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Date: April 21, 2011

To: The Honorable Karen J. Hixon
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Re: Texas Parks and Wildlife Department Staff Perspectives on the Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays Basin and Bay Expert Science Team Report

Senate Bill 3, Article 1 (SB 3), as passed by the 80th Texas Legislature in 2007, created a statewide process for identifying and protecting environmental flow needs. As part of this process, a Basin and Bay Expert Science Team (BBEST) was formed for the Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays (GSA BBEST). The GSA BBEST submitted its final report on March 1, 2011 documenting science-based recommendations for an environmental flow regime for the applicable rivers and bay systems. SB 3 directs each BBEST to develop an environmental flow regime recommendation:

> *...through a collaborative process designed to achieve a consensus. In developing the analyses and recommendations, the science team must consider all reasonably available science, without regard to the need for the water for other uses, and the science team's recommendations must be based solely on the best science available.*

The BBEST engaged resource agency staff and others throughout the process. Texas Parks and Wildlife Department (TPWD) staff assisted and supported the BBEST by providing data, maps, and information related to riparian habitats; assisting with cross-sectional work for the Comparative Cross Section Methodology (CCM); developing lists of instream focal species/guild criteria, habitat suitability envelope curves, and analyses; statistically evaluating blue crab abundance data; enhancing and improving the Hydrology-based

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Environmental Flow Regime (HEFR) methodology; and refining and improving the Flow Regime Application Tool (FRAT). The BBEST fostered participation by TPWD and others that resulted in the use of best available science to generate environmental flow regime recommendations that TPWD generally supports.

Having worked on numerous instream flow and freshwater inflow recommendations over many years, TPWD staff is familiar with the uncertainty embedded in such efforts, cognizant of the challenges faced by the BBEST, appreciative of the efforts expended by the members, and grateful for the many opportunities to provide input throughout the process. Each BBEST had approximately twelve months and a limited budget for outside services to meet the SB 3 charge. The difficulty of the challenge cannot be overstated and the progress of the BBEST is commendable. The GSA BBEST clearly learned and benefitted from the experiences of previous BBESTs and extended the state of the science in many respects. Furthermore, the GSA BBEST had the additional advantage of contemporary, if still incomplete, instream flow studies on the lower San Antonio River, as well as relevant information at selected sites on the lower Guadalupe River. That said, it is widely recognized that the science of environmental flows is not an exact one, and the GSA BBEST did not have the time, data, directive, or budget to perform a definitive analysis.

This memorandum contains general comments regarding the GSA BBEST report and the SB 3 charge to develop an environmental flow regime, and it contains specific comments addressing instream flows and freshwater inflows. More detailed technical comments are provided as an appendix. These comments are intended to assist the Environmental Flows Advisory Group, the Texas Commission on Environmental Quality, and the GSA Basin and Bay Area Stakeholder Committee (GSA BBASC) in reviewing the BBEST recommendations.

General Comments

TPWD staff commends the GSA BBEST for its efforts to address the requirements set forth by SB 3. In general, the BBEST followed guidance provided by the Texas Environmental Flows Science Advisory Committee (SAC) and addressed the requirements set forth by SB 3.

Section 1 contains a thorough explanation of the SB 3 process and the BBEST charge. TPWD staff appreciates the efforts of the BBEST in Section 1.3 to define a sound ecological environment and supports the BBEST's definition, with the mutual understanding that the phrase "to a reasonable extent" is both broad and subjective. TPWD staff understands that it is impossible to provide a precise definition of a sound ecological environment given the scope of the SB 3

tasks. Subsequently, the BBEST concludes that the current conditions "are, broadly speaking, 'sound' today with few exceptions." Several such exceptions are listed on page 1.8 and include declines in the numbers of tarpon, blue crab, southern flounder, and episodic declines in whooping cranes. TPWD staff agrees that additional studies would be required to fully ascertain the influence of freshwater inflows on these observed effects.

Section 2 provides a highly useful overview of the basins and ecosystems, including relevant information on hydrology, water quality, biology, and physical processes.

