CERTIFICATION AND FINANCING PROPOSAL

ALTERNATIVE DRINKING WATER SUPPLY FOR FIVE SCHOOLS IN MONTERREY, NUEVO LEON

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EXECUTIVE SUMMARY

ALTERNATIVE DRINKING WATER SUPPLY FOR FIVE SCHOOLS IN MONTERREY, NUEVO LEON

Project Summary

Project Name:	Alternative Drinking Water Supply for Five Schools in Monterrey
Project Type (Sector):	Drinking water
Objective:	To provide access to safe drinking water for students at five target schools in economically marginalized neighborhoods within urban areas of the City of Monterrey that do not have a reliable water service from the existing water distribution system due to drought conditions, insufficient water supply, and low pressure, resulting in rationing and/or frequent service interruptions.
Expected Outcomes:	▪ Improve access to reliable and sustainable drinking water source for school aged children and adolescents. ▪ Increase drinking water supply from an alternative potable water source. ▪ Eliminate school closures due to lack of drinking water supply.
Population to Benefit: [1]	1,472 students
Sponsor:	Ministry for Sustainable Urban Development of the Municipality of Monterrey, N.L.
Project Cost:	US $550,000.

Financial Summary

Program:	Community Assistance Program (CAP).
Grant Amount:	US$500,000
Percentage of Project Cost:	90.0%
Recipient:	Municipality of Monterrey
Other Funding Sources	US$50,000 from the Municipality of Monterrey.

[1] Source: Information provided by the project sponsor.

CERTIFICATION AND FINANCING PROPOSAL

ALTERNATIVE DRINKING WATER SUPPLY FOR FIVE SCHOOLS IN MONTERREY, NUEVO LEON

1. PROJECT OVERVIEW AND EXPECTED OUTCOMES

The proposed project will provide an alternative drinking water source generated with the use of an innovative hydropanel technology to be installed at five schools in the Municipality of Monterrey, Nuevo León, Mexico (the "Project"). The Project sponsor is the Ministry for Sustainable Urban Development of the municipality of Monterrey, N.L. (SEDUSO). The purpose of the Project is to provide access to safe, sustainable drinking water for school-aged children at schools in marginalized areas of the municipality that have experienced water outages and rationing due to drought, low pressures, and other negative impacts of climate change. The Project is expected to provide sustainable drinking water supply for the schools, minimizing school closures and contributing to a healthy learning environment for students. Approximately 1,472 students at five schools in Monterrey are expected to benefit from this Project.

The Project will be implemented as a pilot approach to evaluate the viability and performance of the panels as a drinking water supply system for areas with similar conditions or remote areas without access. Reporting on water generation and other performance indicators will be required by the funding agreements for the Project.

