

Appendix 5B-B

Quantification of Environmental Impacts of Water Management Strategies and Strategy Evaluation Matrix

In accordance with TWDB rules and guidelines pursuant to TAC 357.5 (e)(4), the East Texas Regional Planning Group (ETRWPG) is required to summarize the approach used for identifying and selecting Water Management Strategies (WMS) for development of the 2016 Regional Water Plan (RWP). This approach classifies the strategies using the TWDB's standard categories developed for regional water planning.

Potential WMSs were developed based on the needs identified for Water User Groups (WUGs) from a comparison of projected demands and existing supplies. Similarly, Wholesale water providers (WWP) supplies and existing contracts were reviewed to determine the needs. Appropriate WMSs were developed for the WWPs to address the needs. In some cases, WMSs were developed for WUGs and WWPs that wanted to increase their system reliability and develop additional supplies even if there was no immediate need.

The viability of the WMS for a given WUG or WWP was determined by using the following considerations:

- Is it preferable to identify a groundwater or surface water or reuse or demand reduction strategy for the WUG/WWP?
- Does this strategy alone meet the entire need for the WUG/WWP or does it need to be paired with other strategy?
- Is the strategy within the reasonable proximity to the location of the water need?
- Is this the most preferred strategy for the WUG/WWP?
- Is the unit cost supportable by the WUG/WWP?
- Are there any flaws identified with the implementation or formulation of the strategy for the WUG/WWP?

After the strategies are developed based on the initial screening process, each WMS was evaluated based on the matrix criteria listed below. Each WMS was given a score from one to five for each analysis criterion and a matrix of rated WMS was developed. The analysis criteria include the following:

- Quantity
- Reliability
- Cost
- Environmental Factors
- Impact on Other State Water Resources



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- Threat to Agricultural Resources/Rural Areas
- Interbasin Transfers
- Other Natural Resources
- Major Impacts on Key Water Quality Parameters
- Political Feasibility
- Implementation Issues

Included below is a discussion of the analysis criterion. A summary of the scoring used for ranking the strategies for each one of the criterion in the evaluation matrix is included in Table 5B-B.2. The evaluation matrix with the ranks for the WMSs is included in Table 5B-B.3.

Quantity is evaluated and scored based on the percentage of the WUG/WWP need the given WMS is expected to meet.

Reliability is evaluated based on the potential for the water to be available during drought. Strategies in which there is considerable competition for water or temporary supplies are rated as low reliability. Strategies that use water from a source that would not exceed 90% of available supply is rated as medium reliability. Strategies that use water from a source that would not exceed 80% of available supply is rated as high reliability. The reliability ranges are presented in Table 5B-B.2.

Cost is evaluated based on the gradation of the unit cost for the given WMS compared to the range defining the scores 1 to 5. The ranges are presented in Table 5B-B.2 below.

Environmental impacts from the WMS to the existing conditions were quantified using the environmental matrix to determine the score of the 'Environmental Factors' category on the Evaluation Matrix. Each category is assessed and assigned a ranking from 1 to 5 to maintain consistency in the scoring process. The ranks were developed based on the range identified in each one of the categories and an attempt to distribute the range into five categories. The Overall Environmental Impacts column averages all of the rankings assigned to the strategy. This value is also illustrated in the Evaluation Matrix as the Environmental Factors rank. Table 5B-B.1 shows the correlation between the rank assigned within each category. The Environmental Matrix takes into consideration the following categories:

- Total Acres Impacted
- Total Wetland Acres Impacted
- Environmental Water Needs
- Habitat
- Threatened and Endangered Species
- Cultural Resources
- Bays & Estuaries



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Table 5B-B.1 - Environmental Matrix Category Ranking Correlation

Rank	Acres Impacted	Threatened and Endangered Species	All Remaining Categories
1	Greater than 500 Acres and/or Wetlands	Greater than 20	High Impact
2	100-500 Acres	Between 15-20	Medium Impact
3	50-100 Acres	Between 10-15 or 'varies'	Low Impact
4	0-50 Acres	Between 5-10	No Impact to Low Impact
5	None	Between 0-5 (or n/a)	No Impact

