

Developing and Implementing Environmental Flows:

Savannah River, GA/SC

a case study



US Army Corps
of Engineers®



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Altered Flow Regimes in the U.S.

- < 2% of all major rivers remain free-flowing
- 1,000's of large dams, including nearly 500 USACE multi-purpose reservoirs:
 - + Flood protection
 - + Hydropower: 24% of U.S.
 - + Recreation: 370M visits/yr
 - + Water supply: ~10M ac-ft (32M people)



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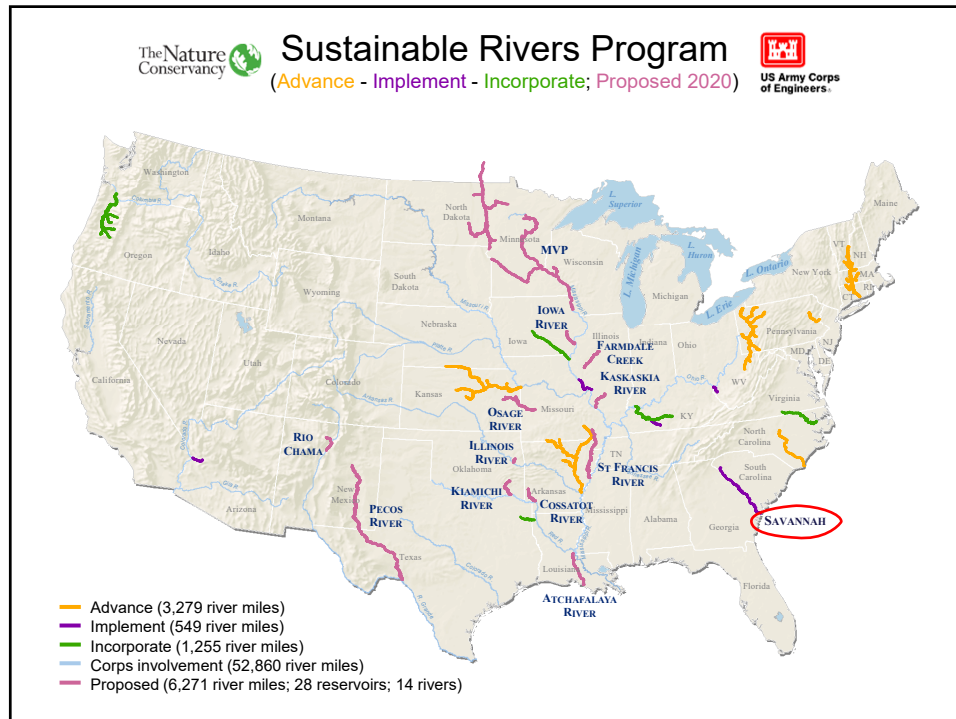
Ecologically Sustainable Water Management

Environmental Flows:

The flow of water in a river or lake that sustains healthy ecosystems and the goods and services that humans derive from them.

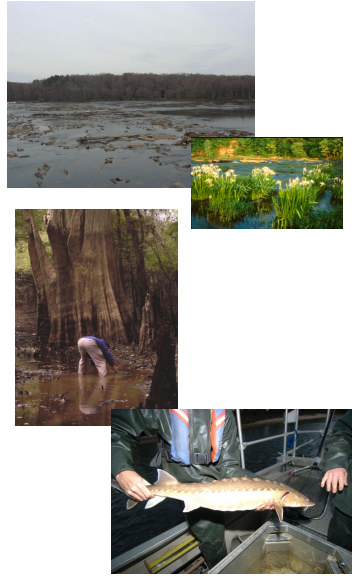
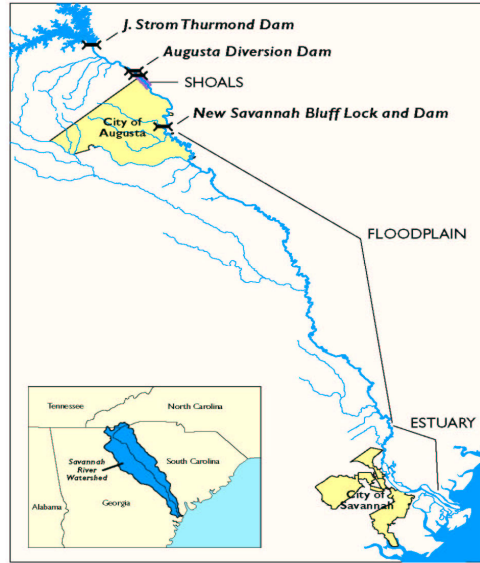


