ZOFNASS PROGRAM
FOR SUSTAINABLE INFRASTRUCTURE
Graduate School of Design
Harvard University

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Harvard University
George Gund Hall
48 Quincy Street
Cambridge, MA 02138
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SANTA LUCÍA SCHOOL – ATLÁNTICO, COLOMBIA

Figure 1: General view of the school
Source: On-site visit November 2015

Dr. Andreas Georgoulias, Cristina Contreras ENV-SP, Mariana Llano Valencia, and Melisa Sherifi prepared this case study for research and education purposes. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation. The authors would like to thank Argos Foundation for its support. Alejandra Zapata, Carolina Jaramillo and Gloria Lucia Galvis provided valuable information and insights; this case would have not been possible without their contribution.

EXECUTIVE SUMMARY

This case study applies the Envision™ Rating System on the Santa Lucía school, a new educational institution supported by the Argos Foundation in Colombia. Envision is a unique system that assesses the sustainability of infrastructure, rewarding efforts that pursue sustainability above and beyond standard practices. The following assessment demonstrates the achievements of the project while identifying aspects to improve through broad range of sustainability indicators. The assessment is organized along the five Envision categories: quality of life, leadership, resource allocation, natural world, and climate and risk.

The Santa Lucía project is part of Argos Foundation's initiative to improve educational infrastructure across vulnerable regions in Colombia. The Foundation has already supported 21 educational institutions that serve 37 municipalities in 9 different regions, and has plans for many more. Santa Lucía Son, completed in 2014, is the largest of the 21 projects, with 28 classrooms that can accommodate 1,132 students. Its vision is to facilitate a sustainable, long-term economic, social, and environmental growth for the City of Santa Lucia, a place that suffered devastating losses during the 2010 rain season and still presents several social challenges within vulnerable and marginalized groups within its communities.

The project started in 2011 with a design competition procured by the Argos Foundation, won by Parque Cultural del Caribe. The entire project was funded by the Foundation, with investment costs of COP$ 6,717,224,579, or US$ 2.5 million. In addition to construction works, funds were provided for social engagement programs, an environmental management plan, sustainability studies, and various workshops on environmental stewardship, including managing waste and protecting the environment.

The project performed best in Envisions' **Quality of Life** category, as it positively impacts the surrounding communities. The project's performance was remarkable in improving the functional aspects of a marginalized community by promoting growth and development, creating jobs, and enhancing people's quality of life. In addition, educational programs on sexuality and planned parenthood are conducted to help integrate every family member into the programs offered at the school. Sustainable growth is stimulated through the promotion of education as a long-term investment for the next generations. By focusing on education, the project enhances local skills and capabilities and helps the community develop competitiveness over the long-term. Overall, the team acknowledged and aligned with the cultural traits of the municipality, through the recognition of the importance of diverse cultural groups and ancestral practices.

Within the **Quality of Life** category, opportunities for improvement exist in certain aspects, such as how people access the school. Currently, motorcycles are the most common means of commuting to Santa Lucia. Although the government has donated bicycles for young students and designated parking spots exist within the school, biking is currently not promoted and the spots remain largely unutilized. As such, raising awareness of the environmental, social, and economic benefits of non-motorized transport and encouraging both parents and kids to bike to school would be of crucial importance. In addition, social programs could focus on further engaging the younger students and the vulnerable groups of the community, such as women and the elders.

The project team demonstrated a strong commitment to **Leadership** through various collaborative efforts to communicate with every stakeholder in project-related decision making. Community leaders and municipal organizations were engaged in particular to address the social aspects of the development, facilitating a community based, self-sustaining educational program. The school faculty, especially the principal, is committed to improving the quality of life of children and contributing to the development of the entire municipality. There is a strong interest in fostering a diversity of activities in arts and culture, focusing on younger students. In conclusion, the project team aimed on generating a change in attitude, fostering leadership and promoting environmental responsibility.

In the **Resource Allocation** category, the team carried out a comprehensive strategy to implement sustainability practices and reduce energy consumption through passive design strategies. However, there is no documentation on actual energy performance and/ or expected human comfort levels. To compensate for this, the Harvard Zofnass Program team conducted a series of energy and human comfort studies and simulations, to quantify the energy performance of the building and the level of comfort for the students and teachers throughout the year. Further opportunities to improve exist on reducing building materials during construction and using recycled materials or materials from sustainability-certified providers.

In regards to the **Natural World** category, the project is located in a previously developed site, minimizing impacts to the environment. The site does not have a history of environmental degradation while no important ecological areas exist within the immediate surroundings of the development. The team, however, has not created contingency plans for natural hazards such as floods, and no information has been provided on the development of a floodplain analysis or on the capacity of its drainage system to cope with excess flooding. This is especially important since the project area was fully flooded in 2010. Additionally, there is little evidence on biodiversity protection initiatives. The preservation of wetlands and water bodies, as well as reforestation

and erosion control measures are important, since they could mitigate and even prevent future flooding events.

In the **Climate and Risk** category the project achieved a low score, primarily because no plans existed to quantify and reduce greenhouse gas emissions, or mitigate and adapt towards climate change. Increasing adaptability and resiliency towards climate change reduces the project's vulnerability and increases its useful life. This can further ensure that the project will be able to meet the needs of the community over the long term. However, the project followed all relevant regulations during construction. For instance, the subcontractor used certified equipment and followed greenhouse gas emission regulations.

In **overall sustainability assessment**, Santa Lucía is one of the best schools built so far by the Argos Foundation. As an educational infrastructure, it improves the overall sustainability of the community and is planned for the needs and aspirations of its people. In addition to an extraordinary and dedicated principal, the school has committed faculty, both of which have been instrumental in implementing programs that positively affect the community. Ultimately, for a successful school, engaging and including the community is equally important to having sustainable infrastructure. The Santa Lucía school is a great example of social revitalization through educational programs and community engagement, and should be promoted as a model for the schools that are yet to be built.

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1. PROJECT LOCATION AND DESCRIPTION

The Municipality of Santa Lucía is located 79,2 km away from the city of Barranquilla, one of Colombia's main regional economic hubs. It passes through 76,200 m2 of the Algodonal corridor that is comprised of 6 towns: La Esmeralda, La Isla, Flechita, El Diquito, Sanaguare, and Bonguito. To the north we find the municipalities of Campo de la Cruz and Manatí; to the east the municipalities of Campo de la Cruz and Suan; to the south along with the Dique Canal the Bolívar Department; and to the west the Dique Canal and the Manatí municipality. Santa Lucía is a municipality in the Atlantic Region of the country, where most of the population is of African descent. Historically, the northern region of Colombia, especially next to the Dique Canal which is a zone of strategic importance for communication and transportation, has had settlements of Afro-descendant slaves. Through time, they have preserved their cultural identity and traditions but are still fighting against social and economic difficulties that came along with their independence.

The Dique Canal is a part of the cultural identity of the people and very important for the location of the site. It is a 113 km branch of the Magdalena River, the most navigable river in Colombia, that goes from Calamar through the city of Cartagena. Such a connectivity made the canal a very strategic place for military and commercial purposes. At first it was developed as a navigational canal in the XVI Century. Since then, it has been utilized multiple times but it was never entirely finished. The S-shaped canal comprises marsh terrain formed by underground canals that link deeper lakes. Its navigation usually depends on whether the water level rises enough after the rain seasons.[1] Moreover, landlords historically preferred the site since the so-called "ciénaga" (or swamp) was appropriate for having cattle and agricultural establishments by providing a constant supply of fresh water and grass.

In 2010 the city of Santa Lucía suffered the devastating consequences of the rain season. In order to recuperate and revive the city, the Argos Foundation decided to reach out to the community and develop an educational institution, focusing particularly on environmental and social challenges. The Santa Lucía project was envisioned by the Argos Foundation as part of their initiative to improve educational infrastructure in Colombia. Argos Foundation promotes community involvement as a basic concept, where the people actively and voluntarily participate in the development and enhancement of the schools.[2] This is particularly significant for the Foundation, since it was created to support high impact initiatives for the enhancement and development of good quality educational infrastructure, to reach more regions, create

[1] García Castro, Karoll, *Trabajo Etnográfico* (Atlántico: 2014), 5.
[2] Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 11.

sustainable initiatives and improve the results in the educational programs.[3] The Argos Company CEO[4], Jorge Mario Velásquez emphasizes that "the private and public sector must work in alliance to be sure that all the kids and youngsters go to school and find in this space the possibility of learning, dreaming, imagining their future and start building their present. Argos is committed to this goal and has assumed it not only as a challenge, but as the cornerstone of its social investments."[5]

The Santa Lucia project is a public-private partnership, led by the Argos Foundation, which not only provides funding for this project but also invests in Colombia's education by building a number of schools across vulnerable regions. Between 2012 and 2014 the Foundation has been involved in public-private partnerships to build 21 schools that serve 37 municipalities in 9 different regions. The Santa Lucía Project, completed in 2014, is the largest of the 21 educational institutions. It can accommodate 1,132 students by providing 28 classrooms, a school restaurant, an administration area, a library, a room for multiple uses, 2 computer labs, 3 labs, a sports and recreation area, and multiple bathrooms. The total cost for the project was COP$ 6,717,224,579, or approximately US$ 2.5 million.[6]

The project has a very strong social and environmental impact, since it is located in a socially and environmentally vulnerable area. By promoting education and cultural integration, the Foundation wants to reverse the trends that led to marginalization and segregation of specific communities in the municipality. Aiming for a deep social transformation, the educational institution enhances the capacities of the people and helps them sustainably develop on their own. The aesthetic aspect of the infrastructure also aims to have a greater impact in pride and sense of ownership.[7]

2. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision™ system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. In this case study, the infrastructure to be assessed is the School Sta. Lucia in Colombia.

[3] Ibid., 2.
[4] In 2006, Argos Cement Company created the Argos Foundation with the aim to promote better opportunities for the people and regions by bringing education to low income areas.

[6] Metropoli, *Propuesta Económica – Institución Educativa de Santa Lucía* (2012), 3.
[7] Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 8.

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

The criteria for the levels of achievement vary from credit to credit, but generally an 'improved' level of achievement is awarded for performance that slightly exceeds regulatory requirements. 'Enhanced' and 'superior' levels indicate additional gradual improvement, while 'conserving' often indicates performance that achieves a net-zero or neutral impact. 'Restorative' is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI[8] and Zofnass Program[9] websites.

3. QUALITY OF LIFE CATEGORY

Envisions first category, Quality of Life, pertains to potential project impacts on surrounding communities and their respective wellbeing. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing social networks, as well as aligned with long-term community benefits and aspirations. Quality of Life incorporates guidance on community capacity building and promotes infrastructure users and local groups as important stakeholders in the decision making process. The category is further divided into four sub-categories: Purpose, Wellbeing, Community and Vulnerable Groups.

Purpose

In the Purpose subcategory the project performed remarkably by directly improving functional aspects of the community, such as growth, development, job creation, and general quality of life aspects. The educational infrastructure improves the overall sustainability of the community, while the community was involved and engaged during the entire decision-making process. The

[8] www.sustainableinfrastructure.org

[9] www.zofnass.org

team studied the history of the region and conducted anthropological and ethnographic research to develop the project with both short and long term horizons. Additionally, community meetings and workshops are regularly organized, which continue to benefit the project. Furthermore, the aesthetic features of the building and the urban development plan have raised awareness and community pride, thus making the project accepted and respected by its own people.

The school stimulates sustainable growth through education, a long-term investment for the next generation. The project engages the people in the decision-making process to bring awareness about the importance of education in the region. Additionally, the buildings have been designed according to sustainable practices, with architectural design based on site conditions that accomplish acoustic and thermal comfort from natural ventilation and lighting. Moreover, the project team engaged in a search for other stakeholders, leaders and participants to stimulate the development of the educational infrastructure throughout the community.

The greater efforts on education create a high long-term competitiveness in developing local skills and capabilities. Bringing awareness inside the local community to recognize the impact of education in the municipality, the team creates engagement within the people and accomplishes sustainability for the programs. The identification and involvement of community leaders and organizations who can support the project, creates powerful alliances and raises the importance of educational activities.

Studies have shown that the region's economy was historically based on agriculture, fishing and cattle; practices that since have been abandoned and are currently stigmatized. To enhance ancestral knowledge of these practices, the institution has a plan to establish an edible garden, run by the students, so that these students can later replicate the knowledge in their homes. This way each household could eventually have its own natural produce. However, the edible garden has not been implemented yet. Finally, the project team identified the most important cultural traits for community development; icons that are taken as inspiration when decorating public spaces and meeting points. Specific programs to promote women empowerment and sexual education in order to prevent early age pregnancy have been considered as key steps to improve the quality of life of vulnerable groups.

Community

The project team has an established agenda to enhance the sustainability of the school project. Individual comfort, health, and mobility are positively impacted by the project. However, areas for improvement still remain. Starting from the standard practices, the construction process follows safety regulations for the workers and the environment. Contractors have to follow the

industrial security legislation and occupational health programs such as the NTC 1700 regulations for safety features. Then, it is important to keep in mind one of the main goals of the project, which is to keep the students safe and out of the dangers of the area. According to these terms the project's performance is outstanding in promoting health and safety in the area, beyond just the risks associated to the construction of the project. The edible garden program could also be a way of enhancing public health, because it has the potential of providing daily nutrition or income for the people in each household.

During construction, the project team has implemented a noise reduction policy, working within the safety levels and following the measures to avoid any health issues for the workers. However, it is recommended to provide information about noise impacts on children, noise levels throughout playgrounds and how these could affect the community. With regard to the architectural of the project and how it will perform during operations, acoustic comfort was part of the design process, aiming to reduce noise with the use of natural strategies for climate control. This strategy however proved not sufficient and the school is about to implement aids for cooling, such as installing ceiling fans in the classrooms.

The project has a high potential for improving mobility and access. Ethnographic studies show the lack of regional connectivity throughout the municipality. Bicycle-taxis and motorized taxis are used for urban transportation, while horses are still used in the rural areas. However, no plans for improving the existing transport systems have been included in the projects' design. Nonetheless, the architectural and landscape design of the project allows pedestrian access with easy connections to the rest of the municipality. The site is located within walking distance from urban establishments, and is accessible by different local modes of transportation. Moreover, the project aims to integrate disabled students in the school, having designed the interior of the building with ramps and wheelchair friendly design. The project also provides public spaces for the community at the entrances of the school as gathering points that provide safety areas when waiting, entering and exiting the buildings. Additionally, playgrounds are provided in these public spaces that are accessible by everyone in the community.

Well-being

In the well-being subcategory the project team performed well in improving the surroundings through context-sensitive design. The team achieved excellent results in how the community integrates with the institution by enhancing the historic and cultural features of the municipality through education. The team completed anthropological, ethnographic and cultural studies of the region and their culture to design the project, along with community meetings. However, the project did not accomplish a social engagement plan with the kids before entering the new school

and the facilities have been vandalized by the youth. Additionally, the project improved the public spaces surrounding the immediate site, and created new ones for both adults and children.

The project was designed according to the natural features of the site, in order to preserve the views and local character of the municipality. The placement of the buildings aids in the use of natural lighting and ventilation. The community was involved in the design process, thus creating a sense of ownership among the people. The buildings are two stories tall avoiding view blockage. Furthermore, the team worked with community members to identify people who had the best historical and cultural knowledge, and also those with outstanding artistic skills, to estimate the immaterial cultural value of the site. The school's faculty is one of their most important assets; the principal and the school teachers are aware of the kid's needs and problems.

The project creates a very important public space: a public school. The buildings are planned to serve as public spaces for the community following the concept of social urbanism. The aim is to generate cultural and educational institutions with high aesthetic standards to facilitate social transformation. By involving the community in the process and creating a sense of ownership, the public space is sustained by the people. Overall, the project revitalizes the urban surroundings of the school site.

As part of the effort to assess the well-being of the students and faculty, the Harvard Zofnass Program performed a comfort simulation[10] (appendix B) in order to measure and analyze indoor human comfort, as well as provide a list of best practices to increase the comfort zone[11]. Plotting climate data on a psychometric chart is a common technique that shows the attributes of a particular climate and its impact on built form, with an emphasis on comfort inside the space.

A yearly average temperature of 27ºC and average relative humidity of 80% to 95% characterize the climate of Santa Lucía. Including the passive design features used in the building, the analysis shows that occupants will be comfortable indoors when the temperature is between 20ºC to 30ºC and the relative humidity ranges from 60% to 100%. In such a climate with a main problem being overheating, A/C and dehumidification are key features to guarantee comfort. Since the Santa Lucia School does not use air conditioning, it is important that all design features focus on minimizing overheating and encouraging ventilation. Some key design features to expand the comfort zone include installing of window overhangs and ceiling fans. It is estimated that the installation of ceiling fans will make rooms feel cooler by virtually decreasing the temperature by

[10] The simulation was done using the Climate Consultant graphic-based computer program, having as an input parameter the weather file of Barranquilla (EPW format)

[11] Comfort zone may be defined differently by different codes in different places. Two models have been used to plot the results on the psychrometric chart California Code 1 and Adaptive Comfort Model in ASHRAE Standard 552

up to 2.8ºC.

Vulnerable groups

The Vulnerable Groups subcategory seeks to improve the quality of life of women and diverse communities identified as part of the vulnerable groups of the area. Projects are encouraged to identify and assess the needs and constraints of different groups so all can benefit from the opportunities provided by the investments made. A key factor of the process is to include marginalized groups when creating employment opportunities, as well as developing and strengthening the aspects of accessibility, education, and empowerment.

The project is located in the predominantly afro-descendant community of Santa Lucía, and as an education infrastructure, it has a generally positive effect on vulnerable groups. The team organized several community meetings when developing the project; faculty, parents and higher level students, both male and female, were invited to participate. The meetings aimed to solicit community feedback regarding the educational system, the school and the community needs. The team identified the strengths, weaknesses, opportunities and threats for the school, and the design process was based on these findings. The social engagement plan did not specifically address women's needs but those of the institution and the stakeholders of the school. Identifying the risks and hazards to women's health and safety in the community would be relevant to the Colombian context. Certain programs for sexual education have been implemented in the school in order to reduce early age pregnancies in the area. The project should consider conducting an assessment on how it would impact their lives and stimulate their economic empowerment through the creation of sustainable livelihoods, local procurement, job creation, capacity building and training programs. The project team should also document how many women are employed and their educational levels, and any efforts implemented specifically to benefit local women.

To improve access, mobility, and safety the project team included women and afro-descendant peoples in the meetings. However, mobility and access were not directly addressed within the scope of the project. The project should consider the mobility patterns and needs of the different social groups, as well as their safety. This could be addressed first by identifying women's and other vulnerable group's barriers on mobility and access, and from these to identify, design and built specific interventions. Moreover, the team should consider the impact of the construction works in the community's mobility and identify any actions taken to avoid barriers.

4. LEADERSHIP CATEGORY

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

Collaboration

The Collaboration Subcategory examines the organization responsible for the project and any external stakeholders that can be engaged in the decision-making process. Commitment and leadership are extremely important in this subcategory, as well as communication within the project team.

