Timing is still everything—capital project prioritization

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ABSTRACT | Prioritization of projects in a capital improvements plan (CIP) is important in squeezing the most out of every dollar, and several utilities have recently explored improvements to their prioritization processes. Most favor multi-criteria analysis, in which projects are assessed and scored, versus such criteria as system reliability, and the financial, social, and environmental issues addressed. In some cases, simple 1–5 scoring systems are used for each category, and the sum of the scores dictates the priority. In other cases, scores range from 1–100 in each category, and each category is weighted. Prioritization using the asset management concepts of risk and triple bottom line valuation has evolved recently to assist utilities in providing customers even more value for their investments.

KEYWORDS | Capital plan prioritization, asset management, triple bottom line

In 2016, the American Society of Professional Engineers' publication "Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future" estimated the 2016–2025 investment gap in the water and wastewater industries at $105 billion. This gap highlights the importance of prioritizing investments to provide the greatest community value. When insufficient funds are available to bridge the gap, every investment matters.

Replacing assets too soon results in not achieving a full useful life from them. Failing to replace them on time could have additional financial consequences, and impacts on customer service and the environment, and potential safety concerns for those performing reactionary repairs. Favoring expansion over aging infrastructure rehabilitation can lead to more reactionary replacements and service interruptions. An imbalance in the other direction can lead to missed opportunity to generate revenue or get ahead of regulatory mandates.

By prioritizing projects that generate the most value, utilities support the overall financial well-being of the communities they serve, provide customers with more reliable service, and protect the environment.

CAPITAL IMPROVEMENTS PLAN (CIP) PRIORITIZATION FRAMEWORKS

Utilities around the world have used various methods to prioritize projects. While the baseline practices at some utilities combine tacit knowledge of system performance with an understanding of the system's most critical portions, more-advanced utilities have been implementing more quantitative, and presumably less subjective, prioritization frameworks.

One major east coast utility's prioritization framework contains nine criteria, each scored on a 1–5 scale. Scores for each criterion are added to calculate an overall prioritization score. Criteria include asset physical condition, performance, regulatory impacts, reliability, financial considerations, and other categories focused on customer impacts and experiences.

Another major east coast utility's prioritization scoring method rates the project's impacts on only three major criteria, based on asset management's three foundational pillars: service levels, costs, and risk. Each criterion is scored on a 1–5 scale. A formula weights the scores and calculates an overall score, also between 1 and 5. Half of the weighting is assigned to risk, 30 percent to service-level alignment, and 20 percent to other considerations.

A third major east coast utility's prioritization scoring method contains eight criteria, each scored on a 1-to-5 scale. Scores are weighted and then added to calculate an overall prioritization score. Criteria include health and safety, regulatory compliance, risk reduction, financial benefits, capacity, and other community-focused criteria.

The Anchorage (Alaska) Water and Wastewater Utility (AWWU) prioritization scoring method contains 10 criteria, subdivided into the following categories: safe environment, impacts on customer needs, financial, reliability, and (utility) sustainability. Each criterion is weighted as a percentage, with scores for each criterion from 0 to 100. Scores are weighted and added to calculate a total prioritization score, also from 0 to 100.

Table 1.
CIP prioritization categories used by major U.S. wastewater utilities

Criteria	A	B	C	D	E
Risk Reduction/Reliability	✓	✓	✓	✓	✓
Customer Service	✓	✓	✓		✓
Regulatory Compliance		✓	✓	✓	✓
Capacity	✓			✓	
Safety	✓			✓	✓
Community Impacts/Public Acceptability	✓	✓	✓	✓	✓
O&M Efficiency/Savings		✓	✓		
Public Health	✓	✓		✓	✓
Environmental Goals Achievement	✓	✓	✓		✓
Overall Financial Impacts		✓		✓	✓
Sustainability			✓		
Community Economic Development		✓			✓
Coordination with Other Projects	✓		✓	✓	✓
Use of Proven Technology or Process	✓				✓

INCORPORATING ASSET MANAGEMENT CONCEPTS INTO CAPITAL PROJECT PRIORITIZATION

In 2017, AWWU sought to improve project prioritization. The drivers for doing so were manifold. First, because the Anchorage metropolitan area represents roughly 40 percent of Alaska's population, the AWWU CIP is heavily scrutinized by the Regulatory Commission of Alaska, which can determine which AWWU projects may be publicly funded. Second, Anchorage's economy and Alaska's in general have not recovered from the Great Recession similarly to many other states, and utility revenue has suffered. Last, leadership did not think past prioritization methods were as effective as possible, leading in many cases to lack of clarity regarding projects to be advanced or deferred.

