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FOR SUSTAINABLE INFRASTRUCTURE
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Terminal Island Advanced Water Purification Facility – Los Angeles, California

ENVISION ANALYSIS CASE STUDY

Figure 1: Terminal Island Wastewater Reclamation Plant/Photograph provided by The Walsh Group, 2017

The Zofnass Program at Harvard University
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John Daley, ENV-SP, prepared this Envision analysis case study under the supervision of Judith Rodriguez, ENV-SP as part of the Harvard-Zofnass Program for Sustainable Infrastructure directed by Prof. Spiro N. Pollalis for the purposes of research and education. The analysis serves as a basis for research and class discussion for the development of case studies focused on the business case for sustainable infrastructure. The cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation.

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1. PROJECT DESCRIPTION & LOCATION

The Terminal Island Water Reclamation Plant (TIWRP) is a wastewater treatment plant serving industrial, commercial, and residential users in the city of Los Angeles and operated by the city's Bureau of Sanitation. Built in 1935, TIWRP had originally been designed to discharge treated wastewater into Los Angeles Harbor. In 1977, state regulators ordered the plant to phase out harbor discharges, leading to a two phase renovation by the Bureau of Engineering to turn the plant into a water recycling facility. During Phase 1, completed in 2001, a plant capable of producing 6 million gallons of recycled water per day (MGD) was built, along with a pipeline distribution system. During Phase 2, a 50 million dollar project completed in 2017, the plant's production capacity was increased to 12 MGD of recycled water, and a new and improved method of water recycling was instituted. The water produced is distributed to a number of users in the area as a replacement for imported potable water. Water users include the Dominguez Gap Barrier Project to prevent seawater intrusion into groundwater (8 MGD), Machado Lake for water level augmentation (0.5 MGD), Harbor area for process water (0.5 MGD), and Los Angeles Harbor area for irrigation (0.5 MGD). The new Terminal Island facility marks an important development in the City's goals to recycle all of its wastewater by 2035, use recycled water for useful purposes, and reduce the need for imported potable water.

Today, there are four main wastewater treatment facilities in Los Angeles, which collectively process around 450 million gallons of wastewater per day for four million residents. The newly renovated Terminal Island facility processes 15 million gallons of wastewater per day, while the Los Angeles-Glendale, Donald C. Tillman, and Hyperion plants process on average 20, 80, and 300 million gallons of wastewater per day, respectively. Los Angeles-Glendale and Donald C. Tillman recycle all of the water they process; however they use less advanced methods than TIWRP and produce lower quality water. Hyperion recycles only about 25% of its water. Thus, although TIWRP is an exemplary wastewater reclamation project, it represents just a fraction of the city's wastewater infrastructure.

2. EXECUTIVE SUMMARY OF ENVISION ASSESSMENT

The Terminal Island Water Reclamation Plant in Los Angeles achieved Envision Platinum award from the Institute for Sustainable Infrastructure, earning 54% of applicable credits across all categories and establishing itself as a global leader in wastewater treatment sustainability. While the Envision project evaluation is for phase 2, some aspects of phase 1 were included in the assessment. Thus, the provided documentation is from phase 1 and phase 2.

One of the most important achievements of the TIWRP project is its contributions to quality of life for surrounding communities. The project was designed to align with two major city initiatives, the Mayor's Sustainable City pLAn and One Water LA, which have a strong focus on water conservation and climate resilience. 85% of Los Angeles' water comes from outside Southern California, and water shortages—exacerbated in recent decades by climate change and aquifer depletion—are perhaps the city's biggest threat[1]. By providing a local source of clean

[1] 2016 June 20. Water Reclamation Plants. https://www.lacitysan.org/san.

recycled water for industrial and municipal uses, TIWRP improves the water supply and quality of life for all residents. The project has a positive impact on the local economy as well. For one, the recycled water is cheaper than imported potable water, costing just $287-504 per acre foot, as compared to $706-845 per acre foot for traditional water supplies. Moreover, 11 new permanent jobs were created at the plant, and 323 jobs were supported during construction, a significant percentage of which were filled by local and/or disadvantaged workers. Other ways in which the project benefits the community include negligible operational noise and new educational signage around the facility for public tours.

A key reason for the project's success was strong city leadership, planning, and stakeholder engagement. Guided by an overall goal of sourcing 50% of its water locally by 2035, the City of Los Angeles has made numerous commitments to sustainability. Most notably, the Bureau of Engineering (which oversaw the TIWRP project) and the City Council have formally pledged to incorporate Envision into city project planning, and to pursue verification when financially feasible.

The Bureau's commitment to sustainability manifested itself throughout TIWRP's planning and design process. During the pre-design phase, the project team organized a Technical Advisory Committee of Bureau of Sanitation specialists, area engineering professors, professional engineers, and manufacturers, which led to the identification of a new method of purifying water that surpasses industry norms for cost, chemical use, and effectiveness. During the design phase, regular meetings were held between the Bureau of Engineering, the Technical Advisory Committee, the Bureau of Sanitation (the future operator of the plant), state and city regulatory agencies, and municipal end users of the recycled water. The general public was also engaged in the process through public comment periods and meetings with neighborhood councils and non-governmental organizations. This collaborative approach reduced logistical and regulatory delays, helped the city determine how to best allocate the recycled water, and led to several important design changes in the project. Beyond planning and construction, the project team worked with the construction contractor and equipment manufacturers to plan for long-term monitoring and maintenance and maximize the useful life of the project. TIWRP employees are required to undergo in person training, and the plant has strict water quality standards and maintenance procedures based on regulations and performance goals.

Resource conservation and environmental protection is TIWRP's most salient area of achievement. Phase 2 boosted the plant's production capacity from 6 million gallons per day to 12 million gallons per day while also improving water quality. This water is used by municipal and industrial users for irrigation and cooling, helping to offset potable imported water use and reduce discharges of wastewater into Los Angeles harbor. Most significantly, 7-8 million gallons of the recycled water are sent to the Dominguez Gap Barrier per day to protect the city's groundwater reserves from seawater intrusion. TWRP also uses its own process water to meet operational needs, and directs 100% of on site stormwater to headworks for treatment. To ensure water quality and operational efficiency, TIWRP has systems in place to monitor flow,

chemical additions, equipment status, and performance for every step of water treatment in real time.

Beyond reducing potable water consumption and managing stormwater, TIWRP mitigates its impact on natural resources and the environment in several ways. Thanks to a comprehensive waste management plan drafted during the design phase, the facility diverts 100% of operational waste from landfills: biosolids from primary wastewater are sent to external facilities for land applications and biogas production, and the chemicals used for water treatment are continuously recycled. During construction, over 50% of construction waste was reused or recycled. The plant also made a commitment to buy renewable energy from the utility, achieving a renewable energy portfolio of 36%.

The project team scored highly in the Climate and Risk category as well. The plant is designed to mitigate both short term and long term risks such as rising sea levels, increased storm severity, disruptions to power supply, urban heat island effect, and seismic activity. The plant also has separate and redundant water treatment modules, so that old equipment can be easily replaced or fixed with no disruption to operations.

While many Envision credits did not apply to this project, there are a few areas in which the project could be improved. First, the plant discharges around 4 million gallons of brine solution per day into Los Angeles harbor. This discharge is strictly regulated and not believed to pose a threat to human health, but finding an alternative use for this brine or reducing the discharges should be pursued for the sake of environmental integrity. In addition, the project team could have addressed sustainable procurement practices more thoroughly by assessing the environmental practices and supply chains of the equipment manufacturers.

3. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision V2 system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. In this case study, the infrastructure to be assessed is the Terminal Island Wastewater Reclamation Plant Advanced Water Treatment Project.

Envision consists of 60 credits grouped into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Each credit pertains to a specific indicator of sustainability such as reducing energy use, preserving natural habitat, or reducing greenhouse gas emissions. Those credits are rated on a five-point scale referred to as a 'level of achievement': 'improved', 'enhanced', 'superior', 'conserving', and 'restorative'. Evaluation criteria are provided to determine if the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a specific credit called "Innovate or exceed credit requirements". This is an opportunity to reward exceptional performance that applies

innovative methods within the subjects that Envision evaluates.

The criteria for the levels of achievement vary from credit to credit, but generally an 'improved' level of achievement is awarded for performance that slightly exceeds regulatory requirements. 'Enhanced' and 'superior' levels indicate additional gradual improvement, while 'conserving' often indicates performance that achieves a net-zero or neutral impact. 'Restorative' is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI[2] and Zofnass Program[3] websites.

[2] www.sustainableinfrastructure.org
[3] www.zofnass.org

4. ANALYSIS BY ENVISION CREDIT

QUALITY OF LIFE		
	Terminal Island Advanced Water Purification Los Angeles, California	
QL1.1 Improve Community Quality of Life	**25**	**Restorative**
		The TIWRP project thoroughly identified community needs, incorporated these needs into the design and construction of the project, and significantly improved the city's water infrastructure, thereby attaining the Restorative level of achievement. The project was designed to align with three community initiatives the Mayor's Sustainable City pLAn, One Water LA, and the Odor Control Master Plan. These initiatives, which include goals of increasing locally d recycled water, healthy local watersheds and recreation areas, resilience against climate change, and management of odorous gases, were developed with significant community engagement. In addition, city agencies held meetings with elected officials and the community about the TIWRP project to help decide where the recycled water would be best used. As a result of phase 2, TIWRP was able to provide increased water for local irrigation, pipe water to Machado Lake to maintain water levels, and lower wastewater discharges into the harbor. In turn, water availability, water quality, community aesthetics, and recreational opportunities were enhanced, improving quality of life for local residents and residents of the city of Los Angeles as a whole.
		Mayor Eric Garcetti. City Sustainable pLAn. p. 4-9, 104-105. *City of Los Angeles. Sewer Odor Control Master Annual Report. 2013. p. 5, 23-24.* *City of Los Angeles. One Water LA. 2015. p. 1.1-1.2, 3.1-3.2.* *City of Los Angeles Department of Water and Power and Department of Public Works. Recycled Water Master Plan. 2012. p. 1-25.* *Wilmington Neighborhood Council. 2017. p. 2.* *Environmental Impact Report for Effluent Management Project at Terminal Island Treatment Plant. 1993. p. ES-1.*
		Conserving

