Water Supply Reserve Account – Grant and Loan Program
Water Activity Summary Sheet

Applicant: Colorado Department of Public Health & Environment – Water Quality Control Division

Amount Requested: $800,000

Water Activity Name: Demonstration of Membrane Zero Liquid Discharge Process for Drinking Water Systems

Source of Funds: Statewide Account - $700,000; Metro Account - $50,000; Arkansas Basin Account – $25,000; South Platte Basin Account - $25,000

Matching Funds: $325,000 of financial contributions and in-kind services (may increase as additional participating entities contribute)

Water Activity Purpose: Technical assistance regarding permitting, feasibility studies, and environmental compliance

County: Adams and Otero

Drainage Basin: Arkansas and South Platte

Water Source: Alluvial aquifers and surface water from the South Platte and Arkansas Basins

Staff Recommendation
The proposed project helps addresses one of the major water issues facing the Arkansas, Metro, and South Platte Basins. Staff recommends approval of up to $700,00 from the Statewide Account, $50,000 from the Metro Account, $25,000 from the Arkansas Basin Account, and $25,000 from the South Platte Basin Account contingent on resolution of the item in the issues/additional needs section.

Water Activity Summary:

Applicant
The Water Quality Control Division is statutorily created at C.R.S. 25-8-301(2) and its duties include:
(a) Carrying out the enforcement provisions of the Water Quality Control Act (WQCA) and the state Drinking Water Statutes;
(b) Administer the permit system as provided in Part 5 of the WQCA;
(c) Monitor waste discharges and the state waters as provided in Section 25-8-303;
(d) Submit an annual report to the commission as provided in Section 25-8-305;
(e) Review and certify, conditionally certify, or deny requests for certifications under the provisions of Section 401 of the federal Clean Water Act and this article, known as "401 certificates." ;
(f) Perform such other duties as may lawfully be assigned to it.

Overview of the Water Activity
Membrane treatment for municipal drinking water supply is the best technology for producing potable water from lower quality/impacted sources that will meet, and often exceed, regulatory requirements adopted pursuant to the federal Safe Drinking Water Act (SDWA) and/or consumer requirements. Currently, many sources of water in the Arkansas and South Platte River Basins exceed the regulatory maximum contaminant level under the SDWA for one or more parameters and/or have high levels of total dissolved solids that are unacceptable to consumers.

At present, drinking water utilities have been reluctant to undertake reverse osmosis (RO) or nanofiltration (NF) membrane projects due to the uncertainty surrounding the availability of feasible disposal options for the concentrate. Zero liquid discharge (ZLD) is a sustainable disposal option that represents a long-term solution to concentrate disposal for utilities that need membrane treatment to produce safe drinking water. The primary barrier to implementing ZLD is the lack of cost and performance data developed for drinking water systems under conditions unique to Colorado. Pilot tests demonstrating ZLD will help resolve the technical and financial uncertainties which currently hinder its implementation making additional water supplies available for municipal use.

Objectives of the proposed pilot testing will include:

- Comparing the performance of alternative ZLD technologies;
- Developing capital, operating and maintenance costs for ZLD technologies;
- Completing a detailed analysis of energy consumption;
- Determining the quantity and quality of the water recovered from the ZLD process;
- Characterizing the quantity and composition of solid created by the process;
- Determining the handling, transportation and disposal requirements for solids created by the process;
- Identifying potential marketable residuals from the ZLD process and summarizing applicable case studies;
- Assessing the different requirements of two distinct source waters representing different water quality conditions for the State of Colorado.

Pilot testing will occur at two sites with two different water qualities for Colorado. The first site at the City of Brighton's RO Water Treatment Plant (WTP) will represent water quality indicative of the South Platte River basin. The second site, located at the City of La Junta's RO WTP, characterizes typical Arkansas River basin water. These plants have distinct water quality challenges. In the case of Brighton, the concentrate disposal challenge is caused by nitrate, whereas, in the case of La Junta, the challenge is caused by selenium. Brighton is a rapidly growing community, in which increased municipal and industrial (M&I) demand is an immediate issue. La Junta is representative of a small agricultural community with limited financial resources that must confront a highly technical and costly disposal issue. These communities are representative of the statewide concentrate disposal issues facing utilities statewide.

The pilot testing consists of 9 tasks:

1. Literature Search
2. Experimental Plan
3. Design Layouts
4. Install Equipment
5. Pilot Operations
6. Water Sampling
7. Support Energy Study
8. Final Report
9. Project Management & QC

Deliverables include various technical memorandum, experimental plan, design drawings, pilot plant equipment, capital and operating costs under multiple conditions, analysis of water samples, analysis of solids sampling, process schematics and water and energy balances, and a final report. Estimated time frame for the project is January 2009 through January 2010.

Threshold and Evaluation Criteria

The application articulates how the project meets all four Threshold Criteria.