Numerous initiatives have been implemented to foster leadership and social development by including stakeholders to address the social aspects of the project, especially within its social and environmental programs. The Argos Foundation developed the Son Santa Lucía project through a social facilitator, Parque Cultural del Caribe (PCC), to establish meaningful programs for stakeholder engagement and involvement. The collaboration between stakeholders, the project team and PCC is backed up by numerous meetings, workshops and activities. Their objective was to achieve one of the biggest social goals of the project, the creation of a meaningful bond with the community.

The mission statement of the Santa Lucía Project indicates the commitment to providing a project that improves the quality of life of children and youth, and contributes to the development of the municipality. The project team has provided monthly reports and documents informing the progress of socio-environmental affair programs conducted by PCC, to effectuate the participation and involvement of stakeholders, as well as to create a permanent channel of communication. The proposed edible garden program, as part of the strategy for environmental conservation, aligns with the socioeconomic development of the local community.

The scope of the mechanisms established by the Santa Lucía project team seems sufficient to address the social aspect of the project, which is a priority for the Argos Foundation. However, there is an opportunity to improve other aspects of the project, for example having a sustainability management system; a communication plan for the project design and contractor teams; developing risk and contingency plans regarding labor accidents; and improving the environmental monitoring program, especially on establishing flooding control measures.

Management

In the Management subcategory, good performances but also opportunities for improvement can be observed. This subcategory addresses how the project takes into account operational relationships among other existing elements of the community infrastructure, either by pursuing synergies between systems, or by optimizing the integration of the project with its surroundings assets, resulting in an overall improvement in the project's sustainability.

The project takes into account the social integration with the community of Santa Lucia, thereby promoting sustainability by creating a sense of ownership among the people so that they start preserving the building. Efforts for project-wide system integration could also be undertaken; by integrating and restoring community infrastructure, the efficiency and effectiveness of the community would be improved. Finally, no information has been provided regarding identification of unwanted byproducts or discarded materials from nearby facilities. Specific research efforts could focus on identifying unwanted byproducts that can be used in the project under study.

Planning

The Planning subcategory is about taking a long-term vision on the project, a key principle of sustainability. A comprehensive understanding of local regulations is necessary in order to avoid pitfalls, as well as to plan effectively for potential future challenges.

The evaluation of the Santa Lucia Project demonstrated that long-term monitoring and maintenance have been incorporated from the design phase. Due to the inherent constraints of a school located in a low income community - therefore with a limited operational budget - the design of the project has been planned for minimal maintenance. Design strategies focused on selecting more durable materials that would not require specific care to maintain good conditions. The use of bioclimatic design is also expected to extend the useful life of the project and avoid using high maintenance equipment, such as A/C systems.

In the case of conflicting regulations, the Argos Foundation has been very effective in establishing collaboration with local institutions, as well as other political representatives such as the Ministry of Education, which was instrumental in developing the school. Further scrutiny of local regulations is advisable to identify potential policy modifications that could improve the sustainability performance of such efforts. Developing and implementing "easy to read and understand" maintenance protocols is also recommended, in order to maintain consistent control of the buildings performance.

An innovation credit has been given in the Leadership category because of Argos Foundation's exceptional efforts in exceeding industry norms and integrating sustainable practices. The main goal pursued with this project - the construction of an educational infrastructure in Colombia- excels any requirement and regulation in the country. This initiative could act as a model for similar institutions worldwide that promote sustainable practices and create a positive impact in their regions.

5. RESOURCE ALLOCATION CATEGORY

Resource allocation deals with use of material, energy, and water resources during the construction and operation phases of projects. The quantity and source of these elements, as well as their impact on overall sustainability, is investigated throughout this section of the Envision rating system. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

The project team strives to use locally sourced materials that reduce the net embodied energy of the project, and therefore its carbon footprint. The bioclimatic and acoustic architectural design takes advantage of natural features, such as daylight and winds, in order to reduce the buildings' energy needs. This passive design approach also minimizes maintenance requirements, since no artificial aids are needed for some areas of the building, such as air conditioning systems or day-time lighting. A principal criterion for the selection of building materials was cost and local availability. For this reason, the main materials chosen were concrete for the structure and concrete blocks or bricks for the facade and walls. Further actions to take would entail more detailed information on material suppliers and any sustainable procurement practices used.

Despite the lack of specific information on the use of recycled materials during construction, the team promotes the use and recycling of organic matter in the edible garden program. According to current plans, organic waste produced onsite will be recycled and the resulting organic matter will be used as fertilizer for the edible garden. Furthermore, the goal is to create a pattern that raises recycling efforts for this type of waste and promotes reuse of such residues.

Even without a clear management plan, a significant portion of organic waste is diverted from landfills. Also, the team has the environmental control over the recycling process during construction, but no detailed information has been provided. Additionally, as an educational institution the team conducts workshops to raise awareness of environmental problems, specifically by teaching how to collect, separate and recycle waste. These workshops also address

how the environment affects people's quality of life and how to care and manage natural resources. Creating an inventory of materials that could potentially be utilized for deconstruction and recycling in the future is also recommended.

Energy

The Energy subcategory assesses the project's efforts to reduce overall energy use, particularly from non-renewable fossil fuel sources. The team has carried out a comprehensive strategy to follow sustainable practices and reduce energy consumption. However, further documentation is recommended to estimate the reduction of energy consumption over industry norms. The bioclimatic architectural features constitute a remarkable way of reducing energy consumption, specifically with the use of natural lighting and ventilation. The geometry and orientation of the buildings benefit from the area's prevailing winds, increasing the school's interior comfort. The selection of materials and crossed ventilation is the main strategy to enhance natural cooling, while at the same time saving energy by reducing the need of artificial cooling of the interiors. Additionally, a green roof maintains thermal control of the ceiling.

No specific assessment was conducted by the project team in order to determine the energy performance of the building, and as such an independent analysis was conducted by the research team at the Zofnass Program. The energy simulation was performed following the project's specific technical information available, as well as data gathered during the onsite visit[12] (Appendix C). The software used to run the simulation is UMI – a software tool that models the environmental performance of buildings, neighborhoods, and cities regarding operational energy, walkability and daylighting potential. For the purpose of this simulation, the buildings have been divided in different categories based on their size, orientation and use among other parameters. Building units include Classroom type 1, Classroom type 2, Bathroom, Library, and Kitchen area. Input parameters for these units, such as occupancy and materials used, affect the results. Results are based on operational energy only; when certain parameters were unknown, assumptions were made in order to model the building.

After running the simulation, values obtained are: Energy Use Intensity (EUI)[13] in Classroom 1

[12] The calculations use common Barranquilla weather data. Based on the architectural drawings provided, these are the facade opening ratios used for this simulation: Classroom 1 - North 70%; West 30%; East 30% and South 10%; Classroom 2 - North 70%; West 30%; East 30% and South 10%; Bathroom - North 70%; West 30%; East 30% and South 10%; Library and PC Room - North 40%; West 0%; East 0% and South 20%; Restaurant and Kitchen - North 40%; West 0%; East 0% and South 30%.

[13] The energy simulation results are shown in units of EUI (Energy Use Intensity), which is a building's annual energy use per unit area. It is typically measured in thousands of BTU per square foot per year (kBTU/ft2/yr) or kWh/m2/yr. EUI can measure "site" energy use (what the building consumes) or "source" energy use (the amount of fuel the power plant burns to produce that much energy). Unless otherwise specified, EUI typically refers to "site" energy use.

EUI = 64.09 kWh/m2/yr; Classroom 2 EUI = 64.09 kWh/m2/yr; Bathroom EUI = 80.46 kWh/m2/yr; Library EUI = 219.01 kWh/m2/yr; Kitchen EUI = 68.94 kWh/m2/yr. Comparing the results with the average performance of an educational building in the US, which is 211 kWh/m2/yr, the performance of Sta. Lucia is much lower not just than the average in the US, but that the 2030 Challenge target, that has estimate a reduction of the energy consumption in 60%, and has set the limit for this type of projects in 73 kWh/m2/yr (table 2 in appendix C). No local benchmarks or targets were found to compare the results to other schools in Colombia and better understand the energy consumption of the project. Simulation graphs can be found in appendix C. According to information gathered during the onsite visit, the current cooling strategy that is based on natural ventilation has not been enough to keep the building's temperature within comfortable levels. As a result, fans need to be installed in classes. This will most likely have a significant impact on the building's overall energy consumption.

The building orientation on site decreases solar radiation exposure in most spaces. Other design techniques, such as double-layered façades, prevent direct solar exposure. Therefore, cooling the interiors becomes easier since direct heat by the sun is prevented. Considering the area's high temperatures, all of these efforts result in a considerable reduction of energy consumption.

The project's architectural design utilizes the environmental features of the site. However, technologies such as solar panels, wind energy, or other innovative technologies have not been included as an alternative to reduce dependency from fossil fuels. Conducting a detailed analysis of potential renewable sources of energy generation is thus recommended.

Water

In the Water subcategory the project's performance could be improved by planning and implementing strategies that reduce water consumption. The project team has not provided specific information concerning water availability, and the implications of water consumption on the area's freshwater reserves. It has to be noted that the proposed composting initiative on the student-run garden would produce an organic fertilizer. This would enhance the macrobiotic activity of the soil, protecting it from soil erosion and increasing the infiltration capacity of water. However, this program has not yet been implemented.

The project team analyzed water availability for the garden program, since the plantations need between 350 and 500 liters per week. The collection and storage of rainwater has been recommended for this purpose, as well as measures to protect it from contaminants. Nonetheless, the program has not yet been implemented and the percentages of reduction that might result are still unknown. This strategy would also reduce potable water consumption

through the collection of rainwater in the roof for later use in the edible gardens. No further information has been provided on school water consumption or any other strategy to minimize water usage. It is recommended to monitor the discharge of oils and waste generated from the kitchen since they could introduce additional risks on water quality. The monitoring program will also prevent spillage and promote leak detection. In addition, any pesticides or hazardous substances used for rats, cockroaches or any other insect should be documented to prevent contaminated water runoff.

An innovation credit has been given to the project in order to acknowledge the team's creative thinking and promotion of bioclimatic design in a public institution located in a low-income area. The Argos Foundation has integrated sustainable practices into the project design as a solution for low maintenance requirements as well as for the improvement of the comfort standards inside the school.

6. NATURAL WORLD CATEGORY

Natural World focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects that enhance surrounding natural systems. Natural World is further divided into three sub-categories: Siting, Land and Water, and Biodiversity.

Siting

The Siting subcategory focuses on where projects should be located to avoid direct and indirect impacts on important ecological areas. Projects should avoid areas of high ecosystem value or of diverse ecological habitats. Previously developed or disturbed land is ideal for preventing further damage to that environment, improving land value, and remediating contaminated grounds.

The Santa Lucía Project is located in a previously developed site, since the previous school was in that same area. Because of the project's proximity to water bodies, located next to Canal del Dique, the site is vulnerable to flooding events. Therefore, it is recommended that the project team develops contingency plans for natural hazards. These would include information on the development of a floodplain analysis and the availability of a drainage system capable of mitigating flooding. It is recommended that the project team takes into consideration a potential beneficial use of storm water runoff by limiting impervious surfaces, so as to allow groundwater infiltration, and maintaining or enhancing vegetation and soil protection zones.

It is important to notice that to due to the specific characteristics of the project and its location,

certain Envision credits have been considered as non-applicable. An example of this is the Avoidance of Adverse Geology. Due to the lack of adverse geologic formations such as faults or karst areas, this credit has been considered as out of the scope of the project evaluated.

Land & water

In the Land and Water subcategory, several opportunities for performance improvement can be observed. This subcategory covers how the project addresses the possible impacts on the existing hydrologic and nutrient cycles, and also how it avoids the introduction of contaminants, whether through stormwater runoff or through the use of fertilizers and pesticides. For this reason, it is extremely important to implement preventative measures early on, in order to avoid potentially harmful disruptions.

The project team understands the need for stormwater retention and reuse, especially for the edible garden program. However, it is advised to implement an action plan in order to address additional activities. A drainage plan, runoff reports and sewage inspections are recommended to prevent soil and water impacts and pollution. In order to minimize stormwater runoff, it is also recommended to promote the use of permeable surfaces and minimize the use of concrete or asphalt pavements. Based on the lack of considerable green areas within the school, the Envision credit related to the use of pesticides and fertilizers has been considered as non-applicable. As identified during the onsite visit, existing vegetation includes several planters located over brick paved areas. Manual techniques are recommended for the management of those relatively small green areas.

Biodiversity

The biodiversity subcategory encourages infrastructure projects to minimize negative impacts on natural species and their habitats, within or nearby the site. Special attention should be paid on avoiding the introduction and spreading of invasive species, as well as on the fragmentation of habitats and animal movement corridors. Considering that the project is located within an urban area and at a previously developed plot - where the flooded school was located- specific measures for the protection or preservation of biodiversity is considered as non-applicable.

Even though the project does not have a major impact on local biodiversity, the project team proposed the development of an edible garden in which students and teachers are involved, thereby improving their ecological responsibility and preserving native biodiversity. The garden guide document, however, does not specifically reference the use of local or endangered species.

One of the strategies to minimize the project's flooding risk was to elevate the building, resulting in minimal soil disruption, and therefore no excessive excavation. No specific information has

been provided on whether the project might affect nearby water bodies or water functions in general. In order to improve the performance of the project, information about maintenance or enhancement of any hydrological connections, water quality, and habitat and/or sediment transportation will be helpful.

7. CLIMATE & RISK CATEGORY

Envision aims to promote infrastructure development that is adaptive and resilient towards long-term climate change. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promoting mitigation and adaptation actions to ensure short and long term resilience to hazards. Climate and Risk is composed of two sub-categories: Emissions and Resilience.

Emissions

In the Emissions subcategory, the project team did not mention any plans to reduce hazardous emissions most likely because the operations of the school do not require hazardous chemicals or pollutants. The project is following local regulations; during construction the subcontractor follows the greenhouse gas emission regulations, and has certified equipment that prevents the generation of contaminants. On the other hand, some of the considerations taken during the project design phase, such as the supply of local materials or the passive strategy used for the building, will impact the trajectory of the total emissions generated by the project over the long term. As such, the project will most likely generate fewer greenhouse gas emissions as compared to a business-as-usual design.

Commissioning and monitoring of air quality during construction was subcontracted to a specialist consultant, in order to reduce the generation of air pollutant emissions. During monthly inspections, the subcontractor did not identify any problems with the emission. The project's performance could be improved by expanding on air quality standards and regulations and by quantifying the percentages of GHG emissions.

Resilience

The project team still has to work on improving resiliency to short and long term risks, such as flooding and fires in the short term, and changes in weather patterns, sea level rise and climate change in the long term. Identifying these risks when designing the project can reduce the project's vulnerability. Increased adaptability and decreased vulnerability supports a longer useful life and ensures that the project will be able to meet the needs of the community for many generations to come.

The project team should consider conducting a comprehensive climate impact assessment and adaptation plan; this plan should include vulnerability, risk and adaptation assessments. The project team should collaborate with community decision makers and stakeholders to enhance the robustness and resiliency of the design. This should facilitate a comprehensive and long-term assessment of the community's resiliency that includes demands and supply resource planning, as well as identifying traps and vulnerabilities.

In regards to long-term adaptability, the project team implemented bioclimatic architecture principles and has developed educational programs that aim to help the community adapt to global changes. However, there is no evidence of any strategies on adaptability plans to prepare for long-term hazards. Short term hazards such as earthquakes, flooding and fires should be considered as potential threats. In terms of managing heat island effects, the project team has taken considerable efforts to introduce soft green surfaces, however, more specific information on this matter is required.

LESSON LEARNED:

- A systematic approach to information and reporting should be integrated into the project design, construction and operation phases. It is recommended that this reporting initiative is a multidisciplinary effort.

- Considerable efforts focused on community engagement programs. However, due to the social challenges in the region - lacking solid family structures- more social engagement programs could be implemented. This would help integrate more children within the new school and promote the value of educational infrastructure in the region.

- A stronger sense of facility ownership should be facilitated in order to guarantee that students and family members support and ultimately preserve the project. Engaging people during the design and construction phases with competitions, drawings, and community mapping, and with artisanal work conducted or built by the community during construction could help enhance and promote a sense of ownership.

- It is expected that the construction of the school will significantly benefit the students and nearby neighborhoods over the long term. The school will further develop an interest in cultural activities in a region where people traditionally have moved to larger cities for better opportunities.

- A strong commitment to leadership has been evident throughout the operating phase of the project, especially from the faculty. Several programs are implemented on site in order to promote stakeholder engagement.

- Strong emphasis is placed on promoting the school as a public space for community interaction.

- Long term monitoring initiatives should be implemented in order to minimize the potential costs of malfunctions during operations.

- It is important to ensure that green design solutions work adequately for the specific site and whether these are aligned with the realities of the place. On the one hand, fans are indeed needed and will be introduced, underscoring that the design is not entirely solving the problems. On the other hand, when openings and gathering spaces are facing the immediate surroundings, non-aggressive strategies for keeping the children students and strangers outside will be needed.

- It is very important that Argos Foundation follows up with the faculty, the students and the community, in order to solicit feedback on the process and the performance of the project.

- It is also recommended to promote this infrastructure for the purpose it is serving, which is education. Argos Foundation can engage in mediating the needs of the community with the government's plans and policies. For example, agricultural and environmental practices are not part of the Colombian national syllabus. Such practices could be relevant in this and similar locations, as well as for the entire country.