2. ELIGIBILITY

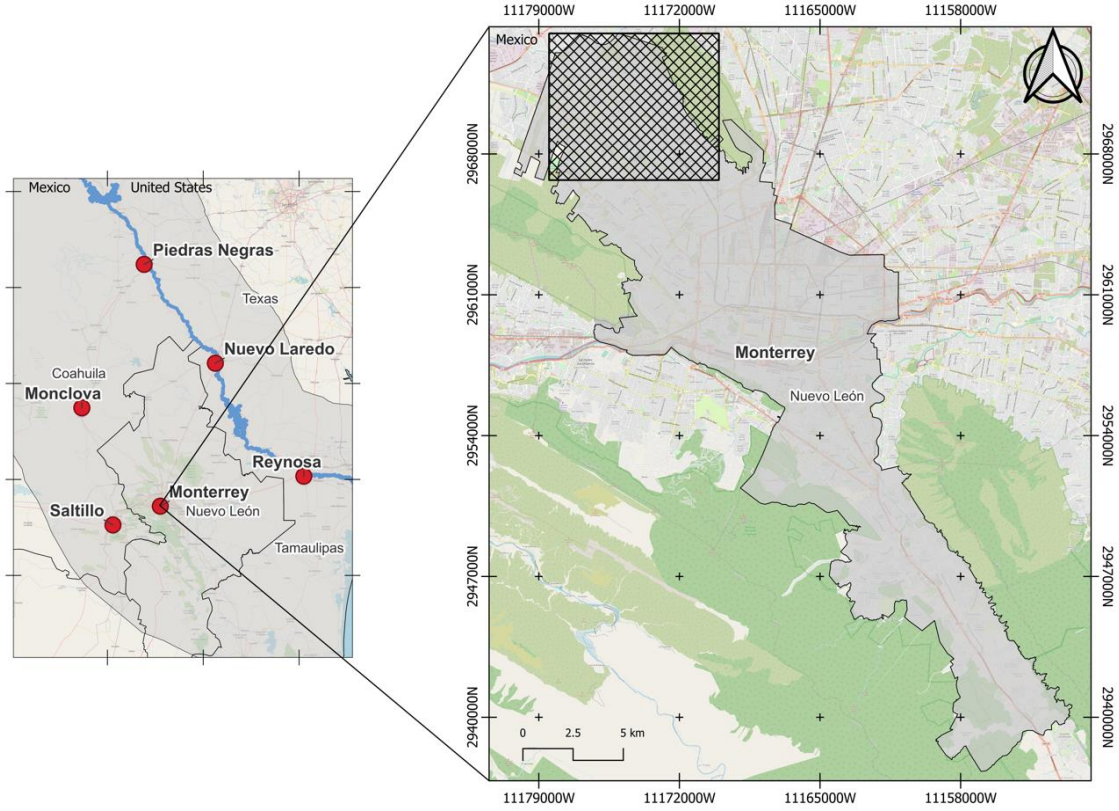
2.1. Project Type

The Project falls within the eligible sector of drinking water.

2.2. Project Location

Hydropanels will be installed at five separate schools within the northern area of the city of Monterrey, Nuevo Léon. The schools are located in the subdivisions of Alianza, Barrio de la Industria, Unidad Modelo, and Valle de Santa Lucía. The proposed Project sites are approximately 95 miles or 150 km south of the US-Mexico border. Figure 1 shows the location of the city of Monterrey in the State of Nuevo Leon and relative to the US-Mexico border, the Project schools are all within the hatched area designated on the figure.

Figure 1
PROJECT LOCATION MAP



2.3. Project Sponsor and Legal Authority

The Project sponsor is the Ministry for Sustainable Urban Development of the Municipality of Monterrey (the "Sponsor" or SEDUSO). SEDUSO is a department of the government of Monterrey, tasked with "guaranteeing the sustainability of the environment, providing social welfare, and improving the quality of life of all Monterrey people". The municipality has provided a letter to SEDUSO with the authorization to proceed with the Project.

3. CERTIFICATION CRITERIA

3.1. Technical Criteria

3.1.1. General Community Profile

According to the 2020 census data completed by INEGI, the metropolitan area of Monterrey has a population of 5,341,171, making it the second largest urban area in Mexico.[2] Approximately 25% of the city's population lives below the poverty level.[3] The Project will be implemented at five schools serving economically distressed populations.

The Project is expected to directly benefit the estimated 1,472 students along with the respective school personnel within the five targeted schools located within areas described as having limited access to basic services such as education, health services, and decent housing in the *Informe de Pobreza y Evaluation 2022 de Nuevo León*. The drinking water generated at the schools may also be offered to families in the surrounding neighborhoods during school holidays or other non-working periods, adding another important social benefit to the implementation of the Project.

Water and wastewater services in Monterrey are provided by the Servicios de Agua y Drenaje de Monterrey (SADM). However, the hydropanels to be installed through the Project will be owned and operated by SEDUSO. SADM will not participate in the Project.

Local Drinking Water System Profile

SADM has overseen the water system in Monterrey since its creation in 1956. Water supply issues are a chronic problem for the municipality, due to its location in a drought-prone area coupled with the rapid growth of the city. Since the 1950s, there have been several decades of double-digit population growth as well as several drought periods. Currently, SADM provides services to more than 5.3 million people.

