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BUILDING WATER INFRASTRUCTURE FOR TOMORROW

AHEAD OF THE CURVE

Programming Your Utility for Sustainable Performance

The Envision framework becomes the standard for forward-thinking water utilities

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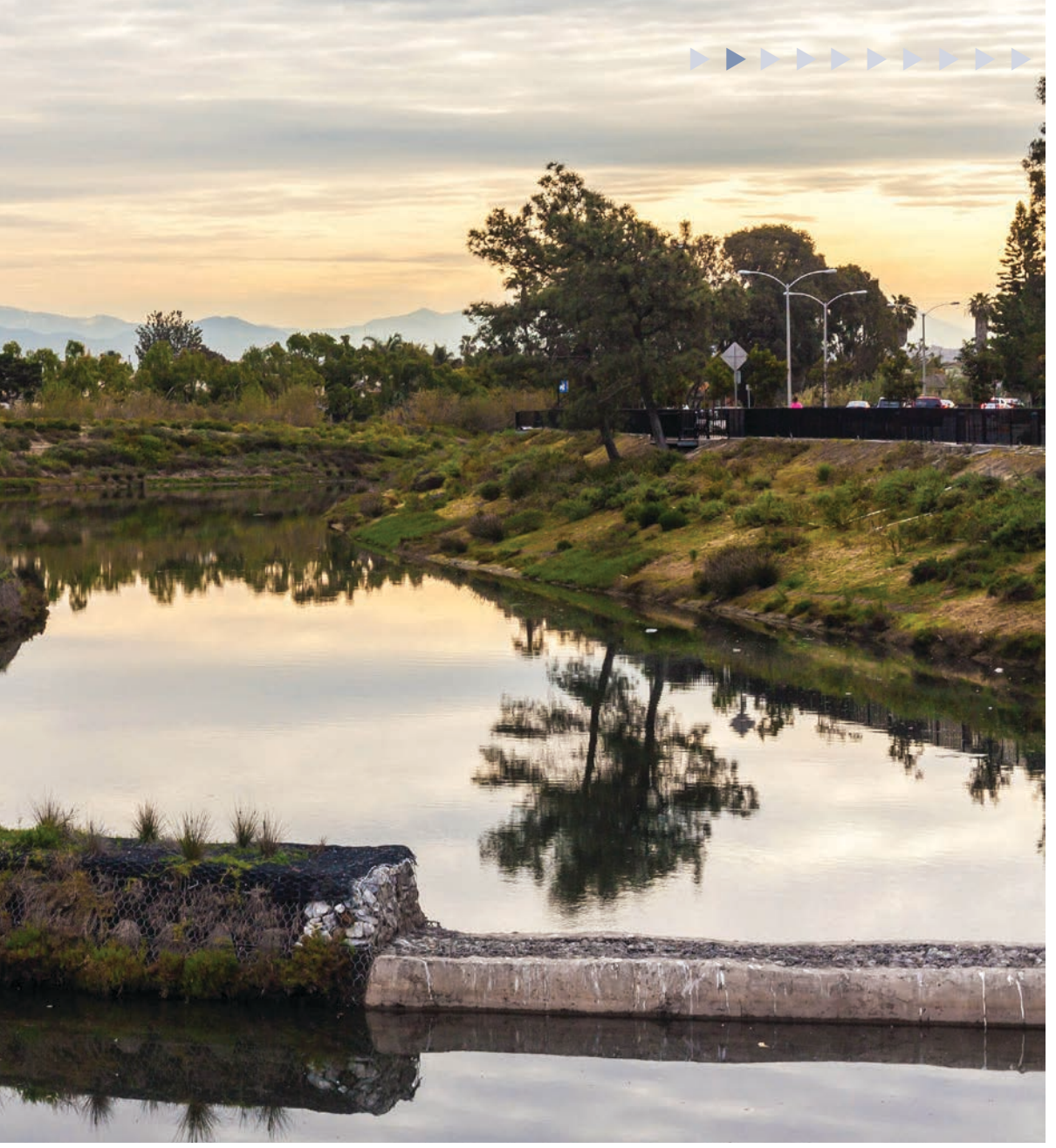


The Oxford Basin in Marina del Rey, Calif., has garnered a self-rating that would place it in the Platinum-level certification. The official verification package for the project is being prepared. Los Angeles County Public Works

Cities and municipalities are increasingly adopting sustainability-focused goals, initiatives, and direct mandates to tackle the myriad challenges they will face in the future and today. Given the criticality and resource intensiveness associated with the operation of water utilities and infrastructure, these agencies are often at the front lines in turning these seemingly unassailable and unquantifiable directives into tangible practices. Many of these agencies are turning to the Envision Sustainable Infrastructure Framework to assist them on this venture.