APPENDIX A: PROJECT PICTURES AND DRAWINGS

Figure 2: General picture of the project
Sources: On-site visit November 2015

Figure 3: Main facade of the school
Sources: On-site visit November 2015

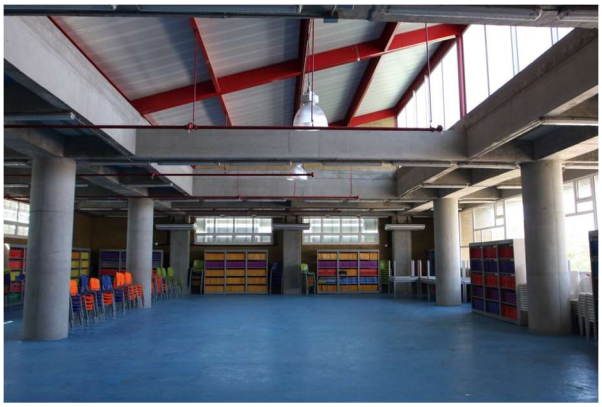


Figure 4: View of the library
Sources: On-site visit November 2015

Figure 5: View of the library
Sources: On-site visit November 2015

Figure 6: Playfields of the school
Sources: On-site visit November 2015

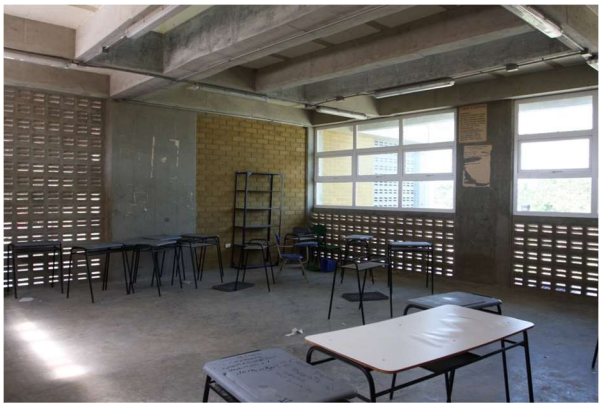


Figure 7: View of the classes
Sources: On-site visit November 2015

Figure 8: Picture from the inside section of the school
Sources: On-site visit November 2015

Figure 9: Picture from the inside section of the school
Sources: On-site visit November 2015

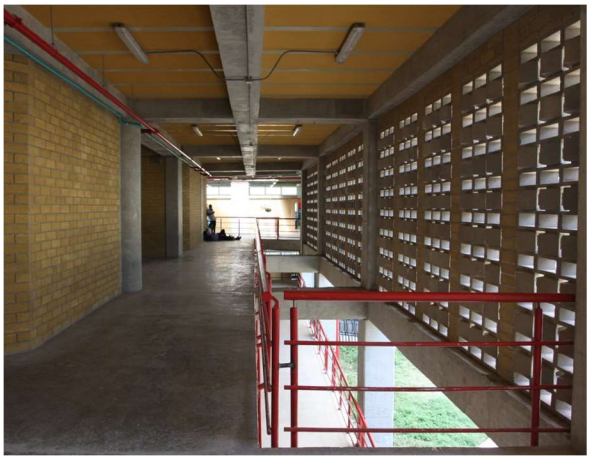


Figure 10: Picture from the inside section of the school
Sources: On-site visit November 2015

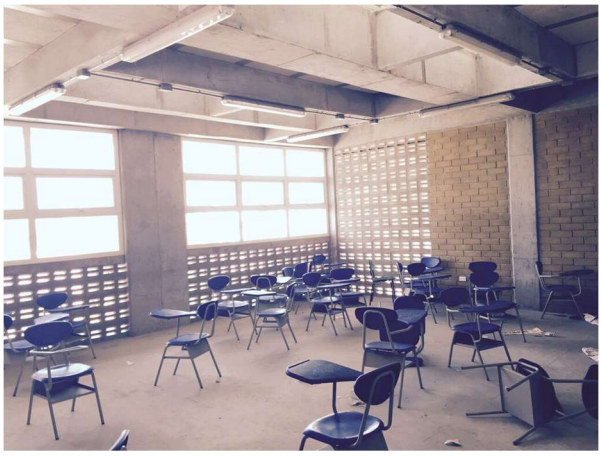


Figure 11: View of the classes
Sources: On-site visit November 2015

Figure 12: View from the outside of the school
Sources: On-site visit November 2015

Figure 13: View from the outside of the school
Sources: On-site visit November 2015

Figure 14: View from the inside of the school
Sources: On-site visit November 2015

Figure 15: Corridors
Sources: On-site visit November 2015

Figure 16: Kids waiting in line before leaving the school
Sources: On-site visit November 2015

Figure 17:Main meeting room
Sources: On-site visit November 2015

Figure 18: Kids lack of care for the furniture
Sources: On-site visit November 2015

Figure 19: Kids lack of care for the equipment
Sources: On-site visit November 2015

Figure 20: Kids lack of care for the equipment
Sources: On-site visit November 2015

Figure 21: Kids lack of care for the equipment
Sources:On-site visit November 2015

APPENDIX B: COMFORT ANALYSIS

A comfort simulation was performed in order to measure and analyze comfort inside Colegio Santa Lucia buildings, as well as provide a list of best practices to increase the comfort zone. Plotting climate data on a psychrometric chart is a common technique that shows the attributes of a particular climate and its impact on built form, with an emphasis on comfort inside the space. The simulation was done using the Climate Consultant graphic-based computer program, which uses annual 8760 hour EPW format climate and translates it into graphics with the right input information, having as an input parameter the weather file of Barranquilla, Colombia (EPW format).

Also, as the comfort zone may be defined differently by different codes in different places, both California Code[14] and Adaptive Comfort Model in ASHRAE Standard 55[15] are used to plot the results on the psychrometric chart.

The Psychrometric Charts shown below are the more advanced features available in Climate Consultant. Each dot on the chart represents the temperature and humidity of each of the 8760 hours per year. Different Design Strategies are represented by specific zones on this chart. The percentage of hours that fall into each of the 16 different Design Strategy Zones gives a relative idea of the most effective passive heating or passive cooling strategies. Based on the climate data, the program helps you to generate a unique list of Design Guidelines for a particular location.

The climate of Baranquilla is characterized by an average temperature of approximately 27ºC and average relative humidity of 80% - 95% throughout the year.

[14] California Code defines a comfort zone as one that has the indoor temperature between 20^{O}C and 24^{O}C., with an upper relative humidity of 80%, and considers the use of heating and cooling systems indoors (HVAC).

[15] Adaptive Comfort Model in ASHRAE standard 55 defines a comfort zone as one where occupants adapt to thermal conditions through clothing and passive features of buildings like natural ventilation or natural heating, without use of an HVAC system

WEATHER DATA SUMMARY

LOCATION: BARRANQUILLA-ERNEST, -, COL
Latitude/Longitude: 10.88° North, 74.78° West, **Time Zone from Greenwich** -5
Data Source: IWEC2 800280 WMO Station Number, **Elevation** 30 m

MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Global Horiz Radiation (Avg Hourly)	448	492	485	463	428	426	429	450	409	360	343	424	Wh/sq.m
Direct Normal Radiation (Avg Hourly)	393	425	355	300	272	285	290	289	215	157	178	386	Wh/sq.m
Diffuse Radiation (Avg Hourly)	205	208	228	240	239	232	232	244	257	255	235	202	Wh/sq.m
Global Horiz Radiation (Max Hourly)	795	888	948	955	897	896	894	891	912	784	771	765	Wh/sq.m
Direct Normal Radiation (Max Hourly)	617	739	709	739	627	677	648	611	701	459	559	655	Wh/sq.m
Diffuse Radiation (Max Hourly)	371	449	477	485	470	460	463	475	478	450	428	399	Wh/sq.m
Global Horiz Radiation (Avg Daily Total)	5131	5725	5806	5672	5354	5382	5402	5566	4942	4237	3952	4829	Wh/sq.m
Direct Normal Radiation (Avg Daily Total)	4502	4949	4253	3683	3397	3607	3648	3579	2603	1853	2054	4391	Wh/sq.m
Diffuse Radiation (Avg Daily Total)	2348	2425	2728	2952	2995	2938	2915	3022	3101	2997	2709	2307	Wh/sq.m
Global Horiz Illumination (Avg Hourly)	51037	56818	56250	53542	49107	48993	49500	51682	46878	40712	38625	48356	lux
Direct Normal Illumination (Avg Hourly)	21457	24697	21340	17673	13907	14773	15302	15278	12757	9377	9935	21395	lux
Dry Bulb Temperature (Avg Monthly)	28	25	27	27	28	28	28	28	27	26	27	27	degrees C
Dew Point Temperature (Avg Monthly)	25	22	22	24	26	25	24	26	24	25	25	22	degrees C
Relative Humidity (Avg Monthly)	84	83	78	83	87	86	82	90	81	95	89	75	percent
Wind Direction (Monthly Mode)	40	40	20	20	40	40	60	20	60	180	20	20	degrees
Wind Speed (Avg Monthly)	5	7	6	6	4	3	4	4	2	2	2	3	m/s
Ground Temperature (Avg Monthly of 3 Depths)	26	26	26	26	26	27	27	28	28	28	28	27	degrees C

Figure 22: Weather data summary
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

Comfort Model following California Energy Code, 2013

The California Code defines a comfort zone as one that has an indoor temperature between 20ºC and 24ºC., with an upper relative humidity of 80% and a lower limit of -2.8ºC Dew Point[16]. This model considers the use of heating and cooling systems indoors (HVAC).

COMFORT MODEL

LOCATION: BARRANQUILLA-ERNEST, -, COL
Latitude/Longitude: 10.88° North, 74.78° West, **Time Zone from Greenwich** -5
Data Source: IWEC2 800280 WMO Station Number, **Elevation** 30 m

COMFORT MODELS:

Human Thermal comfort can be defined primarily by dry bulb temperature and humidity, although different sources have slightly different definitions. Select the model you wish to use:

◉ California Energy Code Comfort Model, 2013 (DEFAULT)

For the purpose of sizing residential heating and cooling systems the indoor Dry Bulb Design Conditions should be between 68°F (20°C) to 75°F (23.9°C). No Humidity limits are specified in the Code, so 80% Relative Humidity and 66°F (18.9°C) Wet Bulb is used for the upper limit and 27°F (-2.8°C) Dew Point is used for the lower limit (but these can be changed on the Criteria screen).

Figure 23: Comfort model
Sources: Umi from Rhino. Simulation by Zofnass Program Research Team

[16] The Dew point is the temperature at which water vapor will condense (shows how much moisture the air can hold).

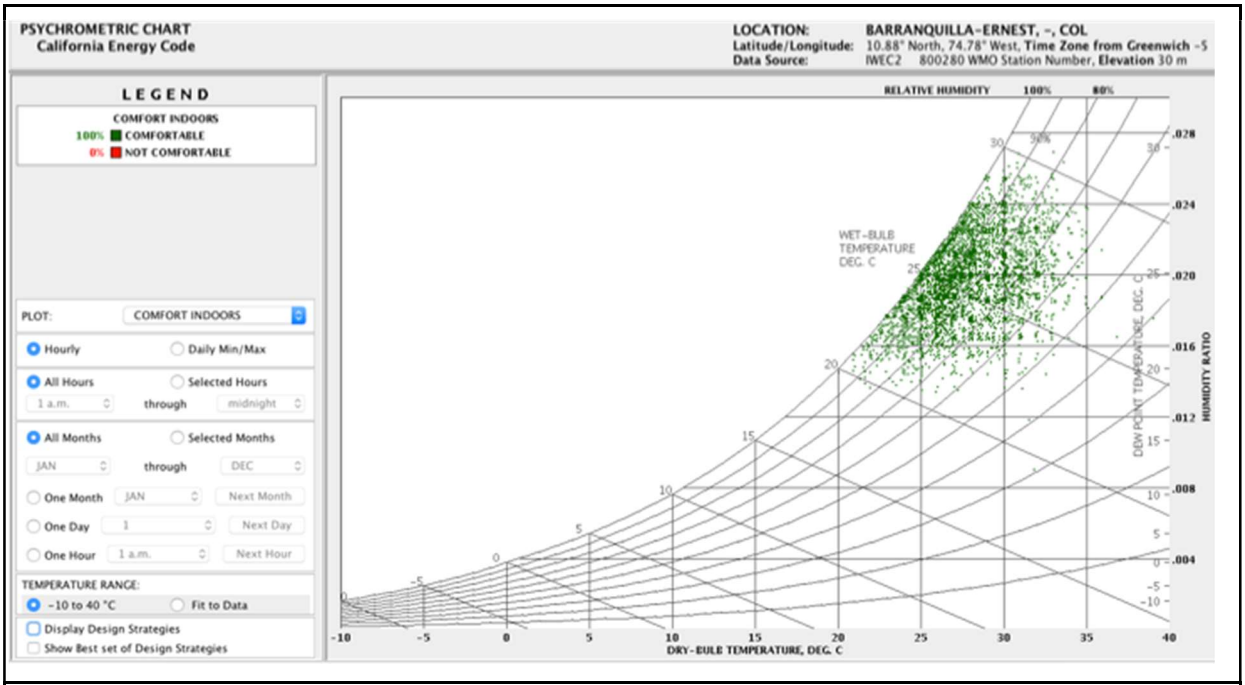


Figure 24: Psychrometric chart _California Energy Code
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

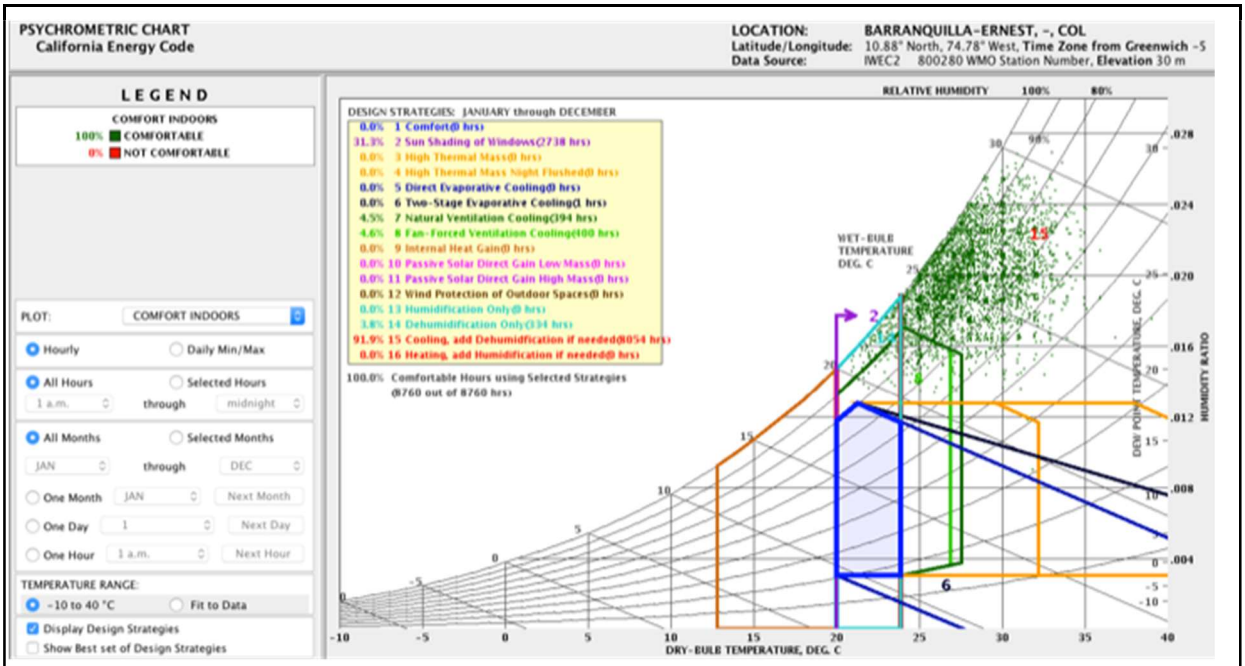


Figure 25: Psychrometric chart_ California Energy Code
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

California Model: Key findings

•Only 60% of the time during the year (psychometric chart / adaptive comfort) will conditions be comfortable if no passive strategies are applied to the building

•If certain passive design features are used in the building, occupants will be comfortable indoors when temperatures range from 20ºC to 30ºC and the relative humidity from 60% to 100%.

•In this climate overheating presents the biggest problems, so air conditioning and dehumidification become of crucial importance. In the case of Santa Lucia School, where no air conditioning is used, it is important that all design features focus on minimizing overheating and encouraging ventilation, especially from May to September when temperatures tend to be higher.

•Some key design features to expand comfort zones (green area in the psychrometric chart) include:

- Using lightweight construction, raised above ground, with openable walls and shaded outdoor areas
- sun shading devices (design wide window overhangs, especially on south facade) Minimize or eliminate west-facing glazing to reduce heat gains during summer and fall afternoons
- Orient most of the sun to north façade shaded by vertical fins

•Also, installing ceiling fans helps circulate air more effectively and makes areas feel cooler by virtually decreasing the temperature by up to 2.8 ºC.

Design Guidelines to Consider

DESIGN GUIDELINES (for the Full Year)
California Energy Code
All Design Strategies, User Modified Criteria

LOCATION: **BARRANQUILLA-ERNEST, -, COL**
Latitude/Longitude: 10.88° North, 74.78° West, **Time Zone from Greenwich** -5
Data Source: IWEC2 800280 WMO Station Number, **Elevation** 30 m

Assuming all 16 Design Strategies were selected on the Psychrometric Chart, 100.0% of the hours will be Comfortable.
This list of Non-Residential Design guidelines applies specifically to this particular climate, starting with the most important first. Click on a Guideline to link to the 2030 Palette for related passive design ideas (see Help).

59	In this climate air conditioning will always be needed, but can be greatly reduced if building design minimizes overheating 2030
37	Window overhangs (designed for this latitude) or operable sunshades (awnings that extend in summer) can reduce or eliminate air conditioning 2030
38	Raise the indoor comfort thermostat setpoint to reduce air conditioning energy consumption (especially if occupants wear seasonally appropriate clothing)
65	Climate responsive buildings in warm humid climates used high ceilings and tall operable (French) windows protected by deep overhangs and verandas 2030
68	Climate responsive buildings in hot humid climates used light weight construction with openable walls and shaded outdoor areas, raised above ground 2030
32	Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain 2030
30	High performance glazing on all orientations should prove cost effective (Low-E, insulated frames) in hot clear summers or dark overcast winters 2030
57	Orient most of the glass to the north, shaded by vertical fins, in very hot climates, because there are essentially no passive solar needs 2030
26	A radiant barrier (shiny foil) will help reduce radiated heat gain through the roof in hot climates
17	Use plant materials (bushes, trees, ivy-covered walls) especially on the west to minimize heat gain (if summer rains support native plant growth) 2030
46	High Efficiency air conditioner or heat pump (at least Energy Star) should prove cost effective in this climate
18	Keep the building small (right-sized) because excessive floor area wastes heating, cooling, and lighting energy
35	Good natural ventilation can reduce or eliminate air conditioning in warm weather, if windows are well shaded and oriented to prevailing breezes 2030
33	Long narrow building floorplan can help maximize cross ventilation in temperate and hot humid climates 2030
43	Use light colored building materials and cool roofs (with high emissivity) to minimize conducted heat gain 2030
56	Screened occupancy areas and patios can provide passive comfort cooling by ventilation in warm weather and can prevent insect problems
42	On hot days ceiling fans or indoor air motion can make it seem cooler by 5 degrees F (2.8C) or more, thus less air conditioning is needed
60	Earth sheltering, occupied basements, or earth tubes reduce heat loads in very hot dry climates because the earth stays near average annual temperature
27	If soil is moist, raise the building high above ground to minimize dampness and maximize natural ventilation underneath the building
25	In wet climates well ventilated pitched roofs work well to shed rain and can be extended to protect entries, outdoor porches, and outdoor work areas 2030

Figure 26: Design guidelines
Sources: Umi from Rhino. simulation by Zofnass program Research Team

Adaptive Comfort Model in ASHRAE Standard 55-2010

The Adaptive Comfort Model in ASHRAE standard 55 defines a comfort zone as one where occupants adapt to thermal conditions through clothing and passive features of buildings such as natural ventilation or natural heating. In this model no HVAC system is used.

*Note: The adaptive model will give a more realistic description of the comfort zone inside the schools in Colombia since this model excludes the use of the HVAC system.

