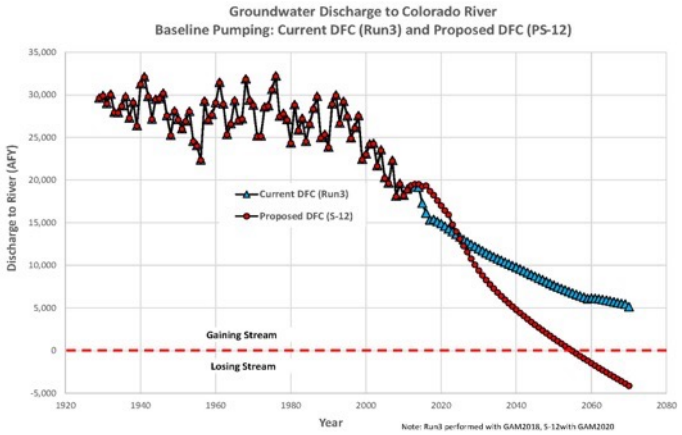
GMA-12 DFCs
Environmental Stewardship's Proposal, Discussion of Current and Proposed DFCs



Presented to
GMA-12
April 20, 2021 - Virtual Meeting

Environmental Stewardship™
A Sustainable Ecosphere

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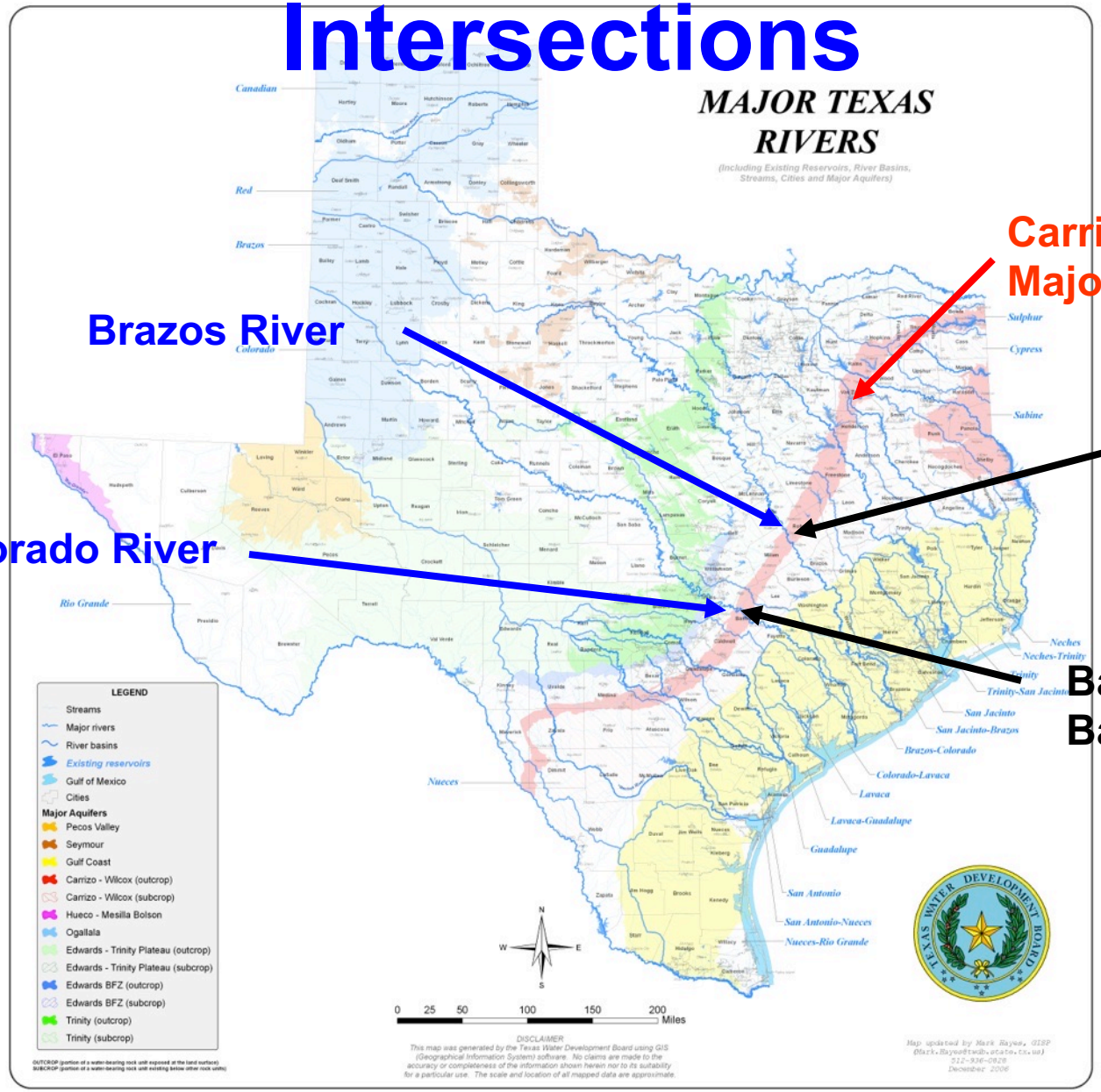
Ground & Surface Water Intersections