QL1.2 Stimulate Sustainable Growth & Development	**13**	Phase 2 of the TIWRP project strengthened sustainable growth and development by creating temporary and long-term jobs, improving local water infrastructure, increasing community attractiveness, and enhancing recreational opportunities. During the design and construction of the project, city engineers logged over 20,000 hours of labor, over $40 million was spent on outside consulting services, and 323 jobs were created for construction. The new and improved water reclamation plant created 11 new long term jobs with the City of Los Angeles Bureau of Sanitation. As mentioned in QL1.1, the TIWRP project was designed in the spirit of existing community initiatives for sustainable growth and development. By increasing the plant's wastewater treatment capacity from 6 million to 12 million gallons of water per day, the city was able to increase water sent to the Dominguez Gap injection wells (which help protect the city's ground water from saltwater intrusion), provide a new source of water to Machado lake, and boost irrigation water availability to surrounding communities. In addition to increasing the water supply, the recycled water is also cheaper than imported potable water ($287-504 per acre foot, as compared to $706-845 per acre foot). Thus, the TIWRP project increases productivity and capacity for local industry, businesses, and residents.
		Mayor Eric Garcetti. City Sustainable pLAn. p. 2. *City of Los Angeles. Sewer Odor Control Master Annual Report. 2013. p. 5, 23-24.* *City of Los Angeles. One Water LA. 2015. p. 1.1-1.2, 3.1-3.2.* *City of Los Angeles Department of Water and Power and Department of Public Works. Recycled Water Master Plan. 2012. p. 1-25.* *City of Los Angeles. UPRS Hours in Planning and Design. 2017. p. 2-10.* *Walsh Construction Company. Project Labor Summary Report. 2017. p. 12.* *Los Angeles Bureau of Sanitation. Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion. 2015. p. 1-1.* *City of Los Angeles Department of Public Works. Machado Lake Ecosystem Rehabilitation. 2009. p. 52.*
		Superior

QL1.3 Develop Local Skills and Capabilities	**5**	The TIWRP project met the city's recommended guidelines for contracting with local business and hiring local and disadvantaged workers during construction, thereby earning a Superior level of achievement. Based on the goals outlined in the Mayor's Sustainable City pLAn, the city's Bureau of Engineering has strong internal policies for local job training and hiring for all their projects. These policies include an 8% bid preference to local businesses, directives to reach out to minorities, women, and disabled-veteran owned businesses during the bidding process, and requirements for 30% of labor hours to be performed by local residents and 10% of labor to be performed by disadvantaged workers (defined as a city resident who is making less than 50% of the area median income and/or facing adverse factors such as homelessness, chronic unemployment, past incarceration, or being a single parent). The TIWRP project exceeded these hiring requirements, and utilized workers at a wide range of skill levels. 31% of workers were local, 29% of hours worked were performed by apprentices, 52% of apprentices were local, and 14% of hours worked were performed by disadvantaged workers. Following project construction, comprehensive training was provided to new and existing plant personnel to provide information on the operations and maintenance of the phase 2 water reclamation process. *Mayor Eric Garcetti. Sustainable City pLAn. p. 2.* *City of Los Angeles Department of Public Works. Bureau of Engineering Strategic Plan. 2015. p. 8-14.* *Walsh Construction Company. Project Labor Summary Report. 2017. p. 12-14.*
QL2.1 Enhance Public Health And Safety	**16**	**Conserving** By thoroughly evaluating risk, adhering to public health and safety standards during construction, rigorously testing the safety of different water purification methods, and instituting operations and maintenance training for plant operators, TIWRP achieved a Conserving level of achievement. Following the city's Bureau of Engineering guidelines, the project team held a pre-construction safety conference to establish an illness and injury prevention program. In turn, site-specific safety measures were required of all contractors on the project. With regards to the water purification technology, the project team tested six different methods of advanced oxidation processes for treating water and concluded that a combination of ultraviolet light and sodium hypochlorite exceeded water reuse regulatory standards, lowered chemical use as compared to traditional methods, and did not pose a threat to human health and safety. The project was subsequently approved by the California Division of Drinking Water and the California Regional Water Quality Control Board. Lastly, the project team updated the plant's standard operating procedures

		with policies and mitigation measures related to the new water purification process.
		City of Los Angeles Bureau of Engineering. Master General Requirements. 2014. Section 01311. *City of Los Angeles Bureau of Engineering. Preconstruction Safety Conference. 2015.* *City of Los Angeles Bureau of Engineering. Environmental Review. 2009.*
QL2.2 Minimize Noise And Vibration	**8**	**Conserving**
		The TIWRP project achieved Conserving for this credit by completing noise and vibration assessments and implementing effective mitigation and monitoring methods. The County of Los Angeles Noise Control Ordinance bans construction between the hours of 9pm and 7am, and on Sundays. It also sets an exterior noise limit of 70 dBa during operation in industrial areas, where the TIWRP is located. As per this ordinance, the project conducted noise studies and found that moderate noise impacts will result from construction, and no significant noise impacts will result from operation. The project also required contractors to test equipment noise and vibration levels prior to and during construction to ensure compliance. The main noise and vibrational concern of this project was with regards to the construction of pipeline near residential areas. To mitigate these impacts, the project team committed to using newer equipment, using equipment noise controls, minimizing revving, eliminating unnecessary revving, and not using pile drivers.
		City of Los Angeles Bureau of Engineering. Master Specifications. 2008. Section 15020. *City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p46-48.*
		Conserving

QL2.3 Minimize Light Pollution	**8**	The TIWRP project successfully completed a lighting needs assessment, reduced unnecessary lighting, and minimized upward directed light, thereby earning a score of Conserving. Following Bureau of Engineering standards, the TIWRP project completed a lighting assessment to ensure its interior and exterior lighting was in compliance with city limits. Due to the 24 hour a day operations of the water treatment facility, adequate visibility is required at all times for employees to operate and monitor the equipment. To reduce energy requirements, the team used solar powered LED light fixtures. Lastly, a canopy over the entire treatment facility helped to minimize light pollution.
		City of Los Angeles Bureau of Engineering. Master Specifications. 2008. Section 16370. *City of Los Angeles Bureau of Engineering. Terminal Island Lighting Plan. 2016. p. 9-43.*
QL2.4 Improve Community Mobility And Access	**1**	**Improved**
		TIWRP met the Improved level of achievement because it performed assessment studies on the effects of its project on community mobility and coordinated with different city departments to minimize construction and traffic impacts during construction. According to the assessment, there were no effects to public transportation or roadways outside the facility because the phase 2 renovation was localized to the interior of the existing facility. However, there was a small increase to local congestion as a result of construction vehicle traffic (roughly 18 construction vehicles per day). The contractor also coordinated with facility staff to minimize the effects of construction on daily operations. In addition, the TIWRP project sought to minimize the disruption caused by adding new water pipelines. In particular, the Los Angeles Department of Public Works coordinated with the Harbor Department to schedule pipeline construction on streets where the Harbor Department was already working. The TIWRP project could have achieved a higher level of achievement for this credit by mitigating construction mobility impacts beyond industry norms.
		City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p44. *Port of Los Angeles. Memorandum of Understanding Between DWP and the PortLA. 2010.*
QL2.5 Encourage Alternative Modes of Transportation	**0**	**Not Pursued**
		Enhanced

QL2.6 Improve Site Accessibility, Safety & Wayfinding	**3**	The TIWRP implemented a variety of signage strategies to allow visitors and plant personnel to easily navigate the facilities, and the project team also implemented detailed plans for emergency situations. The signage at the new plant includes posters in front of each major treatment process and floor signs to help users understand and navigate the facility. The project also crafted a thorough emergency response plan. This plan includes designated evacuation areas, responsibilities of plant personnel in the case of emergency, and plans to review safety plans annually. The safety plan will also be proactively distributed to all relevant emergency agencies in the area. Given the plant's location in an industrial area, the project was inherently limited in its ability to make a positive impact on public safety, local communities, and cultural resources,a higher level of achievement would require the project to promote walkablity, install bike lanes, or improve traffic safety in its surroundings.
		Walsh Construction. AWPF Visitor Experience Submittal Package. 2017. *Los Angeles Bureau of Sanitation. TIWRP Emergency Response Procedure. 2016.*
QL3.1 Preserve Historic And Cultural Res	**N/A**	**Not Applicable**
QL3.2 Preserve Views And Local Character	**0**	**No Level**
		Through its Final Environmental Assessment and California Environmental Quality Act paperwork, the project was deemed to pose no threat to local character and scenic viewsheds. The project was also reviewed by city architects and determined to be exempt from a review by the Department of Cultural Affairs. However, the verifier believed the credit was still applicable, and gave a score of No Level. Given the project's location in a highly industrial and municipal area, there were few, if any, opportunities to achieve natural and historic preservation goals.
		City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. P52. *Department of Buildings and Safety. Application for Building Permit and Certificate of Occupancy. 2013.*
		Superior

QL3.3 Enhance Public Space	**6**	The TIWRP renovations made a previously inaccessible, industrial facility more open to visitors and the general public, thereby earning a Superior level of achievement. As per internal city guidelines, the project was required to assess its impact on public space. The TIWRP facility is located far from any notable parks, plazas, or pedestrian walkways, and the facility is a restricted access zone. However, the facility does offer tour to the public by reservation. As part of the renovation, the project team came up with a plan to significantly improve these tours by adding educational signage throughout the facility. In addition, the Los Angeles Bureau of Sanitation has budgeted for a 10,000 square foot learning center at the plant in the next ten years to further educate the public about water recycling.
		City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p51. *Mia Lehrer and Associates. Enhancing the Public Experience on Terminal Island Concept Package. 2015.* *LA Bureau of Sanitation. Wastewater Capital Improvement Program. 2017. p. 332.*
QL0.0 Innovate Or Exceed Credit Requirements	**N/A**	*Not Pursued*
	85	

LEADERSHIP		
	Terminal Island Advanced Water Purification Los Angeles, California	
		Superior