The application articulates how the project meets each of the Evaluation Criteria. This water activity does an outstanding job of meeting the following Evaluation Criteria:

a. *Addresses Multiple Needs*
The project addresses issues related to making additional poorer quality water supplies available for municipal water supply and is applicable to multiple water supply interests in all basins.

b. *Promote Cooperation and Collaboration*
A wide variety of entities are represented in this application and are working together through a process of cooperation and collaboration to develop the necessary information contemplated by this pilot project. The MTW has brought together a broad spectrum of interests who are cooperatively working together to develop solutions to the problem of environmentally acceptable disposal of membrane treatment concentrate. The pilot testing of ZLD technologies was identified by the MTW as a critical step in solving the problem of concentrate disposal in Colorado. Additionally, this application is being funded by three Basin Roundtables (Arkansas, Metro, and South Platte) and received conceptual support from a fourth (Colorado).

j. *Meets SWSI Objectives*
The proposed project addresses several SWSI objectives including: sustainability in meeting municipal demands, optimizing existing and future water supplies, providing for environmental enhancements, providing operational flexibility and complying with regulations.

As outlined in the October 2007 Report of the Membrane Treatment Workgroup to the Water Quality Control Commission, ZLD technologies are the only viable long-term approach for disposal of concentrate of membrane processes used for meeting Safe Drinking Water Act and Clean Water Act requirements while making maximum use of existing resources.

The ability of this project to meet SWSI objectives is summarized in the conclusion of this report, which has been endorsed by the Water Quality Control Commission:

To assure an adequate and sustainable supply of high-quality water for municipal and industrial uses, the State of Colorado should take a leadership role in demonstrating cost effective and energy-efficient ZLD technologies to manage RO/NF residuals with minimal environmental impact. This role should include active support and financial assistance, in cooperation with private interests, for the development and operation of ZLD pilot testing programs.

m. *Makes New Water Available for Use*
By assisting in solving the membrane concentrate disposal dilemma, many lower quality and saline water sources currently not considered suitable for drinking water sources could be brought into production.

Funding Overview
Grant funding in the amount of $800,000 is being requested; $700,000 from the Statewide Account, $50,000 from the Metro Account, $25,000 from the Arkansas Basin Account, and $25,000 from the South Platte Basin Account. Funding from the WSRA constitutes approximately 74% of the project cost.

Discussion:
This project addresses an important question facing many water providers. SWSI identified that much of the high quality water on the Front Range that can be treated with conventional methods has been appropriated.

Agricultural sources of water, whether a traditional or alternative transfer, will have a large part in addressing Colorado's future water supply "gaps." Many of the future agricultural transfers will involve the diversion and pumpback of lower quality water. In addition, M&I users will also seek to recapture their reusable return flows for use in their potable water systems. Without the ability to effectively treat these lower quality sources and produce safe esthetically acceptable potable water, there could be significant M&I water shortages in the state.

Zero liquid discharge of these waste streams will be necessary to meet not only the water supply gap as identified in SWSI, but many of the identified projects and processes that involve the reuse of legally consumable return flows. The project will provide important data and costs for water resource development that will benefit multiple users, multiple basins, multiple uses. The project is matched strongly with basin funds and local match.

It is important to note how this project relates to a similar pilot study being implemented by East Cherry Creek Valley Water and Sanitation District (ECCV) under a WSRA grant. The ECCV project will test two ZLD processes on a water quality indicative of the South Platte Basin. The proposed MTW study will augment the ECCV pilot study by providing more data on different technologies as well as expanding the study to other state water qualities. It will also diversify the types of communities piloting ZLD, resulting in data applicable to the north Metro area (Brighton), the South Metro area (ECCV), and communities in the lower Arkansas valley (La Junta). Information from the ECCV pilot will be available for use by this project. This study, combined with the ECCV pilot, will provide the State of Colorado a more complete database for means of developing thorough costs and feasibility analyses for ZLD.

Issues/Additional Needs:
As the applicant indicates, the budget provided is a preliminary breakdown of the expected level of effort associated with the major tasks. A final detailed budget will be assembles once the pilot project is awarded to a Consultant. Please provide this detailed budget.

The State of Colorado is interested in the compatibility of these pilot studies with that of ECCV. The applicant states that these pilot studies along with ECCV's will provide a more complete database for developing thorough costs and feasibility analyses for ZLD. To the extent possible, please include a comparison of the Brighton and La Junta pilot tests with the ECCV pilot test in Task 8.

Staff Recommendation:

The proposed project helps addresses one of the major water issues facing the Arkansas, Metro, and South Platte Basins. Staff recommends approval of up to $700,00 from the Statewide Account, $50,000 from the Metro Account, $25,000 from the Arkansas Basin Account, and $25,000 from the South Platte Basin Account contingent on resolution of the item in the issues/additional needs section.

All products, data and information developed as a result of this grant must be provided to CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and will help promote the development of a common technical platform.