Acres Impacted refers to the total amount of area that will be impacted due to the implementation of a strategy. The following conservative assumptions were made (unless more detailed information was available):

- Each well will impact approximately 1 acre of land
- The acres impacted for pipelines is equivalent to the right of way easements required
- Reservoirs will impact an area equal to their surface area
- A conventional water treatment plant will impact 5 acres

Wetland Acres refers to the number of acres that are classified as wetlands are impacted by implementation of the strategy. The only strategy that had an impact on surrounding wetlands was the Lake Columbia strategy.

Environmental Water Needs refers to how the strategy will impact the area's overall environmental water needs. Water is vital to the environmental health of a region, and so it is important to take into account how strategies will impact the amount of water that will be available to the environment. It was conservatively assumed that majority of the strategies will have a low impact on the environmental water needs (unless more detailed information was available).

Habitat refers to how the strategy will impact the habitat of the local area. The more area that is impacted due to the implementation of the strategy, the more the area's habitat will be disrupted. It was assumed that strategies with less than 100 acres impacted will have a low impact and strategies above 100 acres impacted will have a medium impact.

Threatened and Endangered Species refers to how the strategy will impact those species in the area once implemented. The following conservative assumptions were made (unless more detailed information was available);

- Only applicable to strategies implementing infrastructure
- Rankings were based on the amount of threatened and endangered species located within the county. This amount was found using the Texas Parks and Wildlife Database located at <http://tpwd.texas.gov/gis/rtest/> and the U.S. Fish and Wildlife Service Database located at <http://www.fws.gov/endangered/>.



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- This ranking only includes threatened and endangered species as defined in the TWDB guidelines and does not include species without official protection such as those proposed for listing or species that are considered rare or otherwise of special concern.

Cultural Resources refers to how the strategy will impact cultural resources located within the area. Cultural resources are defined as the collective evidence of the past activities and accomplishments of people. Locations, buildings and features with scientific, cultural or historic value are considered to be cultural resources. It was conservatively assumed that all strategies implementing infrastructure will have a low impact on cultural resources.

Bays and Estuaries Impact to Bays and Estuaries (if any) due to the WMSs was identified and quantified accordingly.

Threat to Agricultural Resources/Rural Areas is quantified based on the impacts to water supplies to these users. If a strategy will reduce the available water to agricultural or rural areas by the greater of 10% current use or 5,000 ac-ft/yr, the strategy is determined to have high impacts. If the entity already holds water rights for the strategy, the impacts would be low.

Interbasin Transfer is quantified by means of a yes or no qualifier. If there is an interbasin transfer triggered because of the WMS then the impact is quantified as a “yes” and if there is no interbasin transfer triggered, then the impact is quantified as a “no”.

Other Natural Resources is quantified based on the impact of the WMS to other natural resources in the region. If the strategy significantly alters the natural condition of other resources, the strategy is determined to have high impacts. If the strategy does not alter the natural condition of other resources, the strategy is determined to have no impacts.

Major Impacts on Key Water Quality Parameters is quantified based on the impact that the implementation of the strategy will have on the area’s applicable water quality.

Political Feasibility evaluates the local preference and likelihood for public support or opposition created by the WMS. This evaluation also takes into consideration if a local sponsor is identifiable and committed to implementing the WMS.

Implementation Issues evaluates the potential for factors such as permitting and land acquisition to affect the WMS. It also evaluates the risk to the strategy’s ability to deliver water from natural or man-made disasters such as hurricanes, climate change, or terrorism.

In accordance with TAC 357.34 (e)(10), other factors, such as recreational impacts, were considered when evaluating potentially feasible WMSs and associated WMS projects (WMSPs). The ETRWPG did not deem any other factors as relevant for inclusion as a specific criteria in the WMS evaluation rating criteria matrix. However, other factors were considered and evaluated on an individual basis for WMSs and associated WMSPs, and are discussed in greater detail in their technical memoranda, found in Appendix 5B-A.