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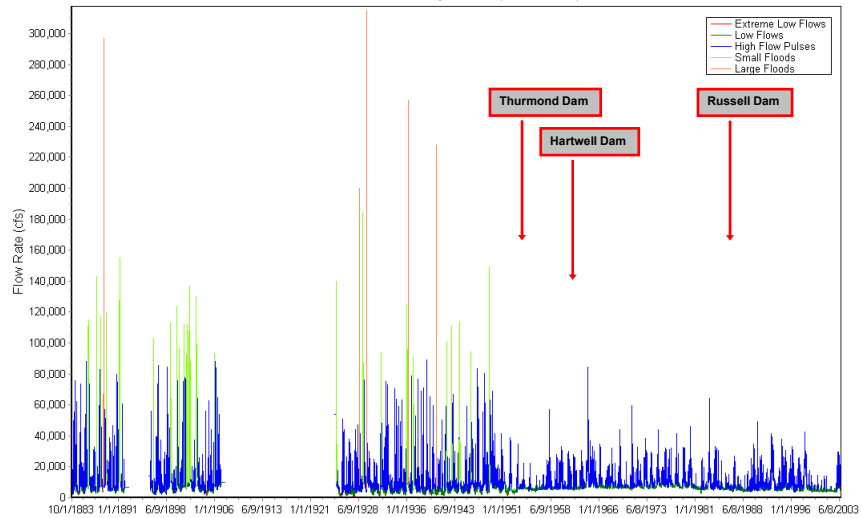
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Lower Savannah River and Estuary