While a multi-criteria analysis methodology was already in place to prioritize projects, AWWU turned to its Strategic Asset Services Section to update its process using an asset management-based solution. The first step was to ensure the process was founded on risk management. Virtually every project on a utility's CIP in some way addresses the risk of failing to provide adequate service levels to customers, or environmental or financial risks. Risk reduction from a project represents the benefits provided, and AWWU sought to capture that magnitude in its project prioritization. Evaluation criteria were therefore divided into two categories according to the two components of risk: likelihood of failure and consequences of failure.

In addition, the consequence of failure categories in the AWWU prioritization were broken down further to ensure all triple bottom line project impacts were captured. Criteria for social, environmental, and financial consequences were incorporated, recognizing that AWWU's infrastructure affects the community and environment it serves, including its industrial and commercial customers as well as the swell of visitors who pour into Alaska each summer through Anchorage.

Table 2. AWWU prioritization criteria by risk and triple bottom line (TBL) categories

Risk Category	TBL Category	Criteria
Consequence of Failure Categories	Financial	• Direct AWWU financial costs/benefits • Impacts on outside entities • Improving asset knowledge/ data driven decision-making
	Social	• Service interruptions • Community disruptions • Stakeholder confidence • Strategic and regional importance
	Environmental	• Security and safe work environment • Environment and regulation
Likelihood of Failure		• Reliability of assets and services

For each of the 10 criteria in Table 2, projects are scored from 0 to 100 using discrete increments or "levels" as shown in Table 3.

Once the assessment criteria were finalized, additional objectives included:

- Increased objectivity within the scoring criteria
- Better justification of smaller projects that provide fewer benefits than larger ones
- Improved inclusion of non-water infrastructure projects in the prioritization process, such as information technology (IT) implementations, asset management, master planning, and other planning projects

Table 3. Scoring for each criteria

Level	Score
I	100
II	50
III	20
IV	10
V	5
n/a	0

Table 4. Environment and regulation prioritization criteria

Level	Score	Former Criterion	Updated Criterion
I	100	Compliance order or regulation that requires immediate action	Compliance order or regulation requires action immediately or within the next 6 years.
II	50	Regulation that requires compliance in near future 1–5 years OR anticipated regulation with major implications for operations	A significant unpermitted environmental discharge, or smaller but more frequent discharges that may lead to significant enforcement action
III	20	Anticipated regulation (regulation in the current legislative/regulator process)	Minor, infrequent, unpermitted environmental discharge
IV	10	Potential regulation anticipated in next 5–10 years	Significant permitted discharge that is infrequent and unlikely to result in additional action by a regulatory body
V	5	Potential regulation anticipated in >10 years	Minor permitted discharge(s) that is/ are unlikely to result in additional action by a regulatory body

- Functionality to score project alternatives that reduce only part of the potential risk
- More granularity among project scores for clearer distinction of priorities

MAXIMIZING OBJECTIVITY

In most cases, projects are placed on a CIP prior to preliminary and final design, with many details to be determined. As a result, reasonable judgment regarding ultimate costs and benefits is necessary in prioritization. A well-designed prioritization process can limit the judgment necessary. As an example, earlier AWWU versions allowed users to assign points to a project that addressed a potential regulation anticipated more than 10 years in the future. These options seem reasonable when addressing a project's benefits, but they are speculative and, in some cases, scoring could be applied inconsistently. Given that wastewater regulations are in place to protect the environment, AWWU replaced those speculative criteria with more objective ones focused on known environmental impacts that projects would address.

JUSTIFICATION OF SMALLER PROJECTS

By their very nature, projects with smaller budgets are less likely to produce the same benefits as those with significantly higher costs. When that is not the case, little thought needs to go into prioritizing the lower-cost projects. In most cases, though, the prioritization scores for smaller projects do not rise to the level of larger ones if prioritization looks only at the benefits. In previous versions of AWWU prioritization, this introduced two issues: artificial inflation of smaller project scores by using speculative scoring criteria, such as the regulatory factors discussed earlier, and the need to subjectively judge which smaller projects should be prioritized despite their lower scores. Both issues were attributed to prioritizing what intuitively seemed like high-value investments not borne out by the scoring process.

The updated version of AWWU prioritization now takes each prioritization score (which measures project benefits) divided by each project's lifecycle cost estimate to produce a benefit-to-cost ratio. By doing so, artificial score inflation is no longer needed, and many small projects rise to the top of prioritization based on their low cost. Examples include a security project, building repairs and office upgrades, and a scum line repair project that had one of the lowest overall project scores but one of the highest benefit-to-cost ratios.