Carrizo-Wilcox Major Aquifer

Brazos River

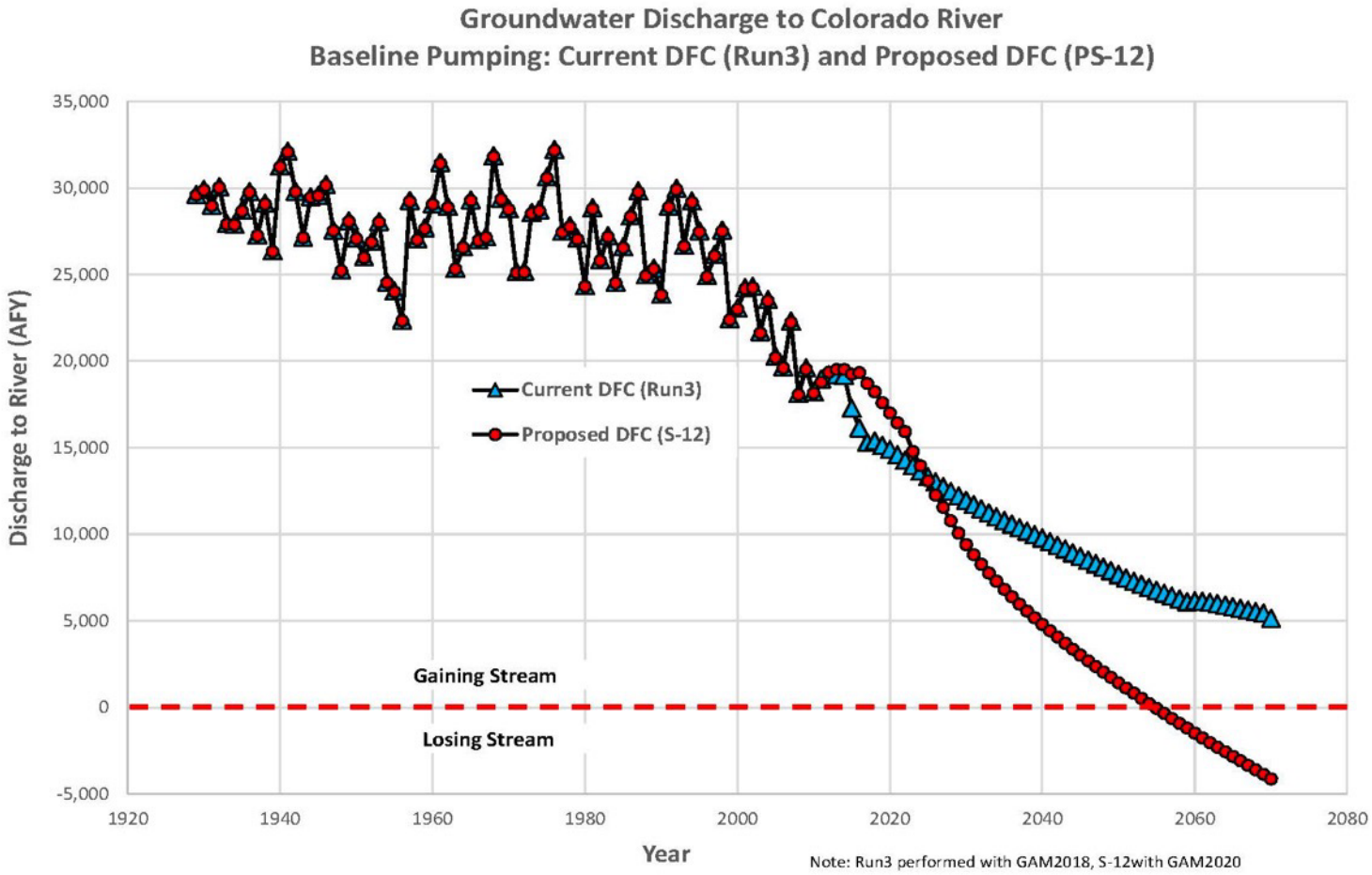
Milam/ Robertson Counties

Colorado River

Bastrop, TX Bastrop County

IMPACT OF PUMPING
ON OUTFLOWS TO MAIN STEM COLORADO RIVER

Adopted 2017 DFCs vs. Proposed DFCs:



Predicted reduction of discharge of groundwater into the mainstream Colorado River due to Current DFC Run 3 and Proposed DFCs S-12 (George Rice, New GAMs).

IMPACT OF PUMPING
ON OUTFLOWS TO MAIN STEM COLORADO RIVER

Discharge to Colorado River - AFY (1)				
Year	Pre-Development	Early Pumping	Current DFC	Proposed S-12
1930	29,600			
1995	27,500			
2011		18,700		
2070			5,150	-4,100
Change from 1930	**-2,100**	**-8,800**	**-22,350**	**-31,600**
	-7%	**-37%**	**-83%**	**-114%**

(1) Data From Rice Current vs Proposed DFC Graph

SURFACE WATER MODELING PREDICTS UNREASONABLE IMPACTS OF GROUNDWATER PUMPING ON SURFACE WATERS OF THE COLORADO RIVER

- **Use of established environmental flow standards is the appropriate means of evaluating the impact of groundwater pumping on surface waters.**

- **Senate Bill 3 on environmental flows acknowledges that *maintaining the biological soundness of the state's rivers, lakes, bays, and estuaries is of great importance to the public's economic health and general well-being*.**

Joe Trungale

Ecological impacts of reduced surface water flows due to groundwater pumping

Joe Trungale
Trungale Engineering
Presentation to GMA-12
April 20, 2021

Impacts on Surface Waters

- **Water in the Colorado River at Bastrop and below has, for all intents and purposes, been fully appropriated; *i.e.* no more water remains available for future appropriation as a water right.**
  - Any reductions in flows negatively impact existing water rights holders.
  - Groundwater pumping appears to create a gradual reduction of reliable streamflows, over a relatively long period of time.
