

APPLICATION OF CFD FOR THE DESIGN OF A CEPP-N RESTORATION PROJECT FLOW DISTRIBUTION FACILITY

Jeong W. Park

Hydrology & Hydraulics Bureau, South Florida Water Management District

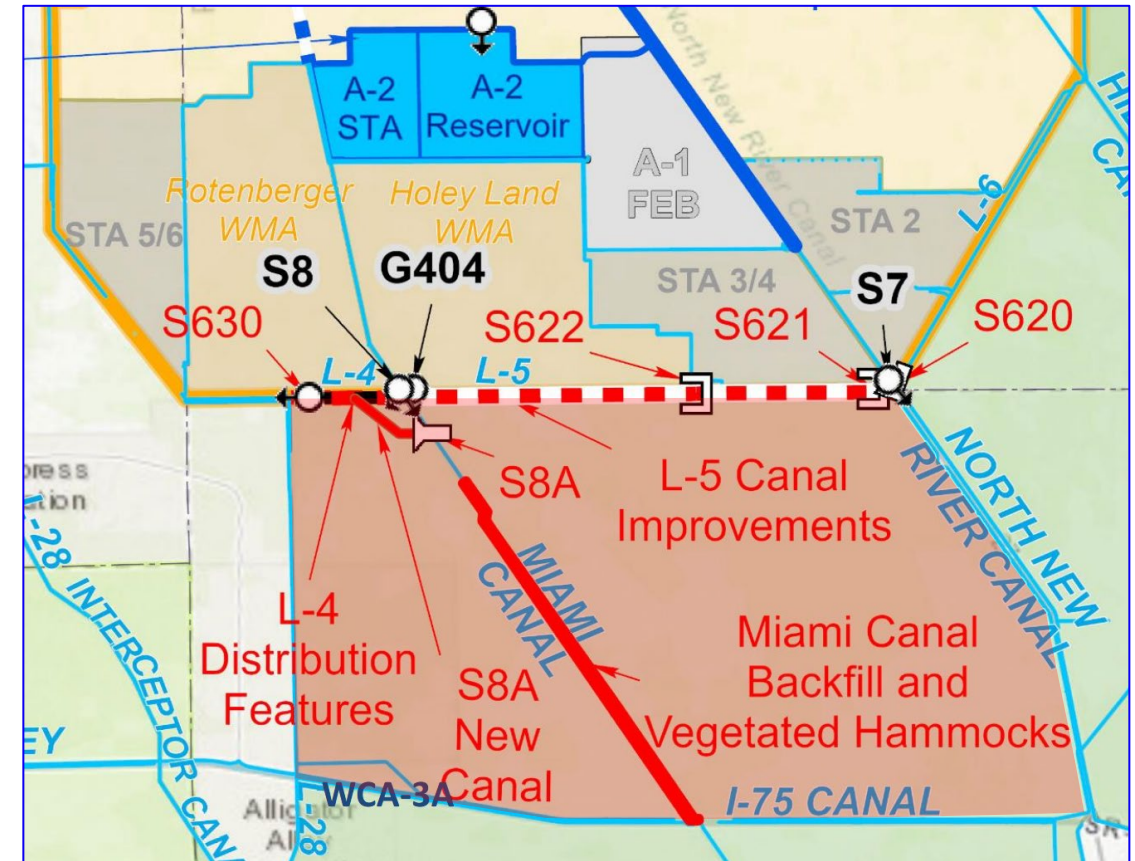
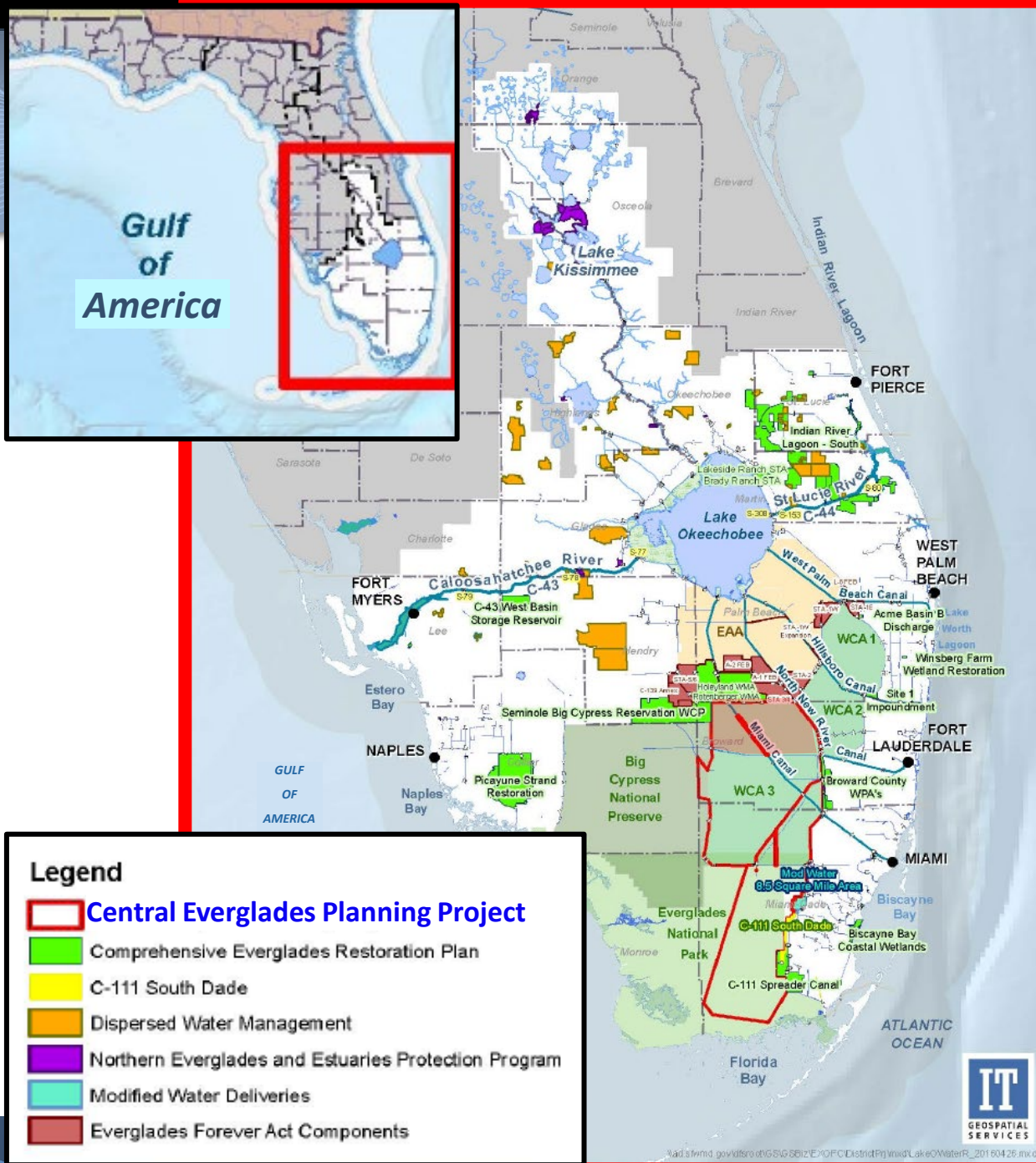
West Palm Beach, FL, USA

Slide Contents

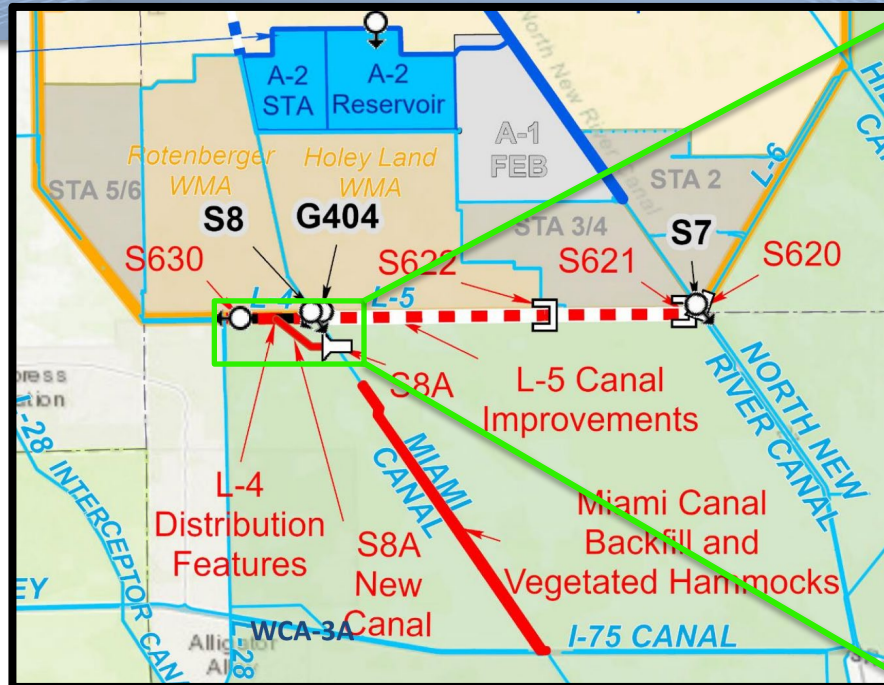
- Location of **Central Everglades Planning Project – North Phase** (CEPP-N)
- Roles of S-8A Complex in CEPP-N.
- S-8A Junction Design Constraints and Requirements
- Computational Fluid Dynamics (CFD) Model Setup
- Model Results and Discussion
- Summary and Future Work

