Binational Study Regarding the Intensive Monitoring Of the Rio Grande Waters in the Vicinity of Laredo, Texas and Nuevo Laredo, Tamaulipas Between the United States and Mexico

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AUTHORITY

This study and report were undertaken by the United States and Mexico pursuant to the International Boundary and Water Commission Minute No. 279, "Joint Measures to Improve the Quality of the Waters of the Rio Grande at Laredo, Texas/Nuevo Laredo, Tamaulipas," dated August 28, 1989.

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- Rio Grande Regional Office, Monterrey, Nuevo Leon
- State Laboratory, Tamaulipas

State Secretariat of Urban Development and Ecology (SEDUE), through the Environmental Laboratory of the Municipal Commission on Potable Water and Sewerage (COMAPA)

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International Boundary and Water Commission, United States and Mexico (IBWC)

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FORWARD

The Governments of the United States and Mexico issue this report through their sections of the International Boundary and Water Commission and the National Water Commission of Mexico. The governments of both countries thank the United States Environmental Protection Agency and the State of Texas, specifically the Texas Natural Resource Conservation Commission, the Municipal Commission on Potable Water and Sewerage, the State Secretariat of Urban Development and Ecology, and the State Commission on Potable Water and Sewerage for their participation in the study.

Copies of this report in English may be obtained from the International Boundary and Water Commission, 4171 North Mesa Street, Suite C-100, El Paso, Texas, 79902.

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

ACMSK	Albion Environmental Clean Metals Sampling Kit
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
^{o}C	Degrees Celsius
CECA	Ecological Water Quality Criteria
CMS	Cubic Meters per Second
CNA	National Water Commission
CFU/100 ml	Colony Forming Units per 100 milliliters
CVAA	Cold Vapor Atomic Absorption
CVAF	Cold Vapor Atomic Fluorescence
DO	Dissolved Oxygen
^{o}F	Degrees Fahrenheit
GFAA	Graphite Furnace Atomic Absorption
IBWC	International Boundary and Water Commission, United States and Mexico
ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma/Mass Spectroscopy
km	Kilometer
mg/l	milligrams per liter
MGD	million gallons per day
MBAS	Methylene Blue Active Substances
MPN/100ml	Most Probable Number/100 milliliters
MxIBWC	Mexican Section, International Boundary and Water Commission
NLIWTP	Nuevo Laredo International Wastewater Treatment Plant
ppb	parts per billion
QA/QC	Quality Assurance/Quality Control
SEDUE	Secretariat of Urban Development and Ecology
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TSWQS	Texas Surface Water Quality Standards
TSS	Total Suspended Solids

µg/L	micrograms per Liter
µmhos/cm	micromhos per centimeter
USEPA	United States Environmental Protection Agency
USIBWC	United States Section, International Boundary and Water Commission
VOC	Volatile Organic Compounds
VSS	Volatile Suspended Solids

EXECUTIVE SUMMARY

The Rio Grande is an important water supply for the United States-Mexico border region. Communities such as the sister cities of Laredo, Texas and Nuevo Laredo, Tamaulipas rely heavily on the river for agriculture and as a drinking water supply. Within the last thirty years, the two cities have been experiencing rapid population growth and expansion due to the increasing trade between the United States and Mexico. The Rio Grande is influenced in this area by treated wastewater effluents, untreated wastewater, and tributary flows. In order to address water quality issues, current information must be available to determine the condition of the river.

In November 2000, the International Boundary and Water Commission, United States and Mexico (IBWC), along with other federal and state agencies, collected seven sets of water quality samples in the Rio Grande along the Laredo/Nuevo Laredo reach to determine the ambient water quality during low flow conditions. The river samples were also compared to current Texas Surface Water Quality Standards (TSWQS) as a point of reference on current water quality conditions. Additionally, samples were collected at the Nuevo Laredo International Wastewater Treatment Plant (NLIWTP) to compare the effluent discharges with the standards established under IBWC Minute No. 279. The information collected from this study would also assist agencies that monitor the Rio Grande identify areas that need additional or increased monitoring.

Results of the study show that overall water quality compared to TSWQS is comparable and the majority of the parameters fall within acceptable limits. Contact recreation (swimming and wading) is not being attained because fecal coliform and *E. Coli.* levels increase as the river flows through both communities. The increase in concentration of bacteria in the mainstem of the river as it flows through the two communities should be addressed in current monitoring programs and extended to a binational level. This effort should include the Rio Grande and its tributaries in this reach to identify the sources of bacterial contamination that continue to affect this portion of the river. Also, this monitoring program should provide the means for the creation of a binational network for the timely exchange of water quality data between water quality monitoring entities in the Laredo/Nuevo Laredo area.

The results obtained by Mexico in this study indicate that the organic compounds detected in the channel of the Rio Grande, such as hexachloro 1-3 butadiene, hexachloroethane and 1-4 dichlorobenzene probably originate from agricultural, municipal, and industrial activities, and are the constituents of major concern according to the criteria employed. The NLIWTP is producing a very good quality effluent. Samples collected from the facility show a very good efficiency removal of solids, and, with the exception of two samples exceeding the fecal coliform limit, the standards established under IBWC Minute No. 279 were being met. The presence of organic compounds was detected in the NLIWTP effluent by both countries. Currently, applicable legislation does not consider the presence of organic compounds, such as the hexachloro 1-3 butadiene, hexachloroethane and 1-4 dichlorobenzene detected in the NLIWTP effluent; however, given the origin, persistence and behavior of these organic compounds, should be included in future monitoring studies.

The monitoring program should be continued at the NLIWTP Influent contemplated under IBWC Minute No. 297 to identify all those companies that discharge wastewater into the sewerage system with the objective of regulating these discharges and protecting the proper functioning of the Nuevo Laredo wastewater treatment process; while for the Rio Grande, we suggest a systematic monitoring program to determine the sources of contamination for the purposes of regulating them and thus preclude the deterioration of the system to be able to use the water whenever required. Future monitoring programs should be designed to efficiently collect the data, which will permit an evaluation of the effects of these applications on receiving bodies of water and their ecosystems.

INTRODUCTION

BACKGROUND

The Rio Grande is the primary water supply for many communities in the United States-Mexico border region (Figure 1). Sister cities along the border utilize this resource for growing crops, industrial processes, recreation, fish consumption, and as a drinking water supply. Increased demands on this natural resource is most evident when trying to secure a sustainable water supply to meet projected increases in population and commercial use while trying to find a balance with traditional uses such as agriculture. As communities continue to grow, the need to protect the Rio Grande from contamination becomes of greater importance.

In the Laredo/Nuevo Laredo area, the Rio Grande is the primary source of drinking water. Waters from the Rio Grande are diverted into two water treatment facilities, one in the United States and the other in Mexico. These facilities remove any settleable solids and disinfect the water prior to distribution. The City of Laredo is the second fastest growing city in the United States with a current population of 177,000. Nuevo Laredo has a population of over 300,000 and is continuing to grow rapidly. Both cities can attribute their rapid growth to industrialization and the trade relationship between the United States and Mexico.

Because of this rapid growth, development of infrastructure projects to adequately treat wastewater lagged and could not support the growing communities. Developing the collection systems and treatment facilities to solve these deficiencies became a priority on both sides of the border. In 1989, the International Boundary and Water Commission, United States and Mexico (IBWC) adopted IBWC Minute No. 279 titled "Joint Measures to Improve the Quality of the Waters of the Rio Grande at Laredo, Texas/Nuevo Laredo, Tamaulipas" to address the border sanitation problem in the international reach of the Rio Grande. In 1996, the Nuevo Laredo International Wastewater Treatment Plant (NLIWTP) began operations and provides the Nuevo Laredo area with wastewater treatment as well as an improved collection and pumping system. Additional plans to complete the development of the collection system in the Nuevo Laredo are underway.

The importance of the Rio Grande to these two cities as a drinking water supply cannot be overemphasized. In order to address water quality issues, current, scientifically valid information must be available to determine the status of the river. In November 2000, the IBWC, along with other federal and state agencies, collected seven sets of water quality samples in the Rio Grande along the Laredo/Nuevo Laredo reach to determine the ambient water quality during low flow conditions. These samples were split between the United States and Mexico and analyzed by their respective laboratories. Additional samples were collected at the NLIWTP influent and effluent to determine the treatment efficiency of the treatment plant and measure the quality of the effluent being discharged into the Rio Grande.

The objectives of the study were to: 1) make a comparative analysis of water quality conditions in the Rio Grande; 2) enhance permanent water quality programs and, 3) measure the beneficial water quality effects of the NLIWTP in the river. An additional component of the study was conducted by the United States Section, International Boundary and Water Commission (USIBWC) and compared current analytical methodologies for metals analysis with new clean metals sampling techniques and analysis using United States Environmental Protection Agency (USEPA) method 1639, 1631 and 1638 (Appendix A).

Figure 1. Aerial photo of the Rio Grande as it flows between Laredo, Texas and Nuevo Laredo, Tamaulipas.

Aerial view of Laredo, Texas & Nuevo Laredo, Tamaulipas.

Color infrared image of the Rio Grande as it flows through both communities.

PREVIOUS ASSESSMENTS

Screening Analysis of Segment 2304

The Texas Natural Resource Conservation Commission (TNRCC) has divided the Rio Grande basin into 14 classified segments, or reaches, for regulatory purposes. The study area in this report is part of Segment 2304-Rio Grande Below International Amistad Reservoir. The Rio Grande in Segment 2304 is of good quality and suitable for use in agriculture, fish consumption, and as a drinking water supply. However, recreational use is limited because of high bacterial levels that makes direct contact, such as swimming, unsafe. A screening analysis of monitoring stations along the Rio Grande was done by compiling all of the data submitted to the TNRCC from January 1995 to present (1, p. 3). The data was analyzed and compared to the TSWQS to identify areas exceeding the standard. It was noted that the increase in concentration of pathogens continues to occur in and below the three major populated areas in Segment 2304; Del Rio/Ciudad Acuna, Eagle Pass/Piedras Negras, and Laredo/Nuevo Laredo (1, p.15). Additional data for pathogens are being collected in Segment 2304 through the USIBWC Texas Clean Rivers Program.

Binational Study Regarding the Presence of Toxic Substances in the Rio Grande/Rio Bravo and its Tributaries Along the Boundary Portion Between the United States and Mexico

The study titled "Binational Study Regarding the Presence of Toxic Substances in the Rio Grande/Rio Bravo and its Tributaries Along the Boundary Portion Between the United States and Mexico" was conducted November 11-15, 1992 and published in September 1994. The main objective of the study was to screen the system for the occurrence and impact of toxic chemicals. Each country, according to their respective analytical capabilities, conducted sampling and analysis at various sites along the Rio Grande. Results indicated that a high potential for toxic chemical impacts existed downstream of El Paso/Ciudad Juarez and downstream from Laredo/Nuevo Laredo (3, p. 65).

Second Phase of the Binational Study Regarding the Presence of Toxic Substances in the Rio Grande/Rio Bravo and its Tributaries Along the Boundary Portion Between the United States and Mexico

A follow up study titled “Second Phase of the Binational Study Regarding the Presence of Toxic Substances in the Rio Grande/Rio Bravo and its Tributaries Along the Boundary Portion Between the United States and Mexico” was conducted from May to December 1995, and published in April 1998. The second phase study was intended to monitor for the presence of toxic substances at areas determined to be of high to moderate concern in the Phase 1 study; and more completely characterize the international reach through the addition of new sampling stations. Results indicated potential impairment by toxic substances in areas of the Rio Grande downstream of El Paso/Ciudad Juarez, Laredo/Nuevo Laredo, and upstream and downstream of Presidio/Ojinaga (4, p. 1).

Binational Study Regarding the Intensive Monitoring of the Rio Grande Waters in the Vicinity of Laredo/Nuevo Laredo Along the Boundary Portion Between the United States and Mexico

Additional work demonstrating similar findings to the above assessment can be found in the study titled “Binational Study Regarding the Intensive Monitoring of the Rio Grande Waters in the Vicinity of Laredo/Nuevo Laredo Along the Boundary Portion Between the United States and Mexico” published in July 1997. The study was conducted at five monitoring stations in the Rio Grande from October 30 - November 3, 1995. The stations were positioned in a specific reach of the Rio Grande that would include both cities and the return flows into the river. The NLIWTP effluent, the sixth location, was not sampled because it was still under construction.

Results obtained from the analyses of United States samples indicated that fecal coliform concentrations exceeded TSWQS at four of the five sites (2, p. 21). Other parameters such as inorganics, organics, metals, and toxicity testing either met the TSWQS or were below detection limits (2, p.21).

Results obtained from laboratories in Mexico indicated that most sites met the Ecological Water Quality Criteria (CECA) and existing Mexican water quality standards that apply to this reach. Results published by Mexico indicated that overall, the water quality and health of the river was acceptable but qualified their findings that return flows and the Rio Grande itself may have been diluted due to rain events (2, p.53).

The results of the study conducted in 1995 compared to this study are illustrated in Tables 1 & 2. The concentrations of most parameters are similar in both studies. There appears to be some improvement in water quality based on the lower concentration(s) of fecal coliform, conductivity, chloride, sulfate, and total dissolved solids (TDS) found in the more recent data.

Trace elements were detected at lower concentrations because of the lower reporting levels used to analyze metals for this study.

Table 1. Comparison of United States data for the Intensive Monitoring Study conducted in 1995 and 2000.

Parameter	Colombia Bridge 1995	Colombia Bridge 2000	Masterson Road 1995	Masterson Road 2000	1 mile (1.6 km) below Arroyo Coyotes 1995	1 mile (1.6 km) below Arroyo Coyotes 2000
Sp. Conductance- µmhos/cm	1270	899	1294	889	1246	904
pH- SU	8.3	8.3	7.9	7.9	7.8	8.26
Temperature-^{o}C	22	16.4	32	17.1	15	17.5
DO- mg/l	8.1	9.3	7.9	8.5	7.9	8.7
T-Alkalinity-mg/l	114	126.9	122	127	119	124
BOD- mg/l	<2	<3	3.9	<3	nd	4.5
Chemical Oxygen Demand (COD)- mg/l	<20	5.8	<20	10.9	<20	6.7
Tot.Organic Carbon (TOC)- mg/l	10	2.5	3.5	2.7	3.3	3.0
Fecal Coliform	63,000	99[1]	35,000	1340[1]	46,000	2248[1]
Chloride- mg/l	160	105	164	105	154	108
Sulfate- mg/l	304	172	282	174	227	175
Fluoride- mg/l	0.82	0.6	0.78	0.6	0.82	0.57
TDS- mg/l	794	561	810	569	781	554
TSS- mg/l	48.4	48.9	193	75.4	95.2	70.9
Nitrate+Nitrite- mg/l	0.21	0.7	0.48	0.9	0.73	1.16
Ammonia- mg/l	<0.1	0.02	<0.1	0.1	0.2	0.13
Aluminum- mg/l (t)	0.2	0.452	0.7	0.593	2.8	0.544
Arsenic- mg/l (t)	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01
Barium- mg/l (t)	0.12		0.14		0.13	
Cadmium- mg/l (t)	<0.005	.0002	<0.005	0.002	<0.005	0.002
Chromium- mg/l (t)	<0.01	0.016	<0.01	0.02	nd	0.027
Mercury- mg/l (t)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel- mg/l (t)	<0.04	0.019	<0.04	0.023	<0.04	0.022
Selenium- mg/l (t)	<0.01	0.003	<0.005	0.002	<0.005	0.003
Silver- mg/l (t)	<0.01	0.008	<0.02	0.008	<0.02	0.008
Zinc- mg/l (t)	<0.02	0.007	<0.02	0.009	<0.02	0.01
Toxicity 48 hr C. dubia	Pass	Pass	Pass	nd	Pass	Pass
Toxicity 48 hr P. promelas	Pass	Pass	Pass	nd	Pass	Pass

[1] geometric mean for seven sets of samples. (t)- total nd- no data available

Table 2. Comparison of Mexican data for the Intensive Monitoring Study conducted in 1995 and 2000.

Parameter	Colombia Bridge 1995	Colombia Bridge 2000	Masterson Road 1995	Masterson Road 2000	1 mile (1.6 km) below Arroyo Coyotes 1995	1 mile (1.6 km) below Arroyo Coyotes 2000
Sp. Conductance- µmhos/cm	1288	973	1315	993	1259	991
pH- SU	8	8.1	7.8	8.04	7.9	8.02
MBAS- mg/l	0.09	0.07	0.06	0.07	0.14	0.09
T-Alkalinity-mg/l	120	135	126	133	122	133
BOD- mg/l	7	4.9	9	10.4	6	10.3
COD- mg/l	12	8.4	20	9	15	13.6
Oil and Grease- mg/l	3	10.1	3	11.7	2	10.4
Organic Nitrogen- mg/l	0.15	ND	0.99	ND	0.53	ND
Chloride- mg/l	180	105	180	107	160	107
Sulfate- mg/l	264	172	283	174	264	175
Nitrite- mg/l	0.002	0.01	0.011	0.02	0.017	0.02
Nitrate- mg/l	0.23	0.70	0.415	0.82	0.53	0.94
Phosphates- mg/l	0.131	0.30	0.258	0.33	0.207	0.38
TSS- mg/l	32	113	114	140	68	122
Potassium- mg/l	5.2	ND	5.4	ND	5.5	ND
Sodium- mg/l	151	ND	156	ND	146	ND
Ammonia- mg/l	0.15	ND	<0.06	ND	0.15	ND
Arsenic- mg/l (t)	<0.001	<0.005	<0.001	<0.005	<0.001	<0.005
Cadmium- mg/l (t)	<0.01	<0.03	<0.01	<0.03	<0.01	<0.03
Chromium- mg/l (t)	<0.05	<0.12	<0.05	<0.12	<0.05	<0.12
Copper- mg/l (t)	<0.015	<0.12	<0.015	<0.12	<0.015	<0.12
Iron- mg/l (t)	0.103	ND	0.487	ND	0.221	ND
Mercury- µg/l (t)	<0.15	<0.005	<0.15	<0.005	2.2[1]	<0.005
Nickel- mg/l (t)	<0.05	<0.2	<0.05	<0.20	<0.05	<0.20
Selenium- mg/l (t)	0.0012	ND	<0.001	ND	<0.001	ND
Silver- mg/l (t)	<0.01	<0.1	<0.01	<0.10	<0.01	<0.10
Zinc- mg/l (t)	<0.01	<0.02	0.012	0.03	<0.01	<0.02

[1] possible error in analysis
(t)- total
ND- No data available

IBWC INTENSIVE MONITORING STUDY

PURPOSE AND SCOPE

The intensive monitoring study conducted by the IBWC in 1995 recommended the following items be considered in future studies:

1. Conduct additional studies in the Laredo/Nuevo Laredo reach of the Rio Grande during normal, ambient conditions.

2. Data should also be collected after the Nuevo Laredo International Wastewater Treatment Plant goes online to assess the impact to water quality in the Arroyo Coyotes and the Rio Grande.

In following with the recommendations from the IBWC Intensive Monitoring Study conducted in 1995, the objectives of this study are as follows:

1. To make a comparative analysis of water quality conditions since the NLIWTP went into operation and determine the water quality of the Rio Grande in the reach between Laredo/Nuevo Laredo. Sample sites were selected to approximate stations used for the study conducted in 1995 and include influent and effluent of the NLIWTP. Water quality data collected and analyzed on the mainstem of the Rio Grande will be compared to TSWQS to determine if water quality is meeting the State of Texas standards and supporting its designated uses.

2. Provide information on the prevailing conditions at the NLIWTP and compare water quality results to the effluent standards specified under IBWC Minute No. 279.

3. Enhance permanent water quality programs. Information from this study may assist the IBWC and other agencies in selecting long-term monitoring sites to better address water quality issues in the Laredo/Nuevo Laredo area.

SAMPLING SITES

Sampling sites were established at three locations on the mainstem of the Rio Grande in the Laredo/Nuevo Laredo reach. Additional samples were collected at the NLIWTP influent (prior to any treatment) and at the NLIWTP effluent (after the final treatment process).

Site 1 is located at the Colombia Bridge International Crossing, (TNRCC Station 15839), located approximately 20 miles (32 kilometers (km)) upstream of the two cities (figure 2, table 3). Access to this site was obtained by entering the river from the Mexican side. This site served as the reference point to determine the water quality of the mainstem of the Rio Grande upstream of Laredo and Nuevo Laredo prior to the influence of the two cities. The predominant land use features are rangeland and agriculture.

Site 2 is located on the mainstem of the Rio Grande at Masterson Road, (TNRCC Station 15815) (figure3, table 3). This site is approximately one mile (1.6 km) upstream of the Arroyo Coyotes (that consists primarily of the NLIWTP effluent discharges). Return flows from Arroyo Los Alazanos and Arroyo El Carrizo in Tamaulipas and Manadas Creek, Chacon Creek, and Zacate Creek in Webb County drain upstream of this site. This site is located in the urban portion of both communities. Discharges of treated and untreated wastes occur in this area along with effluent discharges from the Southside Wastewater Treatment Plant located in Laredo.

Site 3 is located at the headworks of the NLIWTP (figure 4, table 3). The sample was collected, prior to any treatment, in the influent channel. The NLIWTP is a secondary treatment system with activated sludge and a design capacity of 31 million gallons per day (MGD) (1358 liters per second, (lps)).

Site 4 is located in the channel after the final treatment process just upstream of the Parshall flume (figure 4, table 3). The NLIWTP effluent channel continues for about a quarter of a mile before reaching the discharge point into the Arroyo Coyotes. Effluent standards established by the IBWC under IBWC Minute No. 279 include limits for dissolved oxygen (D.O.), total suspended solids (TSS), pH, biochemical oxygen demand (BOD), and fecal coliform.

Site 5 is located downstream of the NLIWTP on the mainstem of the Rio Grande approximately one mile (1.6 km) below the confluence of the Arroyo Coyotes with the Rio Grande, (TNRCC Station 13196) (figure 5, table 3). Access to this site was obtained by entering the river from the United States side. Land use in this area consists mostly of rangeland, agricultural uses with some urban development.

Table 3. Location of water quality sampling sites in the Laredo/Nuevo Laredo area.

Site Number	TNRCC Station ID	Site Name	Latitude	Longitude
1	15839	Rio Grande at the Colombia Bridge	27^{o} 42’ 09”	99^{o} 45’ 00”
2	15815	Rio Grande at Masterson Road	27^{o} 25’ 44”	99^{o} 29’ 30”
3		NLIWTP Influent	27^{o} 25’ 01”	99^{o} 29’ 23”
4		NLIWTP Effluent	27^{o} 25’ 01”	99^{o} 29’ 23”
5	13196	Rio Grande 1 mile (1.6 km) below the Arroyo Coyotes (NLIWTP outfall)	27^{o} 24’ 03”	99^{o} 29’ 18”

Figure 2. Aerial photo of Site 1.

Figure 3. Aerial photo of Site 2.

Figure 4. Aerial photo of Sites 3 &4.

