



Development of a Tool to Evaluate Impacts of Constructed Features on the Hydrology of the Southern Everglades

Ahmed Khalifa¹, Kiren Bahm², Ehab Meselhe¹
Kelin Hu¹, and Jeff Kline²

¹ Tulane University, New Orleans, LA, USA

² National Park Service, FL, USA

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Study Objectives



1

Phase 1: Upgrade the existing 1D model to the new DHI version (MIKE + Rivers)

2

Phase 2: Quantify influence of local features to inform remediation projects

- with and without Ingraham Highway
- with and without Madeira ditches.

3

Phase 3: Quantify effects of the Central Everglades Planning Project 'New Water' on the environment

On-site evaluation of project tasks and complexity (field trip)

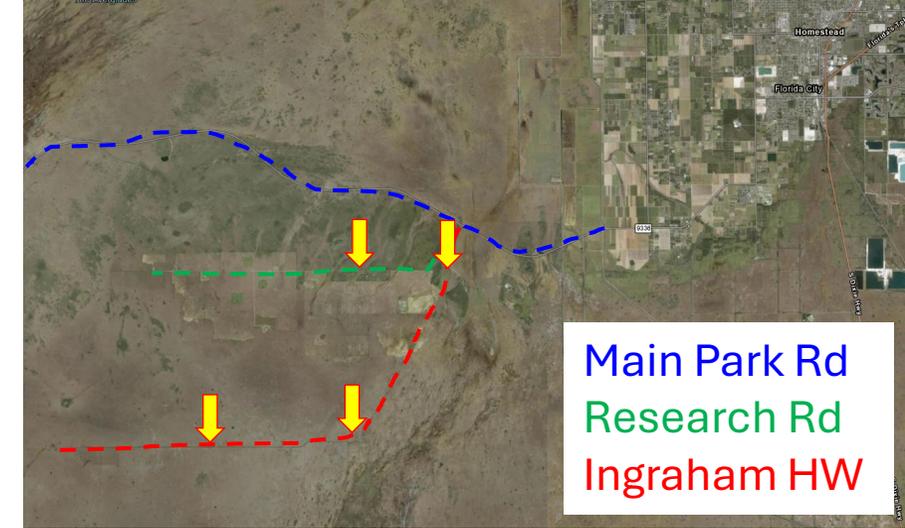


Field Trip

Tulane team visited the park between 7/22/2024 and 7/23/2024

Objectives of the visit:

- Understand the complexity of the park ecological system
- Establish familiarity with the existing features
- Document challenges which the project is aimed to resolve



NPS officials who led the field trip and helped Tulane team to understand the complexities within this ecological system

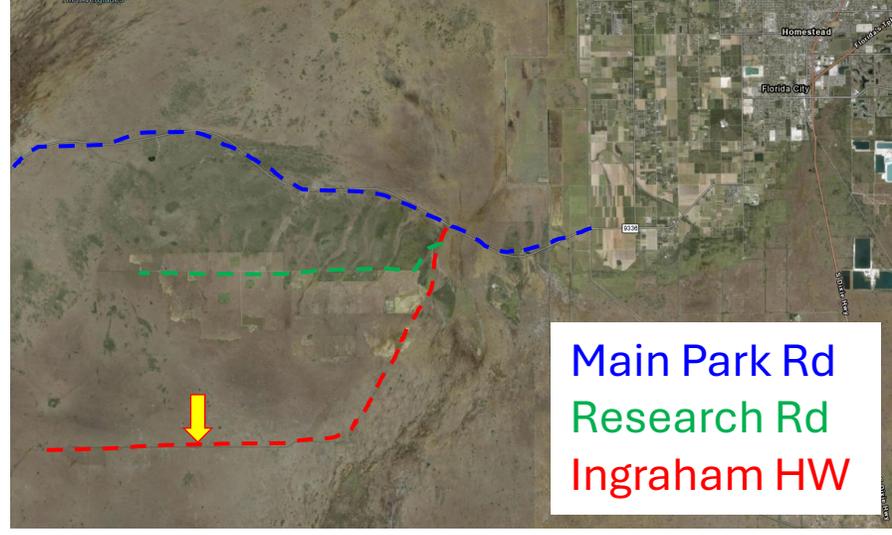
- Melody Hunt
- Jeff Kline
- Erik Stabenau
- Tylan Dean

Field Observations



Flow direction

Ingraham Highway culverts where a subsurface channel parallel to the culvert captures more flow compared to the culvert throw seepage under the road.



