Physically Based Modeling of DICU
A case study of Fabian Tract and Staten Island

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December 18, 2012

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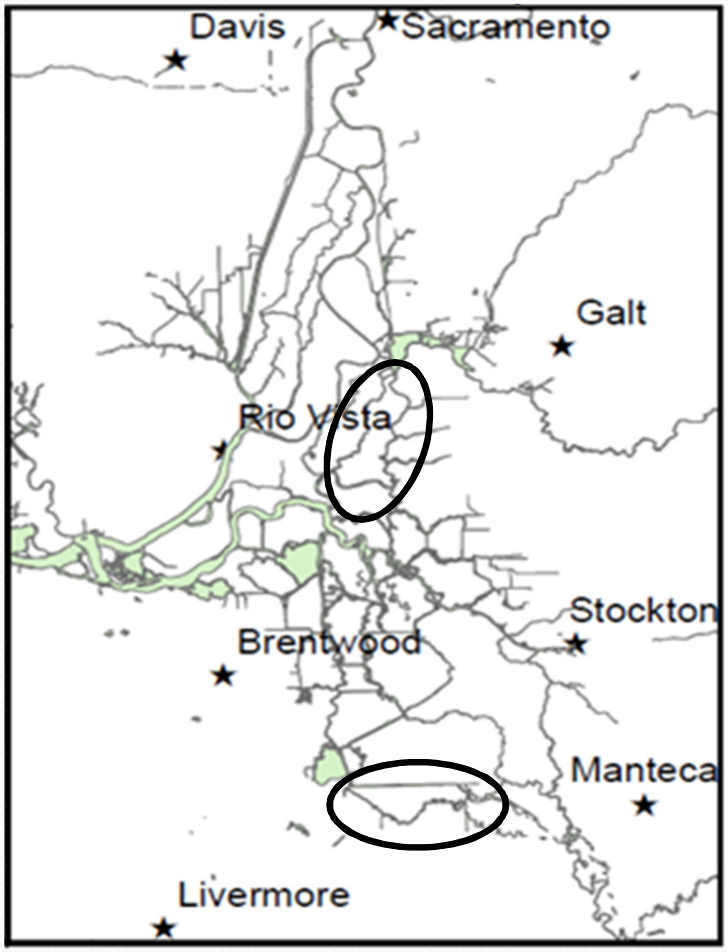
DICU affects Delta model results.

Objectives:

- Reduce uncertainty in DICU locations
- Improve DICU and water quality estimates
- Compare current and more contemporary physically-based DICU estimates
- Produce a model easily updated with future data
- Estimate how further data collection and modeling improves water quality modeling predictions

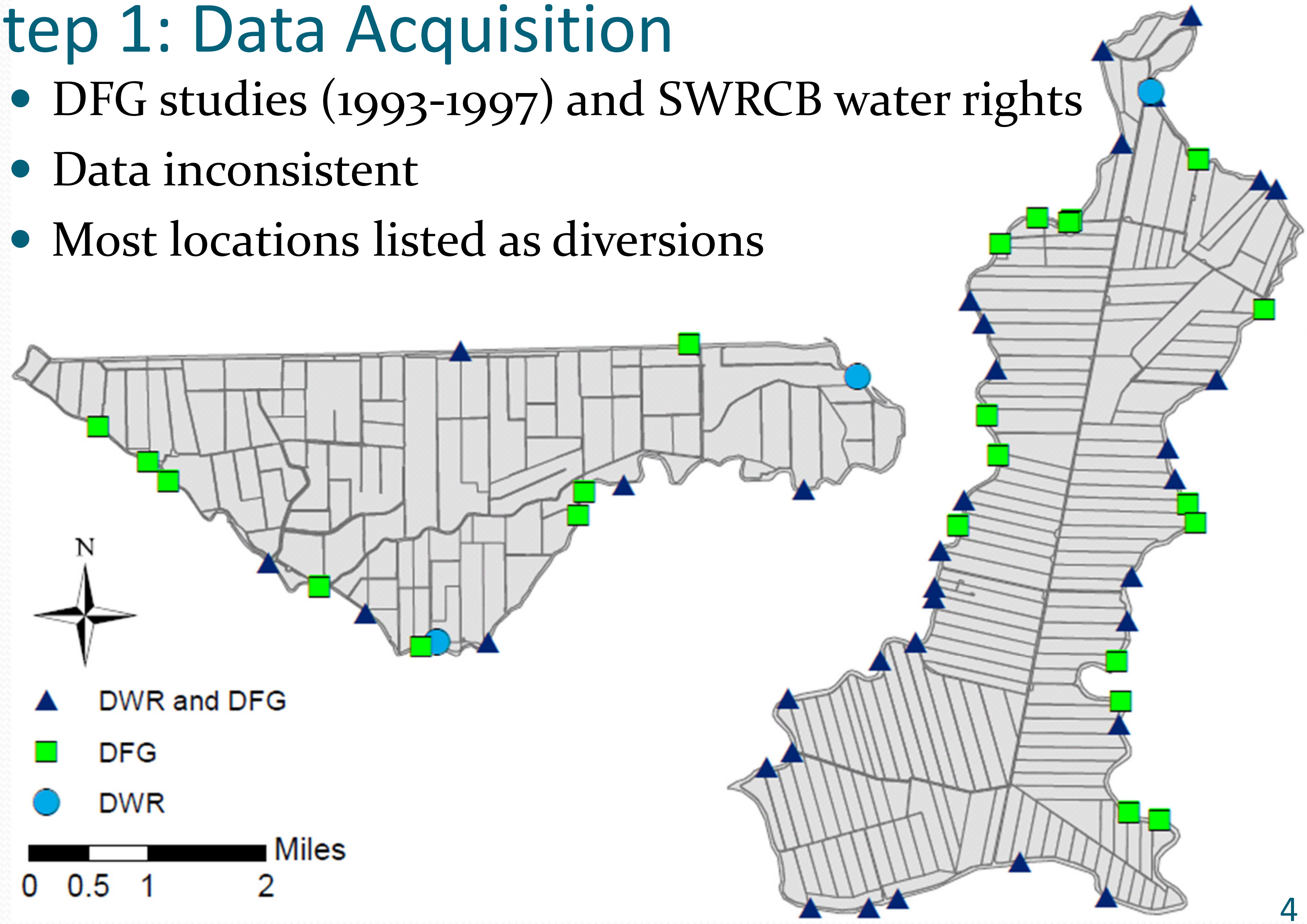
Project Steps

1. Identify Diversion and Return Locations using LiDAR and GIS
   - Supplemented with water rights, place of use, and Google Earth data
2. Ground-Truth Diversion and Return Locations
3. Model Integration
   - Model Selection
   - GIS Analysis
   - Comparison of Results
4. Water Quality Correlation



