CALIFORNIA DEPARTMENT OF WATER RESOURCES

EC-based operating rules in DSM2

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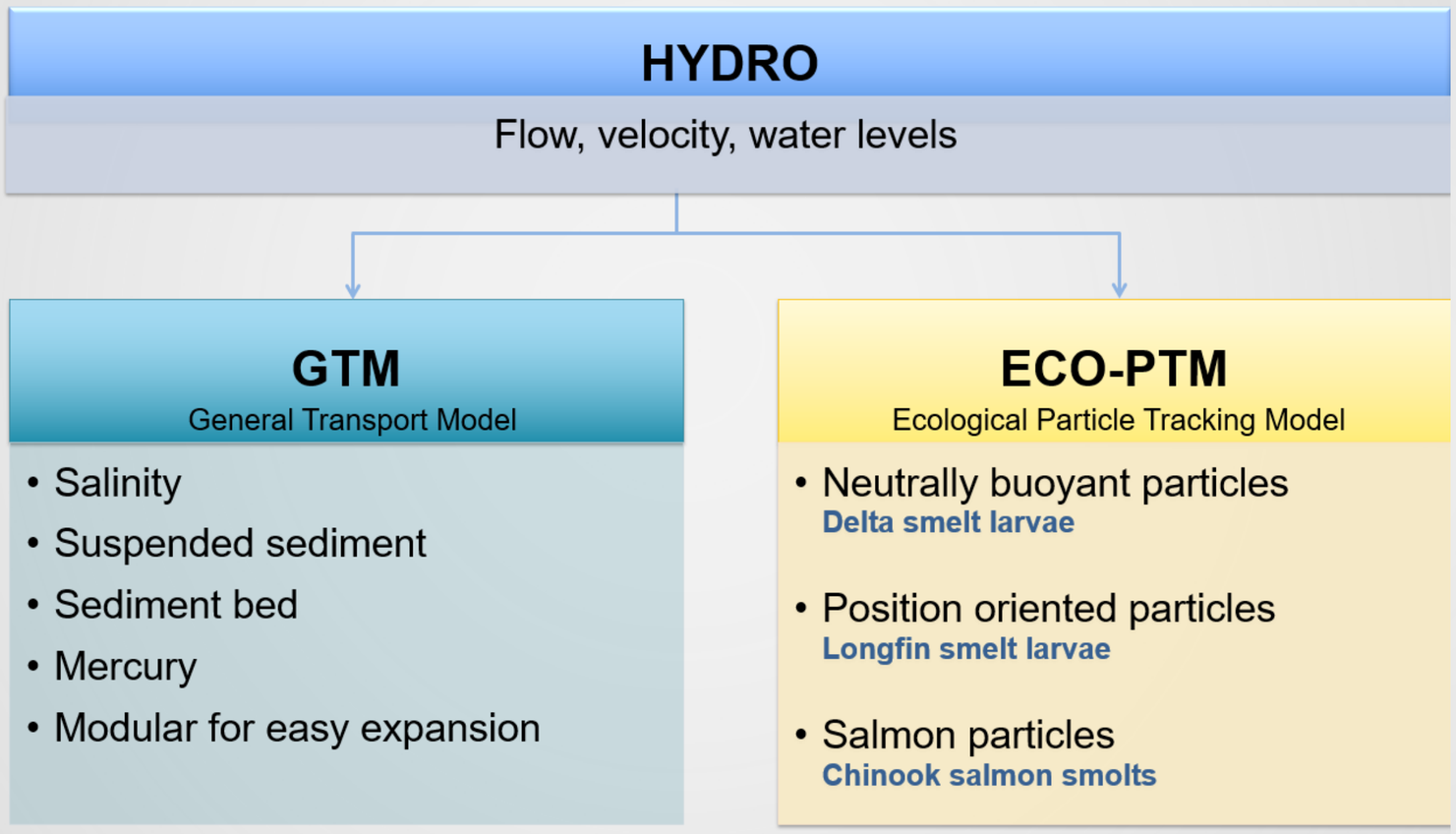
Outline

1. Introduction of DSM2
2. EC-based operating rule in DSM2
3. How to use the rule
4. A simple study example
5. False River barrier example
6. (Upcoming) updates in DSM2

