## BBEST Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Hall, P.E. (Co-Chair)</td>
<td>Lower Neches Valley Authority</td>
</tr>
<tr>
<td>Dr. Richard C. Harrel</td>
<td>Lamar University, Clean Air &amp; Water, Inc.</td>
</tr>
<tr>
<td>Rex H. Hunt, P.E.</td>
<td>Alan Plummer Associates, Inc.</td>
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<tr>
<td>J. Roger Kelley, P.E.</td>
<td>LBG, Inc., Environmental</td>
</tr>
<tr>
<td>Matthew McBroom, Ph.D.</td>
<td>Stephen F. Austin State University</td>
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<tr>
<td>Jack D. McCullough, Ph.D.</td>
<td>Stephen F. Austin State University</td>
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<tr>
<td>David L. Parkhill, P.E.</td>
<td>AECOM Water</td>
</tr>
<tr>
<td>Jack W. Tatum (Chairman)</td>
<td>Sabine River Authority of Texas</td>
</tr>
<tr>
<td>Samuel Kent Vaugh, P.E.</td>
<td>HDR Engineering</td>
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<tr>
<td>Kirk Winemiller, Ph.D.</td>
<td>Texas A&amp;M University</td>
</tr>
</tbody>
</table>
Primary Charge

- Environmental Flow Analysis
- Environmental Flow Regime
Instream Flow Regime Components

- Overbank Flows
- High Flow Pulses
- Base Flows
- Subsistence Flows
Habitat Availability Curve

Taken from recent instream flows research, Lower Colorado River (BIO-WEST 2008).
Sabine and Neches Rivers and Sabine-Neches Estuary (Sabine Lake)
Coastal Plains of the Calcasieu and Sabine-Neches Drainages
Goal and Objectives

- Goal: Maintain a sound ecological environment
- Sound Ecological Environment: the Sabine-Neches BBEST adopted the SAC definition
- Objectives: to meet the criterion of a sound ecological environment
Sabine-Neches BBEST Process
Accomplishment of Primary Charge
Decision Tree
SAC Guidance

- Geographic Scope
- Use of Hydrologic Data
- Fluivial Sediment Transport (Geomorphology)
- Freshwater Inflow Regime
- Water Quality
- Biology
Sabine-Neches Basins: Unique Issues

- Texas/ Louisiana
- Texas State Water Quality Flows (7Q2)
- Senate Bill 2: Lower Sabine River Priority Instream Flow Study
- Toledo Bend Project Joint Operations (FERC Relicensing)
- Sabine River Compact
- Lower Neches River Saltwater Barrier
- Cutoff Bayou: Lower Sabine River
- USACE Sabine-Neches Waterway Feasibility Study
Discipline Reports

- Hydrology
- Biology (Ecological Review)
- Geomorphology (Sediment Transport)
- Application of Water Quality in Environmental Flows
Consultants and Contributors Work

- **Hydrology (Freese and Nichols, Inc.)**
  - Gage Memo, HEFR Memo, WAM Memo

- **Biology (BIO-WEST, Inc.)**
  - Estuarine and Fluvial Focal Species Summary Reports

- **National Wildlife Federation**
  - Salinity Suitability Analyses of *Rangia Cuneata* ...
  - Analyses of Satellite Imagery ... in Support of Developing Overbank Instream Flow Recommendations ... (with the Greater Edwards Aquifer Alliance)
Hydrology-Based Environmental Flow Regime (HEFR)

• Developed by the Texas Parks and Wildlife Department (TPWD) to efficiently use hydrologic data to populate a flow regime matrix.

• The Sabine-Neches BBEST selected HEFR as the desktop method to use for developing the required flow matrices for the Sabine and Neches River Basins and the Sabine-Neches Estuary.
### HEFR Matrix – Big Sandy Creek Near Big Sandy, Texas

#### Full Period

<table>
<thead>
<tr>
<th>Flow Type</th>
<th>Qp</th>
<th>Frequency</th>
<th>Volume</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overbank Flows</td>
<td>2,920 cfs with Frequency 1 per 2 years</td>
<td>Volume is 35,763</td>
<td>Duration is 30</td>
<td></td>
</tr>
<tr>
<td>High Flow Pulses</td>
<td>942 cfs with Frequency 1 per season</td>
<td>Volume is 14,544</td>
<td>Duration is 16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>950 cfs with Frequency 1 per season</td>
<td>Volume is 12,552</td>
<td>Duration is 19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>132 cfs with Frequency 1 per season</td>
<td>Volume is 2,024</td>
<td>Duration is 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>367 cfs with Frequency 1 per season</td>
<td>Volume is 6,035</td>
<td>Duration is 14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>358 cfs with Frequency 2 per season</td>
<td>Volume is 5,932</td>
<td>Duration is 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>313 cfs with Frequency 2 per season</td>
<td>Volume is 5,062</td>
<td>Duration is 13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 cfs with Frequency 2 per season</td>
<td>Volume is 61</td>
<td>Duration is 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>130 cfs with Frequency 2 per season</td>
<td>Volume is 2,189</td>
<td>Duration is 9</td>
<td></td>
</tr>
</tbody>
</table>

**Translation of seasonal pulse flows of specified frequencies into environmental flow standards and permit conditions may result in less frequent occurrence of high flow pulses as a result of the issuance of new surface water appropriations or amendments. This reduced frequency of occurrence is deemed an acceptable environmental risk at this time, subject to review as new studies and information become available.**