Step 1: Data Acquisition

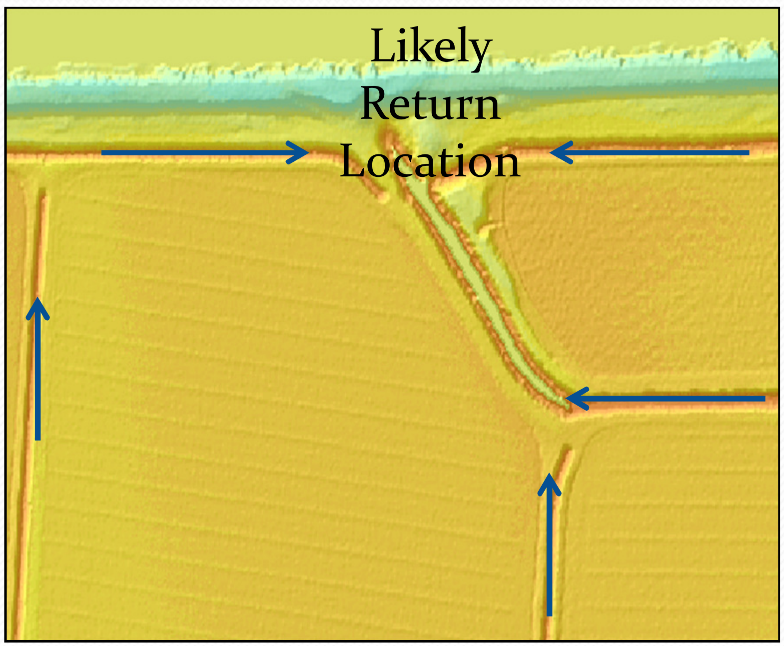
- DFG studies (1993-1997) and SWRCB water rights
- Data inconsistent
- Most locations listed as diversions



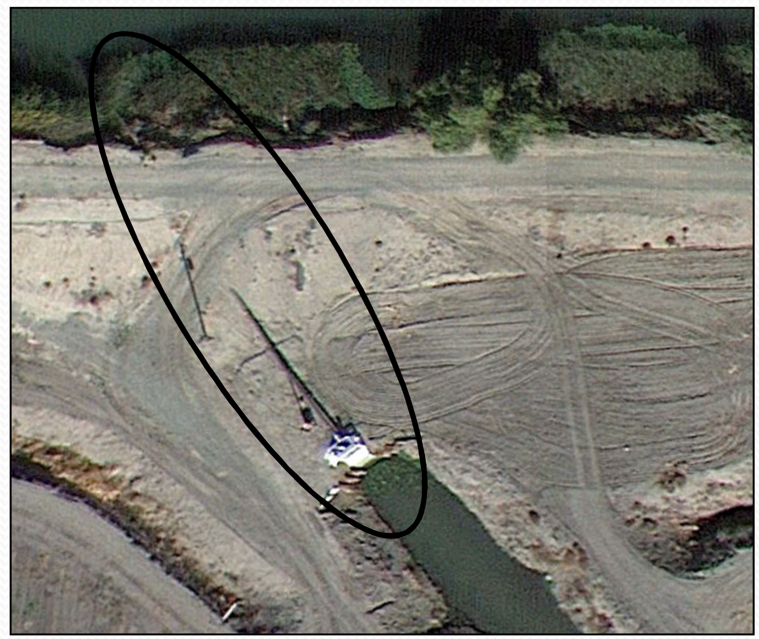
Data Interpolation: LiDAR and Google Earth

- LiDAR in GIS used to determine diversion and return flow patterns and sources
- Google Earth used to verify these locations

LIDAR



Zooming in with Google Earth



Step 2: Ground-Truthing

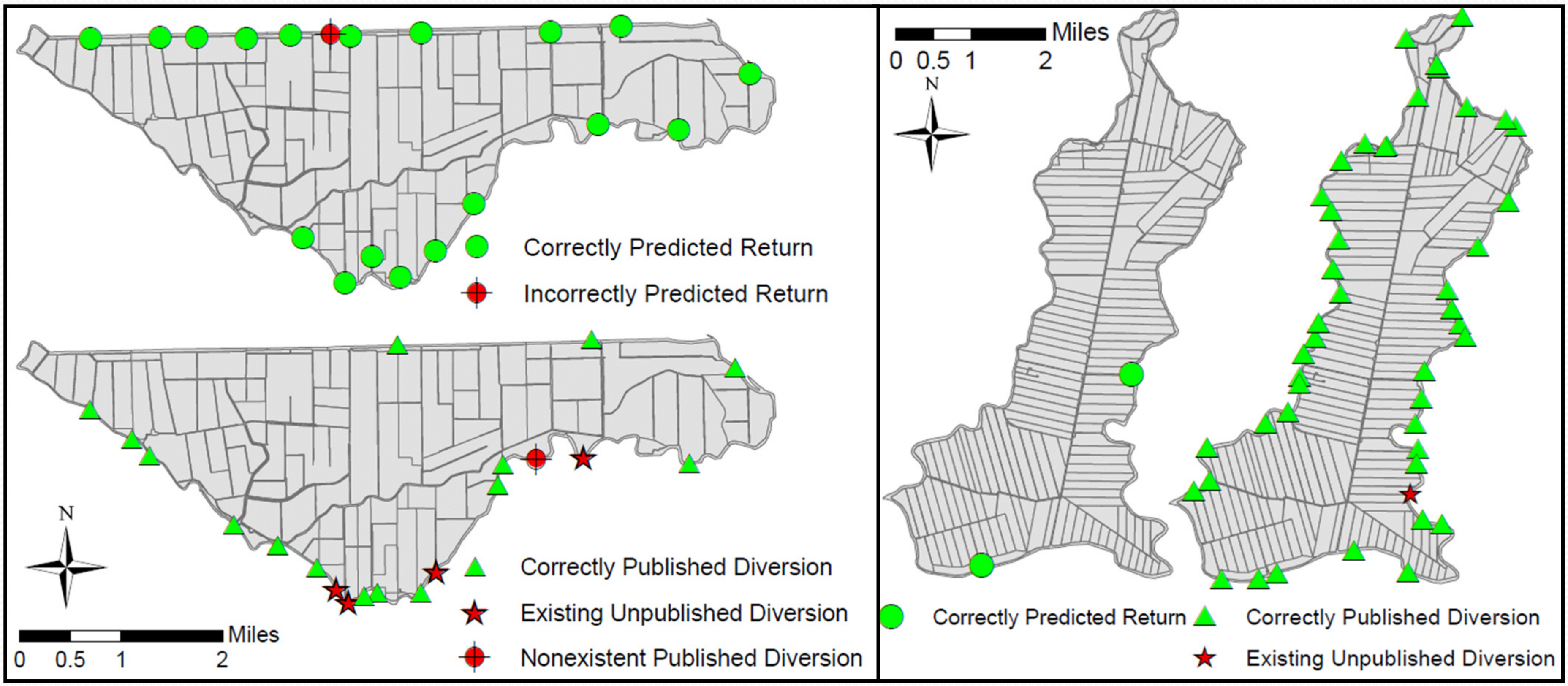
- Used to add clarity, verify locations, and determine their status.