Urgency for Sustainable Infrastructure

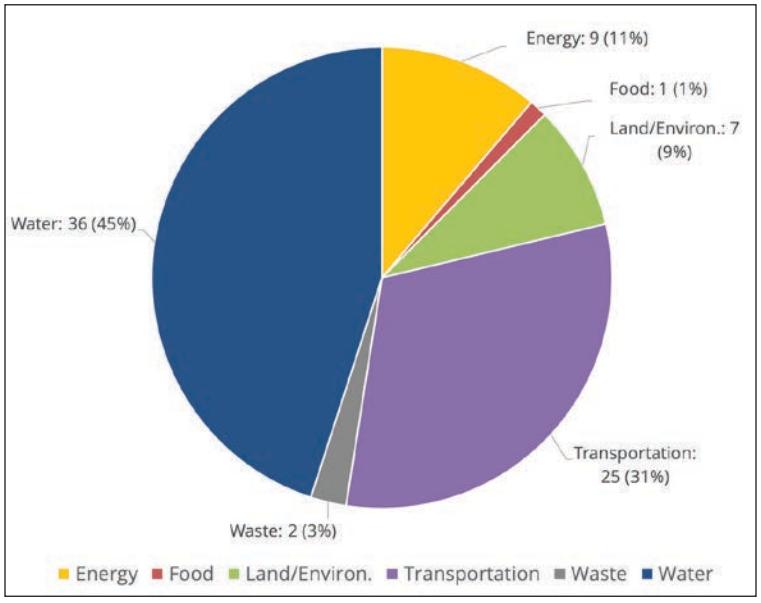
Water infrastructure owners face a multifaceted challenge with the planning, design, and operation of their facilities and assets. The public expects safe and reliable services that will enable their populations and businesses to thrive, all while water facility owners seek to balance affordability with maintaining high levels of service and replacement of assets that have far exceeded their reliable service life. Add sustainability priorities to the mix with capital planning and operations and maintenance, and utilities must examine such criteria as resiliency, energy/carbon reduction, community livability, resource optimization, and planning for uncertain futures.

How can these big picture sustainability challenges be considered within individual pieces of water infrastructure while trying to meet basic operations objectives? These are questions that were asked and answered when the Institute for Sustainable Infrastructure (ISI; Washington, D.C.) developed the Envision framework in 2012.

Envision Overview

While a multitude of sustainability frameworks

Figure 1. Percentage of Total Third-Party Verified Envision Projects by Sector (July 2019)



are available, Envision is the first to comprehensively focus on sustainable and resilient civil infrastructure at all points of its life cycle — planning, design, construction, operation, and decommissioning. The Leadership in Energy and Environmental Design (LEED) program has provided exceptional guidance for sustainable buildings for more than two decades. However, given LEED's focus on inhabited, conditioned spaces, practitioners struggled to beneficially apply its criteria to water infrastructure in the built environment. Envision has filled this gap to help owners enhance sustainability within their culture and infrastructure, all while considering the overall contribution to the community it serves. In the 7 years since its release, it has gained significant traction in major civil infrastructure markets, predominantly in the water sector. (See Figure 1, left.)

Envision is composed of five categories, with a total of 64 individual credits (see the table below) that contribute to a project's triple-bottom-line performance with respect to performance and pathway contributions using the following strategies:

- mitigation hierarchy (avoidance, minimization, abatement, offsetting),
- restoration,
- higher performance (incremental sustainable achievement, project life cycle, stakeholder engagement),
- innovation, and
- education and knowledge sharing.

Anyone can use Envision to identify and implement sustainability features and practices within an organization or within an infrastructure project. ISI offers training for individuals interested in becoming a credentialed Envision Sustainability Professional (ENV SP). Like LEED, Envision provides an optional avenue for third-party verification and award of projects that excel in the use and implementation of elements of sustainability. The levels of recognition are Verified, Silver, Gold, and Platinum, and align with increasing levels of performance.

