



CERTIFICATION AND FINANCING PROPOSAL

DRINKING WATER SYSTEM IMPROVEMENTS TOMBSTONE, ARIZONA

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EXECUTIVE SUMMARY

DRINKING WATER SYSTEM IMPROVEMENTS TOMBSTONE, ARIZONA

Project:	The project consists of improvements to the drinking water supply and to the water storage and distribution infrastructure, including replacement of the roof structure and liner at the surface water reservoir, pipeline replacement and the installation of control valves monitored by a new Supervisory Control and Data Acquisition (SCADA) system in the City of Tombstone, Arizona (the “Project”).
Project Objective:	The purpose of the Project is to improve drinking water quality by blending Well No. 1 water with surface (spring) water to bring arsenic concentrations within the established maximum contaminant level (MCL) of 10 micrograms per liter ($\mu\text{g/l}$), which will contribute to the reduction of health risks associated with high levels of arsenic.
Expected Project Outcome:	The Project is expected to generate environmental and human health benefits related to the following Project outcomes: <ul style="list-style-type: none">• Provide improved drinking water quality for 718 residential service connections.• Full compliance with regulatory standards for arsenic concentrations, which will be reduced to $< 10 \mu\text{g/L}$.
Population Benefitted:	1,380 residents of City of Tombstone, AZ. ¹
Project Sponsor:	City of Tombstone, AZ.
Project Cost:	US\$742,000.
NADB Grant:	US\$500,000 from NADB’s Community Assistance Program (CAP).

¹ Source: Based on the U.S. Census 2010.

BOARD DOCUMENT BD 2016-8
 CERTIFICATION & FINANCING PROPOSAL
 CAP GRANT, TOMBSTONE, AZ

**Uses & Sources of
 Funds:**
 (U.S. Dollars)

Uses	Amount	%
Construction*	\$ 742,000	100.0
TOTAL	\$ 742,000	100.0
Sources	Amount	%
City of Tombstone, Arizona	\$ 242,000	32.6
NADB CAP grant	\$ 500,000	67.4
TOTAL	\$ 742,000	100.0

* Includes costs related to construction and contingencies.

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1. ELIGIBILITY

Project Type

The Project falls within the eligible sector of drinking water.

Project Location

The Project is located in the City of Tombstone, Arizona, approximately 26 miles from the U.S.-Mexico border, and well within the 100-kilometer jurisdiction of BECC and NADB.

Project Sponsor and Local Authority

The public-sector Project sponsor is the City of Tombstone, AZ (the “Sponsor”). Pursuant to Arizona Revised Statutes (A.R.S.) 9-511 and 9-514, the City of Tombstone has the legal authority to operate and maintain water treatment, storage and distribution infrastructure, as well as wastewater collection and treatment systems. The Public Works Department of the City of Tombstone is authorized to provide water utility services to the community and is responsible for developing infrastructure improvement projects.

2. CERTIFICATION CRITERIA

2.1. TECHNICAL CRITERIA

2.1.1. Project Description

Geographic Location

The city of Tombstone is located in Cochise County in the southeastern part of the state of Arizona. It is approximately 61 miles southeast of Tucson, AZ, and 57 miles northeast of Nogales, AZ. Figure 1 shows the location of Tombstone, Arizona.

Figure 1
PROJECT VICINITY MAP



General Community Profile

According to the U.S. Census Bureau, the city had a population of 1,380 residents in 2010.² Its economic activities are based primarily on tourism. In 2010, the unemployment rate in Tombstone was estimated at 6.5%. For the 2010-2014 period, the poverty level for Tombstone was estimated at 25%, above the 18.2% poverty level estimated for the state, and median household income (MHI) was estimated at US\$30,268, which is 39.4% less than the state MHI of US\$49,928.³

The status of public services in Tombstone is described in the table below.

² Source: U.S. Census Bureau, 2010.

³ Source: U.S. Census Bureau, American Community Survey 2010-2014.

Table 1
BASIC PUBLIC SERVICES AND INFRASTRUCTURE

Water System			
Coverage	100% within city limits		
Supply source	Springs (surface) and 2 wells (underground)		
Number of hookups	882 (718 – residential; 164 – commercial)		
Wastewater Collection			
Coverage	53% within city limits (remainder on septic systems)		
Number of connections:	469		
Wastewater Treatment			
Coverage*	100%		
Treatment facilities	Plant	Type	Capacity
	Tombstone WWTP	Oxidation ditch	0.25 mgd
Solid Waste			
Collection coverage	Contracted to the company Waste Management		
Final disposal	Cochise County Landfill		
Street Paving			
Street paving coverage	35%		

Source: City of Tombstone, April 2015.