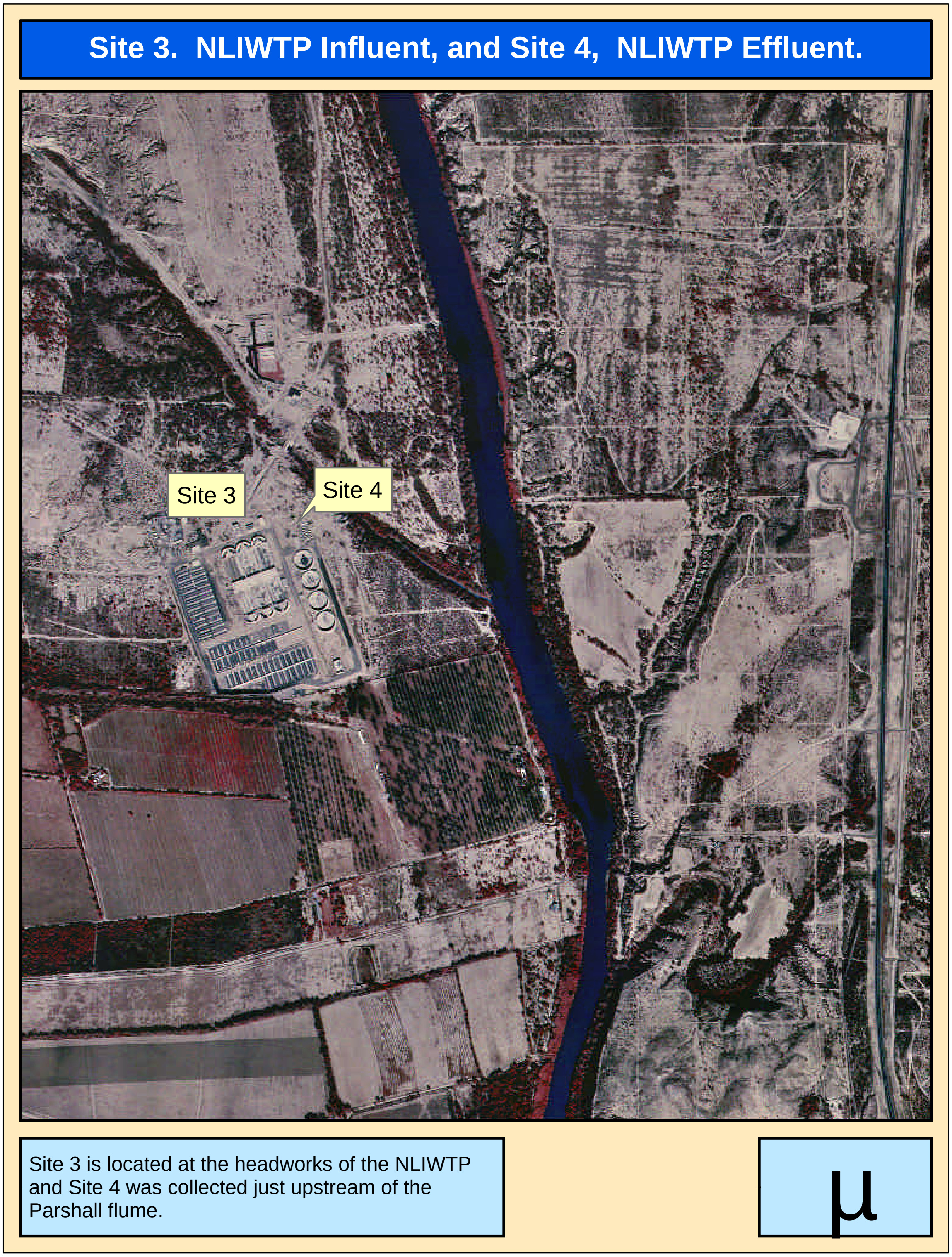
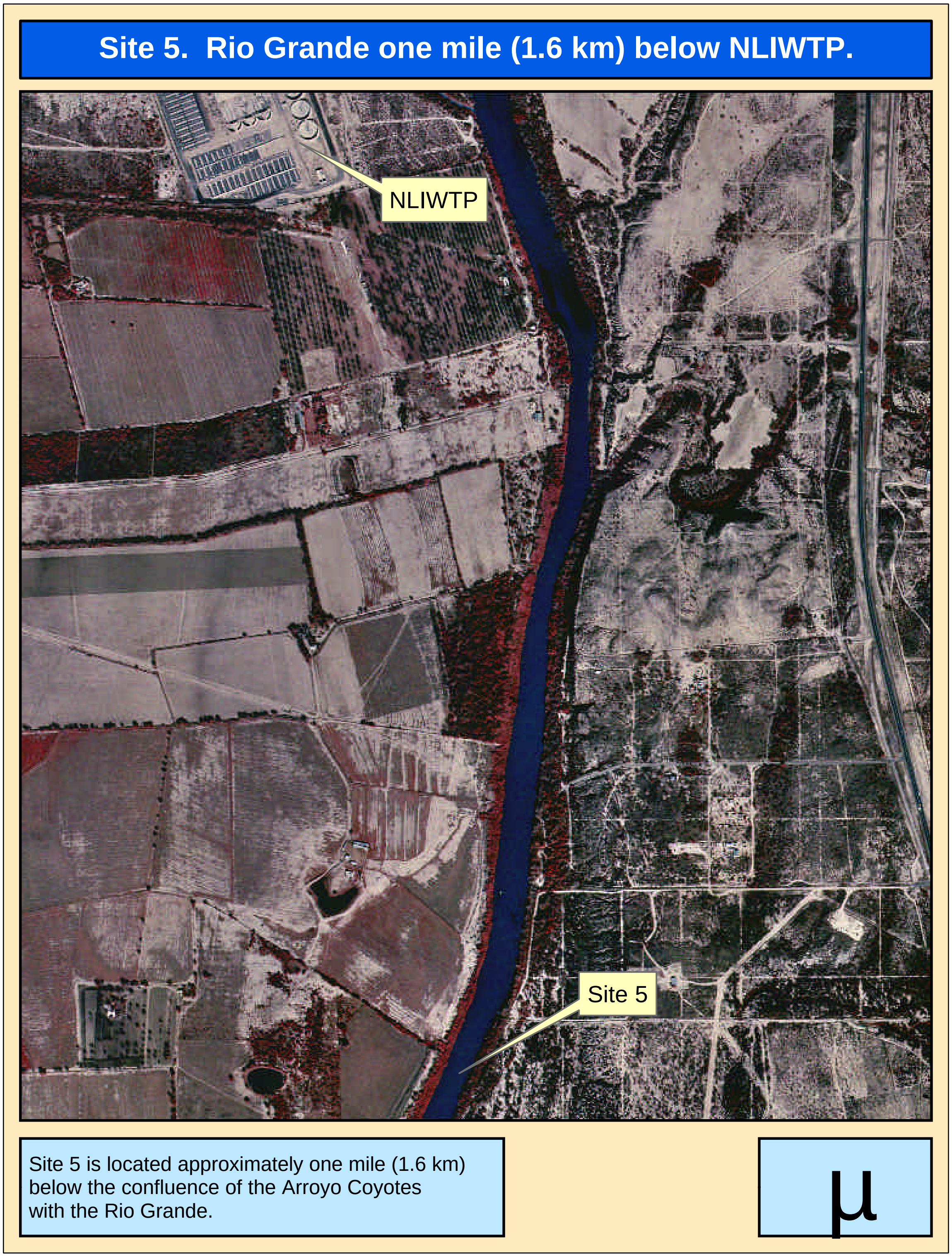


Figure 5. Aerial photo of Site 5.



STUDY REQUIREMENTS

SAMPLE COLLECTION

All samples collected in the mainstem of the Rio Grande were grab (discrete) type samples. The samples were collected utilizing the protocols established under the TNRCC's Surface Water Quality Manual (5, p. 4-1) and the Rio Grande Basin Monitoring Plan- Quality Assurance Project Plan (QAPP) (6, pp. 28-32). Samples were collected at a point closest to the midpoint of the river as possible and at a depth of one foot (0.3 m) below the surface. Samples collected for metals were done using the Clean Hands/Dirty Hands technique with the dissolved metals aliquots filtered at the sample site.

Samples at the NLIWTP influent and effluent were collected using a pair of ISCO™ automated samplers. The samplers were programmed to collect one sample per hour over a 24-hour period. Effluent samples were staggered depending on the flow and detention time of the treatment units so that approximately the same flow is sampled at the influent and effluent. Sample composites were prepared in the NLIWTP laboratory and aliquots were made into the appropriate containers. Parameters that could not be collected as a composite sample, such as Volatile Organic Compounds (VOC's), chlorine residual, bacteriological, and toxicity samples were collected as a grab sample after the sampler completed its 24-hour cycle.

Sample containers used for this study were new containers with appropriate preservatives added by the United States laboratory. The United States laboratory provided the sample containers for both the United States and Mexican samples at all sites. Sample containers for the study were stored at the NLIWTP and at the USIBWC field office in Laredo, Texas. They were covered and kept separate from equipment and sample material that had already been used.

PARAMETERS

The intensive monitoring program included analyses of those parameters in water that may cause inhibition of biological treatment processes, conventional and non-conventional pollutants, and aquatic toxicity tests (Table 4).

Table 4. List of Parameters Analyzed by the United States laboratory.

Method	Parameter	Method	Parameter
SM 5210 B	BOD5	USEPA 200.7	Aluminum (d)
SM 2320 B	T-Alkalinity	USEPA 206.3	Arsenic (d)
SM 2540 C	Total Dissolved Solids	USEPA 213.2	Cadmium (d)
USEPA 300	Chloride	SM 3500 Cr. D.	Chromium, Hexavalent (d)
SM 2540 D	Total Suspended Solids	USEPA 200.7	Chromium (d)
SM 2540 E	Volatile Suspended Solids	USEPA 200.7	Copper (d)
USEPA 300	Sulfate	USEPA 239.2	Lead (d)
USEPA 415.1	Total Organic Carbon	USEPA 200.7	Nickel (d)
USEPA 350.1	Ammonia-Nitrogen	USEPA 270.2	Selenium (d)
USEPA 365.1	Total Phosphorus	USEPA 200.7	Silver (d)
USEPA 353.1-3	Nitrate+Nitrite	USEPA 200.7	Zinc (d)
USEPA 365.3	Ortho-Phosphate Phosphorus	USEPA 200.7	Calcium (d)
SM 10200 H	Chorophyll-a	USEPA 200.7	Magnesium (d)
USEPA 351.1-4	Total Kjeldahl Nitrogen	USEPA 130.1	Hardness, titrated (d)
SM 5220 C,D	Chemical Oxygen Demand	USEPA 200.7	Aluminum (t)
SM 4500 CN C, D, E, G	Cyanide	USEPA 206.3	Arsenic (t)
SM 4500 F- C, D, E	Fluoride	USEPA 213.2	Cadmium (t)
USEPA 425.1	Methylene Blue Active substances (MBAS)	USEPA 200.7	Chromium (t)
USEPA 624	Volatile Organic Compounds (VOCs)	USEPA 200.7	Copper (t)
USEPA 625	Semi-volatile Organic Compounds (SVOCs)	USEPA 239.2	Lead (t)
SW 846 8011/8260	1,2-Dibromoethane	USEPA 245.2	Mercury (t)
8260	Pyridine	USEPA 200.7	Nickel (t)
8121	1,2,4,5-Tetrachlorobenzene	USEPA 270.2	Selenium (t)
	p-Dichlorobenzene	USEPA 200.7	Silver (t)
	Hexachlorohexane	USEPA 200.7	Zinc (t)
	n-Nitrosodiethylamine	USEPA 200.7	Calcium (t)
USEPA/600/4-90/027	Toxicity, 48 hr, acute, C. dubia	USEPA 200.7	Magnesium (t)
USEPA/600/4-90/027	Toxicity, 48 hr, acute, P. promelas	USEPA 130.1	Hardness, titrated (t)

(d)- dissolved
(t)- total

QUALITY ASSURANCE

In order to minimize the contamination that may occur during sample collection or analysis, emphasis was placed on following the data quality objectives outlined in the QAPP. To assess the quality of samples collected, appropriate numbers of duplicate samples, field blanks, and trip blanks were analyzed with the water samples. Additionally, all samples collected were split between the United States and Mexico, respectively. The Quality Assurance/Quality Control (QA/QC) criteria utilized by United States laboratories for analyzing samples is outlined in the QAPP as well as in the analytical methods listed in Table 5 (6, pp. 18-20).

Appropriate field data forms and chain of custody sheets accompanied each set of samples collected in the mainstem and at the NLIWTP. Proper sample collection techniques were utilized along with appropriate preservation and storage. Samples were analyzed using approved methods and within the specified holding time for each parameter. Samples not meeting these criteria were not evaluated in this study.

Table 5 - Data Quality Objectives for the collection and measurement of data.

Field								
PARAMETER	UNITS	MATRIX	METHOD	STORET Code	MAL	PRECISION of laboratory duplicates RPD	ACCURACY of matrix spikes %Rec.	Completeness %
pH	SU	water	Multi-parameter Instrument, TNRCC-SWQM SOP	00400	1.0	NA	NA	90
DO	mg/L	water	Multi-parameter Instrument, TNRCC-SWQM SOP	00300	1.0	NA	NA	90
Conductivity	μmhos/cm	water	Multi-parameter Instrument, TNRCC-SWQM SOP	00094	1.0	NA	NA	90
Water Temperature	◦ centigrade	water	Multi- parameter Instrument, TNRCC-SWQM SOP	00010	NA	NA	NA	90
Secchi Depth	meters	water	TNRCC-SWQM SOP	00078	NA	NA	NA	90
Days since last significant rainfall	days	NA	TNRCC-SWQM SOP	72053	NA	NA	NA	90
Flow	cfs	water	TNRCC-SWQM SOP	00061	NA	NA	NA	90
Flow Method	1-gage 2-Marsh-McBirney 3-Montedoro-Whitney 4-Pygmy	water	TNRCC-SWQM SOP	89835	NA	NA	NA	90
Flow severity	1-no flow 2-low flow 3-normal flow 4-flood 5- high 6- dry	water	TNRCC-SWQM SOP	01351	NA	NA	NA	90
Water Depth	meters	water	IBWC SOP Nov. 1998	82903	0.1	NA	NA	90
Weather	1- clear 2 - cloudy 3 - overcast 4 - rain	NA	Field Observation	89966	NA	NA	NA	90
Wind Intensity	1 - calm 2 - slight 3 - moderate 4 - strong	air	Field Observation	89965	NA	NA	NA	90
Wind Direction	1 - North 2 - South 3 - East 4 - West	air	Field Observation	89010	NA	NA	NA	90
Fecal Coliform	CFU/100mL	water	SM 9222 D	31616	1.0	20	NA	90
E. coli	MPN/100 ml	water	SM 9213 D	31699	1.0	20	NA	90

Conventionals

PARAMETER	UNITS	MATRIX	METHOD	STORET Code	MAL	PRECISION of laboratory duplicates RPD	ACCURACY of matrix spikes %Rec.	Complete-ness %
T. Alkalinity as C_aCO_3	mg/L	Water	SM 2320-B	00410	3.0	10	NA	90
TDS	mg/L	water	SM 2540-C	70300	10.0	20	NA	90
Chloride	mg/L	water	EPA 300	00940	2.0	10	80-120	90
TSS	mg/L	water	SM 2540-D	00530	4.0	20	80-120	90
Volatile Suspended Solids (VSS)	mg/L	water	SM 2540-E	00535	4.0	10	NA	90
Sulfate	mg/L	water	EPA 300	00945	0.5	10	80-120	90
TOC	mg/L	water	EPA 415.1	00680	1.0	10	80-120	90
Ammonia-N	mg/L	water	EPA 350.1	00610	0.02	10	80-120	90
T - Phosphorus	mg/L as P	water	EPA 365.1	00665	0.01	10	NA	90
O-Phosphorous	mg/L	water	EPA 365.3	00671	0.01	10	80-120	90
Chlorophyll-a	µg/L	water	SM 10200-H	32211	3.3	20	NA	90
Nitrate+Nitrite-N	mg/L	water	EPA 353.2	00630	0.02	10	80-120	90

Dissolved Metals in Water

Aluminum	µg/L	water	EPA 200.7	01106	50	10	80-120	90
Arsenic	µg/L	water	EPA 206.3	01000	10.0	10	80-120	90
Cadmium	µg/L	water	EPA 213.2	01025	0.2	10	80-120	90
Chromium, Hexavalent	µg/L	water	SM 3500 Cr D	01220	5.0	10	80-120	90
Chromium	µg/L	water	EPA 200.7	01030	10.0	10	80-120	90
Copper	µg/L	water	EPA 200.7	01040	5.0	10	80-120	90
Lead	µg/L	water	EPA 239.2	01049	2.0	10	80-120	90
Nickel	µg/L	water	EPA 200.7	01065	15	10	80-120	90
Selenium	µg/L	water	EPA 270.2	01145	2.0	10	80-120	90
Silver	µg/L	water	EPA 272.2	01075	2.0	10	80-120	90
Zinc	µg/L	water	EPA 200.7	01090	5.0	10	80-120	90
Calcium	mg/L	water	EPA 200.7	00915	0.03	10	80-120	90
Magnesium	mg/L	water	EPA 200.7	00925	0.1	10	80-120	90
Hardness, titrated, as CaCO3	mg/l	water	EPA 130.1	46570	1.0	10	80-120	90

Total Metals in Water

PARAMETER	UNITS	MATRIX	METHOD	STORET Code	MAL	PRECISION of laboratory duplicates RPD	ACCURACY of matrix spikes %Rec.	Complete-ness %
Aluminum	µg/L	water	EPA 200.7	01106	50	10	80-120	90
Arsenic	µg/L	water	EPA 206.3	01000	10.0	10	80-120	90
Cadmium	µg/L	water	EPA 213.2	01025	0.2	10	80-120	90
Chromium	µg/L	water	EPA 200.7	01030	10.0	10	80-120	90
Copper	µg/L	water	EPA 200.7	01040	5.0	10	80-120	90
Lead	µg/L	water	EPA 239.2	01049	2.0	10	80-120	90
Mercury	µg/L	water	EPA 245.2	71900	2.0	10	80-120	90
Nickel	µg/L	water	EPA 200.7	01065	15	10	80-120	90
Selenium	µg/L	water	EPA 270.2	01147	2.0	10	80-120	90
Silver	µg/L	water	EPA 200.7	01075	2.0	10	80-120	90
Zinc	µg/L	water	EPA 200.7	01090	5.0	10	80-120	90
Calcium	mg/L	water	EPA 200.7	00916	0.03	10	80-120	90
Magnesium	mg/L	water	EPA 200.7	00925	0.1	10	80-120	90
Hardness, titrated, as CaCO3	mg/l	water	EPA 130.1	00900	1.0	10	80-120	90

DATA COMPARISON

One of the primary objectives of this study was to compare the information from this study to a known benchmark. In the case of the samples collected on the mainstem of the Rio Grande, the data was compared to the TSWQS, Title 30, Chapter 307 (Table 6). The standards that apply to this segment are established to protect the designated uses of Segment 2304 and are as follows:

1. Contact Recreation- Activities such as swimming, wading, boating, and fishing. The parameter used to assess this use is bacteriological analysis. In 2000, the State of Texas replaced fecal coliform with *E. coli*. as the primary indicator of contamination. Both indicators were analyzed during the study.

2. Public Water Supply- As stated earlier, both communities rely on the Rio Grande for their drinking water supply. The concentration of dissolved salts was analyzed and compared to the levels required for drinking water purposes.

3. Protection of Aquatic Life- The concentration of dissolved metals was compared to freshwater acute and chronic limits established to protect aquatic life. Increased levels of trace elements can accumulate in aquatic species resulting in bioaccumulation and magnification of the toxic effects through the food chain. Acute toxicity tests (biomonitoring) were conducted using the invertebrate *C. dubia* and vertebrate species *P. promelas* to determine any toxic effects to the aquatic community. The USEPA Houston Laboratory analyzed samples for toxicity. Semi-volatile and volatile organic compounds were not analyzed by the United States due to data collected from previous studies that indicated low levels of residuals were found in the mainstem of the Rio Grande. Samples for organic compounds were collected at the NLIWTP.

4. General Use Criteria- This set of parameters affects overall water quality and applies to all designated uses. These include pH, water temperature, dissolved oxygen, chloride, sulfate, and total dissolved solids.

5. Fish Consumption- This designated use was not assessed in this study.

The comparison of the data to the TSWQS was done strictly to offer a “snapshot” of the ambient condition of the Rio Grande compared to the standards and criteria that apply to this segment in Texas. The criteria to assess water quality for conventional parameters in Texas require a minimum of 10 samples to be collected over a specific index period throughout the year for at least two years to account for seasonal variation. An average of the dataset is compared to the state standard. Additional data collected throughout the year would have to be collected to properly assess Segment 2304 and determine if the river is in attainment of the TSWQS and meeting appropriate designated uses.

The second objective of this study was to provide information on the current conditions at the NLIWTP and compare water quality results to the effluent standards specified under IBWC Minute No. 279 (Table 6). Additional parameters not specified in IBWC Minute No. 279 were analyzed to provide more information on the NLIWTP.

Data collected by the Mexican agencies was compared to the water quality criteria, CECA, which apply to Mexico for the Rio Grande and a comparison of standards at the NLIWTP under NOM-001-ECOL-1996 and IBWC Minute No. 279 (Table 7).

Information from this study should be utilized to plan for future studies and to improve the current water quality monitoring programs already in place (Objective 3). Tables of all data collected during this study by the United States and Mexican teams are provided.

Table 6. TSWQS and IBWC Minute No. 279 effluent standards used for comparison with the data results of the Intensive Monitoring Study.

Parameter	Unit	TSWQS1	TSWQS2	IBWC Minute No. 279
Dissolved Oxygen	mg/l	5		2
pH	SU	6-9		6-9
Water Temp	deg. C	35		
Chlorophyll-a	µg/l		13.7	
Chloride	mg/l	200		
Sulfate	mg/l	300		
Total Dissolved Solids	mg/l	1000		
Total Phosphorus	mg/l		1.1	
Total Suspended Solids	mg/l			20
Biochemical Oxygen Demand	mg/l			20
Ammonia Nitrogen	mg/l		0.16	
Nitrate-Nitrite	mg/l		3.5	
Fecal Coliform	CFU/100 mls	200		200
E. coli.	MPN/100 mls	126		
Dissolved Silver	µg/l	0.92		
Dissolved Aluminum	µg/l	991		
Dissolved Arsenic	µg/l	360	190	
Dissolved Cadmium	µg/l	43	1.3	
Dissolved Chromium	µg/l	2071	247	
Dissolved Copper	µg/l	24	15	
Dissolved Nickel	µg/l	1701	189	
Dissolved Lead	µg/l	107	4	
Total Selenium	µg/l	20	5	
Dissolved Zinc	µg/l	140	127	
Total Mercury	µg/l	2.4	1.3	

TSWQS1**-** State of Texas primary standards used for comparison against samples collected in the Rio Grande. For metals, protection of Aquatic Life, Freshwater Acute criteria are listed.
TSWQS2**-** State of Texas nutrient screening levels provided used for comparison with samples collected in the Rio Grande. For metals, protection of Aquatic Life, Freshwater Chronic criteria are listed.
IBWC Minute No. 279**-** Effluent discharge standards established between the United States and Mexico for the NLIWTP.