ISI also recently provided enhancements to Envision with the release of version 3. This version provides an increased focus on the construction

Envision Category Summary

Envision Category	Envision Subcategories	Envision Category Objectives	Number of Credits
Quality of Life	Well-being Mobility Community	Physical, economic, and/or social effects of project on host and affected communities	14
Leadership	Collaboration Planning Economy	Project team engagement, and long-term holistic view of project life cycle	12
Resource Allocation	Materials Energy Water	Quality, source, and characteristics of consumed resources and their effects on the project's sustainability	14
Natural World	Siting Conservation Ecology	Effects on the natural world around a project, including habitats, species, and non-living natural systems	14
Climate and Resilience	Emissions Resilience	Minimization of emissions that contribute to acute and chronic risks, and risk and resiliency measures	10

The Hampton Roads Sanitation District's SWIFT Research Center is predicted to achieve greater than 50% of applicable points in the Envision framework. This score would qualify the facility for Platinum-level certification. HRSD

phase of a project, equity and social justice, life cycle costs, and resiliency. This version also rolled out the Credential Maintenance program, which requires ENV SPs to maintain a reasonable level of continuing education or engagement on projects that include facets of sustainable design.

Value of Using These Principles

Given its expanding adoption and application within many prominent North American municipal water agencies, Envision is a credible vehicle for the identification, implementation, and documentation of sustainability principles throughout the full life cycle of a piece of civil infrastructure. Through its vetting and use, owners have identified a number of benefits, including

- helping put big picture initiatives into action at the project level,
- helping to identify best practices and consistent contract language and approach to every capital project,
- providing a mechanism for tracking and comparative benchmarking of performance,
- providing a framework for robust multi-criteria decision analysis,
- encouraging long-term thinking through resiliency and preparedness principles,
- strengthening interdepartmental coordination,
- increasing transparency for enhanced public confidence and involvement in decision-making, and
- strengthening the overall outcome of planning, design, construction, and operation phases.

Envision in New York City

As the largest combined water and wastewater system in the nation, New York City is in a unique position to advance sustainable infrastructure. The New York City Department of Environmental Protection (DEP) has a legacy of planning for the distant future and, thanks to this foresight, has been able to meet the current challenges of an uncertain climate with innovative solutions.

Inherent to the nature of the work performed, DEP is the second largest greenhouse gas emitter among NYC agencies, and the third largest consumer of energy. Considering the effect DEP has on the environment, the scale of its operations, and its

More than ever before, the current urban landscape motivates designers to place the triple-bottom-line of social, economic, and environmental considerations at the forefront of design.

The Woodstock Park Equalization Tank project in Hampton Roads, Va., includes a 19.7-million L (5.2-million gal) storage tank that will be used to equalize wet weather flows within the collection system. This project is expected to achieve greater than 40% of applicable points under Envision, which could qualify it for Gold-level certification.
HRSD

established practice of planning for a variable future, the department has the opportunity to make significant strides toward a truly sustainable system on a global scale. Water and wastewater utilities are inherently linked to finite natural resources and water, so stewarding this asset responsibly is of utmost importance to DEP. As a public utility, DEP's most important obligation is to the ratepayers. The truly sustainable utility will deliver on the commitment to provide safe drinking water and clean waterbodies, in both the near and long term.

The incentive for meaningful integration of sustainability is being rapidly provided on a citywide regulatory level. More than ever before, the current urban landscape motivates designers to place the triple bottom line of social, economic, and environmental considerations at the forefront of design. Mayor de Blasio's OneNYC and subsequent related local laws expand on the mainly environmental initiatives of Bloomberg's PlaNYC to include heavy emphasis on human rights and a higher quality of life for all New Yorkers. Ambitious environmental objectives, such as an 80% carbon reduction by 2050, are paired with a human element, such as fostering higher percentages of New Yorkers living within walking distance of a park. The city can be seen as a microcosm for the flexibility and adaptability that will be required of America as we prepare the half of the U.S. population living within 80 km (50 mi) of the coast for an indeterminate future.

The New York City local laws that codify OneNYC are valuable external incentives. However, nothing is a more powerful driver than the core mission of DEP: "to be a world-class water and wastewater utility, while building a sustainable future for all New Yorkers." This is the true driver of sustainability as an entity, and what continues to drive DEP's capital program. The external drivers serve as a mechanism to increase the pace of DEP's ongoing investment into becoming a truly sustainable utility in an environment of competing economic needs.