- **The reduction in flows impact the ecological health of the Colorado River**.
  - Instream flow standards were adopted for the Colorado Rivers that included subsistence, base, high flow pulse, and bankfull flows necessary to maintain a sound environment for the Colorado River.
  - Subsistence flows should be considered “hands off flows” with the goal that flows should be met 100% of the time.
- **Environmental flow standards are not being met at recommended frequencies, and additional groundwater pumping will likely result in further reduction in these attainment frequencies.**
  - Attainment frequencies need to be met below Bastrop during spring when the *base dry and base average flows* are important to maintain the spawning habitat for the Blue Sucker.

Impacts on Surface Waters

In Summary:

- The effect of the proposed groundwater pumping on surface water resources is unreasonable because it increases the shortfalls in meeting environmental flow targets.

- Since the flows in the river are already often below levels needed to maintain the ecological health of the river, then any additional pumping that causes further instream flow reduction is unreasonable.

2021 ES Proposal

▲ Monitor Impacts

- A surface water monitoring project consisting of:
  - Design, install, initial data collection, and develop of monitoring protocols.
  - Ongoing monitoring of the surface water-groundwater (SW-GW) interactions between the Colorado River, its tributaries, the Colorado Alluvial Aquifer, and the Carrizo-Wilcox Aquifer Group.
  - Such monitoring is needed to conjunctively manage these resources.
- Information and data from the project will:
  - Enable *more reliable* predictions regarding the current and future impacts of groundwater pumping on the surface waters in Bastrop County, Texas.
  - Enable DFCs to be adopted.
  - Enable further improvements to the GMA-12's 2020 GAM.

