

# Border Environment Cooperation Commission

## Project for Expansion of the Treated Wastewater Distribution System for Monterrey, Nuevo Leon

### 1. General Criteria

#### 1.1 Project Type

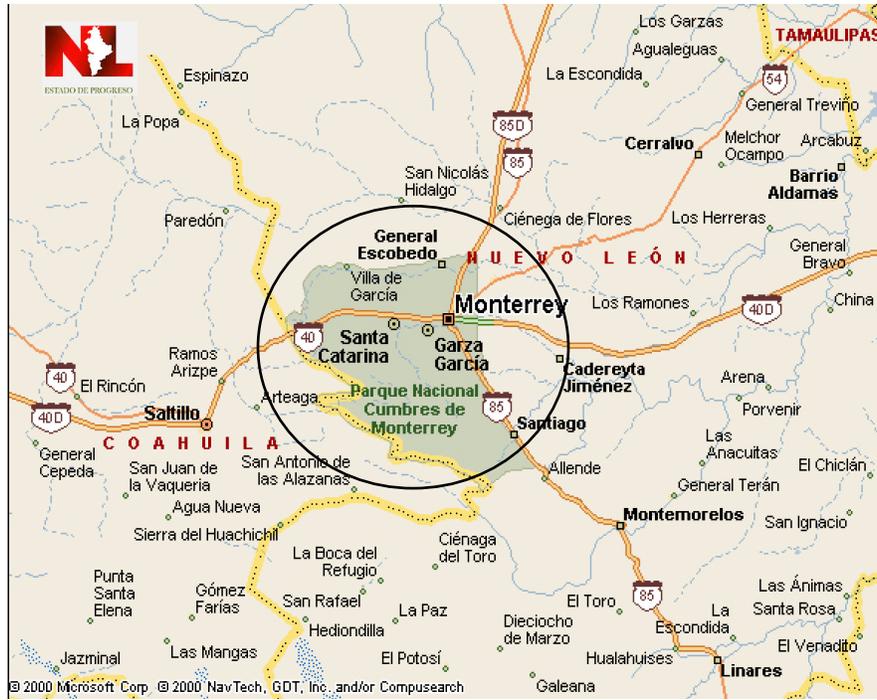
The proposed project consists of expanding the infrastructure available for treated wastewater conveyance in the Monterrey Metropolitan Area and three adjacent communities, for the purpose of increasing the reuse of wastewater for industrial and irrigation of green areas that currently use drinking water. The project includes the construction of treated wastewater conveyance lines, pump stations, and regulation tanks. The project falls under the Border Environment Cooperation Commission (BECC) priority area of wastewater treatment.

The project applicant is Water and Wastewater Utility of Monterrey, Servicios de Agua y Drenaje de Monterrey I.A.P. (SADM).

#### 1.2 Project Location

The following figures show the geographic location of the Monterrey Metropolitan Area.





The city of Monterrey is the capital of the state of Nuevo Leon, a state that is located in the Northwestern part of Mexico. The city covers 1.2% of the total area of the state of Nuevo Leon, and has the following coordinates: north boundary, 25° 48'; south boundary, 25° 29' north latitude; east boundary, 100° 10'; and west boundary, 100° 25' west longitude.

The Monterrey suburban area represents 5.1% of the entire territory of the state, and is located in the Midwestern part of Nuevo Leon. The Monterrey Metropolitan area includes nine cities: Monterrey, Guadalupe, Santa Catarina, San Nicolás de los Garza, General Escobedo, Apodaca, San Pedro Garza García, García, and Juárez. This area is considered one of the largest industrial centers in Mexico. The project is located in the Monterrey Metropolitan Area but also includes the cities of Ciénega de Flores, Santiago, and Cadereyta Jiménez. The project is located within the 300-kilometer border area.

### 1.3 Project Description and Tasks

#### Project Description

The project consists of improvements to the treated wastewater system, with the interconnection of existing infrastructures and the construction of conveyance lines, pump stations, and regulation tanks.

The project's objective is to expand the existing infrastructure in the Monterrey Metropolitan Area, which consists of ten asbestos-cement, steel, and high-density polyethylene branch lines, with Class A-7 diameters that vary between 4" and 30", and

are approximately 160.00 km in length. The existing distribution system is limited in its length and thus, does not obtain the full benefit of the volume of treated wastewater that may be reclaimed and reused for public urban purposes.

This infrastructure will increase treated wastewater reclamation for applications that do not require drinking water, such as the irrigation of green areas and industrial uses. This will allow for more drinking water to be available for human consumption. In 2005, the amount of treated wastewater was estimated at 6.3 m<sup>3</sup>/s, with the this project the capacity for wastewater treatment will be increased to 9 m<sup>3</sup>/s.

The implementation of the project will be conducted in two phase as follows:

First Phase.-

- Part of the first phase has already been constructed and includes ten asbestos-cement, steel, and high-density polyethylene branch lines with Class A-7 diameters varying between 4" and 30" and 160.54 Km in length, as well as ten pump stations with conveyance capacity for 1,450 liters per second.
- SADM strives to complete the implementation of this phase with the construction of ten asbestos-cement, steel, and high-density polyethylene branch lines with Class A-7 diameters varying between 12" and 24" and 101 Km in length, 10 pump stations with conveyance capacity for 770 liters per second, and two regulation tanks with capacity for 2,000 cubic meters.

Second Phase.-

- For this phase, SADM plans to build 101.3 Km of conveyance lines and four pump stations with conveyance capacity for 930 liters per second.

SADM intends to build the complement to the first phase using a loan from the North American Development Bank (NADB).

**Schedule of Project Tasks**

The project scope includes the two phases described above; however, SADM is initially seeking NADB funding to build the complement to the first phase.

First phase work tasks that have already been completed are detailed in the following table:

Reference	Conveyance Line	Plant Capacity (IPS)	Length (Km)
1	García WWTP	50	24.06
2	Northwest	1250	10.38
3	North	2,500	15.30
4	Dulces Nombres	5,000	10.30
5	San Rafael-North	400	15.50
6	San Rafael-West		24.90
7	San Rafael-Huajuco		29.90
8	Santiago- Las Misiones	200	13.00
9	Topo Chico Well	80	15.50
10	Glass Industries	5	1.70
		9,485	160.54

Additionally, ten pump stations have been built. The cost of these work tasks was 416.49 million pesos.

The following table presents the structures that complement the first phase and are pending construction:

No. Task	Reference in Map 2	Description	Description of Tasks
1	II	North-Laredo Highway WWTP 19.7 Km	Feeder 61 cm. (24") Diam , L=4.80 Km 45 cm. (18") Diam , L=8.0 Km 35 cm. (14") Diam , L=5.25 Km 30 cm. (12")Diam , L=1.62 Km
2	V	San Rafael-Huajuco	Villa del Rio Pump Station 150 Hp 80 Lps 29 Km Cathodic Protection
3	VI	Santiago-Las Misiones WWTP	La Chueca Pump Station 300 Hp 100 Lps Feeder 14" Diam , L=10 Km
4	VIII	El Fraile Feeder	Pump Station 4 El Fraile Feeder 14" L=15 Km
5	VII	Dulces Nombres-San Rafael WWTP	San Juan Pump Station 150 Hp 70 Lps Feeder 12" Diam , L=1.00km
6	I	San Rafael-Alamey	1000 m <sup>3</sup> Regulation Tank Propasa 12" Diam Feeder, L=6.25 Km
7	IX	North-Simeprodeso WWTP	Pump Station 75 Hp 80 Lps Feeder 14" Diam , L=5.0 Km
		Distribution Loop	
8	X	Topo Chico III García	Pump Station 4 220 Lps One 1000 m <sup>3</sup> regulation tank Feeder 18" Diam , L = 15 Km
9	IV	North-Arco Vial WWTP	Pump Station 220 Lps Feeder 18" Diam , L=29 Km



