



# **CERTIFICATION AND FINANCING PROPOSAL**

## **DRINKING WATER SYSTEM IMPROVEMENTS IN MAGDALENA, SONORA**

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## EXECUTIVE SUMMARY

### DRINKING WATER SYSTEM IMPROVEMENTS IN MAGDALENA, SONORA

<b>Project:</b>	The proposed project consists of improvements to the drinking water system by establishing three hydrometric sectors in the city of Magdalena de Kino, Sonora (the “Project”), which will include the replacement of obsolete distribution infrastructure; construction of new transmission lines from the wells to existing storage tanks, installation of macrometers, telemetry and residential meters; various improvements at the well sites; and the acquisition of equipment for system operations.
<b>Objective:</b>	The purpose of the Project is to improve access to sustainable drinking water service by assuring adequate water supply, service reliability and system redundancy, which will help reduce the health risks associated with waterborne diseases.
<b>Expected Outcomes:</b>	<p>The Project is expected to generate environmental and human health benefits related to the following Project outcomes:</p> <ul style="list-style-type: none"><li>• Improve access to reliable and sustainable drinking water services for 3,207 existing residential connections.</li><li>• Improve water resource management by limiting water losses within each of the three sectors to no more than 20%.</li><li>• Achieve water savings of approximately 1 million cubic meters (264 million gallons) per year from the three sectors combined.</li></ul>
<b>Population Benefitted:</b>	12,187 residents in of three areas of Magdalena de Kino, Sonora. <sup>1</sup>
<b>Sponsor:</b>	The local water utility, <i>Organismo Operador de Agua Potable Alcantarillado y Saneamiento de Magdalena, Sonora</i> (OOMAPAS).
<b>Project Cost:</b>	\$57,669,195 pesos (US\$3,203,844). <sup>2</sup>
<b>NADB Grant:</b>	Up to US\$500,000 from the Community Assistance Program (CAP).

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<sup>1</sup> Based on the number of residential connections (3,207) multiplied by the number persons (3.8) per household according to the 2010 INEGI Census.

<sup>2</sup> Unless otherwise indicated, all U.S. dollar figures are quoted at an exchange rate of \$18.0 pesos to the dollar, based on the average exchange rate set by Banco de Mexico to pay obligations entered into in U.S. dollars payable in México (FIX) for the last two years.

DRAFT BOARD DOCUMENT BD 2019-XX  
 CERTIFICATION AND FINANCING PROPOSAL  
 MAGDALENA, SONORA

**Uses and Sources of  
 Funds:  
 (US\$)**

Uses	Amount	%
Construction*	\$ 3,101,211	97.0
Equipment: Backhoe	102,633	3.0
<b>TOTAL</b>	<b>\$ 3,203,844</b>	<b>100.0</b>
Sources	Amount	%
Federal grant	\$ 1,351,922	42.0
State grant	1,351,922	42.0
NADB CAP grant	500,000	16.0
<b>TOTAL</b>	<b>\$ 3,203,844</b>	<b>100.0</b>

\* Includes construction, applicable taxes and contingencies. Construction management will be provided by the Sonora State Water Commission (CEA).

**Project Status:**

Key Milestones	Status
Final design	Completed in January 2017
Technical approval from CONAGUA	Obtained on June 25, 2018
Procurement – Other funds	Initiated in August 2019
Procurement – CAP funds	Anticipated in first quarter of 2020
Construction period	Estimated period of 18 months

Mexican National Water Commission (CONAGUA)

# CERTIFICATION AND FINANCING PROPOSAL

## DRINKING WATER SYSTEM IMPROVEMENTS IN MAGDALENA, SONORA

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### 1. PROJECT OBJECTIVE AND EXPECTED OUTCOMES

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The proposed project consists of improvements to the drinking water system by establishing three hydrometric sectors in the city of Magdalena de Kino, Sonora (the "Project"), including the replacement of obsolete distribution infrastructure, construction of new transmission lines from the wells to existing storage tanks, installation of macrometers, telemetry and residential meters, various improvements at the well sites and the acquisition of equipment for system operations. The purpose of the Project is to improve access to sustainable drinking water service for 3,207 existing connections by assuring adequate water supply, improving service reliability and introducing system redundancy. These improvements are expected to reduce water losses to no more than 20% in each sector, saving approximately 1 million cubic meters (264 million gallons) per year, as well as prevent incidents of low pressure and service interruptions, which will help reduce health risks associated with waterborne diseases.