Main Park Rd
Research Rd
Ingraham HW



Channel parallel to the culvert (perpendicular to the road)



Flow direction through the parallel channel by seepage



Field Observations

Old concrete culvert design (2011)



Seepage through the road

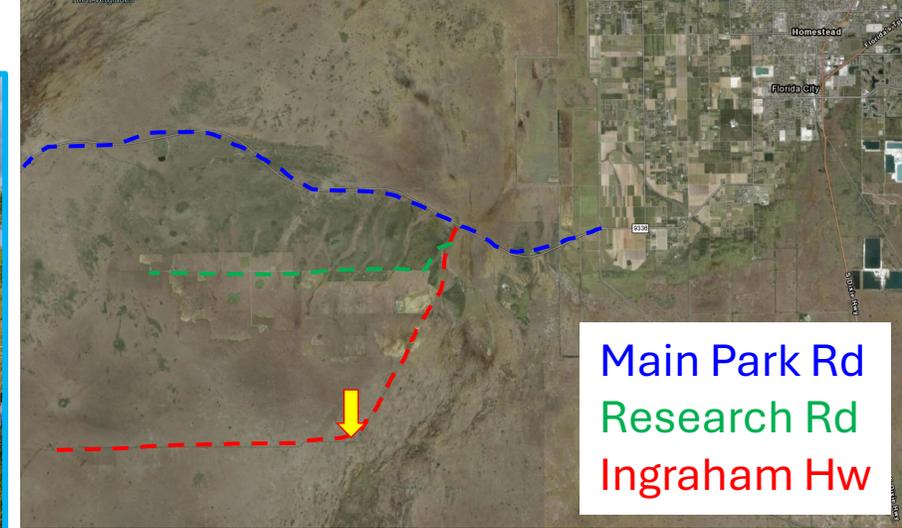


Culvert #2 location. This is an old designed culvert (concrete) in 2011. It shows very fast velocities. There is also a parallel channel that captures part of the flow.

Connection of culverts with Madeira ditches



Flow direction through Madeira ditches



Main Park Rd
Research Rd
Ingraham Hw

Madeira ditches are small channels connected to existing culverts. These ditches **are not studied enough** and experts suggest they **connect water to central Taylor slough and Florida Bay** (losing water from the park to the open water @ southern boundary).

Hyper salinity and grass die off.

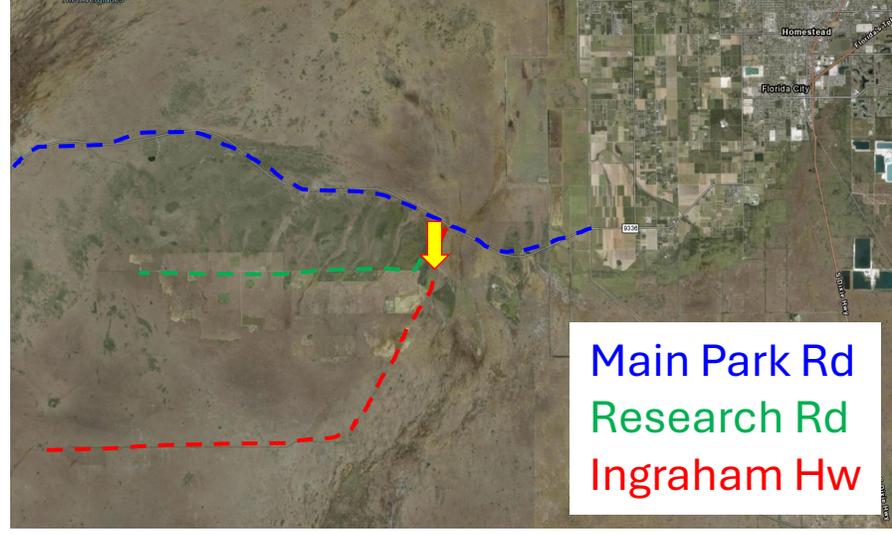
Field Observations



Local erosion on top of the road due to passage of water

A site close to HID:

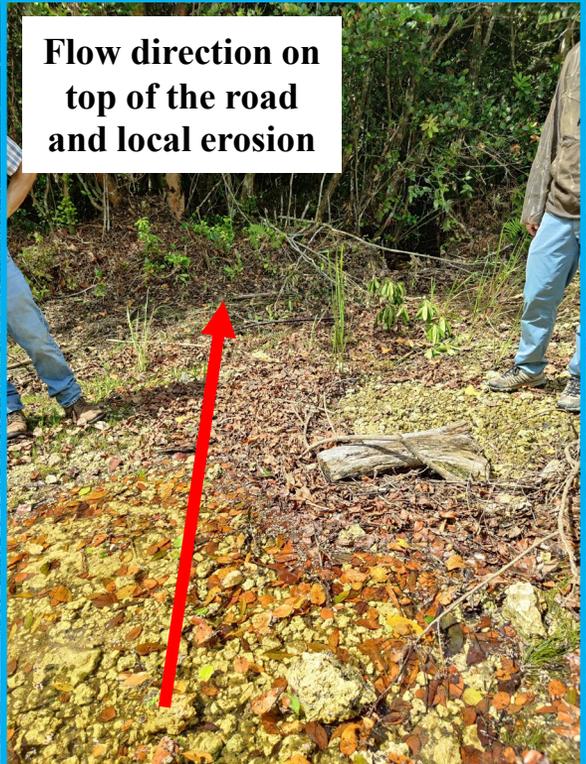
- Road without culverts. Water overtops the road and erosion happens.
- Road is used by campers and school visits.



Main Park Rd
Research Rd
Ingraham Hw



Flow direction on top of the road and local erosion



Flow direction on top of the road and local erosion



Seepage under the road and DS local erosion



Field Observations

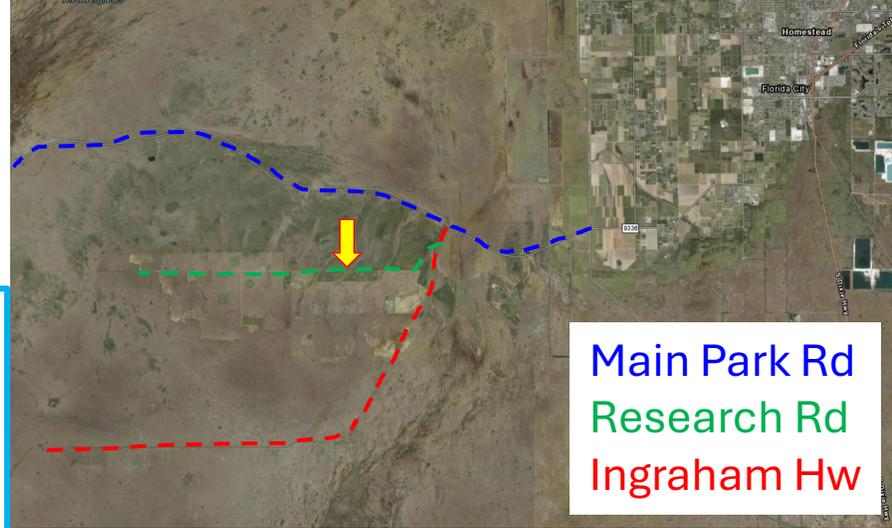


Research Road



Solution holes

Culvert #3 on the research road, unrestored and thick vegetation. Vegetation and sediment clog the culvert. Noticeable shift in vegetation coverage within a small spatial area.



Main Park Rd
Research Rd
Ingraham Hw

Research road:
Right is forest and left is scrapped soil and low elevation marsh.
Solutions holes are abundant in this area of the park.
Significant changes in vegetation coverage within a small spatial area.