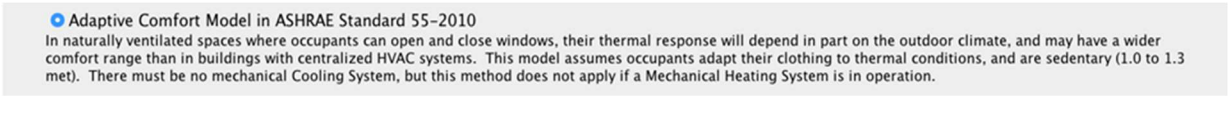


Figure 27: Comfort model used
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

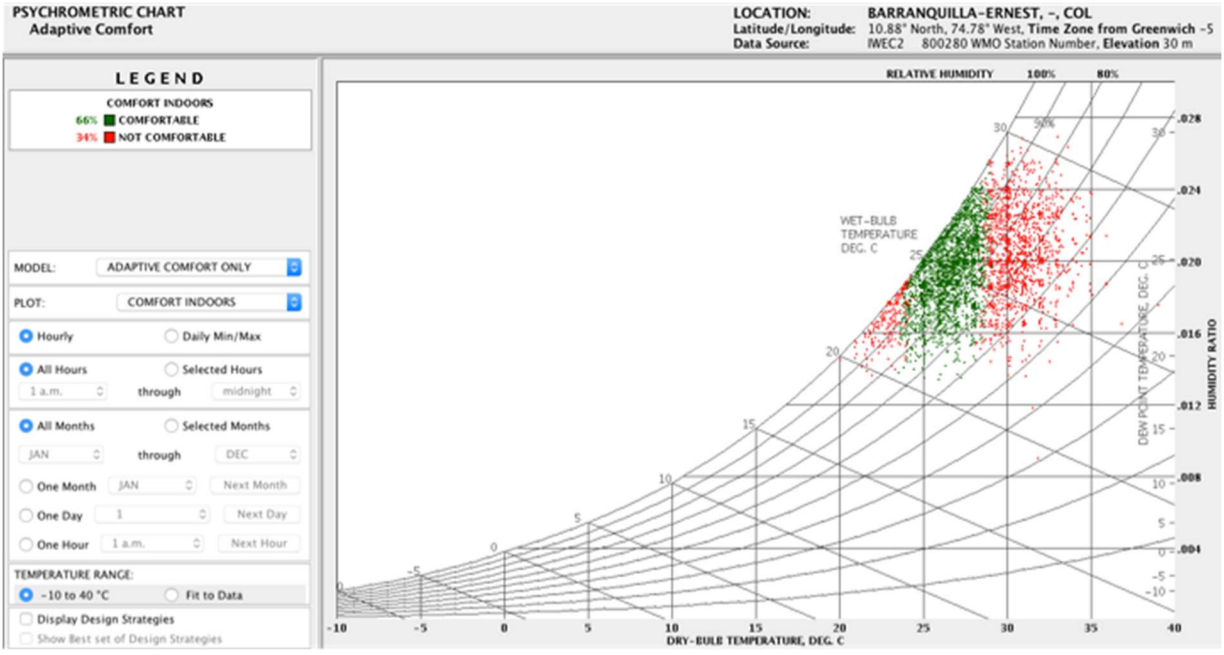


Figure 28: Psychrometric chart_ California Energy Code
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

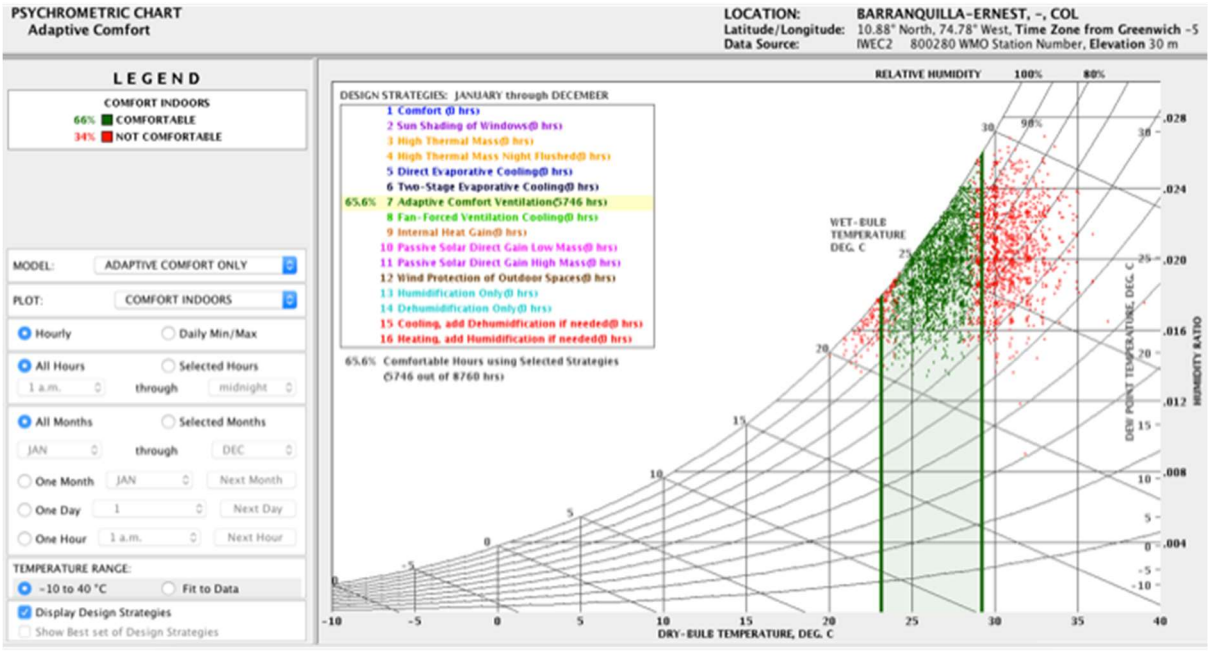


Figure 29: Psychrometric chart_ Adaptive comfort
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

Adaptive Comfort Model: Key findings

•Occupants will be comfortable indoors if the inside temperature ranges from 22ºC to 29ºC and the relative humidity from 70% to 100%.

•A key design feature to expand the comfort zone (green area in the psychrometric chart) is natural ventilation, which can eliminate the need for air conditioning.

•To capture natural ventilation, wind direction can be changed up to 45 degrees toward the building by exterior wingwalls and planting.

•Also, smaller floor plans with doors and windows located on opposite sides maximize cross ventilation.

•Installing ceiling fans can make the room feel cooler by up to 2.8 ºC.

•As for lighting, providing enough north glazing is important to create a comfortable space.

•Other design features that increase comfort and minimize heat gain are:

- West facing glazing
- Window overhangs to shade during summer

Adaptive Comfort Model: Design Guidelines to Consider

DESIGN GUIDELINES (for the Full Year)
Adaptive Comfort
All Design Strategies, User Modified Criteria

LOCATION: **BARRANQUILLA-ERNEST, -, COL**
Latitude/Longitude: 10.88° North, 74.78° West, **Time Zone from Greenwich** -5
Data Source: IWEC2 800280 WMO Station Number, **Elevation** 30 m

Assuming only the Design Strategies that were selected on the Psychrometric Chart, 65.6% of the hours will be Comfortable.
This list of Non-Residential Design guidelines applies specifically to this particular climate, starting with the most important first. Click on a Guideline to link to the 2030 Palette for related passive design ideas (see Help).

35	Good natural ventilation can reduce or eliminate air conditioning in warm weather, if windows are well shaded and oriented to prevailing breezes 2030
34	To capture natural ventilation, wind direction can be changed up to 45 degrees toward the building by exterior wingwalls and planting
33	Long narrow building floorplan can help maximize cross ventilation in temperate and hot humid climates 2030
36	To facilitate cross ventilation, locate door and window openings on opposite sides of building with larger openings facing up-wind if possible 2030
56	Screened occupancy areas and patios can provide passive comfort cooling by ventilation in warm weather and can prevent insect problems
42	On hot days ceiling fans or indoor air motion can make it seem cooler by 5 degrees F (2.8C) or more, thus less air conditioning is needed
47	Use open plan interiors to promote natural cross ventilation, or use louvered doors, or instead use jump ducts if privacy is required 2030
49	To produce stack ventilation, even when wind speeds are low, maximize vertical height between air inlet and outlet (open stairwells, two story spaces, roof monitors) 2030
39	A whole-house fan or natural ventilation can store nighttime 'coolth' in high mass interior surfaces (night flushing), to reduce or eliminate air conditioning 2030
58	This is one of the more comfortable climates, so shade to prevent overheating, open to breezes in summer, and use passive solar gain in winter 2030
62	Climate responsive buildings in temperate climates used light weight construction with slab on grade and operable walls and shaded outdoor spaces
65	Climate responsive buildings in warm humid climates used high ceilings and tall operable (French) windows protected by deep overhangs and verandas 2030
53	Shaded outdoor buffer zones (porch, patio, lanai) oriented to the prevailing breezes can extend occupancy spaces in warm or humid weather 2030
54	Provide enough north glazing to balance daylighting (about 5% of floor area) 2030
55	Low pitched roofs with wide overhangs work well in temperate climates
17	Use plant materials (bushes, trees, ivy-covered walls) especially on the west to minimize heat gain (if summer rains support native plant growth) 2030
25	In wet climates well ventilated pitched roofs work well to shed rain and can be extended to protect entries, outdoor porches, and outdoor work areas 2030
27	If soil is moist, raise the building high above ground to minimize dampness and maximize natural ventilation underneath the building
32	Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain 2030
37	Window overhangs (designed for this latitude) or operable sunshades (awnings that extend in summer) can reduce or eliminate air conditioning 2030

Figure 30: Design guidelines
Sources: Umi from Rhino. Simulation by Zofnass program Research Team

APPENDIX C: ENERGY SIMULATION

The purpose of this analysis is to conduct an energy simulation for Colegio Santa Lucia in order to check the performance of all the passive green features implemented in the design of the buildings in terms of energy. The simulation was performed using Umi – a Rhino plugin that models the environmental performance of buildings, neighborhoods, and cities regarding operational energy, walkability and daylighting potential. For the purpose of this simulation, the buildings (Classroom 1, Classroom 2, Bathroom, Library and PC Room, Restaurant and Kitchen) are drawn on a flat landscape and they all have the same parameters in terms of construction materials. However, the size, orientation and faced opening ratios change in each of the unit buildings included in this simulation. Thus, the energy results are NOT the same on all 5 unit buildings used in this analysis. If other input parameters for these buildings, such as occupancy and materials used, change the energy results will consequently be different. This can be done in a second iteration as more specific information becomes available. It is to be noted that no HVAC is used in all buildings, except the library building. All other buildings rely on passive design features for heating and cooling .Also, the results are based on operational energy only, and when the parameters were unknown, a lot of assumptions were made to model the buildings. Please refer to the input parameters listed below for more information.

Input parameters:

*Weather Data: Baranquilla, Colombia Weather File (epw file) *Usertype: Education *Lifespan: 60 years *Occupancy: 0.1 pp/m2 *Equipment Density: 10 W/m2 *Lighting Density: 12 W/m2 *HVAC Schedule: No HVAC for all buildings except the library *Heating Setpoint: 22 degrees C *Cooling Setpoint: 24 degrees C *Building Schedule: 8am – 6pm Weekdays. *Weekend Off	*Floor to Floor Elevation: 3 m *Building Height: 7.4 m *Infiltration Rate: 0.4 ach *Facade Wall Type: Concrete Frame *Roof Floor Type: Wood Structure / Attic *Interior Floor Type: Concrete Slab *Ground Floor: On Ground Unheated *Thermal Mass Type; Base Thermal Mass *Glazing Type: Double Glazed Low E *Structure Type: Concrete Mass

Facade Opening Ratios:

Classroom 1 - North 70%; West 30%; East 30% and South 10%.

Classroom 2 - North 70%; West 30%; East 30% and South 10%.

Bathroom - North 70%; West 30%; East 30% and South 10%.

Library and PC Room - North 40%; West 0%; East 0% and South 20%.
Restaurant and Kitchen - North 40%; West 0%; East 0% and South 30%.

The energy simulation results are shown in units of EUI (Energy Use Intensity), which is a building's annual energy use per unit area. It is typically measured in thousands of BTU per square foot per year (kBTU/ft2/yr) or kWh/m2/yr. EUI can measure "site" energy use (what the building consumes) or "source" energy use (the amount of fuel the power plant burns to produce that much energy). Unless otherwise specified, EUI typically refers to "site" energy use. EUI is useful for comparing the performance of buildings across sizes, types, and locations. That said, running the simulation in UMI / Rhino for Santa Lucia Colegio buildings produced the results below:

Classroom 1 EUI = 64.09 kWh/m2/yr
Classroom 2 EUI = 64.09 kWh/m2/yr
Bathroom EUI = 80.46 kWh/m^2/yr
Library and PC Room EUI = 219.01 kWh/m2/yr
Restaurant and Kitchen EUI = 68.94 kWh/m^2/yr

These results suggest that the buildings are performing really well in terms of energy consumption. The low energy consumption can be explained by the fact that these buildings use efficient materials and passive features into their design. Additionally, not using an HVAC system has great impacts into a building's total energy consumption. The difference is noticeable when EUI of Library building unit, which uses an HVAC system, is compared to the other buildings on site. Furthermore, compared to similar building types, the amount of energy Colegio Santa Lucia consumes is much lower than an energy efficient building in the U.S., and the result is near achieving the 2030 Challenge Target (refer to Table 3 provided below).

	Classroom 1	Classroom 2	Bathroom	Library	Restaurant & Kitchen
	KWh	KWh	KWh	KWh	KWh
	Total Energy	Total Energy	Total Energy	Total Energy	Total Energy
January	3858.93	3858.93	777.25	20106.62	4093.00
February	3513.83	3513.83	707.74	13729.77	3726.96
March	4003.25	4003.25	806.31	17432.97	4246.07
April	3576.57	3576.57	720.37	16497.58	3793.51
May	4003.25	4003.25	806.31	21736.85	4246.07
June	3840.11	3840.11	773.46	20598.94	4073.03
July	3739.71	3739.71	753.23	19737.36	3966.55
August	4003.25	4003.25	806.31	21916.59	4246.07
September	3720.89	3720.89	749.44	17747.34	3946.58
October	3858.93	3858.93	777.25	16652.07	4093.00
November	3840.11	3840.11	773.46	18732.64	4073.03
December	3739.71	3739.71	753.23	18459.07	3966.55
Total Energy KWh/year	45698.56	45698.56	9204.37	223347.81	48470.40
EUI = Total Energy KWh/year/m²	64.09	64.09	80.46	219.01	68.94

Table 1: Results: Results - Energy Consumption / month and Total Energy Consumption
Sources: Zofnass program Research Team

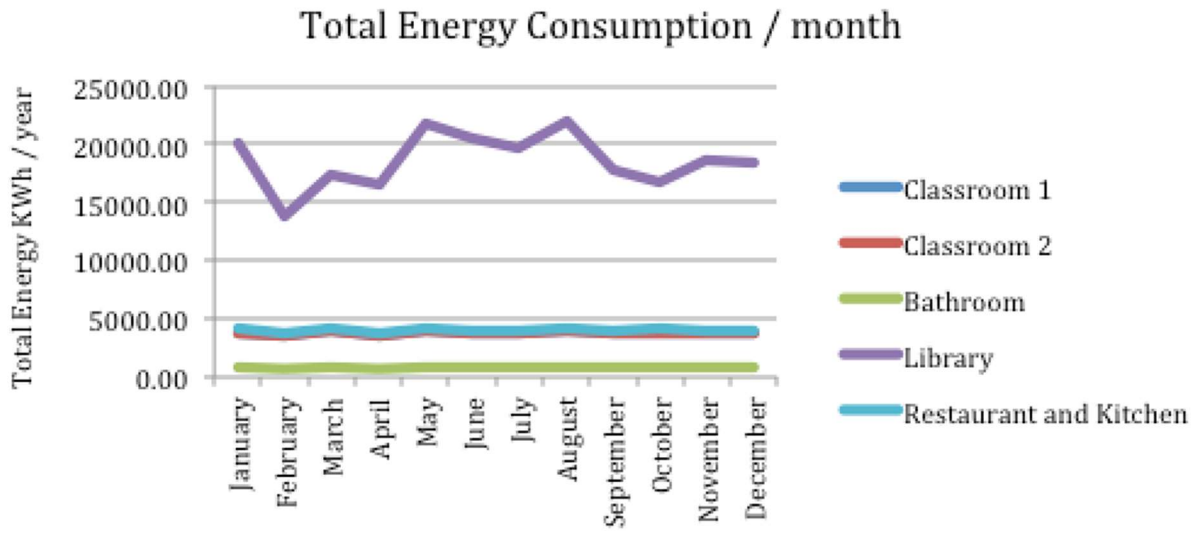


Table 2: Results - Energy Consumption / month for all buildings

Sources: Zofnass program Research Team

These numbers are meant to give a rough idea of EUI ranges in the US.; actual values can vary widely based upon location & specific space uses.

