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December 1, 2025

Kelly Keel
Executive Director
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Re: 2024-2025 biennial report to the Environmental Flows Advisory Group

Dear Ms. Keel,

Pursuant to Texas Water Code (TWC) § 11.1471(g)(2), the Texas Water Development Board (TWDB) provides the following input to the Texas Commission on Environmental Quality (TCEQ) for their biennial report to the Environmental Flows Advisory Group (Advisory Group). Herein, the TWDB includes a list of its activities during the past biennium that are related to the adaptive management of environmental flow standards established under TWC § 11.1471. Additionally, the TWDB includes a summary of relevant environmental flow studies completed since adaptive management efforts began in 2013 (Attachment 1). This attachment includes new and updated studies as well as studies listed in the previous biennial report.

Activities during fiscal years 2024 – 2025

TWDB staff participated in the following public stakeholder meetings, including:

- Trinity-San Jacinto Basin and Bay Area Stakeholder Committee on May 1, 2024, and November 6, 2024.
- Brazos Basin and Bay Area Stakeholder Committee on October 19, 2023, January 11, 2024, April 11, 2024, July 11, 2024, October 10, 2024, April 10, 2025, and October 9, 2025.

In August 2023, the TWDB provided an opportunity for stakeholders to propose studies that support agency strategies to plan and guide the conservation of the state’s water resources, including studies which support adaptive management of environmental flow standards and advance our understanding of a sound ecological environment in streams, rivers, bays, and estuaries. The TWDB received 43 responses addressing topics to advance surface water science, including environmental flows. The TWDB considered these responses along with programmatic needs and funded the following eight projects in support of environmental flow adaptive management efforts.

- Texas A&M University – Corpus Christi. *Evaluation of phytoplankton population metrics as potentially robust, integrative indicators of environmental flows.* Texas Water Development Board Contract #2400012869.

Our Mission

Leading the state’s efforts
in ensuring a secure
water future for Texas

Board Members

L’Oreal Stepney, P.E., Chairwoman | W. Brady Franks, Board Member | Ashley Morgan, Board Member
Bryan McMath, Executive Administrator

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- U.S. Geological Survey. *Coastal water quality monitoring and data collection*. Texas Water Development Board Contract #2400012764.
- Texas A&M University. *Developing a long-term historical daily reservoir evaporation dataset to support water planning and management in Texas*. Texas Water Development Board Contract #2400012867.
- The University of Texas at Austin. *Developing a methodology to derive projected runoff for Texas river basins*. Texas Water Development Board Contract #2400012885.
- Texas State University. *A review of sediment science*. Texas Water Development Board Contract #2500012924.
- The University of Texas Bureau of Economic Geology. *Aerial electromagnetic survey of a portion of the Brazos River Alluvial Aquifer*. Texas Water Development Board Contract #2500012918.
- The University of Texas Bureau of Economic Geology. *Assessing the predictability of transitioning from wet-to-dry and dry-to-wet conditions to assist water management decisions*. Texas Water Development Board Contract #2400012870.
- United States Geological Survey. *Methods for validating reservoir evaporation data*. Texas Water Development Board Contract #2500012904.

Sincerely,



Bryan McMath
Executive Administrator

Attachment: Environmental flow studies 2013 – 2025

Attachment 1. Environmental flow studies 2013 – 2025

The Texas Water Development Board (TWDB) has provided technical and financial support to the adaptive management process since Fiscal Year 2013. Below is a bibliography, organized by basin, of studies conducted that are relevant to environmental flows in Texas. Many studies were funded to support the needs of basin and bay stakeholder committees. Citations noted with a star symbol (*) indicate newly published studies or studies nearing completion since TWDB's 2022 – 2023 biennial report.

