Approved October 10, 2007

Implementation Plan for Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E. V. Spence Reservoir

For Segment Number 1426

Prepared by the:
Chief Engineer's Office, Water Programs, TMDL Section

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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Executive Summary

On February 7, 2007, the Texas Commission on Environmental Quality (TCEQ) adopted *Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E. V. Spence Reservoir*. The total maximum daily loads (TMDLs) address chloride and total dissolved solids (TDS) in Segment 1426, the Colorado River Below E.V. Spence Reservoir. The U.S. Environmental Protection Agency (USEPA) approved the TMDLs on April 9, 2007.

This implementation plan, or I-Plan:

- describes the steps the TCEQ and its stakeholders will take to achieve the pollutant reductions identified in the TMDL report, and
- outlines the schedule for implementation activities.

The TCEQ conducted an investigation to identify possible point and nonpoint sources of chloride and TDS, and to quantify the appropriate reductions necessary to comply with established water quality standards. Field investigations confirmed that excessive chloride and TDS concentrations occur throughout the length of Segment 1426, with significant loadings originating from the watershed of E.V. Spence Reservoir, which is immediately upstream of Segment 1426.

Based on the TMDLs for Segment 1426 the goal of this I-Plan is to ensure that releases from E.V. Spence Reservoir are at or below 550 milligrams per liter (mg/L) of chloride and 1,537 mg/L of TDS in order to meet the criteria defined in the state's water quality standards.

Several implementation activities were initiated to achieve pollutant reductions while the TMDL was being developed.

- The TCEQ awarded a federal nonpoint source grant to the Texas Railroad Commission (RRC) to investigate the nature and extent of known salinity contamination associated with oil and gas production, the development of remediation/abatement alternatives or best management practices (BMPs), and the implementation of BMPs to specifically reduce water pollution.
- The Texas State Soil and Water Conservation Board (TSSWCB) is in the process of administering a multi-year salt cedar control project to reduce salinity loadings in the E.V. Spence Reservoir watershed.
- The TCEQ and the Colorado River Municipal Water District (CRMWD) deployed two continuous monitoring stations to measure specific conductivity. These continuous monitors guide the district in managing flow, and therefore

salinity, from the upper watershed into E.V. Spence Reservoir, which in turn discharges to Segment 1426. To date, management of flow has improved water quality and reduced the level of salinity in E.V. Spence Reservoir, a source of drinking water.

- The RRC is working cooperatively with the TCEQ to eliminate pollution caused by unplugged or improperly plugged wells and reduce the chloride content of the Upper Colorado River basin through a project called Runnels County/Upper Colorado River Saltwater Discharge Minimization Project. Activity associated with oil and gas operations, such as abandoned, improperly plugged, or unplugged oil and gas wells, and salt-water injection and/or disposal wells have been identified as possible sources of salinity. As of June 2006, the RRC has plugged 167 out of 189 wells recommended and approved since the project began in 2003.

Additional sampling at appropriate locations and frequencies will allow tracking and evaluation of progress toward the interim and final endpoints of the TMDLs. These steps will provide reasonable assurances that the regulatory and voluntary activities necessary to achieve the pollutant reductions will be implemented. To ensure stakeholders stay informed about implementation, the TCEQ will post pertinent material on a project web page and schedule meetings as needed. The project information for Colorado River Below E.V. Spence Reservoir is available on the TCEQ's web site at <www.tceq.state.tx.us/implementation/water/tmdl/32-colorado_group.html>.

Introduction

In order to keep Texas' commitment to restore and maintain water quality in impaired rivers, lakes, and bays, the TCEQ will establish implementation plans for each TMDL. The TMDL is a technical analysis that:

- determines the amount of a particular pollutant that a water body can receive and still meet applicable water quality standards, and
- estimates how much the pollutant load must be reduced to comply with water quality standards.

This I-Plan is designed to guide activities that will reduce chloride and TDS in Segment 1426, as defined in the adopted TMDLs. The ultimate goal of the I-Plan is to restore the general uses of Segment 1426 by reducing the average annual concentrations of chloride and TDS to levels that meet the criteria established in the state's water quality standards.

The I-Plan is a flexible tool that governmental and nongovernmental organizations involved in implementation use to guide their program management. The participating organizations may accomplish the activities described in this I-Plan through rule, order, guidance, or other appropriate formal or informal action.

This I-Plan contains the following components:

1) a description of control actions and management measures[1] that will be implemented to achieve the water quality target.
2) a schedule for implementing activities.
3) the legal authority under which the participating agencies may require implementation of the control actions.
4) a follow-up tracking and monitoring plan to determine the effectiveness of the control actions and management measures undertaken.
5) identification of measurable outcomes and other considerations the TCEQ will use to determine whether the I-Plan has been properly executed, water quality standards are being achieved, or the plan needs to be modified.
6) identification of communication strategies the TCEQ will use to disseminate information to stakeholders and other interested parties.

