# DRAFT

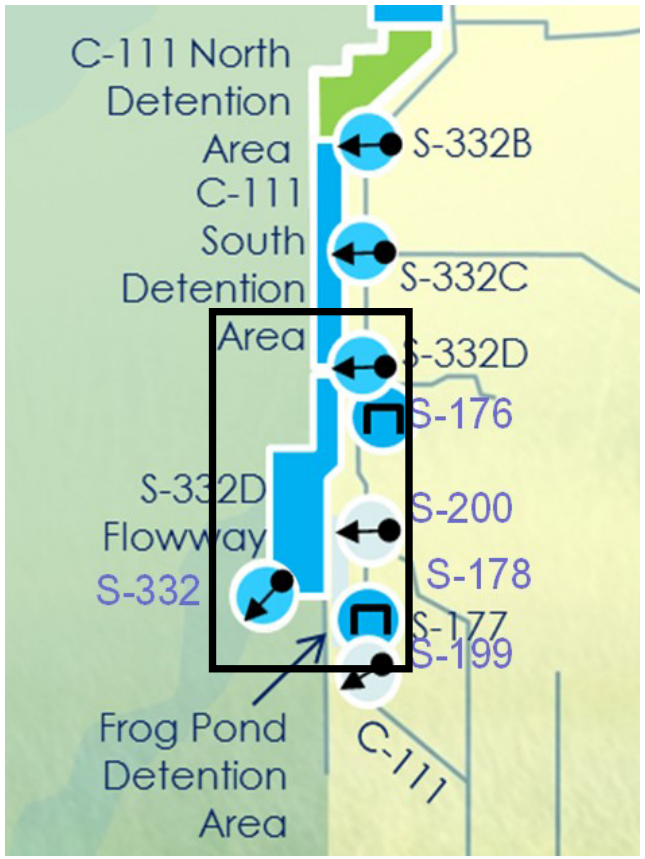
# Modeling Florida Bay Options

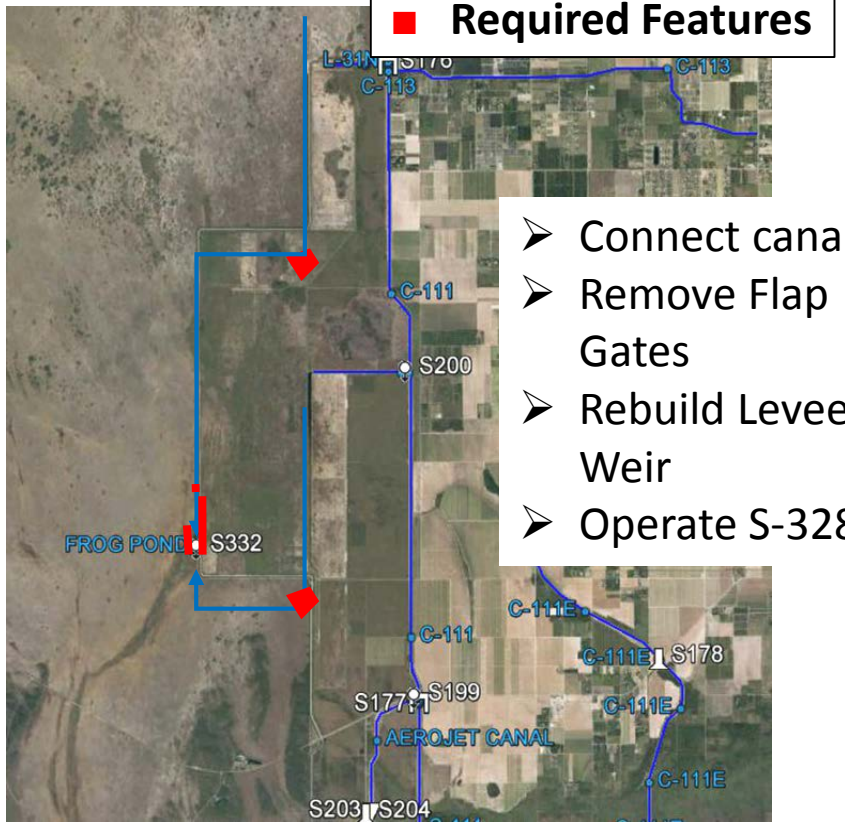
July 7, 2016

# Analysis Performed

- Building upon the positive trends demonstrated in the SFWMD South Dade Study and in response to observed high salinity conditions in Florida Bay, a series of modeling scenarios were performed to examine a range of potential infrastructure enhancements in the vicinity of the Taylor Slough headwaters and the L31W/Frog Pond areas (as shown in the next slide)
- Modeling assessment was performed using the Regional Simulation Model – Glades/LECSA (RSM-GL), an Implementation of the RSM specific to the Everglades and Lower East Coast Service Areas.
  - Previously applied for the CERP DECOMP and the Central Everglades Planning (CEPP) projects
  - Currently, is being used to support ModWaters and C-111 South Dade projects and the SFWMD South Dade Study efforts
  - A regional scale model and should be used for planning purposes
  - Able to capture current or proposed changes in southern system infrastructure and operations.
- Analysis was performed relative to scenarios developed as part of the SFWMD South Dade Study and the work encompasses a range of near-term and longer-term anticipated timeframes to ensure that proposed enhancements are robust across a range of conditions. Information on these starting point scenarios can be found at www.sfwmd.gov/miamidade.

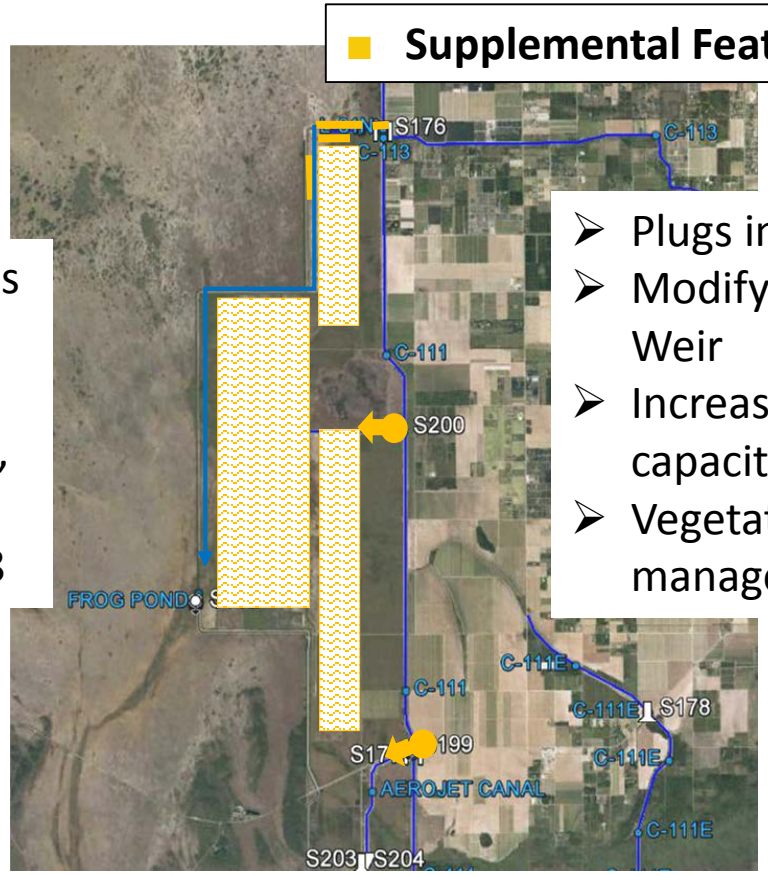
# Proposed Features to Move Water South to Florida Bay




- Connect canals
- Remove Flap Gates
- Rebuild Levee, Weir
- Operate S-328

# Supplemental Features to Move Water South to Florida Bay




- Plugs in L-31W
- Modify S-332D Weir
- Increase pump capacity
- Vegetation management

# RSM-GL Model Details

## Model Domain:

Everglades and Lower East Coast service areas
Domain size: 5,825 sq. miles

## Mesh Information:

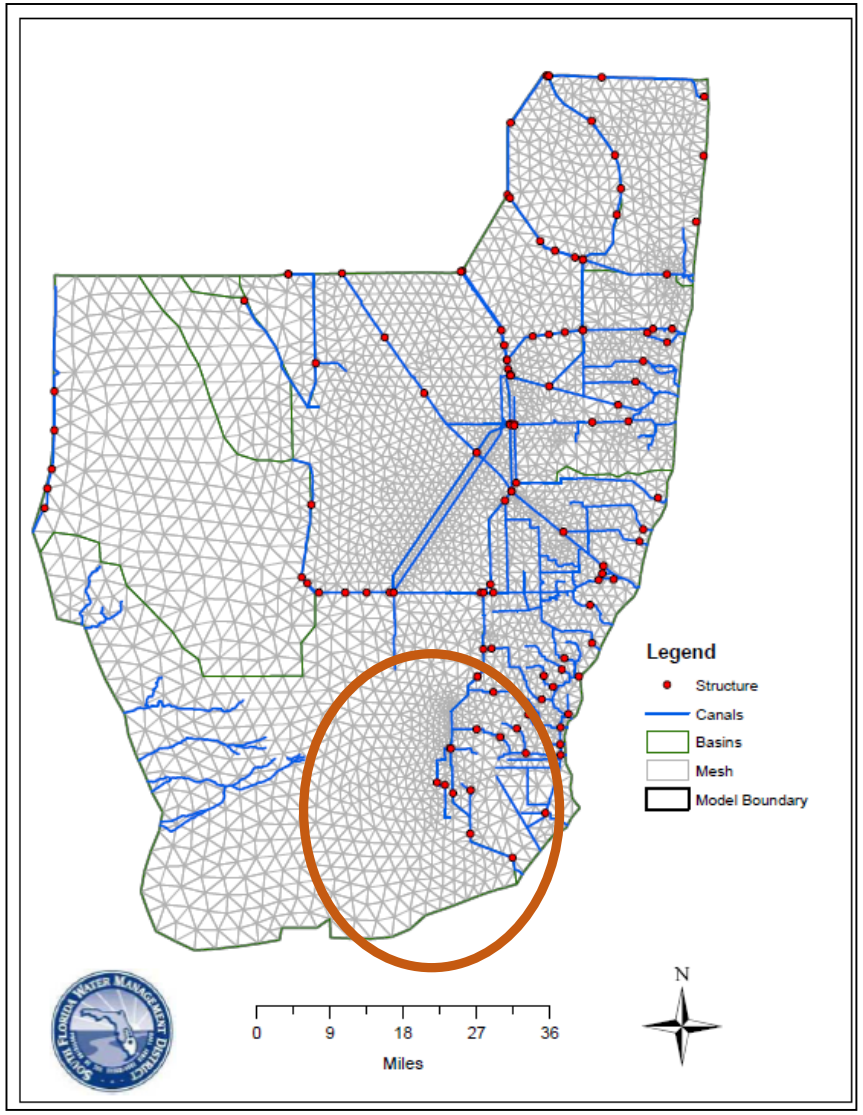
Finite element mesh
Number of cells: 5,794
Average size: ~ 1 sq. mile

## Canal Information:

Total length: ~ 1,000 miles
Number of segments: ~ 1,000
Average length: ~ 1 mile

## Run Time:

~ 1 day



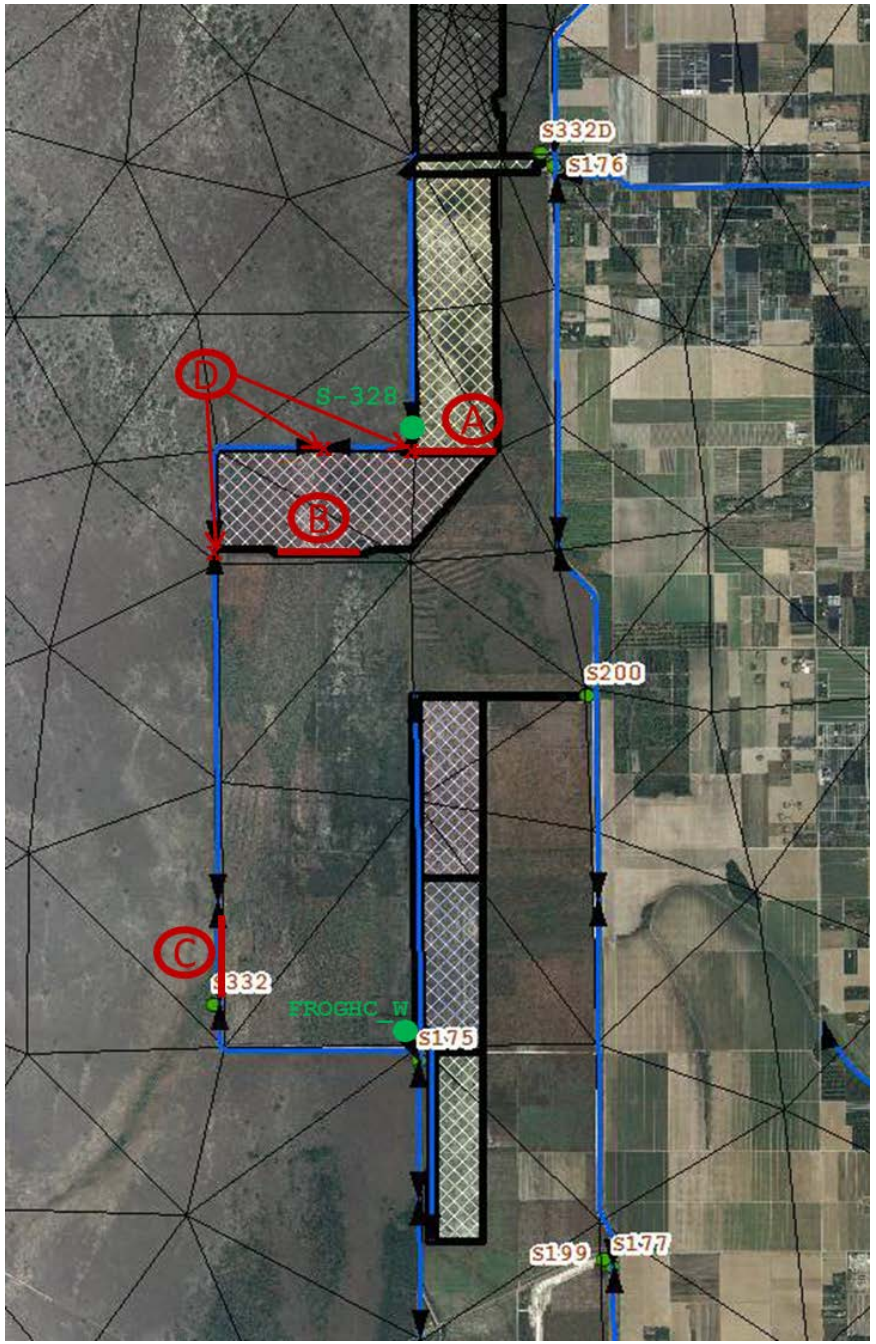

## RSMGL Model Products:

- Stage and Flow Hydrographs
- Stage and Flow Duration Curves
- Ponding Depths Maps
- Stage Maps
- Hydroperiod Maps
- Groundwater Flow Vector Maps
- Overland Flow Vector Maps
- Transect Flows
- Basin Water Budgets

# Near–Term (Increment 1) Analysis

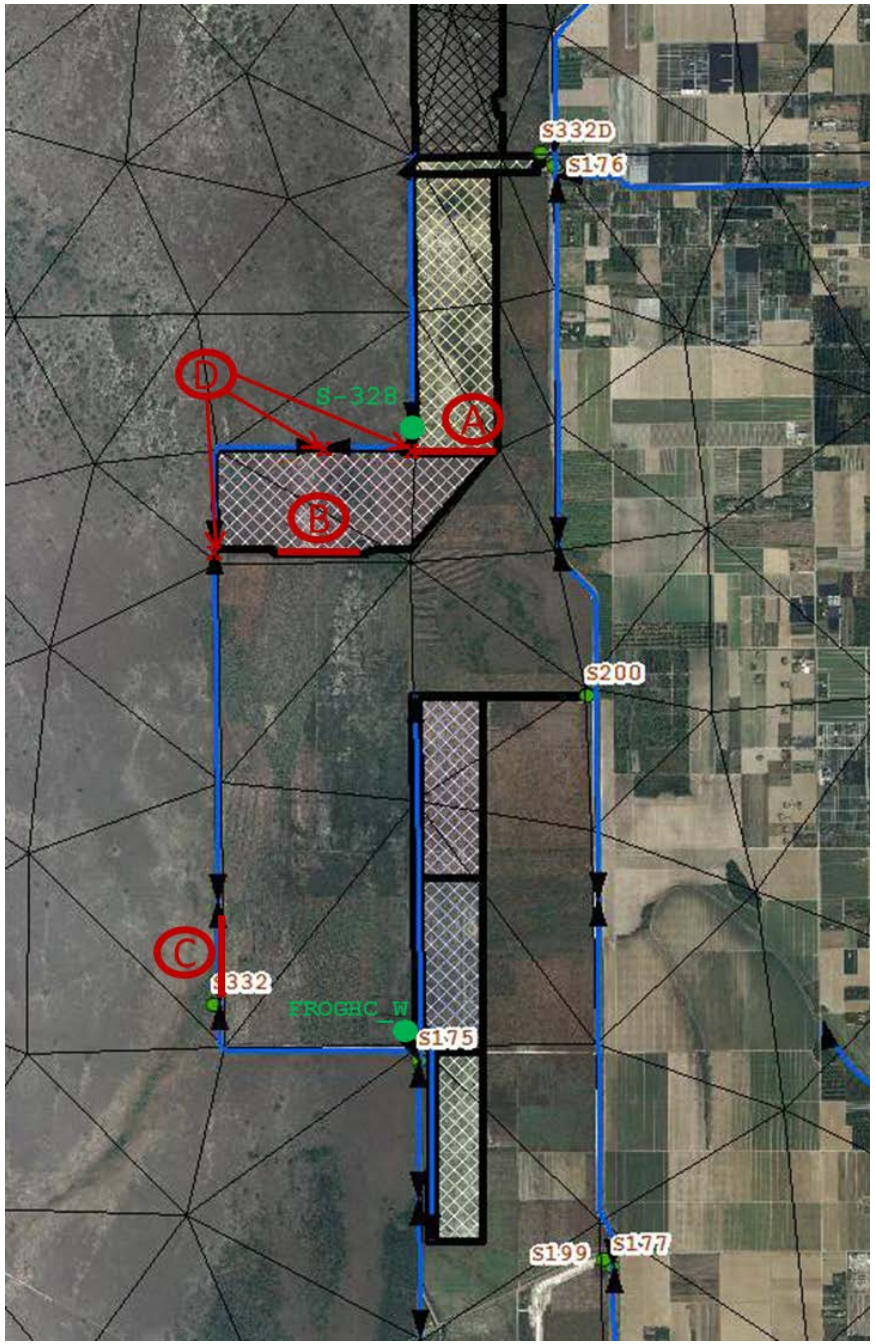
# South Dade Investigation Starting Point: Step 1A3 Assumptions

- Increment 1 operations (L-29 max stage at 7.5 ft + No Contract 8 or 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Infrastructure improvement to promote flows toward Taylor Slough
  - Use existing S-328 to push flows to L-31W canal from 332D reservoir
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - No plugs at L-31W (shown as D) - use L-31W as the fastest route to send water to Taylor Slough)
  - Add a berm at the L31W gap (shown as C) to prevent eastward flows
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



