

The Business Case for Sustainable Infrastructure

CASE STUDIES SERIES

Envision awarded case study



AlexRenew Nutrient Management Facility (NMF) **Alexandria, VA**

Prof. S.N. Pollalis, E. Chatzistavrou

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TABLE OF CONTENTS

ABSTRACT	3
Overview of Project Background Data	4
1. PROJECT DESCRIPTION & DEVELOPMENT	5
1.1. Project Background	5
The Utility’s service	5
The SANUP Program	6
The South Carlyle Strategy - The joint project with the adjacent development	7
1.1. Project Components.....	8
1.2. Project Development	11
1.3. Project Team & Selection Process	12
1.4. Project schedule.....	12
1.5. Project Delivery Method	12
2. SUSTAINABLE FEATURES OF THE PROJECT.....	13
3.1. Overview of Sustainable features through the Envision Categories	13
3.2. Main sustainable features of the project	15
Project Level – Operational Excellence – Environmental Compliance.....	16
Project Level – Community Engagement	17
Utility Level – Sustainable Leadership.....	18
Utility Level – Sustainable Project Management.....	21
3. ECONOMIC PERFORMANCE	23
3.1. Project Funding Sources	24
3.2. Offsetting Costs.....	25
Avoided costs.....	25
The innovative PPP strategy	26
Construction Cost Savings	28
Sustainable Design O&M cost savings	30
Revenues restructuring	30
3.2.2. Revenues generated.....	31
Offsetting project costs through utility’s overall sustainable-economic performance ..	32
4. ENVISION RATING	32
5. CONCLUSIONS	33
BIBLIOGRAPHY	34
APPENDIX.....	37
ABBREVIATIONS	43

Prof. S.N. Pollalis prepared this case study with researchers at The Zofnass Program as the basis for research and class discussion rather than to illustrate either effective or ineffective handling of the design, the construction or an administrative situation.

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ABSTRACT

The AlexRenew Nutrient Management Facility (NMF) is part of the Alexandria Renew advanced Water Resources Recovery Facility of the City of Alexandria in Virginia. The project was the major construction component of a phased series of upgrades of the existing WRRF plant for expanding its capacity to meet stringent nitrogen reduction limits for treated water discharged to the Chesapeake Bay watershed within which the plant is located. The project is innovative and sustainable from its inception: instead of controlling nutrients chemically, *“it is the first time that nutrients loads are managed by introducing storage tanks”*.

However, the case of AlexRenew NMF is exemplary of sustainable planning of a water infrastructure project beyond compliance and outside the typical infrastructure considerations: it also extended the local community’s recreational capacity through the integration of a full-size athletic field on top of the facility. *“Wastewater utilities don’t have to be invisible to the communities they serve, but instead, can, and should, be active partners in creating livable and resilient cities”* (Karen Pallansch, CEO and general manager of AlexRenew utility). This dual-purpose of the facility is the project’s most sustainable feature that breaks out of business-as-usual approaches.

The NMF BC case study aims to point out all those factors that determined the project’s successful outcome: project design and management singularities as well as the project’s background, a utility with a clear straightforward sustainability focus that embraces the **“new mindset of the transition from looking at wastewater treatment as a removal process to a resource recovery operation”**.¹

The project combined two major strategies: the upgrade of the utility’s treatment processes (SANUP) and the South Carlyle Strategy² for restoration and development of a prior landfill, integration to urban context and community engagement.

The case, part of the Zofnass Program “Making the Business Case for sustainability” research case studies series, serves as an example to explore the relation between corporate sustainability and sustainable infrastructure projects and project-level or/and company-level potential sustainability savings. Departing from the research hypothesis that *Sustainable projects have a higher risk-adjusted return on investment (ROI)* the case aims to answer the two research questions:

1. Does it make business sense to plan sustainable infrastructure for (a) the owner and (b) the financiers?
2. Can we quantify the direct financial benefits of sustainable infrastructure?

¹ Sarah Fister Gale, “Sustainable Water Infrastructure: Rethinking water and wastewater systems with resilience in mind,” June 1, 2017, <https://www.mwcog.org/newsroom/2017/02/02/karen-pallansch-making-sustainability-a-priority-in-the-wastewater-sector-region-forward-chesapeake-bay/watershed-utilities-wastewater-water-quality/>

² The NMF site is located in the middle of the planned South Carlyle development area, an on-going mixed use development.

Moreover, and given that sustainable projects and practices not always have tangible benefits, neither there is a common concrete method of quantifying all benefits of infrastructure projects and corporate sustainability - as seen through the BC literature review - the case of AlexRenew may provide some data towards an affirmative concrete answer to the questions set.

Overview of Project Background Data

Project Name:	AlexRenew Nutrient Management Facility (NMF)
Project Type:	Wastewater Treatment
Location:	Alexandria, VA
Area / Length:	100,000ft NMF facility, 10.6 acres (total site), 3 acres (development area)
Capacity:	18 million gallons (54 million gallons per day the total capacity of the WRRF)
Owner / Client :	Alexandria Renew Enterprises (AlexRenew)
Project Team:	Engineer/Designer: CH2M Hill (now Jacobs Engineering)
	Construction Contractor: Clark Civil and Ulliman Schutte Construction (joint venture Clark/US, LLC)
	Construction Manager at Risk (CMAR): Clark/US
	Construction Manager: Jacobs Engineering
	Facility/Project Manager:
	Consultants: KCE and KTLH (structural quality control and field inspections) Dutchland Inc. (Storage Tank construction)
Project Lifespan (per component)	Holding tanks: 50 yrs Process equipment: 25 yrs Deck connector structure: 30 yrs Athletic field: 25 yrs
Current Status:	Operating
Funding model:	WQIF grant/ VRLF Revolving Loan Fund/ Capital Project budget/ PPP
Delivery Method:	CMAR
Overall investment cost:	Contract value \$ 131 M ³
Design & Construction cost:	Total construction cost: \$101,500,000 Engineering services cost: \$2,460,000 Detailed design cost: \$961,000
Construction cost savings	Approx. \$11 M savings through Value Engineering
O&M cost savings	Potential \$400,000 per year

³ According to:
<http://www.ullimanschutte.com/project-spotlight/project/salisbury-wwtp-bnt-enr-upgrades>.
The CMAR contract included the NMF, the Environmental Center and the Deck Connector.

1. PROJECT DESCRIPTION & DEVELOPMENT

1.1. Project Background

This section aims to outline the background that determined the project: the AlexRenew utility's service and the statutory requirements that led to a major upgrade of the utility's facility part of which is the NMF. Moreover, apart from the compliance challenge to be addressed, the site specific challenges, that defined the project development and also contributed to a more sustainable and innovative project, will be described.

The Utility's service

The Alexandria Renew Enterprises or AlexRenew, owner of the NMF project, is the former Alexandria Sanitation Authority (ASA)⁴, a public wastewater utility governed by an independent citizen board. AlexRenew is a political subdivision of the Commonwealth of Virginia. The utility is not-for-profit and neither has shareholders or pays dividends⁵.

AlexRenew provides wastewater interception, pumping, and treatment⁶ since 1956 for 320,000 people in the City of Alexandria and part of Fairfax County with the assigned role to "acquire, construct, improve, extend, operate and maintain a sewage disposal system." The utility transforms 13 billion gallons of wastewater into clean water annually (34 million gallons of wastewater daily) before discharging it into the Hunting Creek and the Potomac River, within the Chesapeake Bay watershed.

AlexRenew has a service agreement with Fairfax County and provides for part of its sewage water.⁷ Under the service agreement, Fairfax County pays a percentage of operating expenses based upon flow volume, as well as contributes 60% for facility improvements. In exchange for these capital contributions, the utility is required to recognize and preserve an equivalent share of the capacity rights of the related facilities for the County's use: 32.4 MGD, 60% of the facility's total capacity of 54 MGD is the capacity entitlement for Fairfax and 21.6 MGD, 40% for the City of Alexandria.⁸

⁴ <http://www.alexandrianews.org/2012/alexandria-sanitation-authority-becomes-alexandria-renew-enterprises-on-earth-day-2012/>

⁵ <https://alexrenew.com/about-alexrenew/faq>

⁶ Water Research Foundation WERF, (2017) "Fostering Innovation within Water Utilities; Case Studies Project #4642"

⁷ Due to the topography of the land in this region, and given that AlexRenew building a wastewater treatment facility sited at a low drainage point to serve both communities made good engineering and practical sense (source: <https://alexrenew.com/faq-page>). The treatment of sanitary sewer for all Fairfax County is accomplished through inter-jurisdictional agreements that allow the sewer flow to convey to six regional treatment facilities: AlexRenew Enterprises Advanced Water Treatment Plant (WTP), Arlington County Water Pollution Control Plant, Blue Plains Advanced WTP, UOSA Regional Water Reclamation Plant, H. L. Mooney Advanced Water Reclamation Facility Plant and Noman Cole Pollution Control Plant. (source: <https://www.fairfaxcounty.gov/publicworks/wastewater/wastewater-treatment>).

⁸ Fairfax participates in the cost of the Environmental Center and Parking Structure at 49% and 32% respectively.

The SANUP Program

The NMF was the largest component of the AlexRenew's State-of-the-Art Nitrogen Upgrade Program (SANUP), a \$160 M comprehensive multi-year program consisting of several projects. The SANUP program was the utility's response to new, stricter water quality regulations by the state of Virginia, the Potomac Embayment Standards, as well as the voluntary requirements of the 1987 Chesapeake Bay Agreement, limiting the nutrient levels (nitrogen and phosphorous) in wastewater facilities' effluent released into the Chesapeake Bay watershed.⁹

The regulations became effective on January 1, 2007 and wastewater facilities were urged to meet final effluent annual waste load allocations for nitrogen and phosphorus by January 2011. In May 2009, acknowledging that efforts to meet goals were falling short, a new deadline was set for all restoration measures to be in place no later than 2025, paced by a series of 2-year milestones. The Total Nitrogen limit went from 8mg/L to 3 mg/L.

In order to meet this challenging limit a combination of strategies was required:

- Increasing the capacity of the existing Biological Reactor Basin (BRB) system to remove nitrogen by adding more biological reactor volume and more supplemental carbon
- Reducing the total nitrogen loading to the BRBs by pre-treating the dewatering centrate
- Reducing the daily variability of the nitrogen loading to the BRBs by diverting a portion of the primary effluent flow to storage tanks when loadings are high and returning it back to the system when loadings are low – this is was performed by the NMF.¹⁰

In addition to the NMF, improvements included supplemental carbon enhancements, the addition of a biological reactor basin, a Centrate Pretreatment Facility, mainstream deammonification systems for additional biological process capacity all within the main plant's site. The upgrades are planned to reduce total nitrogen discharged to the Chesapeake Bay by 20% annually.

The SANUP program was designed to operate within industry best practices for energy efficiency, while reducing potable water consumption, mitigating health and safety risks, increasing community relations and limiting the use of chemicals.

⁹ <https://alexrenew.com/NMF-Envision>

¹⁰ The Wastewater treatment process as realized in the AlexRenew WRRF, prior to the upgrades, included the following stages:

- Initial coarse and fine screenings
- Primary Treatment in Primary Settling Tanks (PSTs); the primary effluent is then pumped to Biological Reactor Basins (BRBs) where the nitrogen removal is realized.
- Secondary treatment entering the Secondary Settling Tanks (SSTs) where the activated sludge and treated water are separated. The activated sludge is returned to the BRBs while the secondary effluent is pumped to Rapid Mix Tanks for phosphorus removal.
- Tertiary Treatment into the Tertiary Settling Tanks (TSTs)
- Final treatment of the tertiary effluent through gravity filtration and UV Disinfection and either final release to Hunting Creek or direction to the reclaimed water network. (Source: AlexRenew NMF Envision Case study)

The nearly ten-year-program was completed in five construction contracts: three design/bid/build and two using a Construction Manager at Risk (CMAR) approach.

The South Carlyle Strategy - The joint project with the adjacent development

The NMF project as developed was driven by unique challenges, one of which was the site constraints and more specifically:

- space constraints of the existing plant for service expansion
- immediate proximity to an on-going mixed-use urban development
- soil contamination due to the site's prior use as a landfill

AlexRenew is one of the most space-constrained WRRF facilities in the U.S. with less than half an acre per million gallons of treatment capacity. The 33-acre urban parcel was entirely built-out and bordered by the Capital Beltway to the south, neighboring with a historic cemetery to the north; an electric substation to the east and beyond that with one of the City's recreational facilities. The only feasible option for expansion was to vacant plots to the west, part of a plan for mixed-use development already approved, the Carlyle and Eisenhower East development (See Appendix).



Fig. 1: AlexRenew main plant site and west site before construction

The process of acquiring the 10.6-acre west site required an amendment of the development's masterplan and rezoning that involved public hearings, extensive involvement of city planners, and a joint project with an adjoining development due to significant impact for all stakeholders involved.