This I-Plan also includes all of the nine key elements (Table 1) for watershed-based plans as prescribed in the *FY 2004 Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories* (USEPA, 2004). Consequently, projects developed to implement nonpoint source elements of this plan that meet the grant program conditions are eligible for funding under the USEPA's Section 319(h) incremental grant program. This I-Plan was prepared by the TMDL Program of the Chief Engineer's Office of the TCEQ.

The commission approved this I-Plan on October 10, 2007. The TCEQ has primary responsibility for ensuring that water quality standards are restored in impaired water bodies and that these standards are subsequently maintained.

Summary of TMDLs

This section will summarize key elements from the TMDL report *Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E.V. Spence Reservoir, For Segment 1426,* including a description of the watershed, a summary of the problem, analysis of the sources, and the load reductions. The TMDL report is available on the TCEQ's web site at <www.tceq.state.tx.us/assets/public/implementation/water/tmdl/32colorado/32-uppercoloradotmdladopted.pdf>.

Watershed Location

The Colorado River Below E.V. Spence Reservoir (Segment 1426) is a freshwater stream approximately 66 miles long, with a watershed greater than 2000 square miles. The segment receives the majority of its flow from E.V. Spence Reservoir. It begins at Robert Lee Dam and flows southeasterly through Coke and Runnels Counties in Texas, ending 2.3 miles below the confluence of Mustang Creek in Runnels County (Figure 1).

[1] Control actions refer to regulated point source pollutant reduction strategies, generally TPDES permits. Management measures refer to nonpoint source pollutant reduction strategies, generally voluntary best management practices.

Figure 1: Watershed of the Colorado River Below E.V. Spence

Concentrations of chloride and TDS are among the numeric criteria used to evaluate the support of general uses. The criteria for chloride (Cl) and TDS are average annual concentrations of 610 mg/L and 2,000 mg/L, respectively (Table 2).

The Edwards-Trinity aquifer is the principal source of groundwater in the Segment 1426 watershed. The aquifer is composed of sandstone and carbonate-rock aquifers and encompasses an area of 818 square miles. Elevations in the watershed range from 1,650 to 2,350 feet above sea level. A majority of the land is well adapted to cultivation. Vegetation can be best described as mesquite savannah. Mineral resources include brick-making clay and oil and gas deposits.

Problem Definition

General water quality uses were identified as impaired in the *2000 Texas Water Quality Inventory and 303(d) List*. A TMDL project was initiated to identify possible point and nonpoint sources of chloride and TDS, and to quantify appropriate reductions necessary to comply with established water quality standards of 610 mg/L, and 2000 mg/L respectively.

Measurements of conductivity and salinity in surface water and shallow groundwater were taken around E.V. Spence Reservoir, along the Colorado River from E.V. Spence Reservoir to below Ballinger, and along numerous tributaries north and south of the Colorado River. Chemical analyses and field investigations of surface water in Segment 1426 and its tributaries verified that salinity is above criteria in E.V. Spence Reservoir

Table 1: Summary of nine key elements

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Causes/Sources of Impairment **Targeted Critical Areas**	**Management Measures**	**Estimated Potential Load Reduction (lbs/Year)**	**Technical and Financial Assistance Needed for Each Measure**	**Education Component for Each Measure (and Other Education)**	**Schedule of Implementation for Each Measure**	**Interim, Measurable Milestones for Each Measure**	**Indicators to Measure Progress**	**Monitoring Component**	**Responsible Entity**
Oil and gas operations in the Wendkirk Oil Field and the Ballinger Seep or dissolution of gypsum from the San Angelo Formation Segment 1426 (Machae Creek Area and Ballinger Seep Area)	site assessments of both the Wendkirk Oil Field and the Ballinger Seep surface water monitoring and groundwater investigations implementation of BMPs	Chloride: 9.53E+06 TDS: 5.86E+06	Section 319 Nonpoint Source Grant	quarterly project reports available electronically via the project web-page	2007 - 2009	n/a	recommendations for abatement, monitoring and/or further investigation eventual reduction in TDS-related concentrations from strategic deployment of BMPs	routine basin monitoring	RRC
Carbonate Dissolution Upper Colorado River Watershed	maintenance of continuous water quality monitors and reservoir management	Chloride: 5.60E+05 TDS: 1.57E+06	Section 106 Water Pollution Control Program Grant	TCEQ web-page and LCRA basin highlights report	2007	n/a	reduction in TDS-related concentrations	continuous monitoring and routine basin monitoring	TCEQ, LCRA, and CRMWD
Brush Control/Salt Cedar Segment 1426 Watershed	Salt Cedar Control	Chloride: 4.29E+04 TDS: 1.20E+05	Section 319 Nonpoint Source Grant	TSSWCB web-page	ongoing	acres of land treated	reduction in TDS-related concentration	continuous monitoring and routine basin monitoring	TSSWCB

and its tributary, Salt Creek, and in the Colorado River from E.V. Spence Reservoir to Ballinger (Figure 2).