George Rice

DFC to Protect Groundwater Discharges to Streams

George Rice
Presentation to GMA-12
April 20, 2021

2021 ES Proposal

FIELD DATA COLLECTION

ES Comments to GMA-12 submitted March 18, 2021, we outline our proposal to collect the field data needed.

- This is a proposal to begin gathering the data needed to establish a realistic and quantifiable DFC to protect groundwater discharges to the Colorado River and its tributaries.

- Groundwater discharges cannot be directly observed. However, the discharges are directly related to water levels in the alluvium along the streams.

- ES proposes establishing a DFC for the Colorado Alluvium Aquifer.

2021 ES Proposal

FIELD DATA COLLECTION

A Proposal to Collect Information Required to Establish a DFC to Protect Groundwater Discharges to the Colorado River and its Tributaries

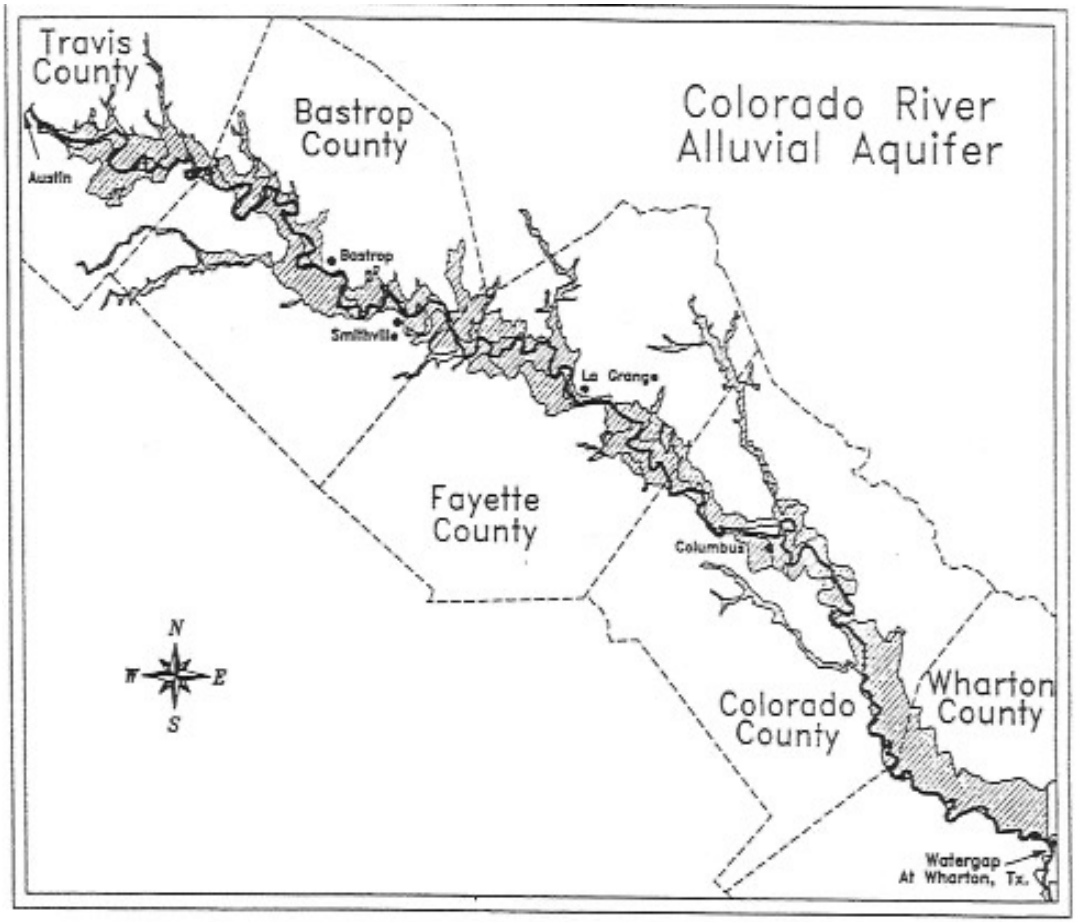


Figure 1. Extent of the Colorado River Alluvium, south-central Texas (after Barnes, 1974).

