



# WATER FOR TEXAS

## APPLICANT CAPACITY ASSESSMENT TOOL FOR THE ECONOMICALLY DISTRESSED AREAS PROGRAM



### Researchers:

Jason Bennett  
Svetlana Dascaluic  
Nick Grossman  
Michael Hunt  
Laura Kenesson  
Tara Madden  
Austin McWilliams  
Whitney Scott  
Megan Stubbs  
Dr. Deborah Kerr, Advisor

### *Project Mission Statement*

To develop an evaluation tool to assist the Texas Water Development Board in assessing the capacity of applicants to complete proposed water projects in economically distressed areas

This project was a partnership between the George Bush School of Government and Public Service at Texas A&M University and the Texas Water Development Board

***Texas Water Development Board***



# Executive Summary

---

Since 1989, the Texas Water Development Board (TWDB) has helped enhance the drinking water and wastewater services of 283,537 Texans through the Economically Distressed Areas Program (EDAP). EDAP, established during the 71<sup>st</sup> Legislature of the State of Texas, provides financial assistance in the form of grants and loans for the construction or improvement of drinking water and wastewater facilities. The Applicant Capacity Assessment Tool (ACAT) included in this report is designed to help TWDB assess the capacity of applicants to successfully complete funded projects. This report also offers recommendations on how TWDB can more effectively devote its limited resources to ensure projects are completed successfully.

EDAP focuses support on water projects in economically distressed areas, which are defined by the Texas Water Code Chapter 17.921 as follows:

- The water supply or wastewater systems are inadequate to meet minimal state standards;
- The financial resources are inadequate to provide services to meet those needs; and
- There was an established residential subdivision on June 1, 1989.

TWDB has funded 92 EDAP projects with approximately \$545 million over the last 16 years, but the program has faced numerous challenges related to projects running over time and over budget. To help address this problem, TWDB asked a team of graduate students at the George Bush School of Government and Public Service at Texas A&M University to develop an evaluation tool to assess the capacity of applicants to complete proposed water projects in economically distressed areas.

The team analyzed many factors that affect an EDAP applicant's ability to complete a proposed project on time and on budget. These factors are included the ACAT, which gives TWDB a standardized, quantitative method to assess applications. The ACAT can also be utilized by applicants as a guide for planning and implementing successful drinking water and wastewater projects. These key factors and the ACAT are discussed in detail within this report.

It should be noted that ACAT is meant solely to evaluate the capacity of an applicant to complete a project on time and on budget. It is not intended to determine whether or not an applicant should receive funding. The assessment tool is not designed to exclude applicants from the funding process, but instead to identify those applicants that might need additional assistance to complete their projects.

The recommendations, analysis, and assessment tool included in this report are based on extensive academic research, advice from subject matter experts, data analysis, and best practices from other states.

# TABLE OF CONTENTS

---

Executive Summary.....	II
Table of Contents.....	III
Introduction.....	1
Project Purpose and Findings.....	1
TWDB Needs .....	1
National Water Infrastructure Needs .....	2
Texas' Water Infrastructure Needs .....	2
The Client's Role: Utilization of Evaluation Tool.....	2
Project Constraints .....	2
Recommendations.....	3
Applicant Capacity Assessment Tool.....	7
Instructions For Use .....	8
Assessment Tool.....	9
Indicators.....	11
Financial.....	11
Managerial.....	14
Technical.....	17
Additional Indicators .....	18
Future Implications.....	21
References .....	22
Appendix I: Research Design and Data Collected.....	24
Appendix II: Suggested EDAP Application .....	29
Appendix III: Examples of Other States' Procedures.....	43
Appendix IV: Relevant Public Statutes.....	44
Appendix V: Additional Literature Review .....	45
Notes.....	58

# INTRODUCTION

---

## PROJECT PURPOSE AND FINDINGS

The Capstone team of the George Bush School of Government and Public Service developed an evaluation tool to assist TWDB in assessing the capacity of applicants to complete proposed water projects in economically distressed areas. The purpose of the Applicant Capacity Assessment Tool (ACAT) is to reduce the occurrence of water infrastructure projects running over-budget and over-schedule.

The ACAT should be used to evaluate the capacity of an applicant to complete the project on time and on budget. A low score does not mean a project should not be funded. Instead, the assessment tool is designed to identify those applicants that might need additional assistance, not to exclude applicants from the funding process.

The ACAT was created based on academic research, data analysis, and assessments of other state processes. It was then evaluated by experts in relevant fields. Through this process, the following findings have been determined:

- EDAP operates within a complex environment and with a high-need clientele, increasing the difficulty of management;
- There is no correlation between projects being over-budget and projects running over-schedule;
- There is limited documentation of the application and evaluation processes within EDAP;
- Evidence exists of collaboration between TWDB and the Texas Commission on Environmental Quality (TCEQ) on TCEQ's Financial, Managerial and Technical (FMT) evaluations. This cooperation is beneficial to all involved because it increases critical information sharing, helping to further identify the needs of EDAP applicants; and
- Experts conclude that qualified project managers are critical for the success of EDAP projects.

## TWDB NEEDS

Since the creation of EDAP in 1989, the program has faced many challenges. EDAP projects frequently run over-budget and over-schedule, adding a resource strain to a program operating on a limited budget. This study surveyed 53 available EDAP projects, 81% of which ran over schedule and 21% ran over budget. The ACAT should help TWDB identify projects likely to run over-time or over-budget. It should also provide a standardized way to assess EDAP applicants' capacity to complete proposed water projects prior to funding approval.

## **NATIONAL WATER INFRASTRUCTURE NEEDS**

There is a national need for upgraded drinking water and wastewater infrastructure, and many states are currently expanding and improving existing infrastructure. The United States Environmental Protection Agency (EPA) estimates that by 2020 it will cost approximately \$178-\$475 billion to upgrade the nations' drinking water infrastructure to achieve required health and environmental standards. An additional \$402-\$719 billion will be necessary to upgrade wastewater infrastructure. This need is attributable to demographic changes, a decline in research and development, and aging infrastructure.

## **TEXAS' WATER INFRASTRUCTURE NEEDS**

According to TWDB, Texas needs approximately \$819 million to upgrade infrastructure and provide drinking water and wastewater services to its distressed areas and their approximately 300,000 residents. To date, Texas has received approximately \$542 million of the \$819 million needed for this purpose (TWDB 2005).

The border region, one of the primary areas served by EDAP, includes approximately 1,300 colonias and other small water jurisdictions. These communities struggle because they typically have access to fewer resources, less technical knowledge, and a smaller financial stream in comparison to larger jurisdictions. According to EPA, these smaller communities face a high risk of failing to provide safe and adequate water resources.

## **THE CLIENT'S ROLE: UTILIZATION OF EVALUATION TOOL**

In order to reduce and eventually eliminate the tendency of EDAP projects to exceed time and budget predictions, TWDB should begin using ACAT and incorporate the recommendations listed in this document into its application process. Potential applicants should be informed that the tool will be used to develop a score that identifies their ability to complete the project on time and on budget, and TWDB should advise applicants to review the tool, address the factors listed, and make the appropriate adjustments to their financial, managerial, and technical plans prior to submitting their applications. This will help educate the applicants about success factors and will support the successful completion of projects.

## **PROJECT CONSTRAINTS**

The development of the evaluation tool was constrained by several research limitations. Available quantitative data on EDAP projects were insufficient to produce statistically significant results when analyzed for a causal relationship between the identified financial, managerial, and technical factors and the project success rate (details are discussed in the Appendix I on page 24). Therefore, the report and subsequent tool rely heavily on qualitative research and expert comment.

In addition, EDAP serves a high-need client (i.e. communities in economically distressed areas). These jurisdictions tend to have limited financial means and a shortage of human capital to ensure projects are planned and completed efficiently. Applying the ACAT and included recommendations does not guarantee the elimination of those problems; instead, their application can help TWDB provide appropriate support at the right time during the project life cycle.

# RECOMMENDATIONS

---

The following recommendations are based on an extensive literature review, review of similar programs in other states, analysis of program data, and information gathered from expert feedback. The recommendations are designed to help TWDB more effectively use its limited resources to manage EDAP.

## **Recommendation #1: Create and Implement a Standard Application**

TWDB should create and implement a standardized application for the EDAP program. The application should include, but not be limited to, the criteria found in ACAT. A standard application will provide TWDB a straightforward way to access the information needed for funding decisions. In addition, it will reduce the administrative burden by streamlining TWDB application processing and increase the quality of information provided by the applicant. Using a web-based system would further increase the efficiency in application processing.

The application should ask clear and specific questions to reduce ambiguity in applicant responses. Asking clear and specific questions will help TWDB utilize the assessment tool to evaluate the applicant because the applicant's information will be provided in a consistent and specific manner in response to the questions.

TWDB should begin by constructing an agency-specific application that will be incorporated in any standardized application initiated in the future.

An example of a standardized application can be found in Appendix II on page 29. This application is based on the ACAT, applications from other states, and the current EDAP application requirements.

### *BENEFITS TO APPLICANTS:*

- Provides specificity and structure to application process
- Increases objectivity of application process
- Improves efficiency by reducing paperwork

### *BENEFITS TO TWDB:*

- Reduces processing time
- Allows for comparison of applications
- Provides for immediate access to specific information
- Improves decision-making process for awarding EDAP grants/loans
- Provides data for future analysis

## **Recommendation #2: Incorporate the ACAT in an Integrated, Web-accessible Application Process**

TWDB should provide a webpage dedicated to EDAP. This webpage should include background information on EDAP, an explanation of the application process, the application, the ACAT (or a modified version), a documented application and evaluation process, and any other relevant information. This public posting of information provides a transparent process from grant application to award. While the ACAT will be most successful if it is launched after the application process has been revised, it can also be used immediately as a stand-alone tool in the current process.

### *BENEFITS TO APPLICANTS:*

- Communicates the evaluation criteria
- Allows applicants to proactively meet the criteria
- Increases likelihood of capacity adequacy

### *BENEFITS TO TWDB:*

- Identifies potentially problematic areas within projects
- Clarifies expectations
- Reduces application resubmissions
- Improves decision-making process for awarding EDAP grants/loans

## **Recommendation #3: Manage for Results**

TWDB should enhance oversight of EDAP projects by requiring regular progress reporting, conducting selective audits of large projects, and increasing monitoring efforts. By improving oversight, TWDB could strengthen financial accountability and project performance. Ongoing monitoring would allow TWDB to anticipate potential problems and provide timely assistance to project managers. This should result in an improved likelihood of on-time and on-budget projects.

### *BENEFITS TO APPLICANTS:*

- Offers applicants timely feedback from TWDB
- Provides applicants with necessary technical and managerial assistance
- Encourages internal organization of the project

### *BENEFITS TO TWDB:*

- Increases financial accountability
- Enhances program performance
- Allows for the anticipation of potential problems
- Motivates performance
- Establishes benchmarks for project progress

#### **Recommendation #4: Collect & Update Data**

TWDB should collect, maintain, and analyze project data on a regular basis. This will provide a powerful managerial tool in all stages of the program from the application stage through post-project evaluation.

TWDB should routinely collect performance data from applicants through a standardized reporting process. The information should be entered into a central database that combines the data from progress reports and applications. This enables ongoing monitoring of the program and builds capacity to complete future statistical analyses that will advance organizational knowledge.

After the completion of each project, TWDB should evaluate the project using all of the data collected. Analysis (Factor Analysis, Regression, and Duration Model) of this data will produce indicators of overall success of the projects, and will help identify specific vulnerable project stages (see Appendix I on page 24 for a description of these methods).

##### *BENEFITS TO TWDB:*

- Increases data analysis opportunities
- Allows for future refinement of the evaluation tool
- Increases transparency and accountability of EDAP
- Enhances internal controls

#### **Recommendation #5: Refine EDAP Applicant Capacity Assessment Tool**

As data are collected, TWDB should use the information gathered to refine the ACAT using the results of the statistical analyses of the collected data. A complex model should be created and tested through factor analysis, regression analysis, and the duration model (See Appendix I on page 24). Once TWDB becomes familiar with ACAT, it should develop scoring ranges for the tool to categorize the capacity of EDAP applicants to successfully complete projects.

