

**FINAL PROJECT REPORT**

**DEVELOPING A BASELINE GIS DATABASE AND TOOLS  
TO IDENTIFY WATER REUSE POTENTIAL IN TEXAS  
(PRIORITY RESEARCH TOPIC #3)**

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## **Executive Summary**

Research suggests that the population of Texas will double by the year 2050, thereby adding significant strain to the state's natural source water supply capacity. To respond to these projected increases in demand, Regional Water Planning Groups (RWPG) across the state consistently promote water conservation and reuse strategies in their planning initiatives and proposed solutions. Water reclamation is potentially a viable alternative for municipalities and industries throughout the state and will become increasingly important as water resources become scarce and more expensive. Both public and private sectors must find more innovative ways to encourage water reuse and reduce their total water demand. The major industries that could potentially reuse treated municipal effluent in Texas today include power plants, refineries, food processors, chemical manufacturing operations, and agriculture (rice farmers).

One way to encourage the more efficient use of water is to make practical data and decision support tools available to municipalities and industry about the sources and potential users, their locations relative to one another, and planning level cost estimates of delivered water. To address this opportunity, the Texas Water Development Board (TWDB) commissioned URS to conduct a pilot study that explored the goals of Priority Research Topic #3, Develop a Baseline and GIS Database and Tools to Identify Industrial Water Reuse Potential in Texas. URS was awarded the research project in September 2007 and worked in partnership with the United States Business Council for Sustainable Development (USBCSD) to complete all project-related tasks and deliverables.

The primary objective in the pilot study was to equip local municipal utilities and industrial facilities of the greater Houston area with practical geospatial data and tools to identify and track industrial water reuse opportunities. By targeting Houston as the area in which to explore water reuse potential, it was possible to look specifically at a large number of municipalities and industrial facilities in close proximity to one another. Although there are many possibilities for water reuse, this project focused on industrial reuse of reclaimed water from municipal utilities.

The project was comprised of three phases:

- Data acquisition and review consisting of reviewing regulations and literature, administering a survey, and analyzing the results;
- Design and creation of a comprehensive Geographic Information System (GIS); and
- Development and implementation of a web-enabled reclaimed water management system.

### **Methodology**

URS began the study by conducting a thorough review of relevant literature to identify any potential regulatory constraints and requirements applicable in the greater Houston area for managing a water reuse program. This effort was intended to establish the parameters to be considered in using reclaimed water as a water supply source and to develop an applicable range of costs. URS continued by recruiting an advisory panel of municipal and industry representatives who provided insight, support, and guidance in the development of a survey and

in the subsequent creation of web-enabled support tools. URS invited more than 800 individuals representing municipal utilities and industrial facilities to participate in an online survey that requested information on current and projected use of reclaimed water.

Survey data was compiled and integrated into a geodatabase to indicate a baseline measurement of the potential for water reuse in the project study area. URS then created an intuitive web-enabled application that allows users to identify, query, and analyze geospatial and attribute features contained in the project geodatabase.

## **Results and Conclusions**

Survey participants submitted individual responses to inquiries from January through March 2008. In total, URS collected responses from 36 industrial respondents and 21 municipal respondents. Survey results showed that municipal utilities show a greater interest and perception of value regarding water reuse than do industrial facilities. However, according to municipal utilities that participated in the survey, very few if any are currently making treated effluent available for reuse by industrial companies. The industrial facilities surveyed indicated that although they did not have a problem obtaining water for their facilities at this time, they would be interested in learning more about the process and price of using reclaimed water.

The information contained in the geodatabase will serve as a preliminary planning data resource for water supply planners and managers in the greater Houston area. The data collected during the pilot study highlights the need for additional education within the region that explores the environmental, social, and economic benefits of considering water reclamation within industrial business operations.

The web-enabled GIS decision support application serves as a powerful, cost-effective tool for extending centralized data resources and information to TWDB constituents. The interface is easy to use and empowers planners, engineers, and managers with a regional resource planning tool that helps municipal suppliers and potential industrial users of treated effluent find one another. They now have an understanding of where these potential partners are located relative to their facility, who is interested in considering treated effluent as a water resource alternative, what sort of volume and quality is associated with the reclaimed water, and how to contact the potential partner to begin a dialogue to address potential transport, timing, and storage concerns. In conjunction with the development of this web-enabled application, URS prepared a technical user guide to document the specific functionality associated with each tool and provide basic instructions for navigating the map, exploring data, conducting basic spatial queries, and generating a map or report.

## **Recommendations**

The technical framework and tools now are in place as a result of the pilot study for water reuse potential in Texas. Future design and execution of an enhanced study could benefit from the following:

- Linking the use of the interactive tool to areas of the state with more limited water supply options and higher water costs;
- Integrating the use of this tool into the regional water planning process to identify potential supplies and needs and incorporating those conclusions into the regional water plan;
- Promoting awareness and understanding of reclaimed water use by survey participants through face-to-face interviews;
- Using regional workshops to educate water managers on the use and benefits of water reclamation and to potentially gather input from them;
- Developing cost-sharing strategies for reuse projects among organizations;
- Looking at alternative strategies to address the transportation and treatment costs, such as the use of regional nodes where reclaimed water could be transported and treated before being sent to the end user; and
- Developing a case study to build the business case for private sector participation and demonstrate significant return on investment.





## **1.0 INTRODUCTION**

### **1.1 Project Context**

Research suggests that the population of Texas will double by the year 2050, thereby adding significant strain to the state's natural source water supply capacity. It is estimated that the current demand for 17M acre-feet of water will increase to 20M acre-feet by mid-century. In an effort to respond to these projected increases in demand, Regional Water Planning Groups (RWPG) across the state consistently promote water conservation and reuse strategies in their planning initiatives and proposed solutions. A meaningful percentage (27%) of the water reuse strategies identified for preserving Texas water resources relies on conservation and reuse methodologies to meet projected water demand needs in 2050. Subsidence districts are now requiring implementation of groundwater reduction plans that achieve 30% reduction in groundwater consumption by 2013 and 60% reduction by 2025. Entities are now required to identify sources and amounts of alternative water supplies, including the use of reclaimed water.

Water reclamation is potentially a viable alternative for municipalities and industries throughout the state and will become increasingly important as water resources become scarce and more expensive. Both public and private sectors must find more innovative ways to encourage water reuse and reduce their total water demand. Many communities recognize the positive effects of this mutually beneficial relationship and need better information and resources to facilitate the implementation of water reuse practices. The major industries that could potentially reuse treated municipal effluent in Texas today include power plants, refineries, food processors, chemical manufacturing operations, and agriculture (rice farmers).

### **1.2 Project Concept**

One way to help encourage the more efficient use of water is to make practical data and decision support tools available to municipalities and industry about the sources and potential users, their locations relative to one another, and planning-level cost estimates of delivered water. No baseline GIS data and tools currently exist to identify and track water reuse opportunities.

In response to this perceived opportunity, TWDB commissioned a pilot study focused on the greater Houston area to explore the goals of Priority Research Topic #3, Develop a Baseline and GIS Database and Tools to Identify Industrial Water Reuse Potential in Texas. By targeting the geographic focus of the pilot study on one large municipality, a better understanding of the potential opportunities and challenges associated with developing this type of data resource could be explored in greater depth. Furthermore, it was determined that key areas within the pilot study area, such as the Houston Ship Channel, should provide adequate industry representation in the initial research effort.

URS was awarded the research project in September 2007 and worked in partnership with the United States Business Council for Sustainable Development (USBCSD) to complete all project-related tasks and deliverables. USBCSD is committed to promoting sustainable development by creating value through action, establishing networks and partnerships, and providing a voice for industry. The organization pledged its support of the research study goals and offered an in-kind

contribution of services through access to their membership database and support of the Advisory Panel.

### **1.3 Project Objective**

The primary objective in the pilot study was to equip local municipal utilities and industrial facilities of the greater Houston area with practical geospatial data and tools to identify and track opportunities for industrial facilities to use reclaimed water from municipal utilities. To achieve this objective, URS conducted a survey of municipal utilities and industrial companies to gather information on potential suppliers and users of treated effluent in the greater Houston area and provide data for a baseline GIS database and web-enabled decision support tools. These data provide a centralized and reliable resource for critical information about current water sources, quality, volume, and potential needs. Web-enabled GIS technology extends the information to potential suppliers and users of municipal treated effluent, streamlining the information exchange process and encouraging communication to make water reclamation a success. These tools will help municipal producers and industrial users find one another, better understand the dynamics of industrial water reuse potential relative to their organization, and support long-term water planning.

The URS project was comprised of three phases:

- Data acquisition and review consisting of reviewing regulations and literature, administering a survey, and analyzing the results;
- Design and creation of a comprehensive Geographic Information System (GIS); and
- Development and implementation of a web-enabled Reclaimed Water Management System.

## **2.0 DATA ACQUISITION AND REVIEW**

### **2.1 Regulatory Review and Cost Analysis**

During *Task 1 – Project Definition*, URS water resource planners and regulatory specialists conducted a thorough review of relevant literature to identify any potential regulatory constraints and requirements applicable in the greater Houston area for managing a water reuse program. This effort was intended to establish the parameters to be considered in using reclaimed water as a water supply source and to develop an applicable range of costs.

#### **2.1.1 Regulatory Review**

Texas Administrative Code (TAC) 30 Chapter 210, Sections 210.1-85, Use of Reclaimed Water, establishes design, operational requirements, and water quality criteria for the production, conveyance, and use of reclaimed water in the State of Texas. Chapter 210 defines reclaimed water as “Domestic municipal wastewater which has been treated to a quality suitable for beneficial use.”

Other areas of reclaimed water covered in this chapter include industrial wastewater and gray water. A great deal of the industry in the Houston Metro area is petrochemical with wastewater not eligible for use as reclaimed water. Gray water is defined as wastewater from showers, bathtubs, handwashing lavatories, sinks that are not used for the disposal of hazardous or toxic ingredients or for food preparation and disposal, and clothes washing machines. These two types of reclaimed water were deemed inappropriate for our study; therefore, we focused on municipal wastewaters and their reuse by industry.

The Texas Commission on Environmental Quality (TCEQ) has established requirements regarding water reuse. These requirements address notification and authorization, general production of reclaimed water, and facility design criteria for conveyance, storage, and use.

Notification must be provided to the TCEQ Executive Director and written approval must be obtained before reclaimed water can be provided. The notification requires:

- 1) A description of the water’s intended use, including the quantity, quality, origin, location, and purpose for the reuse;
- 2) Demonstration of compliance with Chapter 210;
- 3) Evidence that the reclaimed water supply can be terminated for improper use; and
- 4) An operation and maintenance (O&M) plan. Key points in the O&M plan should include a pipe labeling and separation plan for potable and reclaimed water lines, measures to prevent unauthorized access to reclaimed water, procedures for monitoring transfers and uses, requirements for users to minimize the risk of inadvertent human exposure, routine maintenance schedules, health and safety plans, and contingency plans for failures, unauthorized discharges, and upsets.

Texas law classifies two types of reclaimed water that may be used in various applications. Type I water can be used for irrigation or other purposes in areas where the public may be present during the time that the reclaimed water is being used or where the public may come into contact with the reclaimed water. Examples include the irrigation of residences, parks or golf courses, irrigation of food crops, toilet/urinal flush water, and maintenance of impoundments where contact recreation is not designed for but may occur.

Type II water use includes irrigation of areas where the public does not have access when the reclaimed water is being used or the public cannot come into contact with the reclaimed water. Examples of Type II water use include irrigation of sod farms and freeway right-of-ways, irrigation of sites where the owner controls access, irrigation of food crops that are not for direct human consumption, maintenance of water bodies where direct human contact is unlikely, dust control (drift must be minimized), and cooling tower makeup water. Any water meeting Type I criteria can also be used for Type II purposes.

Reclaimed water quality standards for the two types of water are outlined in Section 210.33 and shown in Tables 1 and 2.

**Table 1. Type I Reclaimed Water Use Water Quality Criteria**

Parameter	30-Day Average
BOD5 or CBOD5	5 mg/L
Turbidity	3 NTU
Fecal Coliform	20 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	75 CFU/100 mL (single grab sample)

**Table 2. Type II Reclaimed Water Use Water Quality Criteria**

Parameter	30-Day Average
<b>For a pond system [see 30 TAC 210.33(2)(B)]:</b>	
BOD5	30 mg/L
Fecal Coliform	200 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	800 CFU/100 mL (single grab sample)
<b>For a non-pond system [see 30 TAC 210.33(2)(A)]:</b>	
BOD5	20 mg/L
CBOD5	15 mg/L
Fecal Coliform	200 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	800 CFU/100 mL (single grab sample)

30 TAC Chapter 319 also specifies sampling requirements to ensure that Types I and II wastewaters meet these water quality criteria.

