–2001 drought. The temporary pumps are being manufactured and will be ready for installation, if needed, at S-351, S-352 and S-354. Additional solutions are being developed for supplemental deliveries north of the lake.

Prior to the USACE modeling efforts, regional meetings were held to gather public input, which resulted in a total of eleven alternatives/sensitivity runs being initially modeled, integrating both public input and agency participation. Each PDT member agency selected their recommended alternatives, based on the approved set of Performance Measures, to be advanced into the study's final array of alternatives for full evaluation. These recommendations were based on overall system wide benefits including estuaries, Lake Okeechobee, Water Quality Everglades/Water Conservation Areas, and Water Supply LOSA, LECSA, snail kite habitat, Herbert Hoover Dike integrity, and navigation impacts.

A tentatively selected plan (TSP) was identified by the USACE in June 2006 as balancing the performance measure criteria established for plan evaluation. Substantial comments were received at the public meetings held throughout South Florida to present the TSP and the Supplemental Environmental Impact Statement (SEIS). As a result, the initial implementation date of January 2007 has been substantially extended into 2007 to allow sufficient time for the USACE to address concerns with the TSP and better balance the performance measures of the physiographic areas evaluated. New alternatives will be evaluated, and a revised SEIS and Water Control Plan will be developed accordingly.

3.2.3 TMDL – Lake and Tributaries

The Lake Okeechobee P TMDL of 140 t was adopted by the State in August 2001 (Chapter 62-304.700, F.A.C.) and was approved by Environmental Protection Agency (EPA) in October 2001. Attainment of the TMDL is calculated using a 5-year rolling average of the monthly loads computed from measured flow and concentration values at inflows to the lake. The TMDL is allocated to atmospheric deposition (35 t) and to the sum of nonpoint surface water inputs to the lake (105 t) to achieve an in-lake target P concentration of 40 ppb in the pelagic zone of the Lake. The implementation of the TMDL is in accordance with the Lake Okeechobee Protection Act (Section 373.4595, F.S.) and the Florida Watershed Restoration Act (Section 403.067, F.S). These acts outline the implementation of management strategies following a phased watershed

approach. If new scientific information is available, the TMDL will be re-evaluated within 5 years after adoption and adjusted if appropriate.

USEPA and FDEP are accelerating the development of TMDLS for tributaries in the Lake Okeechobee watershed. In September 2006, EPA proposed TMDLs in the following tributary basins in the LOPP area: Caloosahatchee River, Everglades, Lake Okeechobee, St. Lucie-Loxahatchee, Kissimmee River, and Fisheating Creek. The TMDL allocation for TP is 77 ppb for these tributaries. You can view the TMDLs as well as the public notices at http://www.epa.gov/region4/water/tmdl/florida/index.htm. Once tributary TMDLs are finalized, they will be implemented in conjunction with the LOWOD and ERP regulatory programs.

3.2.4 Implementation of Mandatory Fertilizer BMPs

The FDACS has completed adoption of an amendment to administrative Rule 5M-3 that expands the effective area of the rule from the four priority basins to include the entire Lake Okeechobee watershed. The rule adopts BMP manuals for citrus producers and cow/calf operations; conservation plans for vegetable and row crop producers; and AgNMPs for dairy operations, and discusses the process for implementing these BMPs. Through this rule, the implementation of appropriate BMPs — accompanied with the submission of a Notice of Intent to implement a BMP plan — provides the landowner with a presumption of compliance with Florida water-quality criteria. Landowners who choose not to participate in the FDACS BMP program will be required to monitor the quality of water leaving their properties through the LOWOD (Chapter 40E-61, F.A.C.) permitting program and to demonstrate compliance with existing and future P targets and requirements set forth in the Surface Water Improvement and Management (SWIM) plan (SFWMD, 2002) or an established tributary TMDL.

In addition, agencies are working with the fertilizer industry to produce and distribute low- or no-P fertilizers statewide. Additionally, the SFWMD and FDEP will be working with the municipalities to implement appropriate lawn fertilization BMPs. This initiative is planned for completion in 2008.

4.0 EVALUATION OF LAKE OKEECHOBEE PROTECTION PROGRAM

The 2004 LOPP projected an anticipated load reduction of 78 t (based on reducing 468 t baseline load to 390 t) by 2006 through implementation of the projects outlined in the Plan (SFWMD et al., 2004). However, actual P loads to the lake were 634 t per year, averaged over 2001 to 2006, which is 244 t above the targeted load of 390 t. While information indicates that improvements in water quality are occurring at the edge of farm or basin, these were masked by the hurricane events of 2004 and 2005, as well as by the presence of residual or legacy P in the watershed. For example, for the last five years from 2001 to 2005 as compared to the baseline, flows for the four priority basins plus the lower Kissimmee River basins increased by 65%, while loads increased by 13%.

This report evaluates the P load reduction goals achievable for each activity so that the P Total Maximum Daily Load (TMDL) will be met by 2015. This plan evaluation also defines current and proposed P reduction projects that require future funding, the lead agency responsible for implementing the activities and the estimated P load reduction. The estimated load reductions from current activities were updated based on the new land use data (**Table 3**). The estimated load reductions from future activities were estimated based on the best available information and data (**Table 4**). These reductions were presented under the 10-year baseline condition. The spreadsheet model was used to estimate P load reductions to Lake Okeechobee and within each basin in the LOPP watershed. The methodology of the spreadsheet model is described in Appendix A. To begin to address the increase in P loadings over the last five years (2001 to 2005), a list of P reduction strategies is presented in **Table 4**. The actual load reductions, as measured at the lake inflow structures, will be delayed due to P that has accumulated in soils and tributaries over time. Long-term assessment will continue through the life of the activities to quantify project performance.

Table 3. Current phosphorus reduction activities in the Lake Okeechobee watershed, with lead agencies and the estimated total phosphorus load reduction.

Activities	Estimated P Load Reduction (t)	Lead Agency
Baseline P Load (1991-2000)	**433**	
Current Activities		
Owner Implemented BMPs	35	Agriculture – FDACS Non-Ag. – FDEP
Funded Cost Share BMPs	30	FDACS
Watershed P Control Projects	31	SFWMD
Regional Public Works Project	50	SFWMD
Total under current activities	**146**	

Table 4. Future phosphorus reduction activities in the Lake Okeechobee watershed, with lead agencies and the estimated total phosphorus load reduction.

Activities		Estimated P Load Reduction (t)	Lead Agency
Baseline P Load (1991-2000)		**433**	
Current Activities		**146**	
LOPP Reduction Tools	Typical Cost-Share BMPs That Require Future Funding	31*	FDACS
	Additional Agricultural BMPs	30*	FDACS and SFWMD
	Regional Projects Initiated (Lemkin Creek, Lake O Fast Track Projects, Brighton Reservoir)	27*	SFWMD
	Subtotal	**88**	
Proposed Regional Project: CERP LOWP		**54**	USACE and SFWMD
TMDL (not including the 35 t of atmospheric deposition)		**105**	
Remaining Load		**40**	
Strategies	Aquifer Storage and Recovery (ASR)	10	SFWMD
	Public-Private Partnership – Indian Prairie Basin	22	SFWMD
	Chemical Treatment within Reservoirs	20	FDEP and SFWMD
	Additional Regional Storage/Treatment (TCNS, Indian Prairie Basin, Fisheating Creek)	21	SFWMD
	Managed Aquatic Plant Systems	9	SFWMD
	WOD and ERP Rule Revisions	TBD	SFWMD
	Soil Amendments/Stabilization	TBD	SFWMD
	Deep Well Injection	TBD	SFWMD
	Alternate Water Storage and Treatment	TBD	SFWMD
	Linkages with Other Programs: alternative water supply, wetland reserve program	TBD	SFWMD

* A phosphorus concentration associated with the remaining load for activities within LOPP P Reduction Tools was calculated for each basin using individual basin flows. If the concentration was less than 40 ppb, the load was adjusted to the equivalent 40 ppb load to produce the adjusted remaining load. Once a basin reached the equivalent 40 ppb P load, no additional reductions were considered feasible.

TBD To Be Determined

4.1 Current Activities

Owner implemented Best Management Practices (BMPs) are described in the various BMP manuals adopted by FDACS (Rule 5M-3, F.A.C.). These owner BMPs are affordable, cost-effective practices that do not require cost-share. Suites of owner implemented BMPs are land use specific. For example, cow/calf land uses may reduce P fertilization, improve grazing management, or incorporate better management of nitrogen and micronutrients. Additionally, the owner implemented BMPs for urban areas include reductions in P fertilization and lawn maintenance activities.

Funded cost-share BMPs are BMPs implemented under existing cost-share programs [FDACS (State appropriations) and USDA-NRCS (Federal appropriations)] and reflect BMP implementation efforts primarily within the four priority basins (S-154, S-191, S-65D and S-65E). These BMPs were selected to represent the maximum contribution that the average landowner can afford. Bottcher (2006) describes the typical suites of funded cost-share BMPs provided for each land use, along with the associated P reductions and cost per acre. The P loading reduction of 18.5 t to Lake Okeechobee from selected cost-share BMP projects implemented/planned through June 30, 2007, is delineated in **Table 5**. The P load reductions anticipated from these specific BMP projects (**Figure 6**) are combined with the estimated load reductions from typical cost-share BMPs implemented on cow/calf operations primarily within the four priority basins and the total is reflected in **Table 3**.