WWTP=Wastewater treatment plant; mgd = millions of gallons a day

*Calculated based on the percentage of wastewater collected that is treated at a facility.

Local Water System

The city of Tombstone gets its water supply from two (2) wells and a series of springs. One of the two wells, Well No.1, has arsenic concentration that exceeds the primary water quality standards established by the U.S. Environmental Protection Agency (EPA) through the Safe Drinking Water Act (SDWA) and by the Arizona Department of Environmental Quality (ADEQ). ADEQ adopted this standard for public water systems through Section R18-4-217 of the Arizona Administrative Code. The City was issued a Consent Order by ADEQ to bring the system into compliance.

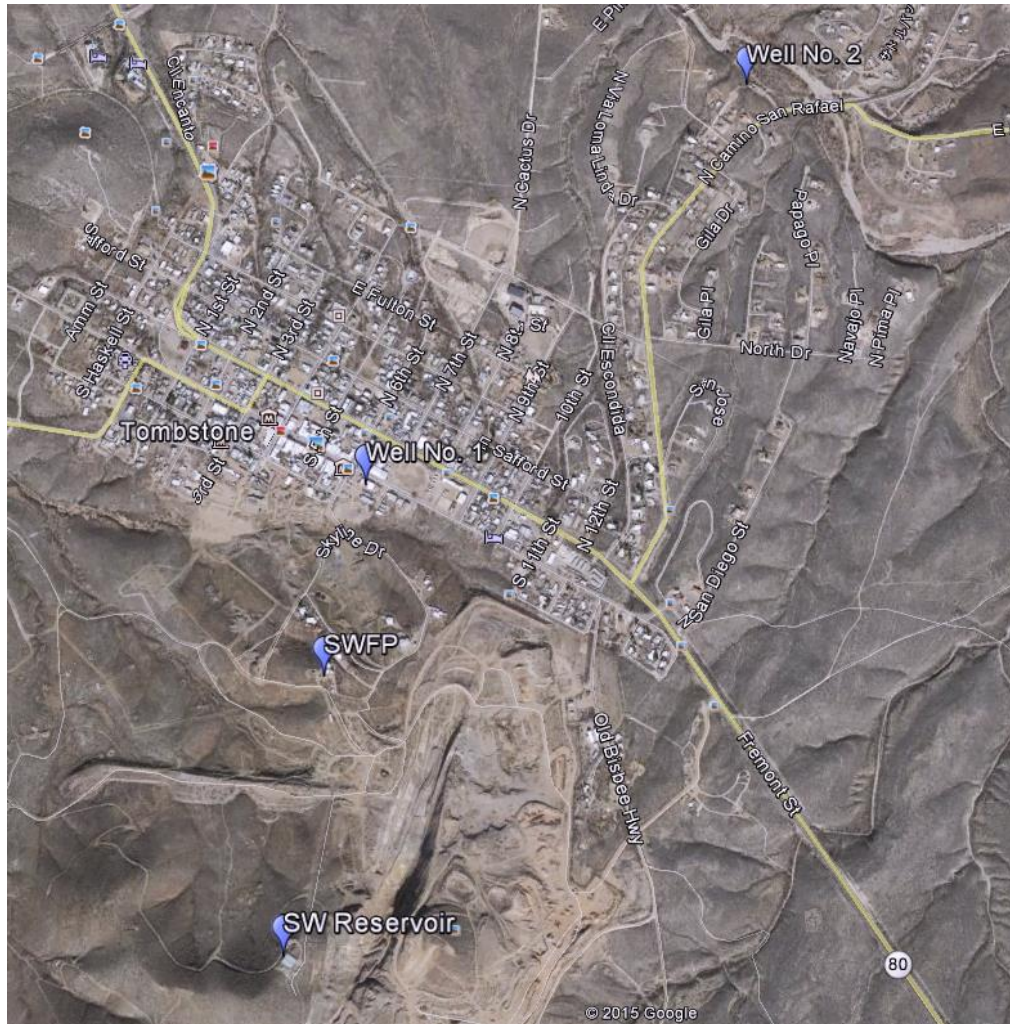
The City also obtains water from four active springs located in the Huachuca Mountains. The water is conveyed by gravity approximately 25 miles through a 7-inch diameter steel pipeline to a 1.2 million gallon (mg) concrete, surface water storage reservoir (the “Reservoir”).⁴ The water flows from the Reservoir down to and through the surface water filter plant (SWFP), is chlorinated and then flows into either the 300,000-gallon and/or the 100,000-gallon storage tank at the same site. From the storage tanks, the water flows by gravity to the city of