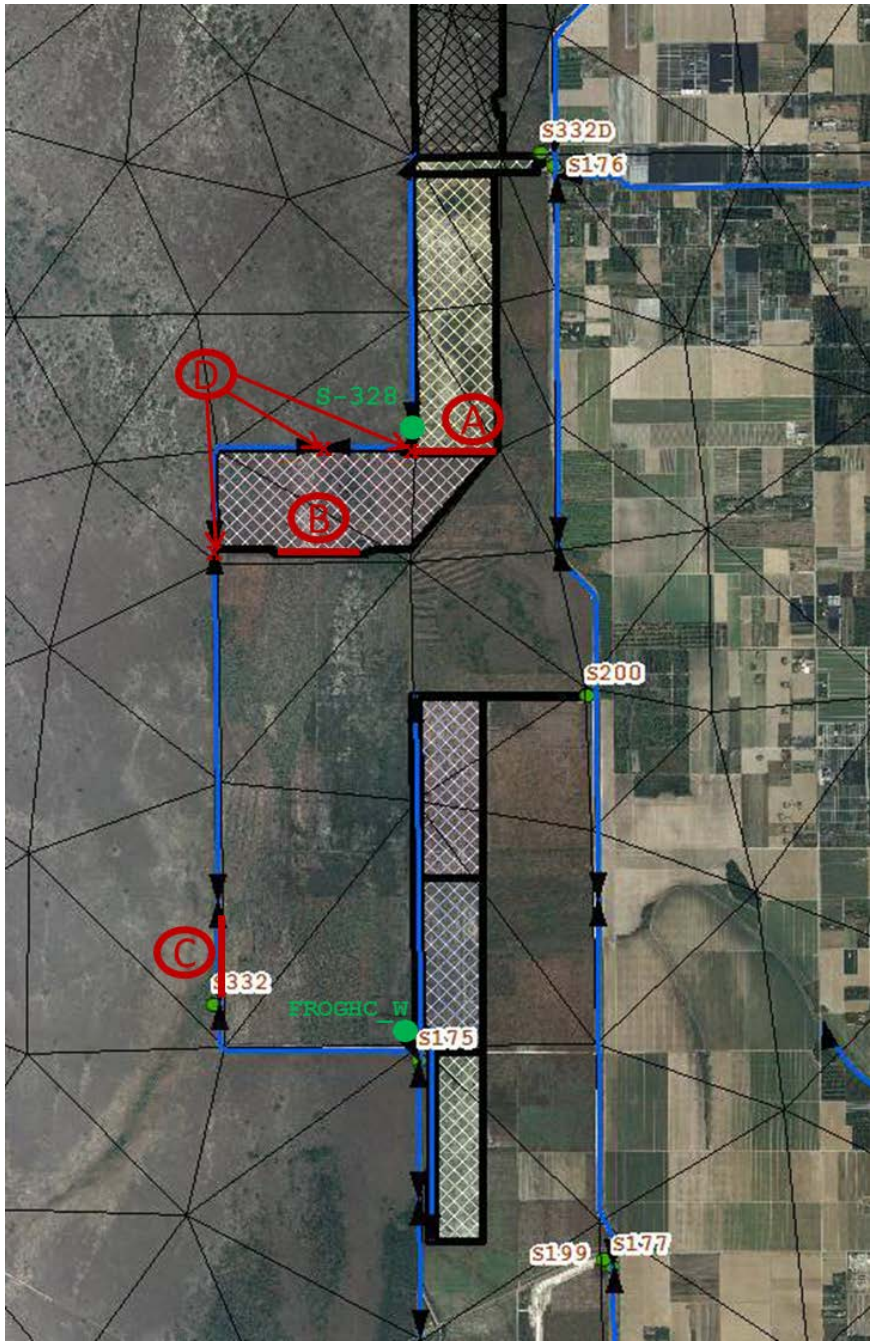
# Step 1A4 Assumptions

- Increment 1 operations (L-29 max stage raised to 7.5 ft + No Contract 8 or 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - Use existing S-328 to push flows to L-31W canal from 332D reservoir
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - No plugs at L-31W (shown as D) - use L-31W as the fastest route to send water to Taylor Slough)
  - 1’ above grade Weir at the L31W gap (shown as C)
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



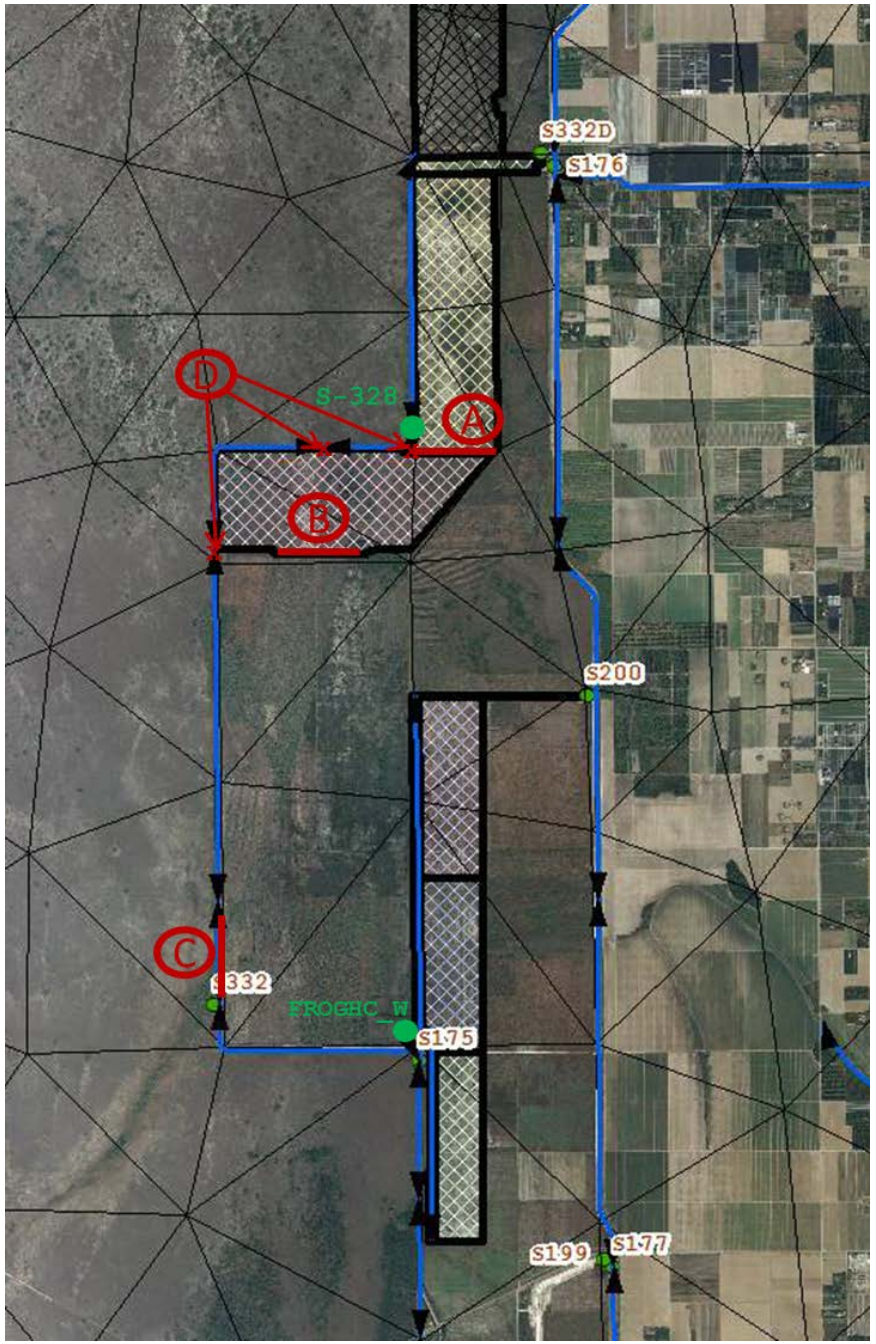
# Step 1A5 Assumptions

- Increment 1 operations (L-29 max stage at 7.5 ft + No Contract 8 or 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - S328 turned off
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - No plugs at L-31W (shown as D) - use L-31W as the fastest route to send water to Taylor Slough)
  - 1’ above grade Weir at the L31W gap (shown as C)
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



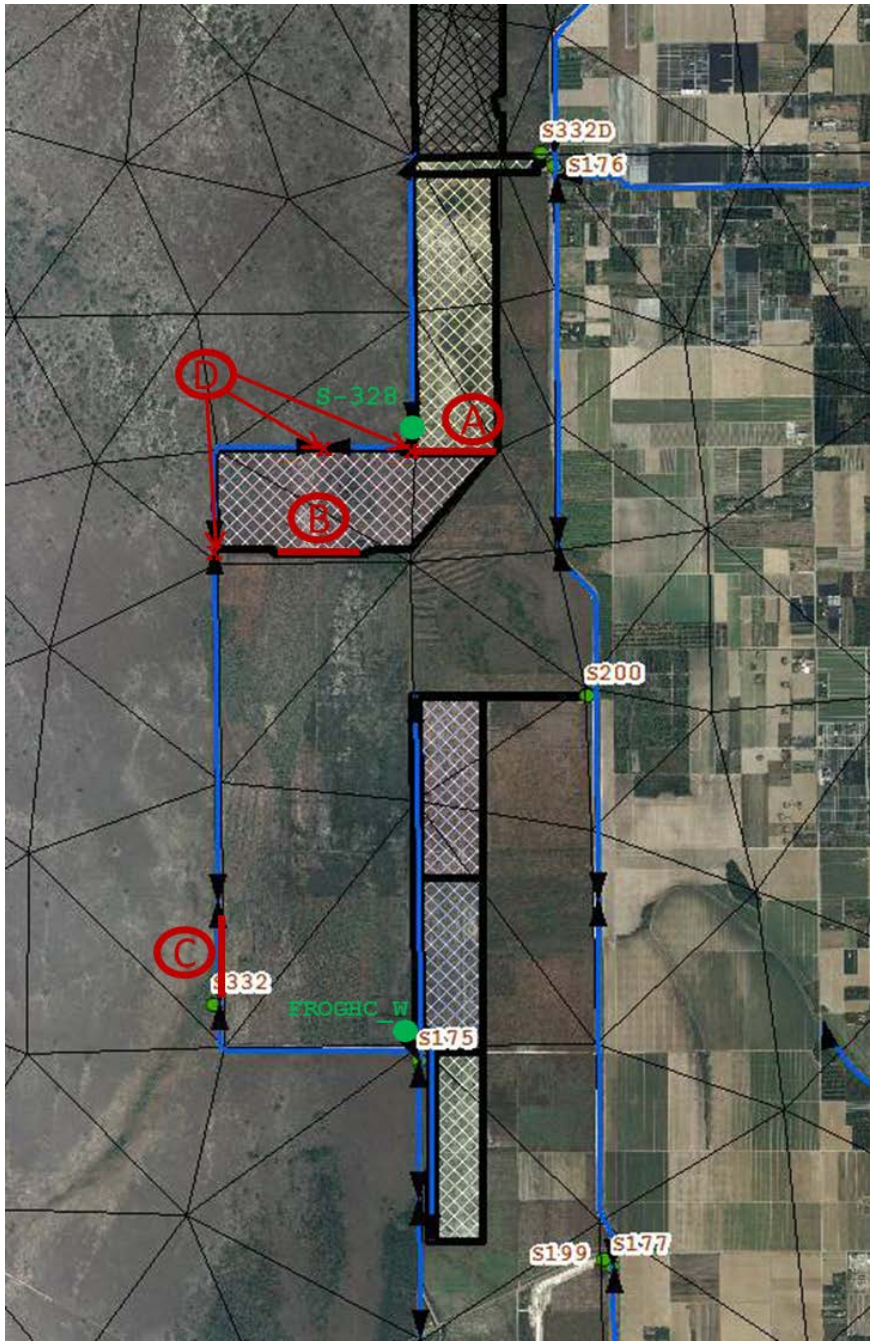
# Step 1A6 Assumptions

- Increment 1 operations (L-29 max stage at 7.5 ft + No Contract 8 or 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - S328 turned off
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - Plugs at L-31W  (shown as D)
  - 1’ above grade Weir at the L31W gap (shown as C)
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.

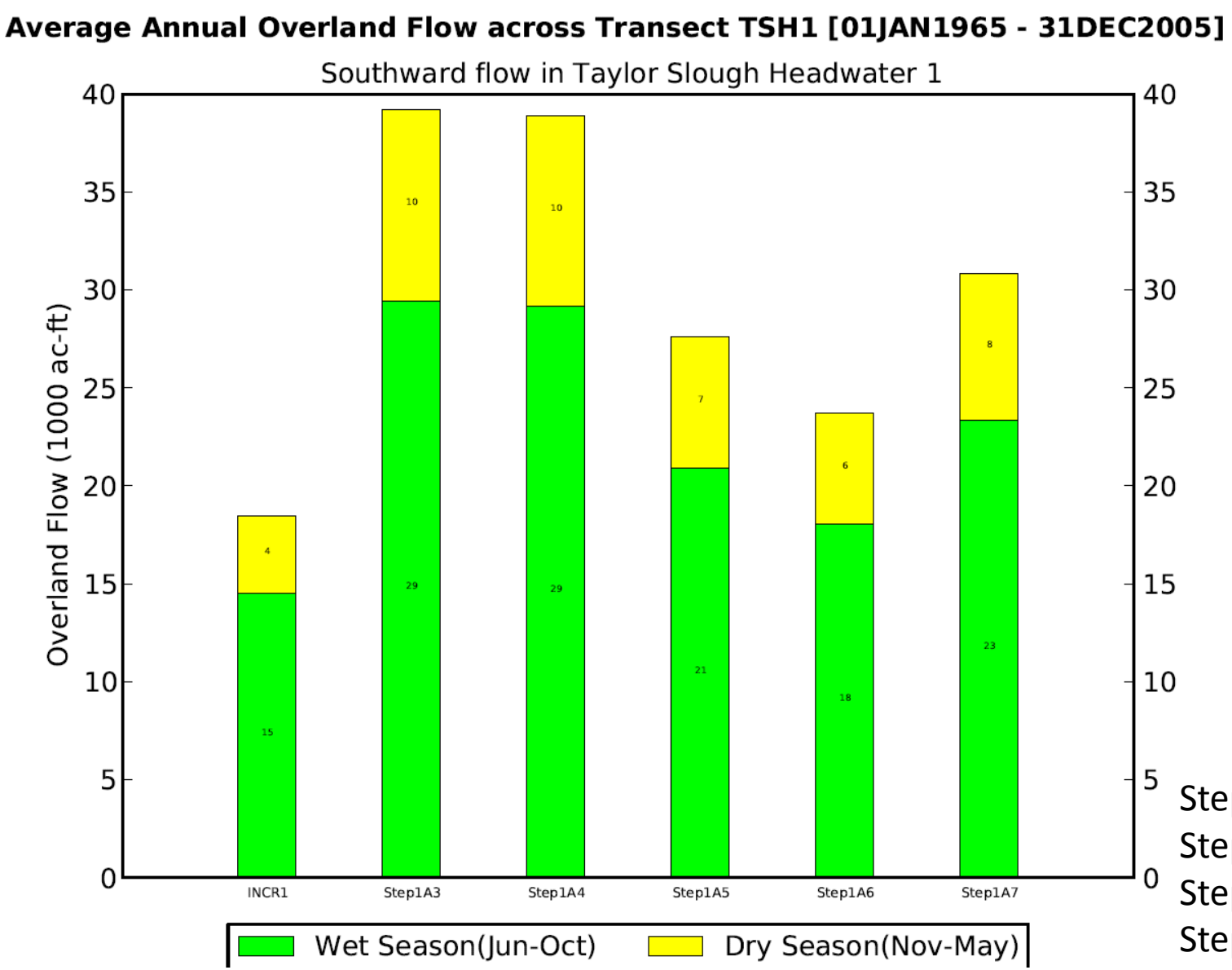


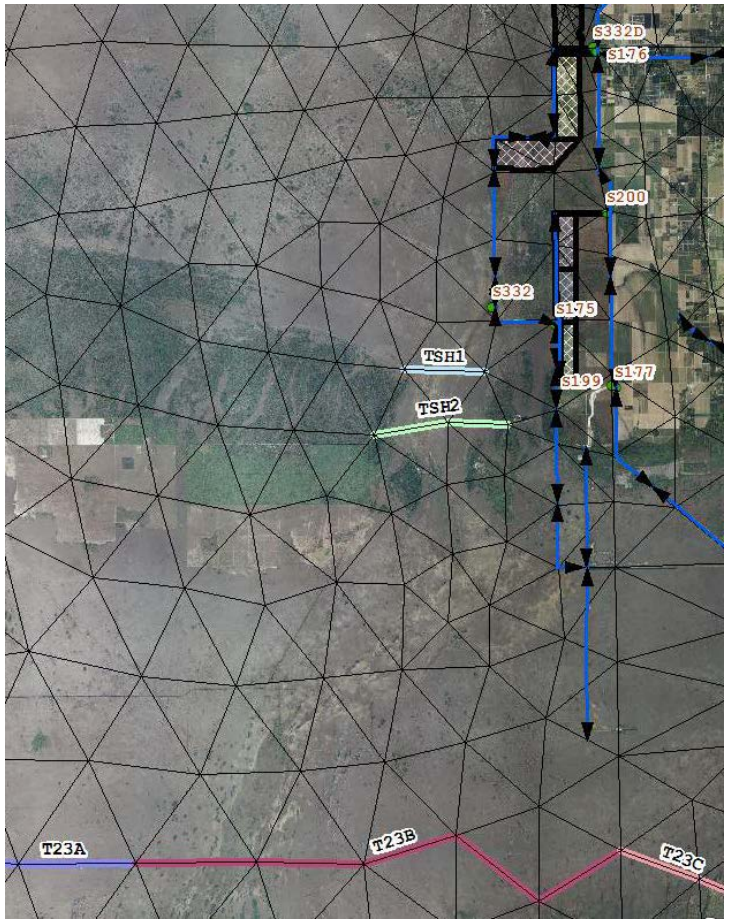
# Step 1A7 Assumptions

- Increment 1 operations (L-29 max stage at 7.5 ft + No Contract 8 or 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - Use existing S-328 to push flows to L-31W canal from  332D reservoir
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - Plugs at L-31W  (shown as D)
  - 1’ above grade Weir at the L31W gap (shown as C)
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



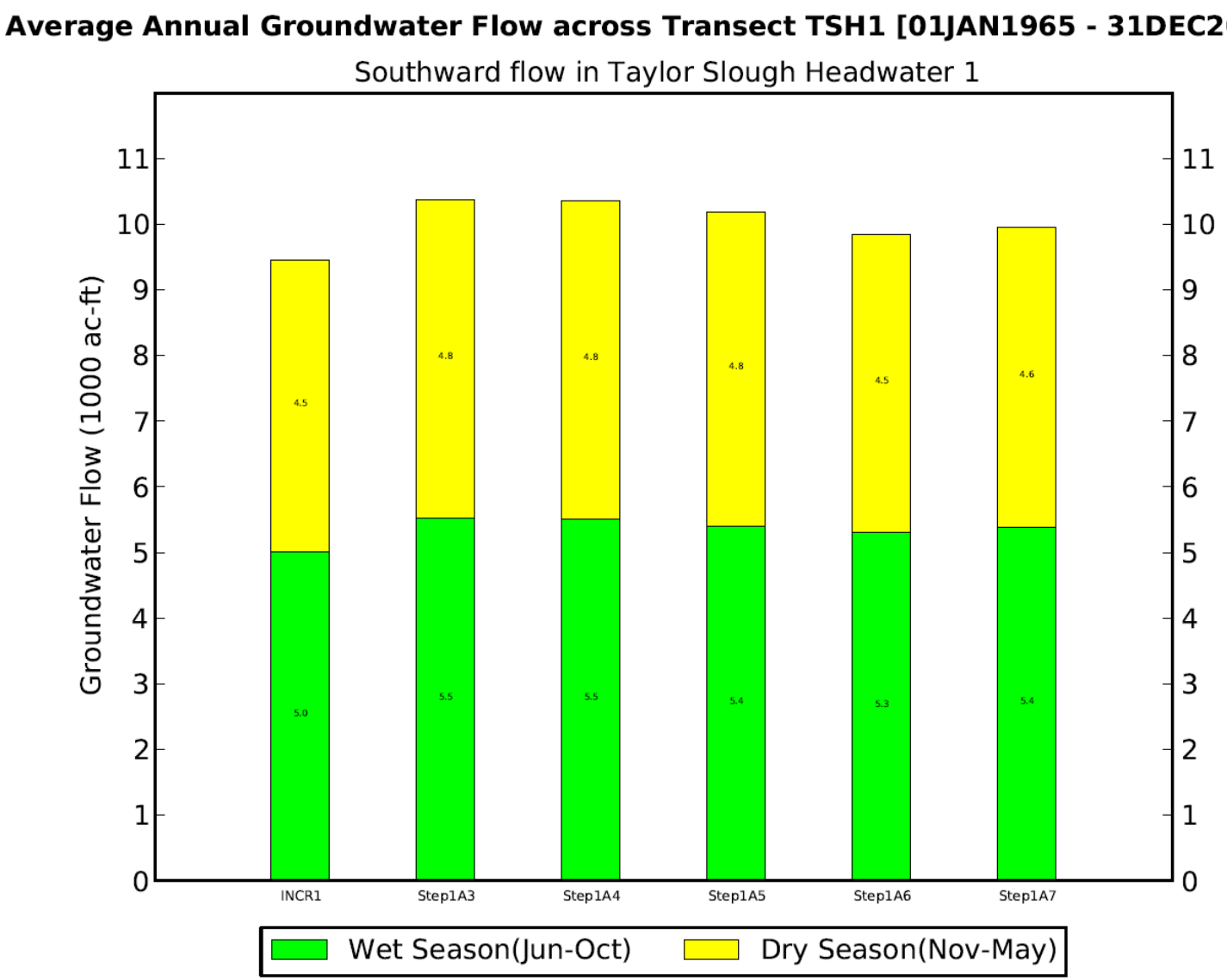
# Overland Transect Flows at Taylor Slough Headwater (TSH1)