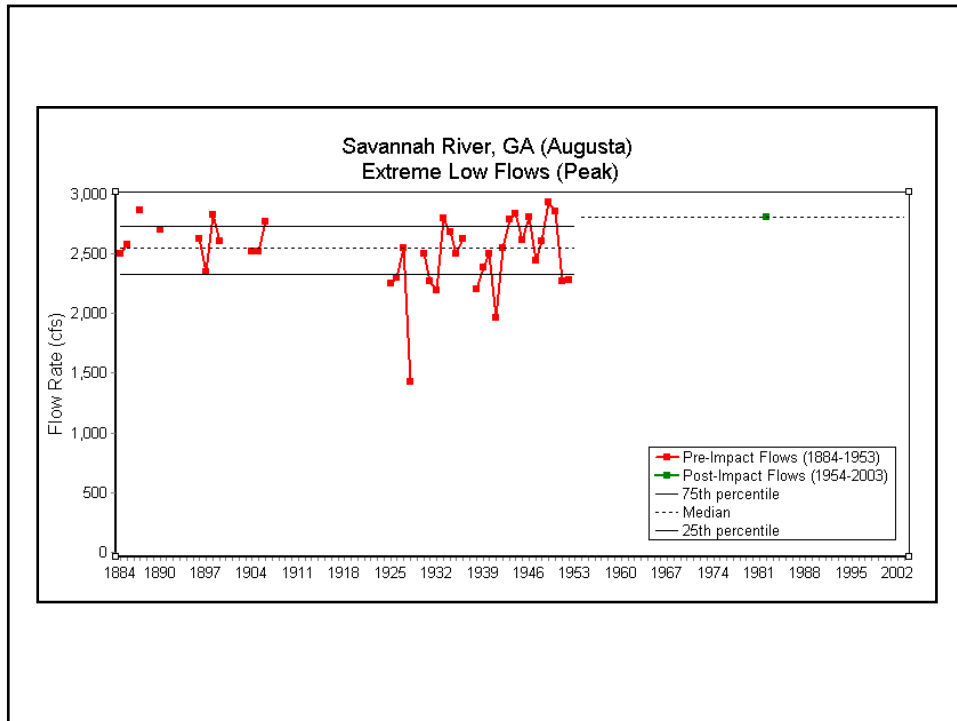


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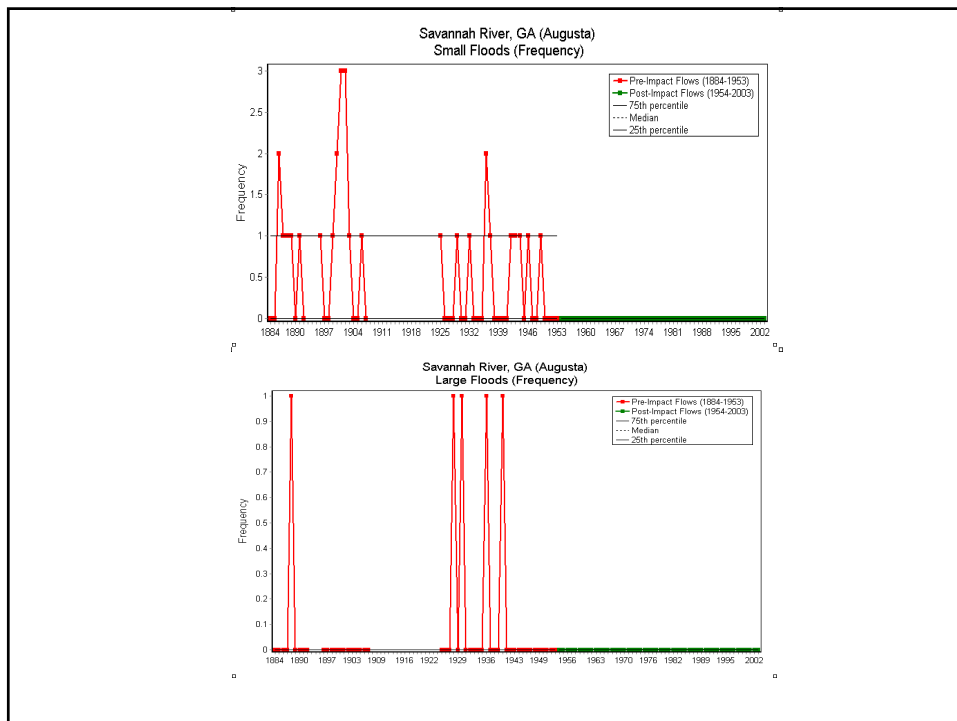
Savannah River, GA (Augusta)
Environmental Flow Components (1884-2003)