⁴ The historic aqueduct was constructed by the Huachuca Water Company in 1881 with high-strength low-alloy steel (HSLA) specially made for Tombstone. The 7-inch main is a very strong pipe that is very difficult to tap or break. The Tombstone maintenance crews drive the 7-inch main weekly to check for breaks or other health or security related problems.

Tombstone. The production rate of the springs varies during the year, and the City adjusts its usage of the water from the springs based on demand. The springs are classified as a surface water source by ADEQ, and the water must be filtered and disinfected prior to potable use. The maximum design flow rate through the SWFP is 300 gallons per minute (gpm).

Figure 2 shows the location of City's water infrastructure, including the Reservoir, SWFP, and Wells No. 1 and 2.

Figure 2
LOCATION OF DRINKING WATER SYSTEM INFRASTRUCTURE



SWFP = Surface water filter plant; SW = Surface water

Project Scope and Design

The Project consists of blending Well No. 1 water with surface (spring) water to bring arsenic concentrations in the drinking water within the established maximum contaminant level (MCL) of 10 micrograms per liter (µg/l), which includes the following components:

- Repair the spring water tank inlet;
- Repair the 1.2 mg reservoir liner and roof structure; and
- Install a blending system to use the spring water with Well No. 1.

When the primary water source from the surface water reservoir is not sufficient to meet the demands of the city, Well No. 2 will serve as the primary backup. In order to integrate and adequately control the contributions of this additional source into the overall drinking water system, the following improvements are required:

- Installation of a new booster pump for Well No. 2;
- Replacement of the pipeline between the wells and the two storage tanks; and
- Installation of control valves at both wells and a Supervisory Control and Data Acquisition (SCADA) system.

The City has obtained the construction permit for the blending plan and infrastructure improvements, which was issued by ADEQ on November 4, 2015. According to the permit, construction must initiate before November 2016. Table 2 shows the proposed schedule for Project implementation milestones.

**Table 2
 PROJECT MILESTONES**

Key Milestones	Status
Procurement	Anticipated: 3 rd quarter 2016
Construction period	Eleven months from initiation

2.1.2. Technical Feasibility

Design Criteria

The final design of the proposed Project was completed in accordance with the minimum design criteria established by ADEQ, as outlined in the Arizona Administrative Code (ACC). The ACC requires that the Project be constructed in accordance with the following regulations:

- Arizona state law, A.R.S. 49-104.B.10, establishing construction requirements according to ADEQ;
- Arizona Administrative Code, Section R18-4-119, which establishes required fittings and valves;

- Arizona Administrative Code, Title 18, Chapter 5, Article 5 (ACC R18-5-502,504), which specifies the minimum design criteria and the requirements for obtaining approval to construct.

Selected Technology

During the final design process, technical alternatives for spring water blending were evaluated. To identify the most appropriate technology, technical alternatives were evaluated pursuant to the following factors:

- Required connection points for the system components
- Investment cost
- Operation and maintenance cost
- Reliability of the materials and equipment
- Environmental impact
- Sustainable technology and practices

The Project improvements are located at four separate locations in and near the city of Tombstone: the Surface Water Reservoir (Site 1), the Water Treatment Site (Site 2), Well No. 1 (Site 3) and Well No. 2 (Site 4). These improvements are described in greater detail in the sections below.

Surface Water Reservoir (Site 1)

The Reservoir is currently supplied by a group of four springs located in the Huachuca Mountains, approximately 25 miles away. These springs are classified by ADEQ as a surface water source and require filtration and disinfection before being considered potable. The supply of water varies considerably, with current estimates of flow ranging from 50 gpm to 400 gpm.