Table 7. CECA, NOM-001-ECOL-1996 and IBWC Minute No. 279 criteria and standards used for comparison with the data results of the Intensive Monitoring Study.

Parameter	Unit	CECA Water Supply Source	CECA Agricultural Irrigation	CECA Fish and Aquatic Life	NOM –001-ECOL-1996 Agricultural use	NOM-001-ECOL-1996 Urban Use	NOM- 001-ECOL-1996 Fish and Aquatic Life	IBWC Minute No. 279
Dissolved Oxygen	mg/l	4 or above		5 or above				2
pH	SU	5-9	4.5-9		5-10	5-10	5-10	6-9
Water Temp	deg. C							
Chlorophyll-a	µg/l							
Chloride	mg/l	250	147.5					
Color	uPt/Co	75						
Conductivity	µmho/cm		1000					
Sulfate	mg/l	500	130	0.005				
Total Dissolved Solids	mg/l	500	500	1000				
Total Phosphates	mg/l	0.1			20-30	20-30	5-10	
Total Suspended Solids	mg/l	500	50		150-200	75-125	40-60	20
Biochemical Oxygen Demand	mg/l				150-200	75-150	30-60	20
Alkalinity	mg/l	400						
Ammonia Nitrogen	mg/l			0.06				
MBAS	mg/l	0.5		0.1				
Nitrite	mg/l	0.05		10				
Nitrate	mg/l	5.0		90				
Oil & Grease	mg/l				15-25	15-25	15-25	
Fecal Coliform	CFU/100 mls							200
Aluminum	mg/l	0.02	5.0	5.0				
Silver	mg/l	0.05						
Arsenic	mg/l	0.05	0.1	0.2	0.2-0.4	0.1-0.2	0.1-0.2	
Cadmium	mg/l	0.01	0.01	0.02	0.2-0.4	0.1-0.2	0.1-0.2	
Total Chromium	mg/l				1-1.5	0.5-1	0.5-1	
Copper	mg/l	1.0	0.2	0.5	4.0-6.0	4.0-6.0	4.0-6.0	
Nickel	mg/l	0.01	0.2	1.0	2-4	2-4	2-4	
Lead	mg/l	0.05	5.0	0.1	0.5-1	0.2-0.4	0.2-0.4	
Selenium	mg/l	0.01	0.02	0.008				
Zinc	mg/l	5.0	2.0	50	10-20	10-20	10-20	
Mercury	mg/l	0.001		0.003	0.01-0.02	0.005-0.01	0.005-0.01	

CECA- Mexico’s ecological water quality criteria used to compare samples collected in the Rio Grande.
NOM 001-Ecol-1996 Mexico’s ecological water quality standards used to compare with the NLIWTP effluent.
IBWC Minute No. 279- Effluent discharge standards established between the United States and Mexico for the NLIWTP.

WATER QUALITY PARAMETERS

Parameters in this study were selected to present information on constituents that can affect water quality, limit the intended uses of the water, or harm the aquatic life. A brief explanation of the parameters analyzed include:

- Acute Toxicity- The capacity of a substance to have deleterious effects on test organisms and result in biological harm or death after a single exposure or dose.
- Alkalinity- A measure of the acid-neutralizing capacity of water. Bicarbonate, carbonate and hydroxide are the primary forms of alkalinity in natural waters. The presence of borates, phosphates, and silicates may increase the concentration of alkalinity.
- Ammonia Nitrogen- Naturally occurring in surface and wastewaters, it is produced by the breakdown of compounds containing organic nitrogen. High levels can be lethal to certain fish species.
- Biochemical Oxygen Demand - A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. High BOD levels are an indicator of increased pollution in the water, which may result in decreased oxygen levels in the receiving stream.
- Chloride- One of the major inorganic ions in water and wastewater. Industrial and agricultural processes can increase concentrations. High levels can affect plant growth and the use of the water for agricultural or municipal use.
- Chlorophyll-a- Photosynthetic pigment that is found in all green plants. The concentration of chlorophyll-a is used to estimate phytoplankton biomass in surface water.
- Conductivity- Dissolved substances in water dissociate into ions that conduct electrical current. Conductivity is a measure of how salty the water is; salty water has high conductivity.
- Dissolved oxygen- The oxygen freely available in water. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors.
- Fecal coliform/*E. coli*.- Bacteria found in the intestinal tracts of warm-blooded animals. These organisms are used as indicators of pollution and possible presence of waterborne pathogens.

- Nitrate-Nitrogen- A compound containing nitrogen that can exist as a dissolved solid in water. Excessive amounts can have harmful effects on humans and animals.
- Oil and Grease- Oil and Grease represents liquids that do not mix with water, primarily derived from domestic and industrial waste discharges. Its presence may reduce the transfer of oxygen, affect water treatment processes, and pose ambient water quality problems.
- Organic Compounds (Volatile and Semi-volatile)- Compounds present in the water that could potentially affect aquatic life and human health.
- Orthophosphate as Phosphorus- Nearly all phosphorus exists in water in the phosphate form. Orthophosphate can be directly utilized by plants and organisms, is usually the least abundant nutrient, and is commonly the limiting factor. Excessive amounts of phosphorus can contribute to the eutrophication of lakes and rivers.
- pH- The hydrogen ion activity of water caused by the breakdown of water molecules and presence of dissolved acids and bases.
- Sulfate- Sulfate is derived from rocks and soils containing gypsum, iron sulfides and other sulfur compounds. Industrial discharges may contain high levels of sulfate and can affect conveyance systems, under anaerobic conditions, due to bacterial activity that converts sulfate to hydrogen sulfide and subsequently forming sulfuric acid.
- Total Dissolved Solids- The amount of material (inorganic salts and small amounts of organic material) dissolved in water. High TDS concentrations can limit the use of water for agriculture, drinking water, and industrial use.
- Total Hardness- The sum of the calcium and magnesium concentrations, expressed as calcium carbonate in mg/l.
- Total Organic Carbon- Method used to determine the amount of organic carbon present in water and wastewater.
- Total Phosphorus- Phosphorus is found in surface water and waste streams almost exclusively in the form of phosphates (PO_4). It is found in solution, particulates, detritus, or in living aquatic organisms. Other sources of phosphates include decomposition of organic material and erosion of rock.

- Total Suspended Solids- A measure of the total suspended solids in water, both organic and inorganic.
- Trace Elements (Metals)- Metals occur naturally in the watershed and may increase when used for anthropogenic processes. High levels can result in bioaccumulation within aquatic species causing short or long-term affects and may pose health concern issues with regards to fish consumption, agriculture, or public water supply.
- 7Q2- The 7Q2 (low flow) is defined as the seven-day, two-year low flow. The lowest average stream flow for seven consecutive days with a recurrence interval of two years, as statistically determined from historical data. For perennial freshwater streams, chloride, sulfate, TDS, acute toxics, and toxicity are the only parameters that are applicable below 7Q2.

DATA RESULTS

FIELD RESULTS OBTAINED BY MEXICO

Table 8 shows that the concentrations obtained for the field parameters taken "in situ" at each of the five monitoring stations do not indicate any concern over their impact on the system and/or the NLIWTP influent or effluent.

The parameters analyzed "in situ" for the NLIWTP influent and effluent were: water temperature, pH, specific conductivity, and settleable solids. The concentrations of the above-mentioned were compared with maximum permissible limits stipulated in IBWC Minute No. 279 and NOM-001-ECOL-1996 which stipulates the daily averages for Type A rivers classified according to the Federal Rights Law (Tables 8a y 8b).

The parameters analyzed at the three stations within the Rio Grande channel were: water temperature, pH, specific conductivity, dissolved oxygen and settleable solids, concentrations which were compared with the CECA for use in potable water supply, irrigation, use in stock raising and protection of aquatic life (Tables 8 c, d and e).

The three stations in the channel of the Rio Grande possessed concentrations of dissolved oxygen above the minimum permissible limits set forth in the CECA for use in potable water supply (4 mg/L) and protection of aquatic life (5 mg/L).

This parameter is very important and influences water quality control. Clean surface waters normally are saturated with dissolved oxygen, but oxygen demand of organic wastes can consume it rapidly. The solubility of atmospheric oxygen in fresh water varies from 14.6 mg/L at 0^0 C to 7 mg/L at 36^0 C, at atmospheric pressure. This is a very important factor since biologic oxidation increases with temperature, and as a consequence, so does the oxygen demand. Conversely, under conditions of high temperature, oxygen is less soluble.

DO is essential to maintaining higher forms of biologic life and the effect of the discharge of wastes into a river can affect the oxygen balance in the system. The dissolved oxygen reading indicates a certain level of organic material contamination, degradation of organic substances and the level of self-cleansing of the aquatic system. The concentrations detected in the reach of the Rio Grande between the Colombia International Bridge and downstream of the NLIWTP indicate self-cleansing of the system, since there was a positive balance in the concentration of dissolved oxygen, as shown in Figure 1.

Thermodynamics have a significant influence in many physical, chemical and biological characteristics of bodies of water. This is an important factor in the hydrologic cycle, principally affecting the processes of evaporation, transpiration and condensation.

Temperatures in bodies of water directly influence the processes of self-cleansing. Both water and air temperatures control heat dissipation in bodies of water, which is of special importance when these are subject to thermal discharges. From the point of view of sanitation, the effects of temperature on the processes of self-cleansing deserve special consideration. Temperature plays a fundamental role in the self-cleansing of organic wastes, simultaneously affecting the speed of stabilization of organic material, the level of saturation with dissolved oxygen, and the rapidity of aeration. Temperature did not exceed any limit criteria at any of the stations in the channel of the Rio Grande, nor in the NLIWTP influent or effluent (Table 8).

Table 8. Summary of field results collected by Mexico during the study.

Table 8a- NLIWTP Influent "in-situ" data.

Date	11/8/00	11/9/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	IBWC Minute No. 279
Time	7:40	8:35	9:35	10:15	11:09	12:06	12:40	
Temp, °C		13	16.6	19.6	21	20	18.3	16-30
pH	7.49	7.41	7.54	7.45	7.42	7.33	6.97	6-9
Conductivity		1610	1706	1687	1750	1701	1694	n/a
Settleable Solids	34	8	5	4	5	0.8	1.5	n/a

Table 8b- NLIWTP Effluent data

Date	11/9/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	NOM-001	IBWC Minute No. 279
Time	11:30	11:45	12:32	13:20	14:47	15:15	16:25		
Temp, °C	14.4	16.4	17.6	14.8	23.6	18.5	13.8	40	n/a
pH	7.17	7.31	7.13	7.05	7.08	6.99	7.04	n/a	6-9
Conductivity	1514	1527	1519	1529	1565	1539	1573	n/a	n/a
Settleable Solids	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2	n/a

Table 8c- Rio Grande at the International Colombia Bridge

Date	11/9/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	Ecological Water Quality Criteria			
Time	14:30	13:45	8:22	8:25	8:45	10:30	13:00	Potable Water Supply	Agricultural Use	Livestock Use	Surface Water
Temp, °C	17.1	15.6	15.2	17.3	17.8	16.4	15.4	Nat. Conditions +2.5	n/a	n/a	Nat. Conditions +2.5
pH	8.15	8.31	8.42	8.27	8.16	8.44	8.44	5-9	4,5-9	n/a	XXXII
Conductivity	876	841	882	893	946	938	918	n/a	1000	n/a	n/a
Dissolved Oxygen	8.94	9.31	9.21	9.42	9.17	9.5	9.31	4	n/a	n/a	5
Settleable Solids	nd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	n/a	n/a	n/a	n/a

Table 8d- Rio Grande at Masterson Road

Date	11/9/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	Ecological Water Quality Criteria			
Time	16:45	15:20	12:15	9:55	11:20	8:20	11:00	Potable Water Supply	Agricultural Use	Livestock Use	Surface Water
Temp, °C	18.4	16.9	16.8	18.1	18.1	16.7	15.8	Nat. Conditions +2.5	n/a	n/a	Nat. Conditions +2.5
pH	8.01	7.05	7.87	7.79	8.26	8.42	8.22	5-9	4,5-9	n/a	XXXII
Conductivity	843	827	903	862	922	948	962	n/a	1000	n/a	n/a
Dissolved Oxygen	7.92	8.51	9.07	9	8.67	8.68	7.86	4	n/a	n/a	5
Settleable Solids	nd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	n/a	n/a	n/a	n/a

Table 8e- Rio Grande below Arroyo Coyotes

Date	11/9/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	Ecological Water Quality Criteria			
Time	17:34	16:10	13:15	10:42	12:20	7:25	9:40	Potable Water Supply	Agricultural Use	Livestock Use	Surface Water
Temp, ^{o}C	18.5	17	17.5	18.6	18.3	16.8	15.9	Nat. Conditions +2.5	n/a	n/a	Nat. Conditions +2.5
pH	8.07	8.31	8.3	8.24	8.31	8.34	8.21	5-9	4,5-9	n/a	XXXII
Conductivity	853	832	924	867	926	946	983	n/a	1000	n/a	n/a
Dissolved Oxygen	7.86	8.52	9.13	8.68	8.79	8.84	8.92	4	n/a	n/a	5
Settleable Solids	nd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	n/a	n/a	n/a	n/a

n/a- not applicable

nd- not determined

IBWC Minute No. 279- Standards set for the NLIWTP effluent.

NOM-001-ECOL-1996- Type A River, daily average.

XXXII- The pH should not vary more than 0.2 SU from the base value of the natural state.

SITE 1- RIO GRANDE AT THE COLOMBIA BRIDGE 20 MILES (32KM) ABOVE LAREDO/NUEVO LAREDO (TNRCC STATION 15839)

The predominant land use feature in this area is rangeland, followed by agriculture (Photo 1). Prior to the collection of samples, there was a minor rain event that could have introduced runoff into the river and affected the results of the first day of sampling. The highest flow measured during the study occurred on the first two days of sampling may indicate increased flows due to runoff. All flows at Site 1 were above the 7Q2 level of 24.6 cubic meters per second (cms). The information collected at Site 1 indicates that water quality at the time of sampling would meet the TSWQS and support the designated uses for Segment 2304 (Table 8).

<u>Contact Recreation</u>

During the seven days of sampling, the concentrations of fecal coliform and *E. coli.* bacteria were below the TSWQS with the exception of one fecal coliform sample collected on 11/09/00. The concentration for fecal coliform was 410 colony forming units per 100 milliliters (CFU/100 mls), which exceeded the single grab maximum of 400 CFU/100mls. The rain event and the runoff mentioned earlier may have affected the concentration of fecal coliform on the first day of sampling.

<u>Public Water Supply</u>

The concentration of dissolved salts met the TSWQS for drinking water. The concentration of chloride and sulfate was below the limit of 300 milligrams per liter (mg/l) and below the TDS limit of 1000 mg/l required for potable water.

<u>Protection of Aquatic Life (surface water)</u>

The concentration of metals analyzed was found to be below chronic and acute levels of toxicity. The sample collected on 11/12/00 exceeded the acute level for dissolved silver. A value of 7.0 micrograms per liter (µg/l) was reported compared to the acute limit of 0.92 µg/l. All other samples for silver were below the reporting limit. Samples analyzed by Albion Environmental for trace metals using USEPA 1600 series, techniques and analysis, showed the concentration of silver to be below the reporting limit of 0.03 µg/l. The difference in concentration for silver between the two methods collected on 11/12/00 may be the result of a false positive. All other samples analyzed for silver were less than the reporting limit for this site. Additional information on silver is discussed in Appendix A of this report. The results of toxicity tests using *C. dubia* and *P. promelas* showed all samples from Site 1 passing the 48-hour acute test for survival.

General Use Criteria

The parameters in this category indicate that overall water quality is being met at Site 1. Dissolved oxygen, water temperature, pH, chloride, sulfate, and total dissolved solids are at levels that support the designated uses for Segment 2304. The sample collected on 11/12/00 showed a higher concentration for total phosphorus compared to the other days. The concentration, 1.22 mg/l, exceeded the screening criteria of 1.1mg/l total phosphorus. High levels of phosphorus in the river can result in algal blooms since it is usually found in low concentrations and is the limiting factor inhibiting excessive plant growth.

Samples Analyzed by Mexican Laboratories

The data collected by Mexico was compared to the criteria that apply to surface water in Mexico. As with the state of Texas, the comparison of data against published levels is being done to present the data from this study against a known benchmark. To properly assess this reach, additional data, collected throughout the year, that meets the criteria for assessment would have to be collected for comparison against known water quality standards. The data from this study should be included when the assessment of the Rio Grande is conducted by the respective state and federal agencies from both countries for this particular reach in Laredo/Nuevo Laredo.

During the first two days of sampling there was rainfall which influenced results; nevertheless, water quality at this site is acceptable for livestock use, but not so for potable water supply, agricultural irrigation and protection of aquatic life, as described below:

Potable Water Supply

Phosphorus is found in natural and wastewaters, and almost exclusively in the form of phosphates. It is found in solution, as particles or detritus, or in the bodies of aquatic organisms. These forms of phosphate originate from a variety of sources, principally from the erosion of rocks or the decomposition of organic material. Small amounts of condensed phosphates are added to the public water supply during the treatment process and greater amounts can be added when the water is used to wash clothes or other cleaning purposes because phosphates are the principal components of many commercial cleaning agents.

Phosphate is an essential nutrient for life in organisms and it exists in the water, both in the dissolved and the particulate form; it is a nutritive element for the growth of algae and aquatic weeds affecting aquatic life uses of the receiving body. Under natural conditions, phosphate is found in low concentrations because it originates in plant activity.

As a consequence of eutrophication, algae proliferate and prohibit light penetration easily to lower parts of the water body. Organic material then accumulates under anaerobic conditions; and as a consequence the available oxygen diminishes.

Potable water use is restricted by the concentrations of total phosphates reported which exceeds the CECA phosphate limits (0.1 mg/L) (Table 9). On average, concentrations of total phosphates on site were 0.30 mg/L, so we suggest that it undergo pretreatment before it enters the potable water treatment plant (Figure 6).

Table 9 indicates the presence of greases and oils that ranged from 6.60 mg/L to 13.30 mg/L. The CECA considers a non-detect value as meeting the criteria. During the sampling period, we did not observe surface films of greases and oils, which would impede the exchange of atmospheric oxygen with the water column. (Figure 7)

Also, TDS were reported in average concentrations of 598.67 mg/L, exceeding the CECA, which allow a concentration of 500 mg/L for this use (Table 9, Figure 8)

Table 9 and Figure 9 illustrate the concentrations of aluminum found at this site. Concentrations ranged from 2.4 to 3.5 mg/L, and exceeded the permissible value reported in the CECA of 0.02 mg/L for this use.

With regard to organic compounds, concentrations of hexachloro 1-3 butadiene of 0.5773 mg/L and of hexachloroethane of 0.1368 mg/L were reported on the first day of sampling

(09-Nov-01). These values exceed the CECA for this use (0.004 and 0.02 mg/L respectively); there were no reports of concentrations of these compounds on the subsequent days (Table 9, Figures 10 and 11).

Agricultural Irrigation

In Table 9 concentrations of TDS averaging 598.67 mg/L were reported, which exceeds the CECA limit of 500 mg/L (Figure 8).

Also TSS concentrations ranging from 37 to 470 mg/L, were reported, which exceed the CECA value of 50 mg/L for this use (Figure 12).

The maximum values reported for this parameter at the end of the sampling period coincide with the precipitation, which occurred at the beginning of the sampling. The precipitation causes a greater dilution of the solids and consequently an increase in conductivity, as can be observed in Figure 13. This use is restricted according to the CECA permissible values of 1000 micromhos per centimeter (μmhos/cm) (Table 9).

Table 9 shows the concentrations of sulfates for all sampling days. Values range from 159 to 184 mg/L, which exceed the values reported in the CECA of 130 mg/L for this use (Figure 14).

Protection of aquatic life (surface water)

Concentrations of aluminum range from 2.40 to 3.50 mg/L, restricting at this station its use for the protection of aquatic life because the CECA permissible value is 0.05 mg/L (Table 9).

Also, concentrations of 0.5773 mg/L of hexachloro 1-3 butadiene and concentrations of 0.1388 mg/L of hexachloroethane on the first sampling day (09-Nov-01) were reported when there was a heavy rain. After this sampling there were no reported concentrations of the two organic compounds because of the dilution of the water in the receiving body caused by the rain. The reported values exceed the permissible concentrations under the CECA (0.0009 mg/L for hexachloro 1-3 butadiene and 0.01 mg/L for hexachloroethane) (Table 9 and Figures 10 and 11).

The values reported in Table 9 for sulfates (Figure 14) exceed the maximum permissible limits in the CECA for the protection of aquatic life of 0.005 mg/L (surface) presenting average concentrations of 172.43 mg/L. The discharges of wastewater from industry could increase the concentration of this parameter, which could be used as a source of oxygen by certain bacteria convert it into hydrogen sulfide under anaerobic conditions.

Figure 15 summarizes the concentration of coliform bacteria, which on 11 and 12 November exceeded the maximum limit established in the CECA of 200 MPN/100 ml. The majority of these organisms originate in water contaminated with human fecal waste. This waste can contain a variety of pathogenic organisms, which can cause gastrointestinal disease. This waste probably originates from municipal discharges, and in many cases, represents a potential risk for its use downstream.


Photo(s) 1 & 2. Site 1- Rio Grande at the Colombia International Bridge monitoring station.

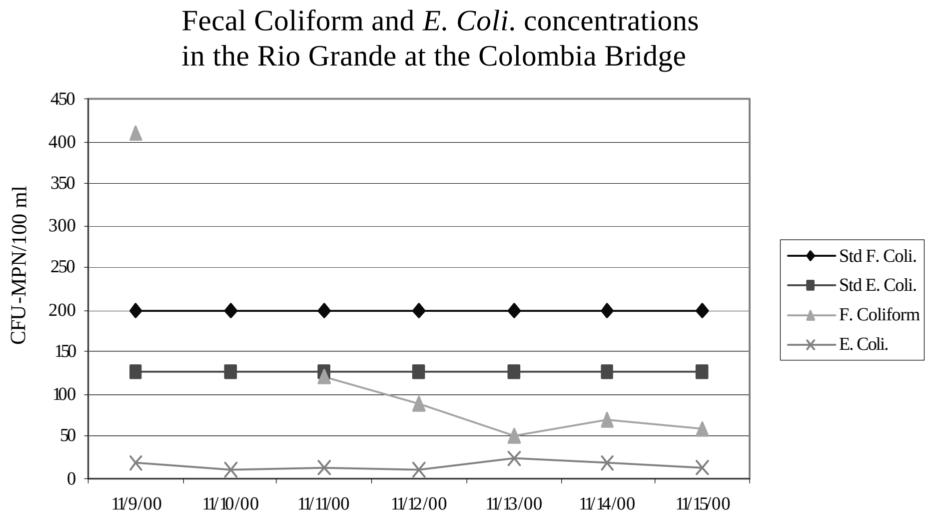
Table 9. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 1.