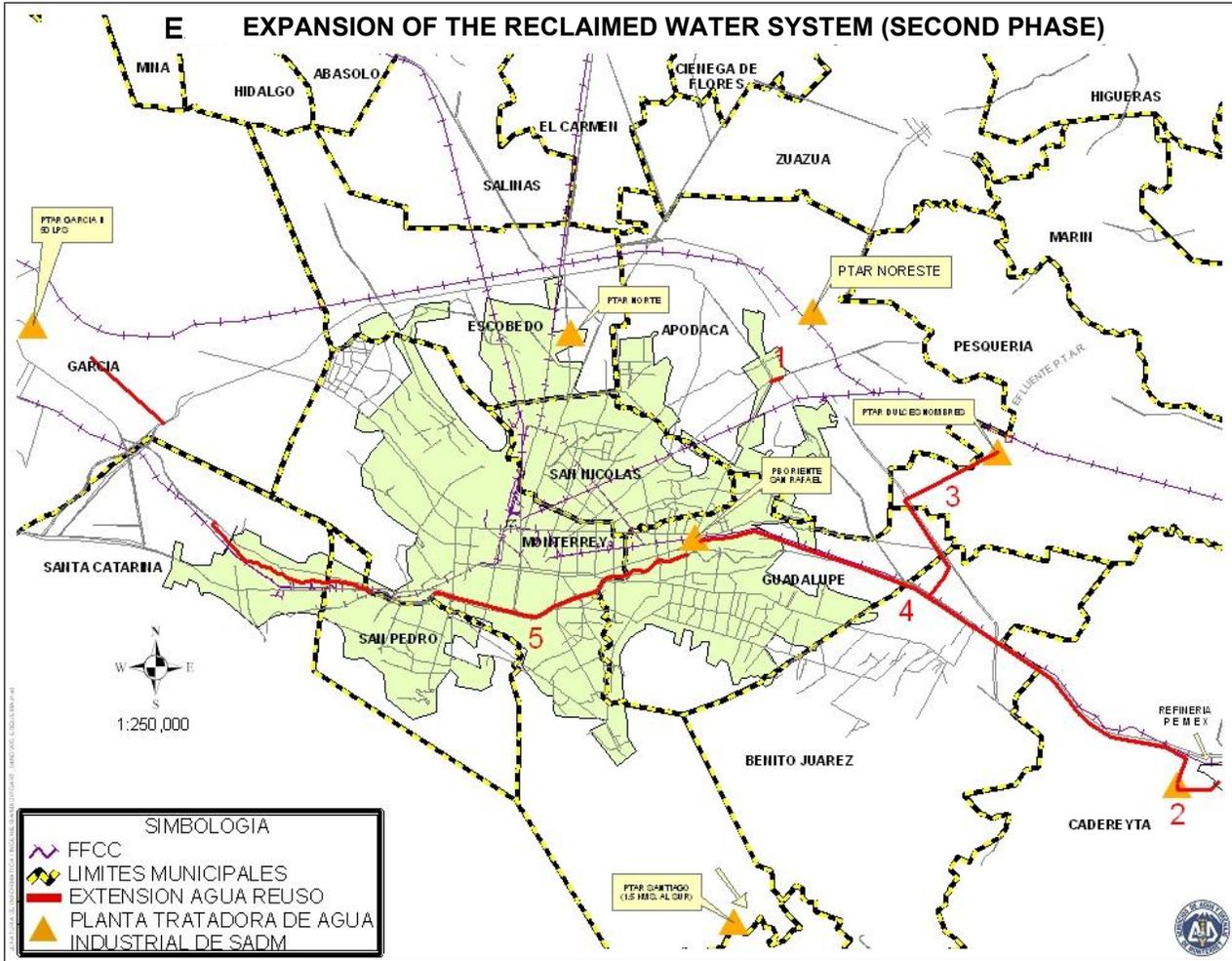


Figure 2 Construction tasks projected for the Second Phase

**Description of the Community**

**Demographics**

The following table shows geographic and demographic data relevant to the Monterrey Metropolitan Area:

Item	Monterrey Metropolitan Area	State of Nuevo Leon
Total Area	3 256 Km <sup>2</sup>	64 200 Km <sup>2</sup>
Population (Dec 2005)	3,592,474 residents	4 242 555 residents

Source: Master Plan for Treated Wastewater Distribution in the Monterrey Metropolitan Area (INEGI 2000): CONAPO Projections.

The following table presents population projections reported by CONAPO for the Monterrey Metropolitan Area:

**Total Midyear Population in the municipalities, 2000-2030**

Code	Municipality	2005	2006	2010	2015	2020	2025
19039	Monterrey	1 139 417	1 141 151	1 145 424	1 145 991	1 142 471	1 135 068
19026	Guadalupe	727 387	735 756	767 547	803 852	836 598	865 403
19048	Santa Catarina	255 884	260 516	278 640	300 409	321 125	340 471
19046	San Nicolás de los Garza	526 328	530 208	544 657	560 693	574 805	586 851
19021	General Escobedo	298 882	310 291	355 775	411 940	466 761	519 360
19006	Apodaca	370 832	386 179	447 542	523 707	598 500	670 753
19019	San Pedro Garza García	140 562	142 838	151 568	161 686	170 948	179 246
19031	Juárez	96 347	101 782	123 866	152 000	180 346	208 390
19018	García	37 635	39 191	45 526	53 644	61 854	69 974
19021	General Escobedo	298 882	310 291	355 775	411 940	446 761	519 360
19049	Santiago	40 238	40 774	42 665	44 841	46 773	48 432
19009	Cadereyta Jiménez	90 762	93 426	103 983	116 910	129 445	141 386

3,592,474

The Monterrey Metropolitan Area is considered an urban zone with no agricultural activities. Its attributed gross internal product is US \$37.4 billion (estimated in 2003). The metropolitan area represents 6.58% of the country's gross domestic product, with the main activities in this area being the industries, manufacturing, trade, and various services.

The break down of manufacturing industries in Nuevo Leon is as follows:

Major Manufacturing Industries	%
Metal products, machinery, and equipment	38%
Foods, drinks, and tobacco	18%
Mineral non-metal products, except oil and carbon products	15%
Chemicals: oil products; rubber and plastic products	11%
Basic metallurgical industries	8%
Cotton textiles and leather industries	4.5%
Paper industries, paper products, printing, promotional office and household items	3%

Source: INEGI. Mexico's National Accounts System (CNA 2003).

**Existing Treated Wastewater Distribution System**

The Monterrey Metropolitan Area currently has 6 wastewater treatment plants with an installed treatment capacity of 9,485 liters per second, and the construction of two additional treatment plants with capacity for 265 lps has been projected. The existing

system supplies treated wastewater to 76 users, two of which are institutional, two are golf courses, and 72 are industries. The volume of flow provided to these users is 1,277.25 liters per second, and their average use is 421.63 liters per second.

The expansion of the system considered in the first phase will make it feasible to supply treated wastewater to 60 new potential users, with an average use of 760 liters per second.

The expansion of the system during the second phase will make it feasible to supply treated wastewater to 12 new potential users, with an average use of 400 liters per second.

### **Project Alternatives**

In order to establish alternatives to the project, SADM considered the Master Plan for the Treated Water Distribution System in the Monterrey Metropolitan Area, developed in April 2005 by IMS Expert Conseils, in collaboration with the Canadian International Development Agency.

For purposes of the preliminary assessment, the following criteria were proposed within the framework of the reclaimed water system expansion project for the Monterrey Metropolitan Area:

- *Potential uses*
- *Peak factor (preliminarily established at 2.0)*
- *Location of main users*
- *Location of existing wastewater treatment facilities*
- *Wastewater effluent quality*
- *Improvements required for existing facilities*
- *Potential construction of new treatment plants*
- *Topography*

Considering the above, the following two alternatives were developed:

1. ***Alternative 1***.- These scheme considered separate areas for water distribution, consistent with the location of wastewater treatment facilities:
  - Zone 1: North-West, supplied by the North treatment facility. The treatment plant will be at its design capacity by the 2021 planning horizon. Five pump stations are required for the primary lines.
  - Zone 2: Santa Catarina. Construction of the Santa Catarina treatment plant, consistent with the utility's project.
  - Zone 3: Northeast, supplied by the Northeast treatment plant. Facilities will be used at their design capacity; it will supply reclaimed water to the Americanas Park (currently being supplied by PEMEX).

Zone 4: South, supplied by the Santiago treatment plant. No specific additional work is required, with the exception of the construction of pump stations projected by the utility.

Zone 5: Central and East. In this area, the Dulces Nombres treatment plant will be used to compensate the disparity between the demand and the capacity of the PEMEX treatment plant.