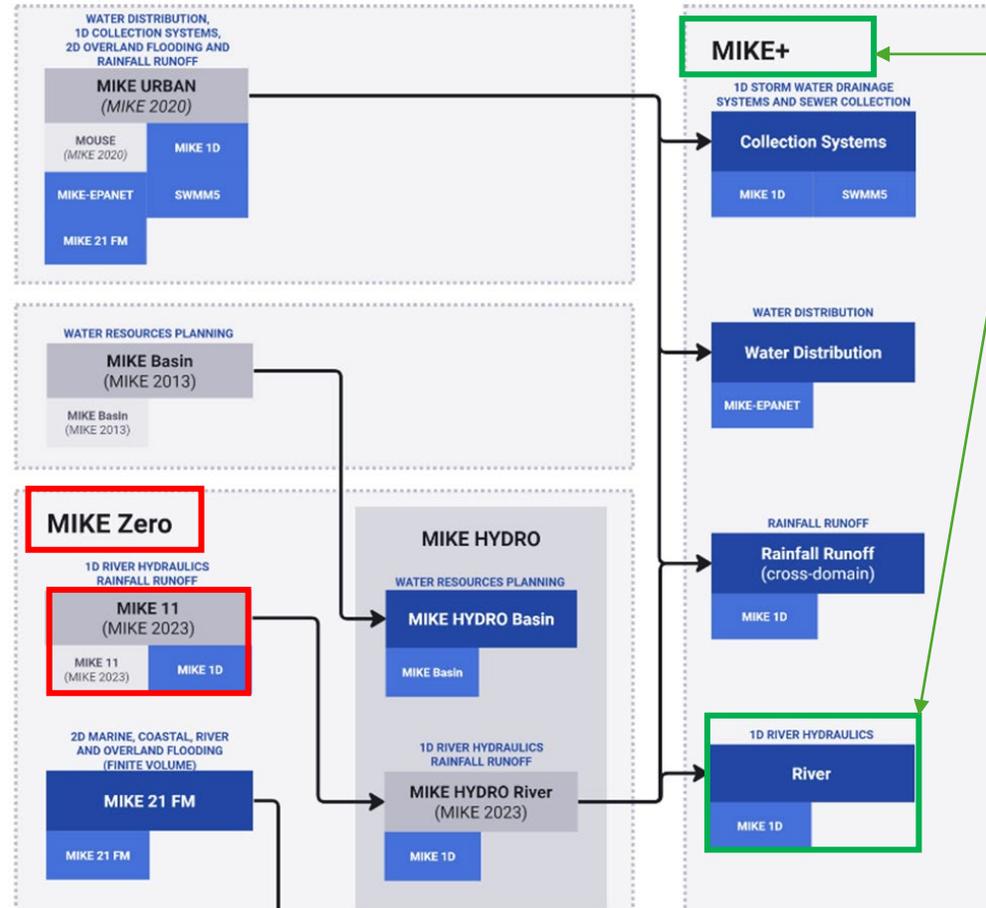
M3ENP Upgrade to MIKE 2025

Phase 1: Upgrade the existing 1D model to MIKE + Rivers

Why upgrade?

- The original M3ENP model uses MIKE 11 (part of MIKE 2023), which was decommissioned by DHI in 2024.
 - MIKE 11 can still be used but is not forward-compatible with newer releases of MIKE SHE and MIKE Zero.
 - Technical support is no longer provided for MIKE 11
- MIKE 2025 (MIKE Zero, MIKE SHE 2025, and MIKE+ Rivers) offers enhanced useability and performance

MIKE Powered by DHI Product Decommissioning Flowchart



The new M3ENP will use MIKE River available through the 2025 MIKE+ platform (coupled with MIKE SHE available through the MIKE Zero platform)

The original M3ENP uses MIKE 11 available through the 2023 MIKE Zero platform (coupled with MIKE SHE in MIKE Zero)



Notes:

MIKE1D is the name of one of the 1D engine. It is a reengineering and merger of the calculation capabilities of MOUSE (Collection System) and MIKE 11 (River).