Parameter	Date							max	min	std dev	mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Dissolved Oxygen- mg/l	8.94	9.31	9.21	9.42	9.17	9.5	9.31	9.5	8.94	0.2	9.3	5	
pH- SU	8.2	8.31	8.42	8.26	8.16	8.44	8.44	8.44	8.16	0.1	8.3	6-9	
Conductivity- umhos/cm	876	841	882	893	946	938	918	946	841	37.2	899.1		
Flow Severity	2	2	2	2	2	2	2	2	2	0.0	2.0		
Flow (cms)	35	35	33.7	33.7	32.6	30.9	26.7	35	26.7	2.9	32.5		
Water Temp.- deg C	17.1	15.6	15.2	17.3	17.8	16.4	15.4	17.8	15.2	1.0	16.4	35	
Chlorophyll-a- ug/l	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3						13.7
Chloride- mg/l	98	91.1	94.5	98.6	118	119	116	119	91.1	12.1	105.0	200	
Sulfate- mg/l	173	154	166	173	183	180	175	183	154	9.6	172.0	300	
TSS- mg/l	80	40	24	54	52	55	37	80	24	17.7	48.9		
VSS- mg/l	17	15	18	12	10	8	<4	18	8	4.0	13.3		
TDS- mg/l	535	510	521	596	622	557	583	622	510	41.5	560.6	1000	
Fluoride- mg/l	0.59	0.53	0.58	0.58	0.61	0.6	0.59	0.61	0.53	0.0	0.6		
Alkalinity- mg/l	124	118	128	133	128	127	130	133	118	4.8	126.9		
TOC- mg/l	2	2.37	2.38	2.48	3.12	3.7	1.24	3.7	1.24	0.8	2.5		
Tot. Phosphorus- mg/l	0.23	0.25	0.27	**1.22**	0.36	0.26	0.3	1.22	0.23	0.4	0.4		**1.1**
Ortho-Phos.- mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01						0.9
BOD- mg/l	<3	<3	<3	<3	<3	<3	<3						
COD- mg/l	<3	<3	<3	<3	<3	5.8	<3	5.8	5.8		5.8		
NH3-Nitrogen- mg/l	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.0	0.02		0.16
Nitrate+Nitrite- mg/l	0.71	0.83	0.86	0.8	0.72	0.52	0.59	0.86	0.52	0.1	0.7		3.5
TKN- mg/l	<.1	0.9	0.78	1.01	1.57	0.9	0.78	1.57	0.78	0.3	1.0		
F. Coliform- CFU/100 ml	**410**		120	90	50	70	60	410	50	137.8	98.8	**200**	
E. Coli.- MPN/100 ml	18.1	11.6	14.5	10.5	24	19.1	12.8	24	10.5	4.8	15.2	126	
C. dubia- acute	pass	pass	pass	pass	pass	pass	pass						
P. promelas- acute	pass	pass	pass	pass	pass	pass	pass						
MBAS- mg/l	<.1	<.1	<.1	0.1	<.1	<.1	<.1	0.1	0.1		0.1		
Oil & Grease- mg/l	1.3	<.9	1.9	1.1	<.9	<.9	<.9	1.9	1.1	0.4	1.4		
Tot. Cyanide- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02						
Tot. Silver- ug/l	<2	<2	<2	7.6	<2	<2	<2	7.6	7.6		7.6		
Diss. Silver- ug/l	<2	<2	<2	**7**	<2	<2	<2	7	7		7.0	**0.92**	
Tot. Aluminum- ug/l	607	554	320	426	452	411	392	607	320	98.2	451.7		
Diss. Aluminum- ug/l	275	308	50	157	117	91.5	69.6	308	50	101.3	152.6	991	
Tot. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10						
Diss. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10					360	190
Tot. Cadmium- ug/l	<.2	<.2	<.2	<.2	0.2	<.2	0.2	0.2	0.2	0.00	0.2		

Parameter	Date							max	min	std dev	Mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Diss. Cadmium- ug/l	<.2	<.2	<.2	<.2	<.2	<.2	<.2					43	1.3
Tot. Chromium- ug/l	12.6	10.1	<10	26.4	<10	<10	<10	26.4	10.1	8.8	16.4		
Diss. Chromium- ug/l	5	16	5	30.7	5	5	5	30.7	5	9.9	10.2	2071	247
Hex. Chromium- ug/l	<5	<5	<5	<5	<5	<5	<5						
Tot. Calcium- mg/l	65.4	64.5	68.8	76.7	82.8	83.7	78	83.7	64.5	8.0	74.3		
Diss. Calcium- mg/l	65.4	64.5	68.8	76.7	82.8	83.7	78	83.7	64.5	8.0	74.3		
Tot. Copper- ug/l	8.6	7.8	<5	12	<5	<5	<5	12	7.8	2.2	9.5		
Diss. Copper- ug/l	5.9	<5	<5	11.9	<5	<5	<5	11.9	5.9	4.2	8.9	24	15
Tot. Nickel- ug/l	<15	<15	<15	18.7	<15	<15	<15	18.7	18.7		18.7		
Diss. Nickel- ug/l	<15	<15	<15	<15	<15	<15	<15					1701	189
Tot. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2						
Diss. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2					107	4
Tot. Selenium- ug/l	2.1	2	<2	2.6	<2	5	3.2	5	2	1.2	3.0	20	5
Diss. Selenium- ug/l	<2	<2	<2	<2	2	<2	2.2	2.2	2	0.1	2.1		
Tot. Zinc- ug/l	10.3	11.2	2.5	8.6	5.5	5.9	<5	11.2	2.5	3.3	7.3		
Diss. Zinc- ug/l	7.4	8.8	2.5	7	2.5	2.5	2.5	8.8	2.5	2.9	4.7	140	127
Tot. Mercury- ug/l	<2	<2	<2	<2	<2	<2	<2					2.4	1.3
Tot. Magnesium- mg/l	21.8	19.4	19.1	17.3	18.9	19.4	18.4	21.8	17.3	1.4	19.2		
Diss. Magnesium- mg/l	20.5	19.2	19.1	17.3	19.2	19.1	18	20.5	17.3	1.0	18.9		

TSWQS1- State of Texas primary standards used for comparison. For metals, protection of Aquatic Life, Freshwater Acute criteria are listed.
TSWQS2- State of Texas nutrient screening levels provided for reference only. For metals, protection of Aquatic Life, Freshwater Chronic criteria are listed.
Concentrations in **bold** indicate values that exceeded the standard.

Graph 1. Comparison of bacterial concentrations compared to TSWQS and a comparison of flow conditions during the study period to the minimum flow requirements to assess water quality data.



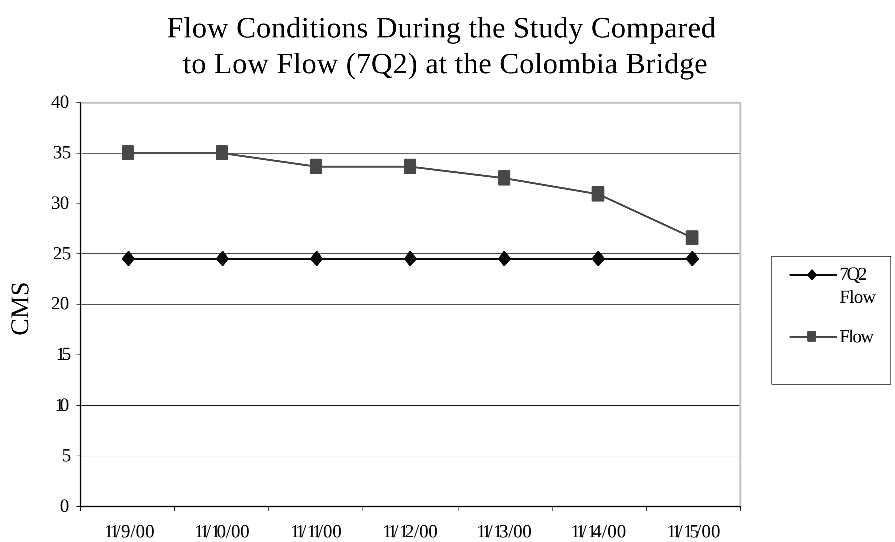


Table 10. Results for the parameters analyzed by Mexico during the Intensive Monitoring Study at Site 1.

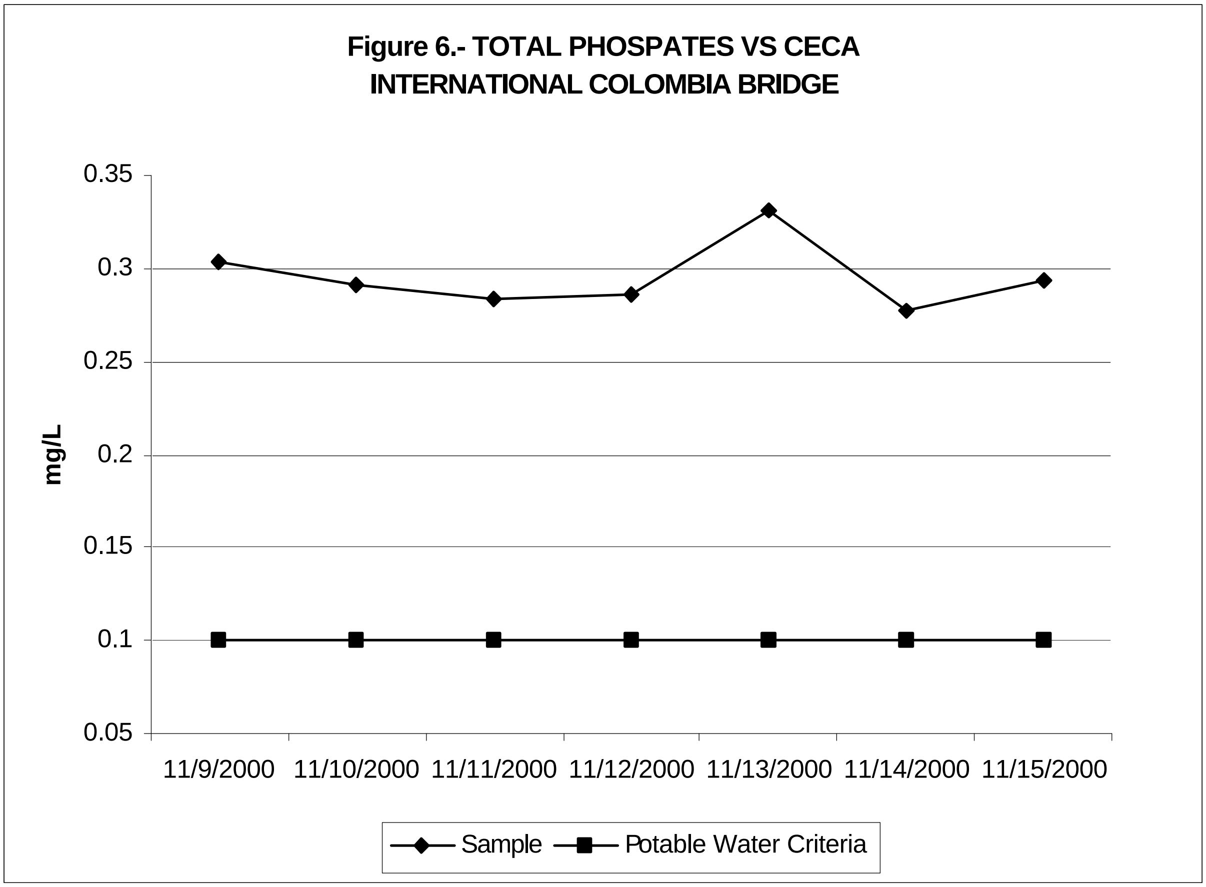
Parameter	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	Max.	Min.	Std. Dev.	Average	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Sample time	14:30	13:45	8:20	13:20	8:45	10:30	13:00								
P-Alkalinity	4.00	6.00	5.00	4.00	6.00	6.00	7.00	7.00	4.00	1.13	5.43	-	-	-	-
Total Alkalinity	134.00	127.00	134.00	138.00	137.00	137.00	139.00	139.00	127.00	4.06	135.14	400	-	-	-
Chloride	106.80	97.30	100.90	105.10	109.27	111.06	105.23	111.06	97.30	4.73	105.09	250	147.5	-	250
Conductivity, uS/cm	973.00	903.00	931.00	984.00	999.00	**1019**	**1001**	1019.00	903.00	41.55	972.86	-	**1000**	-	-
Biochemical Oxygen Demand, mg/l	6.00	4.21	11.63	5.67	2.00	2.60	1.82	11.63	1.82	3.43	4.85	-	-	-	-
Chemical Oxygen Demand, mg/l	6.00	13.00	10.00	5.00	4.00	16.00	5.00	16.00	4.00	4.65	8.43	-	-	-	-
Total Hardness, mg/l as CaCO3	291.00	268.00	284.00	301.00	303.00	302.00	300.00	303.00	268.00	12.93	292.71	-	-	-	-
Calcium Hardness, mg/l as CaCO3	215.00	205.00	220.00	221.00	208.00	222.00	223.00	223.00	205.00	7.20	216.29	-	-	-	-
Magnesium Hardness, mg/l as CaCO3	76.00	63.00	64.00	80.00	95.00	80.00	77.00	95.00	63.00	10.85	76.43	-	-	-	-
Total Phosphates, mg/l	**0.30**	**0.29**	**0.28**	**0.29**	**0.33**	**0.28**	**0.29**	0.33	0.28	0.02	0.30	**0.1**	-	-	-
Oil and Grease, mg/l	**6.60**	**10.10**	**9.40**	**10.00**	**13.30**	**10.90**	**10.70**	13.30	6.60	2.00	10.14	**ABSENT**	-	-	-
Nitrate Nitrogen, mg/l	0.745	0.605	0.663	0.781	0.763	0.672	0.655	0.78	0.61	0.07	0.70	5	-	90	-
Nitrite Nitrogen, mg/l	<0.008	<0.008	<0.008	<0.008	0.013	<0.008	<0.008	0.01	0.01		0.01	0.05	-	10	-
pH, SU	8.06	8.05	8.15	8.11	8.00	8.18	8.18	8.18	8.00	0.07	8.10	5-9	4.5-9.0	-	-
MBAS, mg/l	0.071	0.097	0.070	0.040	0.064	0.035	0.080	0.10	0.04	0.02	0.07	0.5	-	-	0.1
Total Suspended Solids, mg/l	**470.00**	**76.00**	47.00	**50.50**	**63.00**	48.00	37.00	470.00	37.00	157.89	113.07	500	**50**	-	-
Fixed Suspended Solids, mg/l	388.00	17.00	12.00	8.50	4.00	7.00	7.00	388.00	4.00	143.22	63.36	-	-	-	-
Volatile Suspended Solids, mg/l	82.00	59.00	35.00	42.00	58.00	41.00	30.00	82.00	30.00	17.97	49.57	-	-	-	-
Total Dissolved Solids, mg/l	**582.00**	**589.00**	**603.00**	**617.00**		**615.00**	**586.00**	**617.00**	**582.00**	15.19	598.67	**500**	**500**	1000	-
Sulfate, mg/l	**178.00**	**167.00**	**159.00**	**161.00**	**176.00**	**182.00**	**184.00**	**184.00**	**159.00**	10.08	172.43	500	**130**	-	**0.005**
Fecal Coliform, MPN/100 ml	**210**	150	**930**	**930**	90	150	23	930	23	397.23	188.51	1000	1000		**200 XVIII**
Aluminum, mg/l	**3.50**	<2.2	**2.90**	**2.90**	**2.40**	**2.40**	**2.40**	3.50	2.40	0.44	2.75	**0.02**	5	5	**0.05**
Arsenic, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.05	0.1	0.2	0.2
Cadmium, mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.00	0.00			0.01	0.1	0.2	XIII

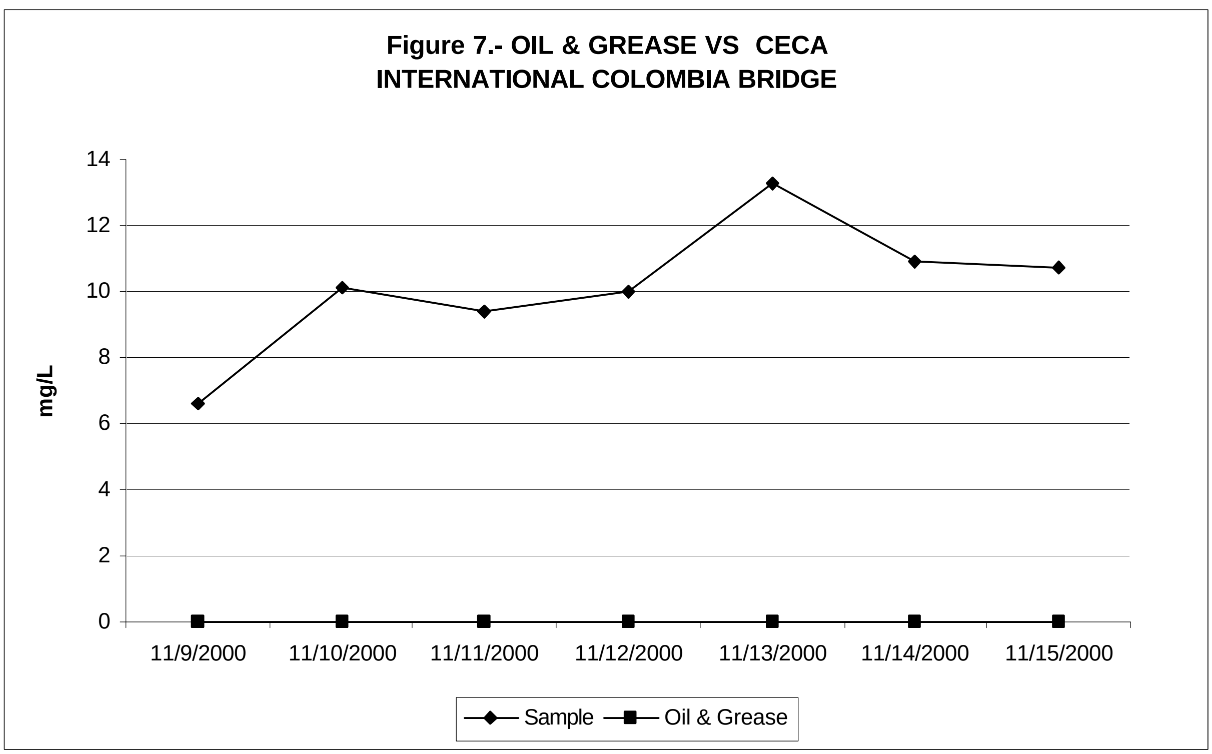
Parameter	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	Max.	Min.	Std. Dev.	Average	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Total Chromium, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00				0.01	0.02	-
Copper, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00			1	0.2	0.5	XVII
Lead, mg/l	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.00	0.00			0.05	5	0.1	XXXIV
Mercury, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.001	-	0.003	0.00001
Nickel, mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.00	0.00			0.01	0.2	1	XXVII
Silver, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.00	0.00			0.05			XXXIII
Zinc, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.00	0.00			5	2	50	XXXVI
Calcium, mg/l	92.55	43.62	87.23	92.55	125.53	102.13	105.32	125.53	43.62	25.05	92.70	-	-	-	-
Magnesium, mg/l	20.70	<0,05	18.78	20.00	20.38	22.31	20.27	22.31	18.78	1.14	20.41	-	-	-	-
Benzene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.00	0.00			0.01	-	-	0.05
Bromochloromethane, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			-	-	-	-
1,2 Dichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			0.005	-	-	1.20
1,1 Dichloroethylene, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			0.0003	-	-	0.116
Hexachloro 1,3 Butadiene, mg/l	**0.5773**	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.58	0.58		0.5773	**0.004**	-	-	**0.0009**
Hexachloroethane, mg/l	**0.1388**	ND	ND	ND	ND	ND	ND	0.14	0.14		0.1388	**0.02**	-	-	**0.01**
Methylene Chloride, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.00	0.00			0.002	-	-	-
Ethylmethylacetone, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			-	-	-	-
Pyridine, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			-	-	-	-
Carbon tetrachloride, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.00	0.00			0.004	-	-	0.30
Chlorobenzene, mg/l	<0.05	<0.05	ND	ND	ND	ND	ND	0.00	0.00			0.02	-	-	-
Chloroform, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	ND	0.00	0.00			-	-	-	-
1,4-dichlorobenzene, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.00	0.00			0.4	-	-	0.01
Toluene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.00	0.00			14.3	-	-	0.20
1,1,1-trichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			18.4	-	-	0.20
Trichlorethylene, mg/l	<0.07	ND	ND	ND	ND	ND	ND	0.00	0.00			0.03	-	-	0.01
1,2-dichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			0.4	-	-	0.01
Bromodichlorobenzene, mg/l	<0.06	ND	ND	ND	ND	ND	ND	0.00	0.00			-	-	-	-
Total Trihalomethane, mg/l	<0.02	<0.02	<0.02	<0.02	ND	<0.02	ND	0.00	0.00			-	-	-	-

ND = Not Determined

NA = Not applicable
XIII = The average concentration of cadmium over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.7852(ln(hardness))*3.490)
XVII = The average concentration of copper over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8545 (ln(hardness))*3.490)
XVIII= The number of organisms should not exceed 200 as Most Probable Number/100 ml in surface water and no more than 10 % in monthly samples should exceed 400 MPN/100 ml.
XXVII = The average concentration of nickel over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8460 (ln(hardness)+1.1645). Hardness= mg/l as CaCo3.
XXXIII= The concentration of silver (in ug/l) should not exceed the value calculated using the following equation (1.27 (ln (hardness))* 6.52). hardness= mg/l as CaCo3.
XXXIV = The average concentration of lead over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (1.273 (ln(hardness)* 4.705). Hardness= mg/l as CaCo3.
XXXIV = The average concentration of zinc over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8473 (ln(hardness)+ 10.3604). Hardness= mg/l as CaCo3.

Graph 2. Graphs of data produced by Mexico at International Colombia Bridge.