LD1.1 Provide Effective Leadership And Commitment	**9**	Following the vision and plans of the City of Los Angeles, all members of the project team made explicit commitments to environmental, economic, and social sustainability throughout every stage of the project, thereby meeting the standard of Superior. As mentioned previously, the City of Los Angeles is working to position itself as a national leader in sustainability, and sustainability commitments have been made in every city department. Moreover, the Bureau of Engineering and the city council formally pledged to incorporate Envision into city projects where applicable via a 2016 motion. Currently, more than 50 Bureau of Engineering employees are Envision Certified Sustainability Professionals (ENV-SPs). With regards to the TIWRP project specifically, numerous statements, commitments, and plans have been made by the Bureau of Engineering, Bureau of Sanitation, and participating contractors in support of sustainability (see "sources"). Chartering sessions were also held among all project participants to discuss sustainability expectations. The TIWRP project is one of several strategies the city has to source 50% of its water locally by 2035. To achieve Conserving, significant other members of the project team (such as Carollo Engineering and Walsh Construction) would have needed to demonstrate the same level of commitment to sustainability as the Bureau of Engineering.
		Mayor Eric Garcetti. Sustainable City pLAn. p. 2. *Mayor Eric Garcettti. Executive Directive No. 7. April 8, 2015.* *City of Los Angeles Bureau of Sanitation. Strategic Plan 2015/16-2020/21* *City of Los Angeles. Public Works Bureau of Engineering. Strategic Plan.* *Joe Buscaino, Councilmember. Los Angeles Envision Motion. October 18, 2016.* *Los Angeles Department of Public Works. Recycled Water Master Planning. 2012. p. 1-22.* *Carallo Engineers, Inc. Sustainability at Carallo. 2018.* *Walsh Group. Sustainability in Services. 2018.* *Parsons. 2018 Corporate Social Sustainability Report. 2018. p.7.* *Stantec. 2017 Sustainability Report. 2017.*
LD1.2 Establish A Sustainability Management System	**0**	**Not Pursued**
		Superior

LD1.3 Foster Collaboration And Teamwork	**8**	The TIWRP project featured extensive collaboration between city agencies, project designers, and contractors throughout the planning, design, and construction, thereby meeting the Superior level of achievement. Interdisciplinary collaboration is written into the Bureau of Engineering's Project Delivery Manual, and the TIWRP project provides a perfect example. During the pre design phase, a Technical Advisory Committee of the Bureau of Sanitation specialists, area engineering professors, professional engineers, and manufacturers tested six different processes to identify the best methods for the new plant's advanced oxidation process. Several meetings between the Technical Advisory Committee and the project team were held. During the design phase, regular meetings were held between the Bureau of Engineering's Environmental Engineering Division specialists (the design team) and the Bureau of Sanitation (the plant owner and operator). By ensuring that the future plant operator was closely engaged from the start of the project, the design team ensured that the plant operator would be satisfied with the final product, and ensured a smoother transition from the end of construction to the beginning of operation. The design team and Bureau of Sanitation also held general meetings with contractors, larger city agencies, city inspectors, and equipment manufacturers to discuss the project as a whole. During construction, weekly meetings were held between Walsh Construction, the design team, the Bureau of Contract Administration, and the Bureau of Sanitation.
		City of LA Bureau of Engineering. Project Delivery Manual. 2012. *City of Los Angeles Bureau of Engineering Environmental Engineering Division. Weekly Design Meetings. 2013.* *Creative Alliance Group. General Partnering Workshop, TIWRP Expansion Project. March 15 2016.* *City of LA Environmental Engineering Minutes. Construction Progress Meetings. 2015-2017.*
		Conserving

LD1.4 Provide For Stakeholder Involvement	**14**	The TIWRP project engaged stakeholders from city departments, regional agencies, regulatory bodies, and the general public throughout the project planning and decision making process, earning a Conserving level of achievement for this credit. Following the Bureau of Engineering's Project Delivery Manual, a specific list of key stakeholder groups and the rationale for selection was drawn up in the early stages of the project. This included Los Angeles citizens (the end users of the wastewater system), the City of LA Department of Public Works--Bureau of Sanitation (the owner and operator of the finished treatment plant, responsible for sourcing the water entering the facility, overseeing the treatment process, and distributing the treated water), the City of LA Department of Water and Power (which owns and operates the Dominguez Gap Barrier Project, a complex groundwater protection project that uses recycled water from TIWRP), the Water Replenishment District of Southern California (the state agency that manages groundwater basins in the LA area and purchases recycled water for the Dominguez Gap), State Water Resources Control Board (which regulates groundwater and surface water quality), the Los Angeles Regional Water Quality Control Board (which regulated discharges to groundwater and surface water), and the Port of Los Angeles (which leases the TIWRP land to the Bureau of Sanitation). During the planning stages of the project, the project team engaged with these stakeholders in several ways. Before phase 1, the project team drafted an environmental impact report in 1993 to comply with the California Environmental Quality Act, and a Final Environmental Assessment in 1999 to comply with the National Environmental Policy Act. These reports involved engagement with the regulatory agencies listed above, and it also included a 37 day public comment period. Prior to phase 2, the Bureau of Engineering wrote a Recycled Water Master Plan, which included plans for the TIWRP phase 2 renovation. This master plan involved significant outreach to neighborhood councils, non-government organizations, and business groups. During the design and construction process, the Bureau of Engineering interfaced extensively with the Port of Los Angeles to get construction permits, and the LA Department of Public Works--Bureau of Sanitation to coordinate the integration of the new plant into the city's sanitation infrastructure. As mentioned in LD1.3, several meetings were held between the Bureau of Engineering, Bureau of Sanitation, and the Technical Advisory Committee to decide on the best process for advanced water purification. The design team also held workshops with a broader array of city and state agencies to keep these stakeholders informed. Additional presentations to the public were also held during this time. The high degree in stakeholder engagement resulted in many tangible improvements to the project. For example, following comments about the Environmental Impact Report from the California Department of Fish and Game and Heal the Bay (a public group), the discharge point for the plant was moved to minimize impacts to shallow water habitat. During another meeting, the LA Department of Water and Power expressed concern about the resiliency of the local recycled water system, which led to a backup 10,000 gallon hydropneumatic tank being included in the design to mitigate changes in system water pressure. *City of LA Bureau of Engineering. Project Delivery Manual. 2012.* *City of LA Department of Public Works. Environmental Impact Report. 1993. p. 2.10-4.7.* *City of Los Angeles Department of Water and Power and Department of Public Works. Recycled Water Master Plan. 2012. p. 1-25.* *Port of Los Angeles. Coastal Development Permit. 2013. p.1-4.* *LA Bureau of Sanitation. LASAN Neighborhood Council Day Presentation. 2013.* *LA Department of Public Works. DWP Surge Tank Evaluation. 2015.*
LD2.1 Pursue By-Product Synergy Opportunities	**0**	**Not Pursued**

LD2.2 Improve Infrastructure Integration	**7**	**Superior**
		Phase 2 of the TIWRP was designed to integrate with the city's existing water infrastructure while also improving water supplies and enhancing community areas, thus earning the project a Superior level of achievement. Phase 2 doubled the amount of recycled water available for reuse. In turn, the project team worked with a diverse array of municipal, public, and private stakeholders to best allocate the new water source and build distribution pipelines. Many external infrastructure projects and users have benefitted from TIWRP recycled water, including the Dominguez Gap Barrier project, Machado Lake, local industry, and local irrigation systems. In addition, the project team worked to optimize the plant and pipeline designs to allow for future Port of Los Angeles construction plans.
		Los Angeles Bureau of Sanitation. Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion. 2015. p. 1-1. *City of Los Angeles Department of Water and Power and Department of Public Works. Recycled Water Master Plan. 2012. p. 1-25.* *LA Department of Water and Power and Department of Public Works. TIWRP Barrier Settlement and Non-Potable Reuse Concept Report. 2012.*
LD3.1 Plan For Long-Term Monitoring & Maintenance	**10**	**Conserving**
		The TIWRP project's comprehensive long term monitoring and maintenance plan earned it a score of Conserving for this credit. Following Bureau of Engineering guidelines, the project team started established goals for long term monitoring and maintenance during the early stages of project planning, and finalized these plans with the contractor during construction. The LA Bureau of Sanitation (the future operator of the plant) was involved throughout this process. The final plan from the Bureau of Sanitation establishes design parameters, water quality limits, maintenance procedures, and plant personnel training standards based on state regulations, manufacturer instructions, and performance goals. Training prior to the opening of the plant will include in-person training from equipment vendors, contractors, and city officials, and other specialists. During operations, the plant is required by state law to submit monthly, quarterly, and annual compliance reports to (1) ensure the quality of the recycled water being distributed to end users and (2) monitor discharge of brine into the harbor. Funding for the plant's staff, operations, and maintenance is comprehensively addressed in the Bureau of Sanitation budget.
		City of LA Bureau of Engineering. Project Delivery Manual. 2012. *LA Bureau of Engineering. Engineering Report. p. 2.6-14.10.* *LA Bureau of Sanitation. Operation Optimization Plan. 2016.*
		Conserving

LD3.2 Address Conflicting Regulations & Policies	**8**	The TIWRP thoroughly assessed wastewater regulations, exceeded regulatory standards by developing a cheaper, more environmentally friendly way to recycle wastewater, and developed new end uses of recycled wastewater. Therefore, it earned a perfect score of conserving for this credit. The City of Los Angeles and other TIWRP stakeholders have been heavily involved in the development of California water recycling regulations for over three decades. In 1977, the Los Angeles Regional Water Quality Control Board ordered TIWRP to cease wastewater discharges into the harbor and develop an alternative water management process. Rather than turning to traditional solutions, the City opted to develop an advanced treatment facility, with the goal of eventually reusing 100% of the recycled water locally. This alternative proposal was accepted by the water quality control board in 1994, exceeding regulatory requirements at the time. Following phase 1 of the TIWRP expansion project, the project worked with regulators to gain permitting for injecting recycled water into the Dominguez Gap Barrier, a groundwater protection strategy overseen by the Department of Public Works. Phase 1 was able to offset potable water use in the Dominguez Gap by 50%, by sending 6 million gallons per day to the site. During Phase 2, under the purview of the California Division of Drinking Water, the LA Bureau of Sanitation, the Bureau of Engineering, and the Technical Advising Committee developed a new and improved method of advanced wastewater treatment that was cheaper and used fewer chemicals. The TIWRP ultimately achieved full advanced treatment* as defined by California regulations, and a new permit was granted that allowed the Dominguez Gap to use 100% recycled wastewater. This new permit was the first of its kind and marked a significant advancement in the field of wastewater treatment. *Full advanced treatment, defined by the State Water Resources Control Board, includes comprehensive limits on microorganisms, contaminants, pH, heavy metals, and other water criteria.
		City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p.15. *California Regional Water Quality Control Board Los Angeles Region. Waste Discharge and Water Recycling Requirements for Harbor Water Recycling Project--Dominguez Gap Barrier Project. 2010. P.1-5.* *Bureau of Sanitation and Bureau of Engineering. TIWRP AWPF Ultimate Expansion Review Meetings with CDPH and TAC. 2013-2014.*
		Conserving

