Hydrogeochemical Conditions of Two Estuarine Mangrove Lake Drainage Systems in the Everglades

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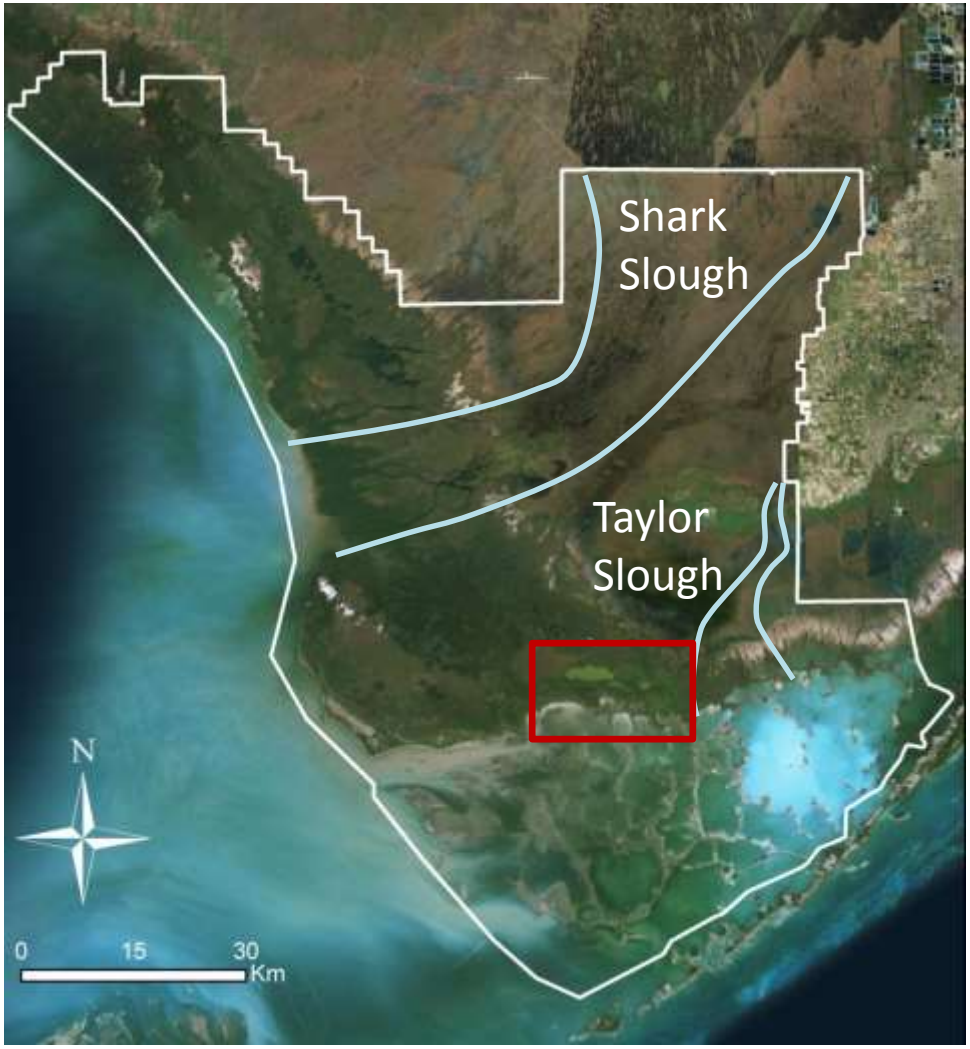
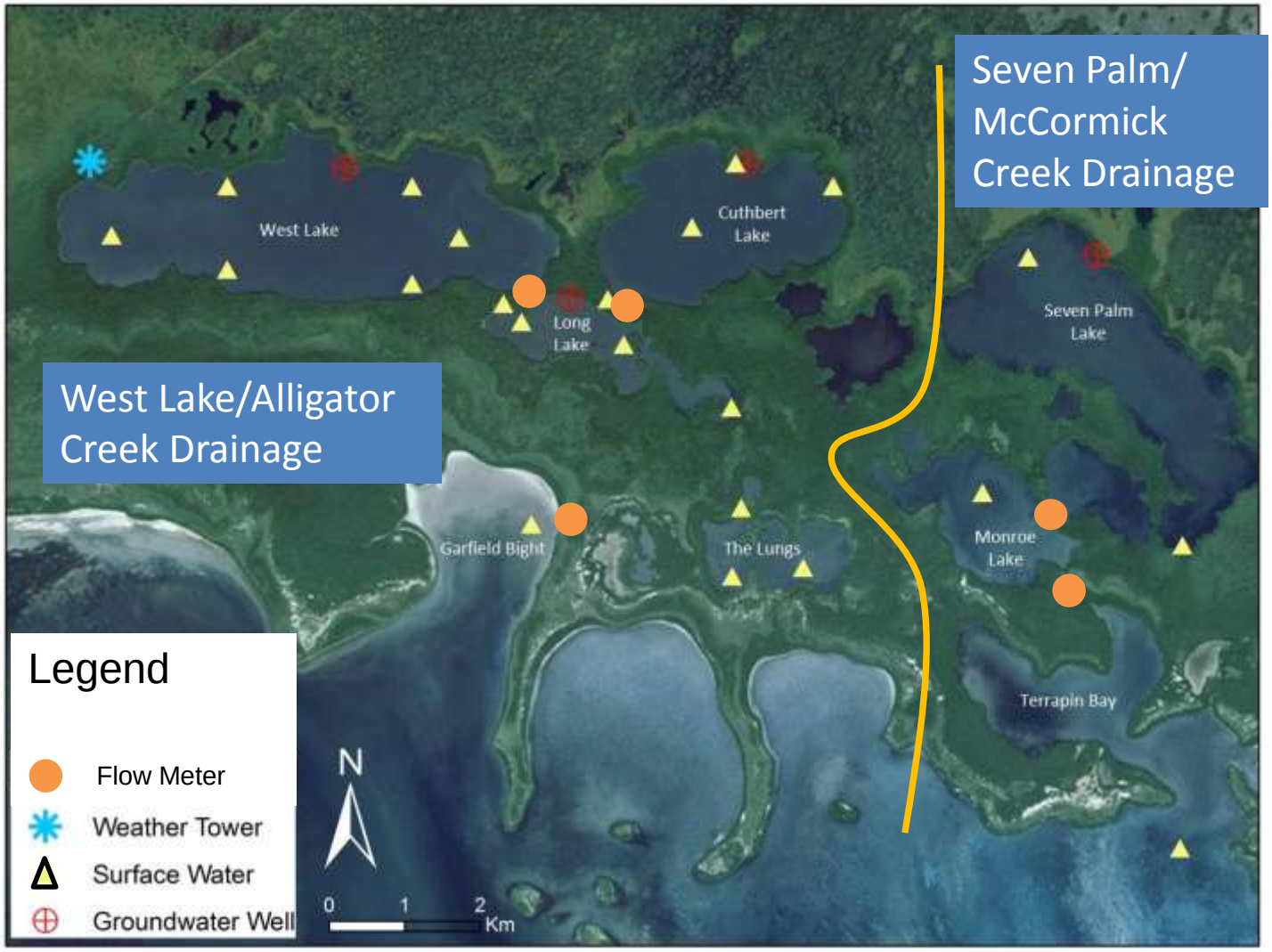
- Mangrove lakes region located to the west of Taylor Slough boundary.
- Small creeks connect the lakes to each other, as well as to Florida Bay.
- Due to close proximity of Taylor Slough, there may be a fresh groundwater influence to the lakes that could be increased with further restoration.