Watershed phosphorus control projects include ongoing multi-year projects to reduce P loading from the northern Lake Okeechobee watershed. Extensive effort has been expended in recent years on BMP implementation in the LOPP area to reduce P loads to the lake. The P loading reduction to Lake Okeechobee from these projects is estimated to be 31 t (**Table 6**). All of these projects have some level of performance monitoring to facilitate the evaluation and potential future use of these types of technologies.

Regional public works projects are projects that are being constructed outside of the Lake Okeechobee Protection Plan but will have water quality benefits for the lake. These include the EAA storage reservoir (CERP); diversion of 298 Districts flows (ECP) and BMPs under Chapter 40E-61, F.A.C. and Chapter 40E-63, F.A.C. in the EAA; Lake Okeechobee Water Retention Phosphorus Removal Critical Project (Taylor Creek and Nubbin Slough STA Critical Projects; the Kissimmee River restoration project, and the C-44 Basin Reservoir). The total load reduction under all current activities (i.e., owner implemented BMPs, funded cost-share BMPs, watershed P control projects, and regional public works projects) is expected to be 146 t (**Table 3**).

Table 5. Phosphorus load reduction projects that are implemented/planned by Florida Department of Agriculture and Consumer Services under typical cost-share Best Management Practice (BMP) program.

Basin	Project Category	Project Site	Annual Phosphorus Reduction to Lake (t)	Construction Completion Date
S-154	Dairy Hurricane Upgrade	Milking R	0.63	7-31-06
S-191	Dairy Composting Project	McArthur 1 and 3	2.74	12-31-06
	Dairy Hurricane Upgrade	Larson 5	0.93	12-31-05
	Dairy Hurricane Upgrade	McArthur 1 and 3	0.40	12-31-05
	Dairy Stormwater Management System	Larson 5 and 6	1.58	6-30-07
	Dairy Stormwater Management System	Larson 7 and 8	1.84	6-30-07
	Florida Ranchlands Environmental Services Project	Williamson Cattle Company	0.09	10-01-06
S-65D and S-65E	Tailwater Recovery Project	Joe Hall	0.36	5-01-06
	Dairy Composting Project	Butler Oaks	1.91	5-01-06
	Dairy Hurricane Upgrade	Butler Oaks	0.28	2-28-06
	Dairy Stormwater Management System	B-4	3.08	6-30-07
	Dairy Stormwater Management System	Butler Oaks	4.45	6-30-07
C-41A	Citrus Variable Rate Fertilizer Technology	Lykes Brothers	0.20	12-30-05
Arbuckle Creek	Dairy Hurricane Upgrade project	Wabasso Dairy	TBD	02-30-06
Josephine Creek	Dairy CNMP Implementation	Sumerset Dairy	TBD	6-30-07
Total			**18.5**	

TBD To Be Determined

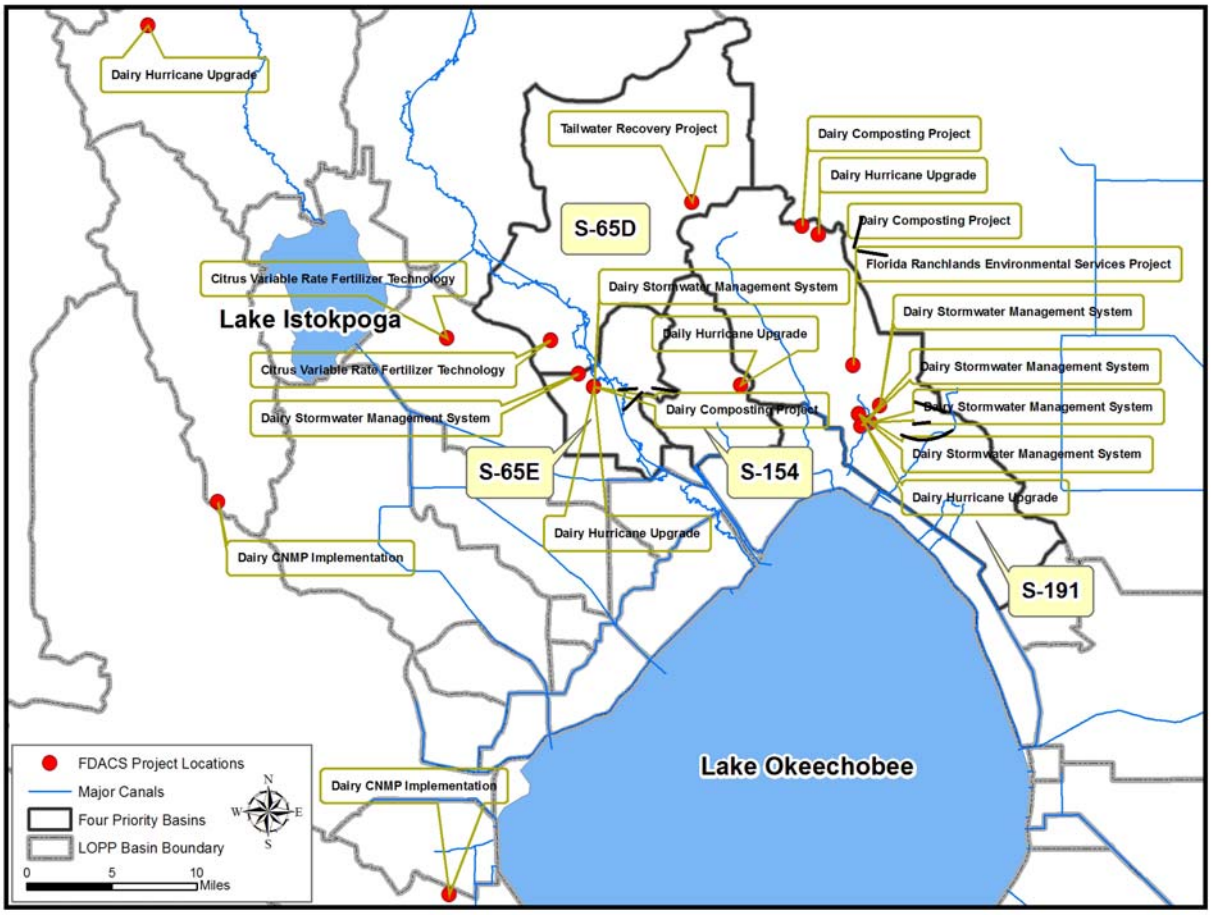


Figure 6. Florida Department of Agriculture and Consumer Services special project locations under cost-share BMP programs.

Table 6. SFWMD phosphorus load reduction projects that implemented/planned under watershed phosphorus control program.

Basin	Project Category	Project Site	Annual P Reduction to Lake (t)	Construction Completion Status
S-154	P Source Control Grant Program	Tampa Farms – Indiantown	1.11	Complete
		Milking "R" Chemical Treatment	0.00	Became part of Dairy BAT
	Dairy Best Available Technology (BAT)	Dry Lake 1	1.48	Complete
		Milking R	0.69	Complete
S-191	P Source Control Grant Program	QED -- McArthur Farms 3	6.02	Complete
		Candler Ranch	0.00	Non-Operational
		Davie-Dairy Cooling Pond	0.39	Complete
		Evans Properties – Bassett Grove	0.13	Complete
		Tampa Farms – Indiantown	2.15	Complete
		Solid Waste Authority	1.16	In Design
		Taylor Creek ATS NRF	1.81	Complete
	Dairy BAT	Davie Dairy 1 and 2	0.68	Complete
	Isolated Wetland Restoration Project	Kirton Ranch	0.81	Complete
		Nubbin Slough Area A Restoration	TBD	Ongoing
		Eckerd Youth Center	0.40	Apr-07
	Former Dairy Remediation	Mattson	0.54	Complete
		McAuthur 5	0.30	Complete
		Candler	0.03	Complete
		Larson Dairy 7	0.29	Jul-07
		Pilgrim	0.29	Jul-07
	Public-Private Partnership	Davie Dairy 1 and 2 offsite stormwater treatment	0.54	Complete
S-133	P Source Control Grant Program	OUA-Ousley	0.22	Complete
	Isolated Wetland Restoration Project	Lemkin Creek	0.12	Ongoing
S-65D and S-65E	P Source Control Grant	Tampa Farms-Indiantown	3.26	Complete
		Smith Okeechobee Farms	0.59	Complete
		Lofton Ranch	0.04	Complete
		Solid Waste Authority	1.16	In Design
	Dairy BAT	Butler Oaks	3.41	Complete
	Former Dairy Remediation	Lamb Island Dairy – East	1.85	Complete
		Lamb Island Dairy – West	0.11	Complete
	Alternative Water Supply Project *	Haynes Williams	0.32	Complete
		David Williams	0.16	Complete
C-40	Florida Ranchlands Environmental Services Project	Lykes Brothers	0.20	Complete
C-41	Florida Ranchlands Environmental Services Project *	Buck Island Ranch	0.37	Complete
Fisheating Creek	P Source Control Grant Program	Lazy S Ranch Iron Humate	0.11	Complete
Total for Watershed P Control Programs			**31**	

* Cost-share with FDACS

TBD To Be Determined

4.2 LOPP Reduction Tools

Typical Cost-Share BMPs that require future funding are the expansion and implementation of BMPs on agricultural lands primarily outside of the previously mentioned four priority basins (**Table 4**). The 31 t P load reduction attributed to typical cost-Share BMPs (**Table 4**) only considers BMPs implemented in the lower watersheds. Implementation of Typical Cost-Share BMPs in the upper watersheds were not factored into the estimated P load reduction for Lake Okeechobee because of the assimilative capacity of the Kissimmee and Istokpoga lakes, implementation of agricultural BMPs in the upper watersheds is still critical to achieve long-term P reductions to ensure that the assimilative capacity in the lakes doesn't decrease over time. Examples include internal fencing of the critical area to keep cows out of wetlands and streams, on-site retention facilities, and/or a stormwater management system.