##### *BENEFITS TO TWDB:*

- Enhances predictability of project success
- Develops institutional knowledge

#### **Recommendation #6: Obtain Complete Financial/Managerial/Technical Information from Texas Commission on Environmental Quality**

TWDB should begin collecting complete information from TCEQ, not only FMT summary reports. FMT summary reports have been valuable to the evaluation process to date, but not all of the information in the reports has been utilized. Incorporating all of the FMT data would enhance the decision-making process. Specifically, the additional qualitative and quantitative data would foster better understanding of the unique circumstances and challenges each applicant faces, helping TWDB take proactive measures.

*BENEFITS TO TWDB:*

- Provides additional information at no additional cost
- Improves interagency communication
- Potentially reduces duplicative work

# APPLICANT CAPACITY ASSESSMENT TOOL

---

The Applicant Capacity Assessment Tool or ACAT is described in this section. Two major goals for the development of the assessment tool were simplicity and clarity. With the goal of validating the criteria in the assessment tool, a group of nine Texas water infrastructure experts evaluated a draft of the ACAT. Their recommendations have been incorporated.

In a review of various state assessment tools, simpler survey designs offered better flexibility and usability than more complicated tools. The federal Governmental Accountability Office offers comparable advice for applications in its report, *Rural Development: USDA's Approach to Funding Water and Sewer Projects* (1995).

Clarity is also essential to applicants' successful submissions. Many applicants have limited experience in applying for aid. Therefore, a clear assessment tool offers the applicants and evaluators the opportunity to communicate in a similar language regarding project applications. Additionally, the scoring criteria offer flexibility for the evaluator in awarding the score; however, the general boundaries ensure two applicants who score poorly on the same criterion are not awarded markedly different scores.

An additional goal of the assessment tool is to avoid criteria that measure the same functions. In other words, the assessment tool is designed to avoid multicollinearity. While the tool includes financial, managerial, and technical functions, efforts were made to minimize multicollinearity within and between the overarching functions.

The intention of the assessment tool is to evaluate the capacity of an applicant to complete the project on time and on budget, not to determine whether or not an applicant should be funded. A low score does not mean a project should not be funded. The assessment tool is not designed to exclude applicants from the funding process but instead to identify those applicants that might need additional assistance. For example, a small water district with a history of wastewater violations will rank very low in the assessment tool because of likely difficulties in permitting and constructing a wastewater facility and its limited resource base. However, this might be precisely the project that TWDB wants to fund to address its stated mission. Thus, TWDB should recognize that this project may need a different level of resources than a large, well-established city applying for a drinking water project.

## INSTRUCTIONS FOR USE

The first step in the application assessment process is to assemble a committee or designate a staff person to evaluate the applications and complete the assessment tool. To the extent possible, the evaluation team should remain constant, so the scoring remains consistent over time. A committee approach, preferable to a single staffer, will better ensure standardized results by pooling the knowledge of several staff experts and reducing the risk of bias that can be introduced if only one person reviews the applications.

The second step in utilizing the application tool is for the evaluation team to collect information for the assessment tool from the application, ongoing monitoring activities, FMT reviews, and follow-up communication. Applicants should provide as much information as possible in advance of the start of the assessment.

Applicants should be encouraged to consult the assessment tool prior to submitting information. Several of the criteria – such as evidence of competitive bidding and commitment to ongoing training – have not typically been addressed by applicants prior to receiving funding. Therefore, applicants will be at a disadvantage if they have not reviewed the tool. It is anticipated that fewer problems and delays will occur if grant recipients consult and address the identified criteria prior to submitting their applications.

## ASSESSMENT TOOL

Criteria	Scoring Guidelines	Maximum Score	Actual Score
<b>Financial Criteria</b>			
Adequacy of projected future net cash flows	No projection, negative=0-1 Even or slightly positive=2-3 Very positive=4-5	5	
Adequacy of past and current net cash flow, including evidence of operating loss over last five years	No projection, negative=0-1 Even or slightly positive=2-3 Very positive=4-5	5	
Feasibility of proposed water/wastewater rate increases	Poor=0-2 Fair=3-4 Good=5	5	
Adequacy of credit rating, including evidence of loan defaults	Defaults=0-1 No rating/less than BBB=2-3 BBB or greater=4-5	5	
Diversification of the rate-paying base	Poor=0-2 Fair=3-4 Good=5	5	
Evidence of competitive bidding (includes cost and quality) or process for competitive bidding of project	Yes=5, No=0	5	
<b>Managerial Criteria</b>			
Qualifications of designated project manager(s)	No experience or technical background=0-1 Minimal experience/technical background=2-3 Significant project management experience/advanced technical background=4-5	5	
Demonstrated evidence of past training and commitment to future training from a recognized authority	No training=0-1 Minimum training=2-4 Well trained and planning for future training=5	5	
Relevant experience of financial and legal advisors	Little to none=0-2 Some=3-4 Very experienced=5	5	
Project consistent with long-term needs of capital improvement plan	Yes=5, No=0	5	

Jurisdiction in existence for five years or more	Yes=10, No=0	10	
<b>Technical Criteria</b>			
Evidence of regulatory violations within the last five years	Repeated violations=0-1 Corrected violations=2-4 No violations=5	5	
Certification and experience of current operator	No certification/no experience=0-1 Certification and modest experience=2-3 Certification and significant experience=4-5	5	
Complexity of engineering design	Highly Complex=0-3 Complex=4-8 Routine=9-10	10	
<b>Additional Criteria</b>			
Does the project include wastewater construction?	Yes=0, No=10	10	
Progress in acquiring land, including easements	No progress=0-3 In progress=4-8 Completed or unnecessary=9-10	10	
Size of jurisdiction	Very small (500 people or less)=0-2 Small (501-3300 people)=3-4 Medium (3301-10,000 people)=5-7 Large (10,001+)=8-10	10	
Is the proposed project within a flood plain?	Yes=0, No=5	5	
Demonstration of community acceptance of proposed project	None/very little=0-1 Resolution=2-3 Resolution and involvement=4-5	5	
<b>TOTAL</b>		<b>120</b>	

# INDICATORS

---

The ACAT is comprised of various indicators to help evaluators assess the capacity of jurisdictions to successfully complete funded projects. The assessment tool includes financial, managerial, and technical indicators as well as additional indicators that do not fit within those three categories. The indicators discussed below have been identified as factors that affect the success or failure of a project. The value of each indicator is discussed so that evaluators and applicants will have a clear understanding of its contribution to the overall success of a project. To provide further explanation and support for the assessment tool, a detailed explanation of the indicators follows.

## FINANCIAL

Several financial factors affect whether or not a project will be completed on time and on budget. These factors primarily influence a jurisdiction's bottom line or net cash flow. Problems identified in this section could hinder a project's progress by stalling it until funding becomes available. Financial indicators help determine how much debt an applicant is able to repay as well as how much grant money a project needs to ensure success.

### **Adequacy of Projected Future Net Cash Flows**

Adequate cash flow is necessary to fund drinking water and wastewater projects throughout the construction process. In order to have adequate cash flow, expected revenues must surpass expected operating and debt service costs (McGuigan 2002). Like any financial projection, expected net cash flow has a level of uncertainty; therefore, it is necessary for the expected net cash flow of EDAP projects to be significantly positive (McGuigan 2002).

The two aspects of revenue that need to be considered for EDAP projects include the jurisdiction's growth rate and the per-unit price of water/wastewater (McGuigan 2002). The applicant should be required to justify both the growth rate and per-unit price to ensure realistic projections. This justification ideally should include the use of historical data from the jurisdiction and similar jurisdictions in the area. When possible, an applicant should provide expert opinions concerning expected population growth rates and expected future water prices.

Expense projections should be given equal scrutiny. Operator salaries should be comparable to operator salaries in other similar jurisdictions. Additionally, maintenance cost projections should include an allocation of funds for non-routine repairs. Projections for needed capital improvements should be reconciled with expected population growth. The applicant should clearly understand the capacity of the new facilities and realize population growth in excess of that capacity will require capital improvements. Overall, it is important to realize that financial analysis of this type is extremely subjective and therefore must be intensely inspected (McGuigan 2002).

Point range	Description
0-1	Project has no projection or negative cash flow forecasts
2-3	Project has projected even/positive net cash flow of 3% or less of total revenue
4-5	Project has projected positive net cash flow 3-5% of total revenue

### Adequacy of Past and Current Net Cash Flow

A history of positive net cash flow is an important requirement for the issuance of debt (McGuigan 2002). Past and current financial competency may be demonstrated by providing financial statements that indicate positive net cash flows during the last five years. Water corporations that have been created for the specific purpose of obtaining an EDAP grant and subsequently have no history should be assigned zero points for this indicator because of the risk inherent in an organization with no history and political uncertainty (McGuigan 2002).

Point range	Description
0-1	Jurisdiction has no or negative historical net cash flow
2-3	Jurisdiction has even/positive net cash flow of 1% or less of total revenue
4-5	Jurisdiction has positive net cash flows at least 1-2% of total revenue

### Feasibility of Proposed Drinking Water/Wastewater Rate Increases

Many EDAP applicants plan to increase rates or taxes in order to support new operating expenses or to service new debt. Some have proposed rate increases as high as 50%. It is important to note that it is difficult to predict how changes in rates will affect consumption. Water possesses price elasticity just like any other consumable (Baumol and Blinder 2003). Therefore, revenue may be overestimated (Baumol and Blinder 2003). The applicant needs to acknowledge that increases in rates may reduce consumption. For large rate increase proposals, the applicant should survey the consumers or hold open meetings in order to solicit consumer feedback. This would help lessen the uncertainty surrounding the effect of increased rates on consumption.

For an applicant who wishes to supplement revenue by increasing some type of tax, uncertainty regarding project revenue can be diminished by passing the tax increase before the application is approved.

Point range	Description
0-2	Poor: applicant expects to increase rates more than ten percent without analyzing the potential impacts of this change
3-4	Fair: applicant expects to change rates by less than ten percent, or for larger changes that have been shown to be feasible
5	Good: project does not require rate increases

## Adequacy of Credit Rating and Evidence of Loan Defaults

Bond ratings by Standard & Poor, Moody's, or Fitch allow TWDB to evaluate an applicant's history of repayment of debt and its financial management competency. These ratings measure risk (McGuigan 2002). A rating of BBB or higher is considered "investment grade," while a rating of less than BBB is considered "junk bond." A jurisdiction that does not have a rating is usually very small or has never issued bonds. "Investment grade" ratings indicate a low loan default risk. A jurisdiction with a "junk bond" rating should be approached with caution as junk bond ratings are below investment grade.

A history of defaulting on loans signals the jurisdiction has trouble successfully managing its finances. A jurisdiction with a history of loan default should be required to provide evidence showing improved financial management. Evidence might include the recent hire of a proven financial manager.

Point range	Description
0-1	Applicant has a history of loan defaults
2-3	Applicant has no bond rating or a rating less than BBB
4-5	Applicant has a bond rating of BBB or higher

## Diversification of the Rate-paying Base

Diversity of the rate-paying base of a jurisdiction is an important factor in determining the certainty of the net cash flow projections (McGuigan 2002). The current policy of requiring the applicant to disclose its ten largest revenue sources is sufficient to score this indicator. A jurisdiction relying on less than three large taxpayers or water consumers for more than twenty-five percent of its revenue is in jeopardy of unexpectedly losing significant revenue if the taxpayer/consumer decides to leave the jurisdiction. Several subject-matter experts agreed that diversification of revenue streams was an integral part of successful projects.

Point range	Description
0-2	Poor: applicant relies on one or two entities for more than 25% of its revenue
3-4	Fair: applicant relies on top ten revenue sources for 25-50% of its revenue
5	Good: applicant relies on top ten revenue sources for less than 25% of its revenue

## Evidence of or Processes for Competitive Bidding (Cost and Quality)

Competitive bidding is crucial for achieving an efficient use of TWDB funds. A recent study in the United Kingdom found that when refuse collection contracts had four bidders, the average cost savings was 13% (Gomez-Lobo and Szymanski 2001). Efficiency aside, competitive bidding ensures a reasonable price for services. By requiring competitive bidding on contracts, TWDB can reduce possible collusion between contractors and applicants by bringing additional parties

into the process. The State of Texas defines competitive bidding to include both cost-effectiveness and quality components.

