A Comparative Analysis of Utility Rate Forecasting: The Cape Coral Experience

Quality/Process Improvement and Management Track

By

Terry A. Anderson, Ph.D.
Chair, Public Administration Department
Troy State University Florida Region

And

Donald A. Forrer, D.B.A.
Management Professor
Troy State University Florida Region

Abstract

Cape Coral, Florida hired an engineering firm to conduct a utility rate update for City water and wastewater systems in May 1991. While the firm's study was well done, utility revenues forecasted by the study grew increasingly more inaccurate for each year projected. This paper examines possible reasons for the errant forecasts. It hypothesizes that four issues led to inaccurate results. In 1994, City staff concluded that data used were flawed and made corrections to account totals for future use. The City commissioned another rate study in 1994. Based on that study, a subsequent rate increase was considered, but voted down.

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Introduction

Cape Coral, founded just over 40 years ago, is described as the largest and most successful master-planned community in the country. The promise of sustaining a lifestyle of abundant sunshine and peaceful waterfront living rested on the development of a plan for City infrastructure and growth. Prior to incorporation in 1970, City designers carefully planned the location of streets, canals, parks, public areas, transportation routes, commercial zones, and industrial parks. The emphasis was always on assuring that commercial and residential growth remains orderly, controlled and balanced. Cape Coral has grown dramatically since its incorporation. In 1960 there was virtually no population. The city's metropolitan market area grew seven times faster than the national average in the 1980s. By 1995, the population had risen to approximately 85,000. Today, it is the most populous Florida Gulf Coast City south of Tampa. Its geographic area of 114 square miles makes it the second largest city in area in the state. With approximately 30,000 of 135,000 building parcels occupied, the City has tremendous room for future growth.

The tremendous growth of Cape Coral has presented City administrators with numerous management challenges. Among them is that of maintaining City-owned reliable water, wastewater, and reuse (irrigation) systems that deliver a high-quality product. At the same time, these systems must also be responsive to consumers, protect the environment, and ensure that the community remains self-sufficient. Coupled with this mandate is the maintenance of financial viability of the community by implementing an effective ad valorem tax structure, debt levels, user fees, and other revenue sources that are equitable and affordable to the community (Raftelis Environmental Consulting Group, Inc., 1995).

City government in Cape Coral experienced the same growing pains as the City's population throughout the 1980's. The City entered the 1980s with approximately 125 employees and by 1991 employed over 1,100. Cape Coral is governed by a City Council with a City Manager who reports to the Council and is responsible for the general administration of City business. Several players in City government are involved in the City's water systems. Daily operations for water production, reclamation and collection/distribution systems are the responsibility of the Utilities Manager. The City Attorney provides legal advice concerning those systems. For assistance in planning and operation of the systems, the City retains legal, engineering, accounting, and financial consultants. The City Clerk and Finance Director are responsible for record keeping and accounting, respectively. The City Council is comprised of eight members who are elected for four-year terms. The Council has the responsibility for approving the budget and all revisions, ratifying all contracts, and approving all rates and charges for the City's water production, water reclamation, and reclaimed water service. The Director of Public Works assists the City Manager in the administration of all affairs of the City's Public Works Department. The City Utilities Department is administered by Public Works.

A consultant hired by Cape Coral to audit the City's Utilities Department identified perhaps the most difficult challenge facing City administrators (Raftelis Environmental Consulting Group, Inc., 1995). Establishing a shared community vision has been made difficult owing to the numerous interest groups in the City. Groups include homeowners and other

residents; developers; owners of undeveloped residential, commercial, and resort properties; citizen groups, and multigenerational citizens. Each of these groups has its own financial, social, business, health, and security requirements. These differing requirements often translate into differing objectives, such that City leadership must be responsive to a diverse set of public needs.

In 1988, Boyle Engineering Corporation, under contract with the City, developed a utility master plan, entitled "Water Independence for Cape Coral," (WICC Plan). The highlight of this plan was the initiative to utilize reclaimed wastewater effluent, in combination with canal withdrawals, for irrigation and other non-potable uses. By providing an irrigation distribution system, the City reduced the demand on the aquifer thereby preserving and prolonging its life.