LD3.3 Extend Useful Life	**12**	The project team designed phase 2 of TIWRP to be durable, adaptable, and resilient, extending the useful life of the plant and the city's water infrastructure as a whole. It earned a perfect score of conserving for this credit. The project team used a variety of strategies during the planning and design stage to reduce future maintenance. Although the stated goal of phase 2 was to install a new advanced oxidation process for water purification, the project team evaluated each unit in the entire water treatment process. This led to several key updates and additions to phase 1 infrastructure (which supplies partially treated water to phase 2 systems). Additionally, a new Distributed Control System integrating phase 1 and phase 2 systems was implemented, facilitating long term operations of the facility. On the recommendation of the Department of Water and Power, a 10,000 gallon hydropneumatic tank was added to the design to buffer against sudden pump shutdowns and other adverse unexpected events. Moreover, the new advanced oxidation process developed for phase 2 was cheaper and used fewer chemicals than industry standards, boosting the future economic resiliency of the project. For every system, specific implementation elements were included in construction contracts. The project placed an emphasis on future expansion and improvement of wastewater recycling infrastructure. Each system in the wastewater treatment plant is separated to allow for easy replacement with newer, more sustainable future technologies as they arise. The project team also identified many future uses for the recycled water (including the Dominguez Gap Barrier, Machado Lake, irrigation, a power plant, and harbor area industrial uses), and designed new water distribution networks to accommodate expansion. At a broader level, the TIWRP is part of a long term city-wide effort to improve water infrastructure for the future. The City of Los Angeles' Recycled Water Master Planning documentation offers an evaluation of the potential cost savings for the City resulting from various recycled water projects, including TIWRP. Several different economic analyses show that increasing the use of recycled water in the city offer substantial cost savings when compared to imported potable water.
		City of Los Angeles Department of Water and Power and Department of Public Works. Recycled Water Master Plan. 2012. p. 1-25. *LA Bureau of Engineering. TIWRP Improvement Projects. 2017. Work Orders 5236, 5229, 5171, 5240, 5239.* *Los Angeles Bureau of Sanitation. Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion. 2015. p. 3.8-3.24.*
LD0.0 Innovate Or Exceed Credit Requirements	**N/A**	Not Pursued
	68	

RE ALLOCATION		
	Terminal Island Advanced Water Purification Los Angeles, California	
RA1.1 Reduce Net Embodied Energy	**0**	**Not Pursued**
RA1.2 Support Sustainable Procurement Practices	**0**	**No Level** Although the project team attempted to earn credit for RA1.2, no level of achievement was awarded because procurement programs were insufficient to ensure that materials and products were coming from manufacturers with sustainable practices. City of Los Angeles guidelines encourage a triple bottom line approach to sourcing materials for all city projects, and the project team did make a strong effort to meet these goals. For example, project guidelines were put in place to ensure that all equipment for the project met standards for durability, energy efficiency, and reduced water use. In addition, the project team sourced materials from manufacturers with overarching commitments to environmental sustainability, supply chain management, and human rights. However, these policies do not fully address sustainable procurement. As defined in credit RA1.2, manufacturers must have environmental management systems consistent with ISO14001 or equivalent, but internal project team policies only required manufacturers to have ISO 9001 certification--a measure of quality, not sustainability. Only two of the five manufacturers (Evoqua and Xylem) were listed as having ISO 14001 certifications in the documentation. The documentation of corporate-level sustainability goals included in the documentation for all the companies is high-level and non-binding, so it does not meet envision standards.
		Mayor Villarigosa. Executive Directive 10 Sustainable Practices in the City of Los Angeles. 2007. *City of Los Angeles Supply Services Division. Los Angeles Suppliers Guide. 2017. P.8-9.* *Evoqua. Sustainability Summary. 2015. p.8-19.* *Doosan. Sustainability Report. 2011. p.26-64.* *Xylem. Sustainability Report. 2015. p.1-64.* *Honeywell. Our Quality and Environmental Commitment. p.1-17.* *Rockwell/Allen-Bradley. Corporate Sustainability Report. 2016.* *Global-Mark. Evoqua Water Technologies ISO 9001-2008 Certification. September 11 2015.* *Global-Mark. Evoqua Water Technologies ISO 14001-2004 Certification. October 17 2014.* *Perry Johnson Registrars. Doosan Hydro Technology ISO 9001-2008 Certification. March 18 2015.* *DNV-GL. Xylem Europe ISO 9001-2008/14001-2004 Certification. December 31*

		2016. *Interek. Honeywell Process Certifications ISO 9001-2008 Certification. December 24 2016.* *DNV-GL. Rockwell ISO 9001-2008 Certification. May 17 2016.*
RA1.3 Used Recycled Materials	**0**	**Not Pursued**
RA1.4 Use Regional Materials	**0**	**Not Pursued**
RA1.5 Divert Waste From Landfills	**11**	**Conserving** The TIWRP project developed cutting edge practices for reducing and diverting 100% of operational waste, thus earning a Conserving Level of Achievement. During the design process, the project team came up with a management plan that identified the categories and amounts of operation waste, and developed strategies for reduction, reuse, and recycling. The biosolids removed from wastewater are sent to sludge handling facilities before being used for energy production, composting, and land application. All chemicals used for water treatment are recycled within the plant, and thorough safety policies are in place to mitigate unlikely spills. The only waste resulting from the project is a brine solution that is discharged into the harbor. This discharge is heavily regulated and does not pose a significant threat to human health or the environment. Overall, the TIWRP project reuses operational waste in creative and beneficial ways, safely recycles its chemicals, and sends zero operational waste to landfills. *City of LA Bureau of Sanitation. Operations Optimization Plan. 2016. p.10-1.* *California Regional Water Quality Control Board. Discharge to Los Angeles Harbor via Outfall 001. 2015.* *City of LA Bureau of Sanitation. TIWRP Hazardous Materials Business Plan. 2014.*
		Enhanced

RA1.6 Reduce Excavated Materials Taken Off Site	**4**	The project team met the criteria for Enhanced for this credit. During planning and design, it was estimated that 13,025 cubic yards of material would need to be excavated during construction. Working with the contractor, the project team identified ways to use 70% of excavated soil on site, minimizing the cost and environmental damage of transporting soil to and from the site.
		City of LA Bureau of Engineering. Specifications for Terminal Island Water Reclamation Plant. 2014. Section 02310.
RA1.7 Provide for Deconstruction & Recycling	**8**	**Superior**
		The project team met the superior level of achievement by considering end of life deconstruction in its planning and designing a majority of the project's components to be recyclable. Following Bureau of Engineering Guidelines, the project team completed an inventory of total materials during the design phase and analyzed each material for recyclability. Based on cost, the project achieved a 53% rate of recyclability. In addition, the renovated water treatment plant was designed to be flexible to future improvements in technology. Each step of the water treatment plant is separate and redundant to allow for easy maintenance and installation of replacement parts without disrupting performance.
		City of LA Bureau of Engineering. Master Specifications. 2014. Section 01572. *City of LA Bureau of Engineering. Terminal Island Advanced Water Purification Facility Ultimate Expansion Materials Summary. 2018.*
RA2.1 Reduce Energy Consumption	**0**	**Not Pursued**
RA2.2 Use Renewable Energy	**6**	**Enhanced**
		The TIWRP project earned an Enhanced level of achievement for sourcing 36% of its power from renewable sources. The TIWRP purchases power from the LA Department of Water and Power (LADWP). Due to state policies, the LADWP has to source 29% of their energy from renewable sources. In addition, TIWRP made commitments to expand the LADWP's renewable energy program by paying extra to source 10% of their power from completely renewable sources. With 90% of TIWRP's power coming from the LADPW standard power source (29% renewables) and 10% coming from the green power program (100% renewable), the TIWRP achieved an overall renewable energy portfolio of 36%.
		Los Angeles Department of Water and Power. Road to Renewables. 2017. *Los Angeles Department of Water and Power. Electric Charges for 445 Ferry St, San Pedro CA. Jan 5 2017.*
		Enhanced

RA 2.3 Commission & Monitor Energy Systems	**3**	The project team designed thorough commissioning procedures for all components of the facility, thereby earning an Enhanced level of achievement. The general requirements to the contractor included the testing of every new component of the renovation to verify performance and energy efficiency as according to manufacturer standards.. Training manuals for plant employees describing operations and maintenance for each system are included as well. The project could have earned higher levels of achievement by including formal training programs for plant staff, and by incorporating advanced monitoring features covering at least 80% of energy usage.
		Los Angeles Bureau of Sanitation. TIWRP AWPF Section 01810 Fundamental Commissioning Requirements. 2014.
RA3.1 Protect Fresh Water Availability	**21**	**Restorative**
		TIWRP uses negligible fresh water resources and actively replenishes ground and surface waters, thereby achieving a perfect score of Restorative for this credit. Water use during construction was negligible, and primarily for worker sanitation and consumption. During operations, the plant also uses very little potable water because it is designed to use its own process water for cooling, washing, and other needs. As mentioned previously, the approximately 12 million gallons per day (mgd) of recycled water produced by TIWRP also helps protect and enhance water resources. The Dominguez Gap Barrier groundwater protection project receives 7-8 mgd, which helps protect city groundwater supplies from saltwater intrusion. Machado Lake receives 0.5 mgd, fortifying ecosystem water levels and enhancing public space and aquatic recreational opportunities. The TIWRP is a crucial component of Los Angeles' long term plans to reduce imported water use, protect groundwater, and increase usage of recycled water.
		Mayor Eric Garcetti. Sustainable City pLAn. p. 4-9, 104-105. *City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p46-48.* *Los Angeles Bureau of Sanitation. TIWRP AWPF Section 02510 Water Distribution. 2014.*
		Restorative

