

Appendix 5-2: Annual Permit Report for the C-4 Emergency Detention Basin

Permit Report (May 1, 2014–April 30, 2015)
Permit Number: EI 13-0192729

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Contributors: Matt Powers, Chris King, and John Leslie

SUMMARY

Based on Florida Department of Environmental Protection (FDEP) permit reporting guidelines, **Table 1** lists key permit-related information associated with this report. **Table 2** lists attachments included with this report. **Table A-1** in Attachment A lists the specific pages, tables, graphs, and attachments where project status and annual reporting requirements are addressed. This annual report satisfies the reporting requirements specified in the permit.

Table 1. Key permit-related information.

Project Name:	C-4 Emergency Detention Basin
Permit Number:	0192729-014
Issue and Expiration Dates:	Issued: 10/29/2014; Expires: Not applicable (in Operation Phase)
Project Phase:	Operations
Permit Specific Condition Requiring Annual Report:	20
Reporting Period:	May 1, 2014–April 30, 2015
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Permit Coordinator:	John Leslie jleslie@sfwmd.gov 561-682-6476

Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Hydrologic Data

PROJECT STATUS

There was no flood pumping into the C-4 Emergency Detention Basin (EDB) or surface water outflow into the C-4 canal in Water Year 2015 (WY2015) (May 1, 2014–April 30, 2015). During the reporting period, no single flow event triggered a sampling trip, so no water quality samples were collected.

CONCLUSIONS REGARDING PROJECT SUCCESS

Project is operating as designed.

PROBLEMS ENCOUNTERED

No problems were encountered.

ACTIONS TO ADDRESS PROBLEMS

No problems were encountered.

INTRODUCTION

The South Florida Water Management District (District or SFWMD) was issued Environmental Resource Permit (ERP) 13-0192729-001 and all associated modifications by FDEP to construct and operate Phases I and II of the C-4 EDB.

PROJECT OVERVIEW

The C-4 EDB, located in the North Trail Wetland Basin in southwestern Miami-Dade County between SW 137th Avenue and Krome Avenue, is accessible via Tamiami Trail (SW 8th Street, U.S. 41), which runs along the facility's southern border (**Figure 1**). It was constructed to reduce the magnitude, duration, and frequency of flooding of low-lying areas within the jurisdictions of the cities of Sweetwater and West Miami, and western Miami-Dade County (the "Flagami District").

The C-4 EDB provides improved flood protection for the City of Sweetwater and surrounding areas during extreme events by providing 3,264 acre-feet (ac-ft) of aboveground storage for floodwaters. During a major storm event, the C-4 EDB pumps convey floodwaters from the C-4 canal into the storage detention basins (both Phases I and II), which help reduce flooding of the area further east. After the event, when stages in the C-4 canal have returned to normal, the floodwaters discharge from the C-4 EDB back to the C-4 canal, and eventually to tide. Construction of the water management infrastructure was certified complete in May 2005. The facility became administratively operational in November 2006, after stage monitoring equipment was relocated and recalibrated to maximize accuracy and minimize siltation. FDEP approved the as-built certification and concurred that the facility was constructed in accordance with the FDEP permit.

Phase I includes the northern section and encompasses 415 acres. Phase II includes the remaining 416 acres. Together, the two areas total 831 acres and the maximum storage depth is 4 feet.

