

**Everglades National Park**

***South Florida Natural Resources Center***

National Park Service  
U.S. Department of the Interior



**Application of a New MODHMS-  
Based Model to  
Analyze the Effects of the C-111  
Detention Area Buildout**

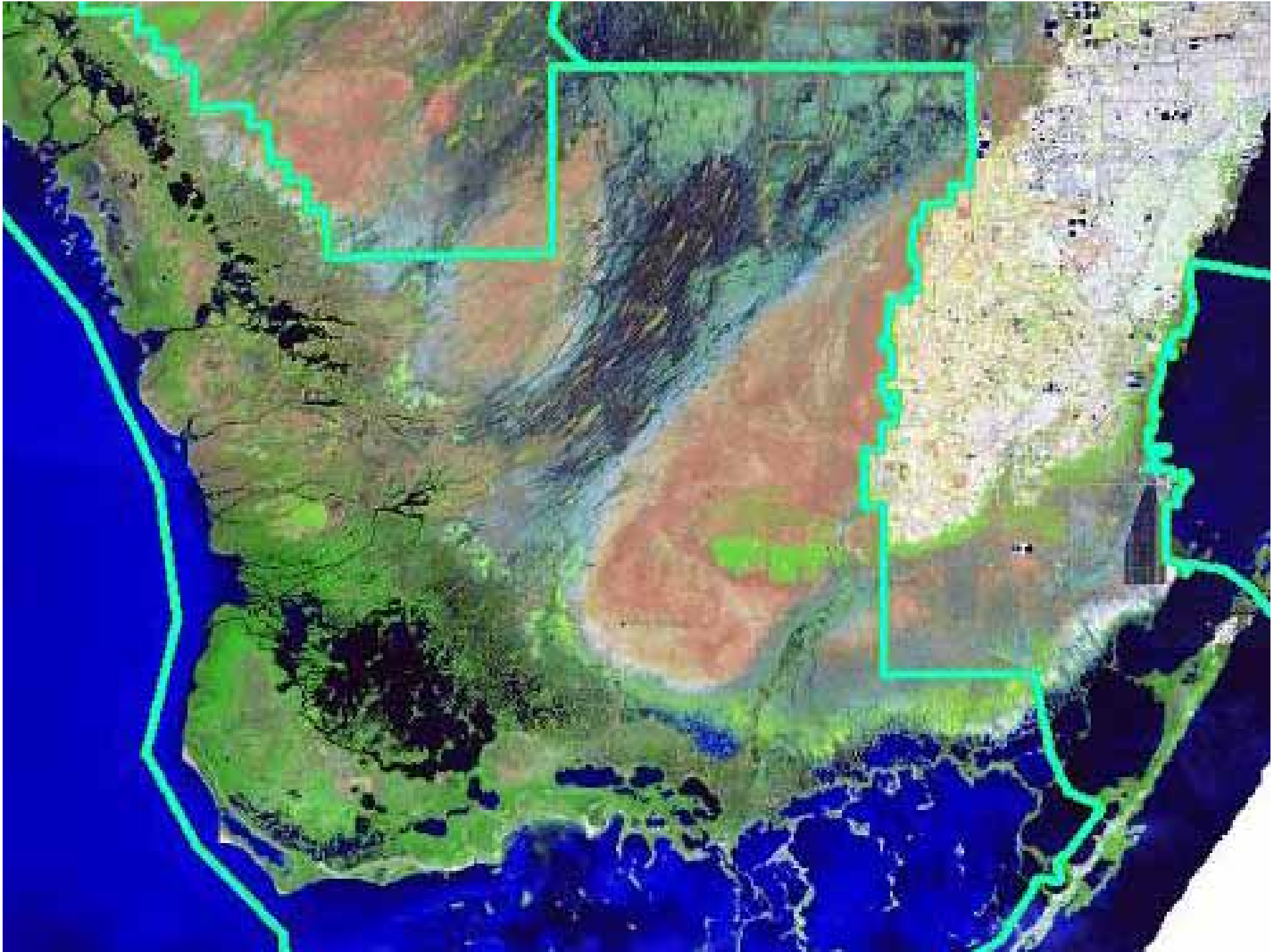
**Kiren Bahm, Kevin Kotun, and Ingrid Bon  
South Florida Natural Resources Center  
Everglades National Park  
July 2008**

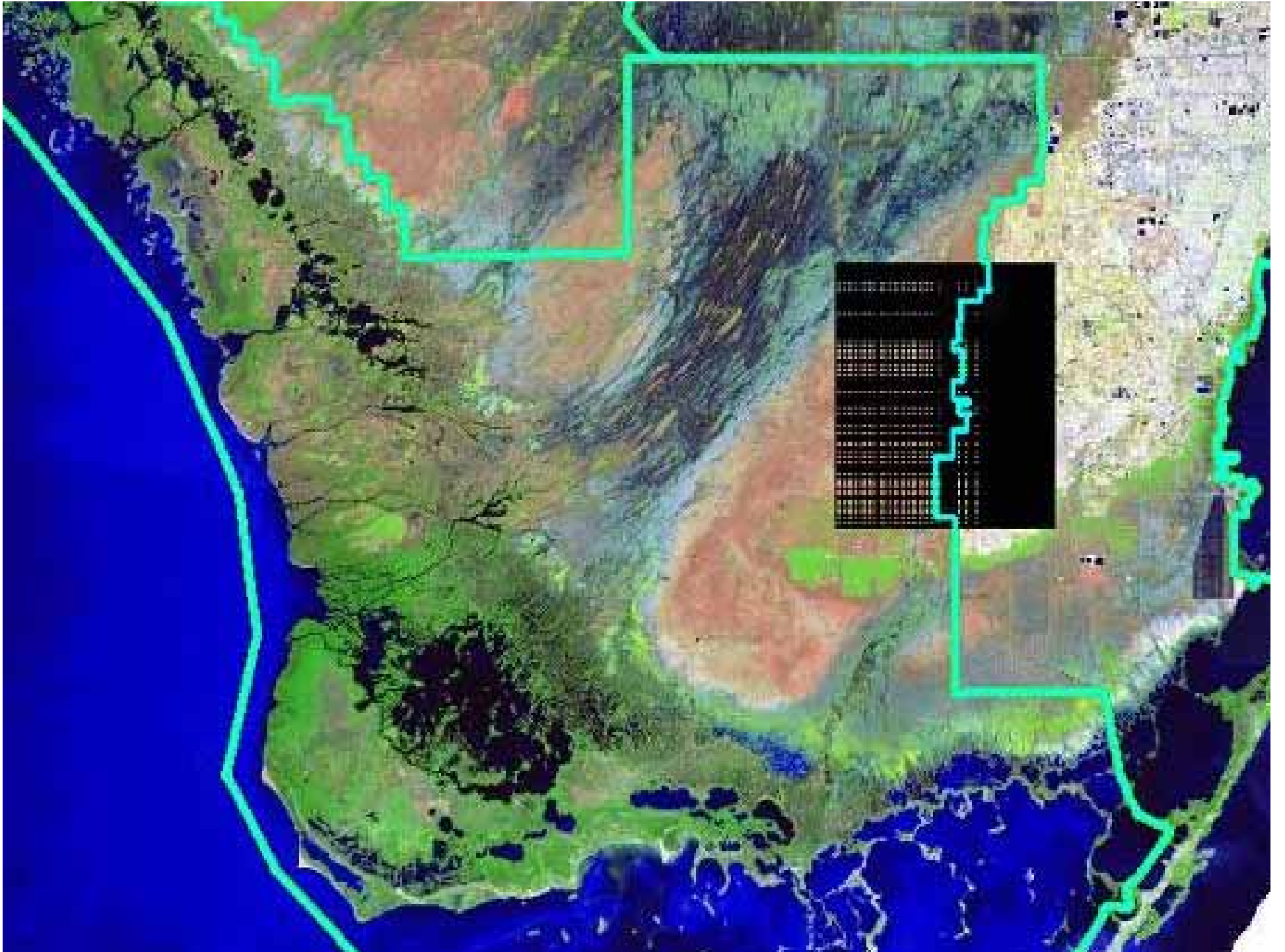
# Everglades National Park

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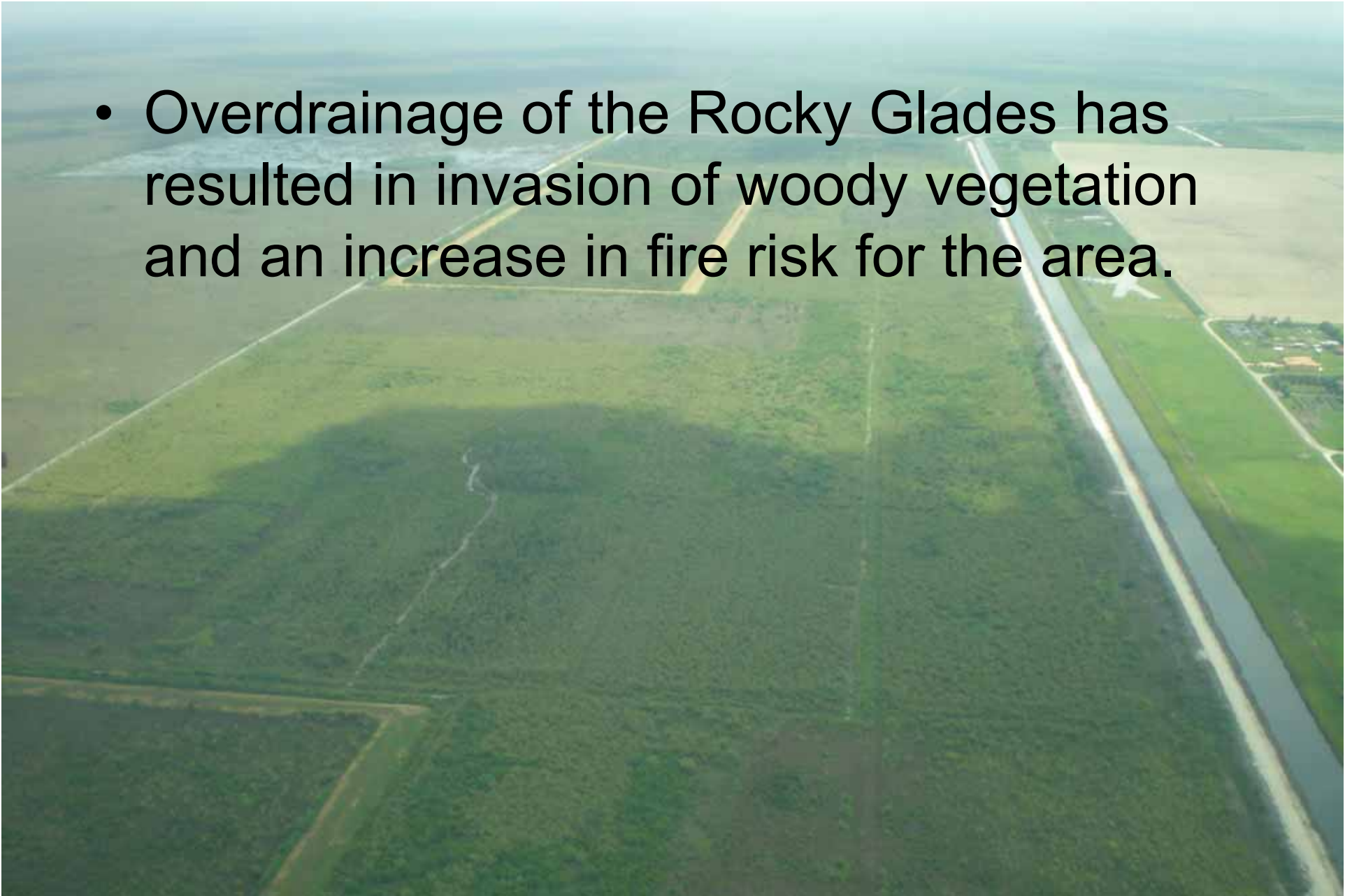








- Overdrainage of the Rocky Glades has resulted in invasion of woody vegetation and an increase in fire risk for the area.