Moreover, the west site was a previous landfill, like the entire South Carlyle area, with contaminated fill, including 5.34 acres of impervious area.¹¹ As a result the site entered into

¹¹ According to pre-project stormwater calculations

Commonwealth of Virginia's Volunteer Remediation Program (VRP)¹² and after the definition of Resource Protection Areas (RPAs) within the property, development was permitted in only 3 acres of it.

In June 2011, the City Council approved the Master Plan amendment and the Development Special Use Permit for expansion of the wastewater treatment facility on the west site.¹³

The masterplan amendment was also supported by the neighboring property owner with the precondition to consider:

1. Installation of appropriate buffers, including a combination of walls, vegetation, and administrative office uses.
2. Design of the expanded facility sensitive to the residential use on the neighboring property.
3. Transportation routes and schedules to the site sensitive to the residential nature of the neighboring properties.¹⁴

In order to establish a common strategy for all involved stakeholders a public-private partnership was formed between AlexRenew, developer and City of Alexandria, the South Carlyle strategy; a plan to develop multiple parcels of land in the Eisenhower Valley, creating a neighborhood on a former brownfield. Important was the role of the Eisenhower East Design Review Board that according to Pallansch challenged AlexRenew to score higher on sustainability¹⁵.

AlexRenew began to collect stakeholder input on the project at a very early stage, and throughout the development made changes based on input from the community and other stakeholders.

The site-related challenges that had to be addressed, added complexity but also created opportunities for innovation that added value to both the project and AlexRenew's corporate image.

1.1. Project Components

The AlexRenew Nutrient Management Facility, part of an advanced Water Resources Recovery Facility, is a primary effluent wastewater storage tank constructed to expand the capacity of the existing treatment facility to manage incoming flow before discharging it into the environmentally sensitive Chesapeake Bay watershed. The NMF stores wastewater to balance the amount of nitrogen that goes into AlexRenew's biological treatment process

¹² Narrative for credit NW1.7 as included in submitted Envision credit documentation coversheets provided by AlexRenew

¹³ Memorandum for "Consideration of a resolution authorizing the city manager to sign a right of first refusal granting the Alexandria Sanitation Authority the right to purchase certain city property located at 801 and 910 South Payne Str if the city decides to sell the property," from Acting City manager to Mayor and City Council, November 16, 2011.

¹⁴ Master Plan Amendment #2007-0004, Planning Commission Meeting, March 4, 2007

¹⁵ One example is challenging AlexRenew to set and accomplish the goal for a LEED Platinum certified building in the case of the Administration office building and eventually Environmental center, after encouraging them to include water and environmental educational elements.

where nutrients removal is realized.¹⁶ Nutrients removal is performed by microbes with a finite capacity to manage nutrients loads at a time, requiring these loads to remain below a certain level. An enhanced performance is established by providing steady nitrogen load to the biological reactor basins, balancing the diurnal peaks.

This helps reduce the amount of chemicals and energy needed to clean water and ultimately the amount of nitrogen discharged into the ecologically sensitive Chesapeake Bay Watershed.

There are two clearly distinct strategies within the project of the NMF that had clearly distinct objectives and separate funding sources:

1. The related to the SANUP Program part of the NMF, the NMF storage tanks and infrastructure to support **environmental (current permit) compliance and operational excellence.**
2. The related to the creation of the athletic field and the integration to the development **to support community engagement**, the South Carlyle Strategy.

The main project components are:

SANUP Program	Nutrient Management Facility (NMF)
South Carlyle Strategy	Athletic Field
	Deck Connector
	Environmental Center/ Administrative Bldg ¹⁷

¹⁶ The WWRf’s entire liquid treatment process as summarized in their website: “Once flows reach our facility from our interceptor system, they go through coarse screens, fine screens, and grit removal to remove large solids (like food and trash) that can damage our equipment. Flows are then transported into rectangular settling tanks for primary treatment and removal of suspended solids and fats, oils and grease. Afterwards, the flow goes to our Biological Reactor Basins (BRBs) for nutrient removal. While in the BRBs, flows are added to microorganisms, called activated sludge, for nitrogen removal. The water settles again and then we remove the phosphorous and filter out any remaining solids. Finally, flows are disinfected using ultraviolet (UV) light.”

¹⁷ The Environmental Center building is part of the west site development however the case will not focus on it.

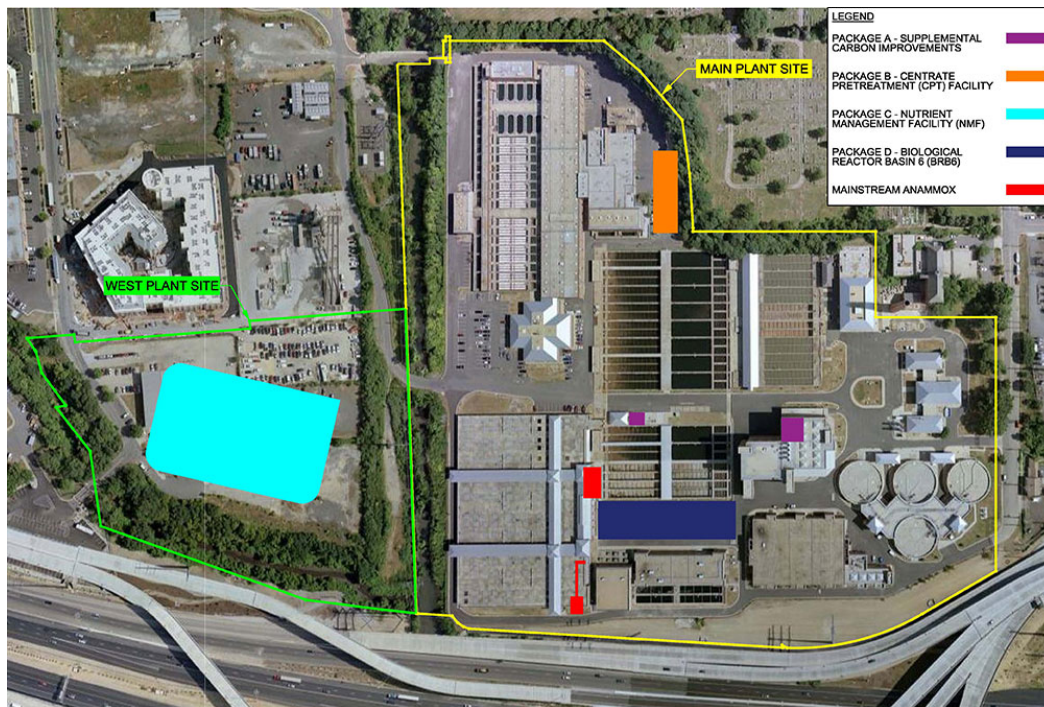


Fig. 2: The SANUP projects within the Main Plant Site and the acquired West Plant site (source: CH2M Hill)

The South Carlyle development, within which the NMF is located, called for an integrated way to develop multiple parcels of land. Integration of the NMF was accomplished through an optimized partially buried tankage configuration for the facility, while a full-size athletic field, the Limerick Athletic Field, was located directly on top of the NMF, bike trails and a playground were incorporated into the site for community use and connection to other public spaces. The Environmental Center, a LEED Platinum certified building next to the field, is also designed to integrate with the development, serving as a buffer of occupied space between the treatment tanks and the planned residential and commercial uses to the north. To address soil contamination, AlexRenew capped the soil with above grade parking and created an elevated public landscape. It changed the ground plane to conceal AlexRenew's structures and parking for the entire development, while open space was blended into the development above, with careful grading, the covering appears as a gentle slope.¹⁸ The NMF tanks rest entirely on 1,800 piles; this structure required a test pile program to validate that it would meet engineering design requirements.¹⁹

¹⁸ Water Research Foundation WERF, (2017) Fostering Innovation within Water Utilities; Case Studies Project #4642

¹⁹ <http://www.aees.org/e3scompetition/2016grandprize-design.php>



Fig. 3: Plan of the South Carlyle Strategy joint project

1.2. Project Development

The facility was designed with sustainability as an integrated component of the project development process from start to finish. The NMF was planned as an integral part of the SANUP program with phased out development planning. Being the larger construction component, the NMF required a multi-year effort for its planning and design development and was aligned with the utility’s long-term sustainability vision from the early planning stages.

A series of workshops were organized and held to define and analyze the problem, set the project scope and develop technical solutions. Engaging all affected stakeholders, such as City Council, local developers, community members and non-profit organizations these workshops allowed them to actively participate in the decision-making process. Shifts in design approaches were made to incorporate each group’s interests. An outcome of this participative process was the development of a custom sustainability framework with defined objectives to guide specific sustainable strategies.²⁰

Given that project management represents one of the core sustainable features of the NMF project, its process is more thoroughly presented in the relevant section of the document.

²⁰ Seven objectives’ categories were outlined focusing on: Energy; Climate change/GHG emissions; Site Development & Natural Environment; Human Health; Stormwater & Water Management; Materials & Waste; Community Relations

1.3. Project Team & Selection Process

The project goals required a multi-disciplinary design team and a long-range planning effort for the whole SANUP program. A 9-year partnership between AlexRenew and CH2M for the planning, design, permitting, and construction services helped incorporate sustainability from the program's inception and successfully implemented the utility's and program's vision. Clark and Ulliman Schutte as a joint venture was the Construction Manager at Risk (CMAR) for the delivery of the NMF and KCE & KTLH provided structural quality control and inspections in the field for the facility. Jacobs was the construction manager and provided the inspection services for the overall program's works.²¹

1.4. Project schedule

Scheduling was under additional pressure because of the owner's need to meet state-mandated deadlines for components of the project, as well as keeping up with the fast track adjacent development given the joint portion of the project. Despite its great complexity, the project was completed 40 calendar days early.²²

The NMF facility's construction was projected to start on March 2013 and to be completed early on 2015. Construction was initiated on September 2013 and the facility was finally put in operation on May 2016. The project met schedule requirements by opening the athletic field in time and by meeting the deadline for the facility to be operational on January 2016.

1.5. Project Delivery Method

Because of coordination requirements with a fast track adjacent development, AlexRenew opted for implementing a Construction Manager at Risk (CMAR) delivery for the NMF after the design was complete. The CMAR contract included the construction of the NMF, the Environmental Center and the Connector deck (connection with the adjacent development). CMAR was chosen to minimize the risks associated to the project's complexity, consisting of multiple projects within a small footprint without relying in more than one contractor, that required a well-sequenced construction; need of an experienced team to handle the environmental remediation portion of the project; the need for timely delivery of the NMF and the transparency in subcontracting and financial management, that was one of eligibility requirements for receiving a fund.

The contract was divided in two phases: Pre-construction and Construction, from December 2012 to January 2016 with an original cost of **\$150M**. The contract included incentives for shared savings in case of early completion, value engineering and final completion under the guaranteed Maximum Price (GMP) submitted. Phased GMPs were also developed to maintain schedule.

²¹ <http://www.aaees.org/e3scompetition/2016grandprize-design.php>

²² CH2M HILL wins CMAA award" Submitted by CH2M on 11th Oct 2005.

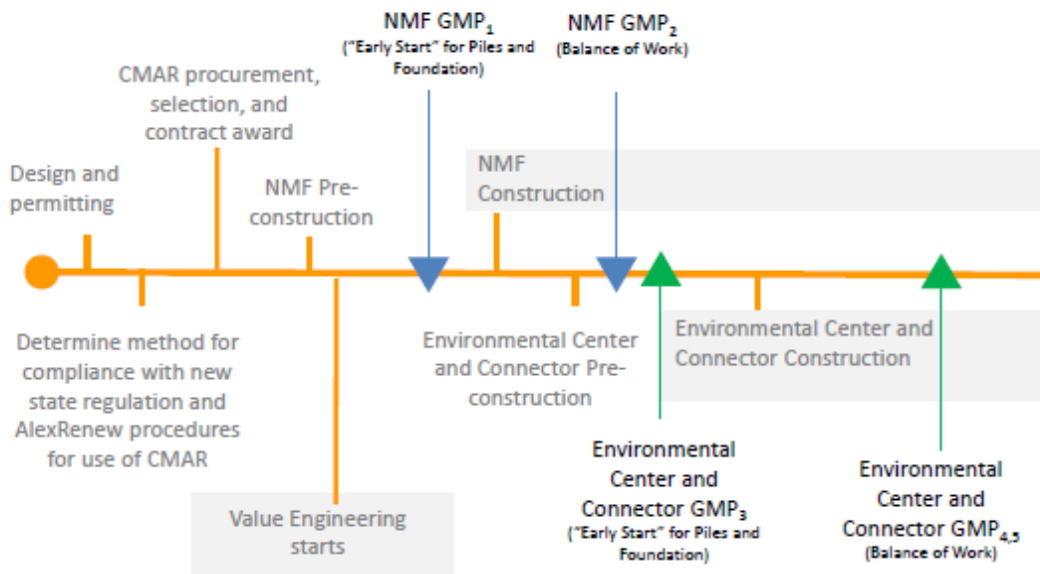


Fig.4: Implementation Approach²³

2. SUSTAINABLE FEATURES OF THE PROJECT

3.1. Overview of Sustainable features through the Envision Categories

The selection of the presented BC case studies has as prerequisite the project’s sustainable performance to support the Business Case for Sustainable Infrastructure Projects. The NMF and the entire SANUP upgrade program have been widely recognized for sustainable performance. The NMF’s performance specifically has been evaluated and awarded with the Envision® Platinum Award recognition by the Envision Sustainable Infrastructure Rating System. The system’s five categories: Quality of Life (QL), Leadership (LD), Natural World (NW), Resource Allocation (RA), and Climate and Risk (CR) will be used to summarize the project’s overall sustainable performance.