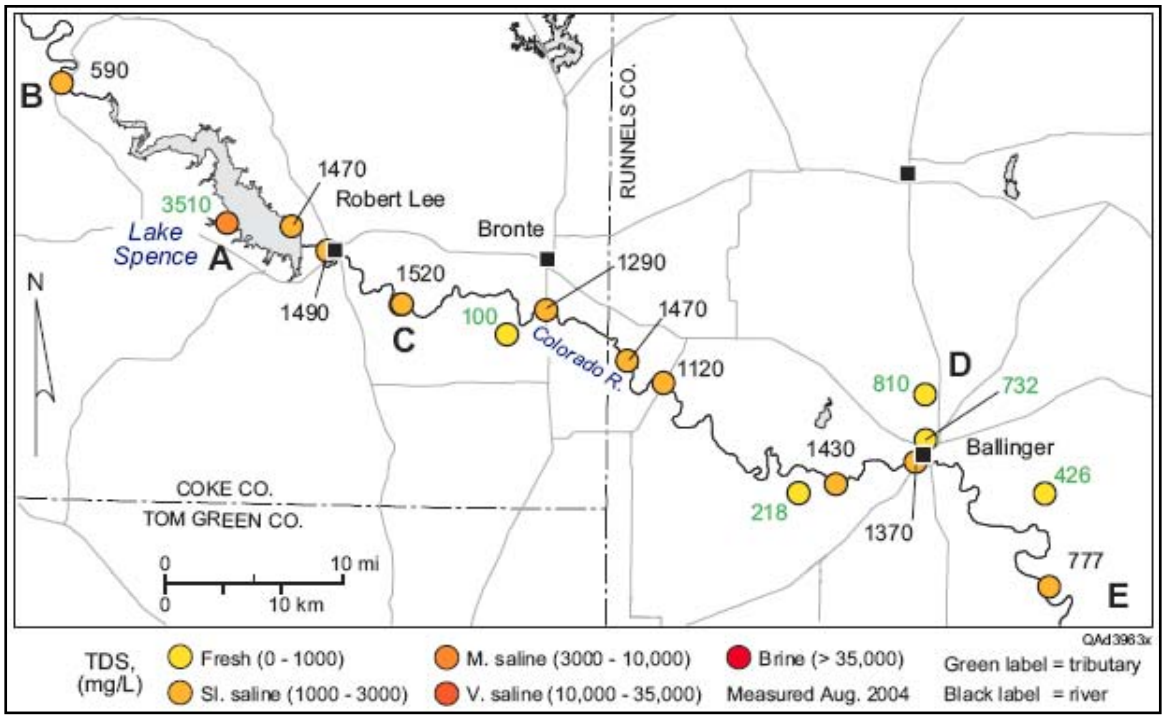
Table 2: Numeric criteria for the Colorado River Below E.V. Spence Reservoir

Segment	Criteria						
	Cl (mg/L)	SO_4 (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L)	pH Range (Standard Units)	Indicator Bacteria #/100ml (E. coli)	Temperature (°F)
1426: Colorado River Below E.V. Spence Reservoir	610*	980*	2,000*	5.0	6.5-9.0	126+/ 394++	91

* expressed as annual average values

\+ expressed as a geometric mean

++ expressed as an instantaneous grab sample



Graduated circles, from yellow to red, represent increased concentrations of total dissolved solids. Circles with green labels represent tributaries off the main stem of the segment. Alphabetical letters in the map represent areas that do not correspond to information presented in this report.

Figure 2: Map of the segment study area (Segment 1426) depicting TDS concentrations measured in August 2004 (Paine et. al., 2005)

Source Analysis

Pollutants may come from several sources, both point and nonpoint. The sources of salinity in Colorado River Below E.V. Spence Reservoir are:

- five permitted wastewater discharger's discharge to the Colorado River Below E.V. Spence Reservoir (Table 3).
- produced water, generated as a by-product of petroleum production, from documented, orphaned, and noncompliant oil and gas wells in Coke and Runnels Counties.
- salt cedar, which is especially detrimental to water quality because of its ability to transport salts from groundwater to its leaves. Salt stored in the leaves is transported to the ground surface when leaves drop, and can contaminate surface waters via runoff. Salt cedar density along stream banks of the Colorado River is estimated at 23,376 plants per acre.
- permian gypsum-salt deposits contribute via the transport action of runoff flowing through mineral beds or by dissolution of natural underground mineral deposits into groundwater that discharges to the surface. Geologic formations containing gypsum are present in the upper portion of the segment.