2. **Alternative 2.-** This scheme proposes distribution sectors. Under this scheme, distribution would be comprehensive, by dividing the distribution system in sectors. In this case, the effluent from the Dulces Nombres treatment plant will be used primarily, with the possibility of using the rest to supplement other sectors in small amounts.

The alternative selected by the applicant (SADM) is Alternative 1.

### **Project Justification**

The implementation of the project will provide the following benefits:

- Drinking water will be freed up for human consumption.
- The withdrawal rate of available supply sources will be reduced.
- Postponement of investments to develop infrastructure for new supply infrastructures, which are limited, considering the geographic situation of the Monterrey Metropolitan Area.
- Rationalization of drinking water usage as a strategy to meet the demand during drought seasons.

The implementation of the first phase will make it possible to reclaim up to 770 liters per second of drinking water to meet the needs of a population of 231,000 residents, considering a daily allocation of 280 liters/resident/day.

The implementation of the second phase will make it possible to reclaim up to 930 liters per second of drinking water to meet the needs of a population of 279,000 residents, considering a daily allocation of 280 liters/resident/day.

### **1.4 Conformance to International Treaties and Agreements**

The project herein falls within the scope of agreements targeted at improving the environment and the quality of life of border residents, which have been signed by Mexico and the United States, such as the La Paz Agreement, the Comprehensive Border Environment Plan, the Border 2012 Program, and the Free Trade Agreement.

## 2. Human Health and Environment

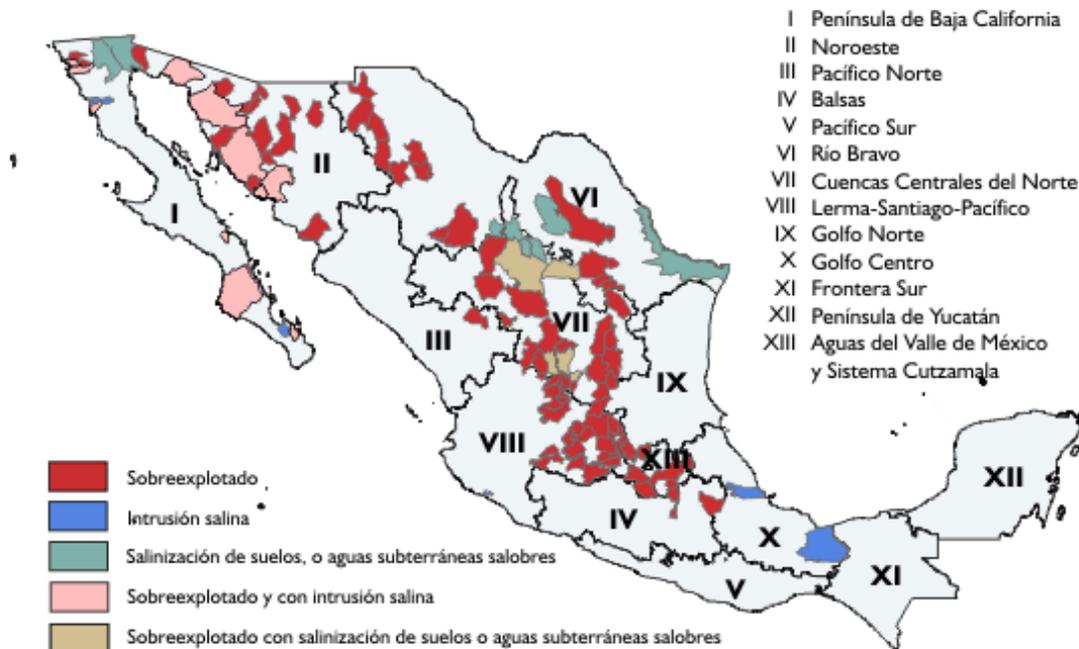
### 2.1 Human Health and Environmental Need.

In Mexico, most of the rainfall comes only during four months of the year. In 30 percent of the country –in the north- the runoff generated is only 4 percent, while in 20 percent of the territory –the southeast and coastal areas- runoff is 50 percent of the national total.

Both the population and the economic activities in Mexico are inversely distributed in relation to water availability. Less than one third of the surface runoff occurs in 75% of the territory, in the areas of lowest water availability, and where the largest concentrations of population, industries, and agricultural land are found (SEDUE, INE, 1992).

The following figure shows the distribution of water, population, and economic activities in Mexico.





Between 1975 and 1994, the number of overexploited aquifers tripled. The number of aquifers where withdrawal rates exceed recharge rates grew from 32 to 104. At the regional level, the largest number of overexploited aquifers is found in the regions known as Lerma-Santiago-Pacífico and Central Basins of the North.

The Monterrey Metropolitan Area is located in the Rio Bravo region, where the natural availability of water drops annually at a tremendous rate. Therefore, in order to meet the demand, importing water from other basins becomes a necessity, a situation that increases production costs and causes potential conflicts among users of the various water basins.

The implementation of the proposed project represents a benefit for the region. Considering the geographical situation of the Monterrey metropolitan area, the project is important because it delays the need to incorporate new sources of water that are limited by addressing reclaimed water demands and substituting drinking water with treated water for industrial uses and irrigation of green areas.

The implementation of the project's first phase will allow reclamation of up to 770 liters per second of drinking water to meet the needs of a population of 231,000 residents, considering a daily allocation of 280 liters/resident/day.

The implementation of the second phase will allow reclamation of up to 930 liters per second of drinking water to meet the needs of a population of 279,000 residents.

The following table presents some of the quality parameters required by the discharge permits issued by CNA to SADM for the effluents of the Monterrey Metropolitan Area treatment facilities.

Parameter	Average Monthly Concentration	Average Daily Concentration
Fecal Coliforms (NMP/100 ml)	1,000	2,000
Grease and Oil (mg/l)	15	25
Biochemical Oxygen Demand (mg/l)	150	200
Total Suspended Solids (mg/l)	150	200

Due to the use of treated wastewater for irrigation of green areas and industrial applications, the effluent of the Monterrey Metropolitan Area treatment facilities must comply with the requirements established by NOM-003-SEMARNAT-1997.

Details on the quality of treated wastewater to be reused in the distribution system are presented in the following table:

Parameter	NOM-003-SEMARNAT-1997		Quality of treated wastewater provided by SADM
	Public services with direct contact	Public services with direct or occasional contact	
Fecal Coliforms (NMP/100 ml)	240	1,000	<200
Helminth eggs (eggs/l)	≤1	≤5	<0.5
Grease and Oils (mg/l)	15	15	<10
Biochemical Oxygen Demand (mg/l)	20	30	<30
Total Suspended Solids (mg/l)	20	30	<30

## 2.2 Environmental Assessment

The Environmental Improvement Department from the Environmental Protection and Natural Resources Agency of the State of Nuevo Leon, determined that the project tasks for the installation of pipes, pump stations, and tanks that will be developed for the treated wastewater system within the Monterrey Metropolitan Area, do not require an Environmental Impact Document.

### Environmental Impacts

During the project implementation stage there will not be any clearing, cutting, or dredging, since all the project components will be implemented in areas that have already been impacted by urban development in existing rights of way.

The project will require excavation, backfilling, and compacting activities for the installation of treated wastewater system pipes and the construction of pump stations and regulation tanks. Impacts associated to air quality, soil, housing, public services, and landscaping, although adverse, will be insignificant, reversible, and temporary in nature. The extent of the effects of these impacts will be contained within the boundaries of the urban area, in sites adjacent to the place where the project components will be implemented.

The following table present the preventive and mitigation actions that will be implemented to mitigate adverse environmental impacts caused by project implementation. The first column shows specific project activities and the second shows the actions that will be taken to prevent, mitigate, or offset the environmental impacts caused by the development of each activity.