Quality of life

The construction of the NMF improved the community’s Quality of Life in several ways. The most important strategy was the construction of the athletic field atop of the NMF’s storage tanks. The project *added recreational capacity to the city* in the form of a multipurpose sports field, a feature rarely accomplished in an urban wastewater utility. AlexRenew also engaged the community in the decision making process by organizing several meetings.

A "zero" odor control strategy was needed to address the extremely close proximity of the public. Odors are collected internally to the NMF, treated using carbon systems, and then treated air is exhausted away from the field.

Leadership

²³ Graph presented at: Janelle Wright Okorie, Director of Engineering and Technology Programs, “Construction Management at Risk Implementation and Lessons Learned,” presented at Virginia Water Environment Association Webinar, 21 October 2015.

Sustainability is a core value of AlexRenew, and the NMF was planned, designed, and constructed in accordance with the sustainability strategies developed by CH2M and AlexRenew for the SANUP program. Sustainable priorities and targets were tracked during design and construction and several documents related to sustainable strategies and achievements were developed.

The project is tangible evidence of both organizations' strong commitments to sustainable development as demonstrated in their public-facing environmental policies and vision statements, organizational structures and business processes.

Resource Allocation

The purpose of the NMF is by definition to protect fresh water availability as it actually treats and cleans million gallons of water prior to its discharge back to the environment. The NMF took into consideration expected city development and also provided for future wastewater infrastructure needs.

The effluent from the facility meets the quality requirements of high value aquatic species and exceeds the permit requirements reported to the Virginia Department of Environmental Quality (VA DEQ) based on daily monitoring and lab testing.²⁴

The project not only protects fresh water resources but it also reduces the consumption of potable water through reclaimed water use. It is estimated that 99.92% of the annual water usage of the NMF is anticipated to be reclaimed water.²⁵ Additionally, a reclaimed water main was included in the project for the adjacent property's irrigation needs as well as other open spaces within the city. In terms of materials sourcing AlexRenew tried to use as much as local and regional material as possible to support local economy and reduce the impact of long transports.²⁶

Natural World

The NMF was designed to preserve floodplain functions by avoiding new development within the floodplain. Acres of impervious surface were replaced with vegetated areas to restore infiltration and water quality functions. A fish and sediment barrier was removed, which improved aquatic habitat connectivity, and a crucial wooded riparian buffer was expanded by 69,000 SF enhancing the natural habitat.

The project team permanently removed 85,000 cubic yards of contaminated soil from the site and replaced 143,000 SF of existing asphalt with clean topsoil and vegetation. 493 trees

²⁴ Narrative for RA3.1 as included in submitted Envision credit documentation coversheets provided by AlexRenew

²⁵ Envision Credit documentation cover sheet as submitted; provided by AlexRenew

²⁶ Interview 2016 with Savita Schlesinger, Project Manager, CH2M; Lisa Racey, Engineering Department, AlexRenew; Sean Stephan, Chief of Sustainability, AlexRenew; Grace Richardson, Sustainability Coordinator, AlexRenew.

and 845 shrubs were planted. The project achieves an Enhanced level of performance by adding 29% stormwater storage volume to the site.²⁷

Climate and Risk

The project team conducted a comprehensive climate impact assessment to identify potential climate threats and an adaptation plan was developed. They have also prepared a Hazard Response Plan which describes how the project can deal with numerous potential long- and short-term hazards that may affect the facility. Regarding short-term hazards preparation AlexRenew has an assigned Environmental, Health, and Safety Officer to provide regular natural and human-induced hazards-related trainings to staff. Heat island effect mitigation has also been considered in the selection of materials for the hard surfaces in NMF, based on high solar reflectance index (SRI) attributes.

3.2. Main sustainable features of the project

To highlight the core sustainable features of the project the case uses a distinction made by AlexRenew²⁸. The utility distinguished Envision credits that received high scores to those typical or expected for Virginia's water industry and those less typical. As typical:

- Long term monitoring & maintenance
- Extending useful life
- Use of regional materials
- Diverting waste from landfills
- Monitoring energy systems
- Monitoring water systems
- Non-potable water use
- Restoring disturbed soils
- Providing for future deconstruction/recycling
- Erosion control & stormwater management

As less typical (beyond compliance):

- Remediating a contaminated site
- Expanding a Resource Protection Area (RPA)
- Adding the athletic field & trail connections
- Adding an arch culvert
- Organizational leadership
- Sustainability management
- Sustainable procurement

The typical high scores are related to sustainable practices that water treatment facilities are expected to implement, while those less typical are the sustainable features of the project that exceeded the norm, the added value that differentiates the project from business-as-usual, and that construct the facility's dual-purpose nature.

²⁷ Envision Credit documentation cover sheet as submitted; provided by AlexRenew.

²⁸ Stephan, Sean (AlexRenew) and Lusk, Howard (CH2M). "AlexRenew's Nutrient Management Facility – Envision Platinum Award," as presented in APWA Mid-Atlantic Chapter Event on February 17, 2017.

Project Level – Operational Excellence – Environmental Compliance

The project is innovative and sustainable from its inception: instead of controlling nutrients chemically, “it is the first time that nutrients loads are managed by introducing storage tanks”.

The NMF consists of four new storage tanks with 18 million gallons capacity. The tanks receive the treated primary effluent and slowly release it in the biological treatment process ensuring consistent feed and diurnal nitrogen load equalization. When nitrogen loading is higher, partially treated water is diverted to the NMF for storage. When nitrogen loading is lower, this water is returned from the NMF to the biological treatment system. A Central Operating Gallery houses process pumps, piping, valves, and instrumentation and controls minimizing routine access requirements into the tanks and providing for future equipment needs. The NMF includes automated nitrogen analyzers.

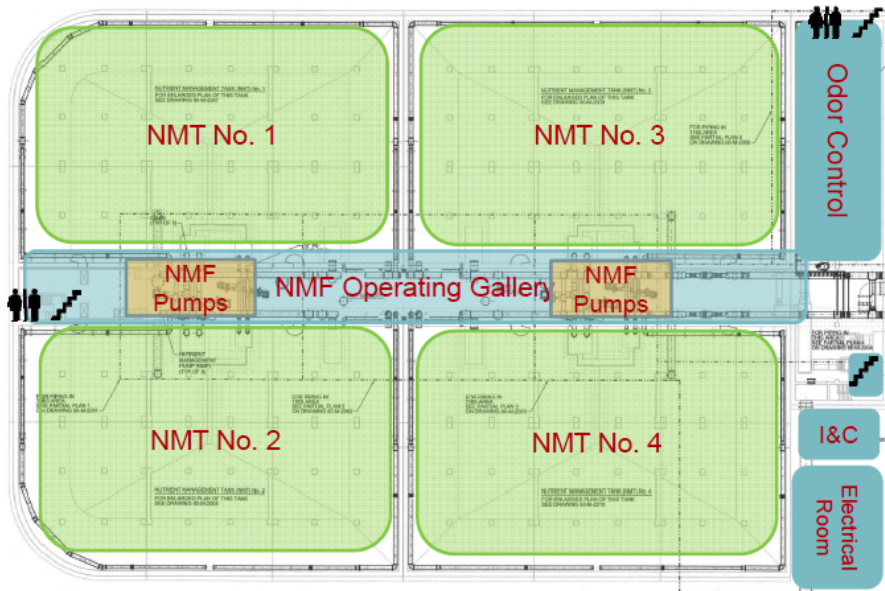


Fig. 5: Plan of the NMF showing the four tanks and the operating gallery²⁹

²⁹ AlexRenew. (October 2015) “SANUP Package C, Nutrient Management Facility”, Process and SCADA training.

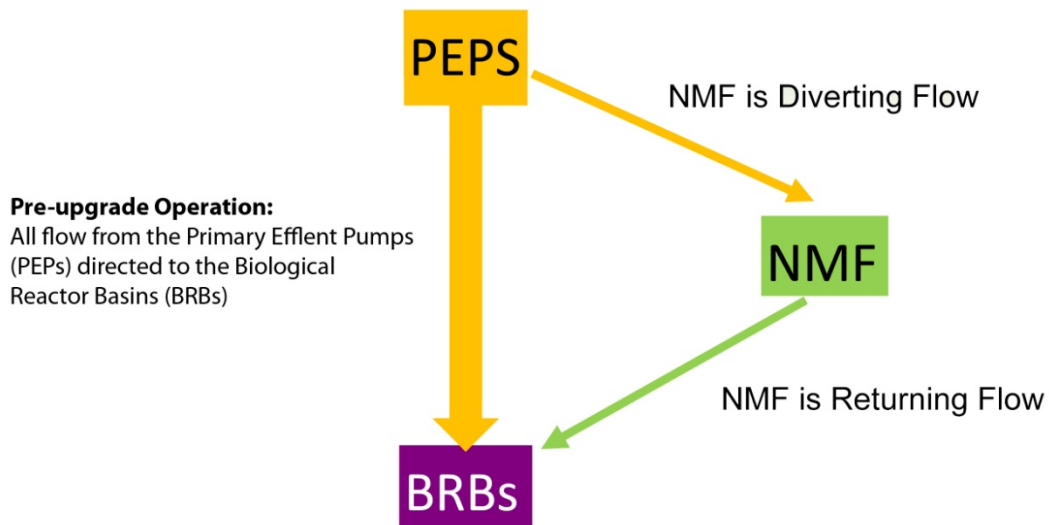


Fig. 6: Simplified diagram of the new process³⁰

The facility supports the transition to the deammonification process, an innovative technology that selectively cultivates naturally occurring micro-organisms, the anammox bacteria, to remove nitrogen from wastewater with less energy and chemical needs as compared to traditional methods. By equalizing the ammonia load to the biological reactor basins, AlexRenew enhances the performance of the microbes to further reduce chemical and aeration demands, with potential annual O&M savings of \$400,000.

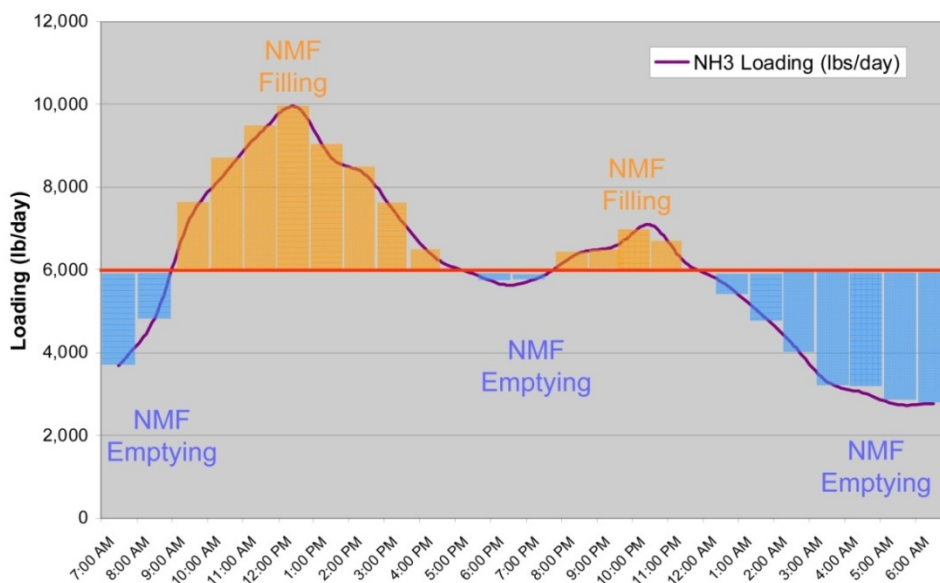


Fig.7: Ammonia Loading Equalization³¹

Project Level – Community Engagement

The west site development has activated a new area of the Eisenhower Valley community. With the multipurpose field atop the nutrient management facility and the Environmental

³⁰ AlexRenew. (October 2015) "SANUP Package C, Nutrient Management Facility", Process and SCADA training.

³¹ AlexRenew Package C Nutrient Management Facility Process and SCADA Training document prepared by CH2M Hill

Center, which invites the community in to experience the service of AlexRenew, the utility has invested in community engagement and inspiring water stewardship like never before.³²

In the early phases of the NMF design, above ground cylindrical tanks were proposed opting for a vertical composition to maximize open space for the development. This initial design concept was rejected by the City of Alexandria and various review boards, because it was deemed incompatible with the Eisenhower East Small Area plan. In response to the feedback AlexRenew received from the city's Eisenhower East Design Review Board during the Development Special Use Permit (DSUP) process the NMF tanks were switched to rectangular and moved to a lower elevation with only a 10 foot projection of the overall structure above grade.³³

Both the athletic field and the Environmental Center are the most visible to the community project components, than make a sustainable process like wastewater treatment from invisible to also visible.