Due to water shortages in the early 1980s, investments were completed to improve water security, including the construction of the Cerro Prieto Dam for water storage. In 1994, the much larger El Cuchillo Dam was completed, greatly increasing the available storage capacity. The reservoir accounts for approximately 75% of the system's storage capacity. SADM also relies on the local Monterrey aquifer, which is currently being pumped at an unsustainable rate. Even with multiple supply sources, SADM currently does not have adequate water supply to provide reliable and sustainable services throughout the Municipality.

In the summer of 2022, as a result of severe drought conditions over multiple years, reservoirs were at approximately 12% capacity, causing SADM to resort to water rationing as an emergency measure. During that year, SADM was able to supply water for only 6 hours daily from 4 am to 10 am. The lack of water supply continues, and in many subdivisions,

[2] Source: https://www.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/nueva_estruc/702825197926.pdf
[3] Consejo Nacional para la Evaluación de la Política de Desarrollo Social de Mexico.

residents report receiving water for only 3 hours a day and at very low pressures. Hauled water has become essential for daily needs, and residents who can afford onsite water storage have purchased private tanks. However, water hauling has not been an option for the targeted schools due to several factors including cost of transport and storage, difficulties in accessing school sites, and security issues for the water haulers.

Due to the lack of water, many local schools have closed or modified their schedules, negatively impacting the access to education. The schools selected for this Project were closed from February to September 2022. Since the emergency water shortages in Monterrey cannot be resolved in the short-term, alternative methods such as this Project are required to provide water for current needs, especially for these more vulnerable populations.

3.1.2. Project Scope

The scope of the Project will provide a new drinking water source at the schools participating in the program. The water harvesting system will consist of up to 108 hydropanels, plumbing, and dispensers at the selected schools. The panels will be installed in vacant areas of the schools' property. The contract will include staff training for school maintenance staff and SEDUSO for care and maintenance of the system and the delivery of quarterly reports to document performance information such as water production, solar power, and relative humidity for the first five years of operations. The names of the schools, number of students and the proposed distribution of hydropanels are presented in Table 2.

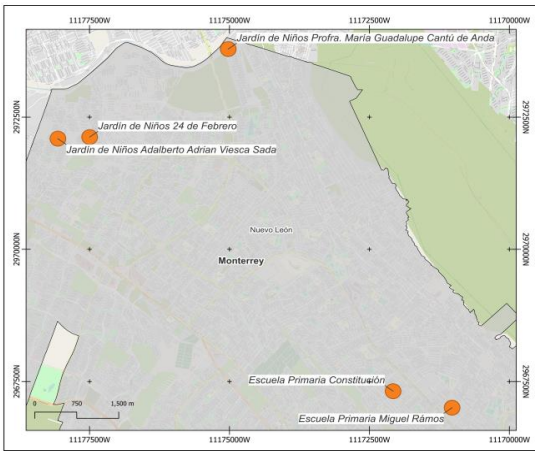
Table 2
Schools Receiving Hydropanels

School	Number of Students	Number of Panels
Professor María Guadalupe Cantú de Anda Kindergarten	40	10
Adalberto Adrian Viesca Sada Preschool	142	20
Constitución Elementary School.	550	28
Miguel Ramos Elementary School	550	30
24 de Febrero Preschool	190	20
Totals	1,472	108

The Project is intended to specifically supplement the drinking water needs of each school. Other needs such as cleaning and sanitary uses will not be supported by the water generated by the hydropanels and will need to be accessed by any water supplied through the traditional services provided by SADM. The panels are a novel approach for generating potable water and this Project will serve as a pilot project to determine the feasibility of using the panels in other locations.