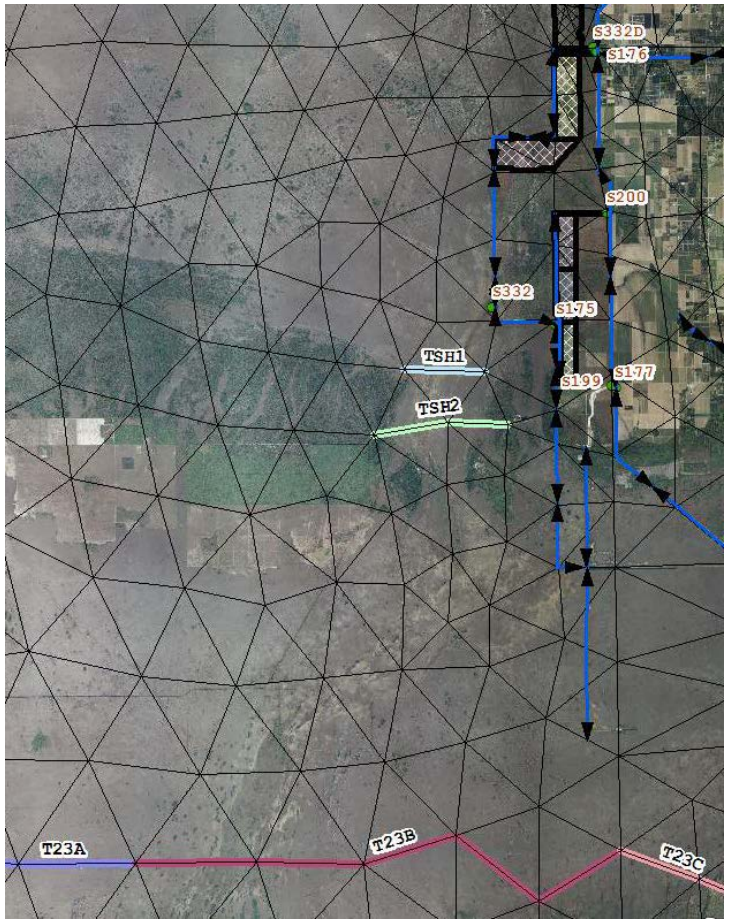



Step1A4 = no plugs at L31W + S328 turned on
Step1A5 = no plugs at L31W + S328 turned off
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

# Groundwater Transect Flows at Taylor Slough Headwater (TSH1)




Step1A4 = no plugs at L31W + S328 turned on
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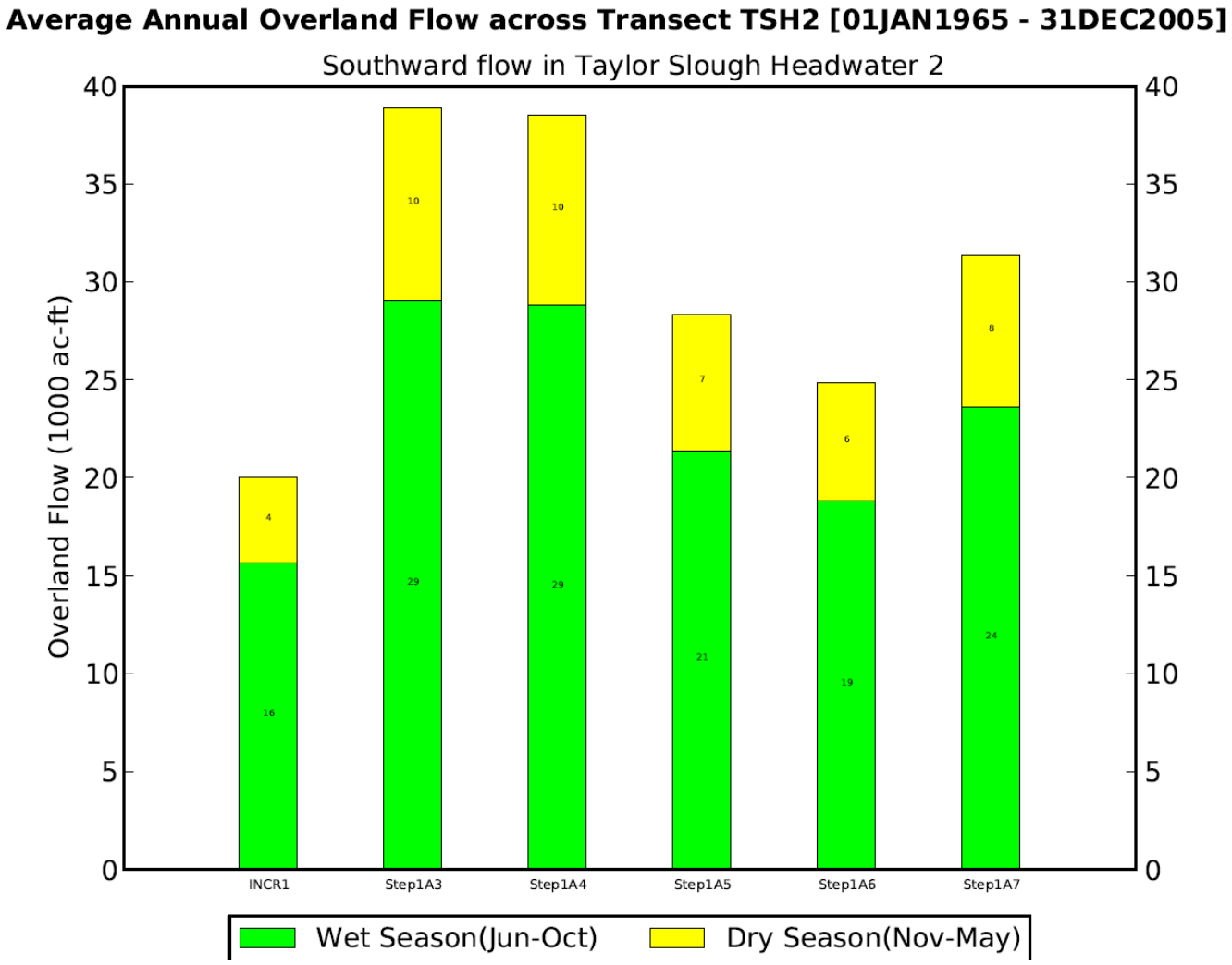
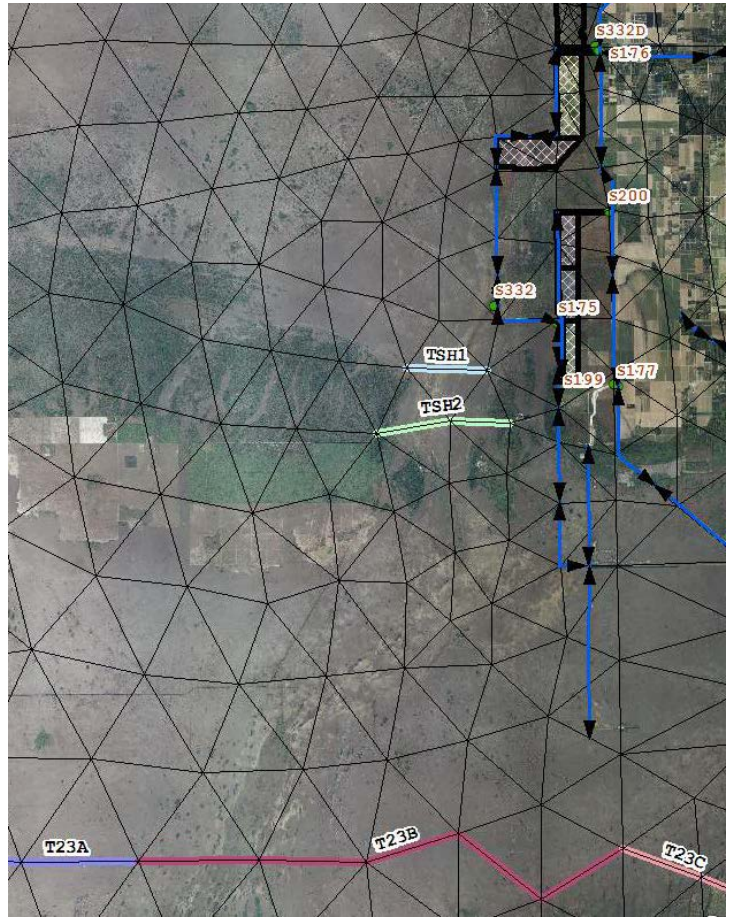
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

# Overland Transect Flows south of Taylor Slough Headwater (TSH2)

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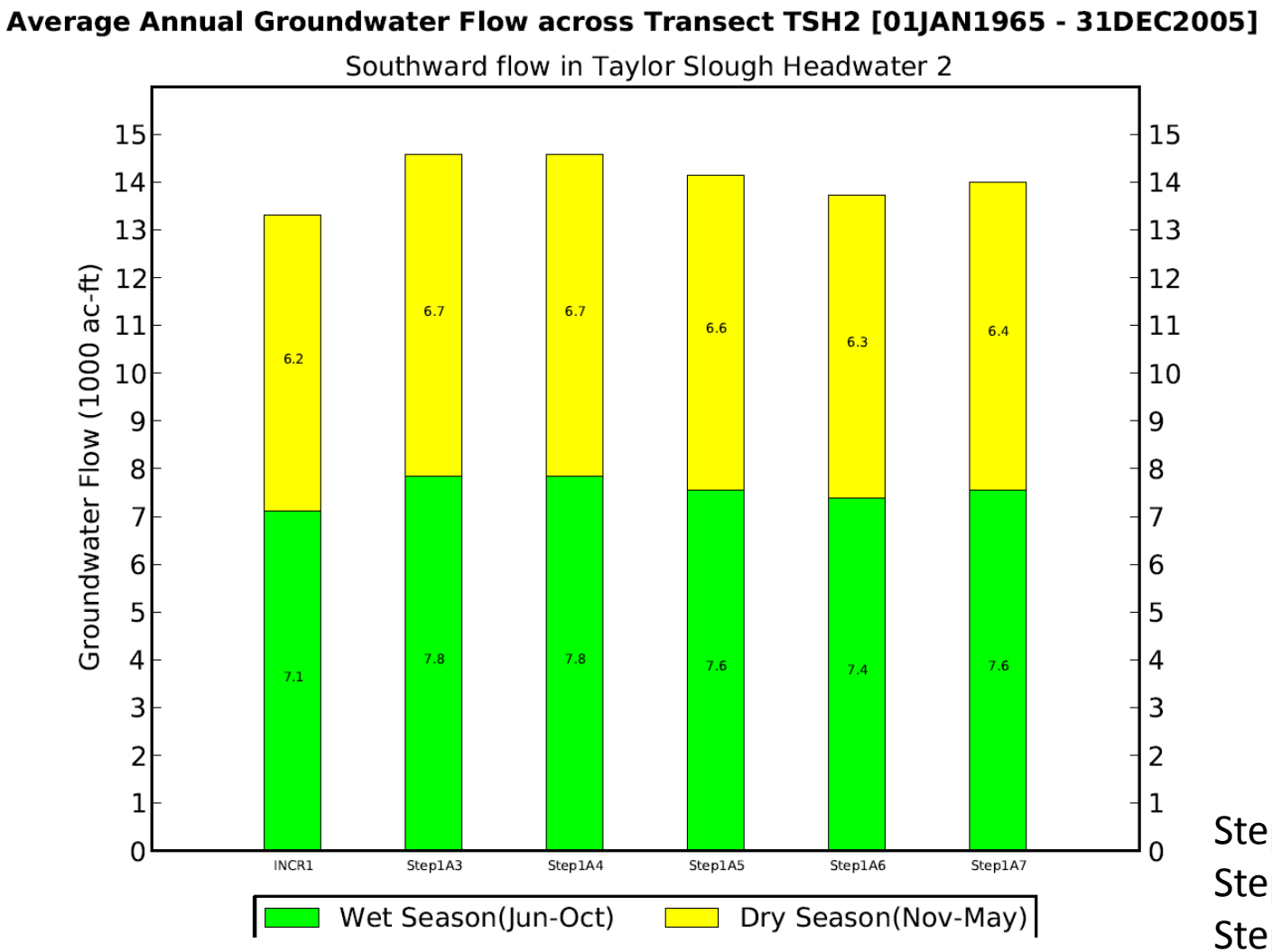
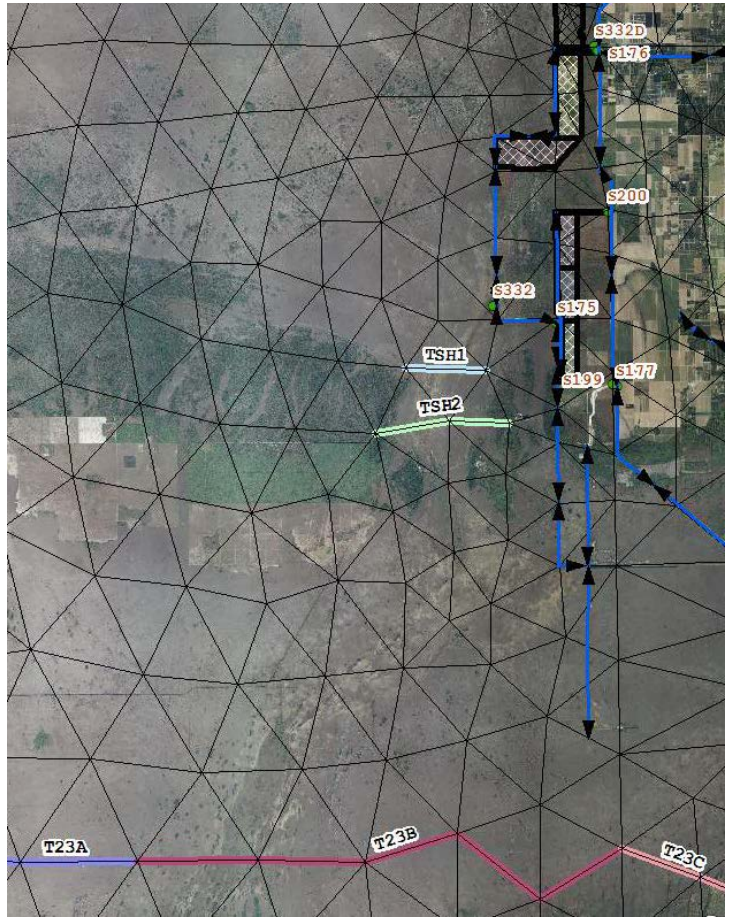
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

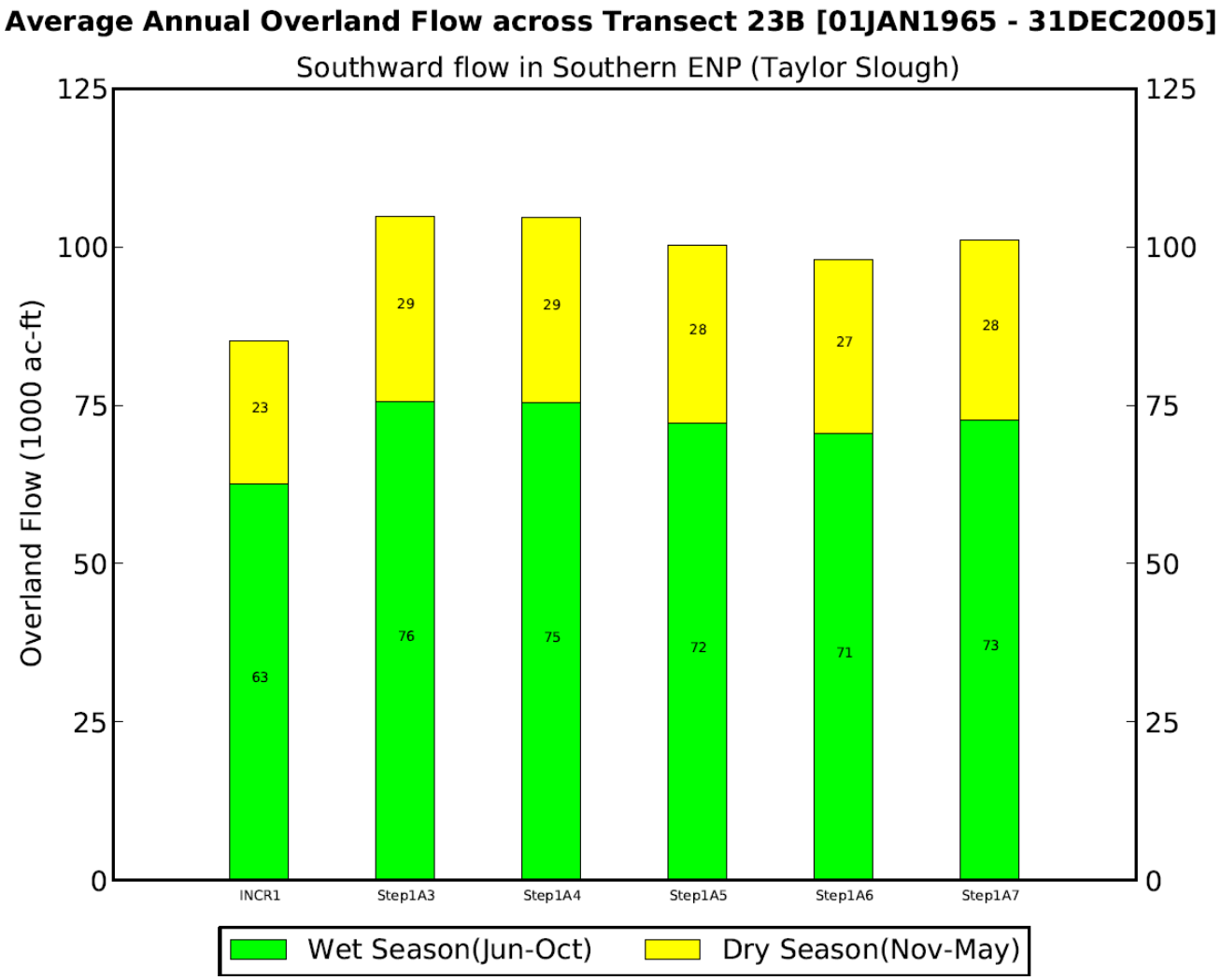
# Groundwater Transect Flows south of Taylor Slough Headwater (TSH2)