Fig. 8- 9: Initial hard infrastructure design for NMF (incorporating wind turbines) VS. Final sustainable design of NMF incorporating community input

AlexRenew demonstrated an innovative way to communicate the project to the public by allowing project's construction oversight and public comments directly to the project team.

Utility Level – Sustainable Leadership

Project as catalyst for sustainable organizational leadership

It was a crisis that initiated the project. Restrictive new regulation hard to meet required the implementation of state-of-the-art technology but also a major culture change (for the utility) in a very short amount of time. *“With the Chesapeake Bay in decline, all water utilities in the Bay watershed were asked to step up, invest in technology to make our water product even cleaner, and lead the way to a cleaner Bay for our region,”* said Pallansch.³⁴

³²http://financedocbox.com/amp/71586296-Financial_Planning/Alexandria-renew-enterprises.html#show_full_text

³³ FY 2016 Operating & Capital budget, July 23, 2015.

³⁴ <https://alexrenew.com/alexrenew-and-ch2m-awarded-state-art-nitrogen-upgrade-program>

The SANUP program is both the reason for the utility's profile change, as well as the materialization of this shift into a project.

Utility's rebranding

In 2012 ASA changed its name to AlexRenew, one befitting the utility's role redefinition: wastewater as a resource, billing to customers as an investment in clean water. *"We created a new logo and brand identity becoming "Alexandria's Water Transformers."*³⁵ AlexRenew externally launched the brand in October 2015. According to Pallansch *"While the transformation was challenging, it helped AlexRenew evolve its thinking toward a more sustainable approach to wastewater management. It also made the leadership team more receptive to new ideas about how to efficiently remove nutrients and reduce energy use while delivering clean water."*³⁶ She adds: *"for many utilities, it takes a crisis or restrictive new regulation to force a change in thinking about these kinds of issues."*

This shift is also integral to the economy of Alexandria, which chartered itself an Eco-City. AlexRenew, together with their partner Siddall Communications LLC,³⁷ executed a brand discovery process. Other water utilities' brand identities and expressions of them were analyzed, as well as three years of AlexRenew communications materials and messages. AlexRenew team members, vendors and board members, who are community members with valuable customer insight, were interviewed.

The Alexandria's Water Transformers brand was developed out of the discovery process and the four brand roles that best reflect the utility's work were defined:

- Innovator – big problems call for real creativity, fresh approaches, and new technology
- Transformer – we do more than just treat water, we transform it
- Good neighbor – we put resources to work so the community and the environment can thrive
- Problem solver – working together, we're helping to reduce our impact, lower risk, and decrease costs

The new AlexRenew brand was externally launched, at FieldFest, a day-long festival celebrating the opening of a new community athletic field on top of the NMF and experienced by hundreds of local residents. This is indicative of how interconnected it was

³⁵ American Academy of Environmental Engineers & Scientists. "2016 Environmental Communications Awards Competition Winner, Honor Award: Rebranding AlexRenew," <http://www.aees.org/ecommpetition/2016honor.php>

³⁶ Sarah Fister Gale, "Sustainable Water Infrastructure: Rethinking water and wastewater systems with resilience in mind," June 1, 2017, <https://www.waterworld.com/articles/print/volume-33/issue-6/features/sustainable-water-infrastructure-rethinking-water-and-wastewater-systems-with-resilience-in-mind.html>

³⁷ https://siddall.com/our_work/alexandria-renew/
"To most people, Alexandria Renew was just a bill in the mail. This utility handles wastewater in Alexandria and parts of Fairfax, right on the edge of the Potomac River. In 2015, we were brought in to brand the utility internally. Through internal messaging, we changed what was once thought of as simply a place to have a job into a place that transformed the environment, touting the breakthrough technology and methods employed by the facility. That brand reached into the public through community events. AlexRenew won an Honor award from the American Academy of Environmental Engineers and Scientists for the rebranding in 2016. We continue to create projects for this groundbreaking client."

with the project, and how the project decisions supported it. It has received enthusiastic response from the board and water sector leaders and target audience responses brand have been wholly positive. According to AlexRenew it has *enhanced positive word of mouth in the community, since it helped the public better understand what we do and has enhanced employee pride. While our results are qualitative, we view them as an encouraging indicator of the response to our future branded communications.*"

The above described process is in line with the business case for corporate sustainability as described in literature^{38 39}.

An insight on "how this transformation of AlexRenew was designed" is offered by Pallansch's recommendations to other utilities: *"start by setting goals around sustainability, and then reading everything about what's already been accomplished"*. More specifically she advised to perform a research of others' business plan paradigms: *"Don't just focus on industry journals. Read Fast Company, the Harvard Business Review, and business magazines to see what folks are doing in other industries and how it might apply for you. Then start with pilot projects to demonstrate small wins and begin to transform the organization's perceptions about the financial, social and environmental benefits of sustainability. If you do a lot of little things, it can have a big impact,"* she said.⁴⁰

Partnerships -Watershed Partnerships

AlexRenew is investing in research on new technologies partnering with a global network of academics and utilities in several high visibility research projects⁴¹. This collaboration has resulted in further enhancement of the treatment processes at AlexRenew and sharing of information and lessons learned with partner utilities.⁴² The utility is the first in the U.S. to implement a full-scale mainstream deammonification system⁴³ and the first utility in the world to use this cutting-edge technology to meet such strict low nitrogen limits.

AlexRenew is also participating in boards, committees and taskforces through a multitude of associations dedicated to the advancement of the wastewater profession, improved water

³⁸The business case for corporate sustainability can be summarized as:

- Value creation for customers, shareholders, and other
- Efficiency- related cost savings at the corporate level
- Revenue increase from customer attraction and market share
- Risk reduction or management

³⁹ Regarding risk reduction it is worth mentioning that in 2010, even before the new brand launch, AlexRenew had scored 100% on Virginia Municipal League Insurance Program's annual risk management guidelines assessment, earning a 5% reduction in insurance premiums. (source: "Redefining the future of wastewater," Alexandria Sanitation Authority 2010 Annual Report)

⁴⁰ Sarah Fister Gale, *"Sustainable Water Infrastructure: Rethinking water and wastewater systems with resilience in mind,"* June 1, 2017, <https://www.waterworld.com/articles/print/volume-33/issue-6/features/sustainable-water-infrastructure-rethinking-water-and-wastewater-systems-with-resilience-in-mind.html>

⁴¹ AlexRenew engages several external collaborators including peer utilities, research centers/foundations, universities, consultants, manufacturers and vendors, and the public to facilitate innovation. AlexRenew has a learning partnership with other utilities such as VandCenterSyd (VCS) Denmark and DC Water on the ANAMMOX technology, and participates in Water Research Foundation (WERF) Research Projects for fostering innovation within water utilities.

⁴² <http://www.aees.org/e3scompetition/2016grandprize-design.php>

⁴³ http://www.werf.org/lift/docs/LIFT_Notes_Docs/2016/Featured_Facility/Featured_Facility_8-18-2016.aspx

policy, and protecting water quality, like the Clean Water America Alliance, Water Environment Research Foundation, Water Environment Federation, National Association of Clean Water Agencies, and WaterReuse Research Foundation.⁴⁴

It is worth mentioning that CH2MHill are among the Clean Water America Alliance Founding Members.

NACWA, WEF and WERF launched the Utility of the Future Today Recognition Program (UOTF) in 2016 and generated “The Water Resources Utility of the Future: A Blueprint for Action–January 2013” publication that proposes an innovative business model (SEE APPENDIX). “Utilities applying Utility of the Future (UOTF) principles are saving millions of dollars in costs, reducing phosphorus discharges, and **earning new revenue streams from the recovery of resources.**”

AlexRenew has been one of the 61 UOTF honorees for 2016 for meeting the following criteria:

- Organizational Culture
- Community Partnering & Engagement
- Beneficial Biosolids Reuse
- Energy Efficiency
- Water Reuse

The partnering water sector groups direct to Effective Utility Management (EUM) framework for guidance.

Utility Level – Sustainable Project Management

Use of Sustainability Guidance Tools

The SANUP, and thus the NMF’s project management is interconnected with the utility’s reinvented sustainable profile: according to how AlexRenew presents the stages of its transformation with key milestones where project management tools used to secure a sustainable outcome stand out.

In 2007 AlexRenew started an Environmental Management System (EMS) and in 2009 began formally integrating sustainability into Contract Documents for capital projects, such as in SANUP.

The *Sustainability Strategies Guidance Document*, a 150-page document of 2009 conducted by CH2M Hill gathered the information and results of the series of workshops that initiated the SANUP project. Some of the SANUP Sustainability Objectives in the *Sustainability*

⁴⁴ It is worth mentioning that Karen Pallansch, current Chief Executive Officer for Alexandria Renew Enterprises, is a current Board member for the WaterReuse Association and Virginia Municipal League Insurance Pool, and Federation Delegate-at-large-position at the Virginia Water Environment Association (VWEA). She has served as a former president of the NAWCA and previous chair of the WERF Research Advisory Council in addition to serving as an ex-officio member of the WERF Board.

Strategies Guidance Document of 2009 were based on LEED credits or redirected to LEED items implementation.

The six strategic outcomes of the Board’s 2040 vision that summarize the utility’s principles:

- Operational Excellence
- Community Benefit
- Watershed Partnership
- Organizational Competency & Structure
- Investment Stewardship by Diversifying Revenue
- Incubator of New Ideas and Innovations

Since Envision was launched and AlexRenew pursued Envision rating and awarded the utility has incorporated it in its procurement processes as more infrastructure related and due to its high alignment with the utility’s decision matrix. The utility’s staff has been trained and certified as ENV SPs.

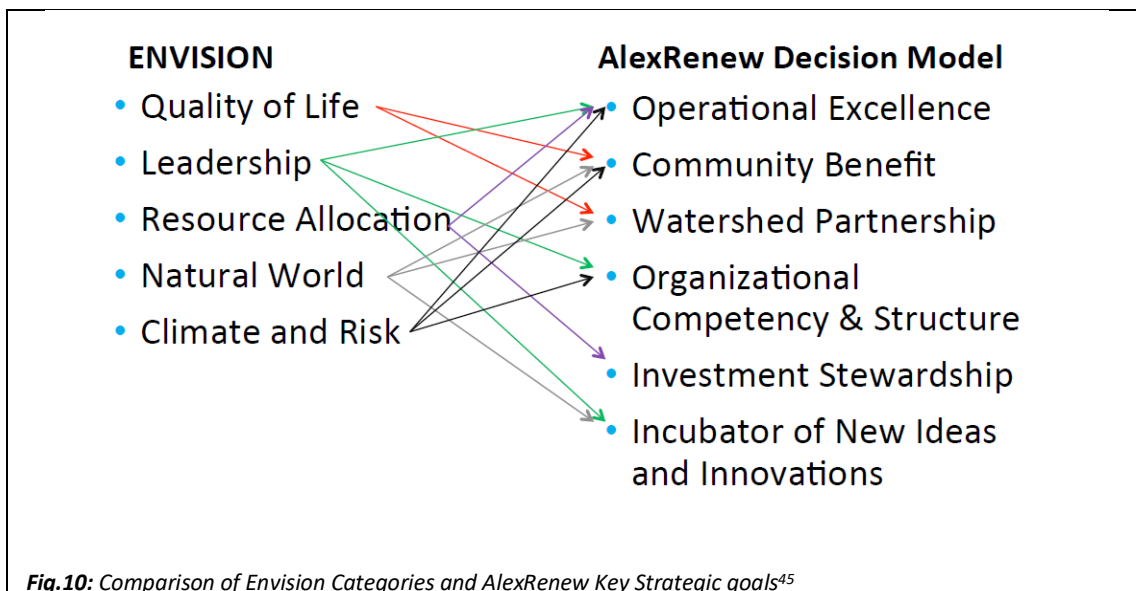


Fig.10: Comparison of Envision Categories and AlexRenew Key Strategic goals⁴⁵

The project owner along with the consulting firm CH2M Hill that was early introduced to the project planning, have created a custom decision model in relation with sustainability strategies to rate alternative solutions during design and guide a decision-making process of elevated complexity. In other words, a multi criteria decision analysis method was used, the SANUP Decision Matrix.

The Matrix for alternatives’ evaluation had certain “weights” assigned to project attributes ranging from 3 to 12 to hierarchize core high impact elements.

The most weighted attributes were:

⁴⁵ Sean Stephan, Grace Richardson, Alexandria Renew Enterprises, “Incorporating Sustainability Leadership to Enhance the Quality of Life of the Community By Optimizing The Efficient Treatment of Water Through the Design of the State-of-the-Art Nutrient Upgrade Program’s Advanced Nutrient Management Facility,” presented in Infrastructure Resilience II Workshop Harvard Graduate School of Design and Harvard Business School, April 4-5,2016.