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Table 5B-B.2 – ETRWPA WMS Evaluation Matrix Rating Criteria

Category	Rating Criteria				
	1	2	3	4	5
Quantity	Meets 0-25% Shortage	Meets 25-50% of Shortage	Meets 50-75% of Shortage	Meets 75-100% of Shortage	Exceeds Shortage
Reliability	Low	Low to Medium	Medium	Medium to High	High
Cost	>\$5,000/ac-ft (High)	\$1,000 to \$5,000/ac-ft (Medium-High)	\$500 to \$1,000/ac-ft (Medium)	\$0 to \$500/ac-ft (Low)	No Cost
Environmental Factors	Significant Negative Impacts	Medium Negative Impacts	Low Negative Impacts	Minimal or No Negative Impacts	High Positive Impacts
Impact on Other State Water Resources	Significant Negative Impacts	Medium Negative Impacts	Low Negative Impacts	Minimal or No Negative Impacts	High Positive Impacts
Threat to Agricultural Resources/Rural Areas	Significant Negative Impacts	Medium Negative Impacts	Low Negative Impacts	Minimal or No Negative Impacts	High Positive Impacts
Interbasin Transfers	Yes/No				
Other Natural Resources	Significant Negative Impacts	Medium Negative Impacts	Low Negative Impacts	Minimal or No Negative Impacts	High Positive Impacts
Major Impacts on Key Water Quality Parameters	Significant Negative Impacts	Medium Negative Impacts	Low Negative Impacts	Minimal or No Negative Impacts	High Positive Impacts
Political Feasibility	No sponsor readily identifiable.	Sponsor identifiable, but uncommitted.	Sponsor(s) identified, commitment level uncertain.	Sponsor(s) are identified and committed to strategy.	Sponsors identified and strategy is in development.
Implementation Issues	High implementation Issues.	Medium High Implementation Issues	Medium Implementation Issues	Low Implementation Issues	Low to No Implementation Issues