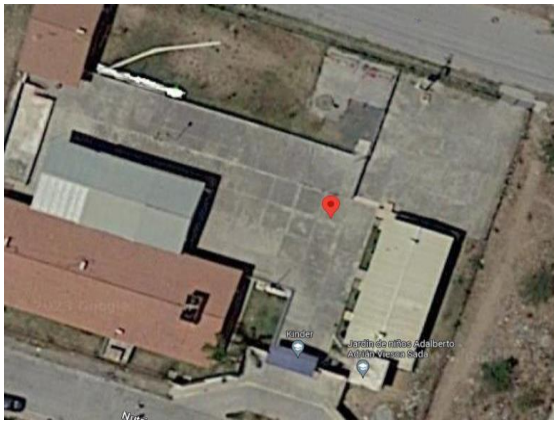
To have a perspective on the layout of each property and space available for the panels, Figure 3 shows the location of the schools and an aerial viewpoint of each school property.

Figure 3
PROJECT SITE SCHOOLS

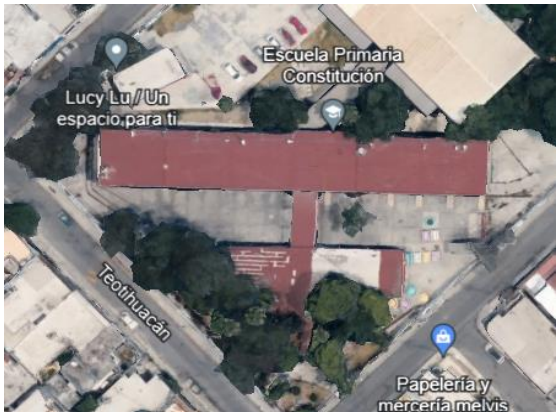


Schools to Receive Hydropanels

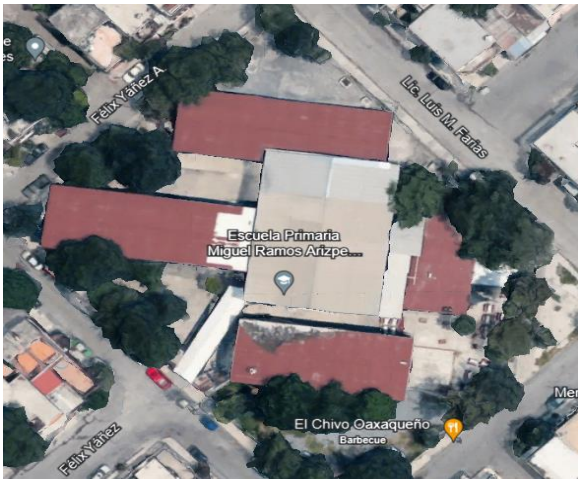
Prof Maria Guadalupe Cantu de Anda Kindergarten



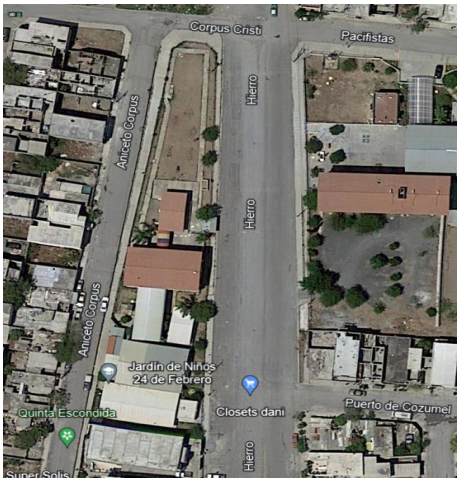
Adalberto Adrian Viesca Sada Preschool



Constitución Elementary School



Miguel Ramos Elementary School



24 de Febrero Preschool

Detailed drawings and instructions for the panel layout, anchor designs and plumbing to the schools will be provided prior to first disbursement along with an approval from the school director or other appropriate authority.