Additional Agricultural Practices reflect the implementation of more aggressive and expensive agricultural BMPs such as edge-of-farm chemical treatment facilities and detention for intensive land uses such as citrus, dairy, ornamental, sod, and row crop.

Regional Projects Initiated include the following three components: 1) Lemkin Creek Stormwater Treatment Project, 2) LOFT Projects, and 3) Brighton Seminole Reservation Reservoir Project**.** The total load reduction anticipated for all of the LOPP Reduction Tools (i.e., typical cost-share BMPS, additional agricultural practices, and regional projects initiated) is 88 t (**Table 4**).

4.3 Proposed Regional Project

The proposed regional project includes the Lake Okeechobee Watershed Project (LOWP) of CERP (**Table 4**). This project will attenuate peak flows from the watershed, provide P load reduction to Lake Okeechobee, bring more natural water level fluctuations in the lake, and restore wetland habitat. These goals will be accomplished by constructing reservoir storage approaching 273,000 ac-ft (33,674 ha-m) in volume and constructing stormwater treatment facilities capable of removing approximately 54 t of P from the tributary flows prior to release to Lake Okeechobee.

4.4 Strategies

The LOPP P reduction tools and the proposed regional projects bring the P loading to the lake to approximately 145 t, which is 40 t above the target level of 105 t when compared with the 10-year (1991 to 2000) baseline load of 433 t (**Table 4**). Several management strategies are being considered to provide additional P reduction capability: Aquifer Storage and Recovery (ASR) wells to be installed in the Lake Okeechobee watershed with 50 mgd capacity and another 10 mgd capacity well to be activated at Taylor Creek; Public-Private Partnership project located at Indian Prairie basin; additional Regional Storage/Treatment facilities; managed aquatic plant systems; and more (**Table 4**). Chemical treatment associated with the three reservoirs proposed by CERP LOWP is also being considered. Feasibility studies relating to these strategies will be performed and the most cost-effective projects will be implemented.

4.5 Assumptions and Uncertainties

Certain assumptions made in the reevaluation effort include hydrology, lake functions, P reduction estimates (project and BMP performance and implementation rates), the amount of residual P in the soils and associated P assimilative capacity, land use changes, lag effects, and overall schedules and funding.

Rainfall affects flow in the system which in turn affects P transport. Flows can vary dramatically on an annual basis, as evidenced by the last two years of very wet conditions (Table 1) including the influence of five hurricanes. Therefore, the original base period was used for comparative purposes. This time period contains wet and dry years, and overall represents average conditions.

Several uncertainties exist in estimating project and BMP performance. Some uncertainties associated with the performance of BMPs include the impacts of different soils and hydrologic conditions, the quantity of water that can be held on a parcel without impacting an agricultural operation, residual P in the soils and the rate of implementation of the BMPs. Long-term P loading in the watershed has created residual P in the soils. The increase in residual P has reduced the P assimilative capacity of soils and wetlands in the watershed, resulting in more P discharge to the lake. The BMP performance estimates were based on best professional judgment and takes into account the uncertainties described above and information available from literature as well as actual performance data observed in the watershed.

Property values had significantly increased over the past five years, but recently have leveled off. Current land prices in the watershed continue to make it more attractive for agricultural operators to divide their landholdings into smaller parcels for development. As a result, land use in the watershed is moving toward single-family ranchettes and subdivisions. The challenge is to assure that these land use changes will not increase P loads to the lake.

Also, uncertainties exist regarding the biological functions of Lakes Istokpoga and Kissimmee. Currently, these lakes are assimilating P, but will eventually become over loaded without intervention. As a result, P reductions upstream of these lakes will not impact P loads leaving the lakes for several years. It is recognized that P reductions north of the Lakes are important to prevent additional loads to Lake Okeechobee from these lakes.

Other uncertainties are focused around implementation schedules and funding, particularly in regards to the CERP LOWP. There are concerns that the project could be delayed if federal funding is not provided in a timely fashion. If federal funding is not available, then the state will need to provide funding to cover the costs of implementing this project. Without appropriate funding, implementation schedules can be delayed. Additionally, it is recognized that P reductions may be delayed even if implemented on time due to the residual P that remains in the soil from past practices.

Throughout this planning process, uncertainties have been addressed by using best available estimates of P load reductions for the initial plan. A monitoring plan has been proposed to provide information on P reductions that will facilitate adapting the LOPP as needed. The LOPP is to be re-evaluated every 3 years to incorporate any new or updated information. Another aspect of the LOPA addresses BMP performance. If actual BMP performance does not meet initial expectations, the LOPA requires that BMPs be appropriately modified to improve their effectiveness. Should there be a significant deviation from the assumptions and performance expectations of this Plan, the plan will be modified accordingly. As noted, the TMDL itself is expected to be re-evaluated at 5-year intervals. Re-evaluation of the TMDL could result in a new TMDL to the lake, thereby changing the P load reduction target for the LOPP.

5.0 SCHEDULE AND EXPENDITURES

5.1 Schedule

The schedule for implementation of the LOPP considers not only the time required to construct the various components but also the lag effect between construction and actual load reductions. Typical agricultural BMP implementation is being conducted in a phased approach that began in 2004. Currently, BMP implementation is ongoing primarily in the four priority basins. BMP Implementation in the portion of the Lake Okeechobee watershed south of S-68 (Lake Istokpoga) and S-65 (Lake Kissimmee) including C-44 and L-8 will be completed by 2009. BMP implementation in the Lake Istokpoga and Upper Kissimmee Basins will commence in 2009. BMPs in the Lake Istokpoga watershed will be fully implemented by 2012. BMPs in the Upper Kissimmee basins will be fully implemented by 2015. The S-4 and Industrial Canal basins located in the Southern watershed have elected to implement the BMP program as described under the EAA-BMP program as part of the renewal of the master WOD permit. An estimated 20 percent P load reduction beginning in 2008 is expected. The implementation of additional agricultural BMPs will start in 2010 and will be completed by 2015 for all basins except the 10 southern basins.

Concurrent with the BMP implementation, the two regional projects (Lemkin Creek Stormwater Treatment Area and Brighton Seminole Reservation Reservoir) will be completed by 2009. The LOER ASR and fast track projects started in 2006 and will be completed by 2010. The construction of the LOWP CERP projects is planned to start in 2012 and will be completed by 2015. Fisheating Creek STAs/Reservoir, the Public-Private partnership projects, managed aquatic plant systems, and chemical treatment have yet to be scheduled but full implementation of all components is planned by 2015. In-lake restoration projects (pilot dredging, large scale replanting of SAV and bulrush, and resurvey/dredge in-lake marinas and waterways) will be completed by 2009, or as water levels allow.

5.2 Budget Requirements

The estimated capital costs for the LOPP and LOWP CERP were calculated in 2006 dollars and the annual operation and maintenance (O&M) costs were estimated for a nine-year period from 2007 to 2015 (**Table 7**). BMP cost estimates were based upon current land use acreages and literature values (Bottcher, 2006). All project costs were obtained from projected values or actual costs where available.

The costs have been updated to reflect modifications in projects and adjust for inflation. The total estimated additional cost for the LOPP from 2007 to 2015 is $1,394.0 million in 2006 dollars, or $1,558.6 million, adjusted for inflation (2% annual rate) (**Table 8**). Implementation of typical cost-share BMPs ranged from $168.6 million (2006 dollars) to $185.3 million, when adjusted for inflation (**Table 8**). Implementation of additional agricultural BMPs ranged from $229.7 million (2006 dollars) to $263.7 million, when adjusted for inflation (**Table 8**). Implementation of the LOWP was estimated to be $1,068 million in 2006 dollars after the costs for LOFT were backed out.

Total state (including SFWMD) costs are listed in **Table 9** in 2006 dollars and dollars adjusted for inflation (2% annual rate). The total state contribution for the LOPP is $1,116.9 million in 2006 dollars and $1,247.0 million adjusted for inflation.

Table 7. Ongoing and future Lake Okeechobee Protection Program activities in the Lake Okeechobee watershed and estimated additional cost from 2007 to 2015. (in 2006 dollars)

Category		Cost (Million $)	
		Capital	**O&M**
Current Activities			
	Owner Implemented BMPs	0	Landowner responsibility
	Funded Cost Share BMPs	Funded with prior year appropriations	Landowner responsibility
	Watershed P Control Projects	Funded with prior year appropriations	11.7
	Regional Public Works Project	Funded through other programs	0
Subtotal under current activities		**0**	**11.7**
LOPP Reduction Tools	Typical Cost-Share BMPs That Require Future Funding	67.4	101.1
	Additional Agricultural BMPs	143.6	86.1
	Regional Projects Initiated	216.3	15.2
	Subtotal	**427.3**	**202.4**
Research and Monitoring		**6.8**	**0**
Exotics Species Management		**9.0**	**0**
In-Lake Restoration		**32.1**	**0**
Feasibility Studies		**12**	**0**
Strategies	Aquifer Storage and Recovery (ASR)	80.6	8.5
	Public-Private Partnership	187.3	0
	Chemical Treatment within Reservoirs	1.5	13.4
	Fisheating Creek STA	382.0	0
	Managed Aquatic Plant Systems	15	4.5
	Others	TBD	TBD
	Subtotal	**666.4**	**26.4**
LOPP Total		**1,153.6**	**240.5**
CERP LOWP (backed out LOFT)		**1,068.0**	**0**
Grand Total		**2,221.6**	**240.5**