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Table 5B-B.3 – ETRWPA WMS Evaluation Matrix Rankings for Recommended and Alternative Water Management Strategies (Alternative strategies are identified in italics)																		
#	County	Entity	Basin Used	Strategy	Strategy Key	Quantity (Ac-Ft/Yr)	Quantity (1-5)	Reliability (1-5)	Cost (\$/Ac-Ft)	Cost (1-5)	Impacts of Strategy on:						Political Feasibility (1-5)	Implementation Issues (1-5)
											Environmental Factors (1-5)	Water Resources and Other WMS (1-5)	Agricultural Resources/Rural Areas (1-5)	Interbasin Transfers	Other Natural Resources (1-5)	Key Water Quality Parameters (1-5)		
1	Angelina	Manufacturing	Neches	Purchase from Lufkin	ANGL-MFG	1,625	4	5	\$326	4	4	4	4	No	4	4	1	4
2	Angelina	Mining	Neches	Purchase from ANRA	ANGL-MIN	572	4	3	\$2,177	2	4	4	4	No	4	4	4	4
3	Cherokee	Alto Rural WSC	Neches	New wells in Carrizo-Wilcox Aquifer	CHER-ALT	191	4	4	\$1,058	2	4	4	4	No	4	4	3	4
4	Cherokee	Rusk	Neches	New wells in Carrizo-Wilcox Aquifer	CHER-RUS	122	4	4	\$1,574	2	4	4	4	No	4	4	3	4
5	Cherokee	Wright City WSC	Neches	New wells in Carrizo-Wilcox Aquifer	CHER-WCW	121	4	4	\$1,574	2	4	4	4	No	4	4	3	4
6	Cherokee	Mining	Neches	Purchase from ANRA	CHER-MIN	247	4	4	\$3,453	2	4	4	4	No	4	4	4	4
7	Henderson	Edom-WSC	Neches	New wells in Carrizo-Wilcox Aquifer	HDSN-EDOM	9	4	4	\$2,125	2	4	4	4	No	4	4	3	4
8	Henderson	Chandler	Neches	New wells in Carrizo-Wilcox Aquifer	HDSN-CHN	101	4	4	\$1,119	2	4	4	4	No	4	4	3	4
9	Henderson	Moore Station WSC	Neches	New wells in Carrizo-Wilcox Aquifer	HDSN-MSW	111	4	4	\$1,045	2	4	4	4	No	4	4	3	4
10	Henderson	Mining	Neches	New wells in Carrizo-Wilcox Aquifer	HDSN-MIN	19	4	4	\$789	3	4	4	4	No	4	4	1	4
11	Houston	Livestock	Neches	New wells in Yegua-Jackson Aquifer	HOUS-LTK	201	4	4	\$194	4	4	4	5	No	4	4	1	4
12	Jasper	Livestock	Neches	Purchase from LNVA	JASP-LTK	8,932	4	4	\$326	4	4	4	5	No	4	4	1	4
13	Jefferson	County-Other	Neches	Purchase from LNVA	JEFF-CTR	1,950	4	4	\$1,232	2	4	4	4	No	4	4	1	4
14	Jefferson	Manufacturing	Neches	Purchase from LNVA	JEFF-MFG	143,513	4	4	\$485	3	4	4	4	No	4	4	1	4
15	Jefferson	Steam Electric Power	Neches	Purchase from LNVA	JEFF-SEP	2,391	4	4	\$1,449	2	4	4	4	No	4	4	1	4
16	Nacogdoches	County-Other	Neches	Lake Naconiche Regional Water System	NACN-LK	1,700	4	4	\$3,155	2	4	4	4	No	4	4	1	4
17	Nacogdoches	D & M WSC	Neches	New wells in Carrizo-Wilcox Aquifer	NACW-DMW	374	4	4	\$997	3	4	4	4	No	4	4	2	4
18	Nacogdoches	Livestock	Neches	New wells in Carrizo-Wilcox Aquifer	NACW-LTK	9,113	4	4	\$296	4	4	4	4	No	4	4	1	4
19	Nacogdoches	Mining	Neches	Purchase from ANRA	NACW-MIN	2,975	4	3	\$1,398	2	4	4	4	No	4	4	4	4
20	Newton	Mining	Neches	Purchase from SRA	NEWT-MIN	115	4	4	\$965	3	4	4	4	No	4	4	1	4
21	Orange	Irrigation	Sabine	Purchase from SRA	ORAN-IRR	526	4	4	\$2,576	2	4	4	5	No	4	4	1	4



