Effects of restoration alternatives on stages and flows in the southern Everglades, using the MIKE Marsh Model of Everglades National Park (M3ENP)

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Everglades National Park, Homestead, FL, USA

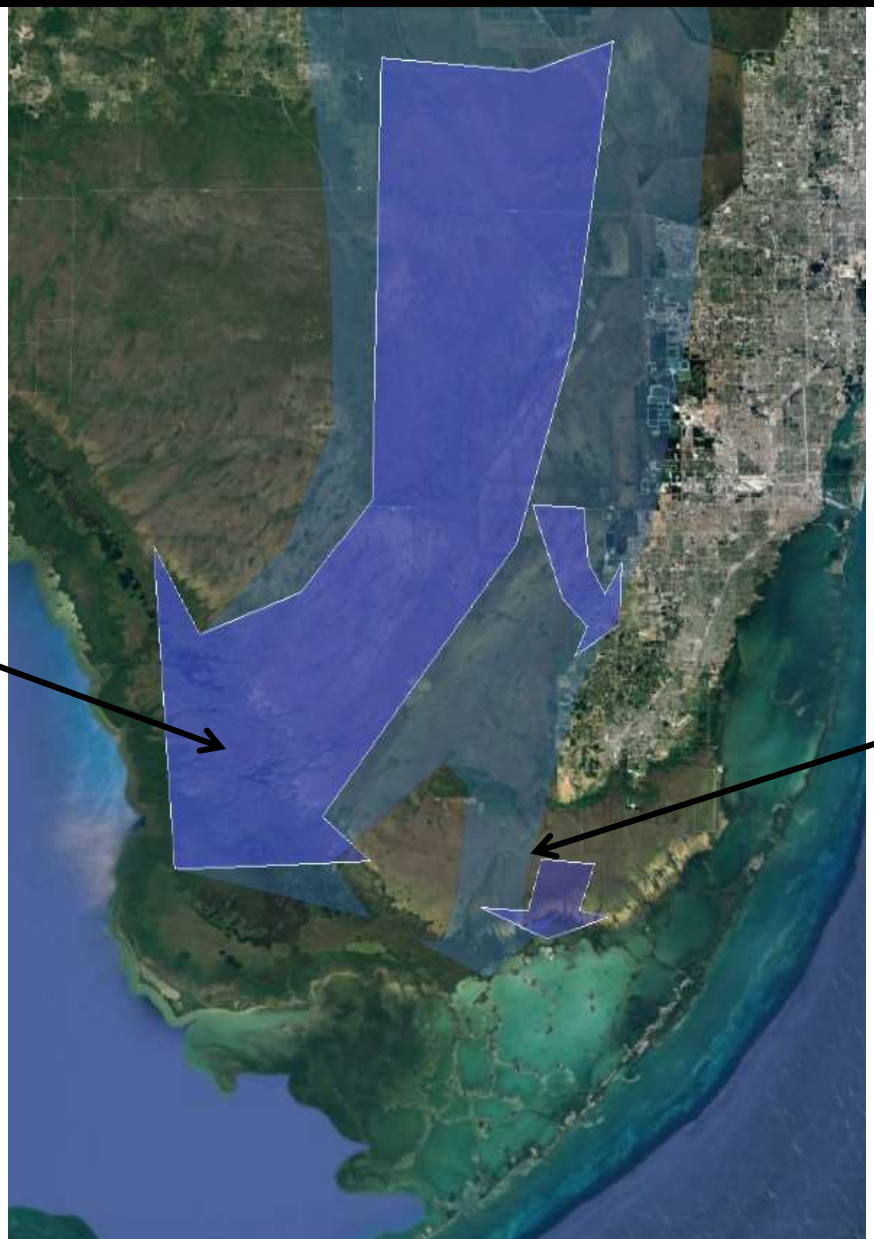
Greater Everglades Ecosystem Restoration Conference

April 18-20, 2017, Coral Springs, FL

Historical Flows

Current Flows

Shark River Slough



Taylor Slough

National Park Service

Everglades National Park

Modified Water Deliveries

C111 Project

Florida Bay Study

National Park Service

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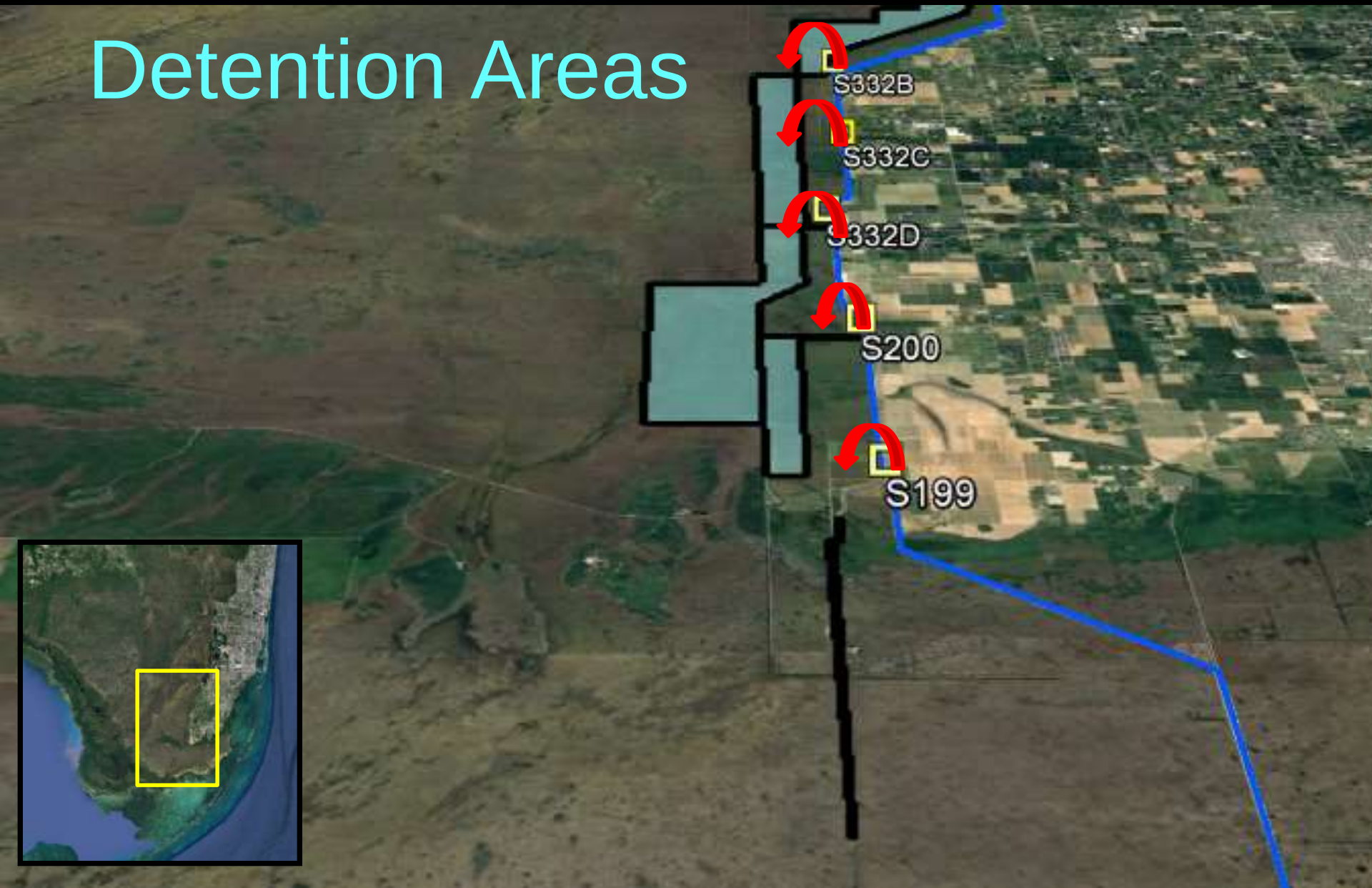
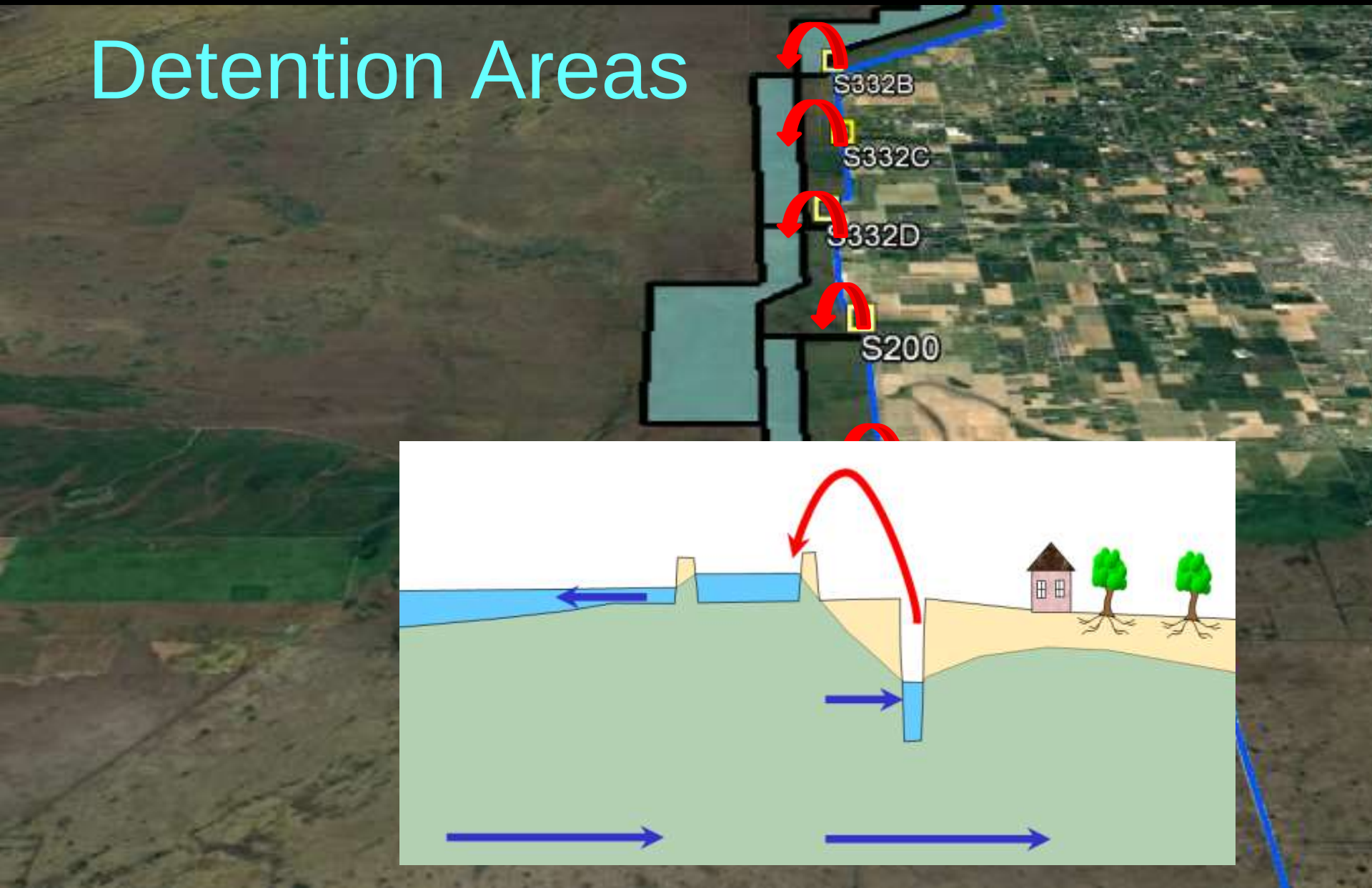
Detention Areas

