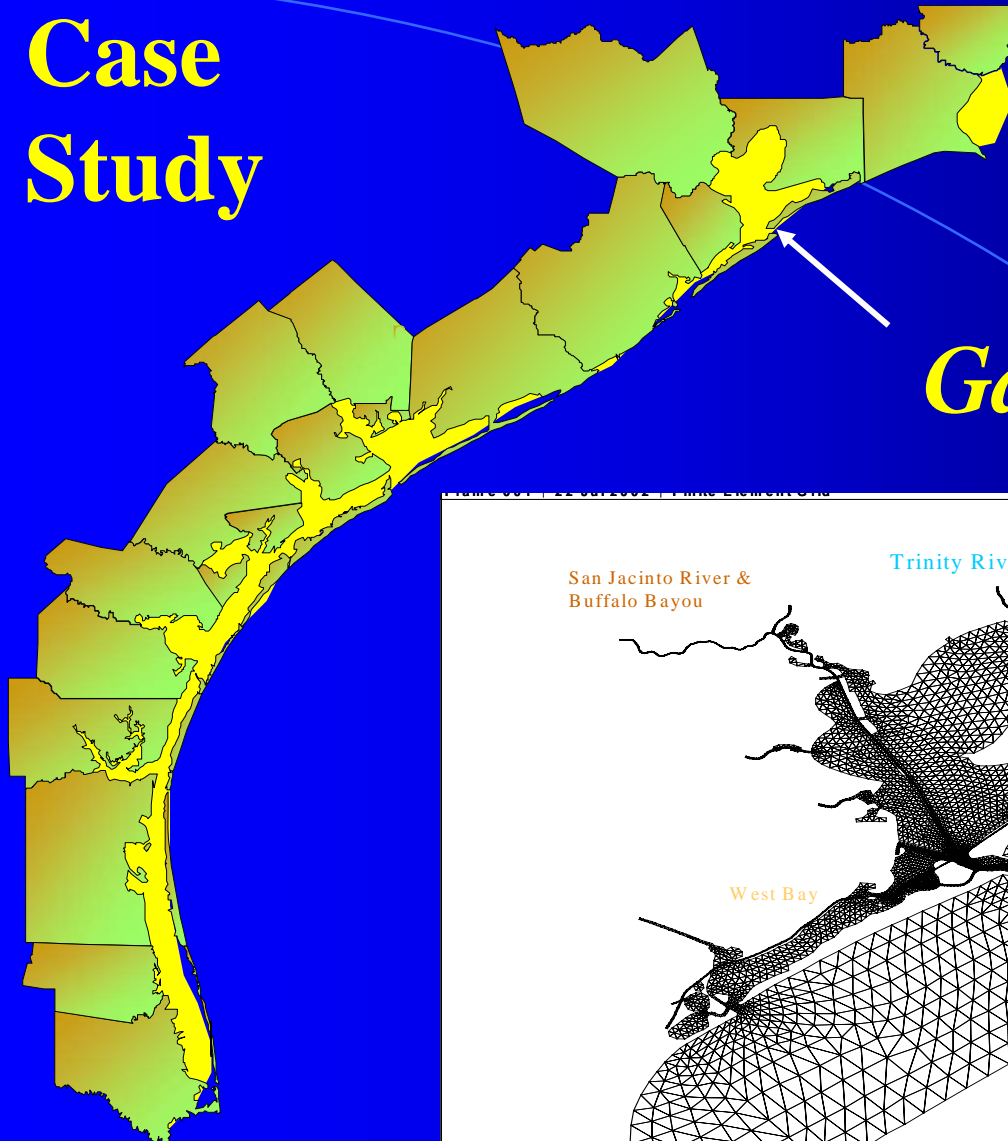


# Securing Freshwater Inflows for Galveston Bay

Glenda L. Callaway, Ekistics Corporation  
Freshwater Inflow Work Group, 6 April 2006

