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

SECTION 319 NONPOINT SOURCE GRANT
UPPER COLORADO RIVER BASIN
Upstream of Spence Reservoir (Segment 1411)
Howard and Mitchell Counties, Texas

Quarterly Report
Third Quarter, FY 2008
June 1, 2008

Introduction

The Environmental Protection Agency (EPA) has awarded a nonpoint source grant through the Texas Commission on Environmental Quality (TCEQ) 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 1411 of the Upper Colorado River, 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 Howard and Mitchell Counties commonly referred to as the West O'Daniel Seep, O'Ryan Seep, Pharaoh Seep, and Dugout Creek Alluvium, which all flow into Beals Creek, into the Upper Colorado River, and then into Spence Reservoir (Segment 1411 of the Colorado River Basin). The Hydrologic Unit Code (HUC) for this study area is 12080007.

Salinity in the Upper Colorado River Basin has been identified as a major water quality problem. Occurrences of poor-quality water in Segment 1411, 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 nonpoint source pollutant loading to the Upper Colorado River. The RRC will implement assessments and remediation projects through the following means:

1) Install monitoring wells up-gradient of known saltwater seeps, and in alluvial deposits along the drainage downstream of known seeps.
2) Sample existing and newly installed monitoring wells in the areas of known seeps.
3) Conduct a non-invasive geophysical survey on selected area(s) suspected of high salinity in groundwater.

4) Conduct further investigations if necessary including dye studies, the installment of additional soil borings and monitor 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, upstream 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 West O'Daniel Seep, the O'Ryan Seep, the Pharaoh Seep, and the Dugout Creek Alluvium project areas. 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 West O'Daniel Seep site is located west of FM 821, approximately 5.5 miles southeast of Coahoma, Howard County, Texas and is one of several saltwater seeps found along the contact of an Ogallala Outlier and the Dockum Group that discharge their water into intermittent streams and drainage ways flowing into Beals Creek, a tributary of the Colorado River. The confluence of Beals Creek and the Colorado River is located upstream of the E. V. Spence Reservoir.

The O'Ryan and Pharaoh Seep sites are located at the head of an unnamed tributary of Dugout Creek approximately 3.5 miles southeast of Coahoma, Howard County, Texas, and are two of several saltwater seeps that discharge their water east into the intermittent Dugout Creek which flows into Beals Creek, a tributary of the Colorado River. The confluence of Beals Creek and the Colorado River is located upstream of the E. V. Spence Reservoir. The O'Ryan and Pharaoh Seeps are also located along the contact of the Ogallala Outlier and the Dockum Group.

The Dugout Creek alluvial area of investigation is located along a length of Dugout Creek approximately 3.5 miles east and ten (10) miles southeast of Coahoma, Howard County, Texas, and discharges water into Beals Creek, a tributary of the Colorado River. The confluence of Beals Creek and the Colorado River is located upstream of the E. V. Spence Reservoir. Dugout Creek is fed from the west by surface drainage and seeps along the base of the Ogallala where it lies unconformably on the Dockum. The O'Ryan and Pharaoh Seeps are included in this drainage from the west.

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 Midland 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 West O'Daniels Seep and with Intera Incorporated (Intera) to investigate the O'Ryan and Pharaoh Seeps and the Dugout Creek Alluvium.

Task 1.3: **The PMT will submit quarterly status reports.** The third quarter fiscal year 2005, is the initial status report of project. The grant period includes fiscal years 2005, 2006, and 2007, and will conclude August 31, 2007. (An application for extension to August 31, 2008, has been approved by the EPA.)

Task 2.1: **West O'Daniel Seep Investigation.** Authorization has been given to TRC to proceed with the investigation. A work plan and health and safety plan have been submitted to the RRC.

Fourth Quarter 2005 Update: TRC has submitted a *Final Work Plan and Health and Safety Plan* for the assessment of the West O'Daniel Seep. The work plan details the assessment activities to be performed at the site including the installation of five (5) monitor wells. Both plans will be included on the N*on-point Source Grants for Investigation and Abatement of Produced Water Impacts and Seeps into Surface Waters of Texas* website, which will be available for access during the first quarter of fiscal year 2006. Field activity is on hold pending the approval of the QAPP for this grant.