RA3.2 Reduce Potable Water Consumption	**21**	Due to its negligible potable water consumption and significant water recycling capabilities, the TIWRP meets the Restorative level of achievement. As mentioned in RA2.2, TIWRP reuses its own process water to meet its operational water needs. This water is then cycled through the plant again. The only use of potable water during operations is for employee consumption and for emergencies. In addition, TIWRP enhances water supplies. Prior to the phase 2 renovation, the plant was only able to recycle 6 million gallons of water per day, and discharged up to 7.5 million gallons of treated water to the ocean. With the new advanced water treatment facility, 12-13 million gallons of water are recycled per day, and the plant's discharges of treated wastewater into the ocean have been eliminated. TIWRP offsets potable water consumption by providing recycled water to a variety of users for non-potable uses. The Dominguez Gap Barrier and Machado Lake are the primary users of the water, and plans are in place to use the recycled water for industrial processes, power stations, parks, and golf courses.
		Los Angeles Bureau of Sanitation. TIWRP AWPF Section 01810 Fundamental Commissioning Requirements. 2014. *Los Angeles Bureau of Sanitation. TIWRP AWPF Section 02510 Water Distribution. 2014.* *Los Angeles Department of Water and Power, CDM Smith. Non-Potable Reuse Master Planning Report. 2012. p.5-12.*
RA3.3 Monitor Water Systems	**11**	**Conserving**
		The TIWRP monitors its water systems using manual protocols and cutting edge automated technology, thereby earning a Conserving level of achievement, the highest score for this credit. The Bureau of Engineering is in the process of working with Honeywell International to implement a new distributed control system, called Los Angeles Wastewater Integrated Network System, which will provide real time monitoring of all of its facilities. For the TIWRP, systems are in place to monitor flow, chemical additions, equipment status, and performance for every step of operations (namely: microfiltration, reverse osmosis, and UV/HOCl oxidation). In turn, all valves and control panels are well labeled and easily accessible to employees in order to quickly respond to any issues pertaining to water quality or quantity. The project team also planned an extensive testing schedule and sampling protocol to ensure the recycled water meets regulatory requirements for water treatment following construction. During operations, the plant is required by state law to submit monthly, quarterly, and annual compliance reports to (1) ensure the quality of the recycled water being distributed to

		end users and (2) monitor discharge of brine into the harbor. Real time monitoring will also allow operators to deliver primary potable water instead of TIWRP recycled water to end users if major problems arise in the facility.
		Los Angeles Board of Public Works. Motion for new control system. December 12, 2011. *City of LA Bureau of Sanitation. Operations Optimization Plan. 2016. Section 13.* *California Regional Water Quality Control Board. Waste Discharge and Water Recycling Requirements issued to Terminal Island Water Reclamation Plant. 2016. p.3-22.*
RA0.0 Innovate Or Exceed Credit Requirements	**2**	For credit RA1.5, TIWRP achieved a perfect score of conserving by diverting 100% of operation waste from landfills. In addition, due to the project team's commitment to reducing construction waste, the TIWRP plant achieved 2 innovation points for this category. Following City of LA goals and Bureau of Engineering guidelines, the TIWRP project team assessed construction waste streams prior to beginning construction and analyzed different strategies for on-site and off-site reuse and recycling. Working with the contractor, the project team was able to divert over 50% of construction waste from landfills. The Bureau of Engineering standards, which require waste management plans, diversion calculations, and minimum diversion requirements, represents a scalable solution to future Bureau of Engineering projects and projects of other city agencies.
	87	

NATURAL WORLD		
	Terminal Island Advanced Water Purification Los Angeles, California	
		Not Applicable

NW1.1 Preserve Prime Habitat	**N/A**	
NW1.2 Preserve Wetlands and Surface Water	**N/A**	**Not Applicable**
NW1.3 Preserve Prime Farmland	**N/A**	**Not Applicable**
NW1.4 Avoid Adverse Geology	**3**	**Superior** The TIWRP project met a Superior level of achievement by thoroughly assessing geologic hazards and instituting spill prevention protocols. Prior to phase 2 design, the project team commissioned a geotechnical engineering report, which analyzed risks and provided recommendations related to seismic activity, soil liquefaction and stability, land subsidence, groundwater, and storm surges. The project site was determined to be geotechnically feasible, a conclusion that agreed with earlier geotechnical reports made for phase 1. The biggest risk was soil liquefaction triggered by earthquakes, but this hazard could be mitigated by standard design elements (see CR2.4). The project also earned points for their stormwater management and contaminant spill plans; all of the facility's on site stormwater and chemical spills are redirected by pipes and catch basins to an in-plant sewer, which returns the water to the facilities headworks for full treatment. *Kleinfelder. Geotechnical Engineering Report Terminal Island Water Reclamation Plant Advanced Water Purification Facility.* *City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. P. 41-43.* *City of Los Angeles. Terminal Island Water Pollution Prevention Plan. 2017.* *Carollo Engineers Inc. Terminal Island Operations and Maintenance Manual. 2017.*
NW1.5 Preserve Floodplain Functions	**N/A**	**Not Applicable**
NW1.6 Avoid Unsuitable Development on Steep Slopes	**N/A**	**Not Applicable**
NW1.7 Preserve Greenfields	**15**	**Conserving** The phase 2 project was located entirely on the existing wastewater treatment facility, a greyfield site, and thus had no impact on undeveloped land. It achieved a score of Conserving. *City of Los Angeles Bureau of Engineering. NavigateLA TIWRP Map.*

NW2.1 Manage Stormwater	**21**	**Restorative** TIWRP is designed to capture 100% of on-site stormwater for beneficial reuse, thereby earning a Restorative level of achievement. As mentioned in NW1.4, the facility was designed with a system of gutters, pipes, and catch basins in order to redirect 100% of stormwater from a climate change adjusted 100-year storm to an on-site sewer. The water from the sewer is then reclaimed by the plant's water treatment process. *City of Los Angeles. Terminal Island Water Pollution Prevention Plan. 2017.*
NW2.2 Reduce Pesticides and Fertilizer Impacts	**N/A**	**Not Applicable**
NW2.3 Prevent Surface and Groundwater Contamination	**14**	**Conserving** The TIWRP project assessed its various impacts on groundwater, designed environmentally friendly leak prevention and response plans, and mitigated polluting substances in construction and operation. The TIWRP addressed its impact on water sources in several different ways. First, it made sure that its construction used minimal hazardous materials and did not interfere with the local groundwater table, which was found in the geotechnical report to be seven feet below the surface. In addition, the project team thoroughly assessed the hydrology, water quality, water budget, and well sites of the West Coast Groundwater Basin (WCGB), where the Dominguez Gap Barrier Project is located. Studying the WCGB was necessary in order to comply with state groundwater regulations, which require recycled water to be retained underground for a least one year before extraction from a potable well. Engineering models indicated that TIWRP's injection of 100% recycled water into the Dominguez Gap would have no negative impacts on groundwater quality. As mentioned in NW2.1, TIWRP also included comprehensive stormwater management into its design. All on site stormwater is collected by a drainage system and discharged to the facility's headworks for treatment. While the use of chemicals is unavoidable in the water treatment process, none of the chemicals used are hazardous. If any chemicals used in the facility were to spill or leak, they would be collected in catch basins and discharged to facility headworks for treatment, or removed off site in an emergency. During normal operation, all chemicals are recycled within the plant. There is some discharge to the harbor of brine from the reverse osmosis process, but this process is tightly regulated, monitored, and not believed to pose a threat to water quality.

		Kleinfelder. Geotechnical Engineering Report Terminal Island Water Reclamation Plant Advanced Water Purification Facility. *Los Angeles Bureau of Sanitation. Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion. 2015. p. 10.3-13.14.* *California Regional Water Quality Control Board Los Angeles Region. Waste Discharge and Water Recycling Requirements for Harbor Water Recycling Project--Dominguez Gap Barrier Project. 2010. P.7-13.* *California Regional Water Quality Control Board. Discharge to LA Harbor via Outfall 001. 2015.*
NW3.1 Preserve Species Biodiversity	**N/A**	**Not Applicable**
NW 3.2 Control Invasive Species	**N/A**	**Not Applicable**
NW3.3 Restore Disturbed Soils	**N/A**	**Not Applicable**
NW3.4 Maintain wetland and surface water functions.	**0**	**No Level** Although the TIWRP delivers water to Machado Lake for surface water augmentation, the Machado Lake Restoration Project is seperate from the phase 2 renovation. Thus, the project earned no level of achievement for this credit.
	0	*Not Pursued*
	53	

CLIMATE AND RISK		
	Terminal Island Advanced Water Purification Los Angeles, California	
CR1.1 Reduce Greenhouse Gas Emissions	**0**	**Not Pursued**
		Enhanced

CR1.2 Reduce Air Pollutant Emissions	**6**	The TIWRP project complied with South Coast Air Quality Management Standards to earn an enhanced level of achievement for this credit. Prior to phase 2, the TIWRP facility had an existing South Coast Air Quality Management Standards permit to operate, and the final environmental assessment concluded that the construction and operation of phase 2 would not raise air quality emissions above significance thresholds. The minor emissions from the plant stem from small engines, sewage gases, and paint sprayers. As part of the permit, all emissions-releasing equipment were monitored and maintained to reduce emissions, and some were installed with scrubbers. Although construction and operation emissions of carbon monoxide, volatile organic compounds, NOx, SOx, and PM10 were found to be insignificant, ozone and lead emission were not calculated, preventing the project from earning higher levels of achievement.
		South Coast Air Quality Management District. Facility Permit to Operate: Terminal Island Treatment Plant. 2017. p2-31. *City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999. p.34-38.*
CR2.1 Assess Climate Threat	**15**	**Conserving**
		The TIWRP expansion project marks a key development in the city of Los Angeles' plans to mitigate and adapt to the effects of climate change. It earned a score of Conserving for this credit. The Sustainable City pLAn includes strong commitments to prepare for the effects of wildfires, droughts, heatwaves, and rising sea levels in a changing climate. This document led to a Greater LA Climate Action Framework with guidelines for climate change response, as well as a One Water LA 2040 Report, with guidelines for water management. At the Bureau of Sanitation level, the Los Angeles Sanitation Climate Risk Assessment and Adaptation Measure Recommendations offers more specific goals and guidelines. These reports and plans were drafted with significant input from the community, state and federal regulators, the EPA, city officials, and other private and public stakeholders.
		Mayor Eric Garcetti. City Sustainability pLAn. p. 34-40, 66-73. *Los Angeles Regional Collaborative for Climate Action and Sustainability. A Greater LA Climate Action Framework. 2016.* *City of Los Angeles. One Water LA 2040 Plan. 2015. P 3.1-3.4.* *United States Environmental Protection Agency. Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets. 2016.*
		Improved