Introduction of DSM2

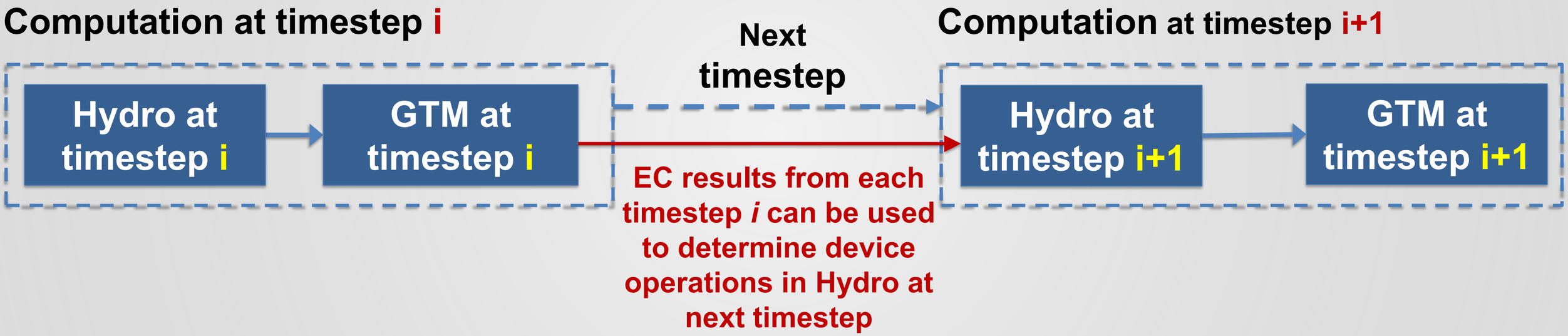


One key feature in Hydro: **operating rules** to control devices based on the state of the simulation

★ **New Feature in Hydro: Operating rules with electrical conductivity (EC)**

How are EC-based operating rules implemented?

- Hydro and GTM are **coupled**



- GTM water quality states can be used for device operating rules

Benefits of coupled Hydro-GTM

- Hydro and GTM now run in one shot
  - Using new binary “hydro_gtm.exe”
- User can specify EC triggers at any location to control device operations

How to use the EC-based oprule

- Trigger keyword in EC-based operating rule
  - chan_ec(channel=user_specified_chan, dist=user_specified_dist)
- GTM start at the same time or later than Hydro
- Command to run coupled Hydro/GTM
  - New binary hydro_gtm.exe
  - hydro_gtm.exe + hydro input file + gtm input file
    - hydro_gtm.exe hydro.inp gtm.inp

Operating rule comparison

	Hydro-based oprule	EC-based oprule
Trigger	Hydro-based parameters (e.g., velocity, stage)	EC results from GTM
Gate operation change	When hydro-based trigger conditon is True	When EC trigger condition is True
Oprule definition example	**chan_vel**(channel=513,dist=0) < -0.1 **chan_stage**((channel=512,dist=6038) - **chan_stage**(channel=513,dist=0)) > 0.3	**chan_ec**(channel=517, dist=7876) < 7000

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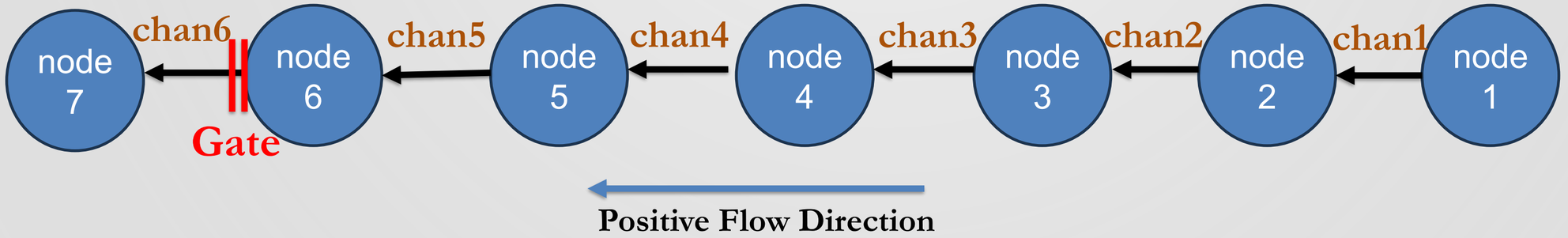
Example – A simple case

Study setup

- 6 channels and 7 nodes
- One gate at node 6 (head of channel 6)
  - 2 weirs and 2 pipes in the gate
  - Gate stays open by default
- Boundary conditions
  - Constant flow and EC BC at node1
  - Tidal stage and EC boundary condition at node 7
    - Downstream EC 5,000 - 35,000 umho/cm