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											Environmental Factors (1-5)	Water Resources and Other WMS (1-5)	Agricultural Resources/Rural Areas (1-5)	Interbasin Transfers	Other Natural Resources (1-5)	Key Water Quality Parameters (1-5)		
22	Panola	Livestock	Sabine	New wells in Carrizo-Wilcox Aquifer	PANL-LTK	982	4	4	\$124	4	4	4	5	No	4	4	1	4
23	Rusk	Jacobs WSC	Sabine	New wells in Carrizo Wilcox Aquifer	RUSK-JAW	22	4	3	\$6,364	1	4	4	4	No	4	4	4	4
24	Rusk	Livestock	Sabine	New wells in Carrizo Wilcox Aquifer	RUSK-LTK	83	4	3	\$289	4	4	4	5	No	4	4	1	4
25	Rusk	Mining	Neches	Purchase from ANRA	RUSK-MIN	305	4	3	\$4,233	2	4	4	4	No	4	4	4	4
26	Rusk	Steam Electric Power	Neches	Purchase from SRA	RUSK-SEP	1,103	4	4	\$2,534	2	4	4	4	No	4	4	1	4
27	San Augustin	San Augustine	Neches	New wells in Carrizo Wilcox Aquifer	SAUG-SAG	120	4	4	\$838	3	4	4	4	No	4	4	4	4
28	San Augustine	Livestock	Neches	Purchase from SRA	SAUG-LTK	2,349	4	4	\$1,754	2	4	4	5	No	4	4	1	4
29	San Augustine	Mining	Neches	Purchase from ANRA	SAUG-MIN	1,102	4	4	\$3,549	2	4	4	4	No	4	4	4	4
30	Shelby	Sand Hills WSC	Neches	Purchase from Center	SHEL-SHW	105	4	4	\$971	3	4	4	4	No	4	4	4	4
31	Shelby	Livestock	Sabine	Purchase from SRA	SHEL-LTK	19,006	4	4	\$978	3	4	4	5	No	4	4	1	4
32	Smith	Bullard	Neches/Trinity	Purchase from City of Tyler	SMTH-BLD	1,145	4	4	\$1,410	2	4	4	4	No	4	4	3	4
33	Smith	Crystal Systems Texas	Neches/Trinity	New wells in Carrizo Wilcox Aquifer	SMTH-CYS	538	4	4	\$429	4	4	4	4	No	4	4	3	4
34	Smith	Lindale	Neches/Trinity	New wells in Carrizo Wilcox Aquifer	SMTH-LIN	696	4	4	\$370	4	4	4	4	No	4	4	3	4
35	Smith	Overton	Neches/Trinity	New wells in Carrizo Wilcox Aquifer	SMTH-OVN	416	4	4	\$2,034	2	4	4	4	No	4	4	3	4
36	Smith	R P M WSC	Neches/Trinity	New wells in Carrizo Wilcox Aquifer	RPM-WSC	17	4	4	\$1,972	2	4	4	4	No	4	4	3	4
37	Smith	Whitehouse	Neches/Trinity	New wells in Carrizo Wilcox Aquifer	SMTH-WHIT	257	4	4	\$2,868	2	4	4	4	No	4	4	4	4
38	Smith	Manufacturing	Neches/Trinity	Purchase from City of Tyler	SMTH-MFG	84	4	4	\$6,488	1	4	4	4	No	4	4	1	4
39	Angelina	Angelina Neches River Authority	Neches	Lake Columbia	ANRA-COL	75,720	4	4	\$311	4	3	4	3	Yes	4	4	4	3



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											Environmental Factors (1-5)	Water Resources and Other WMS (1-5)	Agricultural Resources/Rural Areas (1-5)	Interbasin Transfers	Other Natural Resources (1-5)	Key Water Quality Parameters (1-5)		
40	Angelina	Angelina Neches River Authority	Neches	ANRA Water Treatment Plant and Distribution System	ANRA-WTP	0	4	4	\$2,242	2	4	4	4	No	4	4	4	3
41	Angelina	Angelina Neches River Authority	Neches	ANRA Groundwater wells	ANRA-GW	5,600	4	3	\$569	3	4	4	4	No	4	4	4	4
42	Angelina	Angelina Neches River Authority	Neches	ANRA Run of River Supplies	ANRA-ROR	30,000	4	3	-	5	4	4	4	No	4	4	4	4
43	Henderson	Angelina Nacogdoches WCID#1	Neches	Volumetric Surveys and Normal Pool Elevation Adjustment of Lake Striker	ANCD-VOL	5,600	-	3	\$476	5	4	4	4	No	4	4	4	4
44	Henderson	Athens MWA	Trinity	Indirect Reuse of Flows from Fish Hatcheries	AMWA-FH	2,872	4	4	-	5	4	4	4	No	4	4	4	3
45	Henderson	Athens MWA	Trinity	Additional Groundwater wells in Carrizo Wilcox	AMWA-AGW	2,000	4	2	\$943	3	4	4	4	No	4	4	4	1
46	Henderson	Athens MWA	Trinity	Groundwater Expansion	AMWA-GWE	200	4	4	\$1,090	2	4	4	4	No	4	4	4	4
47	Henderson	Athens MWA	Trinity	Pump Station Improvements	AMWA-BSI	450	4	4	\$127	4	4	4	4	No	4	4	5	4
48	Jefferson	Beaumont	Neches	Amendment to Contract with LNVA	JEFF-BEA	2,249	4	4	\$977	3	4	4	4	No	4	4	4	4
49	Shelby	Center	Sabine	Reuse Pipeline from WWTP to Lake Center	CENT-REU	1,121	4	4	\$234	2	3	4	4	No	4	3	4	4
50	Shelby	Center	Sabine	Pipeline from Toledo Bend to Lake Center	CENT-TOL	2,242	4	4	\$1,544	2	4	4	4	No	4	3	4	4
51	Shelby	Center	Sabine	Volumetric Surveys of Lake Center and Lake Pinkston	CENT-VOL	--	-	-	-	4	4	4	4	No	4	4	4	4
52	Houston	Houston County WCID#1	Neches	Permit Amendment for Houston County Lake	HCWC-PA	3,500	4	3	-	5	4	4	4	No	4	4	4	4
53	<i>Houston</i>	<i>Houston County WCID#1</i>	<i>Neches</i>	<i>New wells in Carrizo-Wilcox Aquifer</i>	<i>HCWC-GW</i>	<i>3,500</i>	<i>4</i>	<i>3</i>	<i>\$522</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>4</i>	<i>No</i>	<i>4</i>	<i>4</i>	<i>4</i>	<i>3</i>
54	Cherokee	Jacksonville	Neches	Supply from Lake Columbia	JACK-COL	1,700	4	4	\$1,853	2	4	4	4	No	4	4	4	3
55	Jefferson	Lower Neches Valley Authority	Neches-Trinity	Purchase from SRA	LNVA-SRA	200,000	4	4	\$551	3	4	4	4	No	4	4	4	3