Mangrove Lakes Background

- Shallow throughout (~1.8m max depth)
  - Extensive SAV beds (historically), waterfowl wintering, habitat for American Crocodile
- Degradation of water quality throughout last century
  - Loss of SAV described in West Lake (Craighead 1971)
  - 20-30 psu increase in mean salinity along north shore of Florida Bay (McIvor et al. 1994)

Mangrove Lakes



Hypotheses

- **Groundwater discharges to the surface water of the lakes**

- **Groundwater discharge is a source of phosphorus delivered to the southern Everglades Mangrove Lakes region.**

- Water budgets for both drainages and individual lakes will be calculated on a daily, weekly, monthly and annually basis.

$$P - ET - Q_{out} + \Delta S = GW + R$$

- Data provided by the weather tower installed on site (August 2014) and flow meters

PET Calculation

- Thornthwaite Equation

$$PET = 1.62 \left(\frac{10Ta}{I}\right)^{a}$$

$$I = \sum_{i=1}^{12} \left(\frac{T_{ai}}{5}\right)^{1.5}$$

$$\boldsymbol{a = 0.49239 + (1.792\ x\ 10^{-2})\ I - (7.71 \text{ x } 10^{-5})\ I^2 + (6.75\ x\ 10^{-7}) I^3}$$

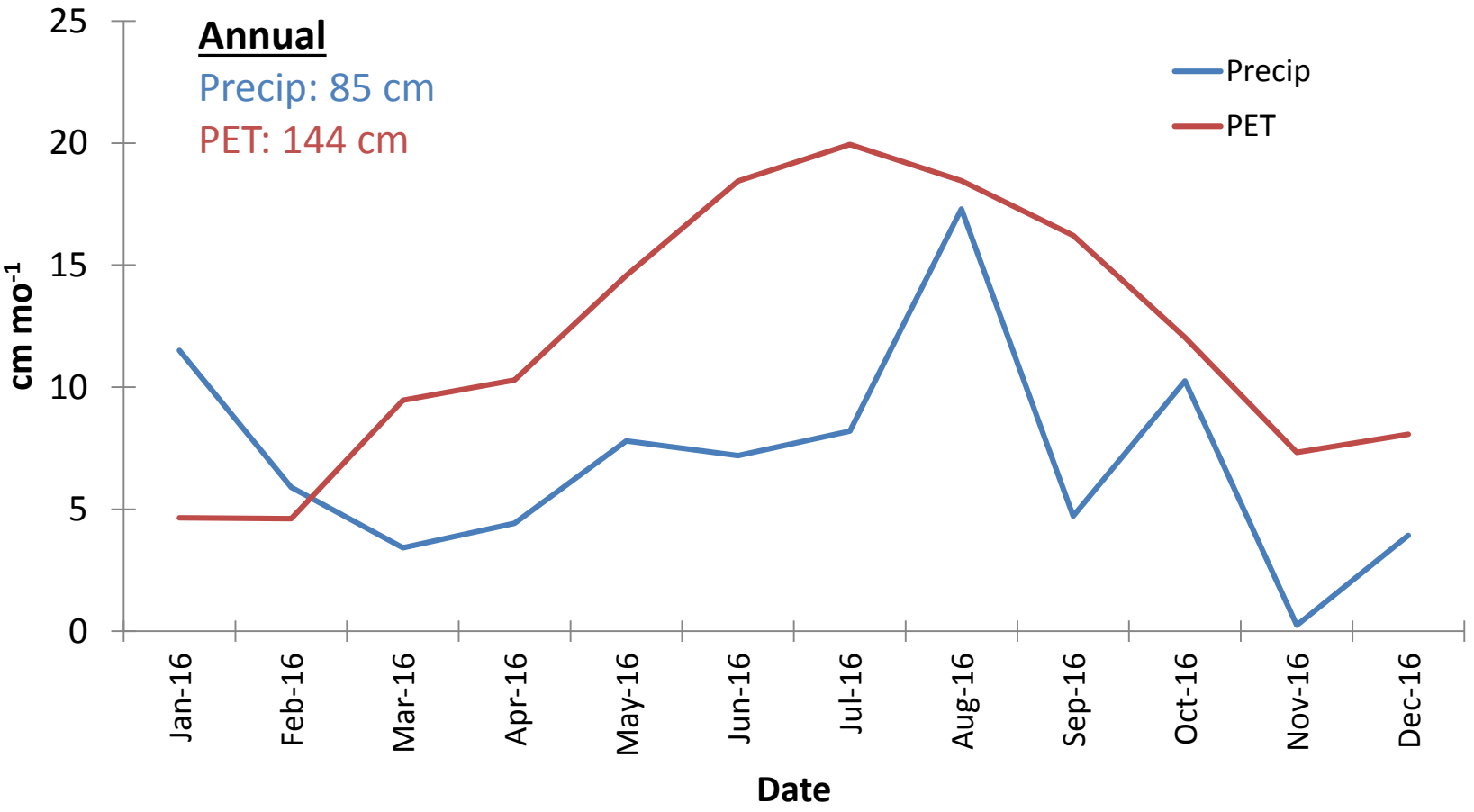
4 groundwater wells (in peat at top of limestone surface) and
4 surface water stations installed between June 2014 and September 2014

