INVESTIGATIONS AND ABATEMENT OF PRODUCED WATER IMPACTS AND SEEPS TO SURFACE WATER

SECTION 319 NONPOINT SOURCE GRANT
UPPER COLORADO RIVER BASIN
Downstream of Spence Reservoir (Segment 1426)
Coke and Runnels Counties, Texas

Final Quarterly Report
4th Quarter, FY 2008
September 15, 2008

Introduction

The Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ) awarded a non-point source grant to the Railroad Commission of Texas (RRC) for the investigation of the nature and extent of known salinity contamination thought to be contributing to water quality problems in E. V. Spence Reservoir, the development of remediation/abatement alternatives or Best Management Practices (BMPs), and the implementation of the BMPs. The TCEQ has placed Segment 1426 of the Upper Colorado River, downstream of E.V. Spence Reservoir, on the State's 303(d) list because it does not meet water quality standards. The project encompasses areas in both Coke and Runnels Counties commonly referred to as the Wendkirk Oil Field and Ballinger Seep, respectively. Surface water and groundwater in the Wendkirk Oil Field also flow into Segment 1426 as the Colorado River runs through the field in Coke County. Discharge from the Colorado River Seep near Ballinger flows directly into Segment 1426 of the Colorado River. The Hydrologic Unit Codes (HUCs) for this study are 12080008 and 12090101.

Salinity in the Upper Colorado River Basin has been identified as a major water quality problem. Occurrences of poor-quality water in Segment 1426, due to elevated salinity levels, have been documented. Possible sources include activity associated with oil and gas operations, such as improperly completed oil and gas wells, abandoned, unplugged oil and gas wells, wells that are improperly or inadequately plugged with respect to current plugging regulations, saltwater injection and/or disposal wells, natural and anthropomorphic conduits, failed gathering and transporting pipelines, historical evaporation pit locations, and abandoned surface facilities.

A mutual objective of the RRC and the TCEQ is to locate sources and to reduce the high salinity that contributes to water quality degradation.

The RRC will conduct various activities to achieve the goal of reduced non-point source pollutant loading to the Upper Colorado River. The RRC will implement assessments and remediation projects through the following means:

1) Conduct a non-invasive geophysical survey on selected area(s) suspected of high salinity in soil and groundwater. (This activity will be determined based on the results of the aerial geophysical survey conducted by the Bureau of Economic Geology [BEG].)
2) Locate soil borings in historic pits, near other suspected oil and gas facilities and in known and suspected release areas.

3) Install monitoring wells in suspected plume areas, up gradient of known saltwater seeps, down gradient of suspected O&G facilities, and in alluvial deposits along the drainage downstream of discharge areas.
4) Sample existing and newly installed monitoring wells.
5) Conduct a study to choose the BMPs and implement the BMPs in order to reduce the high total dissolved solids (TDS) loading.

This project will enhance the pollution prevention efforts of the RRC and the TCEQ as well as help to restore and maintain the water quality in the Upper Colorado River Basin, downstream of Spence Reservoir.

The objective of the project is to identify and investigate the source(s), nature, and extent of elevated salinity in the Upper Basin Watershed of the Colorado River so that the most effective BMPs can be identified and evaluated, specifically in the areas of the Colorado River Seep at Ballinger and in the Wendkirk Oil Field Project. This process requires an inventory of the current and former land uses within the study area(s), ongoing sampling of the known seeps, the installation and sampling of soil borings, and the installation and ongoing sampling of groundwater monitoring wells. The initial list of chemicals of concern includes chlorides, TDS, and sulfate. Because benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbons (TPH) can also be found in produced water, periodic screening analyses for these analytes are scheduled throughout the investigation.

The Ballinger Seep site is located along the Colorado River approximately 0.5 mile east and downstream of Ballinger, Runnels County, Texas. The Colorado River flows through the Wendkirk Oil Field approximately two (2) miles east and downstream of the confluence of Machae Creek and the Colorado in eastern Coke County, Texas.