TBD To Be Determined

Table 8. LOPP and LOWP CERP Program Expenditures. (Values in Million Dollars)

Program Expenditures Required by Fiscal Year (2006 dollars)

Activity		FY ==>	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Typical BMPs that Require Funding	Lake Istokpoga Watershed	Capital	$0.0	$0.0	$2.3	$2.3	$2.3	$2.3	$2.3	$0.0	$0.0	$11.3
		O&M	$0.0	$1.1	$2.3	$2.3	$2.3	$2.3	$2.3	$2.3	$2.3	$17.0
		Sub-Total	**$0.0**	**$1.1**	**$4.5**	**$4.5**	**$4.5**	**$4.5**	**$4.5**	**$2.3**	**$2.3**	**$28.3**
	Lake Kissimmee Watershed	Capital	$0.0	$0.0	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$12.2
		O&M	$0.0	$1.2	$2.4	$2.4	$2.4	$2.4	$2.4	$2.4	$2.4	$18.3
		Sub-Total	**$0.0**	**$1.2**	**$4.2**	**$4.2**	**$4.2**	**$4.2**	**$4.2**	**$4.2**	**$4.2**	**$30.5**
	Eastern Watershed (C-44 and L-8 Basins)	Capital	$1.8	$1.8	$1.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$5.3
		O&M	$0.0	$0.5	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$7.9
		Sub-Total	**$1.8**	**$2.3**	**$2.8**	**$1.1**	**$1.1**	**$1.1**	**$1.1**	**$1.1**	**$1.1**	**$13.2**
	Northern Watershed	Capital	$12.9	$12.9	$12.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$38.6
		O&M	$0.0	$3.9	$7.7	$7.7	$7.7	$7.7	$7.7	$7.7	$7.7	$57.9
		Sub-Total	**$12.9**	**$16.7**	**$20.6**	**$7.7**	**$7.7**	**$7.7**	**$7.7**	**$7.7**	**$7.7**	**$96.6**
	Entire Watershed	Capital	$14.6	$14.6	$18.6	$4.0	$4.0	$4.0	$4.0	$1.7	$1.7	$67.4
		O&M	$0.0	$6.7	$13.5	$13.5	$13.5	$13.5	$13.5	$13.5	$13.5	$101.1
		Sub-Total	**$14.6**	**$21.4**	**$32.1**	**$17.5**	**$17.5**	**$17.5**	**$17.5**	**$15.2**	**$15.2**	**$168.6**
Additional BMPs that Require Funding	Lake Istokpoga Watershed	Capital	$0.0	$0.0	$0.0	$4.4	$4.4	$4.4	$4.4	$4.4	$4.4	$26.2
		O&M	$0.0	$0.0	$0.0	$0.0	$1.0	$2.1	$3.1	$4.2	$5.2	$15.7
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$4.4**	**$5.4**	**$6.5**	**$7.5**	**$8.6**	**$9.6**	**$42.0**
	Lake Kissimmee Watershed	Capital	$0.0	$0.0	$0.0	$3.1	$3.1	$3.1	$3.1	$3.1	$3.1	$18.6
		O&M	$0.0	$0.0	$0.0	$0.0	$0.7	$1.5	$2.2	$3.0	$3.7	$11.2
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$3.1**	**$3.8**	**$4.6**	**$5.3**	**$6.1**	**$6.8**	**$29.8**
	Eastern Watershed (C-44 and L-8 Basins)	Capital	$0.0	$0.0	$0.0	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$10.1
		O&M	$0.0	$0.0	$0.0	$0.0	$0.4	$0.8	$1.2	$1.6	$2.0	$6.1
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$1.7**	**$2.1**	**$2.5**	**$2.9**	**$3.3**	**$3.7**	**$16.2**
	Northern Watershed	Capital	$0.0	$0.0	$0.0	$14.8	$14.8	$14.8	$14.8	$14.8	$14.8	$88.6
		O&M	$0.0	$0.0	$0.0	$0.0	$3.5	$7.1	$10.6	$14.2	$17.7	$53.2
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$14.8**	**$18.3**	**$21.9**	**$25.4**	**$28.9**	**$32.5**	**$141.8**
	Entire Watershed	Capital	$0.0	$0.0	$0.0	$23.9	$23.9	$23.9	$23.9	$23.9	$23.9	$143.6
		O&M	$0.0	$0.0	$0.0	$0.0	$5.7	$11.5	$17.2	$23.0	$28.7	$86.1
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$23.9**	**$29.7**	**$35.4**	**$41.2**	**$46.9**	**$52.6**	**$229.7**
Watershed P Control Projects		Capital	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		O&M	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3	$11.7
		Sub-Total	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$1.3**	**$11.7**
Regional Projects Initiated		Capital	$22.3	$70.1	$79.8	$44.1	$0.0	$0.0	$0.0	$0.0	$0.0	$216.3
		O&M	$0.0	$0.0	$0.2	$2.5	$2.5	$2.5	$2.5	$2.5	$2.5	$15.2
		Sub-Total	**$22.3**	**$70.1**	**$80.0**	**$46.6**	**$2.5**	**$2.5**	**$2.5**	**$2.5**	**$2.5**	**$231.5**
Strategies		Capital	$2.6	$26.0	$49.0	$54.0	$54.0	$137.8	$113.8	$113.8	$115.3	$666.4
		O&M	$0.0	$0.0	$3.8	$1.5	$1.3	$2.8	$1.3	$1.3	$14.6	$26.4
		Sub-Total	**$2.6**	**$26.0**	**$52.7**	**$55.5**	**$55.2**	**$140.6**	**$115.1**	**$115.1**	**$130.0**	**$692.7**
In-Lake Restoration		Capital	$1.90	$15.20	$15.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$32.1
		O&M	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.0
		Sub-Total	**$1.9**	**$15.2**	**$15.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$32.1**
Research and Monitoring			**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$0.75**	**$6.8**
Exotics Species Management			**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$1.0**	**$9.0**
Feasibility Study			**$0.0**	**$3.0**	**$3.0**	**$3.0**	**$3.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$12.0**
LOPP Total		Capital	$43.1	$130.7	$167.2	$130.7	$86.7	$167.5	$143.5	$141.3	$142.8	$1,153.5
		O&M	$1.3	$8.0	$18.7	$18.8	$24.3	$31.5	$35.8	$41.5	$60.6	$240.6
		Total	**$44.4**	**$138.8**	**$185.9**	**$149.5**	**$111.0**	**$199.0**	**$179.3**	**$182.8**	**$203.4**	**$1,394.0**
LOWP CERP		Capital	$0.0	$44.0	$54.6	$54.6	$54.6	$256.0	$201.4	$201.4	$201.4	$1,068.0
		O&M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Total	**$0.0**	**$44.0**	**$54.6**	**$54.6**	**$54.6**	**$256.0**	**$201.4**	**$201.4**	**$201.4**	**$1,068.0**
Grand Total			**$44.4**	**$182.8**	**$240.6**	**$204.1**	**$165.6**	**$455.0**	**$380.6**	**$384.1**	**$404.7**	**$2,462.0**

Table 8. LOPP and LOWP CERP Program Expenditures (continued). (Values in Million Dollars)

Program Expenditures Required by Fiscal Year – Adjusted for Inflation (2% annually)