CR2.2 Avoid Traps And Vulnerabilities	**16**	The project team extensively analyzed traps and vulnerabilities related to climate change, population growth, and financial resources and addressed these factors during the planning process, thereby earning a score of Conserving. As mentioned in CR2.1, the Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets projects the effects of climate change scenarios on Sanitation department facilities. Based on the risks of flooding from rising sea levels and increased storms, the plant is designed to redirect stormwater to headworks for treatment. Another key aspect of the plant's resiliency that was installed during phase 2 is a two million gallon tertiary effluent equilization tank, which lies upstream of the advanced water purification process and downstream of the reverse osmosis equipment. The equilization tank is designed to provide a steady stream of process water to the advanced water treatment step, thus buffering against swings in wastewater. The project team also integrated the newer phase 2 technology with existing sanitation infrastructure; updated and expanded phase 1 systems; left flexibility for future advancements in technology; expanded the piping system to be able to handle 30 million gallons a day; and selected a chemical that was inexpensive and readily available for the advanced oxidation process. Together, these design considerations maximize the useful life of the plant and minimize operational costs. At an external level, the project reduces Los Angeles' long term vulnerability to water shortages by supplying a local, reliable, and clean source of recycled water.
		United States Environmental Protection Agency. Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets. 2016. *Los Angeles Bureau of Sanitation. Engineering Report for the Terminal Island Water Reclamation Plant Advanced Water Purification Facility Expansion. 2015. p. 3.8-3.24.* *City of Los Angeles Bureau of Engineering. Final Environmental Assessment. 1999.*
		Conserving

CR2.3 Prepare For Long-Term Adaptability	**16**	The project team thoroughly assessed and prepared for the effects of climate change on wastewater treatment plant operations and water availability, thereby earning a Conserving level of achievement. The Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets applied the EPA's four step risk assessment process to the Bureau of Sanitation facilities. Following the recommendations of this report, the TIWRP renovation included drainage plans to allow 100% of on site stormwater to be redirected to headworks. TIWRP also has two different electrical supply lines and several back up generators to reduce the risk of power failures, which may become more common in the region due to climate change and population growth. As mentioned previously, the system modules are designed to be separate and redundant to allow for easy installation of new and improved technology as it arises. Lastly, and most importantly, the project provides a reliable source of clean, recycled water to the city, reducing potable water usage and increasing water supply reliability. While water from TIWRP is helping restore the Machado Lake ecosystem, the Machado Lake Rehabilitation Project is separate from TIWRP, and thus TIWRP was not eligible for a Restorative level of achievement. *United States Environmental Protection Agency. Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets. 2016.*
CR2.4 Prepare For Short-Term Hazards	**17**	**Conserving** The project was designed to be resilient to soil conditions, stormwater, seismic events, and other short term hazards, allowing it to meet standards of Conserving for this credit. As per Bureau of Engineering regulations, a Geotechnical Report was commissioned that outlined the major natural and man made threats to the facility. The hazards assessed included seismic activity, soil liquefaction, ground subsidence from a nearby oil field, high winds. In addition, the Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets provided an assessment of flood and tsunami risks during a 100 year storm. The project design mitigated these hazards in many ways. The structures, piping, and equipment are all designed to be conform with Uniform Building Code Seismic Zone 4 requirements. Soil liquefaction due to seismic activity was determined to be the most serious geohazard, so the site's foundation was designed with long underground stone columns to reduce settlement and increase soil density and stability. As discussed previously, drainage systems were devised to treat on site stormwater.

		Kleinfelder. Geotechnical Engineering Report Terminal Island Water Reclamation Plant Advanced Water Purification Facility. *Los Angeles Department of Building and Safety. Compaction Report Approval List. 2017.* *Los Angeles Bureau of Sanitation. TIWRP AWPF Section 02330 Soil Stabilization by Vibro Replacement Dry Stone Columns, Section 15020 Noise, Vibration, and Seismic Control, Section 16030 Wastewater Facilities Electrical Testing Requirements, Section 01571 Stormwater Control Measures. 2014.* *United States Environmental Protection Agency. Los Angeles Sanitation Climate Change Risk Assessment and Adaptation Measure Recommendations for Wastewater Assets. 2016.*
CR2.5 Manage Heat Island Effects	**4**	**Superior** Currently, urban areas surrounding LA are on average 5 degrees Fahrenheit cooler than the city. Following Los Angeles' goal of reducing this temperature differential by 1.7 degrees fahrenheit by 2025, The project designed 81% of its surface to be either shaded or have a solar reflectance index greater than 29. It therefore met the Superior level of achievement. *Mayor Eric Garcetti. City Sustainable pLAn. P. 66.* *SRI Calculator. Percentage of Area Minimizing Heat Accumulation. https://coolcolors.lbl.gov.*
CR0.0 Innovate Or Exceed Credit Requirements	**N/A**	*Not Pursued*
	74	

Points Achieved	367	**Terminal Island Advanced Water Purification: Los Angeles, CA**
Available	676	
	54%	**Envision Platinum**

APPENDIX:
A: PROJECT PICTURES AND DRAWINGS

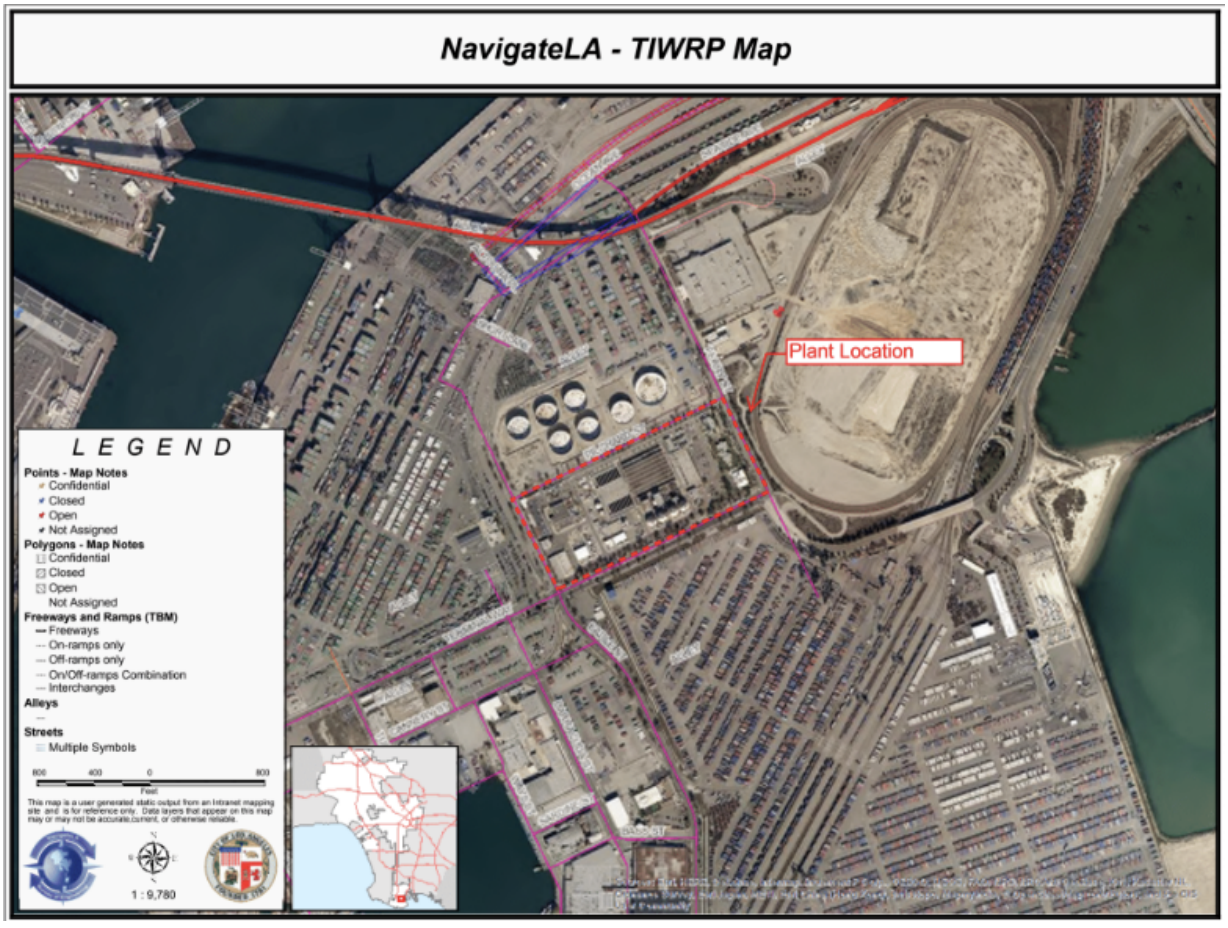


Figure 2: Terminal Island Wastewater Reclamation Plant Location/Map from https://navigatela.lacity.org/navigatela/

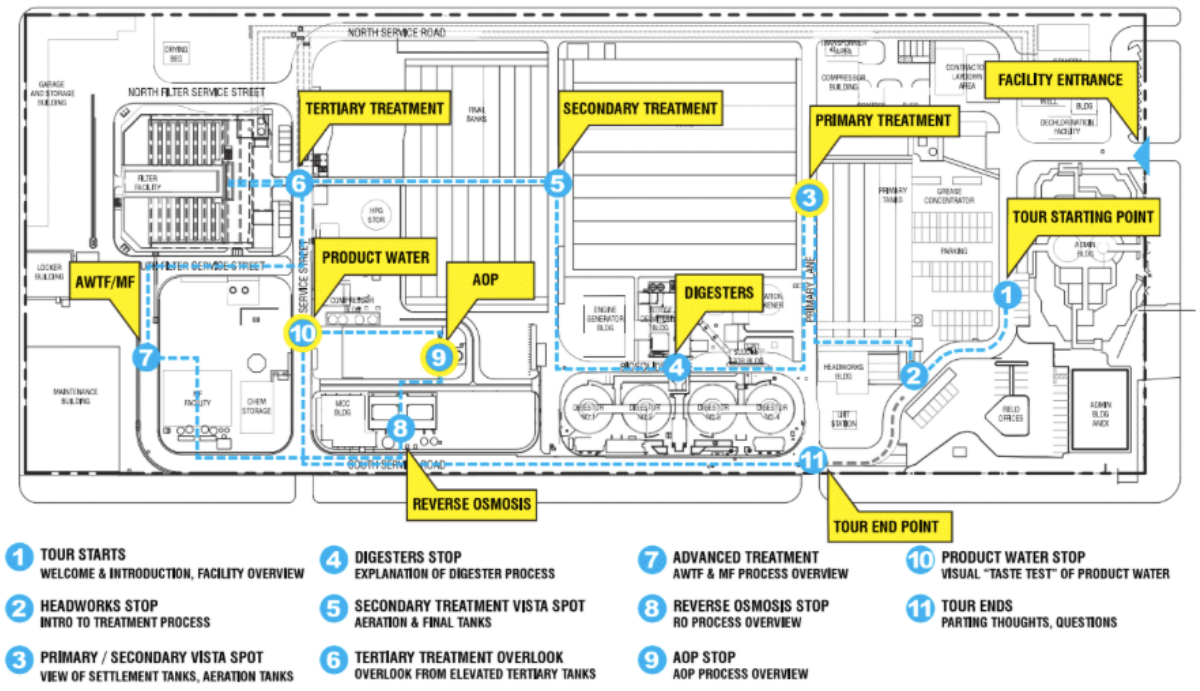


Figure 3: Schematic of a public tour available at Terminal Island Wastewater Reclamation Plant/Mia Lehrer+Associates, 2016