Map of CEPP-*N*

(Central Everglades Planning Project – *North Phase*)



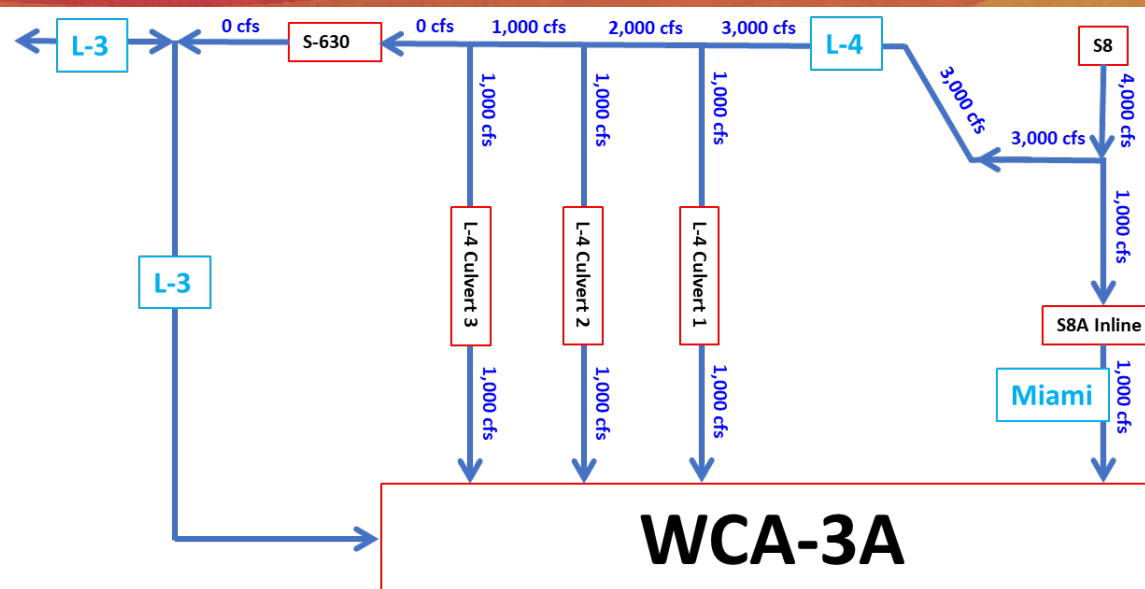
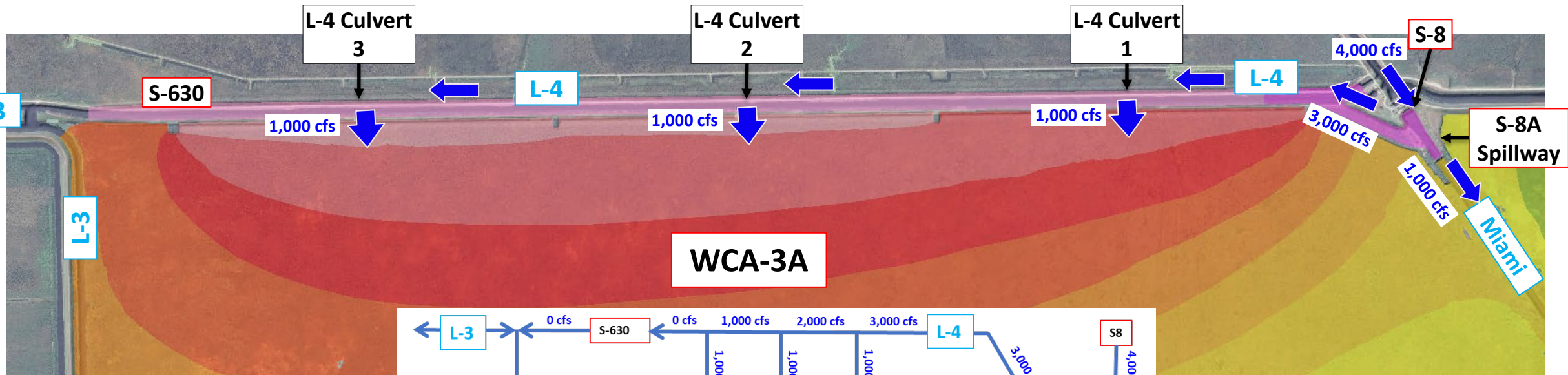
Map of S-8A Complex from CEPP-N