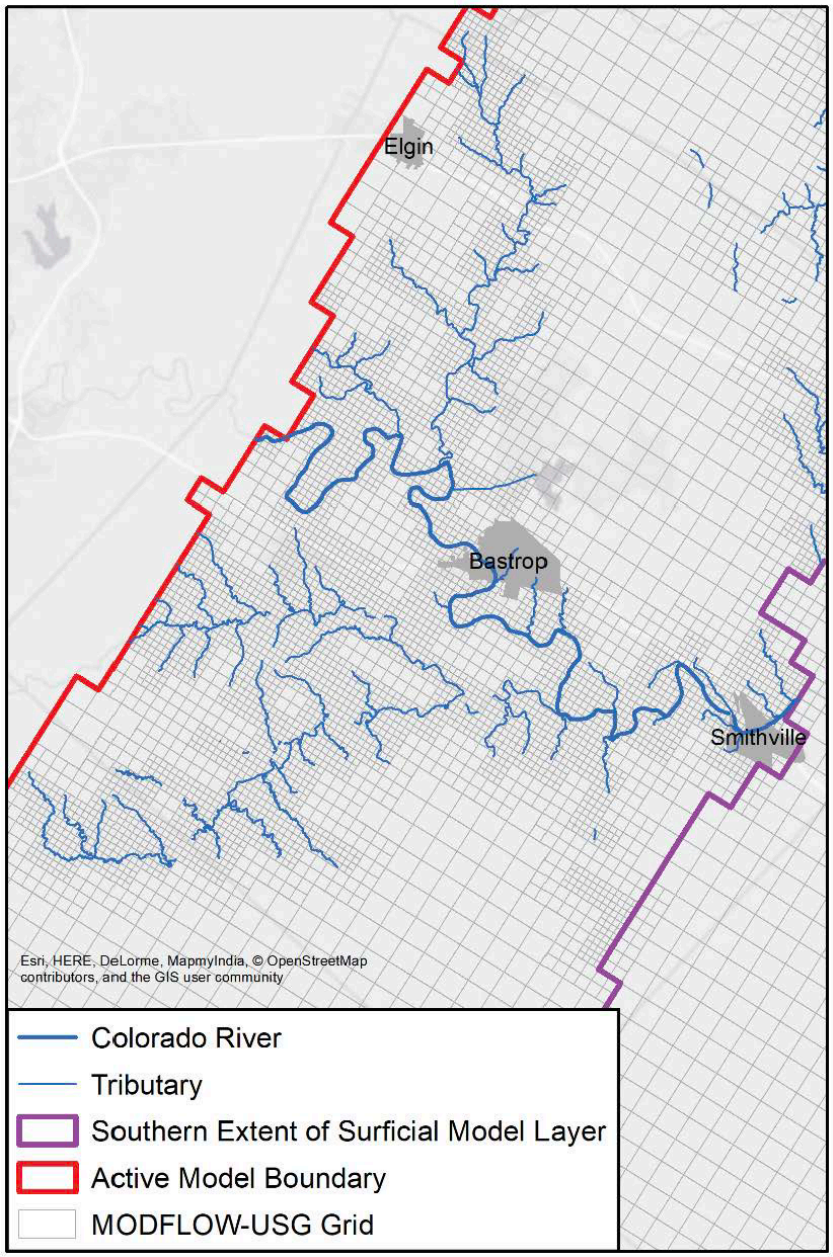
Figure 1. Extent of the Colorado River Alluvium, south-central Texas (after Barnes, 1974)

2021 ES Proposal

FIELD DATA COLLECTION

Extent of the Colorado River Alluvium in 2020 GAM

Numerical grid showing locally-refined grid with 0.25-mile by 0.25-mile square grid cells in the vicinity of the Colorado River and its major tributaries in the updated model.



2021 ES Proposal

FIELD DATA COLLECTION

- A realistic DFC requires a better understanding of the relationship between the alluvium and the streams.
  - Some of the data needed is already being gathered[1].
  - More will be required.
  - ES proposes that GMA-12/Districts
    - Direct its consultants to develop and implement a monitoring plan, and/or
    - Issue a request for proposals (RFP) to collect the required information and monitor long-term trends.

[1] Fenstemaker, Batchelder, September 2020, E.g., the Surface Water/Groundwater Interaction Study at the Vista site.