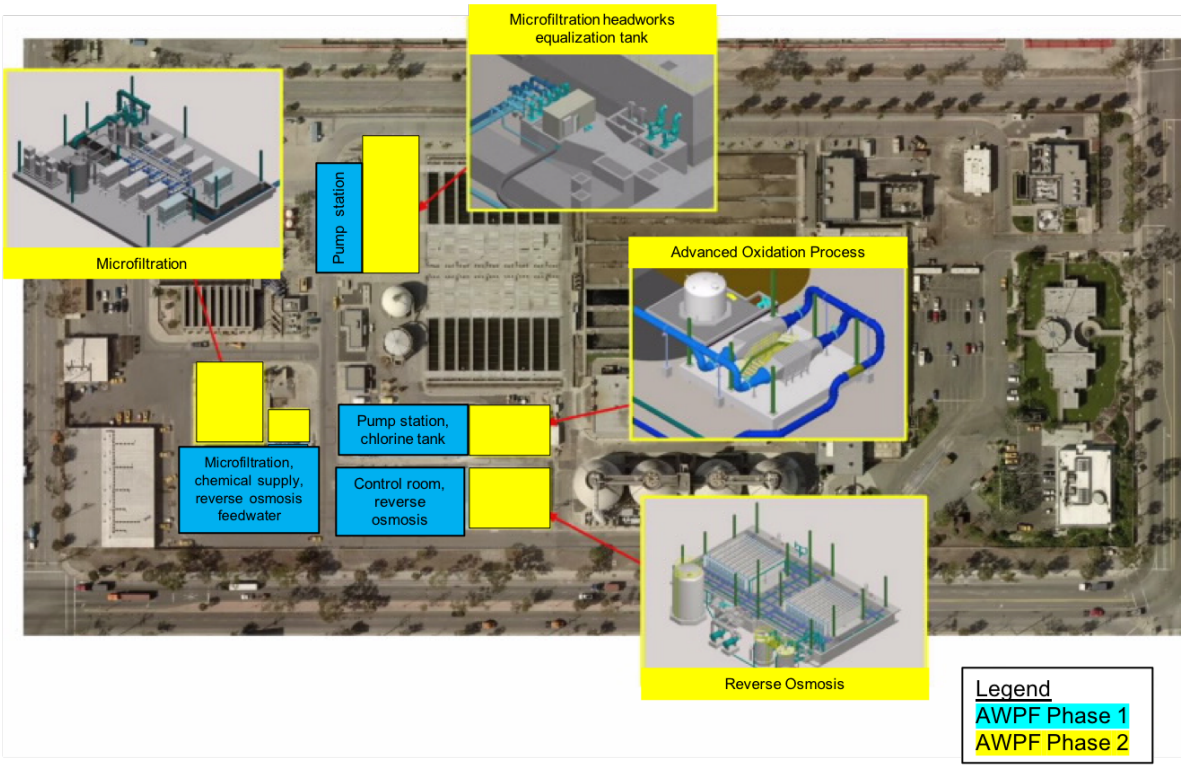


Figure 4: Overview of Phase 1 and Phase 2 Installations/LA Bureau of Sanitation

Figure 5: Microfiltration equipment/LA Bureau of Sanitation

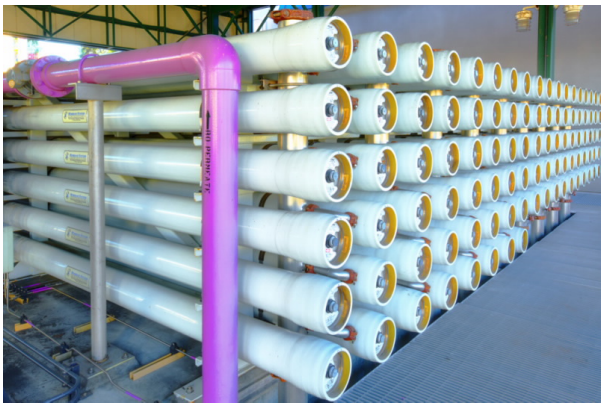
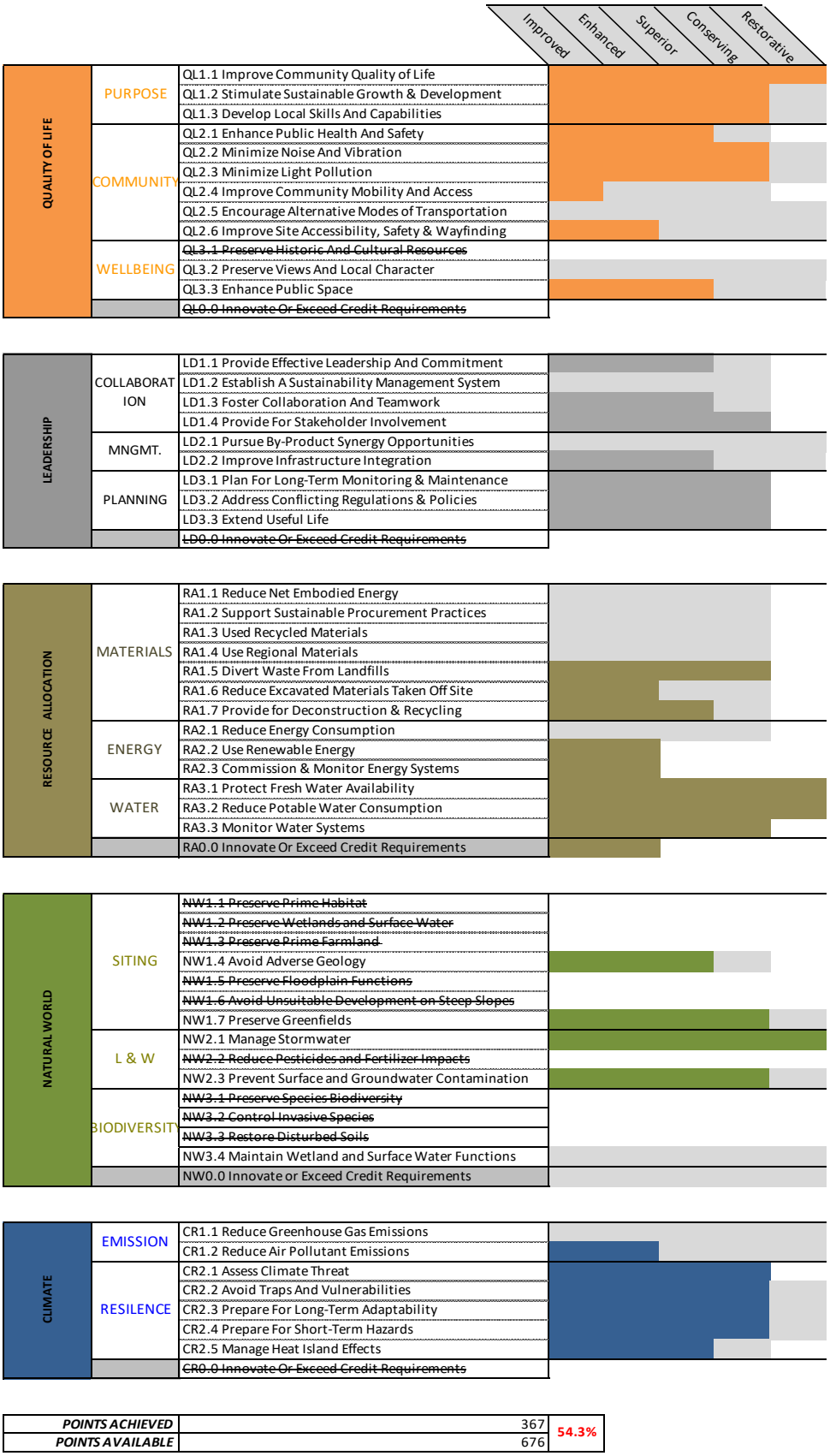