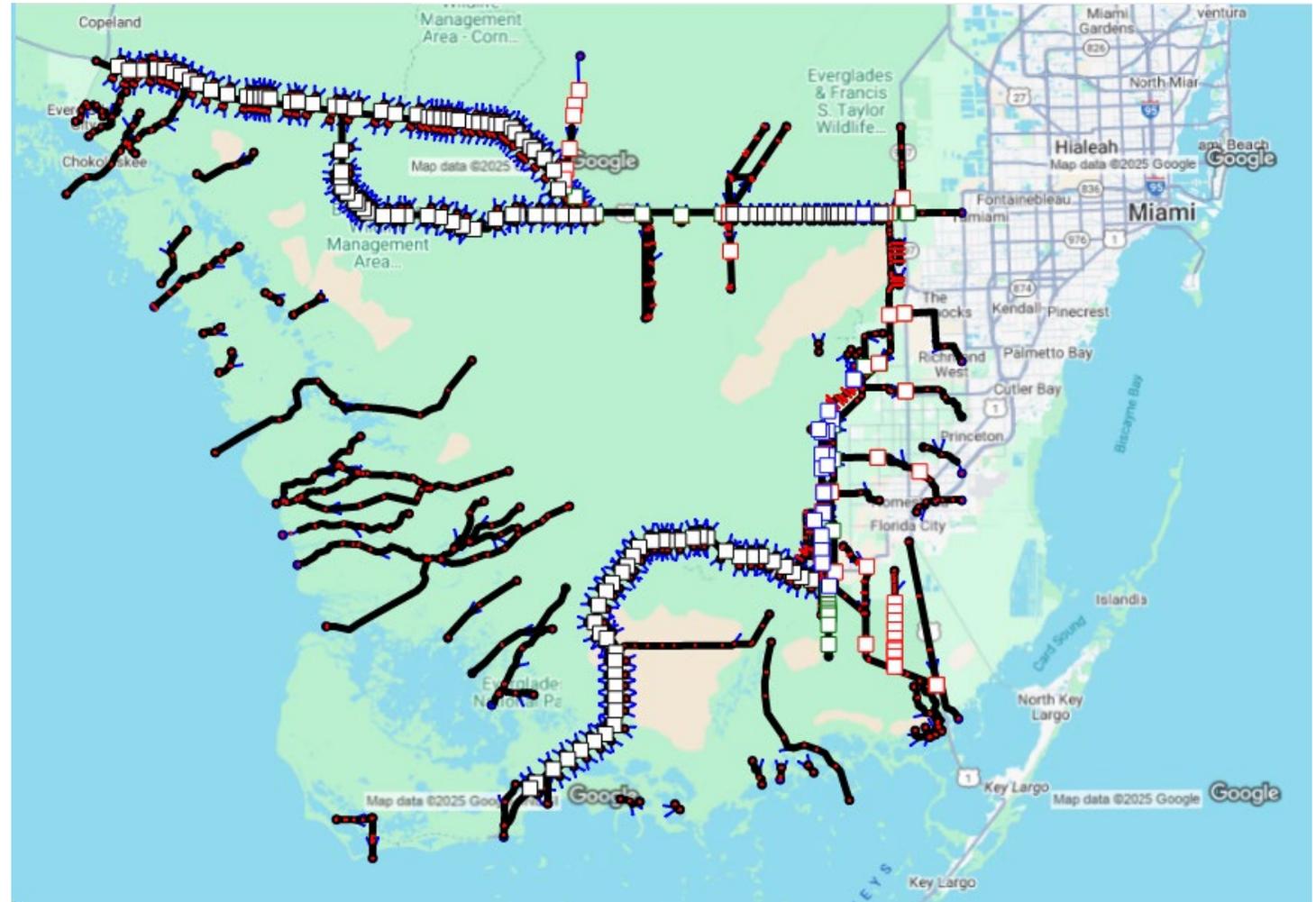
MIKE+ was named MIKE URBAN+ in MIKE 2019 and MIKE 2020 releases

MIKE FLOOD was a coupling user interface requiring MIKE URBAN, MIKE11, MIKE HYDRO River, MIKE 21FM and/or MIKE 21 Classic. Those coupling workflows and tools are embedded by default in MIKE+ and are not provided as a dedicated Module.

2D Overland should be used for 2D overland and river modelling applications from MIKE 2024 version and onward since MIKE+ has dedicated workflows

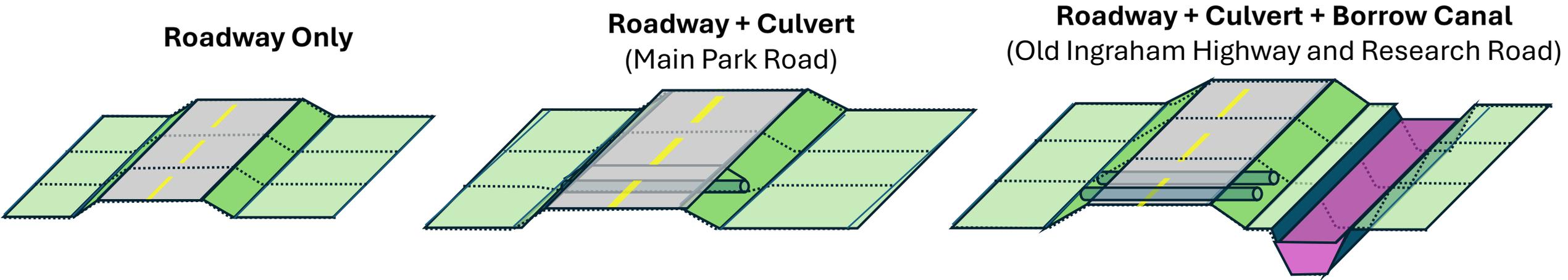
Phase 1: Upgrade the existing 1D model to MIKE + Rivers

- The existing 1D model was upgraded to Mike + Rivers version (2025.Base released in November 2024).
- The upgraded 1D model was coupled with the MIKE SHE 3D model to account for over land, SZ, and UZ flows.
- Calibration period 1/1/1999 – 12/31/2019 runs in 52 hours using 4 cores.