	Source EUI **(power plant's energy consumption)**	Site EUI **(building energy consumption)**	2030 Challenge target **(60% reduction, site EUI)**
Office	**148** kBTU/ft2/yr	**67** kBTU/ft2/yr	**27** kBTU/ft2/yr
	467 kWh/m2/yr	211 kWh/m2/yr	85 kWh/m2/yr
K-12 Education	**141** kBTU/ft2/yr	**67** kBTU/ft2/yr	**23** kBTU/ft2/yr
	445 kWh/m2/yr	211 kWh/m2/yr	73 kWh/m2/yr
Single-family residence	**68** kBTU/ft2/yr	**46** kBTU/ft2/yr	**18** kBTU/ft2/yr
	215 kWh/m2/yr	145 kWh/m2/yr	57 kWh/m2/yr

Table 3: Total EUIs for three building types in the US.
Sources: http://sefaira.com/resources/six-metrics-every-architect-should-know-and-how-to-use-the

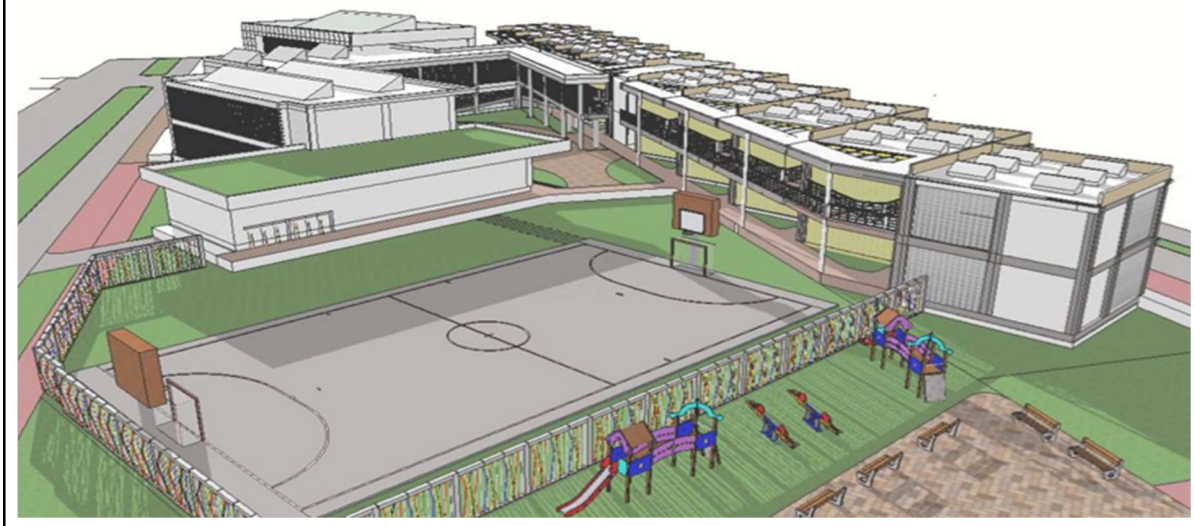
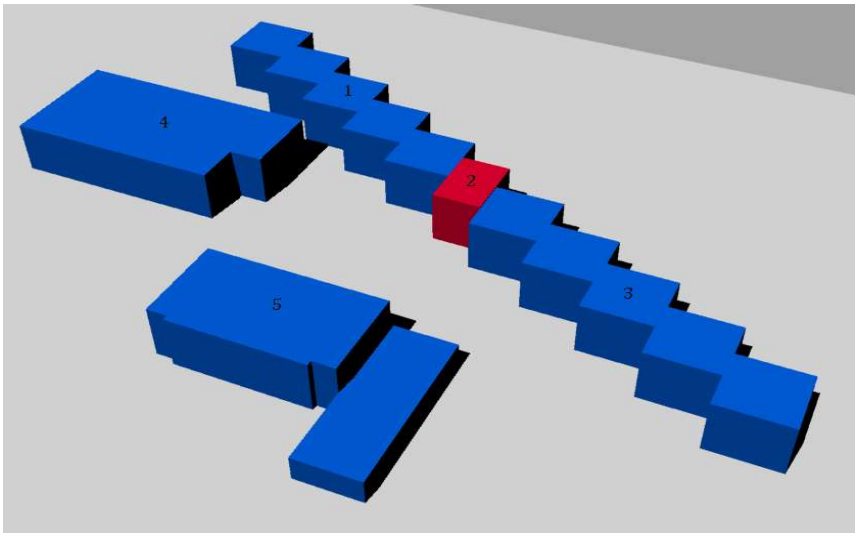


Figure 32: 3D Simulation if the project
Sources: Zofnass program Research Team



1. Classroom 1 Building Unit
2. Bathroom Building Unit
3. Classroom 2 Building Unit
4. Library Building Unit
5. Restaurant and Kitchen Building Units

Figure 33: Simulation diagrams
Sources: Zofnass program Research Team

APPENDIX D: ENVISION POINTS TABLE

ENVISION POINTS TABLE

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

ENVISION POINTS TABLE

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

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

Figure 34: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure

APPENDIX E: GRAPHS

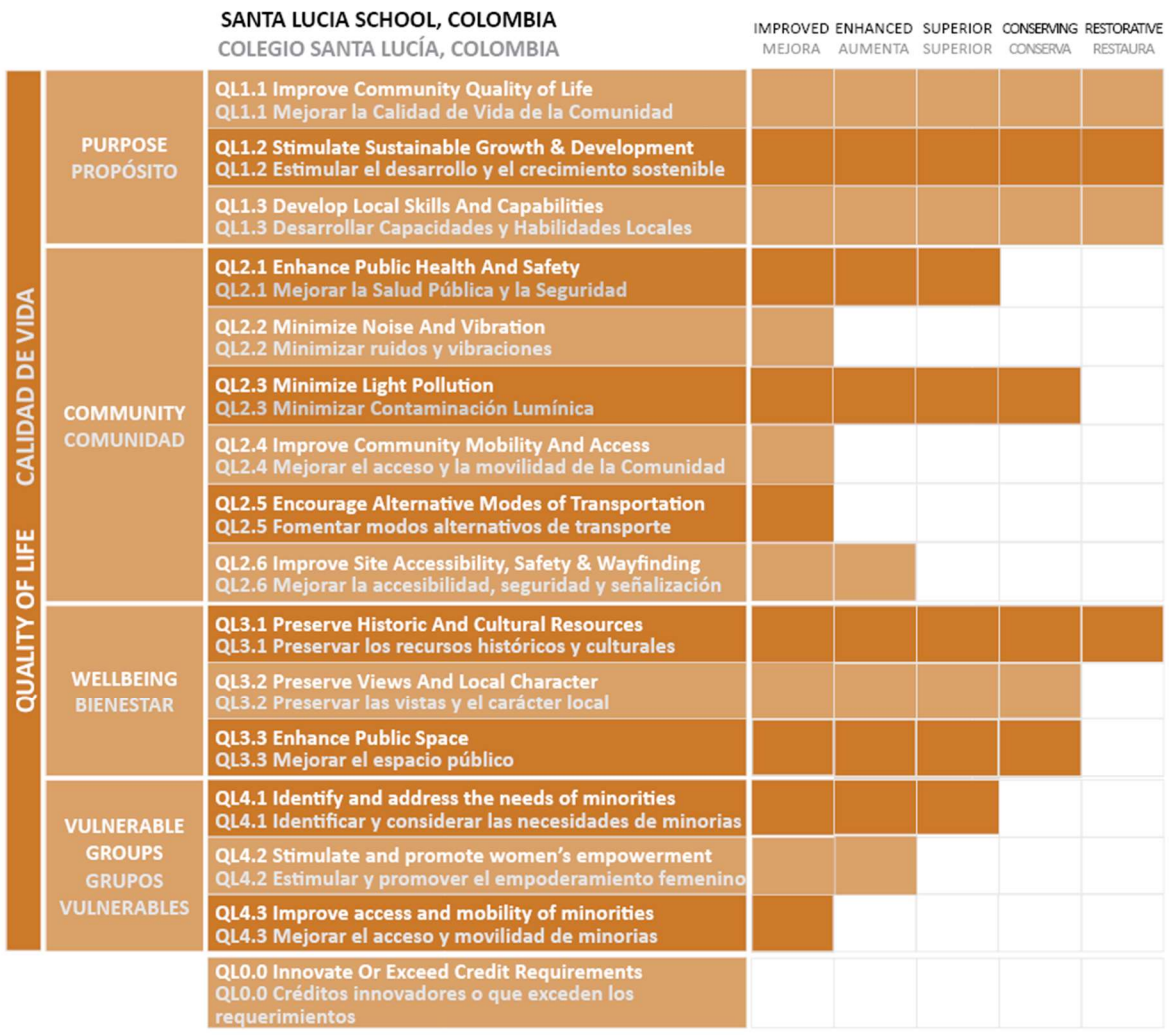


Figure 35: Quality of Life category_ Summary of results

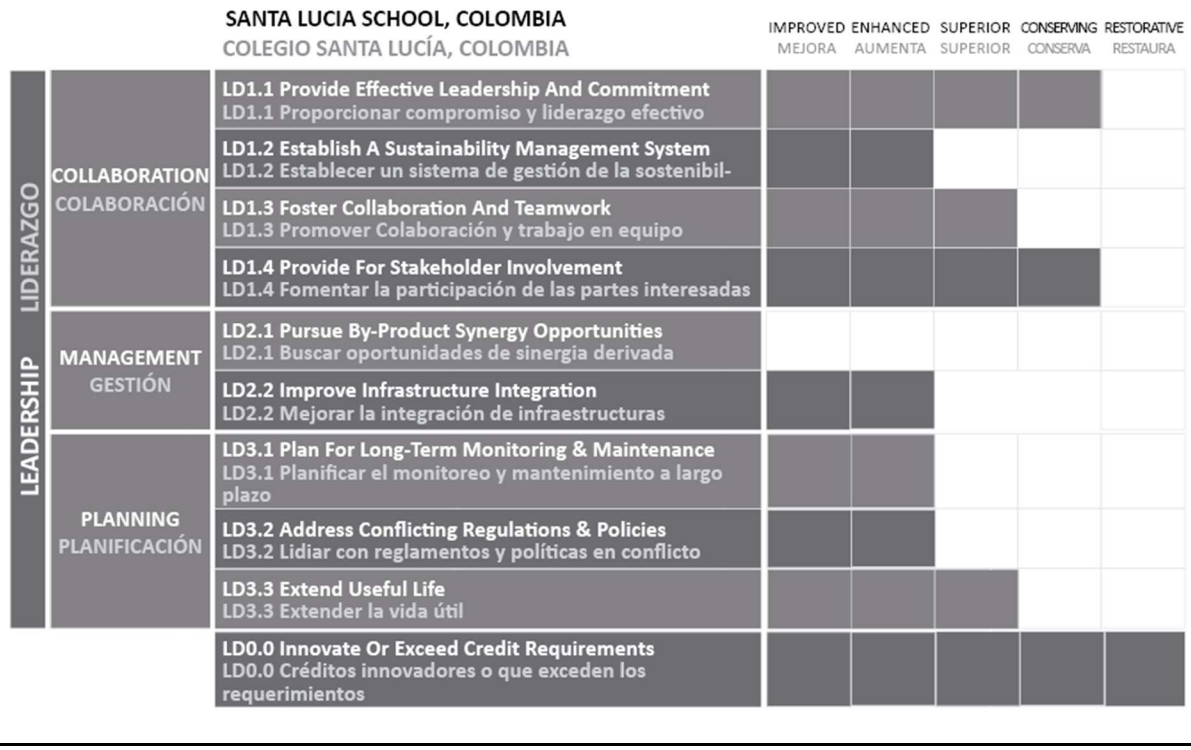


Figure 37: Leadership category_ Summary of results

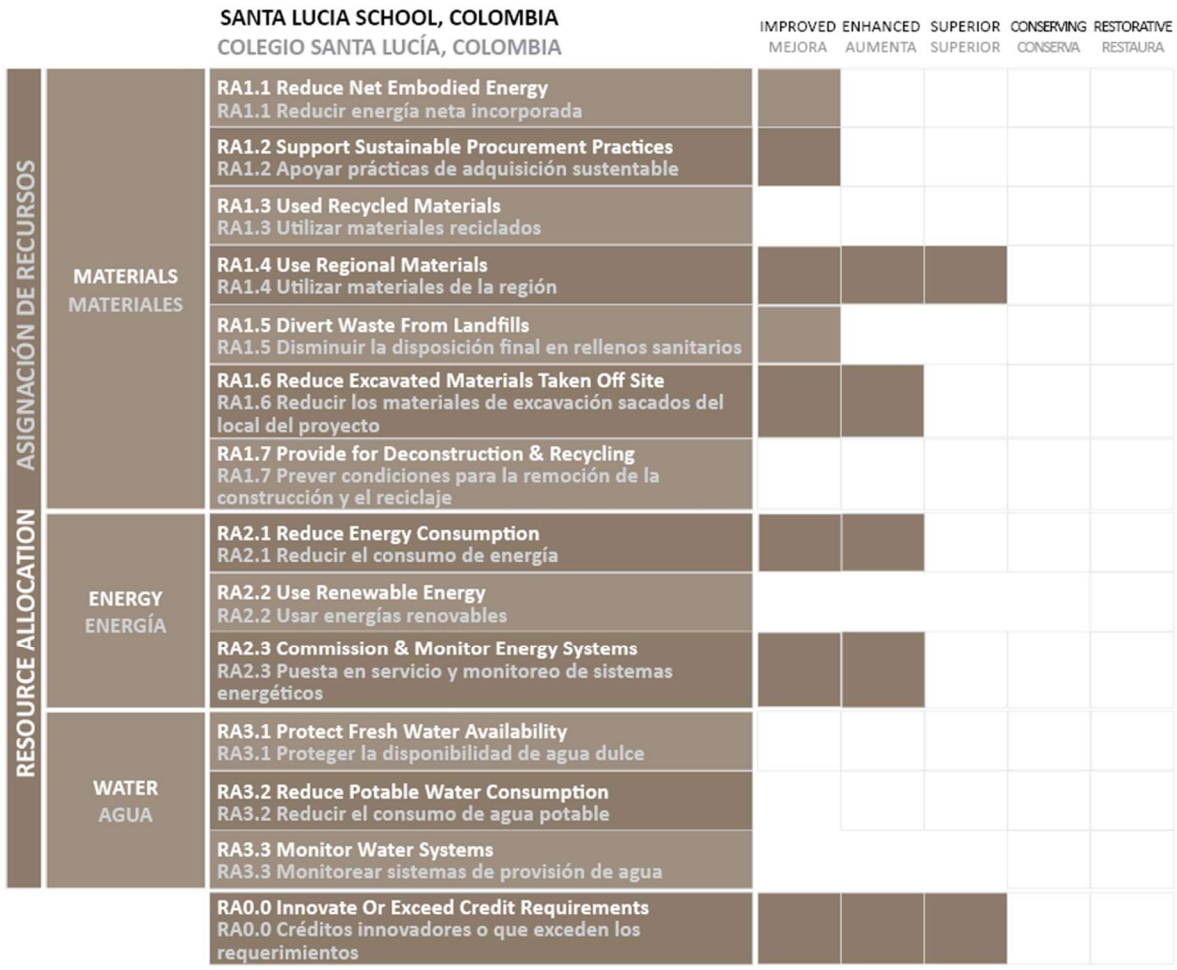


Figure 38 :Resource Allocation category_ Summary of results

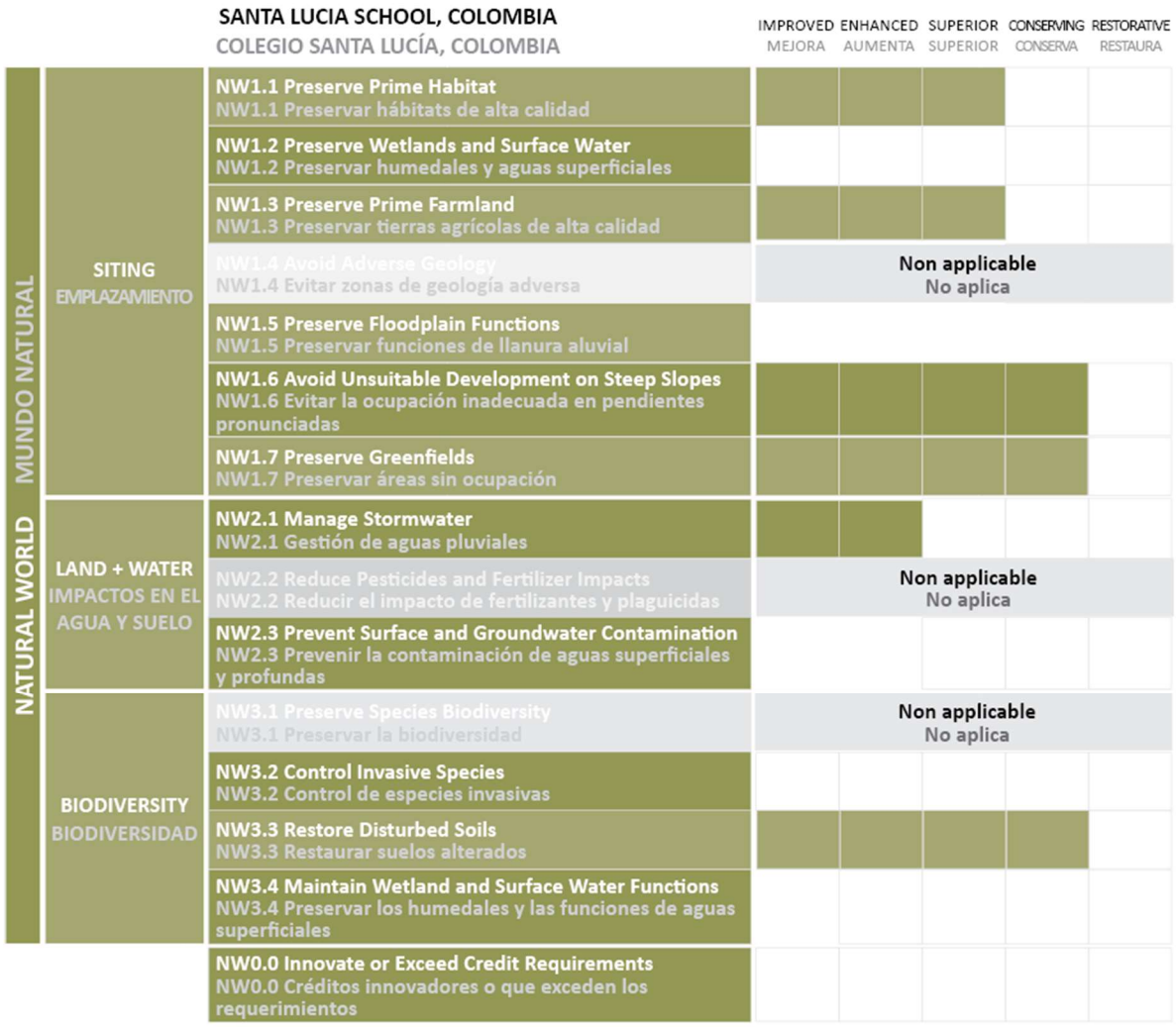


Figure 39: Natural World category_ Summary of results

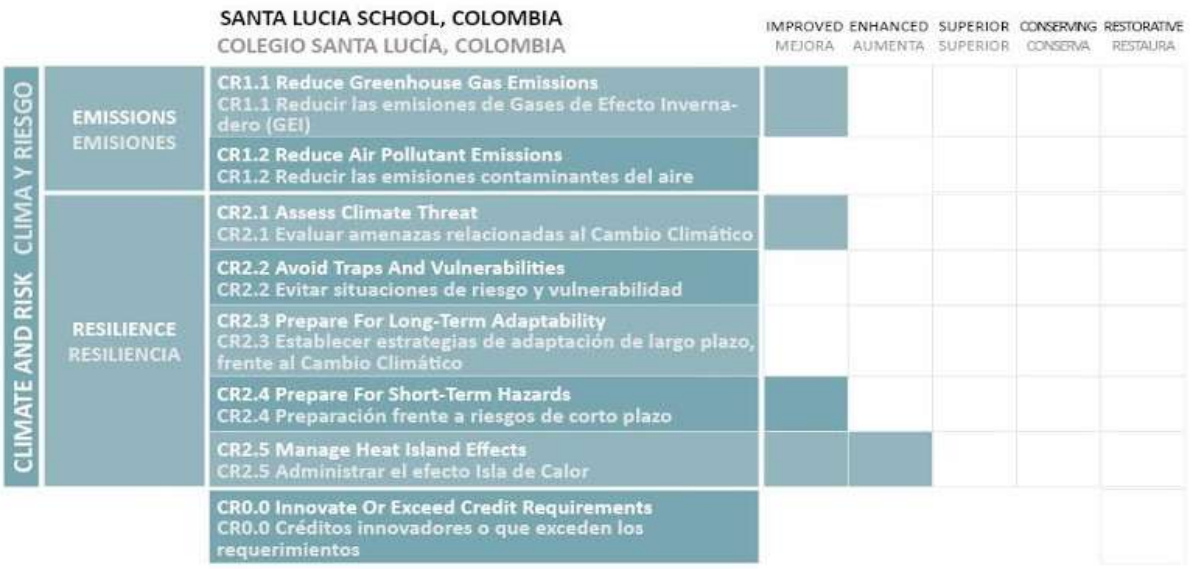


Figure 40: Climate & Risk category_ Summary of results

APPENDIX F: SUMMARY OF THE RESULTS

			STA. LUCIA SCHOOL, COLOMBIA	PT.	Performance
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	25	Restorative
2			QL1.2 Stimulate Sustainable Growth & Development	16	Restorative
3			QL1.3 Develop Local Skills And Capabilities	15	Restorative
4		COMMUNITY	QL2.1 Enhance Public Health And Safety	12	Superior
5			QL2.2 Minimize Noise And Vibration	1	Improved
6			QL2.3 Minimize Light Pollution	8	Conserving
7			QL2.4 Improve Community Mobility And Access	1	Improved
8			QL2.5 Encourage Alternative Modes of Transportation	1	Improved
9			QL2.6 Improve Site Accessibility, Safety & Wayfinding	3	Enhanced
10		WELLBEING	QL3.1 Preserve Historic And Cultural Resources	16	Restored
11			QL3.2 Preserve Views And Local Character	11	Conserving
12			QL3.3 Enhance Public Space	11	Conserving
13		VULNERABLE GROUPS	QL 4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	3	Superior
14			QL4.2 Stimulate and promote women's economic empowerment	2	Enhanced
15			QL4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	1	Improved
			QL0.0 Innovate Or Exceed Credit Requirements	0	0
			QL	126	