Progress and Results by Specific Work Task:

Task 1.1: **Organize a Projects Management Team (PMT).** The PMT has been established and includes personnel from the RRC's Site Remediation in Austin and personnel from the San Angelo District. Bill Renfro, Technical Coordinator in Site Remediation, is the primary contact.

Task 1.2: **The PMT will negotiate with one or more of the contracted environmental engineer companies for investigative work.** The PMT has contracted with TRC Customer Focused Solutions (TRC) to investigate the Wendkirk Oil Field area and with HBC Terracon (Terracon) to investigate the Ballinger Seep.

Task 1.3: **The PMT will submit quarterly status reports.** The third quarter fiscal year 2005 is the initial status report of the project. The grant period includes fiscal years 2005, 2006, 2007, and 2008 and will conclude August 31, 2008.

Task 2.1: **Ballinger Seep Investigation.** Authorization has been given to Terracon to proceed with the investigation. To date, Terracon has completed a preliminary site assessment at the Ballinger Seep, and has submitted a *Work Plan and Safety and Health Plan* for the investigation of the

Ballinger Seep. The field investigation activities were completed during the fourth quarter of fiscal year 2006. Based upon the results of the field activities, additional assessment activities were determined to be necessary to evaluate potential release sources and impacts to groundwater and surface water. A work plan for additional investigation is currently being prepared and will be implemented during the third quarter of fiscal year 2007.

Third Quarter 2007 Update: The field mobilization work plan has been approved. Terracon has completed the installation of supplemental monitor wells and has performed an additional round of groundwater and surface water sampling. Analyses will be completed in June 2007.

Fourth Quarter 2007 Update: Terracon has completed the field investigation of the Ballinger Seep and has evaluated all data that has been gathered. It appears that the main source of saline water seepage may be an uncased cable tool well drilled in 1935, as a dry hole, identified as the Wolverton Well No. 1. Several years ago, the RRC experienced difficulty in the plugging of the well, and the investigation indicates that it remains a problem and continues to feed the seeps along the drainage to the Colorado River. Terracon has distinguished a shallow and a deeper water-bearing zone, both of which are impacted with the shallow zone containing the highest salinity. Both zones contribute to the Colorado River. Terracon recommends the re-entering and plugging of the Wolverton Well No. 1.

First Quarter 2008 Update: RRC personnel have discussed the steps and protocol for the plugging of the Wolverton Well No. 1. Plugging of the well will occur during the fourth quarter fiscal year 2008.

Second Quarter 2008 Update: The San Angelo District of the RRC has submitted the paper work for authorization of funds for the plugging of the Wolverton Well No. 1. When the bidding process has been completed, plugging of the well will begin. The well will be plugged during the fourth quarter of 2008. The investigative phase of the Ballinger Seep project has been completed. (see **Task 3.1**)

Third Quarter 2008 Update: The San Angelo District of the RRC has awarded the bid for the plugging of the Wolverton Well No. 1. Due to the drilling demand for oil and gas exploration and production, plugging of the well has been set for June 2008. The investigative phase of the Ballinger Seep project has been completed. (see **Task 3.1**)

Fourth Quarter 2008 Update: The RRC re-entered and plugged the Wolverton Well No. 1 on June 27, 2008. (see **Task 3.1**)

Task 2.1.1: Review nearby well completion, plugging, workover data and area pit locations. Terracon has reviewed RRC records, aerial photographs, and completed the Ballinger Seep site visit to confirm locations and information. During the site visit by Terracon, conductivity readings of

the seep and tributary were taken to assist in the evaluation of potential sources. Data gathered from the site visit and from the review of RRC well records and aerial photographs were included in the Work Plan along with a list of the oil and gas wells that have been identified.

Task 2.1.1 has been completed.