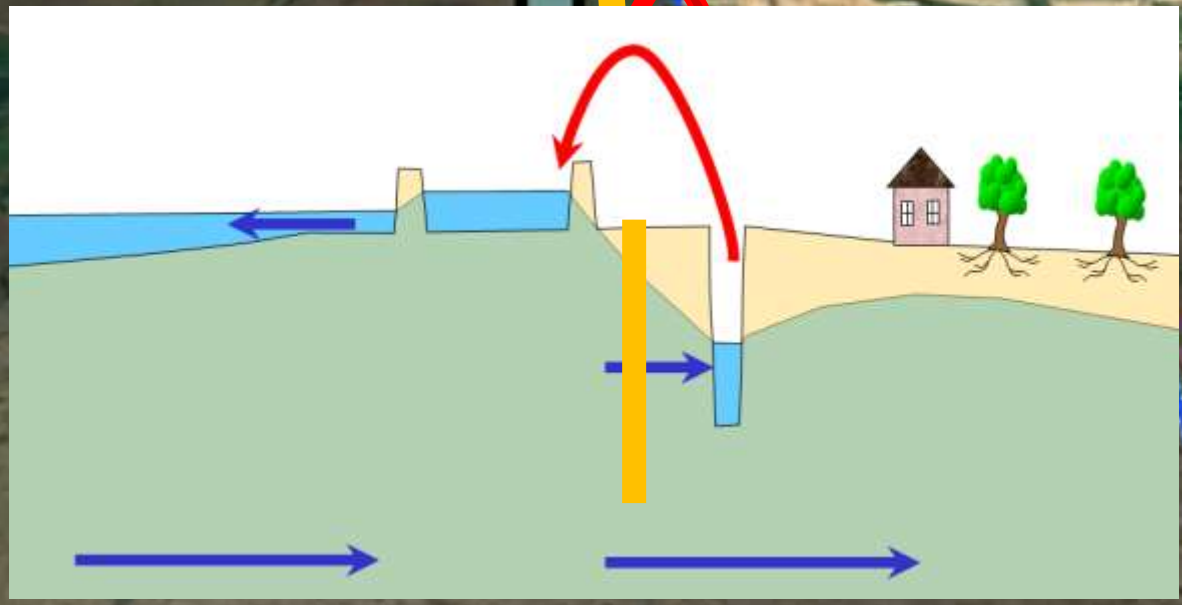


Detention Areas

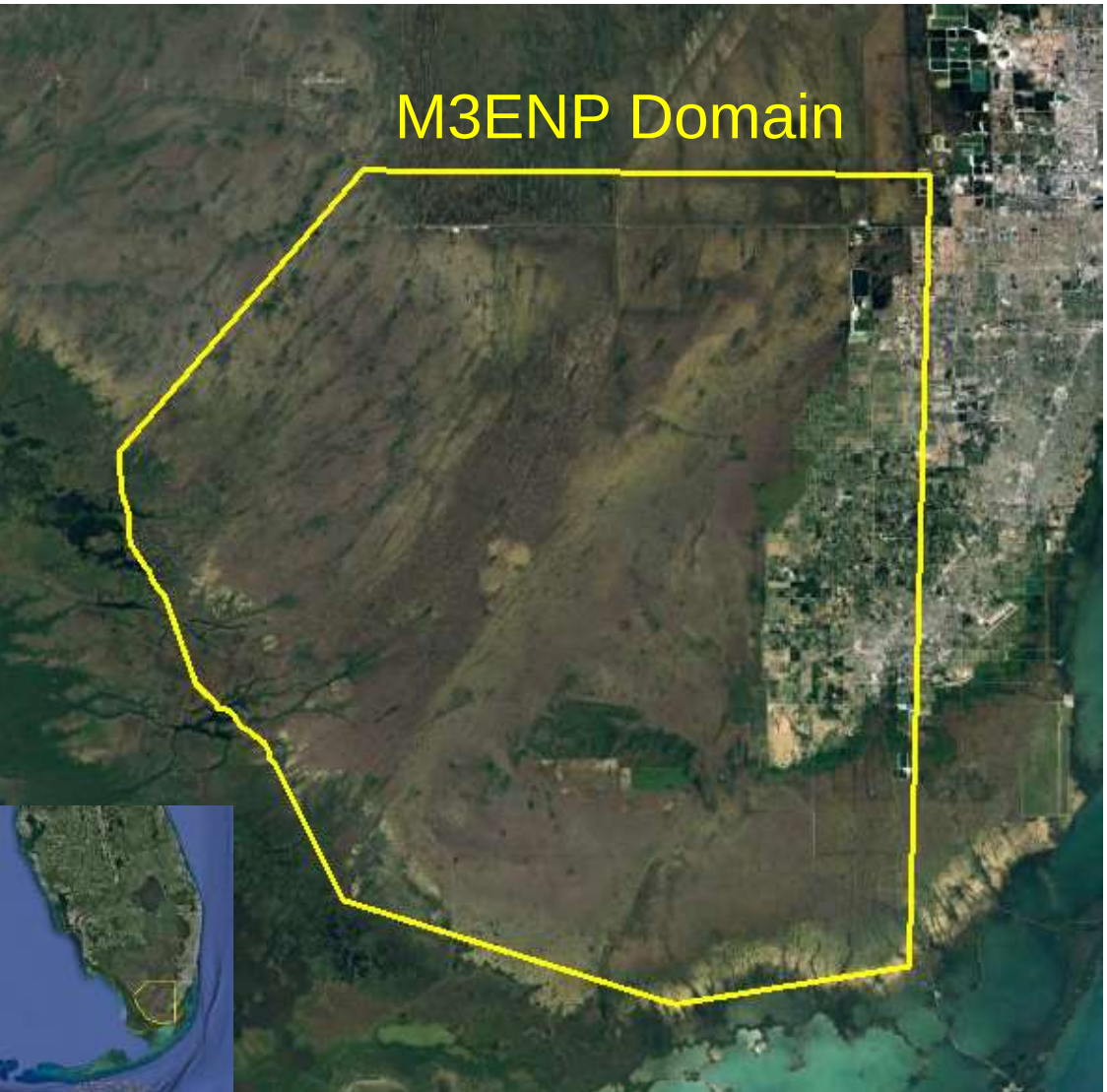


Detention Areas

What is the effect of a seepage barrier?