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### 2. ELIGIBILITY

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#### 2.1. Project Type

The Project falls within the eligible category of drinking water.

#### 2.2. Project Location

The Project will be implemented in the community of Magdalena de Kino, the seat of the municipality of Magdalena in the northern region of the state of Sonora. It is located approximately 80 km (50 miles) south of Nogales, Arizona and the U.S.-Mexico border, at the geographical coordinates: 30° 37' 37" N -110° 58' 03" W. Figure 1 shows the approximate location of the Project.

**Figure 1**  
**PROJECT LOCATION MAP**



### **2.3. Project Sponsor and Legal Authority**

The Project sponsor is the local water utility, *Organismo Operador Municipal de Agua Potable, Alcantarillado y Saneamiento de Magdalena, Sonora* (OOMAPAS or the "Utility"). The Sonora state congress authorized the creation of OOMAPAS by decree published on August 22, 1994, in issue 15, section 1, of Volume CLIV of the official state bulletin. OOMAPAS is authorized, among other activities, to operate and maintain water treatment, storage and distribution infrastructure in the municipality of Magdalena, Sonora. OOMAPAS is overseen by a Board of Governors, which is presided over by the mayor of Magdalena and includes a representative from the Mexican National Water Commission (CONAGUA), a representative from the Sonora State Water Commission (CEA) and the president of the local Advisory Council, among others.

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## **3. CERTIFICATION CRITERIA**

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### **3.1. Technical Criteria**

#### **3.1.1. General Community Profile**

According to the 2010 Census conducted by the Mexican National Institute of Statistics and Geography (INEGI), Magdalena de Kino had a population of 29,707 residents, and based on population projections prepared by the Mexican National Population Council (CONAPO), in 2019, the population in Magdalena was estimated to be 30,652. In 2018, an estimated 41% of the population was living below poverty level, which is higher than the state average of 39%.

The following table summarizes the status of public services and infrastructure in Magdalena de Kino.

**Table 1**  
**BASIC PUBLIC SERVICES AND INFRASTRUCTURE IN MAGDALENA DE KINO**

<b>Water</b>	
Coverage:	96%
Water supply source:	7 wells (6 active and 1 reserve)
Number of hookups:	9,827 (9,285 residential; 505 commercial and 37 industrial)
<b>Wastewater Collection</b>	
Coverage:	90%
Number of residential connections:	8,838
<b>Wastewater Treatment</b>	
Coverage:	100% of the wastewater collected
Treatment facilities:	San Lorenzo Wastewater Treatment Plant, using oxidation ponds
<b>Solid Waste</b>	
Solid waste collection:	100%
Final disposal:	Landfill Km 5 Carretera a Cucurpe

Source: Municipality of Magdalena

### **Local Drinking Water System Profile**

According to a system improvement plan completed in 2017, OOMAPAS currently serves about 9,827 active water accounts.<sup>3</sup> The six active wells supply an estimated average flow of 222 liters per second (3,522 gallons per minute).<sup>4</sup> OOMAPAS extracts 7 million cubic meters (m<sup>3</sup>) of water a year from the wells, while the volume billed is only 3 million m<sup>3</sup>/year, which means that utility has an estimated 4 million m<sup>3</sup>/year of unaccounted water, equivalent to 58% of the annual volume supplied.