The Bureau of Engineering, Design and Construction (BEDC) is the capital project delivery entity for the agency, developing capital projects for the three main operation bureaus. The Sustainability Section within BEDC serves to integrate sustainable design into each project in DEP's capital plan. This section tailors lofty citywide initiatives into appropriate and effective

Envision adds quantifiable metrics to abstract parameters, and additionally aids the agency in compliance with new regulatory requirements.

A project at the 26th Ward Wastewater Treatment Plant in Canarsie, Brooklyn, N.Y., has affected processes throughout the facility and includes the first green roof on an in-city water resource recovery facility (WRRF). This project also was the first WRRF to receive an Envision certification in the U.S., receiving a Silver Rating. New York City Department of Environmental Protection

methodologies and sets projects up for compliance with all sustainability-related NYC local laws. Local Law 32 of 2016 particularly affects BEDC, with requirements for third-party certification (aka LEED or Envision rating systems) for industrial infrastructure.

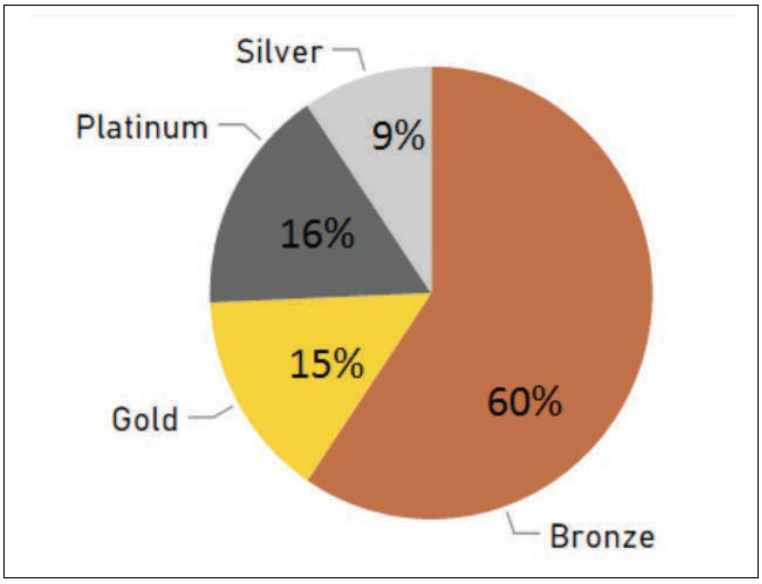
BEDC has adopted Envision to assist designers in placing a quantifiable value to the "intangibles" — things such as community quality of life. DEP infrastructure is, by design, unseen. Pump stations, water resource recovery facilities (WRRFs), and drinking water treatment operations are not open to the public for safety and security reasons. The community should not interact tactilely with this infrastructure; therefore, it cannot be subject to traditional measurements of social impact. Designers as well are challenged to convey the indirect community benefit that can be gained from DEP projects. Visualizing how, for example, a small rain garden project can fit into the abstract concept of the larger community can be difficult and even more challenging to justify during early planning stages when critical design decisions are made. Envision adds quantifiable metrics to abstract parameters, and additionally aids the agency in compliance with new regulatory requirements.

The 26th Ward Wastewater Treatment Plant

The 26th Ward Wastewater Treatment Plant is located on 23.2 ha (57.3 ac) in Canarsie, Brooklyn. The facility, located in the east-central portion of Brooklyn, currently serves a population of approximately 283,400 from a drainage area of 2,390 ha (5,907 ac). The current design dry weather flow is 322 ML/d (85 mgd). Treated and chlorinated effluent is discharged into the Hendrix Street Canal that borders the facility to the east and is tributary to Jamaica Bay.

When the facility set a goal to increase the

Figure 2. Self-assessed Project Award Levels for 124 Public Works Projects



reliability of preliminary treatment at the facility and to improve flow, solids, and grit distribution to the primary settling tanks. The project will include improvements to the primary treatment facilities, pump and blower house, sludge degritting wing, and biological nutrient removal building. This project also will feature installation of the first green roof on an in-city WRRF. This contract was estimated at $134 million. The project completed design in December 2014 and construction completion is targeted at October 2020.

This project received an Envision Silver Rating (30%) under version 2. It was the first WRRF to receive an Envision certification in the U.S., as well as the first DEP project to achieve full third-party accreditation. Goals to incorporate triple-bottom-line initiatives into this traditionally gray infrastructure project included increased durability and energy efficiency, sustainable procurement and reused materials, strategic use of landscaping techniques, installation of a green roof, reduce climate threat, and meaningful stakeholder involvement. Defining the level of public engagement as a key indicator of project success solidified the importance in design and implementation.