Activity		FY ==>	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Typical BMPs that Require Funding	Lake Istokpoga Watershed	Capital	$0.0	$0.0	$2.4	$2.5	$2.5	$2.6	$2.6	$0.0	$0.0	$12.5
		O&M	$0.0	$1.2	$2.4	$2.5	$2.5	$2.6	$2.6	$2.7	$2.7	$19.1
		Sub-Total	**$0.0**	**$1.2**	**$4.8**	**$4.9**	**$5.0**	**$5.1**	**$5.2**	**$2.7**	**$2.7**	**$31.6**
	Lake Kissimmee Watershed	Capital	$0.0	$0.0	$1.8	$1.9	$1.9	$2.0	$2.0	$2.0	$2.1	$13.7
		O&M	$0.0	$1.3	$2.6	$2.6	$2.7	$2.7	$2.8	$2.9	$2.9	$20.5
		Sub-Total	**$0.0**	**$1.3**	**$4.4**	**$4.5**	**$4.6**	**$4.7**	**$4.8**	**$4.9**	**$5.0**	**$34.2**
	Eastern Watershed (C-44 and L-8 Basins)	Capital	$1.8	$1.8	$1.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$5.5
		O&M	$0.0	$0.6	$1.1	$1.1	$1.2	$1.2	$1.2	$1.2	$1.3	$8.9
		Sub-Total	**$1.8**	**$2.4**	**$3.0**	**$1.1**	**$1.2**	**$1.2**	**$1.2**	**$1.2**	**$1.3**	**$14.4**
	Northern Watershed	Capital	$13.1	$13.4	$13.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$40.2
		O&M	$0.0	$4.0	$8.2	$8.4	$8.5	$8.7	$8.9	$9.1	$9.2	$65.0
		Sub-Total	**$13.1**	**$17.4**	**$21.9**	**$8.4**	**$8.5**	**$8.7**	**$8.9**	**$9.1**	**$9.2**	**$105.1**
	Entire Watershed	Capital	$14.9	$15.2	$19.8	$4.3	$4.4	$4.5	$4.6	$2.0	$2.1	$71.9
		O&M	$0.0	$7.0	$14.3	$14.6	$14.9	$15.2	$15.5	$15.8	$16.1	$113.4
		Sub-Total	**$14.9**	**$22.2**	**$34.1**	**$18.9**	**$19.3**	**$19.7**	**$20.1**	**$17.8**	**$18.2**	**$185.3**
Additional BMPs that Require Funding	Lake Istokpoga Watershed	Capital	$0.0	$0.0	$0.0	$4.7	$4.8	$4.9	$5.0	$5.1	$5.2	$29.9
		O&M	$0.0	$0.0	$0.0	$0.0	$1.2	$2.4	$3.6	$4.9	$6.3	$18.3
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$4.7**	**$6.0**	**$7.3**	**$8.6**	**$10.0**	**$11.5**	**$48.2**
	Lake Kissimmee Watershed	Capital	$0.0	$0.0	$0.0	$3.4	$3.4	$3.5	$3.6	$3.6	$3.7	$21.2
		O&M	$0.0	$0.0	$0.0	$0.0	$0.8	$1.7	$2.6	$3.5	$4.5	$13.0
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$3.4**	**$4.2**	**$5.2**	**$6.1**	**$7.1**	**$8.2**	**$34.2**
	Eastern Watershed (C-44 and L-8 Basins)	Capital	$0.0	$0.0	$0.0	$1.8	$1.9	$1.9	$1.9	$2.0	$2.0	$11.5
		O&M	$0.0	$0.0	$0.0	$0.0	$0.4	$0.9	$1.4	$1.9	$2.4	$7.1
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$1.8**	**$2.3**	**$2.8**	**$3.3**	**$3.9**	**$4.4**	**$18.6**
	Northern Watershed	Capital	$0.0	$0.0	$0.0	$16.0	$16.3	$16.6	$17.0	$17.3	$17.6	$100.8
		O&M	$0.0	$0.0	$0.0	$0.0	$3.9	$8.0	$12.2	$16.6	$21.2	$61.9
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$16.0**	**$20.2**	**$24.6**	**$29.2**	**$33.9**	**$38.8**	**$162.7**
	Entire Watershed	Capital	$0.0	$0.0	$0.0	$25.9	$26.4	$26.9	$27.5	$28.0	$28.6	$163.4
		O&M	$0.0	$0.0	$0.0	$0.0	$6.3	$12.9	$19.8	$26.9	$34.3	$100.3
		Sub-Total	**$0.0**	**$0.0**	**$0.0**	**$25.9**	**$32.8**	**$39.9**	**$47.3**	**$55.0**	**$62.9**	**$263.7**
Watershed P Control Projects		Capital	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		O&M	$1.3	$1.4	$1.4	$1.4	$1.4	$1.5	$1.5	$1.5	$1.6	$12.9
		Sub-Total	**$1.3**	**$1.4**	**$1.4**	**$1.4**	**$1.4**	**$1.5**	**$1.5**	**$1.5**	**$1.6**	**$12.9**
Regional Project Initiated		Capital	$22.7	$73.0	$84.7	$47.7	$0.0	$0.0	$0.0	$0.0	$0.0	$228.1
		O&M	$0.0	$0.0	$0.2	$2.7	$2.8	$2.8	$2.9	$2.9	$3.0	$17.3
		Sub-Total	**$22.7**	**$73.0**	**$84.9**	**$50.4**	**$2.8**	**$2.8**	**$2.9**	**$2.9**	**$3.0**	**$245.4**
Strategies		Capital	$2.6	$27.1	$52.0	$58.4	$59.6	$155.2	$130.8	$133.4	$137.8	$756.9
		O&M	$0.0	$0.0	$4.0	$1.6	$1.4	$3.1	$1.4	$1.5	$17.5	$30.5
		Sub-Total	**$2.6**	**$27.1**	**$56.0**	**$60.1**	**$61.0**	**$158.3**	**$132.2**	**$134.8**	**$155.3**	**$787.3**
In-Lake Restoration		Capital	$1.9	$15.8	$15.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$33.7
		O&M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Sub-Total	**$1.9**	**$15.8**	**$15.9**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$33.7**
Research and Monitoring			**$0.8**	**$0.8**	**$0.8**	**$0.8**	**$0.8**	**$0.8**	**$0.9**	**$0.9**	**$0.9**	**$7.5**
Exotics Species Management			**$1.0**	**$1.0**	**$1.1**	**$1.1**	**$1.1**	**$1.1**	**$1.1**	**$1.2**	**$1.2**	**$9.9**
Feasibility Study			**$0.0**	**$3.1**	**$3.2**	**$3.2**	**$3.3**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$12.9**
LOPP Total		Capital	$44.0	$136.0	$177.4	$141.5	$95.7	$188.6	$164.9	$165.5	$170.6	$1,284.2
		O&M	$1.3	$8.4	$19.9	$20.3	$26.8	$35.5	$41.1	$48.6	$72.5	$274.4
		Total	**$45.3**	**$144.4**	**$197.3**	**$161.8**	**$122.5**	**$224.1**	**$205.9**	**$214.1**	**$243.1**	**$1,558.6**
LOWP CERP		Capital	$0.0	$45.8	$58.0	$59.1	$60.3	$288.3	$231.3	$235.9	$240.6	$1,219.4
		O&M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		Total	**$0.0**	**$45.8**	**$58.0**	**$59.1**	**$60.3**	**$288.3**	**$231.3**	**$235.9**	**$240.6**	**$1,219.4**
Grand Total			**$45.3**	**$190.2**	**$255.3**	**$221.0**	**$182.8**	**$512.4**	**$437.2**	**$450.1**	**$483.7**	**$2,778.0**

Table 9. LOPP and LOWP CERP State Expenditures.
(Values in Million Dollars)

Total LOPP State Funding Required by Fiscal Year (2006 dollars)

Activity	FY ==>	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Typical BMPs that Require Funding*	Lake Istokpoga Watershed	$0.0	$0.0	$1.1	$1.1	$1.1	$1.1	$1.1	$0.0	$0.0	$5.7
	Lake Kissimmee Watershed	$0.0	$0.0	$0.9	$0.9	$0.9	$0.9	$0.9	$0.9	$0.9	$6.1
	Eastern Watershed (C-44 and L-8)	$0.9	$0.9	$0.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.6
	Northern Watershed	$6.4	$6.4	$6.4	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$19.3
	Entire Watershed (Subtotal)	$7.3	$7.3	$9.3	$2.0	$2.0	$2.0	$2.0	$0.9	$0.9	$33.7
Additional BMPs that Require Funding**	Lake Istokpoga Watershed	$0.0	$0.0	$0.0	$2.2	$2.7	$3.2	$3.8	$4.3	$4.8	$21.0
	Lake Kissimmee Watershed	$0.0	$0.0	$0.0	$1.6	$1.9	$2.3	$2.7	$3.0	$3.4	$14.9
	Eastern Watershed (C-44 and L-8)	$0.0	$0.0	$0.0	$0.8	$1.0	$1.2	$1.5	$1.7	$1.9	$8.1
	Northern Watershed	$0.0	$0.0	$0.0	$7.4	$9.2	$10.9	$12.7	$14.5	$16.2	$70.9
	Entire Watershed (Subtotal)	$0.0	$0.0	$0.0	$12.0	$14.8	$17.7	$20.6	$23.5	$26.3	$114.9
Regional Projects Initiated***		$22.3	$70.1	$80.0	$46.6	$2.5	$2.5	$2.5	$2.5	$2.5	$231.5
In-Lake Restoration***		$1.9	$15.2	$15.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$32.1
Feasibility Study***		$0.0	$3.0	$3.0	$3.0	$3.0	$0.0	$0.0	$0.0	$0.0	$12.0
Strategies***		$2.6	$26.0	$52.7	$55.5	$55.2	$140.6	$115.1	$115.1	$130.0	$692.7
LOPP Total		**$34.0**	**$121.7**	**$160.1**	**$119.0**	**$77.6**	**$162.8**	**$140.2**	**$141.9**	**$159.7**	**$1,116.9**
LOWP CERP****		**$0.0**	**$22.0**	**$27.3**	**$27.3**	**$27.3**	**$128.0**	**$100.7**	**$100.7**	**$100.7**	**$534.0**
Grand Total		**$34.0**	**$143.7**	**$187.4**	**$146.3**	**$104.9**	**$290.8**	**$240.8**	**$242.6**	**$260.3**	**$1,650.9**

* 12.5% to 87.5% state cost share for capital and 0% for O&M costs. The average value of 50% was used in the computation.
** 12.5% to 87.5% state cost share for capital and 50% for O&M costs. The average value of 50% was used in the computation.
*** 100% state cost share for capital and O&M costs
**** 50% state cost share for capital and 100% O&M costs

Table 9. LOPP State Expenditures (continued).
(Values in Million Dollars)

Total LOPP State Funding Required by Fiscal Year - Adjusted for Inflation (2% annually)