First Quarter 2006 Update: Notification was received November 29, 2005, that the Upstream QAPP has been approved by the EPA. TRC will perform fieldwork at the West O'Daniel Seep during late January or early February. TRC will complete field investigation by the end of the second quarter fiscal year 2006.

Second Quarter 2006 Update: TRC has been authorized to sample three (3) seep areas in Howard County for annual monitoring, the Click, Vincent, and Zant Seeps. Monitor wells and the seeps (if flowing) will be sampled and sent to the lab for analysis. In a previous nonpoint source grant investigation, these three (3) seeps did not constitute problems. The annual monitoring is performed to confirm that the salt impact is not occurring. Authorization has also been given to investigate the Anderson Seep further in an attempt to determine sources. State funds will be used for this purpose. With three (3) authorizations (including the West O'Daniel Seep) in the same county, TRC will use one mobilization to the field. Fieldwork will commence by the end of March.

Third Quarter 2006 Update: TRC completed the fieldwork at the West O'Daniel Seep. With the installation of five (5) new monitor wells on the Ogallala outlier and down drainage direction of the seepage below the Ogallala/Dockum contact, TRC has installed a total of seven (7) monitor

wells for source determination. Samples were taken from TRC's West O'Daniel Seep monitor wells and from monitor wells that were previously installed by the Bureau of Economic Geology (BEG) during an investigation of another seep at the contact of the Dockum and the same Ogallala outlier located northeast of the West O'Daniel Seep. Any water wells in the area were due to be sampled as well as any surface expression of the seep at the contact or along the drainage alluvium. A draft report will be submitted before the end of June. A dye study is scheduled for the fourth quarter of 2006.

Fourth Quarter 2006 Update: TRC has submitted the final report of the West O'Daniel Seep investigation, and the RRC has completed a dye study to determine if dye from the 1999 study performed by the RRC is still present and if a connection exists between the eastern O'Daniel Seep area and the West O'Daniel Seep. Fluorescein dye was found in one of the wells installed by the BEG in 1998 during the investigation of the eastern O'Daniel Seep area, but findings were inconclusive concerning the connection with the West O'Daniel Seep by looking at past dye studies. Another introduction of fresh dye into the system for study will be considered. The final report submitted by TRC will be placed on the new website in its entirety.

First Quarter 2007 Update: The final report of the West O'Daniel Seep investigation has been placed on the Site Remediation NPS Grants website. TRC is in the process of completing a BMP feasibility study to reduce the salt load into the Upper Colorado River via Beals Creek. The feasibility study includes the possibility of an abatement trench and disposal of the impacted water. Possible source removal is also being considered.

Second Quarter 2007 Update: The BMP feasibility study has been completed, and a final report will be submitted early in the third quarter of fiscal year 2007.

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

Fourth Quarter 2007 Update: See Task 3.1.2: BMP Selection and Design Work Plan Development

First Quarter 2008 Update: The West O'Daniel investigation phase of the project has been completed. See Tasks 3.1 and 3.2 (BMP evaluation and choice, design, and implementation)

Tasks 2.2, 2.3, and 2.4: O'Ryan Seep, Pharaoh Seep and Dugout Creek Alluvium Investigations. Intera has submitted work orders, and the RRC is in the process of authorizing the investigations.

Fourth Quarter 2005 Update: Intera has been authorized to investigate the O'Ryan Seep, Pharaoh Seep, and Dugout Creek Alluvium. Work plans

and health and safety plans are being submitted to the RRC momentarily. Field activities will commence when the grant QAPP has been approved.

First Quarter 2006 Update: Notification was received November 29, 2005, that the Upstream QAPP has been approved by the EPA. Intera will mobilize to perform fieldwork at the O'Ryan Seep and Pharaoh Seep and Dugout Creek Alluvium during January. Intera will complete field investigations by the end of the second quarter fiscal year 2006.

Second Quarter 2006 Update: Intera has searched the Pharaoh Seep area for the presence of soil gas vapors. All analytical data was negative indicating that hydrocarbons don't appear to be releasing into the soil. Further investigation with borings and monitor wells will take place in March and April. Nine (9) monitor well locations have been determined along the length of the Dugout Creek alluvium. The non-invasive geophysical electromagnetic (EM) survey was instrumental in the monitor well placement decisions.