  - Active vs. Inactive
  - Permanent vs. Temporary

Data Acquisition: Predicted vs. Ground-Truthed

Fabian Tract

Staten Island



Step 3. Model Selection

- DETAW: Delta Evapotranspiration of Applied Water Model
- MF-MFP: MODFLOW with Farm Management Practices
- IDC: IWFM Demand Calculator
  - IDC selected based on:
    - Capabilities
    - Ease of use
    - Applicability
    - DWR recommendations

IDC Calculations

P=Precipitation

R_p=Direct Runoff

A_w=Applied Water

R_f= Return Flow

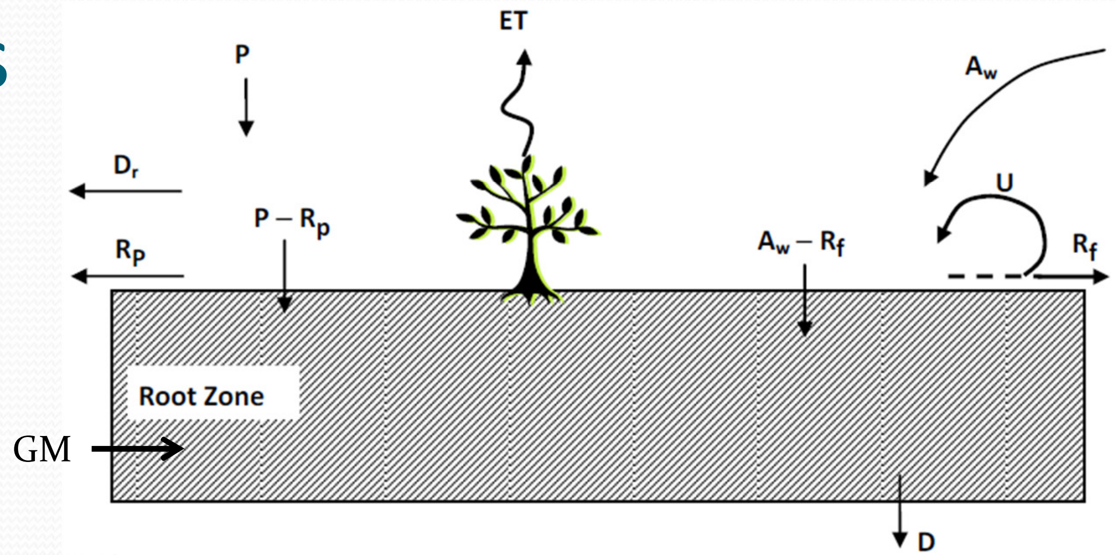
U=Re-Use Fraction

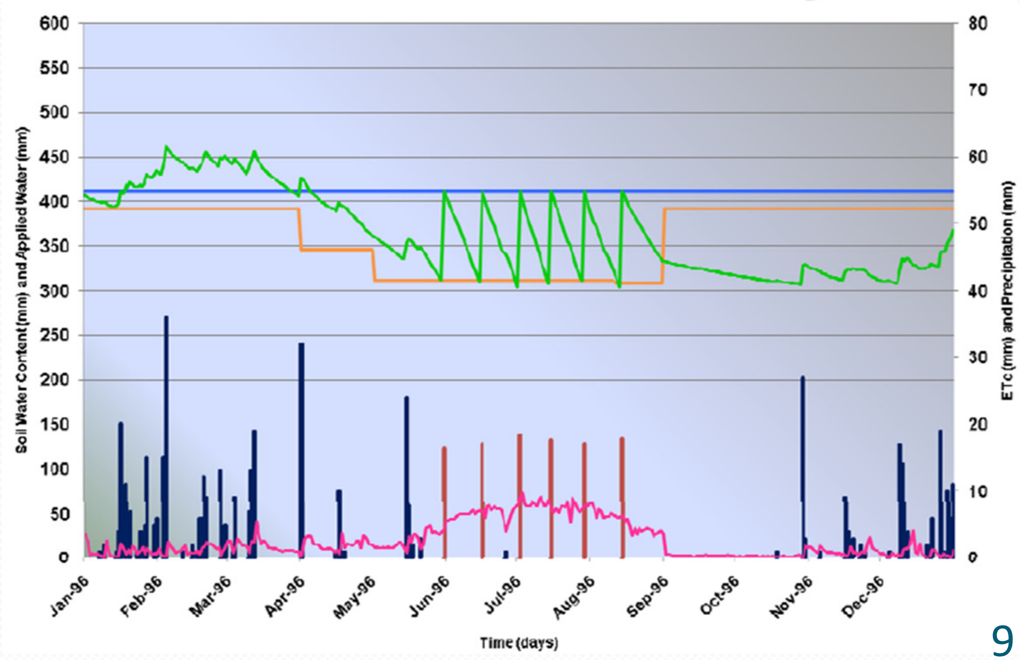
D_r=Drainage of Rice and Refuge Ponds

D=Deep Percolation

ET=Evapotranspiration

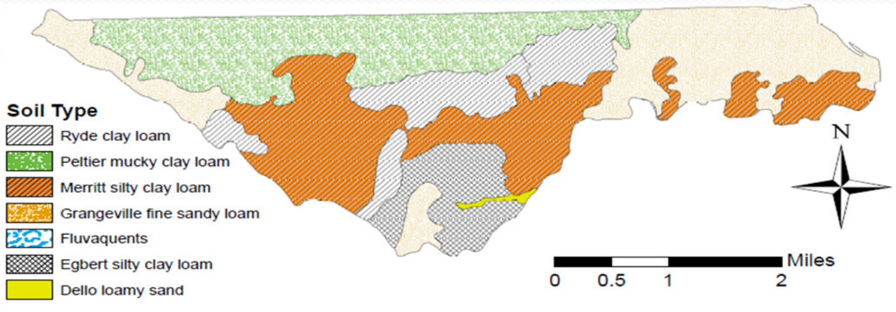
GM=Generic Moisture Source (Seepage)