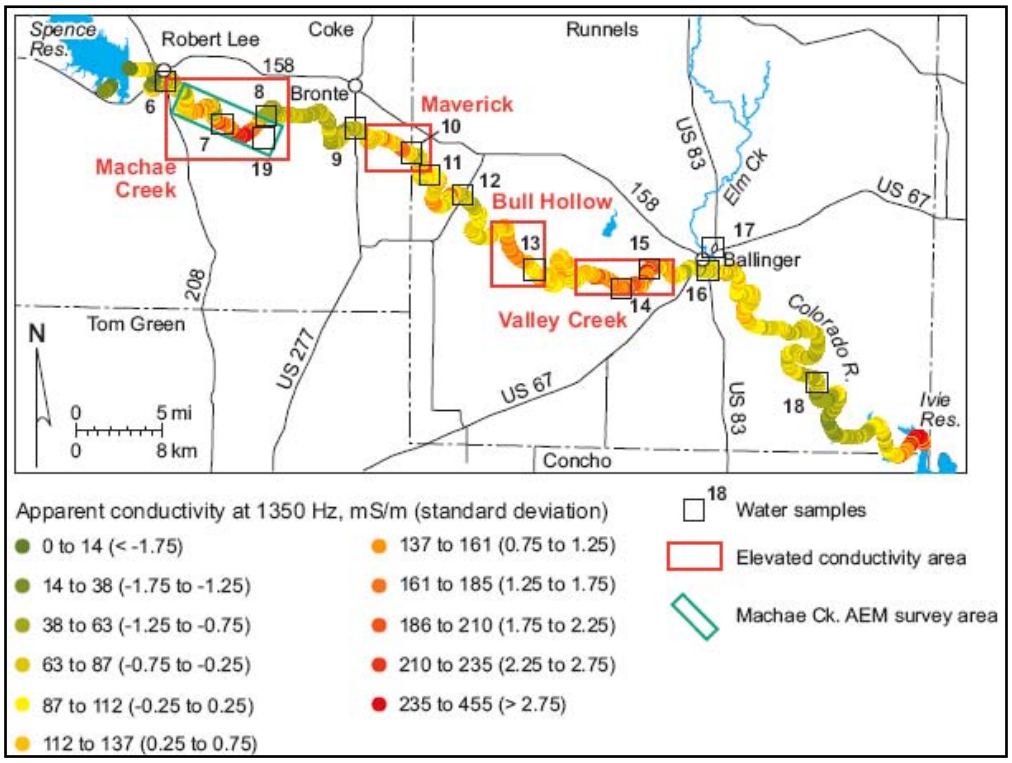
Table 3: Permitted dischargers in the watershed of the Colorado River Below E.V. Spence Reservoir

Permit Number	Name of Facility	Flow (MGD)
WQ0000997-000	AEP Texas North Company (Oak Creek Power Station)	60
WQ0010320-001	City of Winters	0.53
WQ0010325-003	Plant No. 2 City of Ballinger	0.375
WQ0010390-001	City of Bronte	0.15
WQ0013901-001	City of Robert Lee	0.121

Linkage

Sampling and analysis by the CRMWD and others has repeatedly documented elevated concentrations of chloride and TDS in the Colorado River along and upstream from Segment 1426. The salinity of water is strongly correlated to its electrical conductivity. To define the sources of chloride and TDS, the University of Texas Bureau of Economic Geology (BEG) conducted a TCEQ-sponsored airborne geophysical survey using a multi-frequency electromagnetic induction (EM) instrument to delineate the extent and intensity of salinization and identify salinity sources that degrade surface water quality. General observations are listed following.

- There is a high degree of correlation between water quality data results and elevated apparent conductivities measured during Airborne Electromagnetic Surveys over Segment 1426 (Figure 3).



AEM refers to Airborne Electromagnetic Survey

Figure 3: Areas of elevated conductivity measured along the axis of the Colorado River between Spence and Ivie Reservoirs. (Paine et al, 2005)

- The minimum flow release requirements from E.V. Spence Reservoir to sustain habitat for the Concho Water Snake are 4 cubic feet per second (cfs) during the period from April to September and 1.5 cfs from October to March. As stipulated in the revised Biological Opinion issued by the United States Fish and Wildlife Service (USFWS) in December 2004, CRMWD will adhere to these release requirements. These requirements are applicable only when there is inflow to the reservoir and the water level remains at or above 1843.5 feet. Under these conditions, chloride concentrations in reservoir water have ranged from 220 mg/L, to 480 mg/L from top to bottom, based on historical data.
- There has been significant oil and gas exploration and production activity in the study area. As of September 2001, there were a total of 573 gas wells in Coke County and 821 in Runnels County (EA Engineering et al, 2006). The river flows adjacent to the Wendkirk Oil Field at the downstream end of the segment.
- The Machae Creek area is the most upstream conductive river reach within Segment 1426. This area is characterized by formations consisting of gypsum and dolomite.