Activity	FY ==>	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Typical BMPs that Require Funding*	Lake Istokpoga Watershed	$0.0	$0.0	$1.2	$1.2	$1.3	$1.3	$1.3	$0.0	$0.0	$6.3
	Lake Kissimmee Watershed	$0.0	$0.0	$0.9	$0.9	$1.0	$1.0	$1.0	$1.0	$1.0	$6.9
	Eastern Watershed (C-44 and L-8)	$0.9	$0.9	$0.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.8
	Northern Watershed	$6.6	$6.7	$6.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$20.1
	Entire Watershed (Subtotal)	$7.5	$7.6	$9.9	$2.2	$2.2	$2.3	$2.3	$1.0	$1.0	$36.0
Additional BMPs that Require Funding**	Lake Istokpoga Watershed	$0.0	$0.0	$0.0	$2.4	$3.0	$3.6	$4.3	$5.0	$5.7	$24.1
	Lake Kissimmee Watershed	$0.0	$0.0	$0.0	$1.7	$2.1	$2.6	$3.1	$3.6	$4.1	$17.1
	Eastern Watershed (C-44 and L-8)	$0.0	$0.0	$0.0	$0.9	$1.2	$1.4	$1.7	$1.9	$2.2	$9.3
	Northern Watershed	$0.0	$0.0	$0.0	$8.0	$10.1	$12.3	$14.6	$17.0	$19.4	$81.4
	Entire Watershed (Subtotal)	$0.0	$0.0	$0.0	$13.0	$16.4	$19.9	$23.6	$27.5	$31.5	$131.8
Regional Projects Initiated***		$22.7	$73.0	$84.9	$50.4	$2.8	$2.8	$2.9	$2.9	$3.0	$245.4
In-Lake Restoration***		$1.9	$15.8	$15.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$33.7
Feasibility Study***		$0.0	$3.1	$3.2	$3.2	$3.3	$0.0	$0.0	$0.0	$0.0	$12.9
Strategies***		$2.6	$27.1	$56.0	$60.1	$61.0	$158.3	$132.2	$134.8	$155.3	$787.3
LOPP Total		**$34.7**	**$126.6**	**$169.9**	**$128.8**	**$85.7**	**$183.3**	**$161.0**	**$166.3**	**$190.8**	**$1,247.0**
LOWP CERP****		**$0.0**	**$22.9**	**$29.0**	**$29.6**	**$30.2**	**$144.1**	**$115.6**	**$118.0**	**$120.3**	**$609.7**
Grand Total		**$34.7**	**$149.5**	**$198.9**	**$158.4**	**$115.8**	**$327.5**	**$276.7**	**$284.2**	**$311.1**	**$1,856.7**

* 12.5% to 87.5% state cost share for capital and 0% for O&M costs. The average value of 50% was used in the computation.
** 12.5% to 87.5% state cost share for capital and 50% for O&M costs. The average value of 50% was used in the computation.
*** 100% state cost share for capital and O&M costs
**** 50% state cost share for capital and 100% O&M costs

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APPENDIX A

Calculation of Estimated Phosphorus Load Reductions

This Appendix provides an explanation of the methods used to calculate the estimated phosphorus (P) load reductions as shown in Tables 3 and 4. Table A-1 is a summation of estimated P load reductions to Lake Okeechobee under the Lake Okeechobee Protection Plan at the summary basin level. Thirty-four summary basins (61 drainage basins) define the Lake Okeechobee watershed and are considered the LOPP Project Area (Figure 2). The land uses (LU) within each basin were broken up into 13 categories: citrus, dairies, improved pasture, natural areas, ornamentals, other areas, row crops, sod farms, sugarcane, tree plantations, unimproved, woodland pasture/rangeland, and urban (commercial, residential, recreational). The following calculations were performed for each basin:

BASELINE data

Summary Basin: A summary basin contains one or more drainages basins in the LOPP area. For example, the Lake Istokpoga summary basin contains four drainage basins (see Figure 2).

Watershed Area (acres): Area in acres for which the LOPP will implement management strategies for P reduction. Land use acreage for each basin was obtained from GIS LU coverage data updated in 2006.

Average Annual Discharge (1991-2000) (acre-ft): Measured flow discharge from each basin from 1991 to 2000.

Average Annual P Load (1991-2000) (t): Total average P load for each basin in metric tons (t) calculated using measured flow and water quality data for the 10-year period of record from 1991 through 2000.

Average Annual P Concentration (1991-2000) (ppb): Total average P concentration in parts per billion (ppb) for each basin calculated using measured flow and P load for the 10-year period of record from 1991 through 2000.

CURRENT Activities

Owner Implemented BMPs (1): Operational BMPs that can be implemented by landowners without cost-share. The BMP descriptions and associated P load reductions for agricultural land uses, which vary depending on the type of LU, are described in Bottcher (2006). Each typical suite of BMPs per LU has an assigned P reduction factor. These reduction factors were applied to all basins except 715 Farms, East Beach and East Shore DD, S-2, S-3, S-5A, South Florida Conservancy District,

and South Shore/South Bay DD. Landowners in the S-4 and Industrial Canal basins have elected to implement BMPs as described under one of the following programs: 1) the EAA-WOD BMP program as part of the renewal of the LO-WOD Management Plan Master Permit, 2) the LO-WOD BMP program as part of an individual permit, or 3) the FDACS voluntary BMP program. Overall, an estimated 20% load reduction is expected from implementing these BMP programs in the S-4 and Industrial Canal basins. Completion of the 298 District diversion projects associated with the Everglades Construction Project (ECP) will bring the 715 Farms, East Beach and East Shore DD, South Florida Conservancy District, and South Shore/South Bay DD under the jurisdiction of Chapter 40E-63. The urban owner implemented BMPs include the reduction of P fertilizer and implementation of lawn BMPs associated with fertilizer application, which has an overall reduction of 2.5%. This is based on a 5% reduction on 50% of the urban acreage (Bottcher, 2006). The reduction is only applied to 50% of the acreage because approximately 50% of the area is impervious and doesn't receive fertilization.

- **Load Red. (t)**: The load reduction associated with **Owner Implemented BMPs** was calculated by multiplying the **Average Annual P Load (1991-2000)** column value times the appropriate P reduction factor for each land use as shown in Table A-2.

- **Remain. Load (t)**: The remaining load is the difference between **Average Annual P Load (1991-2000)** and **Load Red.** The total remaining basin load is provided at the top of each summary basin. For the Lake Istokpoga and Lake Kissimmee summary basins, the **Remain. Load** is the **Average Load (1991-2000)**. The **Load Red.** from the implementation of **Owner Implemented BMPs** was not subtracted out because the lakes act as buffers and assimilate P. Therefore, any immediate reductions occurring north of the lake will not be seen within the lakes or south of the lakes for several years. However, it is still beneficial to implement BMPs north of the lake to improve the water quality entering Lake Kissimmee and Lake Istokpoga and to prevent future increases in P loads to the downstream waterbodies.

Funded Cost-Share BMPs (2): This column summarizes the P reductions associated with BMPs (primarily cow-calf) implemented under the existing funded cost-share programs offered by FDACS and NRCS. These projects are mainly located in the four priority basins: S-154, S-191, S-65D and S-65E and are being implemented on a fraction of the total basin acreages. (Note that basins S-65D and S-65E are grouped into Basin S-65 A,B,C,D,E.) The P load reductions from the special projects that are implemented by FDACS under typical cost-share BMP programs are also included (Table 5). The BMP descriptions and associated P Load Reductions, which vary depending on the type of LU, are described in Bottcher (2006).

- **Load Red. (t)**: The load reduction was calculated for each LU as follows: [**Remain. Load (t)** from previous category (**Owner Implemented BMPs (1)**)] x [P reduction factor for each land use, Table A-2] x [project acreage] / [total

LU acreage]. The total basin reduction is provided at the top of each summary basin.

- **Remain. Load (t)**: The remaining load is the difference between the total **Remain. Load** from **Funded Cost-Share BMPs (2)** and the calculated **Load Red.**

Watershed P Control Projects (3): The category includes ongoing watershed programs and projects, including P Source Control Grant Program, Dairy Best Available Technologies, Isolated Wetlands Restoration, and Public-Private Partnership program. Table 6 provides a list of all the current projects.

- **Load Red. (t)**: The load reduction was calculated as follows: **Remain. Load (t)** from **Funded Cost-Share BMPs (2)** less the P reduction for each basin

- **Remain. Load (t)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.** The total remaining basin load is provided at the top of each summary basin.

Regional Public Works Projects (4): This category includes P reductions expected from the ongoing or existing EAA, C-43, and C-44 CERP projects; Lake Okeechobee Water Retention P Removal Critical Project; ECP 298 Diversion Projects, and the Kissimmee River Restoration (KRR). The P reductions factors for CERP projects, Kissimmee River Restoration, and the Critical Project are summarized in Table A-3. Reduction factors for the ECP 298 Diversions are included in Table A-4. The basins affected by these projects include 715 Farms, East Beach and East Shore DD, Industrial Canal, S-2, S-3, S-4, South Florida Conservancy District, and So. Shore/So Bay DD, C-44 (S-308C), C-43 (East Caloosahatchee), S-191, and S-65 A,B,C,D,E. For these basins, the **Load Red.** is applied to the entire summary basin and not broken out by land use.

- **Load Red. (t)**: The load reduction was calculated as follows: **Remain. Load** from **Watershed P Control Projects (3)** times the P reduction for each basin according to information in the above tables**.** The S-4 basin actually contributes additional load to Lake Okeechobee after the implementation of these projects.
- **Remain. Load (t)**: The remaining load is the difference between the **Remain. Load** from the previous category **(Watershed P Control Projects (3))** and the calculated **Load Red.** for this category.

LOPP Reduction tools

A P concentration associated with the remaining load for activities within Future Tools was calculated for each basin using individual basin flows. If the concentration was less than 40 ppb, the load was adjusted to the equivalent 40 ppb load to produce the

adjusted remaining load. Once a basin reached the equivalent 40 ppb P load, no additional reductions were considered feasible.