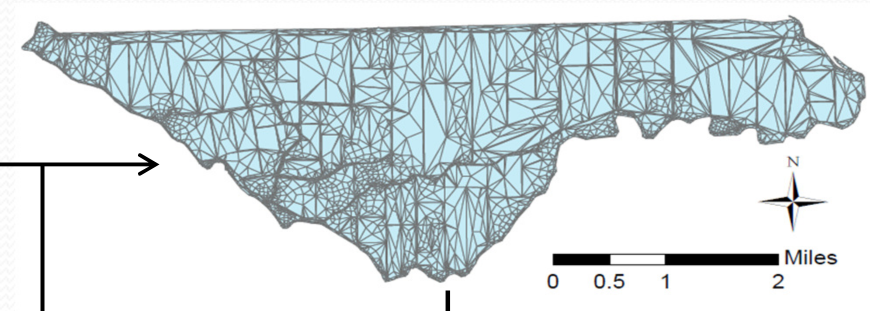


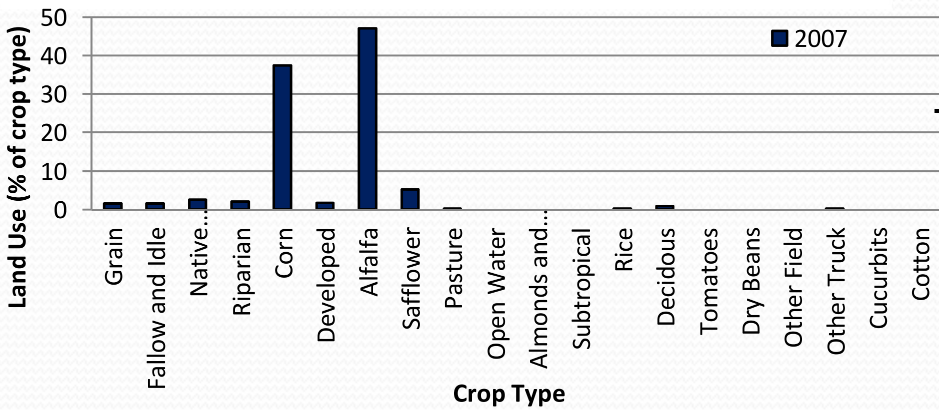


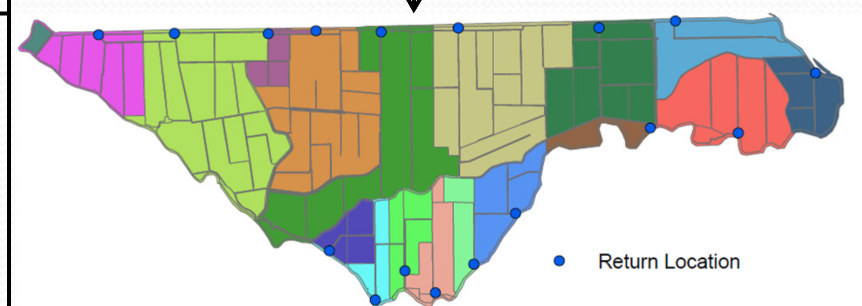
Images from:
Integrated Hydrological Models Development Unit (2011).IWFM Demand Calculator IDC v4.0 Theoretical Documentation and User's Manual, Modeling Support Branch, Bay-Delta Office.