TMDL Expressions

A summary of allocation loads for the Colorado River Below E.V. Spence Reservoir is presented in Table 4. The total load allocations, wasteload allocations, and margins of safety (MOS) for chloride and TDS are summarized in Tables 5 and 6. The natural loads from chloride and TDS are included in groundwater contributions and explicitly considered in the LA. The sum of WLA and LA is divided by 0.95 to obtain the TMDL. The MOS is calculated by subtracting WLA and LA from the TMDL.

Table 4: Chloride and TDS TMDL allocation load distributions by source

Source	Annual Average Loads (lbs/Year)			
	Chlorides	% Total	TDS	% Total
Spence Reservoir	0.56E+06	4.5%	1.57E+06	4.5%
Produced Water	1.27E+06	10.1%	3.55E+06	10.1%
Abandoned Brine Pits	0.36E+06	2.9%	1.01E+06	2.9%
Groundwater	8.26E+06	65.7%	23.1E+06	65.7%
Salt Cedar	0.04E+06	0.3%	0.12E+06	0.3%
Point Sources	2.08E+06	16.5%	5.80E+06	16.5%
Total	12.6E+06	100%	35.1E+06	100%

Table 5: Chloride TMDL (10^6 lbs/yr)

TMDL (lbs/year)	WLA (lbs/year)	LA (lbs/year)	MOS (lbs/year)
13	2	11	< 1

Table 6: TDS TMDL (10^6 lbs/yr)

TMDL (lbs/year)	WLA (lbs/year)	LA (lbs/year)	MOS (lbs/year)
37	6	29	2

Implementation Strategy

The implementation strategy describes actions the TCEQ and stakeholders will undertake to achieve water quality standards. It specifies actions that have the potential to meet the load allocations assigned to point sources and nonpoint sources identified in the TMDL report. Management Measures/Control Actions have been summarized and address in general terms feasibility, costs, support, timing, and other factors.

Management Measure 1.0: Targeted Brush Control (Salt cedar) in E.V. Spence Reservoir Watershed

The TSSWCB is the lead agency in Texas for planning, implementing, and managing programs and practices for preventing and abating agricultural and silvicultural nonpoint source pollution (Texas Agricultural Code §201.026). Additionally, the TSSWCB administers the Texas Brush Control Program for the selective control, removal, or reduction of noxious brush such as salt cedar or other phreatophytes that consume water to a degree that is detrimental to water conservation (Texas Agricultural Code §203.011).

The TSSWCB is working cooperatively with local soil and water conservation districts and others, to implement a multi-year salt cedar control project to reduce salinity loadings in the E.V. Spence Reservoir watershed (Segments 1411 and 1412). This Upper Colorado River Salt Cedar Control Project has been and will continue to be conducted in the manner prescribed in the E.V. Spence Reservoir I-Plan.

Funded through federal Clean Water Act §319(h) nonpoint source grants from the U.S. Environmental Protection Agency leveraged with appropriations from the Texas Legislature, the TSSWCB is administering both chemical and biological components in salt cedar control in Segments 1411 and 1412. Aerial application of *Arsenal*® herbicide in a narrow, riparian corridor along the Colorado River and its principal tributaries was identified as the most efficient and cost-effective method to treat salt cedar. The project goal is to chemically treat 8,700 acres of salt cedar. During 2004, brush scheduled to be treated was not sprayed due to undesirable leaf canopy conditions. Therefore, 2004-scheduled acreage was combined with 2005-scheduled acreage. In 2005, 2,416 acres were treated and 1,500 acres were treated in 2006. While chemical treatment provides rapid control, the life of a one-time chemical treatment is limited. In order to establish long-term, sustainable control of salt cedar regrowth, biological control is important. A tiny Eurasian leaf beetle, the natural predator of salt cedar, has been introduced in the Segment 1412 watershed. Adult beetles lay eggs that hatch into a worm-like larvae that consumes the salt-cedar leaves for food. Research has shown that plants that have been stripped twice, died, and cannot thrive, spread, or consume water. Leaf beetle mortality and dispersal is being monitored along with the beetle's effectiveness at controlling salt cedar.