Statewide/Multi-Basin

- *2024. Coffey, D.M., F.D. Urrutia, and P.A. Montagna. [Focused flows to protect estuarine nursery habitats](#). Texas Water Development Board Contract #2300012670.
- *2024. Du, J. and K. Park. [Development of a cross-scale hydrodynamic model for Texas coastal waters](#). Texas Water Development Board Contract #2300012715.
- *2024. Lee, M. and z, Lucena. *Water quality, nutrient, and sediment monitoring in four estuaries: Trinity-San Jacinto, Colorado-Lavaca, Guadalupe-San Antonio, and Nueces*. Texas Water Development Board Contract #2200012610; data only.
- *2023. Pearson, C., T. Ott, B. Daudert, S. Sueki, B. Zhao, H. Gao, and J.L. Huntington [Monitoring daily reservoir evaporation losses for the State of Texas](#). Texas Water Development Board Contract #2200012601.
- *In Prep. Zhang, Y., H. Nguyen, R. Geressu, Y. Gan. *Enhancing the data to advance Forecast-Informed Reservoir Operations (FIRO) for operational water management in Texas*. Texas Water Development Board Contract #2300012685.
- *In Prep. DeYoe, H. and J. Brier. *Coastal sediment porewater salinity monitoring methods for Texas*. Texas Water Development Board Contract #2300012739.
- 2023. U.S. Geological Survey. *Continuation of suspended sediment sampling at TCEQ environmental flows measurement points in seven river basins: Neches, Trinity, Brazos, Lavaca, Colorado, Guadalupe-San Antonio, and Nueces*. Texas Water Development Board Contract #2000012412; data only.
- 2022. Montagna, P.A. [Long-term benthic data: adaptive management of three basins](#). Texas Water Development Board Contract #2000012436.
- 2022. Winemiller, K., J. Trungale, A. Schwalb, T. Hardy, G. Moore, J. Perkin, D. Hoeninghaus, and D. Buzan. [Environmental flow regime assessment and development of a monitoring framework](#). Texas Water Development Board Contract #1800012317.
- 2021. Dunn, D., S. Schnier, C. Corso, and J. Walker. [Effects of recommended reuse strategies on Brazos basin streamflow](#). Texas Water Development Board Contract #2100012470.
- 2021. Anchor QEA, LLC and Hoffpauir Consulting. [Evaluating the attainment of environmental flow standards](#). Texas Water Development Board Contract #2100012465.
- 2021. Hardy, T., K. Winemiller, E. Buskey, G. Guillen, J. Trungale, D. Opdyke, T. Annear, A. Locke, and C. Estes. [Statewide synthesis of environmental flow studies \(2014-2017\)](#). Texas Water Development Board Contract #1900012284.

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- 2021. Lee, M. and Z. Lucena. *Freshwater, nutrient, and sediment monitoring in four lower river basins: Trinity-San Jacinto, Colorado-Lavaca, Guadalupe-San Antonio, and Nueces*. Texas Water Development Board Contract #1900012323; data only.
- 2020. U.S. Geological Survey. *Suspended sediment sampling at TCEQ environmental flows measurement points in four river basins: Trinity, Brazos, San Antonio, and Guadalupe*. Texas Water Development Board Contract #1800012253; data only.
- 2020. Wetz, M.S. and T. Chin. [Influence of freshwater inflow gradients on estuarine nutrient-phytoplankton dynamics](#). Texas Water Development Board Contract #1800012228.
- 2020. Montagna, P.A., P.M. Cockett, and M. Rohal. 2020. [Using comparative long-term benthic data for adaptive management of freshwater inflow to three basins](#). Texas Water Development Board Contract #1800012223.
- 2019. Hayes, T., and D. Baker. [Riparian productivity in the Brazos, Guadalupe, and Trinity River Basins, Texas](#). Texas Water Development Board Contract #1600011933.
- 2019. Lee, M., R. Banta, Z. Lucena, C. Crow, and D. Okerman. *Freshwater, nutrient, and sediment monitoring in four lower river basins: Trinity-San Jacinto, Colorado-Lavaca, Guadalupe-San Antonio, and Nueces*. Texas Water Development Board Contract #1600011927; data only.
- 2017. Montagna, P.A., M. Wetz, and X. Hu. [Monitoring mid-coastal estuaries - 2016](#). Texas Water Development Board Contract #1600011924.
- 2013 – 2021. *Coastwide bay and estuary water quality monitoring: Sabine-Neches, Trinity-San Jacinto, Colorado-Lavaca, Guadalupe-San Antonio, Nueces, and Laguna Madre*. Texas Water Development Board Contracts #1348311519, 1448311634, #1548311784, #1600011925, #1600011927, #1800012170, #1900012323, #2000012381, #2100012460, #2200012610; data only.

