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Graduate School of Design
Harvard University

Graduate School of Design
Harvard University
George Gund Hall
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Cambridge, MA 02138
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POINT FORTIN DESALINATION PLANT – TRINIDAD & TOBAGO

Figure 1:Point Fortin Desalination Plant
Sources: Seven Seas Water Company Images

Maria Beatriz Garcia-Rincon prepared this case study under the supervision of Cristina Contreras ENV-SP and Judith Rodriguez as part of the Harvard-Zofnass program directed by Dr. Andreas Georgoulias by initiative of IDB for the purposes of research and education.
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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EXECUTIVE SUMMARY

The Point Fortin Desalination Plant consists of a desalination plant developed, constructed, and currently operated by Seven Seas Water Company as part of a larger initiative to give Trinidad and Tobago potable water, after the region has been struggling with obtaining this important resource. The Caribbean nation's government is seeking to improve the water infrastructure so as to promise all citizens 24/7 accesses to clean, fresh water.

Contract for the Point Fortin plant, in southwest Trinidad and Tobago, was awarded in May 2010 and construction started in May 2012 with the intention of supplying water to the area's residents and the industrial sector. Until then the area had had limited potable water sources, with surface freshwater supplied through the country's Water and Sewerage Authority (WASA). The plant's new water output of 4.6 imperial million gallons per day (imgd) will help divert water currently being supplied to the Point Fortin from the Caroni Water Treatment Plant to other communities in the southwest part of Trinidad and Tobago, for a contract period of 17.5 years with a plant extension which was requested in order to expand the plant currently under operation. The purpose is to resolve increased water security issues that have led to riots and violence in the past over severe droughts and limited capacity to deliver water to residents.

US-based Seven Seas Water company constructed the Point Fortin Desalination Plant under a build-own-operate arrangement commissioned by WASA as a public-private partnership. Details on the financial benefits given through WASA to Seven Seas Water have not been released and are not available. Since 2010, WASA has refocused on the provision of water and wastewater services, and awarded 373 contracts worth approximately two billion dollars (TT$) or 305 million US$. Of these contracts only 10% have been awarded to foreign companies such as Seven Seas.

Overall, the project has done a good job of improving the quality of life of its surrounding communities through the product it serves, which is potable water. The project establishes a set of stakeholder meetings to gain an understanding of water needs and how the plant can integrate within the national and local needs. At the national level, the project improves the quality of life through the water it produces and subsequently the monitoring of the effluent returned to the sea. At the local level, the project improves the lives of the residents, saving women and children from the need to fetch water and leaving them more time for school homework or other work.

The project team has taken opportunity to develop better relationships in the surrounding communities, identifying community needs and goals and developing community-based projects for the provision of potable water, electricity, and safety in the area. Seven Seas Water

signed a partnership with the University of Trinidad & Tobago in order to offer apprenticeship opportunities to students enrolled on The National Engineering Technician Diploma (NETD) in Chemical Engineering. As a result, the outcome is more expertise on the water treatment industry for the future growth of this important resource for the island's geopolitcal future. Some of the areas of collaboration between the project team and the students are water plant operations as well as interpersonal and communication skills.

The project has also been completing several community outreach programs that standout. Mainly Seven Seas Water has constructed a tennis court which align with the country's pride in their past tennis court stars. One issue the community has experienced is an increase in tennis court maintenance, which is a reason it has offered to contribute with an additional court. In addition, the company will host World Water Day with small events in which younger students will learn the importance of water conservation. The latter is one first step towards teaching communities how to conserve a resource that is slowly becoming depleted.

In terms of improvements, the project team created a series of mitigation strategies to reduce noise and dust generation during the construction phase and improved site mobility, using internal roads in the industrial zone. Safety signage was important to the trucks traveling on the site. Particularly, local character is preserved because the project is located in an industrial area. The project can use mitigating strategies through creative designs that allow it to camouflage its presence. The project also should try to incorporate more active policies for community outreach, understanding the socioeconomic needs and potential ways they can improve.

In the Leadership category, the project has sought to supply its equipment from companies that achieve sustainable management goals. Dow and its Filmtec membranes are top-notch at delivering a sustainable membrane for the reverse osmosis brine, decreasing energy dependence. The project team has shown a commitment to sustainable development through its Environmental Compliance contract with WASA. In addition, the project collaborated with community stakeholders throughout the pre-phases of the project implementation. Synergies between government policies for water production, pipe infrastructure, and plant construction were synchronized so that the work implemented by the government matched initiatives to develop by the plant. The team also exhibits a long-term view of the project, with an extremely detailed long-term monitoring and maintenance plan that ensures equipment is maintained and continuously produces freshwater. The project's useful life is 17.5 years with the potential of extending it depending on the government's capacity to renew in the future.

The project exhibits a great performance in the Resource Allocation category in relation to energy but could use a more thorough understanding of opportunities present in the Materials subcategory. In terms of Water, the project has mixed reviews, with a restoration of the island's water capacity for freshwater resources but with room for improvement in its water usage and its design to canalize rainwater and use stormwater to its full potential. The reverse osmosis process allows the plant to save 30% of its energy usage in comparison to distilling, which represents business as usual. This simple choice in design has given the project a high performance in energy efficiency. In addition, it mitigates all potential emissions in the construction phase with alternative strategies that decrease emissions. Long-term monitoring and maintenance have also been put in place. The project has the opportunity to develop a waste management plan to decrease waste and divert it from landfills or reutilize excavated materials from the construction of its internal roads, buildings, and drainage.

In the Natural World category, the Point Fortin plant showcased an impressive goal of maintaining marine biology intact and preserves marine habitats, species, and non-living natural systems. It does this by measuring baseline data of all natural habitats before construction of the plant and receiving third-party recommendations to mitigate any negative effects it has on the surrounding environment. Another great aspect was the project's choice of site, which was in a previously developed and polluted space with scrap metal and trash. With the development of the plant, this site was renovated and cleaned, allowing for a more active use of this industrial zone. The project avoids development in a site of high ecological value or adverse geology. The site's main geological risk is its location on the Caribbean, which is prone to the effects of climate change such as high temperatures and sea level rise. In order to address this, the project chose suppliers that met these challenges with adequate equipment and materials for the tanks. Given its siting, defined as industrial, the project spares greenfields and prime habitat from being developed and also saves coastal areas from being unnecessarily built over, reserving these spaces for the natural habitat.

Finally, the plant has indicated a reduction in greenhouse gas and other types of emissions thanks to the type of technology used. Reverse osmosis cuts down on the dependence on distillers as a desalination process (a process that relies on fossil fuels). The project also avoids greenhouse gas emissions in the construction phase with the use of cranes in optimal time and efficiency. The project might also develop a carbon assessment to measure the emissions saved through these mitigation strategies in tons of CO_2 per year. The Climate and Risk category presents an opportunity to approach climate change issues with a more conscious effort. A shift of view from provider to end user is needed to understand how the plant's construction makes it a customer of other resources, encouraging the project team to account for all water and energy usage. The project team has an emergency plan as well as short-term contingency

protocols to put into action in case of any risk associated with the plant itself, and to safeguard its employees from any potential harm. The plan includes training and supervision for numerous threats.

The Point Fortin Desalination excels as a model for generating fresh potable water, as well as for its contribution to Trinidad and Tobago's sustainable development and water goals. At the same time, there are some areas for growth and an opportunity to develop further with a holistic approach to sustainable infrastructure development.

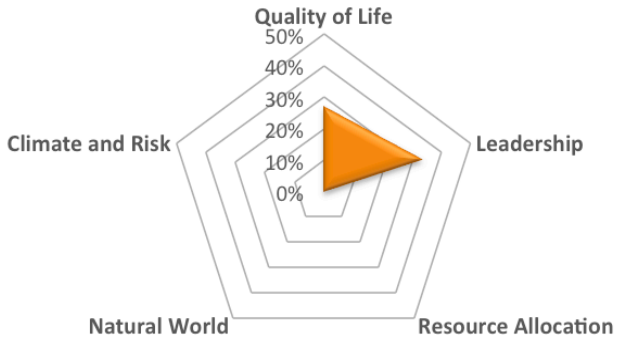


Figure 2 People and Leadership Awards Summary of Results

Figure 3 Climate and Environment Award Summary of Results

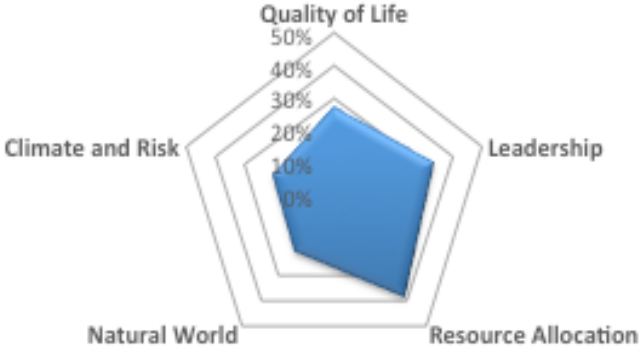


Figure 4 Infrastructure 360 Award Summary of Results

1. PROJECT DESCRIPTION AND LOCATION

Trinidad and Tobago's Water and Sewerage Authority (WASA) commissioned the Point Fortin Desalination Plant as a build-own-operate contract to increase the system's supply of potable water from once per week to at least five days a week in the southwest part of Trinidad and Tobago. Constructed by the US-based Seven Seas Water Company and finished in 2013, the new plant supplies the needs of a 29,000-person population who until recently relied on fetching their own water, along with the country's growing industrial sector, mostly located in this region of the country. The Point Fortin Desalination Plant is located on 4,500 square meters of land in the compound of Petrotrin's Marine Terminal Facility. The site was previously filled with pipes, metals, and industrial waste. The project's desalination plant is built upon existing raw water infrastructure, including a pump house, which was rehabilitated and reused for the project. The infrastructure takes seawater and filters it through a pretreatment plant using primary settling, then deep bed multimedia filtration, and finally the seawater reverse osmosis for full desalination, yielding potable water.[1]

The plant uses new technology in the desalination process, transforming seawater, through pressurized Dow-manufactured semipermeable membranes, into freshwater using a fraction of the energy used in traditional distillation processes such as heating/boiling technology. Distillation was commonly used before desalination plants could access high-tech materials used in pressurized membranes at more affordable rates.

Desalination transforms seawater into freshwater through boiling and results in a condensed evaporation as its output – potable water supply. The key process in distillation as opposed to desalination is heat, which relies on higher energy inputs than desalination plants use. Thus, Seven Seas has enhanced the water output in Trinidad and Tobago, offering 24/7 potable water to communities between Point Fortin and La Brea with a minimum energy input, making it more sustainable than the previously used distillation processes. Communities are being supported by the facility, which has greatly reduced their long travel distances needed to obtain water from standpipes and dam. The 4.6 million imperial gallons of water injected into WASA's transmission system daily has an exponentially positive ripple effect, not only delivering potable water daily to 29,000 people, but allowing WASA's previous water capacity to be delivered to other communities such as Erin, Bennett Village and Environs, Quarry, Palo Seco, Techier, Santa Flora, Siparia, and Fyzabad, which improves their water intake and their lives.

In terms of public-sector commitment to water, the project is part of a set of diverse

[1] Coastal Dynamics Ltd., "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," September 4, 2010, i.

government initiatives, including drilling new wells, to supply citizens with water in a consistent way. The Ministry of Public Utilities has created a set of studies and policies to ensure that natural synergies occur among water-centered solutions in an island that has suffered from water shortages and drought for over 40 years. In 2010, the meteorological drought in Trinidad and Tobago limited fresh water reserves, highlighting the need for the country to supply its citizens and industrial sectors with potable water supplies in critical areas.

The government's obligation in the partnership is to create a paradigm shift on water policies with the initiation of the One Water Concept. To build a sustainable supply of potable water, the Ministry of Public Utilities has contracted several hydrological studies meant to identify ways to deliver water solutions to the country, taking into account technical experts and their respective recommendations on holistic water synergies between watersheds, water capacities, and different infrastructure challenges. Three reports – the Caroni River Basin Hydrological Study, the Caparo River Hydrological Study, and the South Oropouche Hydrological Study – support the government's determination to ensure that decisions on infrastructure are based on thorough analyses of the landscape, geology, and hydrology.

These studies report on water infrastructure alternative projects designed to meet the needs of the domestic, agricultural, industrial, and ecological arenas. A holistic view is currently being integrated in Trinidad and Tobago, and water programs are being implemented to tackle the quality of life of Trinidadians. To accomplish the aforementioned paradigm shift, over $500 million has already been spent on water infrastructure development and upgrades as WASA continues its drive toward the goal of providing a 24/7 system-wide water supply in 2014.

A number of significant projects are designed to increase water production and improve and expand the reliability of service to customers. Given the mandate to achieve "water security for every sector," a plan was developed to increase the total volume of water available for distribution while reducing demand. This initiative was accompanied by the construction of potable water treatment plants at Talparo, Matura, Penal, and Point Fortin with a capacity of 2.2 imgd, and the drilling of wells at Freeport, Valsayn, Point Fortin, Chatham, Cap-de-Ville, and Louis D'Or in Tobago each producing 1.6 imgd, with a total output of potable water of 8.4 imgd. Together these initiatives, and the plan to reinstall and integrate over 578 pipeline projects with 415 km of pipes being installed, cost $474 million.

The Point Fortin Desalination Plant is the country's newest plant, following the construction of the country's first desalination plant at Point Lisas, which began operation in 2002. The Point Fortin plant adds 4.6 imgd to the 24 imgd generated by the first plant. On July 24, 2013, 1.25 imgd of water was successfully released and the desalination plant was fully operational,

meeting its capacity of 4.6 imgd by August 2013.

The facility was constructed in a 25 km^2 area, with a densely populated local community compared to the rest of Trinidad and Tobago. According to baseline measurement reports, there are 762 persons per square kilometer in Point Fortin, located 96 km from Port of Spain and 40 km from San Fernando. The desalination plant is classified as industrial, for it remains within an industrial site at Petrotrin. The population is a low-density residential area with two surrounding beaches: Guapo Bay and Clifton Hill Beach. The latter has largely eroded, leaving Guapo Bay as the recreational area for local residents.[2] Local communities include La Brea, the La Brea Industrial Estate, Point Fortin, Techier Village, Lot 10, Parrylands, Guapo, Vance River, Sobo Village, as well as Petrotrin and Atlantic LNG.

2. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision™ 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. 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 whether the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a special 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[3] and Zofnass Program[4] websites.

[2] Ibid, 77–78.
[3] www.sustainableinfrastructure.org
[4] www.zofnass.org

3. QUALITY OF LIFE CATEGORY

Envision's first category, Quality of Life, pertains to potential project impacts on surrounding communities and their well-being. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing community networks, and consider long-term community benefits and aspirations. Quality of Life incorporates guidance related to community capacity building and promotes infrastructure users and local members as important stakeholders in the decision-making process. The category is divided into four subcategories: Purpose, Well-being, Community, and Vulnerable Groups.

Purpose

The Purpose subcategory assesses the project's impact on related communities and considers the project's goals in relation to the expectations of community stakeholders. It focuses on the functional benefits to communities such as growth, development, job creation, and general improvements in quality of life. The project was created in response to water shortages and severe drought in 2010 that led to a series of riots and protests. In order to improve the limited amount of water, the project identifies potable water as a need to be assessed through the Ministry of Public Utilities and the Water and Sewage Authority (WASA) of Trinidad and Tobago. It is through WASA that the host community's needs are associated with a country's demand for access to clean water. This strategy has involved many stakeholders at differing scales, improving the overall function of water production in a country where water is scarce.

The landscape near Point Fortin is mainly characterized by oil and natural gas installations. The industrial sector's growth has led to increased population in the area and thus to a need to increase the water supply for surrounding communities. The desalination plant has a twofold positive effect. In supplying freshwater to the industrial sector, it allows for southwest Trinidad and Tobago to attract bigger industrial businesses that would not consider working there if their appropriate water needs were not adequately met. Second, the desalination plant improves residents' lives by reducing the time and effort needed to fetch their own water from nearby, standpipes and dam, improving their quality of life with a basic necessity and opening their schedule to other tasks, such as childcare, cooking, and job activities. The time the community saves on fetching water is now available for economically productive activities. In addition, the government's new policy to improve water infrastructure, as a resiliency strategy against the deleterious effects of climate change and the distribution of freshwater in the country, has pushed WASA to improve the country's piping system.

Some job growth is also produced by the project's construction and operational phases – although it has shown little to no efforts to develop capacity training in the area. Data from

various third-party assessments gives information on local hires to construct and operate the desalination plant. Therefore, Seven Seas Water has enabled a first step in the right direction by hiring employees locally including the plant manager. The recommendation is to procure more local companies to collaborated in the process and create synergies between the construction of the plant and other local companies that can deliver the tanks as to improve the local economy. Since all the project's suppliers appear to be from the United States, it is a good sustainable practice to promote local engagement, enhancing Trinidad and Tobago´s economy even more than it is already doing with its hiring practices.

More details on related processes such as waste management companies can be included in the data in order to understand the full ripple effect of local hiring. It is recommended that a ratio of local hires be included in the calculations. This helps determine how the desalination plant is spurring local economic activity. Lastly, the project is encouraged to find ways to detail how disadvantaged groups can improve their skills through the company locally. It is important to look at the plant as a potential spur for local development. For example, if the employees only serve during the 7-month construction period, can they develop skills that allow them to increase their hiring opportunities after their contract ends? Seven Seas begins this process with their Work Study and Apprenticeship program whereby the company hosts World Water Day to begin capacity building to communities surrounding the plant, and create a link between the infrastructure project and its positive presence in terms of sustainably producing water for its citizens.

Well-being

Well-being refers especially to human-centered and context-driven design. Designs that take human nature into consideration tend to move away from standardized infrastructure models based on one-size-fits-all thinking, with results that are somewhat porous within their natural and human environment. Infrastructure should consider its visual and functional impacts on its area, with design that incorporates people's everyday pedestrian and vehicle usages and recreational patterns, giving other plants a model to follow. Thus, this subcategory applauds projects that consider their physical presence and bring ingenuity to their space, incorporating local character into infrastructural design.

In order to properly measure noise, lights, mobility, public space, and transport around the Point Fortin site, a baseline report gathered data on how these variables measured before the desalination plant was installed. The plant is located in an industrial zone, with no communities located nearby. However, employees or other people who are around the industrial site for any reason are still affected by the noise and light pollution. Noise was managed by having heavy

trucks and vehicles avoid rush hour, using the early hours of the morning or late at night. The project team has a set of health policies related to cleaning, maintaining water standards, water monitoring, and making sure filters for water purity are adequately enhanced.

One way the plant can incorporate people's lives into its design is to consider mobility and transportation options. In this case, the biggest impacts often occur during the construction phase, when traffic jams can result from trucks transporting materials and equipment on site. In order to diminish traffic impacts, the project arranged for off-hour truck transportation. Also, the project team strategically timed the construction of the plant in phases, so that all construction hazards and risks were reduced through the resulting flexibility.

The project nurtures a safe physical environment during both construction and operation phases, minimizing light pollution, odors, noise, and vibration for the workers in the Petrotrin industrial site and the residents near Guapo Bay. The infrastructure, while physically established in the port and along the coast, has the capacity to build transportation alternatives and designs for a larger community to access the mobility network.