#### Base Flows (cfs)

<table>
<thead>
<tr>
<th>Month</th>
<th>163</th>
<th>111</th>
<th>26</th>
<th>63</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>106</td>
<td>51</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>30</td>
<td>14</td>
<td>20</td>
</tr>
</tbody>
</table>

**Seasonal base flows represent thresholds for environmental protection based on current scientific understanding of fluvial and estuarine ecosystems. As new studies and monitoring information become available, these base flow thresholds may be revised.**

#### Subsistence Flows (cfs)

<table>
<thead>
<tr>
<th>Month</th>
<th>20</th>
<th>9</th>
<th>8</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fall</td>
<td></td>
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</table>
Numerous man-made alterations have influenced the current ecological condition in the Sabine-Neches Estuary and the lower tidal reaches of the Sabine and Neches Rivers. These systems are generally sound, exhibiting good overall water quality and diverse fish and wildlife communities. The Sabine-Neches Estuary receives more fresh water than all other estuaries on the Texas Gulf Coast (next slide) and provides enough fresh water to Sabine Lake for the focal species studied there (NWF 2009).
Percent Inflow Contributions to Sabine Lake

Texas and Louisiana Coastal Inflows

Sabine River at Debrittee Cage
13.2% (28.6%)

Neches River at Sabine Lake
17.3% (44.5%)

Net Direct Precipitation - Evaporation
2.3%

Sabine Lake

Notation: The Neches and Sabine Rivers contribute approximately 17.3% and 13.2% to Sabine Lake, respectively, based on historical data developed by the Texas Commission on Environmental Quality (TCEQ). The remaining 69.5% of the inflow to Sabine Lake comes from Texas and Louisiana coastal water. The TCEQ's 2005 percent contribution from direct precipitation over Sabine Lake is approximately 2.3%. The contribution of evaporation is further evaluated using normalized flow data for the period 1976-1995 from the TCEQ WAMs for these regions.

% Contribution (Cumulative % Contribution)
Major Texas Estuaries

Major Texas Estuaries

1/28/2010 Sabine-Neches BBEST
Historic Widening and Deepening of the Sabine-Neches Ship Channel*

* The latest USACE draft study report indicates just deepening with selected widening areas; they do not plan to widen the entire channel length.
Development of Environmental Flows/ Recommendations/ Unresolved Issues

- Recommendations
- Recognitions
- Unresolved Issues
- Future Studies
- Adaptive Management
Recommendations (1-3)

1. Definition of a Sound Ecological Environment
   • The Sabine-Neches BBEST recommended the SAC definition that it adopted

2. The Current Conditions of the Sabine and Neches Rivers and the Sabine-Neches Estuary are Sound

3. Acknowledgement That Flows in the Sabine and Neches Rivers and Inflows to the Sabine-Neches Estuary will Change Over Time
Recommendations (4-5)

4. Future Study, Data Gathering, and Adaptive Management are Necessary to Determine Whether or Not Changes in Environmental Flows will Maintain a Sound Ecological Environment

5. Applicable Hydrologic Conditions for the Entire Season are Defined on the Basis of an Assessment of Hydrologic Conditions of Storage in Selected Reservoirs at the Beginning of the First Day of the Season Thereby Recognizing Both Drought Persistence and Practical Operations
Subsistence Flows

The Sabine-Neches BBEST recommends adoption of the seasonal subsistence flows from MBFIT/HEFR, unless:

1. the seasonal value is less than the summer value in which case the summer value is adopted by default, and
2. MBFIT/HEFR failed to calculate a value (this occurred usually for winter) in which case the lowest recorded flow value for that season at that gage was adopted by default.

- Translation of seasonal subsistence flows into environmental flow standards and permit conditions should not result in more frequent occurrence of flows less than the recommended seasonal subsistence values as a result of the issuance of new surface water appropriations or amendments.
7. Base Flows
   - Seasonal base flows represent thresholds for environmental protection based on current scientific understanding of fluvial and estuarine ecosystems. As new studies and monitoring information become available, these base flow thresholds may be revised.

8. High Flow Pulses
   - Seasonal high flow pulses have recognized ecological benefits and are recommended for protection with certain reservations associated with environmental and operational liability risks.
Recommenda­tions (9)

9. Fluvial Matrices Inflow Recommen­da­tions are Adequate to Main­tain a Sound Eco­lo­gi­cal Envi­ron­ment in the Sabine-Neches Estuary (Sabine-Lake)
Overbank Flows Have Recognized Ecological Benefits but are not Recommended

- Overbank flows may cause extensive damage to private property and endanger the public. Therefore the Sabine-Neches BBEST recognizes the ecological benefits of these events, but cannot recommend such events be produced.
2. Toledo Bend FERC* Relicensing
   - The relicensing of the Toledo Bend Project is ongoing at this time. The relicensing will recognize the Project’s primary use as a water supply project with the capability of generating hydroelectric power. Since no major changes in operations are planned, a maintenance flow will continue to be maintained from the spillway.

3. Sabine River Compact
   - The major purposes of the Sabine River Compact are to provide for the equitable apportionment between the States of Louisiana and Texas of the waters of the Sabine River and its tributaries.

4. Cutoff Bayou
   - Environmental flows as well as the diversions for the water supply canal system in Texas are adversely affected by migration of channel flow to the Old River Channel in Louisiana during low and average flow conditions.

* Federal Energy Regulatory Commission
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Environmental Flows Recommendations Report:

http://www.sratx.org/BBEST/RecommendationsReport/