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

Ahmed Khalifa[1], Kiren Bahm[2], Ehab Meselhe[1]
Kelin Hu[1], and Jeff Kline[2]

[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

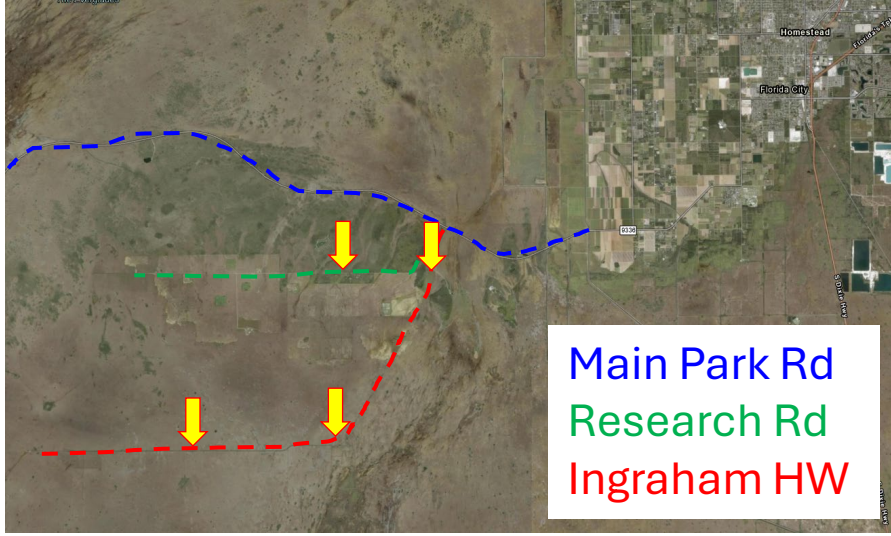
On-site evaluation of project tasks and complexity (field trip)

Field Trip

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

Objectives of the visit:

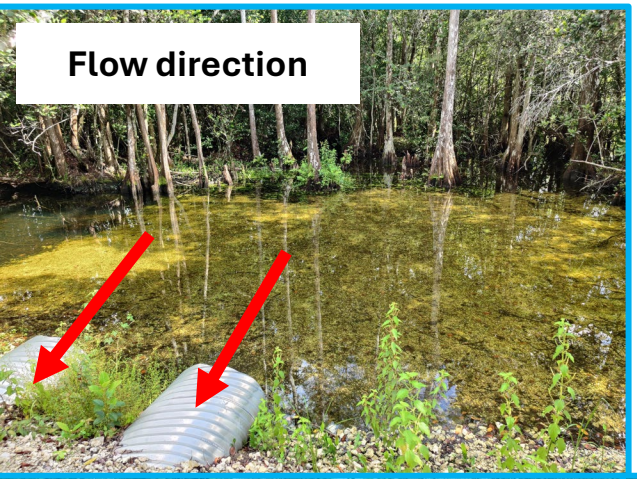
- Understand the complexity of the park ecological system
- Establish familiarity with the existing features
- Document challenges which the project is aimed to resolve



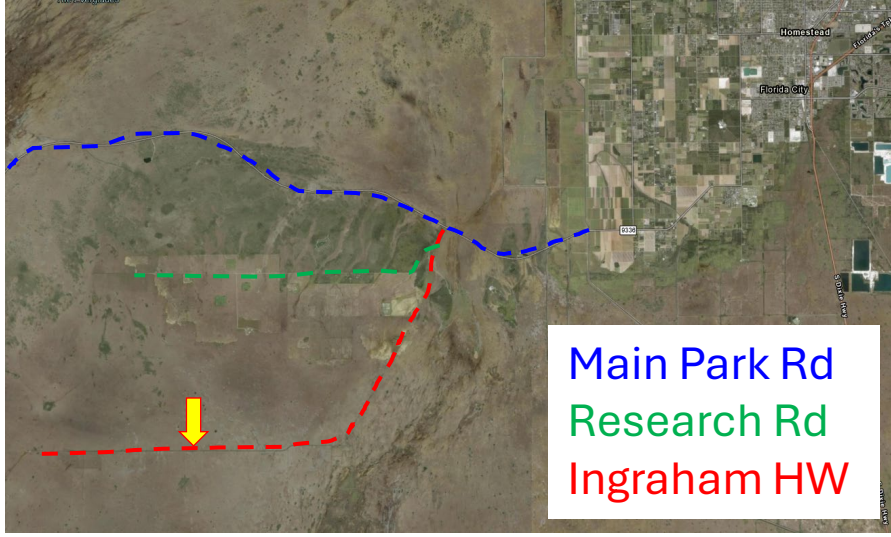
NPS officials who led the field trip and helped Tulane team to understand the complexities within this ecological system