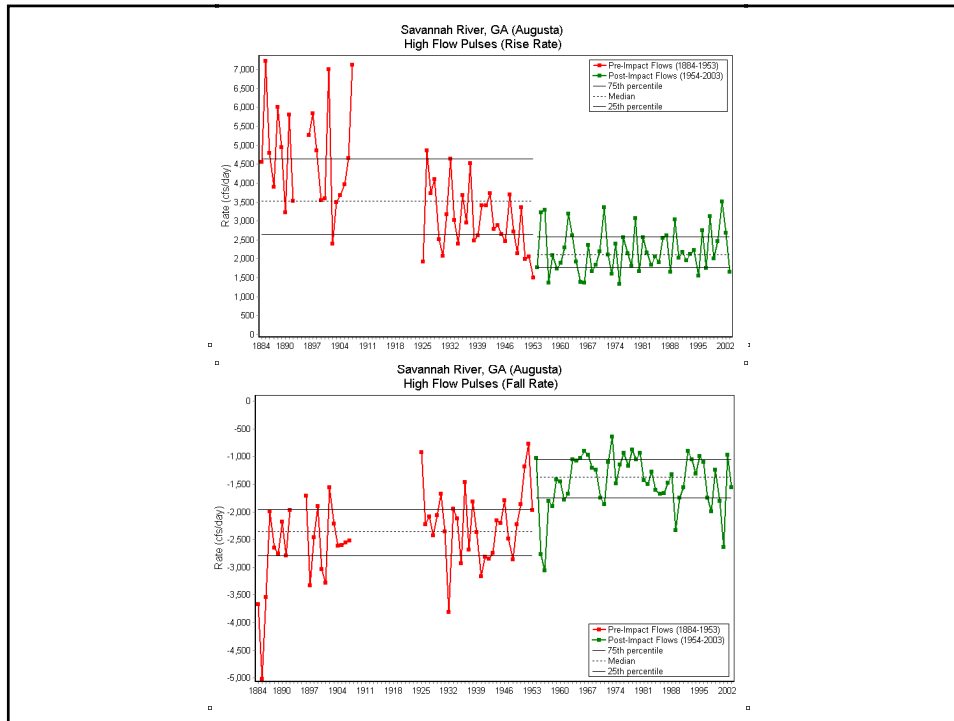
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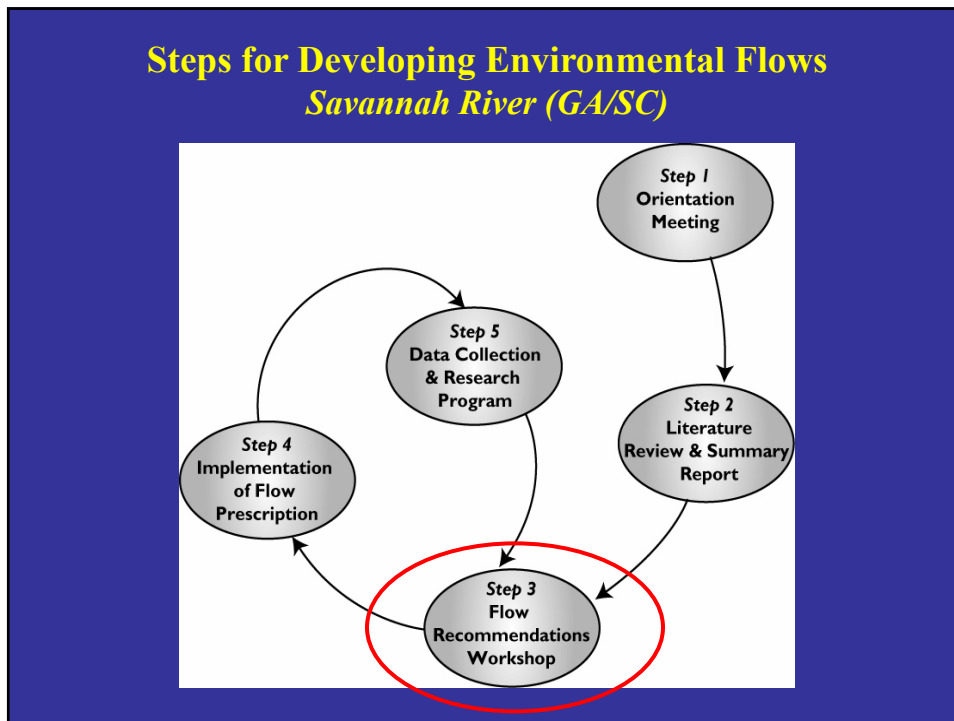
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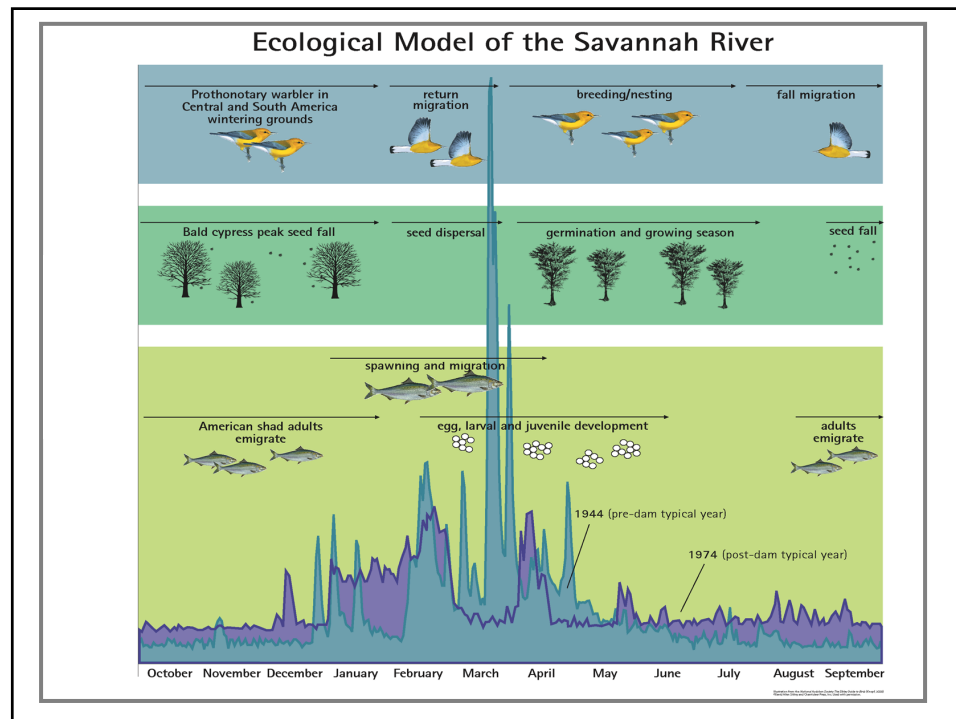
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Environmental Flows Workshop