3.1.3. Technical Feasibility

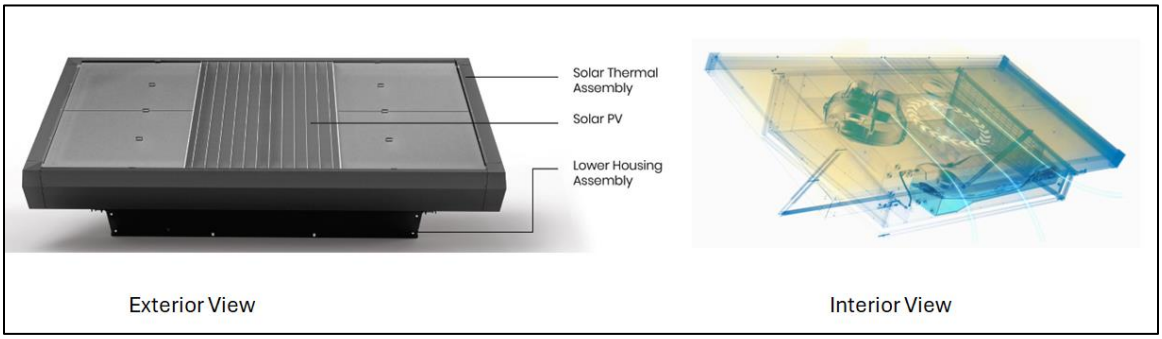
The manufacturer of the hydropanels has provided information related to how the panels function and their expected performance. The panels utilize a hygroscopic material that extracts water from ambient humidity to produce potable water. The anticipated lifespan of the panels is 15 years, and the panels have the capacity to operate within the temperature range of 5 to 55^0 C, with humidity above 10 percent, conditions compatible with the Project location.

The anticipated production rate of the panels, based on the production rates of operating hydropanels in similar environments, varies from 2.5 to 8.2 Liters per panel (L/panel) depending on ambient humidity, which also may coincide with the seasons of the year. For example, drinking water generation is usually reduced during the months of December and January and will unlikely meet the anticipated demands of the students. However, in July and August, humidity in Monterrey is typically higher, and the water produced by the panels will meet most if not all of the demands of the students.

The Project does not include extra water storage, but on weekends, holidays, or any other school non-working days, area residents may be allowed to utilize the available water. Additionally, school staff will empty any available drinking water from the panel reservoirs into containers at the end of the school week for storage over the non-working days. For extended school breaks, the panels can be adjusted to a low production mode and if it becomes necessary, water will be automatically released through an overflow valve and discharged to the ground near the panel.

Each panel is equipped with a fan to pass ambient air across hydrophilic elements used to condense water from the air. Photovoltaic cells and batteries are included in the system to power the fan and to allow each panel to be a stand-alone unit. Individual panels include a six-liter reservoir to retain collected water which is ozonated for sterilization and mineralized with magnesium and calcium ions to improve its taste and fitness for consumption. Water will be pumped from each panel to the distribution systems in the schools, allowing students to access water from a water fountain dispenser. The system consists of a dispenser and the panels shown, as shown in Figure 4.

Figure 4
Hydropanel Schematic



All sites have been assessed for the number of panels and feasibility of installations. Although the original expectation was to place panels on the rooftop of at least two of the schools, existing conditions will require that all five locations will have panels installed on the ground.

Since panels will be producing water specifically for human consumption, the water needs to meet Mexican regulatory standards NOM-127-SSA1-2021, which establish requirements for water quality for human consumption. The Nuevo Leon Health Ministry is responsible for ensuring that water meets the standards established by the Federal Commission for Protection against Sanitary Risks (COFEPRIS). SEDUSO is responsible for reporting the water quality for the source generated by the hydropanels and has developed an agreement with Nuevo Leon Office of the Undersecretary of Health Regulations and Promotion to gather samples and perform the water quality testing.

3.1.4. Land Acquisition and Right-of-Way Requirements

No land or rights of way acquisitions are required for the Project; the panels will be installed on school properties, which are owned by the state of Nuevo Leon. An agreement between Monterrey and the State of Nuevo Leon has been provided (*Convenio general de colaboración entre la SEP de Nuevo León y la Unidad de Integración Educativa de Nuevo León, junto con el Municipio de Monterrey*) to allow the panels to be installed at the schools.