Community

The Community subcategory addresses the conservation of historical resources, public spaces, and preservation of local characteristics. One area that can be improved in the Point Fortin project is the analysis of the potential impact on historical artefacts along the coast. The project team is recommended to work with the country's conservation and historical preservation institutions to audit the site and determine whether any historical objects should be considered for preservation. One important step is for experts to build capacity with stakeholders. This will help to identify whether there are any artefacts that might be destroyed with the project.

The project team is encouraged to continue to find ways to develop public spaces in the area. One example of their service to the surrounding community is their donation of a tennis court. This infrastructure upgrade is a meaningful first-step to a continued positive ripple effect its project has on Trinidad & Tobago. The mayor was consulted and the idea was to bring back a sport that has given the country many tennis stars.

While the project is in an industrial zone, the idea is to conduct meetings and community outreach activities with local residents to identify what public spaces can be enhanced, improved, or created. This exercise has been accomplished with meetings with the mayor, and is encouraged to continue via more thorough social outreach that identifies residents to ask as well. One way to do this is to have a community participatory mapping activity whereby fishermen and swimmers who use the bay for recreation can identify spaces that need

infrastructure upgrading. The plant can then allocate money from its corporate social responsibility funds or appropriate outreach funds to develop these activities. Seven Seas Water can create small interventions, such as placing immovable fishing rod stands so that fishermen can catch from one of the ports, or enhancing a nearby beach where residents enjoy their weekend time. With a little creativity and some brainstorming events, options to explore can be identified. Often, when an area is run down from industrial activities, just a few small interventions can make a big difference in attracting people to use spaces that were previously disowned or overlooked.

Vulnerable Groups

The Vulnerable Groups subcategory attempts to bridge the gap between infrastructure's physical constructions and its effect on the community's most vulnerable populations. In most cases vulnerable groups include women, children, and the country's minority populations, the purpose of including this subcategory is for private industry to see its physical presence as an opportunity to plant seeds in the country. The seeds can be of different types – perhaps educational programs, arts, sports, or culinary development of women's recipes. Which seed is planted is less important than giving opportunities to the most disadvantaged, so that the development of infrastructure does not stop with the product but rather embraces the multifaceted ways private industry has the power to promote change. Coupling creative programs with supportive funding schemes is only one way that private industry can score high in this subcategory.

Vulnerable groups can build their opportunities through capacity-building workshops where communities learn how to take advantage of the daily savings made possible with the piped water system. Capacity building creates a productive opportunity for knowledge building. Tuition or scholarships are another way to allocate funds to people in the community; the project can entice more people to learn about the importance of water management or sustainability. Higher education in sustainable hydraulics engineering is just one innovative way the plant can enable the community to fulfil its objective years after the end of its contract. These ideas are merely examples of how outside-the-box thinking can help enrich local communities.

The project has been able to provide some 200 new jobs for Trinidad and Tobago during the construction phase and 15–20 during the operational phase.[5] Increasing employment is a great advance for the community, and keeping a record of the percentage of women versus men

[5] Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview," presentation, Public Consultation Meeting, Trinidad and Tobago, March 2, 2011, 10.

hired as well as allowing for some employment opportunity for those considered disadvantaged would greatly enhance the score in this subcategory. The project has shown that it has built a close relationship with the municipality, and continuing this relationship by working to identify needed improvements in the municipal area is one way to advance. Embracing new skills necessary to contribute to a family's quality of life is a main way that vulnerable populations can create opportunities from the physical implementation of the plant. Training women, whether or not in areas related to the plant, could offer them alternative employment opportunities.

The project's product – pure, healthy water – has direct beneficial effects. However, the project benefits the community indirectly as well as it finds ways to upgrade infrastructure of nearby schools or offer improvements in community areas, spaces, and other needs, in a similar capacity as the one done for the new tennis court.

For further improvement, a thorough baseline study[6] could assess certain characteristics of the municipal population: for example, mobility for women and Afro-descendants and/or minorities, as well as understanding how the provision of freshwater removes barriers for women. Another recommendation is to provide reports that assess the barriers women and Afro-descendants face on the island in order to provide a social scientific basis for the actions taken as well as the programs proposed (if any). The indirect benefits of water are taken into account, although more detailed reports and assessments are needed to better provide an actionable change that improves the overall population beyond the contract of the desalination plant.

The project did particularly well by innovating through Seven Seas Water;s commitment to enhance the quality of life of the population as well as the growth and development in the area with a signed partnership with the University of Trinidad & Tobago in order to offer apprenticeship opportunities to students enrolled on The National Engineering Technician Diploma (NETD) in Chemical Engineering. As a result, the outcome is more expertise on the water treatment industry.

Some of the areas of collaboration between the project team and the students are water plant operations, interpersonal and communication skills. In other different programs, the students are also invited to assess and identify technical challenges and provide solutions to it, which will serve the water crisis is a positive ripple effect that is applauded as exemplary.

[6] Coastal Dynamics Ltd., "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant."

4. LEADERSHIP CATEGORY

The Leadership category evaluates project team initiatives that establish communication and collaboration strategies early on, with the ultimate objective of achieving sustainable performance. Envision rewards stakeholder engagement as well as encompassing a holistic, long-term view of the project's life cycle. Leadership is distributed into three subcategories: Collaboration, Management, and Planning.

Collaboration

The Collaboration subcategory examines how sustainability is addressed at each stage of the project (including the construction and operational phases) and in the triple bottom line. Sustainable projects must include input from a wide variety of stakeholders to take advantage of areas where the stakeholders could work with one another to encourage cost savings, efficiencies, promoting governmental change, and opportunities for innovation. This type of collaboration between public and private goals takes consistent commitment from the project team. In this type of leadership, teamwork is encouraged to find ways in which the project can broaden its horizons and lead the industry in innovative thinking.

The public sector provided the Point Fortin project with a series of hydraulics reports and analyses from their own hydraulics engineers and environmental assessments (the public sector is understood as all organizations and institutions that conform government sectors). Environmental compliance has spearheaded change in Trinidad and Tobago, and with that forward-thinking attitude the project fits in within the larger puzzle of water infrastructure improvements.[7]

The environmental baseline and the quality assurance reports with the monitoring section are motivated by baseline data to ensure energy savings with specific recommendations, followed by a series of protocols. Additionally, a profound set of weather analyses address potential risks with individualized strategies from response protocols set up for an array of weather-related threats (fires, earthquakes, floods, droughts, etc.).[8]

Public commitments are announced to different stakeholders to engage international organizations, the US embassy, municipalities, and residents regarding sustainable effects of the output of fresh water on the area's economic welfare, social balance, and ecological condition.

[7] "2014 Edison Award Winners," http://www.edisonawards.com/winners2014.php
[8] Engineered Storage Products Company, "As Green as Our Tanks Are Blue," 2009, 1.

The objective of stakeholder meetings is to create lines of communication that run in both directions between the Seven Seas Company and the residents. In practice, there is some community involvement, but this is limited. Furthermore, the feedback can include ways to promote more use of public spaces and ways the plant might create opportunities through infrastructure upgrades. It is also recommended to assess how the feedback received from the community was turned into action.[9]

Management

A desalination plant is a specific project that must be engineered within specific best practice, leading technology, and above-performance production of freshwater. This commitment to perfection within the desalination plant industry is an important first step. The second is to perform a comprehensive analysis of where the project is in comparison to parallel systems in Trinidad and Tobago.

Context is important for understanding the place of this project within the water and hydrological systems. The plant functions to balance the deficiencies in the supply of freshwater with the excess of saltwater on the coast; it produces a by-product while managing the production of this valuable resource within other infrastructure systems, so that redundancies can be collapsed into one system and integrated processes can decrease unnecessary costs and even energy demand, thus enhancing overall sustainability and protecting the plant from future risks.

The quality assurance plan was written by a third-party firm, which consulted on how the project can maintain its management procedures. All data archived during the monitoring activities are maintained in electronic and hard copy. Two different firms check the quality of water effluent to protect the marine biological biodiversity. All records follow a very organized chain of commands, including: a) chain of custody form; b) sample receipts; c) field equipment calibration certificates; d) measurements; e) field observations; f) lab results; g) and log sheets of energy and water.[10]

In order to manage the construction of the plant, the project team attempted constructing over existing infrastructure in order to use the waste products of the older infrastructure in the new one. This idea was later revisited by a third-party engineering company, which suggested that the design be recreated as all existing infrastructure was in below-standard shape for reuse.

[9] ITT Engineered for Life, "Sustainability" and "Sustainability Metrics and Activities," presentation, 2014, 1–2.
[10] Engineering Applied Science and Technology Limited, "Portable Desalination Plant at Port Fortin Monitoring Effluent for CEC Compliance," St. Augustine, 2013, 1–9.

Since the project must maintain good quality to ensure that marine biology is protected, that the water effluent doesn't affect the salinity of the coast, and that the overall equipment is maintained, a compromise was made between reuse of materials and the need for best quality for the efficient functioning of the project.[11]

Therefore, while by-product synergy, which reduces redundancies in systems by identifying potential wastes from nearby facilitates as a resource to be used in the project, was considered in this manner, it had to be overhauled with a new system and new raw materials. If the project team reused any materials other than earthworks, it was not recorded. The original plan was to use the existing infrastructure. In an attempt to develop and manage the different equipment, Seven Seas' engineers incorporated Energy Recovery Inc's PX pressure exchangers to recover waste energy from the brine flow generated by the first-stage pressurized systems, which decreases the overall energy used. This is an example of how thorough research in an industry can identify equipment that offers huge cost savings and energy reductions.

The public sector defines strict environmental guidelines to ensure that the plant upholds above-industry practices and protects the area's biological, chemical, and biodiversity conditions.[12] Consequently, the project and the country benefit from their overall alliance to develop greater infrastructure improvements that integrate the larger hydraulic system with the plant's output of water. The national government and WASA specifically increased production capacity, with 578 pipeline projects that installed 415 km of pipelines.[13] This public-private partnership enables the project team to create multi-sectoral regional strategic planning for sustainability goals meant to improve sustainable outputs in the island at large. Also, locating the plant in an industrial site achieves ease in waste management and infrastructure that allows traffic and heavy machinery to enter and leave the port with ease.

The project from its outset develops an ingenious way to establish infrastructure integration with its public-private partnership, in which all the government's infrastructure upgrades in the area are ultimately connected by virtue of the build-own-operate contract relationship. Thus the plant's contracting phase syncs with the ending phase of the installation of pipes of WASA's water delivery system in the region, previous to the project's planned construction phase. This type of work is not a coincidence, but the conclusion of Seven Seas Water's and Trinidad and Tobago's development of synergies that evolved into a co-production that ensured an overall improvement of infrastructure integration.

[11] Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," n.d., 2–4.
[12] Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, 10.
[13] WASA, *Waterworld*, issue 3, p. 21.

Planning

This subcategory recognizes project teams that streamline processes, develop synergies within the appropriate national regulations, and/or push for change in regulations to further welcome the latest sustainability goals. In order to develop a streamlined long-term plan, the project team must organize logistics for production processes that enable cost savings as well as efficiency between laws and overall production.

Planning in this subcategory is twofold: through government synergies and policies that invite the best companies to work in an inviting regulatory framework; and from the Seven Seas Company's commitment to uphold their design-finance-build-own-operate contract with an option to transfer.[14] This contract is meant to work with the overall infrastructure upgrading that the country is undergoing and pushes the company to have near-perfect maintenance performance, especially with stormwater management, ground- and surface water protection, and waste management, ensuring that the country's scarce resources, vast coastal area, and delicate marine biology are protected.[15]

The public-private agreement facilitates dialogue between stakeholders, including the national government, which also promotes the development of sustainable infrastructure in public announcements and policies. The Point Fortin Desalination Plant made several changes to promote a streamlined process from construction to longer-term planning that consider choice in suppliers and their effects on the plant, translating the prefabricated electrical nodes to decrease safety hazards, and working with the government to meet all local regulations.

The project shifted its design so that the plant is developed through smaller phased modules. The shift made the construction take a little longer with a greater amount of start-up checks, but the prefabricated electrical equipment (installed in containers and shipped to the site) decreased the safety hazards of building at Point Fortin. The example of shipping the prefabricated electrical materials is an example of streamlining to ensure a better process for all involved. The smaller modular components are more durable and flexible, extending the plant's useful life. The smaller phased construction allows for maintenance to replace smaller nodes instead of a whole section of equipment if something goes awry.[16]

[14] Coastal Dynamics Ltd., "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant"; and WASA, *Waterworld*, issue 3, p. 21.
[15] WASA, *Waterworld*, issue 3, pp. 9–11.
[16] Grieves and Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," 2–4.

An overall baseline report analyzed the set of regulations the plant had to follow and did not find any conflicts between the sustainable development of the plant and the steps taken to obtain the permits and abide by national regulations.

In terms of suppliers and materials procured, the advanced membrane technology utilized enhances the overall durability of the plant. Dow tests its materials to prove that they will be stronger and more durable over their lifetime.[17]

5. RESOURCE ALLOCATION CATEGORY

The Resource Allocation category deals with material, energy, and water requirements during the construction and operation phases of infrastructure projects. The quantity and source of these elements as well as their impact on overall sustainability are investigated throughout this section of the Envision rating system. Envision guides teams to choose less toxic materials and promotes renewable energy resources. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

Materials are an essential component of infrastructure. From raw materials comes the development of the physical, built presence of the desalination plant; each supplier and every set of equipment, electrical or otherwise, has raw materials embedded in it. To build all of the parts, materials should be considered, measured, and strategized in order to minimize usage.

Minimizing the materials reduces the dependence on natural resources. The crucial information is where the materials are coming from and where they are being used, with an understanding also about their waste products and the means and processes needed to throw them away. This project considers its suppliers with great strategic understanding that all materials from suppliers should consider sustainability. The Aquastore tanks and the gauges are highly sustainable in their use of materials; however, no identification has been reported of a reduction in weight and volume of natural resources due to the implementation of sustainable practices. Dow membranes are also very sustainable, with documentation of energy savings and life cycle analysis. In order to assess this material and incorporate sustainable practices into the process, the team should keep the life cycle analysis records and allow this information to be available for analysis.

[17] Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatment?," *Water Online*, http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/ (September 18, 2015).

Energy

Fossil fuels are not unlimited and yet are commonly used to energize infrastructure projects large and small. Replacing the demand for fossil fuels with renewable sources, ones that are cleaner and do not emit the types of particles that warm the earth, encourages sustainability.

The project is assessed according to its careful consideration of three aspects of energy: reducing energy consumption through energy saving systems; the use of renewable energy instead of fossil fuels; and the monitoring of energy use to plan and mitigate. If one knows how much energy is used, a sustainability or energy-saving plan can try to reduce this by calculating a saving budget for energy alone. Energy is also monitored to make sure the engineered infrastructure is being used properly and is functioning to its full potential.

To reduce energy, the project team researched the best supplier for the membranes of its reverse osmosis system. The Filmtec Eco membranes reduce energy use by the desalination plant by up to 40%, and the project avoided using a distiller, which depends on fossil fuels. This specific decision is a prime example of the types of choices a private company can make in its individual parts to ensure that a plant works optimally. The next step would be to include a full energy analysis of the plant in order to know the percentage of renewable energy by source (wind, solar, etc.). It is recommended to look for ways to power the plant with less reliance on non-renewable energy sources, which will ultimately decrease its effect on global climate change.

Also in line with the recommended action under the materials section, conducting a life cycle analysis is extremely beneficial in reducing net embodied energy by studying options to minimize materials in terms of transportation distance, manufacturing needs, and extracted natural resources. The project life of the life cycle analysis must include construction, operation, and maintenance to ensure that all materials and their embodied energy are taken into consideration. Net embodied energy is the ending balance of all of the energy required for extracting the raw materials and then transforming them through the supply chain.

The project does not rely on on-site renewable energy sources to reduce energy taken from the national grid. Therefore, the project is encouraged to be a leader in this area by taking a whole-systems approach to energy supply coming from renewable sources.

Water

Water is examined relative to an increased demand for this resource from a growing population. Freshwater scarcity occurs due to contamination of waterways and the effects of climate change on rain, droughts, and evaporation of rivers (to name a few). Like energy, water is measured by the project's ability to monitor and reduce how the plant uses it with alternative sources, such as captured stormwater. Monitoring is critical to see whether the project is ensuring the vital resource's availability and quality. The objective is to validate whether a community's water consumption balances with the project itself.

The project is, therefore, always encouraged to develop a comprehensive understanding of the net impact of water usage over its production. In this case, the project performs above the industry norm both in producing freshwater that is of exceptionally good quality and in monitoring its effluent into the sea. This project creates a clear net positive impact on the community, achieving water supply for 29,000 people. The pipeline system transports water from the desalination plant as well as the Caroni Water Treatment Plant to support water needs. The water works in a closed loop that allows for the project's intake to equal its discharge. In general, the desalination plant has the ability to use, treat, and reuse non-potable water. The reductions are included in keeping employees at a minimum during the operational phase. All toilets are portable and therefore the water use is minimal. No drinking water is delivered to the plant; a sustainability strategy for how drinking water is provided is important to fully understand all water usage.

The plant's water management is part of its public-private agreement, which ensures that all water-related activities (non-potable water, recycled grey water, and stormwater) are suitable and of high quality so as to protect all waterways. In addition, the effluent must be mitigated against any potential contaminants. To achieve this, Seven Seas Water hired a team of specialists to conduct a baseline report that measured the conditions of the site at sea before the installation of the plant, and then followed the report's recommended quality assurance for all freshwater produced at the plant. Monitoring was a key component of the plant's recommendation, with a rigorous set of sampling practices, maintaining all quality with above-industry norms. In addition, the Certificate of Environmental Clearance contract has made an agreement with Seven Seas Water to ensure that all portable toilets are constructed above flood levels to reduce the risk of contaminated runoff during the rainy season. Sanitary waste is treated and handled off-site by the contractor. The effluent of the portable toilets is not to be discharged into surface drains, natural watercourses, or outside of its final waste management off-site location as pre-established with a third-party contractor. All waste records are archived

for EMA review or audits. This last example is one way that both the private and public sectors ensure superb water quality so as to protect the scarce available ground- and surface water.

The monitoring plan for the desalination plant will quantitatively assess environmental conditions. The water quality at Point Fortin may be affected by construction activities as well as operational activities of the desalination plant (e.g., solid and liquid waste generated by employees, fuel, oil and chemical spills from marine vessels, vehicles, machinery, and equipment). Water samples should be obtained from the 6 pre-existing (baseline) sampling stations. Water samples are collected 2 m below the surface and bottom levels at 1.5 m above the seabed.

Macrofauna are monitored quarterly during construction and every six months for the first two years of operation to see if the macrofaunal community is unchanged. All effluent was tested for compliance with the Trinidad and Tobago Industrial Effluent Specification Standard and the Water Pollution Rules of 2001. The Petrotrin facilities are used for the gray and black water disposal. Overall, post-production monitoring measures and checks the water that comes back to the sea to benefit the benthic communities at the bottom of the food chain and other fish up the food chain.

6. NATURAL WORLD CATEGORY

The Natural World category focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects with a focus on enhancing surrounding natural systems. Natural World is subdivided into three subcategories: Siting, Land and Water, and Biodiversity.