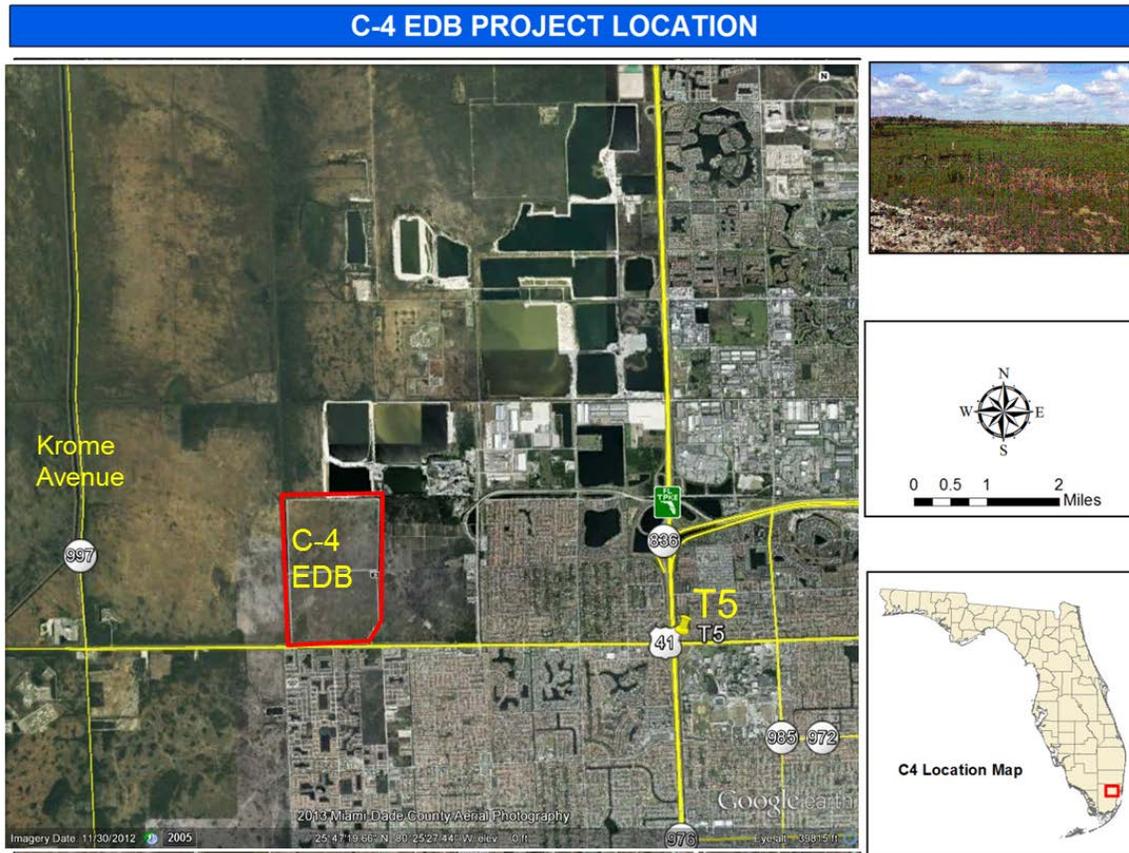


Figure 1. Location of the C-4 EDB.

The Phase I and Phase II lands were both owned by private and public entities. The District obtained a 50-year easement from the State of Florida for Phase I. Phase II lands were obtained with funds from the Federal Emergency Management Agency and the Florida Department of Community Affairs, as well as from the Conservation and Recreation Lands Trust Fund. Phase I will eventually become part of the East Coast Buffer Project. CEMEX, Inc. has mineral extraction rights for a substantial portion of the Phase I parcel for the next 50 years, but the start date and duration of mining are not yet known. During extraction operations, the Phase I section can only be flooded to a maximum depth of 2 feet (ft), rather than the designed 4 ft.

Figure 2 and **Table 3** show the structure locations, types, functions, and dates of initial operation. Water is pumped into Phase II of the C-4 EDB through the G-420 and G-422 structures. Water flows out of Phase II into the supply canal and then to the C-4 canal via the G-421 spillway. Water enters and leaves Phase I through the G-423 culverts, which will remain open until CEMEX, Inc. exercises its mineral extraction option. After the mining operation begins, G-423 will be closed and Phase I will be operated independently of Phase II. The maximum depth of Phase I under the mining operation will be 2 ft, while Phase II will be able to be filled to a maximum of 4 ft. Flow is not monitored at G-423.



Figure 2. Location of monitoring sites and structures in the C-4 EDB.

Table 3. Structures of the C-4 EDB.

Structure	Type	Function	Date of Initial Operation	Operated
G-420	3 x 223-cubic feet per second pump	Inflow	2004	Remotely
G-422	7 x 89-cubic feet per second pump	Inflow	2004	Remotely
G-421	Spillway	Outlet	2004	Remotely
G-423	Culverts	Interbasin transfer	2005	Remotely
G-420S	Seepage pump	Return seepage	2004	Remotely

PERMIT HISTORY

The original ERP permit and all modifications issued to the District are as follows:

- EI 13-0192729-001, issued September 10, 2002, with the expiration of the construction phase on September 9, 2007, was the original permit for Phase I.
- EI 13-0192729-002, issued February 14, 2003, modified the original permit.
- EI 13-0192729-003, issued March 4, 2003, modified the original permit and modification EI 13-0192729-002 to remove the culvert between the seepage canal and the detention basin, to replace this with a pump station, and provided authorization to build the east perimeter levee (Phase II).
- EI 13-0192729-004, issued September 26, 2003, with the expiration of the construction phase on September 25, 2008 (Phase II).
- 13-0192729-005, not applicable to this project.
- 13-0192729-006, issued January 15, 2004, was a Phase II modification.
- 13-0192729-007, issued May 5, 2004, for the Phase II borrow canal.
- 13-0192729-008, issued February 3, 2005, modified the project's monitoring requirements by reducing the frequency of wetlands monitoring within the Phase I and Phase II detention basins.
- 13-0192729-009, issued November 23, 2004, was a permit exemption for installation of a groundwater well.
- 13-0192729-010, issued July 2, 2007, modified the project's monitoring requirements by reducing the frequency of wildlife observations from quarterly to semi-annually, required that periphyton monitoring coincide with the biennial aerial survey, changed the date of the biennial environmental impact evaluation workshop to September instead of July, and the evaluation report due date to November instead of July.
- 13-0192729-011, issued September 25, 2008, modified the project's monitoring requirements by reducing the frequency of wildlife observations to once every other year incidental to ground-truthing for vegetation monitoring via aerial photography for the period 2005 through 2011.

- 13-0192729-012, issued November 6, 2008, was an exemption allowing maintenance dredging of the supply canal.
- 0192729-013, issued February 20, 2012, is a minor modification that reduced the overall monitoring and reporting requirements. The number of water quality parameters was reduced and autosamplers were removed. It retained water quality, stage, and flow monitoring, and eliminated all biennial wildlife, periphyton, and vegetation monitoring and reporting. Additionally, this minor modification changed the reporting frequency from biennial to annual, and required that water quality monitoring be implemented during periods in which wetlands within the detention basin are used for stormwater storage.
- 0192729-014, issued October 29, 2014, is a minor modification that reduced the frequency of post-construction dike and pump station inspection reports from annually to once every five years.