Information regarding the TSSWCB's Upper Colorado River Salt Cedar Control Project is available at: <www.tsswcb.state.tx.us/managementprogram/browseactive/Salt+Cedar +Projects>.

Control Action 1.0: Investigations and Abatement of Loads from Produced Water and Seeps to Surface Water

The RRC has initiated projects both above and below E.V. Spence Reservoir to investigate the nature and extent of known salinity contamination associated with oil and gas production, develop remediation/abatement alternatives or BMPs, and implement BMPs to specifically reduce the high salinity that contributes to water quality degradation. The RRC will implement assessments and remediation projects through the following means:

- install monitoring wells up-gradient of known saltwater seeps and in alluvial deposits along the drainage downstream of known seeps.
- sample existing and newly installed monitoring wells in the areas of known seeps.
- conduct a non-invasive geophysical survey on selected area(s) suspected to have high salinity in groundwater.
- conduct further investigations if necessary, including dye studies, the installment of additional soil borings, and monitor wells.
- conduct studies to choose and implement BMPs that will reduce the high TDS loading.

BMPs will be identified and evaluated for effectiveness for use in six areas where elevated salinity has been confirmed. These areas include seeps to the E.V. Spence Reservoir watershed (the West O'Daniel Seep, the O'Ryan Seep, the Pharoah Seep, and the Dugout Creek Alluvium) and seeps into the Segment 1426 watershed (Wendkirk Oil Field, and Ballinger Seep) (Figures 4 and 5).

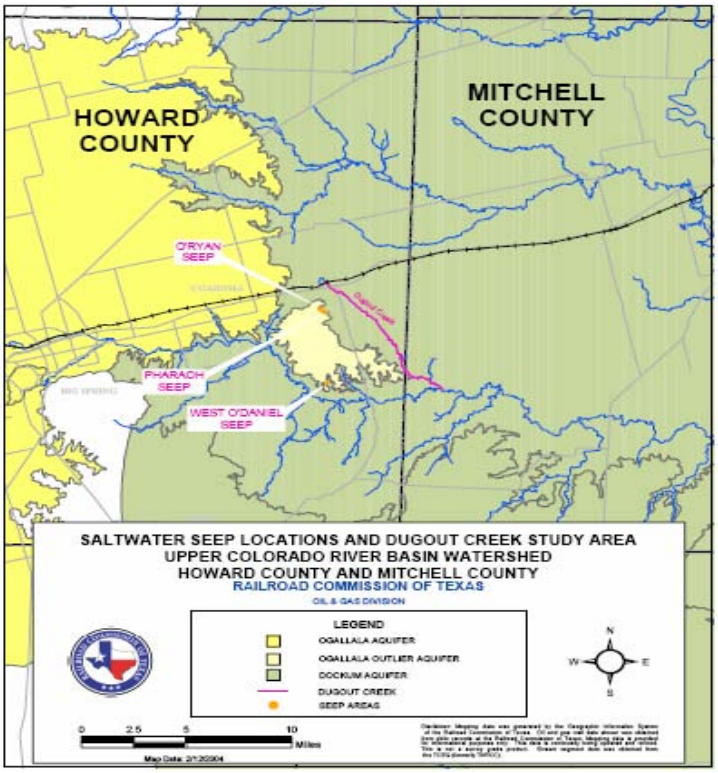


Figure 4: Saltwater seep locations and Dugout Creek study area (RRC)

These projects will enhance the pollution prevention efforts of the RRC and the TCEQ to restore and maintain the water quality in the Upper Colorado River Basin, upstream and downstream of E.V. Spence Reservoir. The projects span fiscal years 2005, 2006, and 2007, and concluded August 31, 2007. A work plan schedule and quarterly reports can be found on the project web site at <www.rrc.state.tx.us/divisions/og/site_rem/nps/upper/>.

These projects are funded through a federal nonpoint source grant from the TCEQ, with matching funds from the state. The RRC is the legal authority tasked with protection of the state's natural resources, the environment, and public safety through the regulation of the oil and natural gas industry, pipeline transporters, natural gas utilities, rail safety, and surface mining operations. Therefore, implementation of regulatory actions to abate produced water impacts and seeps to surface water affecting the Upper Colorado River Basin lies within the jurisdiction of the RRC.