TWDB should require contracts of \$100,000 or more to be bid on by at least four potential contractors (Gomez-Lobo and Szymanski 2001). A jurisdiction unable to solicit four bids should provide a reasonable explanation accounting for this inability as well as the names of the potential contractors contacted. A project with only one bid is of concern because it does not provide competition and risks exposure to unfair pricing. It is also beneficial for TWDB to record the names of the contractors who provide products and services for the projects. This would allow TWDB to discover any positive relationships between particular contractors and successful projects.

Point range	Description
0	No: applicant lacks a competitive bidding system
5	Yes: applicant will or does use a competitive bidding process

## **MANAGERIAL**

The following section highlights the importance of a qualified and experienced manager, well trained staff, and a leadership strategy that plans for the future. Management is crucial to the success of drinking water and wastewater projects as inadequate leadership, mismanagement, and/or lack of planning can stall a project.

Some smaller, more rural applicants may have difficulty demonstrating strength in this area. However, with the help of additional management training and adequate consulting, the chances of success greatly increase.

### **Qualifications of Designated Project Manager(s)**

The applicant should choose a project manager who can meet the needs of the project. The designated project manager should have appropriate qualifications for the size and type of project proposed. “Qualification” as measured for this indicator includes technical knowledge and management experience.

The project manager should have appropriate technical knowledge, such as TCEQ certification or an appropriate engineering degree. Certification is determined by the class level of his or her TCEQ Public Water System Operator license. License levels are ranked A through D, with A being the highest level of license offered by TCEQ. The classes of licenses are distinguished by education level, years of experience, and amount of training credits earned (TCEQ 2005). Possession of a TCEQ Public Water System Operator License is required by law for anyone who conducts on-site, routine operational activities for the public water system (Texas Administrative Code 2000).

The experience level of a project manager should also be assessed. The criteria to be examined include: the education and years of experience as a project manager as well as the size, scope, and success of past projects.

Assigning project management tasks to an unqualified employee will most likely lead to failure or delays (Zimmerman and Cobb 1975). The Tejeda Center and the North American Development Bank (NADB) have stressed the importance of employing a qualified project manager (Muraca and Garza 2005, Flores and Endres 2005).

An applicant from a smaller or rural jurisdiction may lack adequately qualified project managers. A smaller jurisdiction may identify a single person to manage the project and to function as the main operator of the completed facility. For larger jurisdictions, TWDB should encourage applicants to hire both a qualified project manager and a qualified operator (Zimmerman and Cobb 1975).

Point range	Description
0-1	Applicant selects a project manager with no experience or technical background
2-3	Applicant selects a project manager with minimal experience (consulted on one or two projects of comparable size) or technical background (C or D license/engineering degree)
4-5	Applicant selects a project manager with significant management experience (consulted on more than two projects of comparable size) and advanced technical background (A or B license/engineering degree)

### **Demonstrated Evidence of Past Training and Commitment to Future Training**

Past management training and a commitment to ongoing and future training decreases the probability of project failure and increases the chance of long-term success and project stability. Appropriate training provides the necessary knowledge and tools to complete projects and ensure future success.

Many applicants lack sufficient managerial training. The applicant should provide evidence of past training (even if it is minimal) and demonstrate a commitment to future training. An applicant may gain sufficient knowledge through training sources such as the North American Development Bank’s Utility Management Institute and the Tejeda Center. Further information may be accessed at: [http://www.nadbank.org/english/program service/UMI/umi frame.htm](http://www.nadbank.org/english/program_service/UMI/umi_frame.htm) and <http://www.tejedacenter.com>. It is recommended that training by either of these programs (or other equivalent programs) be made mandatory for all applicants.

Point range	Description
0-1	Applicant fails to demonstrate past training or a commitment to future training
2-4	Applicant demonstrates minimum training (i.e., the standard 20 hour requirement for operators)
5	Applicant demonstrates training from an accredited operation and plans to attend future training programs

### Relevant Experience of Financial and Legal Advisors

This indicator is designed to measure the knowledge and relevant experience of the financial and legal advisors hired by the applicant. Experience is defined as years of experience in the water project arena, number of past drinking water and wastewater project consultations, and size and depth of the organization. If the applicant does not have adequate training and experience in drinking water and wastewater construction and operation, a consulting firm should be hired to provide the necessary support and knowledge in these areas.

Point range	Description
0-2	Little/None: financial and legal advisors with less than two years experience
3-4	Some: financial and legal advisors with 2-10 years experience
5	Very experienced: financial and legal advisors with more than ten years of experience

### Project Consistent with Long-term Needs of Capital Improvement Plan

A capital improvement plan describes the coordinated, long-term direction of the community's infrastructure. Long-term planning has the potential to prevent inadequate service delivery, maximize efficient financial allocations, and reduce the number of expensive project alterations (Lee and Johnson 1998). For these reasons, EDAP projects should be based upon the community's capital improvement plan.

Point range	Description
0	No: community does not have a capital improvement plan or project is not consistent with capital improvement plan
5	Yes: project is consistent with capital improvement plan

### Jurisdiction in Existence for Five Years or More

The success of a project is influenced by local circumstances and experience (Brooks 2002). A project is likely to be more successful the longer the applicant has been in existence. Paul Muraca and Jose Garza (2005) with the Tejeda Center claimed that local politics can cause a new organization to develop for the sole purpose of acquiring EDAP funding (Muraca and Garza 2005). They indicated these newly created water jurisdictions are prone to institutional and organizational problems. This indicator is designed to discourage applicants from creating districts in order to obtain EDAP funding.

Point range	Description
0	No: jurisdiction in existence less than five years
10	Yes: jurisdiction in existence five years or more

## TECHNICAL

Technical factors also have an effect on the capacity of a jurisdiction to complete a drinking water or wastewater project on-time and on-budget. The following indicators help TWDB identify projects that exceed the technical capacity of the applicants.

### Evidence of Regulatory Violations

A jurisdiction's history of regulatory violations demonstrates its success in managing the technical aspects of its operation and its ability to learn from past violations. This evaluation should be based on evidence of violations incurred during the preceding five years. An applicant should include all information of regulatory violations as well as documentation of corrective actions taken over the last five years. Repeated violations result in lower scores because they demonstrate that the project managers were unable to conform to regulations.

Point range	Description
0-1	Jurisdiction has a history of repeated violations
2-4	Jurisdiction has past violations but made needed corrections
5	Jurisdiction has no history of violations

### Certification and Experience of Current Operator

The certification and experience of the current operator is important because highly certified and experienced operators will be better prepared to handle difficult situations that may arise in the operation of a new drinking water or wastewater facility.

The TCEQ operator license should be used to assess this indicator. TCEQ awards four levels of licenses, A through D. A represents the highest level of license currently attainable and D the lowest. These licenses vary by the type of water system operated, so it is also important to confirm that appropriate training has been undertaken by comparing the type of license received with the type of project proposed. Specific information regarding the types of licenses can be found at: [http://www.tceq.state.tx.us/compliance/compliance\\_support/licensing/ww\\_lic.html](http://www.tceq.state.tx.us/compliance/compliance_support/licensing/ww_lic.html).

It is important to consider all relevant experience that may or may not be reflected in an operator's current certification. Experience that should be considered is the number of years and positions worked in comparable systems (though heavy emphasis should be given to wastewater and/or drinking water facilities). An operator's experience in other fields must be examined to ensure that it is relevant to effectively operating the proposed project.

Point range	Description
0-1	Applicant operator is not yet certified and/or has no relevant experience
2-3	Applicant operator is certified and has less than two years of relevant experience
4-5	Applicant operator has relevant TCEQ license and more than two years of relevant experience

## Complexity of Engineering Design

The complexity of the wastewater or drinking water facility to be constructed will affect project duration as well as the project costs. Highly complex construction designs will most likely present a challenge to small jurisdictions that do not have the human capital to manage such a project.

There are three basic designs of wastewater systems (Hann 2005). These designs are oxidation ponds, oxidation ditches (a.k.a. racetrack lagoon), and multistage facilities. Oxidation ponds are the least complex type. Multistage designs are the most complex.

There are routine and complex designs of drinking water supply systems. A routine project would consist of a well, chlorine injector, storage tank, and distribution system. A complex system might require additional pumps for hilly terrain, or special treatment equipment if the source water is poor (Eby 2005).

Point range	Description
0-3	Highly Complex (multistage; hilly terrain/poor source water)
4-8	Complex
9-10	Routine (oxidation ponds; simple well and treatment system)

## ADDITIONAL INDICATORS

### Does the Project Include Wastewater Construction?

TWDB provides financial assistance to facilitate two types of EDAP projects: drinking water and wastewater. The data analysis conducted for this report shows that projects with a wastewater component are more likely to run over-schedule than drinking water projects (see Appendix I). Wastewater systems often require greater permitting and technical complexity than drinking water projects. Additionally, colonia populations are less likely to be able to support wastewater projects, thus creating financial problems specific to wastewater enhancement projects (Muraca and Garza 2005).

Point range	Description
0	Yes: wastewater projects
10	No: drinking water projects

### Progress in Acquiring Land

The process of acquiring land is important to the successful completion of projects. Land acquisition for public works is difficult in most locations and for most purposes. It becomes even more difficult when the acquisition is for a proposed sewer treatment facility (Bloetscher 2002).

This indicator measures the progress in obtaining the land necessary to complete the project. Due to its nature, a wastewater project poses more land acquisition difficulties than a drinking

water project. Also, the proposed site's location and the public's perception of the project should be taken into consideration when scoring this indicator.

Point range	Description
0-3	Applicant shows little to no evidence of site location, impact on the surrounding area, and/or public response
4-8	Applicant has started negotiations to acquire the necessary land(s) or has made a preliminary public announcement and received little to no negative feedback
9-10	Applicant has already secured the land, whether it be for easements or right of ways, along with necessary permits

### Size of Jurisdiction

Jurisdiction size affects the ability of a project to achieve economies of scale. Therefore, small jurisdictions typically cost more per customer connection than larger jurisdictions, potentially creating financial challenges.

EPA classifies water systems into five categories based on population served: 500 or less is categorized as very small, 501-3,300 is small, 3,301-10,000 is medium, 10,001-100,000 is large, and 100,001 or more is very large (EPA 2003). The rating system for this indicator uses EPA's definitions but consolidates large and very large into one category.

Point range	Description
0-2	Very small jurisdiction: 500 people or less
3-4	Small jurisdiction: 501-3,300 people
5-7	Medium jurisdiction: 3,301-10,000 people
8-10	Large/very large jurisdiction: 10,001 people or more

### Is the Proposed Project Within a Flood Plain?

Projects located in a flood plain pose increased health risks such as contaminated drinking water, unsanitary living conditions and increased risk of disease (Good Neighbor Environmental Board 2005). Several colonias in need of EDAP funds are located in or near flood plains, and jurisdictions located in these areas risk delays because proper permitting is more extensive. If permits are not obtained prior to the beginning of the project, time delays may result. Additionally, Federal funding is limited for projects located in a flood plain. This relative inability to secure federal funds may result in funding delays (Good Neighbor Environmental Board 2005).

Point range	Description
0	Yes: proposed facilities located within a flood plain
5	No: proposed facilities located outside a flood plain

### **Demonstration of Community Acceptance of Proposed Project**

The demonstration of community acceptance for the proposed project is important because a project is more likely to succeed with community support (Seppälä 2002). One measure of support is a community's contribution of funds toward the construction of the proposed project. Another measure of community support is the passage of a resolution in support of the proposed water project. Like financial support, a written proclamation endorsing the project denotes a community's willingness to work with TWDB to complete a successful project.

Point range	Description
0-1	Applicant has shown no community support for the proposed water project
2-3	Applicant passed community resolution of support but no additional support
4-5	Applicant passed a resolution and has community support for the proposed water project through other actions

# FUTURE IMPLICATIONS

---

Due to funding limitations, TWDB is not currently accepting applications for new EDAP projects. This is due to the fact that TWDB has almost exhausted the state and federal funds allocated to the program (Texas Senate 2004).