Siting

The Siting subcategory highlights the importance for infrastructure projects of avoiding impacting ecological areas of high value such as water bodies and wetlands and of establishing buffer zones to protect them.

The site chosen for the desalination plant was in a previously developed industrial area and was filled with scraps of metal and used and leftover equipment, mostly rusting and disintegrating. The site required some intense cleaning to ensure it met the standards for construction. The scrap metal and waste was got rid of and topsoil was replenished. The surrounding space was mostly industrial zone within a larger coastal area that is prime marine habitat. To preserve the latter, the project hired the environmental consulting firm Coastal Dynamics to measure the

conditions of the site before it was installed and compare them to the conditions after installation. The purpose was to develop managed strategies to minimize altering or negatively affecting the marine biology. In terms of protecting land habitat, the choice of an industrial zone eliminated any question of using a Greenfield; the construction of the project could not alter biodiversity there in a substantial way.

For the marine environment, the project monitored the water's pH and overall composition in order to protect benthic biology, which is central to feeding other marine biological organisms. It is recommended to develop a site plan with a vegetation and soil protection zone boundary to maintain a buffer, so that the construction on the coast doesn't affect the buffered zone. The project team should then try to restore a previously degraded zone, with the restoration locations delineated within a plan that redevelops these zones.

In the process of preserving the benthic communities, the project protects and conserves the larger marine flora and fauna.[18] In terms of the topography and geology of the area, no significant slopes or adverse geologic formations have been identified in the area. Some opportunities for improvement include conducting a geomorphic analysis to stabilize stream banks and sediment transport and thus the shoreline.

Land and Water

The marine baseline report is extremely helpful as it measures all the variables of the surrounding habitat before the project was constructed. Seven Seas Water hired specialists to develop a monitoring system as well as strategies to mitigate any potentially harmful effects of the plant on its habitat. In terms of water management strategies, the project has the opportunity to develop a system for harvesting gray water to use for some of its own cleaning needs. It also can establish a way to manage stormwater and protect underground and surface water. Most of the documentation was provided through WASA and did not necessarily represent the project's proactive choice to protect the existing water of the site.

It is important to minimize any harm to the coast from contaminants in stormwater runoff. According to the documentation provided, stormwater management is applied through the public sector's environmental compliance contract, which requires implementing some best practices. Seven Seas Water doesn't have a set of established policies on how to establish low-impact development measures in the design in order to minimize its increased water runoff.

[18] Coastal Dynamics Ltd., "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant," 73.

Some options commonly include using infiltration, water harvesting, evapotranspiration, and/or cistern storage. The contract signed with Seven Seas Water includes some of these practices, but the project team doesn't directly include a set of documentation from the project's stormwater strategies.

The project is recommended to include strategies to decrease coastal contamination via runoff canalization into drains (natural or man-made). Some strategies could include measuring the site's water storage capacity, with a target capacity of 100% storage to mitigate the negative effects of having impervious built surface area.

In terms of land, the project chose to construct on an existing industrial site. This means the site is perfect for creating a positive change. The site as found was in very poor condition, with waste materials spread all over. The project's construction turned a degraded and waste dump into a source of clean water for 29,000 residents, a great use of a vacant plot within an industrial zone. One issue, though, is the possibility that the plant would create barriers for wildlife. This issue has not been studied and could be further developed to enhance wildlife corridors from one side of the island to another.

Biodiversity

Water quality and biodiversity protection are directly related in this project. The desalination plant tests water quality approximately one kilometer out in Guapo Bay to measure the effects of the plant's discharged effluent.. In cases where the effluent produces higher levels of salinity, increased temperature, and/or total alkalinity, the project has monitored the negative impacts on marine water quality and hence the marine biological environment. On occasions when salinity changes, the reverse osmosis brine used in the desalination process also is affected. The brine in reverse osmosis is denser when impacted with increased levels of salinity and this affects benthic communities, which are at the bottom of the food chain for fishes and marine life.

The project team is aware of this, and through consistent monitoring of the water effluent they manage and mitigate this potential hazard. The team respects the tolerance limits of marine life to different salinity and hires marine biology specialists to explore marine species and develop plans to improve species health in the area impacted by the plant.

7. CLIMATE AND RISK CATEGORY

Envision aims to promote infrastructure developments that are sensitive to long-term climate disturbances. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promotes mitigation and adaptation actions to ensure short and long term resilience to hazards. Climate and Risk is further divided into two subcategories: Emissions and Resilience.

Emissions

The Emissions subcategory looks for a better understanding of greenhouse gas emissions and other pollutants during all stages of a project's life cycle. Reducing emissions improves the project's performance and minimizes short- and long-term risks to the life cycle of the project.

Overall, the project measures its air pollutants and establishes mitigation strategies for each decision in the construction as well as the procurement of materials. Stockpiles are cleared and maintained in dampness when the rain is not abundant because the ambient air and overall public health are very important. Geotextiles and dust screens should be used over stockpiles, keeping the aforementioned in an area that is downwind from the built site location; making sure these piles are smaller is a best management practice that should be used.

In terms of regulations, refrigerants, foams, and aerosols were not permitted in the project to better protect atmospheric ozone. No information was provided for the project regarding a comprehensive life cycle carbon assessment or carbon footprint in order to calculate the reduction of greenhouse gases.

The project is recommended to measure the six criteria pollutants: carbon monoxide, nitrogen oxides, sulphur dioxide, and suspended particulate matter smaller than PM-10, ozone, and lead. Calculating these pollutants following international standards will help increase the air quality in the area.

Resilience

Climate change can have a strong negative effect on the durability and longevity of the plant. The project identifies a list of potential environmental hazards but does not provide alternative design options in the event that the weather conditions change in the area. Taking these

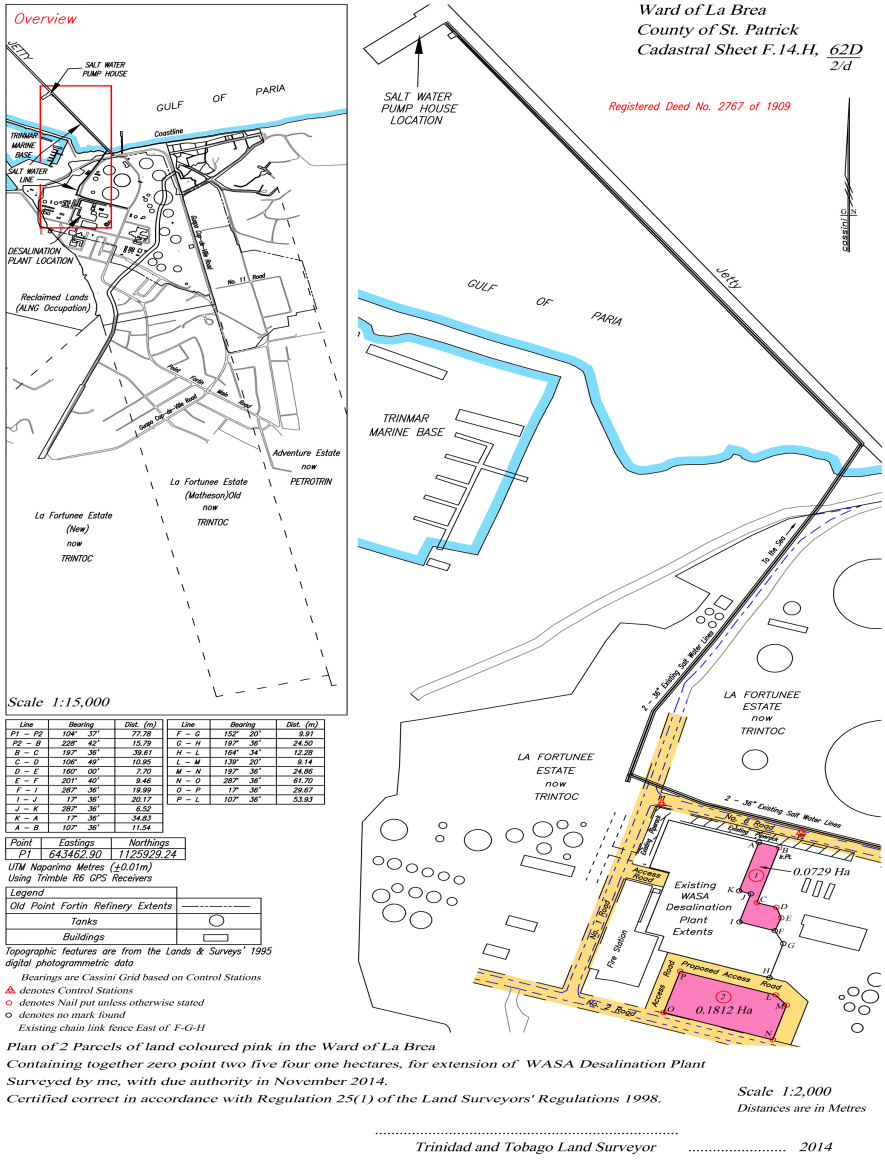
considerations into account in the design of the project can help achieve long-term adaptability.

The project has provided natural hazard assessments, such as for heat waves, droughts, rise in temperatures, floods, etc. Each identified natural occurrence has a contingency plan in the health and safety protocols. When assessing man-made contingencies, such as oil/fuel spills during the construction, the project effectively designed strategies to mitigate leaks in the area. The strategic recommendations made by Coastal Dynamics to mitigate emissions in the construction phase were followed, which allows the project to achieve a greater sustainability by taking into account the negative effects of the construction phase on its environment. In addition, monitoring systems and management plans surpass best practice. For further improvement in this subcategory, taking into account the potential for coastal sea changes affected by climate change, the project would benefit from future scenario-building assessments of the coast's changes and their effect on the plant's rate of water production.

The project also achieves a higher level of sustainability with some of its reverse osmosis membranes by considering sourced products with the highest technical capability that ensures adaptability to unforeseen climate change consequences. The project effectively uses its profit margin to enhance the scientific evidence on effective site selection and holistic mechanisms for ecological interaction, having a greater impact on building sustainable infrastructure. In terms of other climate-related effects, the desalination plant is located in an industrial zone, which by definition avoids development on greenfields, slopes, and important natural habitat. It is recommended that the project take into account the material used on the plant's surface area to decrease its heat island effects. Heat island is produced when a building or built environment's surface area absorbs enough solar radiation to increase nearby temperatures and affect the surrounding habitat in negative ways.

APPENDIX:

APPENDIX A: PROJECT PICTURES AND DRAWINGS



Line	Bearing	Dist. (m)	Line	Bearing	Dist. (m)
P1 – P2	104° 37'	77.78	F – G	152° 20'	9.91
P2 – B	228° 42'	15.79	G – H	197° 36'	24.50
B – C	197° 36'	39.61	H – L	164° 34'	12.28
C – D	106° 49'	10.95	L – M	139° 20'	9.14
D – E	160° 00'	7.70	M – N	197° 36'	24.86
E – F	201° 40'	9.46	N – O	287° 36'	61.70
F – I	287° 36'	19.99	O – P	17° 36'	29.67
I – J	17° 36'	20.17	P – L	107° 36'	53.93
J – K	287° 36'	6.52			
K – A	17° 36'	34.83			
A – B	107° 36'	11.54			

Figure 5: The Site Before the Plant was Constructed
Sources: Design Images, Dropbox Folder, Seven Seas Water

Figure 6: The Site Before the Plant was Constructed
Sources: Kaizen Photos, Dropbox, "Site Before Cleanup".

Figure 7: The Desalination Plant
Sources: Seven Seas Water, Image of Plant

Figure 8: Pipes to the Sea
Sources: Images Seven Seas Water Company

Figure 9: Pipes to the Sea to A*quastore* to the Tanks
Sources: Images Seven Seas Water Company "Pipes 2010-09-01"

Figure 10: The Jetty seen toward the Sea
Sources: The Jetty, photos delivered by Seven Seas Water Company

Figure 11: Oil Well
Sources: Oil Well, Photos given by Seven Seas Water

Figure 12: Oil Well Space
Sources: Oil Well, Dropbox, delivered Seven Seas Water

Figure 13:Oil Well seen from different angles of the Site
Sources: Oil Well, Dropbox Seven Seas Water Company

Figure 14: Oil Well
Sources: Oil Well, Dropbox, delivered by Seven Seas Water

Figure 15: The Site after Clean-up
Sources: The Site after clean-up, Dropbox Delivered by Seven Seas Water

Figure 16: The Well
Sources: A well by Seven Seas Water

Figure 17: Fire Stack
Sources: Fire Stack, by Seven Seas Water

Figure 18 and 19 Structural Photos
Sources: Structural Photos by Seven Seas Water and Fire Stack

Figure 20: Pipes
Sources: Fire Stack by Sven Seas Water

Figure 21: Structural Photos before making Plant
Sources: Structural Photos, Seven Seas Water

APPENDIX B: ENVISION POINTS TABLE

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
		QL3.2 Preserve views and local character	1	3	6	11	14
		QL3.3 Enhance public space	1	3	6	11	13
	VULNERABLE GROUPS	QL4.1 Identify and address the needs of women and diverse communities *	1	2	3	4	
		QL4.2 Stimulate and promote women's economic empowerment	1	2	3	4	
		QL4.3 Improve access and mobility of women and diverse communities *	1	2	3	4	5
					Maximum QL Points:	194**	
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
					Maximum LD Points:	121*	
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
		RA2.3 Commission and monitor energy systems	—	3	—	11	
	WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
		RA3.2 Reduce potable water consumption	4	9	13	17	21
		RA3.3 Monitor water systems	1	3	6	11	
					Maximum RA Points:	182*	

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
					Maximum NW Points:	203*	
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
	RESILIENCE	CR2.1 Assess climate threat	—	—	—	15	
		CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
					Maximum CR Points:	122*	
					Maximum TOTAL Points:	822*	

* Indigenous or afro-descendant peoples
** Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