FACILITY OPERATIONS

Operation of the C-4 EDB is governed by the Interim Seasonal Operation Plan. Once the stage at the T5 monitoring station (see **Figure 1** for the location of T5) reaches a minimum elevation of 4.80 ft National Geodetic Vertical Datum of 1929 (NGVD29), all three pumps at G-420 (total 669 cubic feet per second [cfs]) are to be turned on, and pumping into the C-4 EDB is to begin. G-423 will be opened fully at this time as well. Pumping into the C-4 EDB will increase to 936 cfs (three pumps on at G-420 and three pumps on at G-422) when stage at T5 increases to elevation 5.00 ft NGVD29, and to a maximum of 1,292 cfs (G-420 with three pumps = 669 cfs plus G-422 with seven pumps = 623 cfs) if stage at T5 remains above an elevation of 5.20 ft NGVD29 (SFWMD 2011). The maximum allowed stage elevation in the EDB is 10 ft NGVD29.

In WY2015, there was no flood control related pumping into C-4 EDB or surface water outflow into the C-4 canal. Some pumping at G-420 and G-422, and gate operation at G-421, was conducted for routine maintenance and testing.

HYDROLOGIC MONITORING

Hydrologic data were collected and processed in accordance with permit requirements. Data were obtained from the District's DBHYDRO database, and are available in Attachment B. Flow rating calculations follow the District's flow management assessment quality assurance/quality control processes.

Flow was monitored at the two inflows to the C-4 EDB, G-420, and G-422. Outflow was monitored at G-421. Seepage pumping into the EDB is monitored at the G-420S pump station. Daily variations of inflow and outflow are depicted in **Figure 3** for the four structures.

- Peak flow at G-420 was 18 cfs and total flow was 149 ac-ft
- Peak flow at G-422 was 11 cfs and total flow was 151 ac-ft
- Very little outflow (4 ac-ft) was discharged through G-421 to the C-4 canal
- Seepage pumping was 1,899 ac-ft

Stage in the C-4 EDB was monitored at C4SW2 and the daily variation for WY2015 is shown in **Figure 4**. Most of the water year, the water level was below the average ground elevation of 5.1 ft NGVD29. Water levels were barely (less than 2.5 inches) above ground for 23 days in August and September 2014. In the dry season, water levels were low and below ground.

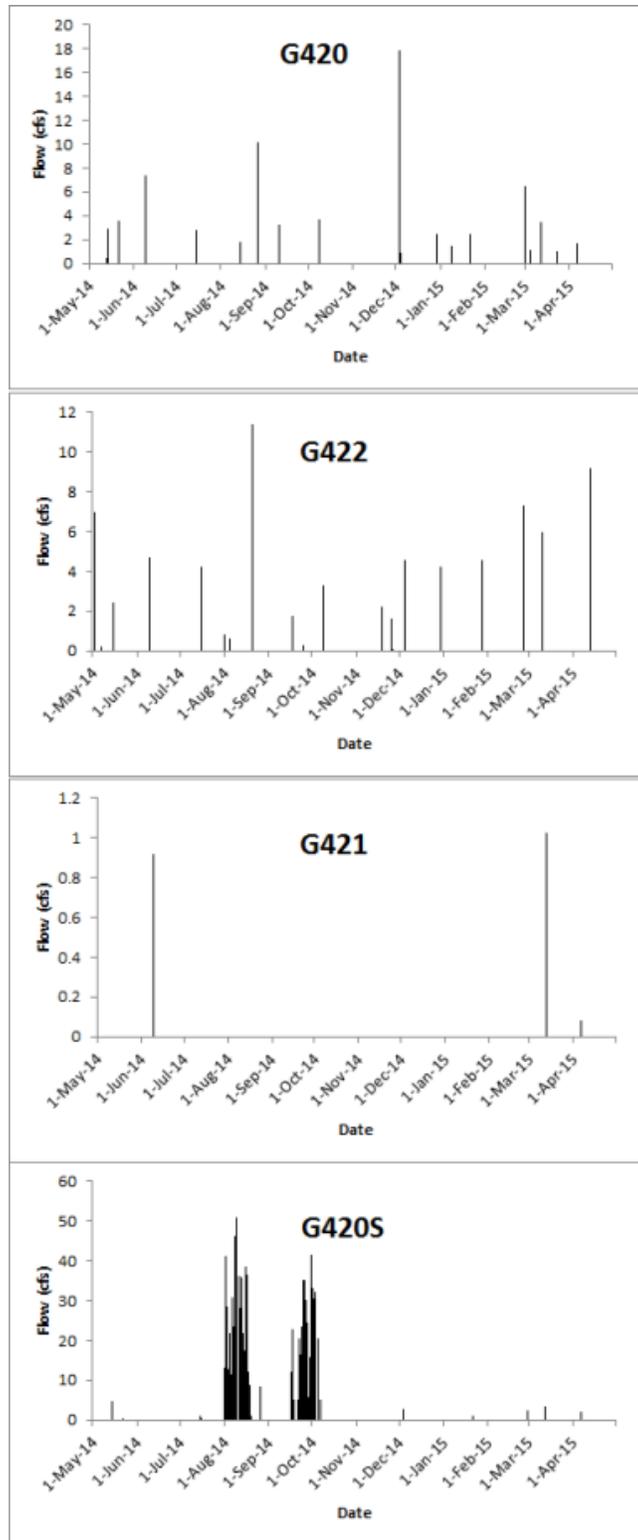


Figure 3. C-4 EDB inflows (G-420 and G-422), outflows (G-421), and seepage pumping (G-420S).