### **2.1.2 General Requirements for Wastewater Reclamation**

General requirements for the production, conveyance, storage, and use of reclaimed water are covered in Sections 210.21-25. Rule 210.22 outlines the general requirements. The rule prohibits the use of untreated wastewater and limits the uses of treated wastewater to specific uses. For example, spray irrigation of crops that are consumed raw by humans is prohibited, while spray irrigation of crops that are substantially processed before consumption is permitted.

Nuisance conditions must be avoided during the storage, distribution, and use of the reclaimed water. No discharge of the reclaimed water to the waters of the state is permitted unless it is the result of a rainfall event or the discharge is covered under an existing permit.

Any holding ponds for Type I or Type II water that are located in areas with a DRASTIC Pollution Potential Index of 110 or greater require a liner to prevent groundwater contamination as outlined in Section 210.23. DRASTIC is an approach to groundwater pollution potential mapping adapted by TCEQ and outlined in Appendix 1 of Section 210. Section 210.23 includes a figure depicting the areas with an index greater than 110. While Harris County is relatively free of such areas except in the eastern portions of the county, certain areas of Fort Bend County fall into these areas. Exemptions can be obtained from the executive director based on water quality and site-specific data.

A minimum horizontal distance of 9 feet of separation is required between reclaimed water lines and potable water lines. If this minimum distance cannot be met, the reclaimed lines must meet the line separation requirements of 30 TAC Chapter 290 relating to water hygiene. A minimum of 3 feet of horizontal separation is required from sewer lines if the reclaimed line is at the same level or higher than the sewer line. Any crossings of sewer lines will have the same requirements as water lines crossing sewer lines.

Piping of reclaimed water systems will follow the guidelines established in 30 TAC Chapter 317. Reclaimed water distribution systems should follow the design guidelines of 30 TAC Chapter 317 (Design Criteria of Sewerage Systems). These design criteria are minimum guidelines to be used for the comprehensive consideration of domestic sewage collection, treatment, or disposal systems and to establish the minimum design criteria pursuant to existing state statutes pertaining to effluent quality necessary to meet state water quality standards. These criteria are intended to promote the design of facilities in accordance with good public health and water quality engineering practices.

The criteria include the minimum requirements for a preliminary engineering report which provides the general engineering concepts underlying the proposed project, as well as the final engineering report detailing the fully developed project along with related plans and specifications. It should be noted that TCEQ is in the process of issuing a new set of design guidelines in 30 TAC Chapter 217 that will replace Chapter 317. Any design should consult the new chapter. These are available in draft form from TCEQ. All ground-level and above-ground storage tanks used for reclaimed water must meet American Water Works Association (AWWA) standards for storage with the exception of health-based standards strictly related to potable water storage practices.

### **2.1.3 Implementation of Wastewater Reclamation**

The first step of wastewater reclamation is to identify the potential user or users for the reclaimed water. This includes determining how the water will be used and what the water demand is. Both average and peak usages should be estimated as well as planning for future demand. Use may be seasonal (irrigation) or constant (industrial). Water quality requirements should be identified at this time as well.

The second step is to identify potential sources and determine their present and projected discharges. Water quality should be quantified. This will determine the amount of additional treatment that will be required. Environmental impacts should be reviewed as well since a reduction in volume and a change in the quality of discharges could impact local water quality, aquatic life, and other animals (particularly threatened and endangered species) and commercial and recreational interests. A conceptual cost can then be calculated including facility constructions, treatment modifications, pumps stations, distribution mains, and any environmental mitigation that may be required.

## **2.2 Cost Analysis**

The costs for the production of reclaimed water will depend on both the source of the water and the water's final use. Municipal wastewater effluent will already meet fairly standard levels that have been established by TCEQ and may be close to meeting many of the requirements for reuse. Seasonal fluctuations, however, can have an impact, resulting in differences of available volume. Municipal WWTPs typically experience their lowest flows during the summer months when the demand for irrigation is at its highest. Industrial wastewater effluent can vary in both quality and quantity depending on the industrial source and the individual permits granted by TCEQ. Industrial sources will likely be more consistent, but the flows can be impacted if treated stormwater is discharged along with the treated effluent.

The final use of the water will have an impact on costs since the level of treatment required will vary from use to use. Typical municipal WWTPs are permitted up to 10 mg/L CBOD, 15 mg/L TSS, and 3 mg/L N-NH<sub>3</sub> standards. This level of treatment is usually sufficient for Type II reuse applications. In such a case, only storage and distribution costs would be incurred. Type I use will typically require additional treatment such as additional filtration and disinfection.

Table 3 presents unit costs for different options for a Type I project (use of municipal reclaimed water by industry) that has minimum pumping requirements and a distribution system already in place. Additionally, cost savings were calculated for this project based on credits that could be recovered from the local subsidence district. This may not be applicable to all projects. Typically, the capital costs for improvements to obtain Type I reclaimed water are about \$1.5 million for an average daily flow of 1 mgd or approximately \$0.41/1,000 gallons. Operating costs will have to be factored in depending on the treatment options selected and the distribution system.

Industrial clients are likely to ask for even a higher quality of treatment depending on their current source to avoid any additional pretreatment costs. A 2005 study of supplying 60 mgd of reclaimed water to industrial customers along the Houston Ship Channel from three (3) City of Houston WWTPs indicated a cost of \$2.28/1,000 gallons. Assuming 5% annual inflation, the cost rises to \$2.51/1,000 gallons in 2007.

**Table 3. Cost Comparison of Different Type I Reclaimed Effluent Treatment Options vs. Treated Surface Water**

<b>Treatment Option</b>	<b>Reuse of Treated Municipal Effluent Total Unit Cost<sup>1</sup></b>	<b>Reuse of Treated Municipal Effluent Credit-Weighted Total Unit Cost<sup>3</sup></b>	<b>Alternative Surface Water Treated to Potable Standards Total Unit Cost<sup>4</sup></b>	<b>Comparative Savings</b>
<b>0.5 MGD</b>	<b>(2007 \$/1000 Gallons)<sup>2</sup></b>	<b>(2007 \$/1000 Gallons)</b>	<b>(2007 \$/1000 Gallons)</b>	<b>(2007 \$/1000 Gallons)</b>
Amiad	\$0.37	\$0.25	\$2.18	\$1.93
Amiad +1 red	\$0.50	\$0.33	\$2.18	\$1.85
AquaDisk	\$0.45	\$0.30	\$2.18	\$1.88
Techna Sand	\$0.51	\$0.34	\$2.18	\$1.84
Alta Filter	\$0.72	\$0.48	\$2.18	\$1.70
Average	\$0.51	\$0.34	\$2.18	\$1.84
<b>1.0 MGD</b>	<b>(2007 \$/1000 Gallons)<sup>2</sup></b>	<b>(2007 \$/1000 Gallons)</b>	<b>(2007 \$/1000 Gallons)</b>	<b>(2007 \$/1000 Gallons)</b>
Amiad	\$0.26	\$0.17	\$2.18	\$2.01
Amiad +1 red	\$0.37	\$0.25	\$2.18	\$1.93
AquaDisk	\$0.26	\$0.17	\$2.18	\$2.01
Techna Sand 6 mod	\$0.32	\$0.21	\$2.18	\$1.97
Techna Sand 4 cyl	\$0.38	\$0.25	\$2.18	\$1.93
Alta Filter	\$0.52	\$0.35	\$2.18	\$1.83
Average	\$0.37	\$0.25	\$2.18	\$1.93

Notes:

1. City of Sugar Land Non-potable Water Feasibility Study, URS, 2007.
2. 10 year payment, interest rate = 5.0%.
3. Includes credit from subsidence district for conversion from groundwater to reclaimed water.
4. City of Sugar Land Update to Surface Water Supply Options Evaluation, LAN, Dec 2005.

Another option for utilizing reclaimed water is to blend it with existing supplies. Blending of reclaimed water will likely require that the water be treated to drinking water standards. Three blending projects of various sizes have been explored in West Texas.

### **2.2.1 Big Spring**

The proposed Big Spring project was designed to provide approximately 1.8 MGD of reclaimed water into the Colorado River Municipal Water District's (CRMWD) Spence Pipeline east of Big Spring. Desalination reject brine would be discharged to Beal's Creek for subsequent

interception and storage in Red Draw Reservoir. The proposed location was adjacent to the Big Spring’s wastewater treatment plant.

**2.2.2 Snyder**

The Snyder project was estimated to provide about 720,000 gallons per day from a proposed site adjacent to the Snyder wastewater treatment plant. A balancing reservoir located near the Snyder water treatment plant was to be implemented, and reclaimed water would be pumped to the new reservoir for blending with raw water from Lake J.B. Thomas. Desalination reject brine would be returned to the wastewater treatment plant outfall and blended with the remaining effluent. Due to water discharge quality constraints, this configuration will limit the fraction of effluent that can be reclaimed.

**2.2.3 Odessa/Midland**

The final project proposed was to reclaim treated effluent from Odessa and Midland. The project was configured to provide additional treatment at a common facility located adjacent to CRMWD’s 100-MG Terminal Reservoir located between the two cities. Effluent would be pumped from each city to the proposed treatment facility at the Terminal Reservoir. Odessa’s transmission line extends along the east side of the city, where effluent could be transferred to the CRMWD’s proposed treatment facility whenever surplus effluent is available. Up to 10.8 MGD of treated reclaimed water would be blended with water from the Ivie, Spence, and Thomas pipelines in the 100-MG Terminal Reservoir.

The estimated costs per 1,000 gallons for each project are shown in Table 4. The average cost for the three projects is \$2.56/1,000 gallons. As might be expected, providing reclaimed water to industrial customers and providing reclaimed water for blending are similar due to the amount of treatment that would be required that goes well beyond the water quality required for Type I and Type II uses.

**Table 4. West Texas Blending Reclaimed Water Costs**

<b>Project</b>	<b>Flow (MGD)</b>	<b>2005\$/1000 gal<sup>1</sup></b>	<b>2007\$/1000 gal<sup>2</sup></b>
Big Spring	1.8	\$1.67	\$1.84
Snyder	0.72	\$2.95	\$3.25
Odessa/Midland	10.8	\$2.35	\$2.59
<b>Average</b>	4.44	\$2.32	\$2.56

Notes:

1. Sloan, Morrison, Grant; Good to the Last Drop - Maximizing Reclaimed Water Use, Texas WET, November 2005, Vol 22, Iss. 6.
2. Annual inflation assumed to be 5%.  
Final blended water quality to meet TCEQ Primary Drinking Water Standards.

A major factor in any reclaimed water project’s cost is the physical distance between the source of the reclaimed water, the treatment plant for the reclaimed water, and the final user. This distance varies and can have a significant impact on overall costs. Lift stations and water mains



may be required for conveyance to any required treatment plant as well as the distribution system for the reclaimed water. The mains will normally have to be a totally independent system, separate from existing potable and sewer systems.

In summary, costs will likely have to be developed for each individual project rather than utilizing a standard estimated cost due to variations in the source of the reclaimed water, the desired use of the water, and its final destination. The approximate average costs to treat municipal wastewater for the different uses based on completed projects are presented in Table 5.

**Table 5. Estimated Average Cost for Municipal Wastewater Reuse**

<b>Reclaimed Water Use</b>	<b>Plant Size</b>	<b>Additional Treatment Required?</b>	<b>Average Approximate Cost (2007\$/1000 gallon)</b>
Type II (Municipal)	varies	Not typically required	\$0.00
Type I (Municipal)	1 mgd	Filter/disinfection	\$0.41
Industrial	60 mgd	Variable	\$2.51
Blending (Municipal)	4.4 mgd	To potable water levels	\$2.56

### 2.3 Creation of an Advisory Panel

To gain a better understanding of municipal water availability and industrial user water quality/quantity needs, URS recruited an Advisory Panel to provide insight, support, and guidance in the development of the survey questionnaire and geospatial data and tools. URS worked in conjunction with USBCSD to organize the project Advisory Panel. The panel consisted of seven municipal utility and industrial firm representatives, as shown in Table 6. These project stakeholders provided valuable insight and perspective in the development and refinement of the survey questionnaire and the web-enabled decision support application.

**Table 6. Advisory Panel Participants**

<b>Panelist</b>	<b>Organization</b>
Cynthia Diaz	City of La Marque
Jerry Meeks	City of Freeport
Lori Gernhardt	Gulf Coast Waste Disposal Authority
Ray Mayo	City of La Porte
Mark Tinianow	Battelle
Ron Sandberg	Conservation Capital
Tim Finley	Dow Chemical

USBCSD was instrumental in recruiting several of its members to serve and represent the industrial perspective on the Advisory Panel. URS Public Involvement Specialist, Nancy Gates, contacted multiple municipal utilities and regional governing authorities to recruit individuals interested in representing the municipal perspective as an Advisory Panel participant.

URS hosted an initial teleconference in November 2007 to introduce and discuss the goals of the project with the members of the Advisory Panel and define specific roles and responsibilities of the panelists. In December 2007, each panel participant was asked to review the survey questionnaire and provide comments on content and organization. Their feedback was very helpful in crafting a survey that would be easy to understand and able to capture detailed information needed to develop the baseline GIS database.