Aqua Troll 200 pressure transducers – measure at 30 minute increments

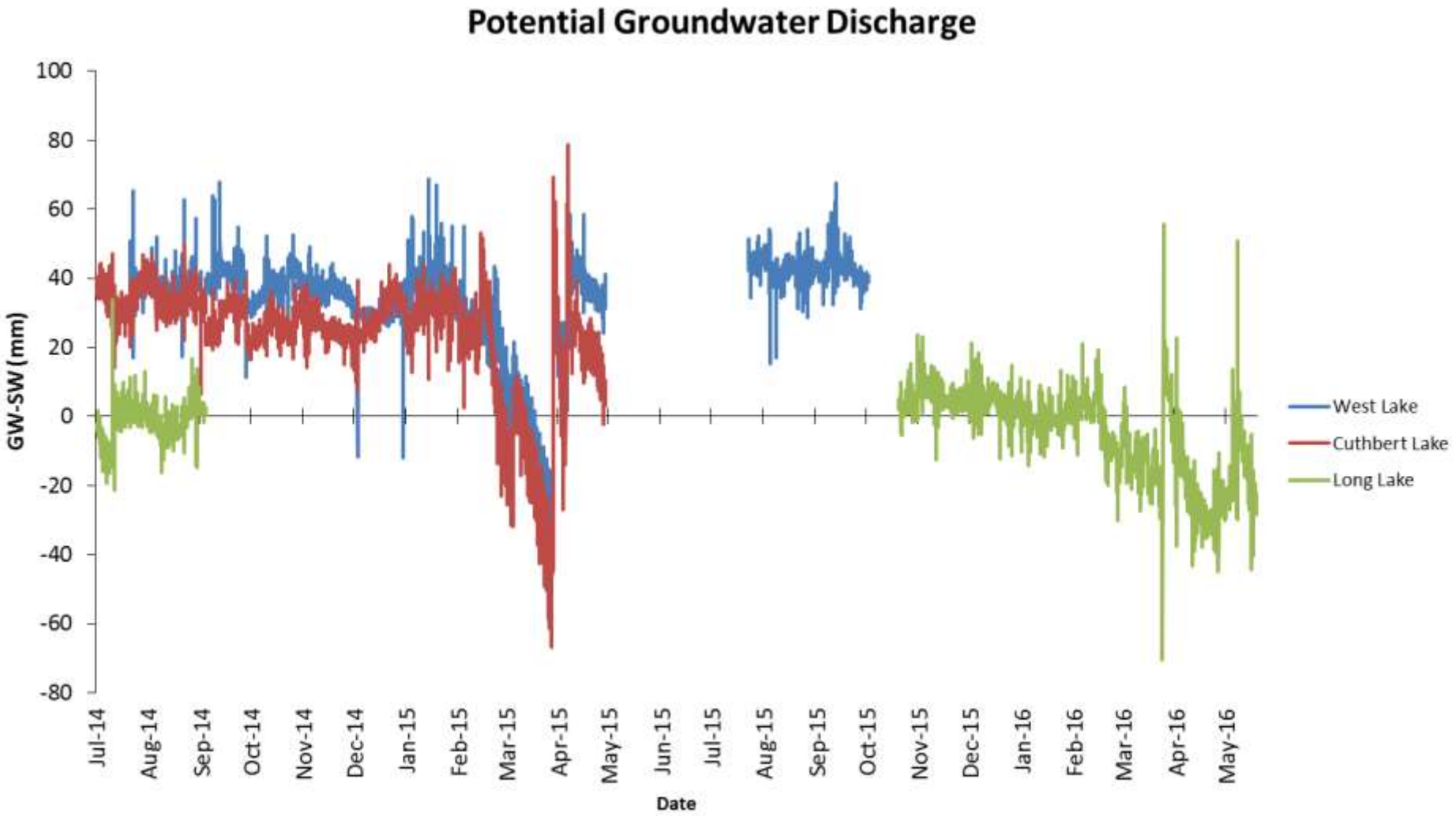
Surface Water Sampling

- November 2013 – September 2017
- Bimonthly sampling
  - Temp, pH, Salinity, Conductivity, DO
  - Alkalinity, Cations, Anions, TP, TN, TOC,