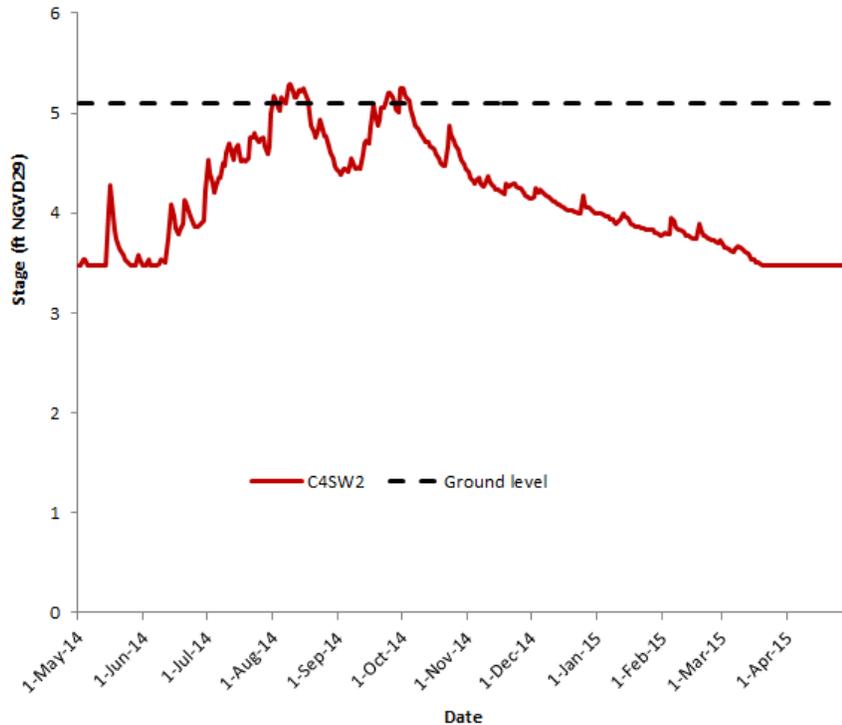


Figure 4. Stage for the C-4 EDB monitored at C4SW2 (average ground elevation is about 5.1 ft NGVD29).

WATER QUALITY MONITORING

The District has been conducting monitoring since May 2005 to identify water quality changes caused by operation of the C-4 EDB, as required by the associated permits. When water quality monitoring data is available, it is used to determine the total phosphorus (TP) mass budget within the C-4 EDB. In WY2015, no single flow event triggered a sampling trip, so no water quality samples were collected.

SAMPLING METHODS

All permit mandated project monitoring is outlined in the Operational Project Monitoring Plan for C-4 Emergency Detention Basin, SFWMD-FIELD-MP-003 (SFWMD 2014a), developed to monitor water quality in the C-4 EDB. This plan assures the consistency and validity of samples and data collected over time. The plan is reviewed annually and revised, as needed, in response to modifications of the project's operation and/or permitted requirements.

At this project, samples are collected using the grab method outlined in the District's Field Sampling Quality Manual (SFWMD 2015b) and in accordance with the FDEP standard operating procedures. To satisfy quality control requirements, equipment blanks are collected along with the grab samples. Samples are analyzed by the District's water quality laboratory in accordance with its Chemistry Laboratory Quality Manual (SFWMD 2015a).

All samples are collected biweekly at station C4IN if there is recorded flow at G-420 and G-422 (**Figure 2**). Grab samples are collected biweekly at station G-421 if there is recorded flow at G-421. Trigger volumes are used to determine the threshold flow for collecting grab samples. The threshold flow for collection of grab samples is two times the trigger volume. A trigger volume for

autosampling was computed for each structure. Further details about this sampling method are presented in the District’s Standard Operating Procedure for Sampling Recorded Flow Related Stations, SFWMD-FIELD-SOP-027 (SFWMD 2014b).

SAMPLING RESULTS

During WY2015, no samples were collected because of the lack of operational flow (**Table 4** and **Figure 5**). The District’s Standard Operating Procedure for Recorded Flow Sampling was followed (SFWMD 2014b).

Table 4. WY2015 flow by structure.