The Advisory Panel also was responsible for the initial beta-testing of the web-enabled decision support application. URS hosted a web-enabled seminar with members of the Advisory Panel to provide a hands-on demonstration of the site and answer questions. Each member of the Advisory Panel was then asked to individually review the application and provide comments for consideration and integration into the final draft to be provided to TWDB.

## **2.4 Creation and Implementation of the Survey**

The URS Team designed and administered a survey of pilot-study participants to assess water reuse needs, preferences, and constraints. The information collected in the survey highlights potential sources and users of reclaimed water in the greater Houston area, providing a baseline measurement of industrial water reuse potential that users will access through the web-enabled decision support application.

### **2.4.1 Initial Design**

URS public involvement specialists drafted two versions of the survey questionnaire, one for municipal utilities and one for industrial respondents. The goal was to develop a concise, understandable survey that was not too lengthy but would still capture enough pertinent and useful information to support the development of GIS-based project deliverables.

URS engineers and analysts then reviewed the initial design of the survey questionnaire and provided additional input. URS application developers translated the revised draft into an interactive web-enabled version that was linked to an Access database to dynamically log individual survey response. The seven-member Advisory Panel was then solicited for review and comment. Each of the suggested revisions provided by panel members was considered and appropriate changes were integrated into the final version of the survey questionnaire. The final versions, municipal and industrial, of the survey questionnaire are referenced in Appendix A-1.

### **2.4.2 Implementation and Distribution**

In January 2008, after TWDB project stakeholders had reviewed and approved the survey questionnaire, the URS team invited 800+ potential respondents to participate in the survey via email notification. To obtain the names of these individuals, URS used distribution list databases

obtained from TWDB, USBCSD, AWWA, Water Reuse Association, and local power utilities such as Calpine (Clear Lake, Deer Park, Pasadena, and Texas City power plants), Centerpoint Energy, and Reliant Energy.

Two weeks after the initial contact was made, URS distributed a follow-up notification as a reminder to all potential survey respondents. In early February 2008, Mike Bagstad, Director of Municipal Water Resources & Infrastructure (URS Houston), attended the SE Texas AWWA Chapter workshop “*21st Century Challenges in Potable Water Industry in Southeast Texas*” and distributed a one-page flyer to further advertise the goals of the project and encourage survey participation.

The initial survey response rate was not as high as had been anticipated or preferred given the geographic scope of the pilot study. At that time, other options for survey distribution and advertisement were explored. The option of including some sort of “incentive” to encourage survey participation was investigated. However, given the current regulations limiting the use of State funds for “gifts,” this alternative was eliminated. URS staff instead continued to make direct calls to individuals on TWDB’s database of past survey respondents to solicit a response. URS also attempted to contact potential respondents by direct calls through information obtained from TWDB, USBCSD, and the Association of Water Board Directors.

In February 2008, URS Project Principal Craig Pedersen and URS Project Manager Kristi Teykl were invited to speak at the USBCSD Winter Meeting held in San Antonio, Texas to further encourage industrial companies within the pilot study area to participate in the project survey.



### **3.0 DESIGN AND CREATION OF A COMPREHENSIVE GEOGRAPHIC INFORMATION SYSTEM (GIS)**

URS compiled all survey responses received and integrated the information into an ESRI personal geodatabase to develop a baseline measurement of industrial water reuse potential in the greater Houston area. Geodatabase schema was designed to reflect the structure and organization of the survey questionnaire.

Within the geodatabase, the survey data was organized and stored in a feature dataset, *TWDB\_Survey\_Respondents*. The feature dataset includes two feature classes, *Industrial\_Facilities* and *Municipal\_Uilities*. Each feature class contains the spatial location and descriptive attributes (survey responses) associated with each survey respondent. Therefore, each field included in each feature class represents a specific question or blank in the survey questionnaire. As requested by TWDB project stakeholders, unique identifiers (CountyNum and AlphaNum) specific to TWDB database specifications were added to the data where appropriate. URS GIS analysts developed Federal Geographic Data Committee (FGDC)-compliant metadata for each feature class, in which definitions for each field are described in detail.

As survey responses were received, the data were dynamically logged into the project geodatabase. URS GIS analysts later added the spatial component (i.e., geographic location of the survey respondent) through standard geocoding, based on the principal contact address or latitude/longitude coordinates provided by the survey participant in Form A of the questionnaire. URS used geocoding services derived from ESRI StreetMap Pro data to locate survey respondents who provided a physical address. Figure 1 illustrates the schema of the project geodatabase and metadata developed for the Industrial Facility feature class.

TWDB project stakeholders were asked to review and provide feedback on any suggested modifications to the project geodatabase. Ginny Vragel (Senior GIS Professional) provided useful comments and each of the suggested modifications was integrated into the final project deliverable.

Figure 1. TWDB Effluent Reuse Geodatabase and Associated Metadata

The image displays two windows from ArcCatalog. The top window shows a table of survey respondents for municipal utilities, and the bottom window shows the metadata for an industrial facility feature class.

SURVEY_TYPE	SURVEY_VOLUME	COMPANY	DEPARTMENT	PRIMARY_CONTACT	TITLE	713-45
MUNICIPAL		City of Jacinto City	Public Works	Kyle E. Reed	Director of Public Works	713-45
MUNICIPAL		City of Galveston, Texas	Municipal Utilities	Eric Wilson	Director of Municipal Utilities	409-79
MUNICIPAL		Memorial Villages Water Authority	Public Works	Michael L. Montgomery	General Manager/Tax Assessor-Collector	713-46
MUNICIPAL		City of West University Place	Maintenance	Patrick J. Walters	Operations Superintendent	713-66
MUNICIPAL		Boys and Girls Country #1	Utilities	Quintan Stark Jr.	Director of Maintenance	281-35
MUNICIPAL		Crosby MIUD	WW Treatment Plant	Ramon Johnson	Manager	281-32
MUNICIPAL		Clear Lake City Water Authority	Washburn Tunnel	Eloy Mendoza	WW Superintendent	281-48
MUNICIPAL		Gulf Coast Waste Disposal Authority	Municipal Services	Gordon Pederson	Facility Manager	713-47
MUNICIPAL		City of Humble	Public Works	Barry K. Brock	Director of Public Works	281-44
MUNICIPAL		City of Alvin	Wastewater Treatment Division	Clemencia Williver	Water Production % Wastewater Treatment	281-38
MUNICIPAL		Mason Creek Utility District	Public Works	James Ramott	Operator	281-57
MUNICIPAL		Gulf Coast Waste Disposal Authority	Municipal Services	Jerad Landis	Superintendent of Municipal Services	281-48
MUNICIPAL		White Oak Bayou				
MUNICIPAL		Harris County Mun				
MUNICIPAL		City of La Porte				
MUNICIPAL		City of Pasadena				
MUNICIPAL		Harris County F.W				
MUNICIPAL		City of Baytown				
MUNICIPAL		City of South Hou				
MUNICIPAL		Harris County W.C				

The bottom window displays the metadata for the 'Industrial\_Facility' feature class. The metadata includes:

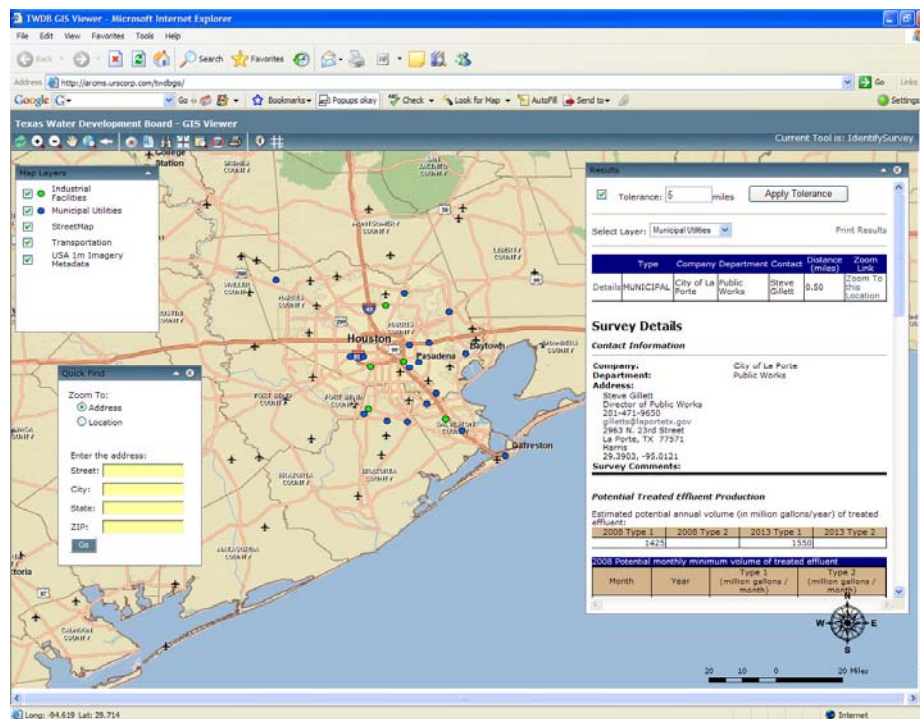
- Keywords:** Theme: water reclamation
- Description:** Abstract: The Texas Water Development Board is conducting a pilot project to streamline and encourage communication between suppliers and potential users of reclaimed water in the greater Houston area. The information gathered during this project will lead to development of two useful tools: 1.) A baseline geographic information system (GIS) database to provide centralized and reliable resources for critical information about water sources, quality, and volume; and 2.) A web-based GIS decision-support tool that will streamline the information exchange process and encourage communication between suppliers and potential users of reclaimed water. To implement these tools, URS collected information from municipal utilities producing treated effluent and industrial facilities that could potentially use the reclaimed water in daily workflow processes. The data contained within this feature class documents the results of the survey.
- Purpose:** The purpose of this feature class is to identify water reuse potential within the greater Houston area.
- Status of the data:** Complete; Data update frequency: As needed
- Time period for which the data is relevant:** Date and time: 2008; Description: publication date

## 4.0 DEVELOPMENT AND IMPLEMENTATION OF WEB-ENABLED RECLAIMED WATER MANAGEMENT SYSTEM

The URS team of GIS application developers created an intuitive web-enabled ESRI application that allows users to identify, query, and analyze geospatial and attribute features contained in the project geodatabase. URS developed the application to be compatible with two ESRI-specific web-enabled platforms utilizing ArcGIS Server and ArcIMS technology and development tools. This will allow TWDB to explore the technical specifications and the aesthetic and functional enhancements of web-enabled solutions developed with ArcGIS Server technology, while maintaining a version compatible with the current TWDB ArcIMS system configuration.

Both versions of the application allow users to access the project survey data and interface with spatial query tools to enhance decision-making. The web-enabled solution consists of three basic components, a table of contents, an interactive toolbar, and a dynamic map display. Figure 2 illustrates the ArcGIS Server version of the web-enabled decision support application. Various custom tools (Identify Results and Quick Find) that were developed for the interface are visible as well.

**Figure 2. ArcGIS Server Version of the Web-Enabled Decision Support Application**



The Advisory Panel participated in the initial beta-testing period to ensure that the application was intuitive and included all relevant tools and functionality. URS hosted a web-enabled seminar with members of the Advisory Panel to provide a hands-on demonstration of the site and each member of the Advisory Panel was solicited for individual review and comment.





## 5.0 DISCUSSION OF RESULTS

The final Project Workshop was held on March 24, 2008 to address the results of the project and demonstrate all project deliverables to TWDB stakeholders.

### 5.1 Survey Response

Survey participants submitted individual responses and inquiries January through March 2008. In total, URS collected responses from 36 industrial respondents and 21 municipal respondents. This data provides a current baseline measurement or snapshot of municipal water reuse potential in the greater Houston area. A more in-depth look at the actual responses submitted in the online versions of the survey and collected during the direct call campaign revealed the following information:

1. A greater interest and perception of value or priority exists within municipal utilities regarding water reclamation. Of the 21 municipal respondents, 13 local utilities (62%) identified projected treated effluent production values for 2008 and 2013, and 11 (52%) indicated an interest in developing an exchange network with local industry. Conversely, four of the 36 industrial respondents (11%) identified projected 2008 and 2013 values for potential treated effluent reuse, and six (17%) indicated an interest in developing an exchange network with local industry.
2. Several industrial respondents indicated a lack of interest in using reclaimed water from local municipalities. Seven of the 36 industrial respondents (20%) noted that it was difficult for company management to see the value of participating in the study or considering water reclamation as an alternative water source since water availability in the Houston area is currently not an issue and the relative cost of water in the region is so low.
3. According to municipal utilities that participated in the survey, very few if any are currently making treated effluent available for reuse by industrial companies. No municipal utilities identified total production values for the calendar year ending December 2007 (treated effluent produced and reused by industrial entities). Similarly, only one industrial respondent identified current treated effluent reuse values (from an external source) for the calendar year ending December 2007.
4. The survey questionnaire was found to be ineffective in some instances and can be improved. During the direct call campaign, two industrial survey respondents indicated the confines of the survey questionnaire were restrictive. As documented in their personal comments, several municipal and industrial respondents did not understand the intent of the survey. Nineteen industrial survey participants (54%) and two municipal survey participants (10%) indicated they did not feel the survey applied to them as they did not currently produce or use reclaimed water. URS made attempts to contact these individuals in these specific cases to clarify the goals of the project and reiterate the importance and benefits of collecting this information, with no response.
5. Several industrial respondents identified a need for additional education focused on the need and benefits of water reclamation. Three of the 36 industrial respondents

(8%) had specific concerns and questions regarding the quality of the treated effluent, potential uses, and price sensitivities.