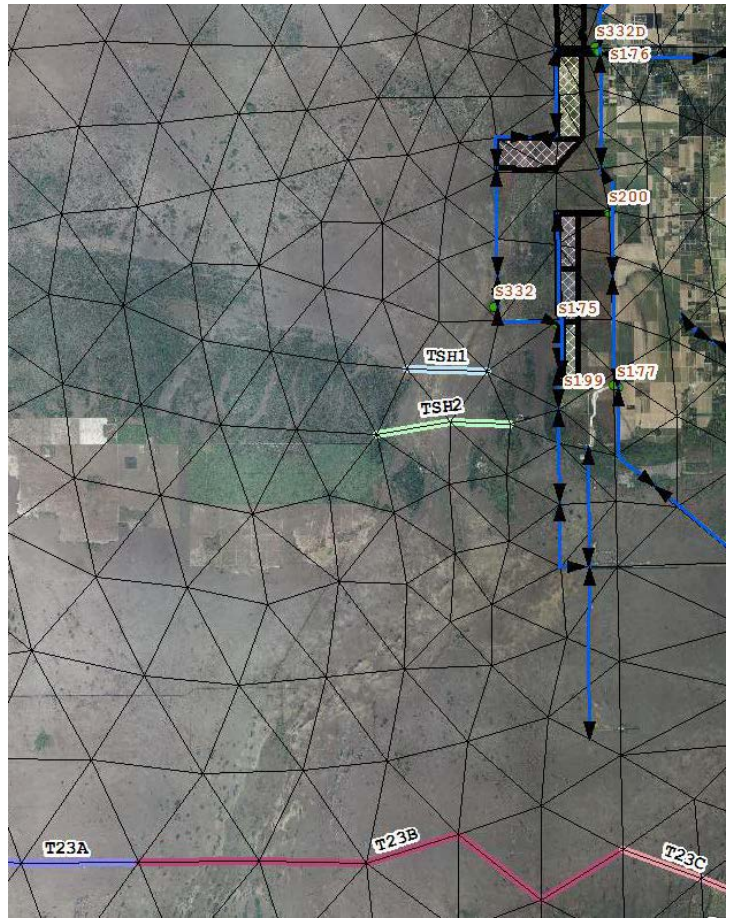



Step1A4 = no plugs at L31W + S328 turned on
Step1A5 = no plugs at L31W + S328 turned off
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

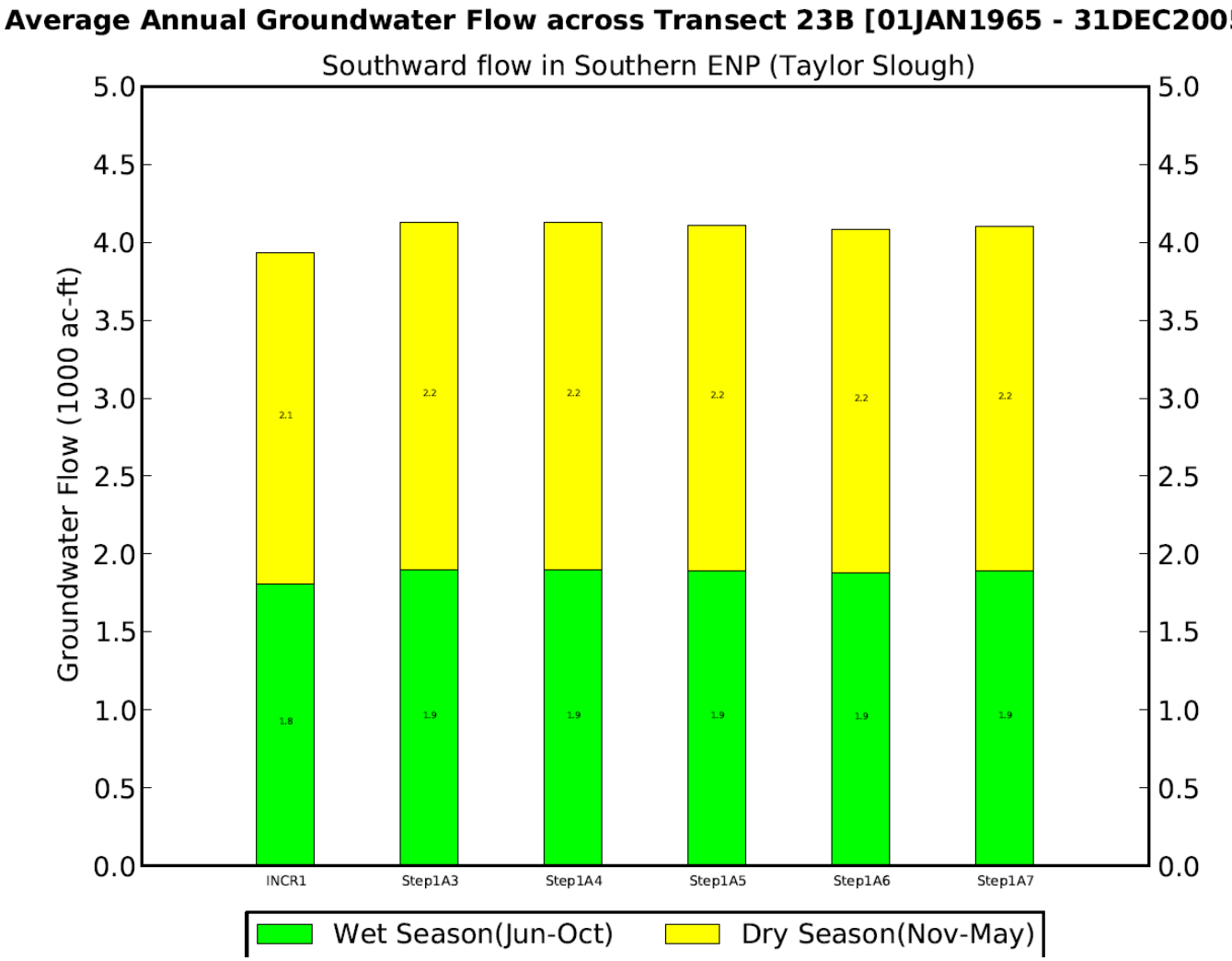
# Overland Transect Flows in Taylor Slough (T23B)

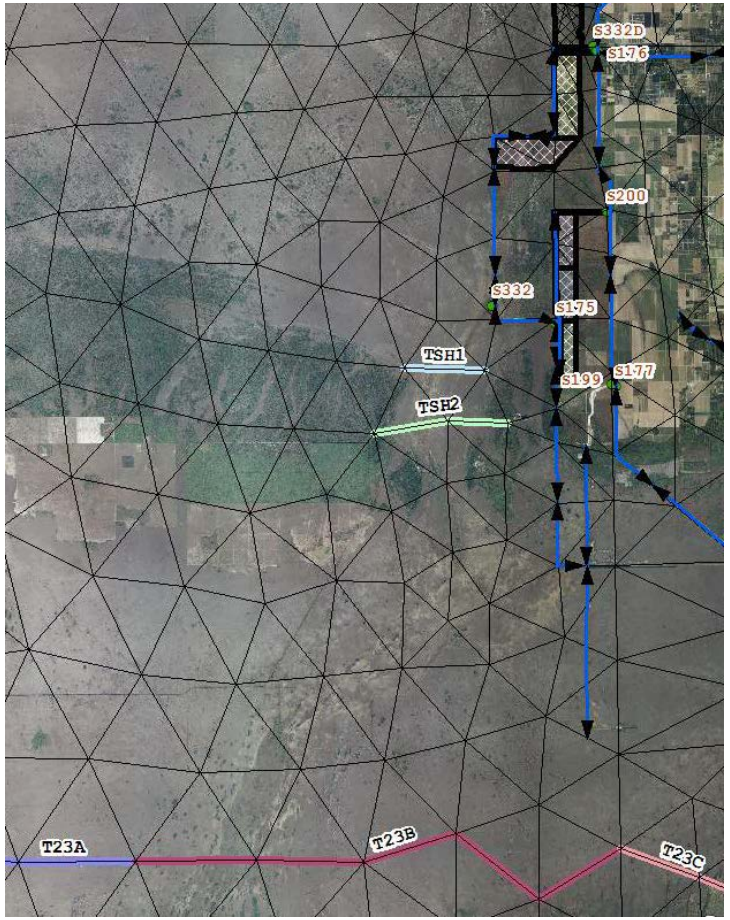



Step1A4 = no plugs at L31W + S328 turned on
Step1A5 = no plugs at L31W + S328 turned off
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

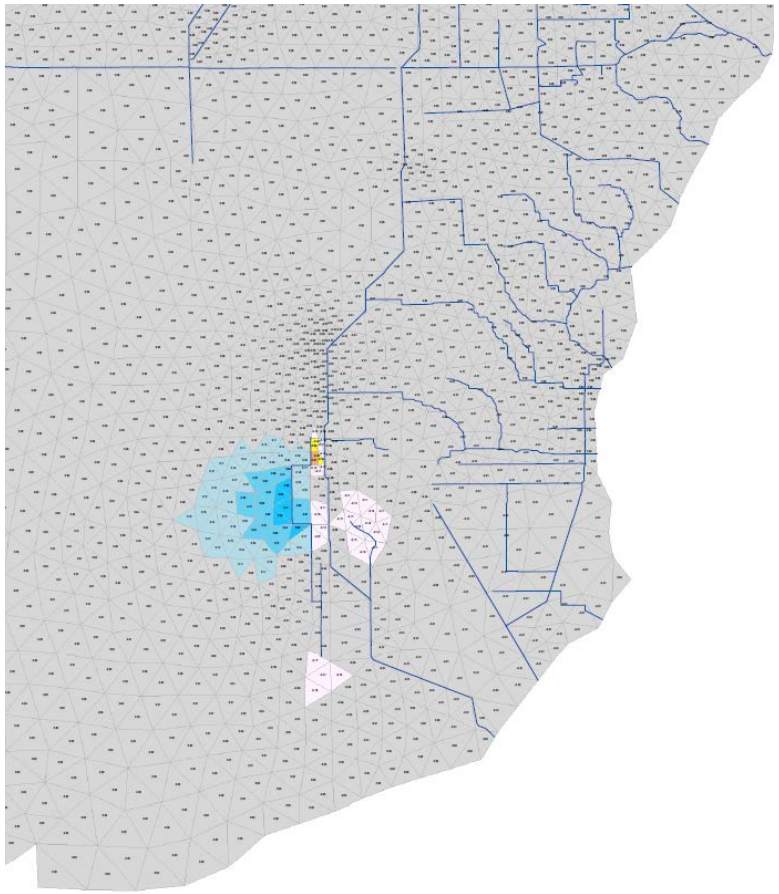
# Southward Groundwater Transect Flows in Taylor Slough (T23B)



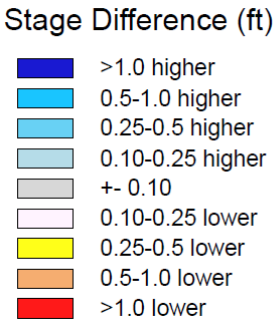



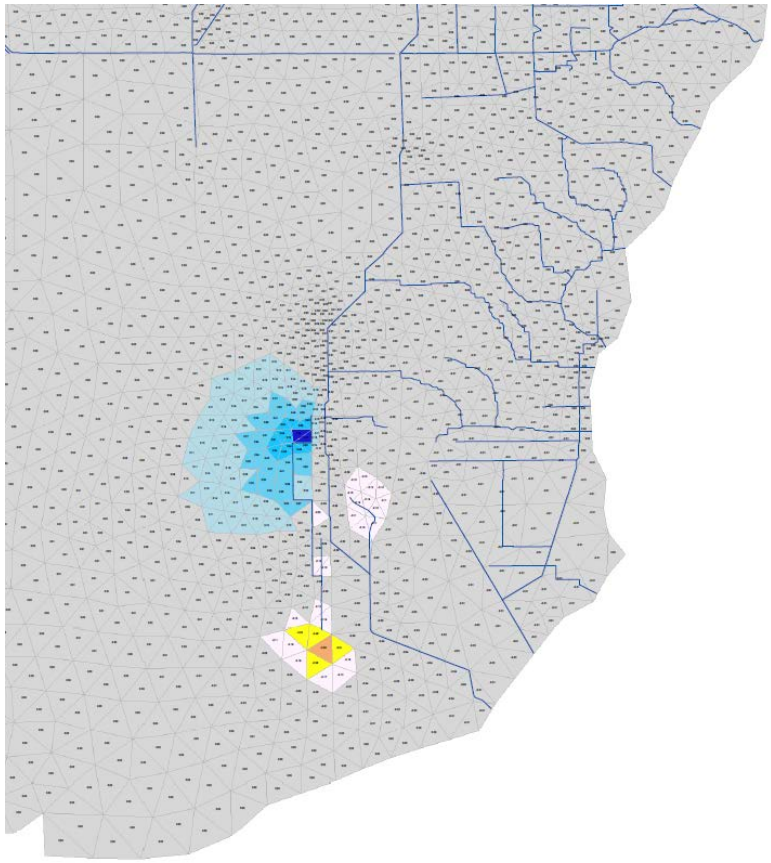

Step1A4 = no plugs at L31W + S328 turned on
Step1A5 = no plugs at L31W + S328 turned off
Step1A6 = plugs at L31W + S328 turned off
Step1A7 = plugs at L31W + S328 turned on

# Monthly Diff Maps (April, 1993): S328 turned on



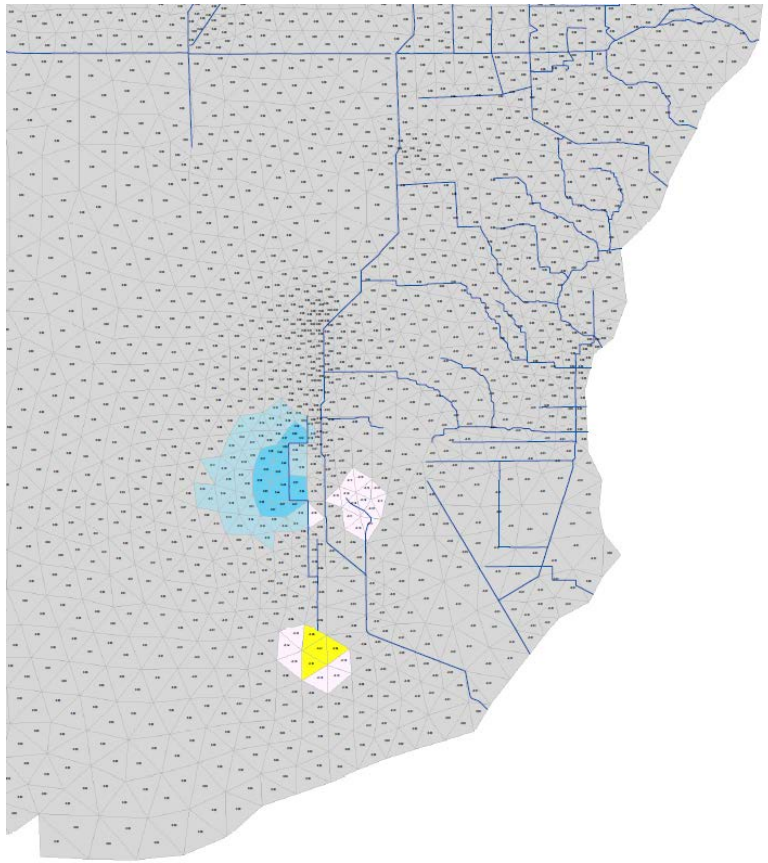
Step1A4: Without L31W plugs



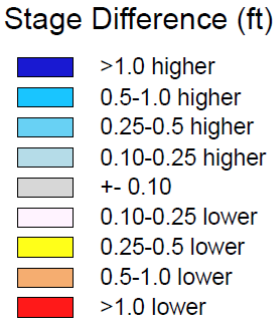



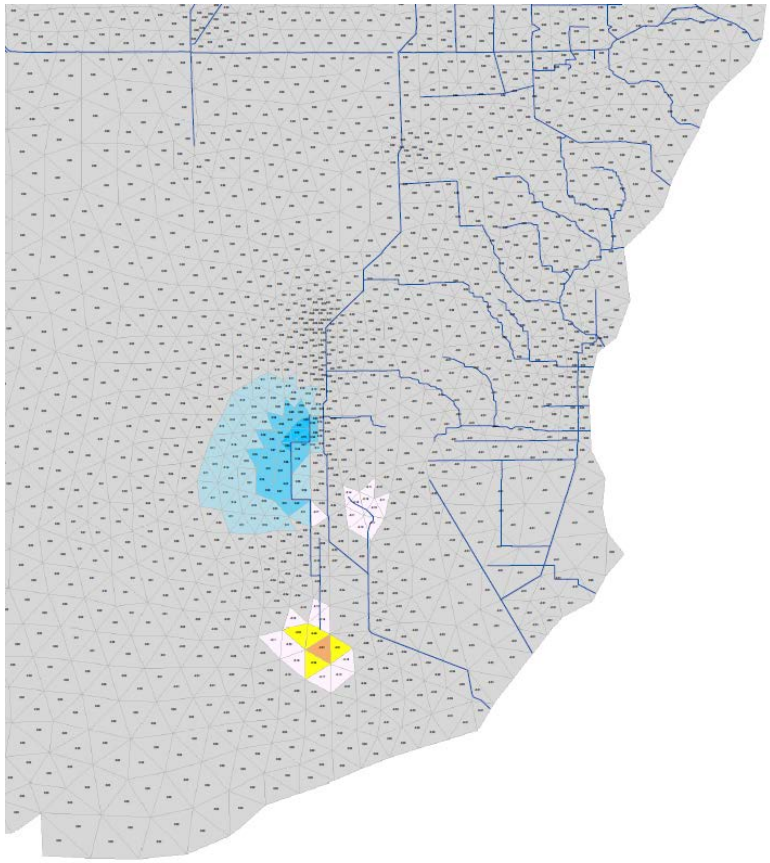
Step1A7 :With L31W plugs

# Monthly Diff Maps (April, 1993): S328 turned off



Step1A5: Without L31W plugs



Step1A6: With L31W plugs

# Average Annual Comparison of Flows (K-AC-FT/yr)

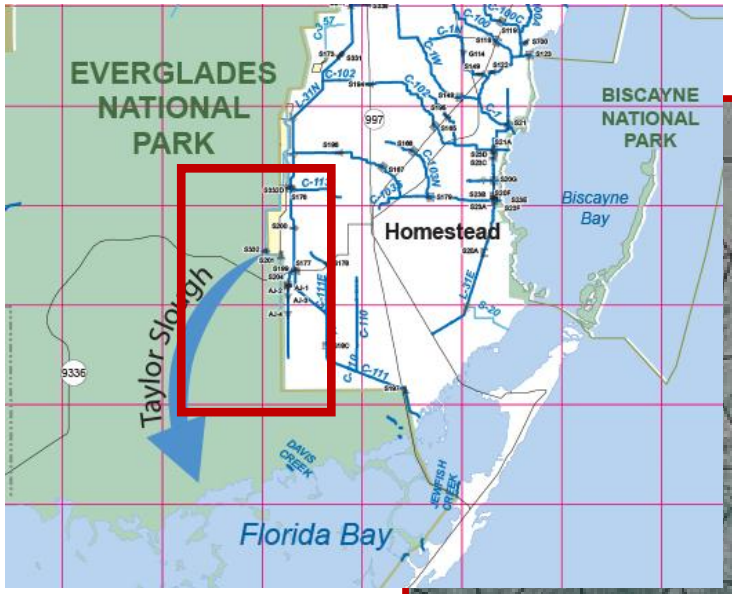
| | Incr1 | Step1A3 | Step1A4 | Step1A5 | Step1A6 | Step1A7 |
|---|---|---|---|---|---|---|
| S332D | 104.5 | 118.8 | 118.8 | 120.0 | 121.0 | 120.6 |
| Berm south of 332D North reservoir | 10.2 | 0.0 | 0.0 | 15.6 | 19.5 | 0.0 |
| Weir south of 332D South reservoir | 1.6 | 0.0 | 0.0 | 2.7 | 6.4 | 0.0 |
| S-328 | N/A | 54.9 | 55.0 | 0.0 | 0.0 | 42.4 |
| S332 Gap | -5.1 | 0.0 | -1.2 | -0.2 | 0.0 | -0.5 |
| | | | | | | |
| Connection from Frog Pond Header Canal to L-31W | N/A | 22.7 | 22.7 | 29.6 | 33.8 | 29.1 |
| | | | | | | |
| TSH1_GW | 9.5 | 10.4 | 10.4 | 10.2 | 9.8 | 10.0 |
| TSH1_OL | 18.5 | 39.2 | 38.9 | 27.6 | 23.7 | 30.8 |
| TSH1_TOT | 27.9 | 49.6 | 49.3 | 37.8 | 33.6 | 40.8 |
| | | | | | | |
| TSH2_GW | 13.3 | 14.6 | 14.6 | 14.1 | 13.7 | 14.0 |
| TSH2_OL | 20.0 | 38.9 | 38.6 | 28.3 | 24.9 | 31.4 |
| TSH2_TOT | 33.3 | 53.4 | 53.1 | 42.5 | 38.6 | 45.4 |