In 1991, the City of Cape Coral hired an engineering firm to conduct a utility rate update for the City water and wastewater utility system. The purpose of this paper is not to critique the report submitted by the engineering firm of Camp, Dresser, and McKee. No one can argue against the fact that the report was professionally prepared. Rather, the focus of this paper is on the forecasting of future revenues used as a basis for the study. Four issues contributed to the forecasting model used in the study producing inaccurate projections: (1) the City was installing 14 square miles of sewer system that was completed behind schedule; (2) the City was installing an irrigation system to homes. These accounts were added at a slower than anticipated pace; (3) the growth rate for the City was anticipated to continue at the 8% level experienced in the 1980s. In fact the rate dropped to approximately 3%; and (4) the data provided by the City for water and sewer accounts were inaccurate.

According to the 1991 rate study, based on account data provided by the City, water accounts were predicted to reach 28,979 and wastewater accounts 23,088 in 1992. The City reported that actual water accounts for 1992 reached 37,098 while wastewater accounts rose to 23,705. The study predicted that the City would make $15,470,594 during that first year. Actual revenues were only $15,406,209. The difference of $96,708 for that first year was insignificant. However, the larger question is how revenues could be short at all when actual accounts appeared to exceed predicted accounts by such a significant margin.

The problem worsened in the second year as the real impact of a faulty forecast was realized. Projections for that year called for 35,327 water accounts and 25,009 wastewater accounts. City statistics for 1993 revealed that actual water accounts reached 38,315 while sewer accounts rose to 23,342. Projected revenues for 1993, based on the rate study were $19,147,161. Actual utility revenues were $15,406,209, representing a difference of $3,740,952. Again, actual accounts appeared to exceed predicted accounts and, given the wide range of error in estimating revenues, there was substantial reason to doubt the ability of the forecasting study to accurately estimate utility revenues.

In 1994, City staff determined that the account data utilized in the 1991 study were flawed and corrected the account totals for future use. As evidence of how far the data were off, the 1991 study had predicted that the City would have 37,044 water accounts and 39,933 wastewater accounts in 1994. Using the 1994 adjusted data, the prediction was for 28,891 water accounts and 17,344 wastewater accounts. The actual figures for 1994 were 28,152 water accounts and 16,203 wastewater accounts. The inflated rate study projected $24,228,719 in utility revenues for 1994. Actual revenues realized were $14,523,876, almost $10 million below

the expected total.

The combination of erroneous data, slower than expected growth rate, slower than projected wastewater construction, and delays in securing irrigation connections created revenue flow problems for the City. Compounding the issue was the fact that City planners budgeted with the projected figures. In 1994, the City of Cape Coral budgeted almost $1.6 million more than actual revenues. The 1991 rate study, in its executive summary indicated that, "from projections of revenues and expenses at existing rates, the water system appears to be self-sufficient only through Fiscal Year 1992 in terms of meeting its operating revenue needs from the standpoint of debt coverage." As later facts became known, this turned out to be a true statement. Clearly the efficiency and effectiveness of the rate study were handicapped by the data used and thus by the forecasting model developed.

Correcting Faulty Forecasting

Clearly, results from the 1991 rate study were flawed, leading to significant underestimating of revenues for City water, wastewater, and irrigation programs. This discussion will focus on how City officials identified the problems with the forecast in the 1991 rate study and then implemented changes to address those problems. Throughout the discussion, changes made in City departments that contributed to a more successful outcome in 1994 will be introduced. The discussion will be within the context of the elements that were identified as leading to successful forecasting as found in the literature review provided in the previous section.

Growth in government means changes in processes and structure. While Cape Coral accomplished this strategically with forward thinking innovations such as a $21 million Water Reclamation Plant, a $125 million Gravity Sewer Project, and a $100 million Dual Water System, the City's data collection system was not as responsive. In 1991, as the rate study was being conducted, the City realized that its computer system would be the key to a cost-effective solution to problems already identified with information processing, data collection and full integration of systems. A proposal was presented to the City Council to replace the WANG VS100 with an IBM AS400 and a fully integrated database provided by Harward Technical Enterprises (HTE). The Wang VS100 utilized a flat file database that required COBOL programmers to customize reports for management. It was adequate throughout the early history of Cape Coral, but not so for maintaining data for an enlarged city with a proactive strategic plan. The AS400 and the HTE software were chosen in 1992, but the implementation process extended into 1994.