At the time of publication, the future of EDAP depended on the passage of Texas Senate Bill 964. This bill provides funding for EDAP and addresses the administration of the program by requiring applicants to include the following information in applications:

- The name of the political subdivision and its principal officers;
- A citation of the law under which the jurisdiction was created and operates;
- A project plan that describes the proposed planning, design, and construction activities necessary to provide water and sewer services that meet minimum state standards;
- A budget that estimates the total cost of providing water supply and sewer services to the area;
- A proposed schedule and method for repayment of financial assistance consistent with board rules and guidelines;
- The total amount of assistance requested from the EDAP account.\*

\* This is not an exhaustive list, but addresses many of the factors discussed previously in this report.

SB 964 grants TWDB the authority to:

- Review managerial, financial, and technical capabilities of applicants;
- Require written determination by TCEQ of the applicants' managerial, financial, and technical capabilities; and
- Request the Texas Comptroller to perform a financial management review of the applicants' current operations and provide TWDB with the results of the review;
- Provide any other information required by the TWDB or the Executive Administrator

In the event the above text in SB 964 is passed by the Texas Legislature, the ACAT and recommendations in this report will be helpful in increasing EDAP's long-term effectiveness and improve the efficiency of TWDB oversight.

# REFERENCES

---

- Baumol, William J. and Alan S. Blinder. 2003. *Microeconomics: Principles and Policy*. Thomson Learning.
- Bloetscher, Frederick and Whitfield Van Cott. 2002. "The Use of Risk for Permitting Groundwater Programs." *Florida Water Resources Journal*: 29-33.
- Brooks, David B. 2002. *Water: Local-Level Management*. Ottawa: International Development Research Centre.
- California State Water Resources Control Board. 2004. Integrated Regional Water Management Grant Program Guidelines: Proposition 50 Chapter 8. November--creation date. Accessed: April 8, 2005  
[http://www.grantsloans.water.ca.gov/docs/Prop50Chap8IRWMFinalGuidelines\\_113004.pdf](http://www.grantsloans.water.ca.gov/docs/Prop50Chap8IRWMFinalGuidelines_113004.pdf)
- Flores, Juan Antonio and Alexia Endres. 2005. Interview by Megan Stubbs. Phone and email correspondence. College Station, TX, 2 March.
- Georgia Environmental Facilities Authority. 2005. State Revolving Fund Loans. Accessed: March 24, 2005 [http://www.ganet.org/gefa/state\\_revolving.html](http://www.ganet.org/gefa/state_revolving.html).
- Gomez-Lobo, Andres and Stefan Szymanski. 2001. "A Law of Large Numbers: Bidding and Compulsory Competitive Tendering for Refuse Collection Contracts." *Review of Industrial Organization*: 105-113.
- Good Neighbor Environmental Board. 2005. Water Resources Management on the U.S.-Mexico Border. February--publication date. U.S. Environmental Protection Agency. Accessed: April 8, 2005 <http://www.epa.gov/ocem/gneb/gneb8threport/gneb8threport.pdf>.
- Kennedy, Peter. 1998. *A Guide to Econometrics*. Cambridge: The MIT Press.
- Lee, Robert D. and Ronald W. Johnson. 1998. *Public Budgeting Systems*, 6<sup>th</sup> ed. Aspen Publisher, Inc.
- Lemos, Maria Carmen, Diane Austin, Robert Merideth, and Robert G. Varady. 2002. "Public-Private Partnerships as Catalysts for Community-Based Water Infrastructure Development: The Border Water Works Program in Texas and New Mexico Colonias." *Environment and Planning C: Government and Policy* 20: 281-295.
- McGuigan, James R., R. Charles Moyer, and William J Kretlow. 2002. *Contemporary Financial Management with Infotrac*. Thomson Learning.
- Muraca, Paul and Jose Garza. 2005. Interview by authors. Personal conversation. College Station, TX, 29 March.

- Oklahoma Water Resources Board. 2004. Rural Economic Action Plan Grants. 12 October--updated. Accessed March 24, 2005  
<http://www.owrb.state.ok.us/financing/grant/reapgrants.php>.
- Seppälä, Osmo T. 2002. "Effective Water and Sanitation Policy Reform Implementation: Need for Systemic Approach and Stakeholder Participation." *Water Policy* 4: 367 – 388.
- State Water Resources Control Board. 2005. Integrated Regional Water Management Grant Program. 6 April--updated. California Environmental Protection Agency. Accessed: March 23, 2005 <http://www.swrcb.ca.gov/funding/irwmgp/index.html>.
- Texas Commission on Environmental Quality. 2005. Water Operation Companies and Water Operators Licensing and Registration. March 9--updated. Accessed: March 23, 2005  
[http://www.tceq.state.tx.us/compliance/compliance\\_support/licensing/water\\_lic.html](http://www.tceq.state.tx.us/compliance/compliance_support/licensing/water_lic.html).
- Texas Administrative Code. 2000. Title 30, Part 1, Chapter 290, Subchapter D, Ruling §290.46. "Minimum Acceptable Operating Practices for Public Drinking Water Systems."
- Texas Senate. 2004. *Texas Senate Committee on International Relations and Trade: Interim Report*. 78<sup>th</sup> Legislative Session.
- Texas State Water Code. 1963. Chapters 6 and 15.
- Texas Water Development Board. 2005. *Water for Texas: Legislative Appropriations Request & Exceptional Items Summary FY 2006-2007*.
- U.S. Government Accountability Office. Resources, Community, and Economic Development Division. 1995. *Rural Development: USDA's Approach to Funding Water and Sewer Projects*. September GAO/RCED-95-258. Washington: Government Accountability Office.
- Virginia Resources Authority. 2005. Applications. Accessed: March 25, 2005  
<http://www.vra.state.va.us/finance/applications/index.htm>.
- Water Infrastructure Finance Authority of Arizona. 2004. Clean Water Revolving Fund. Accessed: March 23, 2005 <http://www.azwifa.gov/>.
- Zimmerman, Stanley and Edwin L. Cobb. 1975. *Guide for the Development of Rural Water-Sewer Projects*. Chicago: Commission on Rural Water.

# APPENDIX I:

## RESEARCH DESIGN AND DATA COLLECTED

---

The ACAT was based on extensive academic research, advice from subject matter experts, data analysis, and assessment process information gathered from other states. This section of the report details the data collection and analysis methods utilized in creating this tool, limitations faced when collecting and analyzing the data, notable data results, and suggestions for future data collection and analysis.

### RESEARCH DESIGN

This report is the result of both qualitative and quantitative research. Qualitative data gathered included academic and professional literature, documents and procedures used by similar agencies in Texas and other states, and interviews with subject matter experts. The quantitative research was based on data available from TWDB and TCEQ.

### DATA SOURCES

The dataset for the statistical analysis was created from the following documents:

- EDAP application packages,
- EDAP write-ups,
- EDAP Status Report,
- EDAP Contract List,
- TCEQ FMT reports, and
- TCEQ FMT working documents.

The reports were current as of February, 2005.

### SAMPLE SIZE

The size of the dataset was small due to the limited number of projects available for analysis and the absence of a uniform application. Small datasets significantly reduce reliability and validity of data analysis results. Statistical analysis becomes more reliable as the sample size increases because the dataset becomes more reflective of the total population. Therefore, large datasets are ideal, (i.e., 1,000 cases or more) increasing the validity of the statistical analysis. In this situation an ideal sample size was not possible; however, portions of the analysis did prove to be significant despite the small sample size.

Only 53 of 92 existing EDAP project applications were used in the analysis. This was the case because 16 of the projects had not yet started and 10 had been archived, making the data unavailable. 11 applications for non-profit sponsored projects were excluded because they were not comparable to other jurisdictions, and the remaining 2 project applications could not be located or lacked essential components.

Of these 53 projects, only 39 had been completed, and could therefore provide final budget and project duration numbers. While the other projects have budget and time variables based upon the current status of the projects (as of February 2005), these predictions may not be accurate since they do not reflect the final project results.

For quantitative statistical analysis to be valid, the minimum number of cases is 30. Although the EDAP dataset meets this requirement, other limitations inhibit robust analysis in such small datasets. For example, a single case could have a disproportionate influence over the regression equation because of its extreme values. While outliers diminish the strength of a regression line in large datasets, they can bias the entire model in small datasets.

The budget and time variables lacked variance because of the small sample size, which presented additional problems for conducting a regression analysis. When there are too few cases to establish meaningful distinction between values, they are treated as a single group. For example, a value of -1.2 for budget (computed as a percentage) is not interpreted in the regression as vastly different from .61, although we know that being 120% under budget is very different from being 61% over budget

In an attempt to create more variance in the dependent variables (budget and time), the values were grouped into categories. Descriptive tests confirmed that variance was created, but subsequent regression analysis failed to identify any significant causal relationships with budget or time.

### **MISSING DATA**

Missing data is a common problem in most datasets. Since the EDAP dataset was small, missing data had a strong influence over the accuracy and usefulness of quantitative analysis. Therefore, while hypotheses of causal relationships were created, they could not be tested due to the number of projects missing pertinent information. For example, the presence of sizeable fixed assets may indicate fiscal health of a jurisdiction, but less than 30 project applications included information regarding fixed assets, resulting in an inability to run this regression. Other similar instances affected the analysis.

### **APPLICATION FORMAT**

EDAP applications and TWDB item summaries (write-ups) were used to provide the variables in the quantitative analysis. The write-ups were in a standardized form with uniform information. This allowed for consistency in variable construction. The applications, however, were not in a standardized form, which contributed to the missing variable problem because the applicants did not uniformly answer questions or provide consistent information. Additionally, terminology used to describe variables differed across applications, leaving room for multiple interpretations.

### **IMPLICATIONS**

Data problems placed serious constraints on quantitative analysis of the data. No robust statistical analysis could be conducted, so no hypotheses could be confirmed or rejected based on statistical significance. Some valuable information was determined using the descriptive statistics. This information contributed to the results and recommendations included in this report.

## SUCCESS INDICATORS

Data from 53 EDAP applications and 9 available FMT reports were analyzed to determine general trends in the applicants' characteristics and to establish possible causal relationships between these characteristics and the probability of successful project implementation. The TWDB defines success as "completing the project on time and on budget," so the analysis primarily focused on these project characteristics. Two performance aspects of each project were analyzed quantitatively: 1) completing a project within an approved budget and 2) meeting established deadlines and schedules. Analysis of these performance aspects was accomplished through the computation of two performance indicators: 1) the ratio of total project cost and approved budget costs and 2) the ratio of the actual number of days from the contract award until completion and the scheduled project duration. Due to the data limitations discussed previously, no reliable causal connections were established and the analysis was primarily limited to producing and interpreting descriptive statistics and possible correlations between variables. The reliability of these findings, however, is significantly limited because approximately 20% of the relevant data were missing for each of the variables.

## QUANTITATIVE RESEARCH

Quantitative research design relied on multivariate regression analysis, tests of correlation, ANOVA tests, and other bivariate analyses of the variables. These tests were meant to determine possible causal relationship between the factors identified in the preliminary research (independent variables) and the success indicators (dependent variables). Multivariate regression tests were employed to evaluate the strength of the causal relationship and the extent of its predictive power. One-way ANOVA tests were run to establish statistical significant difference between performance indicators of various groups of grant recipients. Cross-tabulation analysis tested possible co-variation between variables. This analysis proved insignificant due to the condition of the data (discussed in the *Missing Data* section above).

## MAJOR FINDINGS

- **There is No Evident Correlation between Projects being Over Schedule and Over Budget**

The statistical analysis of the available data did not demonstrate any correlation between the two performance indicator variables. The projects that exceed their budget were not necessarily over schedule, and the projects that were over schedule, did not necessarily exceed their budget. The implication of this finding, given the limitations of the data, is that these issues are to be treated as discrete problems stemming from separate sets of factors.

- **EDAP Projects have Greater Difficulty Meeting the Schedule than Meeting the Budget**

Of 38 completed projects, 28 projects were completed on or under budget, which constitutes 73.7% of the finished projects. The median amount requested as a supplement to the original budget exceeds the initial budget by 35.54%. Very few projects met their proposed timelines. Of 38 projects, 36 were completed over-schedule, the median delay being 28.13% more than the scheduled number of days.

The total sample of the 53 projects included the projects that had not been completed at the time of analysis. Of those projects, 11 (21%) had already exceeded approved budgets, and 43 (81%) had gone over their schedules. If divided by project type, water projects tended to be 26% over schedule, wastewater projects 40% over their allotted time, and combined projects about 44% behind schedule.