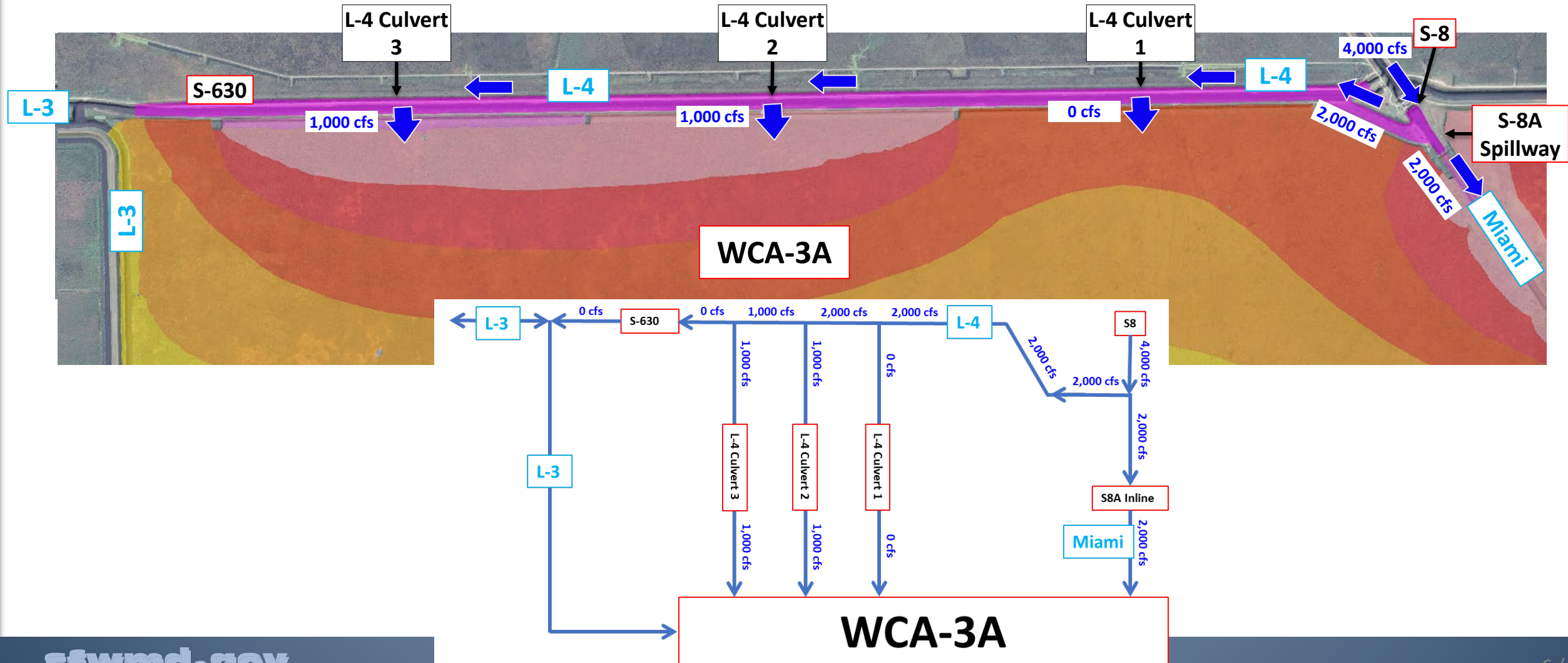
S-8A Complex CFD Modeling Area



Design Scenario 1: 4,000 cfs Design Flow Distribution of S-8A Complex



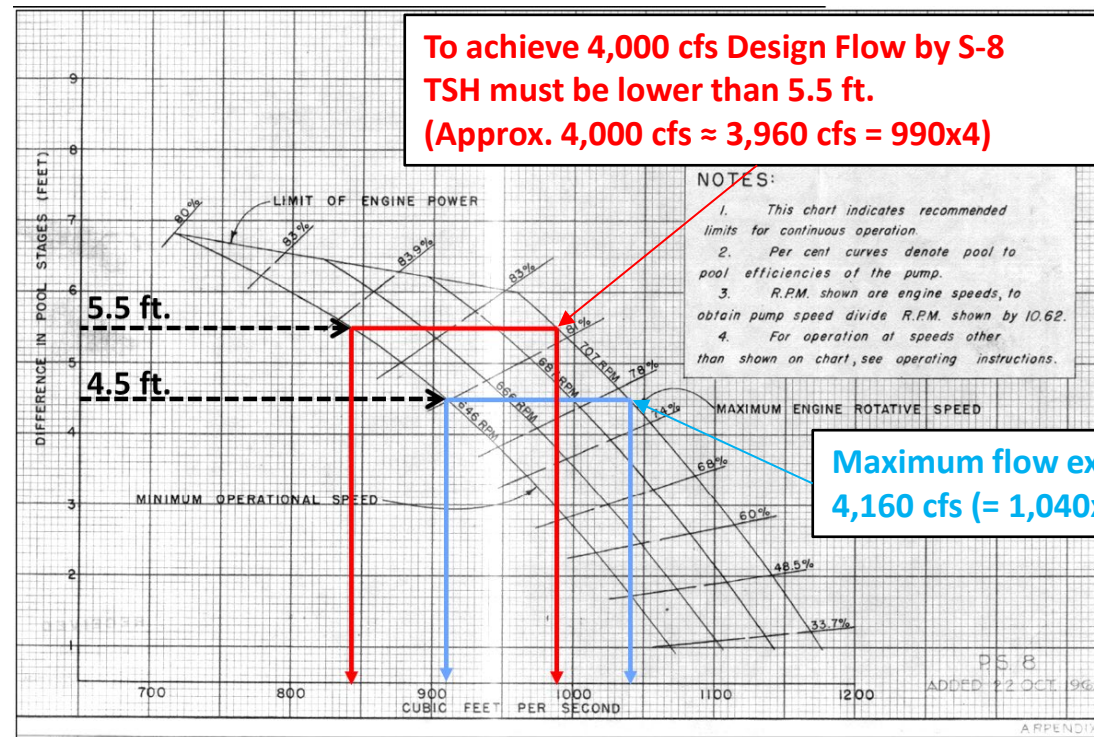
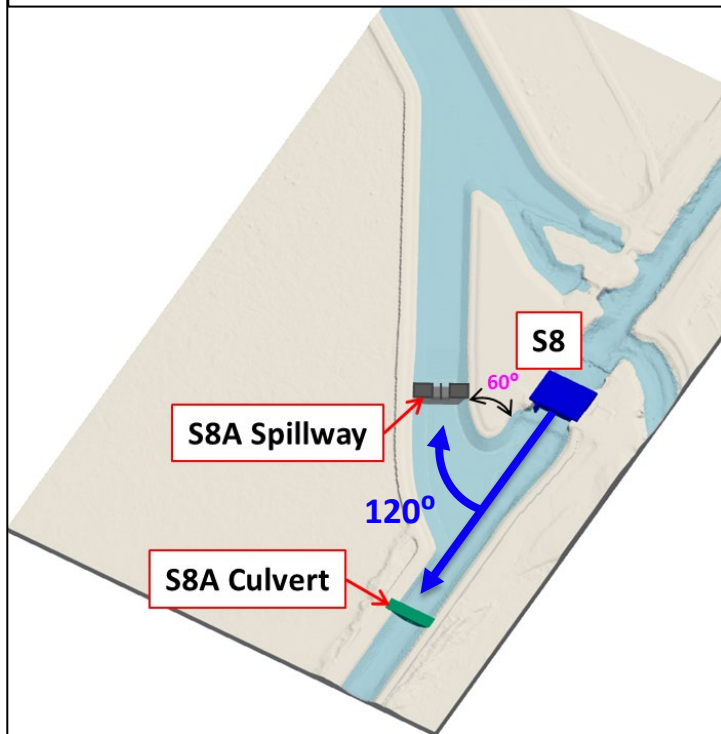
Design Scenario 2: Emergency/Maintenance (E/M) Flow Distribution of S-8A Complex



Design Constraints and Requirements of S-8A Complex

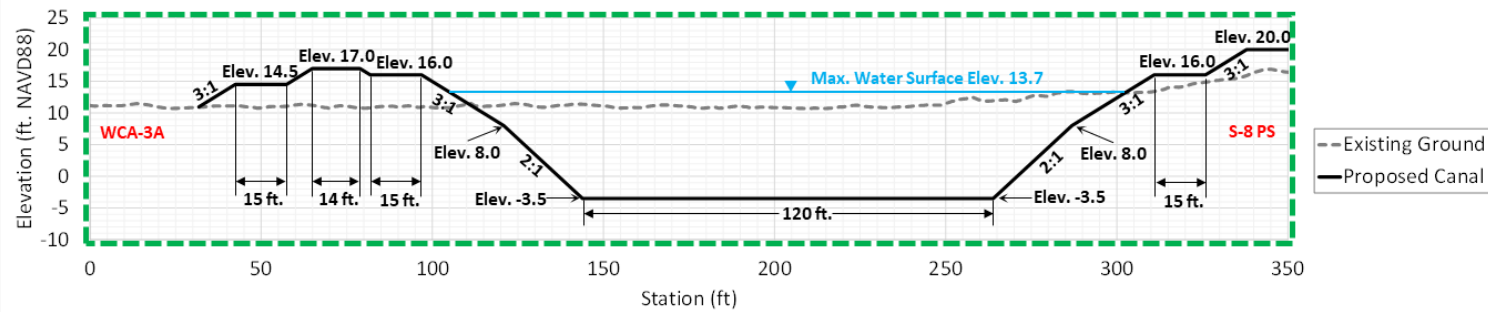
1. Reuse of Existing Pump Station (S-8)
2. Minimization of Wetland Destruction by S-8A Complex
3. 2 fps of maximum flow velocity in Channel Design Guideline

Original Design Layout in Planning Stage

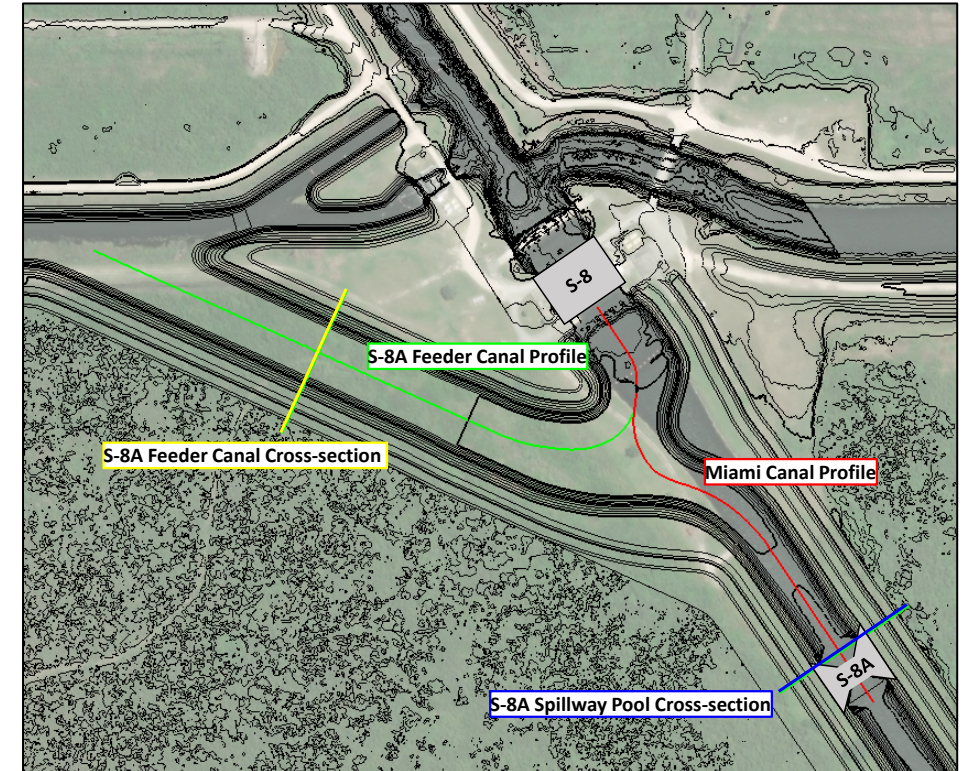
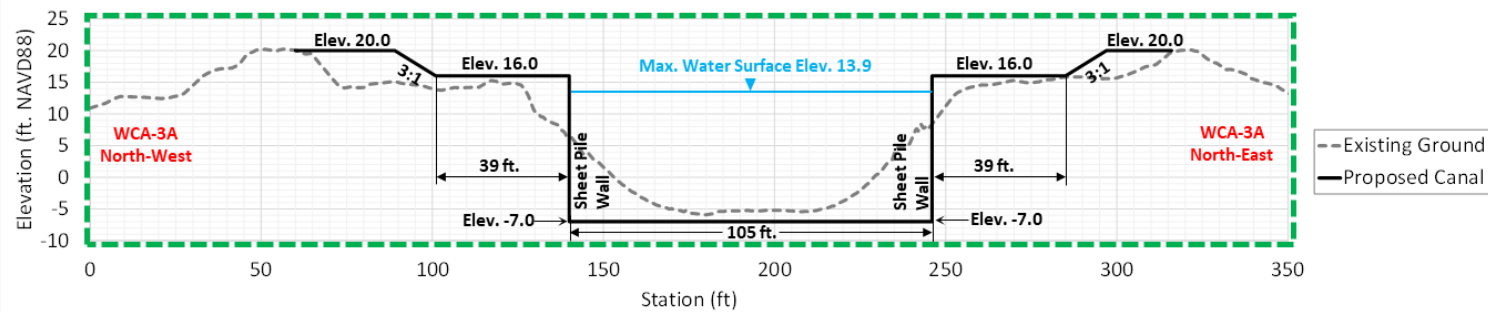