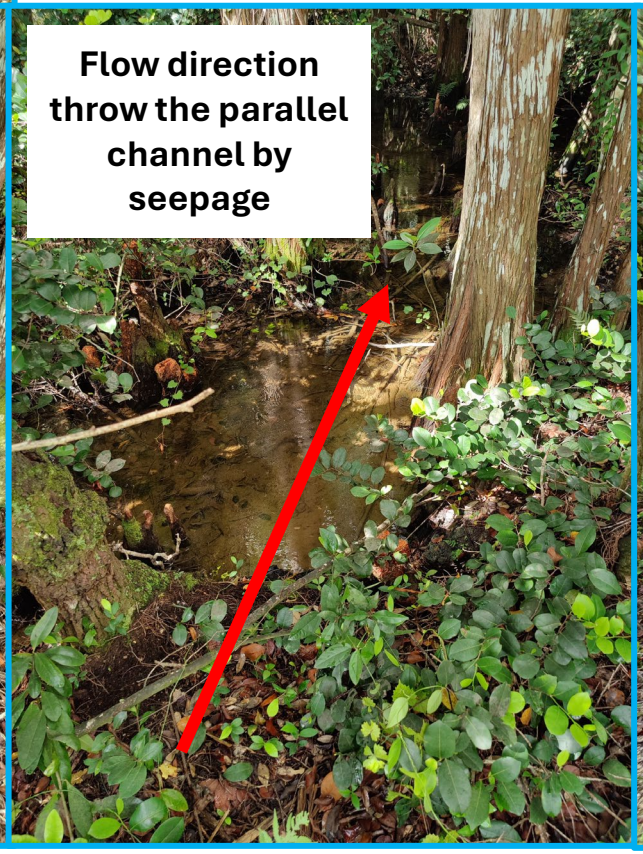
- Melody Hunt
- Jeff Kline
- Erik Stabenau
- Tylan Dean

Field Observations



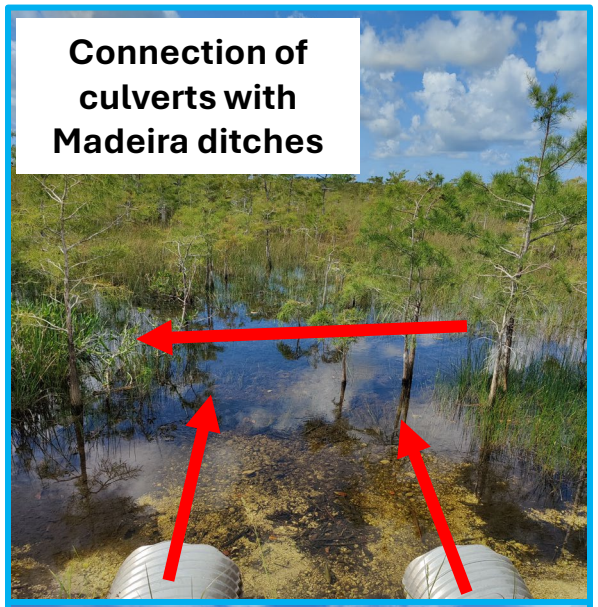
Ingraham Highway culverts where a subsurface channel parallel to the culvert captures more flow compared to the culvert throw seepage under the road.