The upgrades to the Reservoir include replacement of the roof, replacement of the high density polyethylene (HDPE) liner with a new 60-mil HDPE liner, electrical upgrades, a new 4-inch pressure relief valve, gate valves for isolation of components, and approximately 360 linear feet of onsite 8-inch DR9 HDPE piping that will serve as a temporary bypass that can be used during maintenance of the Reservoir.

Treatment/Distribution (Site 2)

From the Reservoir, the spring water flows through a gravity steel pipe into the surface water filter plant (SWFP) and chlorination system. The treated water flows into a pair of hydraulically connected tanks (Tanks 1 and 2). The volume of Tank 1 and Tank 2 is 100,000 and 300,000 gallons, respectively. These tanks hold the filtered and chlorinated water for potable use.



City of Tombstone SWFP went into operation in December 21, 1998 (picture taken in March 2015)

The upgrades at the treatment plant are related to the proposed arsenic blending plan and include installation of a new SCADA system, electrical upgrades, a new sampling station, replacement of existing magnetic meters, and installation of a new chlorine residual analyzer, turbidity meter, reservoir pressure transducer, and approximately 30 linear feet of new piping to route the flows from Well No. 1 into the top of Tank No. 2.

Well No. 1 (Site 3)

Well No. 1 was constructed in 1941 and is capable of pumping 275 gpm into the existing system downstream of the Reservoir. This well currently pumps through the chlorination system at the Water Treatment Site, and from there into Tank 2.

The upgrades at Well No. 1 include installation of a new SCADA system with a human-machine interface (HMI), electrical upgrades, and installation of a new magnetic flowmeter.

Well No. 2 (Site 4)

Well No. 2 was designed to deliver 275 gpm into the 25,000-gallon forebay reservoir of a booster station that pumps into Tombstone's distribution system. This booster station is currently nonfunctional, so the well water is being pumped directly into the distribution system through a tank bypass.

The upgrades at this site include re-equipping Well No. 2, installation of a new 600 gpm prepackaged booster pumping station, associated electrical upgrades, 6-inch and 8-inch site piping, and related appurtenances.

- Equipment: Well No. 2 was designed to pump water into the adjacent reservoir; however, the reservoir is being bypassed with flows going directly to the city's water

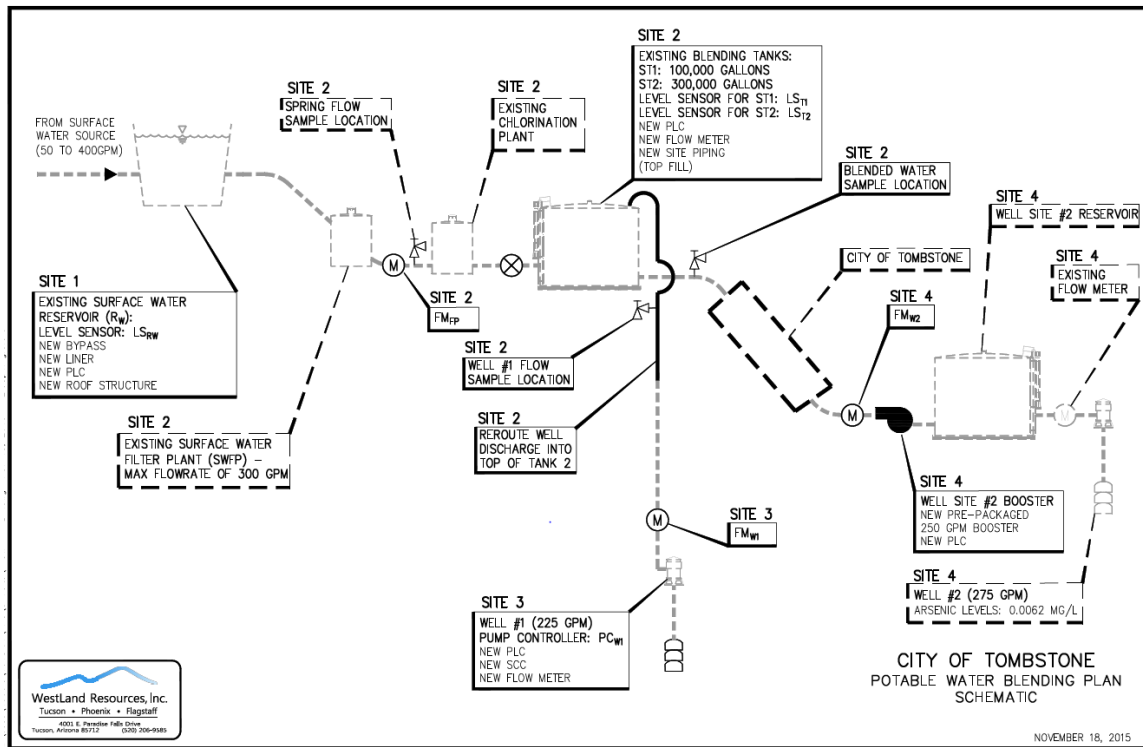
system due to the condition of the booster station. This alternative has likely damaged the pumps, as they are working to send flows far from their original design point. This Project includes removal of the existing well pump, cleaning and inspecting the casing, and testing to select a new pump based on the test results.