Typical Design Channel Cross-sections

S-8A Proposed Feeder Canal Cross-Section @ R.S. 10+80

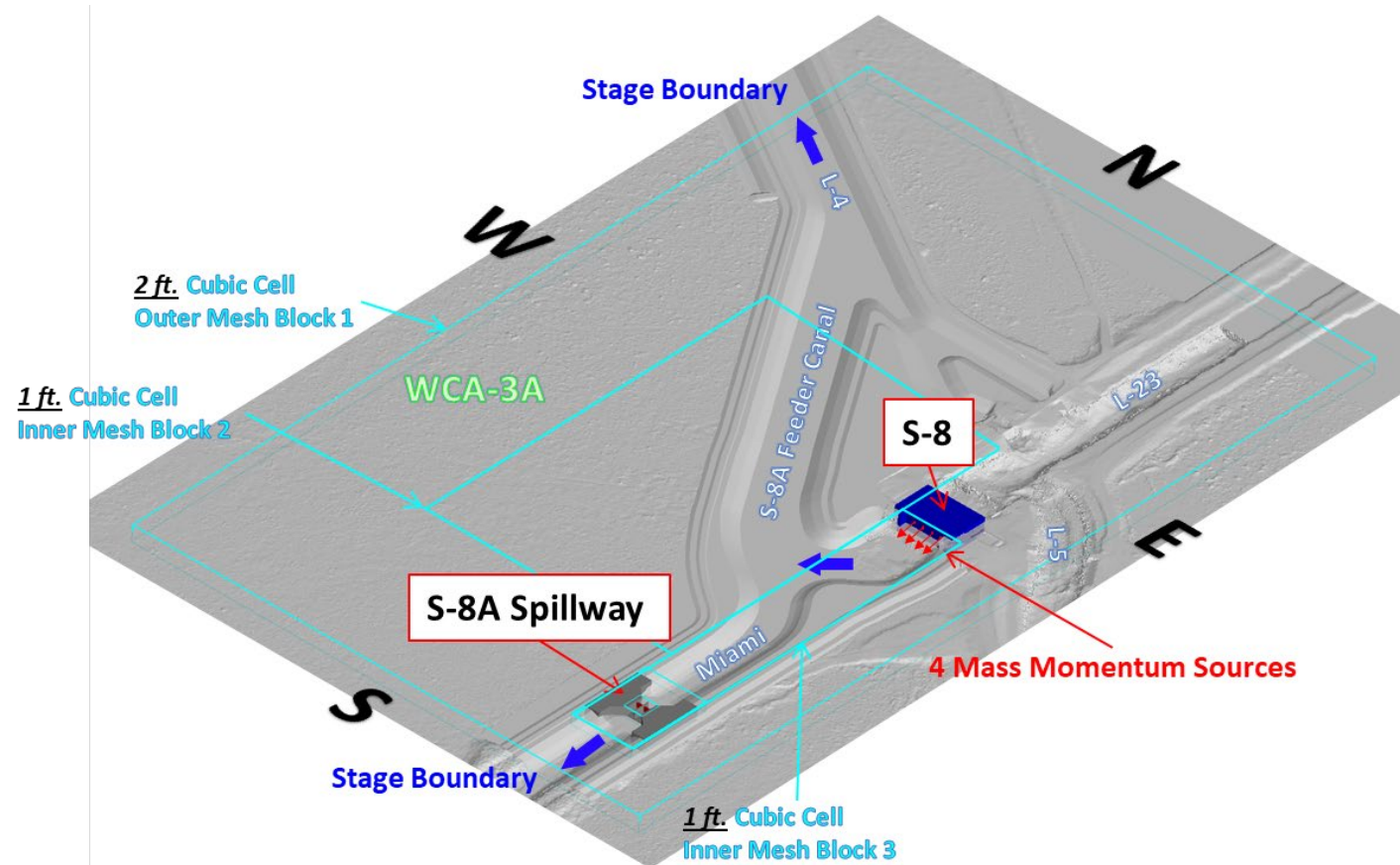


S-8A Proposed Pool Cross-Section @ R.S. 10+32



FLOW-3D CFD Model Setup

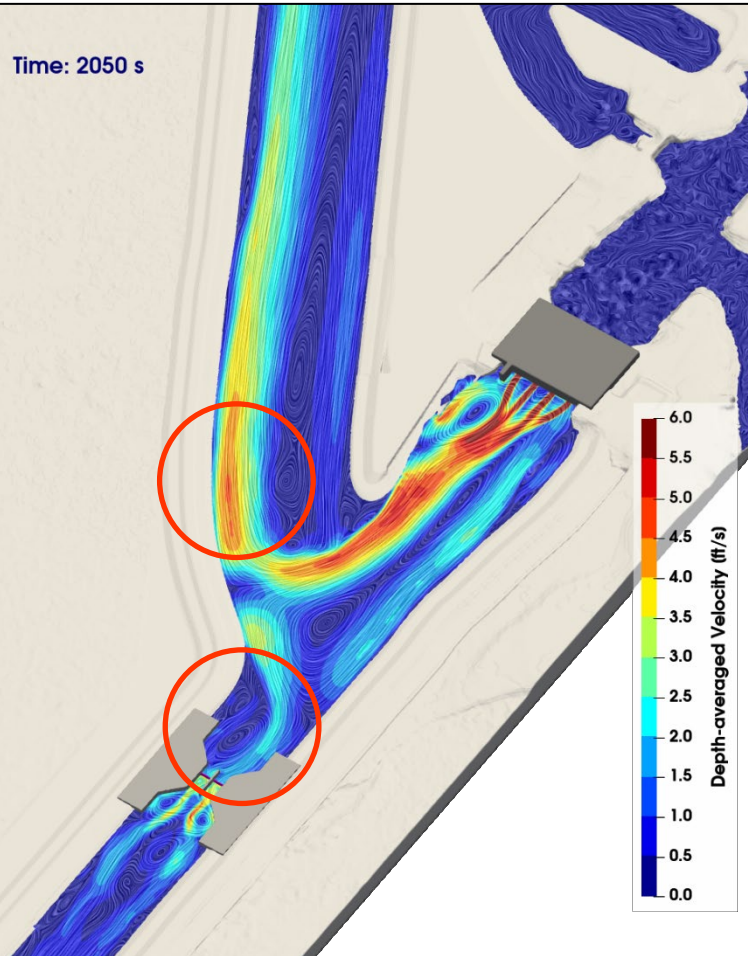
	Normal Design Operation	Emergency Management Operation
Total input flow from S-8	4,000 cfs	4,000 cfs
Outflow stage in L-4 Canal	13.7 ft-NAVD88	13.7 ft-NAVD88
Outflow stage in Miami Canal	12.7 ft-NAVD88	13.7 ft-NAVD88
S-8A Spillway Gate Opening	Partially Open	Fully Open



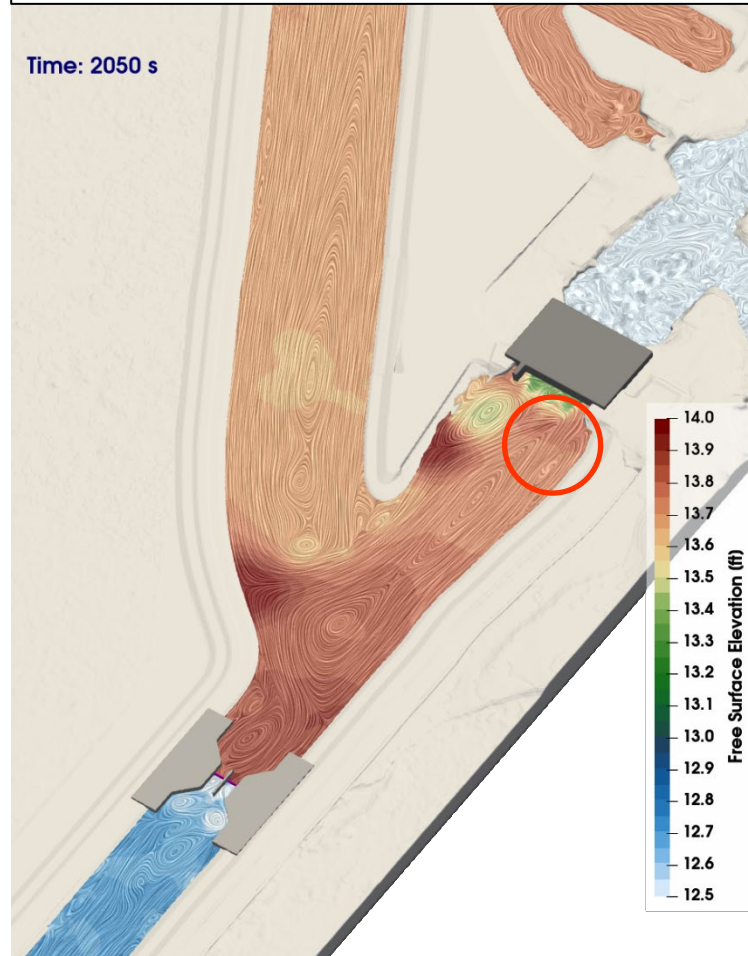
Conceptual Design 1: (2,050 sec.)