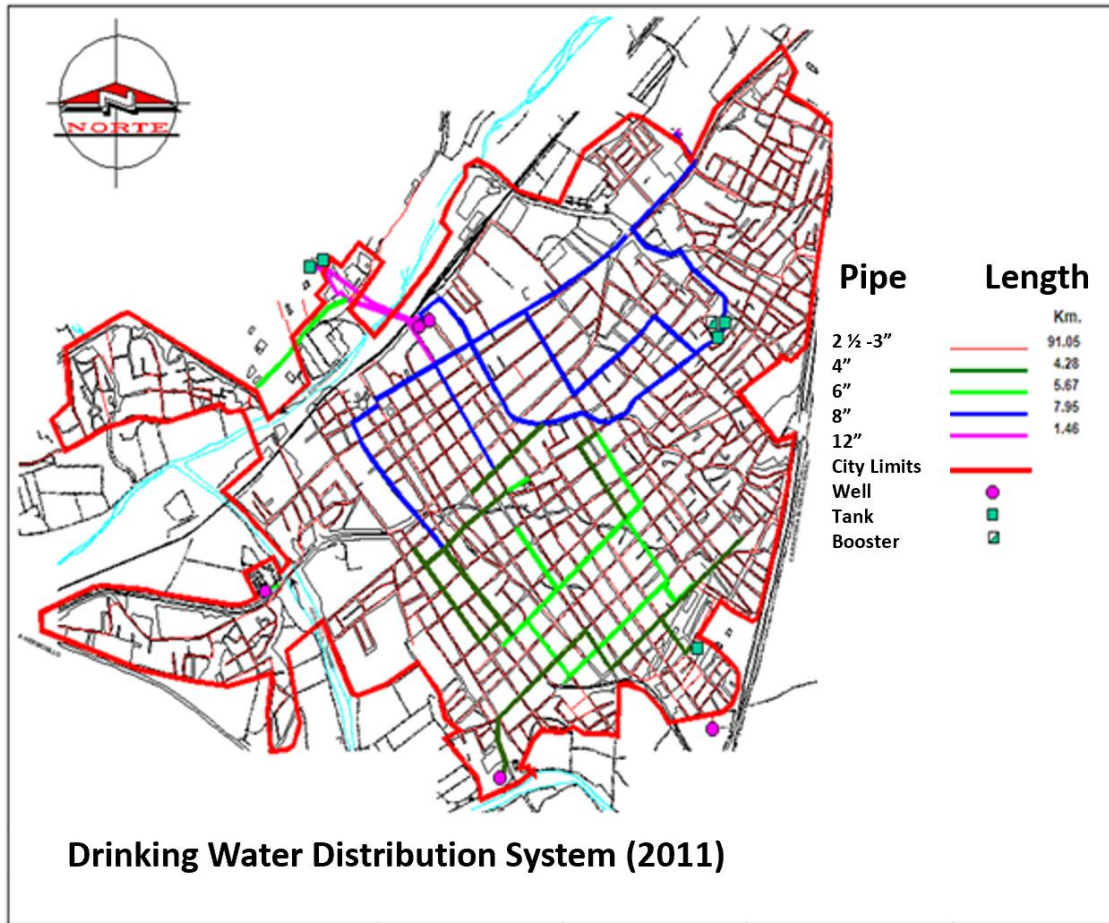
The drinking water system was built 50 years ago and does not have any supply and transmission lines. Water is currently disinfected at the well sites with automatic chlorine dosing systems and must be pumped through the distribution system to fill the existing storage tanks. The pipe diameters are undersized, the household connections are inefficient, and the system lacks waterline looping, which creates conditions that allow water to become stagnant, leading to potential bacteria growth or high levels of residual chlorine, which may compromise water quality for human consumption.

<sup>3</sup> Source: *Proyecto para el Mejoramiento del Sistema Integral de Agua Potable, Alcantarillado y Saneamiento de la Ciudad de Magdalena de Kino, Sonora de enero de 2017* [Project for Improving the Comprehensive Water and Wastewater System in the City of Magdalena de Kino, Sonora, January 2017], funded by NADB through its Technical Assistance Program (TAP).

<sup>4</sup> Only five of the six active wells currently have flow meters.

Figure 2 shows the location of OOMAPAS water infrastructure, including waterlines, wells, tanks and booster stations.

**Figure 2**  
**MAGDALENA DE KINO WATER SYSTEM INFRASTRUCTURE**



### **Wastewater Collection and Treatment Systems**

The wastewater collection system in Magdalena de Kino, similar to the drinking water infrastructure, dates back to 1945 and is comprised of 8-inch laterals that discharge to larger sewer mains and trunk lines with diameters ranging from 10 to 24 inches. Wastewater flows southwest to a pumping station that conveys it to the treatment facility that uses oxidation ponds, located west of the city.