These observations represent some of the underlying trends in the data collected. Additional points of consideration centered on URS recommendations to address the findings of the survey are discussed further in Section 6. For additional reference, each of the individual survey responses is documented in digital form in the final data deliverable.

## **5.2 GIS Baseline Database and Decision Support Application**

The design of the project geodatabase is consistent with the technical specifications required by TWDB current GIS standards and protocol. It has been structured as a flexible and well-documented data resource that will allow for expanded utility and integration with TWDB's applications and GIS system.

The information contained in this baseline database serves as a preliminary planning data resource for water supply planners and managers of the greater Houston area. The data collected during the pilot study highlights the need for additional education within the region which explores the environmental, social, and economic benefits of considering water reclamation within industrial business operations.

The web-enabled GIS decision support application serves as a powerful, cost-effective tool for extending centralized data resources and information to TWDB constituents. The interface is easy to use and empowers planners, engineers, and managers with a regional resource planning tool that illuminates the geographic component of the water reclamation equation. This application helps municipal suppliers and potential industrial users of treated effluent find one another. They now have an understanding of where these potential partners are located relative to their facility, who is interested in considering treated effluent as a water resource alternative, what sort of volume and quality is associated with the reclaimed water, and how to contact the potential partner to begin a dialogue to address potential transport, timing, and storage concerns.

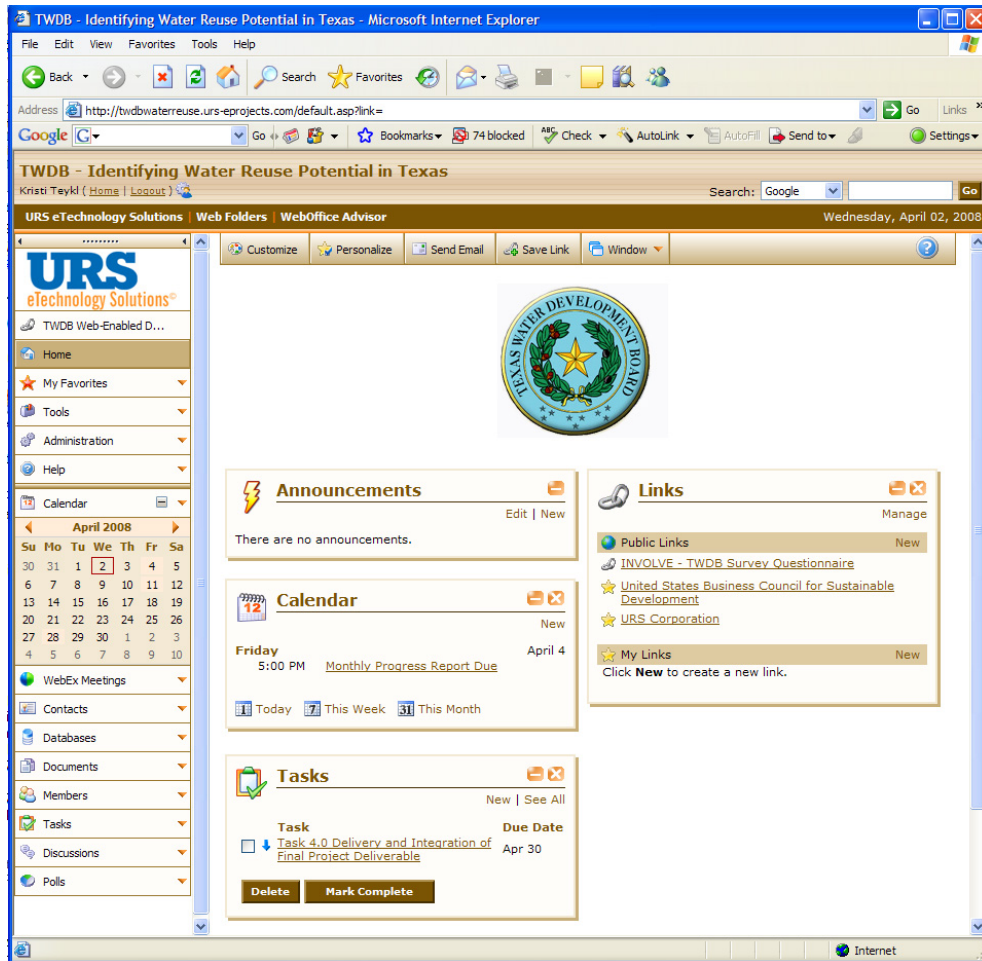
During the Project Workshop, TWDB stakeholders were given an opportunity to assess the completeness, accuracy, and utility of the data and web-enabled decision support application to ensure that the system developed will meet the needs of TWDB and its constituency. Each Project Workshop participant was asked to test the decision support application individually at a later date and provide comments regarding any modifications that should be integrated into the final deliverable.

A technical user guide has been developed to document the specific functionality associated with each tool and provide basic instructions for navigating the map, exploring data, conducting basic spatial queries, and generating a map or report. This technical user guide is documented in Appendix A-4 and is included in digital form as a component of the web-enabled application.

### 5.3 Data and Knowledge Transfer

Throughout the project, URS used a custom eProject portal as a proactive, transparent project management tool to streamline communication among team members and provide access to all pertinent project data and information. This portal served as a centralized resource for all project stakeholders to exchange documents, monitor task progress, access project deliverables (survey questionnaire, project geodatabase, and web-enabled decision support application) and maintain a common calendar of events, upcoming meetings, and deadlines. Figure 3 illustrates the custom eProject site that was developed and managed for this project initiative.

Figure 3. TWDB eProject Portal



At the culmination of all project tasks, URS will work directly with TWDB on site to transfer hosting, administration, maintenance, and user support responsibilities of the project geodatabase and web-enabled decision support application. These data solutions are compatible and easily integrated with the current configuration and data of the TWDB WIID System.



## 6.0 CONCLUSIONS

The primary goal of this pilot study was to equip municipal utilities and industrial companies with practical geospatial data and tools to identify and track potential industrial water reuse opportunities. These data and tools are intended to serve as a viable starting point upon which TWDB can build. The framework has been established, and the concepts, data, and geospatial tools presented in this pilot study can be expanded and adapted to encompass a broader geographic context and have the potential to evolve into a long-term, effective water resource planning tool. Based on experience, observations, and knowledge gained during the course of this research initiative, URS has developed the following recommendations for TWDB consideration.

It should be noted that the overall response rate to the survey was very low. Therefore, the following conclusions that are based on the survey response are more qualitative than quantitative in nature. In some cases, the information provided by survey respondents was anecdotal because the organization was unable to respond to the survey questions and instead provided an oral description of their situation and opinions regarding water reuse. Increased survey participation on any future data gathering efforts would improve the validity of survey results.

Within the context of this pilot study, most industrial survey respondents did not appear to see the near-term value of survey participation and considering water reclamation as a viable alternative. As indicated in the results of the survey, a majority of the industrial survey respondents perceive water source supplies to be adequate and the cost of water relatively low. We cannot tell from the data provided whether this is because of the time horizons of the respondents or strategic planning conclusions of the entity represented. Said differently, we are not sure whether this is the perception of the responder or entity in question or the reality of their calculated water situation. In either case, the result may be the same and may change over time and with changes in circumstances.

We believe that the value of using the database developed for this project will increase with time as water costs increase and use approaches or exceeds supply. Therefore, timing is imperative to the success of implementing a future study. Industrial companies indicated that they are faced with a multitude of demands, and the major focus of current operations is on the bottom line. Until a significant need exists, they do not perceive water reclamation strategies as a priority. They indicated that if they were faced with severe drought conditions or experienced water shortages and significant increases in raw water costs, use of reclaimed water and this type of project initiative would have value, and they would benefit from participating in it.

During the direct call campaign, we found that we were not always contacting the appropriate person within an organization. Finding the “right” person within each organization can pose a challenge since the “right” person in one organization may be a planner, and in other instances, it may be a manager or plant supervisor. More importantly, individuals within the organization may have different perspectives or philosophies regarding water reclamation and the value of current/project water resources. It would be prudent to communicate with or involve the representative who has an actual concern or awareness of the water resource issues at hand.

Based on the opinions indicated in the survey responses, it seems that many of the industrial entities we communicated with were more focused on short-term water needs and costs than long-term issues. Some participants indicated that the content of the survey questionnaire was restrictive. Furthermore, certain respondents expressed confusion as to the intent of the survey and the goals of the project. In reality, perhaps this type of assessment is not so straightforward, and this type of information may not be effectively collected through a survey questionnaire. Face-to-face interviews could serve as a potential solution to remedy these situations. The issues surrounding water reclamation are somewhat complex and many respondents had specific questions about water quality and associated costs that need to be addressed on a case by case basis.

Furthermore, the dynamics of the data exchange process might be different in a locale where water supplies are more constrained, costs are higher, or drought is a more prominent part of the immediate water context. The Houston area used for this study had the advantage of municipal effluent located in reasonable proximity to industrial users of significant quantities of water, and thus, was appealing for this study from that perspective. The fact that the water suppliers in the general area have done a good job managing their supply and costs may have worked against a perception of effluent as a source to meet select water supply needs.

The use of reclaimed wastewater represents a significant new source of water to meet a variety of needs as reflected in the regional and state water planning process. The extent to which the data and tools developed through this effort are timely to help implement those planning solutions remains to be demonstrated. Perhaps had a different area been chosen as the pilot study area the results might have been different.

However, the data and tools developed during this pilot study have been proven to be effective vehicles for communicating effluent supply and potential need information. They provide a solid foundation on which to build water supply solutions in other areas, addressing the storage, treatment, transport, and cost issues present in the water reclamation equation.

## **6.1 Recommendations**

The technical framework and tools now are in place as a result of this pilot study of water reuse potential in Texas. Future design and execution of an enhanced study could include the following:

- Linking the use of the interactive tool to areas of the state with more limited water supply options and higher water costs;
- Integrating the use of this tool into the regional water planning process as a way to identify potential supplies and needs and incorporating those conclusions into the regional water plan;
- Promoting awareness and understanding of reclaimed water use by survey participants through face-to-face interviews;
- Using regional workshops to educate water managers on the use and benefits of water reclamation and to potentially gather input from them;

- Developing cost-sharing strategies for reuse projects among organizations;
- Looking at alternative strategies to address the transportation and treatment costs, such as the use of regional nodes where reclaimed water could be transported and treated before being sent to the end user; and
- Developing a case study to build the business case for private sector participation and demonstrate significant return on investment.





**A-1**  
**Survey Questionnaire (Industrial and Municipal)**



INVOLVE



INDUSTRIAL RECLAIMED  
WATER SURVEY

**Form A**  
Contact Information and Comments

**Form B**  
Potential Reuse of Treatment Effluent

**Form C**  
Actual Reuse of Treated Effluent

Submit

### FORM A: Contact Information and Comments

**Industrial Facility:** \_\_\_\_\_

**Department:** \_\_\_\_\_

**Primary Contact:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Secondary Contact:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Mailing Address:** \_\_\_\_\_

**City:** \_\_\_\_\_ **State:** TX **Zip Code:** \_\_\_\_\_

**County:** \_\_\_\_\_

**Latitude** (in decimal degrees): \_\_\_\_\_

**Longitude** (in decimal degrees): \_\_\_\_\_

**Comments**

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**FORM B: Potential Reuse of Treated Effluent**

**B1.** Please estimate the potential **annual** volume (in million gallons/year) of municipal treated effluent that your facility plans to reuse in the following years.