The dedication and active decision-making on the part of the project designers resulted in the achievement of 28% of the points in Quality of Life, 66% in Leadership, 14% in Resource Allocation, 26% in Natural World, and 42% in Climate and Risk categories of the Envision framework.

Using the Envision system as a decision-making tool enables the mainly internal and highly technical project be more approachable to the community it is designed to benefit. Additionally, the Envision framework allowed for specific environmental aspects of the project to be better communications and quantified via credits; these aspects include the green roof and resiliency efforts to adapt to climate change. Leaders could see the level of achievement designers aspired to on each credit and ask informed questions about which initiatives were realized.

Envision in Los Angeles County

The County of Los Angeles has been using the Envision framework since 2011 to guide the development and evaluation of public infrastructure projects related to transportation (street widening and reconstruction, bikeways, and interchanges) and stormwater management (retention basins, spreading grounds, and dam retrofits). This encourages interagency communication and creates opportunities for multi-benefit projects that are tailored to fit both the social and infrastructure needs of local communities. This community-based approach to developing sustainable infrastructure supports one of Public Works' strategic plan focus areas which is to "Invest in Community Sustainability" by promoting economically sound, socially desirable, and environmentally healthy projects, programs, and services.

On Aug. 16, 2016, the Los Angeles County Board of Supervisors expanded the use of Envision to include county infrastructure projects and programs related to energy, water, waste, transportation, landscape, and information.

To facilitate this approach, a working group was established to develop the best approaches to incorporate Envision and sustainability into Public Works' processes. Using Envision as a guideline, existing planning, design, construction, and maintenance processes were reviewed to identify opportunities to improve sustainability.

It was determined that the conceptual phase of the project planning process — that is, before the project scope is finalized — is the ideal time to apply Envision. Applying Envision early allows for expanded conversations about sustainability across core service areas and helps maximize a project's benefit to the community.

Public Works also analyzed the design process and developed Sustainable Infrastructure Guidelines to assist designers with incorporating sustainability into new projects. The guidelines are designed around the Envision framework and provide design teams with templates to achieve various levels of sustainability. Because contractors sometimes assist with the design of Public Works projects, there was a need to develop specific contract language

Better infrastructure projects are the result of evaluating the project from economic, social, and environmental perspectives as well as evaluating project alternatives and project components based on their life-cycle costs.

requiring consultants to have Envision credentialed staff — the credential is noted by ENV SP — and discuss their experience using Envision in their proposals. Design consultants also are required to use the Envision framework and the Sustainable Infrastructure Guidelines when developing a Project Design Concept Report.

As part of the implementation effort, Public Works hosted several in-person Envision training classes with customized training material highlighting examples of Public Works projects. Public Works currently has 214 ENV SPs on staff and has internally evaluated 124 projects from across all core service areas using Envision. Approximately 60% of the projects rated qualified for an Envision award level. Of those that qualified, 31% rated Gold or Platinum and 69% rated Silver or Bronze (see Figure 2, p. 62).

Public Works received a Platinum award from ISI for the Sun Valley Watershed Multi-benefit Project in 2014 and a Bronze award for the General William J. Fox Airfield Runway Reconstruction Project in 2018. Three additional Public Works projects have been registered with ISI and will be submitted for verification.

Now that key Public Works staff have been trained on the Envision framework, more projects are being selected to undergo third-party verification with ISI. As project teams go through the exercise of preparing documentation and verification packages, the level of effort needed to verify projects is being tracked to help inform future decisions to submit projects for verification. Agency-wide documentation protocols are also being established along with an online storage solution to facilitate easy retrieval of all sustainability related documentation for preparing Envision verification packages.

Case Study — The Oxford Basin Project

Oxford Basin is a man-made flood control basin located on a 4.05-ha (10-ac) site at the intersection of Washington Boulevard and Oxford Avenue in Marina del Rey, Calif. Built in 1959 to provide flood protection to surrounding communities, Oxford Basin is connected hydraulically to Marina del Rey's Basin E by two underground stormwater conduits. This basin is an essential flood control facility that provides flood protection to the surrounding densely populated, highly developed coastal community. Although designated as a Bird Conservation Area in 1963, the site had minimal habitat value and generally was not perceived as a resource by nearby residents.