Third Quarter 2006 Update: Intera completed the field investigation of the O'Ryan and Pharaoh Seeps and Dugout Creek. Nine (9) monitor wells were installed along the alluvial deposits a distance of two (2) or three (3) miles along the creek which drains into Beals Creek in Mitchell County. Intera will submit the reports that contain laboratory data, recommendations, and conclusions early 4th quarter 2006.

Fourth Quarter 2006 Update: Intera has submitted the final reports for the O'Ryan Seep, Pharaoh Seep, and Dugout Creek. The reports have been added to the new website in their entirety and will be available for viewing.

First Quarter 2007 Update: Intera has submitted a work order to complete the investigation and conduct a BMP feasibility study. Authorization is pending.

Second Quarter 2007 Update: The work order to complete the investigation of and conduct a BMP feasibility study for the Dugout Creek, O'Ryan Seep and Pharaoh Seep portion of the Upstream grant has been authorized. Intera is in the process of developing a work plan for fieldwork and feasibility study.

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

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

First Quarter 2008 Update: Intera was authorized to complete a comprehensive site-wide groundwater and surface water sampling event as a guide to BMP Evaluation and Selection. (See Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.)

Second Quarter 2008 Update: Intera has completed the investigation phase of the Dugout Creek, O'Ryan Seep, and Pharaoh Seep projects by the completion of the synoptic site-wide groundwater and surface water sampling event as a guide to BMP evaluation and selection. (See Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.)

Third Quarter 2008 Update: The site-wide groundwater and surface water sampling event final report for Dugout Creek, O'Ryan Seep, and Pharaoh Seep has been included on the Upstream NPS Grant website.

Task 2.4.1: Conduct a non-invasive geophysical survey to determine the location of monitor wells. Intera has completed the EM survey of the Dugout Creek alluvium and the Pharaoh Seep and O'Ryan Seep tributaries. The results of the non-invasive geophysical survey will be included in the pending work plan. Final data, interpretation, and results will be submitted by December 20, 2005, independent of the work plan that was submitted with the QAPP. The final data, interpretation and discussion were accomplished by the end of the second quarter 2006.

Task 3.1: BMP Evaluation, BMP Selection, and BMP Work Plan Development.
As of the third quarter 2007, the NPS Grant Upstream of Spence Reservoir projects have moved into BMP evaluation, selection, design, and implementation activities as a step toward the effective reduction of salt load to the Upper Colorado River.

First Quarter 2008 Update: The West O'Daniel Grant Project is now in the BMP implementation stage. A recovery trench has been chosen and designed as the most effective BMP. Construction of the trench is now in the bid process. The comprehensive site-wide groundwater and surface water sampling event is necessary for a complete BMP evaluation and choice for the Dugout Creek, O'Ryan Seep, and Pharaoh Seep (Dugout Creek) area. Intera will perform the sampling event during the second quarter of fiscal year 2008.

Second Quarter 2008 Update: Intera has submitted a draft of their synoptic site-wide sampling event in a comprehensive report entitled *Sitewide Groundwater and Surface Water Monitoring Report for Dugout Creek (Including O'Ryan Seep, Pharaoh Seep, and Dugout Creek) Howard and Mitchell Counties, Texas.* The final site-wide sampling report submittal and BMP selection will occur during the third quarter 2008.

Third Quarter 2008 Update: Intera has completed the final comprehensive report entitled *Sitewide Groundwater and Surface Water Monitoring Report for Dugout Creek (Including O'Ryan Seep, Pharaoh Seep, and Dugout Creek) Howard and Mitchell Counties, Texas.* The final site-wide sampling report has been included on the Upstream NPS Grant website. Intera is preparing a work order for authorization that will provide an

addendum to the BMP feasibility study previously submitted. Additional alternatives will be a part of this addendum.

Task 3.1.1: BMP Evaluation.

Third Quarter 2007 Update:

West O'Daniel Seep.

The BMP feasibility study report was submitted in April describing research into several abatement alternatives including:

- Series of recovery wells
- Recovery trench
- Recovery through halophytic vegetation
- Capture sumps

The removal of saline water with recovery wells, recovery trench, or sump technology would require disposal options of the recovered saline water. Disposal could involve desalinization, evaporation ponds, oil and gas injection wells (water flood or disposal wells).