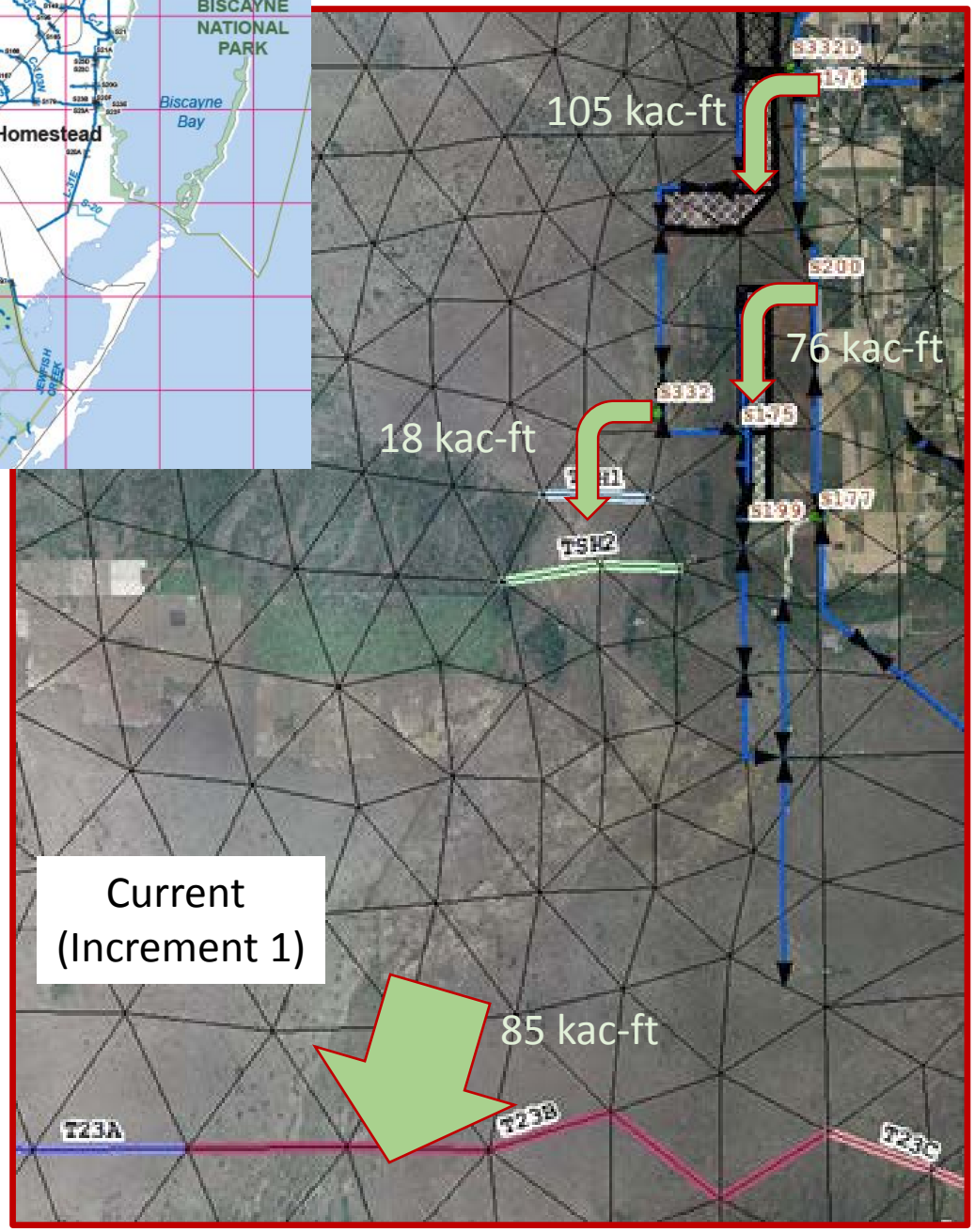
# Increased Flows to Taylor Slough

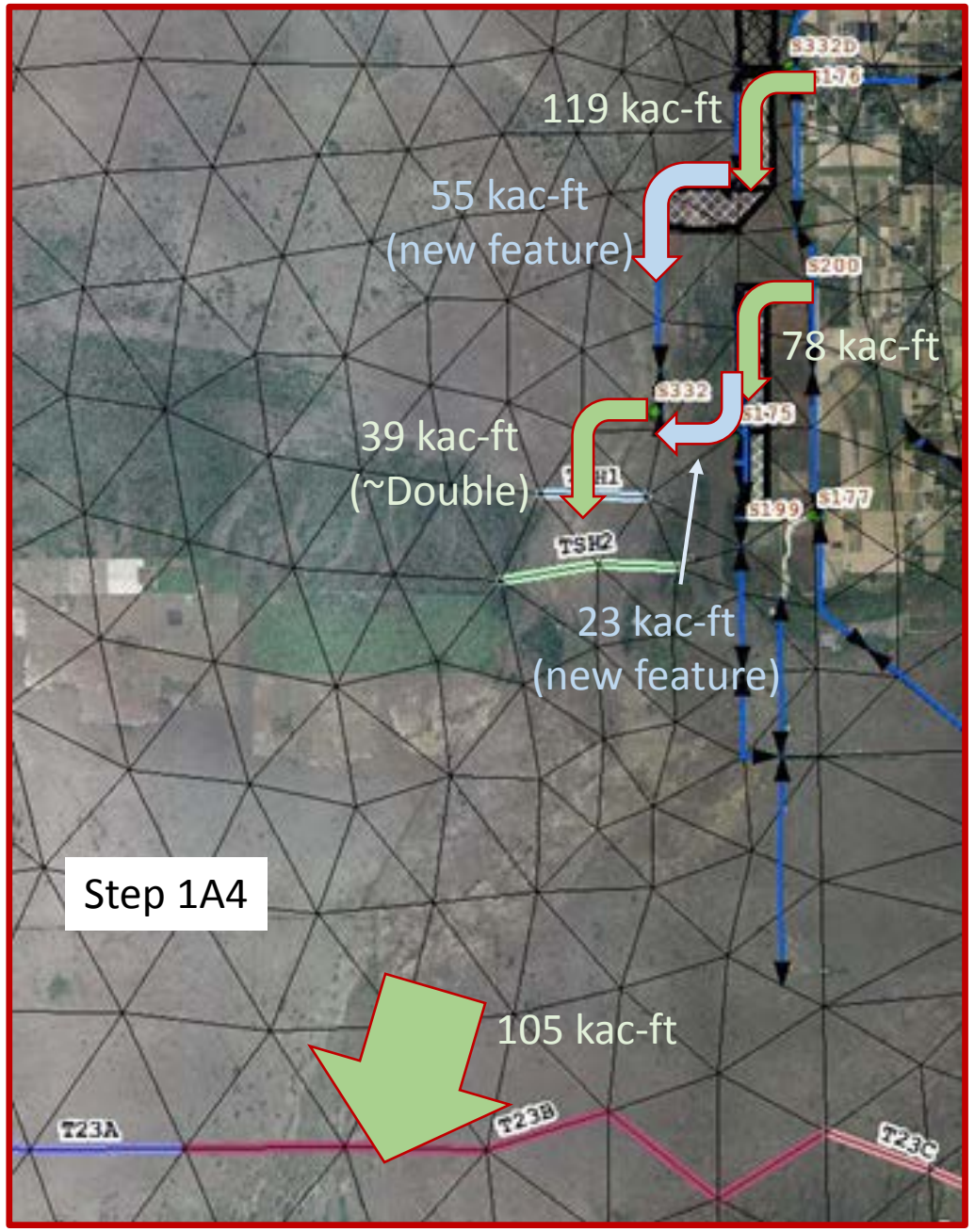
| Transects | Incr1 | Step1A4 | % increase in Step1A4 |
|---|---|---|---|
| TSH1_GW | 9.5 | 10.4 | 9.5% |
| TSH1_OL | 18.5 | 38.9 | 110.5% |
| TSH1_TOT | 27.9 | 49.3 | 76.3% |
| | | | |
| TSH2_GW | 13.3 | 14.6 | 9.6% |
| TSH2_OL | 20.0 | 38.6 | 92.7% |
| TSH2_TOT | 33.3 | 53.1 | 59.5% |

Flow volumes are Average Annual in kac-ft

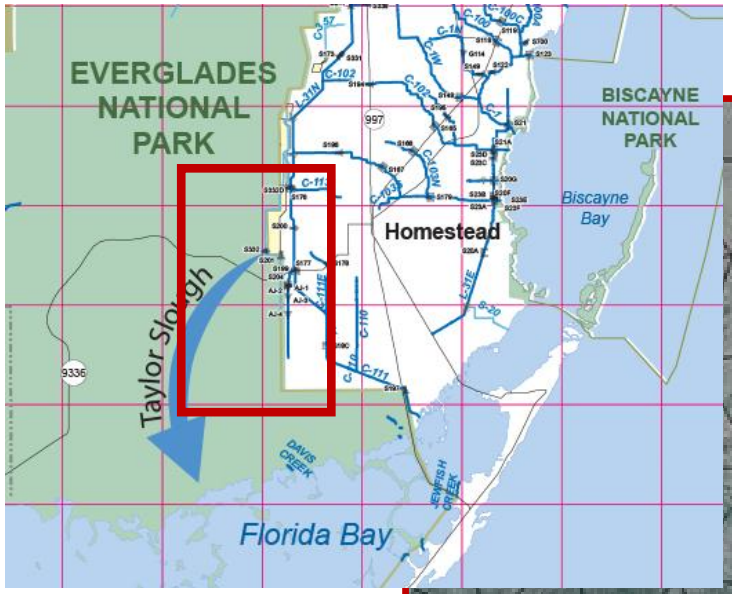
# Average Performance (Flows)



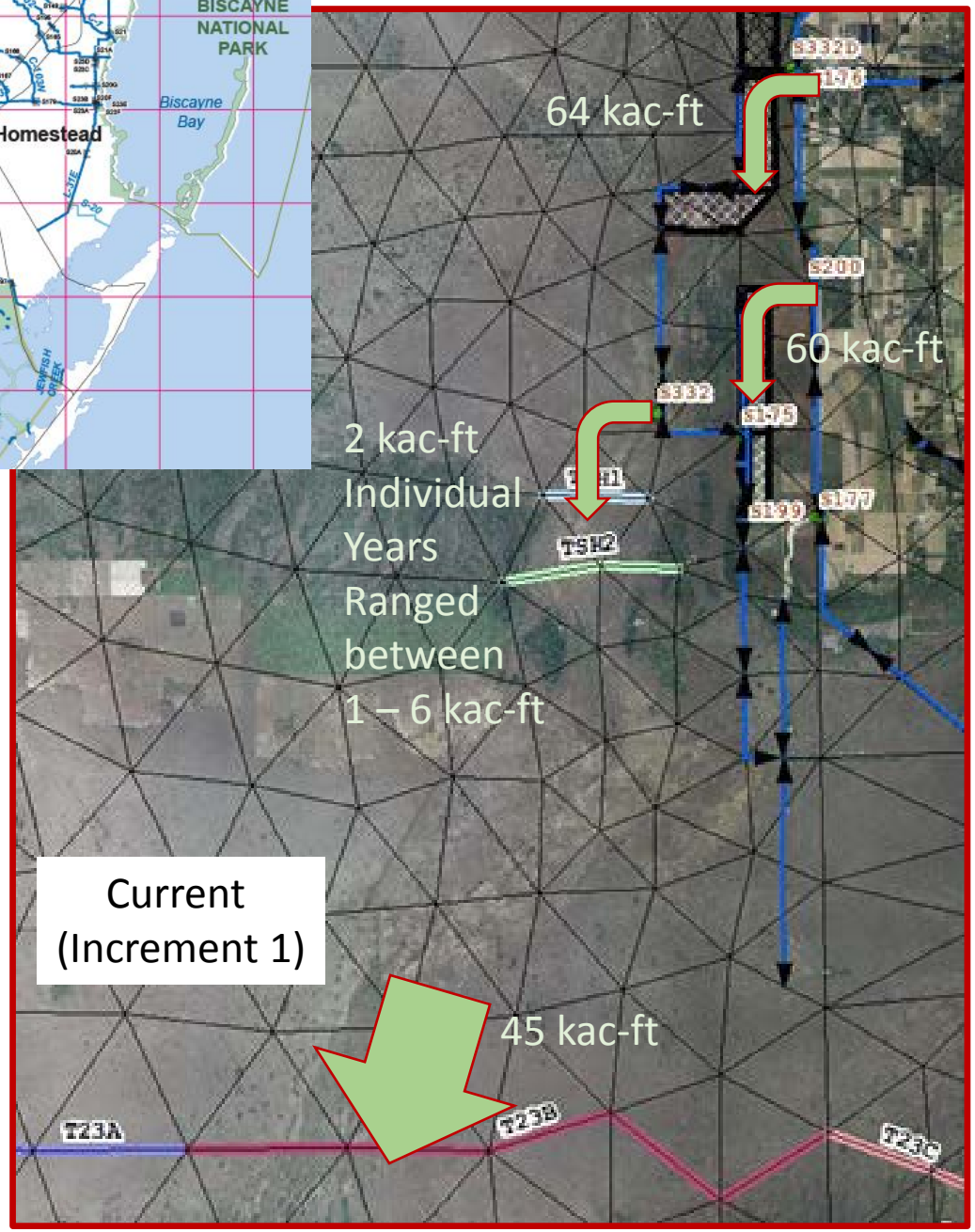



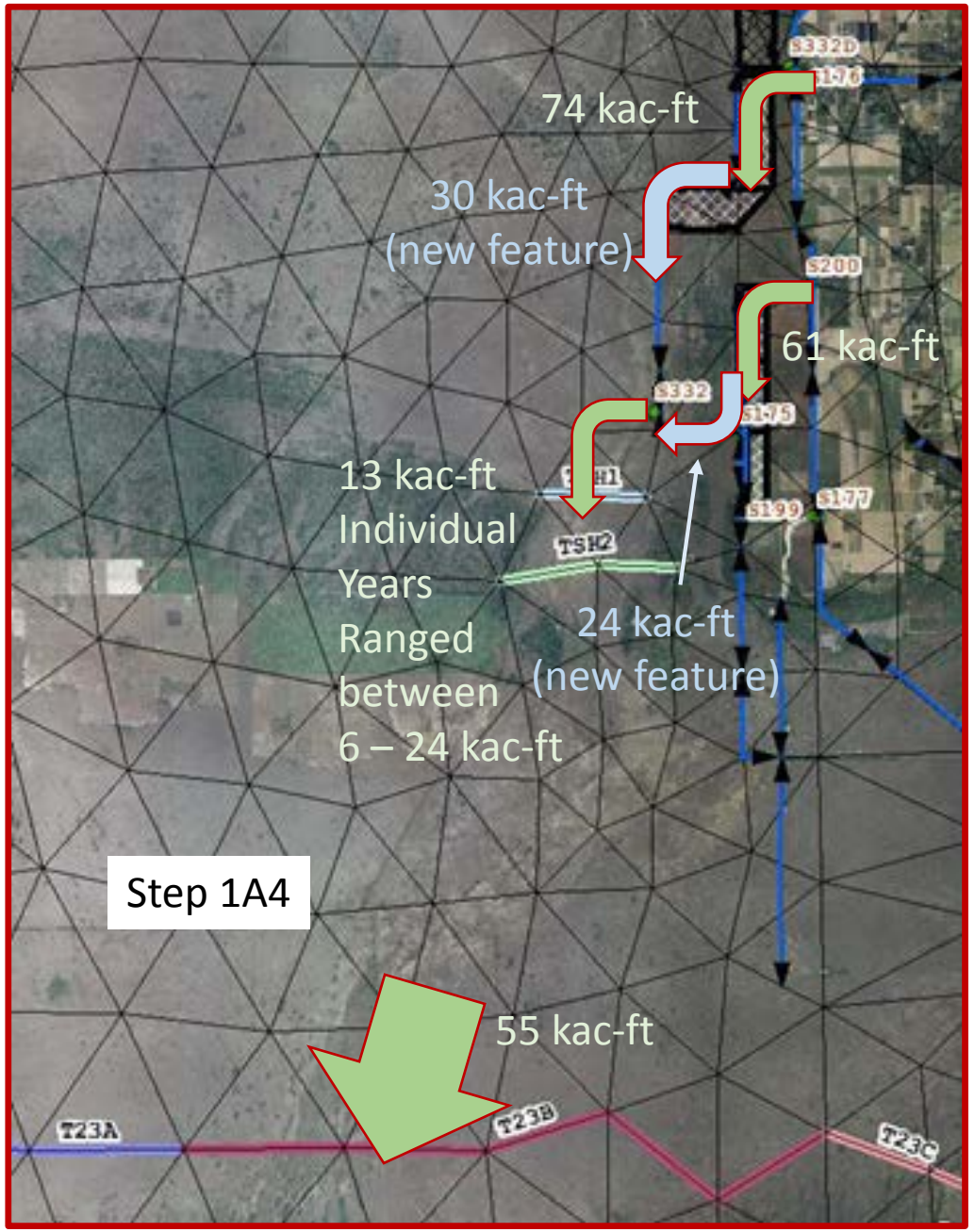



# Average Performance During Dry Years (1971, 1975, 1981 & 1985)

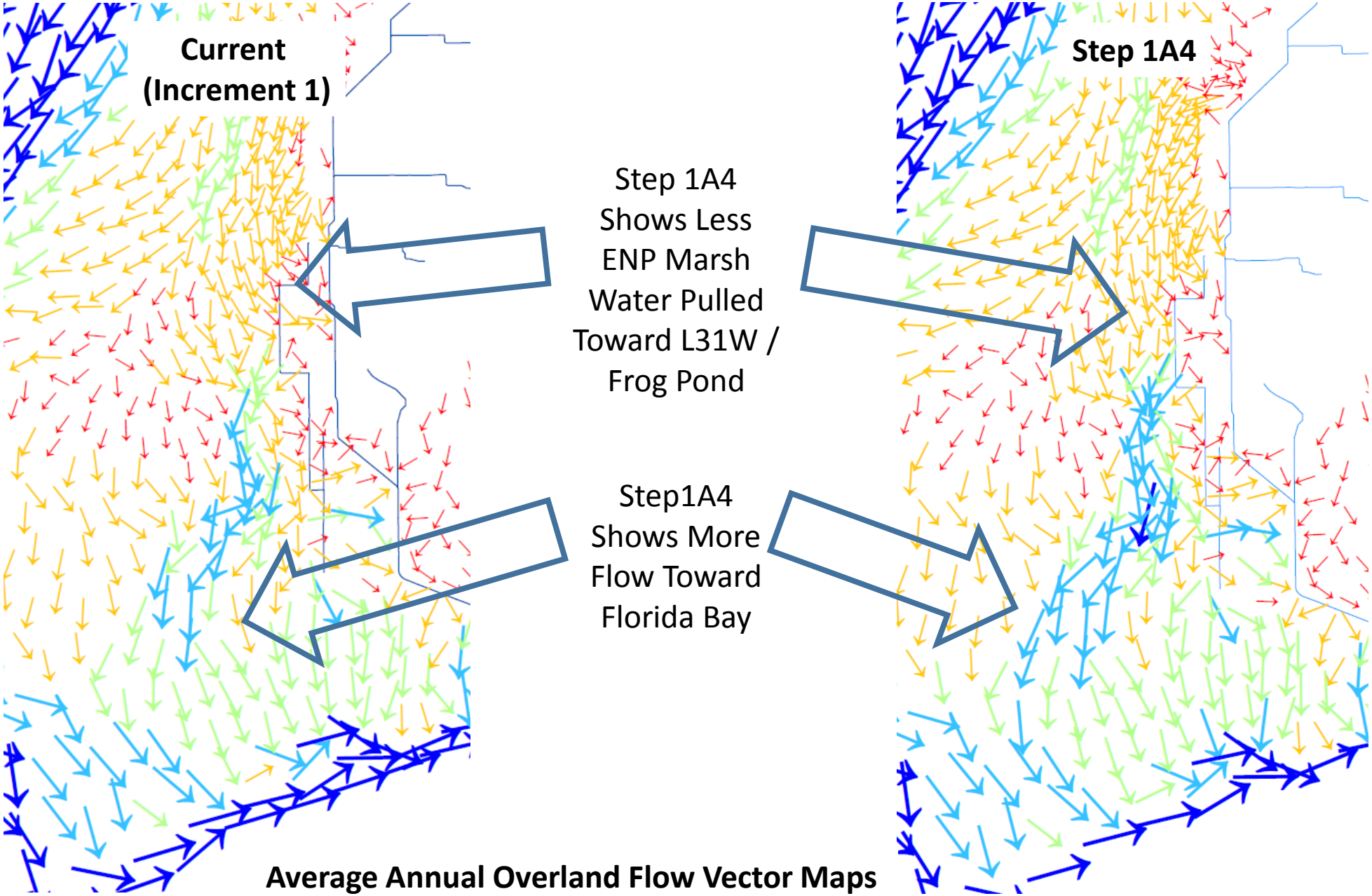



Utilizing the South Dade operations in concert with infrastructure improvements proposed at 7/14 Governing Board extends average deliveries during dry conditions by ~ 1 month (to December) and delivers ~ 4 times more water to establish a wetter antecedent condition.