Currently, 100% of the wastewater collected is conveyed to the treatment plant. Since the proposed Project consists of rehabilitating and improving the existing water system, no increase in wastewater flows to the lagoons is expected.



It is important to note that the existing wastewater collection system only conveys wastewater. Storm water runs through the streets, then through creeks located within the city that empty into the Magdalena River located on the northwest edge of the city.

### 3.1.2. Project Scope

Based on the 2017 final design, water losses were estimated at nearly 60%. The utility has established a goal of reducing these losses to no more than 20% by 2029. The final design identifies the actions necessary to reduce the high level of water losses in the system and meet this goal. The recommended actions include:

- 1) Establish seven hydrometric sectors (districting or sectorization), three of which will be addressed by the proposed Project.
- 2) Replace obsolete water system components, which includes installing larger diameter pipes to increase distribution capacity and reinforcing existing infrastructure.
- 3) Replace household connections using cross-linked polyethylene (PEX) pipe and install residential meters.
- 4) Improve well sites (control booth, discharge manifold, perimeter fence, etc.)
- 5) Install a telemetry system.
- 6) Acquire one backhoe for operation and maintenance.

Hydrometric sectors are formed by separating drinking water distribution system into discrete areas of similar size (sectors) to increase water distribution efficiency and facilitate the detection of problems. Sectors usually include a pressure management component, a macrometer, air release devices and bypasses to maintain consistent water pressure and flow across the service area. By metering the flows into the sector and identifying the aggregate user consumption, the utility can pinpoint water losses and reduce water leaks more efficiently.

Figure 3 shows the seven hydrometric sectors resulting from the 2017 sectorization study, including the three sectors to be addressed with this proposed Project, which are shown in green: San Isidro, Fatima and El Polvorin.

**Figure 3**  
**DRINKING WATER SYSTEM SECTORIZATION OF MAGDALENA DE KINO, SONORA**

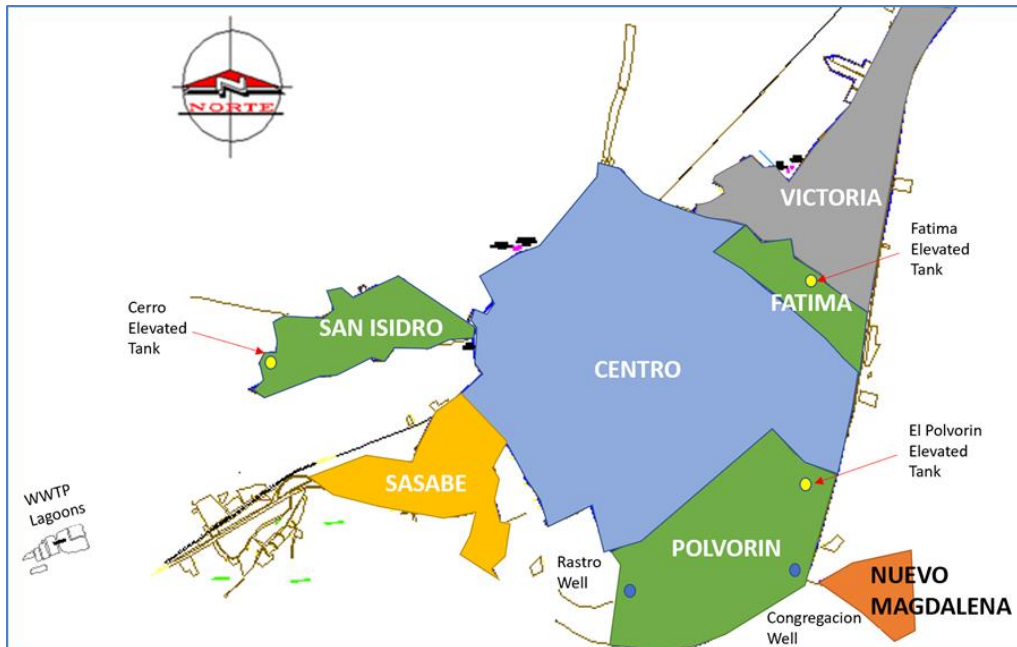


Table 2 lists the improvements that will be made to establish the hydrometric sectors, as identified above.