- **EDAP Applications do not Provide Adequate Data for Analysis**

Descriptive analysis of all related variables demonstrated that the data had serious deficiencies, such as insufficient sample size and missing data, rendering rigorous statistical analysis impossible.

- **EDAP Applicants Demonstrate Great Diversity**

Descriptive analysis of the data demonstrated variance in the characteristics of the applicants, reconfirming the complexity of the EDAP funding process. The populations of the applying jurisdictions ranged from 341 to 606,526, with median annual household income varying from \$4,076 to \$32,124. Some projects served up to 43 colonias, with the colonias' population ranging from 114 to 26,403.

The financial information collected in the application process is also highly diverse: the jurisdictions claimed from \$74,000 to \$15 billion in taxable assets; with both revenues and expenditures varying from \$22,000 to \$97 million per annum. Some jurisdictions were operating with as much as a \$2 million deficit while others claimed up to \$36 million in surplus funds.

- **EDAP Grants Vary in Scope and Purpose**

Based on the dataset constructed during the research, TWDB awarded the majority of the contracts (51%) to projects that included both water and wastewater improvements (27 cases totaling \$242,898,302); 34% of the funds were dedicated to wastewater projects (\$189,150,000) and the remaining 15% to water projects (8 projects totaling \$37,320,000).

Total budgets of the awarded grants ranged from \$310,000 to \$55,430,000. The median project cost (including amendments to budgets) totaled \$3,766,551. The average cost of a water project amounted to \$4,665,000, wastewater projects cost about \$10,508,333 on average, and the median budget for combined projects was \$8,996,233.

## **SUGGESTIONS FOR FUTURE QUANTITATIVE RESEARCH**

TWDB should consider quantitative research that builds on this project. Adding new project information to the dataset, particularly variables pertaining to the indicators included in the assessment tool and on the application, would improve the likelihood of successful statistical analysis. Adding more projects will increase the sample size, causing missing data to have a diminishing affect on the quality of the analysis.

Once a substantial dataset has been developed, factor analysis should be applied in order to identify variables that contribute to project success. Using these variables, an equation can be

created that explains to what extent particular factors affect success. The equations can then be used to calculate likely success rates based on the information included in ACAT.

The duration model is a particular statistical model that would be helpful in determining how long a project will take, or the amount of funding a project will require. The duration model was first used in unemployment analysis to predict how long a period of unemployment was going to last (Kennedy 1998). This model can be applied to the EDAP applicants' time and budget factors.

While it appears that there is no identifiable pattern to project success, the duration model includes a multiplicative error term that accounts for unobservable differences in the projects. The hazard function, a test applied within the duration model, examines individual characteristics that may vary with time. This leads to an ability to predict the probability that a particular project will finish within a given time period. More information about the duration model and how it is designed can be found in *A Guide to Econometrics* (Kennedy 1998).

APPENDIX II:  
SUGGESTED EDAP APPLICATION

---

**Texas Water Development Board**

Application for State Revolving Funds Loan and Grants in

**Economically Distressed Areas**



## Texas Water Development Board Application for EDAP

A complete application will consist of an original and ten (10) copies of the following form and supplemental materials including the general, legal, and fiscal components (except as otherwise indicated). They should be submitted to the Texas Water Development Board. Two (2) additional unbound double-sided copies (no staples or permanent binding) will be requested following staff review and comment.

**The applications should be mailed to:**

Texas Water Development Board  
Development Fund Manager's Office  
P.O. Box 13231  
1700 N. Congress Avenue  
Austin, Texas 78711-3231  
(78701 for courier deliveries)

---

The undersigned representative(s) of the applicant certifies that the information presented in the following application including the attached statements and appendices are true, correct, and complete to the best of his or her knowledge.

Name & Title of Representative(s)	Signature of Representative(s)	Date
_____	_____	_____
_____	_____	_____

---

### APPLICANT INFORMATION

Name of Project: \_\_\_\_\_

1. Legal Name of Applicant: \_\_\_\_\_

2. Address of Applicant: \_\_\_\_\_

\_\_\_\_\_

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

Fax: \_\_\_\_\_

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

3. Primary Contact Person for Applicant: \_\_\_\_\_

4. Title of Contact Person: \_\_\_\_\_

5. Location of Project (County, City or Town, etc.): \_\_\_\_\_
6. Political Subdivision (Agency and/or Jurisdiction): \_\_\_\_\_
7. Authority Under Which Debt is Issued: \_\_\_\_\_
8. Type of Project for which the funding is being requested:  
       \_\_\_\_\_ Drinking Water        \_\_\_\_\_ Waste Water
9. Total Amount of Funding being Requested: \_\_\_\_\_  
       Total Funding Requested from TWDB: \_\_\_\_\_
10. Desired Length of Loan (yrs): \_\_\_\_\_
11. Consultants & Managers:

*Consultants:*

Applicant's Consulting Engineer and/or Architect

Name: \_\_\_\_\_ Title: \_\_\_\_\_  
 Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 \_\_\_\_\_ Fax: \_\_\_\_\_  
 Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_  
 Experience/Qualifications: \_\_\_\_\_

Applicant's Financial Advisor

Name: \_\_\_\_\_ Title: \_\_\_\_\_  
 Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 \_\_\_\_\_ Fax: \_\_\_\_\_  
 Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_  
 Experience/Qualifications: \_\_\_\_\_

Applicant's Legal Counsel

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

Applicant's Bond Counsel

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

Other Counsel Not Mentioned Above

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

*Project Managers:*

Project Manager

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

Water System Operator

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

Additional Project Manager or Water System Operator

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_ Fax: \_\_\_\_\_

Contact Person: \_\_\_\_\_ E-mail: \_\_\_\_\_

Experience/Qualifications: \_\_\_\_\_

---

**Project Description**

12. Attach a brief description of the proposed project. Include relevant history of jurisdiction (date of jurisdiction's establishment, years of water systems existence, types of plants, and previous grants).
13. Attach any estimates of costs and bids from different firms, including the firm you have selected (summary and detailed descriptions).
14. Attach a copy of any Preliminary Engineering Reports and Feasibility Reports.
15. Provide the proposed project budget costs:

Administrative \_\_\_\_\_

Architectural/Engineering \_\_\_\_\_

Project Inspection \_\_\_\_\_

Legal (Local Attorney/Bond Counsel) \_\_\_\_\_

Construction \_\_\_\_\_

Contingency \_\_\_\_\_

Site Costs \_\_\_\_\_

Equipment \_\_\_\_\_

Other (Specify) \_\_\_\_\_

Other (Specify) \_\_\_\_\_

**Total**

16. Fill out for each political subdivision (include any state and federal agencies):

a. Name: \_\_\_\_\_ Current Project Status: \_\_\_\_\_

Ownership Interest: \_\_\_\_\_

Allocation of Project Costs: \_\_\_\_\_

Financing Sources: \_\_\_\_\_

b. Name: \_\_\_\_\_ Current Project Status: \_\_\_\_\_

Ownership Interest: \_\_\_\_\_

Allocation of Project Costs: \_\_\_\_\_

Financing Sources: \_\_\_\_\_

c. Name: \_\_\_\_\_ Current Project Status: \_\_\_\_\_

Ownership Interest: \_\_\_\_\_

Allocation of Project Costs: \_\_\_\_\_

Financing Sources: \_\_\_\_\_

17. Have there been previous applications for this grant?

\_\_\_\_\_ No    \_\_\_\_\_ Yes    If yes, attach description and explanation of previous grants and denials.

18. Has the jurisdiction acquired the necessary land to build/modify the system?

\_\_\_\_\_No \_\_\_\_\_ Yes If no, attach plan and explanation.

19. Is the jurisdiction in a flood plain?

\_\_\_\_\_No \_\_\_\_\_ Yes

20. Population of jurisdiction and number of Colonias involved.

Jurisdiction's Population: \_\_\_\_\_ Number of Colonias: \_\_\_\_\_

List Colonias and Their Populations:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

21. Evidence of community acceptance (funding from jurisdiction, involvement, capital improvement plans, resolution from governing board or taxing authority, etc):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**FINANCIAL INFORMATION**

22. Full Legal Name of Applicant: \_\_\_\_\_

Description of Security for Proposed Debt Issues: \_\_\_\_\_

\_\_\_\_\_

23. Provide audited financial statements for the last five years (most recent audit must include management letter and be performed by a CPA). Include all notes and accounting for public safety facilities. Also include Depository Trust Company league.

Preceding five-year historical data regarding assessed valuation taxes including net ad valorem taxes levied and corresponding tax rate (detailing debt service and general purposes), and tax collection rate.

24. Provide latest financial statements, even if audit has not yet been conducted.

25. Any prior defaults on loans? \_\_\_\_\_ Yes \_\_\_\_\_ No

If yes please cite how many and the circumstances: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

26. Total Outstanding Debt (please attach a consolidated schedule):

Type (G.O. or Revenue):	Total Annual Requirements:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

27. Attach the Direct and Overlapping Tax Rate Table.

28. PROFORMA:

- a. If system revenues are anticipated to be used to repay the proposed debt, a proforma detailing projected gross revenues, operating and maintenance expenditures, net revenues available for debt service showing coverage of current and proposed debt paid from revenues and a clear statement of the revenue pledge being offered; and



30. Current top ten taxpayers, showing percentage of ownership to total assessed valuation. Also, state if any are in bankruptcy and explain anticipated prospective impacts.

Taxpayer	Percentage of Ownership
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
9. _____	_____
10. _____	_____

Bankruptcy Concerns: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

31. Attach the operating budgets for the last five years and include number of customers.

32. Are there any incidents that have occurred since the date of your last financial statements that would significantly affect your revenues or overall financial condition?

\_\_\_\_\_ No                      \_\_\_\_\_ Yes If yes, attach details.

33. Have there been any bond offering prospectuses issued in the last 5 years?

\_\_\_\_\_ No                      \_\_\_\_\_ Yes If yes, attach most recent.

34. Is there any pending or potential litigation by or against the participant?

\_\_\_\_\_ No                      \_\_\_\_\_ Yes If yes, attach description.



40. Is the locality planning on using any credit enhancements? \_\_\_\_\_ Yes \_\_\_\_\_ No

If yes than what type, the authority for it's use, and the firm being used: \_\_\_\_\_

---

---

41. Current outstanding bond ratings:

---

---

---

---

### LEGAL INFORMATION

42. Please attach one, certified original and three copies of:

- a. A resolution/ordinance requesting financial assistance from the Board, authorizing the submission of the application and designating the official representative(s) for submitting the application, executing any necessary documents and appearing before the Board;
- b. An affidavit executed by the official representative stating that the facts contained in the application are true and correct to the best of their knowledge and belief;
- c. An affidavit executed by official representative stating that the application was approved by the political subdivision in an open meeting;
- d. A certificate of compliance executed by an official representative which warrants compliance by the participating political subdivision with all representations in the application, all federal (where applicable), state and local laws, and all rules/published policies of the Board; and
- e. Statement of pending claims or litigation against the applicant that might affect the ability of the applicant to issue debt or that would affect the Board's ability to recover its investment.

43. Please attach three copies of the following executed documents:

- a. Any option, sales, or lease agreement(s) necessary for the project;

- b. Any actual or proposed service contracts for water supply or sewer service indicating adequate supply or capacity for the life of the proposed loan
- c. Any actual or proposed contracts between the applicant and any other entity which will generate revenues pledged to the repayment of the proposed debt
- 44. Please attach three copies of all executed contracts for consultant services included in the total project cost.
- 45. For a proposed revenue issue secured by a subordinate lien, or to be issued on parity, please attach two copies of the resolution/ordinance issuing the prior lien or parity debt.
- 46. Please attach status of Certificate of Convenience and Necessity or documentation of its area of designated service.