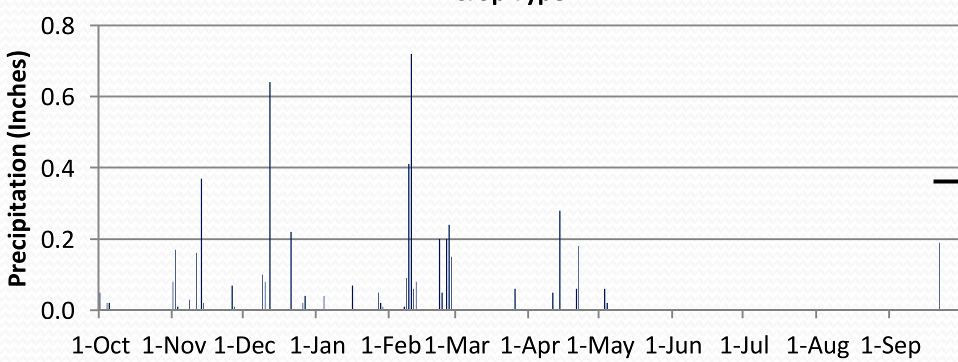
IDC Fabian Tract (IDCFT) Inputs

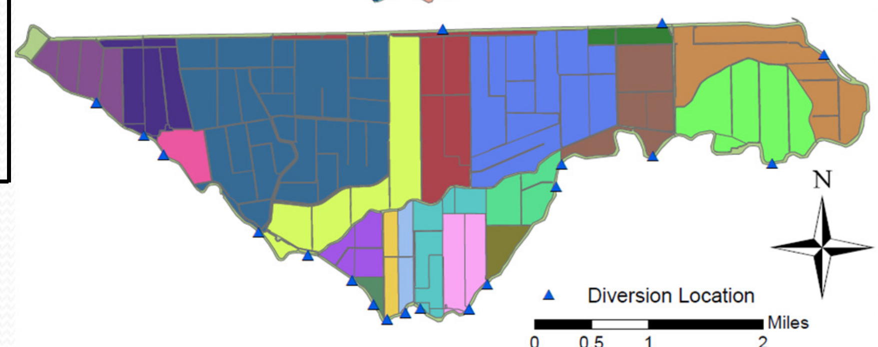






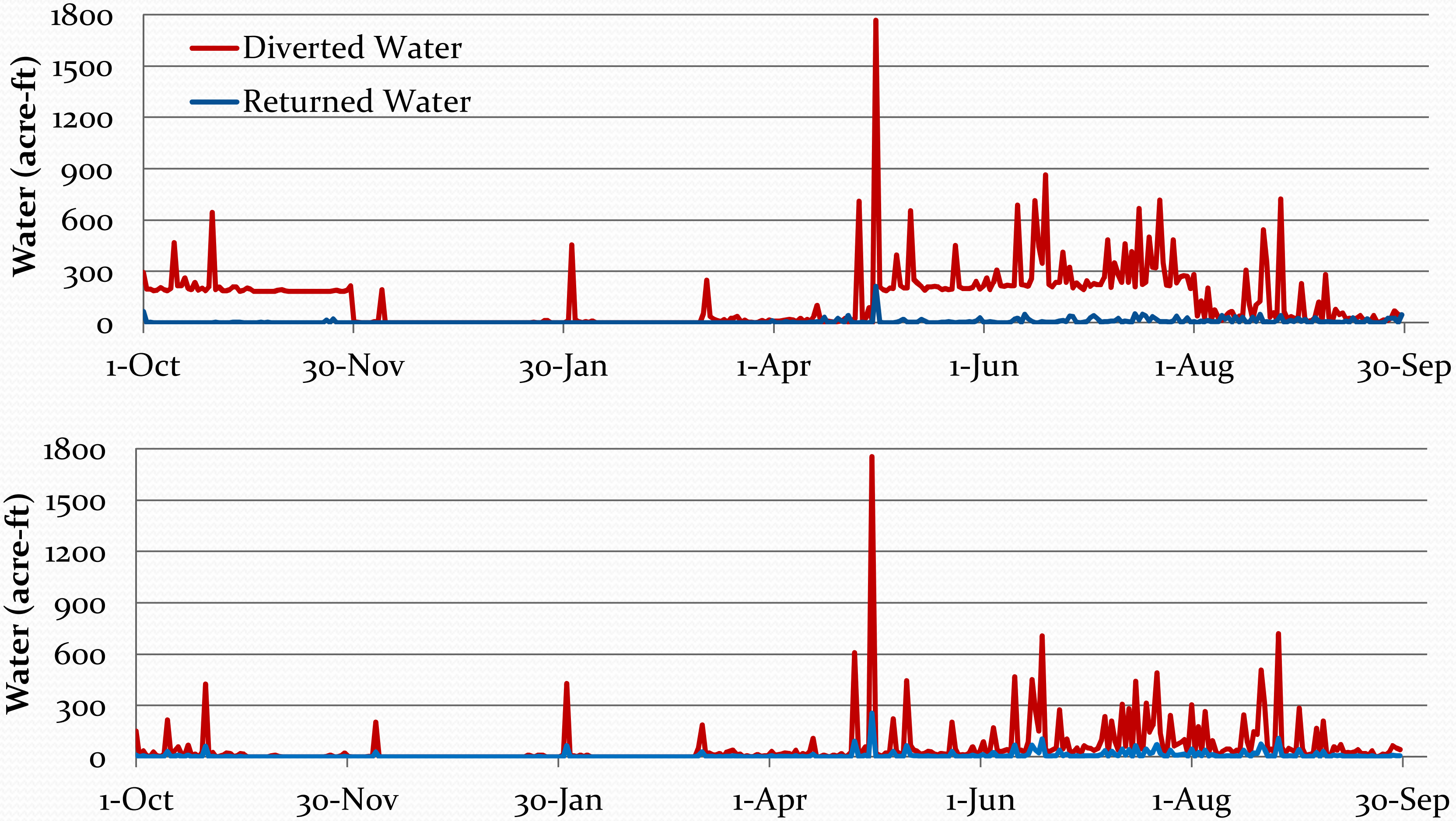






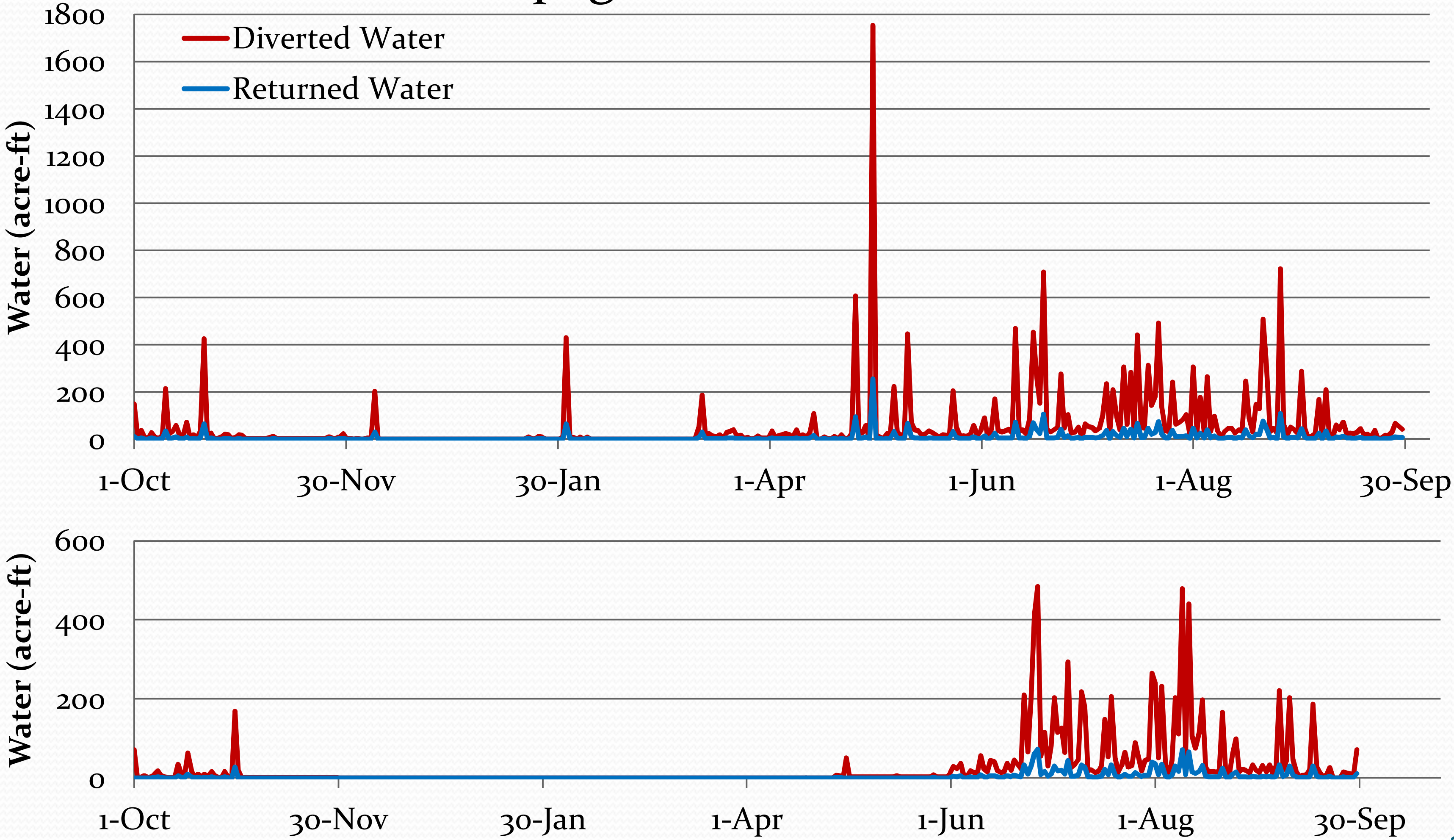
IDCFT Calibration and Sensitivity

- Saturated Hydraulic Conductivity



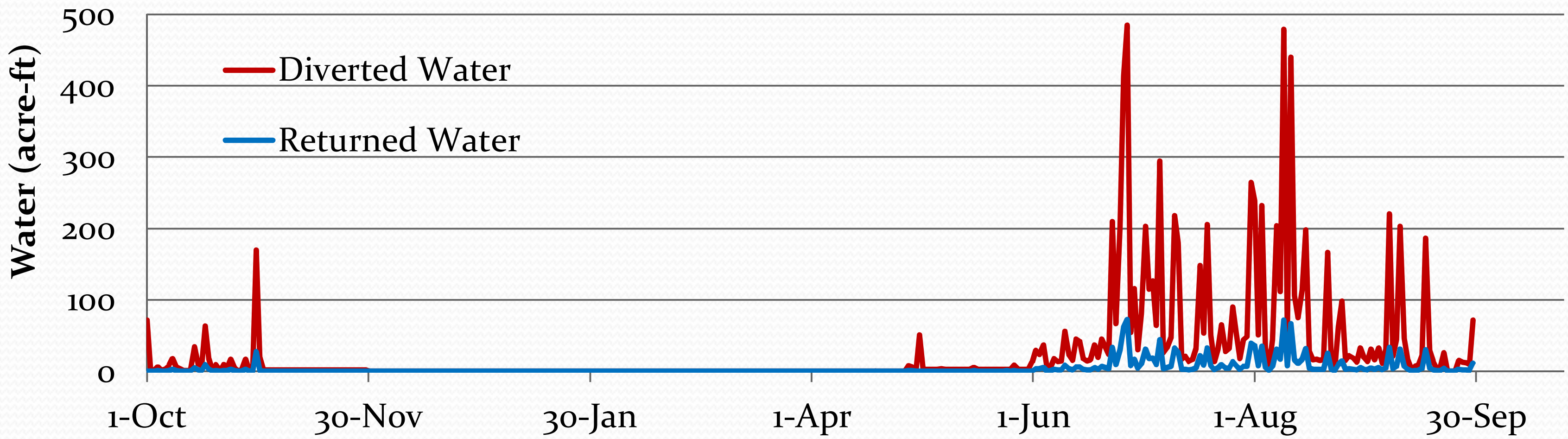
IDCFT Calibration and Sensitivity

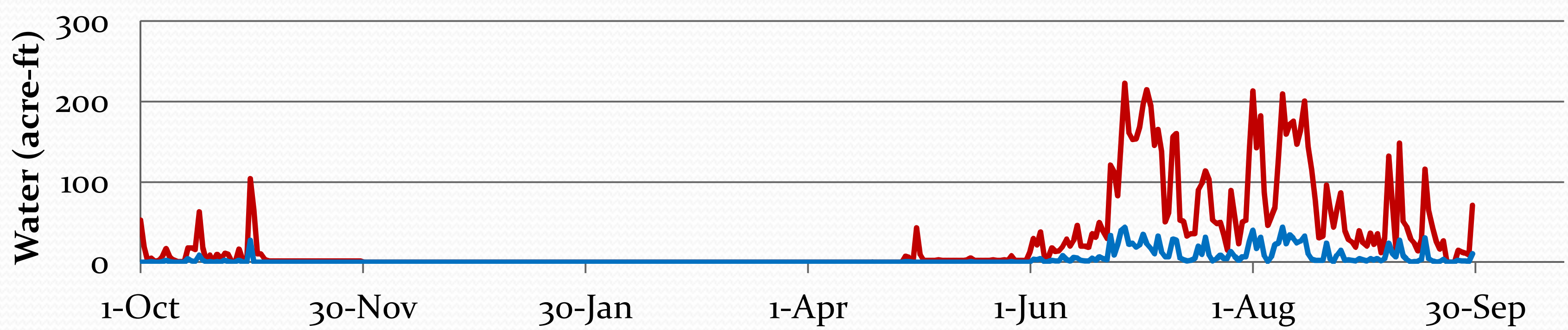
- Ground Water Seepage