3.1.5. Project Milestones

Once the Project is approved and the grant funding agreement is executed, SEDUSO will provide the vendor notice to proceed. The Project is anticipated to be completed in six months. Approximately four months will be required for mobilization and delivery of the panels. Installation and start-up will be completed within two months of starting construction.

Table 3
Project Milestones

Key Milestone	Status
Contracting/mobilization	4 months
Panel installation and start-up	2 months

3.1.6. Management and Operation

The municipality of Monterrey will be the owner of the hydropanel system and will be responsible for their administration, operation, and maintenance.[4] The panels are manufactured and installed by Source Global PBC, managed through its Mexican subsidiary, Source Global Water Technology Mexico S. de R.L. de C.V.

SEDUSO has assigned four personnel to oversee the Project and be responsible for operations and maintenance (O&M). Due to the unique nature of this Project, SEDUSO does not have operational experience with this system; however, the contract with Source Global includes an O&M manual and training for SEDUSO technicians and school maintenance staff. The recommended O&M activities consist of cleaning solar panels, and replacing mineral cartridges, air and water filters, annually. The cartridges and filters will be provided by the manufacturer to support the annual replacement for a period of 15 years and are included in the Project cost.

Additionally, the panels are equipped with sensors, which can be used to monitor basic production and operational data remotely. The telemetry/raw machine data collected from the Hydropanels and Commercial Reservoirs includes information such as water production, water reservoir/tank level, PV power, ambient relative humidity, internal temperatures, fan speeds, pump operation, ozonation or chlorination operation and metrics, and dispense operations. Production is optimized in the following ways:

- If an operational problem or potential problem is recognized based on the telemetry data collected (or a system notification/fault), a service ticket is created in the manufacturer's system, and the problem is resolved by the Network Operations Center (NOC) by issuing remote commands to the Hydropanel or Commercial Reservoir. If the problem cannot be resolved remotely, a Field Technician is dispatched to the site to resolve the issue.
- The NOC proactively issues periodic remote commands to update Hydropanel / Commercial Reservoir firmware to fix firmware bugs and also to implement new features and improvements.

The ability to provide reports and offer remote commands is dependent on the existence of good signal connectivity at each of the various installation sites. The contract also includes a 5-year warranty, to repair or replace any panels which malfunction due to defects related to the panels design, materials or workmanship.

[4] Letter of Intent Source Hydropanels Pilot Project to Supply Renewable Drinking Water to Monterrey Schools and Face Water Scarcity, Gobierno de Monterrey, March 27, 2023.

The sponsor plans to implement security measures to protect the new hydropanel systems from theft, vandalism, and/or tampering. Since the selected schools have well-defined perimeters, access to the sites will be controlled. The sponsor has also committed to efforts such as adding barriers to protect the panels, increasing school security with cameras, and creating a parent committee to monitor installations.

3.2. Environmental Criteria

3.2.1. Environmental and Health Effects/Impacts

A. Existing Conditions

The persistent drought conditions, which began in 2015, has left SADM unable to provide reliable water services. SDAM began water rationing in 2022 by limiting services to only a few hours daily. Table 4 below illustrates the critical status of water supplies in SADM's reservoirs.

Table 4
Storage in SADM Reservoirs

Reservoir	Capacity Mil M^3	% full	Storage Mil M^3
Cerro Prieto	300	48.13	144.4
El Cuchillo	1,123	3.53	39.6
La Boca	39.5	9.78	3.86
Total	**1462.5**	**12.9**	**188**

Sources: https://cnnespanol.cnn.com/2022/06/10/sequia-mexico-monterrey-escasez-agua-orix/
https://www.jornada.com.mx/notas/2023/09/08/estados/anuncian-en-nl-cortes-de-agua-afecta-la-sequia-a-170-colonias/

Due to the lack of surface water, SADM has resorted to pumping more water from the local aquifer. The aquifers used by the city are already over-exploited and current withdrawals are not sustainable. SADM needs to secure and develop new sustainable water sources, but this process will take years to complete.