TASK	ACTIONS TO BE TAKEN
<b>Procure labor</b>	<p><b>PREVENTION:</b></p> <ul style="list-style-type: none"> <li>* Hire local labor. This action will eliminate the need to install workers' camps.</li> </ul>
<b>Demolition</b>	<p><b>MITIGATION:</b></p> <ul style="list-style-type: none"> <li>* Immediately remove debris to prevent the deterioration of the urban landscape.</li> </ul>
<b>Excavation, backfilling, and compacting</b>	<p><b>PREVENTION:</b></p> <ul style="list-style-type: none"> <li>* Obtain required local construction permits and observe restrictions set forth in such instruments in a timely manner</li> <li>* Before digging ditches, identify existing underground infrastructure to prevent any damage during construction.</li> <li>* Alternate traffic routes will be established. The grid-like configuration of the urban road network will enable the project to offer drivers alternate routes to reach their destinations.</li> <li>* Prior to starting the work tasks, issue notices in the local media and post caution signs in areas that will be impacted.</li> <li>* If necessary, shore up ditch walls where the risk of damaging the foundation of nearby structures exists.</li> </ul> <p><b>MITIGATION:</b></p> <ul style="list-style-type: none"> <li>* To the extent possible, the soil will be watered to prevent dust particles from being released into the air.</li> <li>* The project will ensure that construction deadlines for each task are met, in order that the effects related to the movement of materials (emission of total suspended particles, use of additional land areas for equipment and machinery, deterioration of the urban landscaping, and obstruction of pedestrian and vehicle traffic) affect the community only during the minimum timeframe required to complete the tasks.</li> </ul>

TASK	ACTIONS TO BE TAKEN
	<ul style="list-style-type: none"> <li>* If unforeseeable events cause a task to be halted, the project staff will proceed to repair impacted services, fill back the ditch, replace the pavement (if the delay is expected to be longer than one month), and clean up the area. No ditches shall be left open for any reason whatsoever, in view of the hazard they pose for pedestrian and vehicle traffic.</li> <li>* Proceed to immediately repair any damage resulting from excavation to other types of infrastructure, such as water or secondary sewage pipes, electricity cables, and telephone lines.</li> </ul>
<p><b>Operate machinery and equipment</b></p>	<p><b>PREVENTION:</b></p> <ul style="list-style-type: none"> <li>* The machinery and equipment used shall be in good condition, in order to ensure that suspended particle and gas emissions are within the ranges allowed by Mexican regulations.</li> <li>* Appropriate maintenance will be given to the machinery and equipment, in order to prevent them from exceeding allowable noise levels and contamination levels pursuant with Mexican regulations.</li> <li>* The project will avoid developing activities during the night hours, in order to prevent noise emissions from altering residents' sleep cycles.</li> </ul> <p><b>MITIGATION:</b></p> <ul style="list-style-type: none"> <li>* Silencers will be installed in machinery and equipment for noise abatement.</li> <li>* Vehicles that transport materials will be supplied with tarps to avoid dropping or losing materials.</li> <li>* Personal protective equipment will be used (ear plugs for personnel working near noisy machinery or with long term exposure to noise levels above 70 dB.)</li> <li>* To the extent possible, heavy machinery will be moved to the front of the site during the night hours to avoid blocking vehicle traffic.</li> </ul>
<p><b>Obtain water for construction</b></p>	<ul style="list-style-type: none"> <li>* The project proposes to obtain the water required for construction from the wastewater treatment plant and transport it to the site in tank trucks. This will prevent the use of drinking water for these activities.</li> </ul>
<p><b>Obtain construction materials</b></p>	<p><b>PREVENTION:</b></p> <ul style="list-style-type: none"> <li>* Construction materials will be obtained from material banks or suppliers with the appropriate authorization.</li> <li>* Construction companies will be notified that self-removal of sand or any other construction materials is strictly prohibited.</li> </ul>
<p><b>Generation and disposal of solid waste</b></p>	<p><b>MITIGATION:</b></p> <ul style="list-style-type: none"> <li>* Immediately remove the products of excavations to prevent total suspended particle emissions and odors, the use of additional areas to deposit such waste, waste flowing into the sewage system and/or streams and surface bodies of water, the propagation of harmful wildlife, the deterioration of the urban landscape, additional obstructions to pedestrian and vehicle traffic, as well as damages to workers and the community's health.</li> </ul>

TASK	ACTIONS TO BE TAKEN
	<ul style="list-style-type: none"> <li>* Place covered waste containers in strategic sites to deposit waste generated during all phases of project implementation.</li> <li>* Remove trash generated on a daily basis.</li> <li>* Dispose of waste at the site specified by the applicable local authority.</li> </ul>
<p><b>Generation and disposal of liquid waste</b></p>	<p><b>PREVENTION:</b></p> <ul style="list-style-type: none"> <li>* Open-air defecation will be prohibited to prevent odor emissions and unsightly views that alter the urban landscaping and threaten the health of the workers and the community at large.</li> </ul>
	<p><b>MITIGATION:</b></p> <ul style="list-style-type: none"> <li>* Sufficient portable toilets will be used to ensure that workers have easy access to this service, and will receive the appropriate periodic maintenance.</li> <li>* The project will hire a company specialized in liquid waste management for the site preparation and construction phases. The ability of the company to manage these wastes will be verified, in order to ensure their proper discharge.</li> <li>* Verify that used grease and oils are delivered to a company authorized for hazardous waste management and final disposal. Under no circumstances shall these wastes be dumped onto city sewers.</li> </ul>

None of the adverse impact identified will have any repercussion on the structure and operation of the environmental system, and even less so when mitigation measures are applied. In addition, no adverse environmental impacts that may be considered cumulative or synergic are anticipated.

Treated wastewater lines will be laid at a distance from other utility lines and at different depths, with the purpose of avoiding cross-contamination of water and wastewater collection lines. Additionally, a special color code will be used to differentiate them from drinking water lines to prevent cross-connections.

Treated wastewater production is above 9,000 l/s, and in the project's planning period, a flow lower than 3,000 l/s will be reused. Therefore, the project's implementation will not meet the minimum 6,000 l/s wastewater return flow that needs to be delivered to the Marte R. Gomez Reservoir consistent with agreements signed on November 13, 1996 by the Governments of Nuevo Leon and Tamaulipas, and the Water User Associations in Modules of the Lower San Juan River Irrigation District No. 26. These agreements have been approved and endorsed by the Mexican National Water Commission.

**2.3 Compliance with Applicable Environmental and Cultural Resource Laws and Regulations.**

The determination not to require an environmental impact document was endorsed by the Environmental Improvement Department of the Environmental Protection and Natural

Resources Agency of the State of Nuevo Leon through official memorandum APMARN/VII/228/2005 dated November 22, 2005.

Since the project components will be implemented on existing rights of way and sites that already contain facilities similar to those proposed by the project (pump stations or storage tanks), a consultation with the National Institute of Anthropology and History regarding the no-impact to cultural or historical resources was not necessary.

### 3. Technical Feasibility

#### 3.1 Appropriate Technology

High Pressure conveyance lines and/or distribution networks are built using steel pipes or high density polyethylene pipes with painted green color stripes that identifies them for industrial use.

Pump stations are built with air tight pumps using adequate engines, consistent with the project requirements, and stainless steel impellers to prevent corrosion. Pumping systems are defined by an operation philosophy that includes an engine control center with variable speed converter to provide ample operational clearances. In addition, electrical and electronic systems are supplied with PLC and telemetry control to gradually improve the operational system. The above is considered the state-of-the-art technology required for servicing the different users and, in some cases, alternate pumping systems, operated semi-automatically and/or with on-off controls, are use.

All the facilities and materials that will be used for pipes, pumps, engine controls, electrical systems, and boilers, are built using the latest technological advances and meet all international standards to ensure a long life cycle.

The criteria to determine the size of regulation tanks is characterize by allowing the system to continue supplying users with treated wastewater for up to 1.5 hours without having to feed the regulation tank, and to address higher usage rates during peak hours.

Servicios de Agua y Drenaje de Monterrey uses the following Criteria to identify high-density polyethylene pipes:

- Drinking Water                      Blue lines along the length of the pipe.
- Treated Wastewater                Brown lines along the back of the pipe.
- Sewage Pumping                    Brown lines along the back of the pipe.

For the treated wastewater steel line, a green stripe will be painted on the back of the pipe.

The installation of pipes will follow construction specifications provided by Servicios de Agua y Drenaje de Monterrey.

#### Alternatives

Two alternatives were considered for the overall operation of the treated wastewater distribution system. Alterative 1 considers separate areas for water distribution, consistent with the location of wastewater treatment facilities.