Figure 22: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX C: GRAPHS

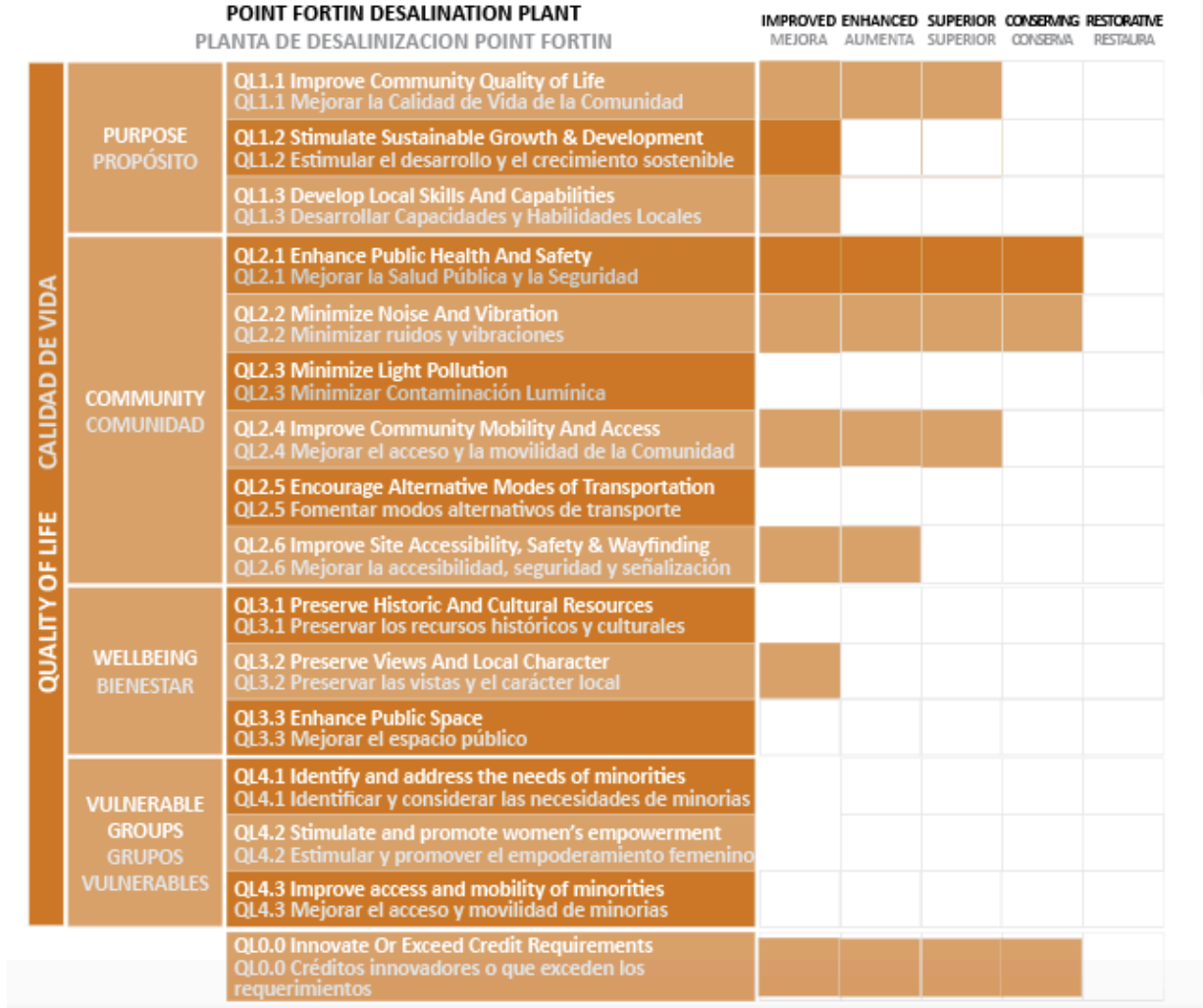


Figure 23: Quality of Life category_ Summary of results

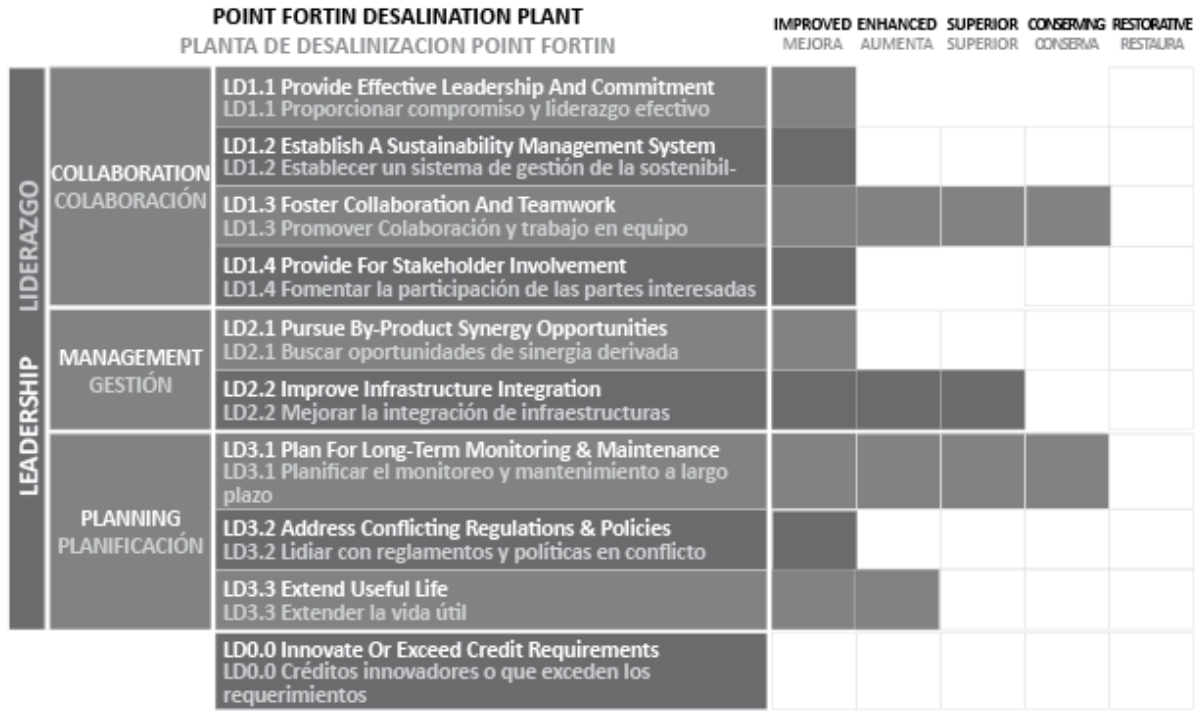


Figure 24: Leadership category_ Summary of results

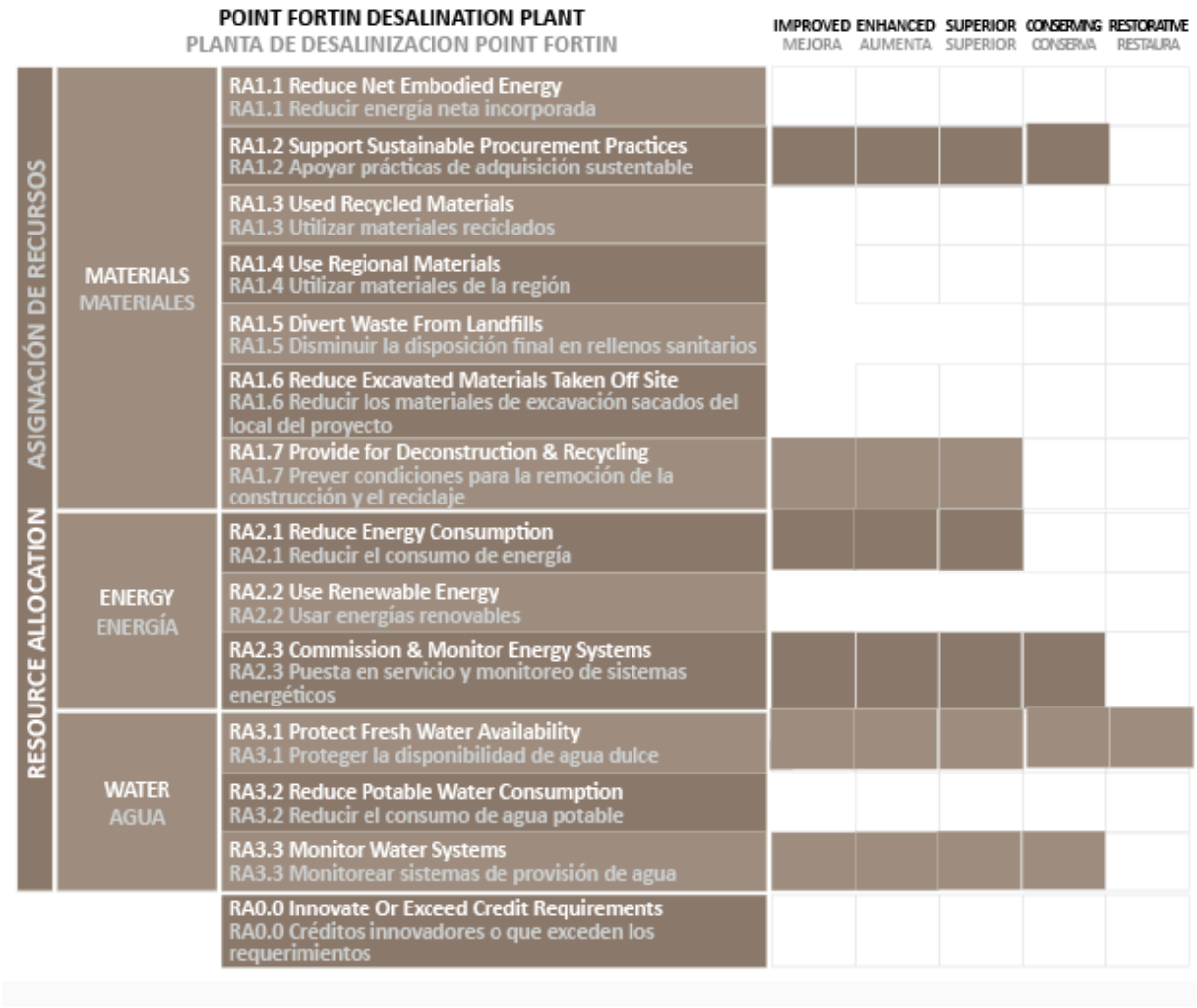


Figure 25:Resource Allocation category_ Summary of results

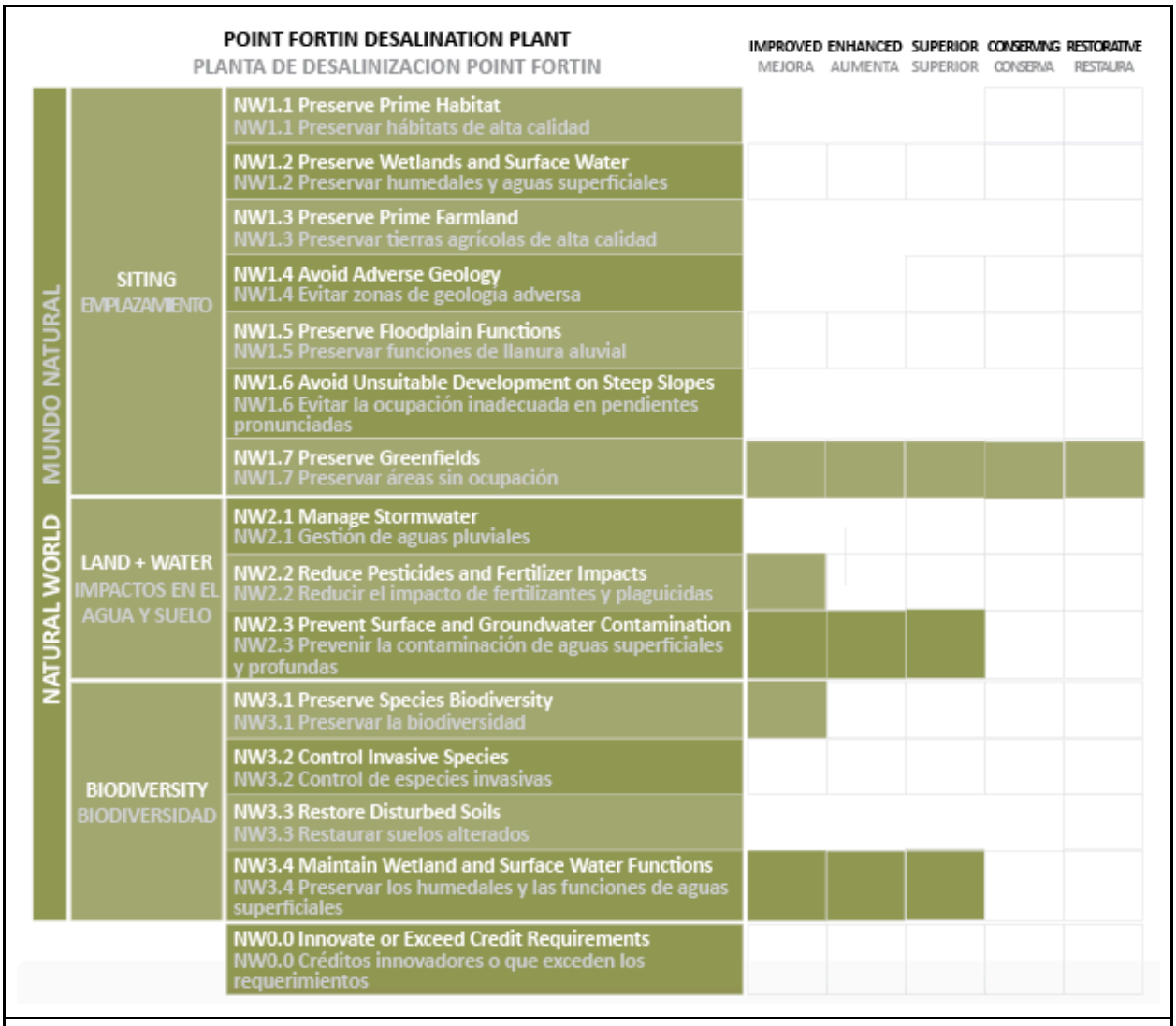


Figure 26: Natural World category_ Summary of results

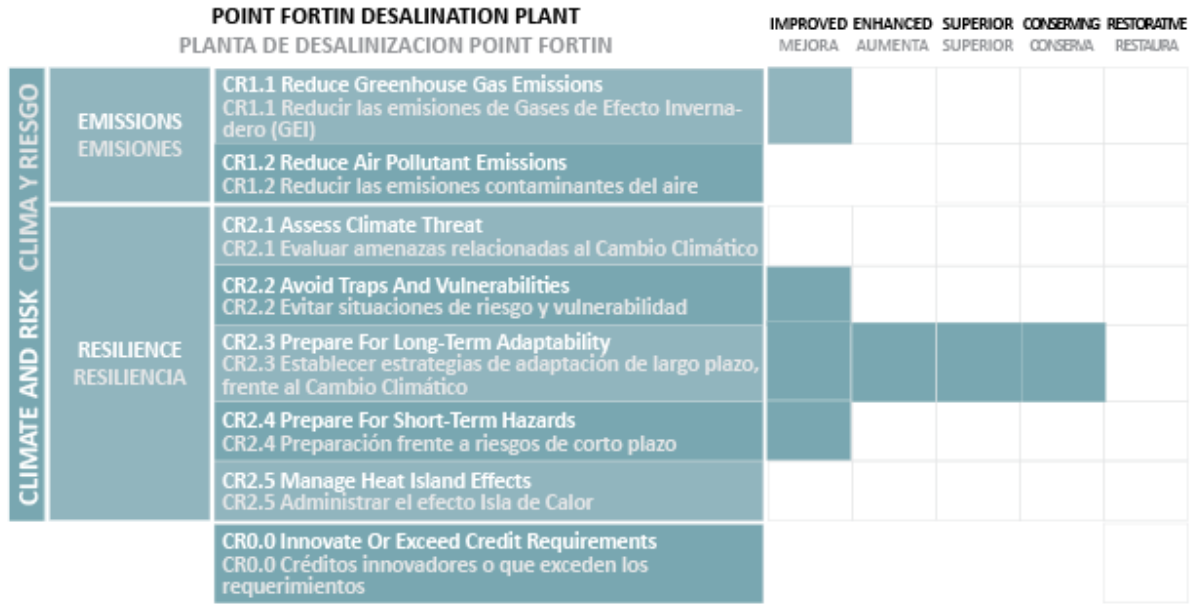


Figure 27: Climate & Risk category_ Summary of results

			POINT FORTIN DESALINATION PLANT, TRINIDAD & TOBAGO	PT.	Performance
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	10	Superior
2			QL1.2 Stimulate Sustainable Growth & Development	1	Improved
3			QL1.3 Develop Local Skills And Capabilities	1	Improved
4		COMMUNITY	QL2.1 Enhance Public Health And Safety	16	Conserving
5			QL2.2 Minimize Noise And Vibration	8	Conserving
6			QL2.3 Minimize Light Pollution	0	No Score
7			QL2.4 Improve Community Mobility And Access	7	Superior
8			QL2.5 Encourage Alternative Modes of Transportation	0	No Score
9			QL2.6 Improve Site Accessibility, Safety & Wayfinding	3	Enhanced
10		WELLBEING	QL3.1 Preserve Historic And Cultural Resources	0	No Score
11			QL3.2 Preserve Views And Local Character	1	Improved
12			QL3.3 Enhance Public Space	0	No Score
13		VULNERABLE GROUPS	QL 4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	0	No Score
14			QL4.2 Stimulate and promote women's economic empowerment	0	No Score
15			QL4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	0	No Score
			QL0.0 Innovate Or Exceed Credit Requirements	6	Conserving
			QL	53	

			POINT FORTIN DESALINATION PLANT, TRINIDAD & TOBAGO	PT.	Performance
16	LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership And Commitment	2	Improved
17			LD1.2 Establish A Sustainability Management System	1	Improved
18			LD1.3 Foster Collaboration And Teamwork	15	Conserving
19			LD1.4 Provide For Stakeholder Involvement	1	Improved
20		MNGMT.	LD2.1 Pursue By-Product Synergy Opportunities	1	Improved
21			LD2.2 Improve Infrastructure Integration	7	Superior
22		PLANNING	LD3.1 Plan For Long-Term Monitoring & Maintenance	10	Conserving
23			LD3.2 Address Conflicting Regulations & Policies	1	Improved
24			LD3.3 Extend Useful Life	3	Enhanced
			LD0.0 Innovate Or Exceed Credit Requirements	0	N/A
			LD	41	

			POINT FORTIN DESALINATION PLANT, TRINIDAD & TOBAGO	PT.	Performance
25	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce Net Embodied Energy	0	No Score
26			RA1.2 Support Sustainable Procurement Practices	9	Conserving
27			RA1.3 Used Recycled Materials	0	No Score
28			RA1.4 Use Regional Materials	0	No Score
29			RA1.5 Divert Waste From Landfills	0	No Score
30			RA1.6 Reduce Excavated Materials Taken Off Site	0	No Score
31			RA1.7 Provide for Deconstruction & Recycling	1	Imrpoved
32		ENERGY	RA2.1 Reduce Energy Consumption	12	Superior
33			RA2.2 Reduce Pesticide and Fertilizer Impacts	0	No Score
34			RA2.3 Commission & Monitor Energy Systems	11	Conserving
35		WATER	RA3.1 Protect Fresh Water Availability	21	Restorative
36			RA3.2 Reduce Potable Water Consumption	4	Imrpoved
37			RA3.3 Monitor Water Systems	11	Conserving
			RA0.0 Innovate Or Exceed Credit Requirements	0	N/A
			RA	**69**	

			POINT FORTIN DESALINATION PLANT, TRINIDAD & TOBAGO	PT.	Performance
38	NATURAL WORLD	SITING	NW1.1 Preserve Prime Habitat	0	No Score
39			NW1.2 Preserve Wetlands and Surface Water	0	No Score
40			NW1.3 Preserve Prime Farmland	0	No Score
41			NW1.4 Avoid Adverse Geology	0	No Score
42			NW1.5 Preserve Floodplain Functions	0	No Score
43			NW1.6 Avoid Unsuitable Development on Steep Slopes	0	No Score
44			NW1.7 Preserve Greenfields	23	Restorative
45		L & W	NW2.1 Manage Stormwater	0	No Score
46			NW2.2 Reduce Pesticides and Fertilizer Impacts	0	Improved
47			NW2.3 Prevent Surface and Groundwater Contamination	9	Superior
48		BIODIVERSITY	NW3.1 Preserve Species Biodiversity	2	Imrpoved
49			NW3.2 Control Invasive Species	0	No Score
50			NW3.3 Restore Disturbed Soils	0	No Score
51			NW3.4 Maintain Wetland and Surface Water Functions	9	Superior
			NW0.0 Innovate or Exceed Credit Requirements	0	N/A
			NW	43	

			POINT FORTIN DESALINATION PLANT, TRINIDAD & TOBAGO	PT.	Performance
52	CLIMATE	EMISSION	CR1.1 Reduce Greenhouse Gas Emissions	4	Improved
53			CR1.2 Reduce Air Pollutant Emissions	0	No score
54		RESILENCE	CR2.1 Assess Climate Threat	0	No Score
55			CR2.2 Avoid Traps And Vulnerabilities	2	Improved
56			CR2.3 Prepare For Long-Term Adaptability	16	Conserving
57			CR2.4 Prepare For Short-Term Hazards	3	Improved
58			CR2.5 Manage Heat Island Effects	0	No score
			CR0.0 Innovate Or Exceed Credit Requirements	0	N/A
			CR	25	

Total points	**231**	**0**

Figure 28: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX D: CREDIT DETAIL

Point Fortin Desalination Plant: CREDIT SPREADSHEET WITH DETAILS

CATEGORY I, PEOPLE AND LEADERSHIP		
SUB CATEGORY: QUALITY OF LIFE		
	Score	**Point Fortin Desalination Plant**
QL1.1 Improve Community Quality of Life	**10**	**Superior** The project was created in response to water shortages and severe drought in 2010 that led to a series of riots and protests. In order to improve the limited amount of water, the project identifies potable water as a need to be assessed through the Ministry of Environment and Water and Sewerage Authority of Trinidad and Tobago's (WASA). It is through WASA that the host community's needs are targeted. The project is recommended to include minutes of meetings whereby a diverse set of stakeholders, outside of the national government and main constituents, are included, such as residents of the neighbourhoods in the area. The project team has incorporated a community needs assessment. A needs assessment allows the community access to clean potable water 5 times a week in South-West Trinidad & Tobago. The project team, however, hasn't presented documentation that shows community objectives and goals are being incorporated into the final design. Many other national stakeholders were involved in meetings that helped design the Desalination Plant at Pt Fortin. The process has involved key stakeholders such as the US Embassy, the Inter-American Development Bank, WASA employees, the Ministry of Environment and the government at large. The plant is constructed, after a set of hydraulic reports that were commissioned and showed a policy called "One Water". Community leaders, community residents and other members have not been identified in the documentation provided, hence there are missing minutes and records that could alternatively demonstrate a community feedback loop, assessed to verify that the plant meets the community needs (in the construction phase and/or operational phase). Water and Sewerage Authority of Trinidad and Tobago (WASA) succeeds at making sure the benefits of this plant does not adversely affect the lives of neighbouring communities by ensuring freshwater is injected into the transmission system, allowing thus an increase in water to neighbouring communities. In this strategy, the new water (imgd) allows for an improvement to the whole region and country. *Source:* *"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".)* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *RECOMMENDATIONS:* *It is recommended to create plans to incorporate community objectives and goals into the design of its plans. The project team should include a project assessment, approval process, and a verification procedure to make sure the community goals meet the plant's construction and operation.* *It is important to realize that even a plant in the sea affects roads, the overall environment and makes a shift in the community, its landscape and its overall infrastructure. A very useful way to accomplish the aforementioned is to connect with the community before the plant's installation,*

		and collect complaint forms or creates forums that enable open communication lines between the host country and the company's design team. This process would enable the project to receive a higher score.
QL1.2 Stimulate Sustainable Growth & Development	**1**	**Improved** Community growth, associated with the Desalination Plant, indirectly affects how the plant can positively affect the economic growth in the area. The potable freshwater provides 2.4 mgb of potable water to the industrial sector. Point Fortin is the industrial capital of the outland of Trinidad & Tobago, and the energy sector is in the Southern Borough of the islands. The landscape is mainly characterized with the oil and natural gas installations in order to expand the industrial activity, which led to the growth of the population. The benefits of the community's growth is related to the plant's output-- water, and has identified some job growth produced in the construction and operational phase, but with little to none additional efforts to develop capacity training in the area. The industrial sector's growth is an indirect cause of water demands creating more pressure on the water transmission system in delivering the current demand of water to the surrounding residents. The increase in water supply allows WASA to feed the industrial sector's water needs, and consistently achieve a continuous supply of water. Having water is central to allowing industries to do business in this area of the country, thus allowing economic growth of this sector and improve the country's employment. The video documentation demonstrates how the desalination plant's supply of freshwater to the industrial sector allows for the South-West to continue to be attractive to businesses and improve the time available to those *who before the plant was installed* had to fetched their water from the nearby dam. The time the community is saving on fetching water is now available for economic productive activities, which improves the quality life all around. In addition, the government has improved the overall pipes in the country to adequate the infrastructure to the increased supply of water. *Source: "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".)* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *RECOMMENDATIONS:* *Include the following documentation to improve the score:* *-Show an analysis of how the project can create new jobs in all phases of the project.* *-Minutes, meetings, and goals set by community plans can show the level of commitment the project team has to improve the overall skills and match the project infrastructure with the overall goals of the community where it is constructed and the country at large.* *-Information, documentation and designs that allow for an improvement of recreational and cultural capacity by improving nearby facilities like school infrastructures, playgrounds, recreational venues, etc.* *-Reports that analyse long term productivity that are enhanced through the work it delivers.*
QL1.3 Develop Local Skills and Capabilities	**1**	**Improved** Specific campaigns are conducted during the World Water Day Celebration. This is focused in children of all ages in order to teach them about the importance of water resources. Staff from the water facility will help in solving all their questions. No specific programs have been identified in order to promote more expertise labour at the project level.