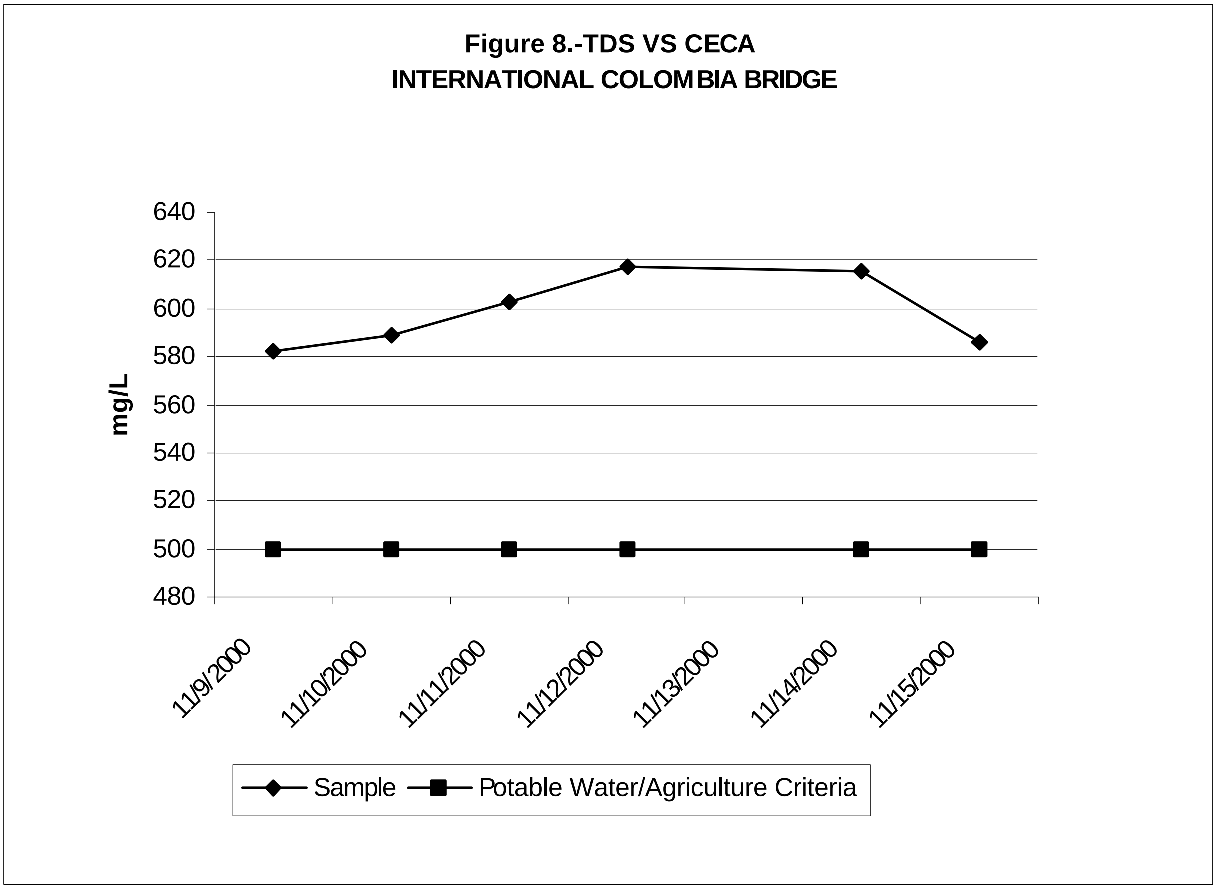


Figure 8.-TDS VS CECA
INTERNATIONAL COLOMBIA BRIDGE
640
620
600
580
560
540
520
500
480
mg/L
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water/Agriculture Criteria

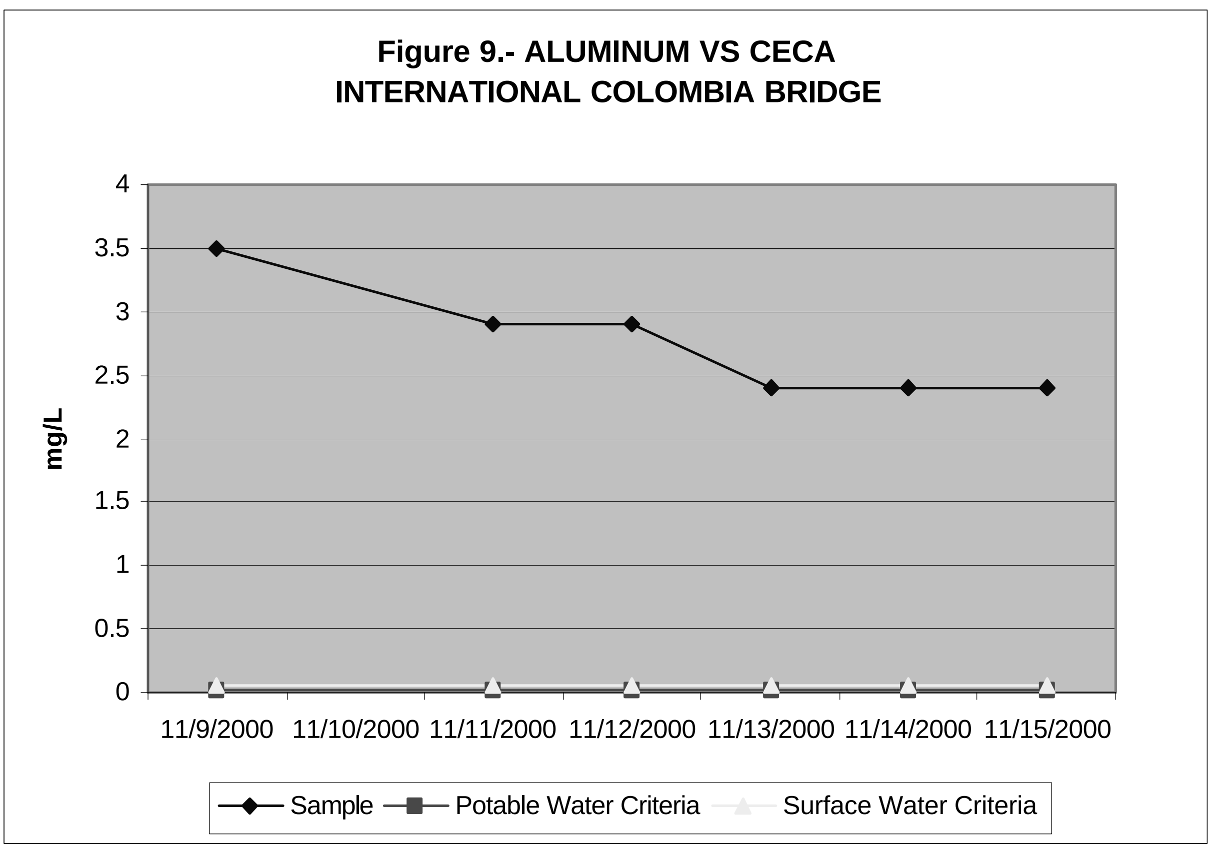


Figure 9.- ALUMINUM VS CECA
INTERNATIONAL COLOMBIA BRIDGE
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Surface Water Criteria

Figure 10.- HEXACLORO-1,3-BUTADIENE VS CECA INTERNATIONAL COLOMBIA BRIDGE

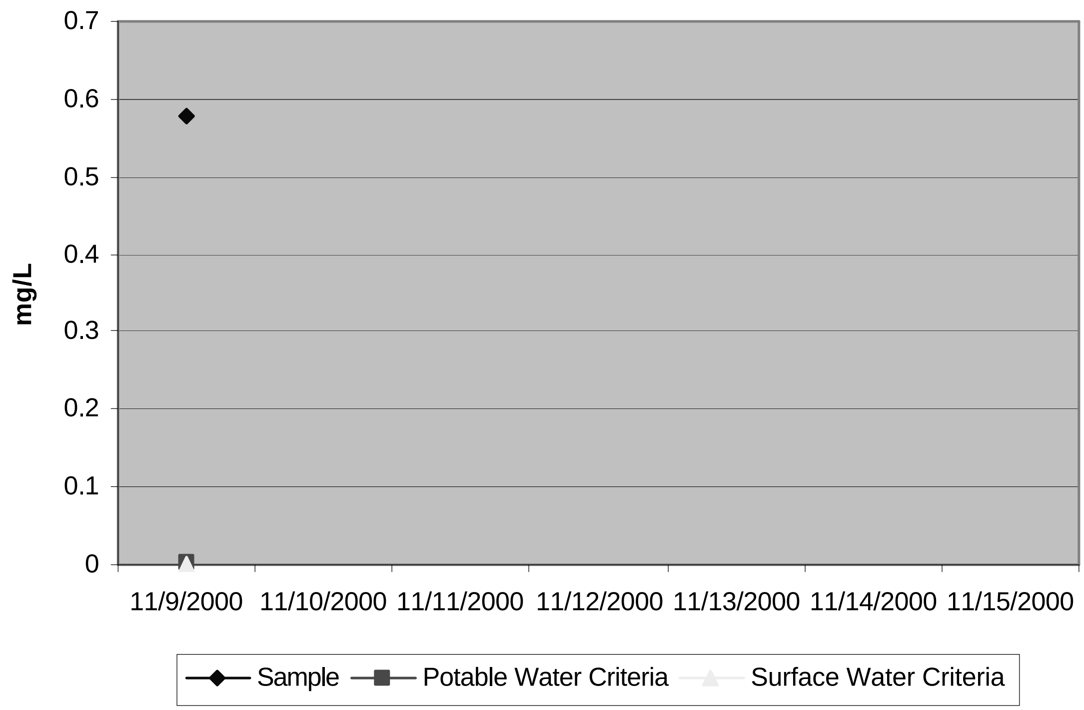
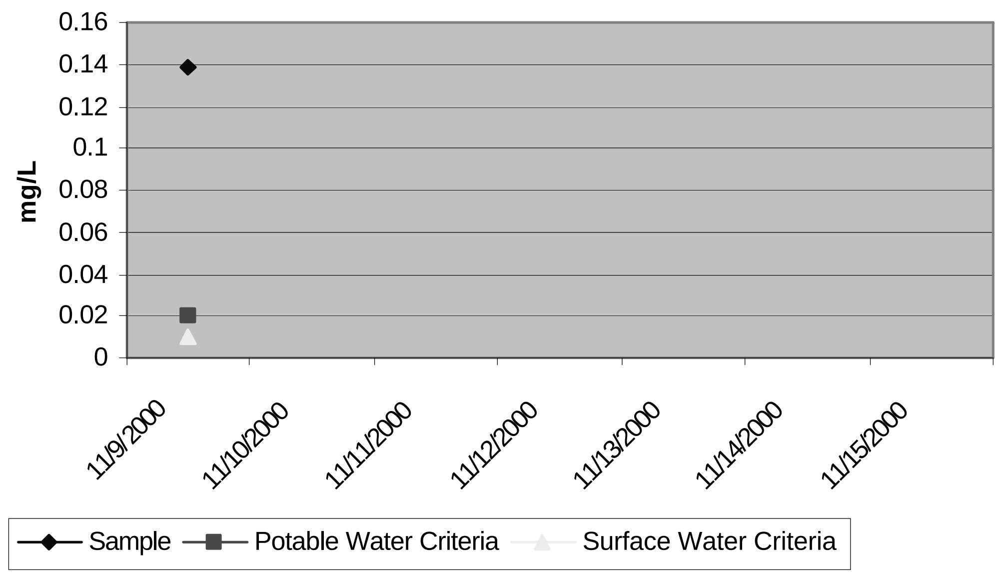


Figure 11.- HEXACLOROETHANE VS CECA INTERNATIONAL COLOMBIA BRIDGE



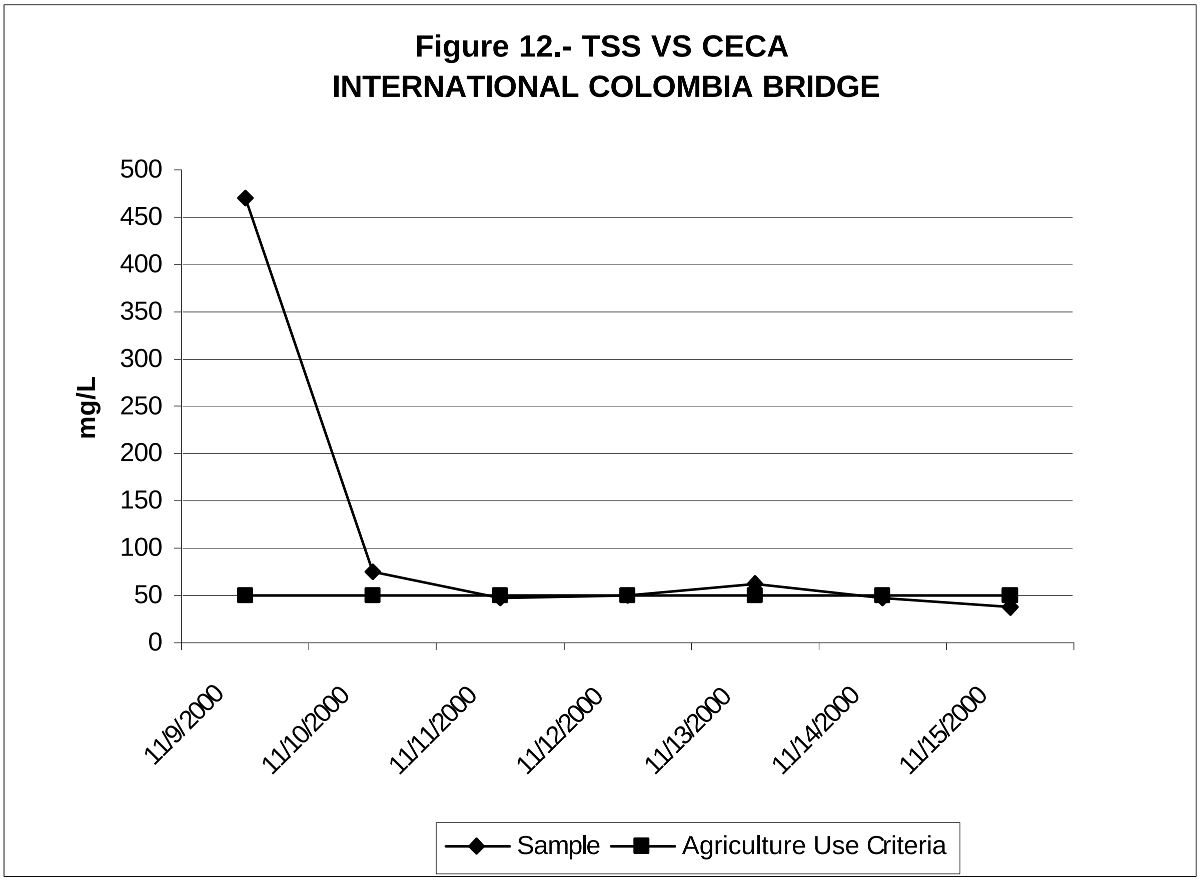


Figure 12.- TSS VS CECA
INTERNATIONAL COLOMBIA BRIDGE
mg/L
500
450
400
350
300
250
200
150
100
50
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agriculture Use Criteria

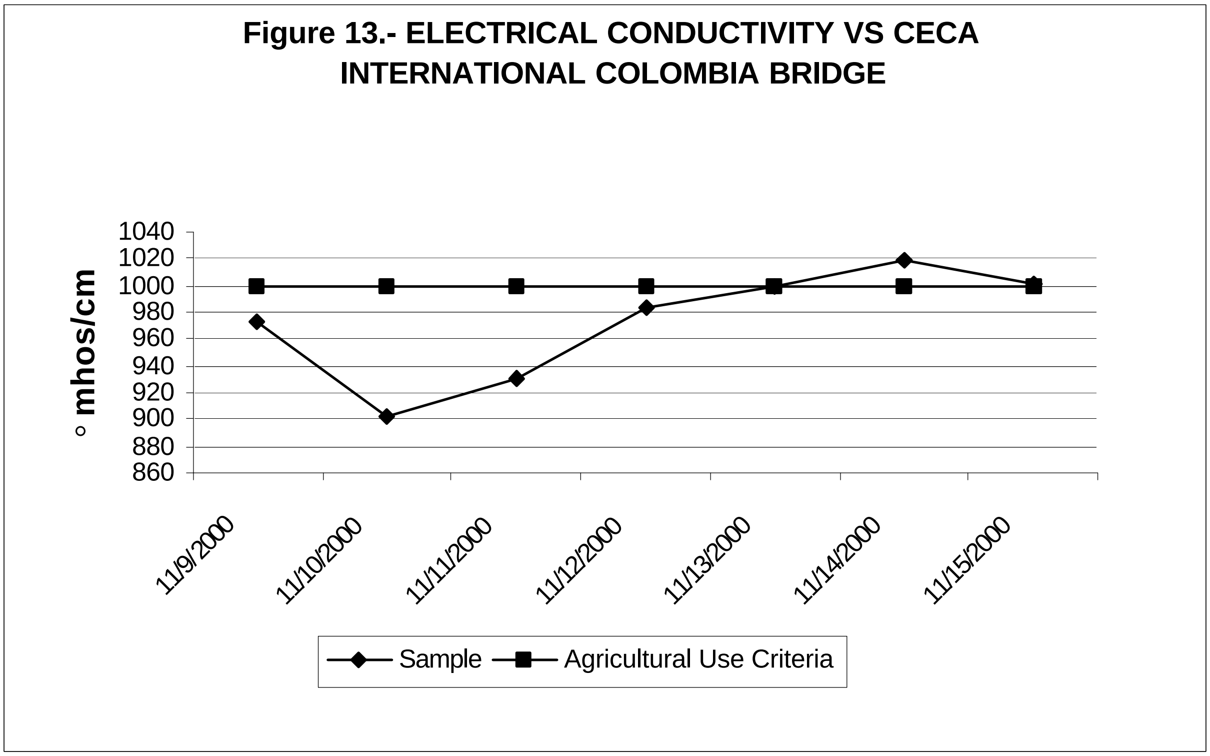


Figure 13.- ELECTRICAL CONDUCTIVITY VS CECA
INTERNATIONAL COLOMBIA BRIDGE
° mhos/cm
1040
1020
1000
980
960
940
920
900
880
860
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agricultural Use Criteria

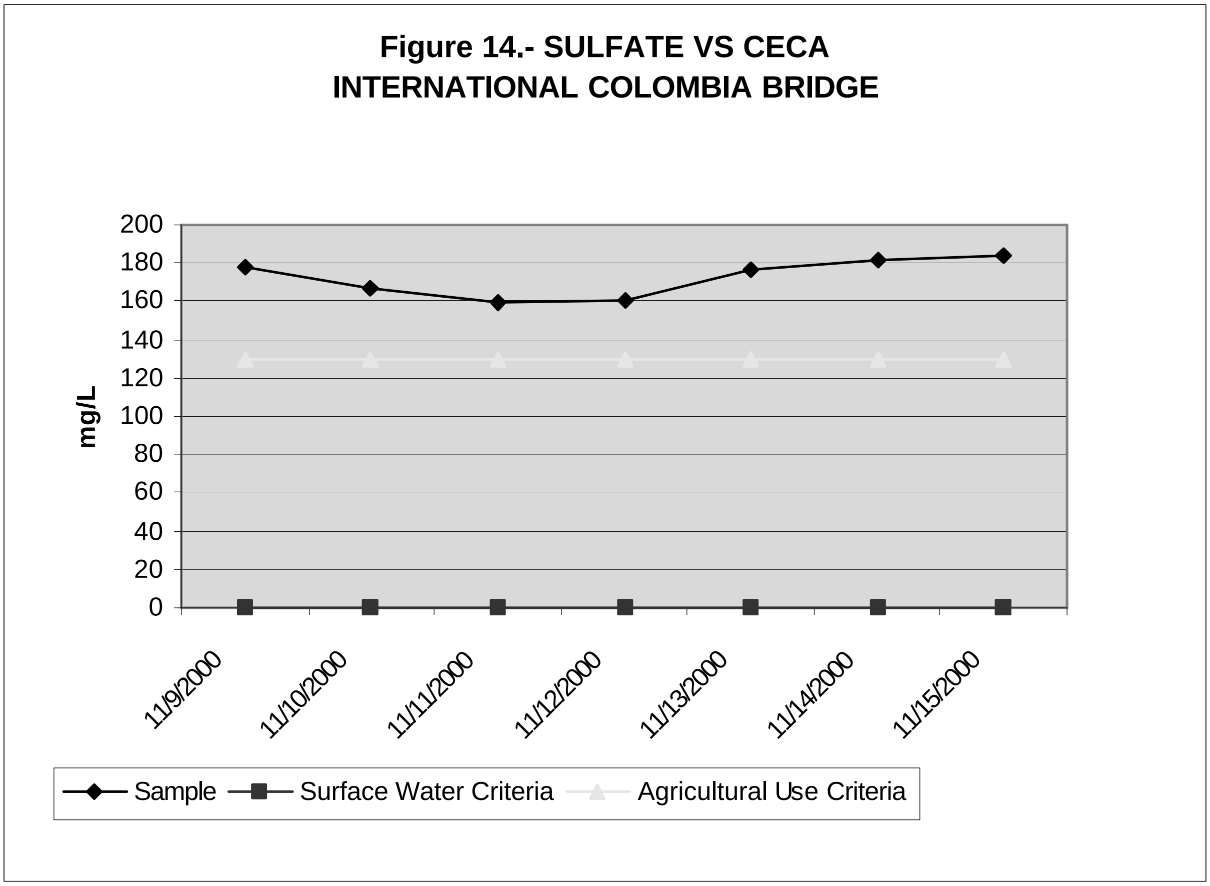


Figure 14.- SULFATE VS CECA
INTERNATIONAL COLOMBIA BRIDGE
mg/L
200
180
160
140
120
100
80
60
40
20
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Surface Water Criteria
Agricultural Use Criteria

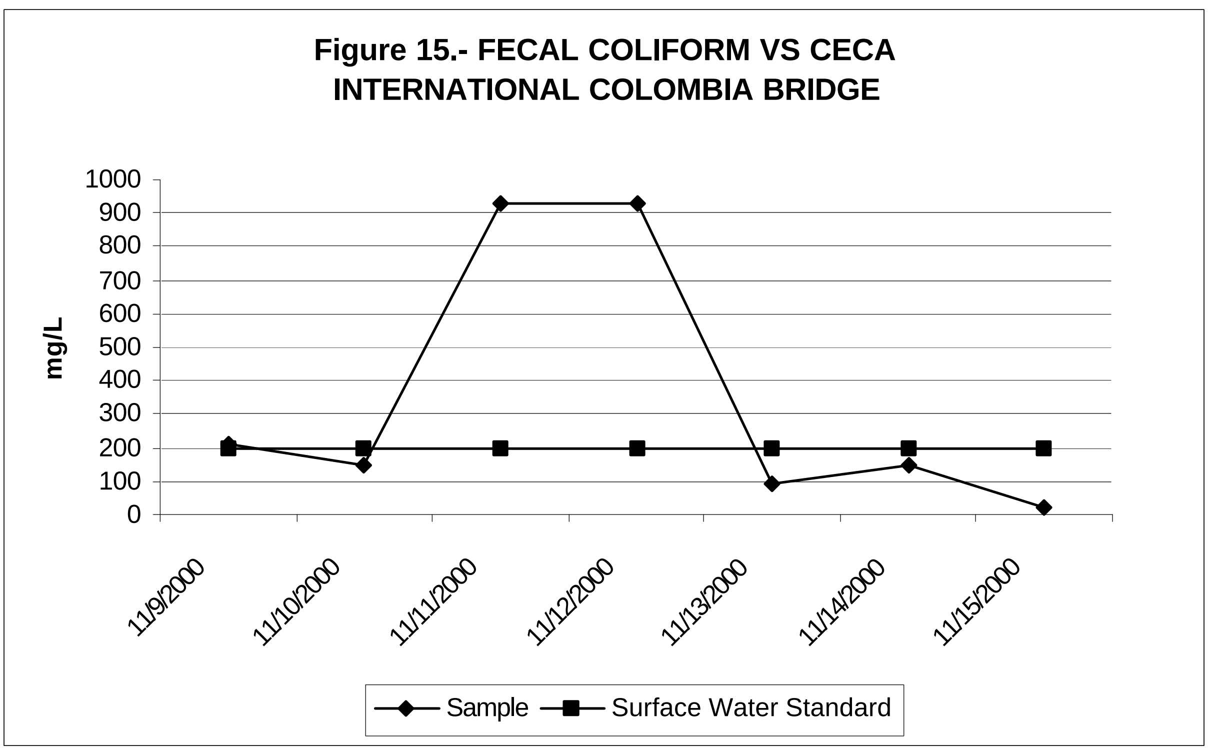


Figure 15.- FECAL COLIFORM VS CECA
INTERNATIONAL COLOMBIA BRIDGE
mg/L
1000
900
800
700
600
500
400
300
200
100
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Surface Water Standard

SITE 2- RIO GRANDE AT MASTERSON ROAD (STATION 15815)

This site is located within both cities and is affected by return discharges from various creeks, municipal, and industrial discharges (Photo 2). As with previous assessments, an increase in bacterial contamination was found at this site. Overall water quality remained consistent with Site 1 with most parameters achieving the TSWQS for Segment 2304 (Table 10).