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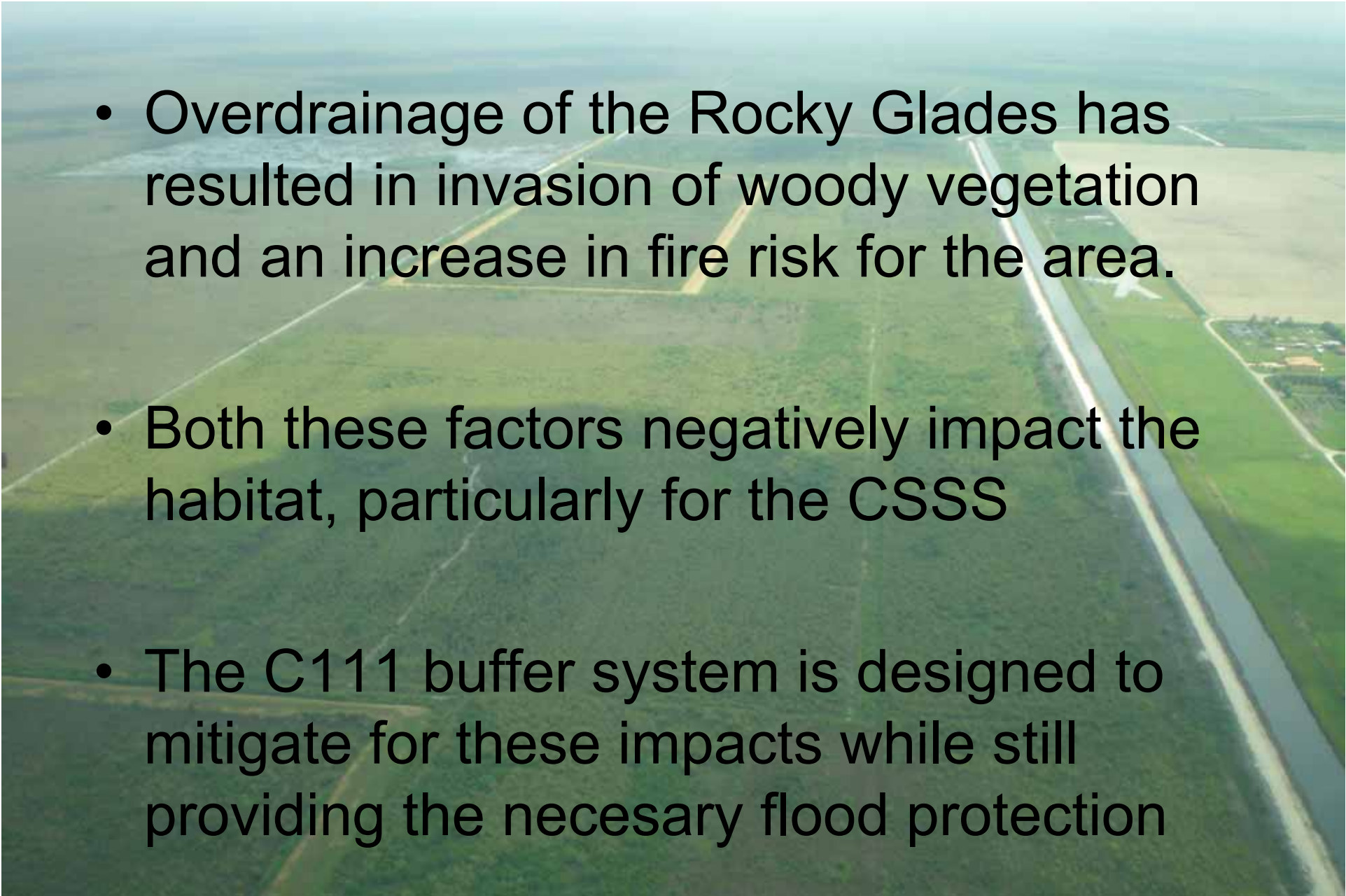
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- Overdrainage of the Rocky Glades has resulted in invasion of woody vegetation and an increase in fire risk for the area.
- Both these factors negatively impact the habitat, particularly for the CSSS



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- An aerial photograph of a wetland area, likely the Rocky Glades. A prominent canal runs diagonally from the top right towards the bottom right. Several roads or levees are visible, forming a grid-like pattern across the landscape. The vegetation is a mix of green and brown, indicating different types of plants and possibly some areas of woody vegetation invasion.
- Overdrainage of the Rocky Glades has resulted in invasion of woody vegetation and an increase in fire risk for the area.
  - Both these factors negatively impact the habitat, particularly for the CSSS
  - The C111 buffer system is designed to mitigate for these impacts while still providing the necessary flood protection



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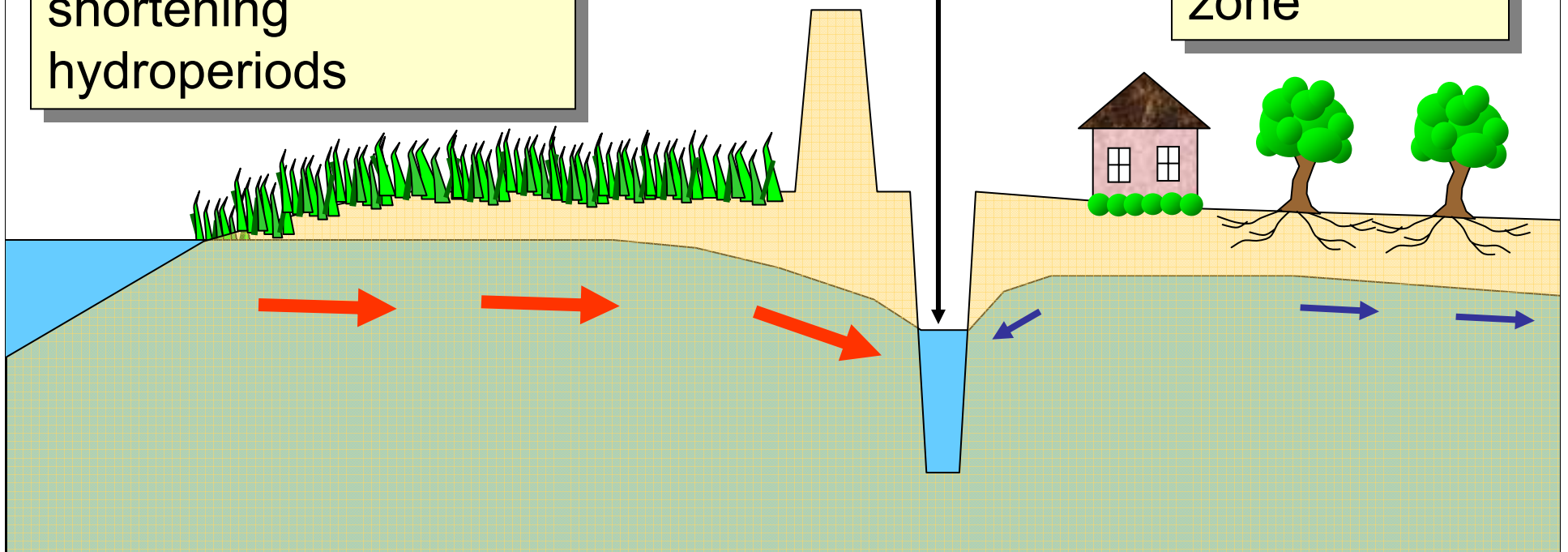


# Flood Control Operations

Low canal stages increase groundwater seepage from ENP, reducing surface water stages and shortening hydroperiods

Canal stages low to facilitate drainage of urban / ag lands to the east.

Low canal stages depress ground water below root zone



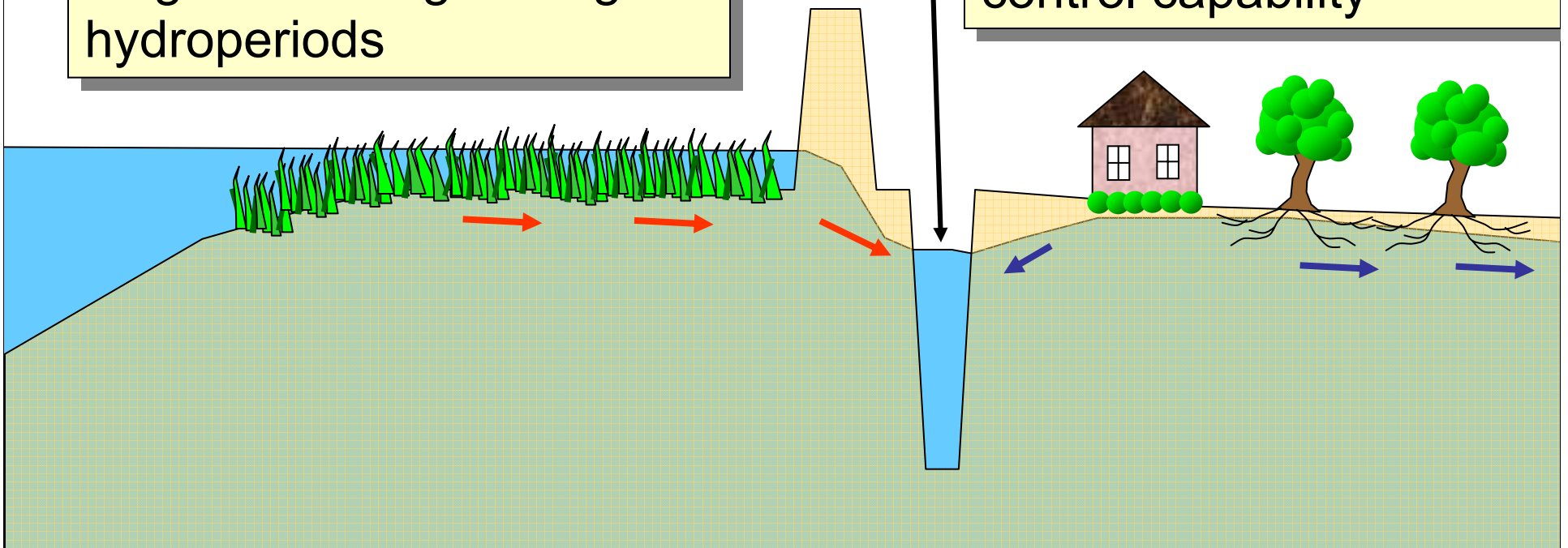


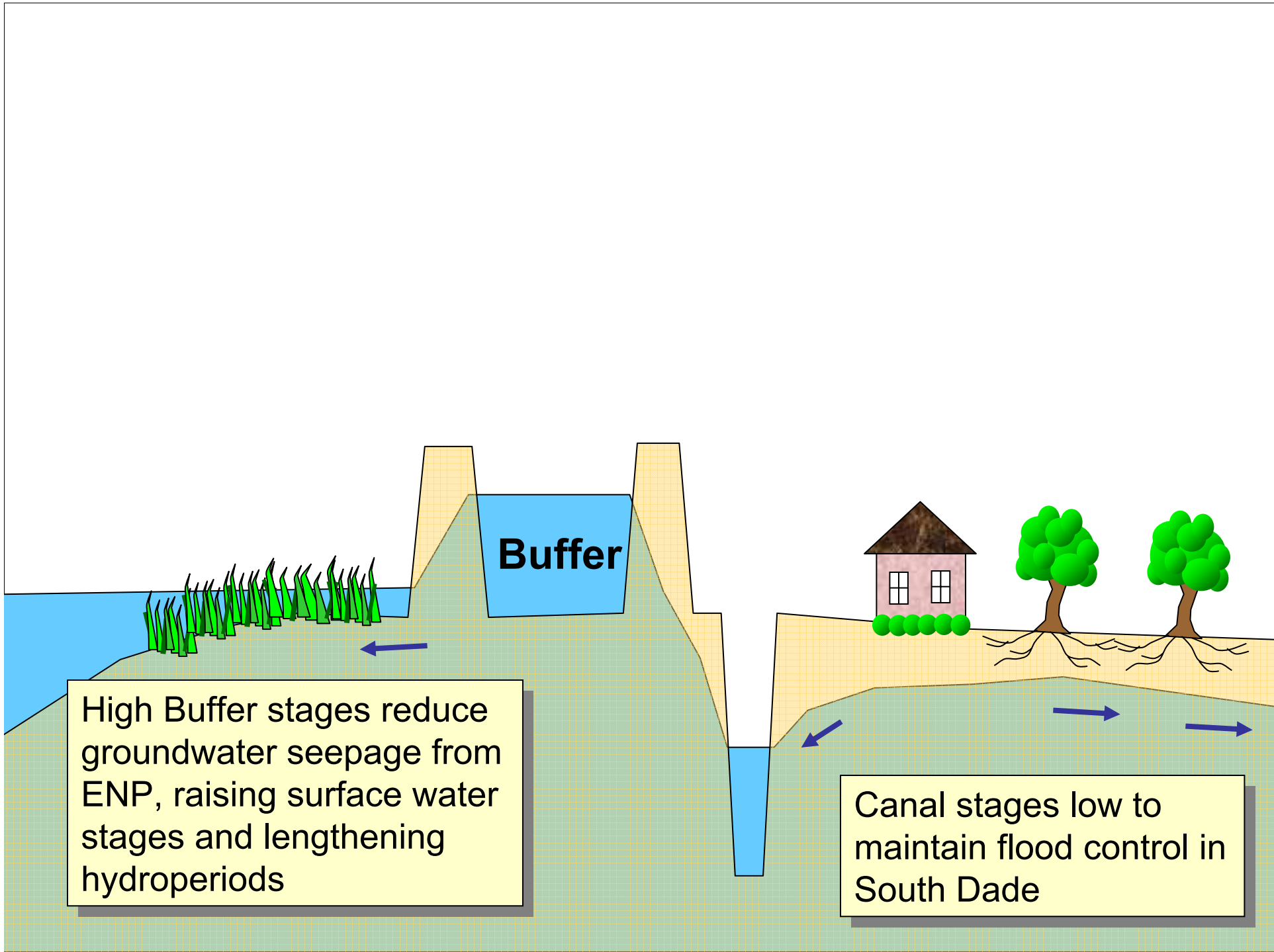
# Restoration Operations

Canal stages high to reduce seepage losses from ENP

High canal stages reduce groundwater seepage from ENP, raising surface water stages and lengthening hydroperiods

High canal stages raise ground water above root zone, and reduce flood control capability