Considering that Monterrey is one of the fastest growing metro areas in Mexico, and it's located in an area vulnerable to drought conditions, SADM is developing a multifaceted approach to sustainably managing its water resources. Potential improvements include infrastructure rehabilitation, water reuse, water conservation, imported water, and desalination projects.

Since the water supply issues in Monterrey are unlikely to be resolved soon, alternative approaches such as the proposed Project are needed to provide water in the immediate future for vulnerable populations. The selected schools are in economically distressed neighborhoods and serve low-income students. The neighborhoods around the schools have been especially hard hit by SADM's water outages, with many of the colonias having lost water services for days at a time, and even when services were available pressures were

reportedly very low. Monterrey residents have resorted to using hauled water, which is expensive and is only adequate for household uses but it is not fit for human consumption. Due to the lack of water, many local schools have closed or modified their schedules, negatively impacting the access to education.

Although health statistics specific to the neighborhoods receiving the panels are not readily available, there are several health issues associated with water scarcity. The most immediate issues associated with water scarcity are hygiene and dehydration. Without water basic hygiene such as hand washing and bathing becomes nearly impossible, increasing the risks of disease transmission including COVID, influenza, diarrhea, and hepatitis.[5]

Dehydration can have both immediate and long-term health impacts. Some immediate impacts of dehydration include fatigue, dizziness, seizures, confusion, diarrhea, and extreme thirst. Chronic dehydration can result in kidney damage and kidney stones.[6] Due to the essential nature of drinking water, it is essential to implement a permanent solution for access to water during the school day.

B. Project Impacts

The Project will help address issues related to chronic water shortages which are disproportionately impacting residents of low-income areas of metropolitan Monterrey.

Specifically, the Project is expected to generate environmental and human health benefits related to the following Project outcomes:

- Improve access to reliable and sustainable drinking water for school aged children and adolescents.
- Increased drinking water supply from an alternative potable water source.
- Eliminate school closures due to lack of drinking water supply.

C. Transboundary Impacts

No negative transboundary impacts are expected from the proposed Project. The Project is located approximately 150 kilometers (95 miles) from the US/Mexico border.

3.2.2. Compliance with Applicable Environmental Laws and Regulations

Since the water being produced by the panels is expressly intended for human consumption, it will need to meet Mexican Regulatory standards for potable water, as described by NOM-127-SSA1-1994. This standard sets permissible limits for contaminants, testing procedures, and reporting requirements. Hydropanels are already in use at other locations in Mexico, and the manufacturer has provided documentation from the laboratory tests to demonstrate that water produced by the panels will meet Mexican Regulatory standards for potability.

[5] https://www.cdc.gov/hygiene/personal-hygiene/index.html
[6] https://www.mayoclinic.org/diseases-conditions/dehydration/symptoms-causes/syc-20354086

Water quality testing is not within SEDUSO normal portfolio of responsibilities, testing will be conducted by la Nuevo Leon Office of the Undersecretary of Health Regulations and Promotion. Any water quality non-conformance will be addressed by the manufacturer or through their local field technician; however, the manufacturer has reported that water quality has consistently met applicable standards for panels that have replaced the required mineral cartridges on an annual basis. The terms and conditions for the grant will include requirements for reporting water quality, a description of what may have caused the water quality concern, and the remedy implemented for any incidents of non-compliance.

A. Environmental Clearance

No adverse environmental impacts are anticipated, and no environmental clearance process is required.

B. Mitigation Measures

Project implementation will have no significant adverse impacts on the environment. The sponsor and hydropanel manufacturer will install the systems using best management practices and will ensure that the panel system sites are secure.

C. Pending Environmental Tasks and Authorizations

No environmental authorizations or tasks are pending.

3.3. Financial Criteria

The total estimated cost of the Project is US$550,000. The Project sponsor SEDUSO has requested a $500,000 CAP grant from NADBank to support the implementation of the Project. Table 2 presents the total Project cost and proposed sources of funding.