---

**EDAP SPECIFIC**

- 47. Please attach a current Capital Improvements Plan. It must include at least five years of future infrastructure construction needs.
- 48. Please attach latest rate study for its utility system; if economically distressed area is outside the boundaries, provide cost of service calculation for the economically distressed area.
- 49. Please attach any information addressing the availability of grants through the county, TDHCA, USDA and any other agency providing grants for water and wastewater projects (include the monies that have been received for the previous two years and any future uses and needs for the next two years).
- 50. Are you planning on utilizing the Colonia Plumbing Loan Program for hookup costs?  
 Yes     No
- 51. If applicant's service area is located within a retail public utility or a public utility that has a certificate of convenience and necessity under Chapter 13 of the Water Code, include an affidavit signed by the chief executive officer of the utility which shall state that the utility does not object to the construction and operation of the services and facilities in its service area.
- 52. If an applicant is a district or nonprofit water supply corporation, the applicant must include with the application a resolution/ordinance of the appropriate governing body indicating that the appropriate county and/or municipalities have given their consent. Is this the case?  
 Yes     No

- 53. To obtain a grant that exceeds 50 percent of the total Board financial assistance plus interest, an applicant must contact their regional office of the Texas Natural Resource Conservation Commission to request a finding that a "nuisance dangerous to the public health and safety exists resulting from water supply and sanitation problems in the area to be served by the proposed project". If this is the case, please attach.
- 54. If financing is for wastewater project, copy of the resolution/ordinance establishing a mandatory hookup policy.
- 55. Status of authorized agent designation process with TNRCC.

---

---

---

- 56. Please attach three plans most recently approved by the applicant (if a municipality) and/or the county.
- 57. Describe policies and procedures for enforcing the Model Subdivision Rules, including: a description of the staff and resources dedicated to monitoring and enforcement, and the methodology used to identify potential violators. Include recent cases where violation have been identified and the outcomes of such cases, and the permitting procedures and other controls in place to ensure that developers and residents comply with applicable requirements for safe and sanitary water and wastewater services.
- 58. Please attach any technical and regulatory violations received in the last five years. Also include what actions have taken place since they were received and explanations if there were repeated violations.

# APPENDIX III:

## EXAMPLES OF OTHER STATES' PROCEDURES

---

A series of assessment tools and procedures from other states were consulted in developing this analysis and assessment tool. Three were particularly instrumental: Arizona, California, and Oklahoma.

California's evaluation tool is thorough and detailed. It has two sets of criteria: one for planning grants and another for implementing grants. Each criteria set contains numerous factors that are presented in the form of specific questions. Related questions are bundled and given a maximum amount of possible points. Points are tallied and provide a basis for funding considerations.

Arizona's tool utilizes an equation in which different variables are calculated, such as median household income and prior year funding. This allows for an evaluator's professional discretion to perform a vital role in the assessment process.

Oklahoma's evaluation has seven components, and each is assigned a point value. There is a maximum of 110 points and any project that receives more than 40 is considered a priority.

Some variables were found on most state tools. For example, median household income, population, indebtedness, and amount of funding requested existed on almost all applications. However, the amount of variables taken into consideration, and the individual weightings of each indicator varied considerably across the states.

In developing the proposed uniform application form, the three most helpful examples were California, Georgia, and Virginia (SWRCB 2005, GEFA 2005, VRA 2005).

California's application is a four-page document that is formatted much like a tax form. It consists primarily of boxes to check and spaces to fill with brief answers and values.

Georgia's application is similar to California's application, though not quite so condensed. This application is particularly notable because it is an online application.

Virginia provides the longest, most detailed application. It is divided into nine sections that thoroughly address varying fiscal, technical, and managerial components of the jurisdiction and proposed project.

# APPENDIX IV:

## RELEVANT PUBLIC STATUTES

---

The following chapters in the Texas Water Code specifically address the powers of TWDB and the administration of EDAP.

### **CHAPTER 6: TEXAS WATER DEVELOPMENT BOARD**

TWDB is responsible for water planning and water financing in the state. The Board may create an advisory council to assist in carrying out these responsibilities efficiently and effectively. There is to be a separation between policy-making and management responsibilities. TWDB is responsible for policy-making and the executive administrator, appointed by the board, is responsible for management of the board's water development activities. The executive administrator is allowed to enter into contracts with federal, state, and local governments as well as other political divisions to carry out the mandate for statewide water development projects.

### **CHAPTER 15: TEXAS WATER ASSISTANCE PROGRAM**

TWDB is vested with the power to determine which jurisdictions receive loans and grants and can reject applications that do not demonstrate the ability to financially support a proposed project. In order to promote the public interest and safety regarding water development in Texas, the water code recognizes that EDAP must meet discrete needs characteristic of colonias and other distressed areas. Therefore, EDAP is not confined to uniform grant and contract management as defined in Chapter 783 of the Government Code.

*Chapter 15.401* provides for the Research and Planning Program to supply funds for “facility engineering in economically distressed areas.” These funds can be used for the preparation of plans and specifications as well as project implementation. The Board can review the political subdivision contracting choices, and the executive administrator may help with the selection process.

*Chapter 15.951* addresses Colonia Self-Help projects. These projects involve the active participation of the residents benefiting from the services. Research has shown that community involvement improves the likelihood that a project will be successful because the community members develop a sense of ownership and responsibility toward the project (Lemos et al. 2002).

# APPENDIX V:

## ADDITIONAL LITERATURE REVIEW

---

American Water Works Association, “Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure,” American Water Works Association, <http://www.awwa.org/Advocacy/govtaff/infrastructure.pdf>

Surveying 20 water programs throughout the nation, the American Water Works Association has extrapolated that due to an aging infrastructure and changing national demographics \$250 billion will need to be spent over the next 30 years by water utilities. This does not include waste water facilities. Water utilities are projected to need to spend 3.5 times as much on replacement costs by 2030 as they do today. Further, the utilities expenses through 2030 are projected to be \$6 billion below current revenues. The study reaffirms existing studies conclusions about the future costs of water infrastructure.

Apogee Research/Hagler Bailly, and Cadmus Group Inc., “Evaluating Business Plans for Small Public Drinking Water Systems Manual,” Pennsylvania Department of Environmental Protection and the U.S. Environmental Protection Agency, <http://www.dep.state.pa.us/dep/subject/advoun/techctr/evalbpmanualfinal3.doc>

This report analyzes the development of benchmark indicators related to technical, management, and financial aspects of water and wastewater infrastructure projects in Pennsylvania. Included is a checklist of various tasks to be completed before awarding a grant or loan. Additionally, the report provides in depth definitions and techniques used to gather the benchmark indicators and variables used in the report. Indicators include technical, managerial and financial, though the financial indicators are the most heavily emphasized in the report.

Beukering, Pieter van, M. van Drunen, K. Dorland, H. Jansen, E. Ozdemiroglu, and D. Pearce. 2004. *External Economic Benefits and Costs in Water and Solid Waste Investments: Methodologies, Guidelines and Case Studies*. Amsterdam: Institute for Environmental Studies.

This paper includes a detailed review of the economic impact of water and wastewater projects and how externalities can and should be considered in the overall cost-benefit analysis of water projects. A series of tools that can be used to recognize, evaluate, and value externalities are presented and tested.

Border Environment Cooperation Commission, “Prioritization Criteria for Drinking Water and Wastewater Infrastructure Projects,” Border Environment Cooperation Commission, [http://www.cocef.org/Prior\\_formats/Criteria\\_Development\\_Final.pdf](http://www.cocef.org/Prior_formats/Criteria_Development_Final.pdf)

The prioritization criteria utilizes the a rank scoring condition that evaluates and applicant based on the following areas: cost per benefited capita, anticipated impact to BEIF, utility institutional

capacity (billing efficiency, collection efficiency, and efficiency improvement), project development status, transboundary impact, and degree of economic distress.

Bloetscher, Frederick, and Whitfield van Cott. 2002. The Use of Risk for Permitting Groundwater Programs. *Florida Water Resources Journal* 11: 29-33.

This article describes several permitting problems, including delays that can result from land acquisition, underground injection controls, and contaminating aquifers. The report reinforces that land permitting, especially for wastewater projects, can lead to delays.

Brooks, David B. 2002. *Water: Local-Level Management*. Ottawa: International Development Research Centre.

This book stresses the importance of local management of water systems as being the key to success. Because water is a scarcity in every part of the world, the authority to control this is important for any governance. Local management is key. This book researches three different approaches to water supply: small-scale water supply; wastewater treatment and reuse; and watershed management and irrigation. The correct application of research and management through social, economic, and political factors are just as important as the technology used. The book goes on to make recommendation broken into two areas: governance and research. One of the key recommendations for governance, as it relates to our project, is that successful local water management requires close collaboration between communities and governments. The book goes on to recommend that to have good governance you have to be transparent, participatory, and continuous.

California State Department of Health Services, "Staff TMF Capacity Evaluation Form for SDWSRF Community Water Systems," California State Department of Health Services, [http://www.dhs.ca.gov/ps/ddwem/technical/dwp/tmf/StaffTMF\\_EvalFrm\\_SDWSRF\\_Community.pdf](http://www.dhs.ca.gov/ps/ddwem/technical/dwp/tmf/StaffTMF_EvalFrm_SDWSRF_Community.pdf)

Site provides a description of the tool used by the Department of Health Services' Drinking Water Field Operations Branch to assess the capabilities of community water services. This survey goes through organization, water rights, technical aspects, training aspects, operation plans, and various other concerns.

California State Water Resources Control Board, "Integrated Regional Water Management Grant Program Guidelines: Proposition 50 Chapter 8," California State Water Resources Control Board, [http://www.grantsloans.water.ca.gov/docs/Prop50Chap8IRWMFinalGuidelines\\_113004.pdf](http://www.grantsloans.water.ca.gov/docs/Prop50Chap8IRWMFinalGuidelines_113004.pdf)

California established thorough rating systems for the planning and implementation process. These scorecards provide indicators and a format worth considering for this capstone project. Specific eligibility guidelines, program requirements, project selection process, standards, and evaluation criteria are some of the sections included in this chapter. The appendices include criteria for planning and implementation

Carter, Nicole, and Leonard Ortolano. 2004. Implementing Government Assistance Programs for Water and Sewer Systems in Texas Colonias. *Water Resources Development* 20: 553-564.

From 1989 to 1997 EDAP was not implemented very successfully. From 1998 to 2002 a great improvement was made in program implementation and completion. The authors characterize the problems in two categories: 1) incentives and management capabilities of grantees, and 2) TWDB's incentives and management capabilities. There is a short review of water and waste water programs in the colonias before EDAP, which describes the problem as being largely ignored. The evolution of EDAP is treated next, describing its funding by the EPA that ended in 1998, and its slow rate of project completion. Next, the incentives and capabilities of service providers are analyzed in context of competing goals and managerial incompetence. An assessment of TWDB's management challenges follow, stating that their core competencies and expertise did not match the needed skills to manage EDAP successfully. TWDB also lacked incentives through the late 1990's to treat EDAP as a priority; publicity of colonias and new governmental oversight changed the trend in the late 1990's. Broad "lessons" for subsidy programs are included: emphasizing oversight and accountability for TWDB and project developers, and alignment of incentives, management capacity, and goals.

Carter, Nicole, and Leonard Ortolano. 2000. Working Toward Sustainable Water and Wastewater Infrastructure in the US-Mexico Border Region: A Perspective on BECC and NADBank. *Water Resources Development* 16: 691-708.

In 1994, BECC and NADBank were created jointly by the US and Mexico. BECC developed project certification based on a set of criteria created with public input. NADBank finances the projects and manages the BEIF grants provided by the EPA. The development of maquiladoras on the border of Mexico and colonias on the US border has increased the need for water development projects. Prior to BEIF, NADBank had difficulty awarding loans in the US because less expensive financing could be secured through State Revolving Funds (SRF) and the municipal bond market. In addition to certifying and financing projects, BECC and NADBank have developed two grant programs: one for technical assistance, and one strengthening institutional capacity for long term sustainability of projects. Utility professionals are trained in long-term utility organization, administration, finance, and management. Between 1995 and 2000 BECC certified 33 projects, and NADbank financed 20 water and wastewater projects.

Conybeare, John A.C. 1982. The Rent-Seeking State and Revenue Diversification. *World Politics* 35: 25-42.

This article provides empirical research showing the affect of tax diversification on a jurisdiction's ability to raise revenue. The researchers find that a rent-seeking state will attempt to diversify its tax base in order to accrue the advantages a diversified tax base provides. However, a diversified tax base does not provide increased revenues in developing countries that do not have the administrative capacity to exploit it fully.