Sabine-Neches Basin and Sabine Lake

Note: The Sabine-Neches Basin and Bay Area Stakeholder Committee has not requested adaptive management studies.

Trinity-San Jacinto Basin and Galveston Bay

- **In Prep.* Gao, H. *Assessment of Subseasonal-to-Seasonal (S2S) streamflow and reservoir storage forecast skills in the Trinity River Basin*. Texas Water Development Board Contract #2300012701.
- 2023. Trinity River Authority. [Evaluation of adopted flow standards for the Trinity River: Phase 4](#). Texas Water Development Board Contract #2000012407.
- 2023. Tull, N., P. Passalacqua, and B. Hodges. [Quantifying hydrological connectivity in the Trinity River Delta](#). Texas Water Development Board Contract #2000012435.
- 2023. Bare, R., S. Glenn, and K. Vernin. [The assimilative capacity of Lake Livingston: nutrients, sediments, and high flow events](#). Texas Water Development Board Contract #2000012458.

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- 2022. Mangham, W., K. McKnight, T. Osting, P. Southard, and D. Flores. [Evaluation of adopted flow standards for the Trinity River, phase 3](#). Texas Water Development Board Contract #1800012226.
- 2020. Li, Z., B. Hodges, and P. Passalacqua. [Building the Trinity River Delta hydrodynamic model](#). Texas Water Development Board Contract #1800012195.
- 2019. Quigg, A. and J. Steichen. [Defining bioindicators for freshwater inflow needs studies, phase 2: defining a sound ecological environment for Galveston Bay](#). Texas Water Development Board Contract #1600011941.
- 2018. Li, Z., P. Passalacqua, and B. Hodges. [Hydrodynamic model development for the Trinity River Delta](#). Texas Water Development Board Contract #1600011928.
- 2017. Mangham, W., T. Osting, and D. Flores. [Evaluation of adopted flow standards for Trinity River, phase 2](#). Texas Water Development Board Contract #1600011940.
- 2015. U.S. Geological Survey. [Determination of freshwater inflow volume from the Trinity River into Galveston Bay, May 2014 – August 2015](#). Texas Water Development Board Contract #1400011697.
- 2015. Mangham, W., T. Osting, and D. Flores. [Lidar acquisition and flow assessment for the middle Trinity River](#). Texas Water Development Board Contract #1400011696.
- 2015. Quigg, A. and J. Steichen. [Defining bioindicators for freshwater inflow needs studies](#). Texas Water Development Board Contract #1400011695.

Brazos River Basin and Riverine Estuary

- *2024. Owens, R., R.G. Aguilar, and J.R. Giardino. Texas A&M University. [Evaluation of geomorphic changes of the Little River, Texas](#). Texas Water Development Board Contract #2300012679.
- *2024. Zhang, Y. and S. Fakhreddine. [A model-based investigation of streamflow in the Upper Brazos River Basin](#). Texas Water Development Board Contract #2200012624.
- 2022. Guillen, G., J. Oakley, and M. Mokrech. [Baseline research studies in support of validation or refinement of the adopted Texas Commission on Environmental Quality Environmental flow standards for the Brazos River Estuary: Methods Summary](#). Texas Water Development Board Contract #1800012239.
- 2021. Schnier, S. [Assessment of how trends in the Brazos River basin may affect surface water availability and attainment of environmental flow standards](#). Texas Water Development Board Contract #2100012466.
- 2017. Bonner, T., J. Duke, G. Guillen, and BIO-WEST, Inc. [Instream flows research and validation methodology framework 2016-2017: Brazos River and Associated Bay and Estuary System](#). Texas Water Development Board Contract #1600012009.
- 2015. Bonner, T., J. Duke, G. Guillen, K. Winemiller, and BIO-WEST, Inc. [Instream flows research and validation methodology framework and Brazos Estuary characterization](#). Texas Water Development Board Contract #1400011722.