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

Investigation completion and BMP feasibility study has been delayed. The proposed site reconnaissance has been delayed by the staff change for the civil engineering support. The issue should be resolved soon so that the project team can proceed with the authorized site visit.

Fourth Quarter 2007 Update:

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

The field investigation and preliminary BMP evaluation have been completed. The investigation determined that O'Ryan Seep and Pharaoh Seep are both contributing high saline concentrations in the alluvial flow of the drainage from the two seeps to the confluences with Dugout Creek. Intera contracted with Crespo Consulting Services, Inc., (Crespo) to fulfill the engineering support for BMP feasibility and design. Crespo has proposed preliminary recommendations that consist of two types of BMPs that separate the capture of the low flow seep water and the higher flow rain/runoff water. The BMPs include storage and disposal or evaporation using sumps and collecting tanks or lined pits near the seeps and a larger capture facility downstream of the surface salt deposits on the O'Ryan Seep drainage. The Crespo recommendations are under consideration by RRC personnel.

First Quarter 2008 Update:

West O'Daniel Seep.

A recovery trench has been chosen and designed as the most effective BMP. A stakeholders meeting was held in Midland in September 2007. Construction of the trench is now in the bid process.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

The comprehensive site-wide groundwater and surface water sampling event is necessary for a complete BMP evaluation and choice. Intera will perform the sampling event during the second quarter of fiscal year 2008.

Second Quarter 2008 Update:

West O'Daniel Seep.

See updates to **Task 3.1.2** and **Task 3.2**

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP evaluation and selection will occur during the third quarter 2008.

Third Quarter 2008 Update:

West O'Daniel Seep.

See updates to **Task 3.1.2** and **Task 3.2**

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP evaluation and selection will occur during the fourth quarter 2008.

Task 3.1.2: BMP Selection and Design Work Plan Development.

Third Quarter 2007 Update:

West O'Daniel Seep.

An interceptor recovery trench was selected as the most efficient abatement BMP for the West O'Daniel Seep. The wastewater will be stored in tanks and hauled to a commercial disposal well.

TRC submitted a BMP Design Work Order and has been authorized to develop an engineering design and specifications for an abatement trench system at the West O'Daniel Seep. In order to determine placement, depth, and length of the trench, TRC submitted a Field Sampling Plan, which is going through approval procedures.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP selections and design work plans have not occurred to date.

Fourth Quarter 2007 Update:

West O'Daniel Seep.

The design of the interceptor recovery trench and disposal system has been completed. TRC will provide bid specifications for the construction of the trench and disposal system, and the package will be released for bid. Design of the system will include the storage of the captured seep water in storage tanks and by hauling the water in vacuum trucks from the tanks to a RRC permitted commercial disposal well.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP selections and design work plans have not occurred to date.

First Quarter 2008 Update:

West O'Daniel Seep

A recovery trench at the West O'Daniel Seep was chosen as the most effective BMP to reduce the flow of saline water due to oil and gas exploration and production activities. TRC developed the engineering design for the construction of the trench, and the design is 100 percent complete as submitted. The bidding process is in progress; and, as soon as

a bid is awarded, construction of the trench will proceed followed by the implementation of the BMP (see Task 3.2)

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP selections have not occurred and design work plans have not been developed to date.

Second Quarter 2008 Update:

West O'Daniel Seep

The bidding procedure is complete. Two bids have been secured for 1) the construction of the tank battery and 2) the construction of the recovery trench. The RRC awarded the bid for the tank battery February 19, 2008. The tank battery will be used to collect the saltwater that is recovered from the trench and will store it for periodic hauling of the salt-water to a commercial disposal well. The RRC is scheduled to award the bid for the recovery trench in early March 2008. Both trench and tank battery construction will begin in March 2008.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP selections have not occurred and design work plans have not been developed to date.

Third Quarter 2008 Update:

West O'Daniel Seep

The construction of the recovery trench and the tank battery has been completed; the system is in the process of start-up including the testing of the trench, the pumps, and the connecting lines.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).

BMP alternatives are being submitted and reviewed for selection.