- *Booster Station Design*: A new booster pump station will replace the existing one that is currently not operational. When the primary water source is not sufficient to meet the demands of the city, Well No. 2 will serve as the main backup. A 132-gallon ASME bladder tank will be installed off of the pump station suction and discharge manifolds to provide additional protection against surges that can occur when the system starts up and shuts down.⁵ The booster station draws from a 25,000-gallon forebay reservoir. Well No. 2 feeds the reservoir, and its pump will turn on automatically when the water level in the reservoir drops to a certain level. If the water level in the reservoir drops below a minimum level, the booster station will shut down.
- *Booster Station Piping*: The booster station pipelines are sized based on a desired velocity range. The suction manifold and laterals are sized to maintain between 3-5 feet per second (fps). The velocity of the discharge manifold and laterals should be between 5-7 fps. The suction and discharge manifold diameters were calculated based on a future design flow of 600 gpm, and the lateral diameters were calculated based on their individual design flows in gpm.

Figure 3 shows the existing components at each site and the proposed Project improvements at each site.

⁵ ASME stands for American Society of Mechanical Engineers.

Figure 3
PROPOSED WATER SYSTEM INFRASTRUCTURE IMPROVEMENTS



2.1.3. Land Acquisition and Right-of-Way Requirements

All infrastructure improvements will be installed along the existing alignment for pipe replacement and within city rights-of-way or sites within existing facilities.

2.1.4. Management and Operations

Management, construction, and operation of the proposed Project will be the responsibility of the Public Works Department of the City of Tombstone, which has sufficient resources and staff available for these purposes. The Project Sponsor has an operation and maintenance (O&M) manual that includes the primary tasks needed to ensure proper operation of the new infrastructure.

The Department serves approximately 882 water hookups and 469 wastewater connections, and provides treatment to approximately 0.25 mgd of wastewater at the Tombstone’s Wastewater Treatment Plant (WWTP).

Currently, the water operator manually controls water distribution by observing the storage tank levels and closing or opening valves. The proposed SCADA system will eliminate this task. Also, Well No. 2 is currently pumping water directly into the distribution system. The proposed

Project will eliminate this operation by pumping the water to the treatment/distribution site, thereby reducing energy consumption. The Sponsor has indicated that the proposed Project will eliminate specific annual maintenance tasks, resulting in a cost savings of approximately US\$1,507. Without Project implementation, the total projected O&M for 2017 is more than US\$150,000. Considering the expected savings, O&M expenses after Project implementation are anticipated to be approximately US\$149,100. An adjustment in user rates is not required as a result of the Project.

2.2. ENVIRONMENTAL CRITERIA

2.2.1. Compliance with Applicable Environmental Laws and Regulations

Applicable Laws and Regulations

The Project will be constructed within the same alignment and city rights-of-way. There are no additional environmental clearance laws applicable to the Project.

In 2001, EPA adopted a new standard, under the Safe Drinking Water Act (Section 1414), for arsenic contamination in drinking water, limiting its concentration to 10 µg/L. The new arsenic rules required all community water supplies to be within compliance by 2006 and are enforced by both ADEQ and EPA. Additionally, ADEQ requires compliance with the following regulations:

- Arizona Revised Statutes (A.R.S.), Title 49, Chapter 2, water quality control; and
- Arizona Administrative Code (A.A.C.), Title 18, Chapter 4 (ACC R18-4), relating to primary drinking water regulations.