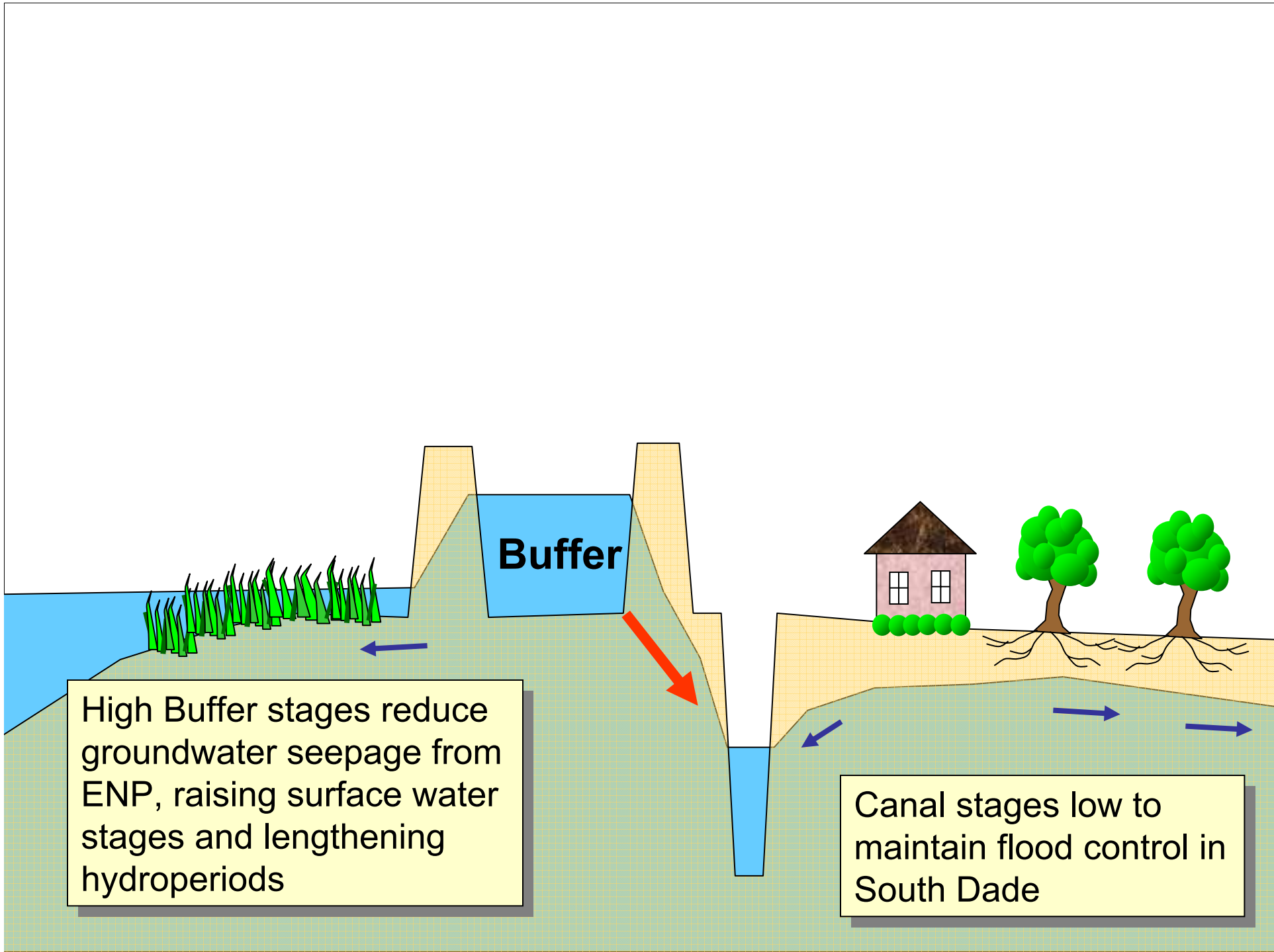




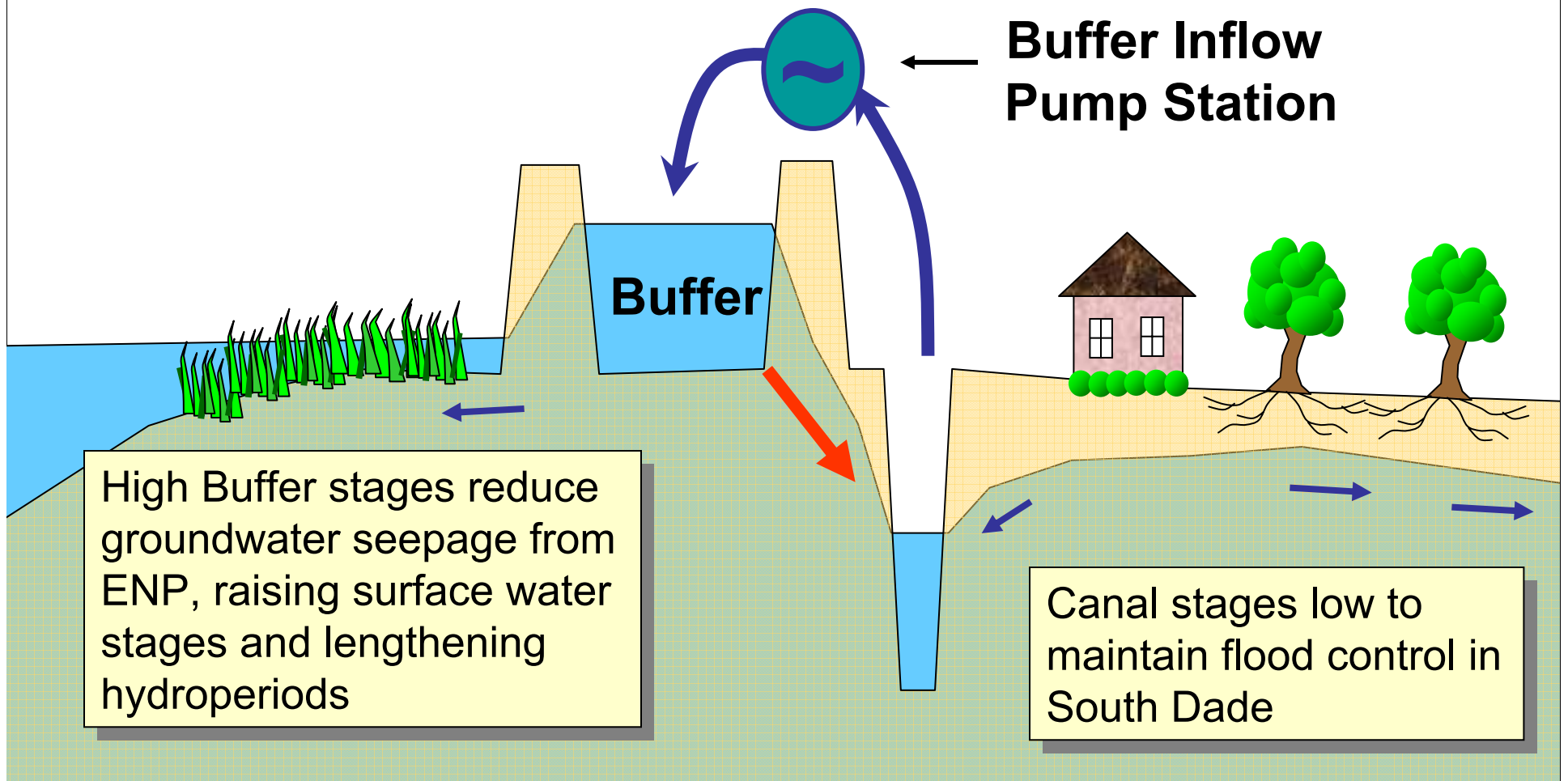
**Buffer**

High Buffer stages reduce groundwater seepage from ENP, raising surface water stages and lengthening hydroperiods

Canal stages low to maintain flood control in South Dade



# The challenge is balancing the amount of pumping to allow for **BOTH** restoration and flood control







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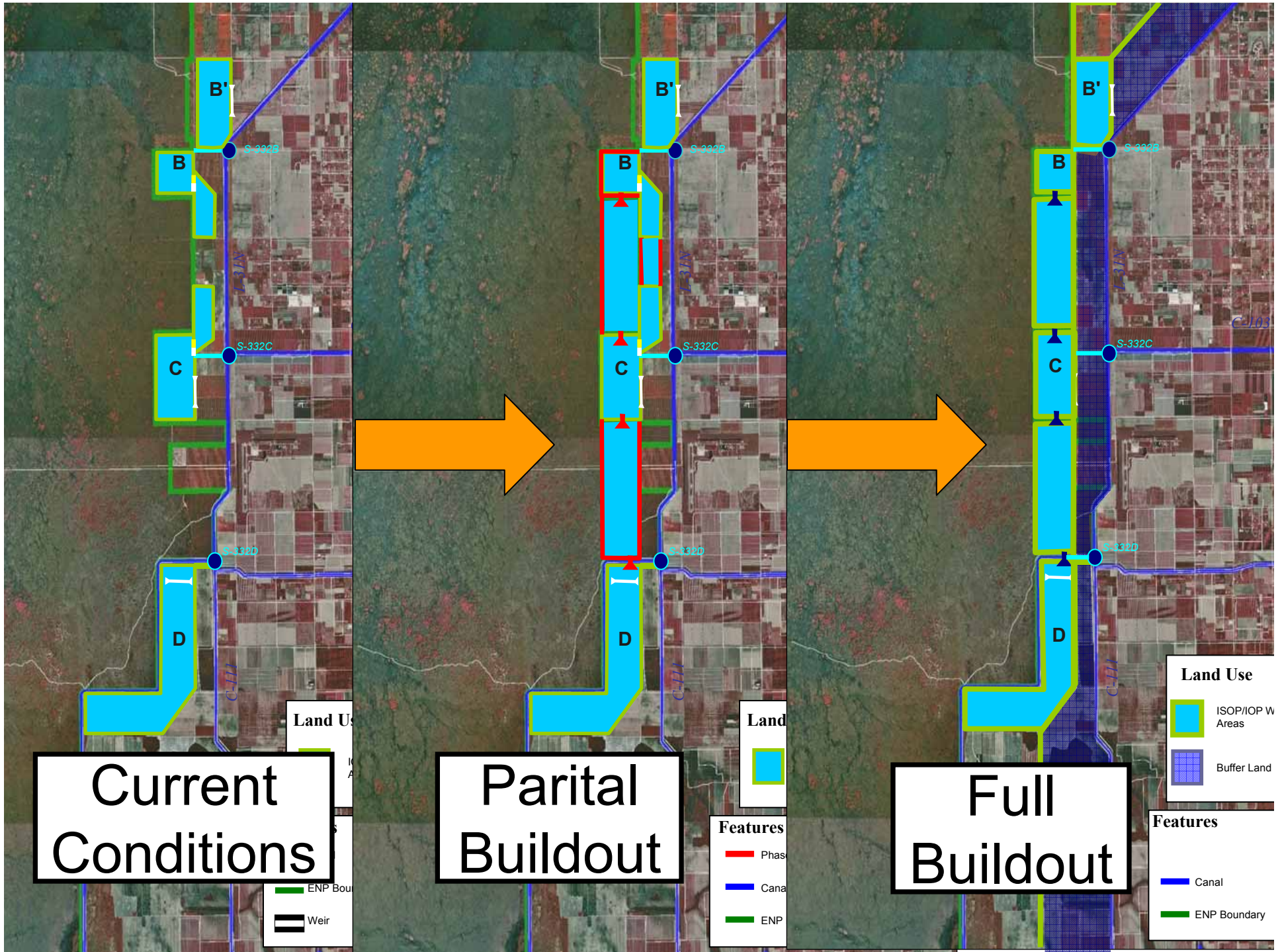