INCORPORATION OF NON-WATER INFRASTRUCTURE PROJECTS

Another enhancement to the AWWU process was accounting for projects such as master plans, IT projects, condition assessments, asset management plans, and other activities that allow better planning and decision-making without affecting infrastructure. Without such projects, decisions on which assets to repair and replace are less clear, and the implications are significant. For AWWU, buried infrastructure management is critical because the average depth of cover for water and sewer mains exceeds 10 ft (3 m) in most of the system. Pipe excavations are costly, so replacing pipes too soon significantly reduces value by not achieving a full useful life, and not replacing pipes on time can lead to reactionary repair costs 5 to 10 times higher than those experienced in the contiguous United States.

A category was added, "improving asset knowledge," to capture the value of making more informed, data-driven decisions. Projects that generate data to support decision-making are now scored based on the types of decisions made with the data.

PARTIAL RISK REDUCTION

Almost all prioritization frameworks assume projects will address the full range of risks. However, so-called "80/20 rule" project alternatives address most of the risk in an area for a small fraction of the cost of total risk reduction. The enhanced AWWU process allows users to indicate the risk levels both before and after project completion, with scoring adjusted to reflect the incremental risk reduction.

MORE GRANULARITY AMONG PROJECT SCORES

Even the most well-designed processes can lead to difficulty in prioritizing the right projects. Most utilities do not have unaddressed "sky is falling" projects, and therefore project prioritization scores tend to cluster in the lower range. For AWWU, prioritization scores could range from 0 to 100, but only 10 percent of the projects scored more than 10 points in previous scoring versions, as shown in Figure 1.

Given that prioritization processes should clarify which projects provide the most value, clustering of projects introduced judgment rather than removed it. Multiplying the resultant scores by an order of magnitude, though simple, led to far better visual interpretation of results and allowed far simpler distinction among projects.

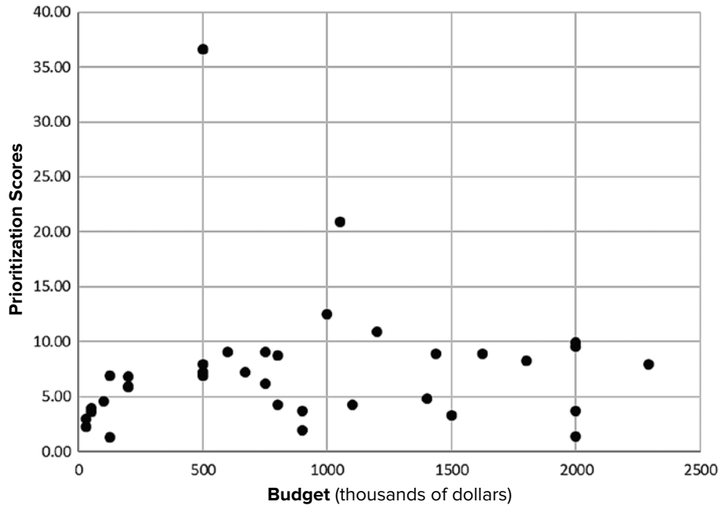

Figure 1. Prioritization score versus budget (despite a potential project score ranging from 0–100, more than 90 percent of projects scored fewer than 10 points in previous versions of the AWWU prioritization framework)

CONCLUSION

AWWU, like many water and wastewater utilities facing tighter budgets, recognized the value of enhancing how it prioritizes investments. By using the principles of risk, triple bottom line valuation, and more data-driven decision-making, AWWU developed a project prioritization framework that better identifies high-value projects more efficiently and objectively. An asset management-based prioritization can be more easily understood and communicated internally and to governing bodies and regulators, facilitating interpretation of results in the context of each utility and its community with the goal of providing the most value to communities being served.

ABOUT THE AUTHOR.

Kevin Campanella is the utility planning leader for Burgess & Niple, Inc. He has 24 years of experience in assisting clients with planning and management of utility infrastructure systems. He has led asset management initiatives for utilities with 4,400 to 1.1 million customers. For seven years, he was the asset management program director at Columbus Public Utilities (Ohio). Mr. Campanella is the chair of the American Water Works Association (AWWA)-Ohio Section Asset Management Committee and focuses on asset management plans and performance management, CIP prioritization, capital project evaluations, renewal and replacement planning, and maintenance program enhancements. He is a native of Wakefield, Massachusetts, and worked for 10 years at Metcalf & Eddy (AECOM) in Wakefield.