		Source: "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".) *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").*
		RECOMMENDATIONS: *In order to improve this score, the project should provide the following:* *An explanation or report that shows how the project has improved the skills of the community through capacity building, workshops and training provided.* *Data that relays information on local hires produced to construct and operate the desalination plant.* *Numbers of companies locally hired to help build and operate the plant, this can include waste management companies and other related companies that contributed to the construction of the plant.* *It is recommended a ratio of local hire to general hire (international and local) be included. Also, the project should include ways in which disadvantaged groups can be improved through skills the company develops locally.*
QL2.1 Enhance Public Health And Safety	**16**	**Conserving** This credit assesses the risk associated with the implementation of new materials or technologies applied to the project. Documentation regarding the aforementioned is missing. Nevertheless, a very detailed plan has been provided according to the safety regulations in place. The project team has a set of health policies for 26 different categories from construction to how to use, clean, maintain equipment, and water standards, water monitoring, and making sure filters for water purity are adequately enhanced. In term of the overall ecological system, it ensures the salt separated from the water in the desalination process is expulsed into the area in the ocean where the sea itself can rebalance its salt concentration. In addition, the health and safety manuals follow OSHA protocols, and also have a specific training and health specifications for every potential hazard identified in its infrastructure plant implementation as well as operation. It has weekly monitoring and monthly monitoring depending on the needs of the equipment. Reverse Osmosis Membrane Maintenance and Cleaning is available with detailed overview and mechanisms. One statement made in the Seven Seas Water's Health and Safety Policy Manual is that it will apply best practice standards in geographic regions of the world where the regulatory environment may have insufficient laws to achieve best practice in EHS policies. Therefore following US government's health and Safety procedures in the company's overseas; projects shows their commitment to uphold high safety standards. Their water monitoring and safety protocols in maintaining the filters, the plant equipment ensure for longevity, safety with the use of tested and emerging technologies surpassing the best practice threshold. The Baseline Report extracts the following issues: "Finally, public safety concerns arise if bathers, swimmers or small boats venture too close to the construction activities. The proposed study area is not used for any recreational or fishing purposes. Fishing is not allowed within the area as there is extensive commercial and industrial vessel traffic. As such there will be no potential significant impacts." Mitigation measures are implemented to further minimize impacts the aforementioned baseline report identifies as risk on health and safety: The mitigation procedures include employing guards to ensure recreational activities are not done on site where those activities are not allowed to avoid potential risks of being near a plant. The project team is also identifying signage and warnings posted to make sure people know

		where the facilities are and where there is potential risk, and a strict adherence to Petrotrin's Health and Safety Policy is implemented and assured though monitoring and checklists that make sure people are aware of the risk and maintenance protocols. OSH Act, 2000 is to be followed during construction and operation of the plant and the plant is fenced off to avoid residents from passing the boundaries into the site. The project has team has conducted safety talks and toolboxes to triple ensure safety rules are abided. Job Hazard Analysis is carried out, and the construction site is set to be neatly organized to ensure not accidents The construction site should be left in a neat condition at all times to ensure the safety of workers as well as there is a first aid station on site to deal with minor issues. In terms of marine healthy water conditions, these are monitored consistently and are meant to protect the health of marine benthic communities so as to avoid negative impacts through mitigation processes and the Environmental Management Plan (EMP). *Source: Seven Seas Water, Environmental Health and Safety Manual Book I (Trinidad & Tobago: Point Fortin, N/A), 2-8.* *Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Wtaer Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015).* *Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 22.* *Ibid, 117* *Ibid, 121* *US Government OSHA, "Occupational Safety & Health Administration (OSHA) Standards ," (n.d.). Seven Seas Water, "Seven Seas Water Corporation Environmental Health and Safety Policy Statement," (n.d).* *Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 4.* *RECOMMENDATIONS If the new technology has any risks that can be produced, it would be advised to further investigate these as a way to minimize the risks.*
QL2.2 Minimize Noise And Vibration	**8**	**Conserving** The project falls under the Zone III called "general area", categorized in The Noise Pollution Rules for 2001, which point out that between 8 am and 8 pm of each day the noise pressure level shall not exceed 5 dBA of continuous sound pressure, and not exceed 120 dB of instantaneous unweighted peak sound. Likewise, the project or people involved in the project shall not exceed 80 dBA when measured for continuous sound pressure. The night -time limits change from 8 pm- to 8 am so that the noise pressure level shall not exceed 5 dBA of continuous sound pressure, and not exceed 115 dB of instantaneous unweighted peak sound. Likewise the project or people involved in the project shall not exceed 65 dBA when measured for continuous sound pressure. According to the baseline study, the project was tested on noise and was evaluated to have minor impacts from noise emissions from construction machinery and equipment and according to the measurements and tests, noise was evaluated as not having a significant effect, which complies with the Noise Pollution Rules for 2001. The project's construction phase lasts seven months in which there are minor noise emissions and vibrations correlated with the project construction, are considered to be small because of the context of being located in PETROTRIN‟S Terminal Operations at Point Fortin. In this context,

		the project's construction phase is being built in a radius where there are not residents that would receive these minor vibration and noise effects. The project has several mitigation measures that are recommended to reduce the impact from noise emissions outlined in Section 5.2: Mitigation Measures (Baseline Report). Mitigation measures include the following to reduce the small vibrations and noises: a) The creation of tall hedges and trees are to be implemented in the design to absorb noise and create a barrier or a noise block between the plant and residents; b) Pumps and equipment that emit noise are to be installed at a distance from residents, measured to ensure these vibrations and noises do not affect them. Designing of trees, hedges and distance as variables for the construction of the plant were taken into consideration. In addition, inspections and maintenance are to function to control noise and keep all emissions in check to local regulations aforementioned in the paragraphs above.
		Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), 89. *Marine Environmental Baseline Study for Desal Plant, Point Fortin, Trinidad, 15.* *Ibid, 101.* *Ibid, 114.*
		RECOMMENDATIONS: N/A
QL2.3 Minimize Light Pollution	**0**	**No Score**
		Documentation regarding light pollution was not submitted to properly evaluate this credit. The baseline support offers information only on the aesthetics and noise but light pollution is not included.
		Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 87.
		RECOMMENDATIONS: The project team should consider to conduct an energy-efficient lighting study that can identified areas with needs of high illumination from others where automatic turnoff systems can be implemented. This will reduce energy usage and will prevent light spillage.
QL2.4 Improve Community Mobility And Access	**7**	**Superior**
		The project team measured and observed that during the construction phase there is a potential for traffic congestion associated with mobilizing machinery, transporting material and equipment *from and to* the site. The latter was minor. One reason for little traffic congestions is that the plant itself was contructed in phases and used mitigation processes for emission cuts. For example, the pump house is located just off the jetty. The existing infrastructure in the jetty was at first stated to be reused, and later modified to develop smaller construction phases to be constructed on site. The project major transported material was cement used to construct the concrete platform and aggregate materials are to be transported to the facility, such as pipes. The fact that some of the materials are on site decreases the demand for mobilization of materials relieving traffic in the area. In the operational phase, trucks delivering chemicals to the facility affect the road traffic adjacent to the site. The traffic is expected to be minimal and only cause issues a few days in the year, around the date of the construction of the cement platform. In the case of traffic, measures to mitigate this issue are outlined: one recommendation is to work with Traffic Management of the Police Service to schedule and manoeuvre the movement of larger materials along public roads. Another mitigation measures for traffic congestion includes creating schedules for truck delivery which avoid peak commuting hours, especially for the transport of chemical materials during the operational phase. All waste materials, likewise, are also to be transported to the landfill outside of Trinidad & Tobago's peak traffic hours.

		Finally, all truck drivers are part of the company's training on safety driving techniques to avoid potential accidents that could lead to heavy traffic. Signage for the trucks to move within the site and the construction of an offload section for construction are other ways the project team identified to decrease traffic. Finally, "With the offshore construction, local traffic is almost eliminated. All equipment and materials delivery is scheduled to be by sea to the barge constructing the elements. Any roadway delivery to the site will be nominal; yet will be done with notice and all required flagman, etc to maintain traffic flow along the existing road. It is noted that with the sea based materials/equipment delivery, the roadway traffic flow is far less, and provides the least impact to current user of the road and future ferry commuters." *Source:* Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 87. Ibid, 100 Ibid, 113. MWA, "Design Memorandum Supplemental Report for EMA Seawater Intake Pump Station," 2010, 18. *RECOMMENDATIONS: It is recommended closer communication with local communities in order to improve better transportation. Closer communication ensures transportation alternatives are identified and the project can develop the alternatives to achieve improved mobility.*
QL2.5 Encourage Alternative Modes of Transportation	**0**	**No Score** The project is in a port and industrial site whereby the baseline report found no incidence on an alteration of traffic flow. The report was written by a third-party consulting agency using a legitimate scientific approach to understand the conditions to which the category of traffic conditions before the plant were, in order to understand if the project can address any issues during the construction phase. In the case of traffic, recreational or public spaces used for recreation are identified as potential causes for traffic. However, since there are little public and recreational areas around the industrial site the projects describes these conditions as the precedent reason no traffic issues are found before the development of the plant. This is all to understand why there is little to no traffic mitigation procedures. The project uses mitigation procedures for trucks coming in and out of the site during the construction phase, and use early morning or after-work day hours to transport materials. In addition, an increase in trucks is identified in which case appropriate use of signage is a way to mitigate the issue. *Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 87.* *RECOMMENDATIONS: The project is recommended to encourage alternative modes of transportation with design around the site that encourage bicycle riding, pedestrian sidewalks, and an overall infrastructure alternative to curb traffic and improve other healthier transportation alternatives. To achieve this, it is recommended the project team consider improving barrier between sidewalks and street traffic exceeding 40 mph; building bike paths with lanes separate from street traffic and barriers in between the bike lane and street traffic; develop a design whereby pedestrian traffic is invited and encouraged with large crosswalks and thicker sidewalks, but also designing sidewalks and signage so areas where pedestrians are discouraged are made clear through the physical design of the pathways.*
QL2.6 Improve Site Accessibility, Safety & Wayfinding	**3**	**Enhanced** Signs are used to indicate the construction zone and movement of trucks and materials as exposed in the Baseline Report. Signage for the trucks to move within the site and the construction has been provided. The signs are placed visibly to demonstrate where the trucks can transport goods, waste indications, hazardous materials and overall follow best practice signage conditions. *Source:* Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010). *RECOMMENDATIONS:* In order to design to decrease accessibility issues and vandalism, one suggestion is to install more surveillance; design public space so that the plant integrates the urban context, which

		could include a landscape design that connects the Trinidad and Tobago Desalination plant with trees that are local to the area and also further, connects to the surrounding residential area. Lighting is essential, as it should have street posts and lights that allow for night crime to decrease and to improve the site accessibility. The lighting should also follow code to avoid light pollution.
QL3.1 Preserve Historic and Cultural Resources	**0**	**No Score** No documentation was provided to score this credit. *Source:* *RECOMMENDATIONS: The project team is recommended to work with the country's conservation and historical preservation institutions to identify audits to the site and see whether any historical objects are needed for preservation. One important step needed to achieve preservation of historical artefacts is to create capacity building by experts in preservation to identify if the site has any meaningful or potential artefacts in the marine site that can be destroyed with the project's construction. While the project is being constructed on site, it is a good idea to look at the reports from preservationists of the previous infrastructure development site to ensure the site does not harm any artefacts found undersea.*
QL3.2 Preserve Views and Local Character	**1**	**Improved** The project team is recommended to work with the country's conservation and historical preservation institutions to identify audits to the site and see whether any historical objects are needed for preservation. One important step needed to achieve preservation of historical artefacts is to create capacity building by experts in preservation to identify if the site has any meaningful or potential artefacts in the marine site that can be destroyed with the project's construction. While the project is being constructed on site, it is a good idea to look at the reports from preservationists of the previous infrastructure development site to ensure the site does not harm any artefacts found undersea. *Source:* Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), 102. *Ibid*. 117 *RECOMMENDATIONS:* *Complete a comprehensive report to identify the changes that the views in the area can specify as a result of the project. It is recommended to also identify areas that can be considered as high value.*
QL3.3 Enhance Public Space	**0**	**No Score** This credit tries to promote the implementation of new areas or amenities that can create a more liveable environment within the project's area and with the communities surrounded. Documentation regarding public space is not available to score this credit. *Source: N/A* *RECOMMENDATIONS:* *The project team is encouraged to find ways to develop the area's public space. While the project is in an industrial area, various reports identify some recreational activities that surround the Guapo Bay area at Petrotrin. The idea is to reach out to local residents vis-a-vis meetings and community outreach activities to identify what public spaces can be enhanced, improved or created. On way to do this is to have a community participatory mapping activity whereby fishermen and swimmers who use the bay for their recreation, identify runned down spaces that need some infrastructure upgrading. The plant then can allocate from their CSR funds or appropriate outreach funds to develop these activities. It can be small interventions, such as placing immovable fishing rod stands, so that fishermen can catch from one of the ports, or enhance a nearby beach where residents enjoy their weekend time. The options are infinite, and with a little creativity and some brainstorming events, these are made possible through private companies that build renewable infrastructure such as this desalination plant. In many occasions,*

		when an area is run down from industrial activities, the private sectors small investments can make a stride of change within these low density population areas, where maybe just a <u>few small interventions make a big difference in attracting people to use spaces that were previously disowned or overlooked.</u>
QL 4.1- Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	**0**	**No Score** The presentations and meetings concerning the stakeholder engagement address opportunities for community development and programs in the neighboring countries where Seven Seas Water company operate desalination plants, such as Saint Marten. The project outline how in neighboring countries the company works to improve community through sports like baseball and other activities that are known in the Caribbean islands to benefit social inclusion for children or young adults, as well as women. However, the presentations do not analyse the socio-economic data that could describe the current conditions of women and children no afro-descendants. One thing the project shows is how women do spent a lot of time fetching water, and how the construction of the facility will decrease this time, allowing them to devote more time to other activities. There is also a mention of an increase in employment to 200 jobs during construction but a breakdown of this data per gender is not available. *<u>Sources:</u> Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), p. 16.* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011).* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 10.* *Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5.* *"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *<u>RECOMMENDATIONS</u> The stakeholder engagement meetings and presentations were held in 2011-2012, here the project was able to identify potential community programs through hiring consultants that are experts in community involvement, social inclusion programs, and social well-being to outline which areas the residents of the area in La Brea, for example, could benefit. One area that can improve is the identification of women's income and salary, educational level (high school, college, etc) in order to give them the skills necessary to contribute to a family's quality of life. Training women in areas not related to plant or training them in areas related to the plant could offer women in the area alternatives in employment opportunities.* *Minutes of the community meeting question and answer portion are highly advised to be kept, documented and shared to properly evaluate this credit. In addition, sociological reports and interviews to residents whereby women and minority needs are assessed are highly recommended as well. Overall, any infrastructure project has a dual set of benefits: a) direct benefits coming from the project's output, in this case pure, healthy water, and b) indirect benefits where he project steps out of the boundaries of the project's output (water in this case) and finds ways to improve communities through infrastructure upgrades of nearby schools, capacity building workshops where women learn how to use the new daily savings in time from fetching water to other productive opportunities. Another example is providing tuition or scholarships to people in the community to go to school for a higher education in sustainable hydraulics engineering. The previous 3 sets of examples only serve as examples but are meant to provide with outside the box thinking for communities to be enriched through the presence of international corporations invited by WASA to work and be in their country- Trinidad and Tobago.*

QL4.2 - Stimulate and promote women's economic empowerment	**0**	**No Score**
		The project team provided documentation that showed overall employment opportunities of 200 new jobs during the construction phase and 15-20 in the operational phase, nevertheless there is no specific focus on women. The potential of providing capacity building training has not been observed in the documents provided.
		Source: Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), p. 16. *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011).* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 10.* *Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5.* *"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").*
		RECOMMENDATIONS: The project team is recommended to keep data on the number of occupations employed by gender as a means to evaluate its impact on gender empowerment. The project should also evaluate how the project will guide any improvements in women's lives. In the documentation, the project makes it clear that the project will help by delivering fresh clean potable water and free people's time, otherwise used to fetch water. However, it is recommended the project seek a third-party consultant or group to analyse community needs through a precise community engagement process that identifies ways in which the specific society can help women improve in the arts, employment and other local endeavours that would capacitate them further to increase their quality of life in terms of discretionary income, skills and abilities (to name a few among many other potentials). *Specialists such as sociologists, anthropologists and social scientists including economists and international development specialists could help derive the specific information that guides the process further. The UN millennium development goals include women's empowerment and employability as a goal, and hence in general provide many guidelines in providing for women in developing countries. Documentation of plans to improve women's workforce is also highly encouraged. The examples in the documentation include specific examples for neighbouring projects in which Seven Seas Water is currently operating, which all show the overall company's commitment to women in similar projects, which is highly commended and encouraged. In such a way, the data must be provided for the country that is being currently evaluated in terms of gender specificities.*
QL4.3 - Improve access and mobility of women and	**0**	**No Score**
		The project should identify the special mobility needs that can affect in a more concrete way to afro-descendant people. In general, the biggest benefit of the population of Trinidad & Tobago is the relative water supply. No specific attention was created to mobility of certain minorities.