Contact Recreation- During the seven days of sampling, the concentration of fecal coliform and *E. coli.* bacteria exceeded the TSWQS. The average concentration of fecal coliform was 1480 CFU/100 mls, which exceeded the average of 200 CFU/100mls. The individual grab limit of 400 CFU/100 mls was also exceeded for all days sampled. The minimum *E. coli.* concentration observed was 525 most probable number per 100 milliliters (MPN/100 mls) with a maximum concentration of 1011 MPN/100 mls compared to the TSWQS of 126 and 394 MPN/100 mls respectively.

Public Water Supply- The concentration of dissolved salts met the TSWQS for drinking water. No significant changes in the concentration between Site 1 and 2 were observed during the study period.

Protection of Aquatic Life- The concentration of metals analyzed were found to be below the chronic and acute levels of toxicity. The sample collected on 11/12/00 exceeded the acute level for dissolved silver. A value of 7.4 µg/l was reported compared to the acute limit of 0.92 µg/l. All other samples for silver were below the reporting limit. The sample analyzed for trace metals using the clean metals sampling technique was below the reporting limit for silver, <0.03 µg/l, indicating that the higher value for the sample collected using traditional techniques may have been contaminated or the analysis of the sample elevated the true value (false positive). See Appendix A for additional information on trace elements. Samples were not analyzed for toxicity tests using *C. dubia* and *P. promelas* at this site.

General Use Criteria- The parameters in this category indicate that overall water quality is being met at Site 2. An increase in the concentration for ammonia nitrogen of 0.29 and

0.17 mg/l was detected in the samples collected on 11/09/00 and 11/10/00. The two concentrations exceed the nutrient screening criteria for ammonia. The total phosphorus level exceeded the TSWQS screening criteria of 1.1 mg/l on 11/11/00 with a concentration of 3.18 mg/l. It should be noted that nutrient parameters have been proposed by the state of Texas for adoption as water quality standards. At this time, the parameters for nutrients are undergoing review for adoption as a state standard in Texas. Increased levels of nutrients may lead to increased plant growth, algal formation, and decreased dissolved oxygen levels.

Samples Analyzed by Mexican Laboratories

The quality of the water at this site is not as good as at the Colombia Bridge site for potable water supply, agricultural irrigation, stock raising and protection of aquatic life as described below:

Public Water Supply- This use is restricted due to the reported concentrations of total phosphates, which exceed the CECA whose value is 0.1 mg/L. On average, the concentrations of total phosphates were 0.33 mg/L (Table 11 and Figure 16).

Table 11 and Figure 17 summarize the concentrations of greases and oils at the site. The concentrations detected range from 6.0 mg/L to 17.0 mg/L, when the CECA permitted value is a non-detect value.

Greases and oils are not miscible in water and their presence reduces oxygen transfer, affects water purification and, depending on the type and quantity, could represent environmental risk. In light of these facts, it would be advisable to follow up on the behavior of this parameter to preclude additive effects with other parameters and avoid conditions of anoxia in the channel.

Also, TDS were reported in concentrations averaging 602 mg/L. These values exceed the CECA, which permit a concentration of 500 mg/L for this use (Table 11 and Figure 18)

Figure 19 illustrates concentrations of TSS at the site. A maximum concentration of 565 mg/L was observed which exceeds the CECA of 500 mg/L. This value was reported on the first day of sampling and later concentrations diminished to 46 mg/L. This decrease in concentration can be attributed to the rainfall that occurred in the first few days. Table 11 reports the minimum concentrations (46 mg/L) and maximum (565 mg/L) for this parameter at the site.

The concentration of aluminum ranged from 3.5 to 5.9 mg/L, and exceeded the CECA of 0.02 mg/L (Table 11 and Figure 20).

With regard to the organic compounds, average concentrations of hexachloro 1-3 butadiene of 0.3492 mg/L were reported on four of the seven days sampled, these values exceed the CECA for this use, which value is 0.004 mg/L (Table 11 and Figures 21 and 22).

Figure 23 summarizes concentrations of coliform bacteria, which for all sampling days exceeded the maximum limit established in the CECA of 1000 MPN/100mL

<u>Agricultural Use</u>- Concentrations of TDS averaged 602 mg/L, which exceed the permitted CECA levels of 500 mg/L (Figure 18). Also, concentrations of TSS ranging from 46 to 565 mg/L were reported (Table 11). These values exceed the CECA limit of 50 mg/l for this use (Figure 19)

Concentrations of aluminum ranging from 3.5 to 5.9 mg/L, were reported. Greater concentrations were observed at the beginning of the sampling and exceed CECA permissible values of 5 mg/L (Figure 20).

On the other hand, the maximum concentration of 1045 µmhos/cm of electrical conductivity restricts this use according to the permissible values reported in the CECA (1000 µmhos/cm) (Table 11). The maximum values reported at the end of the sampling period coincided with the rainfall occurring at the beginning of the sample collection. Dilution of solids consequently elevates conductivity, as observed in Figure 24.

Concentrations of sulfates were reported on all days of sampling, with values ranging from 165 to 187 mg/L (Table 11). These concentrations exceed the CECA limits of 130 mg/L (Figure 25).

Lastly, Figure 23 summarizes the concentrations of coliform bacteria, which for all sampling days exceed the maximum limit established in the CECA of 1000 MPN/100mL.

Livestock Use- Table 11 illustrates aluminum concentrations on the first three days of sampling. The concentrations range from 3.50 to 5.9 mg/L, while in the last two days the concentrations decreased to 3.5 mg/L. Despite the decrease towards the end of the sampling, these values exceed the permissible CECA limit of 5 mg/L for this use (Figure 20).

Photos 3 & 4. Rio Grande at Masterson Road.

Protection of Aquatic Life (surface water)- Concentrations of aluminum ranging from 3.5 to 5.9 mg/L were reported, restricting its use for protection of aquatic life. The permissible value in the CECA is 0.05 mg/L (Table 11 and Figure 20).

Also, average concentrations of 0.3492 mg/L of hexachloro 1-3 butadiene were reported on the first three days of the sampling as well as on the last. Average concentrations of 0.0904 mg/L of 1-4 dichlorobenzene on the first and last day of sampling (09-Nov-01/15-

Nov-01) (Table 11). The values reported exceed the permissible concentrations of the CECA (0.0009 for hexachloro 1-3 butadiene and 0.01 for 1-4 dichlorobenzene) (Figures 21 and 22).

Figure 25 shows that reported values for sulfate exceed the maximum permissible limits in the CECA for the protection of aquatic life of 0.005 mg/L (fresh water) with average concentrations of 174.43 mg/L (Table 11). The wastewater discharges from industry increase concentrations of this compound. This compound is used as a source of oxygen by certain bacteria, which convert it into hydrogen sulfide under anaerobic conditions.

Figure 23 summarizes the concentrations of coliform bacteria. Concentrations exceed the maximum limit established in the CECA of 200 MPN/100mL (for all sampling days).

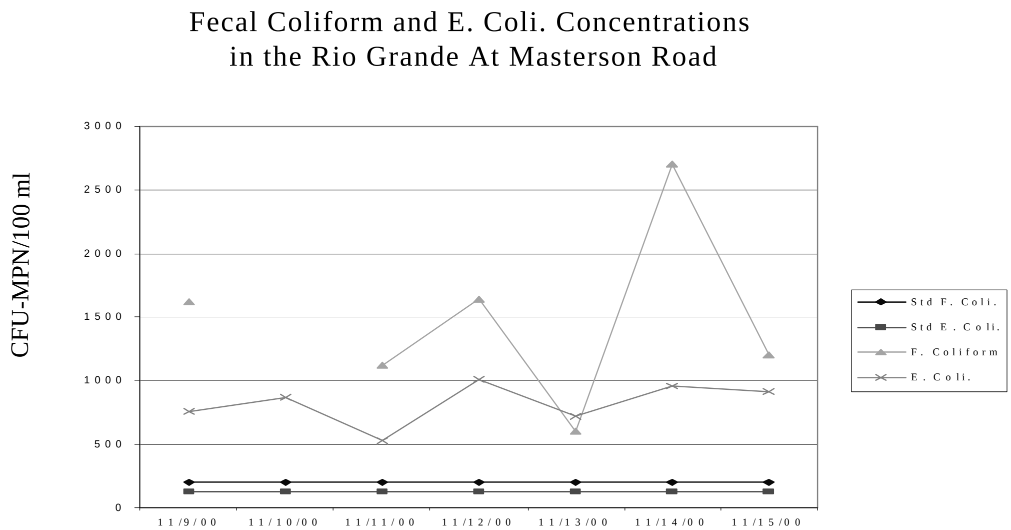
Table 11. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 2.

Parameter	Date							max	min	std dev	mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Dissolved Oxygen- mg/l	7.92	8.51	9.07	9	8.67	8.68	7.86	9.07	7.86	0.5	8.5	5	
pH- SU	8	7.05	7.87	7.79	8.26	8.42	8.22	8.42	7.05	0.5	7.9	6-9	
Conductivity- umhos/cm	800	827	903	862	922	948	961	961	800	61.2	889		
Flow Severity	2	2	2	2	2	2	2	2	2	0.0	2.0		
Flow (cms)	37.9	37.3	36.2	36.2	41.3	37.9	32.8	41.3	32.8	2.6	37.1		
Water Temp.- deg C	17.4	16.9	16.8	18.1	18.1	16.7	15.8	18.1	15.8	0.8	17.1	35	
Chlorophyll-a- ug/l	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3						13.7
Chloride- mg/l	95.3	90.1	100	94.8	112	121	122	122	90.1	13.2	105	200	
Sulfate- mg/l	166	161	182	166	175	183	186	186	161	9.9	174	300	
TSS- mg/l	91	93	77	91	66	58	52	93	52	17.0	75.4		
VSS- mg/l	32	21	13	26	17	4	<4	32	4	9.9	18.8		
TDS- mg/l	509	469	559	579	599	621	645	645	469	62.2	569	1000	
Fluoride- mg/l	0.54	0.52	0.58	0.55	0.59	0.6	0.62	0.62	0.52	0.0	0.6		
Alkalinity- mg/l	125	118	126	122	131	136	129	136	118	5.9	127		
Total Hardness- mg/l	240	266	276	271	304	306	306	306	240	25.2	281		
TOC- mg/l	2.83	2.7	2.35	3.23	<1	<1	2.55	3.23	2.35	0.3	2.7		
Tot. Phosphorus- mg/l	0.06	0.35	**3.18**	0.5	0.34	0.32	0.31	3.18	0.06	1.1	0.7		**1.1**
Ortho-Phos.- mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01						0.9
BOD- mg/l	<3	<3	<3	<3	<3	<3	<3						
COD- mg/l	15.6	<3	16	<3	4.9	6.9	<3	16	4.9	5.8	10.9		
NH3-Nitrogen- mg/l	**0.29**	**0.17**	0.08	0.13	0.08	0.13	0.14	0.29	0.08	0.1	0.1		0.16
Nitrate+Nitrite- mg/l	0.83	<.02	0.82	0.9	0.86	0.93	0.82	0.93	0.82	0.0	0.9		3.5
TKN- mg/l	<.1	0.78	0.45	0.78	1.12	0.67	0.67	1.12	0.45	0.2	0.7		
F. Coliform- CFU/100 ml	**1620**		**1120**	**1640**	**600**	**2700**	**1200**	2700	600	709.4	1340	**200**	
E. Coli.- MPN/100 ml	**756**	**870**	**525**	**1011**	**722**	**961**	**914**	1011.1	525	167.7	806	**126**	
MBAS- mg/l	<.1	<.1	<.1	<.1	<.1	<.1	<.1						
Oil & Grease- mg/l	0.9	<.9	3.7	<.9	<.9	<.9	13.3	13.3	0.9	6.5	6.0		
Tot. Cyanide- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02						
Tot. Silver- ug/l	<2	<2	<2	8.2	<2	<2	<2	8.2	8.2		8.2		
Diss. Silver- ug/l	<2	<2	<2	**7.4**	<2	<2	<2	7.4	7.4		7.4	**0.92**	
Tot. Aluminum- ug/l	650	706	467	557	548	504	717	717	467	98.8	592.7		
Diss. Aluminum- ug/l	264	280	135	128	97.9	134	77.2	280	77.2	79.8	159.4	991	
Tot. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10						
Diss. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10					360	190
Tot. Cadmium- ug/l	<.2	<.2	<.2	0.2	<.2	<.2	<.2	0.2	0.2		0.2		
Diss. Cadmium- ug/l	<.2	<.2	<.2	<.2	<.2	<.2	<.2					43	1.3

Parameter	Date							max	min	std dev	mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Tot. Chromium- ug/l	12.7	13.6	<10	32.7	<10	<10	<10	32.7	12.7	11.3	19.7		
Diss. Chromium- ug/l	<10	<10	<10	32.1	<10	<10	<10	32.1	32.1		32.1	2071	247
Hex. Chromium- ug/l	<5	<5	<5	<5	<5	<5	<5						
Tot. Calcium- mg/l	65	75.1	77.7	81.5	90.9	91.5	88.6	91.5	65	9.7	81.5		
Diss. Calcium- mg/l	26.4	62	70.6	73.6	82.9	87.7	77	87.7	26.4	20.4	68.6		
Tot. Copper- ug/l	7.6	9.8	<5	12.4	<5	<5	<5	12.4	7.6	2.4	9.9		
Diss. Copper- ug/l	<5	<5	<5	12.4	<5	<5	<5	12.4	12.4		12.4	24	15
Tot. Nickel- ug/l	22.7	<15	<15	24.3	<15	<15	<15	24.3	22.7	1.1	23.5		
Diss. Nickel- ug/l	<15	<15	<15	30.2	<15	<15	<15	30.2	30.2		30.2	1701	189
Tot. Lead- ug/l	2.1	<2	<2	<2	<2	<2	<2	2.1	2.1		2.1		
Diss. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2					107	4
Tot. Selenium- ug/l	<2	2.4	<2	2.3	<2	2.9	2	2.9	2	0.4	2.4	20	5
Diss. Selenium- ug/l	<2	<2	<2	<2	2.4	<2	2.1	2.4	2.1	0.2	2.3		
Tot. Zinc- ug/l	10	12.3	<5	10.8	6.7	7.9	6.8	12.3	6.7	2.3	9.1		
Diss. Zinc- ug/l	7.8	8.9	<5	<5	<5	6.1	<5	8.9	6.1	1.4	7.6	140	127
Tot. Mercury- ug/l	<2	<2	<2	<2	<2	<2	<2					2.4	1.3
Tot. Magnesium- mg/l	18.4	19	19.9	16.4	18.7	18.9	20.7	20.7	16.4	1.3	18.9		
Diss. Magnesium- mg/l	18.1	19.2	19.7	16.4	18.6	19.1	19.4	19.7	16.4	1.1	18.6		

TSWQS1- State of Texas primary standards used for comparison. For metals, protection of Aquatic Life, Freshwater Acute criteria are listed.
TSWQS2- State of Texas nutrient screening levels provided for reference only. For metals, protection of Aquatic Life, Freshwater Chronic criteria are listed.
Concentrations in **bold** indicate values that have exceeded the standard.

Graph 3. Comparison of bacterial concentrations compared to TSWQS and a comparison of flow conditions during the study period to the minimum flow requirements to assess water quality data at Masterson Road.



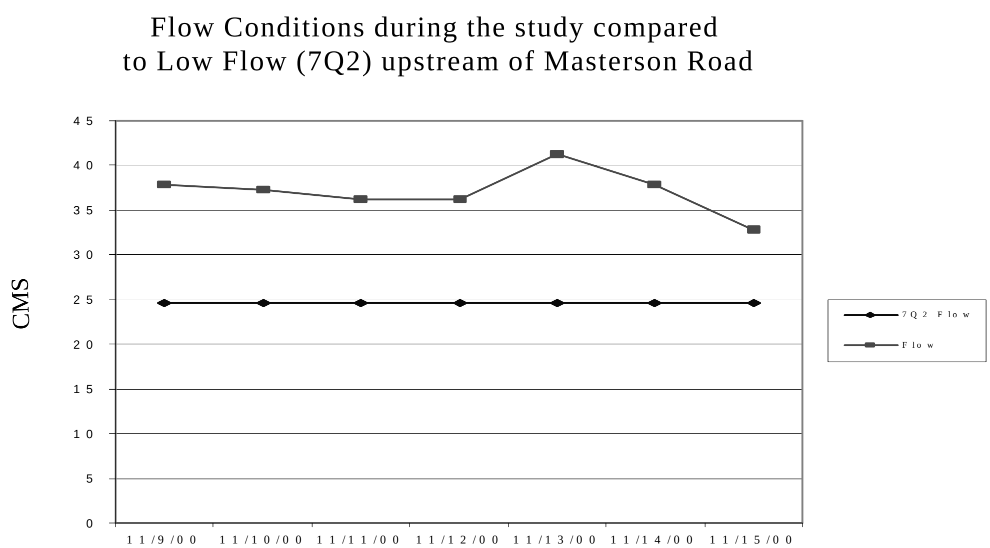


Table 12. Results for the parameters analyzed by Mexico during the Intensive Monitoring Study at Site 2.

Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max.	Min.	Std. Dev.	Average	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Sample time	16:45	15:20	12:15	8:25	11:20	8:20	11:00								
P-Alkalinity	1.00	5.00	4.00	4.00	6.00	7.00	6.00	7.00	1.00	1.98	4.71	-	-	-	-
Total Alkalinity	129.00	127.00	138.00	129.00	135.00	138.00	138.00	138.00	127.00	4.93	133.43	400	-	-	-
Chloride	104.70	96.80	107.30	101.20	114.62	111.86	114.13	114.62	96.80	6.77	107.23	250	147.5	-	250
Conductivity, uS/cm	961.00	922.00	**1013.0**	947.00	**1045.0**	**1023.0**	**1037.0**	1045.00	922.00	48.51	992.57	-	**1000**	-	-
Biochemical Oxygen Demand, mg/l	12.06	11.40	26.27	17.33	0.68	3.22	1.52	26.27	0.68	9.39	10.35	-	-	-	-
Chemical Oxygen Demand, mg/l	6.00	10.00	8.00	9.00	11.00	14.00	5.00	14.00	5.00	3.06	9.00	-	-	-	-
Total Hardness, mg/l as CaCO3	283.00	261.00	293.00	281.00	302.00	302.00	304.00	304.00	261.00	15.61	289.43	-	-	-	-
Calcium Hardness, mg/l as CaCO3	193.00	200.00	220.00	189.00	237.00	227.00	219.00	237.00	189.00	18.24	212.14	-	-	-	-
Magnesium Hardness, mg/l as CaCO3	90.00	61.00	73.00	92.00	65.00	75.00	85.00	92.00	61.00	12.09	77.29	-	-	-	-
Total Phosphates, mg/l	**0.349**	**0.377**	**0.315**	**0.329**	**0.288**	**0.319**	**0.319**	0.38	0.29	0.03	0.33	**0.1**	-	-	-
Oil and Grease, mg/l	**6.00**	**8.10**	**12.30**	**17.00**	**15.60**	**11.20**	**11.60**	17.00	6.00	3.86	11.69	**Absent**	-	-	-
Nitrate Nitrogen, mg/l	0.761	0.800	0.686	1.346	0.721	0.850	0.609	1.35	0.61	0.24	0.82	5	-	90	-
Nitrite Nitrogen, mg/l	0.021	0.019	0.013	0.018	<0.008	0.018	0.015	0.02	0.01	0.00	0.02	0.05	-	10	-
pH, SU	8.02	8.03	7.95	8.06	8.01	8.14	8.09	8.14	7.95	0.06	8.04	5-9	4.5-9.0	-	-
MBAS, mg/l	0.092	0.094	0.081	0.040	0.045	0.064	0.102	0.10	0.04	0.02	0.07	0.5	-	-	0.1
Total Suspended Solids, mg/l	**565.0**	**117.5**	**82.00**	**59.50**	**53.00**	**54.00**	46.00	565.00	46.00	189.20	139.57	**500**	**50**	-	-
Fixed Suspended Solids, mg/l	490.00	23.00	18.00	12.00	4.00	5.00	8.00	490.00	4.00	180.92	80.00	-	-	-	-
Volatile Suspended Solids, mg/l	75.00	94.50	64.00	47.50	49.00	49.00	38.00	94.50	38.00	19.63	59.57	-	-	-	-
Total Dissolved Solids, mg/l	**538.0**	**578.0**	**639.00**	**574.0**	**625.00**	**643.00**	**617.00**	643.00	538.00	39.29	602.00	**500**	**500**	1000	-
Sulfate, mg/l	**175.0**	**167.0**	**170.00**	**165.0**	**178.00**	**179.00**	**187.00**	187.00	165.00	7.70	174.43	**500**	**130**	-	**0.005**
Fecal Coliform, MPN/100 ml	**9300**	**15000**	**24000**	**46000**	**4300**	**9300**	**9300**	46000	4300	14334	12831.65	**1000**	**1000**		**200 XVIII**
Aluminum, mg/l	**5.90**	**5.30**	**4.70**	ND	<2.2	3.50	3.50	5.90	3.50	1.07	4.58	**0.02**	5	5	**0.05**
Arsenic, mg/l	<0.005	<0.005	<0.005	ND	<0.005	<0.005	<0.005	0.00	0.00			0.05	0.1	0.2	0.2
Cadmium, mg/l	<0.03	<0.03	<0.03	ND	<0.03	<0.03	<0.03	0.00	0.00			0.01	0.1	0.2	XIII
Total Chromium, mg/l	<0.12	<0.12	<0.12	ND	<0.12	<0.12	<0.12	0.00	0.00				0.01	0.02	-
Copper, mg/l	<0.12	<0.12	<0.12	ND	<0.12	<0.12	<0.12	0.00	0.00			1	0.2	0.5	XVII
Lead, mg/l	<0.15	<0.15	<0.15	ND	<0.15	<0.15	<0.15	0.00	0.00			0.05	5	0.1	XXXIV

Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max.	Min.	Std. Dev.	Average	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Mercury, mg/l	<0.005	<0.005	<0.005	ND	<0.005	<0.005	<0.005	0.00	0.00			0.001	-	0.003	0.00001
Nickel, mg/l	<0.20	<0.20	<0.20	ND	<0.20	<0.20	<0.20	0.00	0.00			0.01	0.2	1	XXVII
Silver, mg/l	<0.10	<0.10	<0.10	ND	<0.10	<0.10	<0.10	0.00	0.00			0.05			XXXIII
Zinc, mg/l	0.030	<0.02	<0.02	ND	<0.02	0.030	<0.02	0.03	0.03	0.00	0.03	5	2	50	XXXVI
Calcium, mg/l	73.11	71.80	78.33	ND	80.94	75.72	79.63	80.94	71.80	3.66	76.59	-	-	-	-
Magnesium, mg/l	21.77	30.44	21.67	ND	24.55	22.20	22.30	30.44	21.67	3.41	23.82	-	-	-	-
Benzene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					0.01	-	-	0.05
Bromochloromethane, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
1,2 Dichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					0.005	-	-	1.20
1,1 Dichloroethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.0003	-	-	0.116
Hexachloro 1,3 Butadiene, mg/l	**0.3015**	**0.2721**	**0.4731**	<0.08	<0.08	<0.08	**0.3499**	0.4731	0.2721	0.0886	0.3492	**0.004**	-	-	**0.0009**
Hexachloroethane, mg/l	<0.08	<0.08	ND	ND	ND	ND	<0.08					0.02	-	-	0.01
Methylene Chloride, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06					0.002	-	-	-
Ethylmethylacetone, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Pyridine, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Carbon tetrachloride, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07					0.004	-	-	0.30
Chlorobenzene, mg/l	<0.05	<0.05	ND	ND	ND	ND	<0.05					0.02	-	-	-
Chloroform, mg/l	<0.07	ND	ND	<0.07	ND	ND	ND					-	-	-	-
1,4-dichlorobenzene, mg/l	**0.105**	<0.07	<0.07	<0.07	<0.07	<0.07	**0.0761**	0.1046	0.0761	0.0202	0.0904	0.4	-	-	**0.01**
Toluene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					14.3	-	-	0.20
1,1,1-trichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					18.4	-	-	0.20
Trichlorethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.03	-	-	0.01
1,2-dichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.4	-	-	0.01
Bromodichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Total Trihalomethane, mg/l	<0.20	<0.20	ND	<0.20	ND	ND	<0.20					-	-	-	-

ND = Not determined

NA = Not applicable

XIII = The average concentration of cadmium over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.7852(ln(hardness))*3.490)

XVII = The average concentration of copper over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8545 (ln(hardness))*3.490)

XVIII= The number of organisms should not exceed 200 as Most Probable Number/100 ml in surface water and no more than 10 % in monthly samples should exceed 400 MPN/100 ml.