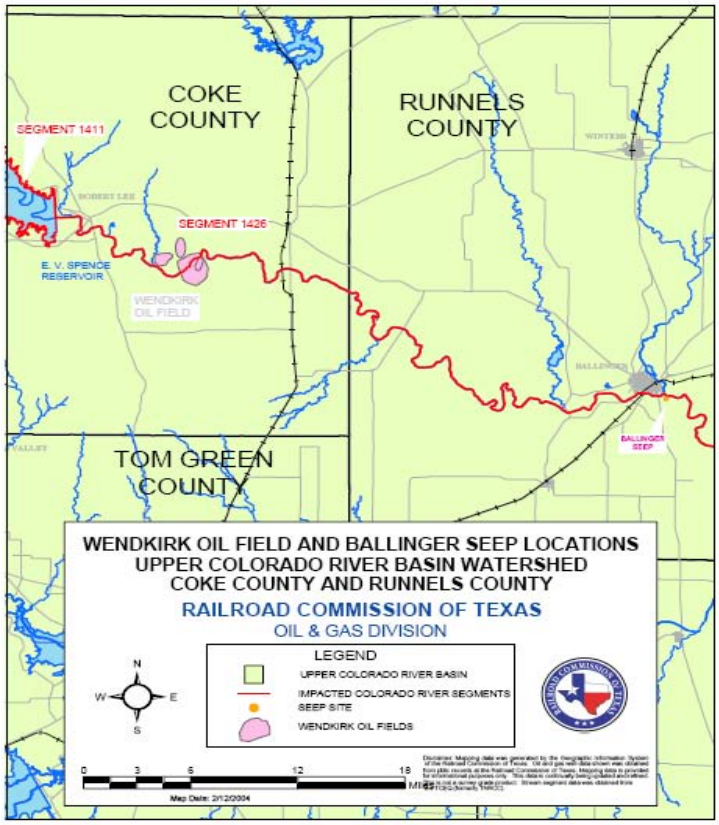


Figure 5: Wendkirk Oil Field and Ballinger seep locations (RRC)

Control Action 2.0: Well Plugging

The RRC is working cooperatively with the TCEQ to eliminate pollution caused by unplugged or improperly plugged wells and reduce the chloride content of the Upper Colorado River basin through a project called "Runnels County/Upper Colorado River Saltwater Discharge Minimization Project." Activity associated with oil and gas operations have been identified as possible sources of salinity. Such sources include abandoned, improperly plugged, or unplugged oil and gas wells, and salt-water injection and/or disposal wells. As of June 2006, 167 of the 189 wells identified, recommended, and approved for plugging have been plugged.

The RRC and the TCEQ began working to eliminate pollution posed by unplugged or improperly plugged wells on February 11, 2003. The original project goal was to plug a total of 115 wells in Runnels County. The project end date was extended to allow time to

remediate 74 additional wells identified during the first phase of the project. As the lead entity, the RRC selected wells in the Upper Colorado River Basin, specifically in the Runnels County area, from a pool of non-compliant (abandoned and orphaned) and improperly plugged wells in the drainage basin.

The RRC will document well plugging operations for the Well Plugging Program on a Form W-3 "Well Plugging Report." This information is stored in the RRC's mainframe database system. In addition, a Well Plugging Invoice Summary Sheet is prepared for each lease/well plugged with state funds, and includes cost information for each well site. To date, the average plugging cost has been $9,646.00 per well.

Control Action 3.0: Reservoir Management and Continuous Water Quality Monitoring

The TCEQ and the CRMWD have deployed two monitoring stations in the Upper Colorado River watershed to accomplish four primary purposes:

- to continuously measure specific conductivity and therefore salinity, of water flowing from the upper watershed into E.V. Spence Reservoir, which discharges to Segment 1426.
- to identify and track trends in water quality.
- to determine the effectiveness of the practices implemented to reduce salinity.
- to assist CRMWD in diverting highly saline flows away from E.V. Spence Reservoir, and therefore Segment 1426 as well.

CRMWD operates a "diverted water" supply system to prevent highly mineralized surface water that occurs routinely under base-flow and low-flow conditions in the Colorado River and Beals Creek (a tributary to the Colorado River) from reaching E.V. Spence Reservoir. Poor quality surface water is captured and pumped to nearby storage reservoirs for evaporation. The less-saline water experienced during high- or flood-flow conditions is allowed to bypass the pumping station and travel downstream to E.V. Spence Reservoir.

The Surface Water Quality Monitoring Team of the TCEQ's Monitoring Operations Division coordinates all aspects of managing the continuous monitoring stations. The monitoring stations are located at the Beals Creek Pump Station southeast of Big Spring and the Colorado River Pump Station northwest of Colorado City (Figures 6 and 7). Both stations are operated and maintained by CRMWD staff. A web page allows users to review, customize, and generate a data report of the continuously monitored data. See the data at <www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/swqm_realtime_swf.html#data>.

Because the data generated will be real-time, CRMWD will be able to monitor changes in salt concentrations (using specific conductance) during base-flow and flood conditions that will assist them in managing their water diversion system and improving the water supply. Implementation of this action is funded through a federal Water Pollution Control Program Grant authorized under Section 106 of the Clean Water Act.