# Case Study



*Galveston Bay*

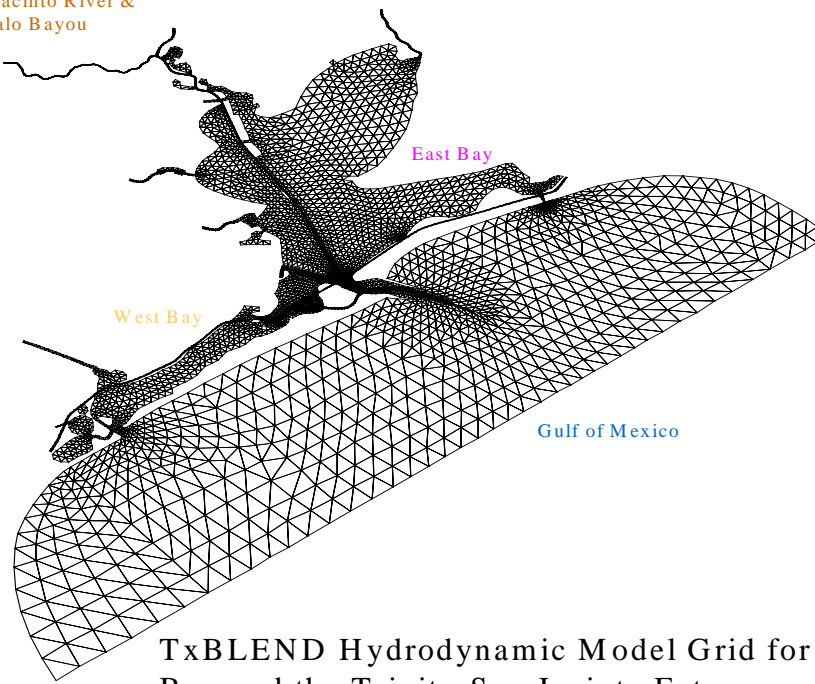
San Jacinto River &  
Buffalo Bayou

Trinity River, Delta & Bay

East Bay

West Bay

Gulf of Mexico



TxBLEND Hydrodynamic Model Grid for Galveston Bay and the Trinity-San Jacinto Estuary.

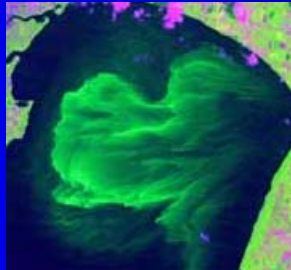
# The Process of Developing FWI Recommendations

## Objectives & Constraints

## Verification



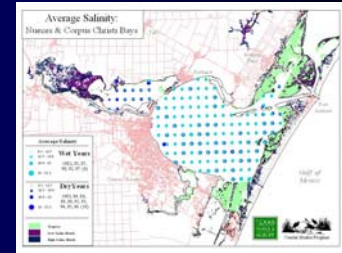
**Fisheries Regression Analysis**



**Nutrient Analysis**



**Fisheries Needs Analysis**



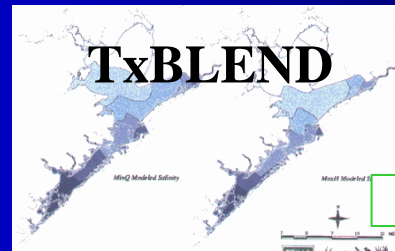
**Hydrology**



**Sediment Analysis**



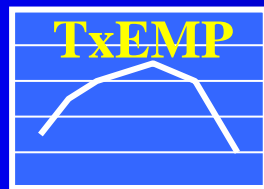
**Hydrographic Survey**



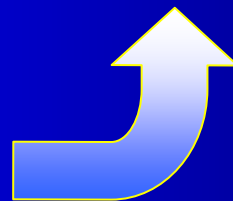
**Hydrodynamic & Conservation Transport Model**