Structure	Flow (ac-ft)	Days with Flow
G-420	149	19
G-422	151	20
G-421	4	3

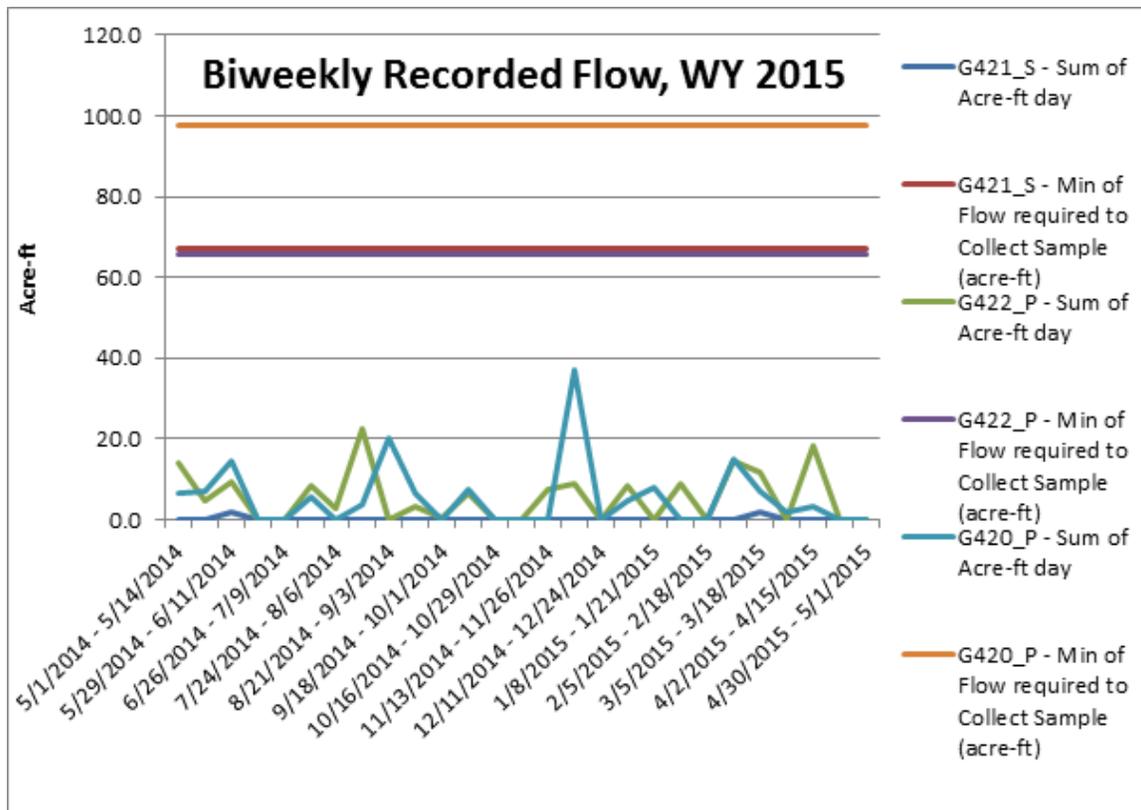


Figure 5. Biweekly recorded flows for C-4 EDB and volume of water necessary to trigger sampling at inflow and outflow stations. As shown, no single flow event triggered a sampling trip, so no water quality samples were collected in WY2015. [Note: acre-ft – acre-feet and min – minimum.]

WATER AND TOTAL PHOSPHORUS MASS BUDGET METHODS

When water quality monitoring data are available, this report provides an estimate of TP mass balance for the C-4 EDB for the associated water year, as required in Specific Condition 11 of permit modification 13-0192729-013, issued February 20, 2012. Determination of the TP mass balance requires calculation of a water budget, as described below.

Water Budget Method

The water budget is calculated as follows:

$$\Delta S = I_p + I_{SP} + R - ET - O_p \pm GW \quad (1)$$

Where:

- ΔS = change in surface/subsurface water storage = $Stage_t - Stage_{t-1}$, $Stage_t$ is the final stage and $Stage_{t-1}$ is the initial stage; for subsurface storage, multiply soil depth by estimated water holding capacity (0.2)
- I_p = inflow pumping (G-420 + G-422)
- I_{SP} = Seepage pumping (G-420S)
- R = rainfall
- ET = evapotranspiration loss
- O_p = outflow pumping (G-421)
- GW = subsurface water loss or gain
- $GW = \Delta S - I_p - I_{SP} - R + ET + O_p \quad (2)$

Daily rainfall measurements were obtained from the nearest station available at S-335. Evapotranspiration (ET) was estimated using potential ET data at S331W. Locations of rainfall and ET stations are shown in **Figure 6**.

Total Phosphorus Mass Budget Method

When TP data are available, the TP mass budget is calculated as follows:

$$\Delta S_{tp} = I_{tp} + D_{tp} + Se_{tp} - O_{tp} \pm GW_{tp(out)} \quad (3)$$

Where:

- ΔS_{tp} = change in TP storage = TP storage change in soil, water, vegetation, unknown
- I_{tp} = TP coming in through inflow pumps
- O_{tp} = TP leaving out of system through outflow pumps
- Se_{tp} = TP pumped into the system through seepage pumps, no TP measurements for seeping out through seepage
- D_{tp} = Deposition estimate based on literature review (Redfield, 2002)
- GW_{tp} = Subsurface losses or gains, unknown
- Retained plus lost through groundwater flow = $\Delta S_{tp} + GW_{tp} = I_{tp} + D_{tp} + Se_{tp} - O_{tp}$

TP load is calculated by multiplying the TP concentration by the corresponding flow. The load calculation is performed using the District's Nutrient Load Program. Atmospheric deposition of TP is calculated by multiplying the area and the deposition rate (36 milligrams per square meter per year from literature compiled by Redfield [2002]). Both inflow and outflow TP concentrations use the concentration measured at site C4IN.