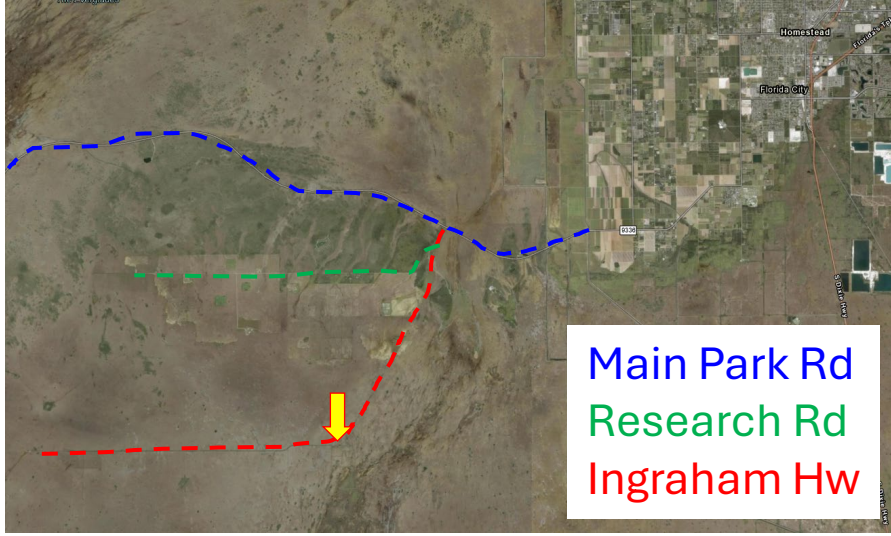




Field Observations

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.





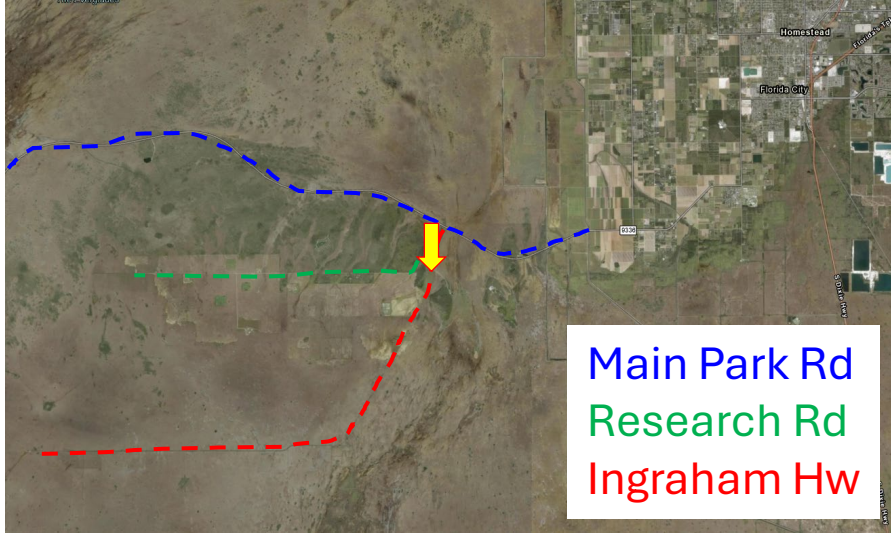
Madeira ditches are small channels connected to existing culverts. These diches **are not studied enough** and experts suggest they **connect water to central Taylor slough and Florida Bay** (losing water from the park to the open water @ southern boundary).

Hyper salinity and grass die off.

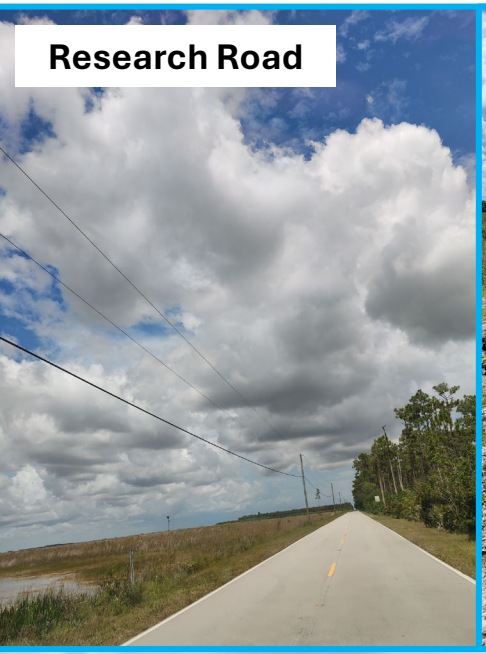
Field Observations

A site close to HID:

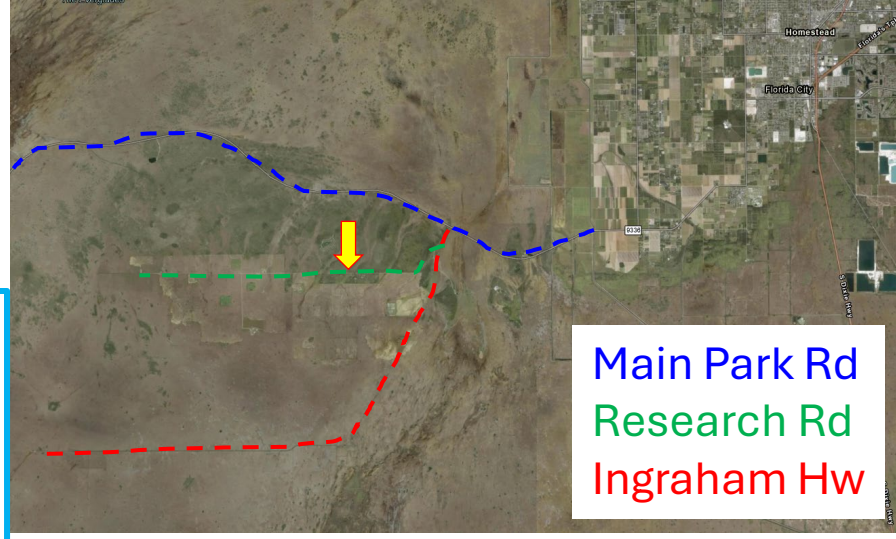
- Road without culverts. Water overtops the road and erosion happens.
- Road is used by campers and school visits.



Field Observations



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.



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.