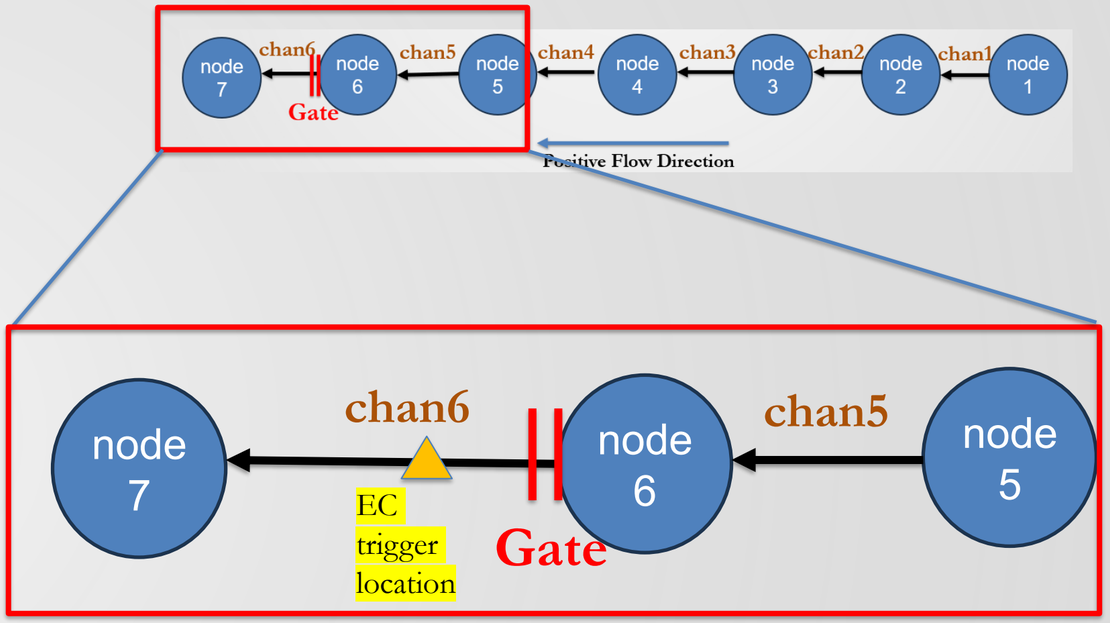


Two scenarios

- Scenario 1: no_EC_oprule
- Scenario 2: with_EC_oprule

  Using downstream EC condition to control the open and close of gates

  - <u>EC trigger location:</u> distance of 4,000 ft of channel 6
  - EC operation trigger
    1. <u>Close</u> weir during flood tide when EC > 6,000 at the trigger location
    2. <u>Open</u> weir during flood tide when EC < 5,000 at the trigger location