**Habitat Analysis**

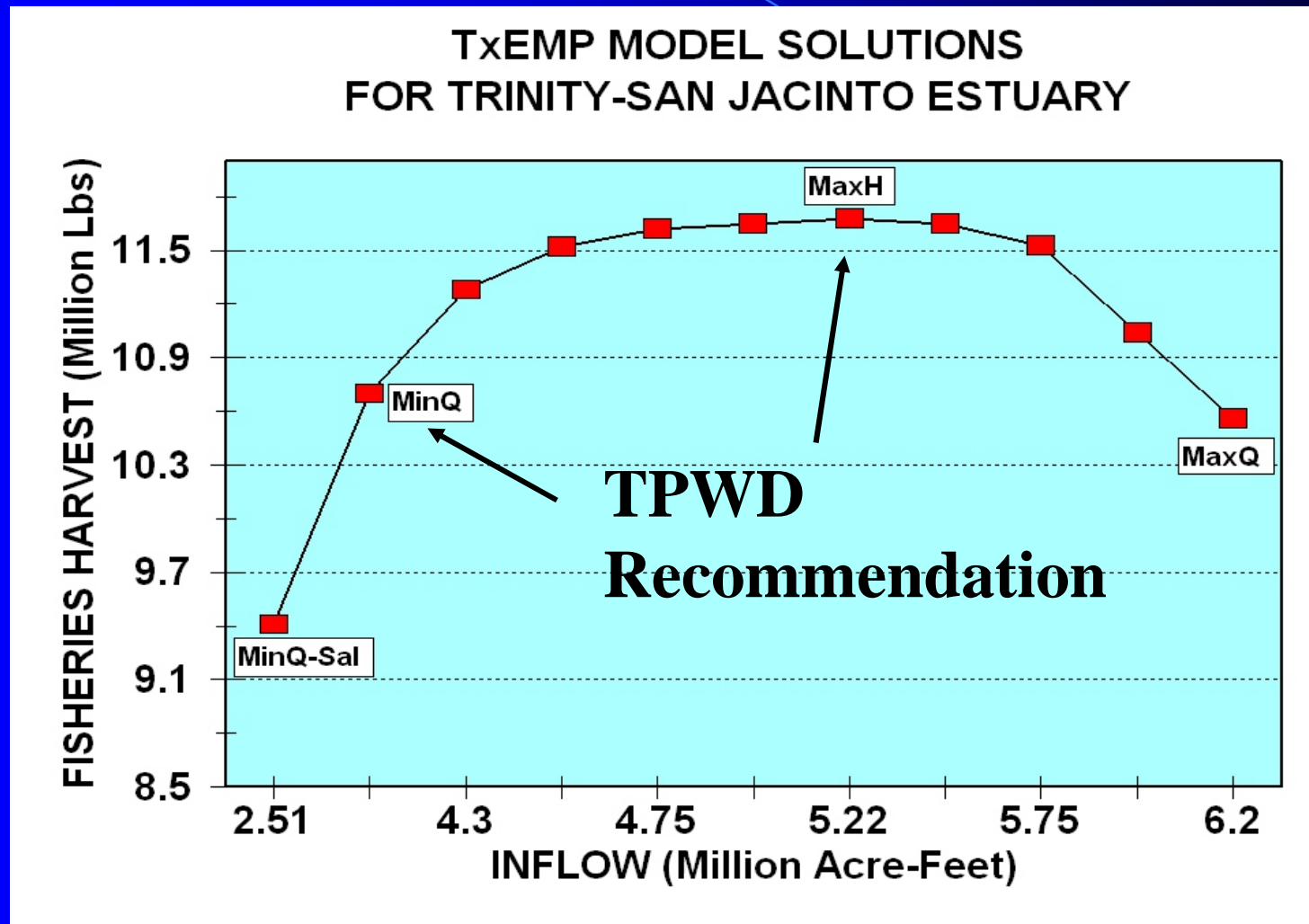


**Optimization Model**

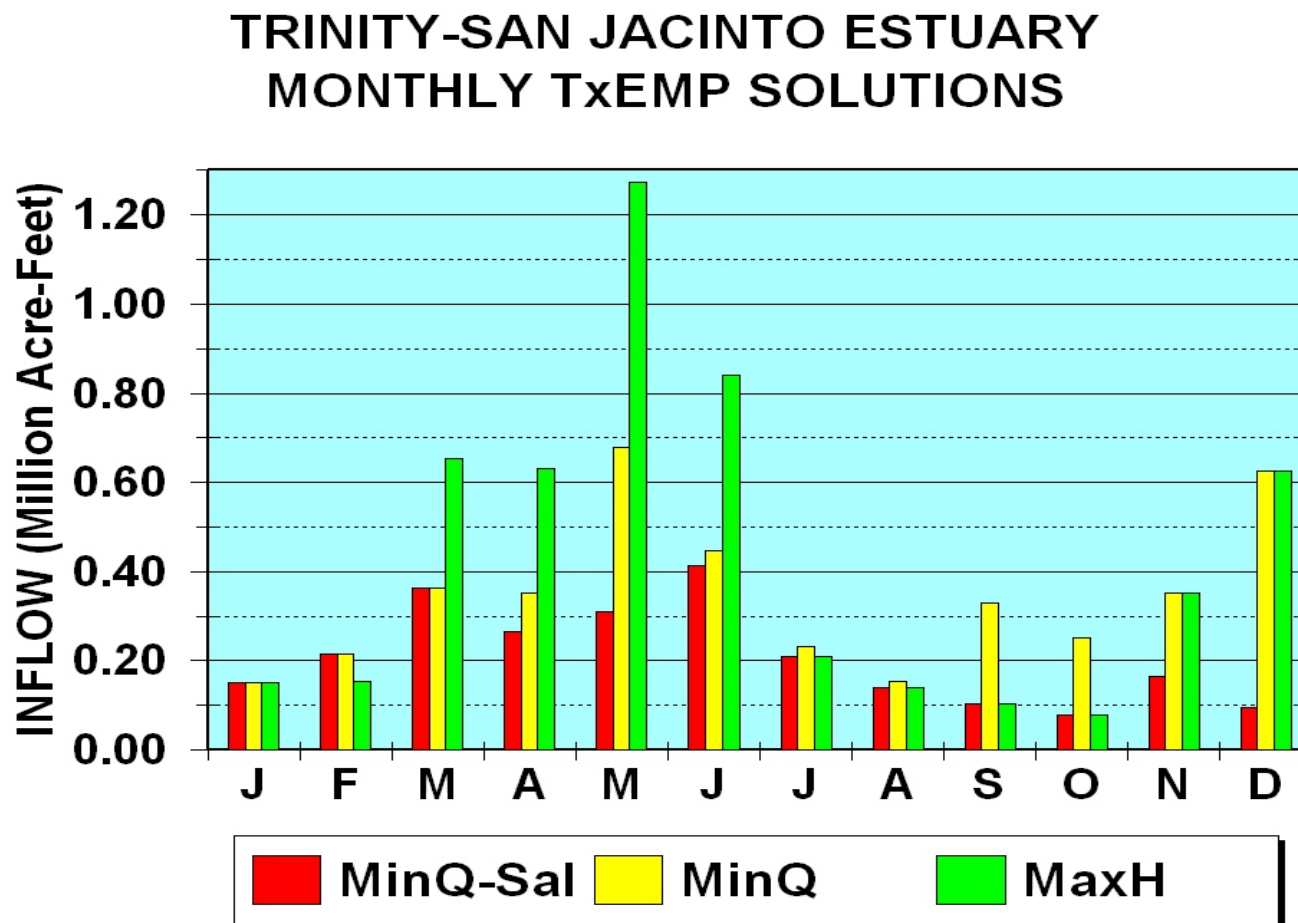


**FWI Recommendation**

# TxEMP MinQ and MaxH Solutions



# TxEMP Monthly Flow Distribution



**So you have an inflow  
recommendation**

**--- NOW WHAT?**





**THE RIO GRANDE  
GOING DRY FROM  
BOTH ENDS**



**Galveston Bay isn't going  
dry –**

**WHY ARE WE WORRIED?**

***Two million, Four million, Eight million....***



# **Water Development in Galveston Bay Watershed**

**1958** Trinity River Master Plan adopted by TRA includes Lake Livingston

**1962** Congressional authorization of Dam and Saltwater Barrier with 19,700 acres reservoir at Wallisville, Texas in River and Harbor Act.