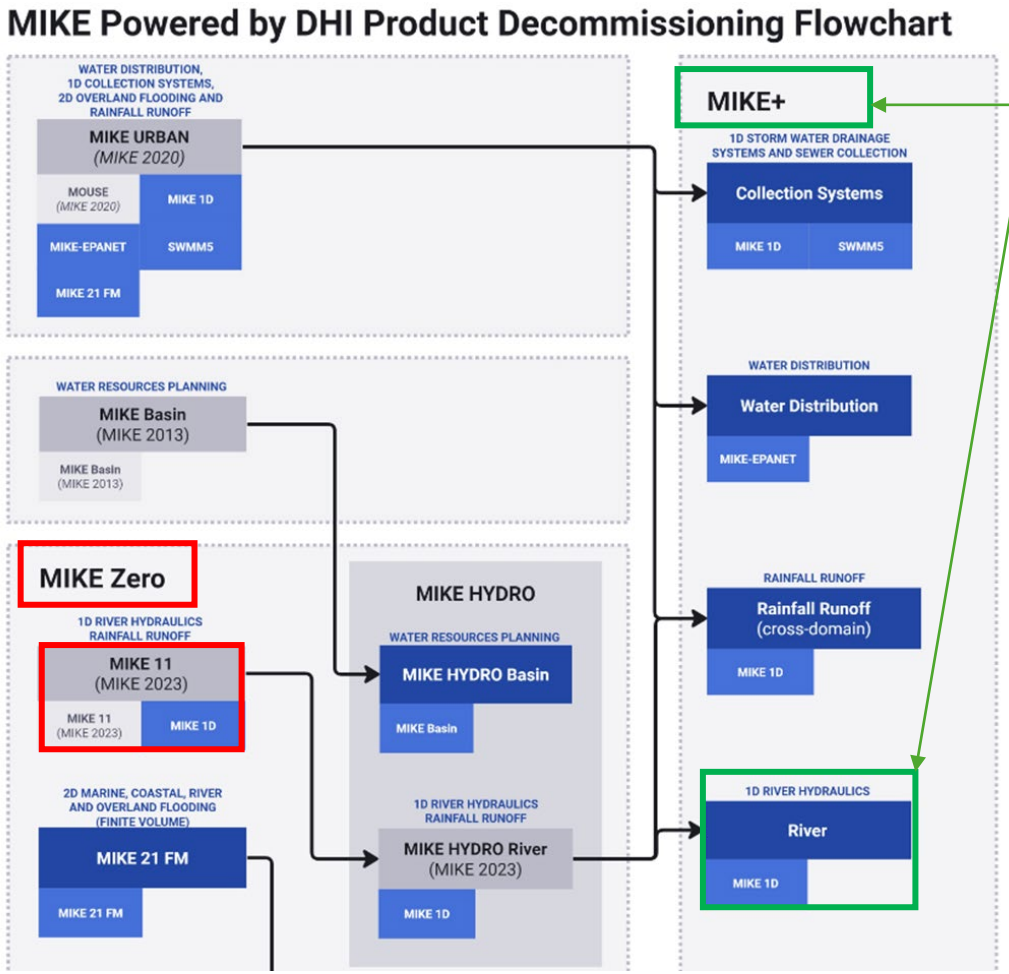
M3ENP Upgrade to MIKE 2025

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

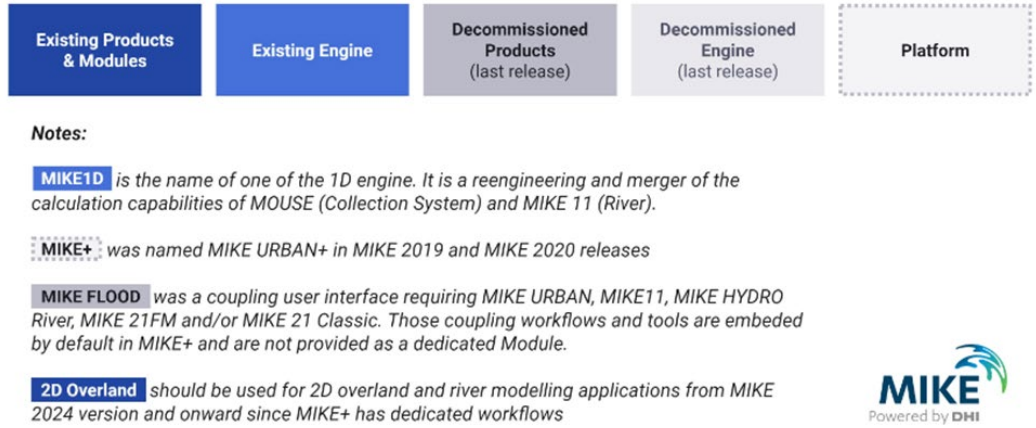
Why upgrade?