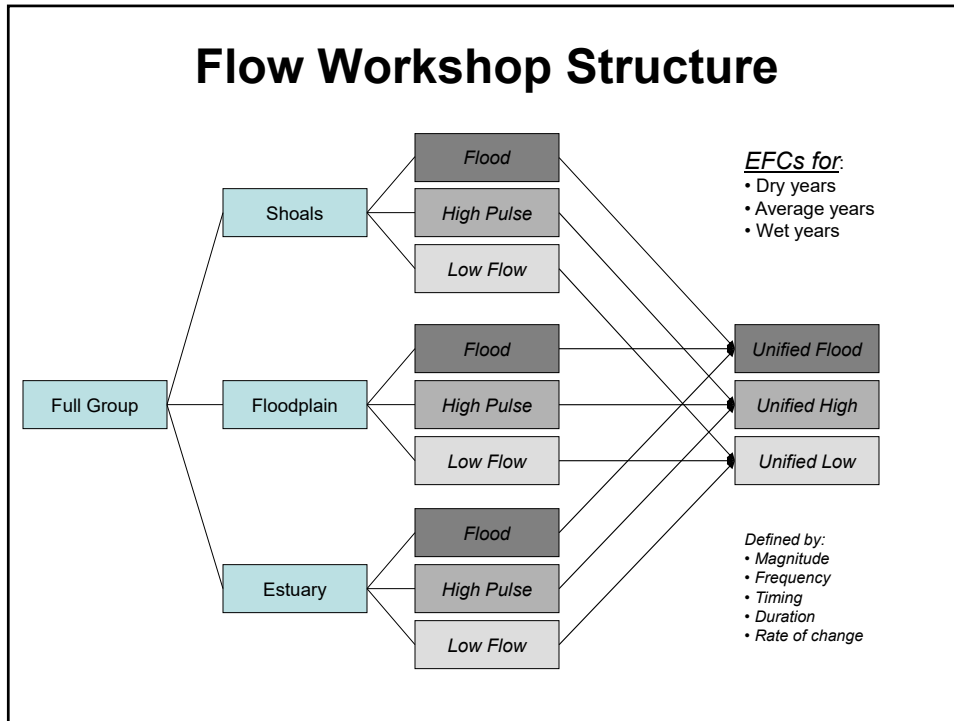


The goal was *not* to create optimal conditions for all species all of the time; rather, we wanted to create adequate conditions for all native species *enough* of the time.