<b>2008</b>		<b>2013</b>
_____ million gallons/year (Type I) <a href="#">Definition</a>		_____ million gallons/year (Type I)
_____ million gallons/year (Type II) <a href="#">Definition</a>		_____ million gallons/year (Type II)

**B2.** Please estimate the potential **monthly** minimum volume (in million gallons/month) of municipal treated effluent that your facility plans to reuse in the following months.

	million gallons/month (Type I)	million gallons/month (Type II)		million gallons/month (Type I)	million gallons/month (Type II)
<b>2008</b>			<b>2013</b>		
January	_____	_____	January	_____	_____
February	_____	_____	February	_____	_____
March	_____	_____	March	_____	_____
April	_____	_____	April	_____	_____
May	_____	_____	May	_____	_____
June	_____	_____	June	_____	_____
July	_____	_____	July	_____	_____
August	_____	_____	August	_____	_____
September	_____	_____	September	_____	_____
October	_____	_____	October	_____	_____
November	_____	_____	November	_____	_____
December	_____	_____	December	_____	_____

**B3.** Are you interested in potentially receiving treated effluent from municipal utilities for reuse in the future?  
 Yes  No

**B4.** Do you expect your demand for reclaimed water to fluctuate or remain constant from month to month?  
 Yes  No

**B5.** Please estimate the potential **annual** volume (in million gallons/year) of treated effluent that your facility might use in the following categories.

Cooling, Condensing, or Refrigeration	_____ million gallons/year
Process	_____ million gallons/year
Washdown	_____ million gallons/year
Boiler Feed	_____ million gallons/year
Air Conditioning	_____ million gallons/year
Irrigation	_____ million gallons/year
Sanitary	_____ million gallons/year
Storm Water	_____ million gallons/year
Other _____	_____ million gallons/year

**B6.** Would you be interested in increasing your treatment capabilities to meet any additional requirements for industrial reuse (e.g., reverse osmosis)?  
 Yes  No

**FORM C: Actual Reuse of Treated Effluent**  
(Calendar Year Ending December 2007)

**C1.** What was the total **annual** volume (in million gallons/year) of treated effluent that you reused at your facility?  
 \_\_\_\_\_ million gallons/year (Type I) [Definition](#)  
 \_\_\_\_\_ million gallons/year (Type II) [Definition](#)

**C2.** What was the **monthly** total volume (in million gallons/month) of treated effluent that you reused at your facility?

2007	million gallons/month (Type I)	million gallons/month (Type II)
January	_____	_____
February	_____	_____
March	_____	_____
April	_____	_____
May	_____	_____
June	_____	_____
July	_____	_____
August	_____	_____
September	_____	_____
October	_____	_____
November	_____	_____
December	_____	_____

**C3.** What percentage of the total **annual** volume came from your facility?  
 \_\_\_\_\_ percent %

**C4.** What percentage of the total **annual** volume came from other sources?  
 \_\_\_\_\_ percent %

**C5.** What are the other sources?  
 Source A: \_\_\_\_\_  
 Source B: \_\_\_\_\_  
 Source C: \_\_\_\_\_  
 Source D: \_\_\_\_\_

**C6.** If you currently use reclaimed water, what is the estimated price/1000 gallons?  
 \$ \_\_\_\_\_ price/1000 gallons

**C7.** Is the amount of treated effluent you reuse metered (M) or estimated (E)?  
 M     E

**C8.** What percentage of the treated effluent that your facility currently reuses falls into the following categories?  
 \_\_\_\_\_ percent (%) - Cooling, Condensing, or Refrigeration  
 \_\_\_\_\_ percent (%) - Process  
 \_\_\_\_\_ percent (%) - Washdown  
 \_\_\_\_\_ percent (%) - Boiler Feed  
 \_\_\_\_\_ percent (%) - Air Conditioning  
 \_\_\_\_\_ percent (%) - Irrigation  
 \_\_\_\_\_ percent (%) - Sanitary  
 \_\_\_\_\_ percent (%) - Stormwater  
 \_\_\_\_\_ percent (%) - Other

**C8a.** Did you provide reclaimed water to any other companies or organizations?  
 Yes     No

**C8b.** If yes, what was the total **annual** volume (in million gallons/year) and to what company or organization did the water go?  
 Company/Organization A: \_\_\_\_\_ million gallons/year  
 Company/Organization B: \_\_\_\_\_ million gallons/year  
 Company/Organization C: \_\_\_\_\_ million gallons/year  
 Company/Organization D: \_\_\_\_\_ million gallons/year



<b>Form A</b> Contact Information and Comments	<b>Form B</b> Potential Reuse of Treatment Effluent	<b>Form C</b> Actual Reuse of Treated Effluent	<b>Submit</b>
---	--	---	---------------

### **Submit**

Thank you for your time and your contribution to this important project initiative. The results of this survey will be made available to all participants in June 2008.

Please click on the submit button below to send us your survey responses.

[<< Back](#)

[Submit](#)

INVOLVE



MUNICIPAL RECLAIMED  
WATER SURVEY

**Form A**  
Contact Information and Comments

**Form B**  
Potential Treated Effluent Production

**Form C**  
Actual Treated Effluent Production

Submit

**FORM A: Contact Information and Comments**

**Municipal Utility:** \_\_\_\_\_

**Department:** \_\_\_\_\_

**Primary Contact:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Secondary Contact:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Mailing Address:** \_\_\_\_\_

**City:** \_\_\_\_\_ **State:** TX **Zip Code:** \_\_\_\_\_

**County:** \_\_\_\_\_

**Latitude** (in decimal degrees): \_\_\_\_\_

**Longitude** (in decimal degrees): \_\_\_\_\_

**Comments**



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### FORM B: Potential Treated Effluent Production

**B1.** Please estimate the potential **annual** volume (in million gallons/year) of treated effluent that your utility produces.

<p><b>2008</b></p> <p>_____ million gallons/year (Type I) <small><a href="#">Definition</a></small></p> <p>_____ million gallons/year (Type II) <small><a href="#">Definition</a></small></p>	<p><b>2013</b></p> <p>_____ million gallons/year (Type I)</p> <p>_____ million gallons/year (Type II)</p>
---	---

**B2.** Please estimate the potential **monthly** minimum volume (in million gallons/month) of treated effluent that your utility produces.

	million gallons/month (Type I)	million gallons/month (Type II)		million gallons/month (Type I)	million gallons/m (Type II)
<b>2008</b>			<b>2013</b>		
January	_____	_____	January	_____	_____
February	_____	_____	February	_____	_____
March	_____	_____	March	_____	_____
April	_____	_____	April	_____	_____
May	_____	_____	May	_____	_____
June	_____	_____	June	_____	_____
July	_____	_____	July	_____	_____
August	_____	_____	August	_____	_____
September	_____	_____	September	_____	_____
October	_____	_____	October	_____	_____
November	_____	_____	November	_____	_____
December	_____	_____	December	_____	_____

**B3.** Would you like to connect with industrial companies that could use your treated municipal effluent?

Yes     No

**B4.** Would you be interested in increasing your treatment capabilities to meet any additional requirements for industrial reuse (e.g., reverse osmosis)?

Yes     No





**FORM C: Actual Treated Effluent Production**  
(Calendar Year Ending December 2007)

**C1.** What was the total **annual** volume of treated effluent (in million gallons/year) that your utility made available for reuse, not including internal reuses?

\_\_\_\_\_ Definition million gallons/year (Type I)  
 \_\_\_\_\_ Definition million gallons/year (Type II)

**C2.** What was the total **monthly** volume (in million gallons/month) of treated effluent that your utility made available for reuse, not including internal reuses?

2007	million gallons/month (Type I)	million gallons/month (Type II)
January	_____	_____
February	_____	_____
March	_____	_____
April	_____	_____
May	_____	_____
June	_____	_____
July	_____	_____
August	_____	_____
September	_____	_____
October	_____	_____
November	_____	_____
December	_____	_____

**C3.** What percentage of the total **annual** volume of treated effluent produced, was reused by organizations other than your own?

\_\_\_\_\_ percent (%) - Industrial  
 \_\_\_\_\_ percent (%) - Landscape Irrigation (parks, golf courses, etc.)  
 \_\_\_\_\_ percent (%) - Agriculture  
 \_\_\_\_\_ percent (%) - Other \_\_\_\_\_

**C4a.** What industrial companies purchased your treated effluent in 2007? Please list company name and the quantity that was sold in million gallons.

Company A: \_\_\_\_\_ million gallons  
 Company B: \_\_\_\_\_ million gallons  
 Company C: \_\_\_\_\_ million gallons  
 Company D: \_\_\_\_\_ million gallons

**C4b.** Was the sold water raw (R), treated (T), or both (B)? Please indicate for each purchaser.

Company A:     R    T    B  
 Company B:     R    T    B  
 Company C:     R    T    B  
 Company D:     R    T    B

**C4c.** In what county was the purchaser located?

Company A: \_\_\_\_\_  
 Company B: \_\_\_\_\_  
 Company C: \_\_\_\_\_  
 Company D: \_\_\_\_\_

**C5.** Is this treated effluent production amount metered (M) or estimated (E)?

M     E

INVOLVE



MUNICIPAL RECLAIMED  
WATER SURVEY

**Form A**  
Contact Information and Comments

**Form B**  
Potential Treated Effluent Production

**Form C**  
Actual Treated Effluent Production

Submit

### Submit

Thank you for your time and your contribution to this important project initiative. The results of this survey will be made available to all participants in June 2008.

Please click on the submit button below to send us your survey responses.

<< Back

Submit

**A-2**  
**Meeting Agendas and Minutes**





## PROJECT KICKOFF MEETING AGENDA

MEETING DATE: Wednesday, October 10, 2007  
TIME: 3:30 PM to 4:30 PM  
LOCATION: TWDB Headquarters – 1700 N. Congress Avenue, Rm. 465a

INVITEES: Dan Hardin  
Craig Caldwell  
Cheri Martz  
Jorge Arroyo  
Hari Krishna  
Ginny Vragel  
Craig Pedersen  
Kristi Teykl  
Julia Presas

1. Introductions
2. Distribute Project Management Plan
3. Review Project Scope
4. Discuss Elements of Quality Assurance Plan
5. Review Project Budget
6. Identify Milestones in Project Schedule
7. Define Methods of Communication and Documentation
8. Discuss Current TWDB Water Use Survey and GIS/IMS Integration
9. Summarize Action Items



## PROJECT KICKOFF MEETING MINUTES

MEETING DATE: Wednesday, October 10, 2007  
TIME: 3:30 PM to 4:30 PM  
LOCATION: TWDB Headquarters – 1700 N. Congress Avenue, Rm. 465a

ATTENDEES: Dan Hardin  
Craig Caldwell  
Cheri Martz  
Jorge Arroyo  
Hari Krishna  
Ginny Vragel  
Craig Pedersen  
Kristi Teykl  
Julia Presas

### 1. Introductions

Each attendee took the opportunity to introduce themselves and briefly define their personal role on the project.

### 2. Distribute Project Management Plan

Kristi Teykl, URS Project Manager, described the purpose of the meeting as an opportunity for the URS Team to meet directly with TWDB project stakeholders, review the scope of work, discuss priorities for the initiative, and answer any questions. Mrs. Teykl is excited about the opportunity to work with TWDB and manage this important project. She believes the data and tools developed over the next six months will be of real value and benefit to TWDB constituents. She distributed a copy of the Project Management Plan (PMP) to each attendee. The PMP is meant to serve as a comprehensive document or resource which outlines all aspects of the project – including scope, technical requirements, a quality assurance plan, work organization, schedule, budgetary constraints, and methods of communication and documentation.

### 3. Review Project Scope

Mrs. Teykl introduced the proposed scope of work to all attendees. The goal of the project is to develop a baseline GIS database and implement an interactive web-based decision support tool to identify industrial water reuse potential in Texas. URS will be teaming with the U.S. Business Council for Sustainable Development (USBCSD) which has committed to providing in-kind services in support of various project goals. URS will conduct a pilot study of the greater Houston area, encompassing Harris County and portions of Galveston and Brazoria Counties. The URS Team will develop a model that can be adapted and applied on a statewide scale. The project will be divided into four major tasks:



- Task 1.0: Project Definition
- Task 2.0: Design and Build a Comprehensive GIS
- Task 3.0: Develop a Web-enabled Reclaimed Water Management System
- Task 4.0: Delivery and Integration of Final Project Deliverables

Each task was described in detail, highlighting project milestones, associated deliverables, and task durations.

#### 4. Discuss Elements of Quality Assurance Plan

The Quality Assurance Plan is based on the URS Quality Management Program, which defines corporate quality assurance guidelines that URS personnel apply to ensure their project deliverables are of high quality, and they are completed on schedule and within budget. Various components of the QAP were identified and discussed, including Detail Checking, Independent Technical Review, the QA Checklist, and the Document Retention Log. Qingzhou Li, URS QA Task Leader, will conduct all periodic QA/QC checks and assess project deliverables for consistency, accuracy, and completeness.

#### 5. Review Project Budget

The Contract is a firm-fixed price agreement with a not-to-exceed value of \$70,000. Given URS' current partnership with the USBCSD, access to pertinent data and technical resources, and the expertise of individual task leaders assigned to the project, the URS Team is confident they will be able to complete all project tasks within budget. Attachment 7 in the Appendix of the PMP contains four tables which summarize the hours and costs associated with each task and subtask.