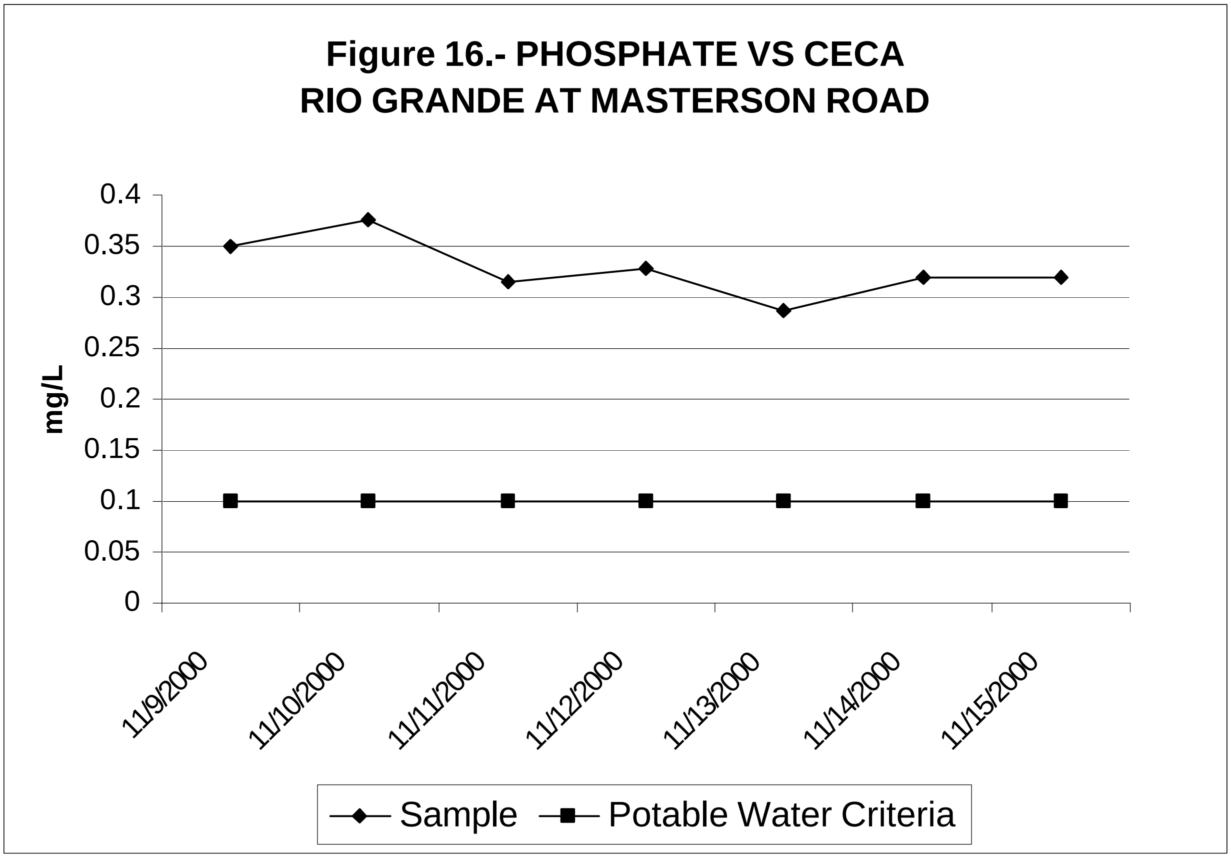
XXVII = The average concentration of nickel over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8460 (ln(hardness)+1.1645). Hardness= mg/l as CaCo3.

XXXIII= The concentration of silver (in ug/l) should not exceed the value calculated using the following equation (1.27 (ln (hardness))* 6.52). hardness= mg/l as CaCo3.

XXXIV = The average concentration of lead over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (1.273 (ln(hardness)* 4.705). Hardness= mg/l as CaCo3.

XXXIV = The average concentration of zinc over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8473 (ln(hardness)+ 10.3604). Hardness= mg/l as CaCo3.

Graph 4. Graphs of data produced by Mexico at Masterson Road.



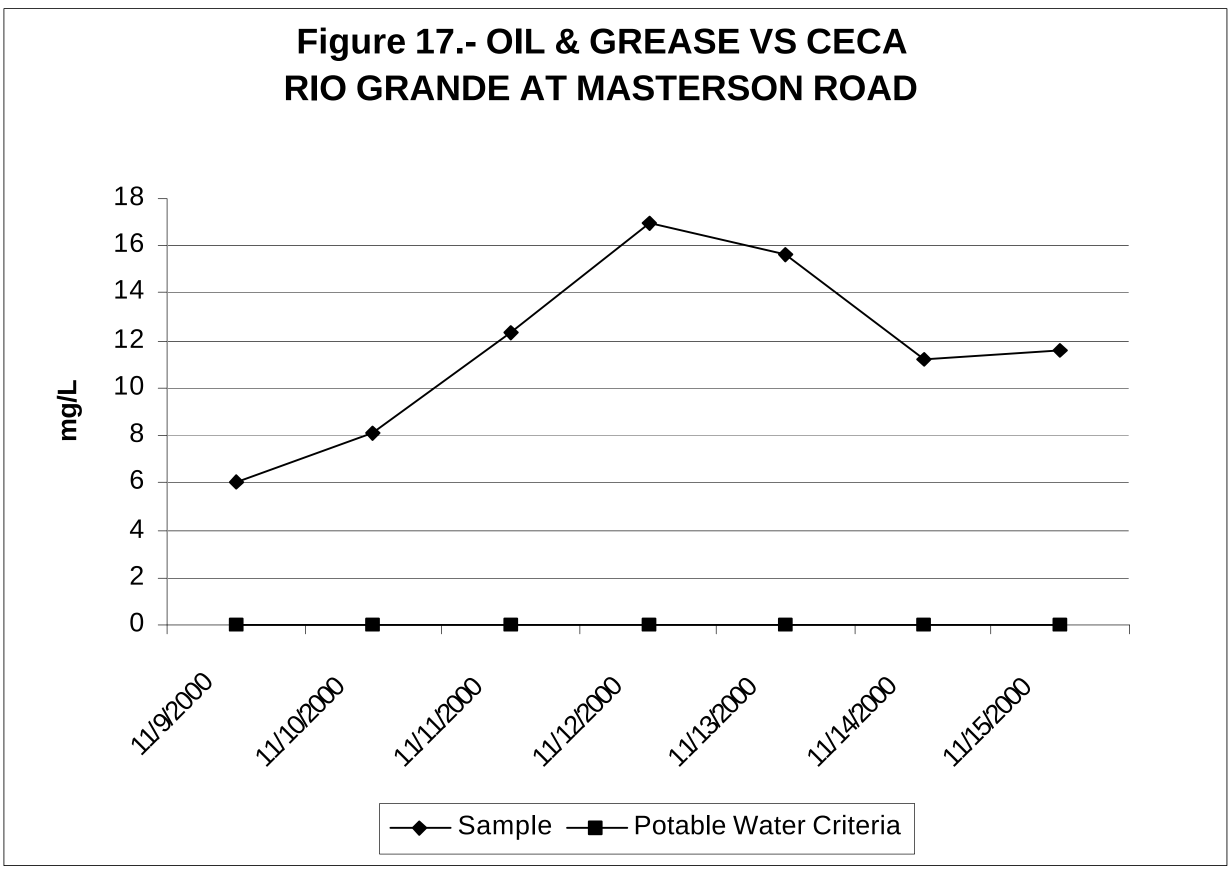


Figure 18.- TDS VS CECA
RIO GRANDE AT MASTERSON ROAD

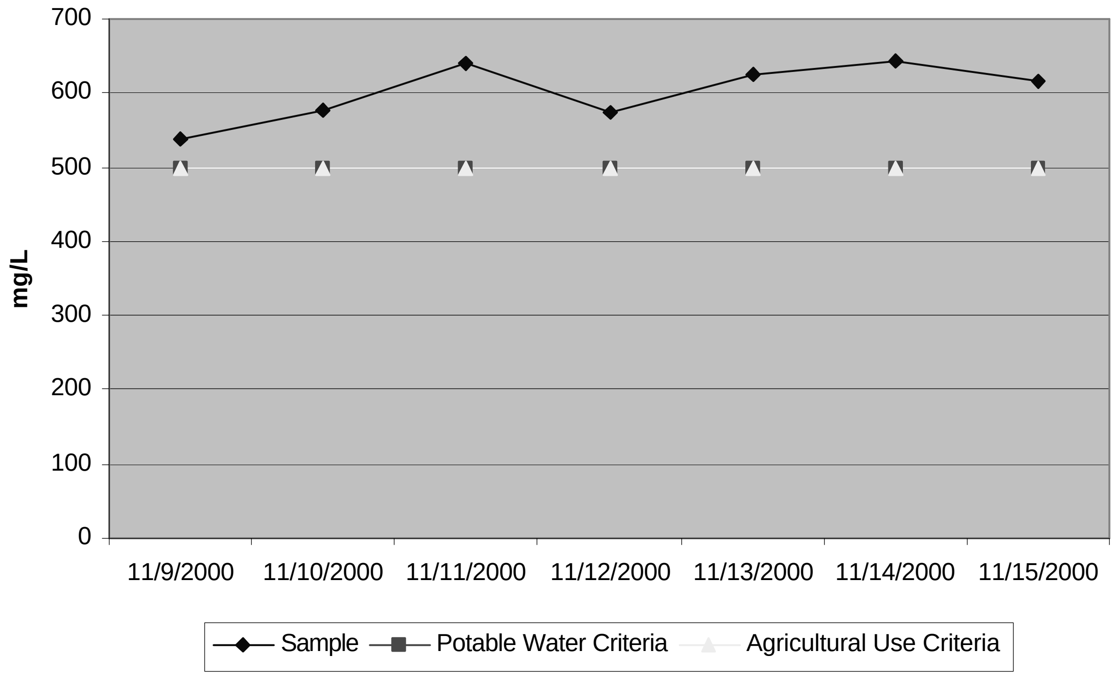
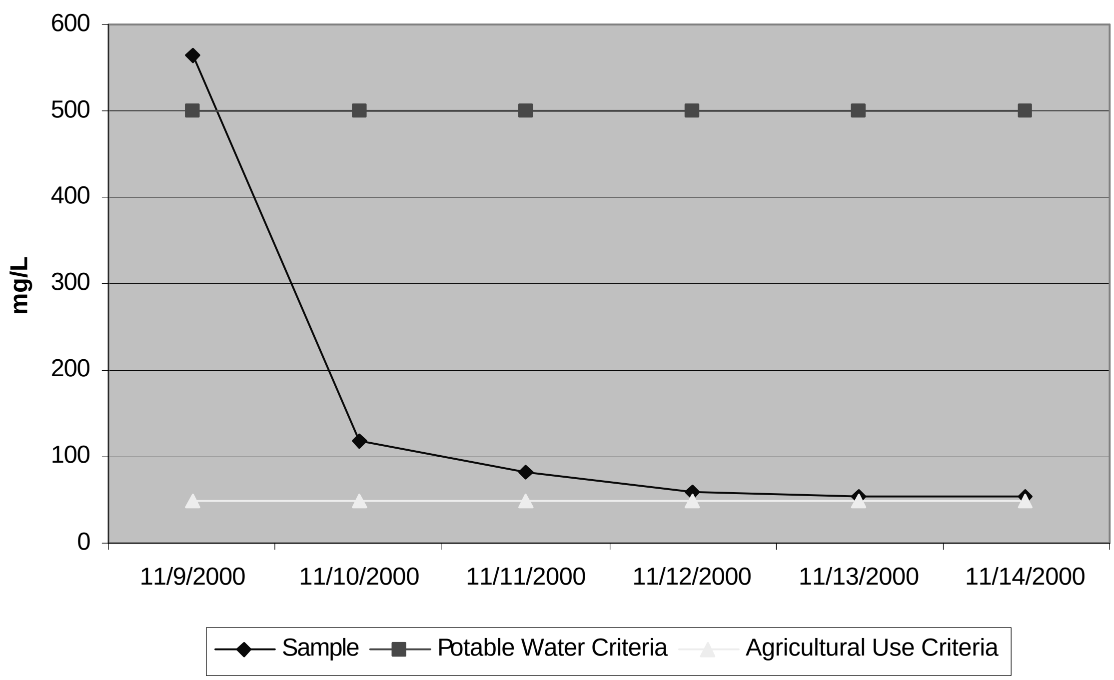


Figure 19.- TSS VS CECA
RIO GRANDE AT MASTERSON ROAD



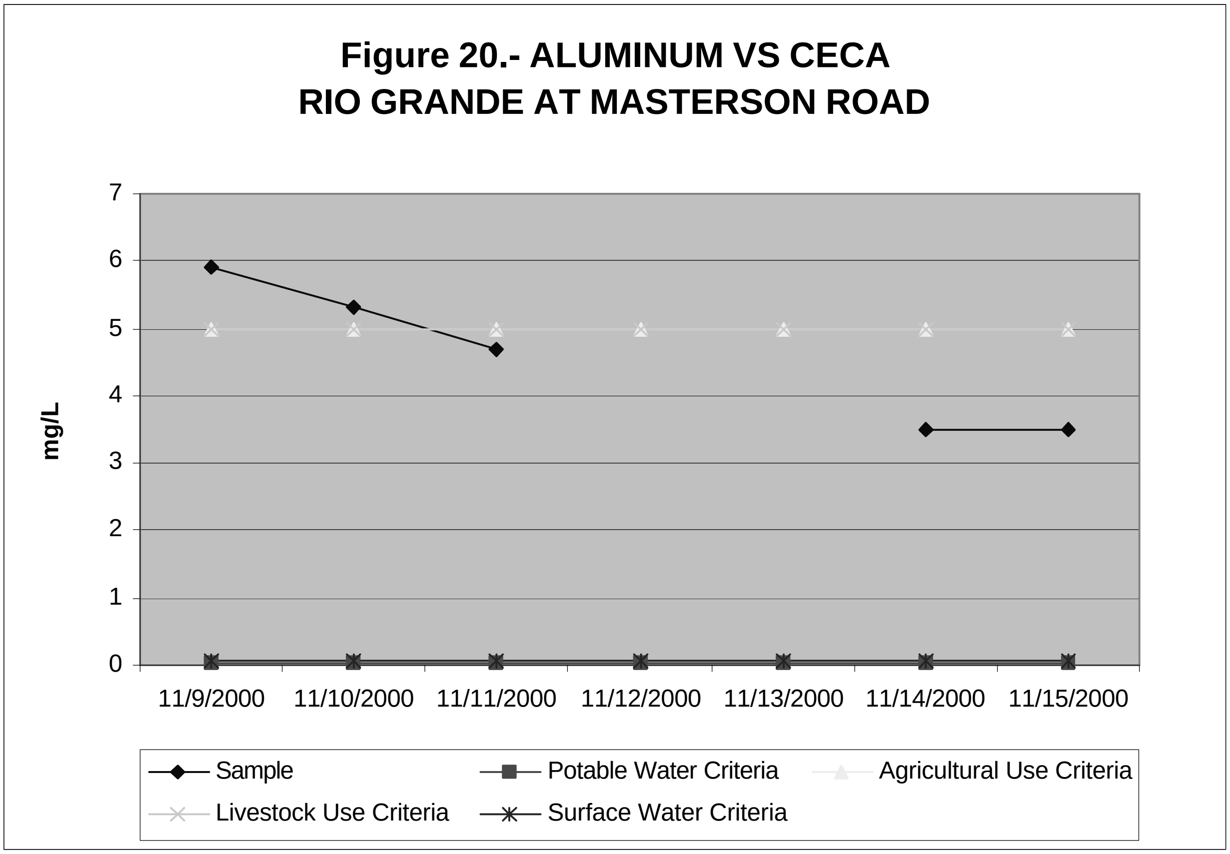


Figure 20.- ALUMINUM VS CECA
RIO GRANDE AT MASTERSON ROAD
mg/L
7
6
5
4
3
2
1
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Agricultural Use Criteria
Livestock Use Criteria
Surface Water Criteria

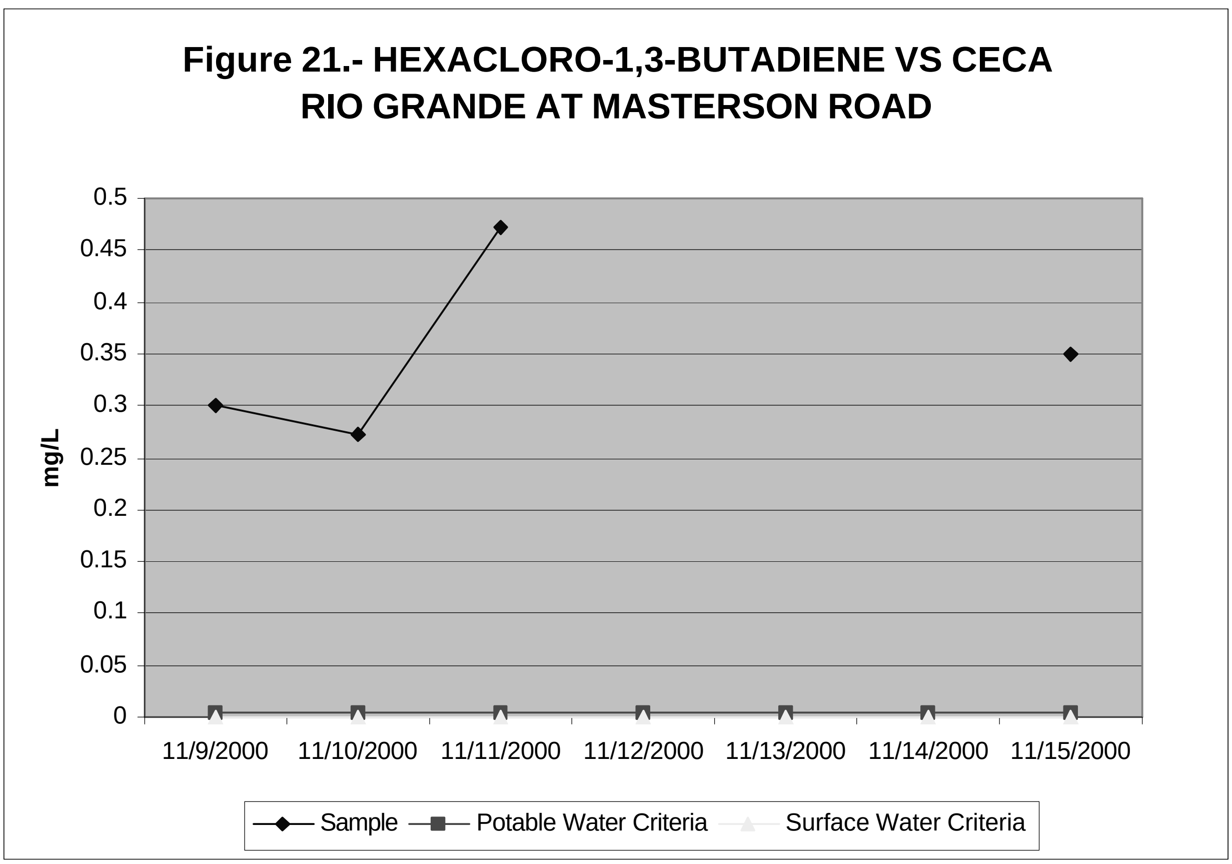


Figure 21.- HEXACLORO-1,3-BUTADIENE VS CECA
RIO GRANDE AT MASTERSON ROAD
mg/L
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Surface Water Criteria