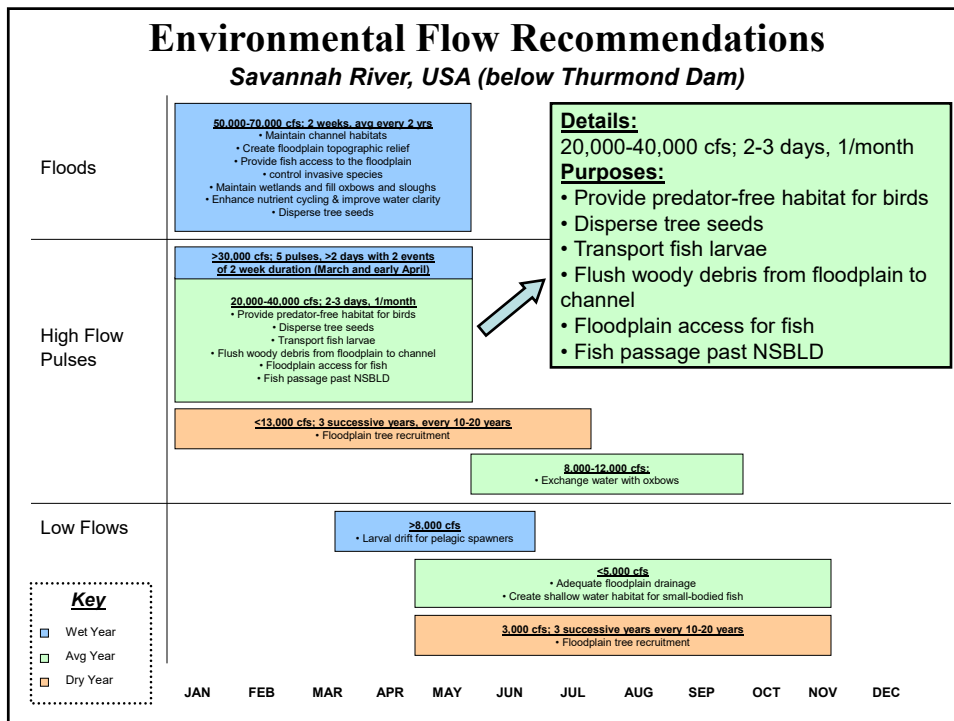
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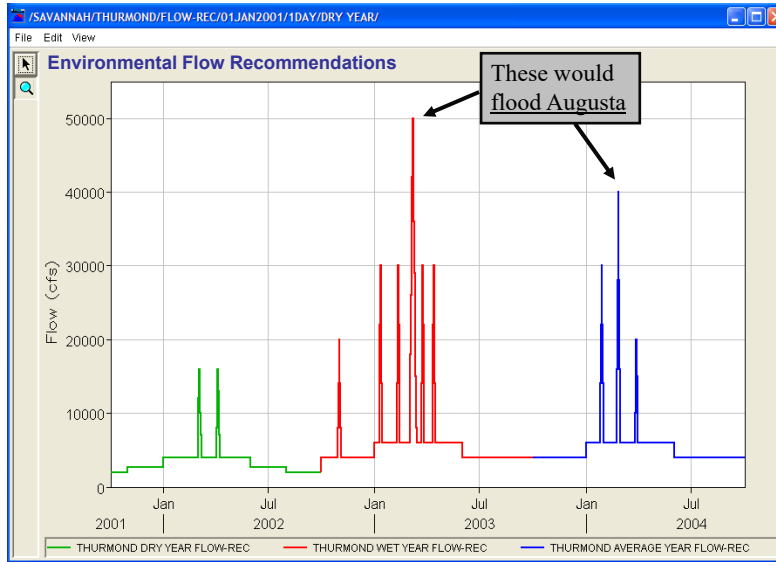