Instream Flow Analyses

TPWD staff supports the GSA BBEST instream flow recommendations with one exception and a few qualifications described below. TPWD staff commends the GSA BBEST members for their use of the best available science (such as preliminary Senate Bill 2 instream flow study data collected on the lower San Antonio and lower Cibolo Creek) to make instream flow regime recommendations. The GSA BBEST recommendations provide an appropriate degree of flow variability required to support a sound ecological environment by incorporating seasonal subsistence, a range of base flow conditions, and a suite of high flow pulses.

Section 3 presents details on the BBEST's instream flow analyses. The BBEST generated flow recommendations at 16 gaged locations. TPWD staff believes that this is a reasonable suite of locations, both in number and spatial distribution. On Page 3.8 the BBEST recommends that TCEQ develop methods to identify environmental flow requirements at intermediate locations on an as-needed basis using drainage area adjustments and/or other reasonable approaches. TPWD staff agrees with this recommendation and encourages the BBEST to give this issue additional attention when assisting the BBASC in developing its work plan if TCEQ does not adopt specific rules in the interim. In particular, the BBEST should make clear if it is their intent for all instream flow recommendations to be extended to the salt water barrier.

The BBEST used the full period of record at all locations except those downstream of the City of San Antonio, where the early period of record was used. TPWD staff agrees with this decision.

For subsistence flow recommendations, the BBEST used the default HEFR flow calculation which results in an extremely low flow at many of the locations. Similar to the approach taken by the Colorado-Lavaca BBEST, TPWD staff recommends the greatest of Q95, TCEQ's critical low flow (generally 7Q2) , or

the default HEFR subsistence flow calculation to support critical water quality and habitat needs during very dry times. As one example, at the Mission River at Refugio location, the BBEST recommended subsistence flow values range from 1.0 to 1.3 cfs. Based on Figure 3.3-24, these flows only protect from 1 to 7% of the maximum habitat for each guild. Comparatively, Q95 for this location is 1.5 cfs and the critical low flow is 4.7 cfs which would protect from 15-35% of each guild's maximum habitat. While recognizing that subsistence flows are not intended to provide optimal habitat at all times, TPWD staff believes that the protection of only 1% of the maximum habitat of deep runs is inadequate. Many of the other tributary and upstream locations exhibit similar results. In addition, use of Q95 or the critical low flow value would enhance the ability to meet the standards for important water quality parameters such as dissolved oxygen and temperature. HEFR provides the options to calculate Q95 and manually enter flow values to address water quality protection.

A series of habitat-flow relationships, one at each location, are provided on pages 3.53 – 3.72. Four locations (lower San Antonio River and Cibolo Creek) are based on preliminary TIFP study results and two locations (Guadalupe River at Gonzales and Victoria) are based on PHABSIM outputs using existing cross-section data. The remaining locations are based on the CCM method, which uses limited site-specific data and hydraulic model outputs. A comparison of CCM results to PHABSIM and preliminary TIFP output would have helped to illustrate the utility and uncertainty of the CCM method. TPWD staff recommends that the BBEST perform such a comparison to help guide the BBASC in setting priorities in their work plan. TPWD staff also supports an analysis of habitat time series for sites with PHABSIM or preliminary TIFP habitat output to assist in evaluating how changes in instream flow recommendations could potentially affect instream habitat.

Freshwater Inflow Analyses

TPWD staff appreciates the significant effort expended by the BBEST to extend the state of the science with regard to the salinity zone approach. While recognizing that the BBEST report is a final report, TPWD submits the following comments (and detailed comments in the appendix to this letter) in the interest of further expanding understanding and communication of the overall approach.