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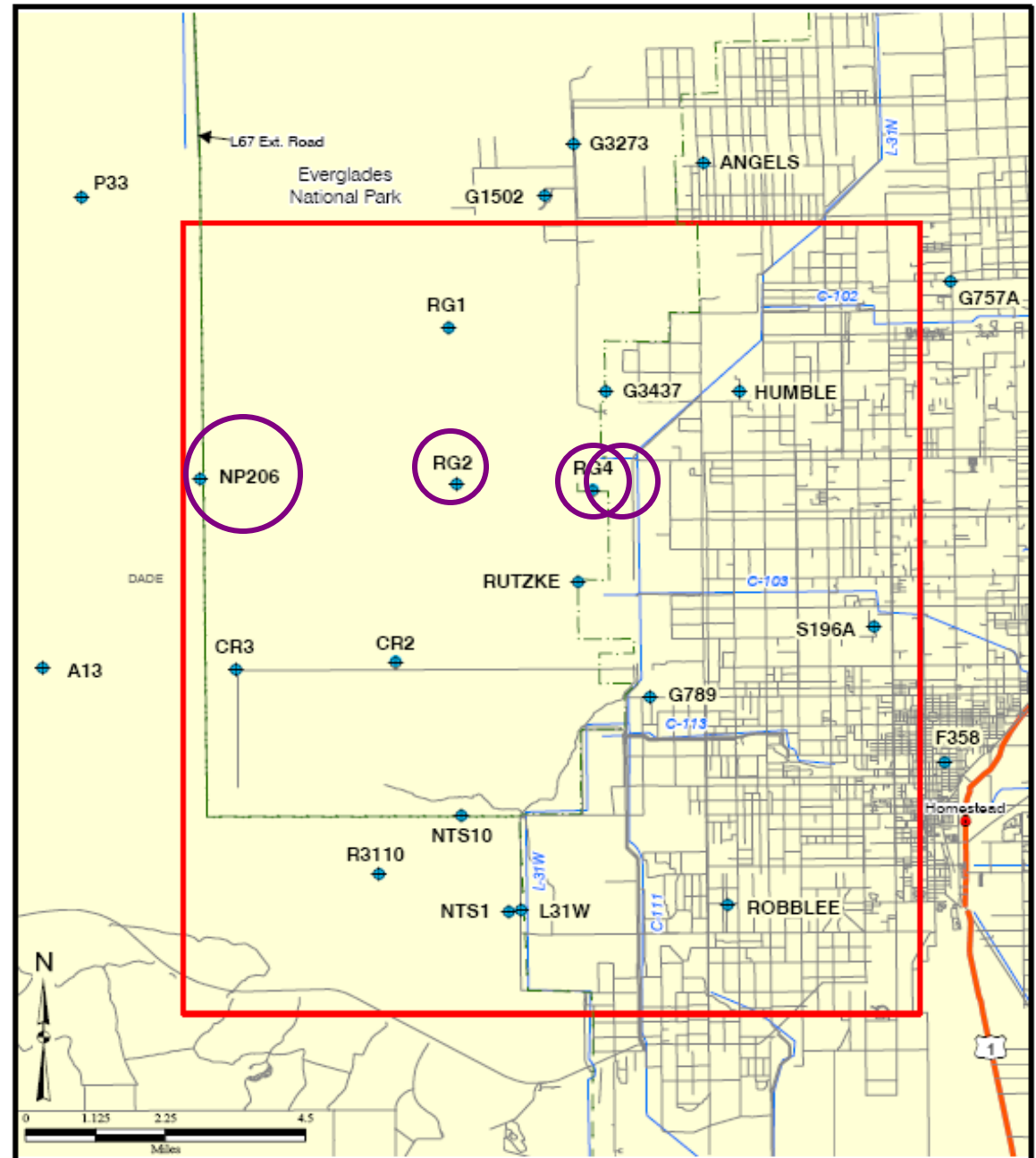
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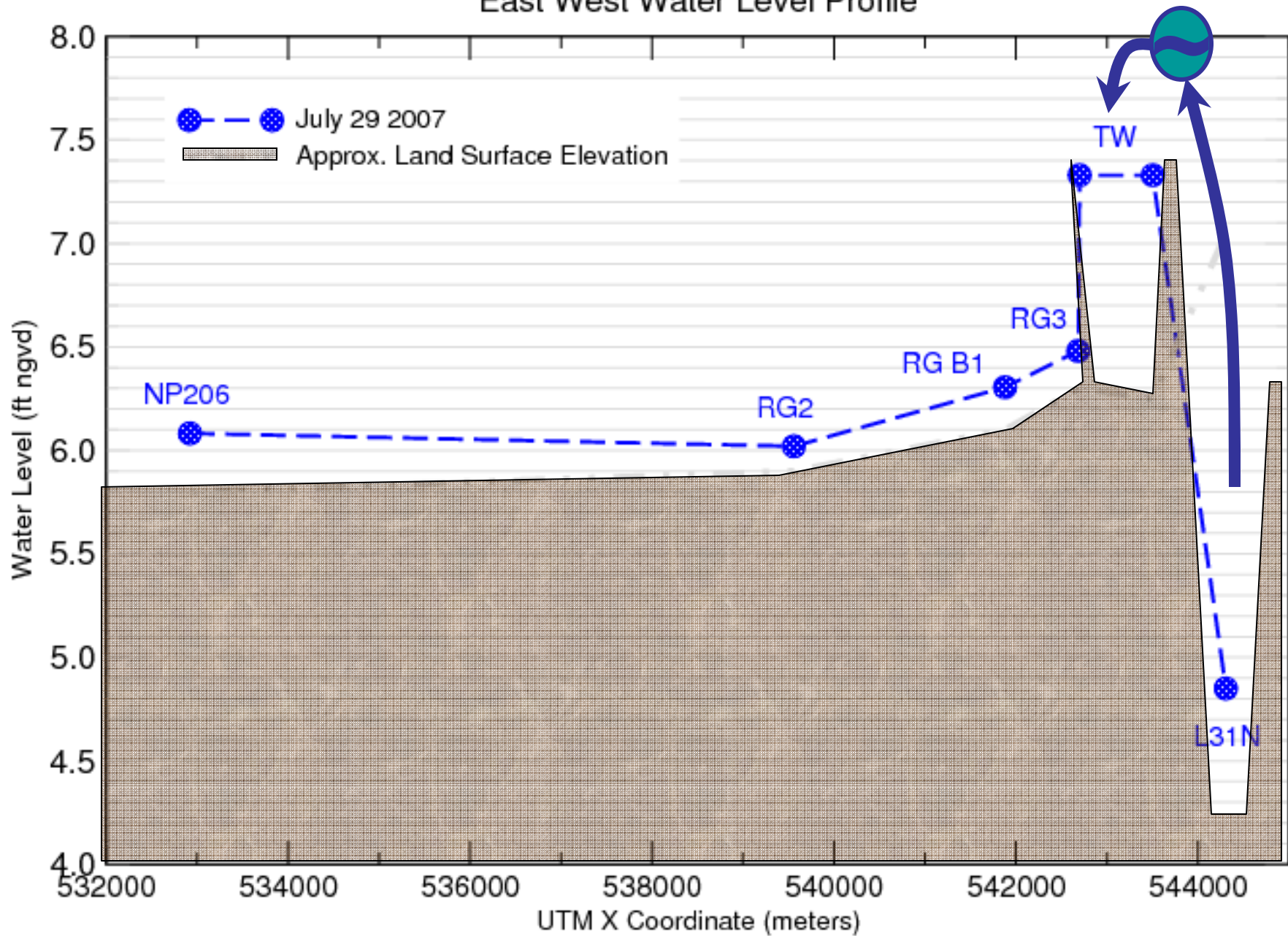
# Hydrological Monitoring Stations



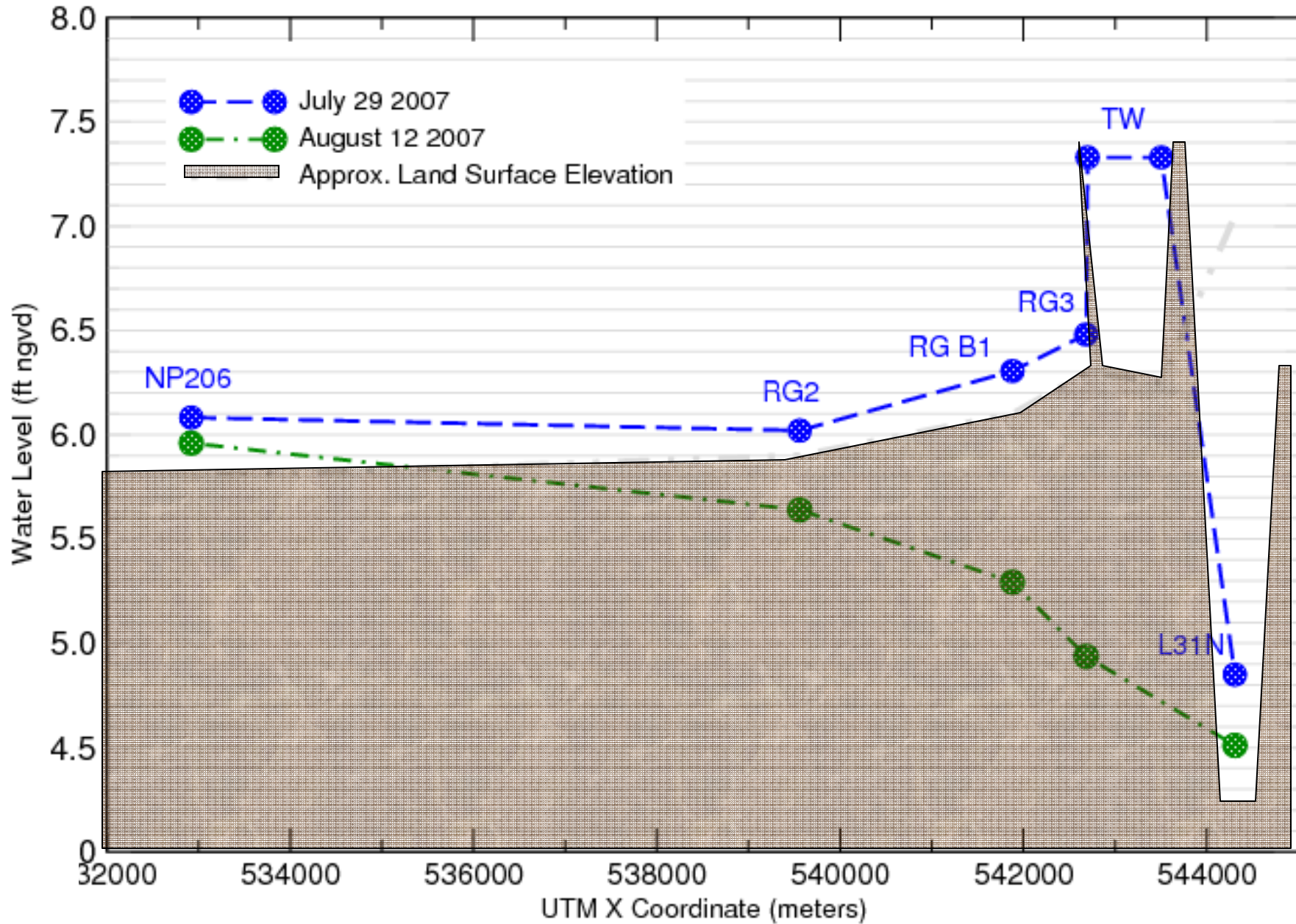
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# East West Water Level Profile



# East West Water Level Profile









# Potential Negative Impacts of the Buffer System

- Introduction of stormwater with poor water quality



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# Potential Negative Impacts of the Buffer System

- Introduction of stormwater with poor water quality
- Introduction of exotic fish species



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# Potential Negative Impacts of the Buffer System

- Introduction of stormwater with poor water quality
- Introduction of exotic fish species
- Producing depths that would change the vegetation from the Muhly Prairie to wetter vegetation like sawgrass

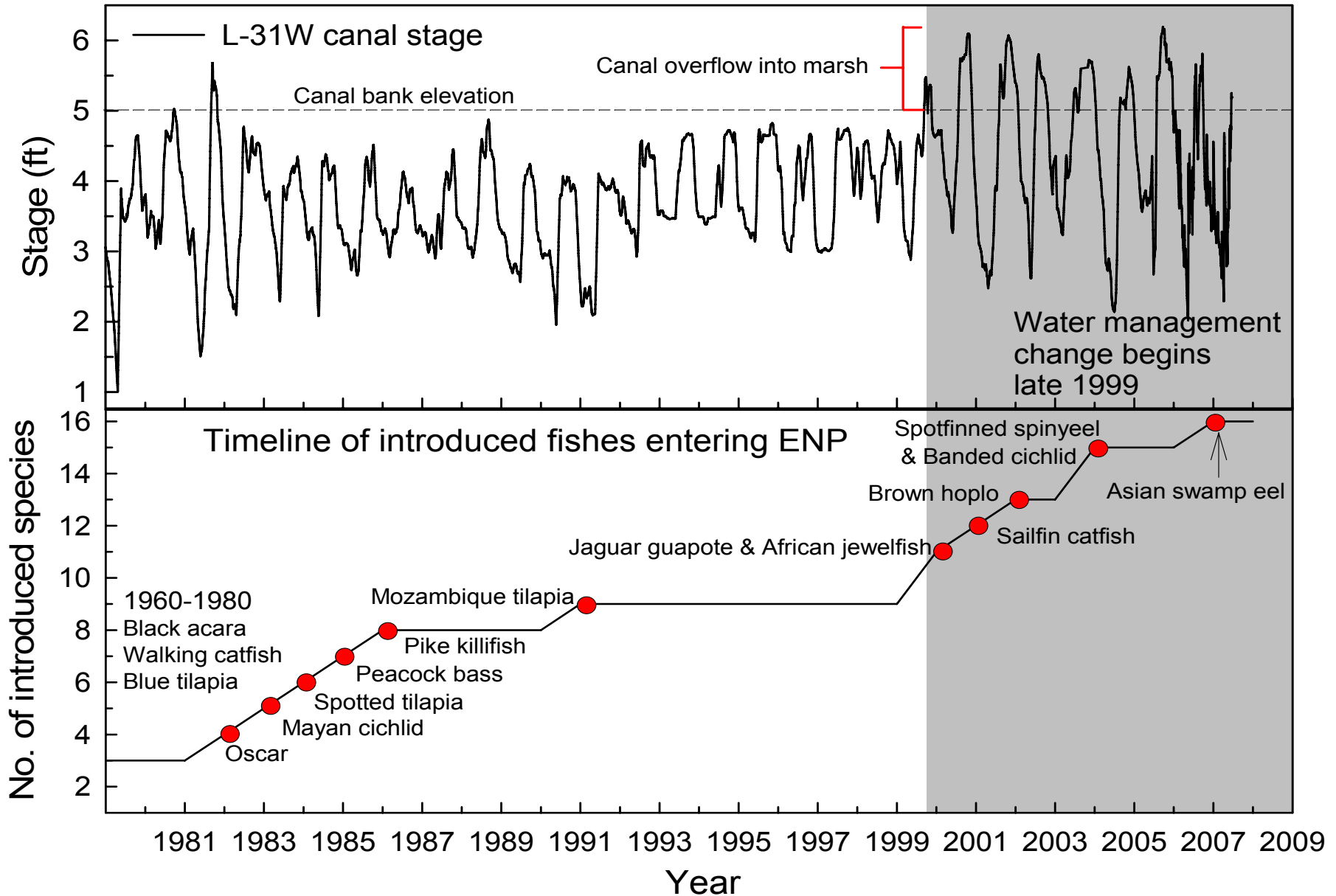


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# Recent History



# Objectives of the Modeling Study

- Investigate the potential impacts of water quality and increased depths



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- Investigate the potential impacts of water quality and increased depths
- Investigate the potential for overflow during storm events



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# Objectives of the Modeling Study

- Investigate the potential impacts of water quality and increased depths
- Investigate the potential for overflow during storm events
- Develop a Marsh Driven Operational Plan focused on extending hydroperiods and moderating recession rates



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# Rocky Glades Model Parameters