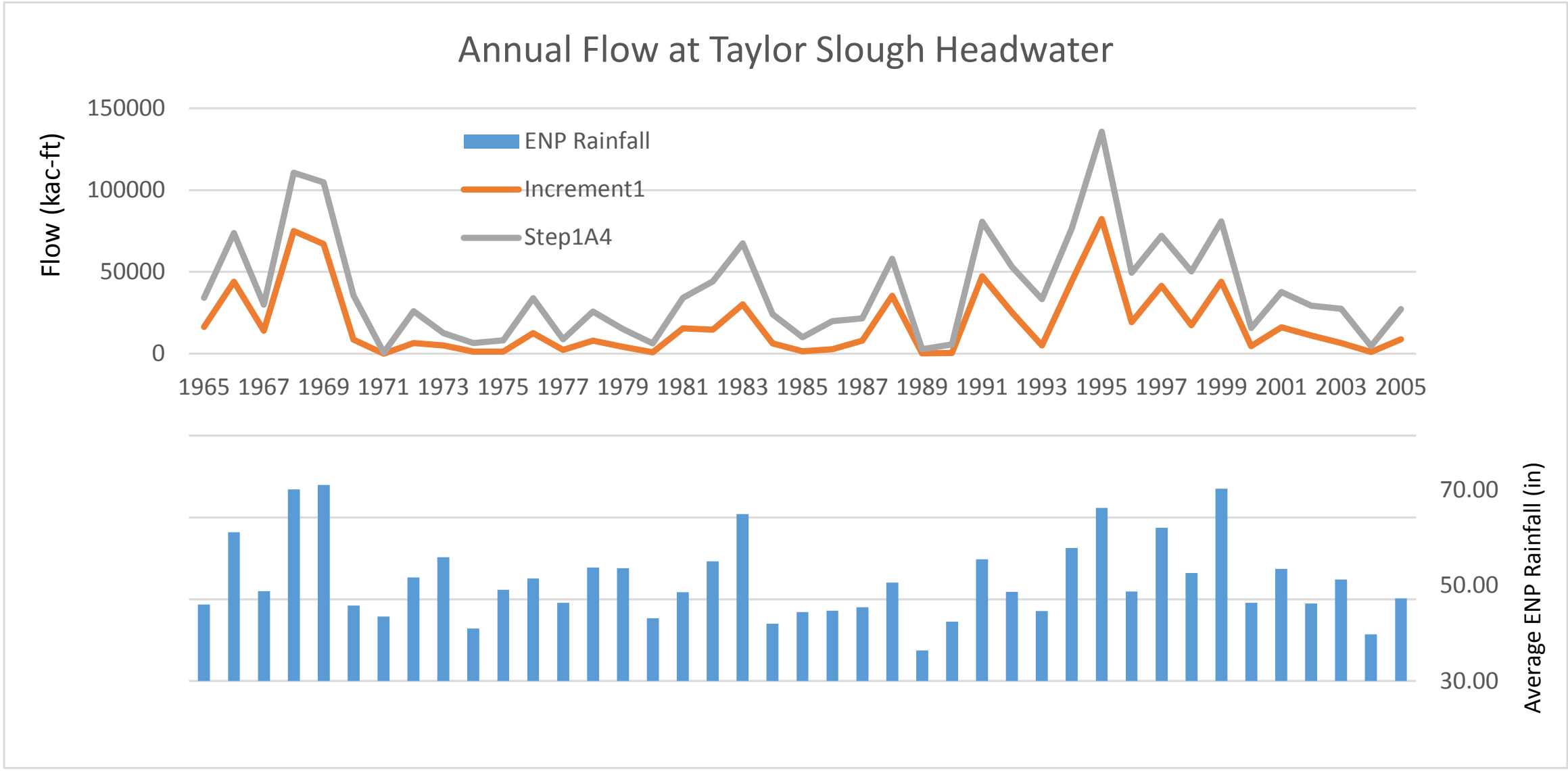



# Simulated Flow Improvements




**Average Annual Overland Flow Vector Maps**

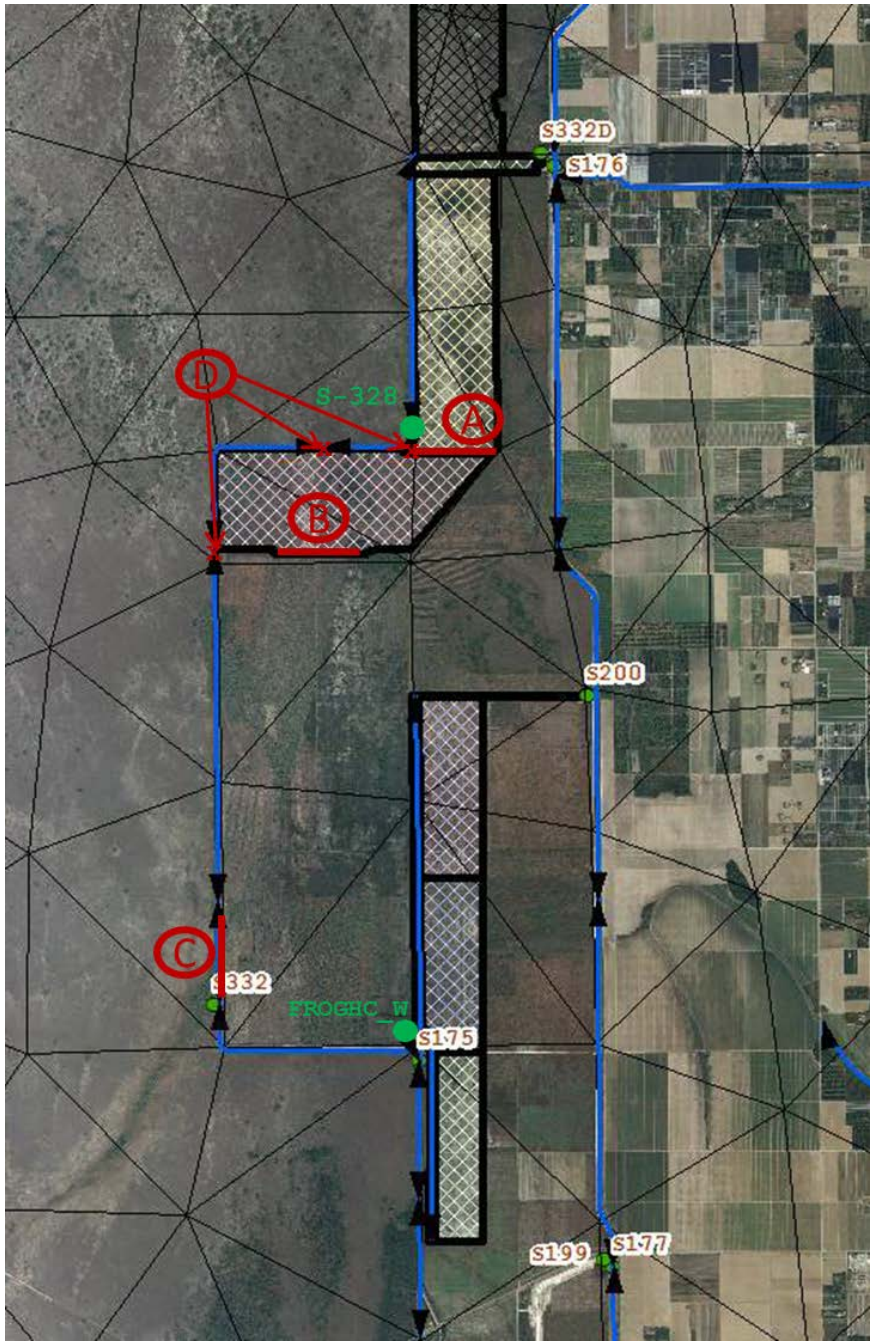
Proposed Plan is Robust, with Observed Increases in Flow Across all Simulated Conditions for Step 1A4 Scenario



# Longer–Term (Increment 2) Analysis

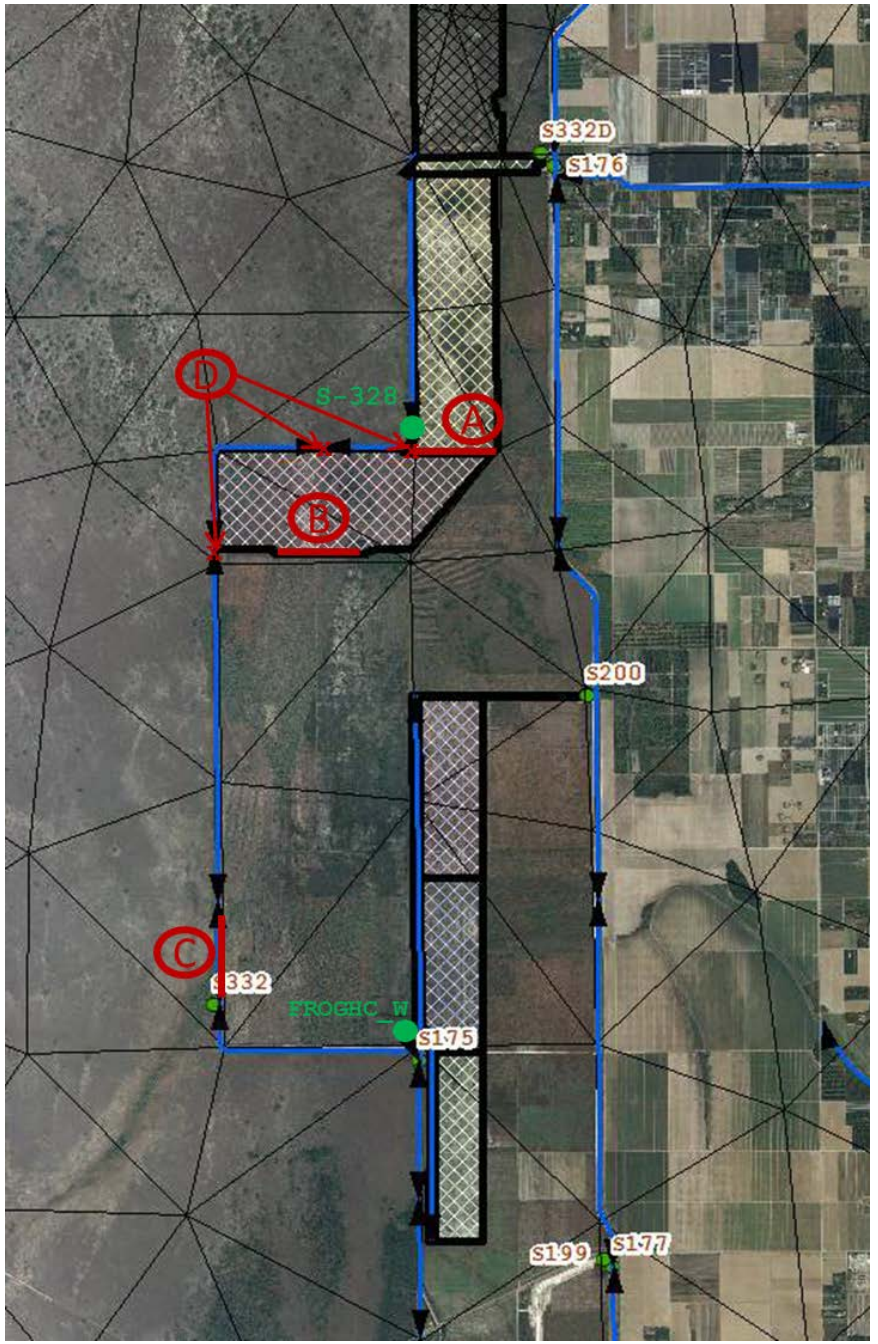
# South Dade Investigation Starting Point: Step 2A3 Assumptions

- Increment 2 like operations (Increment 1 + L-29 max stage raised to 8.5 ft + Contract 8 and 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Infrastructure improvement to promote flows toward Taylor Slough
  - Use existing S-328 to push flows to L-31W canal from 332D reservoir
  - No change in divide berm south of 332D North (shown as A) or weir south of 332D South (shown as B)
  - No plugs at L-31W (shown as D) - use L-31W as the fastest route to send water to Taylor Slough)
  - Add a berm at the L31W gap (shown as C) to prevent eastward flows
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



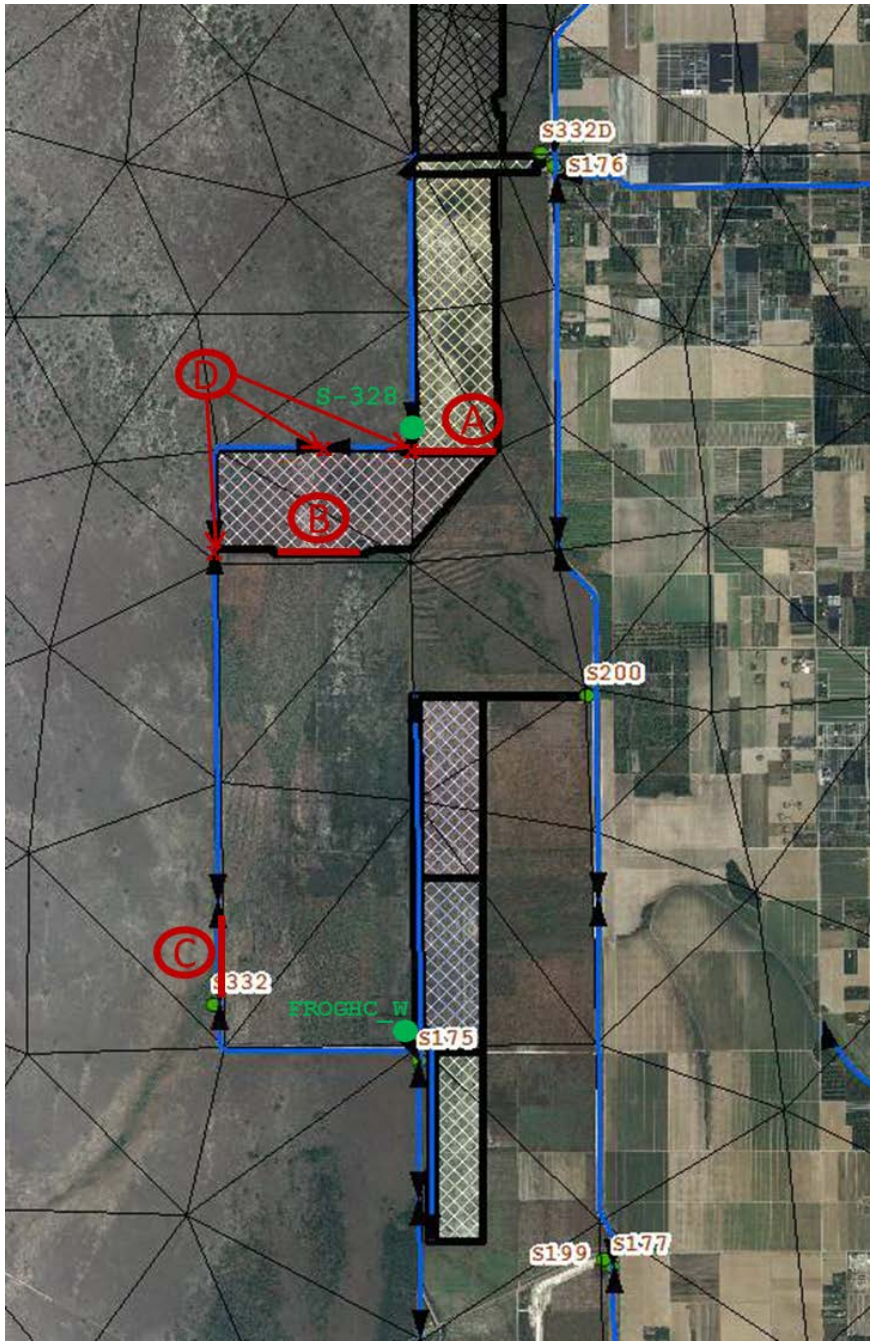
# Step 2A5 Assumptions

- Increment 2 like operations (Increment 1 + L-29 max stage raised to 8.5 ft, Contract 8 and 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - S-328 (to push flows to L-31W canal from 332D reservoir) is not operated
  - Divide berm south of 332D North (shown as A) and weir south of 332D South (shown as B) are removed
  - Plugs at L-31W (shown as D)
  - No berm at the L31W gap (shown as C) - No action
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.



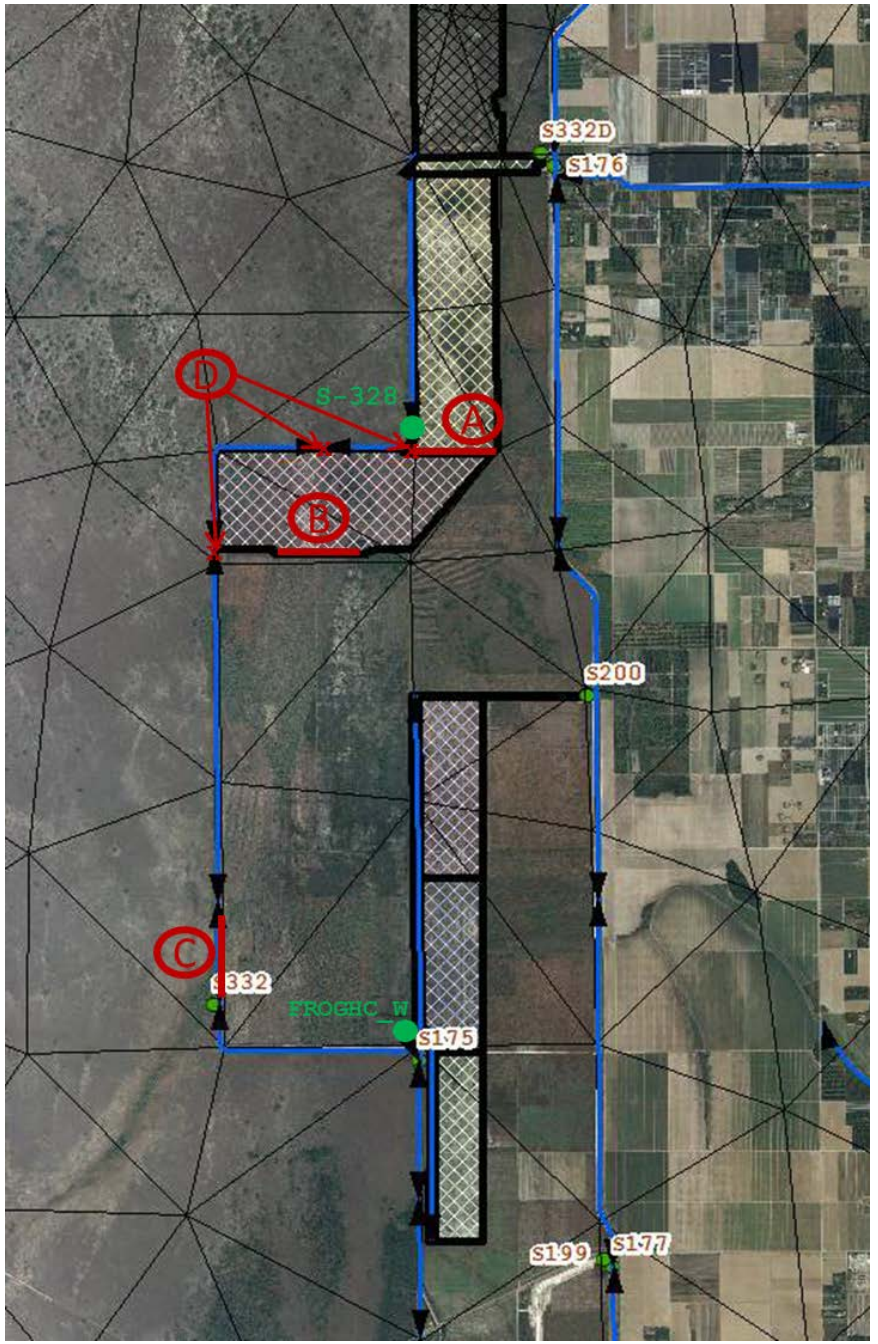
# Step 2A6 Assumptions

- Increment 2 like operations (Increment 1 + L-29 max stage raised to 8.5 ft, Contract 8 and 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - S-328 (to push flows to L-31W canal from  332D reservoir) is not operated
  - Divide berm south of 332D North (shown as A)  and weir south of 332D South (shown as B) are removed
  - Plugs at L-31W (shown as D)
  - 0.75’ above grade Weir at the L31W gap (shown as C)
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.