Dziegielewski, Ben, Roger Beck, and Tom Bik. 2000. *Benchmark Investigation of Small Public Water Systems Economics*. Carbondale: Southern Illinois University Carbondale.

The purpose of this study was to evaluate the potential of financial benchmarking as a management tool for small community drinking water systems. The study used a variety of investigative techniques to identify and solicit information from many sectors of the small drinking water system community. The study began by consulting the literature on small system economics and benchmarking. More than 70 sources were identified and organized into a Topical List of Relevant Publications that is included in Appendix A. Comprehensive annotations for more than half of these studies are also included in the same appendix.

Eby, Beth, interview by Michael Hunt, College Station, Texas, 31 March 2005.

This interview provided a detailed description of water and waste water designs for EDAP recipients. Discussion included a comparison of simple and complex systems and factors that might impact an applicants ability to finish on time and on budget.

Flores, Juan Antonio, and Alexia Endres, interview by Megan Stubbs, College Station, Texas, 2 March 2005.

The North American Development Bank (NADB) provided information on the criteria that lead to project success. These criteria are based on technical, financial, political, and administrative factors. Subcategories are included within these four factors.

Also obtained during the correspondence were actual funding levels and project information regarding all of the NADB financing activities for 2004. This information is divided by project information, description, NADB participation, and project status.

Garcia, Kyle, Tamim Younos, and Christie Thompson. 1999. *Restructuring Strategies for Small Water Systems: Virginia Small Water Systems Co-operative*. SR15-1999. Blacksburg: Virginia Tech Pamplin College of Business and Virginia Water Resources Research Center.

The report explores several innovative funding and management rules in place at several states and recommends a co-operative approach to make small water systems in Virginia financially, administratively, and technically viable. Voluntary co-operatives help preserve local ownership of the small water system but encourage collaboration in resource management. This report provides evidence that collaboration between small water systems improves overall management and performance.

Giusti, Cecilia. 2003. "Policies promoting Microenterprises in Colonias. What works? What does not work? And Why?" Paper presented at Federal Reserve System Community Affairs Research Conference, Washington D.C., 27-28 March, 2003.

Article claims that colonias residents qualify for federal programs that encourage small business development, but because of language and education barriers they are unable to take advantage of the opportunities.

Gomez-Lobo, Andres, and Stefan Szymanski. 2001. A Law of Large Numbers: Bidding and Compulsory Competitive Tendering for Refuse Collection Contracts. *Review of Industrial Organization* 2001: 105-113.

The authors believe that it is crucial to have competition, oversight, and regulation of private providers of infrastructure service like water and wastewater. They advise that a bidding process that includes a stage in which contractors must pre-qualify can produce efficient results. The bidding companies will be motivated to provide quality services that are fairly priced because they can earn a positive reputation that can help them to get future contracts. This paper researched refuse collection services that are contracted by local authorities in the United Kingdom. They found that cost savings is associated with the number of bids that are received per contract. In the cases where four bids were received, the average cost savings was 13% in comparison to the previous cost.

Good Neighbor Environmental Board, "Water Resources Management on the U.S.-Mexico Border," U.S. Environmental Protection Agency, <http://www.epa.gov/ocem/gneb/gneb8threport/gneb8threport.pdf>

The report is a current and comprehensive review of water resources and coordination along the U.S.-Mexico Border. The report recommends stronger coordination between U.S.-Mexico institutions and laws, especially the decentralized legal structure in the United States. The report also recommends enhanced data sharing to reduce gaps and strategic planning. The report singles out the goal of enhancing water efficiency. A section on colonias discusses the improving situation and recommends community efforts directly in place of funding small projects.

Guevara, Marcelo. 1999. *Colonia Legislation: History and Results*. House Research Organization, Texas House of Representatives, April: 76-10.

This article provides a general overview of what and where colonias are found. It highlights water and wastewater service laws that have been passed in the state along with an evaluation of the provisions to the present day (1999). There are additional sections on the stopping of colonia proliferation and education and assistance. The prospects for future policy changes include accountability, exemptions and minimum standards, and the root causes of colonias.

Hann, Roy, interview by Michael Hunt, College Station, Texas, 29 March 2005.

This interview provided a description of the three common types of waste water systems, including diagrams from a text used in his classes and a description of complexities that are associated with each design.

Hutton, Guy. 2001. Economic Evaluation and Priority setting in Water and Sanitation interventions. *Water Quality: Guidelines, Standards and Health*. 2001: 333-359.

This paper examines the need to consider all economic costs and benefits associated with water and sanitation interventions, and the difficulty in measuring many of these effects. Public health policy is complicated by economic decisions that are forced due to limited budgets and scarce resources. The economic analysis that results does cause more transparency within the policymaking process and which in turn has an effect on objectivity. Water and sanitation projects are different from other policy issues relating to health because: "They are more likely to

be regulatory in nature (such as the meeting of quality criteria), they involve cross-sector collaboration and are often financed by non-health agencies, and they provide large non-health benefits (such as time savings, increasing amenity, etc.) which are important to consider.” Unfortunately there are many effects (or externalities) that arise from water projects which are not estimated “with any degree of certainty.”

Jordan, Jeffrey L. 1998. Doing Benefit/Cost Analysis for Water Projects: A Primer. *Georgia Water Series* 2: 14.

This paper looks at ways to use cost-benefit analysis when accessing possible water projects, and how nonmarket goods tend to make the analysis less precise or more difficult. Cost benefit analysis creates “a method for evaluating investments in water projects, for judging alternative projects and estimating the impacts for regulatory changes.” The problem with cost-benefit analysis of water projects is that there are nonmarket goods involved that are hard to value. It is important to decide what the maximization goal is going to be, what the investment criteria is, and what the relevant time frame for the analysis should be. Three investment criteria that are suggested to be appropriate for water projects are: net present value, internal rate of return, and ratio of benefits to costs.

Lee, Terrence, and Vinio Floris. 2003. Universal Access to Water and Sanitation: Why the Private Sector Must Participate. *Natural Resources Forum* 27: 279-90.

While focused on international needs, the report concludes the only way to provide enough financial resources to ensure a safe and clean water supply is to utilize private sector funding. The report concludes that with proper regulation privately managed water resources and superior to public monopolies.

Lemos, Maria Carmen, Diane Austin, Robert Merideth, and Robert G. Varady. 2002. Public-Private Partnerships as Catalysts for Community-Based Water Infrastructure Development: The Border Water Works Program in Texas and New Mexico Colonias. *Environment and Planning: Government and Policy* 20: 281-295.

The WaterWorks program is evaluated in four colonias after a brief theoretical treatment of non-profit involvement in private-public service provision. When basic services are not provided by public or private firms, then it is advocated that non-profits fill the void. Five evaluative characteristics are examined in the case study: 1) flexibility and responsiveness, 2) acquisition of resources, 3) resident involvement and trust, 4) accountability and compatibility with public policy, and 5) dependence on public funds. In general, these variables affect one another and are sometimes in conflict. WaterWorks values responsiveness to colonias. The research concludes that non-profits serve a critical role by connecting colonias, or other disenfranchised groups, with local governments and facilitates resource procurement. The most important attributes of a non-profit are flexibility, adapting to environmental changes, and responsiveness to community needs.

Massachusetts State Office of Coastal Zone Management, “Environmental Permitting in Massachusetts,” the Massachusetts Office of Coastal Zone Management, <http://www.mass.gov/czm/envpermittoc.htm>

This report describes the multiple challenges in receiving a permit, especially for wastewater projects. Sighting a project is the most difficult aspect of developing a wastewater project. The report also analyses the compliance requirements of numerous federal and state statutes.

Morris, Elizabeth D., and Rick L. Travis. 2003. Privatization in State Agencies: A Focus on Clean Water. *Public Works Management and Policy* 7(4): 243-55.

Exploring the privatization literature, Morris and Travis investigated the political, cultural, and administrative aspects regarding why a state may choose to privatize water resources. In general, privatization is favored the more conservatively aligned the state politics, the more independent-minded the culture, and when a specialized agency controls state revolving fund resources instead of a super agency.

Morris, John C. 1999. State Implementation of National Water Quality Policy. *Public Works Management and Policy* 3(4): 317-30.

Using Kingdon's policy streams as a framework, Morris examined the impact of federal devolution on the implementation of the state revolving funds. He found that states implement the state revolving fund largely independently of federal intent. For example, states were awarding fewer and fewer grants to small communities and instead focusing on financial hardship justifications. Additionally, market forces were driving states to invest in safer economic communities instead of those most at risk.

Muraca, Paul, and Jose Garza, interview by authors, College Station, Texas, 29 March 2005.

This interview provided a description of the services provided by the Tejeda Center for EDAP applicants. Discussion included the reoccurring challenges of finishing projects on time and on budget including financial, managerial, and technical factors. Also, discussed the training programs they conduct to license the operators of drinking water and wastewater systems.

Parris, Thomas M., and Robert W. Kates. 2003. Characterizing and Measuring Sustainable Development. *Annual Review of Environmental Resources* 28: 559-586.

Sustainable development does not have a universal definition or measurement system supported by theory. Depending on the mission of the interested party, the goals, indicators, targets and trends are defined differently. Twelve separate efforts to characterize and measure sustainable effort are compared along four questions: 1) how is sustainable development defined, 2) why characterize and measure sustainable development, 3) how are goals, indicators, and targets selected, and 4) How are indicators constructed? The authors recommend the development of a framework that distinguishes between the different criteria used in sustainable development research.

Puerta, Manuel, de la, and David Stemper. 2003. "The Enumeration of Colonias in Census 2000: Perspectives of Ethnographers and Census Enumerators," US Census Bureau, <http://www.census.gov/pred/www/rpts/J.4.pdf>

The report is broken into two parts: 1) ethnographic studies in four colonias, and 2) results from focus groups comprised of census enumerators and crew leaders. The findings concluded that there are several barriers to colonias residents being accounted for accurately. Irregular housing (insufficient house numbering, homes hidden from view, seemingly uninhabitable units that are lived in, and multiple units that appear to be single units) was a difficulty that could be managed. Lack of English language skills and education, concerns about confidentiality, and complex and fluid households were more significant problems. Advertising in Spanish, having cultural facilitators, and focusing on infrastructure improvements were identified as the best tools in working with colonias residents.

Rodriguez, Manuel, Martin Fernandez, and Javier Saez. 2002. Evaluation of Irrigation Projects and Water Resource Management: A Methodological proposal. *Sustainable Development* 10: 90-102.

The paper proposes a methodology for the economic-financial evaluation of public irrigation works for farmlands in Spain for the investment-related decision-making. Specifically, the authors outline a basic theory of water valuation for farming use, the methodological proposal, and apply them to the study of specific areas in southern Spain.

Seppala, Osmo T. 2002. Effective Water and Sanitation Policy Reform Implementation: Need for Systemic Approach and Stakeholder Participation. *Water Policy* 4: 367-388.

This article analyzes development trends in water and sanitation policies and strategies of donor organizations and developing countries. The author finds that while developed countries and nonprofit organizations have been eager to fund water development projects, an integrated, holistic systemic approach has been lacking. Therefore, he feels that to be successful, water development policies must include: political facilitation and will; institutional change and incentives to trigger the reform process; systemic and integrated approaches, recognizing interrelations of sectors; futuristic and prospective thinking; recognition and participation of all relevant stakeholders; capacity building of stakeholder at all levels; and effective communication and dissemination to operationalize policies and reforms in the field.

Texas Water Development Board, "Chapter 375: Clean Water State Revolving Fund (CWSRF)," Texas Water Development Board, <http://www.twdb.state.tx.us/publications/rules/rules.asp>

This is the description of the criteria and rating process for applications. Divided into 8 main sections that cover provisions, program requirements, applications for assistance, board action, engineering requirements, the building phase, and the post building phase. Also discusses pollutions and capitalization of grant funds.

Texas Water Development Board, "Chapter 355: Research and Planning Funding," Texas Water Development Board, <http://www.twdb.state.tx.us/publications/rules/rules.asp>

This site describes how funds are going to be allocated by TWDB and rules and regulations that govern this distribution. It includes definitions, criteria, and subsets of economically distressed areas.