Phase 1: Upgrade the existing 1D model to MIKE + Rivers

Several configurations of roadways, culverts, and borrow canals were identified to be implemented in the model



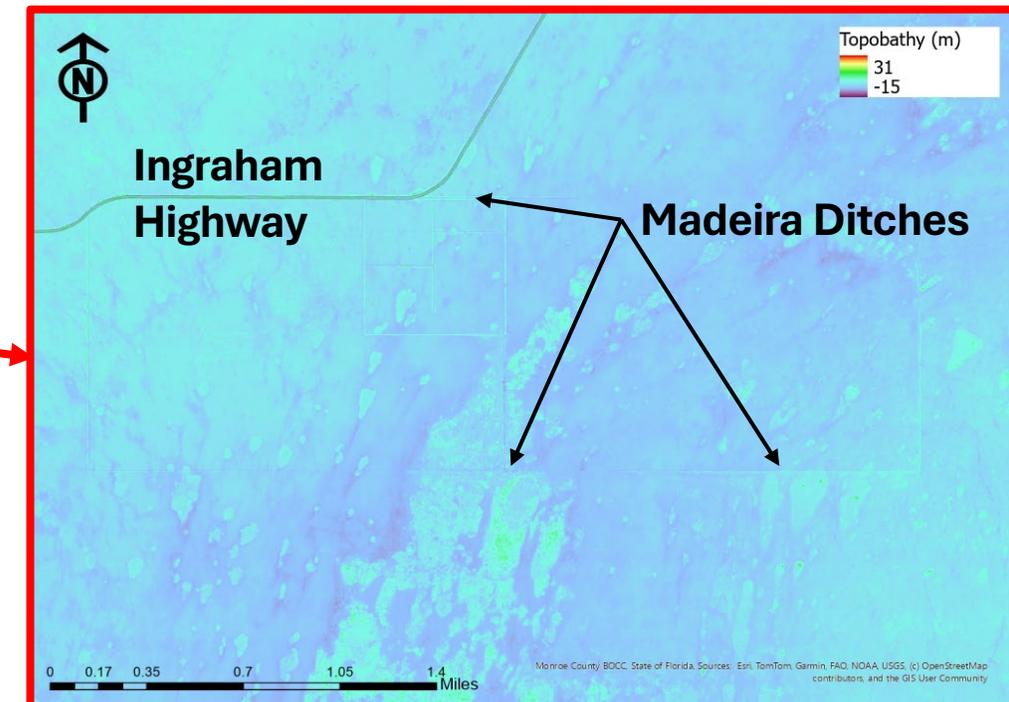