- 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

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

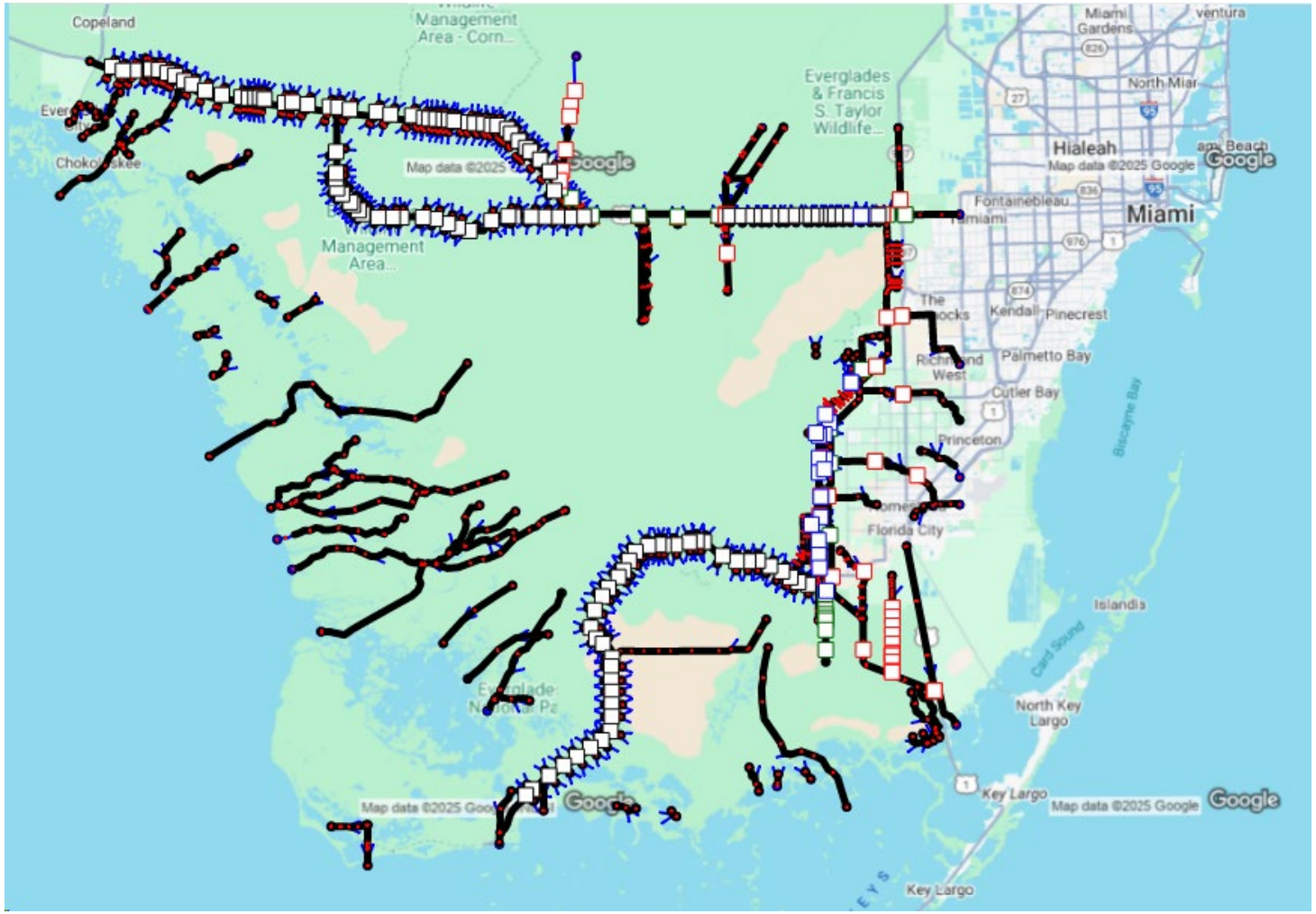


The new M3ENP will use MIKE River available through the 2025 MIKE+ platform (coupled with MIKE SHE available through the MIKE Zero platform)



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

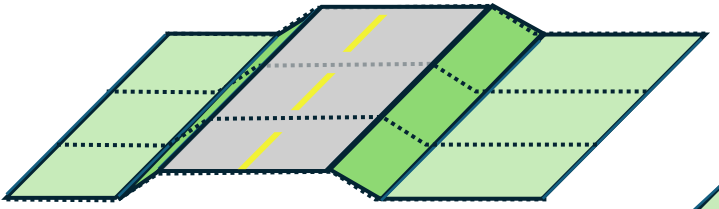
- The existing 1D model was upgraded to Mike + Rivers version (2025.Base released in November 2024).
- The upgraded 1D model was coupled with the MIKE SHE 3D model to account for over land, SZ, and UZ flows.
- Calibration period 1/1/1999 – 12/31/2019 runs in 52 hours using 4 cores.



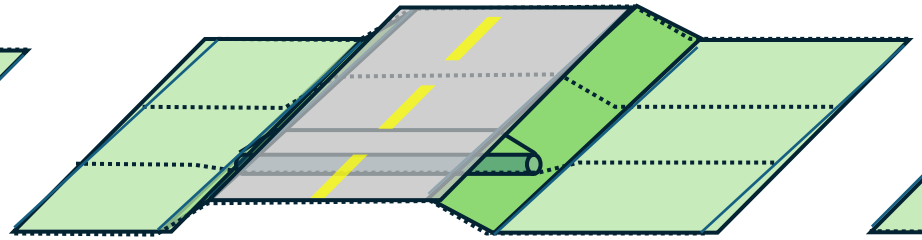
Phase 1: Upgrade the existing 1D model to MIKE + Rivers

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

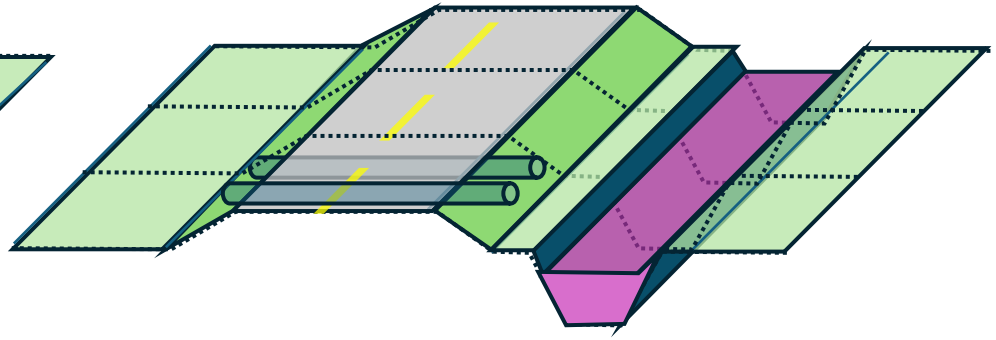
Roadway Only



Roadway + Culvert
(Main Park Road)



Roadway + Culvert + Borrow Canal
(Old Ingraham Highway and Research Road)