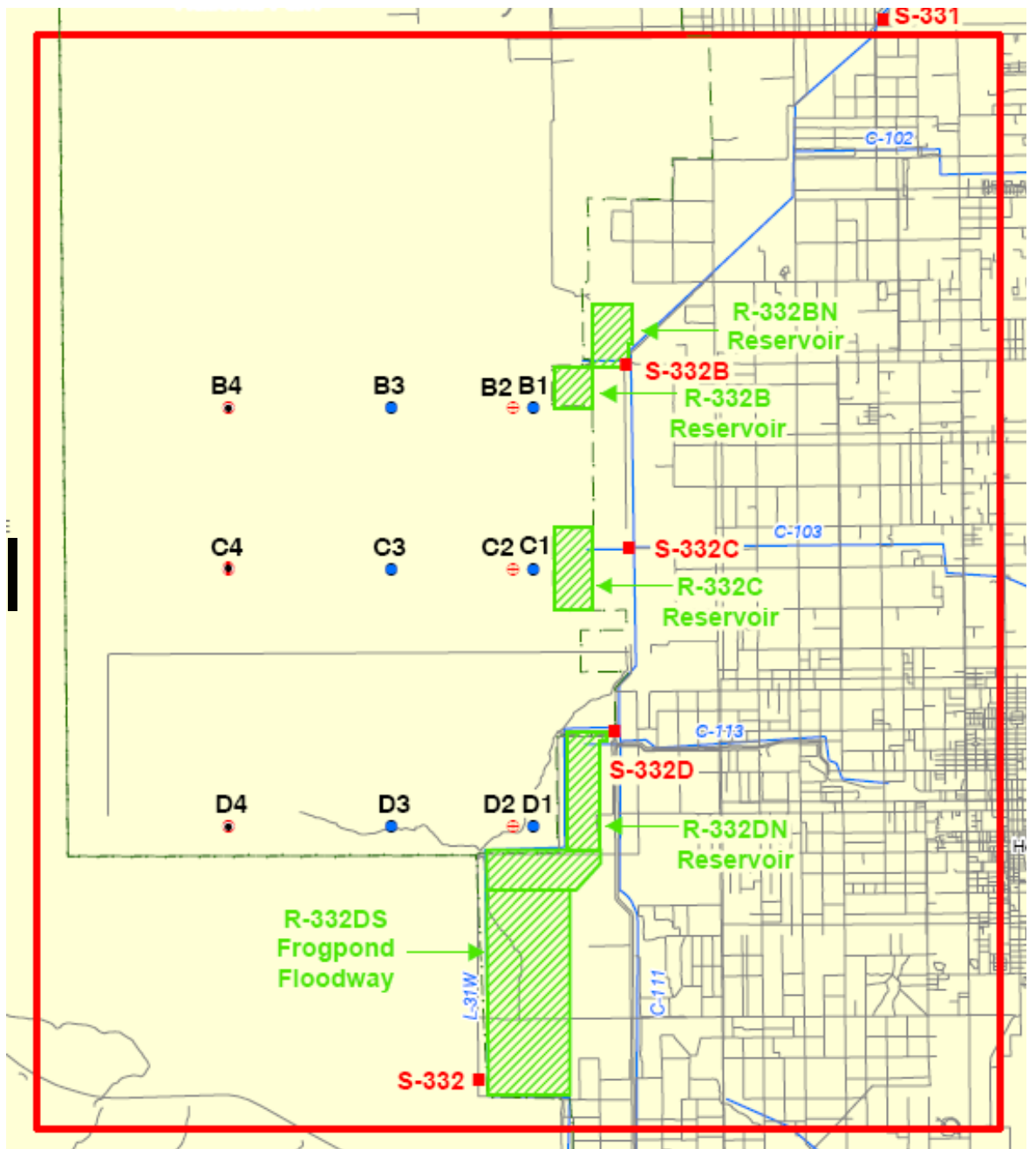
- **Uses MODHMS code from HydroGeologic Inc.**
- **Simulates fully coupled surface and groundwater flow**
- **Simulates channel-groundwater and channel-surface water interactions**
- **Simulates water control structures and rules of operation**
- **Simulates 4 subsurface layers**
- **Can model Phosphorous transport**
- **3-year simulation: 2000-2002**



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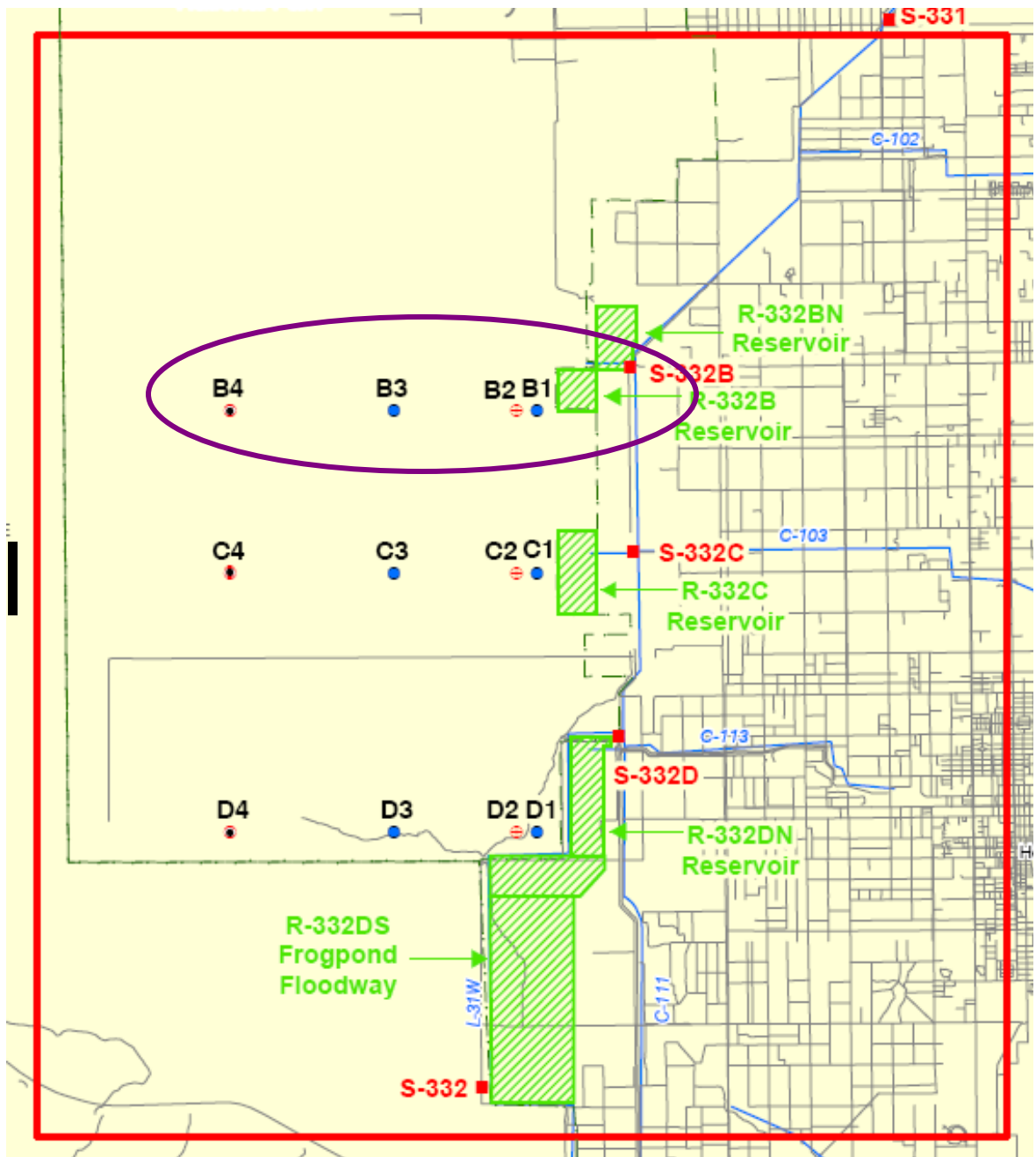
# Marsh Operations Hydrological Monitoring Stations



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# Marsh Operations Hydrological Monitoring Stations

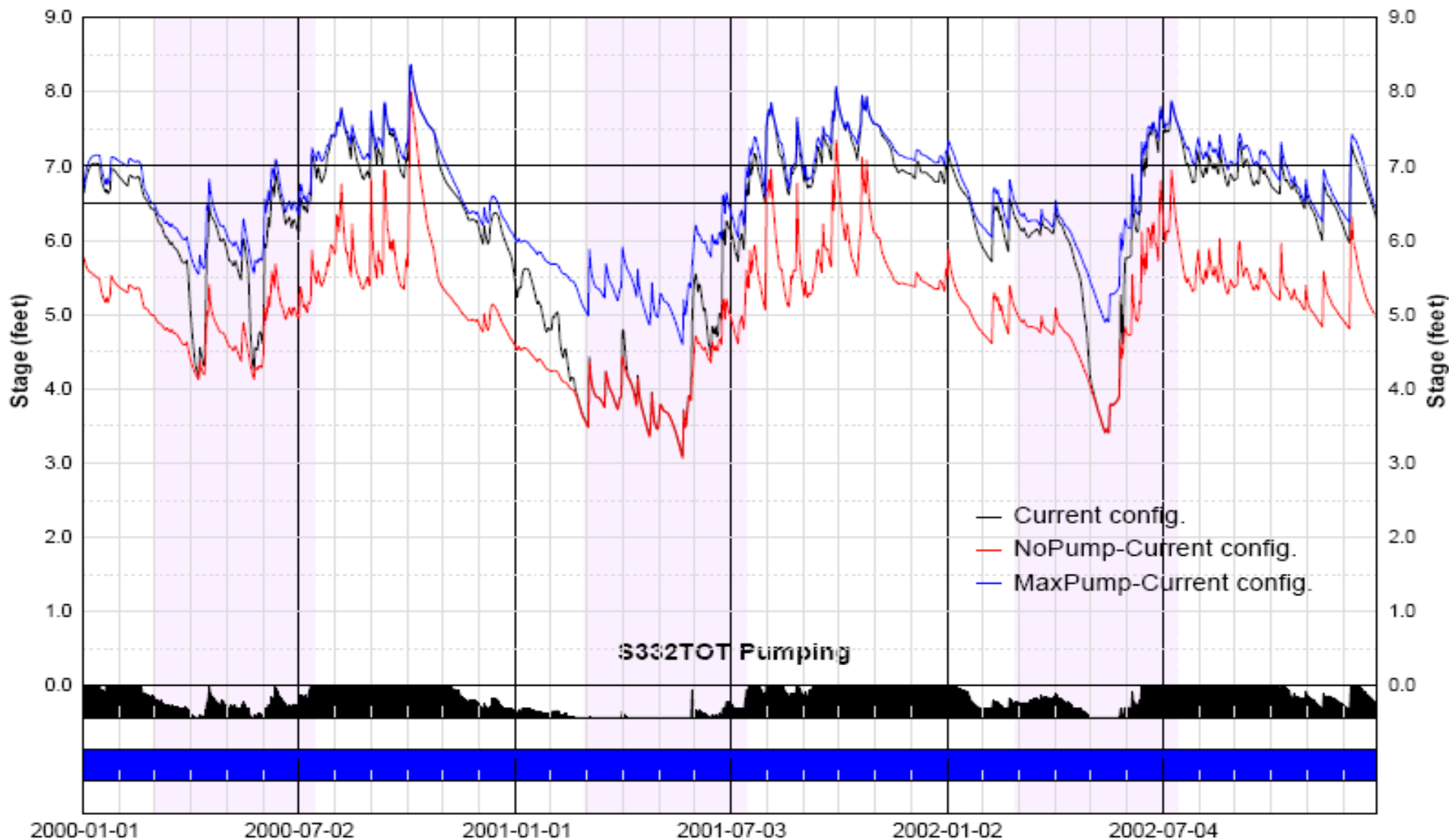


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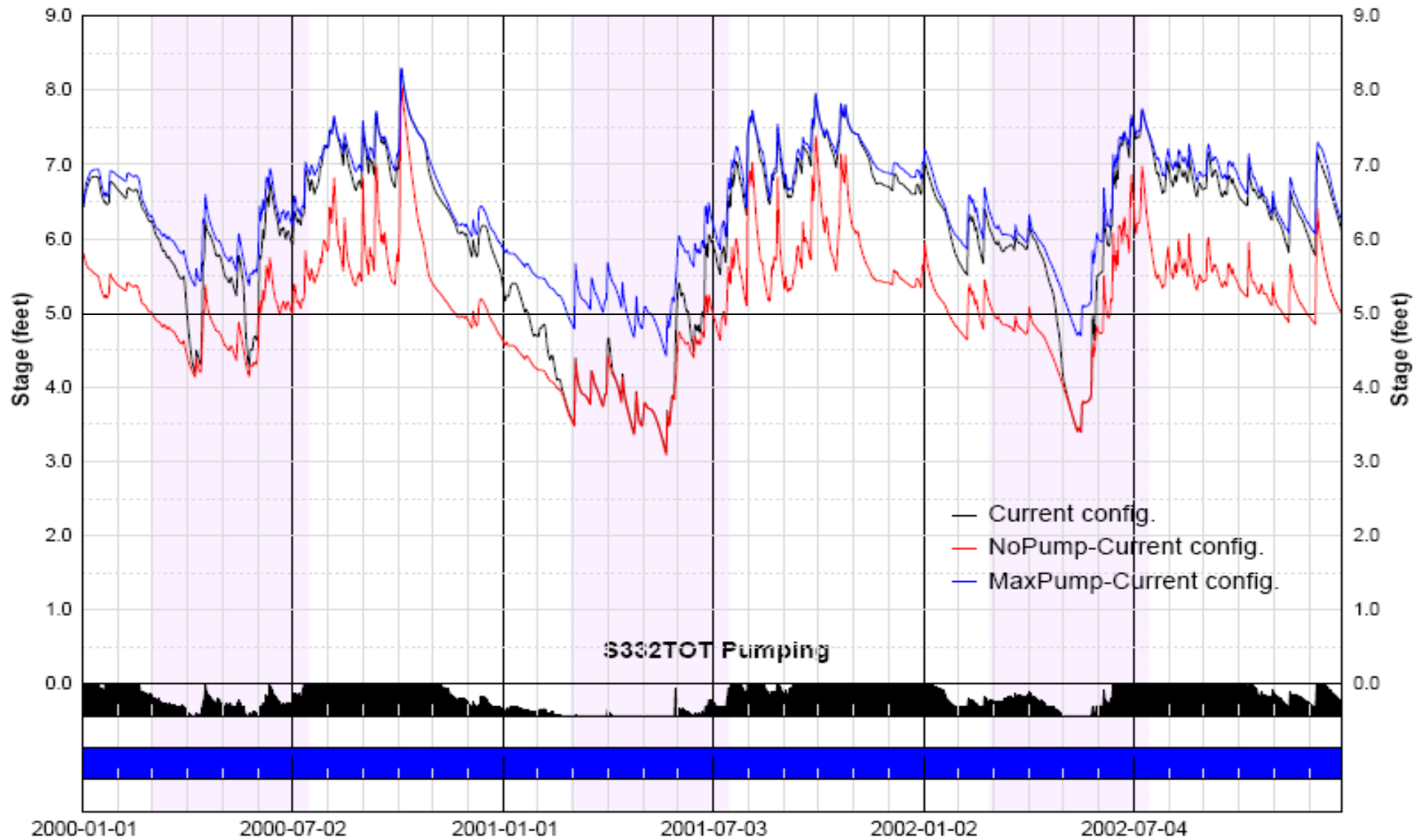
## B-1 stage