Task 2.2: Wendkirk Oil Field Investigation: TRC has attended BEG presentations of the aerial geophysical survey of the Machae Creek and Wendkirk Field area. In early September 2005, the BEG submitted the airborne electromagnetic (EM) survey of Segment 1426 final report. The final BEG report was needed to develop an investigation work plan. In October 2005, TRC submitted a work order, *Wendkirk Oil Field Preliminary Investigation, Coke County, Texas,* to initiate the first phase of the Wendkirk Oil Field investigation. The goal of the preliminary investigation was to collect data to enable the scope of work for the remainder of the investigation to be developed in an effective and efficient manner since the area of investigation is extensive and will require careful strategy for optimum effectiveness. The preliminary investigation was intended to identify project areas and potential sources most likely to be contributing salinity to the Colorado River.

The preliminary investigation was completed in December 2005. Based upon the results of the preliminary investigation, TRC prepared a Phase II investigation work order for field activities involving the installation and sampling of soil borings and groundwater monitor wells, as well as several surface water monitoring events. The work order was authorized by the RRC in June 2006, and the field activities are ongoing. Based upon the results of the initial groundwater investigation phase, an addendum work order was authorized in October 2006, to conduct a geophysical study to assist in the evaluation of possible release source areas and selection of proposed monitor well locations for the next planned phase of groundwater investigation. The next phase of groundwater and surface water investigation/monitoring activities will be conducted during the third quarter fiscal year 2007.

Third Quarter 2007 Update: During March 2007, the Revised Seasonal Groundwater Monitoring Work Plan and the Revised Groundwater Investigation Work Plan submitted by TRC were approved and found to be consistent with the revised QAPP. In April, TRC completed both the Groundwater Investigation Event 2 and the Seasonal Water Monitoring Event 3. The analytical data resulting from the two field events were reviewed by TRC. (For subsequent project information see Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.)

In May, the BEG finalized the ground-based geophysical report.

Fourth Quarter 2007 Update: In preparation of a BMP feasibility study, step tests were completed in six (6) of the monitor wells during the June 2007, mobilization. Visual logging equipment was used during the

mobilization to complete the down-hole logging of the Mays-01 water well, south of the Colorado River, and to collect two (2) discrete groundwater samples from the well. Based on the logging, sampling, and a records search, it was determined that the Mays-01 well most probably was a converted oil well, which had been plugged back to groundwater depths. The high salinity in the well may be due to bottom-hole pressure within the oil reservoir, which causes saline water to rise to the surface or near surface; or, it may be due to impact from the Coleman Junction, a pressurized saline-bearing formation, which the Mays-01 well bore intersects. The step tests indicated that slug tests would be the best measure of aquifer parameters that would provide data for the BMP feasibility study. Two (2) monitor wells and an observation well were installed in the vicinity of the Mays-01 water well. A slug test was performed on the new observation well. A lithologic boring was installed north of the Colorado River to confirm the presence of a claystone that might act as a confining layer to prevent the high saline water found in two of the monitor wells north of the River from flowing into the Colorado from that direction. The final Phase II Investigation Report was submitted in August 2007. It was determined that the high salinity in the groundwater and seeps within the Wendkirk Oil Field contribute to the salinity impact on the Colorado River. TRC has submitted a work order for authorization to complete a feasibility study for the Wendkirk Oil Field project.

First Quarter 2008 Update: The draft BMP feasibility study for the Wendkirk Oil Field was submitted and reviewed. The final report will be submitted during the early second quarter fiscal year 2008. BMPs discussed in the draft report include strategically located recovery wells, trenches, and plugging of wells. Waste disposal of recovered saline water include: the drilling and completion of a disposal well, an evaporation pond and disposal in an existing commercial or non-commercial disposal well, or installation of a battery of holding tanks. The final report will be submitted, discussions of BMP choice(s) will occur, the choice will be made, and design(s) submitted during the second quarter fiscal year 2008.