Table 5
PROJECT INVESTMENT & FINANCING PLAN
(USD)

Uses		Amount	%
Hydropanels, mounts, storage tanks, piping and dispensers		$ 291,500.00	53.0
Installation and delivery		150,155.00	27.3
15-year maintenance consumables		53,105.00	9.7
Value-added tax		55,240.00	10.0
TOTAL		**$ 550,000.00**	**100.0**
Sources	**Instrument**	**Amount**	**%**
NADBank CAP	Grant	$ 500,000.00	90.0
SEDUSO	Equity	50,000.00	10.0
TOTAL		**$ 550,000.00**	**100.0**

The proposed Project complies with all CAP criteria.[7] It is located within the U.S.-Mexico border region served by NADBank, is being sponsored by a public-sector entity and is in an environmental sector eligible for NADBank financing. Additionally, as a drinking water project, it is considered a priority under the CAP program. To comply with CAP program requirements, SEDUSO will fund 10.0% of the total cost of the Project.

The traditional means of providing access to drinking water is not economically feasible at this time nor is it expected to become feasible in the short- to medium-term. In this case, NADBank's CAP is a useful source to support small investments for the development of novel solutions when traditional infrastructure investments may not be feasible. The CAP grant will facilitate the availability of an alternative drinking water source in an area where water shortages have caused extended periods of water rationing and intermittent service. The grant will support the Project to operate as a pilot application and require reporting to better understand the potential use of the alternative technology to address similar conditions throughout the border region.

Finally, since there are no permits or authorizations required for the hydropanels, Monterrey is ready to initiate contracting once funding has been approved.

4. PUBLIC ACCESS TO INFORMATION

4.1 Public Consultation

On May 8, 2024, NADBank published the draft certification and financing proposal for a 14-day public comment period. The following Project documentation is available upon request:

- An agreement between the Secretary of Education for State of Nuevo León and the Municipality of Monterrey dated August 15, 2023, giving the Municipality access to the school sites for the installation of the Hydropanels *(Convenio general de colaboración entre la SEP de Nuevo León y la Unidad de Integración Educativa de Nuevo León, junto con el Municipio de Monterrey*)
- A letter of commitment from SEDUSO to collaborate with the *Subsecretaría de Regulación y Fomento Sanitario del Estado de Nuevo León* to conduct tests monitoring the quality of water produced by the panels.
- SOURCE Hydropanel Technical Specifications

4.2 Outreach Activities

In addition to this Project, the municipality's "Escuelas de Lluvias" initiative, to provide water at schools severely impacted by water outages, supported 16 schools with rainwater collection systems. Schools selected for this Project had sites with adequate space for panel installation and local parent groups at the schools committed to participating, as needed, to

[7] The Sponsor applied for CAP funding and the Project was developed under the previous program guidelines dated April 2020.

secure and use the hydropanels once installed. The municipality applied to NADBank for CAP funding after selecting the targeted schools.

NADBank conducted a media search to gauge public awareness of the hydropanel Project for the schools and did not find any articles. However, there are several articles describing the severity of the drought, efforts to secure new water sources and the existing conditions that support the need for the Project.

- *El Horizonte* (September 5, 2023) – *La buena vecindad; punto de inflexion* [The Good Neighborhood; A Turning Point]. An opinion piece that discussed water as one of the three most significant issues facing the border region. https://www.elhorizonte.mx/opinion/la-buena-vecindad/2635841267

- *El Mañana* (June 7, 2023) – "*Buscará NL reutilizar agua tratada en 2025"* [Nuevo Leon is looking at reusing treated water in 2025]. An article discussing a potential water reuse project in Monterrey. https://www.elmanana.com/noticias/nacional/agua-tratada-en-2025-buscara-nl-reutilizar/5718298

- *Expreso.press* (October 30, 2023) – "*Insiste N León en acueducto y desalinizadora*" [Nuevo Leon pushing for aqueduct and desalinization plant]. Reporting on plans by the State of Nuevo Leon to construct a desalination plant in Matamoros and aqueduct to supply water for Monterrey. https://expreso.press/2023/10/30/insiste-n-leon-en-acueducto-y-desalinizadora/

To date, no opposition to the Project has been identified.