Typical Cost-Share BMPs that Require Future Funding (5) – This category represents the implementation of typical cost-share BMPs by landowners that will require cost-share funding. The BMP descriptions and associated P Load Reductions, which vary depending on the type of LU, are described in Bottcher (2006). The acreage from BMPs included under **Funded Cost-Share BMPs (2)** for the four priority basins (S-154, S-191, S-65D and S-65E) was subtracted from the total basin acreage to come up with an adjusted remaining acreage needing BMPs. Reductions in this category will not be calculated for the ten EAA basins (715 Farms, East Beach and East Shore DD, Industrial Canal, S-2, S-3, S-4, S-5A, South Florida Conservancy District, and South Shore/South Bay DD) because these basins must meet the BMP requirements of Chapter's 40E-61 and 40E-63, FAC.

- **Load Red. (t)**: The load reduction was calculated as follows: **Remain. Load (t)** from **Regional Public Works Projects** times the P reduction factor for each land use. The reduction factors for this BMP group are summarized in Table A-2. The project acreage adjustments for S-154, S-191, S-65D and S-65E were made to avoid double counting. The total summary basin reduction is provided at the top of each summary basin.

- **Adjusted Remain. Load (t)**: The remaining load is the difference between the **Remain. Load** from the previous category (**Regional Public Works Projects (4))** and the calculated load reduction. The total remaining basin load is provided at the top of each summary basin. The **Load Red.** from the Lake Kissimmee and Lake Istokpoga basins under **Typical Cost-Share BMPs that Require Future Funding** was not subtracted out because the lakes act as buffers and assimilate P. Therefore, any immediate reductions occurring north of the lake will not be seen within the lakes or south of the lakes for several years. However, it is still beneficial to implement BMPs north of the lake to improve the water quality entering Lake Kissimmee and Lake Istokpoga and to prevent future increases in P loads to the downstream waterbodies. Where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the basin flow by 40 ppb.

Additional Agricultural Practices (6) – This category describes additional advanced BMPs, as defined by FDACS, implemented by landowners that will require extensive cost-share. These are more aggressive BMPs designed to achieve nutrient balance or low P concentrations that require relatively high levels of funding for capital and O&M. Reductions in this category will not be calculated for the ten EAA basins (715 Farms, East Beach and East Shore DD, Industrial Canal, S-2, S-3, S-4, S-5A, South Florida Conservancy District, and South Shore/South Bay DD) because they must meet the BMP requirements of Chapter's 40E-61 and 40E-63, FAC.

- **Load Red. (t)**: The load reduction was calculated as follows: **Remain. Load** from **Typical Cost-Share BMPs that Require Future Funding** times the load reduction in Table A-2.
- **Adjusted Remain. Load (t)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.** The total remaining basin load is provided at the top of each summary basin. Where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the basin flow by 40 ppb.

Regional Projects Initiated (7) - This column represents reductions from on-going and future large-scale regional projects. These projects are needed as part of the solution, and funding is required for implementation. This category includes the Lemkin Creek stormwater treatment project; Lake Okeechobee and Estuary Recovery (LOER) Fast Track Projects; and the Brighton Seminole Reservation reservoir project. The estimated TP load reduction under each project is listed in Table A-5.

- **Load Red. (t)**: The load reduction was calculated as follows: **Remain. Load (t)** from **Additional Agricultural BMPs (6)** minus the P reduction for the project in Table A-5.

- **Adjusted Remain. Load (t)**: The remaining load is the difference between the **Remain. Load** from the previous category **Additional Agricultural BMPs (6)** and the calculated **Load Red.**, where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the basin flow by 40 ppb.

Table A-1: Summary of Estimated P Load Reductions to Lake Okeechobee under the Lake Okeechobee Protection Plan

Baseline Data					Current Activities*								LOPP Reduction Tools*					
Summary Basin	Watershed Area (Acres)	Average Annual Discharge (1991-2000) (Acre-ft)	Average Annual P Load (1991-2000) (t)	Average Annual P Conc. (1991-2000) (ppb)	Owner Implemented BMPs (1)		Funded Cost-Share BMPs (2)		Watershed P Control Projects (3)		Regional Public Works Projects (4)		Typ. Cost-Share BMPs that Require Future Funding (5)		Additional Agricultural BMPs (6)		Regional Projects Initiated (7)	
					Load Red. (t)	Remain. Load (t)	Load Red. (t)	Remain. Load (t)	Load Red. (t)	Remain. Load (t)	Load Red. (t)	Remain. Load (t)	Load Red. (t)	Adjusted Remain. Load (t)	Load Red. (t)	Adjusted Remain. Load (t)	Load Red. (t)	Adjusted Remain. Load (t)
Example Basin **	94,654	49,799	25.45	414.48	4.12	21.33	0.10	21.24	0.37	20.87	0	20.87	4.33	16.54	4.51	12.03	1.5	10.53
Total	**3,451,086**	**2,246,336**	**433.09**	**156.36**	**34.80**	**398.29**	**29.87**	**368.42**	**30.58**	**337.84**	**49.54**	**288.30**	**30.56**	**257.74**	**30.41**	**227.33**	**26.74**	**200.59**

* To be conservative, where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the basin flow by 40 ppb instead of a lower projected concentration.

** Reductions were applied to individual land uses within the Lake Kissimmee and Lake Istokpoga watershed basins. However, these reductions will have little or no short-term improvements on what is leaving the basins due to the lakes' internal buffering capacities. Therefore, these load reductions were not carried through the remaining spreadsheet. Also, the loads into the Lake Okeechobee from the East Caloosahatchee basin are very small due to the manner in which this basin operates. Therefore, reductions associated with ongoing projects in the Caloosahatchee will benefit primarily the basin itself and no load reduction to the lake is has been shown.

(1) Reduction resulting from Owner BMPs - applied to all basins except eight EAA basins.

(2) Reduction resulting from cost-share BMPs implemented with federal and state subsidies.

(3) Reduction due to ongoing watershed projects: Phosphorus Source Control Grant Program, Dairy Best Available Technologies, Isolated Wetlands, etc.

(4) Reduction resulting from implementation of EAA, C-43, C-44 ongoing CERP Projects, LO Critical Projects, Kissimmee River Restoration (KRR) (including basin BMPs with a total of 25% reduction of base load at S-65E, and the ECP/Diversions (BMPs for 8 of the 10 EAA basins have been realized in 2005).

(5) Typical BMPs implemented by land owners with government cost-share.

(6) Chemical treatment with retention/detention for Citrus, Dairy, Row crop, Ornamentals, and Sod.

(7) Reductions from Lemkin Creek STA, Brighton Reserve Reservoir, and the two LOER fast track projects (Taylor Creek reservoir and Lakeside ranch STA).

Table A-2: Land Use Categories, Unit Load Rates, and P Reduction Factors

				Estimated P Reduction (%)		
Landuse Category	FLUCCS	FLUCCS Description	Unit Load (lbs/ac)	Owner BMPs	Typical Cost Share BMPs	Additional Practices
Urban	1009	Mobile Home Units	0.66	5%	0%	0%
	1100	Residential Low Density				
	1200	Residential Medium Density				
	1300	Residential High Density				
	1400	Commercial and Services				
	1500	Industrial				
	1600	Extractive				
	1700	Institutional				
	1800	Recreational				
Improved Pastures	2110	Improved Pastures	0.72	11%	19%	49%
Unimproved Pastures	2120	Unimproved	0.49	7%	13%	44%
Woodland Pastures/ Rangeland	2130/3000	Woodland Pastures/Rangeland	0.27	4%	6%	35%
Row Crops	2140	Row Crops	6.30	30%	30%	50%
Sugarcane	2156	Field Crops – Sugarcane	0.63	10%	23%	52%
Citrus	2210	Citrus	1.62	12%	20%	42%
Sod	2420	Sod Farms	2.52	20%	27%	50%
Ornamentals	2430	Ornamentals	4.10	32%	35%	50%
Dairies	2520	Dairies	3.38	9%	28%	48%
Tree Plantations	4400	Tree Plantations/Pine	0.18	1%	10%	50%
Natural Areas	4000	Upland Forests (not including 4400's)	0.2	0%	0%	0%
	5000	Water				
	6000	Wetlands				
	7000	Barren Land				
	1900	Open Land				
	8000	Transportation, Communication, and Utilities				
	9000	Special Classifications				
Other Areas	2150	Field Crops	0.7	10%	0%	0%
	2220	Fruit Orchards				
	2230	Other Groves				
	2320	Poultry Feeding Operations				
	2410	Tree Nurseries				
	2450	Floriculture				
	2510	Horse Farms				
	2540	Aquaculture				
	2610	Fallow Crop Land				

Table A-3: Estimated P Load Reductions from Regional Public Works Project

Project Name	Basin	P Load Reduction to the Lake (t)
EAA	715 Farms	0.19
	East Shore DD	0.36
	Industrial Canal	0.15
	S-2	7.48
	S-3	2.60
	South Florida Conservancy DD	0.24
	South Shore/So. Bay DD	0.11
	S-4	0
	East Caloosahatchee (s-77)	0
C-44	C-44	4
Critical Projects	S-191	5.47
ECP & Diversion Projects	10 EAA Basins	9.44
Kissimmee River Restoration*	Upper Kissimmee Basins	19.51
Total		49.54

* **Kissimmee River Restoration (KRR) -** It is estimated that the KRR will result in a TP reduction of 25% at structure S-65E. This percent reduction was applied to the S-65A-E and S-65 basins.