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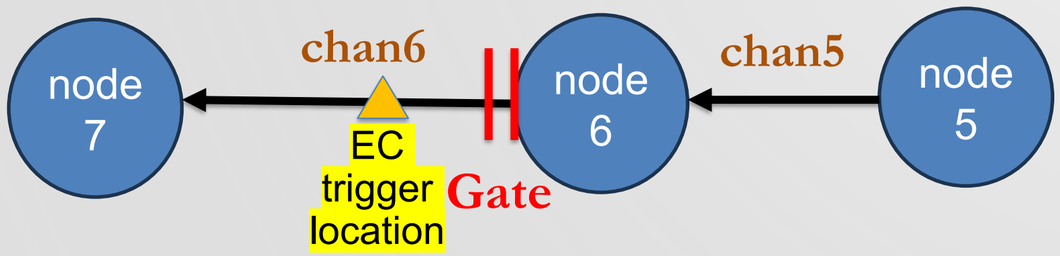
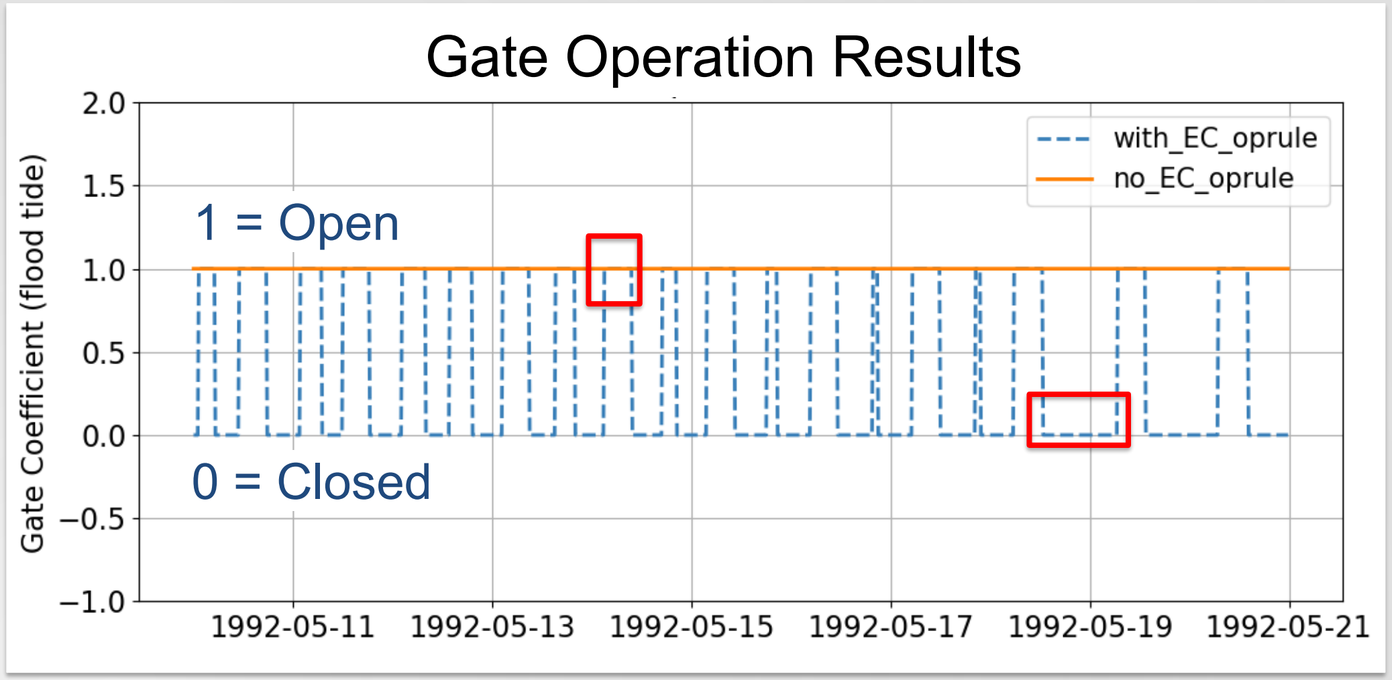
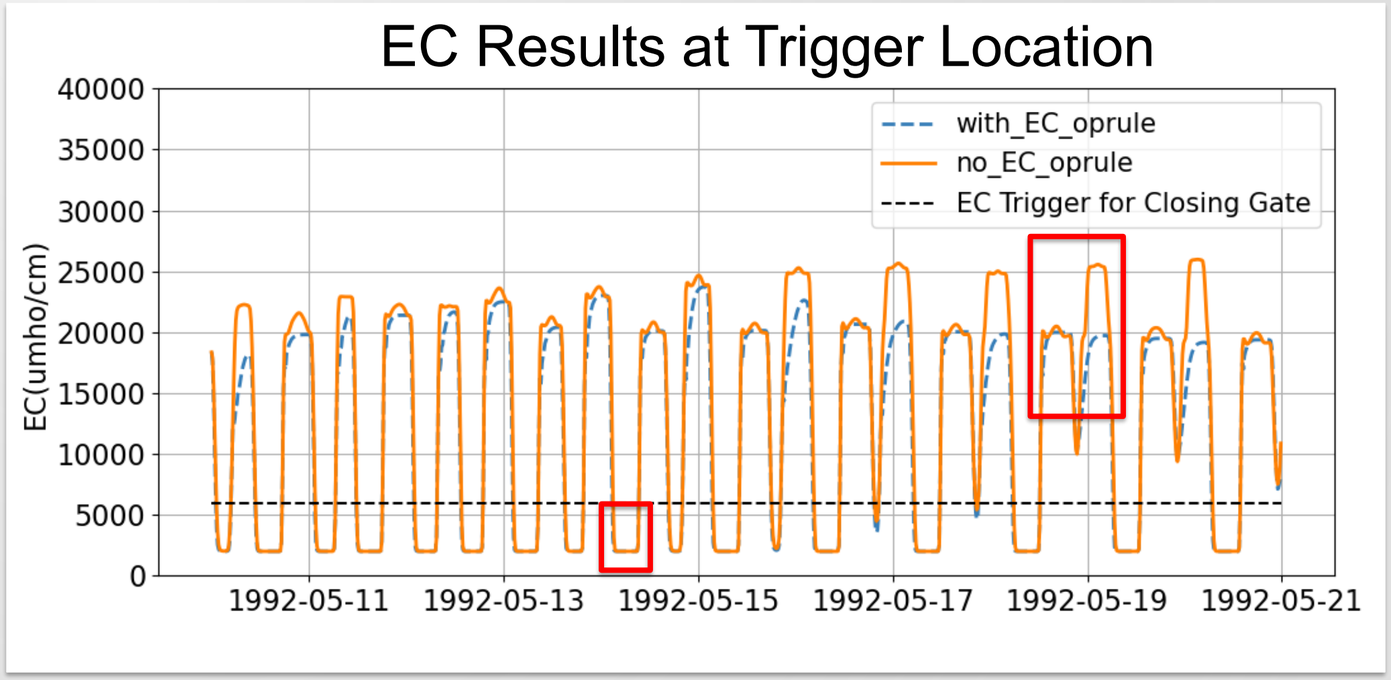
Gate Results Comparison