Alternative 2 proposes distribution sectors. Under this scheme, distribution would be comprehensive, by dividing the distribution system in sectors. In this case, the effluent from the Dulces Nombres treatment plant will be used primarily, with the possibility of using the rest to supplement other sectors in small amounts.

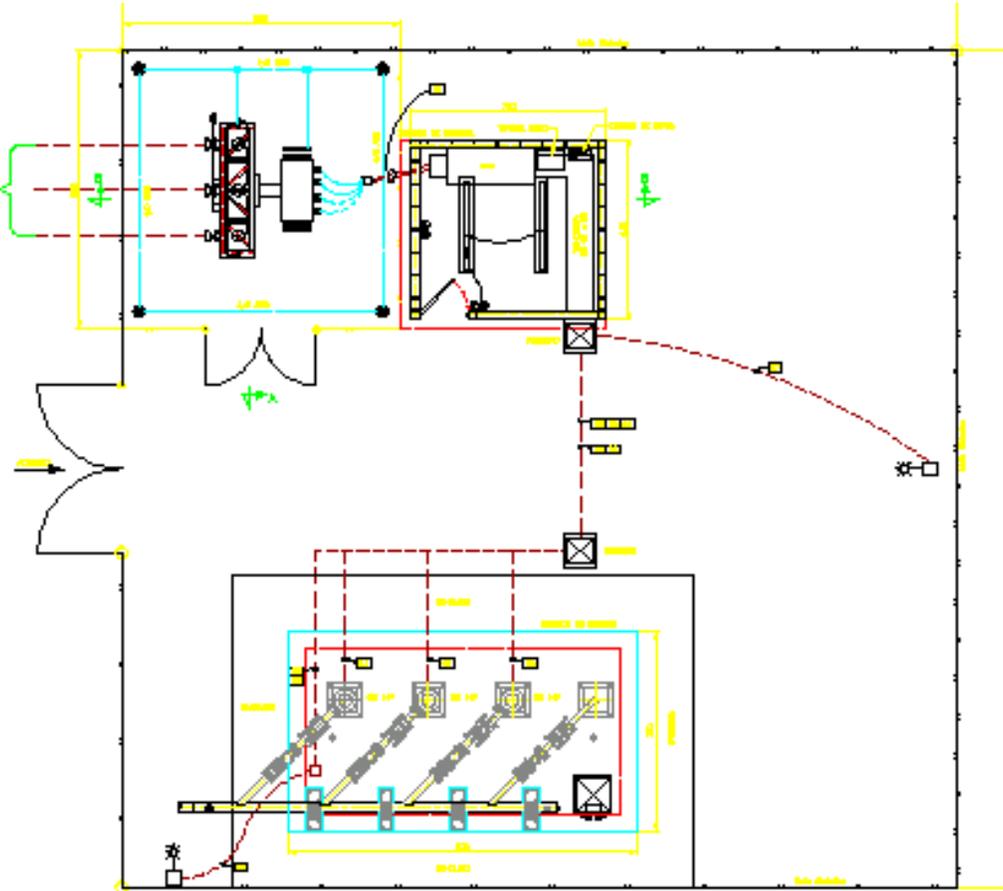
The alternative selected by SADM was Alternative 1, having considering the factors described in Chapter 1.

### 3.2 Technical Process

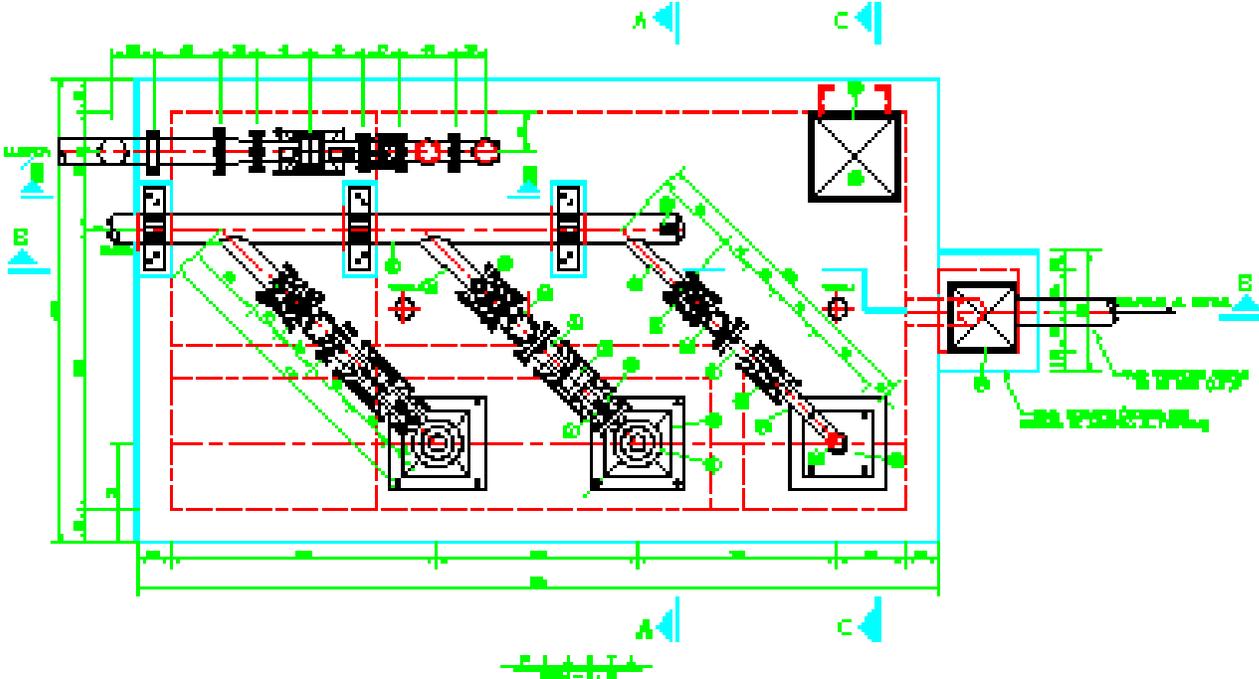
The main design criteria for water reclamation infrastructure include:

- Pumping equipment.  
Maximum pump load. 70 m.  
High-efficiency pumping equipment.  
Operation of equipment with speed converters and soft starters.  
Electrical Substation with capacity for the system's entire load, including standby equipment.  
System operated by Telemetry equipment.

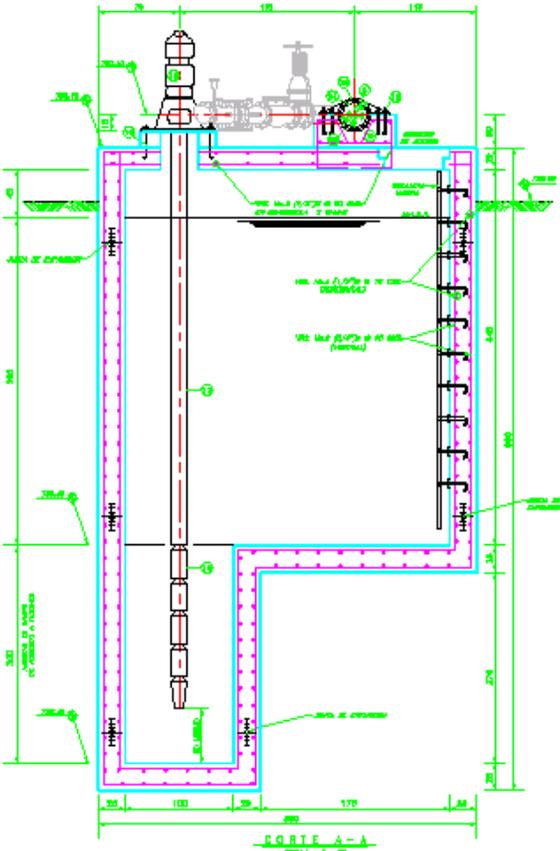
The following figures show the typical layout of a pump station.