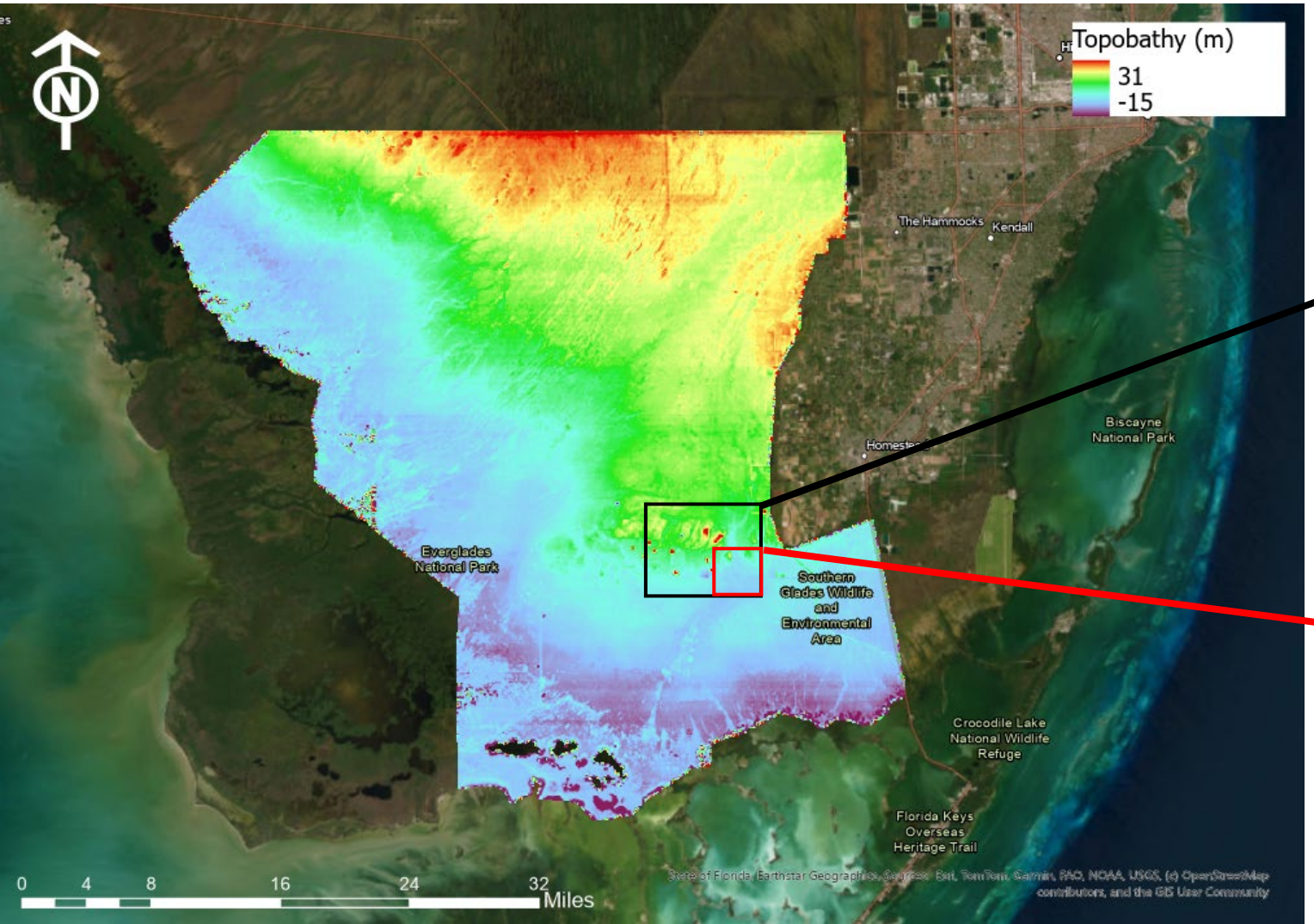
A test model was created to simultaneously evaluate configuration options with collaboration and guidance from Elias Moussoulis and Steve Blake from DHI.