Normal Design Operation (3:1 Flow Distribution Ratio)

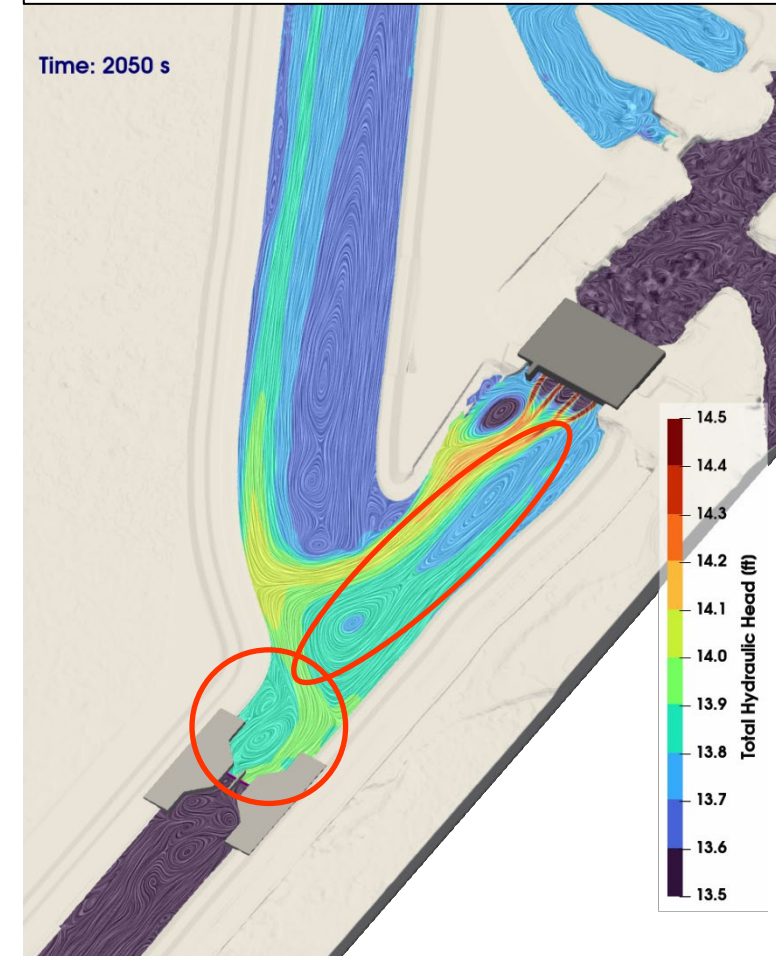
Depth-averaged Velocity



Free Surface Elevation

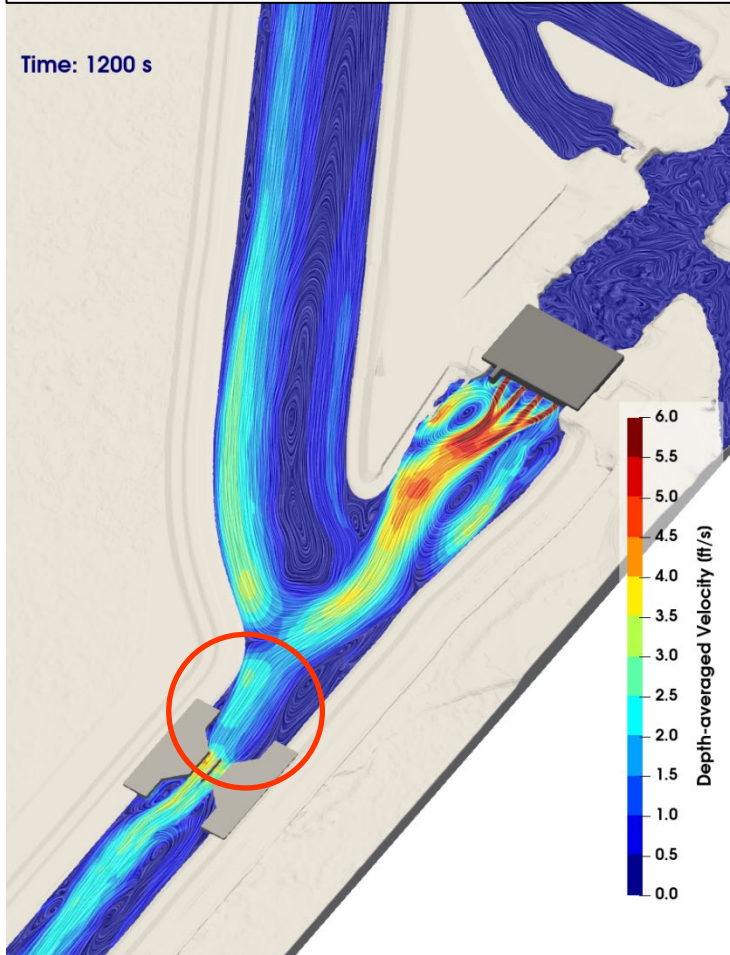


Total Hydraulic Head

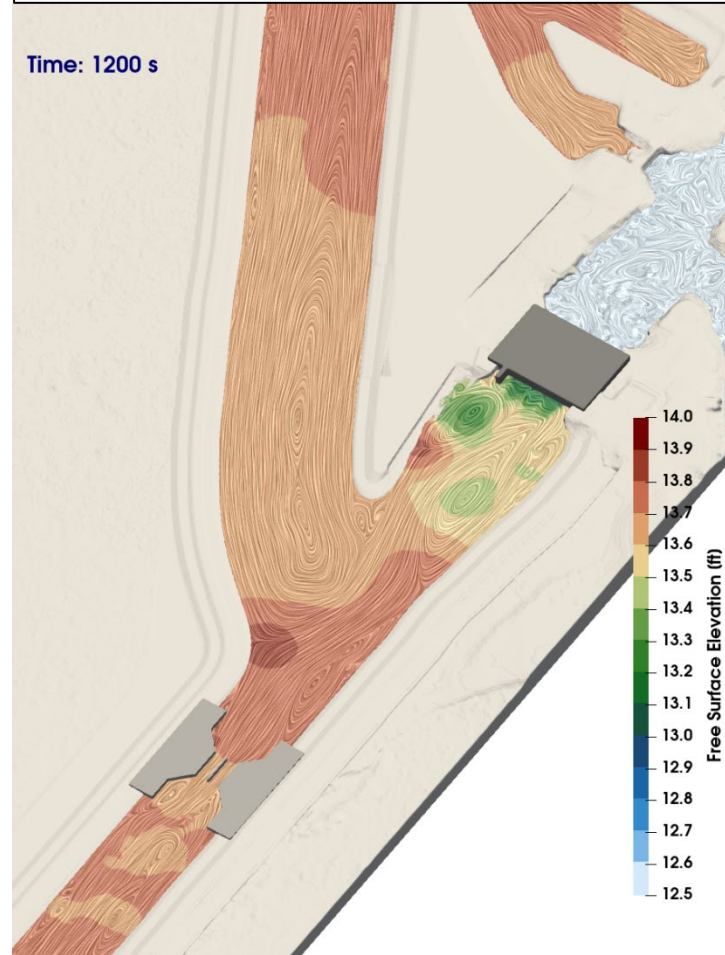


Conceptual Design 1: (1,200 sec.) E/M Operation (1:1 Flow Distribution Ratio)