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Colorado-Lavaca River Basin and Matagorda and East Matagorda Bays

- 2023. Hayes, T.D., Z. Chi, and H. Valencia. [Hydraulic connectivity to riparian habitats in the Colorado and Lavaca basins](#). Texas Water Development Board Contract #2000012438.
- 2022. Batterton, B.E. and K.H. Dunton. [Lavaca River Delta marsh assessment](#). Texas Water Development Board Contract #2000012439.
- 2021. Madewell, M.J., R.A. Feagin, T.P. Huff, and B. Balboa. [Informing environmental flow protection efforts for the sustainability of wetlands in East Matagorda Bay: phase I Big Boggy](#). Texas Water Development Board Contract #2000012414.
- 2021. Bene, J., T. Fenstemaker, and S. Young. [Surface water-groundwater interaction pilot study](#). Texas Water Development Board Contracts #1900012305, #2000012350, and #2000012349.
- 2020. Zhang, Y., M.A. Rahman, M. Ghazvinian, and D.J. Seo. [Developing a multi-model simulation system for estimation and prediction of freshwater inflow to Matagorda Bay](#). Texas Water Development Board Contract #1800012276.
- 2020. Montagna, P.A., P.M. Cockett, E.M. Kurr, and J. Trungale. [Assessment of the relationship between freshwater inflow and biological indicators in Lavaca Bay](#). Texas Water Development Board Contract #1800012268.
- 2019. Furnans, J., M. Keester, and K. Kennedy. [Evaluation of rainfall-runoff trends in the upper Colorado River basin \(phase two\)](#). Texas Water Development Board Contract #1800012283.
- 2017. Kennedy Resource Company, R.J. Brandes Consulting, and Crespo Consulting Services, Inc. [Evaluation of rainfall-runoff patterns in the upper Colorado River basin](#). Texas Water Development Board Contract #1600012011.
- 2017. Bonner, T., J. Duke, and BIO-WEST, Inc. [Instream flows research and validation methodology framework 2016-2017, Colorado and Lavaca Rivers](#). Texas Water Development Board Contract #1600012010.
- 2015. Austin, B., A. Kennedy, T. Osting, and C. Walker. [Evaluation of freshwater delivery alternatives to East Matagorda Bay](#). Texas Water Development Board Contract #1400011759.
- 2015. Anchor QEA, BIO-WEST, Inc., J.F. Trungale Engineering and Science, and T. Soniat. [Studies to evaluate achievement of freshwater inflow standards and ecological response](#). Texas Water Development Board Contract #1400011715.

San Antonio-Guadalupe River Basin and San Antonio Bay

- *2025. Sullivan, K.T., C.R. Kunkel, B.M. Littrell, E.L. Oborny. [Seasonal ecological assessment in the upper Guadalupe Estuary](#). Texas Water Development Board Contract #2300012700.
- 2023. Goldsmith, A. M., M. DeMoulied, X. Rangaswami, A. Kiser, and C. Randklev. [Literature review to evaluate mussel-flow ecology in the lower Guadalupe River basin](#). Texas Water Development Board Contract #2100012464.