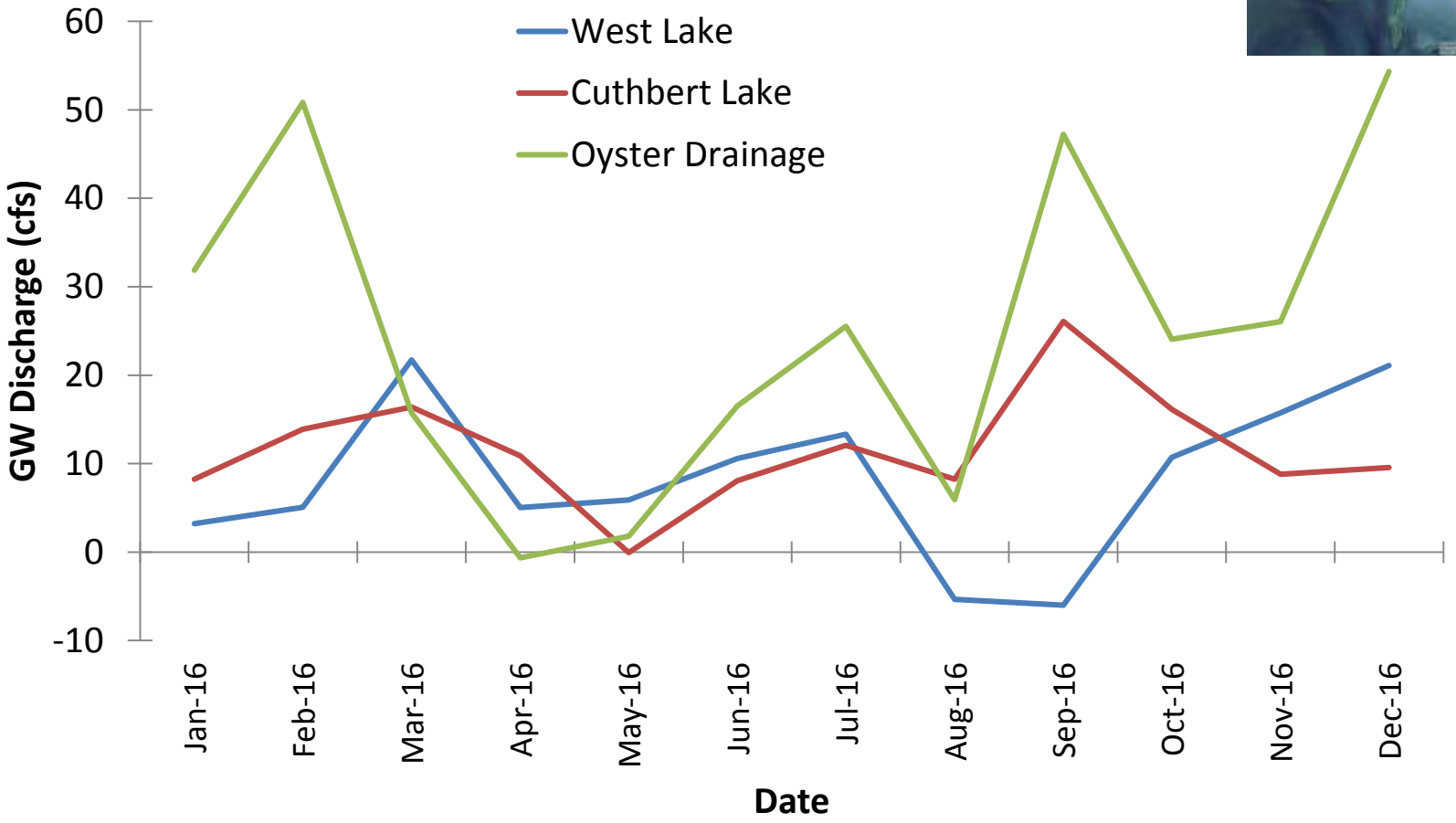
Precipitation vs PET



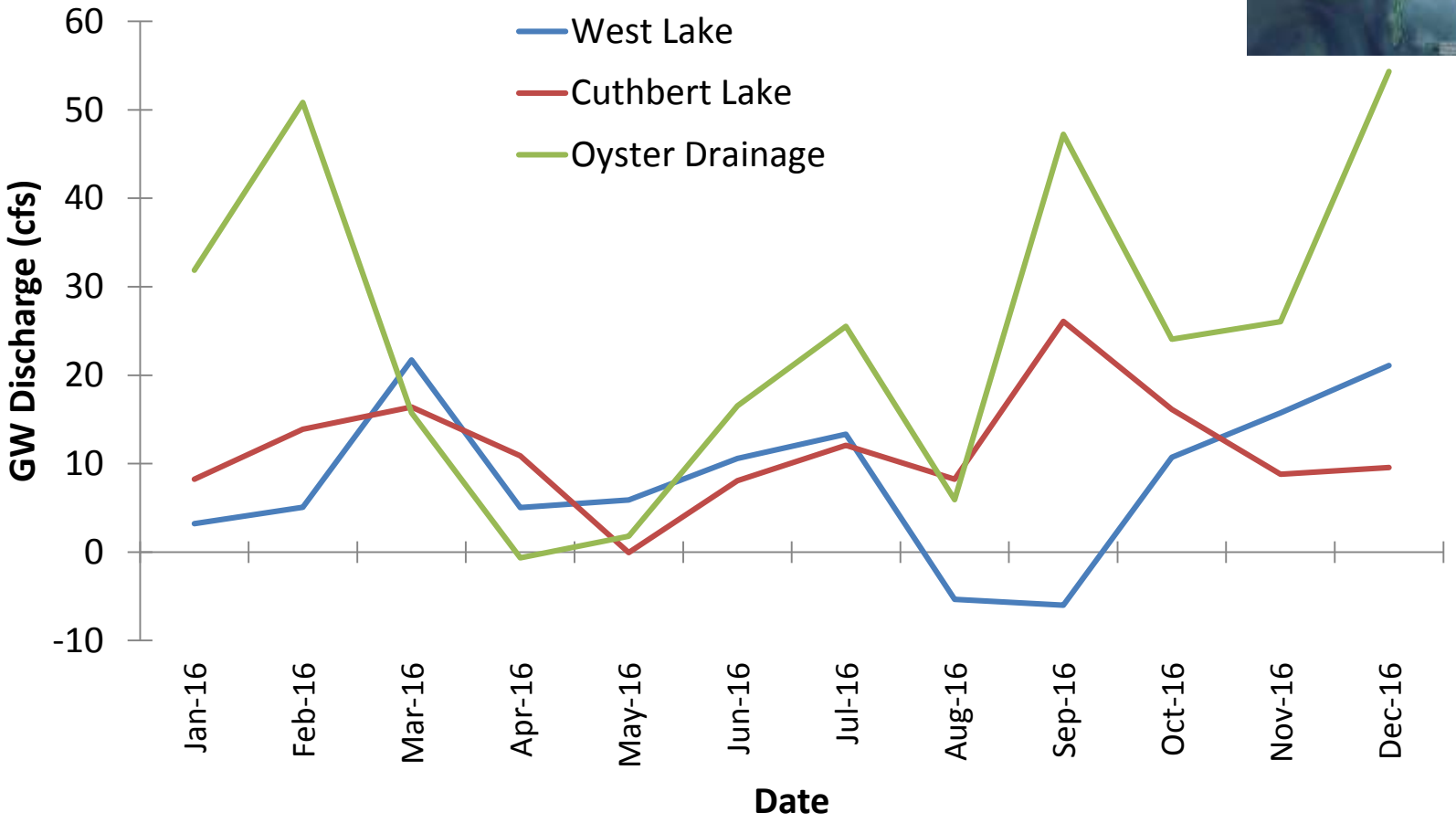
Results


Potential Groundwater Discharge
GW-SW (mm)
100
80
60
40
20
0
-20
-40
-60
-80
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Date
West Lake
Cuthbert Lake
Long Lake