The City's first Business Manager was hired in January 1994. At that time, the utility module was not converted from the WANG system to the HTE system. A new utility rate study was commissioned in early 1994, but not completed until December of that year. Once completed, the new rate study was rejected by the City Council after many sessions of heated public debate. The discrepancies noted between the 1991 rate study and current data in 1994 proved to be confusing to citizen groups and City Council members. Basically, conversion of the WANG system to HTE highlighted data problems that contributed to inaccurate forecasting

during the previous study. The Business Manager assumed responsibility for data conversion. It was apparent at an early stage that the HTE system was an outstanding system that would accomplish everything that the City needed in the area of data storage, management, and security. However, the HTE system was only as good as the data provided by the City and the previous system. Therefore, the first element of conversion became an analysis of data and processes. Through this process, several areas of concern developed.

In 1991, there were few processes in place that involved users in the storage and manipulation of data. This resulted in responsibility for data being maintained at a centralized level with few measurements in place for data accuracy. Additionally, property changes were the responsibility of Lee County. The County utilized a good system for joining and dividing property. However, once the action was accomplished, the County transferred the changes on a weekly basis to the City for inclusion in their database. There was no process in place for the data to be entered in the City's database; therefore, each week the data held by the City of Cape Coral were deteriorating.

Also in 1991 there was no accounts receivable database available for a water assessment. Citizens paid as they were connected and the results were logged, but not maintained so that they could be queried or analyzed. Several accounts, totaling approximately $65,000 were not billed for their annual payment. In 1993, some 24 months later, the properties involved were assessed liens by the City but still not billed. In 1994, the accounts were billed by the incoming Business Manager. However, due to the liens not being placed until 1993, several properties had new owners. This caused a huge customer service problem. Additionally, the absence of a database resulted in several homes being missed and not connecting as legally required by City ordinance.

Finally, in 1991, water and wastewater accounts and housing units were tracked by a report from the WANG system. Though this report was difficult to read, the 1991 report relied primarily on this historical data for its forecasting model. This customer data obtained from internal records proved to be the Achilles heel of the rate study. Data retrieved from historical files indicated that over time, City staff had erroneously transposed units and accounts. Each dwelling is considered a unit, while only the metered accounts are measurable for revenue purposes. The reporting system used by City staff consisted of reports from various internal forms that were consolidated in the Customer Service department on a written monthly report.

Compounding the issue was the fact that these reports to management were simply compiled on the monthly reporting sheet and then filed. Without the benefit of a spreadsheet, it was easy for management to miss the transposition of erroneous data. This caused customer complaints and data that were virtually useless for planning purposes. Since the reports were filed and not followed on a spreadsheet, the significant difference in the number of units was not discovered until the City converted to the new computer system in 1994.

The 1991 rate study predicted that the City would experience a 20% reduction in water consumption due to the implementation of Water Independence for Cape Coral, the earlier report commissioned in 1988. This projection was built into the model, but did not compensate for erroneous data provided by the City. In 1994, the City Business Manager analyzed six months of water usage for the first 10,500 customers receiving the dual water system. This review determined that in a six-month window, 9,500 users having irrigation in 1994 and no irrigation in

1992 consumed 203 million fewer gallons of potable water. With a City average of 207 million gallons per month, this constitutes two full months of water and wastewater revenues with only 33% of the potential users connected. While this variable was considered, its effects on new irrigation revenues were considered to be minimal. Further analysis of accounts in preparation for the 1994 rate study revealed inaccuracies in approximately 8,000 water accounts and 5,000 wastewater accounts.

In 1991, the City was structured for a centralized information system division that allowed no ownership of data by the individual departments. As stated earlier, the MIS Manager and two programmers managed the WANG system. This was a system of centralization by necessity. The COBOL programming required to provide reports was complicated and cumbersome. While department managers controlled input through account entry at the various service counters, very little control over or responsibility for data was provided to department managers. Therefore, many of the data entry requirements fell on the MIS division. Managers requiring reports would request the necessary data through the programmer and wait on results. Due to the complexity of the COBOL programming, managers had to assume that the programmer understood the requirements.

In 1991, responsibility for data and processes was placed at the lowest level rather than with senior management. The engineering firm was provided data by a divisional supervisor based on reports provided by the MIS division. Measurement and accuracy checks were not in place at higher levels of the organization.

The rate study conducted in 1994 was ultimately rejected in the face of problems realized with the earlier study. In addition to inaccuracies identified in the data provided for the 1991 study, citizens blamed City officials for delays in ongoing projects and voted the 1994 study down. The City began to explore the various reasons given for the study's rejection and in early 1995, realized that implementing a new computer system was not the complete answer to data accuracy. A new City Department, the Office for Business Management and Information (OBMI), was formed from the existing Business Office and the MIS Division of General Services. This allowed the processes of revenue collection to be integrated with the implementation of the new computer system.