**Table 2**  
**COMPONENTS OF THE HYDROMETRIC SECTORS**

San Isidro Sector	Quantity	Source of Funds
Construct transmission line from well to storage tank	1,357 linear meters (4,452 linear ft)	CONAGUA/CEA
Replace obsolete pipe	3,900 linear meters (12,795 linear ft)	CONAGUA/CEA
Replace residential connections	928 connections	CONAGUA/CEA
Install residential meters	928	NADB CAP
Install macrometer, telemetry, well site improvements		NADB CAP
Polvorin Sector		
Construct transmission line from well to storage tank	640 linear meters (2,100 linear ft)	CONAGUA/CEA
Replace obsolete pipe	7,100 linear meters (23,294 ft)	CONAGUA/CEA
Replace residential connections	1,187 connections	CONAGUA/CEA
Install residential meters	1,187	NADB CAP
Install macrometer, telemetry, well site improvements		NADB CAP
Fatima Sector		
Construct transmission line from well to storage tank	1,200 linear meters (3,937 linear ft)	CONAGUA/CEA
Replace obsolete pipe	12,900 linear meters (42,323 linear ft)	CONAGUA/CEA
Replace residential connections	1,092 connections	CONAGUA/CEA
Install residential meters	1,092	NADB CAP
Install macrometer and telemetry		NADB CAP
Operational Equipment		
Acquire backhoe		NADB CAP

Mexican National Water Commission (CONAGUA); Sonora State Water Commission (CEA); Community Assistance Program (CAP)

The construction activities led by CEA have been divided into two phases for each sector based on the availability of funds in 2019 and the funds requested from CONAGUA for 2020. Phase 1 includes approximately a third of the infrastructure to be built or 7,800 linear meters (25,591 ft) out of 23,900 linear meters (78,412 ft) total and 1,198 of the 3,207 residential meters. Nearly half of the total investment will be completed in Phase 1.

An initial procurement process for Phase 1 components was conducted by CEA in August 2019, and the corresponding construction activities began in early September 2019. An additional procurement process for the remaining components financed with Mexican funds is expected to be carried out during the second quarter of 2020, with the requirement that construction be completed by the end of 2020.

Procurement for system improvements supported by CAP funds is anticipated to initiate during the first quarter of 2020.

### **3.1.3. Technical Feasibility**

NADB provided technical assistance to the Project Sponsor to develop a comprehensive water and wastewater system improvement plan, which identified priority infrastructure needs in the water distribution, wastewater collection and wastewater treatment systems serving the community. Because of the findings related to high water losses, improvements to the drinking water system were prioritized for implementation.

During the final design process, multiple alternatives were considered for increasing water system reliability and efficiency, while meeting local, state and federal health and safety regulations. The no-action alternative was not considered viable for the Project, since lack of access to safe and reliable drinking water could result in significant health and safety hazards for the public. Also, the reduction of water losses will increase the efficiency and financial sustainability of the OOAMPAS.

The first recommendation in the plan was to delineate hydrometric sectors based on geographical areas that could be isolated by the location and availability of an independent water supply and elevated storage tank. A total of seven sectors were identified. Each sector must comply with the required flow rates and pressure levels to assure continuous service within the entire sector, which will be accomplished by installing new transmission and distribution lines, pressure management equipment, macrometers, telemetry equipment and residential meters.

To identify the most appropriate solution for achieving water loss goals and system compliance within each sector, the technical alternatives related to pipe materials, control valves and metering were evaluated based on the following factors:

- Capital costs;
- Operation and maintenance costs; and
- Reliability of the materials and equipment.

Pipe diameters were calculated using suitable pressure and strength ranges. The analysis also considered various pipe materials that meet the specifications established in current standards and regulations. High-density polyethylene (HDPE), PVC and asbestos cement pipes were assessed, taking into consideration their characteristics and suitability for the soil type in the Project area. PVC was selected as the best material for the transmission and distribution lines and cross-linked polyethylene (PEX) pipes for the household connections.

Operational equipment—such as control valves, macrometers, residential meters and the backhoe—will be procured with performance specifications that reflect the best available technology and regulatory compliance.