MIKE Marsh Model of Everglades National Park (M3ENP)



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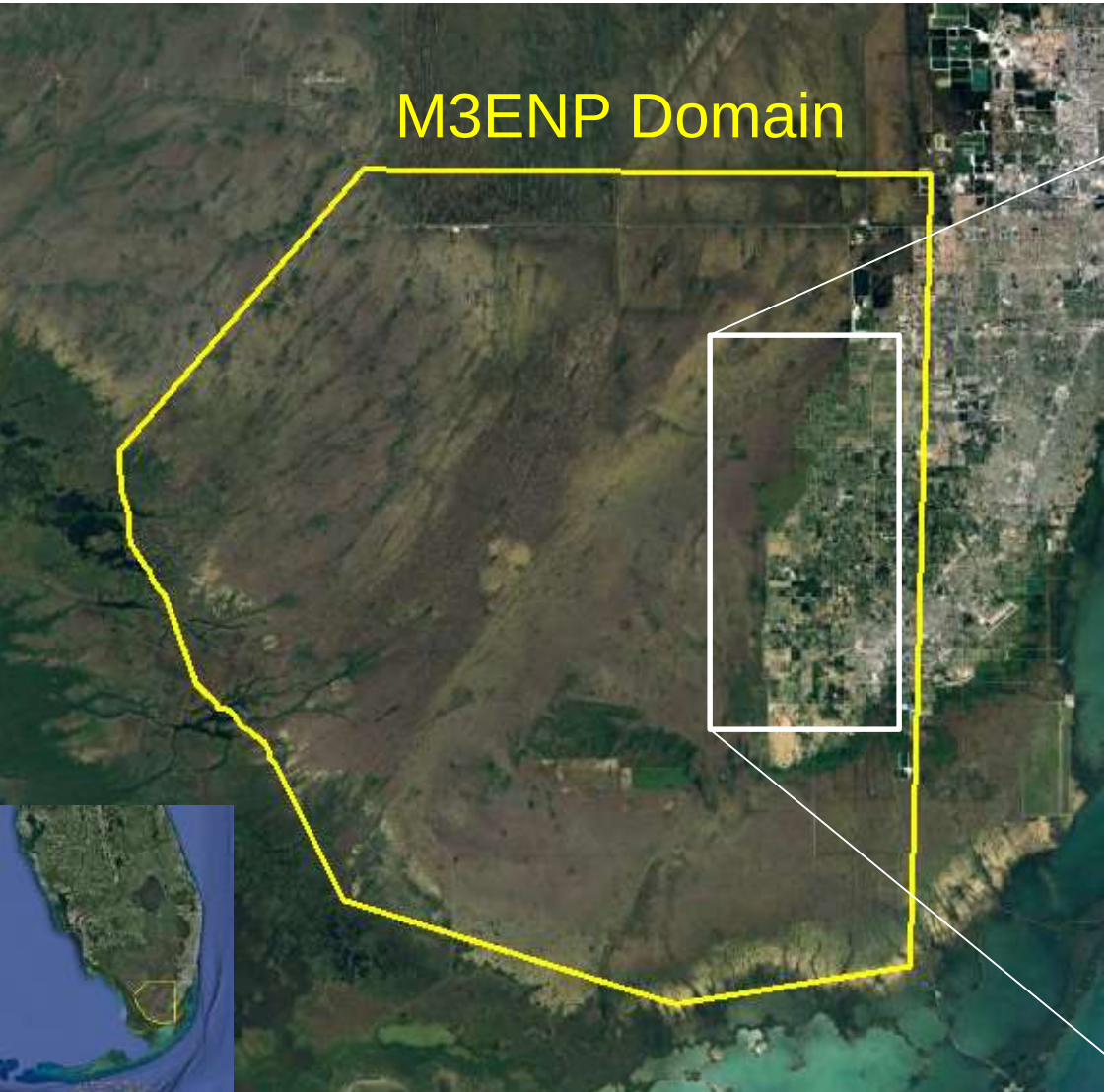
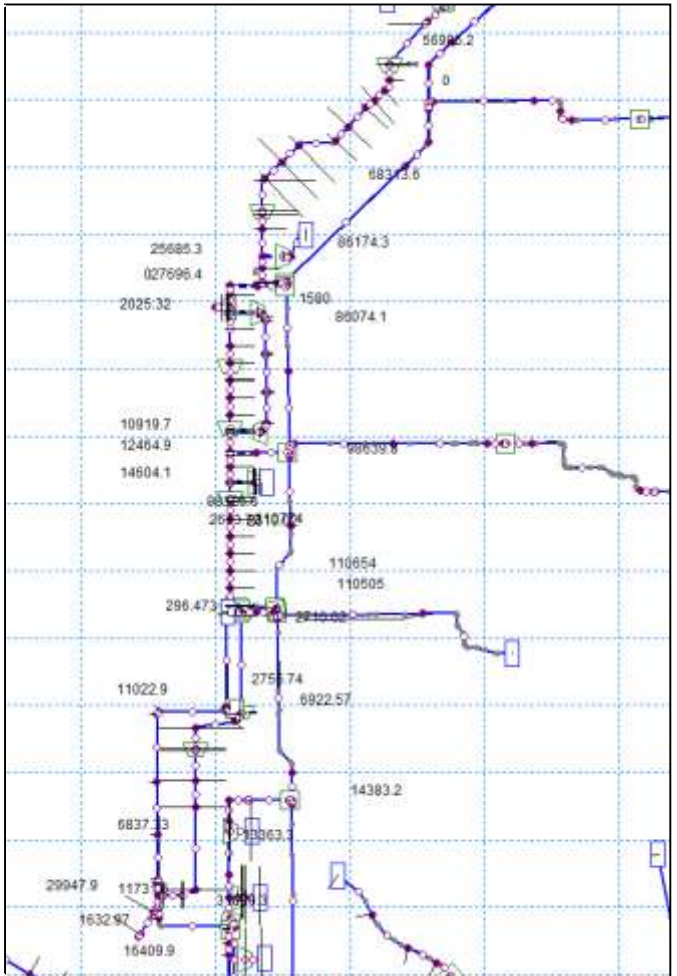
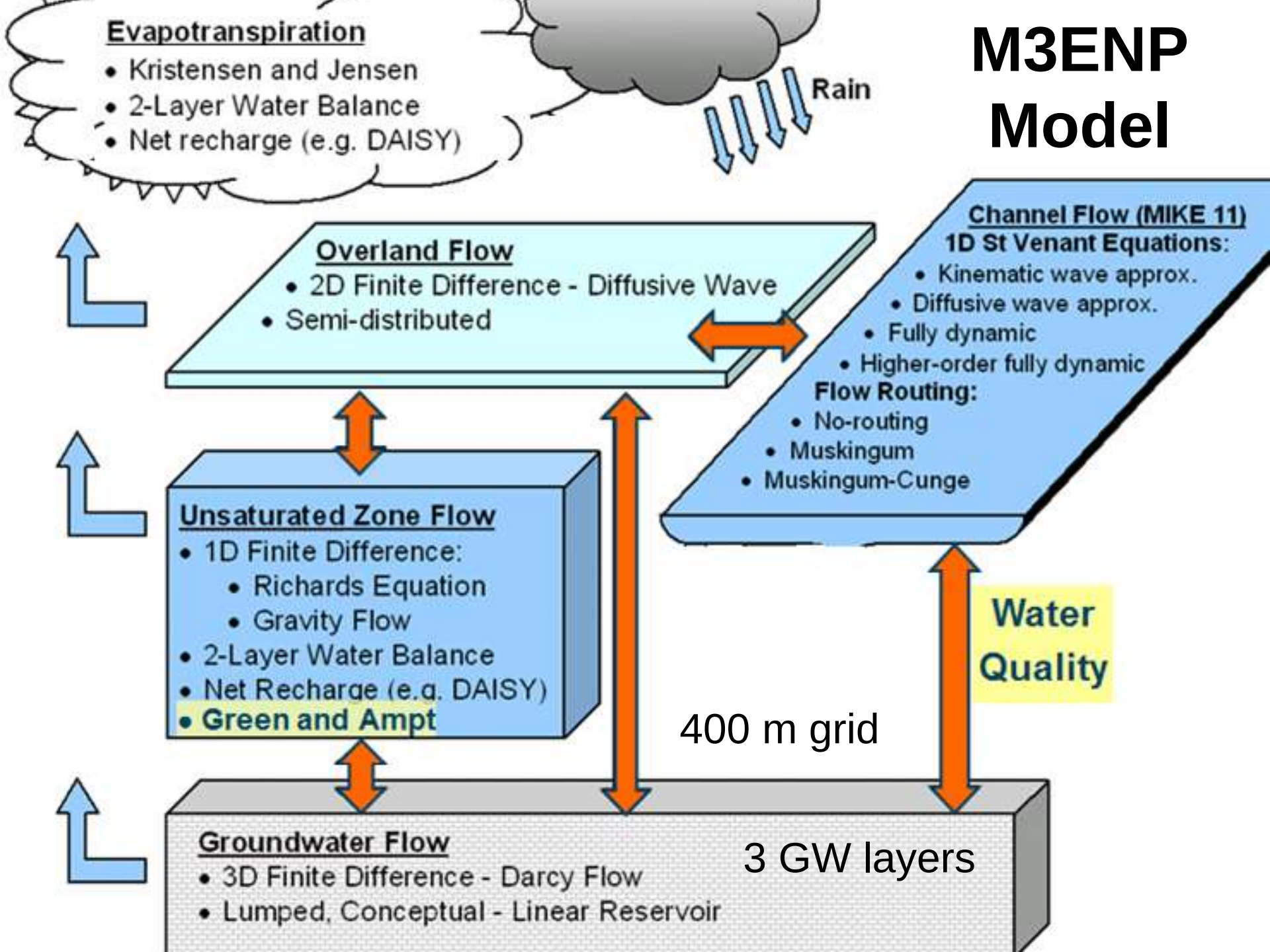