The habitat-based salinity zone approach employed by the BBEST to develop quantitative freshwater inflow recommendations relies heavily upon salinity preferences of two species: *Rangia* and oysters. As a result, the recommendation lacks explicit freshwater inflow recommendations for certain months. In addition, the beneficial effects of freshwater inflows other than salinity, e.g., nutrient and sediment delivery, are not considered. Nutrients and

sediments are largely delivered during high flow pulses ("Very High Inflows" and "Med-High Sustained Inflows w. Pulse(s)", in the lexicon of Figure 4.1-2). Since nutrients and sediments are not considered in this method, no recommendations are provided for such events. As a result, high flow pulses receive no quantitative discussion or specification. For the "missing months" those months which have no freshwater inflow recommendations, the BBEST has explicitly specified that instream flow requirements are to be extended to the bay. TPWD staff is unclear if this extension of instream flow recommendations to the bay is a recommendation of the BBEST for all months. The section "3.1.2.6 Geographic Interpolation" does not specifically state the intent of the BBEST in this regard. TPWD staff believes that that it is important to extend the instream flow recommendations to the bay in all months, in light of the limitations of the habitat-based salinity zone approach. TPWD staff encourages the BBEST to follow this approach when assessing impacts of future water development scenarios.

The BBEST recommendation allows for a 25% reduction in the frequency of G2-A and G2-B conditions (Table 4.5-2). Support for this decision is provided by a Heinz Center report and an EPA report with sediment contaminant breakpoints, but TPWD staff is uncertain of the EPA report's relevance. TPWD staff notes that the BBEST recommendation allows greater than a 25% reduction in other flows. For example, any flows in the G2-A range could be diverted down to the floor of the G2-A category, with 25% of such events diverted down to the G2-B floor, and still be in compliance with the recommendation. Thus, in this context, the BBEST recommendation of a 25% reduction is effectively a minimum allowed reduction in flows. This does not appear to be consistent with the maximum 25% reduction in key flow characteristics (with unknown reductions in other flows) used by the Heinz Center to classify minimally impacted sites, assuming that the 25% Heinz number is a relevant and appropriate precedent for the BBEST to adopt. Furthermore, in the 69 year historical record, 28 years exceeded the maximum of the G2-A flow range and thus provide sub-optimal (i.e., too fresh) habitat. These years are afforded no protection by the habitat-based methodology and essentially unlimited diversions would be allowed in these years except as potentially limited by instream flow requirements. TPWD staff understands the difficulty in judgment calls related to acceptable reductions in flows. TPWD staff also understands that such calls must be made by the BBEST. However, TPWD staff questions whether a minimum 25% reduction in flows is appropriate or supported by the literature.

TPWD staff agrees that freshwater inflows in the summer months may be most critical for oysters because of the proliferation of parasites during hot months. However, appropriate salinity conditions are beneficial to oysters throughout the year, and TPWD staff believes that an annual schedule of beneficial inflows

should have been recommended for oysters, as was done by the Colorado-Lavaca BBEST.

The BBEST makes the case that while salinity may not significantly influence white shrimp, other effects of freshwater inflows may (page 4.115). The BBEST then provides a series of statistical analyses to relate freshwater inflows to white shrimp abundance, most notably Figure 4.5-26, which is a regression between these two variates (using freshwater inflows from June-Sept). This regression has a modest R^2 value, but it does appear to demonstrate increases in abundance as inflow increases. Ultimately, the BBEST concluded that "below 250,000 ac-ft, [total for July-Sept] there would appear to be a significant limiting effect on abundance..." TPWD staff believes freshwater inflow does influence white shrimp abundance and recommends further evaluation of the relationship between white shrimp abundance and freshwater inflows be considered in the work plan.

Integration of Instream Flow and Estuary Inflow Regimes

TPWD staff questions whether it is appropriate to simply add the HEFR tables for Goliad and Victoria (plus downstream ungaged flows) to facilitate a comparison to the recommended freshwater inflow regime. Appendix B of the SAC guidance document (Methodologies for Establishing a Freshwater Inflow Regime for Texas Estuaries Within the Context of the Senate Bill 3 Environmental Flows Process) takes a different approach, wherein daily flow data from various locations (Goliad, Victoria, TxRR) are summed to create a total inflow hydrology which is then entered into HEFR as an input and then a single new flow matrix is generated. Without a more detailed analysis, it is difficult to compare the advantages and disadvantages of the BBEST and SAC approaches. As long as the results are simply used semi-quantitatively to compare to freshwater inflow requirements, perhaps both approaches are acceptable.