The final design was prepared pursuant to CONAGUA guidelines and the provisions of Mexican standards NOM-001-SEDE-2012 and NOM-127-SSA1-1994 and its 2000 amendment. Technical validation of the final design was issued on June 26, 2018, by the CONAGUA Northwest Watershed Agency in Hermosillo, Sonora.

### 3.1.4. Land Acquisition and Right-of-way Requirements

Construction will be completed within existing property and public rights-of-way. No additional land or easement is required to implement the Project.

### 3.1.5. Project Milestones

Once the notice to proceed is issued, construction is expected take approximately 18 months to complete. Table 3 provides a summary of critical Project milestones and their respective status.

**Table 3**  
**PROJECT MILESTONES**

Key Milestones	Status
Final design	Completed in January 2017
Technical validation	Obtained on June 26, 2018
Procurement – Other funds	Initiated in August 2019
Procurement – CAP funds	Anticipated in the first quarter of 2020
Construction period	Estimated period of 18 months

### 3.1.6. Management and Operation

Management and operation of the proposed Project will be the responsibility of OOMAPAS, which currently serves 9,817 water connections and is organized in several departments, including operations, finance and administration.

The Project may generate an increase in operation and maintenance (O&M) costs related to the new infrastructure and equipment; however, the reduction in water losses and corresponding reduction in pumping requirements should also produce significant savings. Better regulated and more consistent system pressure could also lead to additional savings deriving from less frequent maintenance requirements. Consequently, the Project is expected to result in an overall reduction in O&M costs. Based on the budget history of OOMAPAS, revenue generation from existing customers is sufficient to support projected O&M costs. An adjustment in user fees is not required as a result of Project implementation.

Additionally, OOMAPAS will ensure that the drinking water distributed by the Project complies with Mexican standard NOM-127SSA1-1994, which establishes quality standards for drinking water.

### 3.2. Environmental Criteria

#### 3.2.1. Environmental and Health Effects/Impacts

##### A. Existing Conditions

The water supply and distribution system in Magdalena de Kino was built 50 years ago using asbestos cement pipes and is now obsolete. More than 80% of the distribution lines are also undersized. Because of the poor condition of the pipes and aging joints, water losses are extremely high from leaks that may go undetected for years. Line breaks and leaks increase the risks of cross-contamination and backflows in the city distribution system, creating a health risk that can impact the entire community.

As a reference for existing health statistics in the area, Table 4 shows reported cases of waterborne disease for the municipality Magdalena, Sonora.

**Table 4**  
**WATERBORNE DISEASE STATISTICS FOR THE MUNICIPALITY OF MAGDALENA, SONORA**

Disease	Number of Cases / Year					
	2014	2015	2016	2017	2018	June 2019
Amebiasis	1	2	1	2	1	
Giardiasis	2	1				
Salmonellosis		1	1			
Typhoid Fever						4
Other organisms	315	242	359	579	352	333

Source: General Office of Epidemiology, Sonora State Ministry of Health.

Additionally, the distribution system is failing to comply with the standards necessary to meet service demand. Insufficient redundancy in the system and the current practice of filling the storage tanks by pumping water through the smaller lines of the distribution system is inefficient and makes the system more vulnerable to service interruptions. During the last six months, OOMAPAS received 752 customer complaints concerning water leaks and low pressure. These problems, along with a lack of system looping, increase the potential for stagnant water and risks related to bacteria growth or high levels of residual chlorine, which may compromise water quality for human consumption.

##### B. Project Impacts

The Project will help conserve water and assure an adequate water supply for the city by eliminating leaks in the distribution system, as well as improve service reliability by regulating system pressure and introducing system redundancy. These measures will help prevent the risk of cross-contamination from leaks and stagnant water in the lines and will thus improve health conditions for residents in the Project area.

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 services for 3,207 existing residential connections.
- Improve water resource management by limiting water losses within each of the three sectors to no more than 20%.
- Achieve water savings of approximately 1 million cubic meters per year (264 million gallons per year) from the three sectors combined.

**C. Transboundary Impacts**

No negative transboundary impacts are anticipated.