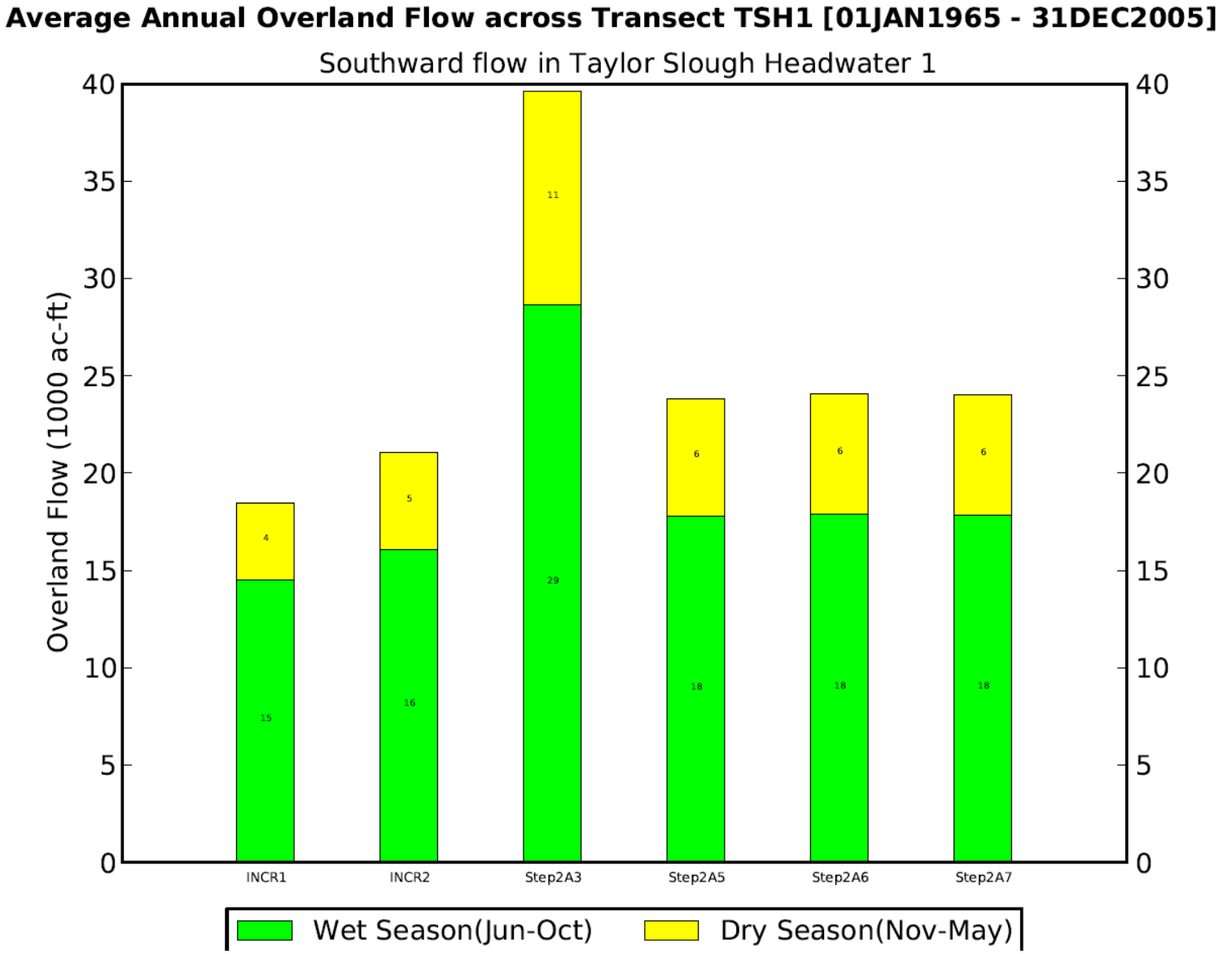


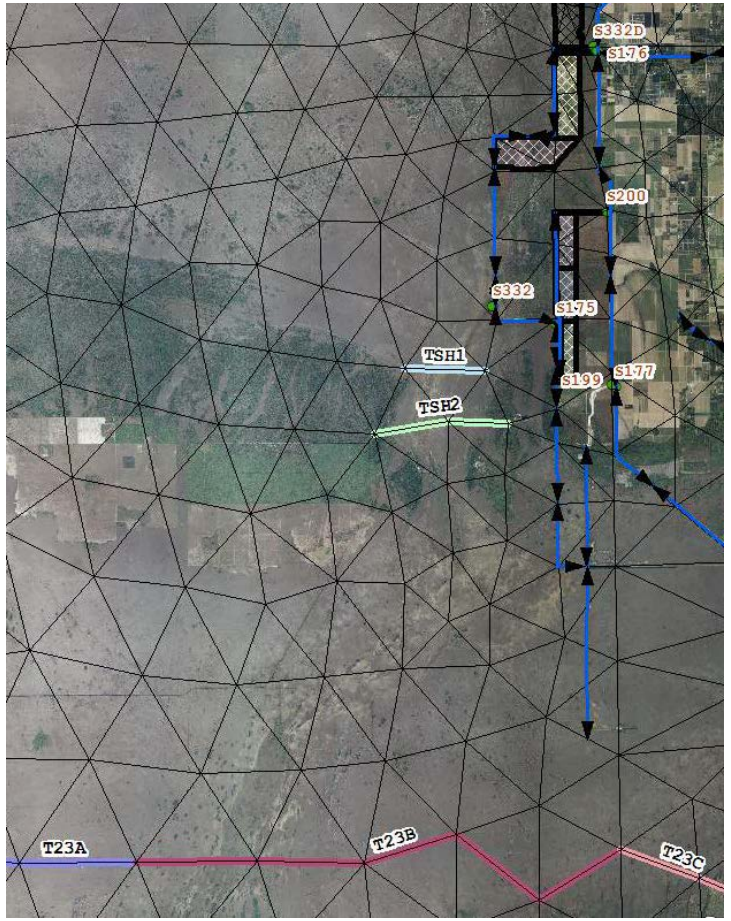
# Step 2A7 Assumptions

- Increment 2 like operations (Increment 1 + L-29 max stage raised to 8.5 ft, Contract 8 and 8A)
- Lower operations at S332s, S199s and S200s for Aug-Dec and transition to current ops Jan1-Feb15
- Additional unit with 75 cfs each for S199 and S200
- Revised operations to allow more frequent, lower capacity opening of S176 and S177
- Revised Infrastructure improvement to promote flows toward Taylor Slough
  - S-328 (to push flows to L-31W canal from 332D reservoir) is not operated
  - Divide berm south of 332D North (shown as A) and weir south of 332D South (shown as B) are removed
  - Plugs at L-31W (shown as D)
  - Berm at the L31W gap (shown as C) to prevent eastward flows
  - Add a gravity structure to connect Frog Pond header canal to L-31W north of S-175.

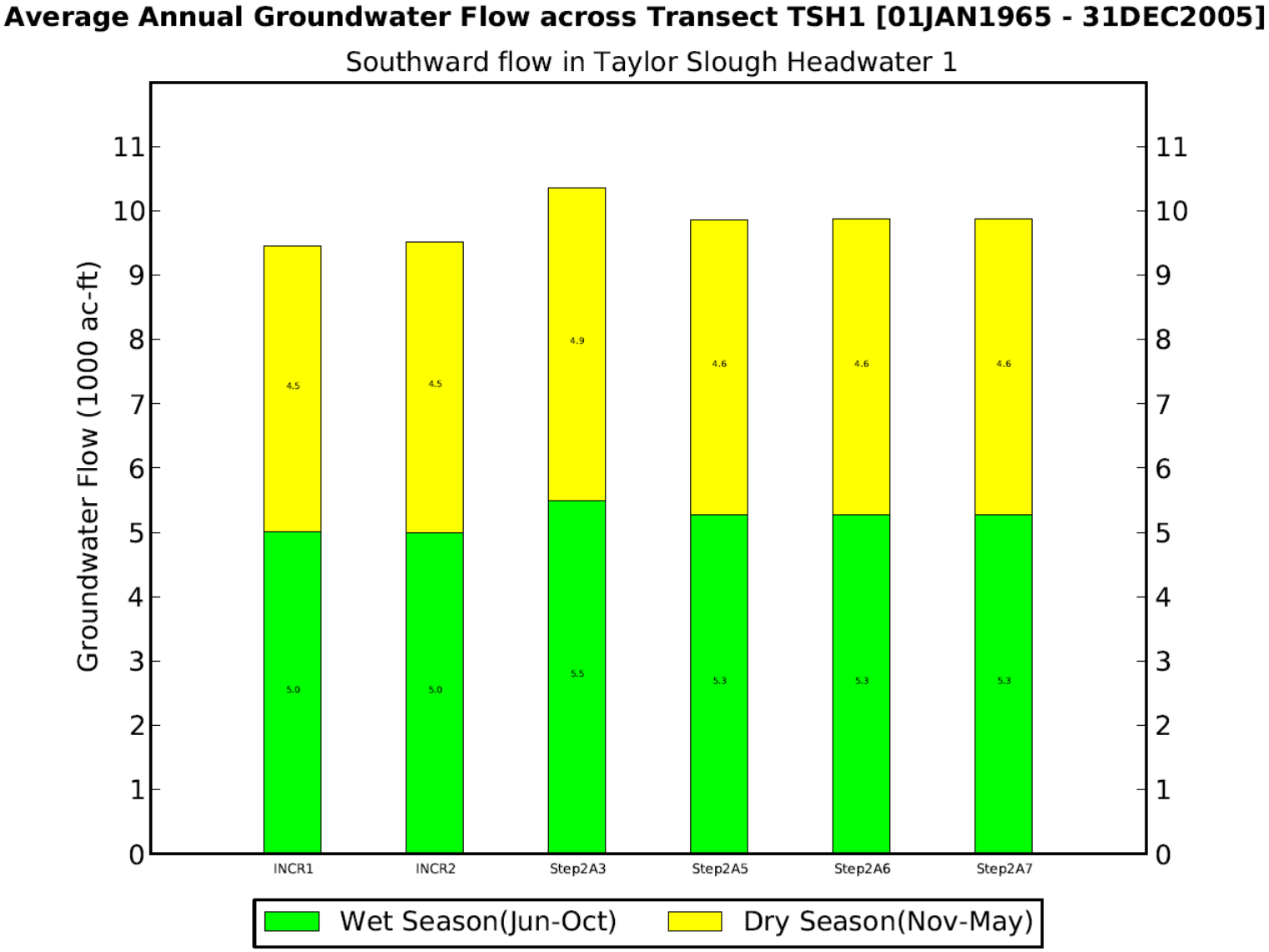


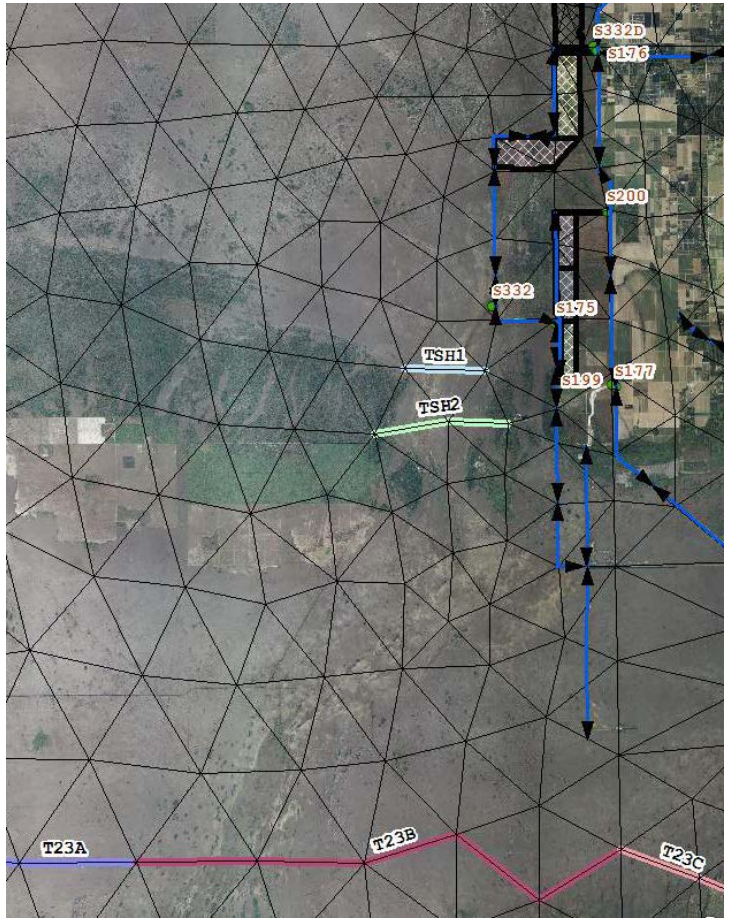
# Overland Transect Flows at Taylor Slough Headwater (TSH1)



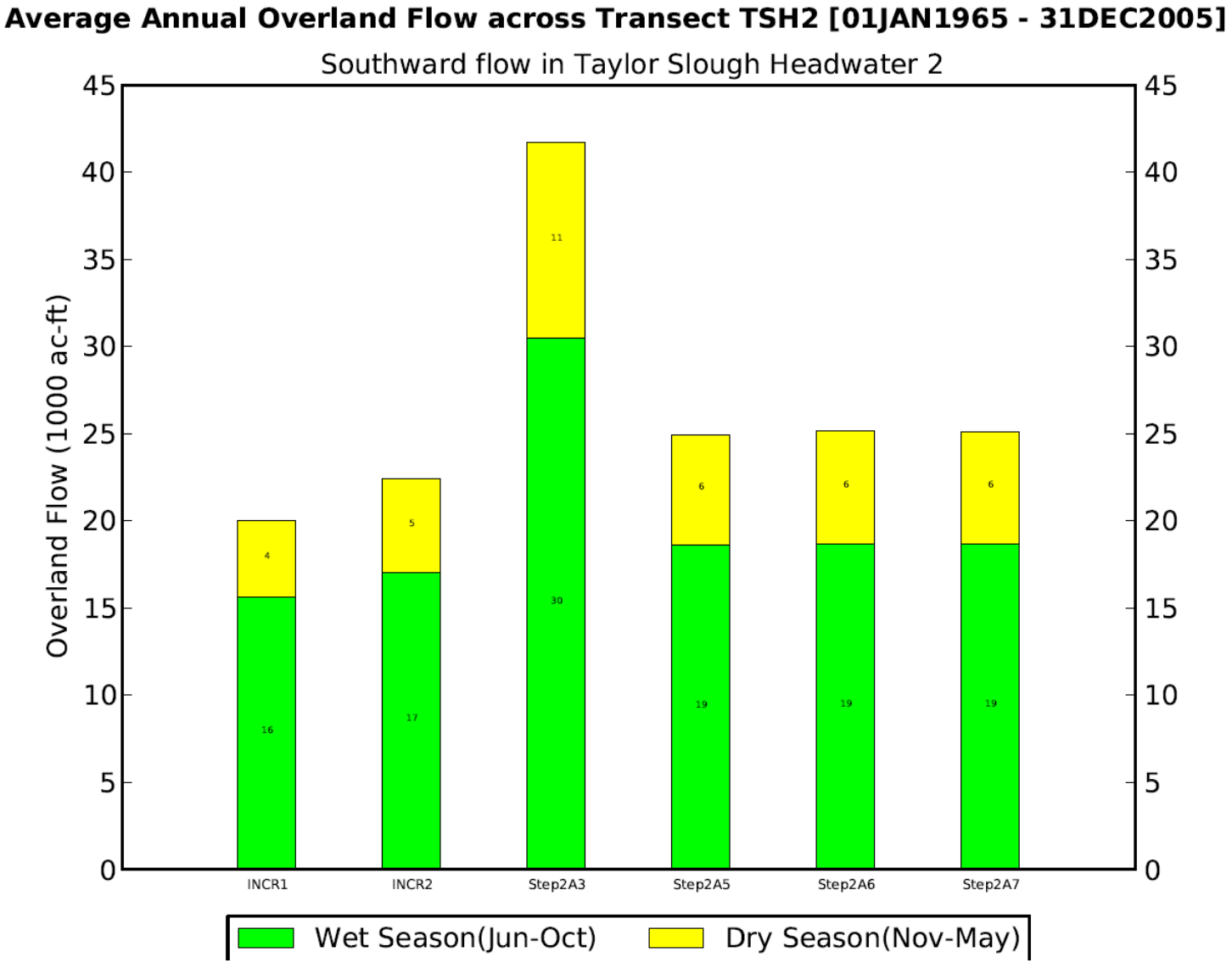



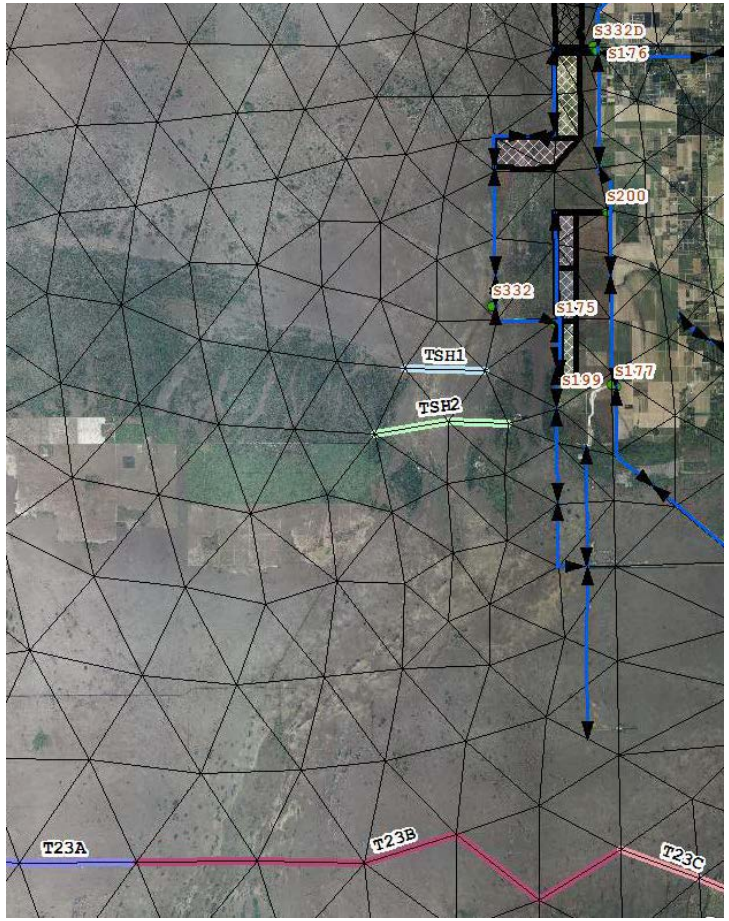
# Groundwater Transect Flows at Taylor Slough Headwater (TSH1)