2021 ES Proposal

▲ Establish Desired Future Conditions For Colorado Alluvial Aquifer under Section 36.1071(a)

- **Sec. 36.108 JOINT PLANNING. (d-2):** This subsection does not prohibit the establishment of desired future conditions that provide for the reasonable long-term management of groundwater resources consistent with the management goals under Section 36.1071(a)

2021 ES Proposal

- **Sec. 36.1071. MANAGEMENT PLAN.** (a) Following notice and hearing, the district shall, in coordination with surface water management entities on a regional basis, develop a management plan that addresses the following management goals, as applicable:
  (1) providing the most efficient use of groundwater;
  (2) controlling and preventing waste of groundwater;
  (3) controlling and preventing subsidence;
  (4) **addressing conjunctive surface water management issues;**
  (5) **addressing natural resource issues;**
  (6) **addressing drought conditions**;
  (7) addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective; and
  (8) addressing the desired future conditions adopted by the district under Section 36.108.

2021 ES Proposal

- **Proposed Surface Water DFC**

  - To provide long-term conjunctive management of the Colorado Alluvial Aquifer in Bastrop County by maintaining water levels in the alluvial aquifer x ft above water levels in the river in order to protect groundwater baseflow contributions to the environmental flows in the Colorado River and tributaries, during normal, dry and drought conditions, in perpetuity.

  - Maintain Colorado Alluvial Aquifer water level ABOVE the river water level.

2020 ES Proposal

▲ DESIRED FUTURE CONDITION (DFC)

- **Performance Standards:**
  - Long-Term (in perpetuity)
  - Maintain a desired amount of flow of groundwater from the alluvial aquifer to the Colorado River and its tributaries throughout each succeeding management period based on:
    - Water levels in the alluvial aquifer (and other aquifers if appropriate),
    - Desired outflows to the river and its tributaries.
    - **DFCs established for the Colorado Alluvium Aquifer**

  - Near-Term (Present through ~2027)
  - Quantify the desired amount of flow of groundwater from the alluvial aquifer during the fourth DFC review cycle from field data collected in the interim.
    - Install monitoring and maintain stations (similar to Vista site) to quantify flows between aquifers, and between the aquifers and the streams.
    - Install and maintain monitoring wells or piezometers in the alluvium throughout Bastrop County in order to measure and quantify water levels in the alluvium, establish baselines, and detect trends.

2021 ES Proposal

▲ GCD MANAGEMENT PLANS

- Management plans are required to addresses the eight management goals, as applicable, including:
  - conjunctive surface water management issues,
  - natural resource issues,
  - drought conditions,
  - conservation, and
  - desired future conditions.

- Management plans are required to be updated and re-adopted following each joint-planning cycle.

2021 ES Proposal

▲ Adoption of 2022 DFCs: Explanatory Report should

- Explain the intent to ultimately adopt a DFC for the Colorado River Alluvium,
- Explain the activities planned and the information to be gathered in order to adopt a DFC in the next cycle.

Advisory Board on SW-GW Interaction

HB 2652 and SB 1039 to establish an advisory board to study groundwater and surface water interactions.

Per Lyle Larson (Author):

- To provide a meaningful forum to study and develop policy solutions to guide the legislature forward in dealing with this issue.
- We are spending 10's of millions of dollars fighting the state adjacent to us and we don't recognize this in our own state.
- This brings us forward, to stop the hypocrisy, we need to address this issue.
- We see the next significant drought; this is where the litigation is going to be based.
- We can preempt this by addressing the issues, having the stakeholders at the table and develop a process to have a seam-full regulatory process for all of water in Texas instead of having the two.

Discussion of CONSIDERATION 4

ES has presented evidence that surface waters have been, and will be, considerably impacted by groundwater pumping.

- Does the groundwater pumping in the Proposed DFCs have the potential for unreasonable impacts?

- Does the groundwater pumping from the Proposed DFCs provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, … of groundwater and surface waters… in the management area?
  - Including the Colorado Alluvium Aquifer.

- What actions need to be taken to prevent or mitigate impacts on surface waters?
  - Monitor SW-GW interactions?
  - Monitor Colorado Alluvium Aquifer?
  - Set DFC to protect Colorado River and Tributaries?
  - Develop Management Plans to guide monitoring and future actions?
  - Amend Rules to provide for actions described in Management Plans?