Understanding that the problems with the rejected 1994 rate study were not due to the methodology utilized by the engineering firm, but due to the data provided by the City, managers embarked on several changes to strengthen future rate models. First, the City fast tracked the conversion to the HTE system. The City's implementation of the utility module of the HTE system was delayed during the initial phase due to implementation concerns. Data provided to the engineering firm were from the WANG system that was running simultaneously during conversion. Conversion of revenue data was given new emphasis and authority under the responsibility of OBMI. The City created the Office for Business Management and Information (OBMI) by combining offices of Utility Customer Service, Assessment Billing, Lot Mowing Billing, Stormwater Billing, and the MIS Division of General Services. With the exception of MIS, all of these offices were divisions of the Utilities Department. The City's creation of OBMI allowed for centralization of the data process engineering.

Further, the Accounts Reconciliation Project was developed by the Business Manager as a task force to analyze data and assign responsibility. This project was established to assign responsibility for data. Each process was flowcharted by teams of individuals that were involved with the collection, processing, storage, and analysis of data. Once complete, responsibility and accountability measures were implemented to ensure accurate data throughout each City department. The Raftilis Study (1995-1996) was commissioned to analyze utility operations and provide an operational look at City utilities. Finally, a group of volunteer citizens formed an ad-hoc committee to analyze City utility operations. This watchdog group evaluated past City processes to determine if the best interests of the City were considered during each transaction.

The final result of these changes was that forecasting for future utility needs became easier due to improved data. In response to revenues being underestimated, the City eliminated several capital projects that were planned. By reducing current spending levels, the City managed current operations without funding from the 1994 rate study. However, significant amounts of money and man-hours were wasted due to inaccurate data.

Working closely with the Finance Director, the Director of OBMI provided forecasting data for budgeting purposes that proved accurate during FY 1995 and FY 1996. However, because the City had not raised rates in FY 1995 as proposed, the self-sufficiency of City utilities was jeopardized. The Department of Public Works Director wrote in late 1995 that City utility rates should be raised “to make necessary repairs to our collection system and provide an interconnect which will allow us to divert sewage from the southwest section of town to the Southwest Reclamation Facility (SWWRF) for treatment.”

The 1994 utility rate study was not approved by the City Council due to the many questions raised by community activists during the public hearings. The study was not successful due to the many "pitfalls in forecasting.” Insufficient and inaccurate data due to inadequate structure and processes made forecasting for an accurate utility rate extremely difficult. The result was obviously a study that did not respond to the needs of City management.

Despite significant problems associated with erroneous data, there were elements of the rate study project that were positive. For example, successful forecasts require that the forecaster show that the project will improve operations in accordance with the needs of management. This project clearly set out to produce accurate estimates of revenues to be collected to facilitate management’s budgeting for water, wastewater, and irrigation projects. In addition, forecasters must work carefully with management in order to lead to results that will meet management’s goals. To this end, CDM representatives met regularly with City officials and staff to ensure that the project remained on track and that both sides were informed of the project’s progress. These discussions were important since City representatives were not experts at forecasting.

A key element in forecasting is the time frame in which data are collected and analyzed in comparison to the time frame for the forecasting. Data used in 1991 were on a short time frame since the City’s computer system only held 90 days worth of data. This was an acceptable range since the study was needed relatively soon after it was commissioned. An apparent weakness, however, is the fact that no trend or time series analysis could be conducted on data obtained for such a short time frame. This diminished the ability of the forecaster to anticipate other potential outcomes since a valuable point of reference was lost.

Successful forecasts result when forecasters understand the culture and operational goals of the organization. In retrospect, it seems apparent that this is the point at which things began to go awry. The forecasters did not go so far as to put themselves in management's shoes. The right questions were never asked and vital information was not shared. CDM began analyzing data provided by the City in blind acceptance that the data were accurate.

The City of Cape Coral has begun to rebound from its forecasting failure in 1991. In 1995 the annual report of Cape Coral's water and wastewater system described the City's systems at that time. The City water system included 24 raw water supply wells, 6 miles of raw transmission mains, a reverse osmosis water treatment plant, associated brine disposal system, two storage and repump stations, 540 miles of potable water mains, and 450 miles of irrigation (reuse) mains (Hartman & Associates, Inc., 1995).