The project faced several significant challenges due to the facility's functional needs, the site's location, history, public legacy, and environmental concerns. To address these challenges, the project team adopted sustainability as a core value driving project scoping and design at the earliest stages of project development. The project team was highly proactive in engaging with the community and regulatory agencies, exploring novel solutions to solving the technical challenges of the project and meeting the desires of the community.

Perhaps the most significant project innovation was the decision to consider the site as not just a closed-off flood control facility, but potentially as a significant recreational resource to the community. Instead of simply addressing the basin's flood control functionality, the project was designed using a multi-benefit approach that incorporated as many sustainability elements as possible. These elements included

- a 174-linear-m (570-linear-ft) vegetated berm to enhance circulation and increase water oxygenation within the basin,
- computerized tide gates to better simulate natural tidal exchange,
- removal of more than 2,500 yd^3 of contaminated sediment and soil from within and along the perimeter of the basin,
- three bioswales to treat roadway runoff,
- planting 45,000 native and drought-tolerant trees and plants,
- construction of a 1,067-linear-m (3,500-linear-ft) decomposed granite walking path,
- installation of high efficiency wildlife-friendly lighting, and
- construction of six observation areas with seating and educational signage.

The Oxford Basin Project has been registered

Figure 3. Result SWIFT Research Center Project Envision Evaluation

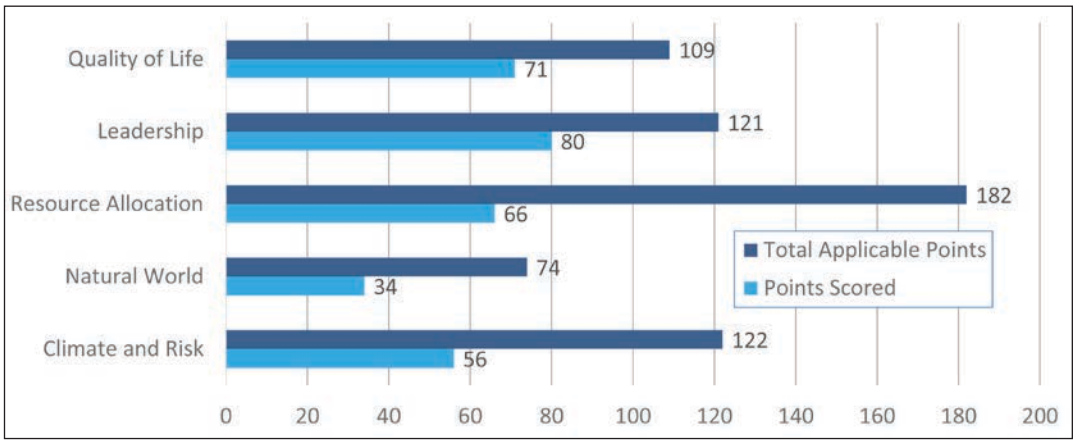
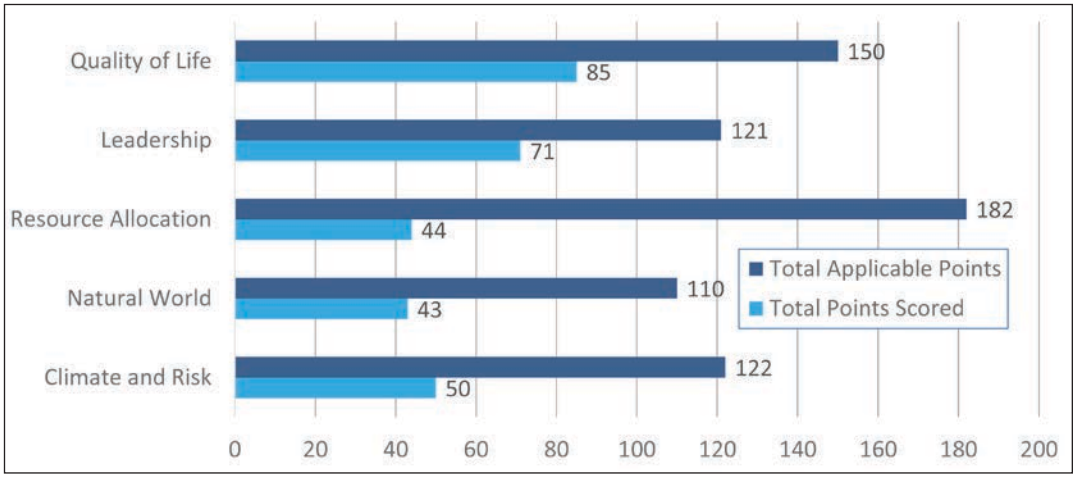