#### 6. Identify Milestones in Project Schedule

Attachment 8 in the Appendix of the PMP details the progression of Tasks 1.0 – 4.0 and all individual subtasks. Mrs. Teykl highlighted the following project milestones:

- Summarize the findings of the regulatory review and definition of water quality parameters and a range of associated costs
- Compile results from URS' assessment of municipal water availability and industrial water quality/quantity needs
- Public Opinion Survey results
- Workshop 1: Review of baseline GIS database
- Workshop 2: Review of web-enabled decision support tool
- Delivery of final project report
- Data and knowledge transfer

#### 7. Define Methods of Communication and Documentation



Mrs. Teykl introduced the URS I3 Solution which will serve as the primary medium of communication among project stakeholders. This web-enabled project and data management system consists of three password secure web-based interfaces:

- eProject Management Tool
- ESRI Web-Map Viewer
- INVOLVE public participation portal

These applications are seamlessly integrated to deliver a cost-effective, transparent solution to streamline and enhance team communication. Project stakeholders will receive login information by October 19, 2007, to begin accessing and using the web-based system.

#### 8. Discuss Current TWDB Water Use Survey and GIS/IMS Integration

Meeting attendees discussed specifics of the data collected annually in the TWDB Water Use Survey and technical requirements of current IMS configuration.

Mrs. Teykl and Julia Presas, GIS Task Leader, will work directly with Craig Caldwell and Cheri Martz of TWDB to acquire a subset of the archived Water Use Survey data specific to Harris, Brazoria, and Galveston Counties for the most current year available. They will also coordinate with TWDB to ensure that the data schema of the project geodatabase is compatible with TWDB current technical specifications.

Ginny Vragel of TWDB will work directly with Julia Presas to transfer all relevant base map data to URS for use on the project.

#### 9. Summarize Action Items

The following immediate action items were assigned the appropriate team member:

Kristi Teykl

- Activate eProject website and distribute login information to project stakeholders
- Draft and post Project Kickoff Meeting Minutes to eProject website
- Work with USBCSD and local agencies to recruit Advisory Panel





## PROJECT WORKSHOP AGENDA

MEETING DATE: Monday, March 24, 2008  
TIME: 1:00 PM to 3:00 PM  
LOCATION: TWDB Headquarters – 1700 N. Congress Avenue, Rm. 465a

INVITEES: Dan Hardin  
Craig Caldwell  
Cheri Martz  
Jorge Arroyo  
Hari Krishna  
Ginny Vragel  
Craig Pedersen  
Kristi Teykl  
Julia Presas  
Nancy Gates  
Wade Shults

1. Introductions
2. Discuss Survey Results
3. Review Geodatabase (DRAFT)
4. Demonstrate Web-enabled GIS Decision Support Tool (DRAFT)
5. Lessons Learned
6. Define Path Forward
7. Summarize Action Items



## PROJECT WORKSHOP MINUTES

MEETING DATE: Monday, March 24, 2008  
TIME: 1:00 PM to 3:00 PM  
LOCATION: TWDB Headquarters – 1700 N. Congress Avenue, Rm. 465a

ATTENDEES: Dan Hardin  
Craig Caldwell  
Cheri Martz  
Jorge Arroyo  
Ginny Vragel  
Craig Pedersen  
Kristi Teykl  
Julia Presas  
Nancy Gates

### 1. Introductions

Kristi Teykl introduced Nancy Gates to the workshop attendees and defined her personal role on the project as the Public Involvement Specialist.

### 2. Discuss Survey Results

Kristi Teykl, URS Project Manager discussed the survey approach and results achieved during the project. Initially, URS invited 800+ potential respondents to participate in the survey via email notification. Potential survey candidates were selected from various data collected from TWDB, US Business Council for Sustainable Development (USBCSD), American Water Works Association (AWWA), Water Reuse Association, and several power utilities. URS also distributed a one-page flyer at the Southeast Texas AWWA Chapter workshop – “*21st Century Challenges in Potable Water Industry in Southeast Texas*” to connect with potential survey respondents and encourage their participation. The URS Team pursued additional respondents with a direct call campaign to follow up directly with survey candidates that were contacted in the first distribution. Craig Pedersen and Kristi Teykl spoke at the USBCSD Winter Meeting (February 2008) in San Antonio, Texas to encourage industrial companies within pilot study area to participate. Survey responses were received January through March 2008. To date 35 industrial firms and 21 municipal utilities participated in the survey. The data submitted by these participants will provide a baseline measurement or snapshot of industrial water reuse potential in the greater Houston area. Based on the data provided in the survey responses, a greater interest and perception of value/priority for this use of reclaimed water exists within municipal utilities. These utilities identified projected production for 2008 and 2013 and indicated they had a significant interest in developing an exchange network with local industry



### 3. Review Geodatabase (DRAFT)

Kristi Teykl described the database schema and provided a snapshot view of the data stored in the project geodatabase.

### 4. Demonstrate Web-enabled GIS Decision Support Tool (DRAFT)

Kristi Teykl provided a hands-on demonstration of the web-enabled GIS decision support tool that was developed during the project. The web-enabled application allows users to access the project survey data and interface with spatial query tools to enhance decision-making. Several attendees request additional modifications during the demonstration. URS will ensure that these enhancements will be integrated into the final deliverable.

### 5. Lessons Learned

Craig Pedersen led an interactive group discussion to emphasize some of the issues that were encountered during the project. The following points of consideration were discussed and will be addressed in the final report document.

- Timing is imperative to success
- Need exists for additional education
- Find the “right” person within each organization
- Face-to-face interviews

### 6. Define Path Forward

The following task list identifies the work that will be completed in the last 5 weeks of the project:

- Collect additional survey data from USBCSD members
- Finalize Project Report and Deliverables
- TWDB Review and Comment Period
- Address TWDB Comments and Update Report and Deliverables for Final Submittal
- Integrate Project Data and Web-enabled Application with TWDB WIID System

### 7. Summarize Action Items

The following immediate action items were assigned the appropriate team member:

Kristi Teykl

- Contact other TWDB technical staff to notify them of the data/knowledge transfer
- Finalize project report and deliverables based on input from TWDB
- Ensure that data/knowledge transfer is complete
- Submit final project invoices



**A-3**  
**Quality Assurance Documentation**



## Project Quality Assurance Checklist

Project Name: Texas Water Development Board – Priority Research  
 Topic #3  
 Project Number: 41008620  
 Project Manager: Kristi Teykl

Start Date: 9/24/2007  
 Completion Date: 7/21/08  
 Principal-in-Charge: Craig Pedersen

QAM Element or Clause	REQUIRED QA AND QC ACTIVITIES	Applicable	Compliance	Deficiency	Comments	Correction Date	Verification Date
4.2.2	Establish Project Central File	*	x				4/30/08
4.2.2	Prepare Project Quality Assurance File Folder	*	x				4/30/08
3.2/2.2.2.1.1	Review Proposal/Contract, obtain approval in accordance with the Auth. & Resp matrix and annotate (Negotiations Correspondence, memos, etc.)	*	x				4/30/08
2.2.2.1.2	Prepared Project Quality Assurance Plan, obtain approval from Principal-in-Charge, include in Project Management Plan (Exhibit 2.2-1)	*	x				4/30/08
4.4	Prepare Project Criteria Document, include in Project Management Plan						
6.3.2	Prepare/Review procurement document, obtain approval from Office Manager (subcontracting agreement)		x				4/30/08
2.2.2.1.3	Prepare Project Management Plan, obtain approval from Principal-in-Charge (Exhibit 2.2-2)	*	x				4/30/08
3.2/2.2.2.1.1	Conduct Project Kick-off Meeting		x				4/30/08
4.5	Work Product Output (Work Product Directives)		x				4/30/08
4.9	Changing the Work Product						
5/2.2.2.1.10	Document and Data Control (Exhibit 5.1-1)	*	x				4/30/08
7/2.2.2.1.11	Controlling Client-Supplied Products						
4.7.2	Prepare Computer Program Log (Exhibit 4.7-9)						
4.7.2	Prepare/Check Computer Program Verification, if required (Exhibit 4.7-8)						
4.7.1.6.1	Include Report Disclaimers						
4.7.1.6.2	Use procedures to prepare and detail-check calculations, using guidelines of Exhibit 4.7-1 (Exhibit 4.7-2)						
4.7.1.6.2	Complete Calculation Cover Sheet (Exhibit 4.7-2)						
4.7.1.6.3	Use procedures to prepare and detail-check drawings, using the guidelines of Exhibit 4.7-4 (Exhibits 4.7-3 and 4.7-5)	*	x				4/30/08
4.7.1.6.4	Use procedures to prepare and detail-check specifications, using the guidelines of Exhibit 4.7-6 (Exhibit's 4.7-3 and 4.7-5)	*	x				4/30/08
4.7.1.6.5	Review Draft Study/Report (Exhibit's 4.7-3 and 4.7-5)		x				4/30/08
4.7.1.6.6	Review Draft Estimate (Exhibit 4.7-7)						
4.2.4	Client Feedback (Exhibit 4.2-1)		x				7/8/08
6.4	Evaluate/Verify/Accept Subconsultant's Services						

QAM Element or Clause	REQUIRED QA AND QC ACTIVITIES	Applicable	Compliance	Deficiency	Comments	Correction Date	Verification Date
2.2.2.1.7	Conduct Independent Technical Review of Contract Deliverables	*	x				7/21/08
2.2.2.1.7	Complete ITR Report (Exhibits 2.2-3 and 2.2-4)	*	x				7/21/08
2.2.2.1.8	Conduct Coordination Review, if more than one technology, office, subconsultant, etc. on the project						
2.2.2.1.8	Complete Coordination Review Report (Exhibits 2.2-3 and 2.2-4)						
8	Identify and trace product (product tags; product records)						
13	Use procedures to identify & report nonconformances (Exh. 13.2-1, 13.2-2)						
14	Use procedures to correct & prevent nonconformances (Exh 14.1-1, 14.1-2)						
15	Use procedures to handle, store, package, preserve and deliver products		x				4/30/08
16	Use procedures to store quality records						
17	Conduct QA Audits						
17	Complete QA Audit and Findings Report, and Audit Check List (Exhibits 17.1-1, 17.1-2, and 17.1-3)						

Legend: \* = always applicable

**Required documentation**



## Project Quality Assurance Plan

Project Number: 41008620

Client/Project Name: Texas Water Development Board – Priority Research Topic #3

I. The following elements of the URS Quality Assurance Manual are applicable to the above project. Include a schedule of deliverables, planned independent technical reviews and assigned reviewers (if known) in the Project Quality Assurance Plan.

- 2.2.2.1.3 \*  Project Management Plan \_\_\_\_\_ waiver approved (note reason in Section II)
- 2.2.2.1.3  Project Health and Safety Plan
- 2.2.2.1.7 \*  Independent Technical Review
- 2.2.2.1.8  Coordination Review
- 3  Contract Review
- 4.2.4  Client Feedback
- 4.4 \*  Work Product Input (Project Criteria)
- 4.5  Work Product Output (Work Product Directives)
- 4.7.1 \*  Work Product Verification - Detail Checking
  - Calculations \_\_\_\_\_ Drawings
  - Specifications \_\_\_\_\_ Studies and Reports
  - Cost Estimates \_\_\_\_\_ Disclaimers
- 4.7.2  Verification and Control of Computer Programs
- 4.9  Changing the Work Product
- 5 \*  Document and Data Control
- 6  Purchasing (Procurement of Subconsultant Services)
- 7  Controlling of Client-Supplied Product
- 8 \*  Identifying and Tracing Products
- 10  Construction Administration
- 15 \*  Packaging, Storing, Preserving and Delivering Client Deliverable
- 17 \*  Internal Quality Audits
- 18  Training
- 20  Statistical Techniques

\* Applicable to all projects requiring application of URS Quality Assurance Program

II. \_\_\_\_\_ While general review of the output documents will occur, formal application of the URS Quality Assurance Program is not required for the following reason(s): Project-specific quality assurance guidelines more suitable for GIS data and application development have been proposed and approved by the client.

III. \_\_\_\_\_ The following project-specific supplementary programs, procedures and instructions shall be applied to the above project: Please note procedure descriptions in the Project Management Plan.

Prepared by: \_\_\_\_\_ Date 7/21/2008  
Project Manager

Approved by: \_\_\_\_\_ Date 7/21/2008  
Principal-in-Charge or designee

## Detail Checking

Client: Texas Water Development Board Project Number: 41008620

Project Name: Priority Research Topic #3

**I. Assigned Checker:** Julia Presas  
(To be completed by the Project Manager)

Document to be Detail-checked: TWDB Effluent Reuse.mdb

(Title/Revision Number) 5

Submitted by: Kristi Teykl Date: 4/30/2008  
Project Manager

---

**II. Review Summary**  
(To be completed by the checker)

I have checked the above-referenced document in accordance with the appropriate checklist/s and project scope. My conclusions are as follows:

I have verified the accuracy and completeness of the project geodatabase in accordance with the specifications as defined in the scope of work and any subsequent requested modifications submitted by TWDB.