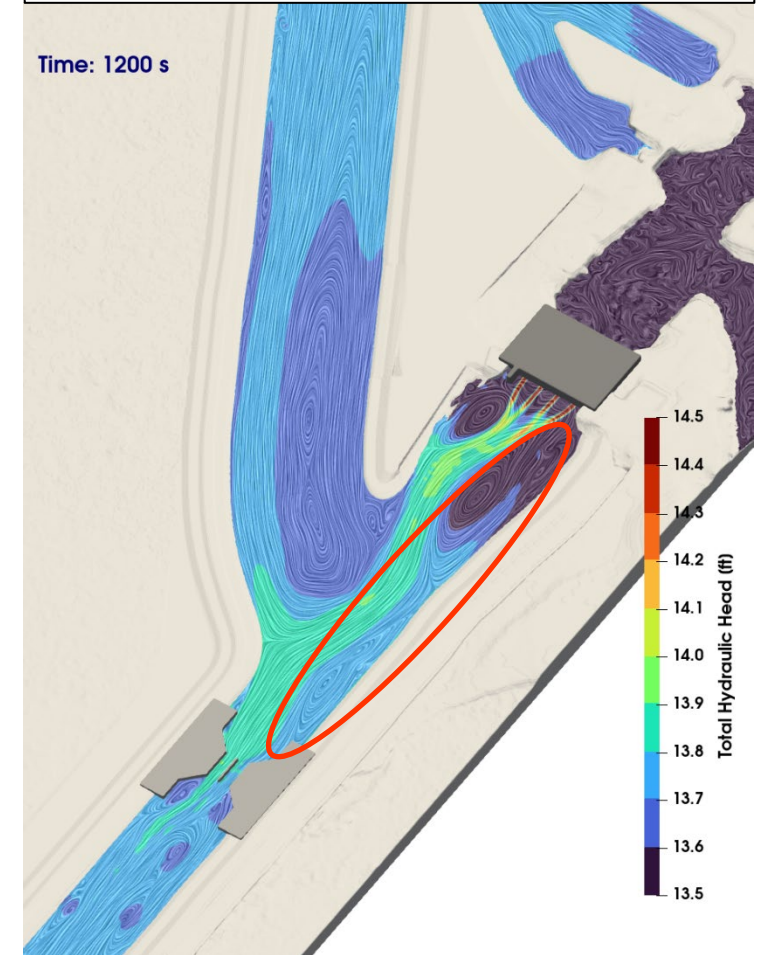
Depth-averaged Velocity



Free Surface Elevation

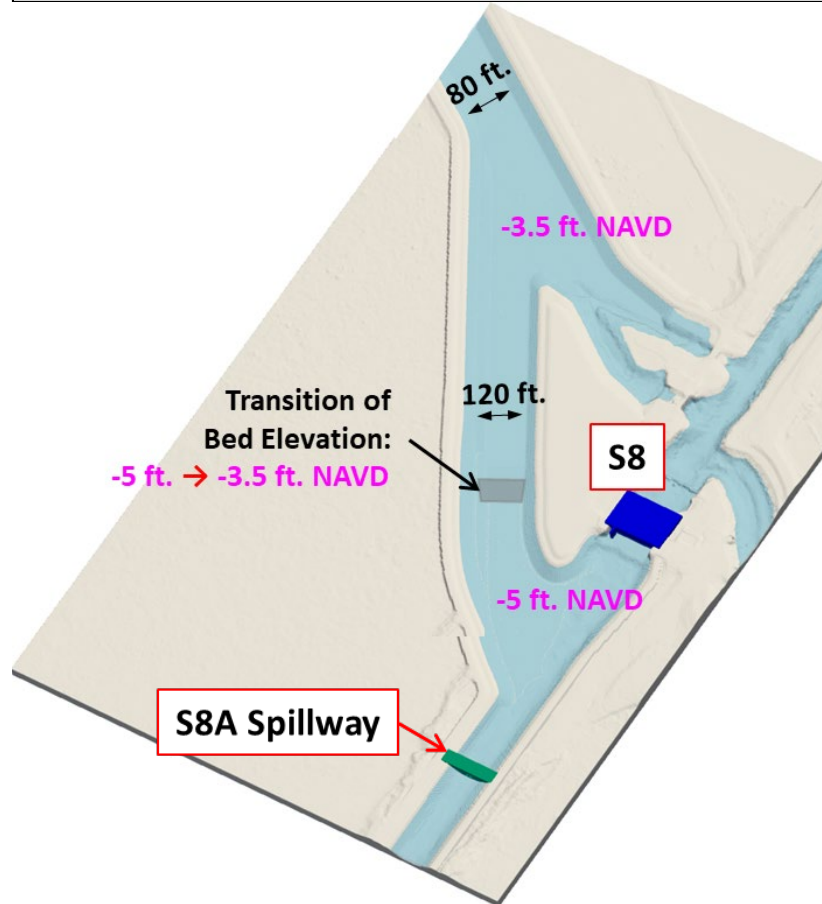


Total Hydraulic Head

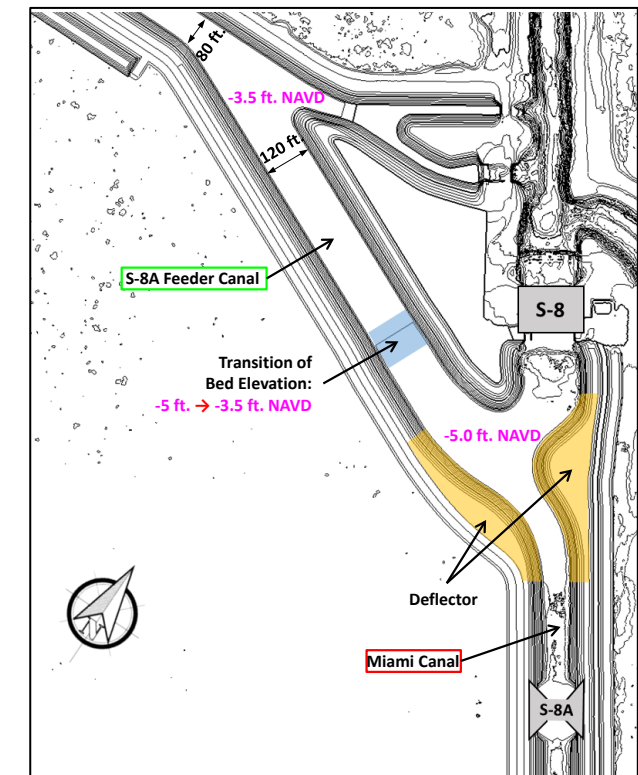
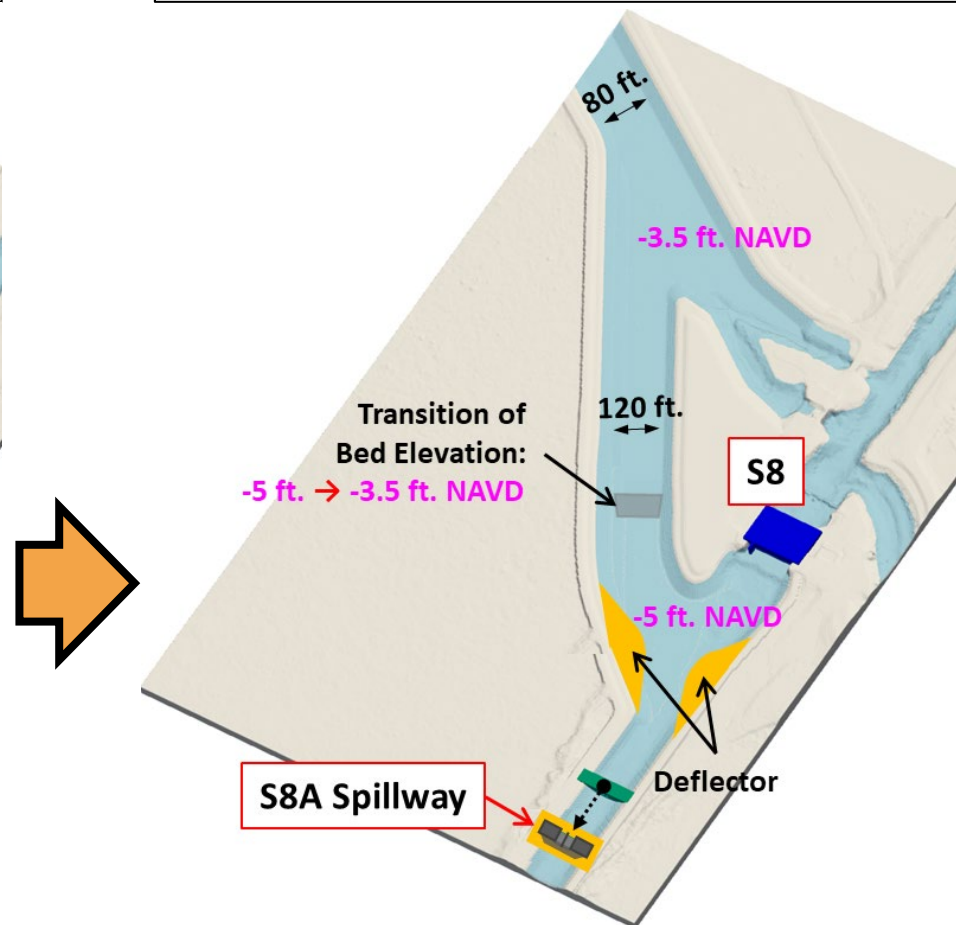