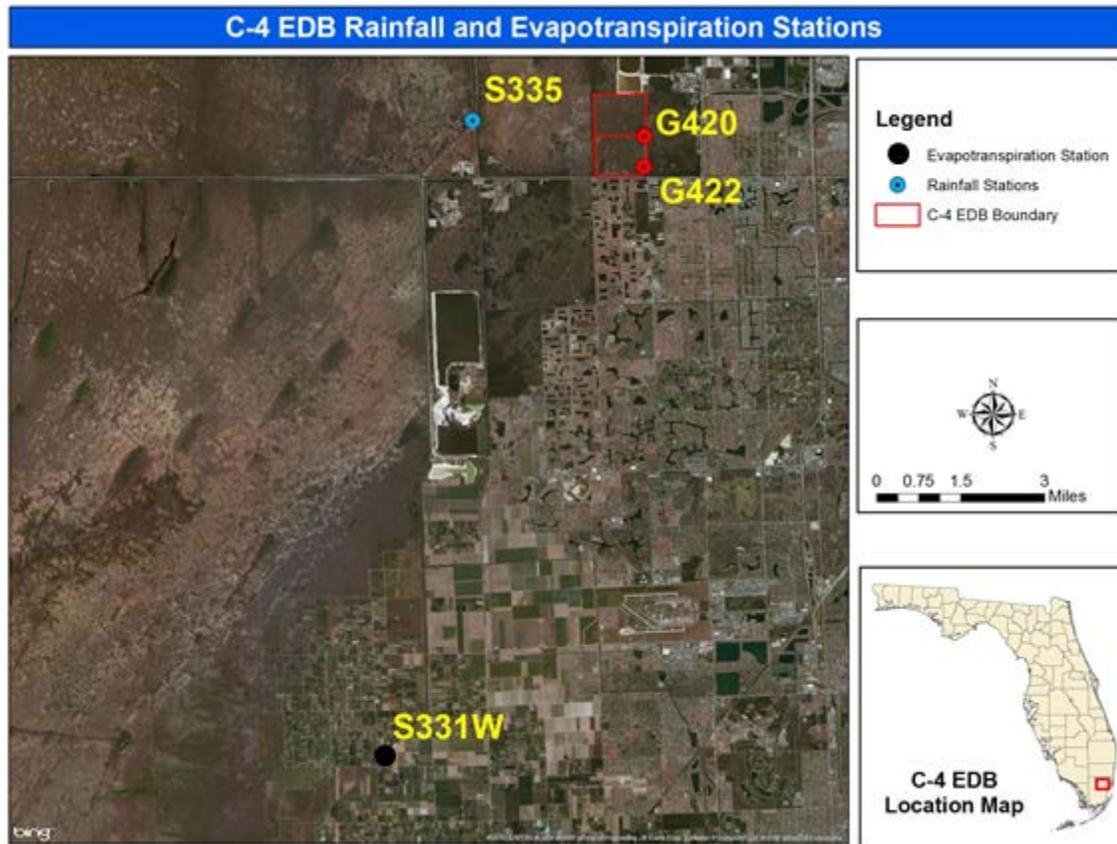


Figure 6. Location of rainfall and ET monitoring stations with reference to the C-4 EDB.

RESULTS

Water Budget

Water budget components include rainfall (**Figure 7**), potential or wetland ET (**Figure 8**), and storage changes (**Figure 9**). There was no major inflow pumping in WY2015. The most pumping in a month was 48 ac-ft in August 2014 and 60 ac-ft in December 2014. Water level was barely above ground with mostly belowground storage change of a few inches (**Figures 4 and 9**). There was 1,899-ac-ft seepage pumping into the C-4 EDB in August, September, and October 2014. Water level was above ground for few days during seepage pumping in this period. The continuous recession of storage in the C-4 EDB was due to high seepage rates caused by its porous karst formation as demonstrated by the water budget with subsurface water loss of 31.41 inches (**Table 5**). Little water was continuously stored in the system. The water budget is summarized in **Table 5**. The major inflow components to the water budget are precipitation and seepage pumping. The major outflow components are ET and groundwater loss. Outflow discharges, storage change, and inflow pumping are minimal.