Reference comments are on:  work product. (Yellow =Item is checked and correct; red =item to be corrected/deleted/added, or:  Exhibit 4.7-5, pages \_\_\_\_\_ through \_\_\_\_\_

---

**III. Checker Report**  
(To be completed by the checker; approved by the Project Manager or Principal-in-Charge)

- A.  The checker's comments have been provided. Checker's signature: \_\_\_\_\_ Date: 4/30/08
- or B.  All items have been found to be correct.
- C.  Backcheck of checker's comments has been performed by originator, and all issues have been resolved between originator and checker. (Checked with green = agree with reviewer's comment)
- D.  All unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.
- or E.  Verification of correct incorporation of resolved comments into final document is complete. (Highlighted with yellow = comment has been incorporated; highlighted with blue over yellow = corrections verified by checker)

Submitted by: \_\_\_\_\_ Date 4/30/2008  
Checker

This detail check has been completed. Any significant issues not resolved between the detail checker and the originator have been resolved by me.

Approved by: \_\_\_\_\_ Date 4/30/2008  
Project Manager or Principal-in-Charge or designee (as applicable)

## Independent Technical Review

Client: Texas Water Development Board Project Number: 41008620

Project Name: Priority Research Topic #3

**I. Assigned Independent Reviewer: JT Stewart**

(To be completed by the Project Manager)

Document to be Reviewed: Final Project Report and Deliverables

(Title/Revision Number) Final Draft

The review scope (continued on the attachment): \_\_\_\_\_

Submitted by:	<u>Kristi Teykl</u>	<u>7/21/2008</u>	<u>Kristi Teykl</u>	<u>7/21/2008</u>
	Project Manager	Date	Author	Date

**II. Review Summary:**

(To be completed by the Independent Reviewer)

I have reviewed the above-referenced document in accordance with the appropriate checklist(s) and project scope. My conclusions are as follows:

All project deliverables are consistent with the specifications defined in the approved scope of work.

Reference comments on:  Work product or  Exhibit 2.2-4, pages \_\_\_\_\_ through \_\_\_\_\_

**III. Reviewer Report:**

A.  The Reviewer's comments have been provided.

Date 7/21/2008

\_\_\_\_\_  
Reviewer's Initials

(To be completed by the Independent Technical Reviewer; Approved by the Project Manager or Principal-in-Charge, if and when comments are provided.)

B.  Verification of correct incorporation of resolved comments into final document is complete

(To be completed after verification of comment incorporation OR if there are no comments)

Submitted by: \_\_\_\_\_ Date \_\_\_\_\_  
Independent Technical Reviewer

C.  This review has been completed. Any significant issues not resolved between the Independent Technical Reviewer and the Originator have been resolved by me. (To be signed after A and B are completed)

Approved by: \_\_\_\_\_ Date 7/21/2008  
Project Manager or Principal-in-Charge or designee (as applicable)

Note: If there is a dispute between the author and reviewer, the Project Manager or Principal-in-Charge is consulted.



**A-4**

**Technical User Guide (Web-Enabled GIS Decision Support Application)**



**Texas Water Development Board  
Web-Enabled Decision Support Application  
Technical User Guide**

**July 2008**

Prepared by:  
URS Corporation  
9400 Amberglen Boulevard  
Austin, TX 78729





## Document History

Version	Primary Authors	Description	Date Completed
Technical User Guide v1.0	URS Corporation	Documents Web-enabled Decision Support Application Functionality	April 2008

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## **Product Introduction**

### **Overview**

The web-enabled GIS decision support application serves as a powerful, cost-effective tool for extending centralized data resources and information to TWDB constituents. The interface is easy to use and empowers planners, engineers, and managers with a regional resource planning tool that helps municipal suppliers and potential industrial users of treated effluent find one another. They now have an understanding of where these potential partners are located relative to their facility, who is interested in considering treated effluent as a water resource alternative, what sort of volume and quality is associated with the reclaimed water, and how to contact the potential partner to begin a dialogue to address potential transport, timing, and storage concerns. In conjunction with the development of this web-enabled application, URS prepared a technical user guide to document the specific functionality associated with each tool and provide basic instructions for navigating the map, exploring data, conducting basic spatial queries, and generating a map or report.

### **Understanding this User's Guide**

This User's guide is organized from an end-user perspective. It tackles topics in the order a first time user would generally encounter them (e.g. it begins with system requirements and logging into the application, and then develops to ultimately explain more specific advanced tasks). The first section of this guide covers accessing the application, specifically focusing on what software and credentials are needed. The following section familiarizes users with the general layout of the application, including application windows, tools, and components. The last sections deal with using the application to perform a variety of tasks ranging from controlling the field of view, to querying data and creating hardcopy output.

For more information beyond this User's Guide, please consult on-line help accessible through the TWDB Reclaimed Water Management System application, or contact Kristi Teykl (URS) at (512) 419-5186.

## Client Workstation Requirements

The TWDB Reclaimed Water Management System utilizes ESRI technology and ESRI Software to serve GIS data through an Internet browser. The following is necessary for the application to run on a client workstation.

System Requirements: Any PC computer capable of running Microsoft Internet Explorer™ 5.0 or greater.

Recommended Browser: Internet Explorer 6.0

Connection Type: Cable, DSL, or LAN Broadband Internet connections required. Modem connections are not recommended.

*Additional Note: No specific Internet browser plug-ins are required to use the TWDB Reclaimed Water Management System application.*

## Getting Started

### Site Access

TWDB Reclaimed Water Management System is available through the TWDB eProjects site. Using Microsoft Internet Explorer 5.0 or later, you can access the site at:

<http://twdbwaterreuse.urs-eprojects.com>

Access to the web server is password-protected. Once connection to the site is achieved, you will be prompted for a User Name and Password to use the site. If you do not already have login credentials, please contact your System Administrator, Kristi Teykl (URS) at (512) 419-5186.

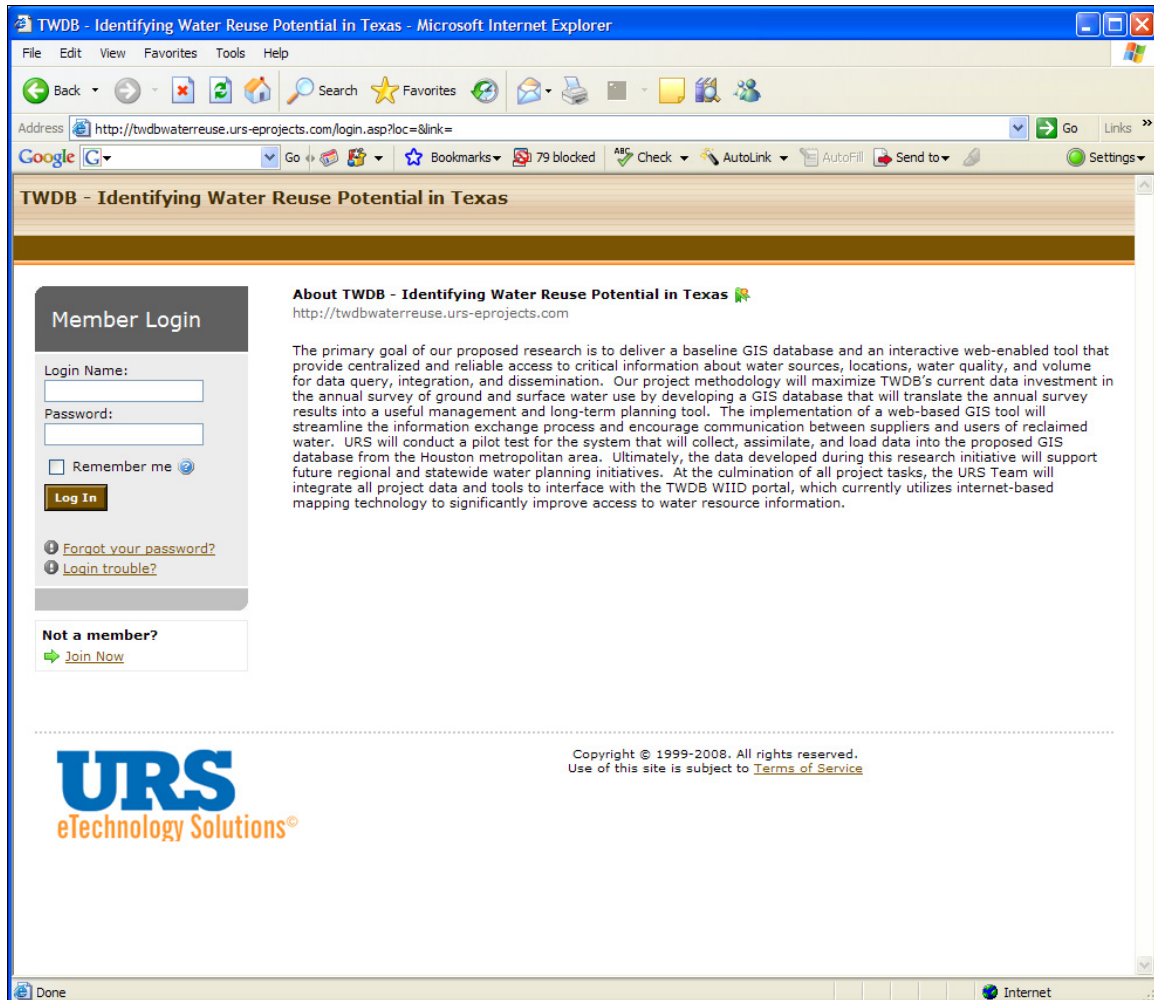


Figure 1 – Login Screen

## Application Layout

After a successful login in, you will see “Loading Map Viewer...” begin to fade in and out while the layers and elements of the page are being loaded. Please be patient during this process. Depending on your connection speed, it may take up to 30 seconds to load all the information for the site.

Once all the data has been loaded, the site is ready to use. The default service will be displayed, showing only the essential data layers. Below is a screenshot of how the application will appear when you first log in.

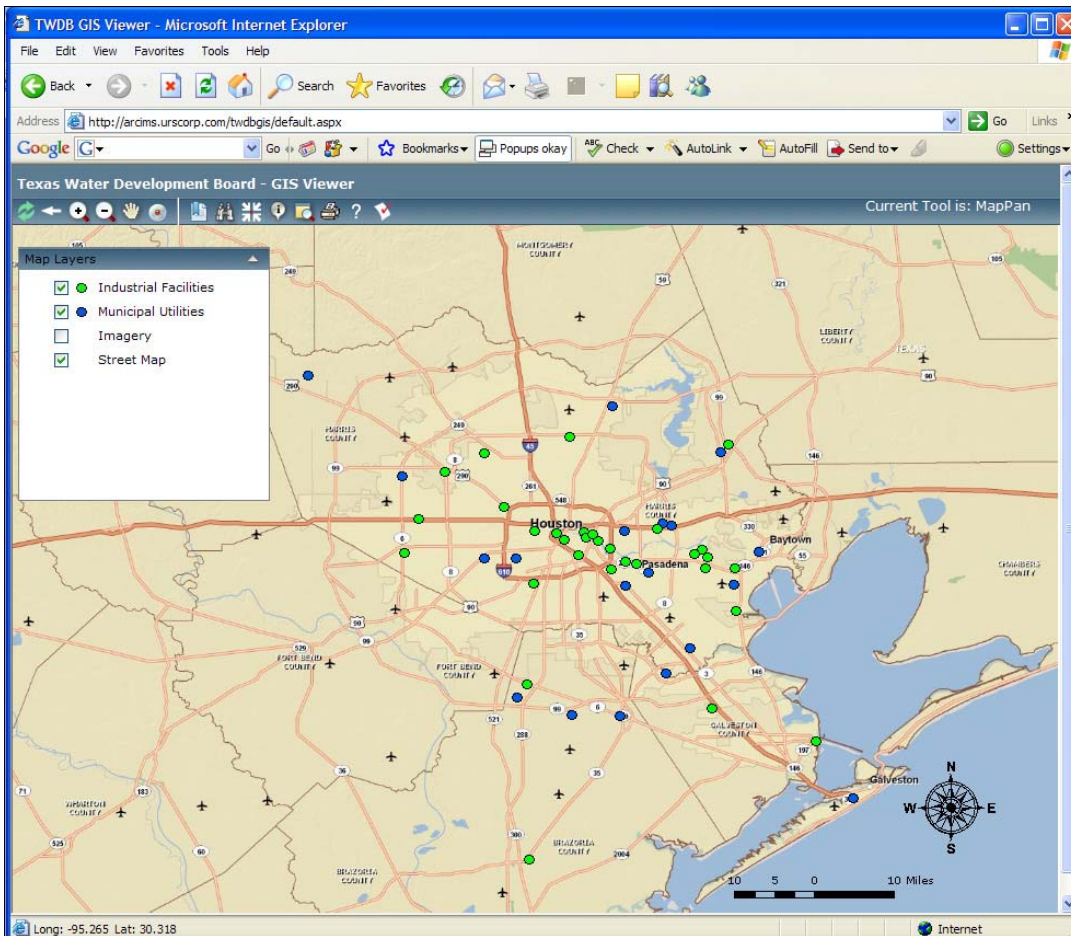


Figure 2 – Default map display

The TWDB Reclaimed Water Management System consists of three main components: the Map Frame, the Table of Contents (TOC) and the Icon Toolbar. The Map Frame is where all geospatial information is graphically represented and occupies the bottom-right portion of the application window. The TOC displays all the basic component elements of the application, including the standard data layers accessed and viewed in the application. These data are used to control many aspects of the application. The TOC is located on the left edge of the application window. Finally the Icon Toolbar, located above the Map Frame, provides cursor tools for navigating the map, as well as buttons to link to other areas of the application, such as the Identify and the Quick Find options. The following pages explain each main component of the application in more detail.