General pump station layout



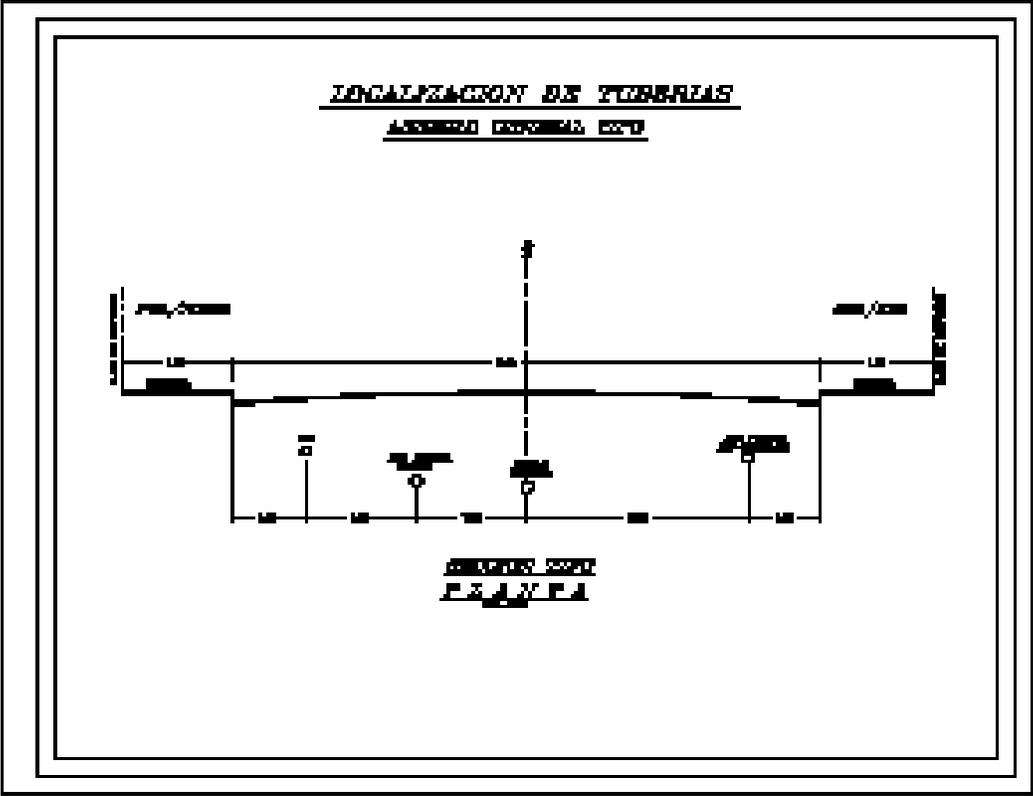
Typical layout of firefighting equipment



Typical layout of a lift station.

- Pumping lines.  
 High density, high-molecular-weight polyethylene pipes with coextruded green lines coding (minimum 3) to identify treated wastewater, consistent with the following Standards: EHMW-PE-3408 (Resin), AWWA-C-906 (Water pipes) NMX-E-18-1996, NOM-002-CNA, ASTM-O02239-89, ASTM-03035-89, ASTM-D1248-89 specifications, minimum pipe thickness RD-17.  
 Use of steel pipes in special crossings or for pipes exposed to inclement weather. These must meet International Standard AWW-C-200-86. Welding must meet AWS-7010 anchoring requirements pursuant to AWS-A5.1-79, and hot pass, filler pass, and cap welding must conform to AWSE-7010 pursuant to AWS-A-5.5-69 Standard. Anti-corrosion protection for steel pipes requires compliance with AWWA-C-203-80 Standard, and for outdoor anti-corrosion protection, materials must comply with Petroleum Standard 3-374.1, NACE-MR-02-74, and table D.10.b.2 XIIG3, and test methods shall be DGN-J-159-1976 and DGN-J-120-1970. Rubber gaskets must meet DGN-T-21-1974 specifications, and specifications in ASTM sections D-412, D-395, D-573, D-471 and D-2240.  
 Special parts will be made Steel, AI-36 Steel, API-5-LB. Steel must conform to ANSI and AWWA-C-177-77 specifications.  
 Mechanical joints must conform to ANSI-A-21-11.

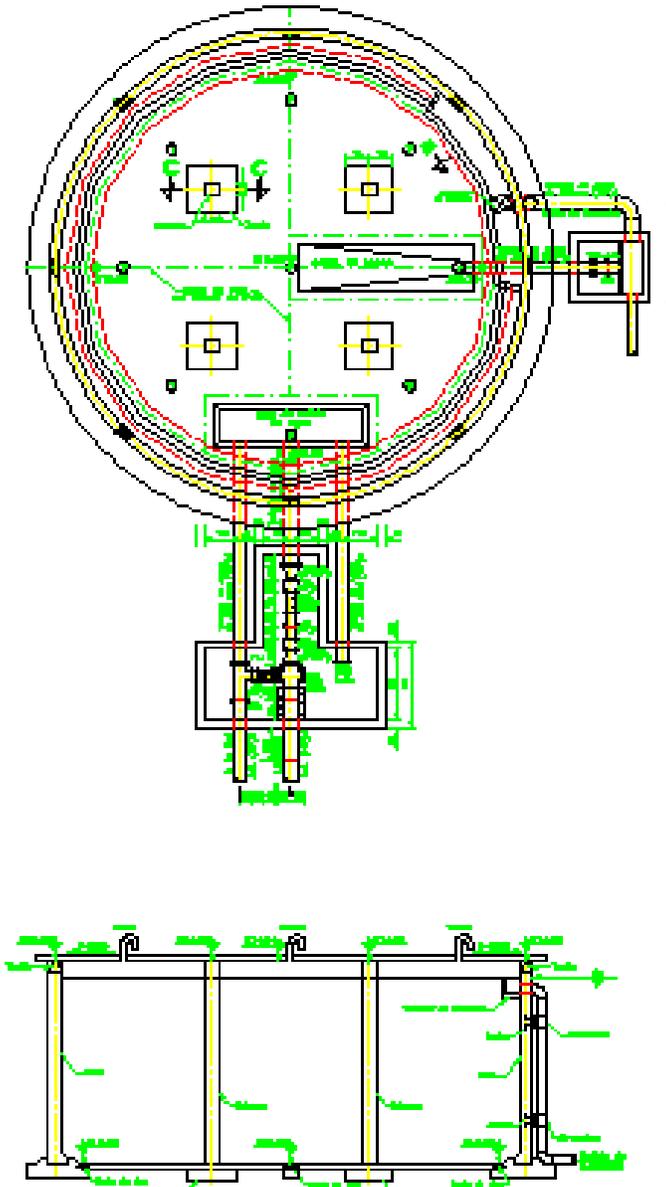
The following table shows the layout of utility pipes along streets.



Location of water, wastewater, and treated water pipes along streets

- Regulation tanks.  
Tanks will be built with the same technical characteristics of those used for drinking water distribution systems, conforming to technical specifications established by CNA design manuals for drinking water distribution systems.  
Materials:     Concrete  $F_c = 350 \text{ kg. /cm}^2$   
                  Steel Reinforcement  $F_y = 4,200 \text{ kgs. /cm}^2$

The following figure shows the typical structure of a regulation tank.



**Typical regulation tank structure.**

- Sectioning Valves.  
Butterfly valves must conform to International Specification AWWA-C-504-80. They must be wafer type if up to a 50 cm diameter and thereafter, with flanged ends ASA150 Lbs. /sq in.  
Gate valves must conform to International Specifications AWWA-C-500-71, AWWA-C-110, AWWA-C-115, ANSI-A-2110, and ANSI-B-1610.  
Air Intake and Outflow valves must be manufactured in conformance with Specification ASTM-A-48, Class 30, with stainless steel floats ASTM-A-240.

Controlled Shutoff Valves must conform to Specification ASTM-A-126, Class B, or A-216-WCB. The piston must be bronze, pursuant to ASTM-B-62.

- Safety Valves must conform to Controlled Shutoff Valve specifications.

Final designs have not been completed and are currently under development. Final designs of representative project components have been completed, such as conveyance lines, pump stations, and regulation tanks. SADM staff estimates that the remaining of the final designs for the first phase will be completed by April 2006.