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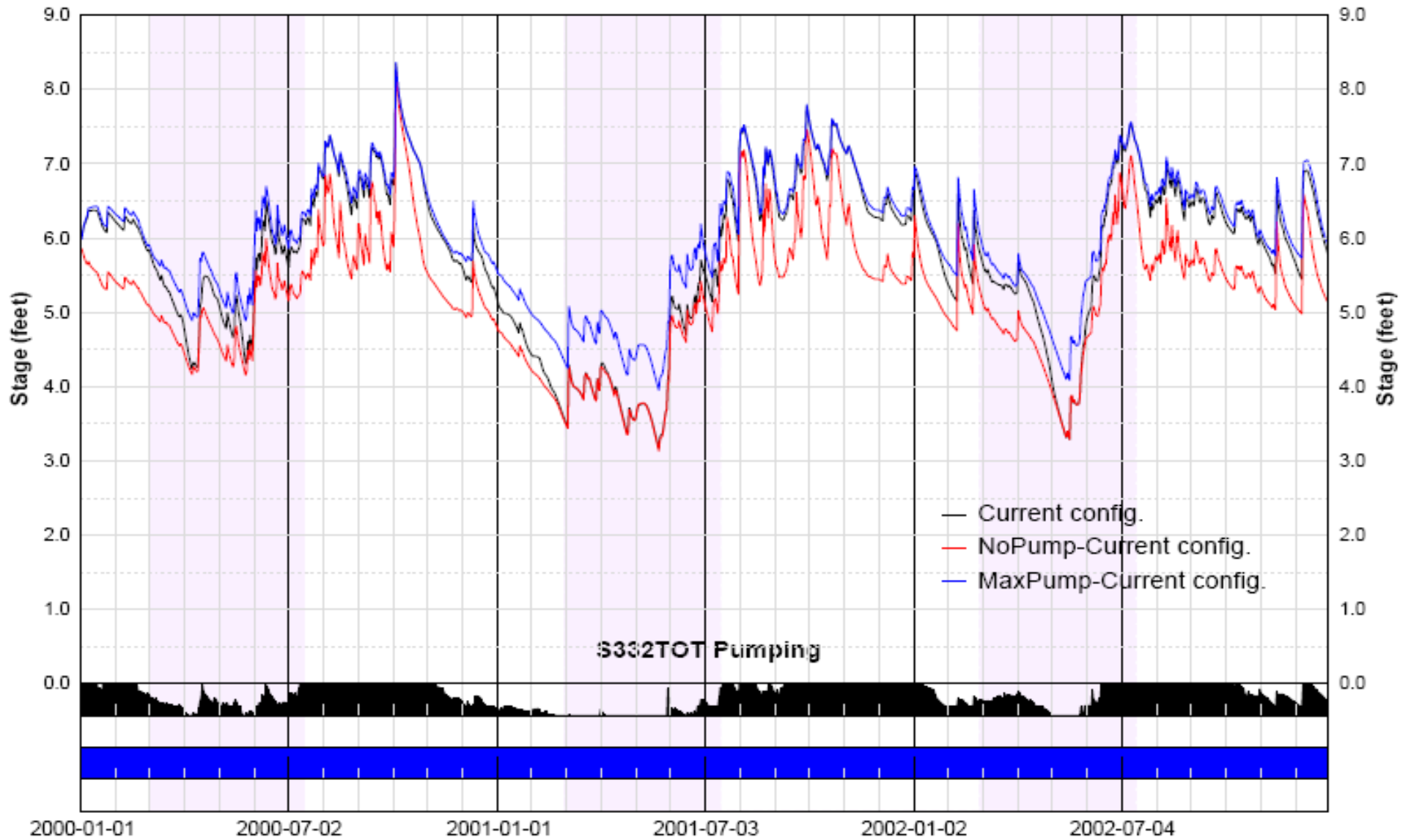
## B-2 stage



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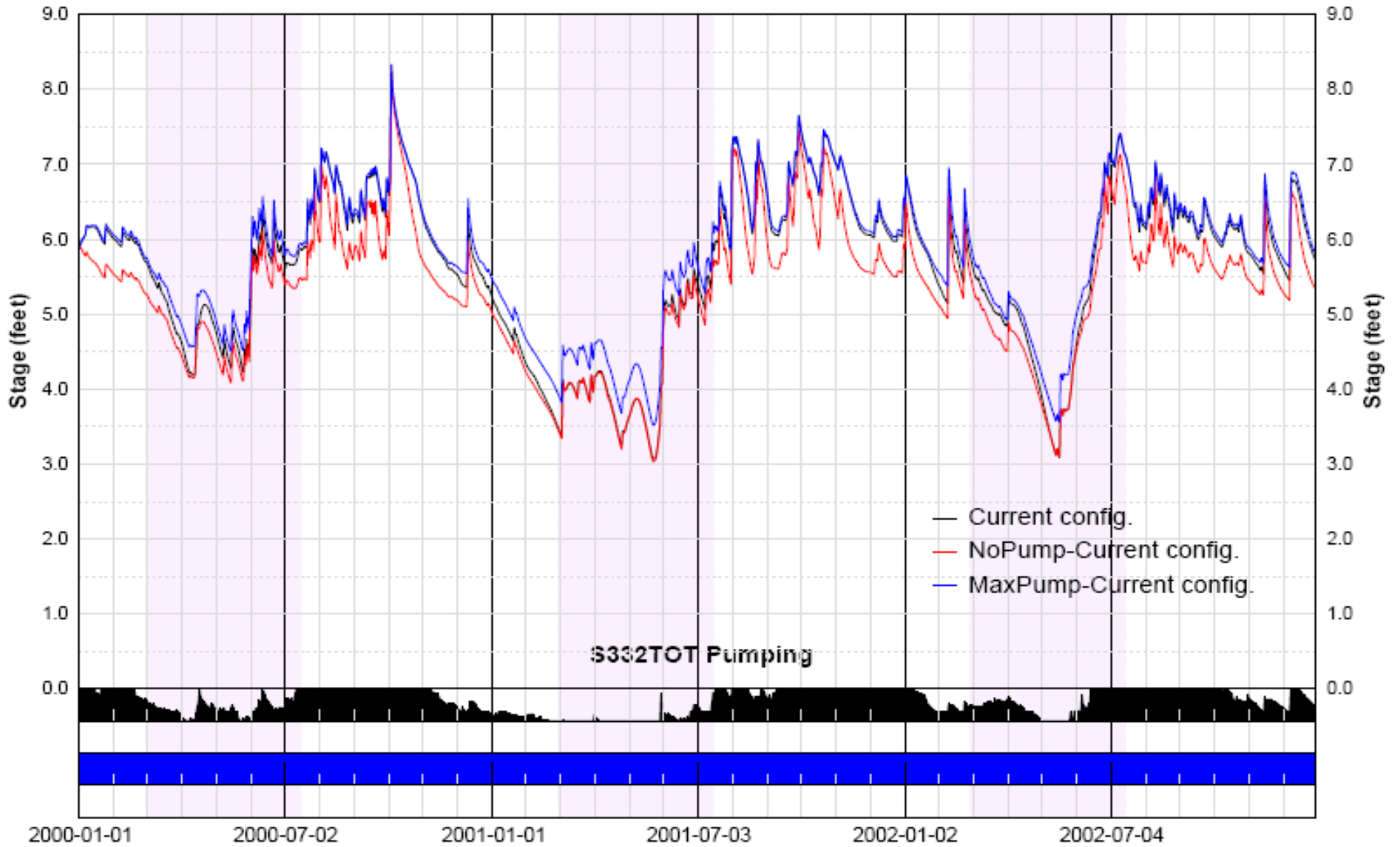
## B-3 stage