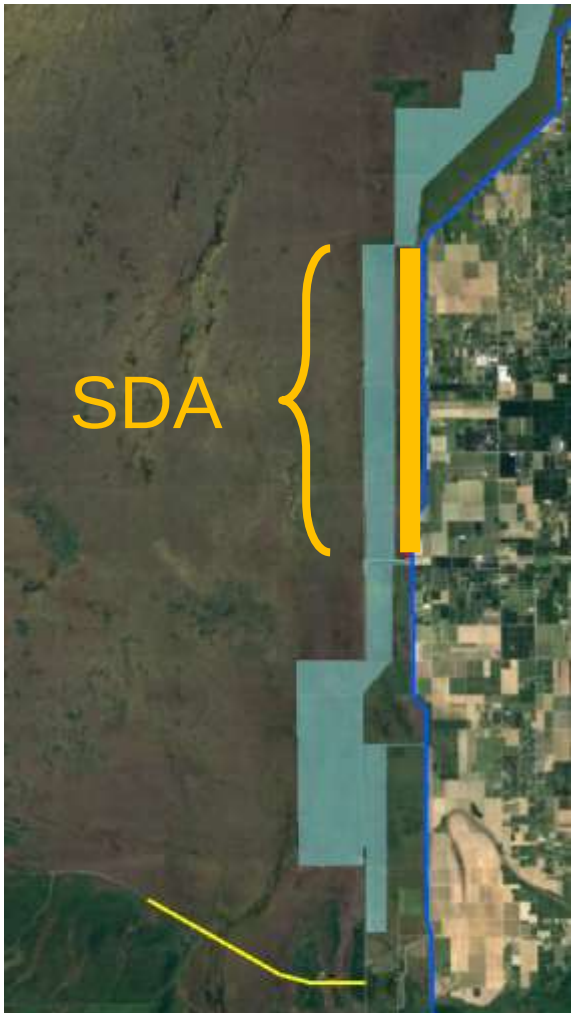
Canal Network

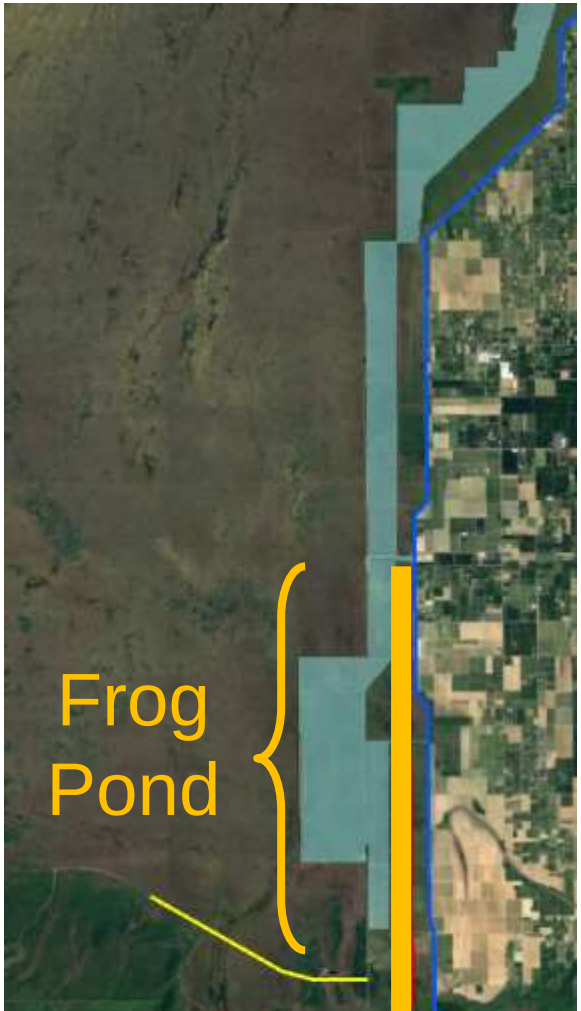


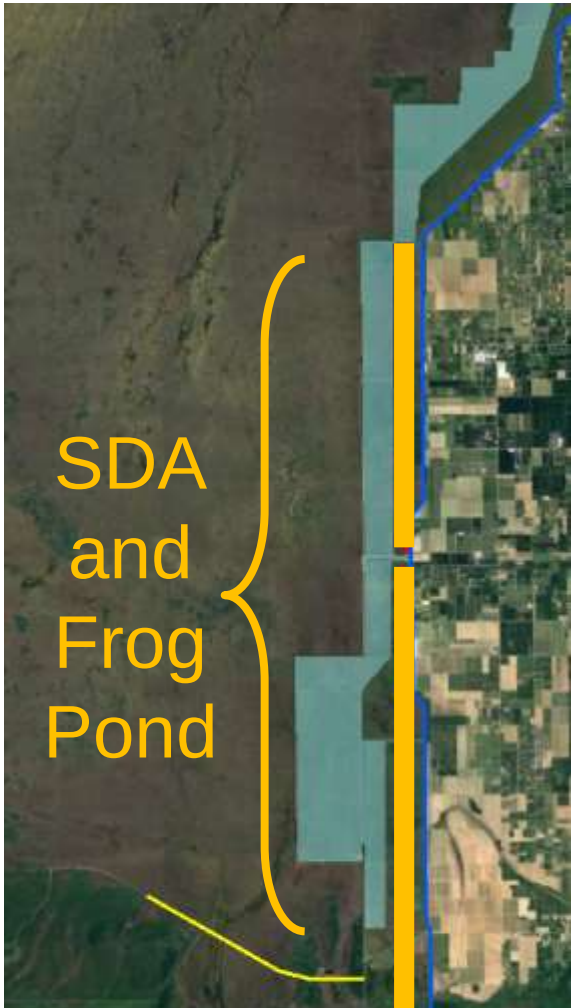
M3ENP Model


Evapotranspiration
• Kristensen and Jensen
• 2-Layer Water Balance
• Net recharge (e.g. DAISY)
Rain
Overland Flow
• 2D Finite Difference - Diffusive Wave
• Semi-distributed
Channel Flow (MIKE 11)
1D St Venant Equations:
• Kinematic wave approx.
• Diffusive wave approx.
• Fully dynamic
• Higher-order fully dynamic
Flow Routing:
• No-routing
• Muskingum
• Muskingum-Cunge
Unsaturated Zone Flow
• 1D Finite Difference:
• Richards Equation
• Gravity Flow
• 2-Layer Water Balance
• Net Recharge (e.g. DAISY)
• Green and Ampt
Water Quality
400 m grid
Groundwater Flow
• 3D Finite Difference - Darcy Flow
• Lumped, Conceptual - Linear Reservoir
3 GW layers

