Appendix 3-A

Environmental Flows Recommendations Report Executive Summary for the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholders Committee

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This appendix contains the Executive Summary for the Environmental Flows Recommendations Report prepared by the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team. The report was issued on November 30, 2009, and contains a comprehensive report on the Sabine and Neches River Basins and Sabine Lake Estuary.

EXECUTIVE SUMMARY

The Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team (Sabine-Neches BBEST) was appointed by the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholders Committee (Sabine-Neches BBASC) under Senate Bill 3 (Texas Legislature 2007), the third in a series of three omnibus water bills related to the State of Texas meeting the future needs for water. Under its SB 3 charge, the Sabine-Neches BBEST used the "best available science" to develop environmental flow analyses and recommend flow regimes for the Sabine and Neches Basins and the Sabine-Neches Estuary. These recommendations are provided to the Sabine-Neches BBASC, Texas Environmental Flows Advisory Group (EFAG), and the Texas Commission on Environmental Quality (TCEQ).

The Sabine-Neches BBEST held twelve monthly meetings and several workshops beginning with its initial meeting on December 8, 2009. To accomplish this task the Sabine-Neches BBEST established subcommittees for:

- gaging
- hydrology
- biology
- water quality
- geomorphology
- Recommendations Report preparation.

Two consulting firms were retained to provide modeling and research in addition to extensive committee/subcommittee work. The meetings were an open process that benefited from participation and contributions from the resource agencies – TCEQ, Texas Water Development Board (TWDB) and Texas Parks and Wildlife Department (TPWD), environmental groups such as the National Wildlife Federation (NWF), and the public.

The Sabine-Neches BBEST believes the body of work presented and discussed in the Recommendations Report (Report) has enabled it to move the Texas environmental flows process forward and to address the charge to develop environmental flow analyses and recommend an environmental flow regime in a positive manner within the limited time frame and full recognition of the best science available. The Report is comprised of:

- a Preamble, which outlines the charge, goal and objectives;
- Summary of Recommendations, Recognitions and Rationale, which highlights the report findings;
- Basins and Bay Descriptions and Current Conditions, which describes the Sabine River Basin (Texas and Louisiana), the Neches River Basin, Sabine Lake Estuary (Sabine-Neches Estuary, Texas and Louisiana); Regional Water Planning (SB 1 ongoing process), and Sabine-Neches Study Area Unique Issues;
- Texas Environmental Flows Science Advisory Committee (SAC) which provided guidance documents for this process as well as overall direction, coordination, and consistency from the broader state perspective;

- Discipline Reports from the four disciplines – hydrology, biology, water quality and geomorphology;
- Development of Environmental Flows Recommendations/Recognitions/Unresolved Issues which includes instream flow regime application, environmental flow matrices for selected stream flow gages, and inflows to Sabine-Neches Estuary; and
- Appendices which includes the full body of work and references that the Report is based on.

The SAC, an objective body of experts tasked to advise and make recommendations to the Environmental Flows Advisory Group, provided valuable assistance to the Trinity-San Jacinto BBEST and Sabine-Neches BBEST as the two initial BBESTs. To date, the SAC, composed of members with expertise in a number of technical fields including hydrology, hydraulics, water resources, aquatic and terrestrial biology, geomorphology, geology, water quality, and computer modeling, has developed six technical guidance documents for BBEST use. These are as follows:

- Geographic Scope of Instream Flow Recommendations;
- Use of Hydrologic Data in the Development of Instream Flow Recommendations for the Environmental Flows Allocation Process and the Hydrology-Based Environmental Flow Regime (HEFR);
- Fluvial Sediment Transport as an Overlay to Instream Flow Recommendations for the Environmental Flows Allocation Process;
- Methodologies for Establishing a Freshwater Inflow Regime for Texas Estuaries Within the Context of the Senate Bill 3 Environmental Flows Process;
- Nutrient and Water Quality Overlay on Hydrology-Based Instream Flow Recommendations; and
- Essential Steps for Biological Overlays in Developing Senate Bill 3 Instream Flow Recommendations.

Unfortunately, the Sabine-Neches BBEST was unable to take full advantage of all guidance documents since the SAC's development timeline coincided with the Sabine-Neches BBEST timeline. However, the SAC member performing as liaison to the Sabine-Neches BBEST assisted the group by providing the initial drafts of works in progress to allow the process to move forward. This resulted in an evolving process through the twelve months with the Report reflecting a transition of understanding from SAC guidance to the Sabine-Neches BBEST, to its consultants' work, its subcommittees' reports, input from the resource agencies, and the NWF studies. This input and work influenced the understanding and progress along the twelve month timeline. The final Report reflects the evolving and transitional understanding as the year unfolded and additional information and data was brought into the process.