Second Quarter 2008 Update: The final report of the BMP feasibility study was submitted during the second quarter fiscal year 2008, and BMPs that were chosen include: 1) the plugging of a water well, known as the Mays 01, that appears to have been converted from an oil well and plugged back to a freshwater zone; and, 2) a recovery well system and tank battery for storage for hauling and disposing the high saline water. The investigative phase of the Wendkirk Oil Field project has been completed. (see **Task 3.1**)

Third Quarter 2008 Update: The San Angelo District of the RRC has awarded the bid for the plugging of the Mays 01 well. Due to the drilling demand for oil and gas exploration and production, plugging of the well has been set for June 2008. The 100% design for the recovery well system and tank battery has been submitted. The investigative phase of the Wendkirk Oil Field project has been completed. (see **Task 3.1**)

Fourth Quarter 2008 Update: The RRC plugged the Mays 01 water well. (see **Task 3.1**)

Task 2.2.1: Review well completion, plugging, and workover data, area pit locations, pipeline and tank battery releases, abandoned O&G well locations, and other exploration and production activities in the Wendkirk Oil Field.

TRC proposed in the work order, *Wendkirk Oil Field Preliminary Investigation, Coke County, Texas,* to collect and evaluate information through records review and field reconnaissance. TRC subsequently developed topographic maps and aerial photo maps with data gathered from the implementation of this task. The maps include water well locations, oil and gas well locations and descriptive data, and physical structures such as residences, tank batteries, etc.

Third Quarter 2007 Update: See Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.

Fourth Quarter 2007 Update: A comprehensive records review was completed in July 2007 to determine if the Mays-01 water well is a converted (plugged back) oil well and if other water wells in the field have been converted from wells drilled as oil wells.

Task 2.2.1 has been completed.

Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.

As of the fourth quarter fiscal year 2007, both projects of the NPS Grant Downstream of Spence Reservoir have moved into the BMP evaluation, selection, design, and implementation portion of the grant as a step toward the effective reduction of salt load to the Upper Colorado River.

Task 3.1.1: BMP Evaluation.

Third Quarter 2007 Update:

Wendkirk Oil Field:

In May 2007, TRC met with RRC personnel to review the existing data and discuss BMP possibilities such as:

- Groundwater management control recovery wells installed strategically along the Colorado River and within the field.
- Plugging of water wells, water wells converted from oil and gas wells, and oil and gas producing and injection wells if determined to be sources.
- Pit excavation and backfilling or capping.
- Abatement trenches installed in optimal locations where seepage occurs.

TRC submitted a work order to perform Engineering Design Field Activities to gather aquifer data, investigate a water well that may be a converted oil well and may be a principle source in the area, and gather

data, which, combined with previous data, will be helpful in a feasibility study. The work order is going through the authorization process presently.

Fourth Quarter 2007 Update:

Ballinger Seep:

Terracon will evaluate BMP possibilities for the Ballinger Seep to mitigate the impact of the saline water seepage into the Colorado River. It appears that the Wolverton Well No. 1 may continue to be a source of the salinity in the seeps. Terracon has recommended that this well be re-entered and re-plugged. The evaluation will be completed during the first quarter of fiscal year 2008.

Wendkirk Oil Field:

TRC submitted a work order requesting authority to conduct a BMP feasibility study. The study will be authorized in September and will be completed during the first quarter fiscal year 2008.

First Quarter 2008 Update:

Ballinger Seep:

The BMP has been chosen. RRC will proceed with the plugging of the Wolverton Well No. 1.

Wendkirk Oil Field:

The draft BMP feasibility study for the Wendkirk Oil Field was submitted and reviewed. The final report will be submitted during the early second quarter fiscal year 2008. BMPs discussed in the draft report include strategically located recovery wells, trenches, and plugging of wells. Waste disposal of recovered saline water include: the drilling and completion of a disposal well, an evaporation pond and disposal in an existing commercial or non-commercial disposal well, or installation of a battery of holding tanks. The final report will be submitted, discussions of BMP choice(s) will occur, the choice will be made, and design(s) submitted during the second quarter fiscal year 2008.