- Scenario 1 *(no_EC_oprule)*: always open
- Scenario 2 (*with_EC_oprule)*: Gate opens and closes based on the EC trigger condition

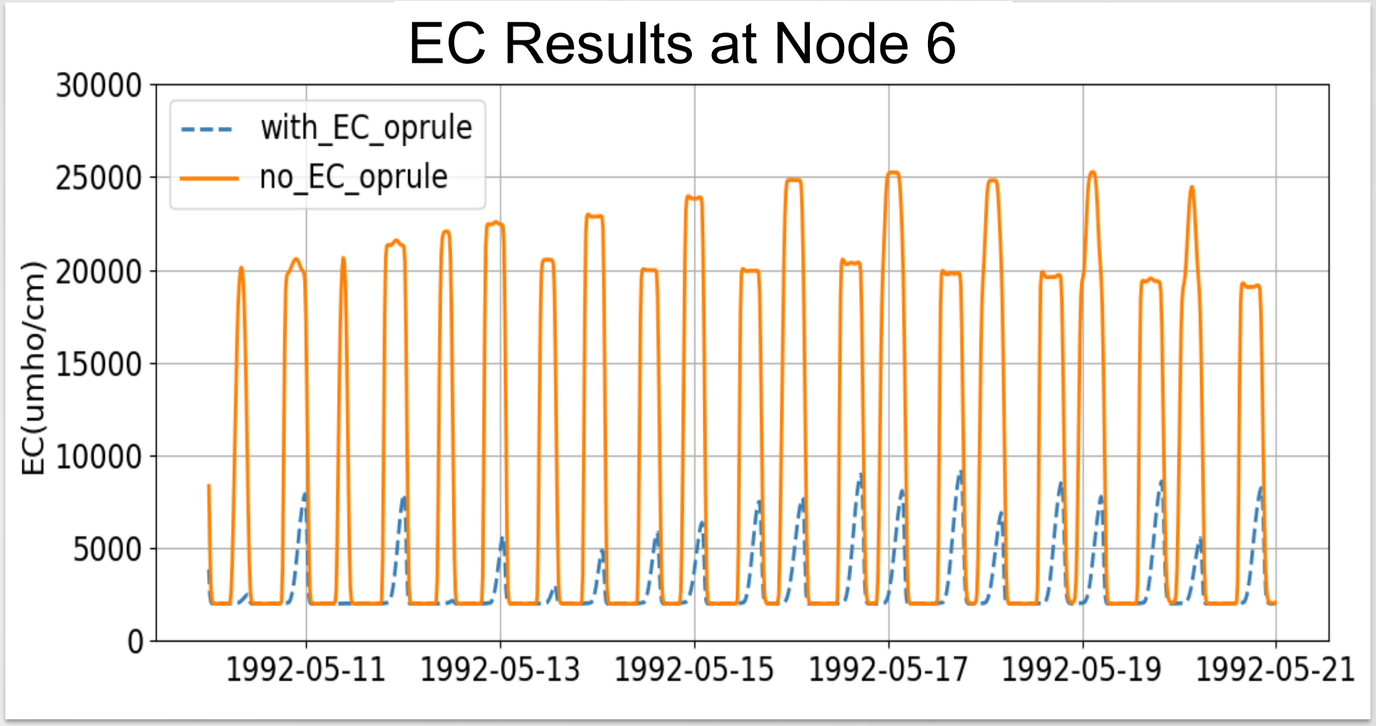


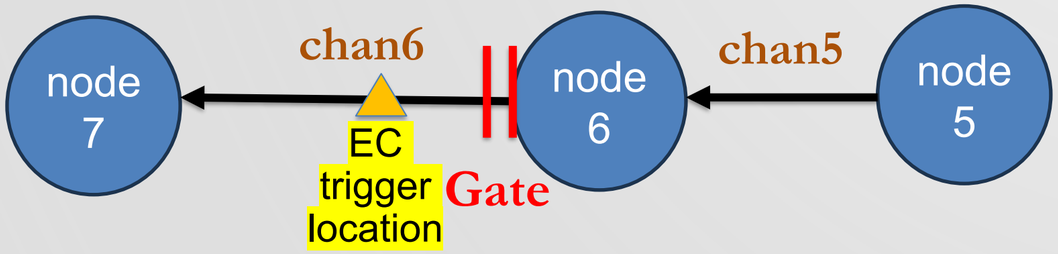




EC Results upstream of Gate

- Scenario 1 *(no_EC_oprule)*: EC always higher than scenario 2
- Scenario 2 *(with_EC_oprule) : EC* significantly lower due to gate operation