Figure 6: Beals Creek Pump Station southeast of Big Spring

An Act of the 51st Legislature of Texas in 1949, Article 16, Section 59 of the Constitution of Texas established the Colorado River Municipal Water District and conferred its power and authority. According to the statute, the CRMWD is constituted and declared to be a water control and improvement district and as such, may provide for the control, storage, preservation, and distribution of its water and floodwater and the water of its rivers and streams, as well as provide for the protection, preservation, and restoration of the purity and sanitary condition of the water. CRMWD was issued a certificate of adjudication on August 19, 1977, recognizing they have a water right in the Upper Colorado River Basin including E.V. Spence Reservoir.

Figure 7: Colorado River Pump Station northwest of Colorado City

As a participant of the Clean Rivers Program, the CRMWD is tasked with maintaining a basin-wide water quality monitoring program, identifying water quality problems and known pollution sources, and setting priorities for taking appropriate actions to eliminate those problems and sources. These roles make CRMWD the agency with the authority

and purpose appropriate to implement the water quality diversions and reservoir management measures.

Implementation Tracking

This I-Plan includes provisions to track the progress of the plan using both implementation and water quality indicators. These terms are further defined as:

- **Programmatic Indicator** – A measure of administrative actions undertaken that result in an improvement in water quality.
- **Water Quality Indicator** – A measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, and water quality standards.

Implementation tracking provides information that can be used to determine if progress is being made toward meeting goals. Tracking also allows stakeholders to evaluate actions taken, identify those which may not be working, and make any changes that may be necessary to get the plan back on target. The RRC, LCRA, CRMWD, and TCEQ will work collaboratively to ensure monitoring data are assessed to track progress.

Programmatic Indicators

Several monitoring and remediation projects are planned or underway as part of this implementation plan. Additional details of the various monitoring efforts are described in the "Water Quality Indicators" section of this document.

The TCEQ and its stakeholders will further evaluate the need for, and effectiveness of, the various mitigation and remediation options, and site-specific natural attenuation, based on periodic evaluation of monitoring results. Timetables for additional monitoring and/or the implementation of any BMPs, and estimates of the time necessary for restoration of the general use, will be further developed as the results of the ongoing monitoring are known. Interim evaluations will be made as appropriate, with final evaluations to be performed following completion of ongoing and scheduled efforts.

Water Quality Indicators

Verification that designated uses have been restored requires the measurement of applicable water quality indicators. The measurable outcome of all phases of this I-Plan shall be the attainment of the TMDL endpoints for chloride and TDS in Segment 1426.

The CRMWD will monitor chloride and TDS in surface water at several stations on Segment 1426. Conductivity in the upper Colorado watershed above E.V. Spence Reservoir will be monitored continuously via continuous monitors. Progress related to these environmental indicators will be analyzed by the CRMWD, LCRA, and the TCEQ.

Review Strategy

The TCEQ and stakeholders in TMDL implementation projects periodically assess the results of the planned activities and other sources of information to evaluate the adequacy of the I-Plan. Stakeholders evaluate several factors, such as the pace of implementation, the effectiveness of best management practices, load reductions, and progress toward meeting water quality standards. The TCEQ will document the results of these evaluations and its rationale for maintaining or revising elements of the I-Plan, and will present them as part of the state's normal reporting process, as summarized in the following section.

Communication Strategy

Communication is necessary to ensure that stakeholders understand the I-Plan and its progress in restoring water quality conditions. The TCEQ will disseminate the information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, nongovernmental organizations, and individuals. Though management measures and control actions are underway, a phased approach has been selected to determine the progress of this I-Plan. Implementing TMDLs under the phased approach establishes a timetable for the evaluation of management measures, data collection, the assessment for water quality standards attainment, and if needed, additional predictive modeling. If monitoring determines that the measures underway are not sufficient to achieve water quality standards, then the next phase of management practices shall be implemented.

The evaluation of management measures for Colorado River Below E.V. Spence Reservoir will be scheduled into three separate phases.

- Phase I of implementation plan progress will begin upon adoption (2007) of the plan by the commission.
- Phase II will commence after three years (2010) upon determination that Phase I BMPs have not improved water quality sufficiently to achieve water quality standards.
- Phase III will begin after eight years (2015) of implementation upon determination that Phase II BMPs have not improved water quality sufficiently to achieve water quality standards.

Updates on these analyses will be provided to stakeholders via the TCEQ's project web page. Results and progress will be documented in the TMDL Program's biennial status report. Regionally, the progress of this implementation plan will be reported in the annual reports prepared by the Lower Colorado River Authority under provisions of the Texas Clean Rivers Program.

References

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