Environmental Flow Regime Recommendations

As noted above, TPWD staff does not support the subsistence flow recommendations. This concern is somewhat ameliorated by the 50% diversion rule spelled out in Section 6.1.1. This implementation rule provides significantly increased protection, as compared to the BBEST's initial strawman recommendation of allowing all water to be diverted down to the subsistence flow value (when flows are below base under dry hydrologic conditions). However, if the implementation rule is not carried forward into the GSA

BBASC recommendation or is not adopted in TCEQ rulemaking, TPWD staff believes that the subsistence flow recommendations should be re-evaluated.

Concluding Comments

TPWD plans to remain involved with the important work of SB 3 and the Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays by offering technical and professional assistance and guidance to the GSA BBASC as requested. TPWD staff looks forward to assisting the BBASC and BBEST with the development of a focused and prioritized work plan that addresses many of the issues raised in the BBEST report and this letter.

Attachment

Appendix of Detailed Comments (listed by page number)

Page 4.10: Figure 4.1-2 illustrates various "inflow regime levels" with associated seasonality and ecosystem functions. These four flow levels are very similar to the four flow components commonly used in instream flow efforts (overbank events, high flow pulses, base flows, and subsistence flows). It's unclear whether there is a compelling reason to maintain different terminology, for essentially the same ideas, in the estuarine section as compared to the instream section.

Page 4.30: *Rangia* and oysters were chosen as focal species. However, since TPWD does not use sampling gear and methodologies designed to quantitatively sample *Rangia*, there is significant uncertainty related to this species' distribution, abundance, and trends.

Page 4.64 describes the occurrence of a few varieties of "low salinity-sensitive plant species." Given that the freshwater inflow recommendations are based on only two species (*Rangia* and oysters) and cover only 6-8 months (depending on flow level), the use of additional species, particularly ones with different life cycles, would have been beneficial. The limited data regarding these species is essentially the same as the (also limited) data that was available to the Trinity-San Jacinto BBEST in its salinity zone analysis of *Vallisneria*. TPWD staff recommends that additional species, particularly those with different life cycles, be further considered in the work plan.

Page 4.66: The report states that "for oysters the time window was chosen to cover the high temperature time of year July – September when the 'dermo' parasite can be problematic at high salinities". According to page 4.33, dermo "proliferates at temperatures above 68F and at salinities above 20psu suggesting a focus on non-winter months". A review of the TPWD Coastal Fisheries database suggests that the months of April – October have average temperatures above 68 °F. TPWD staff suggests that the BBEST revisit the temperature data and consider expanding the suite of months associated with oyster health in the work plan.

Page 4.84: Table 4.4-2 has a value of 0.73 for 2008. The chart on page 4.84 shows this at approximately 0.65 instead of 0.73. One of these is incorrect.

Page 4.94: TPWD staff recommends that the BBEST evaluate the expected frequency of *Rangia* spawning in their work plan. The inflow recommendations may vary if *Rangia* need to spawn every year to maintain viable populations.

Page 4.66 states "the salinity zone approach needs salinity data thoroughly covering the entire habitat extent, reflecting variations therein." TWPD staff questions the degree to which data "thoroughly covering…" are actually needed. As shown in Figure 4.2-7, isohalines (i.e., lines of equal salinity) are fairly smooth across both the oyster and *Rangia* habitat areas. Given the uncertainty in salinity suitability curves, it appears that the effort associated with the BBEST's approach could be reduced, with limited impact on the results, if simply two locations associated with each habitat area (one on the upstream end and one on the downstream end) were carried forward in the analysis.