Decision Tree – To help follow this process from start to finish, the Sabine-Neches BBEST developed a DECISION TREE (Figure 4, page 8). The Decision Tree traces the decisions made throughout the process. The decision tree was instrumental in tracking decisions and pathways and the concept should be of great value to future BBESTs.

During the course of the past year, the Sabine-Neches BBEST recognized its recommendation charge required further clarity. Taking its charge from the "theoretical" to the "practical", the Sabine-Neches BBEST was able to make some specific environmental flow recommendations, while in other cases (for example overbank flows), the group agreed to recognize (recognition) the ecological value of such flows but not recommend them. The Sabine-Neches BBEST was able to move forward with the environmental flow process by agreeing that some issues, due to the severe time constraint and limitations of available science would remain 'unresolved issues'. These unresolved issues would need 'future studies' and, ultimately, as envisioned by the SB 3 process, 'adaptive management' to resolve. Thus, over time, the path forward became:

1. Recommendations;
2. Recognitions;
3. Unresolved Issues;
4. Future Studies; and
5. Adaptive Management.

Recommendations and Recognitions

The following recommendations and recognitions are presented in the Report with qualifying language and in some cases remain unresolved issues that will need future study and adaptive management to determine if particular flow components need to be altered. The recommendations and recognitions are presented in the Report with supporting rationale based on information and data summarized from a substantial body of work in the appendices and noted references. They are summarized as follows:

Recommendations:

1. Recommendation 1: Definition of a Sound Ecological Environment.
   The Sabine-Neches BBEST recommends the SAC definition that it adopted (see Section 1.2.4, page 11) for sound ecological environment.
2. Recommendation 2: The Current Conditions of the Sabine and Neches Rivers and the Sabine-Neches Estuary are Sound.
3. Recommendation 3: Acknowledge that Flows in the Sabine and Neches Rivers and Inflow to the Sabine-Neches Estuary will Change Over Time.
4. Recommendation 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. Recommendation 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.
6. Recommendation 6: Subsistence Flows.
   The Sabine-Neches BBEST recommends adoption of the seasonal subsistence flows from MBFIT /HEFR, unless:
   i. the seasonal value is less than the summer value in which case the summer value is adopted by default, and

ii. 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. Recommendation 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. Recommendation 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.
9. Recommendation 9: Fluvial Matrices Inflow Recommendations are Adequate to Maintain a Sound Ecological Environment in the Sabine-Neches Estuary.
   Recognizing that the Sabine-Neches Estuary is a system in transition (Tatum 2009) and that the Sabine-Neches Estuary receives the freshwater inflows determined by the flow component recommendations for the Sabine-Ruliff, Neches-Evadale, and Village Creek gages (as well as other inflows), the Sabine-Neches BBEST recommends that these inflows are adequate to maintain a sound ecological environment in the Sabine-Neches Estuary.

Recognitions

1. Recognition 1: 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. Recognition 2: Toledo Bend Reservoir 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. Recognition 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. Texas retains free and unrestricted use of the water of the Sabine River and its tributaries above the Stateline, subject only to the provisions that the minimum flow of 36 cfs must be maintained at the Stateline. All free water (free water means all waters other than stored water) and stored water in the Stateline reach, without reference to origin, will be divided equally between the two states.

4. Recognition 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.

Basins and Bay Descriptions and Current Conditions

The Study Area defined for the Sabine-Neches BBEST is the Sabine River Basin and the Neches River Basin with each having a watershed of approximately 10,000 square miles with the total drainage of some 20,000 square miles being received by the Sabine-Neches Estuary. Detail descriptions and maps are found in the Report and supporting appendices and references. SB 1 Regional Water Planning for this area is presented in Regions I, D and C plans since the geographic footprint extends into all three regions. SB 2, or Texas Instream Flow Program (TIFP), studies include only the lower Sabine River from Toledo Bend Reservoir to tidal. (The State of Louisiana owns half the flow in this stateline reach, but does not have a program similar to SB 2). Unique aspects of the Study Area include:

1. Texas/Louisiana (stateline flows, water supply reservoir and estuary);
2. Texas State Water Quality Flows (Texas – 7Q2/Louisiana – 7Q10);
3. SB 2 priority study – lower Sabine River;
4. Toledo Bend Reservoir Project Joint Operations – Federal Energy Regulatory Commission relicense of Toledo Bend hydropower facility;
5. Sabine River Compact which provides for equitable apportionment of waters between Texas and Louisiana;
6. Lower Neches River Saltwater Barrier - minimum flow requirement;
7. Cutoff Bayou – migration of water to Louisiana's Old Sabine River channel affecting environmental flows and water supply users in Texas; and
8. USACE proposed deepening of existing ship channel through the Sabine-Neches Estuary to upstream ports.