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											Environmental Factors (1-5)	Water Resources and Other WMS (1-5)	Agricultural Resources/Rural Areas (1-5)	Interbasin Transfers	Other Natural Resources (1-5)	Key Water Quality Parameters (1-5)		
56	Jefferson	Lower Neches Valley Authority	Neches-Trinity	Beaumont West Regional Reservoir	LNVA-WRR	7,700	4	5	\$256	4	4	4	4	No	4	4	4	4
57	Jefferson	Lower Neches Valley Authority	Neches-Trinity	Neches Trinity Basin Interconnect	LNVA-RGH	67,000	4	5	\$133	4	3	3	4	Yes	4	3	4	4
58	Angelina	Lufkin	Neches	Conveyance from Sam Rayburn to Kurth Lake	LUFK-RAY	28,000	4	4	\$919	3	4	4	4	No	4	4	4	4
59	Nacogdoches	Nacogdoches	Neches	Lake Columbia to Nacogdoches Raw Water Transmission System	NACP-COL	8,551	4	4	\$788	3	4	4	4	No	4	4	4	3
60	Smith	Tyler	Neches	City of Tyler - Lake Palestine Expansion	TYLR-PAL	16,815	4	4	\$915	3	4	4	4	No	4	4	3	4
61	Anderson	Upper Neches River Municipal Water Authority	Neches	Neches Run-of-River Diversion, Neches with Lake Palestine	UNM-LP	68,625	4	4	\$688	3	3	4	4	No	4	4	3	2
62	<i>Anderson</i>	<i>Upper Neches River Municipal Water Authority</i>	<i>Neches</i>	<i>Neches Run-of-River Diversion, Neches with Tributary Storage</i>	<i>UNM-TS</i>	<i>75,000</i>	<i>4</i>	<i>4</i>	<i>\$355</i>	<i>4</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>No</i>	<i>4</i>	<i>4</i>	<i>3</i>	<i>2</i>
63	<i>Anderson</i>	<i>Upper Neches River Municipal Water Authority</i>	<i>Neches</i>	<i>Neches Run-of-River Diversion, Neches with Groundwater</i>	<i>UNM-GW</i>	<i>84,875</i>	<i>4</i>	<i>4</i>	<i>\$451</i>	<i>4</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>No</i>	<i>4</i>	<i>4</i>	<i>3</i>	<i>2</i>
64	Multiple	Multiple	-	Conservation	WUG-CONS	-	-	4	-	3	4	4	4	No	4	4	2	4



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