Three Barrier Configurations Evaluated

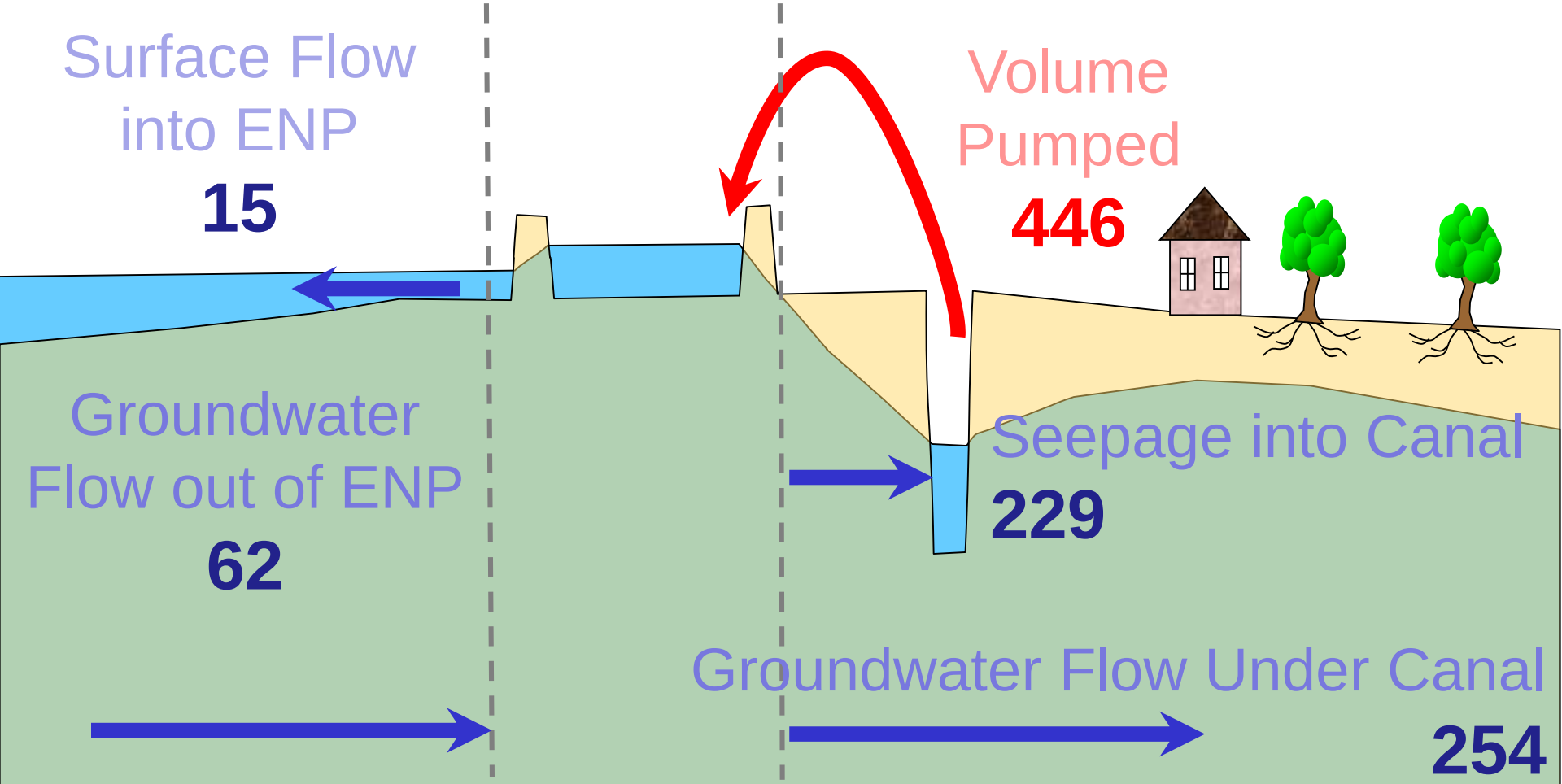






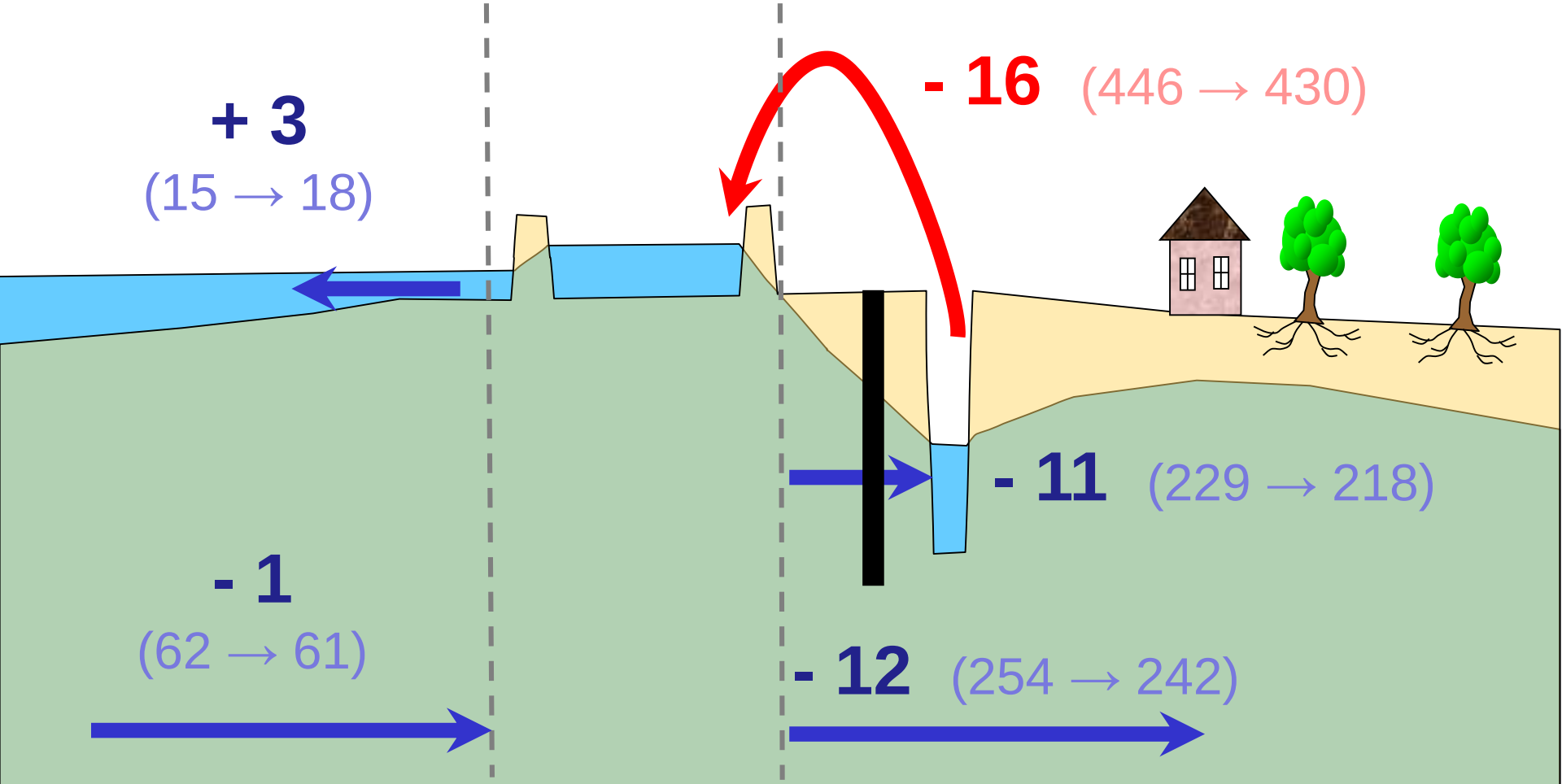
No Barrier (Base Condition)