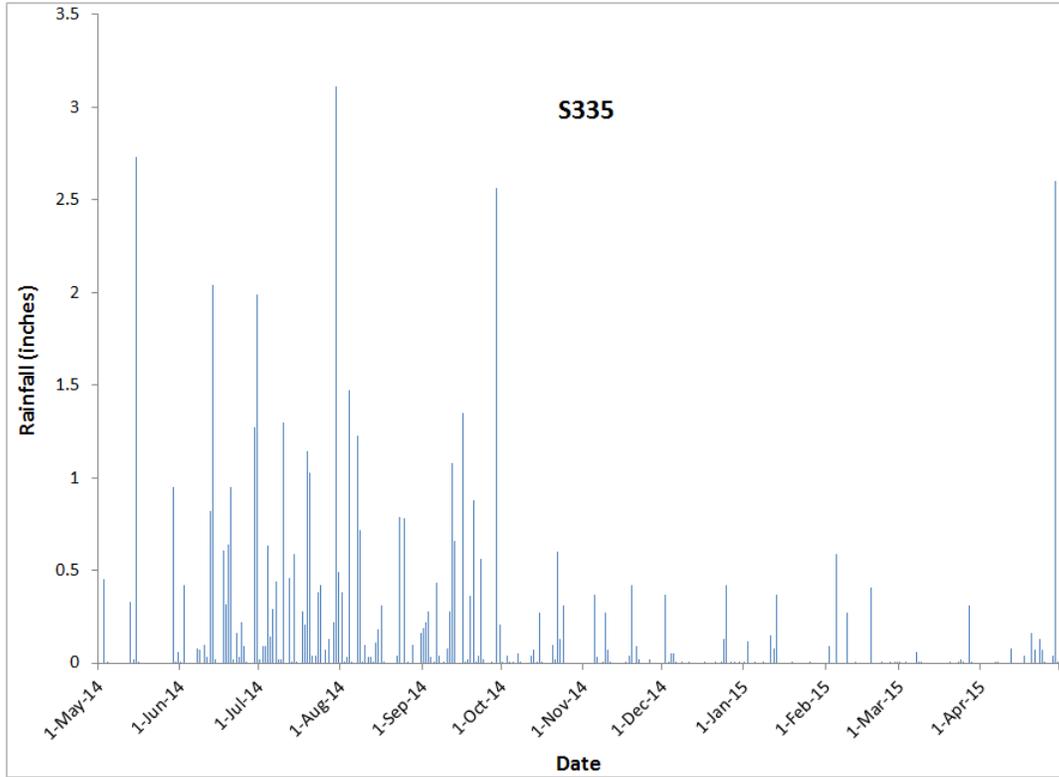


Figure 7. Rainfall for the C-4 EDB in WY2015.

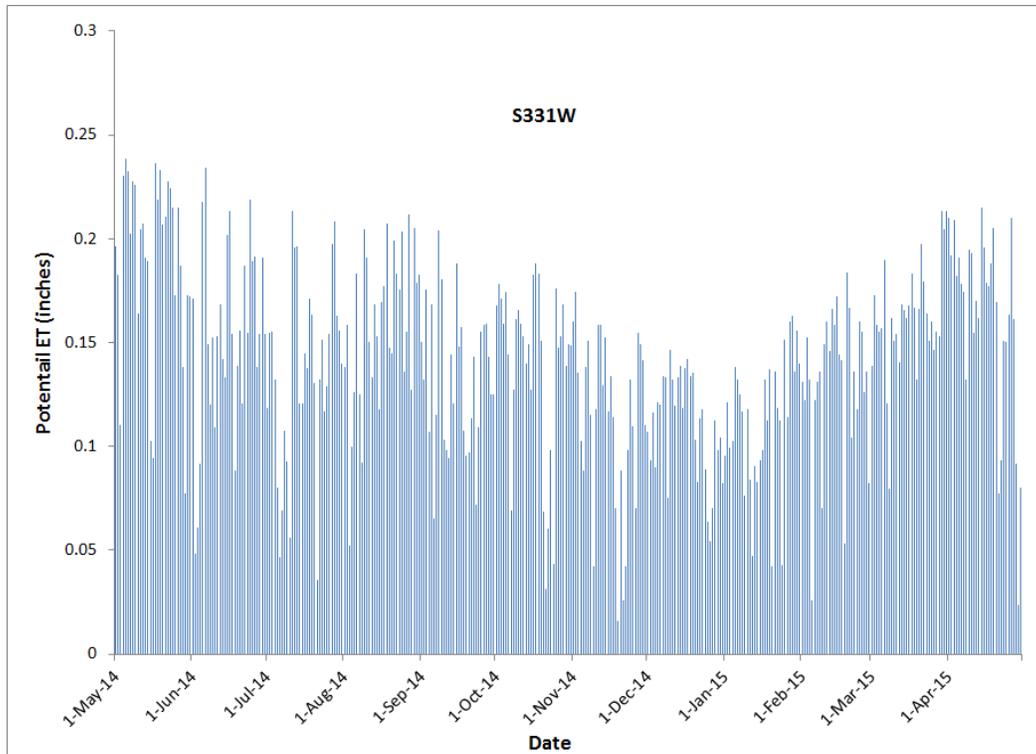


Figure 8. Potential or wetland ET for the C-4 EDB in WY2015.