- Flexibility to adapt to changing regulations (12)
- Ease of Operation (11)
- Capital Cost Management (11)
- Annual Cost (11)
- Neighborhood/ City Relations (10)
- Staff Engagement (10)

Table 1: SANUP EVALUATION CRITERIA

Strategies	People	Environmental Leadership	Efficiency	Community Awareness	Fiscal Responsibility
weights	21	26	15	16	22
	Ease of Operation	Current Permit Compliance	Reliability	Neighborhood/ City relations	Capital Cost Management
	weight: 11	weight: 5	weight: 3	weight: 10	weight: 11
	Staff Engagement	Flexibility to adapt to changing regulations	Capacity	Public Partnering	Annual Cost
	weight: 10	weight: 12	weight: 4	weight: 6	weight: 11
		Manage Environmental Footprint	Site Open Space		
		weight: 9	weight: 5		
			Embed Sustainable practices		
			weight: 3		

The AlexRenew uses the Triple bottom line (TBL) approach, which seeks to broaden the focus on the financial bottom line by businesses to include social and environmental responsibilities. The triple bottom line measures a company's degree of social responsibility, its economic value, and its environmental impact evident by the weight/ importance given to environmental compliance, neighborhood/ city relations and costs.

3. ECONOMIC PERFORMANCE

Financial considerations were introduced early in the decision-making process however they were not weighted more than the environmental compliance, the operability, and the neighborhood/ city relations.

Breaking down the cost of the project per component:

Table 2: Project cost per task & per component

	NMF	FIELD	ENV CENTER	DECK
Land acquisition			36,000,000	
Detailed design cost	961,000			

Engineering services cost	2,460,000
Site remediation	
Pile structure	
Total construction cost	\$101,500,000
Commissioning	3,725,000

The estimated useful life of the NMF facility is: **50 years** for the holding tanks & **25 years** for process equipment and the athletic field. The estimated useful life of the Connector deck and Environmental center structure is 30 years. The project provided flexibility for future regulations, e.g. provision for additional future pumping needs etc.

3.1. Project Funding Sources

The project took advantage of locally available funds and revolving loans for funding and moreover, as already mentioned, it was adjusted to be eligible for state funding.

The NMF SANUP part of the project received a capital grant by the Commonwealth of Virginia's⁴⁶, Department of Environmental Quality (DEQ), the Water Quality Improvement fund (WQIF) that covered 28.8% of the total AlexRenew cost share. Project eligibility to receive Virginia WQIF⁴⁷ funding was limited to design and installation of nutrient reduction technology at Chesapeake Bay watershed publicly-owned wastewater treatment plants. The WQIF fund's requirements concerned all stages of the project: pre-design studies such as cost-effectiveness analysis; design plan review and approval by DEQ; construction reporting, tracking of progress, periodic evaluation and monitoring by DEQ; post-construction, operation and maintenance period performance tracking of nutrients concentrations.⁴⁸

Part of financing was also through the Virginia Clean Water Revolving Loan Fund (VRLF) with low interest rates for any expansion, upgrade, extension, replacement, repairs, rehabilitation, and/or additions to publicly-owned wastewater treatment plants to improve water quality or prevent future problems.^{49,50} The VRLF provides flexibility through

⁴⁶ Commonwealth of Virginia is partner in *Chesapeake Bay Program, that co-signed the Chesapeake Bay Watershed Agreement* in 2014.

Reduce the nutrient levels (nitrogen and phosphorous) in the plant effluent to meet the water quality requirements of the Potomac Embayment Standards and the voluntary requirements of the 1987 Chesapeake Bay Agreement.

⁴⁷ One of Virginia Department of environmental quality Clean Water Financing & Assistance programs

⁴⁸ Virginia Water Quality Improvement Fund Guidelines, November 2006

⁴⁹ <https://www.virginiaresources.gov/page/clean-water-revolving-loan-fund/>

Benefits of the VRLF include:

- below-market interest rates:1% below prevailing rates
- 0% loans for some localities meeting eligibility criteria
- No bond issuance costs
- Payment waiver during construction

⁵⁰ The Department of Environmental Quality administers the program and policy aspects of the fund on behalf of the State Water Control Board (SWCB).Virginia Resources Authority (VRA) serves as the financial manager of the fund: underwriting loans, issuing bonds, investing monies, closing loans, making disbursements, and maximizing economic benefits. <https://www.virginiaresources.gov/page/clean-water-revolving-loan-fund/>

structured repayment schedules adjusted to the borrower’s needs. The loan has a 30-year term(?)

Though the State Clean Water Revolving Fund programs in general are not prescriptive about how to accomplish water quality goals, they do encourage cost-effective investments in sustainable infrastructure, e.g. encouraging the adoption of green infrastructure and expansion of its use across the wastewater sector.⁵¹ The VRLF supported the construction of the Connector Deck.

Table 3: Project Financing for FY2015 & FY2016⁵²

	FY2015		FY2016	
Cost		113,383,817		3,725,000
Financing				
AlexRenew		17,839,631	40.0%	1,490,000
Fairfax	60.0%	68,030,290	60.0%	2,235,000
AlexRenew share of cost	40.0%	45,353,527		
This share was paid by:				
Virginia Revolving Loan Fund (VRLF)	27.6%	12,500,000		
Water Quality Improvement Fund (WQIF) Grant	28.8%	13046895		
Line of Credit	4.3%	1,967,001		
AlexRenew	39.3%	17,839,631		
		45,353,527		
Total cost		113,383,817		

Due to the available financing sources and the contribution of the Fairfax County’s cost share, in FY2015 AlexRenew Enterprises eventually covered the **15.7%** of the total budget of \$113.38 M for the NMF that fiscal year.

3.2. Offsetting Costs

Part of AlexRenew business plan is to identify ways to reduce costs, but after the the SANUP program it was imperative to offset costs, NMF project included. However, this with the certainty that the SANUP program projects will not only reduce nitrogen discharges to just 3 mg/L, but will also be reducing energy and chemical needs and offsetting future cost increases. So, AlexRenew opted for short-term costs vs. long-term cost savings.

Avoided costs

If the plant was not permitted to expand to the west site the utility would not be able to comply with the enhanced nutrient removal requirement by the deadline of January 2011

⁵¹ See EPA’s Clean Water State Revolving Fund publication of 2015: *Financing Green Infrastructure: A best practices guide for the Clean Water State Revolving Fund*).

⁵² FY 2016 operating & capital budget, July 2015

and would be in violation of Federal and State law. The existing 33 acre ASA property was completely built-out, so the utility would be forced to demolish existing structures and pile up additional treatment facilities. Estimates indicated that **expanding the plant on-site would be the most expensive option** resulting in costs onto the ratepayers. In addition, the demolition and reconstruction of existing facilities would also result in extended periods of untreated discharged effluent thus without complying with current permit requirements. The consequence of these violations would include fines of up to \$32,500 per day per violation.⁵³

The innovative PPP strategy

*“As part of the project recreational green space was expanded, a public education center promoting the value of reclaimed water was provided, and this was all possible without impacting rates due to the innovative financial agreements with partners”.*⁵⁴

*“Funding for the multipurpose field was separate from the \$92 M cost of the treatment plant upgrade. The field cost less than \$1.5 M and did not affect AlexRenew’s rates, since the cost was offset through transfer of development rights and sale of property with AlexRenew’s development partner, JM Zell Partners Ltd. real estate developer in the South Carlyle Strategy PPP,”*⁵⁵

The basis for cost offsets through the PPP was the avoided costs through the NMF project for all stakeholders involved: AlexRenew, developers and the City of Alexandria.

As already mentioned the impact of expanding to a new site for the developer and the city meant a loss of approximately 170,000 SF of residential use and 500,000 SF of office use for the development. This loss was counterbalanced by:

- The new development’s reliance on sewage treatment capacity expansion. If the required capacity based on projections was not secured, *“the development would be substantially delayed if not altogether precluded.”*⁵⁶ Moreover not meeting permit requirements for discharged effluents would result into the city not complying with regulations and thus would mean fines for the city.
- The sale of development rights to the developer of a 2-acre parcel to the north of the west site owned by AlexRenew⁵⁷. Given that the Carlyle and Eisenhower East development allowed for floor area to be “transferred” from one block to another (density transfer) with special use permit approval by the Planning Commission and City Council, a sale of development rights was proposed to the developer.

⁵³ Master Plan Amendment #2007-0004, Planning Commission Meeting, March 4, 2007

⁵⁴ <https://www.nacwa.org/about-us/member-spotlight/2017/01/10/alexandria-renew-enterprises-taking-community-engagement-to-the-next-level>

⁵⁵ Jeff Smith, “Going underground,” in Treatment Plant Operator Magazine, June 2016. https://www.tpomag.com/editorial/2016/06/alexrenew_where_soccer_meets_wastewater_treatment

⁵⁶ Master Plan Amendment #2007-0004, Planning Commission Meeting, March 4, 2007

⁵⁷ This parcel was not large enough for AlexRenew intended expansion and would have larger impact on the intended mixed-use development so it was not a viable option to consider for the NMF project.

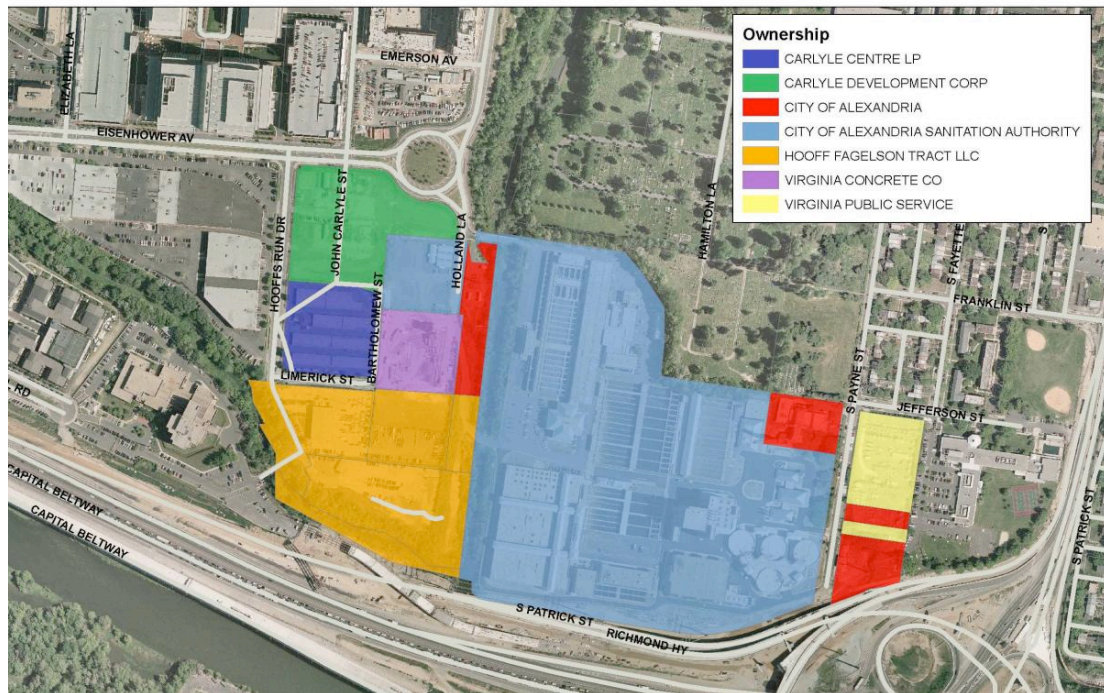


Fig.11: Ownership status of the parcels around AlexRenew WRRF ⁵⁸

The land acquisition of the west site by AlexRenew took place in 2010 after a long process of negotiations with the landowner that finally reached settlement at \$36 M for land value. The density transfer helped AlexRenew recoup some of the funds expended on buying the west site, and temper its wastewater rates for its customers receiving the amount of \$15.2 M in 2013.

The unique ten-year public-private partnership was enabled by the Virginia’s Public- Private Education Facilities and Infrastructure Act of 2002 (PPEA) Va. Code §56-575.1 et. Seq that authorizes AlexRenew to partner with private entities to acquire, design, construct, improve, renovate, expand, equip, maintain, or operate what are called “qualifying projects”.⁵⁹

Moreover, PPP partnerships are ruled by specific guidelines that determine AlexRenew activities within a PPEA: “Alexandria Renew Enterprises Public-Private Education Facilities and Infrastructure Guidelines, Revised April 2016”. The guidelines require a project’s financing proposal to be supported by a total life-cycle cost specifying methodology, by specifications on all parties involved, on financing mechanisms and schedule of project revenues and project costs. Regarding Project Benefit and Compatibility the guidelines require among other things, identification of who will benefit from the project, how and how the project will benefit the overall community, region, or state; identification of any anticipated public support or opposition; strategy and plans that will be carried out to involve and inform the general public, business community and governmental agencies in areas affected by the project; and identification of anticipated significant benefits to the

⁵⁸ MASTER PLAN AMENDMENT #2007-0004, SECTION 9.06 CASE # 2007-0004, Planning Commission Meeting, March 4, 2007, by Alexandria Sanitation Authority

⁵⁹ <http://thelandlawyers.com/virginias-public-private-transportation-act-of-1995/>

community, region or state including anticipated benefits to the economic condition of AlexRenew and whether the project is critical to attracting or maintaining competitive industries and businesses to AlexRenew or the surrounding region.