Average Annual Flow Volumes in Kaf



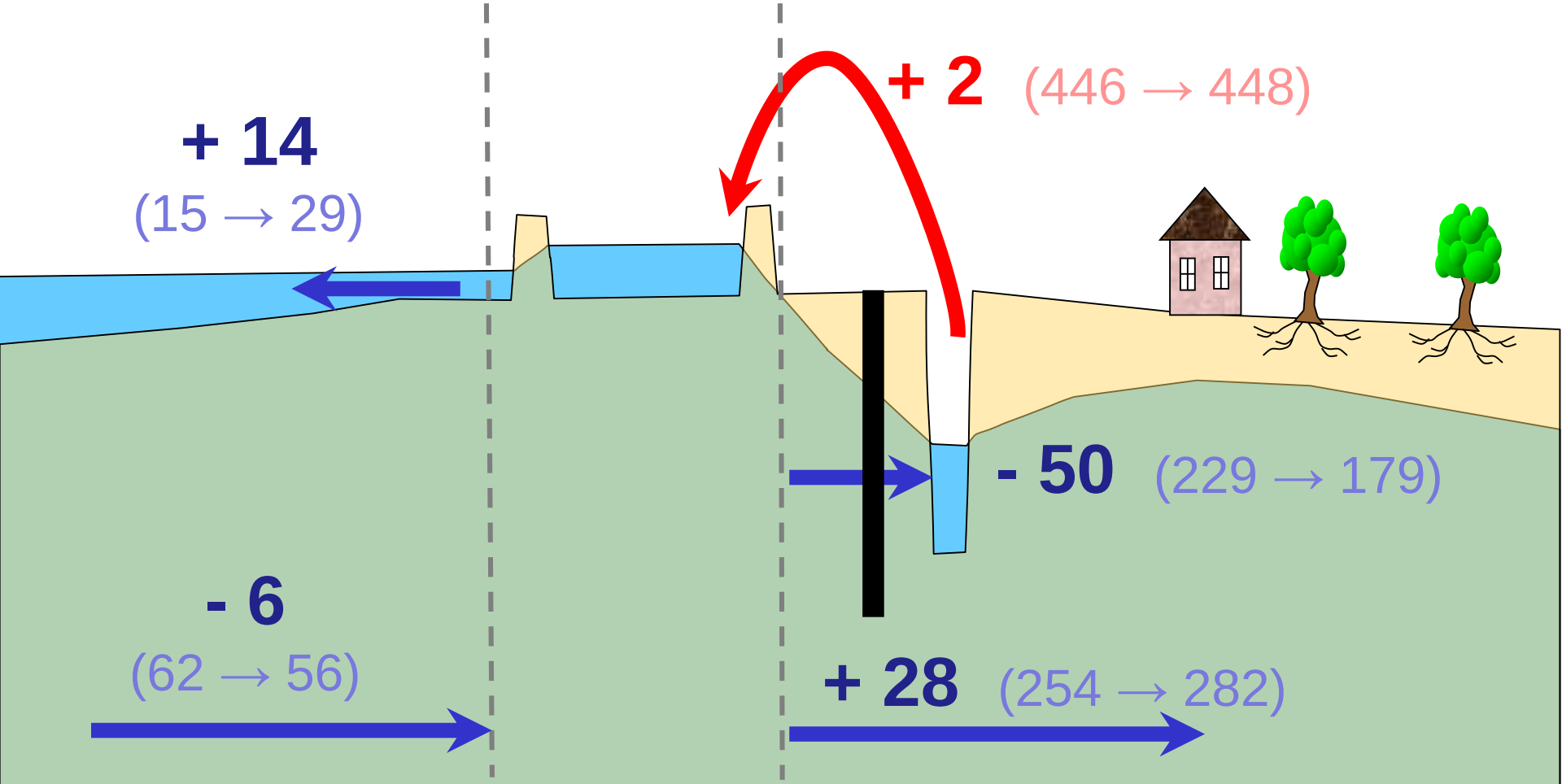
SDA Barrier

Average Annual Flow Volumes in Kaf



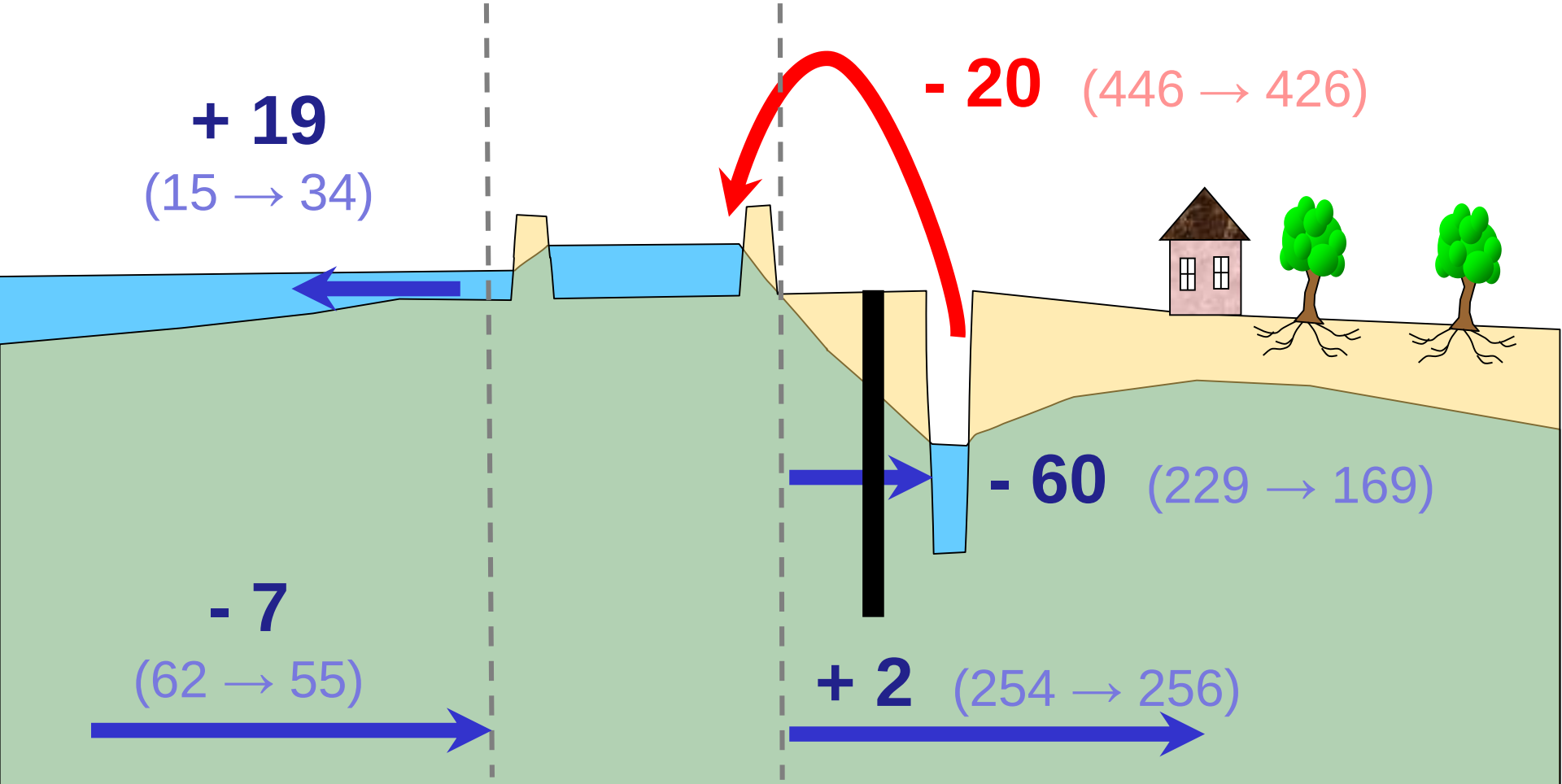
Frog Pond Seepage Barrier

Average Annual Flow Volumes in Kaf



SDA and Frog Pond Barriers

Average Annual Flow Volumes in Kaf



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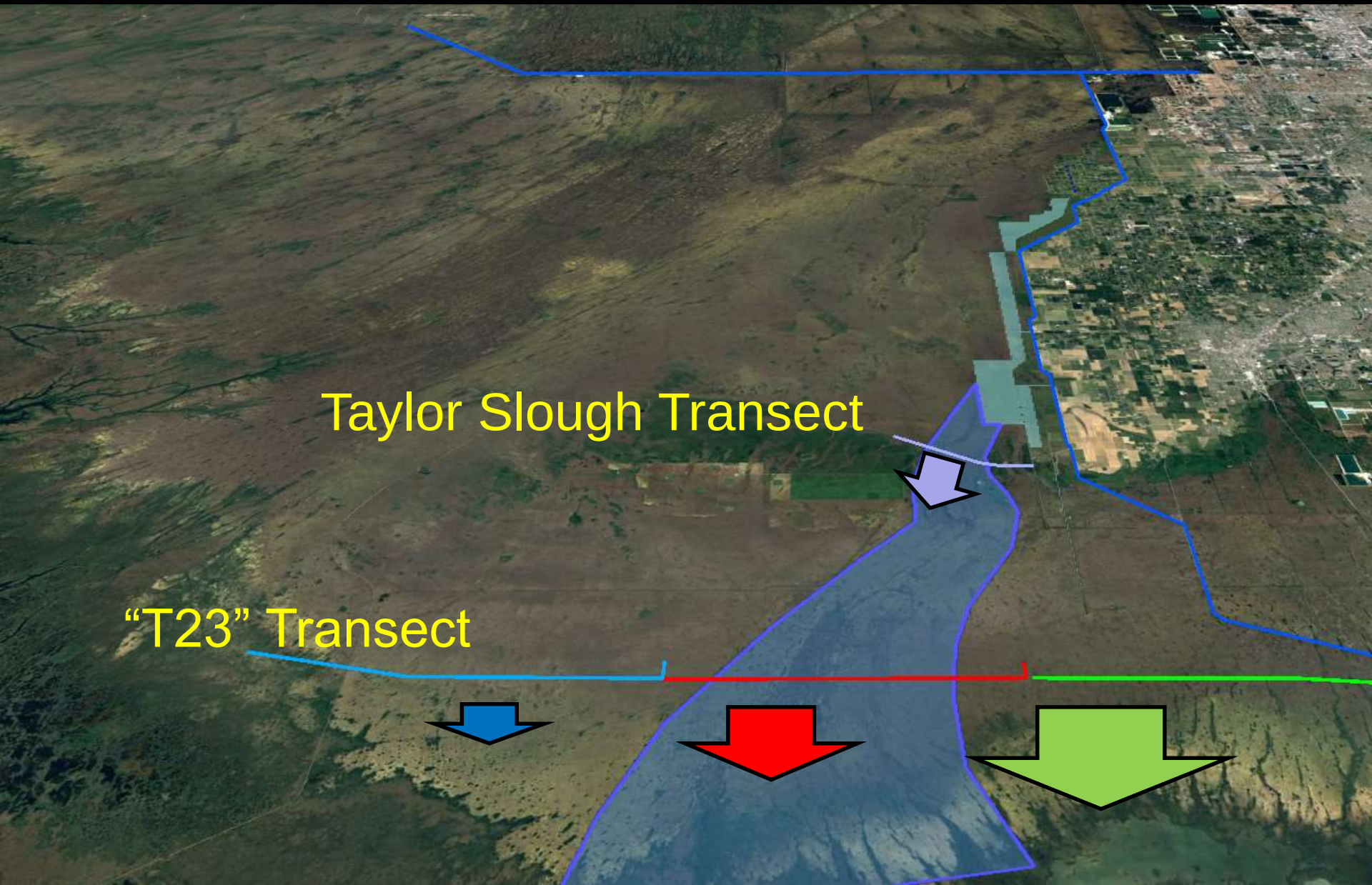