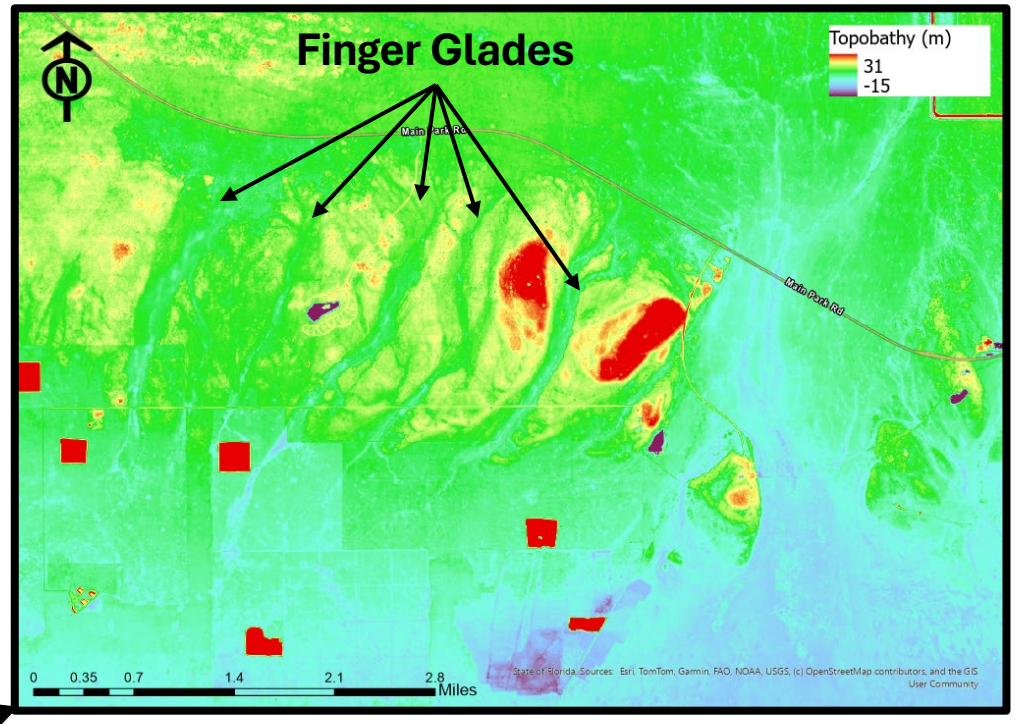
Adding Important Topographic Features

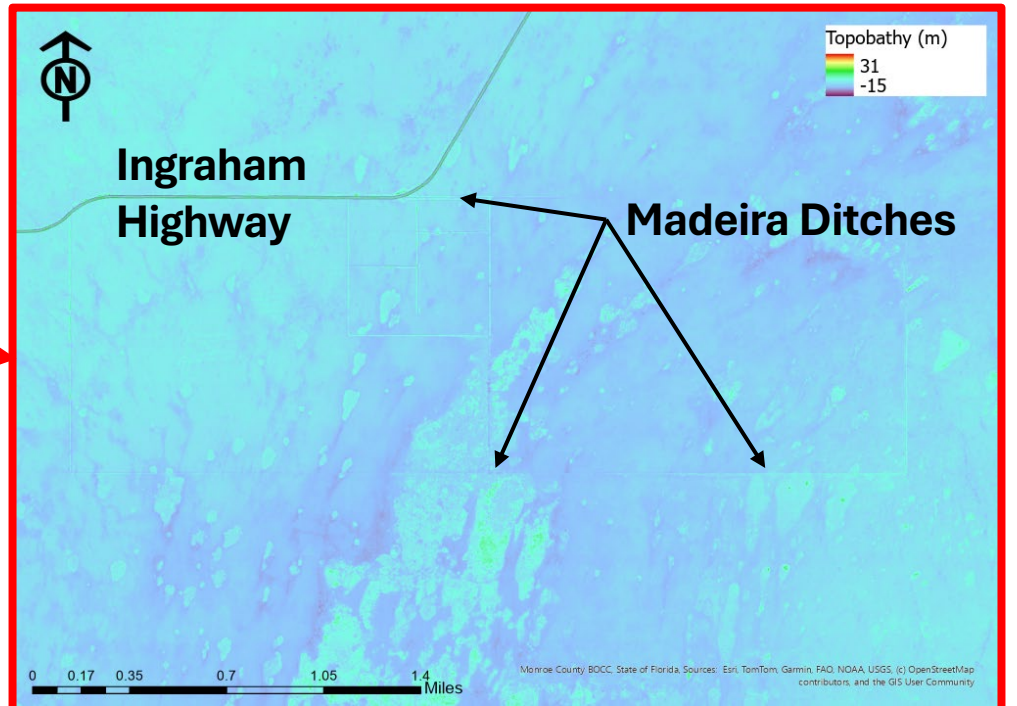
Phase 2: Quantify influence of local features to inform remediation projects

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 Maderia 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

THANK YOU

Questions?!

Tulane

akhalifa1@tulane.edu