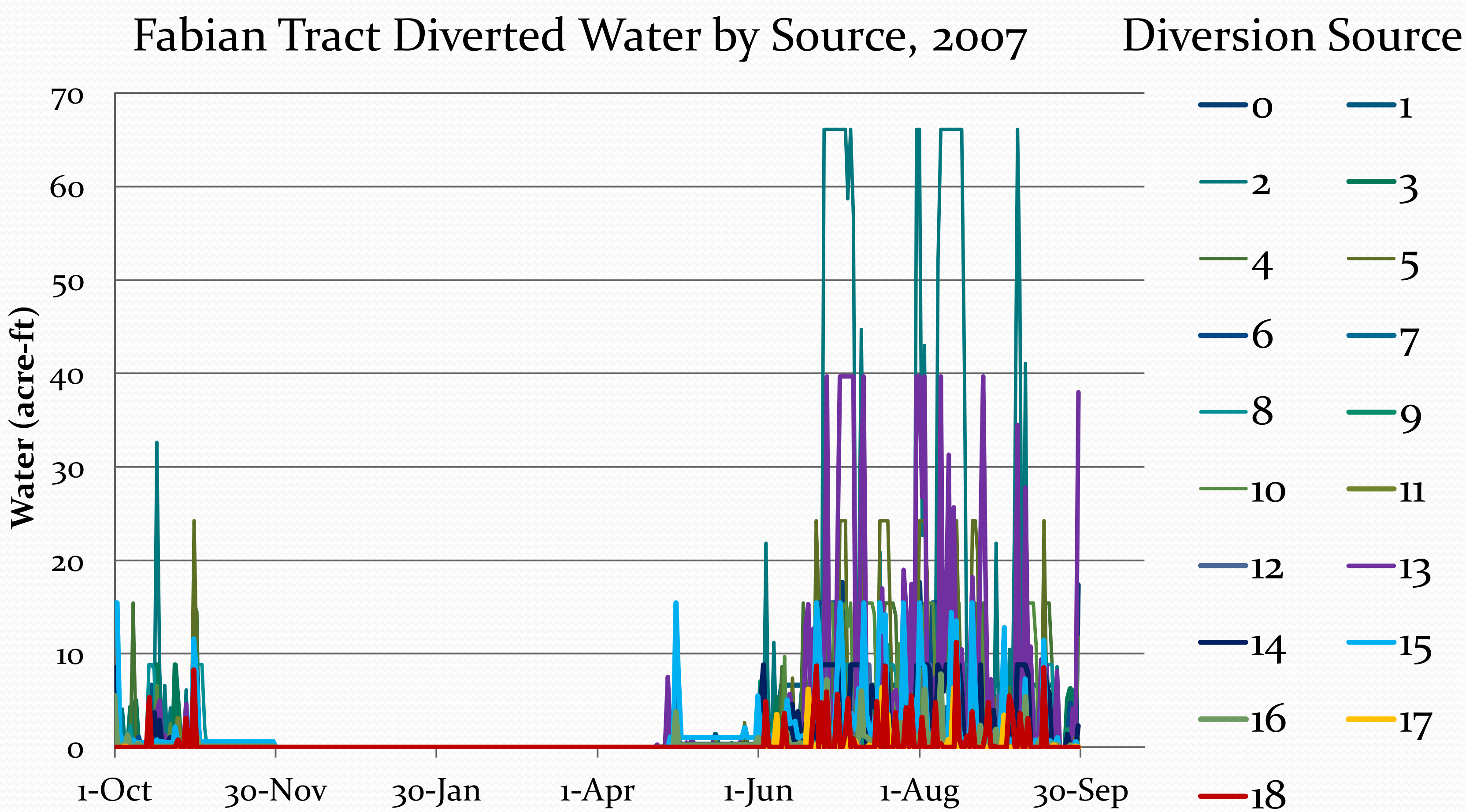
IDCFT Calibration and Sensitivity

- Pumping and Siphoning Rate Constraints

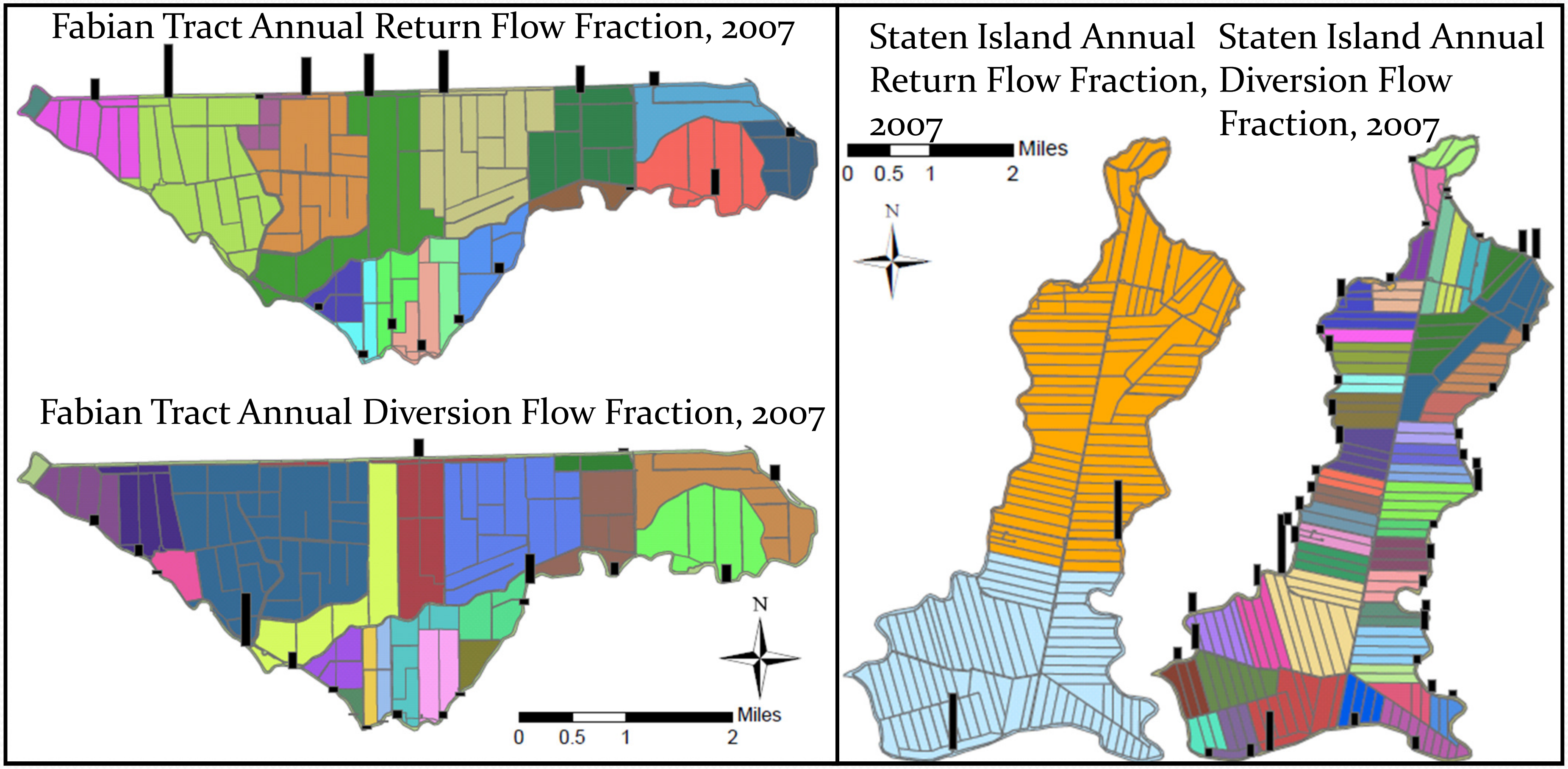




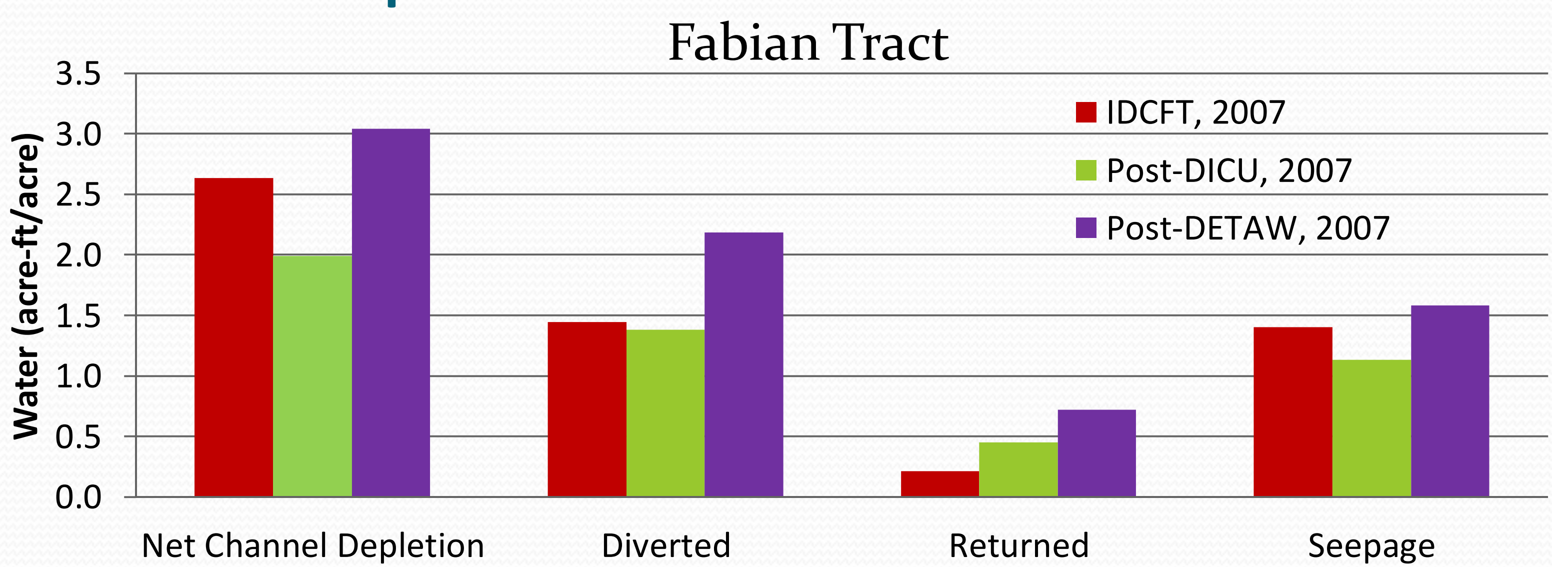
IDCFT Results: Diverted Water

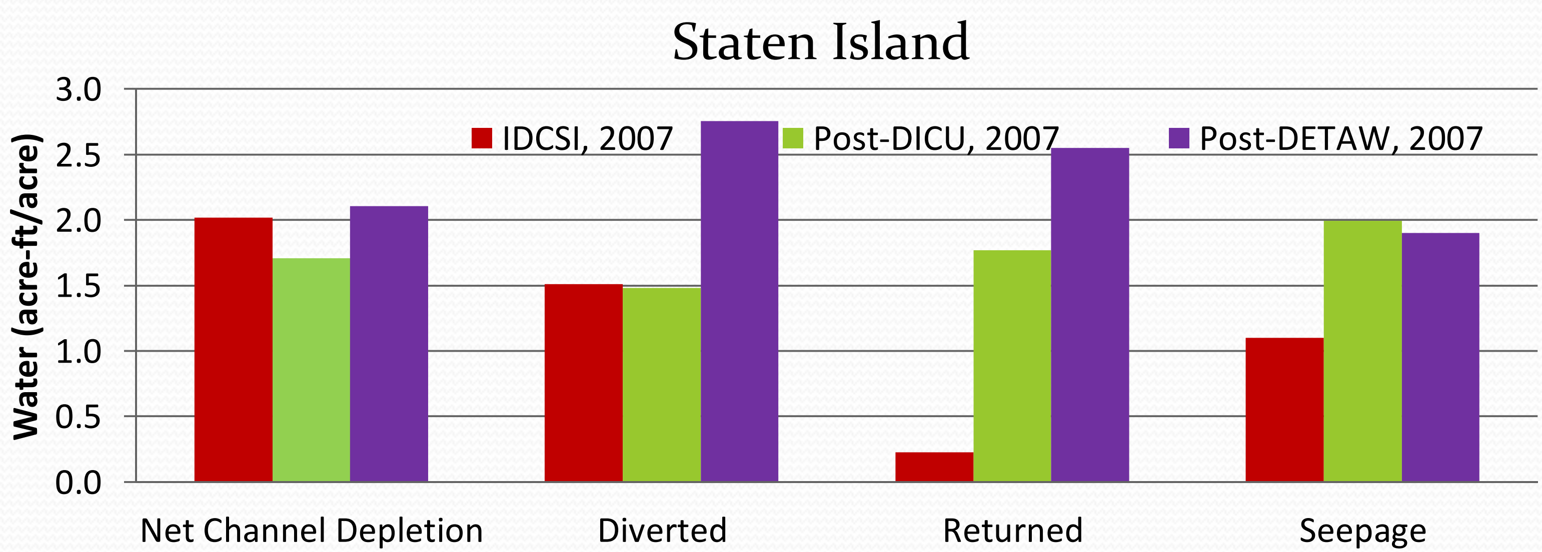


IDCFT Results: Flow Fraction Watershed



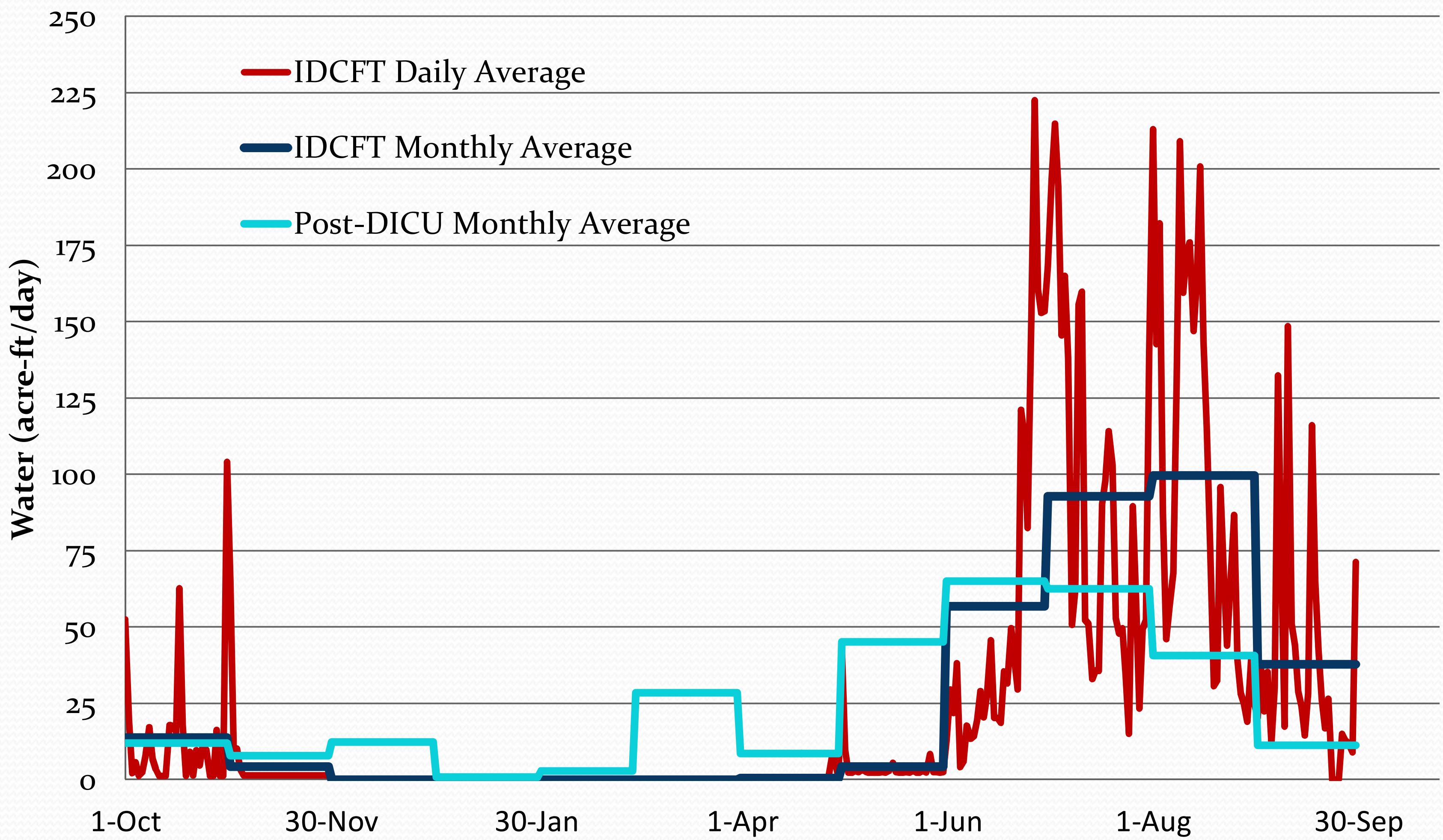
Model Comparison: Annual Total