Negotiations also included addressing AlexRenew expressed concern that the field on top of the tanks was limiting any future vertical construction in the case of unknown future regulations or capacity issues. In response to this concern it was proposed that the City allows AlexRenew to acquire two city-owned parcels adjacent to the treatment facility to the east of 0.56 and 1.2 acres, if sold. With approval by the City Council, AlexRenew was **granted right of first refusal**⁶⁰ to acquire these two parcels at market value commencing in year 2020 and ending no later than the year 2050. The right of first refusal would also provide a credit for depreciated athletic field construction costs against the future purchase price of these properties; credit applicable if ASA would provide an additional of 10-years of City use to 2037 of the athletic facilities. The two parcels were assessed at \$8.5 M and field- related construction costs were estimated at around \$3 M. Assuming a 25-year life for the field, the capital value of city use each year would be \$120,000. In the case of sale, the value of the two parcels would be balanced with the field use expenses. If the City would not sell the two parcels to ASA, then ASA would bear the full cost of the athletic field construction. In any case, the City would be responsible for operating and ongoing capital maintenance costs of the athletic field.⁶¹ What is interesting about the right of first refusal is that through this agreement AlexRenew was given a kind of guarantee for future expansion and an important advantage, given that site restriction is a major limitation for AlexRenew.

AlexRenew has an ongoing partnership with Carlyle Plaza Partners (CP2), which includes use of reclaimed water and other AlexRenew products⁶².

Construction Cost Savings

Through Value Engineering (VE) that initiated from the preconstruction phase the schedule performance was improved and the construction costs and risks reduced. Major changes were made based on the CMAR's suggestions and some parts of the project were redesigned. This is highly unusual for projects of this type, made possible through collaboration.⁶³ The CMAR and the designers met in person biweekly to collaborate and coordinate design changes throughout the project. The VE change proposal to switch to a different type of construction for the NMF, precast panels and piles instead of the original cast-in-place concrete construction, was selected as the best value after conducting an evaluation of various factors, including cost, speed of installation, and noise pollution during

⁶⁰ Right of first refusal (ROFR or RFR) is a contractual right that gives its holder the option to enter a business transaction with the owner of something, according to specified terms, before the owner is entitled to enter into that transaction with a third party.

⁶¹ Memorandum for "Consideration of a resolution authorizing the city manager to sign a right of first refusal granting the Alexandria Sanitation Authority the right to purchase certain city property located at 801 and 910 South Payne Str if the city decides to sell the property," from Acting City manager to Mayor and City Council, November 16, 2011.

⁶² 2016 Utility Honorees Utility of the Future Today

⁶³ Envision Credit documentation cover sheet as submitted; provided by AlexRenew

construction. Off-site manufacture occurred simultaneously with on-site works and shortened significantly the project schedule. BIM-driven 3D modeling was used to coordinate the process and was repeatedly reengineered as needed and assessed, over a span of 6 months. This change ended up saving \$6M to the owner.

The overall SANUP cost of \$131 M compares favorably to the baseline budget of \$154 M. Design error and omission-based change orders for the design/bid/build packages were a combined 3.0% of constructed value. **Work executed under a CMAR approach yielded a 10.4% reduction against the established guaranteed maximum price amounts.**⁶⁴

AlexRenew has presented the CMAR method along with lessons learned from its implementation at the NMF in a Virginia Water Environment Association (VWEA⁶⁵) Webinar, one of VWEA’s training & leadership development programs on water industry- related and trending topics, in October 2015⁶⁶. AlexRenew shared its experience on CMAR as a viable option for large, complex projects and significant value for the owner.

GMP Cost Summary	Entity	Unit	Unit Cost	Item Cost	MBE/WBE/Local Participation
Core Project Management Team	CMAR				
Insurance, Bonds, Other Indirect					
Miscellaneous GCs					
Direct cost					
Bid Package 1 – Site Demo	ABC Earthworks				
Bid Package 2 – SOE and Dewatering	DEF Shoring Specialist				
Bid Package 3 – Piles	GHI Construction				
Allowances					
Contingency	Identify subcontractor trades for easy reference				
CMAR Fee					
Subtotal					
Shared Savings Disbursement					
Total GMP					

Owners should work with the CMAR to format the GMP cost summary according to their needs.

This is particularly important if work needs to be tracked by funding source (e.g., work eligible for state reimbursement vs. non-eligible).

This format can be easily adapted to serve as the Schedule of Values (SOV) and included in payment applications

Fig. 12: Cost Summary⁶⁷

⁶⁴ American Academy of Environmental Engineers & Scientists. “2016 Excellence in Environmental Engineering and Science™ Awards Competition Winner, Grand Prize – Design: State-of-the-art nitrogen upgrade,” <http://www.aaees.org/e3scompetition/2016grandprize-design.php>

⁶⁵ The Virginia Water Environment Association is a non-profit, technical and educational organization focused on producing quality programs for continuing education and training for our members, the technical community and the general public. VWEA is a member association of the Water Environment Federation (WEF) and collaborates with many other industry organizations, such as WEF and the Virginia Section of the American Water Works Association. <https://vwea.site-ym.com/>

⁶⁶ Janelle Wright Okorie, Director of Engineering and Technology Programs, “Construction Management at Risk Implementation and Lessons Learned,” presented at Virginia Water Environment Association Webinar, 21 October 2015.

⁶⁷ Table presented at: Janelle Wright Okorie, Director of Engineering and Technology Programs, “Construction Management at Risk Implementation and Lessons Learned,” presented at Virginia Water Environment Association Webinar, 21 October 2015.

Sustainable Design O&M cost savings

The NMF plant is in operation since May 2016. Potential annual **O&M cost savings** related to the operational efficiency of the NMF are estimated to reach \$400,000 due to reduction of energy and chemicals use needs.⁶⁸ Moreover, it is expected to offset increases in O&M costs from additional regulatory processes.⁶⁹

The field is managed by the City of Alexandria's Recreation, Parks and Cultural Activities Department for recreational activities, so the project does not increase O&M costs for AlexRenew. As for Deck Connector, O&M cost will be shared with an owner's association that will be created to assume joint responsibility for the long-term maintenance of this improvement.

Moreover, to offset the cost of the SANUP and other upgrade projects of about \$222M in total, AlexRenew **looked for additional facility-wide energy cost-saving measures**. Working with an Energy Service Company (ESCO) they identified energy conservation measures, and implemented them through an Energy Savings Performance Contract (ESPC). The ESCO successfully redirected the digester gas to the pasteurization process burner that used to be fueled by natural gas, reducing natural gas costs. Building improvements in 780,000 SF of facility space in 20 buildings provided additional savings through lighting system upgrades, steam trap retrofits and boiler replacements. By installing electric boilers took full advantage of the Alexandria's electric rate structure that makes it more cost-effective to use off-peak electricity rather than natural gas. Project savings totaled \$267,000 in energy costs and \$42,000 in non-energy costs. The environmental benefit is substantial, removing 546 tons of greenhouse gas emissions from the atmosphere each year. The project cost was \$5.9 M.⁷⁰

Revenues restructuring

AlexRenew has two major sources of revenue, including wastewater treatment charges paid by Alexandria customers and reimbursements of a proportion of expenses by Fairfax County under a service agreement already mentioned.

In order to cover the costs of the SANUP upgrade as well as other plant upgrades, a rate revenue increase was needed. AlexRenew's Board of directors set rate plans in multi-year increments. In order not to affect customers significantly these rate changes have been modest and predictable and remained competitive with those of other water-cleaning facilities in the region.

For the period 2010-2012 as explained in AlexRenew (ASA at that time) 2010 annual report: "[...] after a detailed rate study, ASA's Board opted to approve a three-year phased

⁶⁸ The implementation in 2015 of mainstream Anammox, an innovative water cleaning process that will reduce energy costs, and save on the chemicals we use to remove nitrogen, since the Anammox microbes do it naturally. http://financedocbox.com/amp/71586296-Financial_Planning/Alexandria-renew-enterprises.html#show_full_text

⁶⁹ https://alexrenew.com/sites/default/files/budget-reports/fy_2017_operating_capital_budget.pdf

⁷⁰ Energy Savings Performance Contracting for Water Resource Recovery Facilities, March 2018

approach: a first increase going into effect October 1, 2010, and subsequent increases in 2011 and 2012. The rate increase did not affect the per gallon charge for water consumption, but it did increase the ASA account service charge by roughly \$0.25/month and added a new **Bay Protection Charge** – a fixed charge to recover capital expenses needed to upgrade ASA infrastructure.”⁷¹ The Bay Protection Charge was of \$11.24/quarter.⁷²

For the period 2013-2015: an effort to counterbalance the prior three-year charges was made through a restructuring of residential and commercial wastewater treatment and disposal fees. AlexRenew eliminated Virginia American Water’s account service charge and replaced these duties at a reduced cost. An additional charge of 15 cents per 1,000 gallons used — a new rate of \$6.51 per-thousand-gallons used versus \$6.36 was planned for the first year and small rate increases for each of the following two years. The total rate restructuring for the 3-year span is 26 cents. Combined with the elimination of the service charge, many residential ratepayers would not see increase in their bills. The Chesapeake Bay Protection Fee was not changed.⁷³

Revenues generated

Other revenue sources related to the project could potentially be from nutrient trading. In Virginia there is a nutrient trading program since 2005, administered by the Department of Environmental Quality (DEQ), to provide wastewater treatment plants with flexible options for meeting and maintaining permitted nutrient load limits. AlexRenew is member of the Virginia Nutrient Credit Exchange Association, a voluntary association of 73 owners of 105 treatment facilities cleaning wastewater in the Chesapeake Bay watershed to reduce nitrogen and phosphorus. The Nutrient Exchange was established in 2005 to coordinate and facilitate nutrient credit trading among its members to help improve water quality efficiently and cost-effectively. Today, the Nutrient Exchange is considered the largest and most successful water quality trading program in the United States. The market price for discharge rights creates a financial incentive for firms to continuously seek new ways to reduce (rather than relocate) both effluent loads and control costs.⁷⁴ ⁷⁵ However, given that credits do not exist until the end of the year accounting has been completed, it is unclear the extent to which WRRFs will rely on these credits as a long term nutrient management strategy.

⁷¹ “Redefining the future of wastewater,” Alexandria Sanitation Authority 2010 Annual Report

⁷² Virginia American Water, “How to read your bill”

⁷³ John Hill, Alexandria Renew Enterprises board chairman, “Water rates to get an overhaul,” posted in Alexandria Times on June 6, 2013.

⁷⁴ For 11 consecutive years, AlexRenew has received the National Association of Clean Water Agencies (Washington, D.C.) *Peak Performance Platinum Award* for its compliance record. The Virginia Department of Environmental Quality recognizes AlexRenew for achieving the highest level of environmental excellence and as an extraordinary environmental enterprise.

⁷⁵ To ensure that trading actually reduces (rather than relocates) pollution no entity may generate and sell credits unless it has first met its own pollution reduction obligation (“baseline”); and only pounds reduced beyond baseline are eligible to be certified and then traded. If at the end of the year a source’s discharge is less than the baseline, credits are created and can be sold to point sources whose discharge exceeded their baseline. Unused credits expire at the end of the year.

In 2013 Alexandria Renew not only achieved the highest rating for environmental compliance, but it also began selling “nutrient credits” to assist neighboring utilities to meet the watershed’s higher environmental standards.⁷⁶

Offsetting project costs through utility’s overall sustainable-economic performance

Finally, and in order to draw conclusions on the project’s cost-effectiveness it is necessary to see the project’s performance within the utility’s sustainable-economic planning.

In the mid-2000s, AlexRenew embraced the aggressive goal of becoming a net-zero energy user and has been gradually reaching interim targets for energy efficiency as guided by a plant-wide Energy Master Plan Study completed in 2014.

Participating in the Department of Energy’s Superior Energy Performance Program the utility has reduced its energy intensity by at least 25% over 10 years, and in 2015, AlexRenew generated 157 million cubic feet of renewable methane gas and used 92% of it to operate its facilities and offset purchased energy by 32% saving \$600,000.⁷⁷ It is worth noting that it takes 20 Btu of energy to treat each gallon of dirty water received and about 250 billion Btu are used annually.

As stated by the utility *“we view wastewater as a renewable resource and are committed to the sustainable recovery of nutrients, energy and water throughout our treatment process.”*

1.4 billion gallons of treated water per year is reused in daily operations of the plant saving \$3M in potable water costs. The NMF facility includes a reclaimed water system for irrigation needs for the city’s green spaces, expecting about 5 million gallons/day.