At that time, and continuing until today, Cape Coral has one of the largest operating reverse osmosis plants in the country. With a rated capacity of 15 million gallons per day (mgd) of potable water, the system provides Cape Coral with reliable flow of purified drinking water, drawn from the aquifer deep beneath the city. Current consumption is about half of the plant's current capacity, promising that the community's water needs will be met easily for years to come.

The City's system for reclaimed water includes 400 miles of gravity sewer mains, 6,339 manholes, 170 lift stations, 48 miles of force mains, two water reclamation facilities, and an irrigation system for water reuse and effluent disposal. The irrigation system includes 450 miles of water reuse mains, two storage and pump stations located at the water reclamation facilities, and five canal pump stations (Hartman & Associates, Inc., 1995).

To further assure plenty of pure potable water to its businesses and residents, Cape Coral introduced one of America's first, largest, lowest costs, and most successful, residential dual water systems. A separate system reclaims and recycles domestic wastewater, adds water from fresh-water canals, and distributes the water exclusively for irrigation and fire fighting.

In 1996, City Council and staff recognized the need to update the WICC Plan, as sound engineering judgments for the future needed to be based on current data rather than assumptions made the previous decade. To this end, the City engaged Dames & Moore to update the existing WICC Plan. Their scope of work involved three distinct phases: Initial Planning, Engineering Planning and Update of the Master Plan. This effort was completed in October/November 1998.

The initial planning phase consisted of a tremendous data collection effort to establish existing utility, financial and local conditions. All pertinent information was collected, catalogued, stored and managed in a GIS database. The key products of this phase were the development of hydraulic models for the potable water, wastewater and secondary systems. Field calibration of these models was also accomplished to ensure that predicted modeled values were closely correlated with actual outcomes.

The engineering planning phase of the project involved the development of the next utilities expansion areas. To do this, Dames & Moore, together with a team from the City, distilled and refined a set of engineering planning criteria against which unserved units of the City would be evaluated. The criteria included: projected density, land value, rate of growth, proximity to existing utilities, groundwater protection, surface water effects, economic

development, land use conformance, existing utility availability, and planned capital improvements.

All areas of the City were evaluated against these criteria resulting in the identification of units which appeared to merit expansion. Given these interim results, a financial feasibility review was applied to further narrow the candidate units for new utilities. The outcome derived from this process pretty much validated the Council's initial assessment of what the next expansion areas should be. That is, the Pine Island Corridor, an area in the northeast (Purple area as designated on the City planning map), and the rapidly developing Southwest area.

This master plan phase of the project will provide the utilities "road map" to the future. The initial look at the future will be at 2002, then 2005, 2010, 2020 and build-out. At build-out, the population of the City is projected to be approximately 400,000 people. Sizing of utility lines at build-out has been determined as well as at 2020. With the results of the Utilities Master Plan Update, the City's utilities expansion will be planned to be efficient and orderly thereby assuring the continued growth and stability of Cape Coral.

Conclusion

Due to the public hearing process, the City of Cape Coral learned a valuable lesson about accurate forecasting. The 1991 rate study produced a false target resulting in overspending by City government and the need for a utility hike in 1994. Inaccurate data and the inability to explain the deficiencies, led to mistrust of government staff and the voting down of the 1994 rate study.

During the public hearings, citizens were blaming everything from expensive supplies to government corruption as the problem. Laubach (1995) wrote an article titled "City Utilities Losing $200,000 a Month" in which a quote from then Public Service Director places the blame for the losses with the predictions made for the 1991 utility rate study and delays in the wastewater project. The debate over utility rates resulted in demands by City Council members for audits of the entire system. City Council voted to delay any rate increase until a determination of cause could be established.

Overall, pitfalls in forecasting brought budget deficits, audits, citizen committees, and criticism from the City Council and the public. Along the way, resignations were tenured, thousands of dollars were spent, and trust in City staff was diminished. Following good management principles in the forecasting of utility rates would have precluded or minimized this problem.

Cape Coral has hopefully learned a valuable lesson through its experience with forecasting. Data and information management must be taken seriously and given priority throughout the planning and budgetary processes. Those responsible for managing information must be part of the inner circle of the decision making process. The past reveals that data management issues are critical to sound planning and forecasting and will often be a significant determinant in a future of continued growth and prosperity.

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