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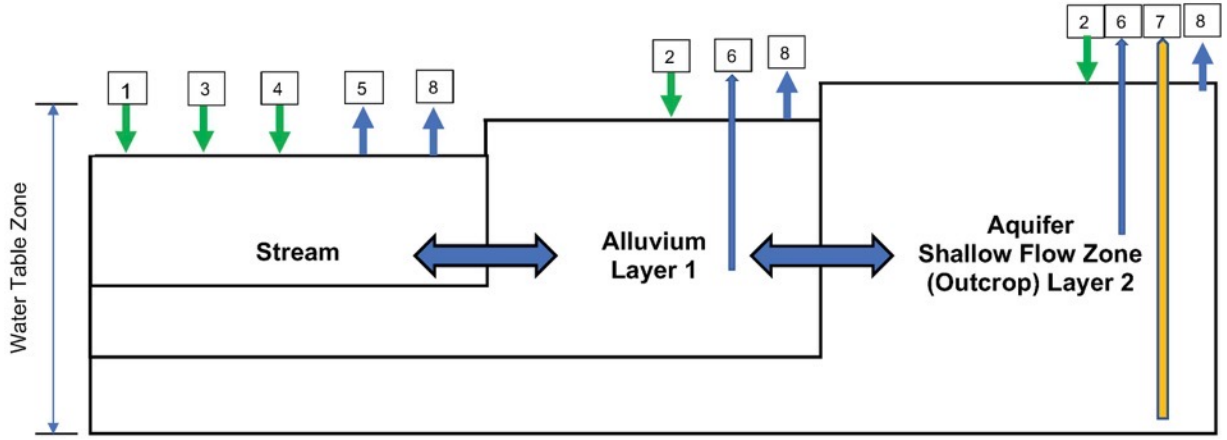
2021 ES Proposal

Inflows and outflows relative to stream, alluvium, and aquifer layers



Inflows

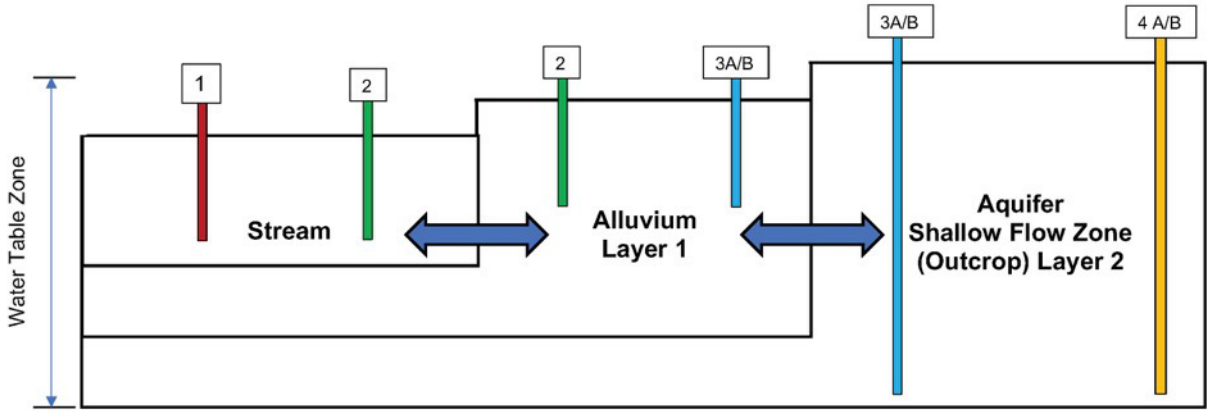
1. Precipitation (Storm Water)
2. Precipitation (Recharge)
3. Municipals (Return Flows)
4. LCRA (Highland Lake Releases as directed by Water Management Plan)

Outflows

5. Surface Water Rights (diversions)
6. Exempt wells (withdrawals)
7. Commercial Non-exempt wells (withdrawals)
8. Evapotranspiration (outflow)

2021 ES Proposal

Conceptual layout of monitoring measurement tools in relationship to stream, alluvium and aquifer layers.



1. USGS Stream Gage	Measures water level, flow rate, and discharge
2. Piezometer	Measures water level, temperature, dissolved solids
3. Monitoring Well	
Type A - Drilled and spaced	Measures depth and water quality
Type B - Existing	Measures depth and possibly water quality
4. Production Well	No monitoring measurements
Type A - Exempt Domestic	
Type B - Non-Exempt Commercial	