## Map Frame

The Map Frame is where all geospatial information is graphically represented. This is where the information regarding the industrial and municipal survey participants will be shown in the context of the physical layout of the greater Houston area. Following are two views of the Map Frame.

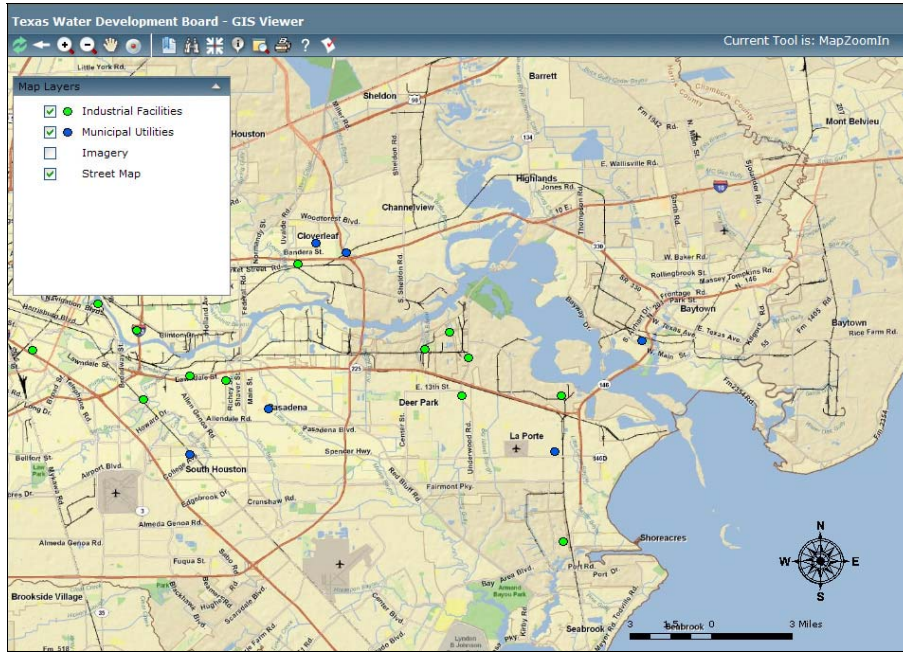


Figure 3 – View of Map Frame

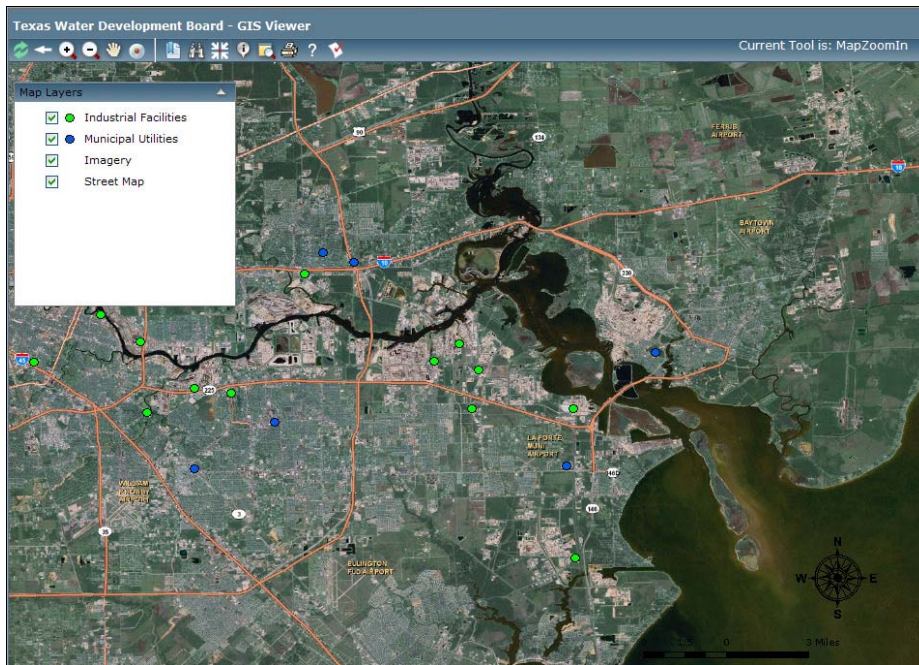


Figure 4 – Alternate View of Map Frame

## Table of Contents

The TOC, located to the left of the Map Frame, allows for the selection and control of layer visibility, as well as provides a legend of data layer symbology. Clicking on the triangle at the top of the frame will toggle control to minimize or maximize the frame.



Figure 5 – Table of Contents

### Map Layers

The TOC shows all layers available within the current map service. All the data layers are located within a folder structure in the IMS system. By drilling down into these folders you can turn on and off the visibility of any layer as well as make it active or inactive.

The checkmarks indicate that a layer will be graphically represented on the map. If you uncheck a box, the application will automatically refresh to remove the data layer from visibility. Conversely, if you check a box next to a specific data layer that is not currently visible in the map view, the application will automatically refresh and the data will again be displayed in the current field of view.














## Icon Toolbar

Above the Map Frame, you will find the Icon Toolbar. Each icon in the toolbar allows you to interact with the map and the attribute data.



Figure 6 – Interactive Toolbar

Each icon is described below.

-  **Zoom In:** Click on map to define zoom area by clicking and dragging a rectangle.
-  **Zoom Out:** Click to zoom out by 2X or define a zoom out ratio by clicking and defining a zoom out box.
-  **Pan:** Click and drag to pan around map.
-  **Center At:** Click on map to center field of view at that point.
-  **Refresh to Default Extent:** Click on icon in toolbar to automatically refresh the map view to display the original default extent of the study area.
-  **Zoom to Last Extent:** Click to return to the previous extent.
-  **Bookmark:** Click on map to save the current location or extent of the map view.
-  **Quick Find:** Activate spatial query tool to find and zoom to a specific address or location (bookmark).
-  **Zoom to Coordinate:** Type in longitude and latitude coordinates of a site and zoom to that point.
-  **Identify Feature:** Click on Municipal Utility or Industrial Facility in the map and access attributes stored in the database associated with that feature.
-  **Toggle Magnifier:** Specify a magnification scale and hover over area of interest to magnify details of that location.
-  **Print Current Map:** Choose this tool to print the current map.
-  **Help:** Access the technical user guide in electronic form for quick reference.



**INVOLVE:** Link to the survey questionnaire (municipal and industrial forms) to submit new data to the project database.

Figure 7 – Toolbar Icon Functionality

## Using TWDB Reclaimed Water Management System

Once you are familiar with the general layout, you can start using the application tools to perform tasks. The following sections outline how to use the various tools to perform to perform spatial queries and support decision making.


### Querying Map Elements

The Industrial Facilities and Municipal Utilities data layers can be queried to view available information within the database. In order to do this, the layer must first be visible in the map view. Be sure to check the box next to the data layer in the TOC you would like to query. The most effective way to retrieve information for a feature is to use the *Identify* Tool.

#### Using the Identify Tool

Use the Identify tool when you want to graphically select one feature and interact with the database information that pertains to that feature.



To do so, select the  *Identify* icon from the Icon Toolbar and click on a feature within the active layer to view the data.

*Note: After selecting a feature with the Identify tool, the Results window will automatically become visible and display the information.*

Within the Results window, you have several options to interact with the data available for that feature.

1. Click the pull down menu to the right of “*Select Layer:*” to toggle between Industrial Facilities and Municipal Utilities and select the data layer you would like to query.
2. Click “*Details*” to the left of the facility Type (first column in the results table) to display a detailed summary of responses each participant submitted in the survey for that facility.
3. Click “*Print Results*” to print a paper copy of the information currently displayed in the Results window.
4. Click “*Zoom to This Location*” in the Zoom Link column in the results table to zoom in closer to a specific facility.
5. Check the box to the left of “*Enable Custom Tolerance*” to identify features within a specified radius or distance from a designated location that you click in the map. After you check the box, enter a numerical value into the box (immediately to the right of “*Tolerance:*”) to indicate the appropriate search radius to be applied in the spatial query. Then click the *Apply Tolerance* button. The application will return the Industrial Facilities or Municipal Utilities located within the search radius, depending upon which data layer you indicated in the *Select Layer* pull down menu. The same functionality, as previously described in options 1 – 4, applies to each of the facilities or utilities listed in the results returned from your spatial query.



## Map Information Display

The TWDB Reclaimed Water Management System has a general Map Information Display area at the lower left corner of the Browser window that provides Map coordinates for the position of the cursor within the map frame.

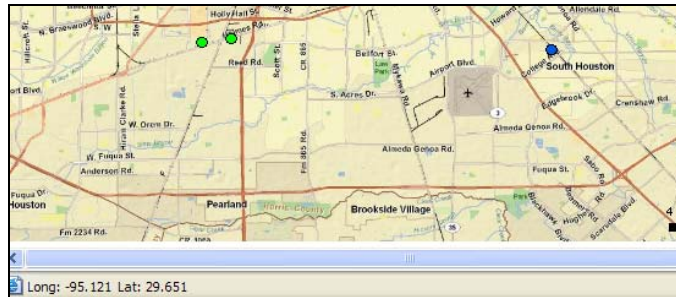


Figure 8 – Map Information Display

The Scale Factor of the current map dynamically displayed and represented by a scale bar in the lower right corner of the map frame along with a North Arrow to convey sense of direction as the user navigates throughout the map.

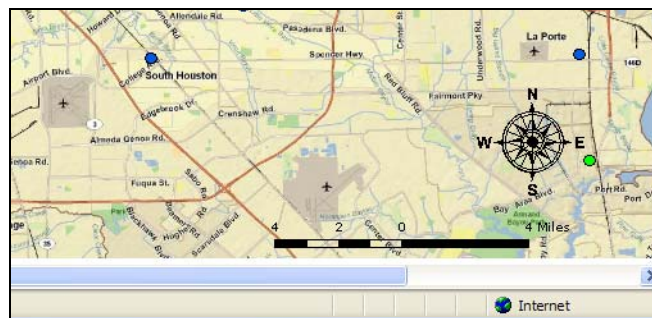


Figure 9 – Scale Factor and North Arrow Display

## Printing a Map

The TWDB Reclaimed Water Management System has basic map printing capabilities. This allows for professionally formatted, report quality maps to be generated and printed on your local printer. There are 4 components to consider when creating and printing a map. These components are explained below.

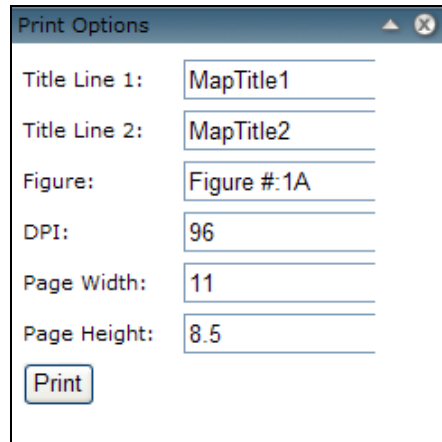


Figure 10 – Custom Print Dialog


**Title Block:** Information entered here is printed next to the map. You have the ability to designate a Main Heading in Title Line 1 and a Subheading in Title Line 2.

**Figure Number:** Enter a descriptor to identify the appropriate figure number in a sequence.

**DPI:** DPI is a measure of printing or map display resolution. The default value of 96 will most oftentimes be an acceptable level of resolution. Enter values up to 300 if you need to increase or enhance the resolution of the map generated for your plot.

**Orientation:** Map orientation is specified by page width and height. The orientation option allows the user to choose which way to orient the map on a sheet of paper. The default values should suffice for a basic plot of a specific site, but you have the option to modify these numbers as necessary.

The steps for creating and printing a map are as follows:

1. Center your map frame on the desired area.
2. Click the “Print” icon  to get the custom print dialog box
3. Define the contents of the title block and specify a figure number that is appropriate.
4. Select the desired resolution (if different from the default value of 96).
5. Adjust your page orientation if necessary.
6. Press the Print button.

Once complete, another browser window will open with an image of the newly created map. Click on “Print” to then plot the map on your local printer.