Discipline Reports

The Sabine-Neches BBEST Subcommittees submitted reports –on the disciplines of hydrology, biology, water quality and geomorphology – key components identified by the TIFP Technical Overview.

Hydrology – The Hydrology Subcommittee benefited from outside consultant work which prepared three memoranda:

1. Analysis of Sabine-Neches BBEST Stream Gages;
2. Hydrology-Based Environmental Flow Regime (HEFR) Analyses for Sabine-Neches BBEST; and
3. Water Availability Analyses for Sabine-Neches BBEST.

The subcommittee worked with the consultant in the preparation of these memos and used this baseline work to develop flow regime matrices for each of the selected gages for use by the other disciplines.

Biology – The Biology Subcommittee assisted in the selection of representative focal species for the two river basins and the estuary, and also worked with an outside consultant to prepare reports on Fluvial Focal Species and Estuarine Focal Species. The flow regime matrix produced by the HEFR statistical analyses of the historical stream gage records was used to evaluate the available biological information for the focal species related to subsistence flows, base flows, high flow pulses, and overbank flows. Using SAC guidance, the estuarine ecosystem evaluation was enhanced with the NWF analysis of habitat suitability for key estuarine species under alternative flow regimes. Changes to the estuary including the ship channel, intracoastal waterway, and secondary channels into the marshes were discussed along with a need for habitat restoration in marshes in Texas and Louisiana. Adaptive management as envisioned by the SB 3 process was considered along with the need for future studies to address the unresolved issues in the Report.

Geomorphology (Sediment Transport) – The Geomorphology Subcommittee, utilizing SAC guidance, worked with the TWDB to address sediment transport in the Study Area. The TWDB has conducted studies of sediment transport and geomorphologic characterization within Texas river systems and most recently has worked with Dr. Jonathan Phillips of the University of Kentucky to conduct studies in the lower Sabine River as part of the SB 2 study. TWDB modeling was undertaken for each of the gages as well to determine how these systems are functioning. Estuary sediment delivery was also considered.

Water Quality – The Water Quality Subcommittee evaluated water quality as an overlay application in environmental flows. Water quality is an important aspect of environmental flow recommendation development. Available water quality was compiled and evaluated for the study area along with water quality standards, flow and water quality relationships, and the integration of water quality into environmental flow recommendations.

Development of Environmental Flows Recommendations/ Recognitions/ Unresolved Issues

As illustrated in the Report's Decision Tree (Figure 4, page 8), the decision process and statistical analyses created, in effect, a statistical river which resulted in HEFR output matrices for each of the twelve gages (six in the Neches Basin and six in the Sabine Basin). These are listed with descriptions of each location and the corresponding matrix (for example – HEFR Matrix for Big Sandy Creek near Big Sandy) which presents the numbers associated with these decisions on a seasonal basis (Sabine-Neches BBEST selected Jan-Mar for winter, Apr-Jun for spring, and so on) for subsistence, base, high flow pulses and overbank flows with qualifying language regarding the interpretation of these flow components. For base flows, seasonal numbers were generated for dry, average and wet conditions which were arbitrarily chosen to be 25^{th} /50^{th} /75^{th} percentiles.

The Sabine-Neches BBEST developed an example application of a flow regime to focus on key elements of a HEFR output matrix and considerations in order to understand how such flow regimes might be applied to new surface water appropriations and/or diversions. The group's understanding of potential flow regime application is summarized in a series of examples for Big Sandy Creek near Big Sandy, Texas.

The Sabine-Neches Estuary current status is summarized from the discipline reports, appendices, and reference documents. The SAC guidance, Sabine Lake history, State Methodology, percent inflow schematic documenting inflows (from the Sabine River, the Neches River, and coastal inflows), and HEFR as an estuary inflows recommendation tool are presented. The USACE's project to deepen the ship channel includes extensive studies. Hydrodynamic salinity modeling, water supply planning using the 2007 Texas Water Plan (Texas Water Development Board. 2007) data modeling current and future water use (50 year) conditions, and marsh habitat mitigation/restoration in Texas and Louisiana are included.