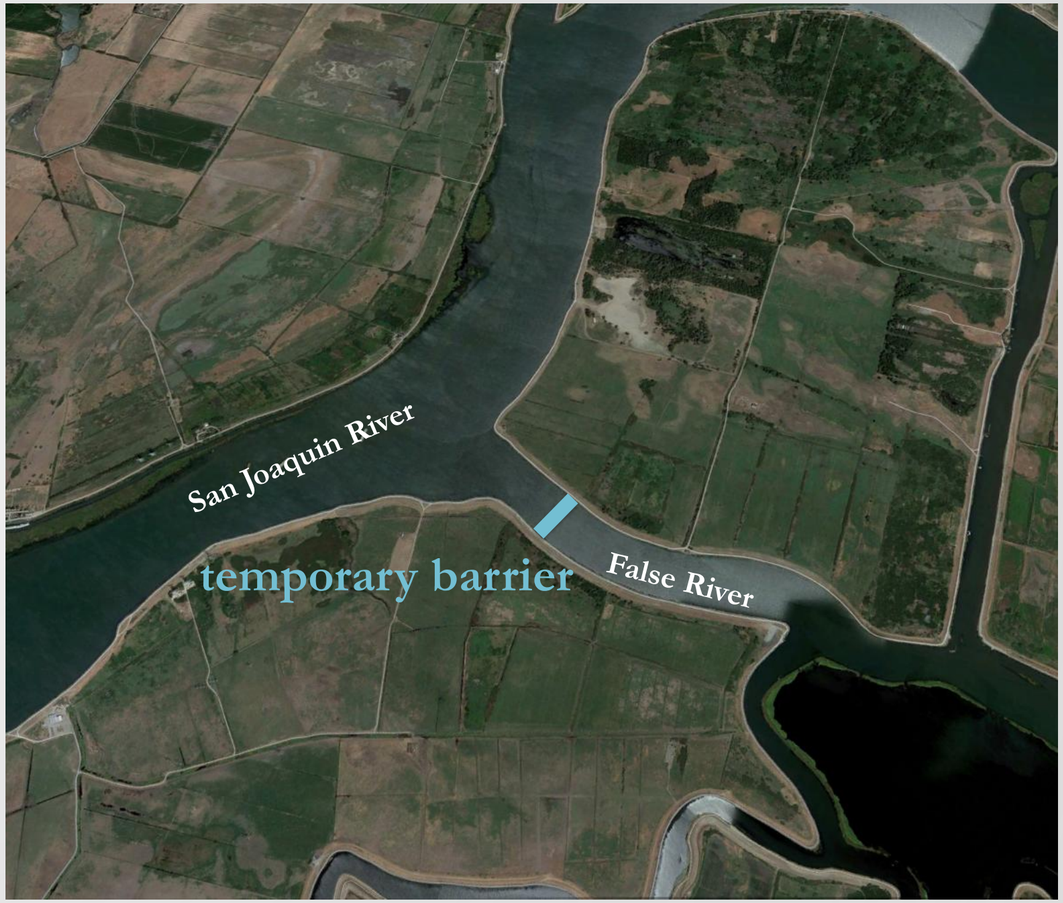




Example – False River Barrier

A temporary drought salinity barrier was installed in False River <u>twice over 10 years</u> to prevent salinity intrusion.

<u>What if</u> *there is an operatable gate at False River, can EC-based oprule help manage EC?*