			STA. LUCIA SCHOOL, COLOMBIA	PT.	Performance
16	LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership And Commitment	17	Conserving
17			LD1.2 Establish A Sustainability Management System	4	Enhanced
18			LD1.3 Foster Collaboration And Teamwork	8	Superior
19			LD1.4 Provide For Stakeholder Involvement	14	Conserving
20		MNGMT.	LD2.1 Pursue By-Product Synergy Opportunities	0	No Score
21			LD2.2 Improve Infrastructure Integration	3	Enhanced
22		PLANNING	LD3.1 Plan For Long-Term Monitoring & Maintenance	3	Enhanced
23			LD3.2 Address Conflicting Regulations & Policies	2	Enhanced
24			LD3.3 Extend Useful Life	6	Superior
			LD0.0 Innovate Or Exceed Credit Requirements	0	0
			LD	63	

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

			STA. LUCIA SCHOOL, COLOMBIA	PT.	Performance
38	NATURAL WORLD	SITING	NW1.1 Preserve Prime Habitat	9	Superior
39			NW1.2 Preserve Wetlands and Surface Water	0	No Score
40			NW1.3 Preserve Prime Farmland	6	Superior
41			~~NW1.4 Avoid Adverse Geology~~	~~0~~	~~Non Applicable~~
42			NW1.5 Preserve Floodplain Functions	0	No Score
43			NW1.6 Avoid Unsuitable Development on Steep Slopes	6	Conserving
44			NW1.7 Preserve Greenfields	15	Conserving
45		L & W	NW2.1 Manage Stormwater	4	Enhanced
46			~~NW2.2 Reduce Pesticides and Fertilizer Impacts~~	~~0~~	~~Non Applicable~~
47			NW2.3 Prevent Surface and Groundwater Contamination	0	No Score
48		BIODIVERSITY	~~NW3.1 Preserve Species Biodiversity~~	~~0~~	~~Non Applicable~~
49			NW3.2 Control Invasive Species	0	No Score
50			NW3.3 Restore Disturbed Soils	8	Conserving
51			NW3.4 Maintain Wetland and Surface Water Functions	0	No Score
			NW0.0 Innovate or Exceed Credit Requirements	0	N/A
			NW	48	

			STA. LUCIA SCHOOL, COLOMBIA	PT.	Performance
52	CLIMATE	EMISSION	CR1.1 Reduce Greenhouse Gas Emissions	4	Improved
53			CR1.2 Reduce Air Pollutant Emissions	0	No Score
54		RESILENCE	CR2.1 Assess Climate Threat	4	Improved
55			CR2.2 Avoid Traps And Vulnerabilities	0	No Score
56			CR2.3 Prepare For Long-Term Adaptability	0	No Score
57			CR2.4 Prepare For Short-Term Hazards	4	Improved
58			CR2.5 Manage Heat Island Effects	2	Enhanced
			CR0.0 Innovate Or Exceed Credit Requirements	0	N/A
			CR	14	

Total points	**286**	**0**

APPENDIX G: CREDIT DETAIL

STA. LUCIA PROJECT: CREDIT SPREADSHEET WITH DETAILS		
SUB CATEGORY: QUALITY OF LIFE		
	Score	**STA. LUCIA PROJECT.**
QL1.1 Improve Community Quality of Life	25	Restorative
		The project team has accomplished a major community renaissance effort and considerably improved their quality of life. The team has taken into account different studies on the region considering its historical, anthropological and ethnographic features, and studying the problems the community currently deals with in order to develop the project. The educational infrastructure is also planned through community engagement, by having community meetings and workshops, which have elevated the overall quality of life of the people. Further, the aesthetic features of the infrastructure and the urban development plan has a widespread positive impact in the community, not only raising awareness and pride, but also making the project sustainable by its own people. The faculty is committed to enhancing children's lives, specifically by introducing sexual education and parenthood teaching programs that help families get used to the school. However, the social engagement plans lacked a specific focus on kids, which has become an issue due to recent vandalism events. Focusing social engagement plans on kids of all ages, could have helped reduce reported vandalism events
		Source: 1. Fundación Argos and Parque Cutural del Caribe, *Investigación del Patrimonio Inmaterial del Municipio de Santa Lucía: Balance Historiográfico.* (Atlántico: 2014), 1-12. 2. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-42. 3. Son de Santa Lucía, *Informe de Avance del 1 al 30 de Septiembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-38. 4. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9.

		RECOMMENDATIONS A better social engagement strategy for kids would be of great importance since there seems to be a lack of knowledge about the importance of the school for the community. The use of maps, videos and other interactive models with the community and the children, would be useful in helping the community and children understand their territory and environment, while also soliciting feedback on the planning process. Ensuring that the community's ideas are taken into account would benefit the school and create a greater sense of ownership. The surrounding environment significantly impacts the health of people's lives; showing the importance of sustainability, climate change and promoting practices that create a healthy environment such as recycling, can further enhance the quality of life of the people. Informational sessions about the risks of pollutants and harmful chemicals such as pesticides or types of paint, with the help of interactive media that assist people in understanding how to prevent environmental disasters, spillages or even how to avoid chemicals in the water, could be helpful to prevent them from using hazardous products that might adversely impact their health. This is important due to the high risk of flooding in the area, because dangerous chemicals can very easily spread throughout the region in cases of excess flooding. Nutritional programs are also very helpful in improving the community's well-being and could be introduced into the extra-curricular courses offered by the faculty
QL1.2 Stimulate Sustainable Growth & Development	16	Restorative
		Being a long-term investment for the next generations, the project revitalizes the municipality through education, thereby stimulating sustainable growth. The project team has integrated the community into the decision-making process and encourages the engagement of people to raise awareness about the importance of education in the region. Additionally, the project has been designed following sustainable practices, with architectural design that follows passive energy consumption based on site conditions, to accomplish acoustic and thermal comfort benefiting from natural ventilation and lighting. Additionally, the design and the social engagement component of the project facilitate a sense of ownership and pride amongst the community. Moreover, the project team has specifically strived to identify other relevant stakeholders and local leaders for the development of the educational infrastructure.
		Source: 1. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-42. 2. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-42. 3. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9.
		RECOMMENDATIONS The project team overestimated the effect of architectural design on heat management, so community feedback on how the design is actually performing should be solicited to reevaluate the needs. The project team could also teach people how to construct and preserve the buildings on their own, so they become knowledge about how to build other critical infrastructure for the community by themselves. The students should also be involved in these processes as they represent the core user group of the facility. Being able to develop lasting programs with the faculty would be instrumental in obtaining a sustainable growth in the level

		of education offered to the community.
QL1.3 Develop Local Skills and Capabilities	15	Restorative
		The project results in enhanced long-term competitiveness and local skills and capabilities by devoting considerable efforts on education. The team engages the people and improves the sustainability of the programs by working with the local community to understand the impact of education in the municipality. The faculty is one of the project's main assets because they are aware of the difficulties facing the population. The project team was also committed to identifying and working with community leaders and organizations that could support the project in order to create powerful partnerships and promote education. Furthermore, the project team acknowledges that the region has historically had an economy based on agriculture, fishing and cattle; practices that have been abandoned and stigmatized. The institution has implemented strategies to strengthen these historical community values through education. An edible garden program driven and managed by the students, was planned but has not yet been implemented, so youngsters can learn to replicate these initiatives in their homes. This way each house could eventually have its own edible garden and produce its own daily supplies. Also, the project team identified the "Son de Negros" and the "Sexteto musical" as the cultural trait with the highest potential for community development. Therefore, these icons serve as inspiration for the decoration of public spaces and meeting points.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 2. Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual De Interventoria N° 8 Periodo Desde 01 Enero Al 31 De Enero De 2014* (2014), 55. 3. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-42. 4. Son de Santa Lucía, *Informe de Avance del 1 al 30 de Septiembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-38. 5. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 8.
		RECOMMENDATIONS The project should also focus on improving instructor and teacher skills. It would be especially relevant to focus on attracting local instructors since many of the existing ones come from larger cities like Barranquilla, located 2 hours away by car. Making sure that the teaching profession gradually becomes the most valued profession in the municipality will ensure that education gains greater attention. Further, the better the teachers are, the more they will be looked after by the students. Moreover, the school could introduce additional adult programs by replicating the existing ones for parents in order to help them improve their own behavior. Kids constantly learn by replicating what the elders do, so having instructive courses for parents and adults would indirectly enhance their behavior as well. The school could further be used for night courses for adults and teachers to enhance local skills and capacities, as well as to introduce additional local opportunities for entrepreneurship.
	12	Superior

QL2.1 Enhance Public Health And Safety		The main goal of the institution is to create a safe space for kids to learn and develop away from the existing dangers of the area where the school is located. It is estimated that by offering several -in school- alternatives for students' health and safety risks will be greatly minimized. In terms of safety of the school during the construction process, construction contractors follow the relevant industrial security legislation and occupational health programs. These reports show the regulations that must be followed during construction to avoid risks, and the team has given clear instructions on which specific procedures should be applied to enhance safety. Additionally, the project team follows the NTC 1700 regulations for safety features, such as maintaining appropriate distance to emergency exits, the correct number of exits in each floor, and the amount of exits according to the capacity and area.
		Source: *1.* Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual De Interventoria N° 8 Periodo Desde 01 Enero Al 31 De Enero De 2014* (2014), 1-74. 2. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 26.
		RECOMMENDATIONS The project team should explicitly analyze the current risks faced by the school. Having a place where the teachers and students give constant feedback about their concerns in terms of health and safety and developing programs to motivate teachers and children to solve the identified problems can become a sustainable way of making the school safe and more appealing for students.
QL2.2 Minimize Noise And Vibration	1	Improved
		The project team has implemented a noise reduction policy for construction works, which specifies safety levels and measures to be followed to avoid any health issues for workers. Moreover, the team has provided acoustic recommendations for the school as part of the bioclimatic architecture. Acoustic comfort was part of the process to avoid interference with the use of natural strategies for climate control. However, the project team did not provide studies on operational noise levels or whether children noise could adversely affect the community
		Source: 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 28. 2. Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual De Interventoria N° 8 Periodo Desde 01 Enero Al 31 De Enero De 2014* (2014), 56, 59. 3. Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual Nº 1 – Periodo 1 al 30 de Junio de 2014 – Interventoría Para La Construcción De 8 Aulas Y Batería Sanitaría En La I.E. Francisco De Paula Santander Sedes 1 Y 2* (2014), 3.

		RECOMMENDATIONS An analysis forecasting operational noise and vibration levels could help avoid excessive children noises levels and prevent community disruptions. Natural barriers made from trees and soft materials like fabric could be added to the design of playgrounds and areas with higher noise levels to absorb excess noise.
QL2.3 Minimize Light Pollution	8	Conserving The school will not result in excessive light pollution since considerable glare or lighting levels at night are not to be expected. School infrastructure will primarily be used during daytime. *Source:* 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 23. 2. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46. *RECOMMENDATIONS* An analysis of the increase of lighting in the areas according to the occupation times of the project is recommended.
QL2.4 Improve Community Mobility and Access	1	Improved The project team does not document the ways in which community mobility and access could be improved within the project's immediate surroundings. Ethnographic studies show the connectivity of the municipality by navigation and terrestrial mediums, acknowledging the lack of a terminal, transit offices, as well as bad signage. Moreover, urban transportation is dominated by bicycle-taxis and moto-taxis, and in the rural areas by the use of horses. Several private motorcycles regularly come in and out of the school, while the government has provided the kids with bicycles as part of the program. The school has designated bike parking areas but these are not regularly used; it would be particularly good to encourage kids to use their bikes to go to school instead of using motorcycles. *Source:* 1. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 27. *RECOMMENDATIONS* The project team could take advantage of the findings in the studies about mobility and connectivity of the municipality to improve the local ways of moving around. The team can also take a good educational approach on how to improve walkability in the city and to engage the communities in improving traffic. Similarly, the team could implement programs to promote safe use of motorcycles, moto-taxis and bicicle-taxis, because motorcycles are sometimes used inside the facilities, which could be dangerous for children and people in the building. Improving street signs and painting bike paths could also help avoid accidents.

QL2.5 Encourage Alternative Modes of Transportation	1	Improved
		The architectural and landscape design of the project allow pedestrian access with easy connections to the rest of the municipality. The site is located within an easy walking distance from urban houses, and is accessible by different local modes of transportation. Moreover, the project team aims to offer the same opportunities for disabled people in the school, so the school has been suited with ramps and wheelchair friendly design. As part of the government donation program, the children were given bikes and the project includes specific parking spots for these.
		Source: *1.* Son de Santa Lucía, *Informe de Avance del 31 de Octubree al 30 de Noviembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 15-17.
		RECOMMENDATIONS The project team could aim to improve the way kids get to school with simple programs like a walking route by instructors where kids can walk to school accompanied by an adult. Creating walk paths and developing programs for the kids to paint crosswalks, could improve safety and raise awareness of the importance of having a walkable city. Also, encouraging the use of bikes given by the government would be useful to improve mobility.
QL2.6 Improve Site Accessibility, Safety & Wayfinding	3	Enhanced
		The architectural design features improve the accessibility, safety and wayfinding of the site. The location of the buildings and the internal pathways and ramps allow a better understanding of the site and thus improve access for people with reduced mobility. The project also provides some public space at the entrances of the school as gathering points that provide safety points to enter and exit the buildings. Additionally, designated kid's areas were built in these public spaces, which are accessible by everyone in the community. However, these unprotected areas seem to be interfering with the learning environment, and the school has proposed to construct perimeter fences in order to avoid any kind of interferences between students and non-student outsiders.
		Source: 1. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46.
		RECOMMENDATIONS The project team should identify the best ways of placing signage to have clearer, easily identifiable and intuitive signs for safety. Additionally, the team should consider introducing signage for people with limited vision or hearing loss. Social engagement processes are recommended as part of the strategy to keep the kids and community in harmony, by finding ways of improving the school's safety without having to build fences and walls.
QL3.1 Preserve Historic and Cultural Resources	16	Restorative
		The project preserves and enhances the historic and cultural features of the municipality through education. The team conducted anthropological, ethnographic and historic studies of the region and the culture to design the project. Using these studies and through community

		meetings the project team wants to enhance and focus on the cultural and historic local traditions. Moreover, this project is an educational institution that aims to enrich the culture, involving leaders and other stakeholders, and engaging the community in the entire decision-making process. Additionally, the project improved the surrounding public space, and created new public spaces for adults and children. Moreover, to preserve the local traditions of agricultural practices, the team implemented a program to teach and engage students in creating an edible garden for them to replicate at home, thus providing food for their families over the long-term.
		Source: *1.* Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 8. 2. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 3. Son de Santa Lucía, *Informe de Avance del 30 de Diciembre al 30 de Enero, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 1-32. 4. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36.
		RECOMMENDATIONS The project team is committed to studying and involving the community to preserve and enhance their culture. To further improve these efforts, the environment could be also part of the conservation, restoration, and educational initiatives, to raise awareness of the environmental richness of the region.
QL3.2 Preserve Views and Local Character	11	Conserving
		The project was designed with respect to the natural features of the site to preserve the views and local character of the region. The buildings are 2 stories tall to avoid blocking the view and were placed in such a way to utilize natural lighting and ventilation The design process aims to instill an enhanced sense of ownership and respect for the importance of infrastructure among the people. The project team also collaborated with community members to identify those who had the best historical and cultural knowledge, and those with artistic skills, to identify the immaterial cultural value of the site. In addition, the team researched the local fauna and flora of the region to evaluate the ecological significance of the place. Furthermore, the team organized an activity open to the community to embellish a building by painting a mural, thus reaffirming cultural processes, historic memory and reinforcing social networks. This also helped in raising the self-esteem of community members by introducing something for them to be proud of.
		Source: 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 1-34.