Since 2008 AlexRenew has consistently produced more than 20,000 tons of Class A biosolids, the highest quality level biosolids possible. Through a partnership with Synagro Technologies Inc., Baltimore as contract operator for biosolids distribution, 5,500 dry tons of biosolids were land applied at farms in more than 15 Virginia counties.

AlexRenew has also reduced greenhouse gas emissions by more than 20% since 2005.

The NMF is going to help for a higher performance, e.g. it is estimated that 99.92% of the annual water usage of the NMF is anticipated to be reclaimed water.⁷⁸

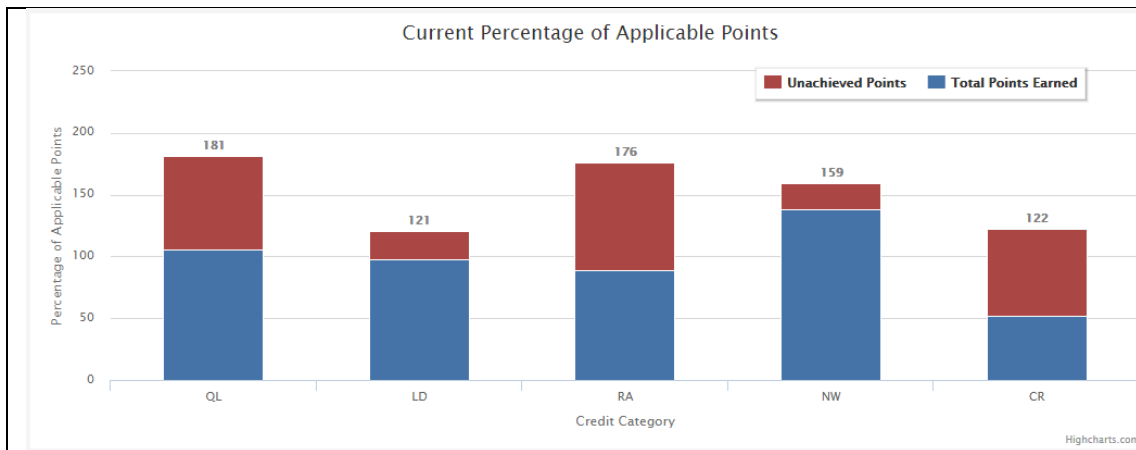
4. ENVISION RATING

The project applied for Envision after most part of the major construction was completed. NMF has scored a total of 56% at the Envision rating and received the Platinum award, the higher award of the Envision certification process on December 2016.

⁷⁶ Alexandria Renew Enterprises Annual Report 2013

⁷⁷ http://www.werf.org/lift/docs/LIFT_Notes_Docs/2016/Featured_Facility/Featured_Facility_8-18-2016.aspx

⁷⁸ Envision Credit documentation cover sheet as submitted; provided by AlexRenew



Credit Category	Submitted Score Information			Verified Score Information		
	Applicable	Submitted	Percentage	Applicable	Verified	Percentage
QUALITY OF LIFE	165	101	61%	165	87	53%
LEADERSHIP	121	78	64%	121	71	59%
RESOURCE ALLOCATION	176	87	49%	176	87	49%
NATURAL WORLD	159	119	75%	159	119	75%
CLIMATE AND RISK	122	49	40%	122	49	40%
Total Points / %	743	434	58%	743	413	56%

5. CONCLUSIONS

In literature the business case for corporate sustainability mainly appears as applied to a generic company; when the company is a wastewater infrastructure utility, the infrastructure projects that this utility generates are and should be an integral part of this business case. And we could argue that the business case for corporate sustainability and the business case for sustainable infrastructure projects coincide or overlap.

In the case of the NMF project, the owner, AlexRenew, followed a Triple bottom line approach for its project planning to incorporate social and environmental features to financial considerations and then looked for ways to offset project costs, through:

- High efficiency sustainable operations, identifying additional operation and maintenance cost reducing measures as for example ECMs that do not necessarily have to do with the project
- Reusing the byproducts of the treatment process within and out of the facility
- Alternative financing mechanisms
- Innovative public-private partnerships
- Rate revenues increase in a way that would not affect customers significantly

The challenges the project had to address are the ones that determined its most sustainable and ground-breaking features. We could isolate the costly strategies, such as the site

remediation, building on a piles structure that could not be avoided given the site soil conditions. The features introduced for site integration were borne through an innovative development partnership.

In the case of a sustainable company a project's economic performance cannot be separated from the overall company's performance as part of the business plan is to offset costs through operations etc. and the project ends up adding value to corporate image.

Key to the success of the project has been the long-term collaboration between the owner and the engineer consultant Ch2M Hill and the selection of a qualified team. A "The 9-year partnership between AlexRenew and CH2M⁷⁹ successfully implemented the vision of the State-of-the-Art Nitrogen Upgrade Program, maximizing use of available resources, utilizing cutting-edge technology to drive towards energy neutrality while integrating seamlessly with the community to provide long-term aesthetic and recreational value."⁸⁰

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⁷⁹ CH2M's partnership with leading water agencies around the globe earned the firm one of the highest honors in the water industry—the 2015 Stockholm Industry Water Award, for leadership in potable reuse technology and public acceptance. The firm was also named Water Company of the Year at the 2012 Global Water Awards.

⁸⁰ American Academy of Environmental Engineers & Scientists. "2016 Excellence in Environmental Engineering and Science™ Awards Competition Winner, Grand Prize – Design: State-of-the-art nitrogen upgrade," <http://www.aaees.org/e3scompetition/2016grandprize-design.php>

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APPENDIX



Fig. 13: Proximity of the acquired West Plant site to ongoing developments (map created by the author)

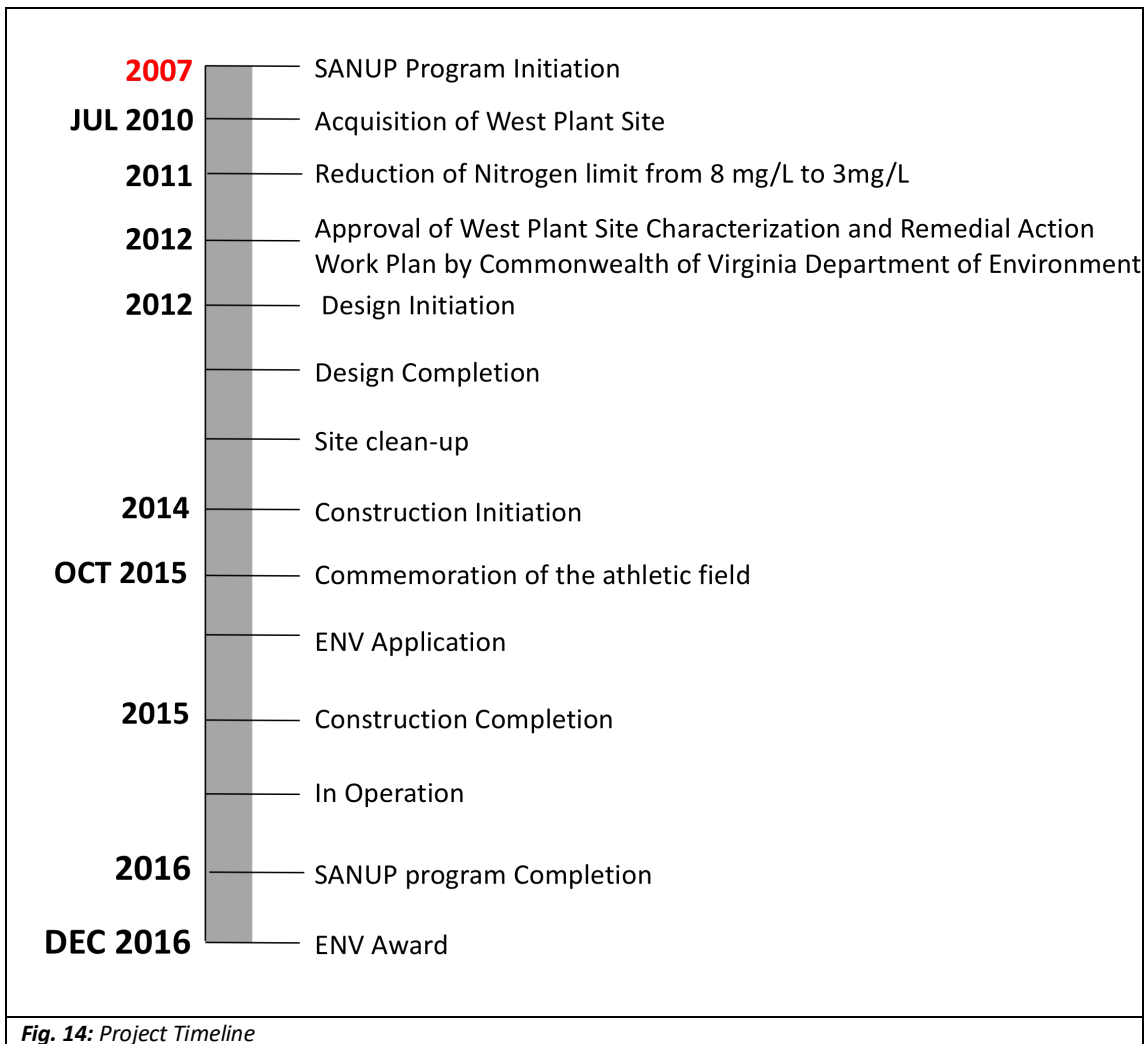


Fig. 14: Project Timeline

Table 4: ALEXANDRIA RENEW ENTERPRISES ANNUAL REPORT 2013 - EXPENDITURES

JOINT CAPITAL IMPROVEMENTS	28,979,628	42.3%
DEBT PRINCIPAL AND INTEREST PAYMENTS	11,105,426	16.2%
ALEXANDRIA ONLY PROJECTS	2,881,389	4.2%
OPERATIONS & MAINTENANCE	2,693,442	3.9%
JOINT IR&R	2,492,463	3.6%
UTILITY SERVICE PURCHASE (natural gas, electricity, water)	2,909,351	4.2%
CHEMICALS	1,697,440	2.5%
PERSONNEL SERVICES	11,643,814	17.0%
PROFESSIONAL SERVICES (Providing outsourced services to help AlexRenew run efficiently)	1,361,174	2.0%
BUSINESS SUPPORT	1,319,583	1.9%
ARLINGTON SEWAGE DISPOSAL	1,455,427	2.1%
	68,539,137	

Table 5: ALEXANDRIA RENEW ENTERPRISES 2013 OPERATING REVENUES		
Sewage treatment charges	36,848,976	
Fairfax County - Operating share	10,993,596	
Fairfax County - Improvement, Renewal & Replacement share	2,073,000	
Other	438,004	
Total Operating Revenues	50,353,576	
ALEXANDRIA RENEW ENTERPRISES 2013 NON-OPERATING REVENUES		
INVESTMENT INCOME	180,961	
PROCEEDS FROM DEBT	2,837,992	
GRANT	3,278,596	
FAIRFAX COUNTY CAPITAL IMPROVEMENTS PROGRAM CONTRIBUTION	14,475,509	
PROCEEDS FROM LAND DISPOSAL	14,996,403	
Total Non-operating Revenues	35,769,461	
TOTAL REVENUES	86,123,037	

Cross-Checking project cost – utility expenditures – and utility revenues. The cost for 2013 was 42.3% of total expenditures and 33.6% of total revenues.

Table 6: THE BUSINESS CASE OF UOTF (Utility of the future)⁸¹					
		Example innovations	Environmental effects	Utility effects	Regional economic effects
REDUCED COST	Energy & process efficiency	Energy efficient equipment & networks	• Reduced consumption of fossil fuels	• Reduced energy demand • Reduced operating costs	• Reduced imports/ better trade balance • Enhanced investment in R&D • Creation of technology jobs • Increased household incomes • Increased local GDP • Increased local tax receipts
		Photovoltaic installations	• Reduced greenhouse gas emissions		
		Wind turbine installations	• Reduced air pollution		
	Energy recovery	Methane production from biosolids	• Reduced consumption of fossil fuels		
Hydrogen production from biosolids		• Reduced greenhouse gas emissions			
Recovery of heat		• Reduced air pollution			
		Hydrokinetic energy recovery			
INCREASED REVENUES	Water reuse	Supply of treated effluent for cooling	• More fresh water for higher valued uses	• Creation of new revenues • Reduction of biosolids disposal costs	• Reduced imports/ better trade balance • Enhanced investment in R&D • Creation of technology jobs • Increased household incomes • Increased local GDP • Increased local tax receipts
		Recharge of effluent to groundwater	• Less salt water intrusion		
		Effluent for landscape, golf course irrigation	• Reduced discharges to cleaner waterways		
	Materials recovery	Ammonia recovery	• Reduced loadings to cleaner waterways		
		Phosphorous compounds recovery	• Healthier ecosystems		
		Nitrogen compounds recovery			
		Metals recovery			

⁸¹ National Association of Clean Water Agencies, Water Environment Research Foundation and WEF, (2013) "The Water Resources Utility of the Future: A Blueprint for Action."