Conceptual Design Changes of S-8A Junction

Conceptual Design 1



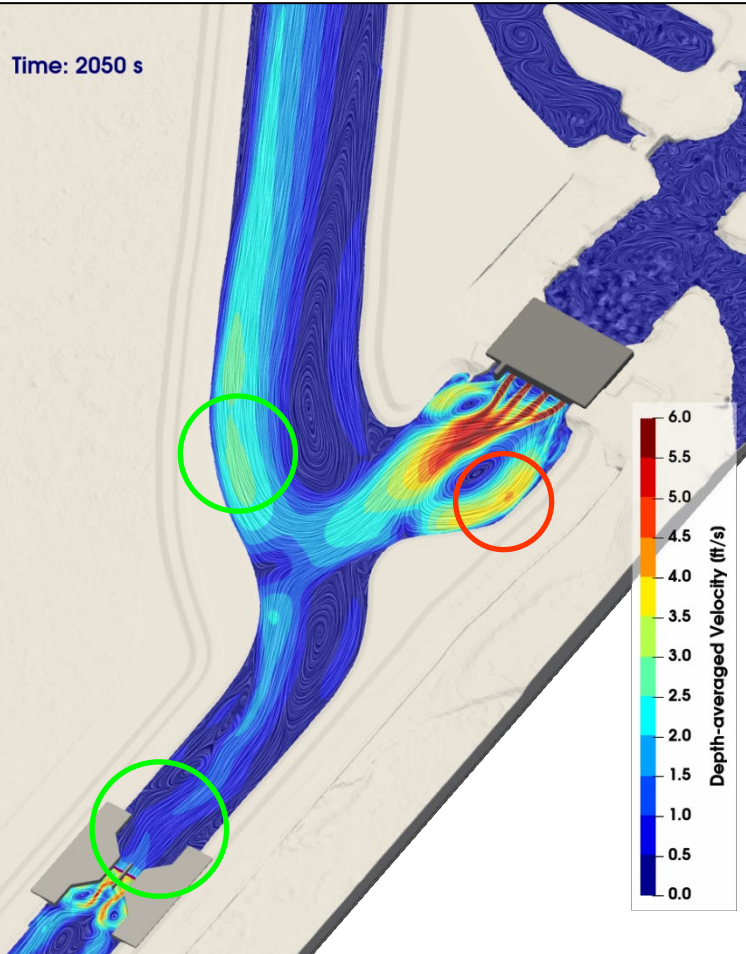
Conceptual Design 2



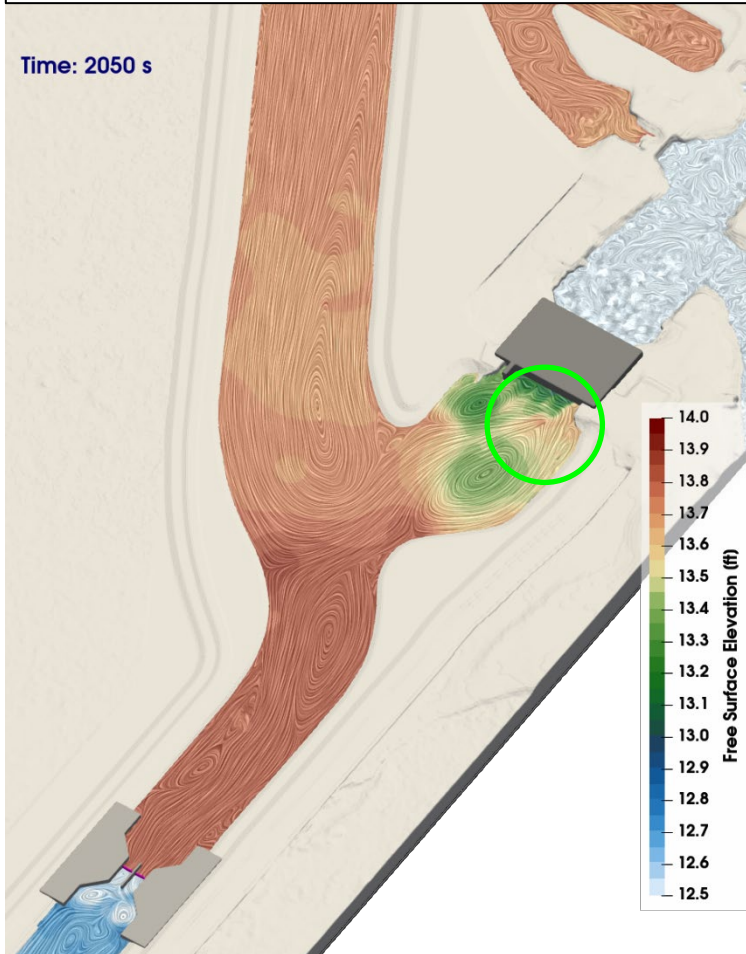
Conceptual Design 2: (2,050 sec.)

Normal Design Operation (3:1 Flow Distribution Ratio)