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## B-4 stage

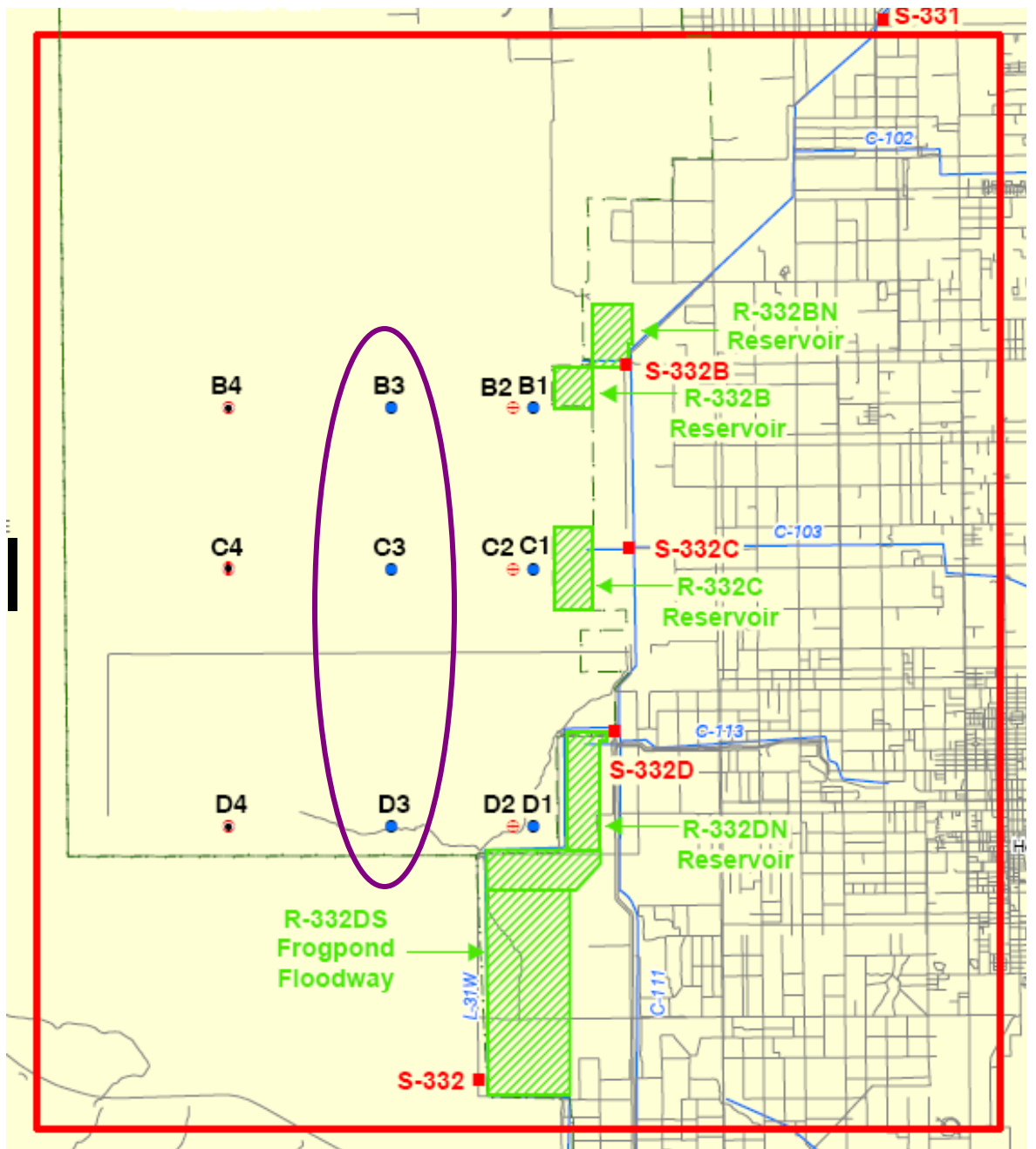


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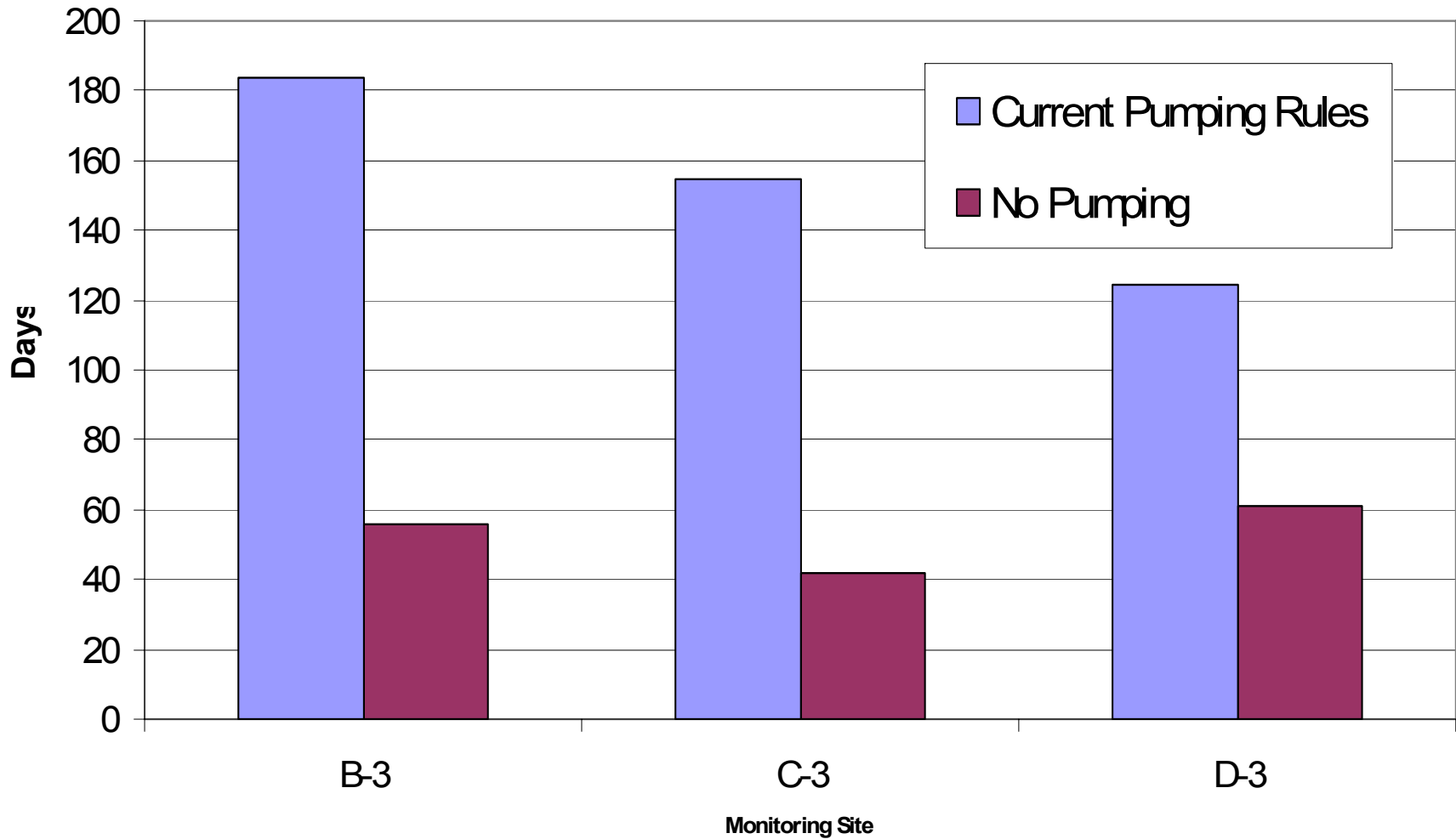
# Marsh Operations Hydrological Monitoring Stations



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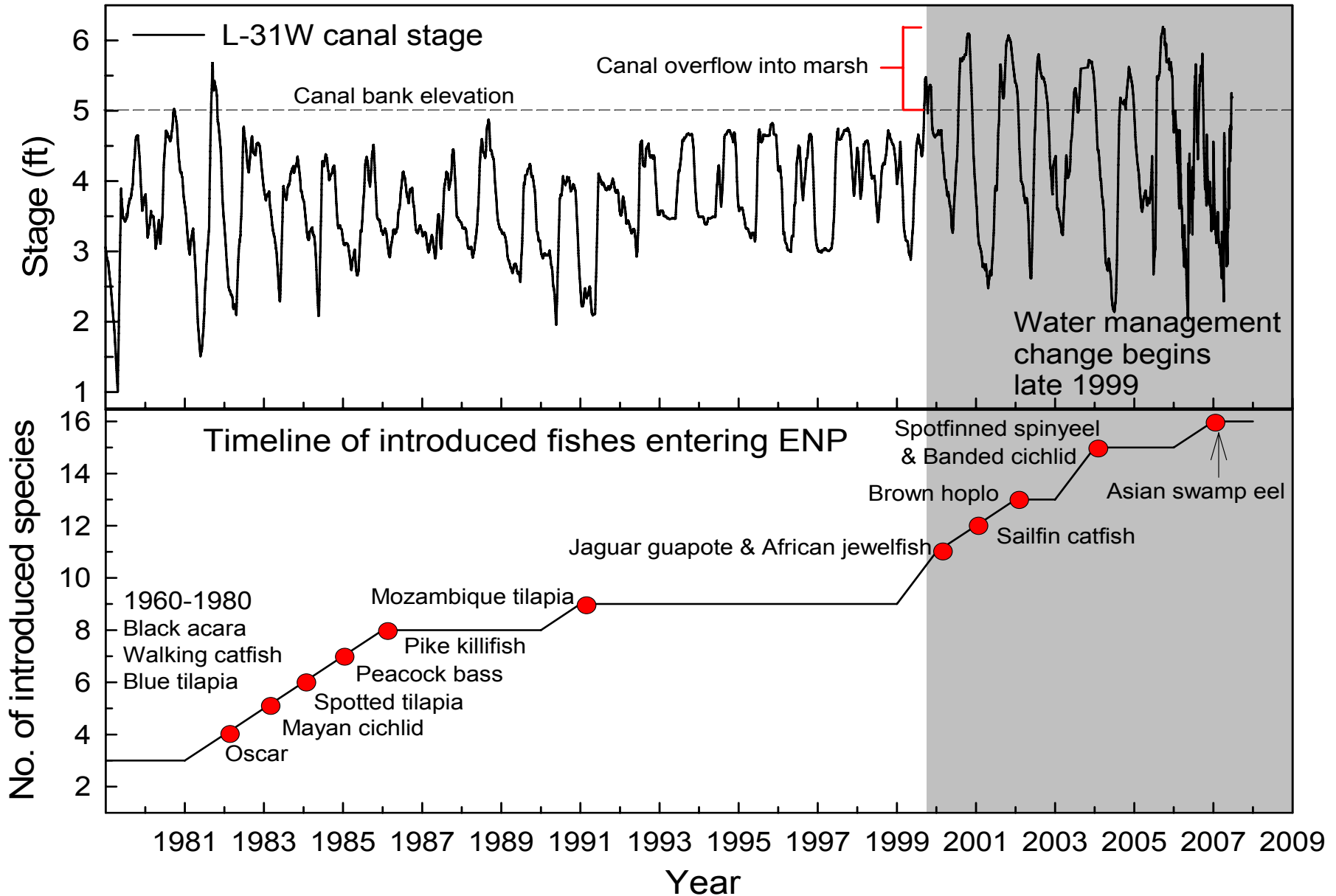
# 3-year Discontinuous Hydroperiod



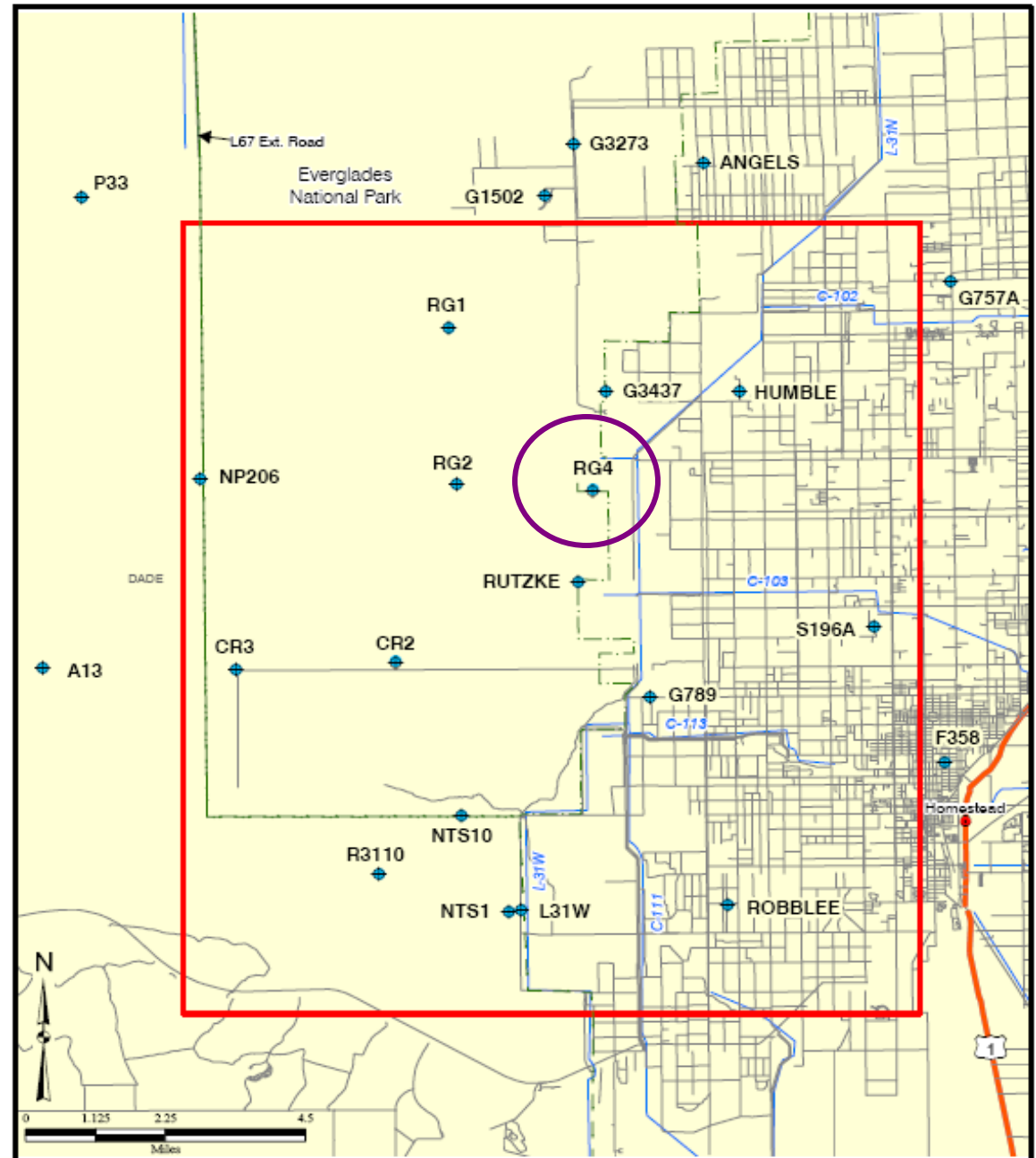
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# Recent History