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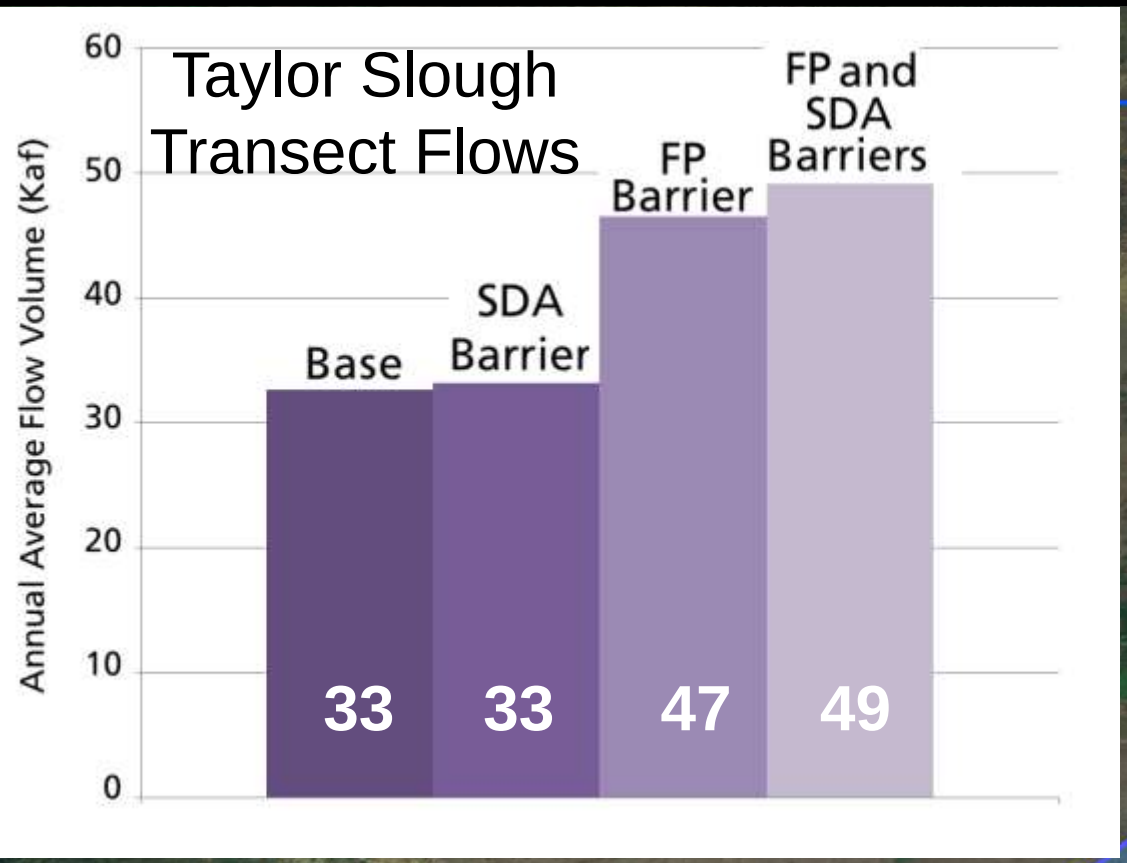

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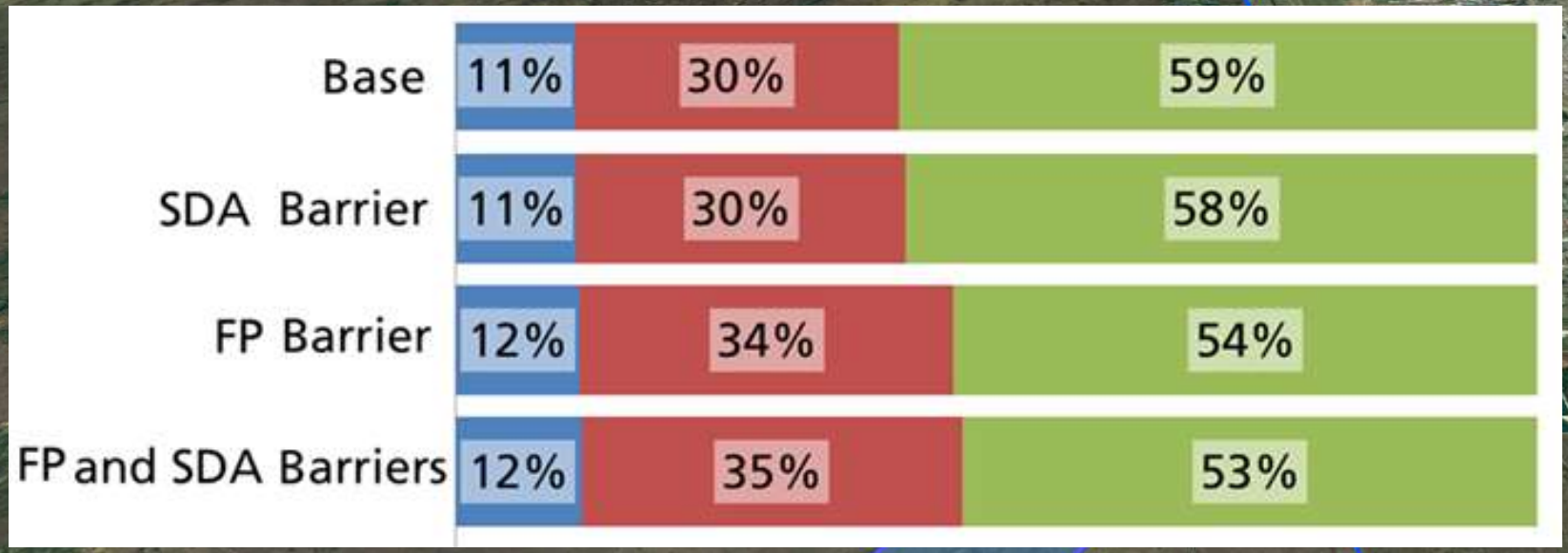
“T23” Transect Flows



Summary

- The M3ENP model is being used to examine the effects of existing and proposed water management alternatives on the hydrologic resources of ENP.