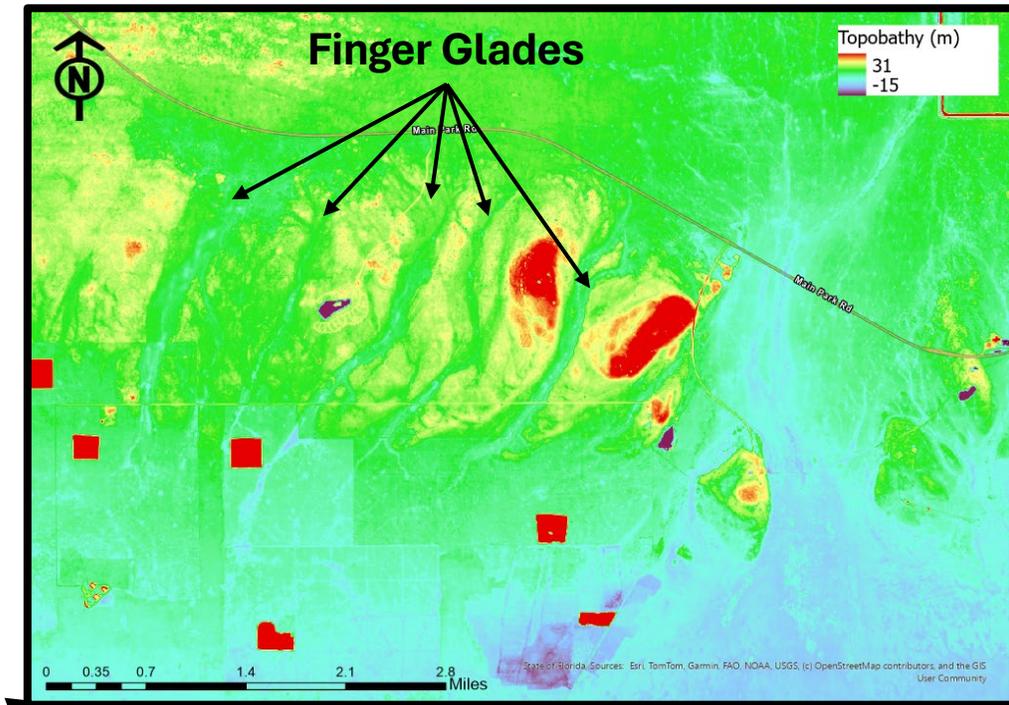
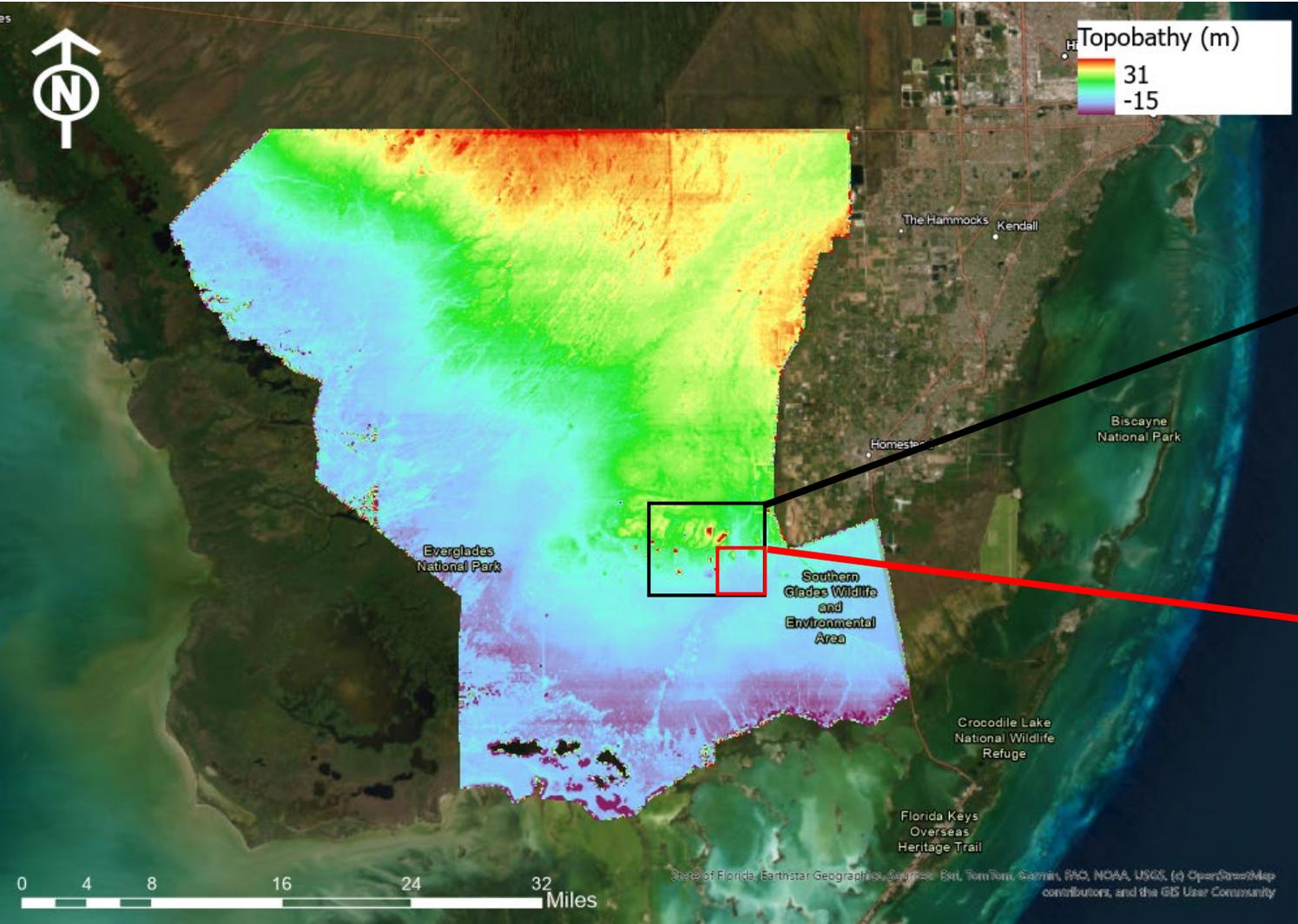
A test model was created to simultaneously evaluate configuration options with collaboration and guidance from **Elias Moussoulis** and **Steve Blake** from DHI.