Currently, Tombstone is not in compliance with the arsenic rules; however, the proposed Project will address this issue.

Environmental Studies and Compliance Actions

The City of Tombstone obtained an Approval to Construct (ATC) from ADEQ (File No. 20150263). This certificate gives the City permission to improve the water system, as long as notice is given to ADEQ as required in A.R.S. Section 49-104.B.10.

Pending Environmental Tasks and Clearances

There are no pending environmental tasks or authorizations.

Compliance Documents

Formal authorization has been obtained for the Project from ADEQ through Approval to Construct (ATC) File No. 20150263.

2.2.2. Environmental Effects/Impacts

Existing Conditions and Project Impact – Environmental

The purpose of the Project is to improve drinking water quality by blending water from Well No. 1 with spring water to bring arsenic concentrations within the established maximum contaminant level of 10 micrograms per liter ($\mu\text{g/l}$), which will contribute to the reduction of health risks associated with high levels of arsenic.

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

- Provide improved drinking water quality for 718 residential service connections.
- Result in full compliance with regulatory standards, as arsenic concentrations will be reduced to $< 10 \mu\text{g/L}$.

The environmental impact resulting from Project implementation will be positive overall, given that this Project will improve water quality for human consumption. The Project will support the community's capacity to achieve arsenic compliance and has an arsenic concentration target of less than or equal to $8 \mu\text{g/L}$.

Mitigation of Risks

Only minor environmental impacts are anticipated during construction of the Project, provided that the tasks are implemented in accordance with best management practices. Potential impacts that may occur during the construction phase include:

- Fugitive dust emissions;
- Combustion gas emissions from construction machinery; and
- Temporary roadway blockages and the presence of workers in the area.

Typical mitigation measures to be practiced:

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

In accordance with the ATC issued by ADEQ, the Project must be constructed following all applicable laws, including Title 49, Chapter 2, Article 9, of the Arizona Revised Statutes and Title 18, Chapter 5, Article 5 of the A.A.C. which describes disinfection and testing requirements to be documented in the Engineer's Certificate of Completion and submitted to ADEQ. Upon review and acceptance of this information, an Approval of Construction will be issued by the agency.

Natural Resource Conservation

The Project will contribute to a more efficient use of water sources through improved system controls provided by the SCADA technology, resulting in optimized production, storage and distribution performance and prevention of non-beneficial spills at the Reservoir. Additionally,

improvements to the Reservoir cover will help protect surface water resources from external contaminants. The transmission of water from the springs to the Reservoir, to the SWFP, and to the distribution system is all powered by gravity, requiring no energy and thus avoiding the associated emissions.

No Action Alternative

The no-action alternative was not considered viable. Failing to implement actions to improve the city’s water quality could result in fines by ADEQ and EPA for non-compliance with primary water quality standards. The City has implemented a temporary solution to avoid non-compliant water quality by interrupting water production at Well No. 1; however, this approach is not sustainable, because existing water demand cannot be sufficiently met.

Existing Conditions and Project Impact – Human Health

Arsenic primarily enters the body through inhalation of contaminated dusts or through ingestion of contaminated food, and water. It can also enter through the skin, but dermal absorption is not as common. At low concentrations arsenic can be processed in the liver where it is biomethylated then excreted primarily in urine. Typically, a single low-level dose can be excreted within a few days. However, as arsenic concentrations rise and exposure becomes chronic, the body is less efficient at processing and excreting it.

The health effects from arsenic can be the result of a single large dose or from repeated low doses, such as found in Tombstone’s drinking water. Chronic exposure to arsenic is associated with lung, skin, and bladder cancers, but the mode of carcinogenesis is unknown. Other cancer risks may exist, but linkages are not as clearly established.

Waterborne diseases are caused by pathogenic microorganisms that are directly transmitted as a result of inadequate wastewater disposal practices and unsafe water supplies. An individual can become ill after drinking water that has been contaminated with these organisms, eating uncooked foods that have been in contact with contaminated water, or through poor hygiene habits that contribute to the dissemination of diseases by direct or indirect human contact. Table 3 shows waterborne statistics for Cochise County, Arizona.