Page 4.82: If TPWD staff understands the method correctly, 15 individual linear regressions between TXBLEND modeled salinity and Guadalupe River inflows were developed, one for each of the Thiessen polygons shown on Figure 4.4-9. Two correction factors were then added to each regression, one for low flows and one for high flows. Because the objective here is to fit modeled salinity data with a regression, it appears that a non-linear regression (e.g., quadratic) have been both simpler and more accurate than a linear regression with two correction factors.

Page 4.91: Figure 4.5-1 shows that the suite of freshwater inflow recommendations includes 6 tiers (A, B, C, CC, D, and DD). Some of these categories represent multiple years in the 69 year period of record. However, category CC represents only a single year and D represents only 2. Additionally, category CC is the only category where antecedent flows are part of the recommendation. Finally, category CC is recommended to occur no more than 1/6 of the total of categories C (as stated in Table 4.5-2, or 1/4, as stated in footnote #5 to Table 4.5-2) and CC combined, which have an unspecified combined recommended occurrence but only a 10% combined historical occurrence. TPWD staff wonders if the clearly rare category CC is so necessary that it warrants the inclusion of such complexity. If category CC could be dropped or modified, the complicated analyses and rules associated with the June antecedent flow could be avoided.

Page 4.102: The regression analysis of both Guadalupe and Mission-Aransas inflows concludes that "most of the behavior of salinity in this area, as related to inflow, is dominated by the influence of Guadalupe River inflows." This is based on the very modest improvement in R^2 values when the Mission-Aransas inflows are added to the regression (Figure 4.5-7). However, there could be an alternative explanation. If Mission-Aransas inflows are highly correlated to Guadalupe inflows, then it is possible that Mission-Aransas inflows actually have a substantial impact on salinities but this impact is masked by the statistical approach employed by the BBEST (i.e., running statistics using Guadalupe inflows, then adding Mission-Aransas). TPWD staff understands that the BBEST also performed the statistics with Mission-Aransas inflows first and then adding Guadalupe inflows, with the conclusion remaining that Guadalupe inflows are much more important to salinities than Mission-Aransas inflows. TPWD staff recommends that the BBEST and BBASC explore the dependence of Mission-Aransas salinities on Mission-Aransas inflows further in the work plan.

Page 4.134: To maintain *Rangia* habitat in Copano Bay, page 4.113 notes that the G1-Aprime category includes both a Guadalupe Estuary inflow value as well as a Mission-Aransas inflow value (50-125k ac-ft/yr). This latter Mission-Aransas inflow value does not appear in the synthesis inflow regimes on page 4.134. TPWD staff recommends that the BBEST clarify their intent with regards to the Mission-Aransas inflow requirements under the G1-Aprime criteria level.

Page 4.135: The attainment frequencies specified in the attainment goal tables (e.g., Table 4.6-3) are somewhat ambiguous. For example, G1-Aprime is recommended "at least 12% of years" and G1-A is recommended at least "12% of years." Consider the scenario where a model

simulation predicts that G1-Aprime will be met in 14% of years and G1-A in only 10% of years. Seemingly, this would be satisfactory from an ecological perspective, but this is clearly not allowed under the written recommendations. It may be helpful for the BBEST, in its deliberations with the BBASC, to recast these frequencies as "this category or a higher category." For example, G1-A could be recommended to be equaled or exceeded (up to the ceiling of the G1-Aprime category) at least 24% of the time.

Page 6.25: TPWD staff questions the value of Section 6.2 (Comparisons to Water Rights Permits) in the BBEST report. A comparison to special conditions in existing permits may not be useful in that such conditions were developed using a more limited technical analysis than that employed by the BBEST under its charge to use the best science available. It does not appear that these comparisons influenced the BBEST's recommendations.

Page 6.30: Clause 6.4.2(2) suggests that only 50% of the flows above subsistence must be passed, whereas the example clearly shows that this 50% is in addition to the subsistence flow itself. TPWD staff believes that the intent is clear, but the language ("...then 50% of the difference between inflow and the seasonal subsistence value must be passed, and the balance may be impounded...") could be misinterpreted. TPWD staff recommends that the BBEST closely coordinate with the BBASC and TCEQ to ensure that the correct intent is carried forward.