Second Quarter 2008 Update:

Ballinger Seep: (See **Task 3.1.2**)

Wendkirk Oil Field:

The final report of the BMP feasibility study was submitted during the second quarter fiscal year 2008, and BMPs that were chosen include: 1) the plugging of a water well known as the Mays 01 that appears to have been converted from an oil well and plugged back to a freshwater zone; and, 2) a recovery well system and tank battery for storage for hauling and disposing the high saline water. The investigative phase of the Wendkirk Oil Field project has been completed. (See **Task 3.1.2**)

Third Quarter 2008 Update:

Ballinger Seep: (See **Task 3.1.2**)

Wendkirk Oil Field: (See **Task 3.1.2**)

Fourth Quarter 2008 Update:

Ballinger Seep: (See **Task 3.2**)

Wendkirk Oil Field: (See **Task 3.1.2**)

Task 3.1.2: BMP Selection and Design Work Plan Development.

Second Quarter 2008 Update:

Ballinger Seep:

The San Angelo District of the RRC has submitted the paper work for authorization of funds for the plugging of the Wolverton Well No. 1. When the bidding process has been completed, plugging of the well will begin.

Wendkirk Oil Field:

The San Angelo District of the RRC has submitted the paper work for authorization of funds for the plugging of the Mays 01 Water Well that appears to be a converted oil well which has been plugged back to a freshwater zone. When the bidding process has been completed, plugging of the well will begin.

TRC will submit an 85% Engineering Design for a recovery system of six (6) recovery wells and a tank battery for storage for hauling and disposal. The 85% Engineering Design will be submitted in early March. It is anticipated that the 100% Engineering Design will be completed during the first part of the third quarter 2008.

Third Quarter 2008 Update:

Ballinger Seep:

The San Angelo District of the RRC has awarded the bid to plug the Wolverton Well No. 1. Plugging will be completed during June 2008.

Wendkirk Oil Field:

The San Angelo District of the RRC has awarded the bid to plug the Mays 01 Well. Plugging will be completed during June 2008.

The 100% Engineering Design for a recovery well system and tank battery has been submitted. Authorization for the installment of six recovery wells by TRC and to request bids for the construction of the tank battery will be given during the first half of June 2008.

Fourth Quarter 2008 Update:

Ballinger Seep: (see **Task 3.2**)

Wendkirk Oil Field:

The installment of the recovery well and a tank battery system depended on the findings of the plugging of the Mays 01 water well, access issues and sufficient funds. Time became a factor due to access negotiations and

delays in plugging the Mays 01 water well. Funds remaining in the grant were not sufficient for implementation. (see **Task 3.2**)

Task 3.2: Implementation of the BMP(s)

Second Quarter 2008 Update: The plugging of the Wolverton No. 1 Well at the Ballinger Seep and the plugging of the Mays 01 Well in the Wendkirk Oil Field will be completed during the fourth quarter fiscal year 2008.

Third Quarter 2008 Update: The plugging of the Wolverton No. 1 Well at the Ballinger Seep and the plugging of the Mays 01 Well in the Wendkirk Oil Field will be completed during fourth quarter fiscal year 2008.

The Engineering Design for the recovery well system in the Wendkirk Oil Field will be the basis for constructing the BMPs during the fourth quarter fiscal year 2008.

Fourth Quarter 2008 Update:

Ballinger Seep:

During the re-entering and plugging of the Wolverton No. 1 well (completed on June 27, 2008), saltwater flow was discovered. This observation reinforced the conclusion that the Wolverton No. 1 has been the primary source of salinity in groundwater in the immediate area of the plugged well, which feeds the seepage of salinity into the Colorado River. The RRC will continue to sample the monitor wells, the seeps, and the Colorado River to determine the effectiveness of the BMP.

