

## Assessment of Osmotic Mechanisms Pairing Desalination Concentrate and Wastewater Treatment

PREPARED FOR: Dr. Saqib Shirazi, Texas Water Development Board  
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COPIES: Dr. Jorge Arroyo, Texas Water Development Board  
DATE: October 29, 2009  
TWDB CONTRACT NUMBER: 0804830852

Dear Dr. Shirazi,

Please find attached the project update for activities up to October 29, 2009.

We have substantially completed Task 1 and Task 2 of our scope of work, while maintaining a small allowance for revision work. A subcontract with Colorado School of Mines was signed and approved by all parties. Two amendments to the contract were also approved by TWDB staff. Amendment #2 is of particular importance because it extends the contract schedule through August of 2010.

An invoice and supporting information summarizing the project financials through 10/31/09 will be submitted by 11/06/09. To date, no expenses have been occurred on travel.

Please contact me if you have any questions regarding this progress report.

Sincerely,



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## **Section C - Outside Contractors**

A subcontract with Colorado School of Mines was signed and approved by all parties. Two amendments to the contract were also approved by TWDB staff. Amendment #2 is of particular importance because it extends the contract schedule through August of 2010.

## **Section D - Travel and Subsistence**

Nothing to Report.

## Agenda

1. Invoicing and Contract Language
2. Subcontracting
3. Project Status
  - a. Draft Table of Contents – Report

## PROGRESS REPORT

### 1. Invoicing and Contract Language

Questions arose regarding invoice back-up and the contract language, and amount payable from Ms. Sharon Moore of TWDB. CH2M HILL provided back-up regarding the methodology with which the invoices have been prepared. In summary, CH2M HILL had invoiced TWDB only for their share of the study, with CH2M HILL's in-kind contribution tracked on the monthly report. Ms Moore indicated that this methodology appeared to be in conflict with the contract language. Ms Moore indicated that:

“In Section I, (L), (M), and (N) it defines the Total Study Costs, the Board Share and the Local Share. For the Board Share it states "the *lesser* of \$90,000 *or* 66 percent of the total study costs *or* individual payment submission". So I tried determine how you arrived at \$4,474.17 as our portion of this individual payment submission. And I can not arrive at the figures using the percentages outlined in the contract with the information provided. I also noticed that the percentage for Local Share that is in the contract is incorrect. The contract has it at 33 percent of each voucher submission, but it should be 34 percent.”

I requested that my contracts officer review the contract language once again. On review of the contract language, it appeared that Section I and Attachment C of the contract would not be reconcilable.

Following this discussion, Ms. Phyllis Moore of TWDB indicated that a contract modification of section I, removing the "...*or* individual payment submission" language would be sought to ensure that invoicing will be transparent in the accounting system. CH2M HILL has agreed to modify the invoice to match the information currently in the reports.

Amendment #1 was approved to resolve the issue mentioned above.

CH2M HILL received payment for all invoices submitted to TWDB with the exception of April's invoice. Additional information for Invoice dated 5/29/09 covering project charges through 5/1/09 was requested by Phyllis Thomas and submitted by CH2M HILL for her review and approval.

An invoice for project charges through 10/31/09 will be submitted to TWDB next week.

## 2. Subcontracting

A subcontract with Colorado School of Mines was signed and approved by all parties. This issue was finally resolved.

## 3. Project Status

### 3.1 Draft Table of Contents.

CH2M HILL submits the following Table of Contents for the final report.

- Front Cover
- Inside Cover
- Executive Summary
- Table of Contents
- Table of Figures
- Table of Tables
- Acknowledgements
- Section 1. Introduction
  - Desalination in Texas
  - Concentrate Disposal in Texas
  - Forward Osmosis
  - Objectives
- Section 2: Background
  - Fundamentals of Desalination
  - Osmosis
  - Desalination
  - Forward Osmosis
  - Costs of Forward Osmosis
- Section 3: Characterization of Waters in Texas
  - Desalination in Texas
  - Wastewater treatment facilities in proximity of desalination plants
  - Characteristics of brackish water concentrate
  - Characteristics of seawater concentrate
  - Characteristics of treated wastewater
  - Osmotic Potential of various waters in Texas
- Section 4: Performance of Spiral Wound Forward Osmosis Membranes
  - Introduction
  - Methodology
  - Results
  - Discussion
- Section 5: Development of a Forward Osmosis Cost Model
- Section 6: Feasibility Analysis of Osmotic Mechanisms
- Section 7: Conclusions and Recommendations
- References
- Glossary
- Acronyms and Symbols
- Appendices
- CD-ROM

We are currently working on Section 1, 2 and 3 which correspond to Task 1 and Task 2 of our contract.

### **Progress by Task**

#### **Task 1. Survey of Water Categories and Quality**

An initial review of desalination facilities in the State of Texas was conducted. This task is substantially complete. A small budget reserve is being maintained.

#### **Task 2. Screening and Selection of Hybrid Forward Osmosis System Configurations**

This task is substantially complete. A small budget reserve is being maintained.

#### **Task 3. Testing of the Novel Forward Osmosis Spiral Wound Membrane Element**

CSM contract is finally in place. to conduct their portion of the work. CSM is ready to start testing the required water qualities identified under Task 1 and Task 2.

#### **Task 4. System and Process Modeling**

We are anticipating beginning to prepare our RO process modeling for the non-forward osmosis system components. We can not begin the FO module until after the data from Task 3 is developed.

#### **Task 5. Cost Modeling**

We are beginning to prepare our cost curves for the non-forward osmosis system components. We can not begin the FO module until after the data from Task 3 is developed.

#### **Task 6. Final Report Preparation**

We have prepared a draft Table of Contents for TWDB review.