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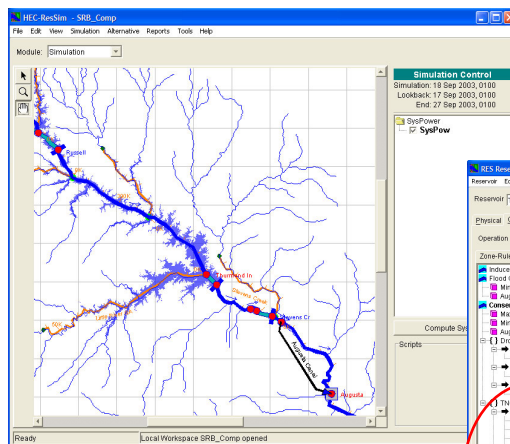
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Environmental Flow Recommendations



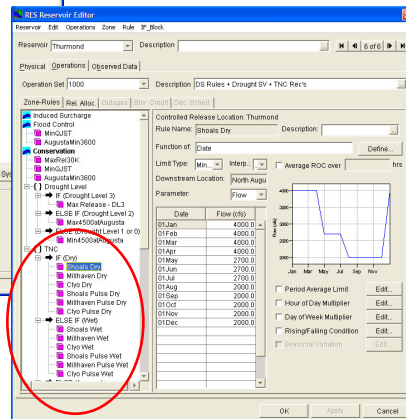
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HEC-ResSim



Reservoir Evaluation System – Reservoir modeling to analyze water management alternatives

Advanced Features used by Savannah District – System Hydropower; State Variables; If, Then, Else Logic...



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Ecosystem Functions Model

River-Floodplain Section

Floods

- Maintain channel habitats: 50-75,000 cfs
- Create floodplain topographic relief: 50-75,000 cfs

High Flow Pulses

- Provide pulse flow habitat for birds: >25,000 cfs
- Distribute base flows, transport fish larvae: >25,000 cfs
- Flush woody debris from floodplain to channel: >25,000 cfs
- Exchange water with oxbows: 5-10,000 cfs
- Flush woody debris from channel: >25,000 cfs
- Provide habitat for fish: >25,000 cfs
- Flush woody debris into channel: >25,000 cfs
- Base flow: >10,000 cfs for 5-yr recurrence

Low Flows

- Extend O&M for peat/soil treatment: <5,000 cfs
- Adequate floodplain drainage: <5,000 cfs
- Habitat for river-shallow pool fishes: <5,000 cfs
- Base flow: >10,000 cfs for 5-yr recurrence

Savannah.efm - HEC-EFM

Relationship name: Base - Habitat for Shad and Striped Bass

Description:

- Base - Habitat for Shad and Striped Bass
- Pulse - Habitat for Shad and Striped Bass
- Base - Spring Sturgeon Spawning
- Base - Shoals Spider Lily
- Pulse - Shoals Spider Lily
- Base - Habitat for Resident Fish and Outmigrants
- Base - Fall Sturgeon Spawn
- Pulse - Fall Sturgeon Spawn

Options:

- Write computation arrays
- Hypothesis tracking - increased flow will
- Confidence tracking: eco-health

Statistical queries:

- Season
- From: 01/01 (m/d)
- To: 05/31 (m/d)
- Duration of: 30 days
- Sustained high: Average high
- Sustained low: Average low
- Rate of change: Slope Flow
- Time series specifications:
 - 50 % exceedance (of time)
 - Flow frequency Flow duration
 - Individual water year
 - Relationship-defined water year

Ecosystem Functions Model (EFM) –
 Analyze alternative flows (ResSim)
 from an ecosystem perspective

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Environmental Flows

Sustainable Rivers Project: Savannah River

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            graph TD
            S1((Step 1 Orientation Meeting)) --> S2((Step 2 Literature Review & Summary Report))
            S2 --> S3((Step 3 Flow Recommendations Workshop))
            S3 --> S4((Step 4 Implementation of Flow Prescription))
            S4 --> S5((Step 5 Data Collection & Research Program))
            S5 --> S3
            S5 --> S1
            
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