**Table 3
 WATERBORNE STATISTICS FOR COCHISE COUNTY, ARIZONA**

Disease	Number of Cases per year				
	2009	2010	2011	2012	2013
Amebiasis	0	5	8	3	0
Campylobacteriosis	5	18	19	23	17
Cryptosporidiosis	0	0	0	0	0
Giardiasis	0	1	1	1	0
Shigellosis	6	12	10	10	7
Vibriosis	1	0	0	2	1

Source: Arizona Department of Health Services, Office of Infectious Disease Services.

The Project will help prevent health problems by ensuring the transmission and distribution of safe drinking water throughout the city. According to the World Health Organization, access to safe water and sanitation facilities, as well as better hygiene practices, can reduce ascariasis-related morbidity by 29%.⁶

Transboundary Effects

No negative transboundary impacts are anticipated.

2.3. FINANCIAL CRITERIA

2.3.1. Uses and Sources of Funds

The total estimated cost of the Project is US\$742,000. The Project Sponsor requested a US\$500,000 grant from NADB through its Community Assistance Program (CAP) to complete the financing of the Project. Table 4 presents a summary of total Project costs and the sources of funds.

**Table 4
 USES AND SOURCES OF FUNDS**

Uses	Amount	%
Construction*	\$ 742,000	100.0
TOTAL	\$ 742,000	100.0
Sources	Amount	
City of Tombstone, AZ	\$ 242,000	32.6
NADB-CAP (GRANT)	\$ 500,000	67.4
TOTAL	\$ 742,000	100.0

* Includes costs related to construction and contingency.

2.3.2 Program Criteria Compliance

The proposed Project complies with all CAP criteria. It is located within the U.S.-Mexico border region served by BECC and 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 has agreed to cover almost a third of the project costs, well above the 10% minimum required under the program.

Moreover, all necessary permits and authorizations have been obtained, and the Project Sponsor is ready to initiate bidding for construction once funding has been approved.

⁶ Source: WHO, Water, Sanitation and Hygiene Links to Health, Facts and figures updated November 2004 (http://www.who.int/water_sanitation_health/publications/facts2004/en/).

2.3.3. Conclusion

For the above reasons, NADB proposes providing a CAP grant for up to US\$500,000 to the City of Tombstone, Arizona, for construction of the Project.

3. PUBLIC ACCESS TO INFORMATION

3.1. PUBLIC CONSULTATION

BECC published the Draft Certification and Financing Proposal for a 14-day public comment period beginning April 29, 2016. The following Project documents were made available for public access:

- Approval to Construct Water Facilities, ADEQ File No. 20150263, issued November 4, 2015; and
- Tombstone Public Works Department, Tombstone Water Infrastructure Improvement Plans prepared by Westland Resources, Inc., of Tucson, AZ, dated September 29, 2015.

The public comment period ended on May 13, 2016, with no comments received.

3.2. OUTREACH ACTIVITIES

The Sponsor promoted the Project at several city council meetings. The meetings were open to the general public, and meeting agendas were made available beforehand. During the general election on November 5, 2014, voters narrowly passed a one-million-dollar bond for water infrastructure repairs, which will provide the required sponsor contribution for the proposed Project.

During a special council meeting on March 18, 2015, the City approved the hiring of an engineering firm for the water infrastructure improvements to be funded with the bond proceeds and the proposed CAP grant from NADB. According to the City of Tombstone Building Official “Mac” McMillon, the City is working with the engineering firm, Westland Resources, Inc. to assist with the design and construction of all the domestic water system upgrades.

BECC conducted a media review and found that the Project received attention from local media, such as the *Tombstone News*. Both the bond issuance results and the hiring of the engineer for the Project were included in this local news source.

Additionally, the City of Tombstone also made national news (CNN). The city sits in the desert but gets most of its water from springs in the Huachuca Mountains. Some of the springs are in a wilderness area protected by the U.S. Forest Service. From the Huachuca’s, the water runs 26 miles east to Tombstone through one of the longest gravity-fed water systems in the country. Portions of Tombstone’s water line were damaged in the massive “Monument Fire” in 2011.

Kathleen Nelson, the acting ranger in charge of the Coronado National Forest, says “the Forest Service has been letting Tombstone do some work, as long as it complies with the 1964 Wilderness Act. In the wilderness, Tombstone can dig with shovels, not bulldozers.” Repairs to the pipeline have been completed and this summer (2016), the City plans to use pack mules to remove debris (damaged pipes and fittings) caused by a recent fire in the area.

No opposition to the proposed Project investments has been detected in the community.