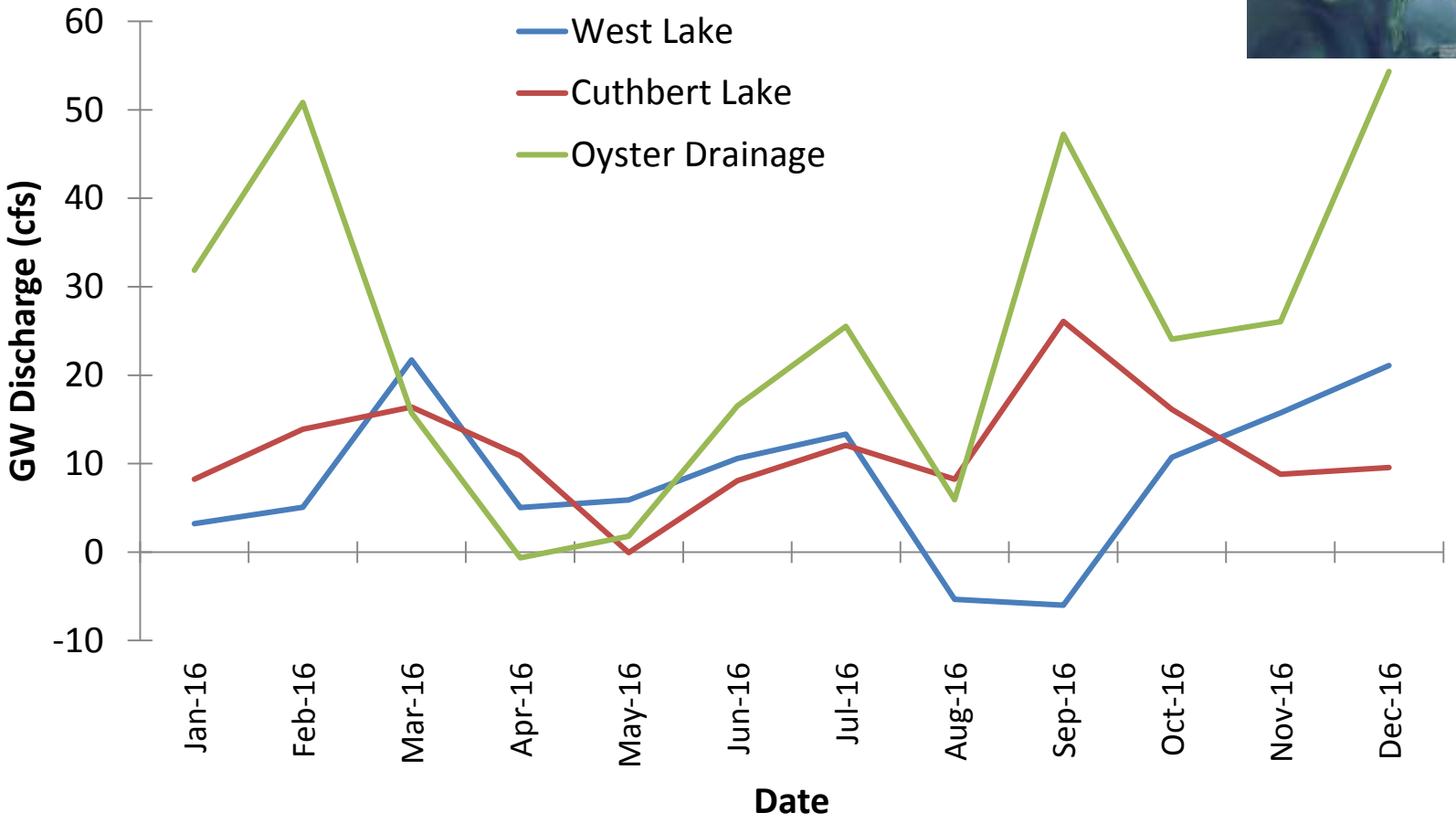
GW Discharge

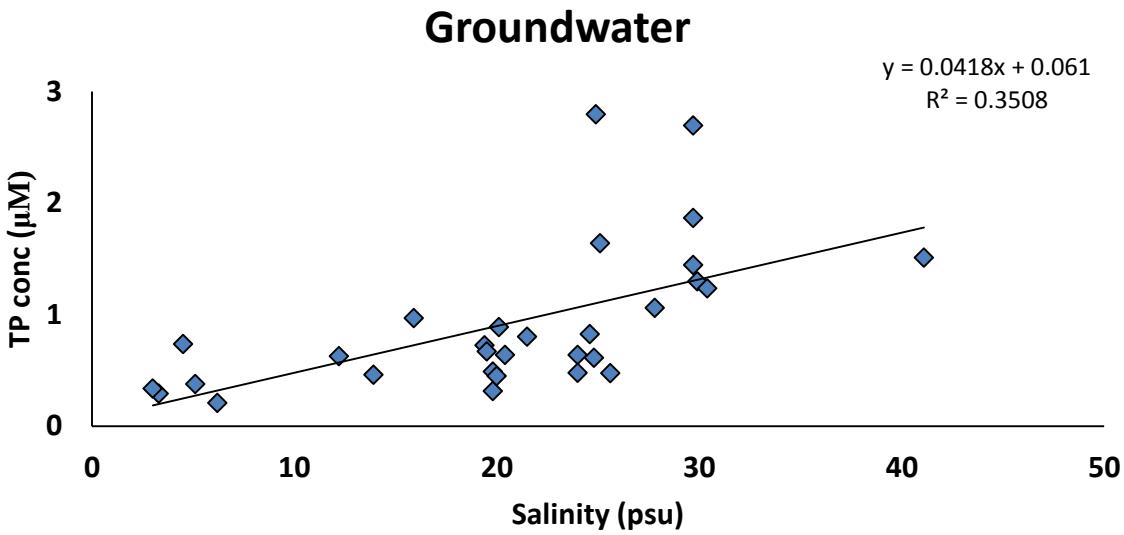


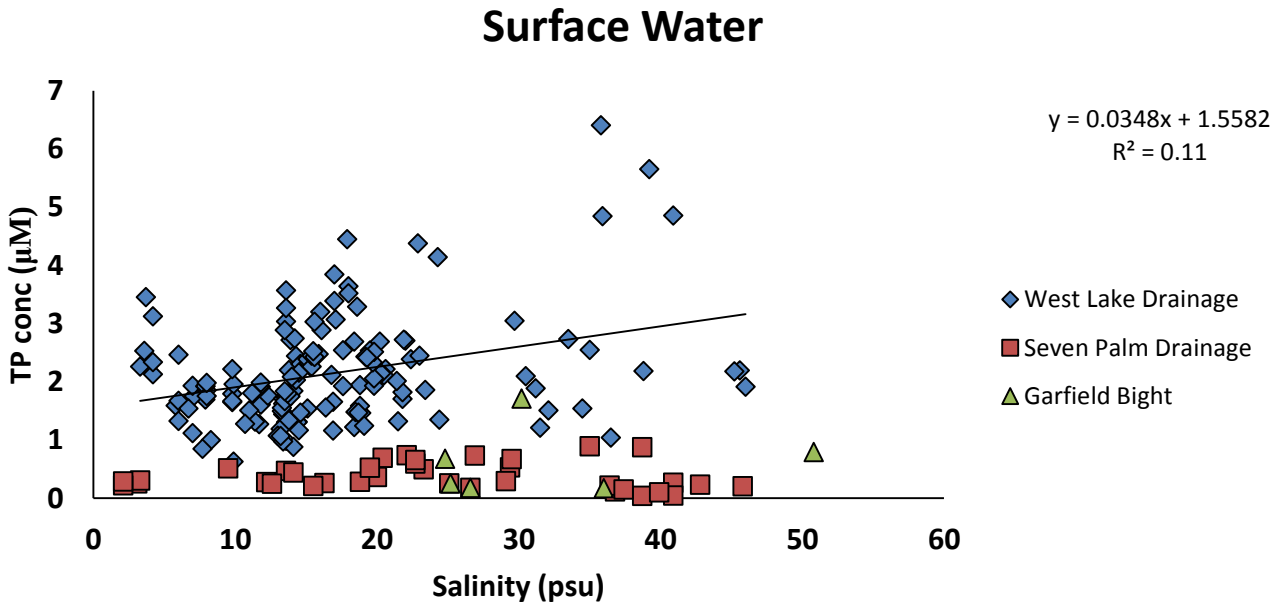
GW Discharge



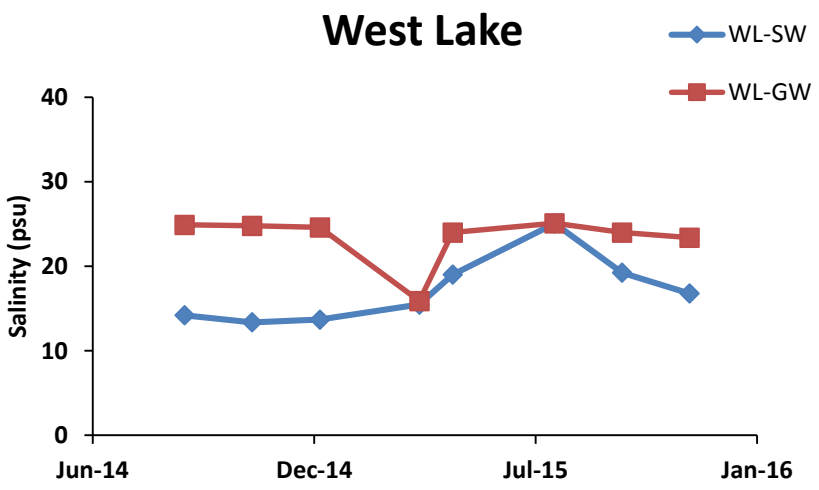