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- 2022. Jenkerson, J. T., Sullivan, K.T., B.M. Littrell, and E.L. Oborny. [Seasonal ecological assessment in the upper Guadalupe Estuary](#). Texas Water Development Board Contract #2100012475.
- 2020. Sullivan, K., C. Williams, B.M. Littrell, and E. L. Oborny. [Seasonal ecological assessment in the upper Guadalupe Estuary](#). Texas Water Development Board Contract #1800012267.
- 2019. Scheef, L.P. and E.J. Buskey. [Assessing the effects of freshwater inflows and other key drivers on the population dynamics of blue crab and white shrimp using a multivariate time series modeling framework: phase 2](#). Texas Water Development Board Contract #1600011966.
- 2017. San Antonio River Authority, T. Bonner, J. Duke, BIO-WEST, Inc. [Instream flows research and validation methodology framework 2016-2017: Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays Basin](#). Texas Water Development Board Contract #1600011937.
- 2017. Guadalupe Blanco River Authority. *San Antonio Bay water circulation monitoring and data collection*. Texas Water Development Board Contract #1600011930; data only.
- 2015. San Antonio Bay Partnership, Inc., Trungale Engineering & Science, and ASR Systems, LLC. [Strategy options for meeting attainment frequencies for the estuaries](#). Texas Water Development Board Contract #1400011713.
- 2015. Buskey, E.J., L.P. Scheef, and J. Xue. [Assessing the effects of freshwater inflows and other key drivers on the population dynamics of blue crab and white shrimp using a multivariate time series modeling framework](#). Texas Water Development Board Contract #1400011712.
- 2015. Black, B.A. and M. Heaney. [Rangia clam investigations](#). Texas Water Development Board Contract #1400011711.
- 2015. Carothers, R., Hodges, B., and P. Passalacqua. [Guadalupe bayou flow and inundation study](#). Texas Water Development Board Contract #1400011710.
- 2015. San Antonio River Authority, T. Bonner, J. Duke, BIO-WEST, Inc. [Instream flows research and validation methodology framework: Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays Basin](#). Texas Water Development Board Contract #1400011709.

Nueces River Basin and Mission-Aransas and Corpus Christi Bays

- 2019. Dunton, K.H., T. Whiteaker, and M.K. Rasser. [Patterns in the emergent vegetation of the Rincon Bayou Delta, 2005-2016](#). Texas Water Development Board Contract #1600011971.
- 2019. Scheef, L.P. and E.J. Buskey. [Nueces Bay circulation assessment using tilt current meters](#). Texas Water Development Board Contract #1600011935; available upon request.
- 2018. Saylam, K., J.R. Hupp, J.R. Andrews, and A.R. Averett. [Airborne lidar survey of the Frio River, Texas](#). Texas Water Development Board Contract #1800012220.
- 2017. Buzan, D. and E. To. [Alternative methods to add freshwater to the Nueces Delta](#). Texas Water Development Board Contract #1600012016.

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- 2017. Anchor QEA, LLC. [Nutrient budget for Nueces Bay](#). Texas Water Development Board Contract #1600012015.
- 2017. Shockley, A.C. and Z. Stein. [Nueces BBASC work plan study: re-examination of the 2001 Agreed Order monthly targets: phase 2](#). Texas Water Development Board Contract #1600012014.
- 2017. Dodson, J., G. Jackson, C. Koester, M.E. Vega, K. Thompson, H. McNeil, B. Hodges, C. Jalbert, A. Gilmer. [Using landform and hydraulic modifications to increase the benefit of freshwater inflows to Nueces Bay and Nueces Delta – phase II: verification and feasibility assessment for landform modifications in the Nueces Delta](#). Texas Water Development Board Contract #1600012013.
- 2016. Dodson, J., K. Dunton, E. Hill, B. Hodges, G. Jackson, B. Nicolau, M.K. Skoruppa, D. Sullivan, K. Thompson, and G. Ward. [Using landform and hydraulic modifications to increase the benefit of freshwater inflows to Nueces Bay and Nueces Delta](#). Texas Water Development Board Contract #1400011717.
- 2015. Li, Z. and B.R. Hodges. [Modeling salinity fluxes in the Nueces Delta](#). Texas Water Development Board Contract #1400011719.
- 2015. Lemonds, P.J. [Nueces BBASC work plan study no. 3: Nueces watershed pre- and post-development nutrient budgets](#). Texas Water Development Board Contract #1400011718.
- 2015. Shockley, A.C. [Nueces BBASC work plan study no.1: re-examination of the 2001 Agreed Order monthly targets and safe yield versus current demand evaluations](#). Texas Water Development Board Contract #1400011716.

Rio Grande Basin and Laguna Madre Estuary

- 2023. *Lower Rio Grande Valley: Stream and estuary observational monitoring*. Texas Water Development Board Contract #2100012462; data only.