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GIS in Water Resources
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Refining Environmental Flow/Pulse Flow Standards Using GIS and Precipitation-to-Flow Modeling

In order to protect the waters of Texas while permitting water diversions by people and corporations, the Texas Commission on Environmental Quality (TCEQ) is putting in place “environmental flow” standards across the state. These standards are designed to keep Texas' water from being over-allocated: they comprise base flow requirements, which assure a minimum flow at all times to prevent streams running dry, and pulse flow requirements, which prohibit the diversion of water during a certain number of high flow events per season so as to assist in reservoir recharge and the other positive consequences of occasional high flows. The pulse standards require diversion permit holders to stop diverting when a certain level of flow is reached and not begin again until a given amount of time has passed or a given amount of water has flowed past the diversion point.

These pulse standards are already being applied in a few places – the Trinity River, the San Jacinto River, Galveston Bay, the Neches River, and the Sabine River and Sabine Lake Bay – but they may not be fair to all permit holders. The current system forces everyone who diverts from a particular waterbody or any of its tributaries to obey the standards identically. However, precipitation and the other events that might cause temporary high flows (such as a release of water from a reservoir) do not necessarily affect the tributaries and the main stem of the stream in the same way. Imagine, for example, that water is released from a reservoir, causing a high flow event downstream. Now consider a permit holder who diverts water along a tributary that joins the stream just below the reservoir. The tributary will not experience a high flow because of a reservoir release into the main stem of the river, but that permit holder might nevertheless be required to stop diverting water until the pulse standards have been met. The goal of this project is to refine the standards to avoid such situations.

The project will begin with a thorough review of the information necessary to understand both the problem and an approach to a solution. This will include reports from the TCEQ on the process of developing these standards, data from the TCEQ on current standards and the actual flows and diversions in the basins where they apply, and information from Cedric David's dissertation research on modeling how precipitation becomes overland flow and eventually reaches surface waterbodies. A GIS will then be developed to incorporate the locations of TCEQ permit holders' diversion points and the model created by David to allow adjustment of pulse flow requirements depending on location-specific flows and display of the results for use by the TCEQ in applying these adjusted standards.