		2. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 3. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36. 4. Son de Santa Lucía, *Informe de Avance del 30 de Diciembre al 30 de Enero, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 7-14
		RECOMMENDATIONS The project team should prepare an inventory of all natural landscape features that need to be protected around the project (or provide the fauna and flora studies that have been conducted) to show what has been done to preserve these natural features. Additionally, significant cultural sites and man-made features should be identified and considered in the design process.
QL3.3 Enhance Public Space	11	Conserving
		The project creates new public spaces for the community and a very important facility: a public school. The buildings are planned to serve as public spaces for the community following the concept of social urbanism. The aim is to generate cultural and educational institutions with high aesthetic standards to facilitate social transformation. By involving the community in the decision-making process, public spaces can be sustained by the people, creating an enhanced sense of ownership.
		Source: 1. Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 8.
		RECOMMENDATIONS The project team is committed to enhancing public spaces; adding educational programs on urbanism and parks could help further improve public space throughout the region. For example, the project could invite the kids and the community to picture, draw or describe what public spaces would they prefer to see in their municipality. Eventually, these ideas could be assessed and, like the mural, be part of contests driven by the community.
QL 4.1- Identify and address the needs of women and diverse communities (indigenous or afro-	3	Superior
		To identify and align with the needs of diverse communities the project team engaged people through community meetings before developing the project. First, the team selected a team of faculty, parents, and students from the higher levels, with whom they developed a methodology to identify community needs. The activities aimed to solicit community feedback regarding the educational system, the school and the aspirations of the community. The meetings included women and men, and the project's architect, Carlos Bell, was in charge of coordinating the activity. The community identified several weaknesses, strengths, opportunities and threats relevant to the proposed school and the design process was based on these findings.

descendant peoples)		*Source:* 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9.
		RECOMMENDATION Even though women were part of the meetings, the project did not specifically address their needs and vulnerabilities directly. The social engagement activities focused on the needs of the institution and the stakeholders of the school in general. A report that documents the risks and hazards to women's health and safety in the community would be relevant to the problems with sexism in the Colombian context. Researching these and implementing relevant initiatives would be the next recommended step. Moreover, it is also recommended to identify issues concerning the LGBT community, specifically how they could be integrated in the project and into the community, and how their needs and safety cold be addressed.
QL4.2 - Stimulate and promote women's economic empowerment	2	Enhanced
		The project address issues concerning women in terms of sexual education to prevent pregnancy at early ages and aims to stimulate the community's economic empowerment over the long-term.
		Source: 1. N/A
		RECOMMENDATIONS The project team should consider assessing how could the building affect women's lives and stimulate their economic empowerment through the creation of sustainable livelihoods, local procurement, job creation, capacity building and training programs. The project team should document how many women are employed and their skill levels, and any efforts implemented specifically to benefit local women.
QL4.3 - Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	1	Improved
		With the goal to improve access, mobility, and safety the project team included women and people of African descent in the meetings. However, the topics concerning mobility and access were not directly addressed in these stakeholder meetings.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9.
		RECOMMENDATIONS The project team should consider the mobility patterns and needs of the different social groups, especially with regard to their safety. This could be addressed first by identifying barriers to women's and other vulnerable groups' mobility and access, to then locate, design and construct future projects aimed to tackle these issues. Feedback mechanisms on how the project has changed the safety and transportation of vulnerable groups and what could be done to improve them, are especially relevant to the current phase of the project. Moreover,

		the team should consider whether the development is affecting the mobility patterns of the community, and focus on identifying initiatives to avoid relevant barriers.
QL0.0 Innovate Or Exceed Credit Requirements		N/A
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SUB CATEGORY:LEADERSHIP		
	Score	**STA. LUCIA PROJECT.**
LD1.1 Provide Effective Leadership And Commitment	17	Conserving There project team is committed to leadership and achieving sustainability goals. The mission statement of the Santa Lucía Project operators underscores their commitment to providing a public school to improve the quality of life of the children and youth, and contribute to the development of the municipality. The project team has provided monthly reports informing the progress of the socio-environmental program called *Son de Santa Lucía* and the edible garden plan as part of their strategy for environmental conservation, which aligns with the socioeconomic development of the local neighborhoods. The Santa Lucía Project exemplifies effective leadership and commitment by striving to integrate the public school with the surrounding community. The project team is sharing the responsibility in the decision-making process by using a dynamic technique called METAPLAN. which uses cards to allow the free expression of each participant, a SWOT matrix that enables rapid problem diagnosis within the given situation, brainstorming to decipher the expectations of the community regarding the school. The team also informs students about professional career paths, which stimulates and engages their professional interests. The team's commitment is supported by activities undertaken beyond the scope of the direct influence area of the project. Some efforts have been taken to foster leadership and social development to address the economic, environmental and social aspects of the community, especially with its edible garden program. The municipality of Santa Lucia was historically characterized by an economy based on agriculture, fishing and cattle, but these practices are now abandoned. The project team recognizes that it is essential to focus on these practices from basic education, and has thus proposed the edible garden initiative with the goal to revitalize a degraded area and enhance the skills and capabilities of the students so that they can replicate these initiatives in their homes. *Source:* *1.* Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-33. 2. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 3. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36.

		RECOMMENDATIONS: The project team's commitment to supporting the development of the community is evident, through the aforementioned initiatives and efforts to consider community input on the project. The project team should provide clear documentation of how the community input was incorporated in the design and how sustainability was approached.
LD1.2 Establish A Sustainability Management System	4	Enhanced
		The project team recognizes the importance of sustainability, but there is no single point authority at a high level in the project, and there are no clear roles and responsibilities amongst the project team with regard to sustainability, nor a sustainability management system. The Santa Lucia project's sustainability approach is mostly focused on the social pillar through the social programs implemented during the design, construction and operation phases, as well as the bioclimatic architectural features. Certain environmental, economic and social aspects of the Santa Lucia project have been prioritized within the project team's goals and commitments, for instance, the social program *Son de Santa Lucia* that ensures that the project is aligned with the community needs, the edible garden program, and the environmental aspect of the project covered through bioclimatic architectural design. The scope of the initiatives established during the design, construction and operation phases of the Santa Lucia project seem sufficient to address the social aspects of the project. The project team's goal to create a sustainable building is achieved by following sustainable design practices**,** but no information has been provided on studies assessing flooding risks or any other possible natural hazards to establish preventative measures or contingency plans.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 2. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36. 3. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 1-34.
		RECOMMENDATIONS: The project team should focus on creating a management system that ensures effective operations after the completion of construction works and clarifies the roles and authorities responsible for the sustainable performance of the project, considering economic and environmental parameters in addition to the social pillar. The team should also show how the project aligns with health and safety standards to improve social performance and how these could be affected with time. The project should be able to handle extraordinary change in environmental operating conditions and documentation should be provided on its ability to address these changes.
LD1.3 Foster Collaboration And Teamwork	8	Superior
		The owner and the project team recognize the importance of working together as a team to achieve high levels of sustainable performance. Principles of collaboration and teamwork are incorporated in the design, construction and operation phases of the project through meetings and workshops that involve a set of stakeholders. The project team started during the design phase by identifying the affected communities, such as students and their parents,

		through the use of an interdisciplinary team on site, the *Parque Cultural del Caribe* (PCC). The work of the PCC enhanced the sense of property and pride amongst the community. The project team organized several meetings with the affected communities to identify their concerns, and how could they prevent any problems associated with the previous school from happening again. Collaboration and teamwork were also fostered through various activities to identify opportunities for improving the project's sustainability performance. Through the edible garden program students and instructors would have the opportunity to plant and to learn how to appreciate and enhance this stigmatized cultural practice. Student participation is also strongly encouraged, through social engagement programs and cultural activities. This commitment aims to generate a change in attitude and foster youth leadership and environmental responsibility throughout the community.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 2. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36. 3. Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-33. 4. Son de Santa Lucía, *Informe de Avance del 30 de Diciembre al 30 de Enero, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 8.
		RECOMMENDATIONS The project team could try to identify additional activities to specifically address sustainability from an environmental perspective and how the community's input could be better addressed in the design process. Community meetings could include activities were people propose sustainable strategies such as new recycling methods and how to reduce energy and water consumption. These meetings could consider the importance of risk sharing to attain higher performance. The project team could also provide documentation explaining how the integration of the project team and the contractor team was achieved, specifically how did employees communicate and whether planned works affected nearby communities.
LD1.4 Provide For Stakeholder Involvement	14	Conserving The *Argos* Foundation has the goal to establish a social affairs program to foster the participation and involvement of stakeholders. As such, the Santa Lucia project team has established a meaningful program for stakeholder identification, engagement, and involvement in project decision-making, the *Son de Santa Lucia* initiative. *Parque Cultural del Caribe* (PCC) was chosen by the *Argos Foundation* to act as the social facilitator and account for community needs, goals, and issues through a series of activities that could facilitate the participative process. The Argos Foundation initially used a process that followed specific methodologies after

		affected people were identified, such as such SWOT matrices that enable rapid problem diagnosis of the situation; the dynamic METAPLAN methodology, which uses cards to allow the free expression of each participant; brainstorming to understand the expectations and community aspirations regarding the school. PCC held numerous meetings with the community; the main goal was to develop a comprehensive strategy based on strengthening the cultural identity and social structure of communities, thereby facilitating and promoting community participation, while also demonstrating tools for their sustainability.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 2. Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-33.
		RECOMMENDATIONS Additional documentation is needed to demonstrate how did the community's input contribute to the design of the school, and their involvement in project decision making during the planning phase of the project. Moreover, it is important to consider younger children as stakeholders because they are the users of the school and is their responsibility to take care of the facilities. This should be considered as a two-way communication in which the project listens to their needs and they provide coherent answers to their worries. Children could be easily involved in activities and that is helpful for the socialization process.
LD2.1 Pursue By-Product Synergy Opportunities	0	No Score
		No information has been provided indicating the use of unwanted materials or by-products from nearby facilities. The identification of such materials could considerably reduce project costs, especially discarded materials from nearby locations.
		Source: 1. N/A
		RECOMMENDATIONS The project team should investigate the availability of nearby industrial facilities and provide documentation showing comprehensive efforts to identify and pursue by-product synergy opportunities. Educational programs on reducing, reusing, and recycling waste and materials would also be especially relevant for an educational institution.
LD2.2 Improve Infrastructure Integration	3	Enhanced
		The team took comprehensive efforts to align the project with the context and needs of the community, The design respects the non-physical assets of the municipality of Santa Lucía, and social engagement programs acknowledge and promote the needs and aspirations of nearby communities. The Son de Santa Lucia program for socio-environmental integration helped promote and acknowledge the community's ancestral practices. The project team also promoted the cultural activities of the municipality, through the recognition of the importance of the "Son

		de Negros" and the "Sexteto musical", which were the inspiration for a panel in front of the school painted with characters from these cultural groups.
		Source: 1. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. 2. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46. 3. Fundación Argos and Parque Cutural del Caribe, *Investigación del Patrimonio Inmaterial del Municipio de Santa Lucía: Balance Historiográfico.* (Atlántico: 2014), 1-12. 4. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36. 5. García Castro, Karoll, *Trabajo Etnográfico* (Atlántico: 2014), 1-50.
		RECOMMENDATIONS The project team should consider investigating additional methods and issues other than social-related initiatives. The team could also consider optimizing the urban infrastructures of the area around the school, restoring them in such a way to enhance the overall community efficiency and effectiveness. In regards to performance in this credit, the team should provide documents demonstrating the efforts to integrate the project and how the facilities could be used for other purposes. The team should also consider the risks of the area and ensure that kids are safe inside the school. Some creative ways of safeguarding the school include water ponds and small bushes. Fences and walls are not recommended.
LD3.1 Plan for Long-Term Monitoring & Maintenance	3	Enhanced
		Due to the inherent constraints of a school located in a low-income community, the design strategy of the project aims to minimize maintenance requirements. The strategy included the selection of more durable materials that would not require specific maintenance to sustain good conditions.
		Source: 1. N/A
		RECOMMENDATIONS Besides the use of low-maintenance materials for the construction of the project, it is recommended to provide additional information on the availability of monitoring and maintenance processes during the entire lifespan of the project.
LD3.2 Address Conflicting Regulations & Policies	2	Enhanced
		The Argos Foundation has established partnerships and focused on collaborating with local institutions, as well as other political representatives such as the Ministry of Education.
		Source:

		1. N/A
		RECOMMENDATIONS Provide documentation on how the project team has analyzed local laws, standards, regulations, and/or policies, and addressed if they may hinder the project's sustainability performance. The project team should develop an assessment of negative impacts from conflicting regulations and policies.
LD3.3 Extend Useful Life	6	Superior
		As a result of the initiatives to use more durable materials it is expected that the useful life of the building will also be extended. The school is part of a bigger institution that will allow kids to transfer from one to another according to age and grade. This creates a full education system approach what will help guarantee full education coverage throughout the area.
		Source: 1. N/A
		RECOMMENDATIONS The project team should consider incorporating a life cycle assessment or the specifications for durable materials (compared to the ones specified in industry norms). It is important to conduct a feasibility study to identify potential areas where investments to extend the useful life would offer long-term cost savings in regards to a possible future expansion design, the durability of the building and reduced maintenance. Moreover, using and researching vandal-resistant materials and construction techniques would be useful for new repairs and future projects.
LD0.0 Innovate Or Exceed Credit Requirements	6	Industry norms were exceeded in regards to performance and integration of sustainable practices. The goal specified by the Argos Foundation - construction of educational infrastructure in Colombia- excels any requirement and regulation in the country and should be promoted as a model for other institutions worldwide that want to promote sustainable practices and positively impact the region.
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CATEGORY II: CLIMATE AND ENVIRONMENT		
RESOURCE ALLOCATION		
	Score	
RA1.1 Reduce Net Embodied Energy	2	Improved
		The bioclimatic and acoustic architectural features were simulated before construction by using a small-scale model. By analyzing the building's performance before construction and applying natural features such as daylight and winds, allowed the team to efficiently implement its design strategy, which focuses on reducing energy consumption. No artificial aids were added in most areas of the building, such as air conditioning systems or bulbs, which minimizes maintenance costs. However, the calculations did not adequately

		simulate the area's high temperatures and the school is currently installing fans. This will increase the energy consumption but will also enhance comfort. The project should consider soliciting feedback from every department to understand what they lack and whether that might impact energy consumption. The documentation mentions the use of local materials, which overall decreases the net embodied energy since it reduces the need for imported materials. The project team did not provide a life-cycle energy assessment to support the quantification of the net embodied energy of the project. If conducted, this study should follow recognized and accepted methodologies with correct data sources and software; the origin and type of materials used should also be incorporated into this assessment.
		Source: 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 3-5.
		RECOMMENDATIONS A life-cycle energy assessment should be conducted and detailed information should be provided on the exact source of the materials. It is further recommended to ensure that the sustainable practices such as the bioclimatic architectural features are working efficiently. It is important to get feedback from the users to see how well the facilities perform.
RA1.2 Support Sustainable Procurement Practices	2	Improved
		The project team strives to use local materials and support sustainable procurement practices. The concrete used for construction was supplied by Argos (which uses sustainable procurement practices), however, no additional information has been provided for the rest of materials used during construction. The bioclimatic architecture proposal aims to avoid the use of artificial controls for heating and cooling. Instead, the climate and natural phenomena of the site are utilized to satisfy energy needs. Moreover, the team wants to follow local construction techniques and technologies, but there is little documentation on whether local materials or architectural practices used in the project, nor a list of sources for the materials and suppliers.
		Source: 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 3.
		RECOMMENDATIONS The project team should develop a list of providers to increase the amount of materials sourced from suppliers with sustainable procurement policies and practices. Policies and criteria to identify and select materials and suppliers should also be clearly defined, while it is especially relevant to search for local producers. Moreover, it would be very beneficial for the region at large to help these local material suppliers enhance their practices and achieve sustainability standards.

RA1.3 Use Recycled Materials	0	No Score
		The project team did not provide information on the exact percentage of recycled materials used in the project. There is no information on the use of potentially recyclable building components and construction materials, especially those that could have been recycled from the previous school.
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 12-18.
		RECOMMENDATIONS The project team should have an inventory of the materials and components that are recyclable. Since the project is essentially a reconstruction of a new school, some materials and by-products of the previous building could have been used for the works. This should be documented to identify the potential for virgin material reduction that could be achieved for future projects.
RA1.4 Use Regional Materials	9	Superior
		One of the principal criteria in the project design phase was to maximize the use of inexpensive and durable material that can be easily replaced when broken. As identified during the onsite visit, the majority of the concrete was used in the structure and some for pavements, concrete bricks for walls, aluminum for windows and regular bricks for some other areas of the school. It is estimated that these materials were locally sourced (distance was less than 800 km)
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 12-18.
		RECOMMENDATIONS The project team develop an inventory of every material used in the project that specifies their source. . Ideally, soils or aggregates should be located within 50 miles, plants within 250 miles; and other materials no further than 500 miles.
RA1.5 Divert Waste from Landfills	3	Improved
		The documentation demonstrates that the team has environmental control over the recycling process during construction, but no detailed information has been provided. As an educational institution the team conducts workshops to raise awareness of environmental problems and how to collect, separate and recycle waste. Furthermore, how the environment affects quality of life, and how to care for and manage natural resources is also explained. Specific efforts should focus on food waste from the school kitchen and how to best process it, especially to avoid unsanitary disposal and minimize water and soil pollution risks.
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 12-18.

		2. Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 6. 3. Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual Junio de 2013* (2013), 26.
		RECOMMENDATIONS The team should develop a waste management plan to reduce waste generation, increase recycling and divert waste from landfills during the operation of the school. The plan should demonstrate the different types of waste and the methods used to reduce, reuse or recycle, them. The team also needs to consider what types of waste are toxic to minimize their generation. The team should have clear policies on how contractors need to manage waste to avoid landfill disposal, but also to avoid using toxic materials that are not recyclable or biodegradable. Moreover, an inventory could also show the percentage of waste produced in the kitchen and specify methods for recovery, such as composting.
RA1.6 Reduce Excavated Materials Taken Off Site	4	Enhanced
		Since the building has been elevated from the ground level in order to reduce flooding risks, small amounts of excavated materials were expected during construction. The building is located on a flat area, and as such cut and fill excavation requirements were low.
		Source: 1. N/A
		RECOMMENDATIONS The team should report the exact percentage of excavated materials reused on-site. Regarding the demolition of the previous school, some materials could have been useful for new construction or to elevate the terrain and achieve enhanced sustainability performance.
RA1.7 Provide for Deconstructio n & Recycling	0	No Score
		The project team did not provide an inventory of the materials that could be used during the deconstruction and recycling phase, while the structures and components do not seem modular enough to allow for efficient recycling in the case of deconstruction.
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 12-18.
		RECOMMENDATIONS The project team should consider the entire life cycle of the educational institution beyond its useful period, and how its structures could be used in case the school is decommissioned The design should be flexible for multiple future uses and the team should consider strategies for deconstruction, recycling and upcycling for all materials and equipment. Additionally, an

		inventory of materials that have some value for future use is recommended, and the team should consider this before choosing materials or building components. This is also applicable to the toxicity levels of some materials that cannot be recycled or are not biodegradable.
RA2.1 Reduce Energy Consumption	7	Enhanced
		The project team is committed to following sustainable practices and reducing energy consumption. However, there is no documentation demonstrating reduction percentages over industry norms. The geometry and orientation of the buildings takes advantage of dominant winds through bioclimatic architectural features, providing enhanced thermal comfort inside the buildings. The concrete structure provides cooling through specialized cross ventilation in the slabs. This pressure system works as a hot air extractor and keeps the temperature cool, thus the savings in energy are considerable. Additionally, a green roof also helps with thermal control on the ceiling. Moreover, the buildings are placed in such a way to decrease solar radiation exposure in most of the project's spaces. The library has a double-layered façade that prevents direct solar exposure and helps A/C systems work efficiently since they need to cool the interior of the building and not the heat generated by the sun. Considering the usual hot temperatures in the area, all of these efforts result in great reductions in energy consumption; however, currently the users of the building feel that these strategies were not enough to sustain comfortable temperatures and additional aids will eventually be required.
		Source: 1. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 3-34.
		RECOMMENDATIONS The project team should first consider conducting an energy assessment to forecast the annual energy consumption levels over the entire life cycle of the project. Processes and equipment that reduce energy consumption in the long term can then be specified. The industry norms should be used as a benchmark and every energy source should be converted into BTU for the calculations. The project team should also solicit feedback from the users of the facility to identify potential performance problems. Since the design strategies were not enough to provide comfortable temperatures throughout the school, the team should consider the identified gaps and add any aids required to prevent high temperatures from influencing the school's learning environment. Importantly, since this would impact the school's energy performance, it is recommended to consider these aids at the beginning of the energy assessment.
RA2.2 Use Renewable Energy	0	No Score
		The project utilizes the landscape of the site as a passive source of renewable energy with the help of architectural design. However, the use of active technologies such as solar panels, wind turbines, or other technologies is not specified in the documentation. Moreover, there is no assessment on the operational energy consumption, which should be broken down by source type.