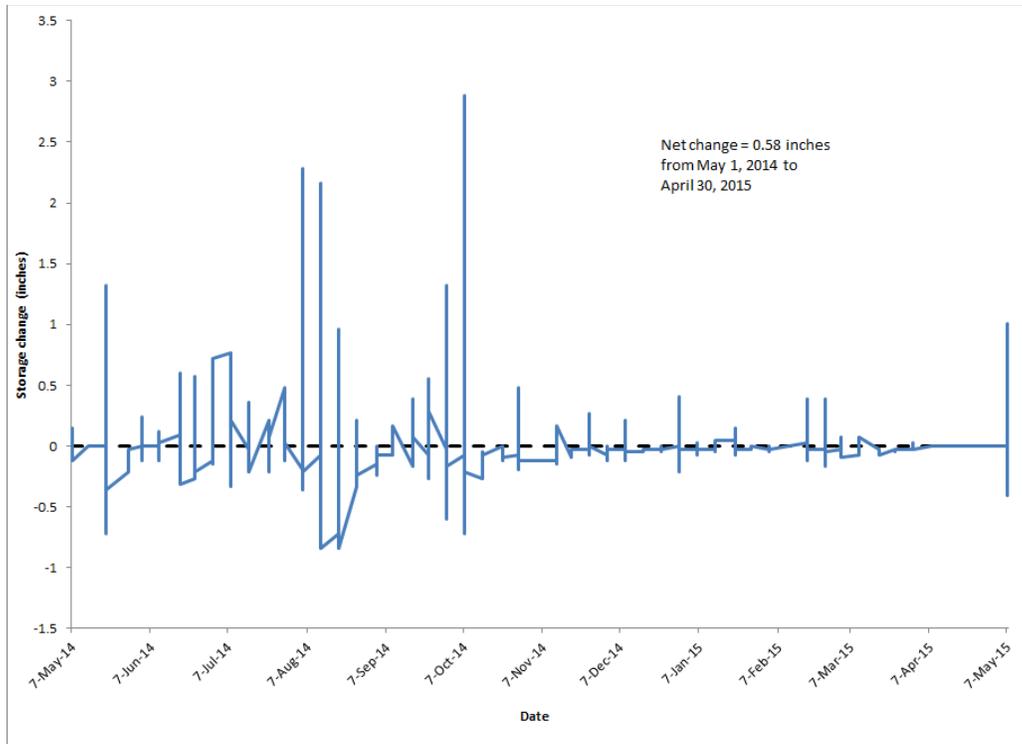


Figure 9. Storage changes for the C-4 EDB in WY2015.

Table 5. Water budget for the C-4 EDB for WY2015.

Component	WY2015 Total (inches)	WY2015 Total (ac-ft)
Rainfall (R)	52.1	3608
Evapotranspiration (ET)	51.8	3587
Inflow (I) ^a	4.33	300
Outflow (O) ^a	0.06	4
Seepage Recycle (S _e) ^a	27.42	1899
Storage Change (ΔS)	0.58	40
Groundwater (GW) ^b	31.41	2175

a. Calculated by flow volume divided by total detention area (831 acres).

b. Groundwater (out) = Inflow + Rainfall – ET- Outflow – ΔS (change of water level).

Total Phosphorus Mass Budget

Because no samples were collected in WY2015, flow-weighted mean TP concentrations and TP loads at the C-4 EDB structures are not included in this report. The TP mass budget for future water years will be reported in the associated years' reports if water quality sampling data are available.

HIGHLIGHTS

The water budget supports the following:

- The major inflow components to the water budget were precipitation and seepage pumping. The major outflow components were ET and groundwater loss.
- No single flow event triggered a sampling trip, so no water quality samples were collected in WY2015.

LITERATURE CITED

- Redfield, G.W. 2002. Atmospheric Deposition of Phosphorus: Concepts, Constraints, and Published Deposition Rates for Ecosystem Management. Technical Publication 360, South Florida Water Management District, West Palm Beach, FL.
- SFWMD. 2011. C-4 Basin Operating Plan. South Florida Water Management District, West Palm Beach, FL.
- SFWMD. 2014a. Operational Monitoring Plan for C-4 Emergency Detention Basin (C4IP). SFWMD-FIELD-MP-003. South Florida Water Management District, West Palm Beach, FL.
- SFWMD. 2014b. Standard Operating Procedure for Recorded Flow Sampling, SFWMD-FIELD-SOP-027. South Florida Water Management District, West Palm Beach, FL.
- SFWMD. 2015a. Chemistry Laboratory Quality Manual, SFWMD-LAB-QM-2015-001. South Florida Water Management District, West Palm Beach, FL.
- SFWMD. 2015b. Field Sampling Quality Manual, SFWMD-FIELD-QM-001-08.2. South Florida Water Management District, West Palm Beach, FL.

Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented in this report for the C-4 EDB Phase I Project (ERP permit EI 13-0192729-001) and Phase II Project (ERP permit EI 13-0192729-004, Mod -014).

Specific Condition	Description	Applicable Phase	Action Taken	Reported in 2016 SFER Vol. III, App. 5-2 in:			
				Narrative (page #s)	Figure	Table	Attachment
3	Addresses: Reports and notices submitted to FDEP in accordance with this permit	Operation	Reports and notices were submitted as required.	---	---	---	---
11	Water Quality Monitoring	Operation	No water quality sampling occurred in WY2015, because no single flow event triggered a sampling trip.	8-14	5-9	4-5	---
14	Stage and Flow Monitoring	Operation	Conducted stage and flow monitoring as required.	6-9	3-4	---	B
15	Dike and Pump Station Inspection	Operation	Required every 5 years. Last submitted in March 2014; next due in 2019.	---	---	---	---
20	Annual Status Report	Operation	Report completed as required.	ALL	ALL	ALL	ALL
21	Data Quality	Operation	No water quality sampling occurred in WY2015, because no single flow event triggered a sampling trip.	6, 8-9	---	---	---

Attachment B: Hydrologic Data

This project information is required by Specific Condition 14 of the C-4 EDB permit (EI 13-0192729), and is available upon request.