GW Discharge

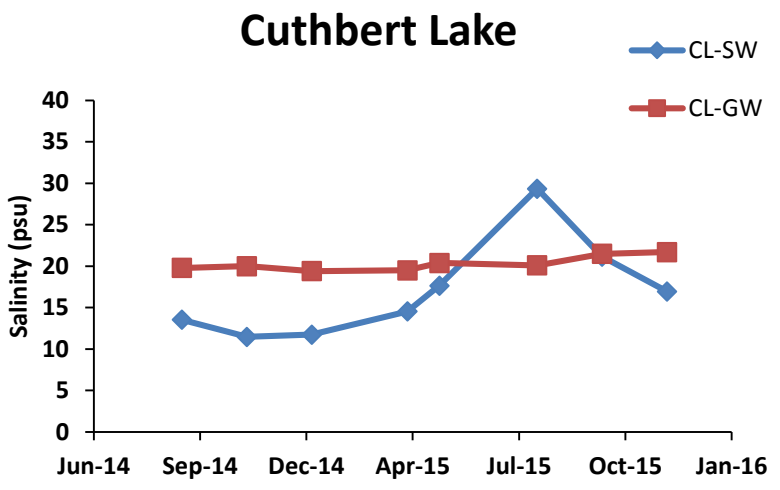


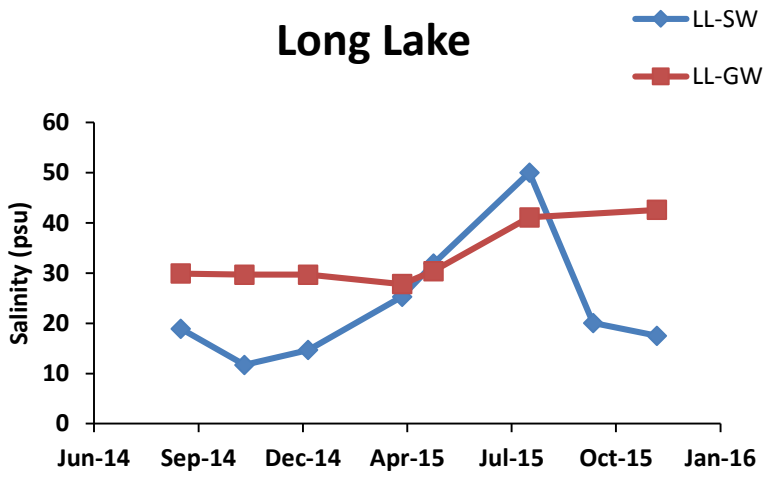

Groundwater
y = 0.0418x + 0.061
R² = 0.3508
TP conc (µM)
Salinity (psu)
0
1
2
3
0
10
20
30
40
50