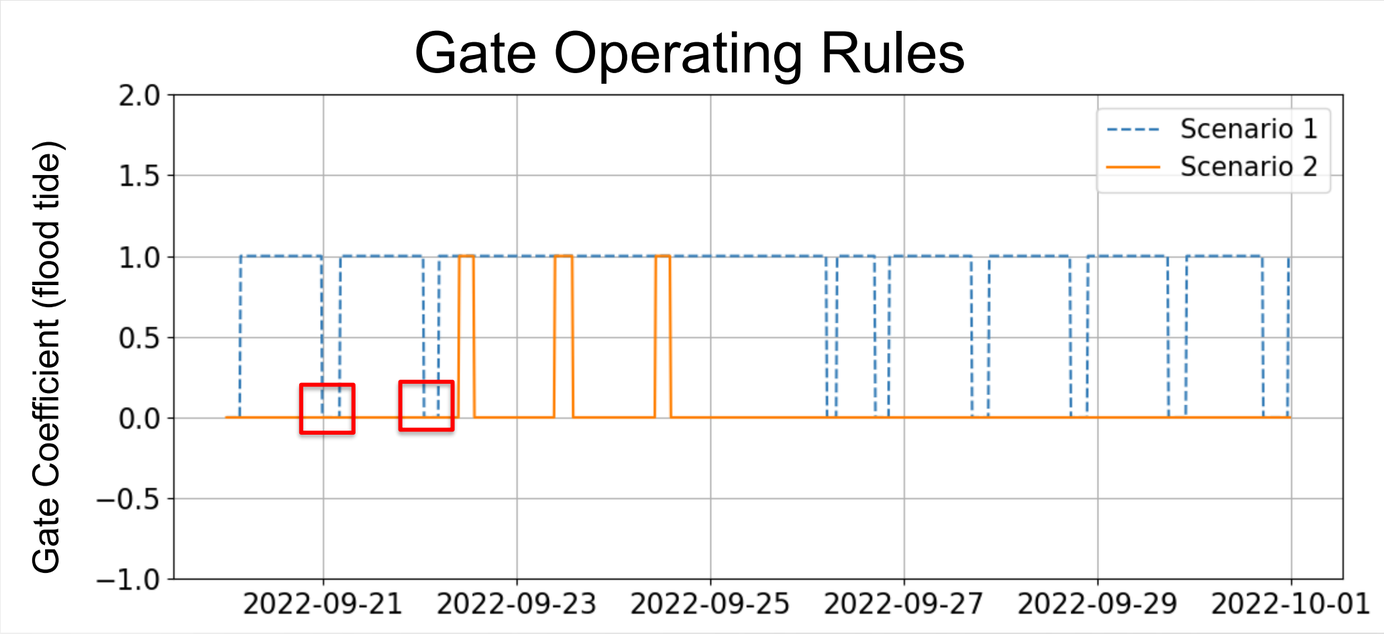
Example – False River Barrier

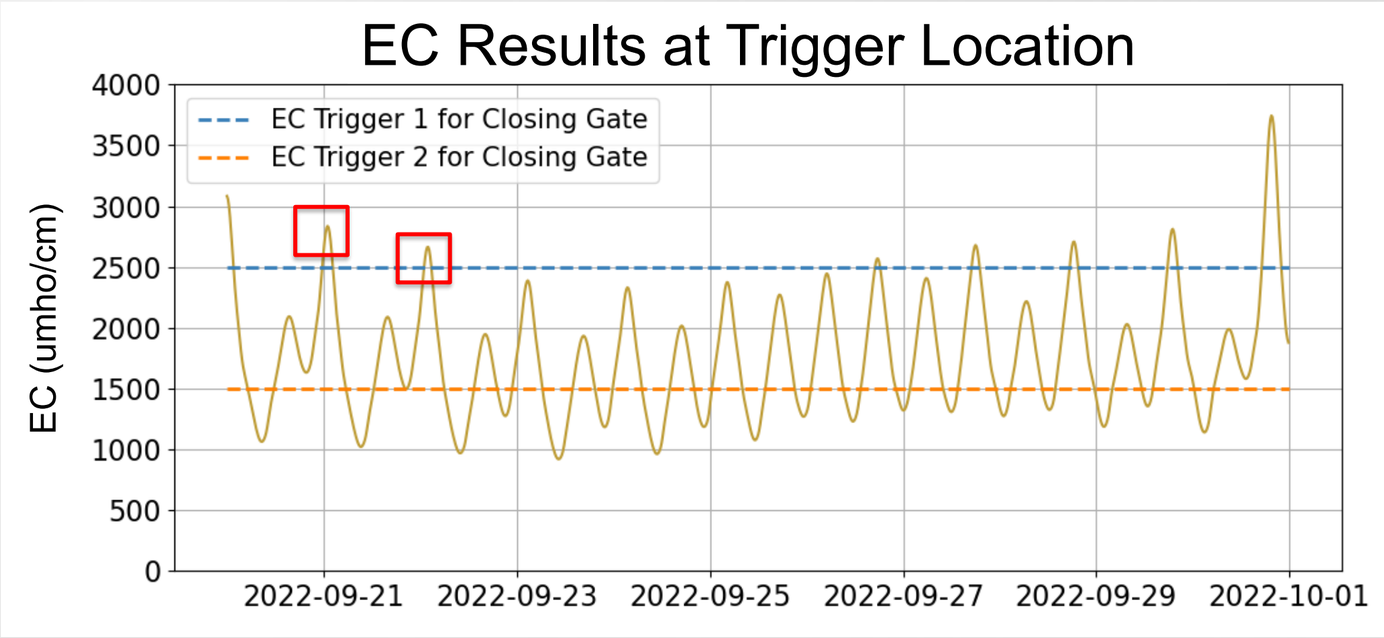
- Trigger location:
  - 3 River Miles downstream of **assumed gate**
- EC oprule