	Materials Conversion	Bioplastics production from biosolids	<ul style="list-style-type: none"> • Less landfilling • Less mining and burning of fossil fuels • Reduced net carbon emissions 				
		Pyrolysis of biosolids to fuel oil					
		Algae biomass fuel production					
		Biosolids solid fuel production					
		Biosolids fertilizer pellets & soil conditioner					
	Biosolids reuse	Use of biosolids slurries as liquid fertilizer	<ul style="list-style-type: none"> • Less landfilling • Better absorption of nutrients, less runoff 				
SUPPORT COMMUNITY AND ECONOMY		Upgrades & expansions to accommodate industrial and housing development	<ul style="list-style-type: none"> • Less groundwater contamination • Less sewage overflow to waterways • Reduced nutrient loads to waterways 	<ul style="list-style-type: none"> • Stronger community partnerships 	<ul style="list-style-type: none"> • Creation of manufacturing jobs • Increased household incomes • Increased local GDP • Increased local tax receipts 		
		Managed package plants to replace septic systems					
		Implement Non-point source controls within watershed					
		Green infrastructure for wet weather flows					
		Convert community bio-waste to electricity	<ul style="list-style-type: none"> • Reduced landfill demand • Reduced methane emissions 	<ul style="list-style-type: none"> • Reduced electric bills • Increased tipping fee revenue • Reduced grease sewer blockage 			

Table 7: AlexRenew NMF Envision Scorecard (to be updated with the verified scores)

		ENVISION CREDITS	APPLICABLE POINTS	LEVEL OF ACHIEVEMENT	POINTS ACHIEVED	TOTAL POINTS	% OF POINTS ACHIEVED
Quality of Life							
QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	YES	Conserving (20)	20	25	80%
		QL1.2 Stimulate Sustainable Growth & Development	YES	Superior (5)	5	16	31%
		QL1.3 Develop Local Skills and Capabilities	YES	Superior (5)	5	15	33%
	COMMUNITY	QL2.1 Enhance Public Health and Safety	YES	Improved (2)	2	16	13%
		QL2.2 Minimize Noise and Vibration	YES	Conserving (8)	8	11	73%
		QL2.3 Minimize Light Pollution	YES	Conserving (8)	8	11	73%
		QL2.4 Improve Community Mobility and Access	YES	Superior (7)	7	14	50%
		QL2.5 Encourage Alternative Modes of Transportation	YES	Enhanced (3)	3	15	20%
		QL2.6 Improve Site Accessibility, Safety & Wayfinding	YES	Conserving (12)	12	15	80%
	WELLBEING	QL3.1 Preserve Historic and Cultural Resources	YES	Superior (7)	7	16	44%
QL3.2 Preserve Views and Local Character		YES	Conserving (11)	11	14	79%	
QL3.3 Enhance Public Space		YES	Restorative (13)	13	13	100%	
	QL0.0 Innovate or Exceed Credit Requirements	YES					
TOTAL					101	181	55,8%
Leadership							
LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership & Commitment	YES	Conserving (17)	17	17	100%
		LD1.2 Establish a Sustainability Management System	YES	Conserving (14)	14	14	100%
		LD1.3 Foster Collaboration and Teamwork	YES	Superior (8)	8	15	53%
	MANAGEMENT	LD1.4 Provide for Stakeholder Involvement	YES	Enhanced (5)	5	14	36%
		LD2.1 Pursue By-Product Synergy Opportunities	YES	Conserving (12)	12	15	80%
		LD2.2 Improve Infrastructure Integration	YES	Superior (7)	7	16	44%
		LD3.1 Plan for Long-Term Monitoring & Maintenance	YES	Conserving (10)	10	10	100%
	PLANNING	LD3.2 Address Conflicting Regulations and Policies	YES	Superior (4)	4	8	50%
		LD3.3 Extend Useful Life	YES	Superior (3)	3	12	25%
		LD0.0 Innovate or Exceed Credit Requirements	YES	Conserving (12)	12	12	100%
TOTAL					92	133	69,2%
Resource Allocation							
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce Net Embodied Energy	YES	No added value	0	18	0%
		RA1.2 Support Sustainable Procurement Practices	YES	Improved (2)	2	9	22%
		RA1.3 Use Recycled Materials	YES	Enhanced (5)	5	14	36%
		RA1.4 Use Regional Materials	YES	Enhanced (6)	6	10	60%
		RA1.5 Divert Waste from Landfills	YES	Superior (8)	8	11	73%
		RA1.6 Reduce Excavated Materials Taken Off Site	NO				
	ENERGY	RA1.7 Provide for Deconstruction and Recycling	YES	Superior (8)	8	12	67%
		RA2.1 Reduce Energy Consumption	YES	No added value	0	18	0%
		RA2.2 Use Renewable Energy	YES	No added value	0	20	0%
		RA2.3 Commission and Monitor Energy Systems	YES	Conserving (11)	11	11	100%
	WATER	RA3.1 Protect Fresh Water Availability	YES	Conserving (17)	17	21	81%
		RA3.2 Reduce Potable Water Consumption	YES	Superior (13)	13	21	62%
		RA3.3 Monitor Water Systems	YES	Conserving (11)	11	11	100%
		RA0.0 Innovate or Exceed Credit Requirements	YES	No added value	0		
TOTAL					81	176	46,0%
Natural World							
NATURAL WORLD	SITING	NW1.1 Preserve Prime Habitat	NO	No added value			
		NW1.2 Protect Wetlands and Surface Water	YES	Enhanced (4)	4	18	22%
		NW1.3 Preserve Prime Farmland	NO	No added value			
		NW1.4 Avoid Adverse Geology	NO	No added value			
		NW1.5 Preserve Floodplain Functions	YES	Conserving (14)	14	14	100%
		NW1.6 Avoid Unsuitable Development on Steep Slopes	NO	No added value			
		NW1.7 Preserve Greenfields	YES	Restorative (23)	23	23	100%
	LAND & WATER	NW2.1 Manage stormwater	YES	Enhanced (4)	4	21	19%
		NW2.2 Reduce pesticide and fertilizer impacts	YES	Conserving (9)	9	9	100%
		NW2.3 Prevent surface and groundwater contamination	YES	Restorative (18)	18	18	100%
	BIODIVERSITY	NW3.1 Preserve species biodiversity	YES	Conserving (13)	13	16	81%
		NW3.2 Control invasive species	YES	Superior (5)	5	11	45%
		NW3.3 Restore disturbed soils	NO	Restorative (10)	10	10	100%
		NW3.4 Maintain wetland and surface water functions	YES	Restorative (19)	19	19	100%
TOTAL					119	145	82,1%
Climate and Risk							
CLIMATE	EMISSION	CR1.1 Reduce Greenhouse Gas Emissions	YES	No added value	0	25	0%
		CR1.2 Reduce Air Pollutant Emissions	YES	No added value	0	15	0%
		CR2.1 Assess Climate Threat	YES	Conserving (15)	15	15	100%
		CR2.2 Avoid Traps and Vulnerabilities	YES	No added value	0	20	0%
	RESILIENCE	CR2.3 Prepare for Long-Term Adaptability	YES	Conserving (16)	16	20	80%
		CR2.4 Prepare for Short-Term Hazards	YES	Conserving (17)	17	21	81%
		CR2.5 Manage Heat Island Effects	YES	Superior (4)	4	6	67%
		CR0.0 Innovate or Exceed Credit Requirements	NO				
TOTAL					52	122	42,6%
GRAND TOTAL					445	757	59%

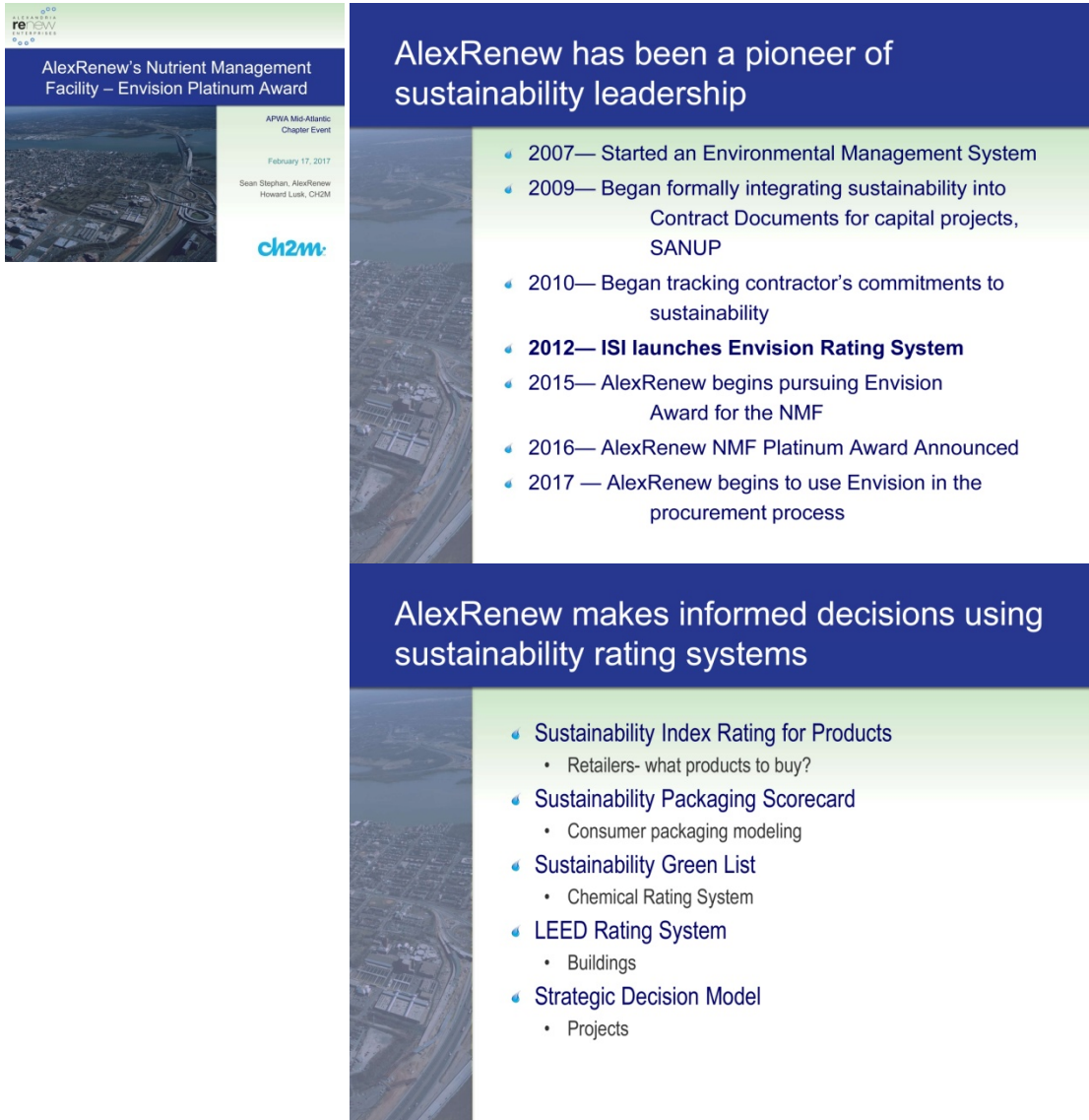


Fig.15: The importance of sustainability tools used by AlexRenew as highlighted in the utility's presentations⁸²

⁸² Presentation at the 2015 CWEA O&M Committee Seminar Laurel, MD – June 12th, 2015.

ABBREVIATIONS

ASA	Alexandria Sanitation Authority
BIM	Building Information Management
BNR	Biological Nutrient Removal
BRB	Biological Reactor Basin
CMAR	Construction Manager at Risk
CR	Climate and Risk
DEQ	Department of Environmental Quality
Envision®	Envision® Rating system for Sustainable Infrastructure
ENV SP	Envision® Sustainability Professional
ESCO	Energy Service Company
ESPC	Energy Savings Performance Contract
GMP	Guaranteed Maximum Price
GHG	Greenhouse Gas
I&C	Information and Communication
ISI	Institute for Sustainable Infrastructure
LD	Leadership
MGD	Million Gallons per day
NW	Natural World
QL	Quality of Life
RA	Resource Allocation
RPA	Resource Protection Area
MGD	Million Gallons per day
NMF	Nutrient Management Facility
NMT	Nutrient Management Tank
O&M	Operation and Maintenance
PE	Primary effluent
PEPS	Primary Effluent Pump Station
PPP	Public-Private Partnership
ROI	Return on Investment
SANUP	State-of-the-Art Nitrogen Upgrade Program
UOTF	Utility of the Future
VA DEQ	Virginia Department of Environmental Quality
VE	Value Engineering
VRLF	Virginia Revolving Loan Fund
WRRF	Water Resources Recovery Facility
WWTP	Wastewater Treatment Plant
WQIF	Water Quality Improvement fund