# Hydrological Monitoring Stations

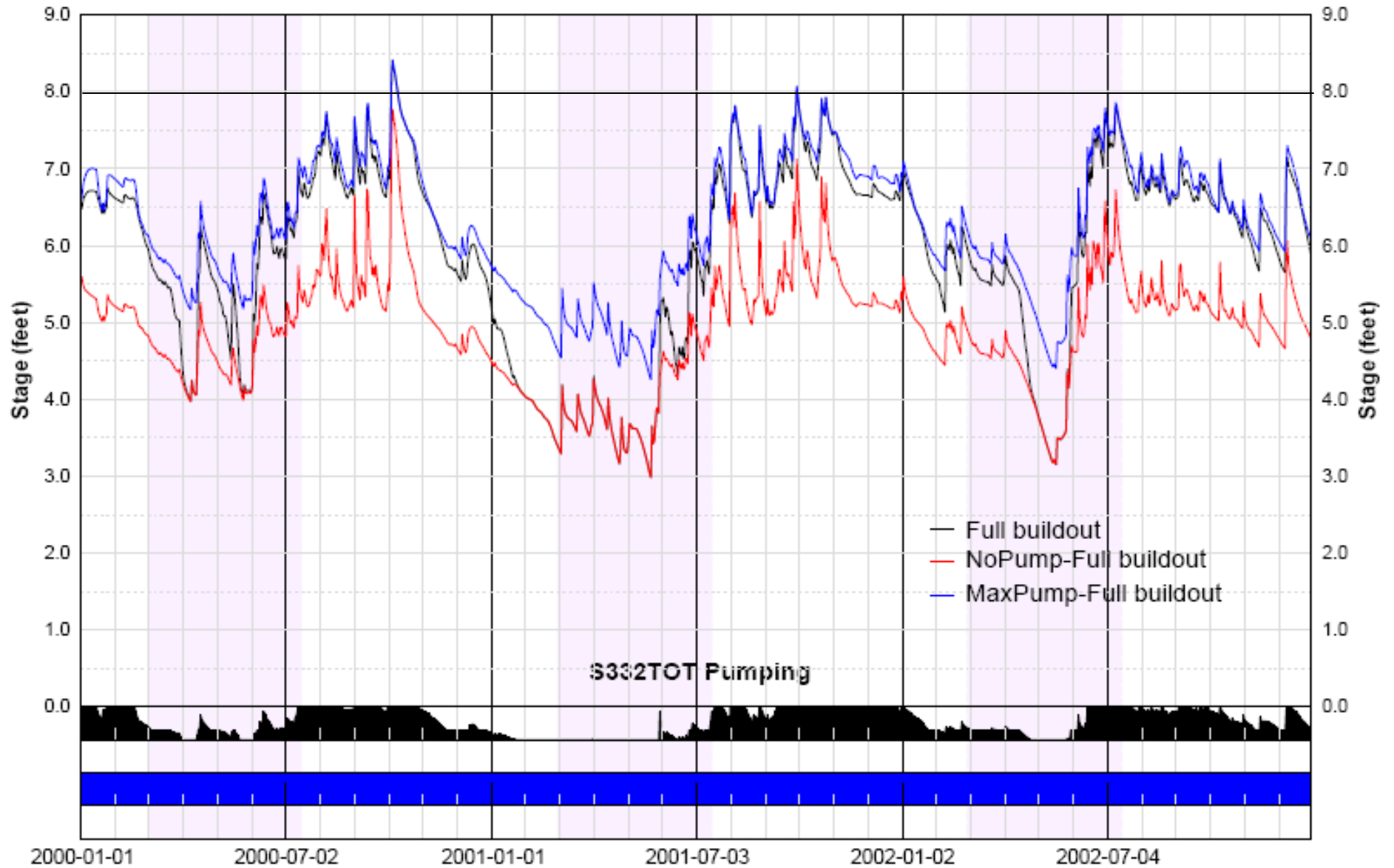


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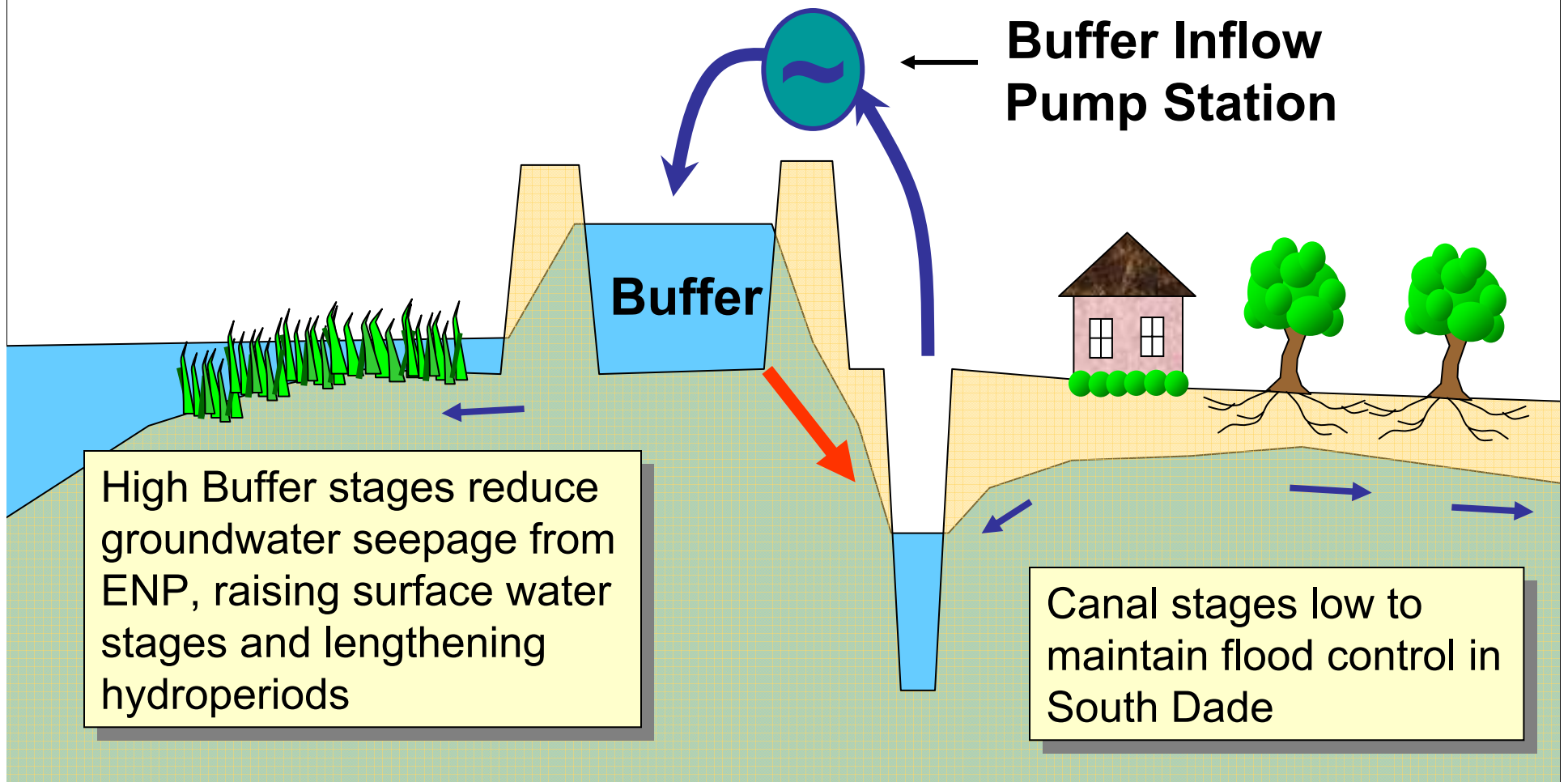
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# RG4 stage

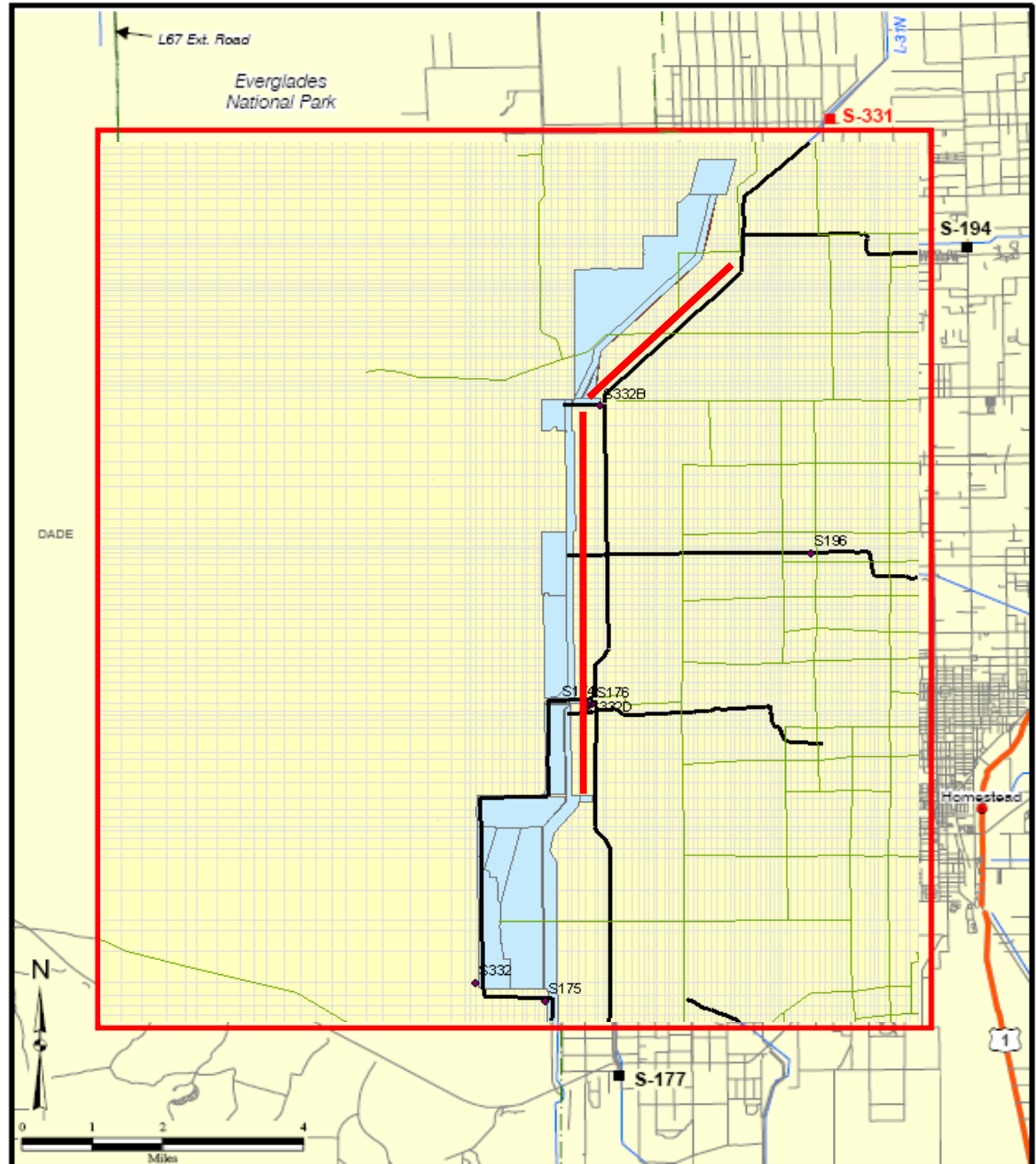


# Curtain Wall?



# Full Buildout + Long Curtain Wall

HGL—National Park Service, FL



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## 3-Year Total Pump Flows (in kAF)

	Full Buildout	Full Buildout + Curtain Wall
S332Bs	191	149
S332C	189	144
S332D	194	78
<b>All S332s</b>	<b>574</b>	<b>372</b>



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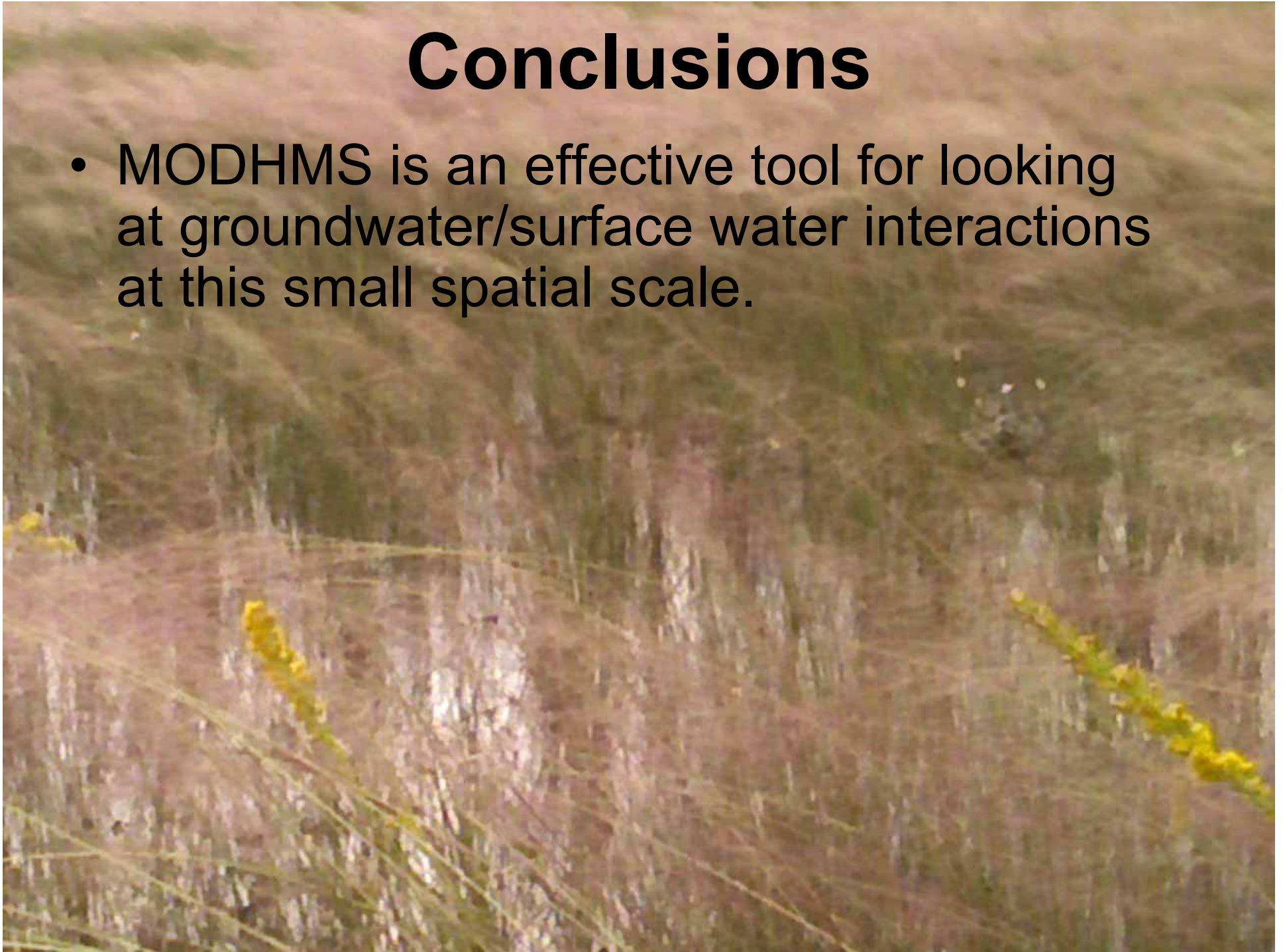


# Conclusions



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- Overflow from the detention areas with full build out appears to be minimal (verifying this will be the focus of future efforts)



# Conclusions

- MODHMS is an effective tool for looking at groundwater/surface water interactions at this small spatial scale.
- Hydroperiod improvements up to at least one mile into the marsh.
- Overflow from the detention areas with full build out appears to be minimal (verifying this will be the focus of future efforts)
- Preliminary results indicate that the buffer system can be utilized to moderate recession rates



# Future Work



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# Future Work

- Expand the grid to coastal ridge and south to S18C



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# Future Work

- Expand the grid to coastal ridge and south to S18C
- Develop Marsh Driven Operational Plan for the full buildout including the new pump station at S357



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# Future Work

- Expand the grid to coastal ridge and south to S18C
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- Hydrogeologic is currently working on calibrating the solute transport aspects of the model as part of a cooperative project with a team from FIU



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**Thank You!**



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