diverse communities (indigenous or afro-descendant peoples)		*Source: Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), p. 16.* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011).* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation,Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 10.* *"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".)* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5.*
		RECOMMENDATIONS: *The project is recommended to develop assessment studies on the effects of the desalination plant to women and afro-descendent mobility, studying how infrastructure development of freshwater removes barriers for women. The report should follow specific social science methodologies. In addition, a list of decisions made specific to the aforementioned populations and their respective actions should be listed as to understand how the project met the needs of the population with programs that allow for upward mobility and an increase in status, class and economic well being. Another recommendation is to provide reports that assess the barriers women and afro-descendants face in the island, in order to provide social scientific basis for the actions taken as well as the programmes proposed (if any are proposed). The indirect benefits of water are taken into account however more detailed reports and assessments are needed to better provide a score for this credit. It is highly recommended that all the documentation be reports using scientific research methods to showcase the relationship between the programs and results on women. Impact assessments are therefore a recommendation for this specific case study.*
QL0.0 Innovate Or Exceed Credit Requirements	**6**	As part of the commitment of Seven Seas Water to enhance the quality of life of the population as well as the growth and development in the area, a partnership has been signed with the University of Trinidad & Tobago in order to offer apprenticeship opportunities to students enrolled on The National Engineering Technician Diploma (NETD) in Chemical Engineering. As a result, the outcome expected is more expertise on the water treatment industry in the long term. Some of the areas of collaboration between the project team and the students are water plant operations, interpersonal and communication skills. This education will complement the on-campus learning. In other different programs, the students are also invited to assess and identify technical challenges and provide solutions to it.
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SUB CATEGORY:LEADERSHIP		
Score	**Point Fortin Desalination Plant**	
LD1.1 Provide Effective Leadership And Commitment	**2**	**Improved** The project team has made public commitments in their videos and presentations to different stakeholders to allude to the sustainable affects the output of fresh water has on its society's economic welfare, social balance and ecological benefits. The credit hopes to define the level of sustainability that is specific to the organizational structure. The credit tries to define how sustainability is addressed at each stage of the project installation, including the construction and operational phase, and how it attempts to address sustainability in the triple bottom line. *Source: Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), p. 16.* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011).* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation,Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 10.* *"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".)* *"WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").* *Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5.* *RECOMMENDATIONS: The project is recommended to develop a corporate sustainable approach to the way in which it operates. While the information on energy savings is available as a comment, it is recommended the amount of energy saved be measured and included in the report. The project has many levels of sustainable thinking, but this category measures how sustainability is addressed within the plant and its respective operation, as well as every step of its construction. Minutes of meeting whereby the project owner, designer, contractor, and operator, address sustainability within the plant itself and issues pertaining the project are recommended. In a more general recommendation, the sustainability component within the plant is to move from making statements of sustainability to developing internal strategies that address many forms sustainable thinking from within and throughout its employees and in the equipment, material waste management, energy savings of the plant itself.*
LD1.2 Establish A Sustainability Management System	**1**	**Improved** The project team shows the company's commitment to sustainability as a concept at large within the country and in relation to its product, water. Also, the project's health and safety manual showcase a commitment to delivering a good overall work environment for its employees. Source: Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), 16. Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011). Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation,Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), 10. "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of

		Trinidad and Tobago ("WASA"). "WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA"). Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), 3-5. Seven Seas Water, Environmental Health and Safety Manual Book I (Trinidad & Tobago: Point Fortin, N/A), 2-8. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015), 1-2. Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), 22. Ibid, 117 Ibid, 121 US Government OSHA, "Occupational Safety & Health Administration (OSHA) Standards ," (n.d.). SevenSeas Water, "Seven Seas Water Corporation Environmental Health and Safety Policy Statement," (n.d).
		RECOMMENDATIONS: The project team is recommended to establish a sustainability management system. Currently, many companies perform or develop environmental management systems, and some other companies are moving their business processes to engage a sustainable management system, which commits their company from a hierarchy of sustainability goals, integrating these goals within the position description of top managers as well as lower management, and enabling a process within procurement and the horizontal procedures. These sustainable organizational goals are to be met within the company's management goals and should achieve internal management triple bottom line, such as improving employees' health, safety and employment skills; improving the project's use of unsustainable mechanisms (printing one sided, using disposable coffee cups, as examples, etc), and gearing the company to achieve economic improvements while dealing with the employees and procurement of materials sustainably. Company policy should guide this shift from environmental management to sustainable management, which includes an equal focus to environmental outputs like to social and economic outputs within the company's processes. The policy should show a commitment with the project team's approval to exceed health and safety best practice protocols, improving ethical guidelines, and including social aspects for its employees to enjoy improvements in the social arena; all customized to meet the project's product goals. The project therefore is to provide documentation regarding their current environmental management system handbook or overall procedures and ways in which this plan is being converted into a sustainability management plan through flowcharts, organizational chart with the respective sustainability job position and/or job descriptions with the sustainability portion included and highlighted; sustainability goals from within the company; and if possible a sustainability management system procedure's plan. If the project does not have the latter, a consultant specialized in the area can become part of the team in order to shift the company's policy (top-down and bottom-up) to achieve a higher score in this credit.
LD1.3 Foster Collaboration	**15**	**Conserving**
		The Seven Seas Water Company's policy on Water-As-A-Service ensure a company whole systems

And Teamwork		approach with team members, engineers, and field service operators to work in a collaborative manner to ensure any issue is handled as a team and ensure plant performance with consistent and continuous feedback loop with one another so that the process of water delivery is improved upon on a consistent basis throughout the 10-year lifespan of the organization. The project follow a business model called "Water-As-A-Service™ (WAASTM)", with the long-term goal of providing a return on investment that depends entirely on effective management and operations of the plants. The project therefore is quite collaborative in the operational phase and has no documentation regarding the construction phase. *Source:* "Seven Seas Water Company Water-As-A-Service Policy," last modified Sep 2015, http://sevenseaswater.com/en/the-way-we-work/water-as-a-service/ *RECOMMENDATIONS:* *Integration and collaboration of the different entities that are taking part on the project is recommended to be done in an early phase on the process. In order to prove the willingness to collaborate is important to establish risk/reward sharing in the contract signed between the parties.*
LD1.4 Provide For Stakeholder Involvement	**1**	**Improved** The project has provided a set of presentations for the mayor of the corresponding site in Trinidad & Tobago, and three meetings on March 2nd 2011, on February 17 2011, and January 11 2012. It provided with a forum in a conference room setup with 20-30 attendees from the community and 4 panellists for answers and questions, the presentation ranges from 5 slides to 34, showcasing the project, its improvement on water, the engineering and safety aspects related to the project and the overall process. The four meetings define a limited program for stakeholder communication and are characterized as developing information transfer. The objective of these meetings is to enhance and create lines of communication for some community involvement, but these are limited. Minutes and discussion points are not provided in the presentation or as a separate documentation to assess how the feedback received from the community was turned into action. *Source: Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), 1-16.* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011).* *Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation,Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), 1-10.* *Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), 1-5.* *Images 1-4 of Stakeholder meeting, photographer Sven Seas Company, Date: N.D., attendance 20-30 people.* *RECOMMENDATIONS: The project team has shown documentation on the meeting images and the presentations, which is a good start. The next step is to keep a good documented method for the minutes of each meeting and then a series of actions that will be taken to allow for the community's feedback to be incorporated. If the feedback is not incorporated, the project is encouraged to show how the community is being reciprocated for their concerns. Letter and memoranda, included for higher level officials, describing their concerns, and responses documenting how both parties negotiated a middle ground or appeased the stakeholder, is a way to demonstrate that the project manager solicited and assessed stakeholder issues.* *Also, allowing for the community to have a way to leave anonymous feedback through meetings whereby the community learns how to assess the company's website where online complaint forms are available or even a centrally located. Also it is recommended an accessible place for community members to leave any suggestions and complaints in a standardized form or an open-ended white page, which can help facilitate communication among interested parties. The project team has yet*

		to truly incorporate stakeholder input into the project plans and decision-making. In the context of this being a public-private partnership, the project team appeases the government by following the terms of the contract in which they enter upon being given the BOO contract. However, the community needs to be assessed more thoroughly and more opportunities for communication can be accomplished through more robust stakeholder engagement processes. Therefore, an operating stakeholder involvement program is highly recommended for continuous feedback to be integrated into the way the plant operates.
LD2.1 Pursue By-Product Synergy Opportunities	**1**	**Improved** The project improves the performance and reduces project costs with the use of constructing over existing infrastructure. By-product synergy reduces redundancies in systems by identifying a potential waste from nearby facilitates as a resource to be used in the project. In general it uses the by-product or wastes of one system in the creation or development of the second. In this case, the project uses existing infrastructure. The exact way it uses the existing infrastructure is not shown explicitly but is mentioned in several documents. In addition, Seven Seas' engineers incorporated Energy Recovery Inc's PX Pressure Exchangers to recover waste energy from the brine flow generated by the first stage-pressurized systems, which decreases the overall energy used. *Source:* Frederick Hung (YP Business Analysis) in discussion with Maria Beatriz Garcia and Cristina Contreras, telephone Conference (Cambridge, Trinidad & Tobago and Venezuela), September 17 2015. *RECOMMENDATIONS: The project's score could improve if all materials reused were quantified and measured and identified in an inventory with its applicable techniques used to reuse the material. The project is recommended to create a systematic approach to searching and screening for opportunities in nearby facilities to use the unwanted by-products.*
LD2.2 Improve Infrastructure Integration	**7**	**Superior** The project is created through a public-private partnership, in which Trinidad & Tobago work closely with Seven Seas to manage collaborative opportunities. One example is the coordination between Seven Seas' engineers and WASA to connect their newly installed distribution pipeline to the Point Fortin Desalination Plant. The national government and WASA specifically increased production capacity, installing 578 pipeline projects laying 415 km of pipelines. These projects resulted in significant improvements in neighborhoods and communities such as (in alphabetical order): L'Anse Mitan Carenage, Biche, Bristol Villages, Brasso Venado, Covigne, Cushe, Diego Martin, Mayaro, Navet, Plum Mitan, Union, Tabaquite where residents received pipe borne water as opposed to the previous absence of pipes. The project's infrastructure was built over a well and integrated within the Petrotrin's industrial facilities. This site, therefore, integrates into the industrial amenities and follows the Petrotrin's overall infrastructure, so that these coordinate and function well-- one within the other. The project from its onset develops an ingenious way to establish infrastructure integration with its public-private partnership in which all the infrastructure upgrades the government is installing in the area is ultimately connected by virtue of the BOO contract relationship. Therefore, the plant's contracting phase syncs with the ending phase of the region's installation of pipes of WASA's delivery system previous to the project's planned construction phase. This type of work is not a coincidence, but the conclusion of the Seven Seas Water and Trinidad & Tobago's development of synergies that evolved into a co-production that ensured an overall improvement of infrastructure integration from the work developed in the island's areas in term of pipes and the work in constructing the plant. Moreover, the project is part of the government's policy and regulatory framework, whereby the government's commitment for improved service is followed through by a set of policies that creates synergies between sectors, allowing 29,000 citizens nearby to benefit from the collaborative relationship and contract. This public-private partnership enables the project team to create multi-sectoral regional strategic planning for sustainability goals meant to improve sustainable outputs in the island at large.

		Source: "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA"). "WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA"). Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p i. WASA, Waterworld, Issue 3, p. 21.
		RECOMMENDATIONS: It is recommended that the project not just look at the interaction of the facilities nearby, but also with the communities surrounding it in a way that it achieves enhancement of community assets.
LD3.1 Plan For Long-Term Monitoring & Maintenance	**10**	**Conserving**
		Seven Seas Water Corporation (SSWC) contracted a third-party called, Engineering Applied Science and Technology Limited (EAST) to monitor the outflow of water from a manmade structure (effluent) quality. The first monitored result is reported through a detailed report written by the third-party EAST conducted on October 31, 2013. The aforementioned report is meant to meet the requirements for the Environmental Management Authority's Certificate of Environmental Clearance, and followed the protocol set-forth though the Quality Assessment Project Plan (QAPP) dated June 01, 2013. The monitoring of the water measures the effluent at their desalination plant in Point Fortin. 11 times during the first year under this contract. The monitoring of effluent occurs weekly for the first month, and then slows down to monitor monthly for the next five (5) months. Starting at month 7 form the one year monthly sampling and measurements, the effluent quality is measured quarterly from thereon. Triplicate water samples are collected from a tap water place that was installed to be able to retrieve the samples. The triple samples are delivered to the laboratories "Analytical Technologies Limited" (ATL), "Point Lisa"s and "International Analytical Group" (IAG) within a methodologically established the stipulated holding times. All data samples were collected between October 2013 and November 2014 in order to determine the effluent effect on the marine biodiversity, ecology and water salinity in compliance with the Water Pollution Rules 2001. In terms of monitoring for long-term usages, pressure gauges were installed strategically along the system delivery. The pressure gauges are daily measured and checked daily through operators and technical officers . The officers provide feedback to WASA's Operations Control Centre for the project to be maintained in the long-term after the project is delivered.
		Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), iii. Ibid, 58-78. Engineering Applied Science and Technology Limited, "Portable Desalination Plant At Port Fortin Monitoring Effluent for CEC Compliance," St. Augustine: 2013, 1-2. t Ibid, 3-5 WASA, "Point Fortin Desalination Plant Operations South Division," Trinidad & Tobago: N.D., 4.
		RECOMMENDATIONS: The project scored the highest in this category, and therefore no further recommendations are made.

LD3.2 Address Conflicting Regulations & Policies	**1**	**Improved**
		Letters, memoranda, fax messages and minutes of meetings as a well as all relevant communication between Seven Seas Water and government institutions at the national and regional/local scale were documented to demonstrate that the company adhered to all regulations. In determining whether there were conflicts between the sustainable practice of the plant's construction and operation, the overall baseline report analysed the set of regulations that applied to the project and did not find any conflicts between the development of the plant, sustainably, with the steps taken to obtain the permits and abide by national regulations needed to construct and operate within Trinidad & Tobago. In addition, the project team has addresses all regulations in conformity of Trinidad & Tobago and was able to meet the requirements to develop sustainably the construction of the Pt. Fortin Desalination Plant. Permits were requested the following areas: Civil Aviation, Drainage Division, Environmental Management, Maritime Division, Ministry of Energy & Energy Affairs, Ministry of Planning and Economy, nevertheless this does not provide score in this credit since it is considered mandatory to achieve those permits in order to execute the project. A letter to the government states that it has a commitment to sustainably deliver water, from drinking water to the water used to take a shower, in every aspect of their plant's operations. The public-private agreement allows for the private as well as public sector to engage and easily facilitates dialogue between stakeholders, including the national government, which also promotes the development of sustainable infrastructure in public announcements and the policies drafted for Trinidad & Tobago to achieve drinking water in the most sustainable mechanism. Through the thorough review of the documentation, the project is not considered to unintentionally abide by regulations that run counter to sustainable goals as it procures suppliers that follow and have earned recognition for having rigorous environmental management plans and sustainability management programs in their own operations, as it also adheres to stringent US goals being a US company as well as the regulations that are quite strict on marine quality and protection of the coast and its marine biodiversity.
		Source: Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 2-4.
		RECOMMENDATIONS: Identify possible regulations that may be contrary to the integration of sustainable principles within the project.
LD3.3 Extend	**3**	**Enhanced**

Useful Life		The project team have delivered on many aspects of extending the useful life of the desalination plant. One helpful element considered was the maintenance conducted on the equipment and the quality assurance plan that accompanies the maintenance and monitoring plan. The site where the plant was constructed enabled a modular phased design versus the permanent larger scale design that is usually used in putting together and installing a desalination plant. the change in mechanism in the manner the desalination plant was built also created its longer lasting flexibility. The design had to change and become more flexible due to this restraint in space. The way it was built was through phases, whereby the design was built in smaller modules, which led to having to change the electrical and mechanical pieces in smaller bundles. The fact that the electrical and mechanical equipment was needed in smaller pieces produced a greater number of pieces to be commissioned and an extended time in installing it. The overall shift in design and its smaller phased modules, led to a greater amount of start-up checks, a need for prefabricated electrical equipment, which were installed in containers and shipped on site, so as to decrease the safety hazards of building it at Point Fortin. The maintenance and safety requirements for these design, was successfully monitored, and followed, surpassing WHO protocol. The smaller modular components is a way to reconfigure and have the smaller modular packages of equipment to be durable as maintaining the smaller modules helps to extend its useful life, and replacing parts will only affect smaller segments of the larger infrastructure. In terms of suppliers and the materials procured, the "DOW FILMTEC" (which is the name of the copyrighted membrane technology). The aforementioned technology allows the plant to extend the durability by using this technological advance. DOW tests its materials to prove to be stronger and more durable over the lifetime. Documentation on the process through which DOW chooses its equipment is included. Details on the Life Cycle of its materials are done by the supplier of this advanced technology. However the LCA is not included as documentation.
		<u>*Source:*</u> Coastal Dynamics Report, " Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination, Trinidad & Tobago: 2010. C.E.P. Limited Report, "Point Fortin Salt Water Reverse Osmosis Plant," (a structural evaluation) MWA, "Design Memorandum Supplemental Report for EMA Seawater Intake Pump Station," Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 2-4. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015).
		<u>*RECOMMENDATIONS:*</u> *A recommended improvement involves providing:* *Documentation showing the specification of durable materials and how these improve upon industry norms.* *The project team conducted a feasibility study but should consider adding how a list of identified inventory can have potential long-term cost savings in regard to designing for future expansion durability.*
LD0.0 Innovate Or Exceed Credit Requirements		*N/A*
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CATEGORY II: CLIMATE AND ENVIRONMENT		
RESOURCE ALLOCATION		
	Score	**Point Fortin Desalination Plant**
RA1.1 Reduce Net Embodied Energy	**0**	**No Score** The project team assessed that there are energy savings in materials and have procured the equipment and plant materials with four companies that follow very sustainable practices. The project team, however, does not score because the documentation does not include a Life-Cycle Assessment (LCA) of the plant's material's embodied energy. The plant's supplier of Reverse Osmosis Membranes effectively conducted a LCA. From the four suppliers and the information supplied for this evaluation, DOW's FILMTEC™ ECO is the only one with a statement for the LCA. *Source:* *RECOMMENDATIONS: It is recommended that full documentation on DOW's FILMTEC™ ECO LCA, which Envision defines as an assessment that measures environmental impacts at each stage of a product's life, from the extraction phase to its disposal. Each one of the supplier is motivated to deliver its LCA to understand if there was any embodied energy reduction. The project team should seek a Life-Cycle Analysis of its entire plant's material use, developing a list of materials used and their respective material's life cycle. A plan that takes into accounts embodied energy and a way to find a decrease it.* *-Specifically, the project is recommended to develop the following documentation materials:* *-Hire a third-party to conduct a LCA and write a report with the results of the energy LCA and include the LCA model that is being used. In cases where the project team pictures to a large supplier, the LCA of the supplier's net embodied energy should be included with information on reasons each material was chosen and the amount of energy saving incurred with such selection.* *-The methodology of the LCA should follow recognized and accepted methods that are universally accepted. Using measured embodied energy material use assessments in infrastructure is limited to materials that are significantly used.* *-Report on the selection of the life-cycle energy assessment model used and/or databases referenced.* *-Design documents that showcase how certain materials reduce the net embodied energy of the project and a the reason each is chosen with a strategy for each long term durability is useful and necessary to achieve full points. In some cases, materials will be changed to include materials with lower embodied energy.*
RA1.2 Support	**9**	**Conserving**