Table A-4: Estimated TP Load Reductions from ECP and Diversion Projects

Basin	Average Load	ECP Project - 298 & 715 Farm Diversions	Diversion Project - Flows returned to Lake through S2 or S3 Pump stations	**Total Load Red. ECP Project & Diversions**
	1991-2000	Load Red.	Load Increase	
	(t)	(t)	(t)	**(t)**
715 Farms (Culv 12A)	1.67	0.94	0.19	**0.75**
East Beach DD (Culv 10)	8.73	5.01	0.00	**5.01**
East Shore DD (Culv 12)	3.10	1.81	0.36	**1.45**
Industrial Canal	2.99	0.97	0.15	**0.82**
S-2	8.16	0.00	0.00	**0.00**
S-3	2.33	0.00	0.00	**0.00**
S-4	6.87	0.00	0.00	**0.00**
South FL Conservancy DD (S-236)	1.42	1.07	0.24	**0.83**
South Shore/So. Bay DD (Culv 4A)	1.07	0.69	0.11	**0.58**
S5A Basin (S-352-WPB Canal)	0.00	0.00	0.00	**0.00**
Total	36.34	10.49	1.05	**9.44**

Table A-5: Estimated TP Load Reduction from Regional Projects Initiated

Project Name	Basin	Basin P Load Reduction (t)	P Load Reduction to the Lake* (t)
Lemkin Creek Stormwater Treatment	S-133	1.12	1.12
LOFT	S-191, S-154, and S-135	26.30	24.12
Brighton Seminole Reservation Reservoir	C-41	1.50	1.50
Total		28.90	26.74

* A phosphorus concentration associated with the remaining load for activities within P Reduction Tools was calculated for each basin using individual basin flows. If the concentration was less than 40 ppb, the load was adjusted to the equivalent 40 ppb load to produce the adjusted remaining load. Once a basin reached the equivalent 40 ppb P load, no additional reductions were considered feasible.

Appendix B
Public Comments and Responses
To Draft Report Dated December 12, 2006

Agency/ Public Entity	Comment	Response
Paul N. Gray, Science Coordinator, Lake Okeechobee Watershed Program, Audubon of Florida	(1) Water quality baseline must be updated The LOPA instructed the agencies to, "…develop a water quality baseline to represent existing conditions for total phosphorus…" The 2004 LOPP used the years 1991-2000 as the baseline, but now there are an additional five years of data that should be added to the baseline. Instead, the Evaluation labeled the last five years as "anomalous," because of prevailing wet conditions, and omitted them from the baseline. Audubon strongly objects to this omission.	A baseline period of 1991 to 2000 used to develop the initial Lake Okeechobee Protection Plan. However, the final plan must meet TMDL of 105 metric tons of phosphorus to the Lake, regardless of the baseline. In recognition of high load events of last five years, additional phosphorus reduction strategies have been added to the Plan.
	(2) Evaluating success to date As part of the original LOPP efforts in 2004, the agencies made calculations of expected phosphorus load reductions to Lake Okeechobee for each year between 2004 and 2015, based upon expected project completion dates and subsequent effectiveness. This 3-year Evaluation should have taken those projections and compared them to actual phosphorus loads to date (with data normalized for inflow amounts), to evaluate whether the projections were accurate. Such a comparison is critical to help determine if "further phosphorus load reductions" may be necessary for compliance. This single exercise, omitted thus far, is one of the most informative exercises that can be done of the LOPP at this time, and must be done as part of the final Evaluation.	We concur and additional analyses have been included in the evaluation report. The 2004 Plan projected an anticipated load reduction of 78 metric tons by 2006. While information indicates that improvements in water quality are occurring at the edge of farm or basin, these were masked by the hurricane events of 2004 and 2005, as well as the presence of residual or legacy phosphorus in the watershed. For example, for the last 5 years as compared to the baseline, flows for the 4 priority basins plus the lower Kissimmee River basins increased by 65%, while loads increased by 13%.

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Agency/ Public Entity	Comment	Response
	(3) Need to include more evaluation of the performance of Best Management Practices Best Management Practices (BMPs) are a critical part of meeting the Lake's TMDL. The LOPA directed that, "The district or department shall conduct monitoring at representative sites to verify the effectiveness of agricultural nonpoint source best management practices." This verification exercise was not mentioned in the draft Evaluation and should be added to the final Evaluation. This is particularly important because prediction on the effectiveness of BMPs is based heavily on best professional judgment (BPJ), not actual measurements, and subject to very large uncertainties. We recognize that the BPJ assumptions were re-visited (i.e., Bottcher 2006), but remain uncomfortable that they remain unverified assumptions.	In cooperation with UF/IFAS, FDACS is conducting BMP demonstration and evaluation projects at representative sites for all agricultural land uses in the watershed, including dairies, beef cattle, citrus, and vegetable production. This effort incorporates regional and sub-regional water quality monitoring in collaboration with the SFWMD and the United States Geological Survey (USGS). BMP performance estimates have been updated and will be verified using the above information.
	There also are calculations in the updated BMP predictions that raise concern about inaccuracies in the expected reductions. For example, row crop BMPs, with all practices in place, are predicted in Table A-2 to remove more phosphorus than is even present (110% reduction), which not only is impossible, but certainly not a reality considering the vast amounts of phosphorus that is added to row crops each year (higher per acre than dairies), and recently-measured phosphorus levels emanating from some of these operations. Similarly, full implementation of Dairy BMPs are projected to remove 85% of the P, yet such a result has not been documented to date (although the few dairies with BATs might eventually achieve a similar result, most dairies do not have this capability). It is desirable to replace the low-reliability BPJs with empirical field measurements at the earliest possible date.	All calculations are correct. For example, we assume the base load is 1 metric ton for row crop. The owner implemented BMPs will reduce the P load by 30% as shown in Table A-2. The P load after the owner BMP will be 1* 70% = 0.7 metric tons. The next BMP is the typical cost share BMP and the P load reduction is expected to be an additional 30%. The P load after cost share BMP will be 0.7*70%=0.49 metric tons. The additional practice BMP is expected to bring a 50% load reduction. Therefore, the final P load after implementing all three BMPs would be 0.49 * 50% = 0.25 metric tons.

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Agency/ Public Entity	Comment	Response
	(4) BMP schedule evaluation The Evaluation reports that in the four years between 2002-2006, BMPs (including CnMPs, and AgNMPs) have been implemented for 278,000 acres. This figure represents only about 11% of the 2.5 million acre watershed upstream of Lake Okeechobee that is slated for BMP implementation. Considering only 9 years remain to complete BMPs, it appears this program is significantly behind schedule. Additionally, 166,000 of the 278,000 acres (60%) actually are not completed, but rather still in development, making this effort appear even further from its goal. This is of major concern and this Evaluation should emphasize this challenge to policy makers. We do note that recent agency experience with BMP implementation, and an increase in staff knowledgeable of these practices, makes the agencies poised to greatly accelerate these efforts, if funding is adequate.	To clarify, the evaluation reports that "plans have been completed for 278,000 acres" and "BMPs are in various stages of implementation". More than half of the agricultural acreage in the entire watershed is currently under voluntary FDACS programs to plan and implement practices to control offsite movement of phosphorus. At the current rate of participation, FDACS is on schedule to complete BMP-based plans for the remainder of the agricultural acreage in the watershed by July 2010, and fully implement BMPs by 2015, as required by the Lake Okeechobee Protection Plan.
	(5) Need for phosphorus control activities in the Kissimmee Chain of Lakes and Lake Istokpoga Watersheds The Kissimmee Chain of Lakes (KCOL) region covers about 40% of Okeechobee's watershed and Istokpoga's watershed covers about 10%. The LOPA directed the agencies to "…conduct an assessment of the sources of phosphorus from the upper Kissimmee Chain of Lakes and Lake Istokpoga, and their relative contribution to the water quality of Lake Okeechobee. The results of this assessment shall be used by the coordinating agencies to, develop interim measures, best management practices or regulation, as applicable."	An integral part of the LOPP is the implementation of Best Management Practices for both Lake Istokpoga and Kissimmee Chain of Lakes watersheds, to be completed by 2015. In addition, the District is pursuing opportunities for water storage on public and private lands throughout these regions, as well as revising the ERP and WOD regulatory programs to achieve additional water quality improvements. Furthermore, some of the additional strategies that are being evaluated could potentially be implemented in the KCOL and Istokpoga region. The implementation schedule is provided in Section 5.0.

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Agency/ Public Entity	Comment	Response
	(6) Lake Okeechobee Operations Permit The LOPA mandated "By January 1, 2004, the district shall submit to the department a permit modification to the Lake Okeechobee structure permits to incorporate proposed changes necessary to ensure that discharges through the structures covered by this permit achieve state water quality standards, including the total maximum daily load …" To our knowledge, no such permit modification has been made available to the public for review, and the permit has not been renewed. This permit was last renewed in 1987. That renewal expired in 1992. Table 3.1 of the Evaluation contains expected phosphorus loads, by basin (i.e., structure), and it seems these data could be used as a basis for the new permit. Not having renewed this permit for such a long period is inappropriate.	The Notice of Intent to Issue the Lake Okeechobee Operating Permit was signed by FDEP on January 26, 2007.
Randy Sargent, Wildlife Conservation Counsel, National Wildlife Federation	I. The final evaluation's water quality baseline should rely on current data; II. The final Evaluation should determine the accuracy of prior phosphorus load reduction projections; III. The final evaluation should evaluate the effectiveness of agricultural nonpoint source BMPs; IV. The final evaluation should emphasize that the BMP program is behind schedule; V. The final evaluation should use phosphorus assessments for the Kissimmee Chain of Lakes and Lake Istokpoga to recommend future improvements; VI. Lake Okeechobee structure permits must be renewed and modified; and VII. Because of the immeasurable value of resources such as the snail kite and the effects of phosphorus loading on such resources, it is critical that the Lake Okeechobee Protection Plan be thoroughly evaluated.	All comments have been addressed above.