### **Operation and Maintenance Plan**

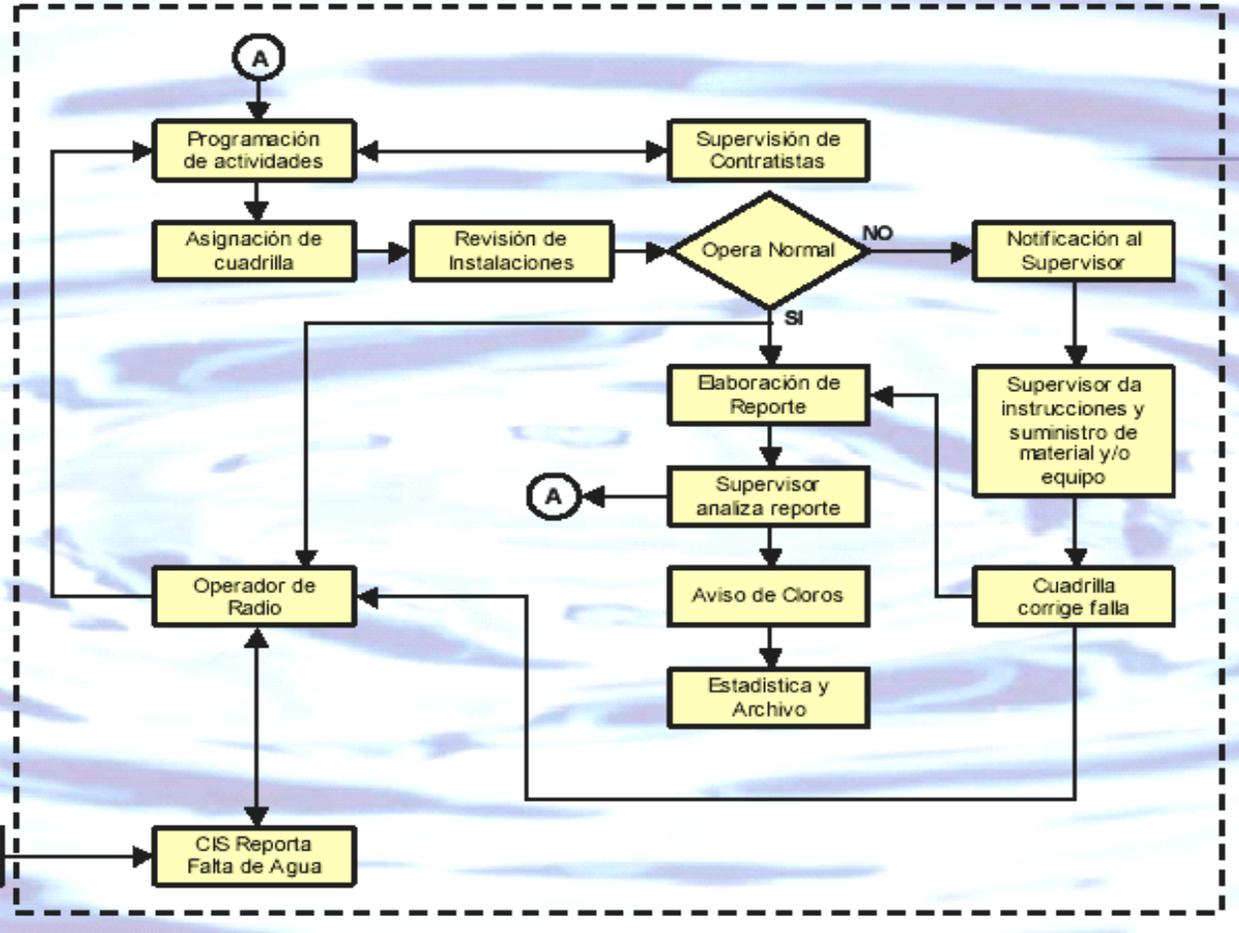
SADM has manuals and procedures, as well as annual budget allocations to operate and perform preventive and corrective maintenance of the existing treated wastewater distribution system, as well as the lines that will be built upon the implementation of the proposed project. SADM manuals meet the requirements of the ISO-9001-2000 Quality Management System. SADM is currently in the process of obtaining such Quality Certification.

Personnel from the Operations Division will operate the treated wastewater distribution system and perform preventive and corrective maintenance of conveyance lines, electrical and mechanical equipment at pump stations, and regulation tanks. Additionally, personnel from the Maintenance Department will perform preventive and corrective maintenance of movable property (transportation vehicles, equipment, compressors, cranes, jet-vacs, hydrocleaners, pumps, etc.) and real property (operations buildings, pump houses, tanks, wells, etc.).

The frequency of maintenance activities for the treated wastewater distribution system is determined by SADM pursuant to the Annual Preventive Maintenance Program established by the Operations Division and the Maintenance Department.

The following figure shows the review and maintenance process for the pumping facilities.

Pump Station Review and Maintenance  
PR-OPR-PR-08



3.3 Compliance with Applicable Design Standards and Regulations

Final designs for the conveyance lines, pump stations, and regulation tanks that make up the project were developed in accordance with technical specifications contained in the Drinking Water Manual prepared by CNA's Technical Subdirectorate. The treated wastewater effluent produced by the treatment plants meets the quality requirements of NOM-001-SEMARNAT-1996 and NOM-003-SEMARNAT-1997.

## 4. Financial Feasibility and Project Management

### 1. Financial Feasibility

The North American Development Bank (NADB), after reviewing the financial information submitted by the Project Sponsor, determined that the financial capacity and structure proposed by the water and wastewater utility (*Servicios de Agua y Drenaje de Monterrey* [SADM]) are adequate. The information submitted and the financial analysis include:

- i) Historical and pro forma financial statements;
- ii) Project's financial structure;
- iii) Capital improvement program;
- iv) Historical and pro forma operating and maintenance budget; and
- v) Economic and demographic information on the project area.

A detailed analysis of the project's financial information is contained in the loan proposal that will be submitted to the NADB Board for authorization. A summary of the financial analysis is presented below.

The total cost of the project's First Phase is estimated at MX\$716.49 million, including loan closing costs, supervision, construction, value-added tax, and contingencies.

Item	Amount (Million Pesos)
Construction	716.33
Loan closing costs	0.16
TOTAL	716.49

SADM has proposed a financial structure that will allow for a successful project implementation. The table below summarizes the proposed structure:

Funding Source	Amount (Million Pesos)	%
SADM Contributions	416.49	58
NADB Loan	300.00	42
TOTAL	716.49	100

SADM shows a solid financial situation, as reflected by their level of revenue and expenditure control. SADM will earmark part of their revenues to service the debt.

SADM has efficient financial management practices. Their use of resources and financial discipline has translated into an operational surplus. The NADB loan will not affect the utility's financial situation, so SADM will be able to continue addressing future infrastructure needs.

## 2. Rate/Fee Model

SADM has a rate schedule for the sale of treated wastewater. Such scheme provides SADM sufficient income to cover their operation and maintenance costs and to service their NADB loan. In addition, SADM will allocate funds as needed to complete the project's construction, as well as to operate and maintain the associated infrastructure.

The purchase rate for reuse water in the metropolitan area of Monterrey is the following:

<b>Reuse</b>		
<b>Monthly Usage M<sup>3</sup></b>	<b>Flow in liters per second</b>	<b>rate \$/m<sup>3</sup></b>
1 a 130,000	50	5.90
130,001 a 259,200	50 to 100	5.54
259,200 a 518,400	100 to 200	5.14
518,400 a 777,600	200 to 300	4.74
777,600 y más	More than 300	4.33