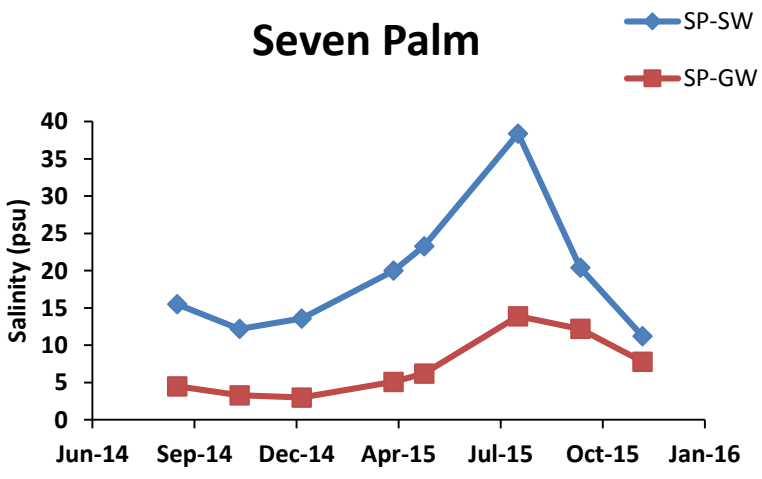

Surface Water
y = 0.0348x + 1.5582
R² = 0.11
TP conc (µM)
Salinity (psu)
West Lake Drainage
Seven Palm Drainage
Garfield Bight
0
1
2
3
4
5
6
7
0
10
20
30
40
50
60