- Detailed water budgets can be calculated that allow us to assess surface and groundwater flow, canal flows, and seepage into and out of the detention areas

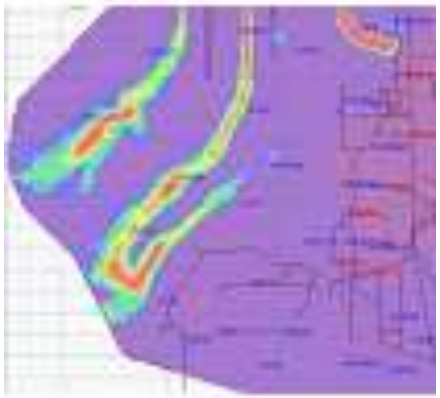
Summary

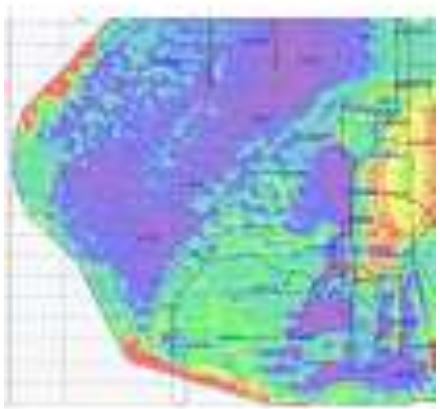
- In this study, a seepage barrier between the Frog Pond detention areas and the C111 will redirect water towards the center of Taylor Slough
- The Frog Pond barrier resulted in an increase of flow at Taylor Slough Bridge of 14 kaf, or 30%
- A barrier along the SDA increased this effect slightly, and has a larger effect if used *in addition* to the Frog Pond barrier

Next Steps Include:

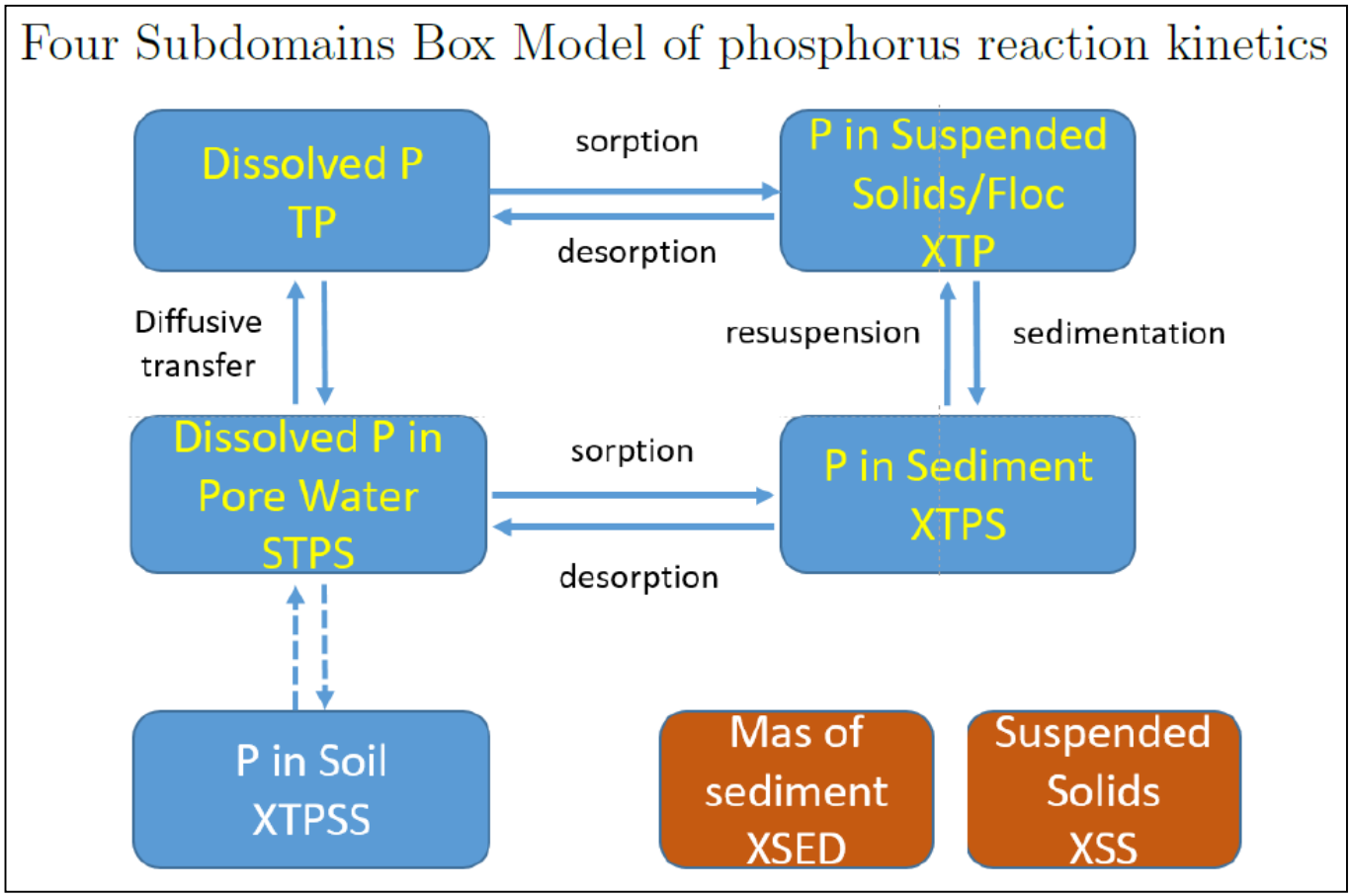
- Seasonal operations
- Incorporate RSM into boundary conditions
- Model comparisons with RSM and 2x2
- Application of Water Quality Model…
- Expanded domain…

M3ENP Water Quality Model



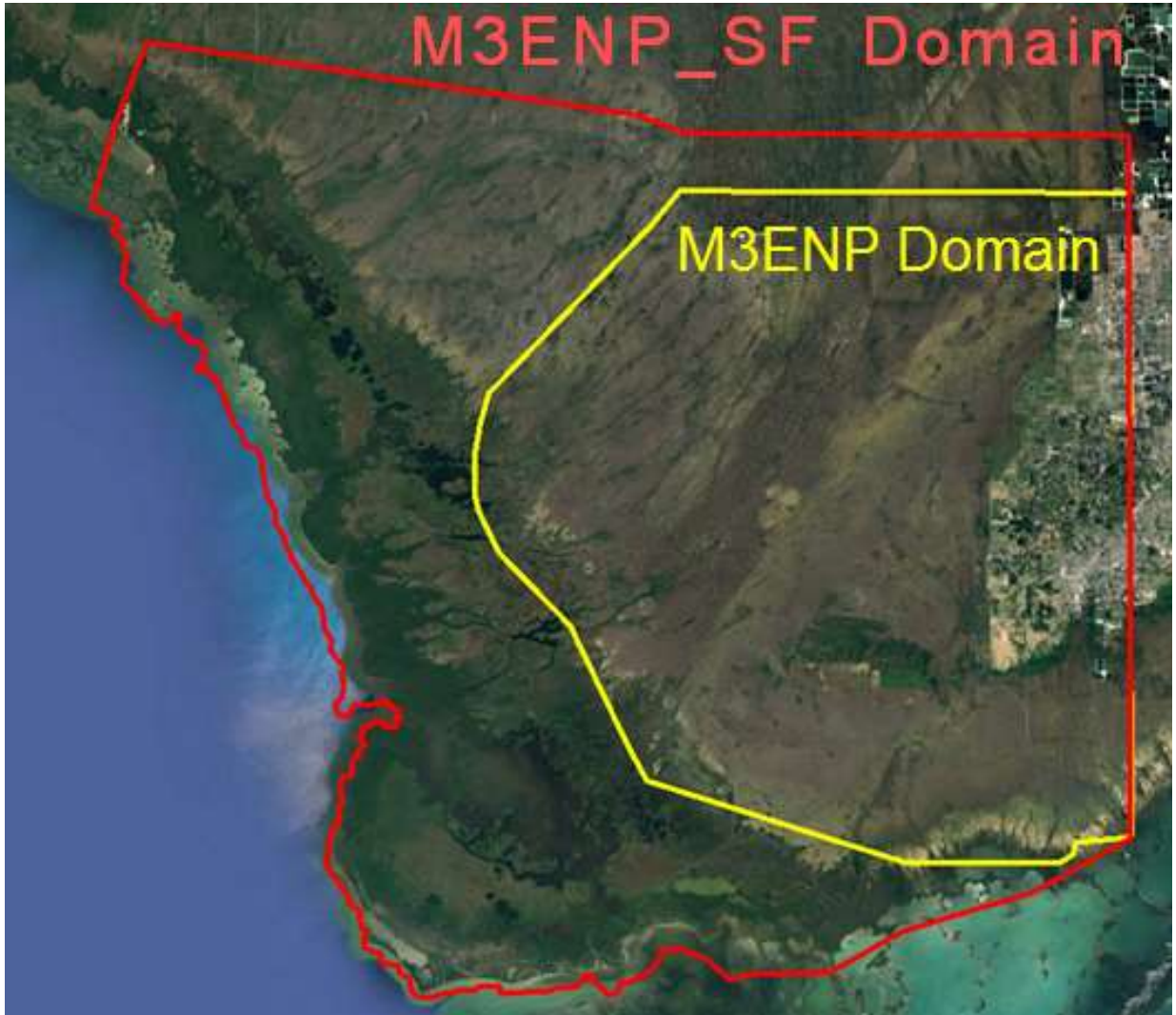
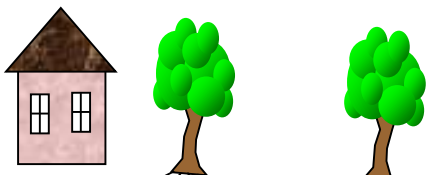


Four Subdomains Box Model of phosphorus reaction kinetics



Animations here -> YouTube Georgio Tachiev

Coming Soon: Expanded Domain



Thank You