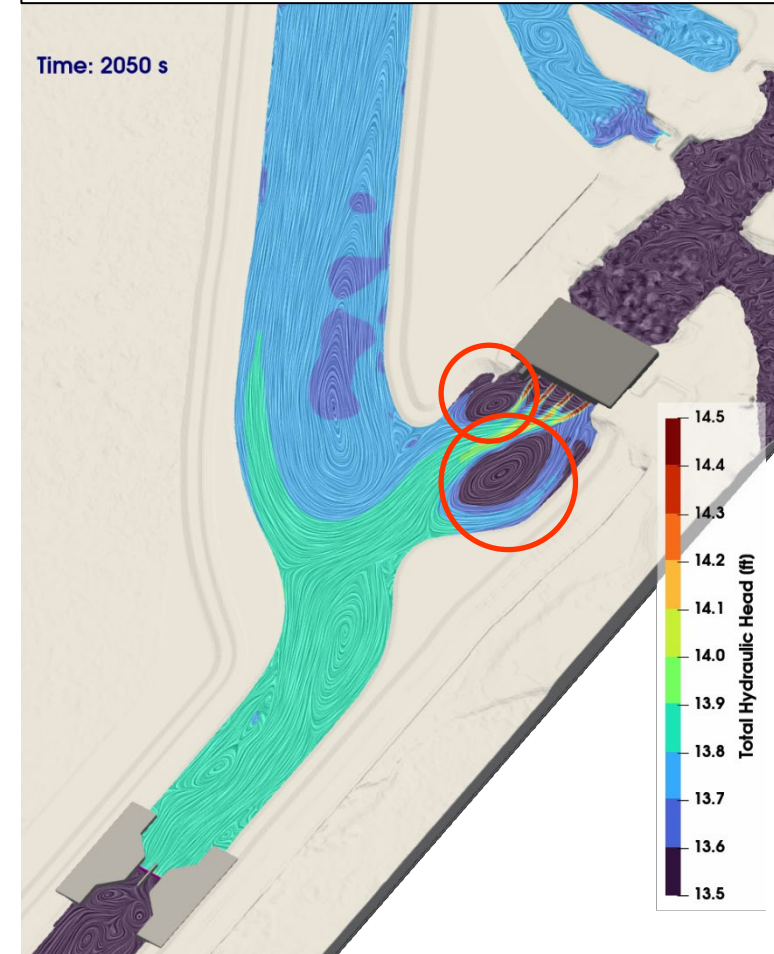
Depth-averaged Velocity



Free Surface Elevation

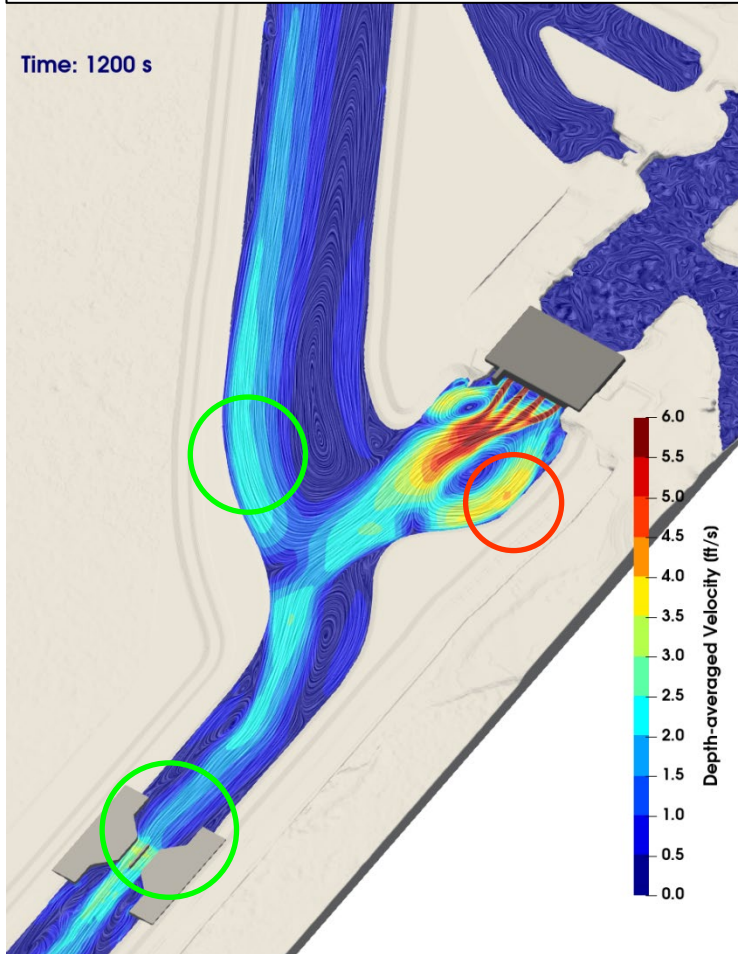


Total Hydraulic Head

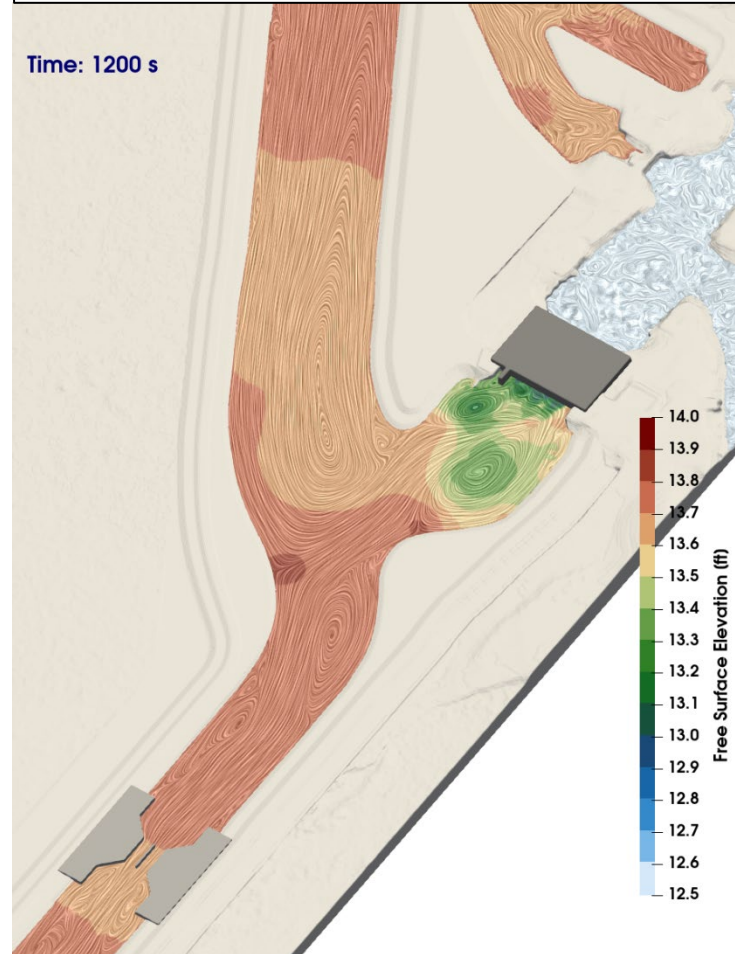


Conceptual Design 2: (1,200 sec.) E/M Operation (1:1 Flow Distribution Ratio)

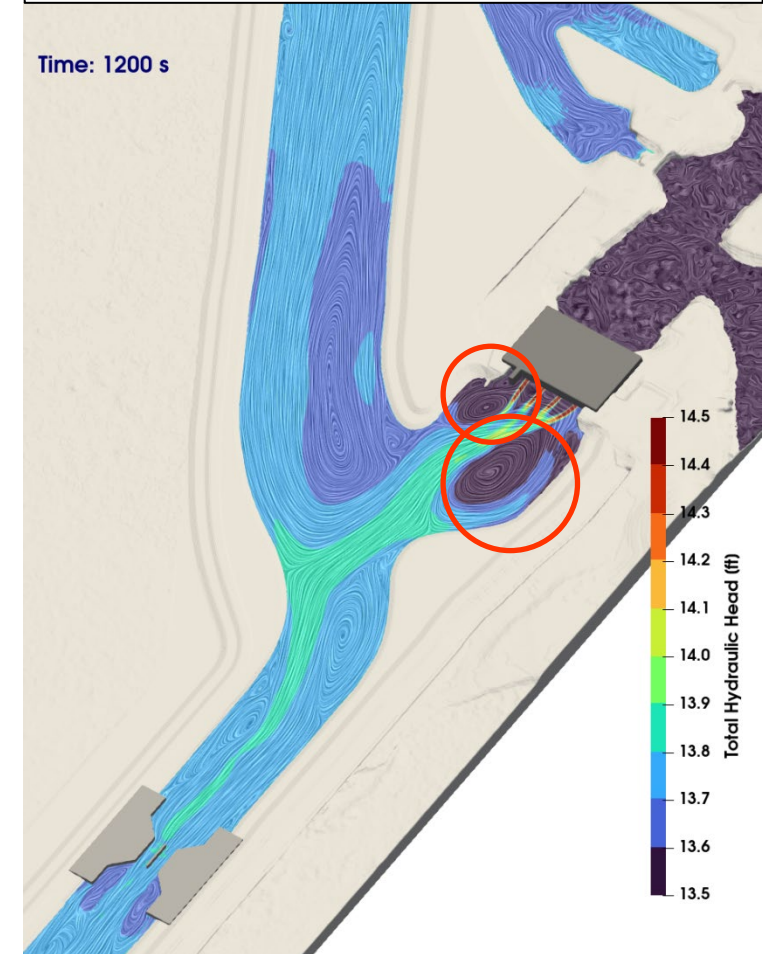
Depth-averaged Velocity



Free Surface Elevation

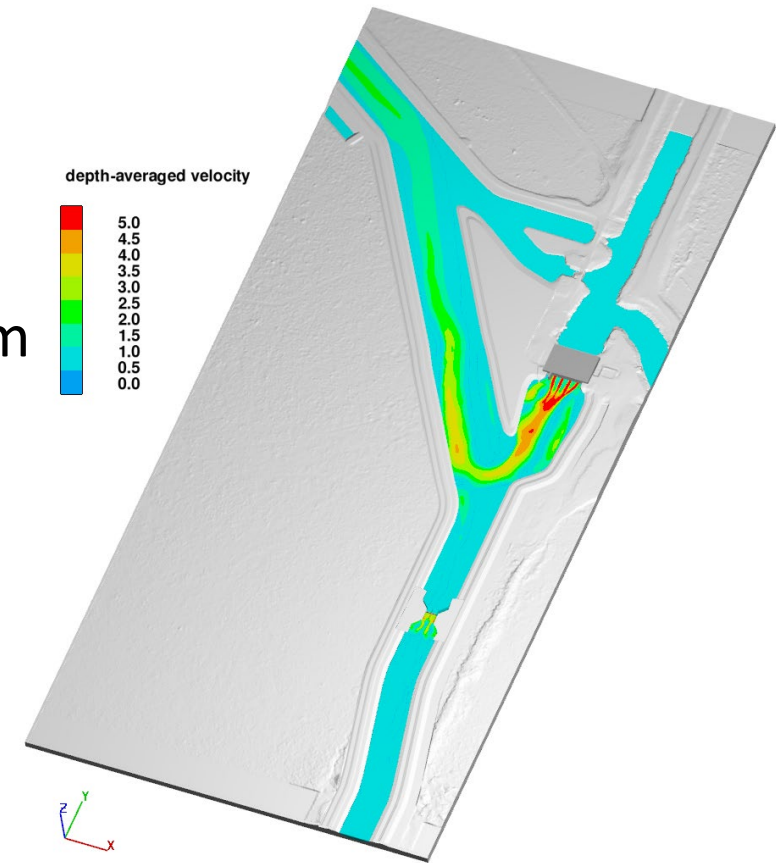


Total Hydraulic Head



Summary and Future Work

- Based on CFD Analysis of Conceptual Design 1,
 1. Add deflectors in the junction of S-8A complex.
 2. Move S-8A spillway downstream from the junction.
- The results of new design features in Conceptual Design 2:
 1. Reduced large eddies at the junction.
 2. Reduced velocity and stabilized flow pattern downstream of the junction.
 3. Distributed flow evenly across both S-8A spillway bays and reduced lateral movement of flow in the downstream of Miami canal.
- Remaining Challenges and Future Work
 1. Fast eddies and dynamic flow in the S-8 discharge pool
 2. Offset design of the downstream reach of the junction.



Questions?



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