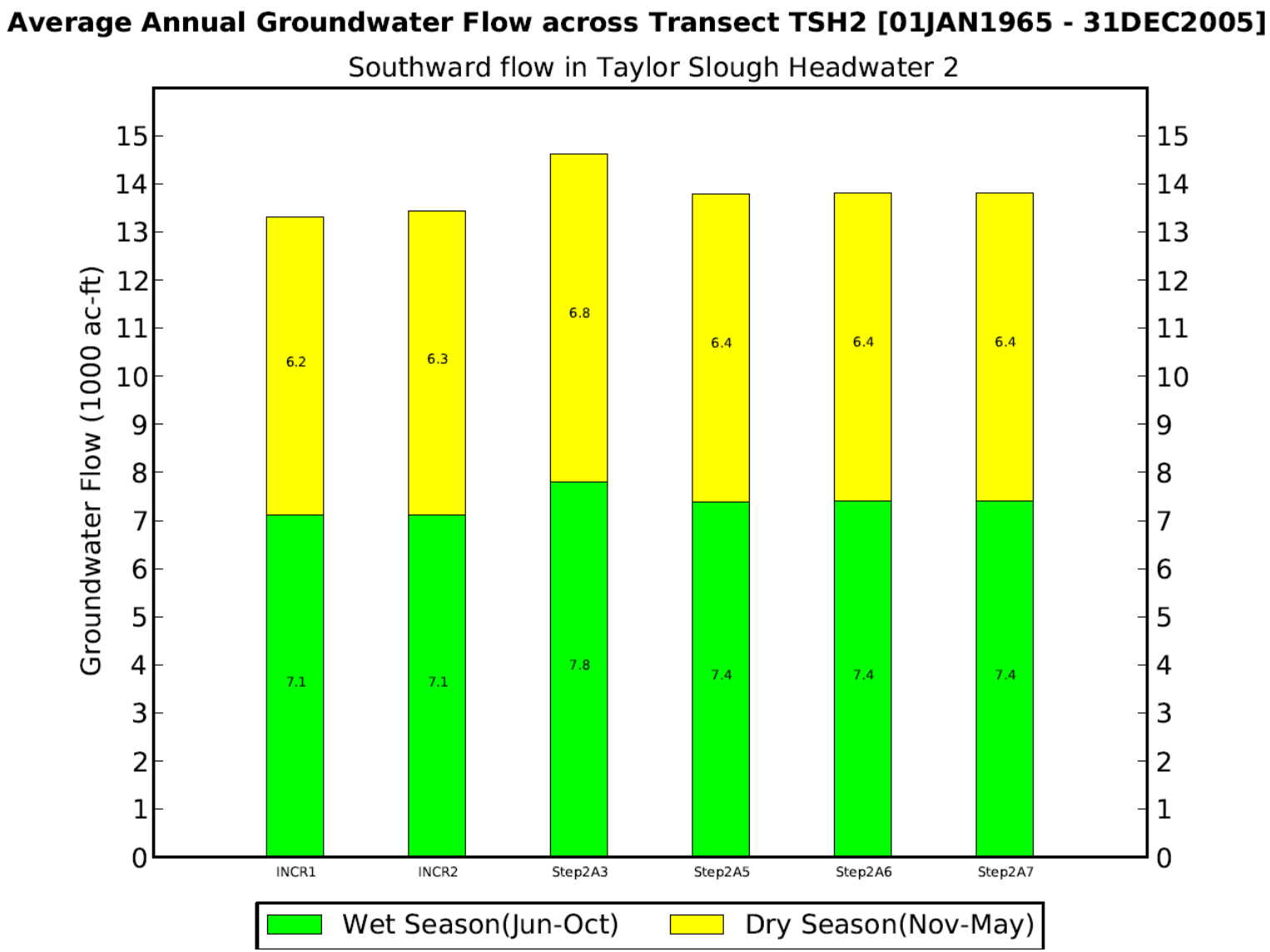



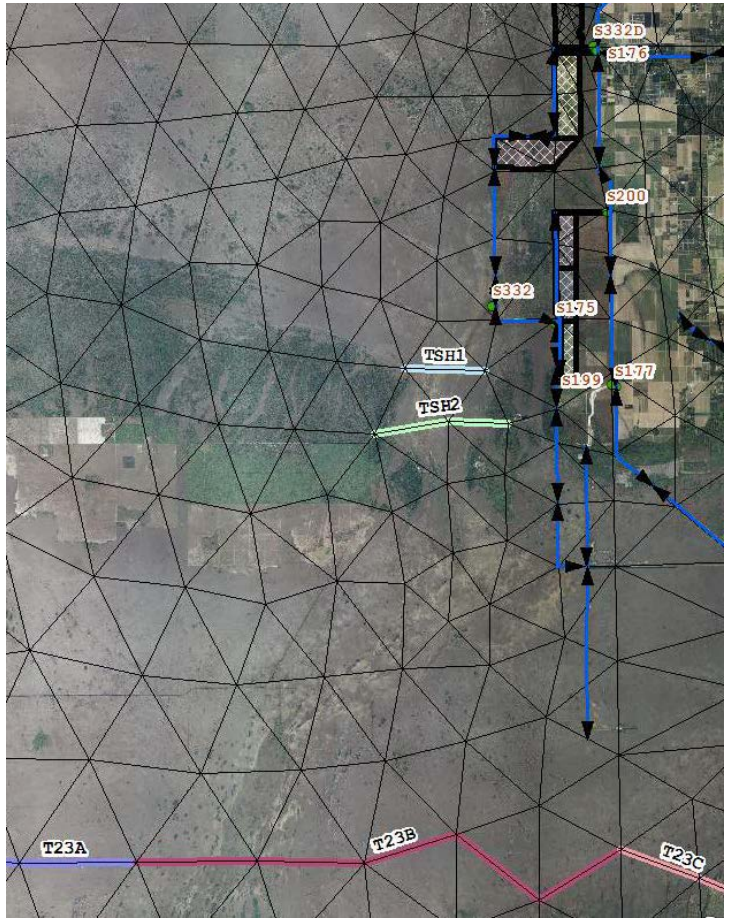
# Overland Transect Flows south of Taylor Slough Headwater (TSH2)



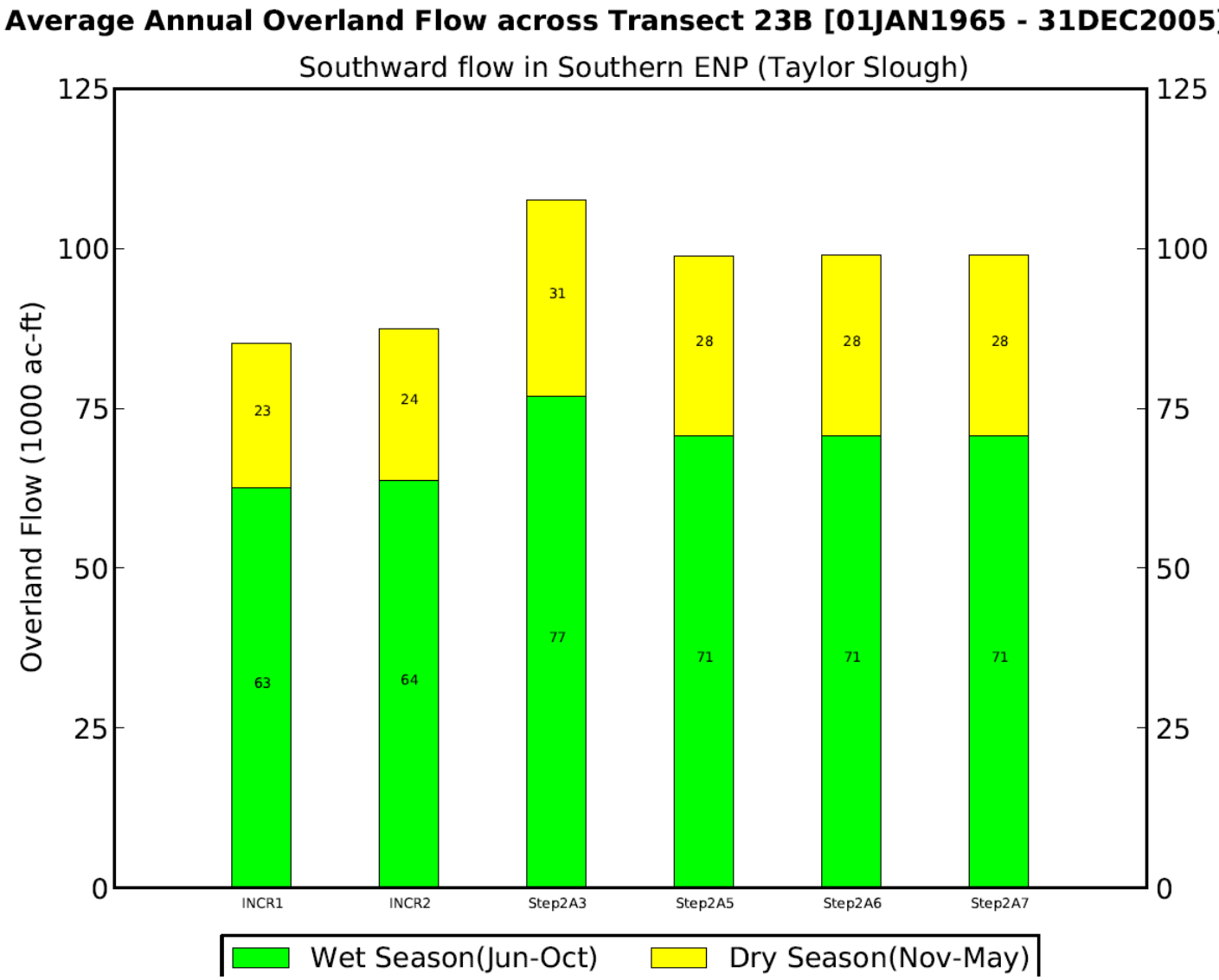



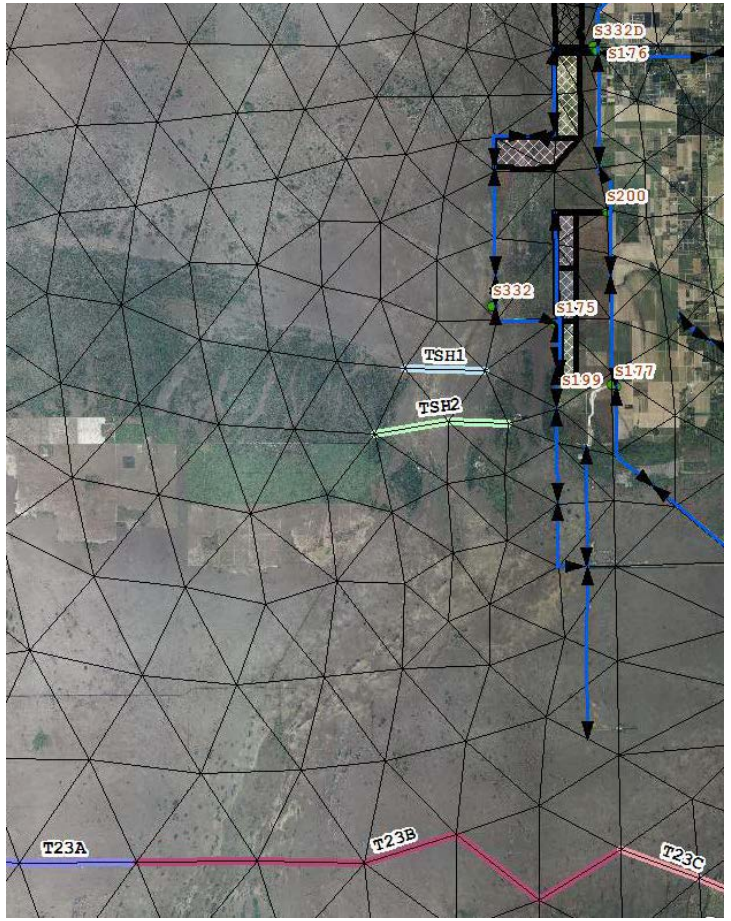
# Groundwater Transect Flows south of Taylor Slough Headwater (TSH2)



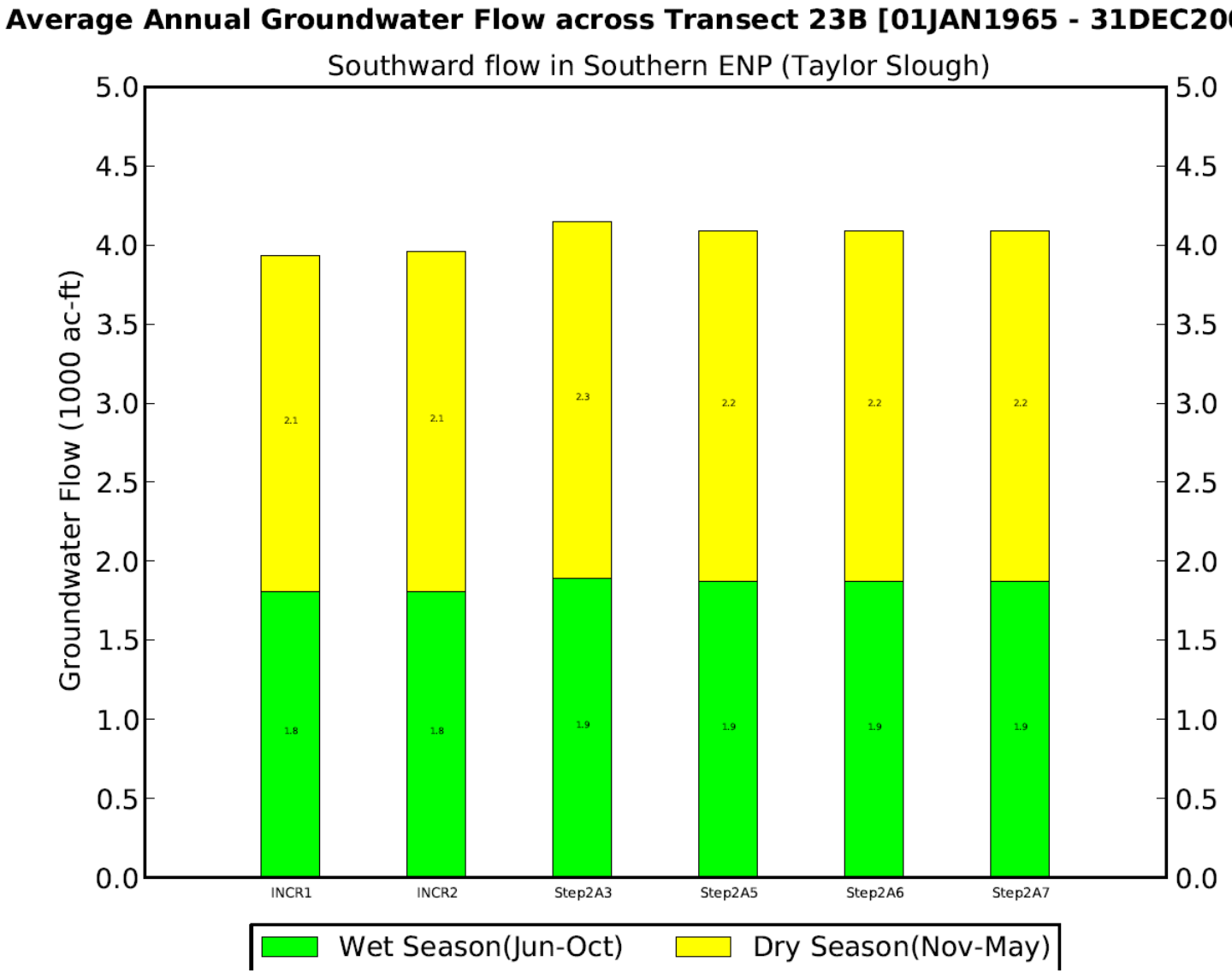



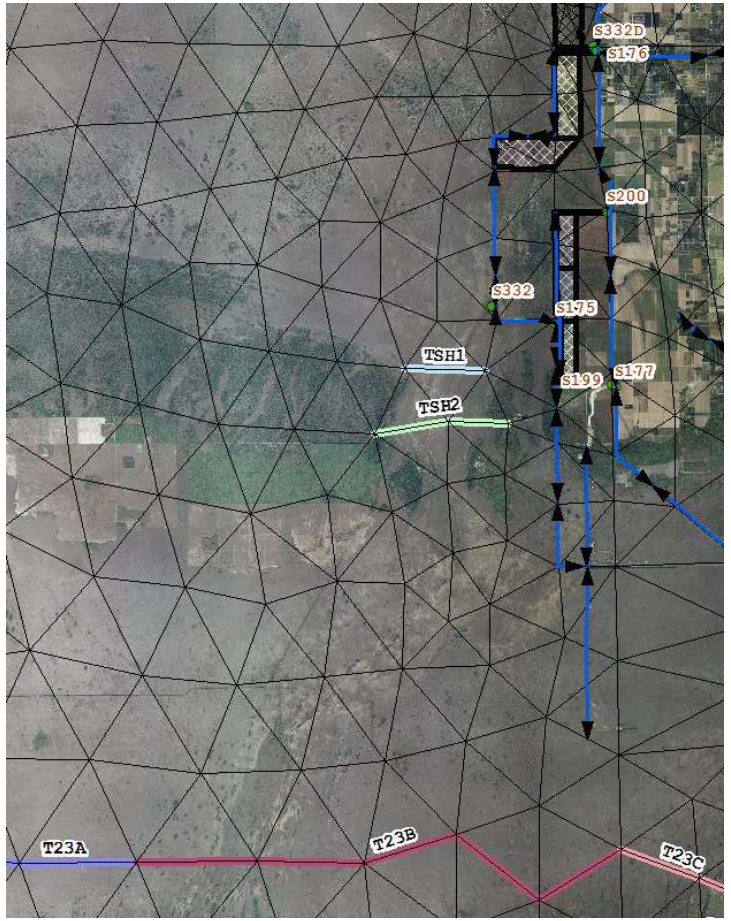
# Overland Transect Flows in Taylor Slough (T23B)



# Southward Groundwater Transect Flows in Taylor Slough (T23B)



# Comparison of Flows (K-AC-FT/yr)

| | Incr1 | Incr2 | Step2A3 | Step2A5 | Step2A6 | Step2A7 |
|---|---|---|---|---|---|---|
| S332D | 104.5 | 104.7 | 118.2 | 119.1 | 119.1 | 119.1 |
| Berm south of 332D North reservoir | 10.2 | 12.1 | 0.0 | 61.4 | 61.4 | 61.4 |
| Weir south of 332D South reservoir | 1.6 | 2.2 | 0.0 | 46.4 | 46.4 | 46.4 |
| S-328 | N/A | N/A | 55.1 | 0.0 | 0.0 | 0.0 |
| S332 Gap | -5.1 | -5.9 | 0.0 | -2.0 | 0.1 | 0.0 |
| | | | | | | |
| Connection from Frog Pond Header Canal to L-31W | N/A | N/A | 21.8 | 34.3 | 34.1 | 34.1 |
| | | | | | | |
| TSH1_GW | 9.5 | 9.5 | 10.4 | 9.9 | 9.9 | 9.9 |
| TSH1_OL | 18.5 | 21.1 | 42.1 | 23.8 | 24.1 | 24.0 |
| TSH1_TOT | 27.9 | 30.6 | 52.5 | 33.7 | 33.9 | 33.9 |
| | | | | | | |
| TSH2_GW | 13.3 | 13.4 | 14.6 | 13.8 | 13.8 | 13.8 |
| TSH2_OL | 20.0 | 22.4 | 41.6 | 24.9 | 25.2 | 25.1 |
| TSH2_TOT | 33.3 | 35.8 | 56.2 | 38.7 | 39.0 | 39.0 |