GW and SW Salinity

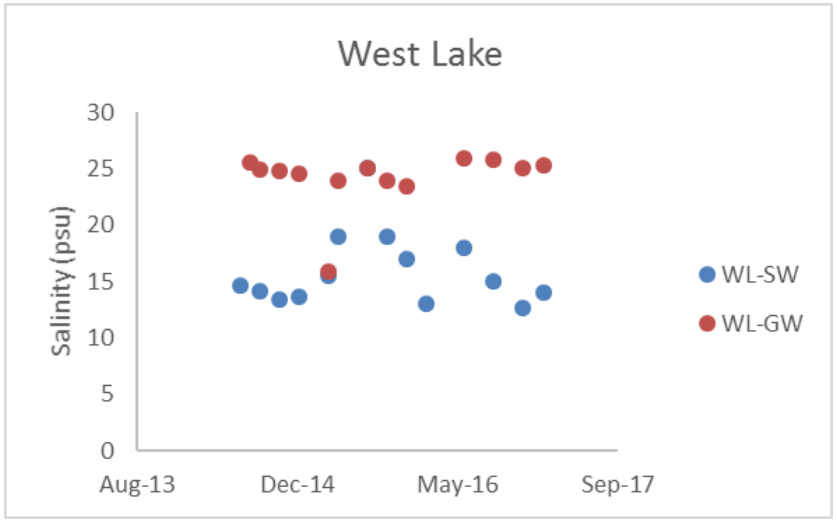


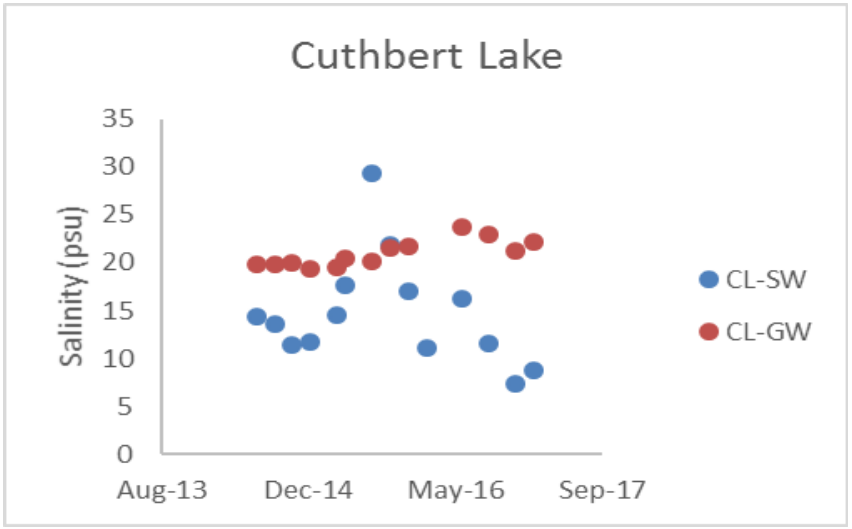


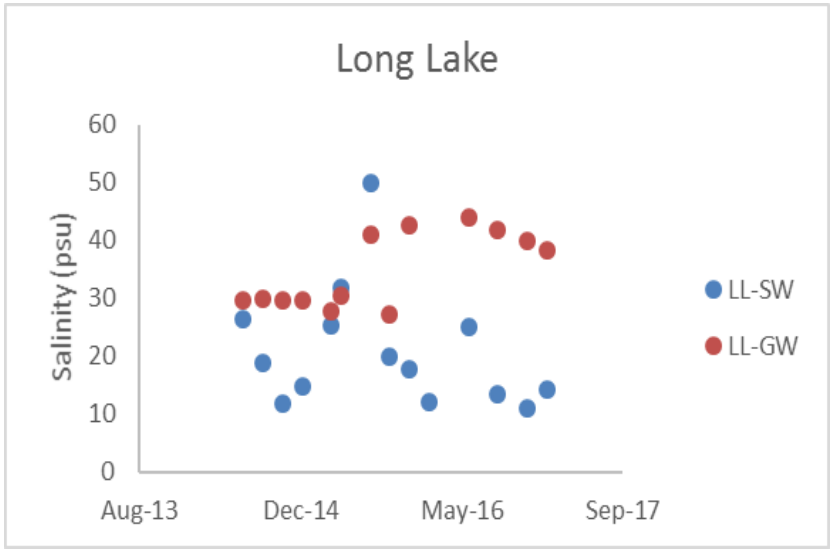


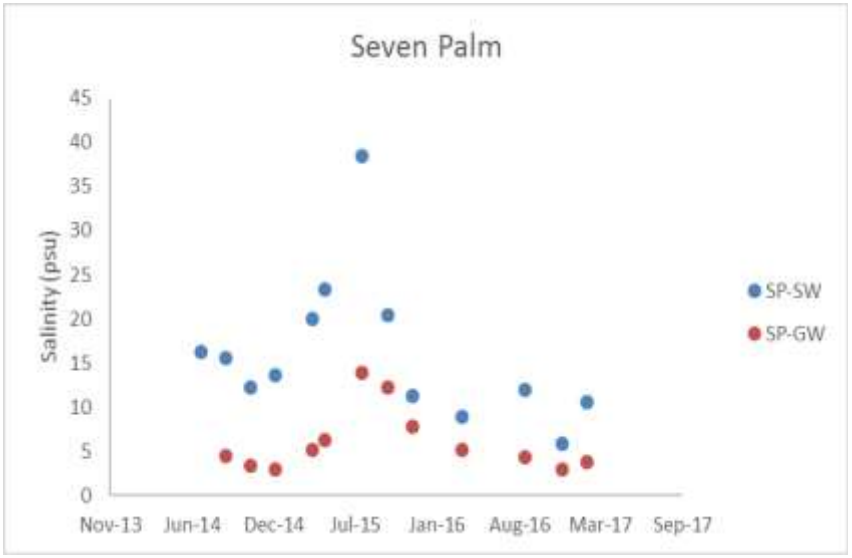


GW and SW Salinity









Conclusions

- GW DOES discharge to the mangrove lakes SW.
- GW discharge seems to be dominated by marine inputs from Florida Bay in the West Lake drainage and Taylor Slough (freshwater source) in Seven Palm Lake drainage.
- GW discharge is likely a source of P delivered to the West Lake region.

Questions?

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