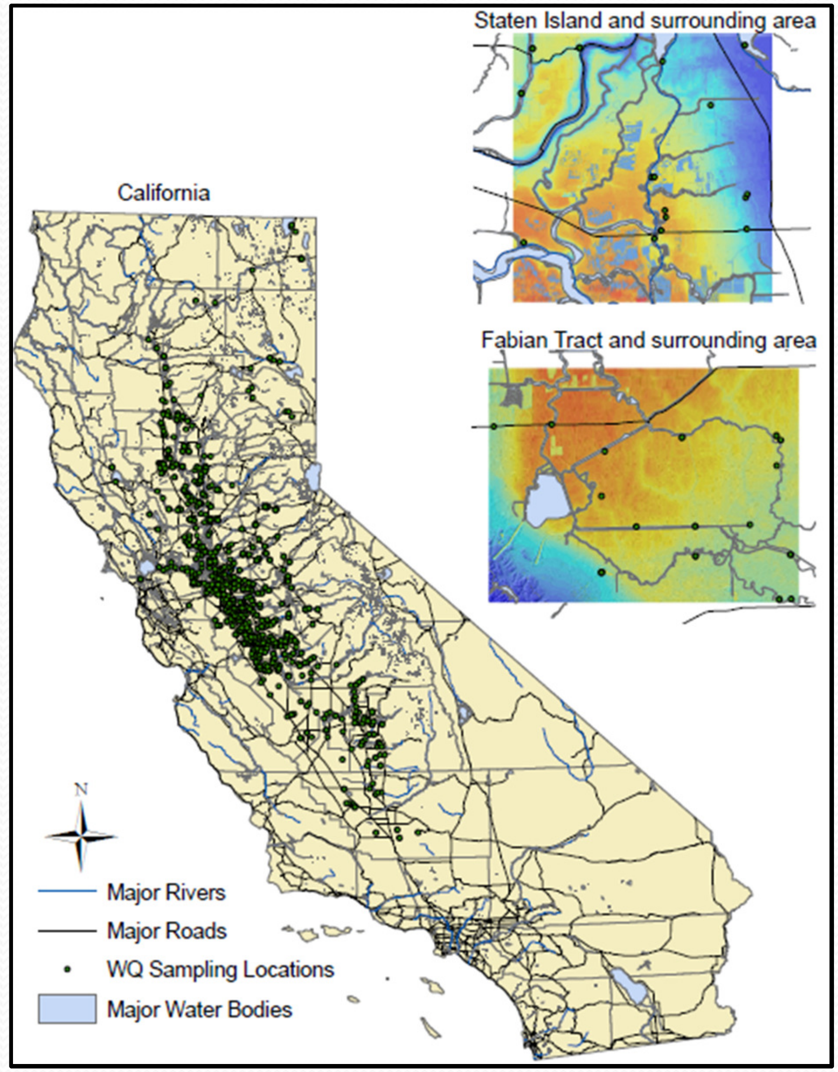
Model Comparison: Daily vs. Monthly Diversions

- Fabian Tract



Step 4. Water Quality Correlations

- Central Valley Regional Data Center Water Quality Data
- Obtained data insufficient to determine water quality correlations for current model years
- Older data available to establish EC or turbidity correlations



Conclusions

1. Physically Based Modeling of DICU
2. Diversion and return locations and patterns found accurately using GIS and satellite imagery
3. Ground-Truthing adds clarity
   - Google Earth might substitute
4. IDC model provides physical basis for daily DICU estimates (timing, locations, routing of diversions and returns)
5. Do flow quantity differences affect water quality?
   - DSM2 results?
6. A physically based modeling approach could improve Delta water quality estimates