**1966** Wallisville construction begins.

## **(Water Development - continued)**

- 1967** Cooperative Bays and Estuaries study initiated by TWDB as input to the 1968-1969 Texas Water Plan.
- 1969** Lake Livingston begins operation.
- 1971** Lawsuit filed on Wallisville Project; injunction issued pending revised EIS. Freshwater inflows were a major concern of environmental groups.

## **Early B&E Studies**

- 1975** 64th Legislature enacts SB-137  
(Required comprehensive studies of  
the effects of freshwater inflows on  
bays and estuaries.)
- 1979** B&E studies for state's seven  
major estuarine systems completed  
December 31 and published.

## Early B & E Studies - continued

**1980** Scientists, engineers, and legislators question adequacy of data bases supporting freshwater inflows analyses from the 1979 studies.

**1984** Joint Interim Legislative Committee study proposed three additional years of data collection and legislative language to protect estuarine resources when considering water permits.

# **Wallisville Saga Continued...**

**1981** Corps of Engineers issued Post Authorization Change Report (PACR) for Wallisville Project recommending a 5,600 acre reservoir with staged filling to 4 feet above msl.

**1987** The injunction against the Wallisville Project was lifted.

# Second Round of B&E Studies

**1985**      69th Texas Legislature enacts HB-2 authorizing the Bays and Estuaries Studies currently in use.

**1987**      70th Texas Legislature enacts SB-683 with clarifying amendments; reports due December 31, 1989. TPWD and TWC (now TCEQ) to review and determine freshwater inflows needed for water resources management. (TWC 11.1491, 11.147)



# **1987 Was a Very Good Year**

- ➡ **National Estuary Program was established by the Federal Water Quality Act of 1987.**
- ➡ **Galveston Bay Foundation (GBF) was incorporated in July 1987; Initial board meeting January 1988.**

## **NEP continued**

**1988** Governor completes nomination of Galveston Bay for NEP in May.

**1989** Five-year Management Conference for Galveston Bay National Estuary Program established.

# Water Development Developments

- 1990**      Endangered bald eagle sighted at Wallisville Project site; project limited to a 2-foot reservoir covering 3,800 acres.
- 1991**      Construction of Wallisville Project resumed; only partial funding appropriated by Congress.
- 1993**      Trans-Texas Water Program Southeast Area Study begins.

## **Studies are Completed**

- 1994** Galveston Bay Plan published in October by GBNEP identifies Freshwater Inflows as a high priority action item.
- 1994** “Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs” published Dec. 31 by TWDB and TPWD.
- 1995** Galveston Bay Plan adopted by Governor and approved by Administrator of EPA in April.

# More Water Development Developments

**1995** Draft Environmental Assessment of revised Wallisville Project issued in March.

**1995** GBF opposes “appropriation of any additional federal or any local funds for the Wallisville project until meeting the freshwater inflow needs of Galveston Bay, as well as the long-term water supply needs of Houston, has been resolved.”