**3.2.2. Compliance with Applicable Environmental Laws and Regulations**

The Project complies with Official Mexican Standard NOM-127SSA1-1994, which establishes quality standards for drinking water. It was also designed to comply with all the guidelines for water systems established by CONAGUA and with NOM-001-SEDE-2012 for all electromechanical installations. The project has been reviewed and validated by CONAGUA.

**A. Environmental Clearance**

The Project will be constructed within previously disturbed areas, including existing rights of way. The Project will not require an Environmental Impact Statement from the Mexican Ministry of Environment and Natural Resources (SEMARNAT), as confirmed by Official Letter No. DOP-US-57/2018-21 issued by the Office of Infrastructure, Urban Development, Public Works and Municipal Ecology of Magdalena, Sonora.

**B. Mitigation Measures**

Only minor environmental impacts are anticipated during construction of the Project, provided that the tasks are implemented in accordance with best management practices. Typical mitigation measures to be practiced include:

- Application of water to reduce fugitive dust emissions;
- Vehicle tune-ups to reduce emissions; and
- Placement of warning signs to prevent potentially hazardous situations.

By following best management practices, the temporary impacts due to construction will be minimized. In addition, final designs include the implementation of green building practices, such as using high-efficiency equipment and local materials, reducing excavation processes, etc.

**C. Pending Environmental Tasks and Authorizations**

There are no environmental authorizations pending.

### 3.3 Financial Criteria

The total estimated cost of the Project is \$57,669,195 pesos (US\$3,203,844), which includes construction and the acquisition of a backhoe for operations and maintenance. The Sponsor requested a US\$500,000 grant from NADB through its Community Assistance Program (CAP) to support implementation of the Project. Table 5 presents a breakdown of total Project costs, as well as the sources of funding.

**Table 5**  
**USES AND SOURCES OF FUNDS**  
 (US \$)

Uses	Amount (US\$)	%
Construction*	\$ 3,101,211	97
Equipment: Backhoe	102,633	3
<b>TOTAL</b>	<b>\$ 3,203,844</b>	<b>100.0</b>
Sources	Amount (US\$)	%
Federal grant (CONAGUA)	\$ 1,351,922	42
State grant (CEA)	1,351,922	42
NADB CAP grant	500,000	16
<b>TOTAL</b>	<b>\$ 3,203,844</b>	<b>100.0</b>

\* Estimated costs include construction, applicable taxes and contingencies.

The proposed Project complies with all CAP criteria. It is located within the U.S.-Mexico border region served by NADB, is being sponsored by a public-sector entity and is in an environmental sector eligible for NADB financing. Additionally, as a water project, it is considered a priority under the CAP program. As shown in the above table, the Project Sponsor, CONAGUA and CEA have agreed to cover approximately 84% of the Project costs, which is above the 10% minimum required under the program. Additionally, CEA is providing construction management services for the entire Project.

Completion of the final design and procurement documents was supported by a grant from the NADB Technical Assistance Program (TAP). Additionally, all necessary pre-procurement permits, and authorizations have been obtained, and the Project Sponsor is ready to initiate bidding for construction once funding has been approved.



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## 4. PUBLIC ACCESS TO INFORMATION

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### 4.1 Public Consultation

NADB published the draft certification and financing proposal for a 14-day public comment period beginning October 17, 2019. The following Project documents are available upon request:

- Project for Improving the Comprehensive Water and Wastewater System in the City of Magdalena de Kino, Sonora, January 2017
- Approval to construct water facilities from the Municipality of Magdalena, issued through official letter No. SIN-112/19, dated May 7, 2019;
- Technical validation from CONAGUA, issued through official letter No. BOO.803.06.03-0199 dated June 15, 2018; and
- Official Letter No. DOP-US-57/2018-21 issued by the Office of Infrastructure, Urban Development, Public Works and Municipal Ecology of Magdalena, Sonora.

### 4.2 Outreach Activities

The Sponsor promoted the Project at several of its monthly board meetings to keep Board members up to date on Project progress. The meetings were open to the general public, and meeting agendas were made available beforehand.

NADB also conducted a media search to identify potential public opinion about the Project; however, no specific articles or references to the Project were found. No public opposition to the Project has been detected.