Travis, Rick, John C. Morris, and Elizabeth D. Morris. 2004. State Implementation of Federal Environmental Policy: Explaining Leveraging in the Clean Water State Revolving Fund. *Policy Studies Journal* 32(3): 461-80.

Analysis was conducted on what variables are linked to the leveraging of loans provided by the Clean Water State Revolving Fund. While conclusions were not absolute, there is indication that the “size of needs, size of demand for loans, and size of federal appropriations” drives leveraging. This is markedly different from EPA’s expectation that leveraging be based upon the state’s environmental need and the need of loans from local communities. The article also shows dangerous long-term fiscal concerns when funds are leveraged to assist short-term needs.

U.S. Environmental Protection Agency, “Factoids: Drinking Water and Ground Water Statistics for 2003,” U.S. Environmental Protection Agency, [http://www.epa.gov/safewater/data/pdfs/factoids\\_2003.pdf](http://www.epa.gov/safewater/data/pdfs/factoids_2003.pdf)

The document displays the latest statistical data for ground and drinking water. Included in the data is information regarding the number of health-based violations per state. This article provides statistical comparisons for Texas versus other states.

U.S. Environmental Protection Agency, “Report to Congress on the Impacts and Controls of CSOs and SSOs,” U.S. Environmental Protection Agency, [http://cfpub.epa.gov/npdes/cso/cpolicy\\_report2004.cfm](http://cfpub.epa.gov/npdes/cso/cpolicy_report2004.cfm)

This report is the most comprehensive source on combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) within the United States. Considerable health and environmental risks occur because of CSOs and SSOs, including 7 percent of beach closings and 3400 to 5500 illnesses. EPA estimates “at least an additional \$50.6 billion is required to capture no less than 85 percent of the CSO by volume, and an additional \$88.8 billion is required to control SSOs over the next 20 years.” The Clean Water State Revolving Fund can be utilized to reduce CSOs and SSOs.

U.S. Environmental Protection Agency, “Colonia Facts,” U.S. Environmental Protection Agency, <http://www.epa.gov/owm/mab/mexican/clnfcts.pdf>

The fact sheet provides a history and updated statistical information regarding colonias along the US-Mexican border. Information is not necessarily specific for Texas as the fact sheet covers the entire border from the Gulf Coast to the Baja Peninsula.

U.S. Environmental Protection Agency, “Funding Water Efficiency through the State Revolving Fund Programs,” U.S. Environmental Protection Agency, [http://www.epa.gov/owm/water-efficiency/wef\\_final.pdf](http://www.epa.gov/owm/water-efficiency/wef_final.pdf)

This short report emphasizes in very plain terms the importance of water efficiency in saving ratepayers money, plus saving scarce water resources. For example, much of the water distribution system is designed for nonpotable uses (i.e. irrigation) and running dual distribution

lines increases efficiencies. Additionally, the report provides an example where Houston has saved \$3.70 for every \$1.00 invested in water efficiency.

U.S. Environmental Protection Agency, “Handbook for Coordinating Funding for Water and Wastewater Infrastructure,” U.S. Environmental Protection Agency, [http://www.epa.gov/safewater/dwsrf/pdfs/guide\\_dwsrf\\_funding\\_infrastructure.pdf](http://www.epa.gov/safewater/dwsrf/pdfs/guide_dwsrf_funding_infrastructure.pdf)

This very high-level, non-specific handbook encourages coordination of water and wastewater infrastructure funding. Additionally, this handbook reminds participants that several federal agencies besides EPA contribute funding for water needs. Six state case studies are provided in the handbook.

U.S. Environmental Protection Agency, “The Drinking Water State Revolving Fund Program: Financing America’s Water from the Source to the Tap,” U.S. Environmental Protection Agency, <http://www.epa.gov/safewater/dwsrf.html>

This report is perhaps the most comprehensive source on funding and statistics for the drinking water state revolving fund program. The statistics show that subsidized loans are occurring with loans generally between 2 and 4 percent “compared to the 20 year Bond Buyer Index interest rate (a proxy for market rate), which ranged between 5.1 and 5.8 percent for the same period.” Additionally, the report shows that just seven percent of water systems are responsible for serving 81 percent of Americans.

U.S. Environmental Protection Agency, “The Clean Water and Drinking Water Infrastructure Gap Analysis,” U.S. Environmental Protection Agency, <http://www.epa.gov/safewater/gapreport.pdf>

This widely-cited report is a comprehensive source for the national need for clean water and drinking water infrastructure. Using economic projections, EPA estimates “an increase in real rate of growth spending of three percent per year above the rate of inflation” is needed for municipalities to meet demands for water infrastructure. This is potentially consistent with long-term economic growth projections. However, the report identifies small communities below 10,000 persons as particularly vulnerable and unlikely to have appropriate financial support. Various modeling of future needs is provided in the report.

U.S. Environmental Protection Agency, “Financing America’s Clean Water Since 1997,” U.S. Environmental Protection Agency, <http://www.epa.gov/owmitnet/cwfinance/cwsrf/progress.pdf>

This report summarizes the national successes of the Clean Water State Revolving Fund since 1997. The report mentions the various types of water projects, such as estuary protection and nonpoint source reductions, which can be funded by the Clean Water State Revolving Fund. In general, the report is very positive and states that each federal dollar invested has resulted in a \$.73 state match.

U.S. Environmental Protection Agency, “Integrated Planning and Priority Setting in the Clean Water State Revolving Fund,” U.S. Environmental Protection Agency, [http://www.epa.gov/owmitnet/cwfinance/cwsrf/ipps\\_web.pdf](http://www.epa.gov/owmitnet/cwfinance/cwsrf/ipps_web.pdf)

The report provides criteria used in several different case analyses to examine priorities for distributing clean water loans. The Integrated Planning and Priority System is explored in detail, including factors such as impaired water systems and water efficiencies. Overall, this report offers an excellent how-to guide for developing a criteria document for distributing clean water loans.

U.S. Environmental Protection Agency, “Status Report on the Water-Wastewater Infrastructure Program for the US-Mexico Borderlands,” U.S. Environmental Protection Agency, <http://www.epa.gov/owm/mab/mexican/usmexrpt/>

The report provides detailed statistical and summary water and wastewater infrastructure information for the regions along the US-Mexico border. The data includes health information and funding shortfalls needed to support long-term projects through 2020 along the Rio Grande and Gulf of Mexico Coast Basins. The US portion of the Rio Grande Basin is estimated to need approximately \$517 million in water and waste-water projects through 2020 while the Gulf of Mexico Coast Basin needs \$229 million.

U.S. Environmental Protection Agency, “The Drinking Water State Revolving Fund Program: Case Studies in Implementation III. Disadvantaged Communities,” U.S. Environmental Protection Agency, <http://www.epa.gov/safewater/dwsrf/case.html>

This report is specific with regard to disadvantaged communities in the drinking water state revolving fund. In general, there is no universal definition of disadvantaged communities. Under the provisions of the fund, up to 30 percent of a state’s capitalization grant may be awarded each year to disadvantaged communities. Additionally, the loans can be extended from 20 to 30 years for disadvantaged communities.

U.S. Environmental Protection Agency, “Drinking Water Infrastructure Needs Survey,” U.S. Environmental Protection Agency, <http://www.epa.gov/safewater/needs.html>

One of the most widely cited reports on drinking water infrastructure, EPA estimates \$150.9 billion is needed over the next 30 years to help water systems comply with the Safe Drinking Water Act. The survey covers approximately 55,000 community and 21,400 nonprofit community systems. Interestingly, the Safe Drinking Water Act requires 15 percent of a state’s Drinking Water Revolving Fund monies to go to systems serving under 5,000 persons, whereas states generally allocate over 41 percent.

U.S. Government Accountability Office. 2004. *Drinking Water: Experts’ Views on How Federal Funding Can Best Be Spent to Improve Security*. GAO-04-29. Washington: Government Accountability Office.

The report surveyed 43 national experts to determine the biggest criteria and needs to direct funding for water security. Overwhelmingly, the experts agreed that funding should be focused in areas having a high vulnerability assessment and serving high density populations. Additionally, the report recommends more security, technological improvements, cooperation with local homeland security operations, and training.

U.S. Government Accountability Office. 2002. *Drinking Water: Key Aspects of EPA's Revolving Fund Program Need to be Strengthened*. GAO-02-135. Washington: Government Accountability Office.

The report questions EPA's assessment in its 1999 "Drinking Water Infrastructure Needs Survey" that \$150.9 billion is needed over the next 30 years. The GAO finds EPA's methodology for determining its precision in the report to be flawed. However, the report does provide great breakdowns in infrastructure needs by water drinking system size.

U.S. Government Accountability Office. 2001. *Water Infrastructure: Information on Federal and State Financial Assistance*. GAO-02-134. Washington: Government Accountability Office.

The report provides financial and historical information regarding the funding of the Clean Water and Drinking Water State Revolving Funds. Additionally, the report provides excellent statistical information regarding the current state of water infrastructure needs.

U.S. Government Accountability Office. 1992. *State Revolving Funds Insufficient to Meet Wastewater Treatment Needs*. GAO/RCED-92-35. Washington: Government Accountability Office.

The report provides historical perspective on the under funding of the nation's wastewater treatment needs. Much like the current series of under funding reports, this report speculates that a long-term solution is needed to funding. This is a classic report often cited over the years to build support for additional funding for water projects.

U.S. Government Accountability Office. 1998. *Rural Water Projects: Federal Assistance Criteria*. GAO/RCED-98-204R. Washington: Government Accountability Office.

This letter addressed to Chairman Jon Kyl (Subcommittee on Water and Power) provides information on projects that are proposed in legislation and the criteria that different federal programs use when considering applications for water assistance. The letter looks at the criteria for funding rural water projects at the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), and the Bureau of Reclamation (BOR). Both the USDA and EPA have programs that fund rural water projects using specific criteria, however the BOR has no such program or criteria. All three agencies responded to three different proposed projects as if these projects were in fact applicants to their program. Though all three projects showed adequate need, concerns arose over construction costs. The program budgets in the area where the project was located was only a fraction of the total funds needed and the projects expected federal cost-sharing above what the program actually provided.

U.S. Government Accountability Office. 1995. *Rural Development: USDA's Approach to Funding Water and Sewer Projects*. GAO/RCED-95-258. Washington: Government Accountability Office.

In 1994 the U.S. Department of Agriculture (USDA) provided over \$1.3 billion for water programs in rural areas of the U.S. including both drinking water and wastes water projects. This report was provided to Rep. William F. Clinger, Jr. as an overview of the USDA's process for allocating loans and grants for water projects. The report contains information on three different areas: (1) funding levels for water and sewer projects for rural communities, (2) the current allocation formula (as of 1995) used by the USDA to administer loan and grant funds to its state offices around the country, and (3) how funds are awarded to the different within the states and district offices.

This report found that since the rural water program's conception in 1965, the USDA has distributed over \$28 billion and benefited over 12,500 communities throughout the U.S. The USDA allocates the loan and grant funds to USDA state offices using a formula that is based on rural population, rural poverty, and rural unemployment. The report found that the allocation formula is easy to administer and may partially reflect the states' need and ability to pay. Once the money is allocated to the states it is the state office's responsibility to administer the funds through the district offices. The report found that this process allowed for flexibility in funding decisions at the local level. At the time of this report Texas received the highest allocation of all of the states; \$1.9 billion.

Zimmerman, Stanley, and Edwin L. Cobb. 1975. *Guide for the Development of Rural Water-Sewer Projects*. Chicago: Commission on Rural Water.

This book is written to the project applicant. It summarizes the 'do's and don'ts' about how to get through a project development process. The first chapter gives information on the national water problem. This is outdated and less useful today. Chapter 2 includes detailed evaluations tools, questions, and outlines about how to assess the area's needs and the project developer. Chapter 3 is about how to assemble a development team. This consists of advise on base organizations, catalyst groups, and a 'how to' create a project budget. Most of chapter 5 is not relevant to the project though it does provide an overview about how to prepare a financial package for consideration. There are also chapters on obtaining official approval, organizing the local community, and designing and constructing the facilities. The 'supporting system operations' chapter highlights key follow-up questions about support functions, training programs, and performance evaluation. There is a good listing of supporting tasks that include several financial, technical, and managerial roles.

# NOTES

---