Figure 6: Reverse osmosis equipment/LA Bureau of Sanitation

Figure 7: Advanced oxidation process equipment/LA Bureau of Sanitation, 2018

Figure 8: GreenWay Series Solar Powered LED mount/Sol by Carmanah, 2019

B: ENVISION POINTS TABLE



POINTS ACHIEVED	367	**54.3%**
POINTS AVAILABLE	676	

C: GRAPHS

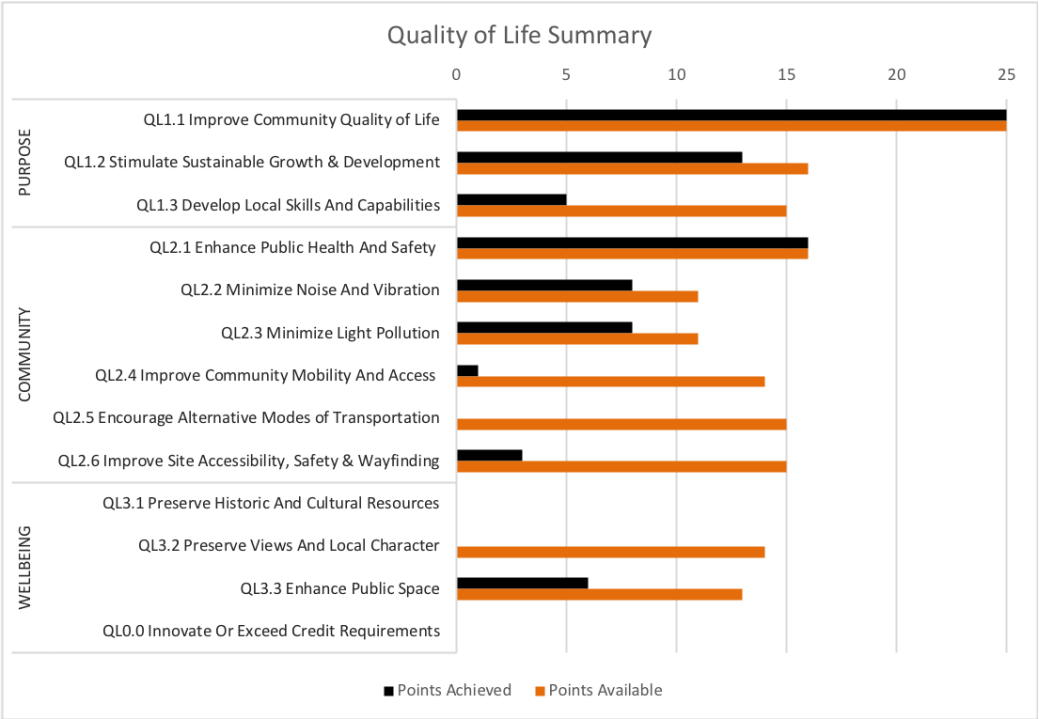


Figure 9: Quality of Life category summary of results

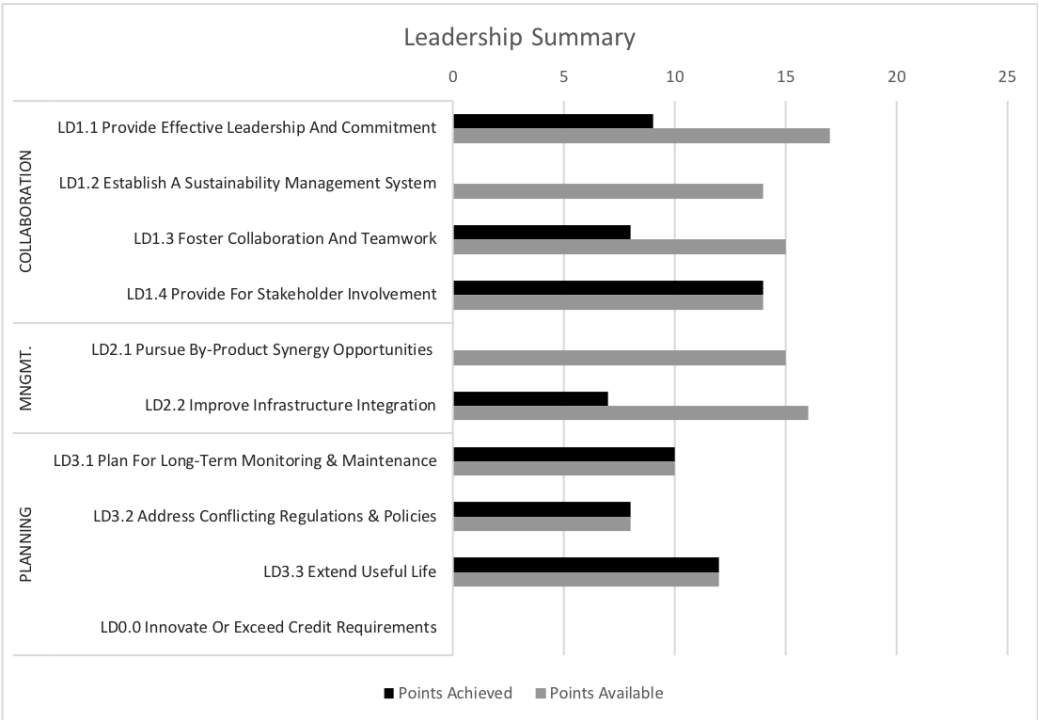


Figure 10: Leadership category summary of results

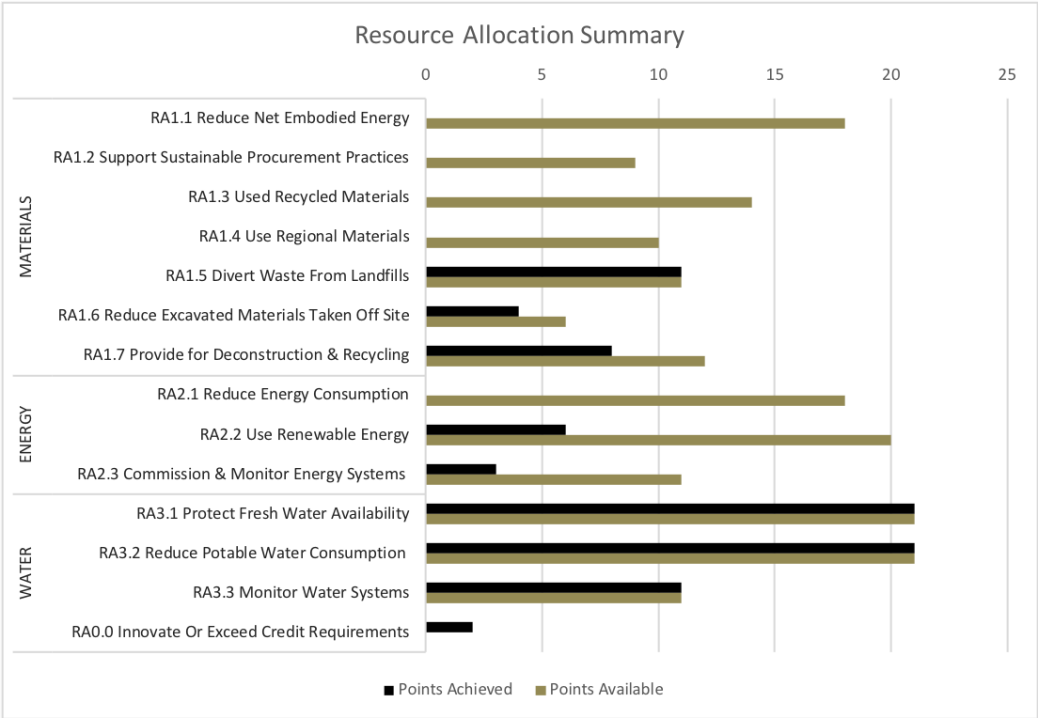


Figure 11:Resource Allocation category summary of results

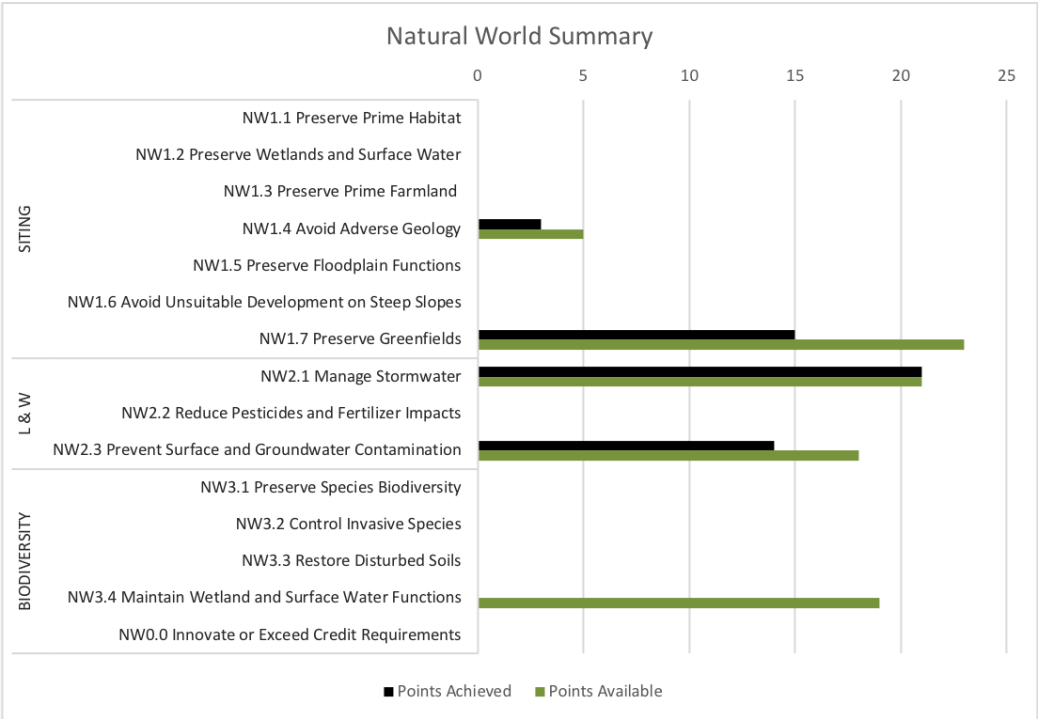


Figure 12: Natural World category summary of results

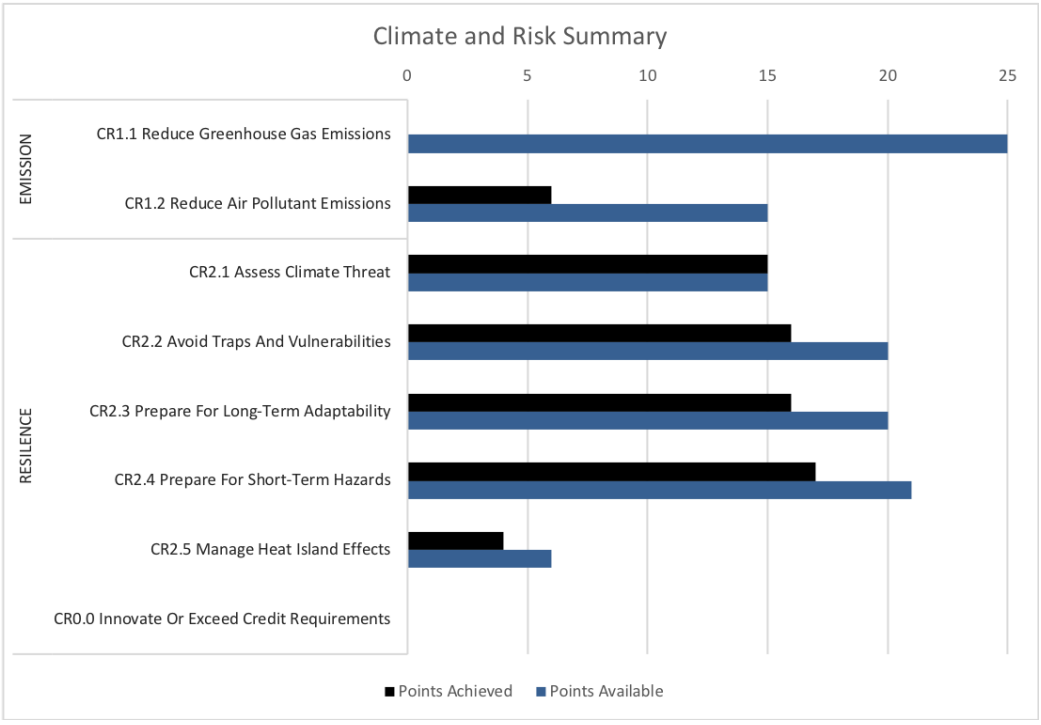


Figure 13: Climate & Risk category summary of results

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