Sustainable Procurement Practices		The project team has sustained procurement practices that make sure that the equipment and materials used to operate the desalination plant are supplied through vendors that follow sustainable practices. Allen Bradley was a vendor for Seven Seas Water and WASA's desalination plant with whom many materials were manufactured. The CEO, Keith D. Nosbusch, introduce the Connected Enterprise an industrial concept that ensures integration between the assets produced in the industry assets and the value chain. The latter concept, a value chain, is a firm that operates a set of activities to deliver value in the product or service it delivers. The main idea is to follow the model so as to receive raw material as input and add value through industrial processes, thereof adding value to the output. In 2014, the manufacturing was named through Ethisphere Institute, one of the World's Most Ethical Companies and follows Dow Jones Sustainability North American Index. The company applies sustainability to view energy efficiency in holistic terms; incorporating advanced waste management plans as well as corporate social responsibility (CSR). The CSR is advanced in that it has a Product Environmental Compliance team and Product Certification Engineering. The former makes sure 300,000 products meets environmental laws and make-sure 'end-of-life' waste management and the latter tries to certify that products meet safety standards. On a similar token, the supplier of the Reverse Osmosis membranes use triple bottom line with an emphasis on the latest sustainable standards. This product was awarded an Edison Award™, which is amongst the highest achievement for human-centered innovation and business success. In the commerce and resource management category, Dow Water & Process Solutions innovated with FILMTEC™ ECO, which uses Reverse Osmosis (RO). Green *Aquastore* develops as its name reveals *Aquastore* tanks, which are manufactured in the United States and is made in steel through the Engineered Storage Products Company. The *Aquastore* tank is an efficient high strength steel design, which is made to reduce energy consumption. The component's of the material is made to reduce emissions in comparison to the industry standard. The product is constructed in top-down manners and minimizes its footprint. The product takes into account trying to minimize its effect on the landscape. Proprietary Vitriol glass-fueled-to-steel technology and minimizes the release of volatile organic compounds (VOCs) and fine particulates related to sandblasting and painting. The tanks produced in through *Aquastore* do not require repainting, which reduces poisonous particulate in the long term. In addition, ITT Company engineers valves according to the Environment Management System ISO 14001:2004 Certification according to BSI Management Systems, a third party verifier of sustainability of the company's valves manufacturing. The company follows a well-balanced sustainability program, and manages sustainability at the core of its company's policies. Its use of metrics measure waste, water, energy, and carbon footprint through ITT Mesh System. They follow small business sourcing to enhance local economy. The company includes policies to coordinate during natural disasters with tracked volunteering programs Community is taken into account with an ethics ombudsman, a diversity maturity modelling system to ensure diverse workforce.
		Source: Allen-Bradley, Rockwell Software, and Rockwell Automation, "Smart, Safe, Sustainable Manufacturing Rockwell Automation 2014 Corporate Responsibility Report 2014", 2014, 3-7. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015). Ibid, 1. "2014 Edison Award Winners, <,http://www.edisonawards.com/winners2014.php>, 2014. Engineered Storage Products Company, "As Green As our Tanks are Blue," USA: 2009, 1.

		ITT Engineered for Life, "Sustainability," and "Sustainability Metrics & Activities (Presentation 2014), 1-2.
		RECOMMENDATIONS: The project should add the following detailed inventories: *Materials used must be included with each material's total weight or volume with its respective cost and each one's acceptable measure. The materials should include the vendor's sustainable procurement practices.*
RA1.3 Used Recycled Materials	**0**	**No Score**
		The project team considered constructing the plant over existing infrastructure, in an attempt to reuse materials. The project was unable to use the material because the engineering third-party report claimed all existing infrastructure was in delicate state and could not be re-used when considering if it can abide with its support functions. Therefore, the project had to be constructed in phases and the design had to be modified to accommodate the need to construct the plant using new materials and in a smaller, compact space. The modified version was delivered to be constructed. The summary serves to give credit in attempting to create material reuse and redundancies infrastructure. The materials found on site-included pipelines that were undersized, aged and encrusted, some with severe leaking issues, which led to a need to replace with new pipes. The following pipes were restored with new 7.47km of 100mm PVC distribution pipelines (replaced GWI lines); 1.23km of 100mm PVC pipeline where no pipes existed; and ten (10) pressure reducing valves (PRV) to improve pressure management and reduce leakage.
		Source: Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 2-4. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/> (September 18, 2015). WASA, "Point Fortin Desalination Plant Operations South Division," Trinidad & Tobago: N.D., 1.
		RECOMMENDATIONS: The project team is encouraged to develop a plan that assists in procuring reused materials, or material with recycled content.
RA1.4 Use Regional Materials	**0**	**No Score**
		This credit measures the percentage of materials used that were sourced within specific distances from the project, encouraging the minimization of transportation costs and impacts while also retaining and enhancing regional benefits. The specification of local materials should not compromise the quality, durability, or safety of them. The project has not turned in sufficient documentation to adequately assess this credit.
		Source:
		RECOMMENDATIONS: The project team has signed an environmental agreement that forces the project to follow best practice in terms of its use of materials. The CEC compliance obligates the project to seek to handle various issues pertaining to the contract with sustainable best practice. In terms of regional use the project scores if it procures its aggregate, soil, concrete, and plants at a certain distance from the site. Soils, mulches, sands and aggregates are to be bought within a 50 miles (80 KM radius); concrete at 100 miles (160 km); plants at 250 miles (400 km); and all other materials not found in the listed materials aforementioned are to be bought at 500 miles (800 km). *The project is recommended to keep an inventory of the percentage of project materials and their respective costs with an indication if they are sourced locally. The key is to source within the outlined radius to decrease its dependency on carbon intense fuel emissions that are related to transporting the equipment and materials from far away distances. In this project there was the need to reconstruct sections of the site with concrete. Having an inventory of the amount of concrete used and where the materials are being bought and how they are transported is central to being able to score this category. If the concrete was brought from nearby locations then this*

		category could redeem some points and prove that sustainable practices and a conscious effort to reduce its dependence on fuel intense transportation systems is very important in this specific credit. *In addition to locally sourced materials, reused materials from nearby facilities (by-product synergy) or reused materials salvaged from the site and reused is important to include and describe the rationale for reusing some materials based on local market interactions. In some cases, materials can be harvested on site, which can count toward meeting the credit requirements. All calculations must include its respective cost or a calculated replacement value. All equipment (electrical, mechanical, or plumbing) should not be included in the calculations and inventory list.*
RA1.5 Divert Waste From Landfills	**0**	**No Score** No specific information has been provided to assess this credit. The contract on the public side of the private-public agreement, establishes regulations for the plant, in which it must abide by rigorous waste management rules, but the documents don't include a mention of a landfill either. Rather it includes the disposal of hazardous materials. Solid waste from all phases of the project is to be handled and thrown in waste bins that are covered and closed. These bins go to Trinidad & Tobago's municipal waste system. They rely on the country's municipal waste management plan. In order to receive credit the project is encouraged to take a more active role in considering all waste materials, including chemical waste as well as non-chemical waste. Encouraging waste to be handled differently from landing the end of material life cycle in landfill waste. All non-hazardous material is handled through Borough Corporation to handle this type of waste due to the very delicate nature of the waste. Hazardous Waste include waste chemicals, spent lubricants lead-acid batteries, used oils, are collected, treated and remediated through facility, equipment and personnel that can state the waste is non-hazardous prior to disposing of it. All hazardous materials should be secured in containers and returned to the suppliers of the aforementioned hazardous chemicals or materials for proper handling. *Source:* The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, 9. *RECOMMENDATIONS: The project team mentions that there was not a waste management plan created for the project. The operational phase has between 10-15 employees with waste bins for their trash. However a waste management plan includes hazardous waste, non-hazardous waste, and the everyday waste. Having a waste management plan allows the project to think holistically of its project within the larger ecosystem in Trinidad & Tobago, hence knowing where the trash is being dumped must be included so the credit can be evaluated.* *The reason is toxins in landfills seep through the soil and can have deleterious effects on the surrounding chemical composition of the soil. Many sustainable loops include analysing where all a site's waste ends and considers more sustainable ways to deal with the waste or excess by-product it produces. This way of thinking is very holistic and in many times included within the analysis of a Life Cycle Analysis (LCA). Specialists of the LCA may include strategies that manage surplus materials and waste in ways that use its net embodied energy to produce energy in other functions it needs. This is the starting point of thinking of any site of having a comprehensive effect on its surrounding. Private industry can have a positive ripple effect, which can be restorative to its surrounding ecology when it considers waste an important aspect of maintaining a clean loop of functioning.*
RA1.6 Reduce Excavated Materials Taken Off Site	**0**	**No Score** This credit measures the extent to which the project team has considered limiting the movement off site of soil and excavated materials during construction, reducing the need for transportation and in turn minimizing environmental impacts. No documentation was received to properly score this credit.

		Source:
		RECOMMENDATIONS: This credit hopes to understand if the project transported most of the soil used for the construction of the project from a far distance. Soil used in most projects have the potential of changing water drainage patterns and can add to sedimentation processes that can contaminate rivers downstream with soil.
RA1.7 Provide for Deconstruction & Recycling	**1**	**Improved**
		The project's contract with WASA obligates the project is deconstructed and upcycle all materials. Upcycling is another way of defining reuse of materials, whereby the waste of one process (by-products) is transformed into useful materials for another process. Therefore upcycling is a way to create from waste, and redefine the usage, always saving material its that were once created for one use, into another use. Seven Seas Water is required to remove the equipment at the end of the contract in 15 years. The contract obligates the system to create a site to the clean and safe condition.
		Source: Coastal Dynamics Report, " Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination. Trinidad & Tobago: 2010. Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 2-4.
		RECOMMENDATIONS: The project has yet to develop an inventory of all materials used and the percentage of that material that was recycled and reused, post the life cycle of the project's contract. The premise of this credit is to make sure all materials that are used can be reused if the material is deemed useful. The inventory list must include cost of the material, its weight and the volume that is meant or planned to be recycled. *The management of the future use of materials must be included as a by-product or result of disassembly after the termination of the contract. This plant is obligated to be disassembled after the project terminates in approximately 15 years, but there is little evidence on how the equipment, and raw materials will be used. A specialist on upcycling, can determine which materials can be resold or sent back to its manufacturer to be used. This type of tight cycle of use creates a more efficient use of materials whereby the project team is conscious of the amount of energy and materials that are needed to create these. Some of these tasks can be subcontracted and plans can be ensured these materials are in fact reused or returned to manufacturers for its reuse.*
RA2.1 Reduce	**12**	**Superior**

Energy Consumption		The project is connected to the national electricity grid to get the energy required for construction and operation. The project engineers and procures parts of the plant that enable an effective reduction of its overall energy consumption. The project team developed a mitigation plan for every design component that involved emissions and the use of energy in order to reduce energy-use in every aspect of construction, measuring emissions as well as developing mitigation measures to decrease energy reliance. The operations of the plant uses Dow's company polymer technology with its membrane module that filters 40% more salt than its competitor's purification membranes and consumes 30% less energy than the industry standard. The project team also documents overall consumption, which shows a reduction on energy over other potential suppliers would have been able to serve. The project also uses the multi-port diffusers with the brine jetted through the ports at an angle of 90 degrees to the pipeline in a downward direction. The use of small diameter port openings will create the required momentum to rapidly dilute the effluent in the Near Field Region (NFR), which also allows for energy consumption to decrease. The pipe diameter along with the membranes reduces energy usage on average with 50% reduction in the desalination overall life cycle. The alternative design would have used distillers, which rely on heating through oil or coal. Reverse osmosis ensures heating sources are not needed. In terms of the construction and operation of the plant other than the pressure gauges, the membrane selection, and the overall design that ensure 50% energy consumption, measured and detailed, the project uses the grid's energy and doesn't provide further documentation on savings outside the scope of the elements described above. In addition, an engineering analysis was done to determine the topographic characteristics, pressure profile of the system, and sub-zones. The latter three explained the need for pressure reducing valves used at specific distances and points in the overall system and determined PRVs installed at offtakes. This system also ensured an overall decrease in energy usage.
		Source: Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015). Ibid, 1. "2014 Edison Award Winners, <,http://www.edisonawards.com/winners2014.php>, 2014. Engineered Storage Products Company, "As Green As our Tanks are Blue," USA: 2009, 1. Engineering Applied Science and Technology Limited, "Portable Desalination Plant At Port Fortin Monitoring Effluent for CEC Compliance," St. Augustine: 2013, 1-2.
		RECOMMENDATIONS -
RA2.2 Use Renewable Energy	**0**	**No Score** The project does not use renewable energy and consumes its operational phase energy from the electricity taken from the national grid. The project diverts the use of energy through its use of reverse osmosis and not distillers (See credit for RA 2.1). The latter consumes oil or coal to heat desalination plants while the former uses the electricity powered by the grid. If the national grid relies mostly on renewable sources than so would the desalination plant. The energy consumption is therefore reliant on the national government's overall policy on its dependency of renewable or non-renewable sources for their electricity grid nevertheless the installation of renewable energy technology on the site is highly recommended. *Source:* Frederick Hung (YP Business Analysis) in discussion with Maria Beatriz Garcia and Cristina Contreras, telephone Conference (Cambridge, Trinidad & Tobago and Venezuela), September 17 2015.

		RECOMMENDATIONS: The objective is to consider the infrastructure presence in the ocean as having a holistic effect on its environment. Its coal existence relies on energy that is then sourced through the grid, if the grid only uses on-renewable energy than it in some way is creating more demand for these sources, obligating the country as a whole to consume more of this unclean energy. Therefore, the best practice is to analyse how much energy the plant consumes and try to match it with renewable energy. A Life Cycle Analysis (LCA) of energy is very useful in this credit and can be contracted out to specialists as independent contractors or companies that after dedicated to developing sustainability plan that would take this specific credit into account.
RA 2.3 Commission & Monitor Energy Systems	**11**	**Conserving**
		The project team uses strategic placement of gauges that are checked daily by system operators and technical officers. Feedback on the gauge measurements are delivered and commented on so as to indicate the level of supply customers receive in terms of water, and keep energy measurements too. In addition to this long term monitoring they track their daily and monthly electricity usage. The contract provided between the client, WASA, and the Seven Seas Corporation has a guaranteed limit ensured by both parties through the aforementioned contract agreement. The usage must always be below this threshold amount agreed upon previous to the operation of the desalination plant. The measurements and documentation provided ensures the energy in effectively monitored with sub-meters for the plant and tracks daily. Any energy that surpasses this amount can be subject to additional audits by governmental institutions and can subsequently have effects on the overall contract.
		Source: The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010.
		RECOMMENDATIONS:
RA3.1 Protect Fresh Water Availability	**21**	**Restorative**
		Trinidad & Tobago has a shortage of fresh water availability. Regional water production is equally as scarce as its availability. The water that is produced depends on wells and a well-fed water treatment plant. WASA has established programs to search for water sources in the region, the analyses presented by third-parties show there is no indication that any new sources of water will be found. In addition, water quality is an issue that continues to pose a risk both groundwater and surface water sources' level of contamination. Fresh water is so scarce that WASA predicts the production capacity is unable to meet the growing demand for water, and therefore have prepared the country to treat non-traditional water sources, such as the sea, to obtain the much needed water. The pipeline system transports water from the Desalination Plants as well as Caroni Water Treatment Plant to support the water needs. The conditions of scarcity are very severe and the plant is given the task to replace the non existing fresh water in the area. The facility works in a close loop in which the discharge of the water follows above industry methodologies to ensure a good balance of salt in the seawater is left as it was taken in by the system to create freshwater.
		Source: Coastal Dynamics Report, " Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination, p 1. Engineered Storage Products Company, "As Green As our Tanks are Blue," USA: 2009, 1. Frederick Hung (YP Business Analysis) in discussion with Maria Beatriz Garcia and Cristina Contreras, telephone Conference (Cambridge, Trinidad & Tobago and Venezuela), September 17 2015. Kelley Grieves and Lauren Thomas, "Comparison of Three 2013 Caribbean SWRO Systems," N.D., 2-4. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-

		s-breakthrough-revolutionize-water/>(September 18, 2015). Ibid, 1. "2014 Edison Award Winners, <,http://www.edisonawards.com/winners2014.php>, 2014. Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), 1-16. Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011). Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 1-10. Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 1-5. "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".) "WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA").
		RECOMMENDATIONS:
RA3.2 Reduce Potable Water Consumption	**4**	**Improved**
		The purpose of the desalination plant is to help increase potable water availability. The water management of the plant has a contract with Trinidad and Tobago's. The aforementioned contract ensures all water related activities protect other water sources such as: non potable water, recycled graywater and stormwater. Mitigation of all stormwater related activities are developed at the coast to ensure the plant does not increase any contaminants. To achieve this they developed a baseline report to measure the conditions of the site at sea before the installation of the plant. In addition, the project must reduce water in the toilet use. CEC contract has agreed with Seven Seas Water to secure all portable toilets and a made sure stationary toilets were not allowed for this site. All toilets had to be constructed above flood levels. Sanitary waste was agreed to be treated off-site by the contractor and handle this waste. The effluents of the portable toilets are not allowed to be discharged into surface drains, natural watercourses or outside of its final waste management off-site location, pre-established with a third-party contractor. All waste records are obligated to be maintained and archived for EMA review or audits.
		Source: The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, 9. *Frederick Hung (YP Business Analysis) in discussion with Maria Beatriz Garcia and Cristina Contreras, telephone Conference (Cambridge, Trinidad & Tobago and Venezuela), September 17 2015.*
		RECOMMENDATIONS: The project should include the necessary design for reduction potable water reduction strategies during operation and maintenance of the project. *All water potentials such as the alternatives for nonpotable water such as recycled greywater, and stormwater should be shown as strategies to divert potable water usage.* *The water management system and strategies should analyze feasibility and cost analysis to*

		reduce potable water reduction with an inventory of the water consumed and the amount being reduced through the mitigation strategies employed. Calculations of annual water consumption are to be calculated over the life of the project and measurements on percentage reduction must be included.
RA3.3 Monitor Water Systems	**11**	**Conserving**
		As part of this study a hydrodynamic modelling exercise was conducted to analyze the water conditions and its possible impacts of construction and operational phases. Specific details were observed, such as the type of diffuser used, and conditions like location and depth that may be used for the Desalination Plant in order to adequately disperse the effluent in the marine environment thereby achieving conditions to meet the regulatory requirements of the Water Pollution (Amendment) Rules 2006.
		Source: Coastal Dynamics Report, " Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination, 2-5.
		RECOMMENDATIONS
RA 0.0 Innovate Or Exceed Credit Requirements		*N/A*
	69	