Scenario1	Scenario2
Close gate during **flood tide** when EC > 2500	Close gate during **flood tide** when EC > 1500
Open gate during **flood tide** when EC < 2000	Open gate during **flood tide** when EC < 1000

Gate Results Comparison

- Gate closes during flood tide when EC exceeds the trigger value
- Gate stays closed during flood tide, unless EC falls below the trigger value for opening the gate





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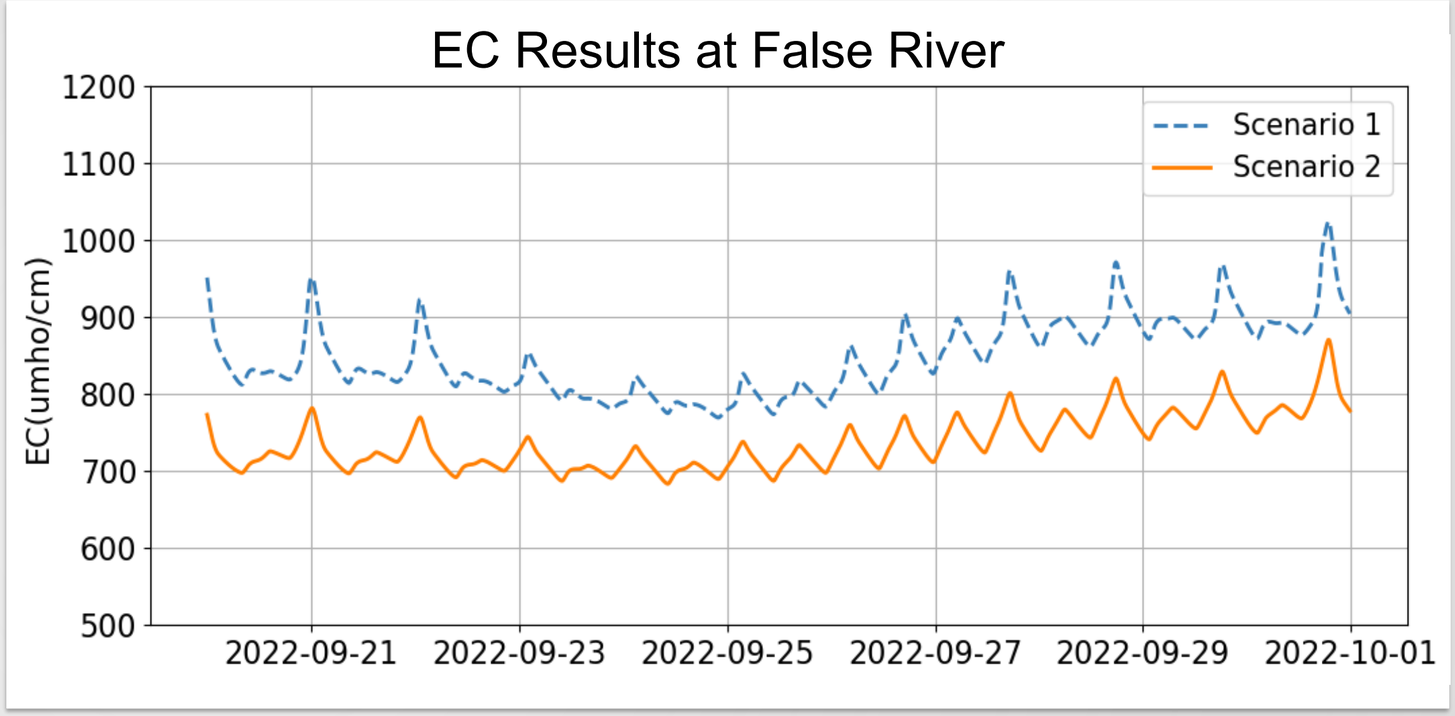
EC Results at False River

- The EC levels at False River follow the EC-based trigger condition
- A lower EC trigger for gate closure reduces upstream EC level



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Summary

- The new binary “hydro_gtm.exe” allows users to run HYDRO and GTM in one shot
- The EC-based operating rule closes/opens the gates dynamically based on user-defined EC triggers
- EC-based operating rule allows operators/modelers to evaluate operational scenarios in the Delta
- Github link for **beta version** of DSM2
  - https://github.com/CADWRDeltaModeling/dsm2/releases

Other upcoming DSM2 updates

- User defined dx (spatial step) value for each channel
- Better restart file in DSM2
- Python binding

Thank you!

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Extra slide

Flow and Stage Results

- Flow
  - Near 0 during flood tide when gate is closed in scenario 2 *(with_EC_oprule)*
- Stage
  - Lower stage in scenario 2 with gate closed