		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 11-18.
		RECOMMENDATIONS The project team did not provide any evidence of plans to use renewable energy sources. The composting process in the edible garden program would produce methane, which could be studied as a potential source of natural gas for energy. The team could also encourage students to study and propose new technologies through science fairs and experiments. Additionally, the team should investigate the operational energy consumption levels, and the sources of energy used for each operation to identify whether renewable energy alternatives might be used as an alternative.
RA 2.3 Commission & Monitor Energy Systems	3	Enhanced
		Specific initiatives have been implemented during the design phase in order to minimize the use of energy systems. The bioclimatic design features are expected to minimize the need of A/C systems within the building reducing the amount of controls required for operations.
		Source: 1. N/A
		RECOMMENDATIONS Some of the design features could fail because of human errors or degradation over time during operations. A monitoring plan to ensure that equipment and bioclimatic architectural features are working efficiently could enhance the building's performance over the long term. The project tem should make sure to consult an independent commissioning authority.
RA3.1 Protect Fresh Water Availability	0	No Score
		There is no evidence demonstrating that the team has conducted a water availability assessment to protect freshwater bodies. However, the production of organic fertilizer through composting and its use in the edible garden would help prevent soil erosion. For the edible garden program the team quantified the water requirements since the plantations need between 350 and 500 liters of water on a weekly basis. Therefore, the collection and storage of rainwater has been promoted for this purpose, as well as measures to prevent water contamination. It is important to note that these strategies have not yet been implemented.
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 5-18.
		RECOMMENDATIONS The team needs to conduct a water availability assessment to identify the location, type, quantity, rate of recharge and quality of available water resources in the immediate surroundings. The assessment should include estimations of long-term needs and average

		peak demands, including estimates on how much water is available, how would it be replenished, whether it could be recycled, and finally where and how will water be disposed. The quality and quantity of discharged water, as well as potential water discharge impacts should be taken to consideration. The team should identify initiatives to minimize the consumption of fresh water and protect the availability of water resources in the region. Planning for a long-term net positive impact would be instrumental in avoiding impacts on natural ecosystems.
RA3.2 Reduce Potable Water Consumption	0	No Score
		The team has investigated the feasibility of collecting rainwater in the roof for later use in order to reduce potable water consumption. However, the exact potential percentage of reduction is not shown and strategies to reduce water consumption are not demonstrated in the documentation.
		Source: 1. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 5.
		RECOMMENDATIONS The team could implement educational and awareness strategies to protect and reduce the consumption of potable water. Design features could include water efficient equipment and mechanisms to recycle rainwater or greywater. Utilizing non-potable water can reduce water consumption and may be accomplished through design, construction and operational modifications with a conservation approach. The project team must also document the exact percentage that could be saved by implementing these strategies.
RA3.3 Monitor Water Systems	0	No Score
		There is no evidence of water usage monitoring plans and preventative measures to detect leaks and avoid spillages. The project team needs to meet regulatory requirements for long-term monitoring of water consumption.
		Source: 1. N/A
		RECOMMENDATIONS A water monitoring plan and assessment should be conducted by the project team. An independent monitoring authority should be responsible for data collection and benchmarking.
RA 0.0 Innovate Or Exceed Credit Requirements	5	An innovation credit has been given to the project in order to acknowledge the creative thinking and innovative bioclimatic design practices. The Argos Foundation has integrated sustainable practices into the project design as a solution for low maintenance as well as to enhance the school's learning environment.
	35	

NATURAL WORLD		
	Score	STA. MARIA PROJECT
NW1.1 Preserve Prime Habitat	9	Superior
		The project is located in a residential area. The site was previously used for a school that was destroyed by the excess floods of 2010, therefore the ecological value of the immediate surrounding is relatively low. No information has been provided in regards to local fauna and flora, or protected natural areas and whether the project introduces potential risks to natural environments. The edible garden program promotes agricultural practices and would facilitate the introduction of native plants, that may or may not be in risk of extinction.
		Source: 1. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46. 2. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36.
		RECOMMENDATIONS The project team should provide third-party documentation supporting that the site is not considered as prime habitat and no sensitive areas are located within the immediate surroundings. Further documentation is required demonstrating the size of the proposed edible garden or any other green areas within the project's boundaries, as well as a site map outlining the location and species of used plants.
NW1.2 Preserve Wetlands and Surface Water	0	No Score
		Although the project is located in a previously developed site, no documentation was submitted stating that a vegetation and soil protection zone was implemented to protect adjacent wetlands and water bodies. The *Canal del Dique* is located close to the project site, but no information was found regarding initiatives for the development of buffer zones around this water body.
		Source: 1. Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46.
		RECOMMENDATIONS This credit evaluates the project based on its proximity to a wetland, shoreline or any other water body, and the creation of a buffer zone to protect the wetlands and surface water. Documentation regarding any buffer zone, either the proposal of a new buffer zone or the restoration of an existing one, is necessary for the evaluation of this credit. The preservation of wetlands and water bodies is of greater importance to the project since they can prevent or mitigate future floods. The project could also provide documentation demonstrating that the project does not affect the *Canal del Dique,* which is the closest water body.
NW1.3 Preserve Prime Farmland	**6**	**Superior**
		This credit evaluates the identification and protection of soils designated as prime farmland, unique farmland, or farmland of national importance. The project is located in a previously developed area. This area was previously occupied by the old school; therefore, prime

		farmland was not disturbed for the construction of the project. ***Source:*** **1. N/A** ***RECOMMENDATIONS*** Provide documentation (government surveys or soil studies) demonstrating that the project is not located in a prime farmland, and indicating if there is any prime farmland located close to the site.
NW1.4 Avoid Adverse Geology	**0**	**Non Applicable** To be able to score in this credit, the project team has to identify and delineate any faults and other adverse geologic formations, as well as identify and safeguard aquifers close to the project; it is currently unknown if adverse formations exist in the area, therefore this credit is considered non applicable ***Source:*** **1. N/A** ***RECOMMENDATIONS***
NW1.5 Preserve Floodplain Functions	**0**	**No Score** This credit is considered non applicable. Documentation of floodplain identification and studies regarding the maintenance of water management capacities and capabilities is required. ***Source:*** **1.** *N/A* ***RECOMMENDATIONS*** It is recommended to provide information regarding floodplain identification, and efforts to avoid and maintain floodplain functions. A flood emergency management plan to address the operation and/or evacuation plan for the project is very important due to the high risk zone. It is recommended that the project team takes into consideration the possible beneficial use of stormwater runoff, limits or eliminates the use of impervious surfaces to allow groundwater infiltration, and maintains or enhances the vegetation and soil protection zones. Using mangrove and other native species or wetlands could help the project mitigate flooding in the area.
NW1.6 Avoid Unsuitable Development	**6**	**Conserving** This credit evaluates if the project avoids steep slopes, or if erosion control and other measures are implemented to protect the constructed works. No hillsides or steep slopes exist within the boundaries of the project.

on Steep Slopes		***Source:*** **1.** N/A
		RECOMMENDATIONS Erosion control and other preventative measures could increase the resiliency of the project, especially since eroded soils absorb less water and are not as helpful during flooding periods.
NW1.7 Preserve Greenfields	15	**Conserving**
		The school is located in a previously developed site, therefore greenfields have not been disturbed by the project.
		Source: **1.** Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 3-5.
		RECOMMENDATIONS Provide documentation showing the exact percentage of the site that was formerly developed and may be classified as a greyfield (by a local state or federal agency)
NW2.1 Manage Stormwater	**4**	**Enhanced**
		According to the documentation, the edible garden program would harvest stormwater for plant irrigation. However, the program has not yet been implemented. Furthermore, documents demonstrating the availability of a drainage plan and applicable runoff reports, were not submitted. Utilizing runoff water could help minimize costs and improve overall water management and water storage capacity.
		Source: **1.** N/A
		RECOMMENDATIONS It is recommended to document the initial pre-development, and final post-development water storage capacity, infiltration, evaporation, water harvesting or cistern storage capacity, and stormwater management plans. Moreover, information about operational aspects of the tanks that are already in place should be provided.
NW2.2 Reduce Pesticides and Fertilizer Impacts	**0**	**Non Applicable**
		Based on the low availability of green spaces within the boundaries of school this credit is considered non applicable.
		Source: **1.** Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 11-18.
		RECOMMENDATIONS

NW2.3 Prevent Surface and Groundwater Contamination	**0**	**No Score**
		No documentation has been provided demonstrating measures to prevent pollutants from contaminating surface and/or groundwater, and monitor impacts over the operation of the project.
		Source: **1.** N/A
		RECOMMENDATIONS The project team should establish adequate and responsive surface and groundwater quantity and quality monitoring systems to ensure that construction works will not affect water resources. The team should also consider filtering and treating water before releasing it back to water bodies. Finally, documentation demonstrating efforts to reduce the use of or replace hazardous and/or potentially polluting materials with non-hazardous or non-polluting materials should be provided.
NW3.1 Preserve Species Biodiversity	**0**	**Non Applicable**
		This credit is considered non applicable. No documentation was provided in regards to the implementation of species biodiversity preservation activities and it is currently unknown whether the project team intends to improve or restore surrounding natural habitats.
		Source: **1.** Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36.
		RECOMMENDATIONS
NW 3.2 Control Invasive Species	**0**	**No Score**
		The use of locally sourced non-invasive plants is recommended for the edible garden project, however the documents lack information on preventative measures to control invasive species. A small list of pesticides to be made on site is provided in case of pest disturbances, however, further information is needed regarding management/maintenance of invasive species.
		Source: **1.** Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36.
		RECOMMENDATIONS The project team should demonstrate that all species introduced on site are noninvasive. The project team should implement a management plan to counter invasive flora and fauna that may emerge on site. Moreover, documentation of collaboration with state or local

		agencies/personnel qualified for environmental consulting and analysis should be provided
NW3.3 Restore Disturbed Soils	**8**	**Conserving**
		The school building was elevated as part of the team's strategy to minimize flooding risks. This required minimal soil disturbances and excessive excavation was not necessary.
		Source: **1.** N/A
		RECOMMENDATIONS Revegetation efforts will help restore soils and thus the area will be better equipped to support, biological communities, water storage and water infiltration. Disturbed soils cannot hold water, making them incapable of supporting vegetation and absorbing floodwater. Revitalizing disturbed soils helps prevent floods, so an overall healthy soil environment is strongly recommended. Soil restoration activities should be thoroughly documented.
NW3.4 Maintain wetland and surface water functions.	**0**	**No Score**
		No information was provided to determine whether the project could directly or indirectly affect wetland and surface water functions now or in the future.
		Source: **1.** N/A
		RECOMMENDATIONS Documentation demonstrating any maintenance or enhancement of hydrological connections, water quality, habitat and/or sediment transportation should be provided. Further, the team should document the quality of the project's main sources of potable water, and analyze how could water quality be maintained after the construction works.
NW 0.0 Innovate or Exceed Credit Requirements		***N/A***
	48	

CLIMATE AND RISK		
	Score	**STA. LUCIA PROJECT**
CR1.1 Reduce Greenhouse Gas Emissions	**4**	**Improved**
		The project team has not referenced a life-cycle carbon assessment or footprint analysis that demonstrates a reduction in greenhouse gas emissions. During construction, the subcontractor

		follows the greenhouse gas emission regulations, and has certified equipment that prevents the generation of these contaminants, but the exact percentage of reduction is not shown. Nonetheless, If the school has science labs with harmful chemicals, these should be documented and included in the assessment. Also, the possibility of methane generation from the edible garden composting process should be taken into consideration.
		Source: **1.** Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual De Interventoria N° 8 Periodo Desde 01 Enero Al 31 De Enero De 2014* (2014), 59.
		RECOMMENDATIONS The project team should conduct a life-cycle carbon assessment or a footprint analysis using rigorous available data sources and software. Some devices and applications that check air quality could be introduced if any factories and industrial sites exist near the project. By identifying the presence of pollutants in the air, the team could try to find the source and reduce carbon emissions. The goal should be to achieve carbon neutral status in and around the school, to improve air quality and the learning environment. The use of native plants such as bamboo could also be helpful in reducing emissions, while every source of greenhouse gas emissions should be documented and managed.
CR1.2 Reduce Air Pollutant Emissions	**0**	**No Score**
		In order to reduce air pollutant emissions, the team has appointed CONSORCIO TECNISUELOS GUTIÉRREZ DÍAZ (a private enterprise) to monitor air quality during construction. In the monthly interventions, the subcontractor did not identify any emissions issues. However, this credit is not directly applicable to the project since the team does not follow air quality standard regulations and has not explicitly implemented initiatives to avoid their generation.
		Source: **1.** Gutierrez Diaz y CIA and Tecnisuelos, *Informe Mensual De Interventoria N° 8 Periodo Desde 01 Enero Al 31 De Enero De 2014* (2014), 55-59.
		RECOMMENDATIONS The team should specifically focus on identifying hazardous materials, including types of paints with lead, or asbestos that can be very harmful to the children. Moreover, dust should be managed regularly and if chemistry labs exist in the school or other departments that use potentially hazardous chemicals, preventative measures should be documented to avoid introducing additional risks.
CR2.1 Assess Climate Threat	**0**	**No Score**
		The project team did not provide documents referencing studies on the effects of climate change. The site is located in an area prone to extreme flooding, while the previous school was completely flooded in 2010. Therefore, the team should study the risks of extreme weather events, and temperature and precipitation changes that may influence water and energy consumption.
		Source:

		1. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 25-40.
		RECOMMENDATIONS The team should consider conducting a comprehensive climate impact assessment and adaptation plan that includes a vulnerability assessment, a risk assessment, and an adaptation assessment. A life-cycle assessment that quantifies the net carbon emissions should also be conducted. The process should include collaborations with local emergency department and meetings with the community.
CR2.2 Avoid Traps And Vulnerabilities	**2**	**Improved**
		The school building was elevated in order to minimize the vulnerabilities of the site, especially to extreme flooding. The team should demonstrate how the issue of vulnerability was addressed in the design process and review local regulations and standards that could introduce other risks.
		Source: **1.** N/A
		RECOMMENDATIONS The team should work with community decision makers and stakeholders to enhance the project's robustness and resiliency. Producing a comprehensive and long-term assessment of the community's resiliency, including resource demand and supplies and resource and infrastructure traps and vulnerabilities is strongly recommended. The team should also investigate long-term risks and consider design alternatives The identified design criteria can be used in future educational infrastructures.
CR2.3 Prepare For Long-Term Adaptability	**0**	**No Score**
		There is no evidence of any strategies or adaptation plans to prepare for long-term hazards.
		Source: **1. N/A**
		RECOMMENDATIONS The project team should investigate potential long-term hazards and implement preventative measures to safeguard the project against these effects. Hazards include desertification, beach erosion, and loss of wetlands, among others. The team should especially consider flooding and extreme weather events due to the vulnerability of the site. Some of the strategies could include decentralizing systems to distribute risk and enhance robustness, and using natural infrastructure such as green areas that can absorb water and prevent flooding, The team should also consider identifying alternative sources of supplies.
CR2.4 Prepare For Short-Term Hazards	**4**	**Improved**
		Short-term hazards such as earthquakes, flooding and fires should be considered as potential threats to the educational infrastructure. The project team has slightly minimize the risk of flooding by raising the project, nevertheless a plan to prepare for long term climate change should be implemented on the project to minimize the possible risks. No specific technical information has been provided according to the raise of the project.

		Source: ***1.*** **On site visit**
		RECOMMENDATIONS A detailed risk assessment should be conducted to determine what are the short-term risks that can compromise not just the safety of the building but the one from the students as well. Increase the permeable surface through more green spaces can be one of the strategies to follow in order to minimize the risk of flooding in the future.
CR2.5 Manage Heat Island Effects	**2**	**Enhanced**
		Although the project team strived to use soft green surfaces, a percentage of reduction in the Solar Reflectance Index SRI is not specifically presented in the documentation. The Solar Reflectance Index (SRI) "is a measure of the surface's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black is 0 and a standard white is 100." Measuring the SRI is important because many hard surfaces can alter the area's microclimate, since they absorb a large percentage of solar radiation, thus heating surrounding surfaces and environments. This not only affects energy consumption because of the need for additional cooling, but can also affect local vegetation and wildlife, as well as community comfort.
		Source: **1. N/A**
		RECOMMENDATIONS The project team should consider using materials with high SRI when possible, and avoid hard surfaces that support the heat island effect. Some of the initiatives that could be implemented include to increase vegetation, which cools through evapotranspiration, and shaded areas, either through structures such as shade panels, or trees that provide shade within five years of planting (as measured at 12 noon on summer solstice). Rooftops and pavement need special attention since they are common triggers of heat island effects.
CR0.0 Innovate Or Exceed Credit Requirements		***N/A***
	10	
OVERALL:	**282**	

Santa Lucia School, Colombia

APPENDIX H: SOURCES

DOCUMENTATION PROVIDED
General Information.
Fundación Argos and Parque Cutural del Caribe, *Investigación del Patrimonio Inmaterial del Municipio de Santa Lucía: Balance Historiográfico.* (Atlántico: 2014), 1-12. Son de Santa Lucía, *Informe de Avance del 30 de Noviembre al 30 de Deciembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-42. Son de Santa Lucía, *Informe de Avance del 24 de Julio al 30 de Agosto, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-33. Son de Santa Lucía, *Informe de Avance del 30 de Diciembre al 30 de Enero, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 1-32. Son de Santa Lucía, *Informe de Avance del 1 al 30 de Septiembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-38. Son de Santa Lucía, *Informe de Avance del 31 de Octubree al 30 de Noviembre, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2013), 1-25. Fundación Argos and Fundación Telefónica, *Proceso de Socialización Comunitaria del Proyecto para el Nuevo Colegio de Santa Lucía* (Barranquilla: 2012), 1-9. Casseres, S. and Ayala, N. *Diseño del Huerto Escolar del Municipio de Santa Lucía* (Atlántico), 1-36. Arquitectura & Bioclimática, *Asesoria en Comportamiento Térmico, Eficiencia Energética y Recomendaciones Acústicas* (Bogotá: 2011), 1-34. García Castro, Karoll, *Trabajo Etnográfico* (Atlántico: 2014), 1-50.

Son de Santa Lucía. *Informe de Avance del 30 de Diciembre al 30 de Enero, del Acompañamiento Socio Ambiental - Proyectos de Infraestructura Educativa Santa Lucía* (Atlántico: 2014), 1-32.

Carlos Bell Lemus Arq., *Nuevo Establecimiento Educativo De Santa Lucia* (2011), 1-46.

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