Adding Important Topographic Features

Phase 2: Quantify influence of local features to inform remediation projects

Adding Important Topographic Features

- The existing MIKE SHE model has a 400 m resolution which is to be refined to 50 m in order to define Finger Glades and Madeira Ditches.



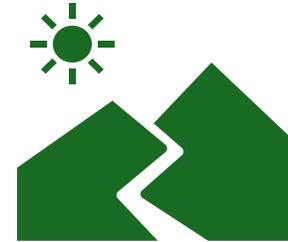
Ongoing and Future Work



Ongoing work

Upgrade 128 culverts in the existing setup of the Mike + Rivers

Refining the MIKE SHE model grid (bathy and vegetation) to 50 m

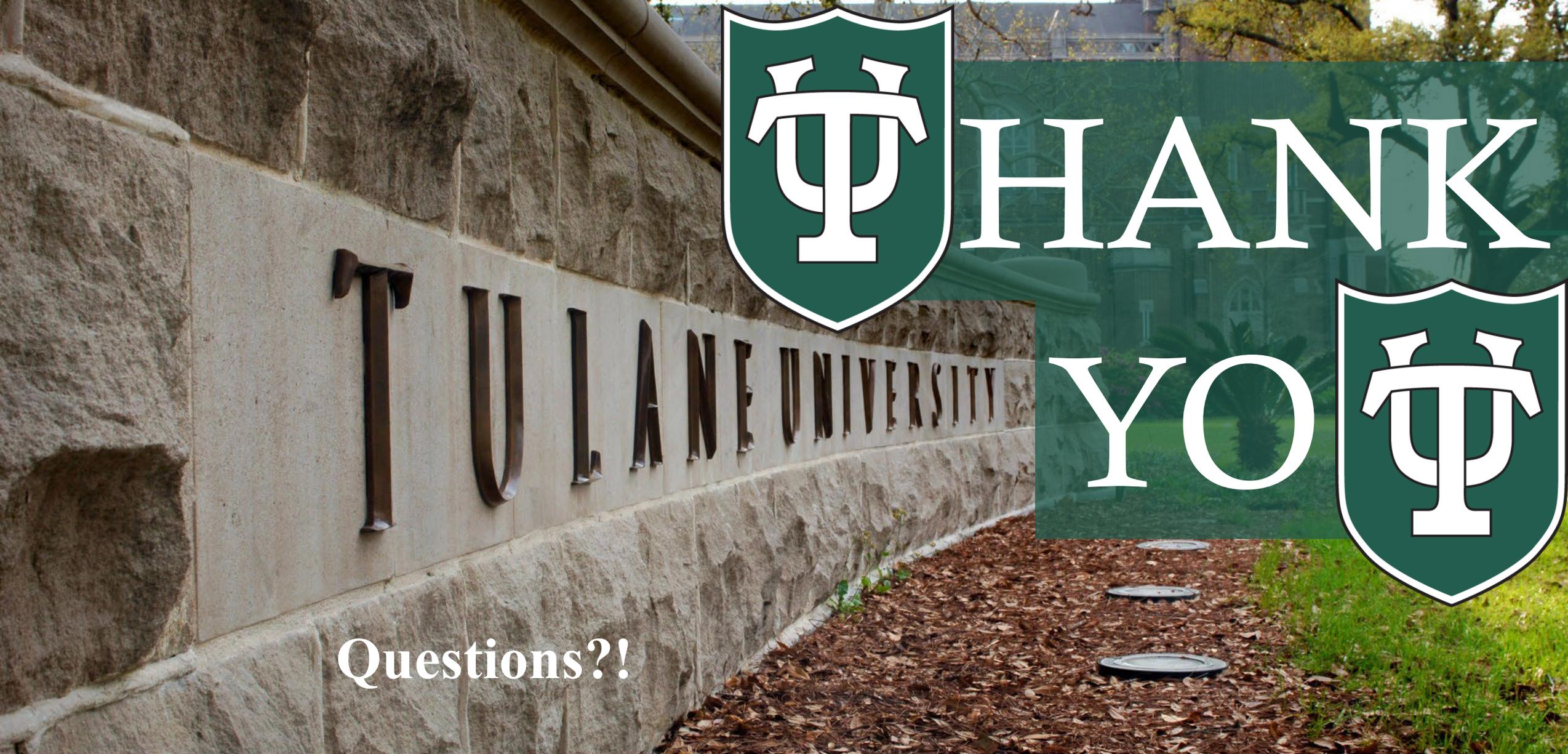


Future work

Phase 2: Run the revised model to assess two main features:

- without Ingraham Highway
- without Madeira ditches

Phase 3: Assess impact of the Central Everglades Planning Project 'New Water' on the environment



Questions?!

Tulane

akhalifa1@tulane.edu