NATURAL WORLD		
	Score	**Point Fortin Desalination Plant**
NW1.1 Preserve Prime Habitat	**0**	**No Score**
		The project was developed on an industrial site at Petrotrin in Point Fortin. The site has pipe infrastructure that connects to most industrial companies in the Southwest portion of the city. The plot was found with scrapped materials and on unsorted waste materials that were just accumulated onsite. Previous to this project, the site was used for a well, and had degraded infrastructure, which could not be used to support the new plant. The prime habitats are confounded to marine biology, and therefore continuous and periodic (weekly) monitoring of the water's chemicals, pH, and overall composition to analyse if it does not affect bethnic biology that was described above as being central to feeding other marine biological organisms. Consistent examination of these benthic communities, ensures these are protected, and hence preserving the larger marine flora and fauna.
		Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," Trinidad & Tobago: 2010, 73.
		RECOMMENDATIONS
NW1.2 Preserve Wetlands and Surface Water	**0**	**No Score**
		The Desalination Plant has an effect on the environmental water quality coming from the discharge of liquid effluent. Liquid effluent is discharged in the coast shore regional coast at one kilometer in Guapo Bay. The project by virtue of what it does is to create a buffer between the project and the coast or shore, however, this project is not considering this as an option. Moreover it follows the CEC contract to obtain the appropriate environmental permits.
		Source:
		RECOMMENDATIONS: The project team is recommended to develop a site plan with a VSPZ

		boundary set-aside for a natural zone to maintain a buffer so that the coast where it is constructed doesn't affect the buffered zone. The project team should then try to restore a previously degraded zone whereby the restoration locations are delineated within a plan that redevelops these zones. This can include a stabilization of a shoreline with a geomorphic analysis to stabilize stream banks and sediment transport.
NW1.3 Preserve Prime Farmland	**0**	**No Score** Not applicable due to the fact the desalination plant is located in a coastal region of South-West Trinidad & Tobago's Guapo Bay within the pre-developed Point Fortin in the proper seawater. *Source:* *RECOMMENDATIONS: Farmland is usually on flat, drained, and on well-maintained, fertile soil. Many developers seek to buy farmland so as to save on having to flatten out the land and can buy on land where housing can easily be built. Housing needs have pushed the growing amount of developers to use farmland to meet the growing demand. However, maintaining farmland is increasingly important to sustain the national food needs, employ a portion the population, and create food security for coming generations. It sustains the habitat, flood control, groundwater recharge and also helps to balance the need for carbon sequestration. While this project does not deal with farmland directly, many of the potential Corporate Social Responsibility (CSR) projects could include an urban farming plan, vertical farms for nearby populations or urban garden with the necessary clean up for contaminated soils for disadvantaged populations. These are minimal suggestions that could help restore some of the island's agricultural needs. In Caribbean islands, many depend on importing food to cover the needs of the people, but if some acupuncture urban farming programs are developed through its programs for the underprivileged, this and other quality of life categories could increase their points.*
NW1.4 Avoid Adverse Geology	**0**	**No Score** This credit examines how the project avoids affecting potential aquifers and geologically vulnerable areas by avoiding installing infrastructure in areas documentation as being geologically vulnerable or with a high risk of polluting aquifers. The project was placed on a pre-developed site. No documentation on geology is presented. *Source:* *RECOMMENDATIONS*
NW1.5 Preserve Floodplain Functions	**0**	**No Score** Floodplains are described as flat or nearly flat land adjacent to a stream or river that experiences flooding during periods of high discharge. The natural meandering and flooding of streams and rivers and represent areas likely to experience regular flooding form floodplains. The project is located in an area not considered floodplain, therefore it does not apply at this point. *Source:* *RECOMMENDATIONS*
NW1.6 Avoid Unsuitable Development on Steep Slopes	**0**	**No Score** This credit encourages the protection of steep slopes and hillsides from unsuitable development in order to avoid risks from erosion, landslides and other natural hazards, this credit measure the degree to which development on such sites is avoided by the project team. The project is constructed on a previously developed coastal area. This coastal area does not have any steep slopes. The credit attempts to study projects that avoid steep slopes for their development. *Source:* *RECOMMENDATIONS The project's context is not around steep slopes and chose a flat, industrial zone for the development of the plant, therefore the project followed best practice in this credit.*
NW1.7 Preserve	**23**	**Restorative**

Greenfields		This credit evaluates the preservation of greenfields by location the project in a previously developed area considered like greyfields and/or sites classified as brownfields. This project has been located in an area previously developed and with oil spill, that were cleaned up for the development of the project. This has been seen as a restoration initiative conducted in the project. *Source: Seven Seas Water Company, "Photographic Evidence," (Images 2010-2015).* *RECOMMENDATIONS: Detailed information on how the remediation plan was conducted in order to minimize the environmental impacts on the area.*
NW2.1 Manage Stormwater	**0**	**No Score** Once an infrastructure project is developed, the construction of the desalination plant increases impervious surfaces, meaning that they do not absorb the rainfall. As the amount of impervious surface increases, and the amount of water excess increases. They are directly proportional to one another. This is how surface runoff begins to accumulate in certain areas where there is little or no drainage. There begins to accumulate an excess of the amount of water not absorbed by what would have normally been the environment in its natural stage. The project team does not include documentation for this credit and how it strategizes to mitigate the effects of runoffs as a result of the construction of impervious surface area. *Source:* *RECOMMENDATIONS: The project must include a set of strategies it will include in the design of the plant that will decrease the contamination through runoff created with the plant's presence. Since the project is located on a pre-developed site, then the project team should include the following:* *Determine the amount of water storage capacity.* *Document the initial water storage using TR-55 Curve Numbers (CNs) for a continuous simulation-modelling method to best describe the site,* *Include information on whether 100% target water capacity mitigate the effects of having the impervious surface area constructed.*
NW2.2 Reduce Pesticides and Fertilizer Impacts	**0**	**Improved** The DOW membranes, called RO FILMTEC ECO are made to follow the latest technologies and ensure: "the high purity, [in] low-energy space. With that said, an analysis of the economic value of the technology over the lifetime of the element shows that chemical and energy savings are significant compared to standard products." In this excerpt the keywords are "high purity" and "chemical...savings" because it provides municipal and industrial markets a higher level of freshwater purity with less chemical use. When chemical elements are taken into account exponentially, they lead to higher health outputs in the host community where the technology is being used, which is what Seven Seas accomplished with procuring the DOW membranes for the desalinization plant. There is no evidence that pesticide or fertilizer or any other chemical are used in the facility in any other way. *Source:* Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015), 1. *RECOMMENDATIONS: Information showing the reduction of chemical used compared with a a business as usual desalinization facility.* *Documentation showing what plants are being used for landscaping if so, and that it their need in terms of pesticide or fertilizer.*
NW2.3 Prevent Surface and Groundwater Contamination	**9**	**Superior** Seven Seas Water has supporting infrastructure, services and management to control stormwater, sediment and erosion within the identified drainage networks. The project shall be managed in such a way that no washings from pre-mixed concrete trucks be allowed to contaminate municipal drains or natural watercourses. Facilities shall be separated to minimize risk in contamination from fuels, lubricants or chemicals with a drainage sump and a wall height

		of 15 cm to allow rainfall and barrier in foams. All the dispensing areas are separated as well with impermeable surfaces and say from natural flows of water (river, coast, the sea, and drainage of rainfall). The project's vision is contained by conducting construction in phases with schedules that make into account all wind activity and natural weather patterns. All construction is scheduled so that it occurs the dry season in Trinidad & Tobago. Barges and vessels places pipelines and piles with drains, gutters and drip trays to contain leaks and any risks of contaminating natural water ways. Buffers are built to make sure all drains don't overflow and contaminate stormwater flows. Lastly, toilets are even considered by forcing these to be potty porters with enough height so as to avoid floods that can bring the human waste as well as greywater to flow over and contaminate sensitive areas.
		Source: The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, iii. Ibid, 5-7. Ibid, 9. Ibid, 10.
		RECOMMENDATIONS:
NW3.1 Preserve Species Biodiversity	**2**	**Improved**
		Benthic communities in marine coastal regions are used as a way to measure the health of the overall biological environment. All those marine organisms that live in benthic fauna are key feeding other larger organisms, as they are the bottoms of the food chain. Benthic organisms are therefore considered indicators of environmental balance since they stay in their own area, and these are not able to move away from negative stimuli. Most of the benthic fauna (80%) consist of epifaunal population, among them are barnacles, bryozoans, mussels, and sponges, which live on the surface of soft sediment and hard bottoms. Infauna is the second type of benthic organism and consists of burrowing clams, polychaete worms, and gastropods. Third type of benthic organisms is benthopelagic fauna, such as crabs, prawns and flatfish, live in close to the substrate, but they are mobile and swim above. In order to protect these bottom feeders, the baseline studies collected faunal surveys of two hundred and thirty-three (233) specimens from 8 sample stations. The sample showed (33) taxa (species), which were identified to the lowest possible level. The use of DOW technology has allowed the reverse osmosis process to be optimal for the water salinity. In cases where the water effluent has an increase in salinity, the monitoring is so strict it can alert when changes would affect bethnic communities. Thus, the rigorous monitoring enables protocols to mitigate the negative effects of increased salinity and thus eliminate the risk of altering marine biology.
		Source:
		RECOMMENDATIONS: Exploration of restoration measures to minimise the impact in existing habitats.
NW 3.2 Control Invasive Species	**0**	**No Score**
		This project is on pre-developed industrial zone which has not identified if there are invasive species. Invasive species include plants and animals. In this case, invasive species can be a result of sea shipment whereby animals and plant species from other areas in the world can inadvertently contaminate the native plants and animals of the project site. Some of the species have the potential hazardous effect of creating a plague that kills native plants and animals of the island.
		Source:
		RECOMMENDATIONS: Identification of potential invasive species in the region that can create a danger for the native ones, this can be both plants and animals. In case of identification, establish

		a protocol for monitoring or removal of these species
NW3.3 Restore Disturbed Soils	**0**	**No Score**
		This credit rewards projects that have made significant efforts to restore soils and areas that have been disturbed during the construction phase of the project, bringing back original ecological and hydrological functions. This project removed topsoil to construct the plant, and used several practices to compact the soil to try to bring it back to their original state. In this case improving the conditions previous to the development has restored the project. The area was previously polluted and filled with scrapped materials and on unsorted waste materials. A clean up process was done on the site to eliminate the pollution in that soil.
		Source: Frederick Hung (YP Business Analysis) in discussion with Maria Beatriz Garcia and Cristina Contreras, telephone Conference (Cambridge, Trinidad & Tobago and Venezuela), September 17 2015.
		RECOMMENDATIONS Clear identification of the percentage of soil restored in this process.
NW3.4 Maintain wetland and surface water functions.	**9**	**Superior**
		The Point Fortin Plant will maintain healthy waterways by restoring surface, groundwater and hydrologic collection. Many of these waterways documented the baseline waterway's normal flow, to allow it to continue the same course after the plant was constructed. The quality of water was also enhanced and best practice infiltration systems were put into place that helped remove potential pollutants from contaminating the waterways. The ecosystem was maintained through many studies that promised to keep the waterways and natural sediment transports to continue. These variables were all considered and put into practice through the recommendations of the Marine Baseline Study. Many healthy waterways receive much of their normal flow from underground sources. Maintaining or restoring the water quality of surface water and groundwater sources was documented. The project created infiltration that disconnected direct surface water discharges.
		Source: Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), 22.
		RECOMMENDATIONS
NW 0.0 Innovate Or Exceed Credit Requirements		*N/A*
	43	

CLIMATE AND RISK		
	Score	**Point Fortin Desalination Plant**
CR1.1 Reduce Greenhouse Gas Emissions	**4**	**Improved**
		The Barge and installation of the Crane are used to offload the equipment. The Barge was chosen as a mitigation strategy to negate the need for onshore heavy equipment and create continuity of onshore processes. The Barge and Crane emissions are an environmental issue that equal land-based construction. The mitigation strategy includes timing the use of its construction machinery to maximize efficiency and minimize use time, which leads to less emission. Therefore, the time required for Barge and Crane will be reduced with a strict organized schedule and work sequence so that downtime does not exist. Staging equipment in the proper order for effective work sequence allows for the crane to be used in optimal time records and decreases overall emissions, nevertheless no life cycle carbon assessment or information accounting for the volume of emissions removed from the atmosphere has been provided in order to estimate the % of carbon emissions.

		Source: MWA, "Design Memorandum Supplemental Report for EMA Seawater Intake Pump Station," 2010, 18. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015). The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, p 10. *Ibid*, 11.
		RECOMMENDATIONS
CR1.2 Reduce Air Pollutant Emissions	**0**	**No score**
		The project is scored on its ability to measure the six criteria pollutants: carbon monoxide, nitrogen oxides, sulfur dioxide, and suspended particulate matter smaller than PM-10, ozone, and lead. This project could measure the amount of trucks used for the whole project and the amount of contamination created by these trucks, nevertheless no information about the other criteria pollutants has been provided.
		Source:
		RECOMMENDATIONS: Calculations of expected pollutant emissions are recommended to be added. not just during the construction of the project but also during the whole operation of it. *It is recommended to define which international standards will be used to measure the aforementioned emissions in order to minimize or implement methodologies that account for these emissions.*
CR2.1 Assess Climate Threat	**0**	**No Score**
		This credit measures the steps taken by the project team to prepare for climate variation and natural hazards. The project team should provide a comprehensive Climate Impact Assessment Plan and Adaptation Plan in order to score in this credit. No specific information has been provided in order to determine how climate change can affect the project and their operations.
		Source:
		RECOMMENDATIONS: Documentation showing which are the possible effects that the different climate threats can place in the project, and the measures taken to address them.
CR2.2 Avoid Traps And Vulnerabilities	**2**	**Improved**
		The monitoring report considers temperature, pH salinity and other water related vulnerabilities for the environment. It checks these through monitoring, and reduces risks by implementing changes that could improve water quality so that it is the same as was registered in the baseline report. They checked that this resource would be available at the same quality as when it arrived.
		Source:
		RECOMMENDATIONS: The project affects natural resources. In the case of the desalination plant, the community receives potable water, which is later released back into the system and cleaned through a wastewater treatment centre and returned to the sea. The water that is released into the sea could have a changed temperature, which can affect the fish and marine life.
CR2.3 Prepare	**16**	**Conserving**

For Long-Term Adaptability		The intent of this credit is to ensure that infrastructure systems are designed to be resilient to the consequences of long-term climate change and to adapt to changing scenarios. Various mitigation measures are planned and strategically established to minimize the short-term construction impacts as well as design features. The project installs all equipment is a phased way to mitigate the long-term impacts of these structures. The CDL report presents an assessment of the Impacts each construction phase and construction has on its environment after Mitigation.
		Source: MWA, "Design Memorandum Supplemental Report for EMA Seawater Intake Pump Station," 2010, 17. Seven Seas Water, Environmental Health and Safety Manual Book I (Trinidad & Tobago: Point Fortin, N/A), 2-8. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015). Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 22. Ibid, 117 Ibid, 121
		RECOMMENDATIONS: It is recommended to identify specific measures to follow in order to prepare for Long-Term Adaptability. *Certain climate consequence of long-term climate change can be increase of intensity and frequency of extreme weather events, water scarcity, sea level rise, beach erosion, heat waves or extended droughts among other.* *To achieve the highest score plans or designs proving restoration efforts should be provided.*
CR2.4 Prepare	**3**	**Improved**

For Short-Term Hazards		The project team considered manmade and natural hazards. Manmade hazards are centered on potential spillage of chemicals, issues with machinery that can change the sodium balance natural to the coast and the marine biology of the area. The project conducted a baseline study to ensure all properties are improved or stay the same as they were found, and monitor the different categories, such as noise, hazards, environment in order to know each specific potential hazard does not occur. The CEC agreement obligates the project to create an emergency response plan (ERP) and follow MEEA and OSHA regulations, and should not be redundant but base its plan on the national ERP. The project-specific short term emergency plan has to identify all potential climate related risks. The emergency plan set-up by the plant must be archived on-site and available to all national led audits from the EMA. The emergency protocols must follow and include potential spills, cleavage, contaminants from water management plan, and must include any changes over 10 litters. Under the emergency plan must include Spill Response Plan that specifically caters to spills of contaminants to ensure all sea coastal water is kept in the way it was found. The site must ensure to have a way to absorb and supplies necessary for emergency situations. The public part of the public-private agreement ensures that project follow a strict emergency plan. The quality assurance plan takes into account how these plans ensure long-term materials are protected, maintained and can long last. The mentoring plan of the coastal seawater ensures the entire water outfall does not affect the marine ecosystem delicate balance. The health and safety manual has a category that explicitly manages each potential hazard identified specifically for the *Guapo Bay* area of Petrotrin's desalination plant.
		Source: The Environmental Management Authority, "Certificate of Environmental Clearance (CEC): The Certificate of Environmental Clearance Rules," 2010, 4. Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Point Fortin Meeting, in Trinidad & Tobago, January 11, 2012), p. 16. Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation, Stakeholders Meeting, in Trinidad & Tobago, February 17, 2011). Seven Seas Water, "Point Fortin Desalination Plant Technical and Environmental Overview" (presentation,Public Consultation Meeting, in Trinidad & Tobago, March 2, 2011), p. 10. "WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA"). "WASA Point Fortin Desalination Plant.MP4," 00:05:30. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA"). Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5. Seven Seas Water, Environmental Health and Safety Manual Book I (Trinidad & Tobago: Point Fortin, N/A), 2-8. Kevin Westerling, "Views from the Top: Will Dow's Breakthrough Revolutionize Water Treatement?," Water Online , <http://www.wateronline.com/doc/views-from-the-top-will-dow-s-breakthrough-revolutionize-water/>(September 18, 2015), p 1-2. Coastal Dynamics LTD, "Marine Environmental Baseline Study for the Construction of a Portable Salt Water Desalination Plant, Point Fortin, Trinidad," (Sep 4 2010), p 22. Ibid, 117

		Ibid, 121 US Government OSHA, "Occupational Safety & Health Administration (OSHA) Standards ," (n.d.). Seven Seas Water, "Seven Seas Water Corporation Environmental Health and Safety Policy Statement," (N.D).
		RECOMMENDATIONS: *The strategy explanations used to protect the project from potential hazards match rigorous codes established through international laws and the national strict adherence to environmental protection.* *In this way the project truly matches with the overall codes and regulations and surpasses its role on safety protocols and monitoring to ensure all systems function properly in case of any hazards. trying to find ways to deliver restorative action would include documentation of strategies used to minimize the risk of future hazards using environmental restoration.*
CR2.5 Manage Heat Island Effects	**0**	**No score**
		The intentions of this credit it to encourage the minimization of surfaces with low solar reflectance in order to reduce heat accumulation and manage microclimates. No information has been provided according to the type of materials used of the solar reflectance index in order to minimize the effect of sun irradiation absorption in these materials.
		Source:
		RECOMMENDATION: Strategies such as vegetated roofs and areas with softscape vs. hardscape will be recommended.
CR0.0 Innovate Or Exceed Credit Requirements		*N/A*
	25	

OVERALL:	**231**	**Point Fortin Desalination Plant**

APPENDIX E: SOURCES

PROVIDED DOCUMENTATION
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Engineered Storage Products Company, "As Green As our Tanks are Blue," USA: 2009, 1.
"2014 Edison Award Winners, <,http://www.edisonawards.com/winners2014.php>, 2014.
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Water and Sewerage Authority (WASA), "Point Fortin Desalination Plant Areas to Benefit" (presentation, Trinidad & Tobago, n.d.), p 3-5.
WASA, Waterworld, Issue 3, p. 21.
"WASA's Point Fortin Video Feature.MP4,"00:07:59. Posted by Water and Sewerage Authority of Trinidad and Tobago ("WASA".)
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"Seven Seas Water Company Water-As-A-Service Policy," last modified Sep 2015, http://sevenseaswater.com/en/the-way-we-work/water-as-a-service/