**1995**      Freshwater inflows were identified as a priority problem by the Galveston Bay Plan:

*“Future demands for freshwater and alterations to circulation may seriously affect productivity and overall ecosystem health. “*



## ***Galveston Bay Plan:***

***By 1995, determine annual and seasonal inflow needs.***

***Action FW-1: Complete current studies to determine freshwater inflow needs for the bay.***

***Action FW-2: Expand streamflow, sediment loading, and rainfall monitoring.***

## ***Galveston Bay Plan:***

***By 2000, incorporate inflow needs in regulatory authority and planning processes.***

***Action FW-3: Establish management strategies for meeting freshwater inflow needs.***

***Action FW-4: Establish inflow regulations to protect ecological needs of the estuary.***

# **Some Agreements are Reached**

**1996** GBF and City of Houston agree in writing that bay inflows should be considered and addressed as a water demand; GBF ceases opposition to Congressional funding for completion of redesigned Wallisville project.

# **Genesis of GBFIG, c. 1996**

- ➡ **Galveston Bay National Estuary Program (TCEQ, EPA and partners)**
- ➡ **B&E studies (TWDB, TPWD, TCEQ)**
- ➡ **Trans-Texas Water Program (TWDB and partners)**
- ➡ **Proposed Wallisville Reservoir (USACE, City of Houston, Trinity River Authority, GBF and environmental groups)**

## **GBFIG continued**

**1996-1997** “Galveston Bay Freshwater Inflows Group” convenes and organizes

- ➡ to explore ways to address need for inflows;
- ➡ to coordinate with and report findings to Galveston Bay Estuary Program and SB-1 Regional Water Planning Group.
- ➡ Chartering letter signed by Directors of TWDB, TPWD, TNRCC (now TCEQ) and TGLO.

# GBFIG Members - Agencies

- ➡ Texas Commission on Environmental Quality (Austin & GBEP)
- ➡ Texas Parks and Wildlife Department
- ➡ Texas General Land Office
- ➡ Texas State Department of Health Services
- ➡ Texas Water Development Board

(No Federal Agency Members)



# **GBFIG Members – Water and Development**

- ➡ Chambers-Liberty Counties Navigation District
- ➡ City of Dallas
- ➡ City of Houston, Public Works
- ➡ Greater Houston Partnership (Chamber of Commerce)
- ➡ North Texas Municipal Water Authority
- ➡ Port of Houston Authority
- ➡ San Jacinto River Authority
- ➡ Tarrant Regional Water District
- ➡ Texas Utilities
- ➡ Trinity River Authority

# **GBFIG Members – Environmental and Conservation**

- ➡ Bayou Preservation Association
- ➡ Coastal Conservation Association
- ➡ Coastal Oyster Leaseholders Association
- ➡ Galveston Bay Foundation
- ➡ Houston Audubon Society
- ➡ Houston-Galveston Area Council (COG)
- ➡ PISCES
- ➡ Sierra Club (Lone Star and Houston)
- ➡ Texas RICE

# GBFIG Operation

- ➡ Facilitated meetings with support staff
- ➡ Established ground rules:
  - ➡ Speak up
  - ➡ Respect others
  - ➡ Silence is consent.....
- ➡ Mission: to reach consensus on a process to secure freshwater inflows to Galveston Bay
- ➡ Developed (and later revised) Workplan to move from science to management

# **Revised GBFIG Workplan**

**Task I: Establish the Galveston Bay Freshwater Inflows Group (GBFIG)**

**Task II: Obtain Necessary Background Information**

**Task III: Conduct Analyses Required to Determine under what Hydrologic Conditions would Freshwater Inflows to Galveston Bay be Inadequate**

**Task IV: Assess Feasibility of Various Options for Addressing Freshwater Inflow Deficits**

**Task V: Develop Freshwater Inflow Management Recommendations for Galveston Bay**

# **GBFIG Continues with SB-1 Planning**

**1998** Draft “Freshwater Inflow Recommendation for the Trinity-San Jacinto Estuary” presented to Senate Interim Committee on Water and to GBFIG by TPWD in January; document finalized in December 1998.

**1998-1999** GBFIG agrees in June to begin initial work on developing management strategies.

**1999** Region H Water Planning Group directs consultants to work with GBFIG to develop freshwater inflow needs.

## **Closure on Some Topics**

- 1999** Legislature enacted SB-708 directing TNRCC and other state agencies to implement approved estuary management plans.
- 1999** Wallisville Saltwater Barrier Project dedicated on 1 November.
- 2001** GBFIG recommendation on freshwater inflow targets included in Region H Water Plan.