Figure 4. Result Woodstock Park Equalization Tank Project Envision Evaluation



with ISI under Envision version 2 and the verification package is currently being prepared. The initial self-rating of the project achieved 80% of the points in Quality of Life, 50% in Leadership, 15% in Resource Allocation, 77% in Natural World, and 33% in Climate and Risk categories resulting in an overall rating of Platinum.

The project's extensive stakeholder engagement — project-specific community meetings, a project website, on-site fence graphics and construction signage, photo-realistic renderings, and community mailings — contributed directly to the strong ratings in Quality of Life and Leadership categories. Flood control and habitat restoration balanced out the project with high ratings in the Natural World and Climate and Risk categories.

Envision in Hampton Roads Sanitation District

HRSD (Hampton Roads Sanitation District; Virginia Beach, Va.) is the regional wastewater authority serving 1.7 million people within 18 cities and counties in Southeastern Virginia. HRSD's vision is, "Future generations will inherit clean waterways and be able to keep them clean." HRSD's strategic plan includes the following sustainable components:

- Infrastructure – Holistic infrastructure planning that balances social, environmental and economic issues.
- Environmental Impact – Base decisions on reducing our "net environmental impact."

HRSD currently spends $150 million per year and plans to increase this spending to $300 million per year to fund its capital improvement program. HRSD strives to sustainably deliver projects. Many infrastructure projects have a design life far exceeding 50 years, so taking a long-term sustainable approach to the design, construction, and operation of these facilities is an obvious best practice.

To be consistent and develop a common understanding of what sustainability means, HRSD uses the Envision checklist when evaluating and designing projects. This checklist becomes the basis of the sustainability review process and assists the project team in identifying and engaging stakeholders, identifying project risks

and opportunities, and evaluating the project from multiple perspectives. Because project adjustments can be most economically incorporated early in the project design, the first use of the Envision checklist typically occurs sometime after the preliminary engineering phase and before the start of final project design.

The primary goal of utilizing Envision is to plan, design, and construct better infrastructure projects for HRSD, its ratepayers, and its local partners — not to receive accreditation or an award. Better infrastructure projects are the result of evaluating the project from economic, social, and environmental perspectives as well as evaluating project alternatives and project components based on their life-cycle costs. The features of the sustainability review process include

- engage an ENV SP to facilitate the workshop(s),
- include as many project stakeholders as reasonably possible (including external stakeholders when appropriate),
- add value items to the project,
- document decisions made during the workshop, and
- facilitate the discussion of sustainability.

The SWIFT Research Center

The SWIFT (Sustainable Water Initiative for Tomorrow) Research Center is a 3.8-ML/d (1-mgd) aquifer replenishment and public education and demonstration project that will inform HRSD's future, full-scale, 379-ML/d (100-mgd) program. Some of the sustainable features of the project include

- rain water harvesting,
- solar panels,
- extensive public outreach and engagement, and
- pervious pavement.

This project is on track to achieve greater than 50% of applicable points, which could qualify for Platinum level certification. Figure 3 (p. 64) breaks down the estimated scores.

Woodstock Park Equalization Tank

The Woodstock Park Equalization Tank project includes a 19.7-million L (5.2-million gal) storage tank that will be used to equalize wet weather flows within the collection system. The facility is located within an existing city park that features a skate park. Because the tank will require a significant footprint within the park, a new skate park is integrated into the tank and park design. Some of the sustainable features of the project include

- wheeled-sport park integrated into design with community input,
- avoidance of natural areas on south side of site,
- rain harvesting to flush and clean tank interior,
- skylights within tank interior in lieu of traditional lighting,
- educational and interactive utility exhibits inside the park, and
- a green roof to reduce stormwater runoff and heat islands.

This project is on track to achieve greater than 40% of applicable points under Envision. This score would qualify the project for Gold-level certification. Figure 4 (p. 64) describes the predicted scoring.

Use of the Envision framework allows HRSD to validate project decisions and assure the rate payers of Southeastern Virginia that we have invested their money wisely.

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