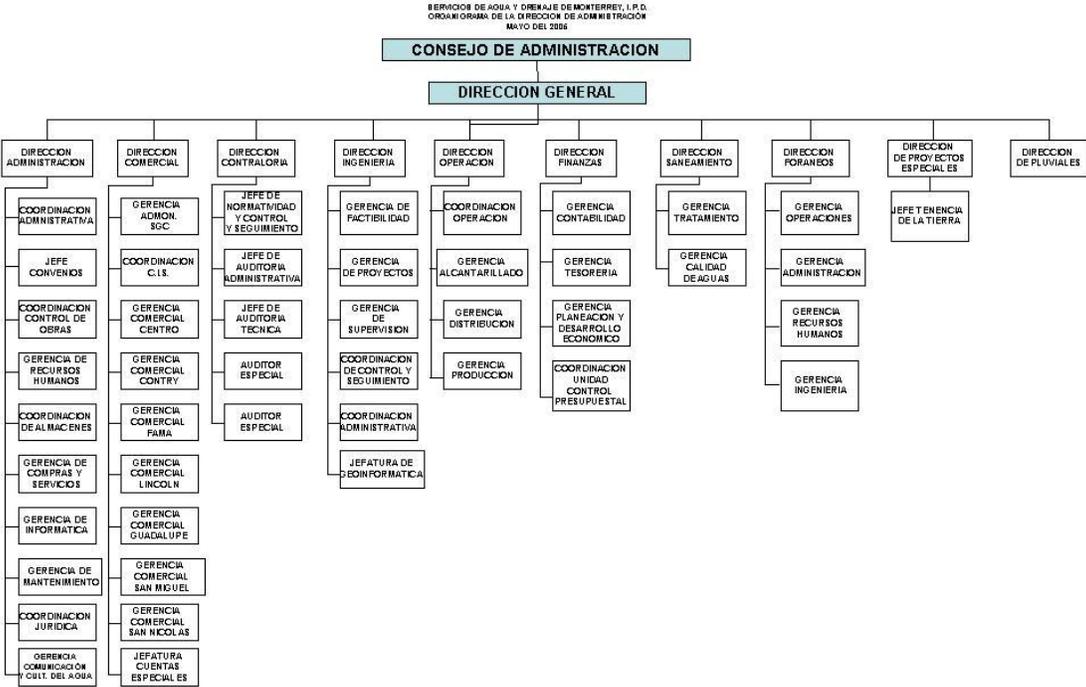
## 3. Project Management

The project will be managed by SADM. The utility has adequate staff to manage the proposed infrastructure and address any potential contingencies related to the project's operation and maintenance.

The management of the Project will include the following departments of the Utility;

- The Project Development Department within the Engineering Division is responsible for the final design of the project.
- The Construction Department with the Administration Division, procures and contracts for the construction of the project.
- The Supervision Section within the Project Development Department will supervise the construction of the Project.
- Control and Follow-up Section in conjunction with the Administration Section within the Engineering Department are responsible for the receipt, review, and verification of invoices during the construction.
- The Treasury Department within the Finance Division will process the invoices during construction.
- The Distribution Department within the Operations Division is responsible for the operation of the Reuse infrastructure.

The following is the organizational chart for the utility:



## 5 Public Participation

### a. Comprehensive Community Participation Plan

The Comprehensive Community Participation Plan developed by the Steering Committee was approved by BECC on March 10, 2006. This program includes a program for public outreach regarding the tasks proposed for certification, the benefits that these tasks will provide to the community, and their costs. In addition, the program includes information that will be disseminated through mass media, as well as a program for meetings with various sectors of the community, such as professional organizations, the academic sector, and grassroots associations. At the end of the public participation process, the majority of the community should be aware of the project and the benefits it intends to provide for the population at large.

**1) Local Steering Committee:** The Steering Committee was established on March 10, 2006 for the Project for Improvements to the Treated Wastewater Distribution System in Monterrey, Nuevo Leon. The meeting was attended by the guests listed below:

-CP. Luis Alberto Villarreal	Director de Modernización y Proyectos de la Secretaría de Servicios Públicos
-Ing. José Luis Bueno Zamora	Sociedad Mexicana de Aguas
-Lic. Beatriz Landa Hernández	Cámara de Propietarios de Bienes Raíces
-Lic. Guillermo Dillon Montana	Director General de CAINTRA
-Lic. Jesús Marcos Giacomán	Presidente de CANACO
-Dr. Gabriel Mayagoitia Fragoso	Consejero de CANACO
-Dr. Betzahel Treviño Zamora	Director del Instituto del Agua del Estado.
-Ing. Genaro Leal Martínez	ATHENA
-Dr. Fernando Gutiérrez Moreno	IPA CAINTRA
-Ing. Lombardo Guajardo Guajardo	Director General SADM.
-Ing. Tomás Garza Guillén	Director Comercial SADM
-Ing. Jorge Infante Fuentes	Gerente de Planeación SADM
-C.P. Pilar Mayagoitia Fragoso	Área Comercial SADM
-Ing. Jaime Galván Ancira	Coordinador de Dirección Comercial SADM.

A board of directors was elected for this Committee:

- Chairman of the Steering Committee: Dr. Fernando Gutiérrez Moreno, IPA CAINTRA.
- Vice-Chair: Ing. José Luis Bueno Zamora, representante de la Sociedad Mexicana de Aguas.
- Technical Secretary of the Steering Committee: Mr. Tomas Garza Guillen, from SADM.

During the same meeting, the Committee was informed of the tasks that comprise the project submitted for BECC certification.

**2) Meetings with Local Organizations:** The program developed meetings with various professional, grassroots, and non-governmental organizations with local representation.

**3) Public Access to Project Information:** The Steering Committee, with support from SADM, prepared a project summary with the purpose of making it extensively available during public meetings. Information about the project was also made available at the SADM office and website for review by interested individuals or institution.

**4) Public Meetings:** As part of the BECC eligibility criteria, at a minimum of two public meetings have to be conducted to present project details and address questions about its development, as well as to obtain the residents' input. The reasons behind the proposed actions must be detailed, along with the benefits resulting from their implementation. The benefits resulting from the proposed project must also be explicitly stated.

**First Public Meeting:** The first meeting was held on March 23, 2006 at the Center of CINTERMEX in Monterrey, Nuevo Leon with approximately 19 people attending. Exit surveys taken at the public meeting demonstrated 100% support of the project as well as an understanding of the need and benefits of the project.

**Second Public Meeting:** The second public meeting was held on April 19, 2006 at the same place, the Center of CINTERMEX in Monterrey, Nuevo Leon. With about 36 participants, the financial aspects of the project were presented including the financial structure and the applicable rate schedule. Exit surveys at this meeting demonstrated 100% support the financial aspects of the project.

b. Report Documenting Public Support.: The Final Public Participation Report was delivered to BECC with the supporting documentation that shows the extent and fulfillment of the public participation objectives and public support for the project as outlined in the BECC certification requirements.

## **6. Sustainable Development**

### **1. Definition and Principles**

The project to improve the Treated Wastewater System in the Monterrey, Nuevo Leon Metropolitan Area meets the definition of sustainable development promoted by the BECC: "Conservation oriented social and economic development that emphasizes the protection and sustainable use of resources, while addressing both current and future needs, and present and future impacts of human actions."

The project's objective is to expand the water reclamation infrastructure available in order to meet the growing water demands of industries and green areas located in and adjacent to the Monterrey Metropolitan Area.

Overall, the proposed project will achieve significant environmental, human health, and social benefits, inasmuch as the following feasible objectives have been established:

- Reuse treated wastewater that is not being reclaimed.
- Through the rationalization of water usage, the project intends to free up drinking water for human consumption and to reduce the rate of withdrawal from existing water supply sources.

### **2. Institutional and Human Capacity Building**

Given the nature of the project, institutional capacity building actions are not required. The treated wastewater distribution lines, expanded with the project, will be operated by Servicios de Agua y Drenaje de Monterrey I.A.P., an entity that possesses the administrative, technical, and financial capacity needed to operate and maintain the new infrastructure proposed with the implementation of the project.

### **3. Conformance to Local and Regional Conservation and Development Plans**

This project compliments the actions considered in the Monterrey Municipal Development Plan and the Monterrey 2002-2020 Urban Development Plan, which propose strategies and actions to encourage collaboration with public and private organizations, in order to take advantage of alternative programs and investment funds available to benefit the community.

In the area of regional planning, the project incorporates actions and tasks included in the 2001-2006 National Water Program (PNH), specifically addressing one of the plan's basic principles, which seeks to promote a culture that encourages the effective use of water and the appreciation of its economic and strategic value, which will provide for a more efficient use of this resource in the Monterrey Metropolitan Area.

#### **4. Natural Resource Conservation**

Considering that the Monterrey Metropolitan Area has significant wastewater treatment infrastructure, by which treated wastewater with adequate quality for public urban uses is obtained, the project proposes to reclaim treated wastewater, making it possible to free up drinking water, to increase the availability of water resources, and defer the need to implement costly investments to improve water availability and supply in the Monterrey Metropolitan Area.

#### **5. Community Development**

The project will positively impact the community, benefiting large stretches of the urban sprawl located on the outskirts of the city, primarily in areas with low water availability and aquifer potential. Above all, it makes it possible to supply treated wastewater and to potentially free up flows to meet first-use water demand.