# IMPLEMENTATION OF ENVIRONMENTAL FLOW NEEDS IN REGIONAL WATER PLANNING AND FUTURE STATE WATER PERMITTING

<u>Target Amount</u>	<u>Historical Frequency</u> (Exceedence)	<u>Target Frequency**</u> (Exceedence)
<b>Above Normal Conditions</b> [MaxH = 5.2 M Ac-Ft/Yr]*	~66%	>50%
<b>Below Normal Conditions</b> [MinQ = 4.2 M Ac-Ft/Yr]*	~70%	>60%
<b>Dry Conditions</b> [MinQ-Sal = 2.5 M Ac-Ft/Yr]*	~82%	>75%
<b>Drought-of-Record</b> [Min Historic = 1.8 M Ac-Ft/Yr]*	~98%	>90%

\*Flows from Texas Water Development Board and Texas Parks & Wildlife;

\*\*Target Frequencies from Galveston Bay Freshwater Inflow Group (Region H)

**So you have an inflow  
recommendation**

**--- NOW WHAT?**

# Water Rights

- ➡ Applications filed for environmental flow permits were denied by TCEQ in 2003. (Appeals Court opinion in early 2006 may change that.)
- ➡ SB-1639 set a 2-year moratorium on any permits for environmental flows (but not for other uses). (Subsequent legislation changed law.)
- ➡ Following completion of the WAMs, a number of permit applications were filed for water that is unappropriated.
- ➡ Applications also were filed for indirect reuse of wastewater.

# Water Rights (continued)

- ➡ Applications filed for unappropriated flows and for indirect reuse of wastewater flows were submitted by SJRA and the City of Houston in the San Jacinto basin in 2003/2004.
- ➡ These were new water rights applications and were not part of the 2001 Region H Water Plan, so there was a question of “consistency” with the regional plan.
- ➡ An amendment to the 2001 Region H Water Plan was proposed by the RHWPG and was adopted in November 2005.
- ➡ These applications were discussed in the GBFIG forum because of their potential impacts on freshwater inflows to Galveston Bay.

# Where We Are Today

- ➡ GBFIG met in November 2005 and members reconfirmed their intent to continue working to secure freshwater inflows to Galveston Bay.
- ➡ Will consider scenarios for management strategies, e.g. how reservoirs will be refilled after Hurricane Rita damage is repaired and how one species responds to changes in freshwater inflows.
- ➡ Target inflows remain in the 2006 Region H Water Plan, but no mechanism to ensure them is included.
- ➡ GBEP has a 10-year assessment in progress and is reviewing its action plans.

# So what is the GBFIG Approach?

- ➡ Science and management can't be divorced
- ➡ “Sound science” should inform management decisions
- ➡ Stakeholders must be involved in discussion of science and in management decisions
- ➡ Adaptive management and precautionary principle in practice

# Science and Environmental Flows in the Future

- Science must continue to develop in the presence of all interested parties if consensus is to be built and bloodshed is to be avoided
  - Define critical elements (low flow, annual / seasonal flow profile, flushing flows, etc.?)
  - Define what is an unacceptable consequence for the ecosystem
- Adequate funding for monitoring, data collection and scientific analyses in the resource agencies is essential

# Science and Flows Management in the Future

- Need to design acceptable management structures that accommodate adaptive management and incorporate best available scientific knowledge
  - Water planning
  - Flow requirements
  - Permits
  - Watermasters



# Science and Flows Management in the Future

- Not a quick process – need interim strategies that continue stakeholder efforts to use science associated with:
  - National Estuary Programs
  - Local/regional FWI groups, e.g. GBFIG
  - Regional Water Planning
  - State B&E and Instream Flow studies

In the end...



we want water for **both** people and the environment