Wendkirk Oil Field:

During the plugging of the Mays 01 water well (completed on July 9, 2008), the RRC discovered that this particular well was drilled as a water well and was not converted from a plugged-back oil well into a water well. The total depth of the well was determined to be at 179 feet below ground surface. During plugging of the well, the RRC drilled new hole from 179 feet to 190 feet below ground surface. The wellbore of the Mays 01 water well does not penetrate the pressurized brine bearing Coleman Junction Formation as previously considered. The RRC concluded that the high salinity of the water from the Mays 01 water well must migrate into groundwater in the vicinity by means of another source or pathway.

The BMP that includes recovery wells and a tank battery system for the reduction of salt load into the Colorado River will be the focus of a future project when funding becomes available. In the meantime, the RRC will continue to sample the monitor wells, springs, seeps, and the Colorado River within the Wendkirk Oil Field.

Tasks 5.1 and 5.2: Creation of a website and update quarterly. The website has been created. This quarterly report, along with other preliminary information, reports, and future work plans, will be included on the website.

Third Quarter 2007 Update: The third quarter 2007 quarterly report may be viewed on the website.

Fourth Quarter 2007 Update: The fourth quarter 2007 quarterly report may be viewed on the website.

First Quarter 2008 Update: The first quarter 2008 quarterly report and other final investigation and design reports for both the Ballinger Seep and the Wendkirk Oil Field projects may be viewed on the website.

Second Quarter 2008 Update: The second quarter 2008 quarterly report and other final reports that have been submitted may be viewed on the website.

Third Quarter 2008 Update: The third quarter 2008 quarterly report and other final reports that have been submitted this quarter may be viewed on the RRC website.

Fourth Quarter 2008 Update: The fourth quarter 2008 quarterly report and other final reports that have been submitted this quarter may be viewed on the RRC website. The grant final report will be included on the RRC website.

Task 5.4: Share Data and Designs with Major Stakeholders. All data, designs, and plans will be available for viewing on the website. Meetings will be held when necessary for dissemination of information, clarification or discussion.

Second Quarter 2008 Update: The landowner and the operator in the area of the Wendkirk Oil Field that is nearest the proposed BMPs have been contacted by telephone and apprised of the BMP choices. Discussions have been on going.

Third Quarter 2008 Update: Personnel from the Austin and San Angelo District Offices met with the landowner concerning agreement for access to install six (6) recovery wells, manifolds, piping, tank battery and turn-around at the Wendkirk Field Site. Discussion concerning the agreement is now ongoing and may take a month or more to resolve. When the 100% design of the recovery system is received, Site Remediation personnel will meet with the TCEQ NPS Grants Manager and with the RRC Commissioner Offices, the RRC Director of the Oil and Gas Division and RRC Executive Director.

Fourth Quarter 2008 Update: Subsequent activities, analytical data and monitoring for effectiveness will be reported via the RRC website.

Task 6.1: Provide the Quality Assurance Project Plan (QAPP) prior to the collection of any sampling data. The initial draft of the QAPP was submitted by the RRC to the TCEQ in the fourth quarter of FY05. The QAPP was approved in March 2006.

Third Quarter 2007 Update: The revision of the Downstream QAPP has been approved and signed by the EPA on April 24, 2007, and has been distributed to all persons on the distribution list.

Third Quarter 2008 Update: The renewal of the Downstream QAPP was submitted to the EPA this quarter.

Fourth Quarter 2008 Update: On July 16, 2008, EPA approved and signed the revisions of the Downstream QAPP.

Fiscal Year 2009 Projections:

Ballinger Seep BMP – The RRC will continue to sample the monitor wells, the seeps, and the Colorado River to determine the effectiveness of the BMP.

Wendkirk Oil Field BMPs – A BMP that includes recovery wells and a tank battery system for the reduction of the salt load into the Colorado River will be the focus of a future project when funding becomes available. In the meantime, the RRC will continue to sample the monitor wells, springs, seeps, and the Colorado River within the Wendkirk Oil Field. The RRC will continue to determine sources and steps for source eradication in fiscal year 2009.