Task 3.2: Implementation of the BMP(s)

The construction of the BMP at the West O'Daniel Seep will take place following the awarding of the bid(s).

Second Quarter 2008 Update: For the *West O'Daniel Seep*, bid procedures have been completed, and construction of the recovery trench and the tank battery is due to commence in March 2008, and be completed in May 2008. Start-up is scheduled for May 2008.

Third Quarter 2008 Update: For the *West O'Daniel Seep*, the recovery trench and the tank battery have been constructed and are in the process of start-up.

Tasks 5.1 and 5.2: Creation of a website and update quarterly. A website is in the process of creation and will contain this quarterly report along with other preliminary information. Work plans will be included on the website in the future.

Second Quarter 2006 Update: The website is in draft form and is expected to be operational by March 31, 2006.

Third Quarter 2006 Update: The website creation is now in the hands of the Internet Manager and will be operational by the end of July. The new website will contain this quarterly report along with other preliminary information. When work plans are developed and approved, they will be included on the nonpoint source website.

Fourth Quarter 2006 Update: The website has been created and is in the process of being activated on line. This quarterly report, along with other preliminary information, the final reports that have been submitted, and future work plans, will be included on the website.

First Quarter 2007 Update: The website is now available and contains the final investigation reports of the West O'Daniel Seep, the O'Ryan Seep, the Pharaoh Seep, and Dugout Creek. To find the NPS Upstream Grant web page follow the path:

Railroad Commission of Texas Website
www.rrc.state.tx.us
Agency Services
Environmental Protection
Site Remediation
Nonpoint Source Grant

Second Quarter 2007 Update: The second quarter 2007 update may be viewed 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 reports that have been submitted 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 website.

Task 5.4: Share Data and Designs with Major Stakeholders.

Quarterly reports and final submitted reports and designs are placed on the website. A meeting was held in Midland on September 21, 2007, at which

the major stakeholders who were in attendance discussed the West O'Daniel Seep Trench design and future approaches to the oil and gas related salinity in the groundwater and surface water.

Task 6.1: **Provide the Quality Assurance Project Plan (QAPP) prior to the collection of any sampling data.** The second draft of the QAPP is presently in the process of completion for submittal to the TCEQ.

Fourth Quarter 2005 Update: The QAPP signature page has been signed by RRC, TRC, Intera, and the laboratories for final submittal to the TCEQ. It is anticipated that the QAPP will be approved by mid October.

First Quarter 2006 Update: The QAPP has been approved by the EPA and is being distributed to all parties involved in the investigations and abatement of produced water impacts and seeps to surface water in the Upper Colorado River Basin upstream of the Spence Reservoir (Segment 1411).

Second Quarter 2006 Update: The QAPP has been delivered in CD form to everyone on the QAPP distribution list. The RRC has a complete hard copy of the QAPP.

First Quarter 2007 Update: A revision of the Upstream QAPP is in the process of being submitted for approval.

Second Quarter 2007 Update: The revision of the Upstream QAPP has been approved by the TCEQ and submitted to the EPA.

Third Quarter 2007 Update: The revision of the Upstream QAPP has been approved and signed by the EPA on April 24, 2007.

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

Fourth Quarter FY 2008 Projections:

West O'Daniel Seep.
The fourth quarter of fiscal year 2008, is the final quarter of the grant. The interceptor and recovery trench and tank battery at the West O'Daniel Seep will be in full operation and will be observed for effectiveness. Operations and maintenance will continue under RRC jurisdiction.

Dugout Creek (O'Ryan Seep and Pharaoh Seep).
The final BMP feasibility study will be completed and BMPs chosen for the Dugout Creek area. It is anticipated that design and construction of the BMPs for this site will not take place during the present grant period due to the lack of funds and time. Future construction of the BMPs at Dugout Creek and Pharaoh and O'Ryan Seeps will take place when funds are secured by the RRC. The plugging or work over of two wells, one each at the Pharaoh Seep and the O'Ryan Seep, will be accomplished by operators of the

wells under RRC jurisdiction. If these two particular wells are found to be major sources of the two seeps, BMPs may not be necessary.

The Upstream NPS Grant Final Report will be submitted during the 4th Quarter.