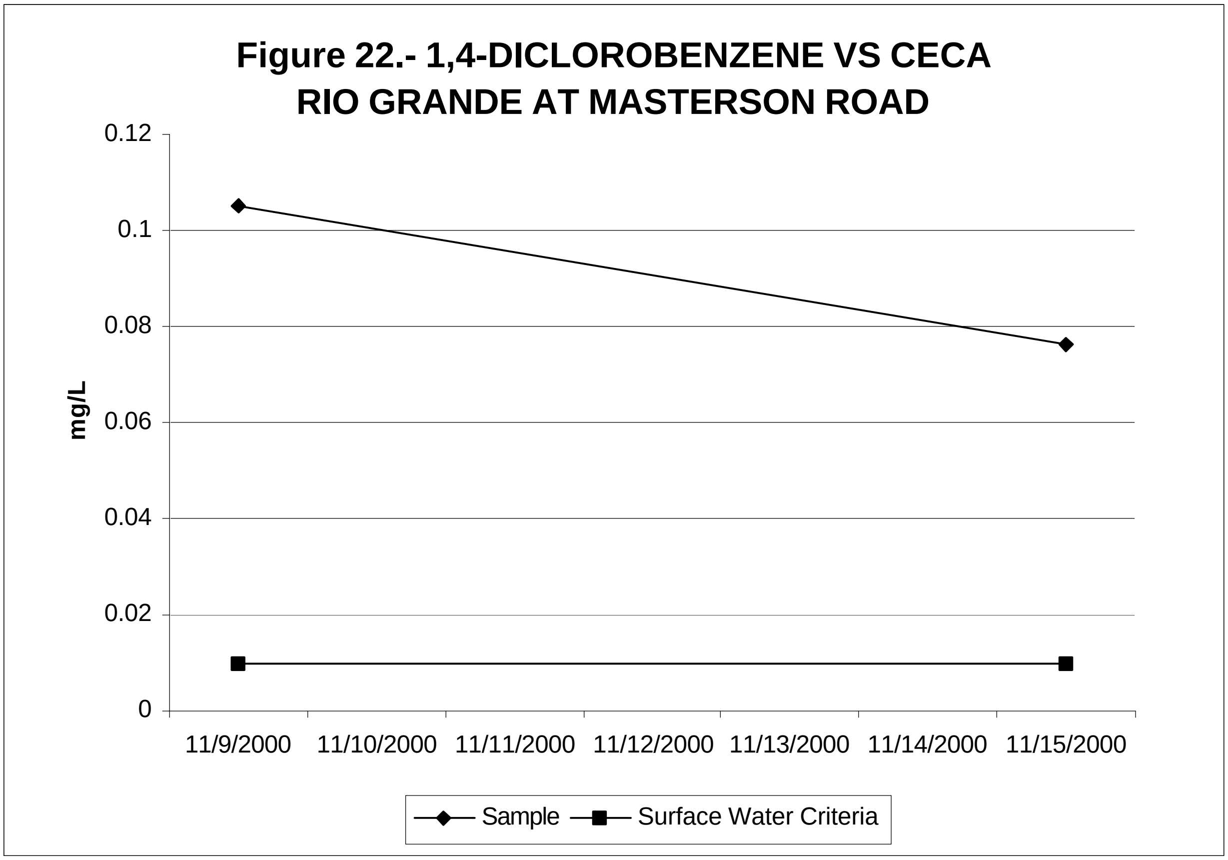


Figure 22.- 1,4-DICLOROBENZENE VS CECA
RIO GRANDE AT MASTERSON ROAD
mg/L
0.12
0.1
0.08
0.06
0.04
0.02
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Surface Water Criteria

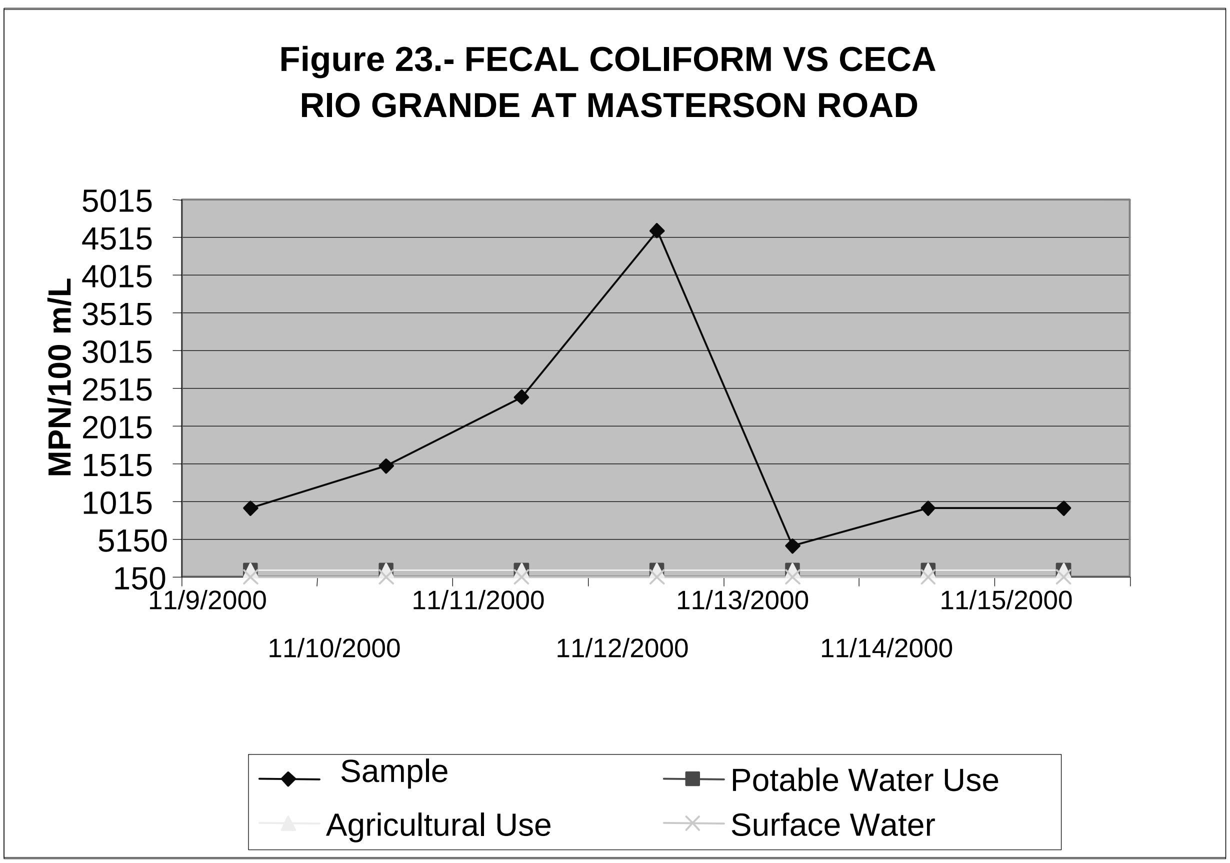


Figure 23.- FECAL COLIFORM VS CECA
RIO GRANDE AT MASTERSON ROAD
MPN/100 m/L
5015
4515
4015
3515
3015
2515
2015
1515
1015
5150
150
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Use
Agricultural Use
Surface Water

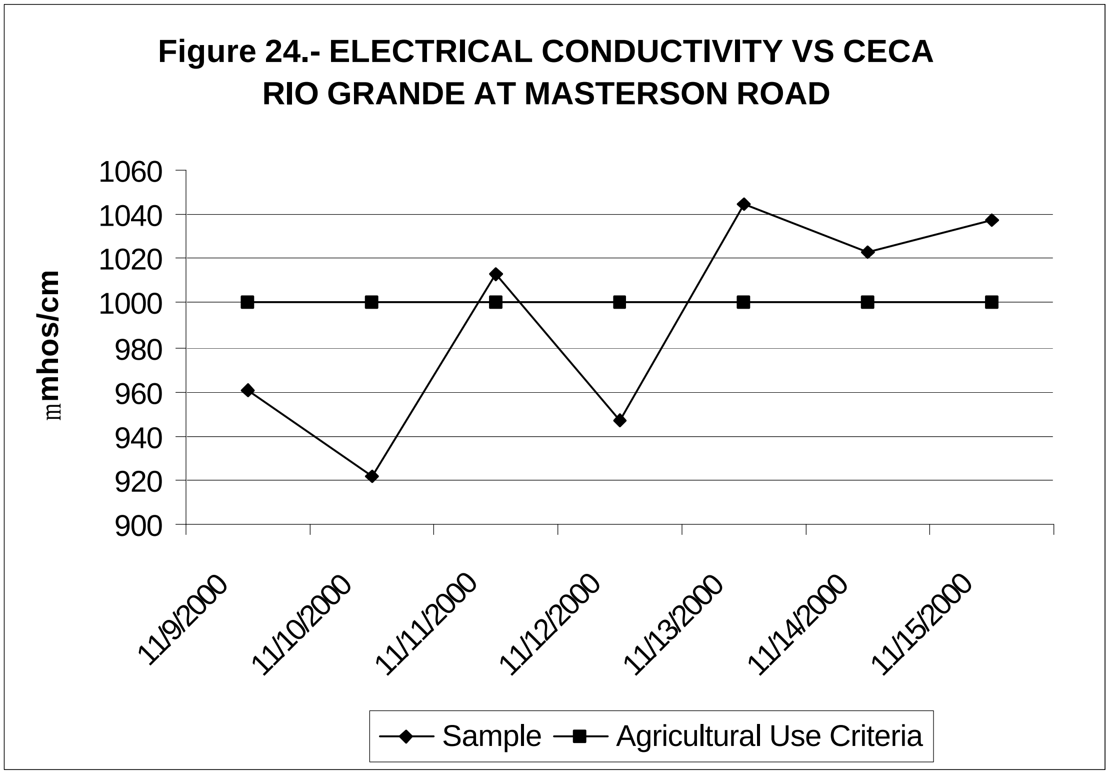


Figure 24.- ELECTRICAL CONDUCTIVITY VS CECA
RIO GRANDE AT MASTERSON ROAD
mmhos/cm
1060
1040
1020
1000
980
960
940
920
900
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agricultural Use Criteria

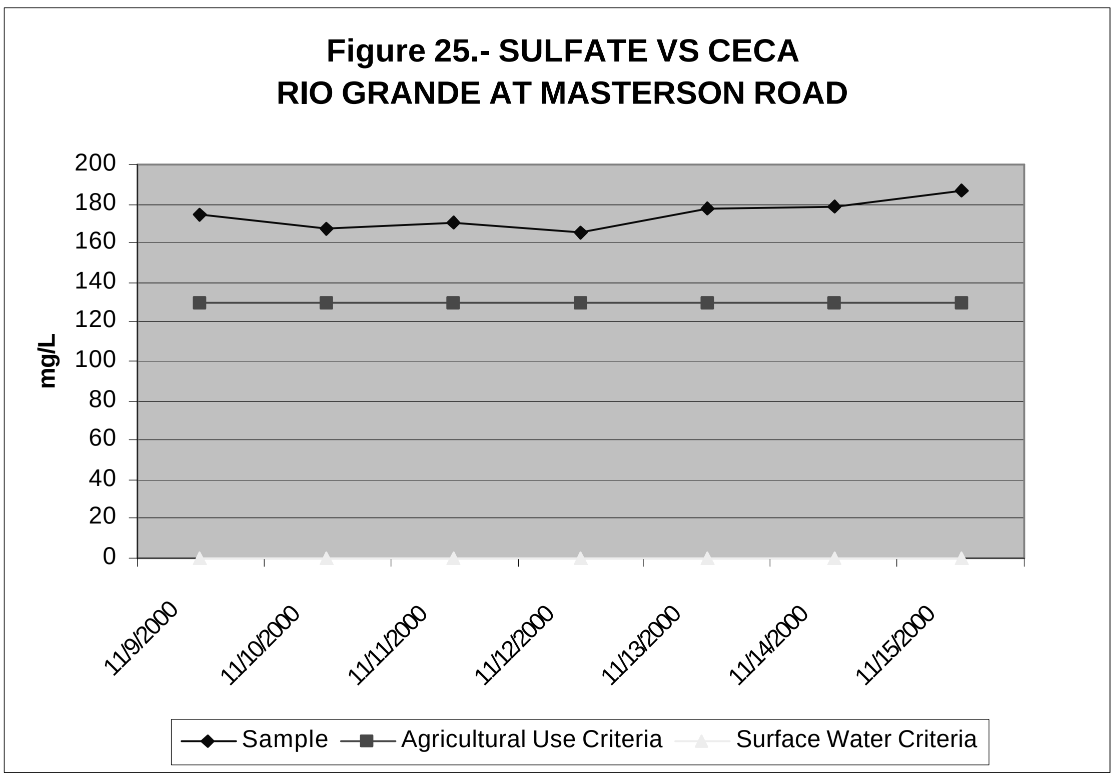


Figure 25.- SULFATE VS CECA
RIO GRANDE AT MASTERSON ROAD
mg/L
200
180
160
140
120
100
80
60
40
20
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agricultural Use Criteria
Surface Water Criteria

SITE 3- NUEVO LAREDO INTERNATIONAL WASTEWATER TREATMENT PLANT INFLUENT (NLIWTP).

The sample collection site for the NLIWTP influent sample was located at the headworks facility prior to any treatment. The samples were collected to provide information on the type and strength of the wastewater received at the NLIWTP as well as to estimate the overall performance of the NLIWTP when compared to effluent concentrations (Table 12). Samples that could not be collected as a composite sample (bacteria, VOC, and oil and grease) were collected as grabs at the end of the 24 hr composite cycle using a bucket.

The NLIWTP headworks facility begins in the influent channel, maintaining a flow of 2 feet per second to keep sediment from settling. Bar screens remove trash and other large debris from the waste stream. The influent is aerated to maintain a constant dissolved oxygen level and to prevent anaerobic conditions. Grit removal is accomplished using a vortex type separator.

Conventional Parameters. As mentioned earlier, the influence of a rain event prior to sampling is evident in the first composite sample collected on 11/07-08/00 at the influent, most likely due to infiltration of runoff. The BOD and COD concentrations increased in sample 1 indicating a higher organic, and to a certain extent, inorganic loading to the NLIWTP. The minimum BOD concentration of 70 mg/l occurred in sample 4 on 11/10-11/00, compared to the 292 mg/l observed in the first sample. The COD concentration of 544 mg/l on the first day was almost twice the concentration of any other sample collected at the influent. Total and Volatile Suspended Solids also increased on day 1, and were almost three times as high as the other influent samples. The concentrations for all conventional parameters after day 1 were within the range of average/below average concentrations for domestic/industrial sewerage coming into the NLIWTP.

Trace Elements. Aluminum and zinc were found in higher concentrations than any other trace elements. The average aluminum concentration was 1511 µg/l and 261 µg/l for zinc. This increased level in trace elements is not typical of domestic wastewater.

Organic Compounds. Two semi-volatile organic compounds were detected in the influent samples, cresols and phenol. The presence of phenol may be the result of an industrial discharge. VOC's detected in the influent were 1,4-dichlorobenzene, benzene, bromodichloromethane, chloroform, dibromochloromethane, total trihalomethane, and toluene. These VOC's may be of domestic, commercial, or industrial origin.

SAMPLES ANALYZED BY MEXICAN LABORATORIES

The concentration of alkalinity in the influent of the NLIWTP (average 282 mg/l) exceeds the design value of 270 mg/L. Wastewater entering the sewerage system does not have adequate treatment to reduce the concentrations of alkalinity. (Figure 26)

The values obtained from the analysis of the NLIWTP influent samples show concentrations of BOD average 119.74 mg/L. This value does not exceed the maximum permissible limits of IBWC Minute No. 279, which establishes a limit of 220 mg/L. Water from the sewerage system entering the NLIWTP does not contain a great quantity of organic material, which could interfere with the treatment of the same (Figure 27).

The values of total suspended solids reported from the NLIWTP influent exceed the maximum permissible limits established in IBWC Minute No. 279 (Figure 28). These concentrations could inhibit the NLIWTP treatment processes.

Figure 29 shows pH levels during the five sampling days and these concentrations do not exceed the limits established in the IBWC Minute No. 279 criteria. This parameter does not impact the NLIWTP treatment processes.

Table 13, shows concentrations of hexachloro 1,3 butadiene, hexachloroethane and 1-4 dichlorobenzene detected in the NLIWTP influent. Current legislation in national territory does not consider it and, the reported concentrations cannot be compared with any legislative limit.

Photo 5. Site used for the collection of the NLIWTP influent.

Photo 6. NLIWTP laboratory, used for preparing composite samples.

Photo 7. NLIWTP Influent.

Table 13. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 3.

Parameter	Date							max	min	std dev	mean
	11/07-08/00	11/08-09/00	11/09-10/00	11/10-11/00	11/11-12/00	11/12-13/00	11/13-14/00				
pH- SU	7.49	7.41	7.54	7.45	7.42	7.33	6.97	7.54	6.97	0.2	7.37
Alkalinity- mg/l	264	233	235	238	240	230	251	264	230	12.0	242
Total CN- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02				
Fluoride- mg/l	0.55	0.56	0.55	0.57	0.59	0.5	0.6	0.6	0.5	0.0	0.56
TDS- mg/l	854	965	878	835	1100	1000	1030	1100	835	99.4	952
Chloride- mg/l	217	212	217	217	217	208	215	217	208	3.5	215
Chlorophyll a ug/l	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3				
Sulfate- mg/l	308	297	301	305	309	295	278	309	278	10.7	299
NO3+NO2- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	0.3	0.3	0.3		0.30
COD- mg/l	544	322	252	220	294	199	242	544	199	117.1	296
Tot-Phosphorus- mg/l	13.1	9.85	16.4	14.8	7.85	7.45	8.45	16.4	7.45	3.6	11.1
o-Phospate- mg/l	7.35	5.47	5	4.9	5.64	5.16	5.74	7.35	4.9	0.8	5.61
BOD- mg/l	292	100	73	70	118	100	110	292	70	76.5	123
TKN - mg/l	48.3	34.3	33	32.3	33.6	29.5	33.2	48.3	29.5	6.1	34.9
NH3-Nitrogen- mg/l	20	17.9	21.5	20.9	23.8	23.8	24.3	24.3	17.9	2.4	21.7
Total Hardness- mg/l	473	321	354	363	126	368	379	473	126	105.6	341
TOC- mg/l	54.8	46	59.3	59.7	79.9	81.3	7.56	81.3	7.56	24.8	55.5
TSS- mg/l	907	261	255	364	320	118	184	907	118	261.2	344
VSS- mg/l	428	167	142	150	178	83	116	428	83	113.7	181
MBAS- mg/l	0.23	<.1	<.1	<.1	<.1	0.1	<.1	0.23	0.1	0.1	0.17
Tot. Aluminum- ug/l	3740	1870	165	1520	1580	673	1030	3740	165	1143.6	1511
Tot. Arsenic- ug/l	<10.0	<10	<10	<10	<10	<10	<10				
Tot. Cadmium- ug/l	1.9	0.6	0.5	0.5	0.5	<.2	0.4	1.9	0.4	0.6	0.73
Tot. Calcium- mg/l	150	86.6	95.5	103	114	107	111	150	86.6	20.1	109.6
Tot. Chromium- ug/l	<10	13.3	16.7	<10	38.5	<10	<10	38.5	13.3	13.7	22.8
Tot. Copper- ug/l	12.7	11.6	15.5	<5	16.2	<5	0.4	16.2	0.4	6.4	11.3
Tot. Lead- ug/l	43.2	21.7	15	18.2	16.2	<2	<2	43.2	15	11.7	22.9
Tot. Magnesium- mg/l	24.1	25.5	28.1	25.8	23.7	24.8	24.7	28.1	23.7	1.5	25.2
Tot. Mercury- ug/l	<2	<2	<2	<2	<2	<2	<2				
Tot. Nickel- ug/l	<15	25.6	<15	<15	32.2	<15	<15	32.2	25.6	4.7	28.9
Tot. Selenium- ug/l	<2	<2	<2	<2	10.2	<2	<2	10.2	10.2		10.2
Tot. Silver- ug/l	<2	<2	<2	<2	8.1	<2	<2	8.1	8.1		8.1
Tot. Zinc- ug/l	670	250	185	224	214	91.5	194	670	91.5	187.1	261.2
Benzidine- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3				
Bis (Chlormethyl) Ether- ug/l	<4	<4	<4	<4	<4	<4	<4				

Parameter	Date							max	min	std dev	mean
	11/07-08/00	11/08-09/00	11/09-10/00	11/10-11/00	11/11-12/00	11/12-13/00	11/13-14/00				
Bis (2-Ethylhexyl) Phthalate- ug/l	<10	<10	<10	<10	<10	<10	<10				
Cresols- ug/l	<6	<6	<6	<6	<6	13.5	<6	13.5	13.5		13.5
Hexachlorobenzene- ug/l	<2.1	<2.1	<2.1	<2.1	<2.10	<2.1	<2.1				
Hexahlorbutadiene- ug/l	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2				
Hexachloroethane- ug/l	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6				
Nitrobenzene- ug/l	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8				
n-Nitroso-Di-n-Propylamine- ug/l	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6				
Pentachlrobenzene- ug/l	<4	<4	<4	<4	<4	<4	<4				
Pentachlorophenol- ug/l	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2				
Phenanthrene- ug/l	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7				
Phenol- ug/l	2.2	1.59	3.2	<1.3	3.83	5.87	<1.3	5.87	1.59	1.7	3.3
2,4,5-Tetrachlorobenzene- ug/l	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2				
Pyridine- ug/l	<10	<10	<10	<10	<10	<10	<10				
1,2,4,5-Tetrachlorobenzene- ug/l	<4	<4	<4	<4	<4	<4	<4				
p-Dichlorobenzene- ug/l	<2	<2	<2	<2	<2	<2	<2				
Hexachlorohexane- ug/l	<4	<4	<4	<4	<4	<4	<4				
n-Nitrosodiethylamine- ug/l	<4	<4	<4	<4	<4	<4	<4				
O & G mg/l	4.5	11.8	16.4	11.5	17.1	18.7	25.8	25.8	4.5	6.7	15.1
1,1,1-Trichloroethane- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3				
1,1-Dichloroehtane- ug/l	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9				
1,2-Dibromoethane- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5				
1,2-Dichloroethane- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5				
1,4-Dichlorobenzene- ug/l	9.1	15.1	21	18	27.2	23.2	24	27.2	9.1	6.1	19.7
2-Butanone (MEK)- ug/l	<62	<62	<62	<62	<62	<62	<62				
Bezene- ug/l	3.7	4.5	4.85	4	4.2	3.45	3.15	4.85	3.15	0.6	4.0
Bromodichloromethane- ug/l	<.3	4.8	<.3	<.3	<.3	<.3	<.3	4.8	4.8		4.8
Carbon tetrachloride- ug/l	<.8	<.8	<.8	<.8	<.8	<.8	<.8				
Chlorobenzene- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3				
Chloroform- ug/l	<.7	11.8	9.4	9.4	8.95	9.2	9.35	11.8	8.95	1.1	9.7
Dibromochloromethane- ug/l	<.4	4.35	<.4	<.4	<.4	<.4	<.4	4.35	4.35		4.4
Methylene chloride- ug/l	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3				
Tetrachloroethene- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5				
Toluene- ug/l	7	9.35	12.7	11.2	13.1	10.4	16.7	16.7	7	3.1	11.5
Trichloroethene- ug/l	<.6	<.6	<.6	<.6	<.6	<.6	<.6				
Total Trihalomethanes- ug/l	<.01	21	9.4	9.4	8.95	9.2	9.35	21	8.95	4.8	11.2
Vinyl chloride- ug/l	<.7	<.7	<.7	<.7	<.7	<.7	<.7				

Table 14. Results for the parameters analyzed by Mexico during the Intensive Monitoring Study at Site 3.

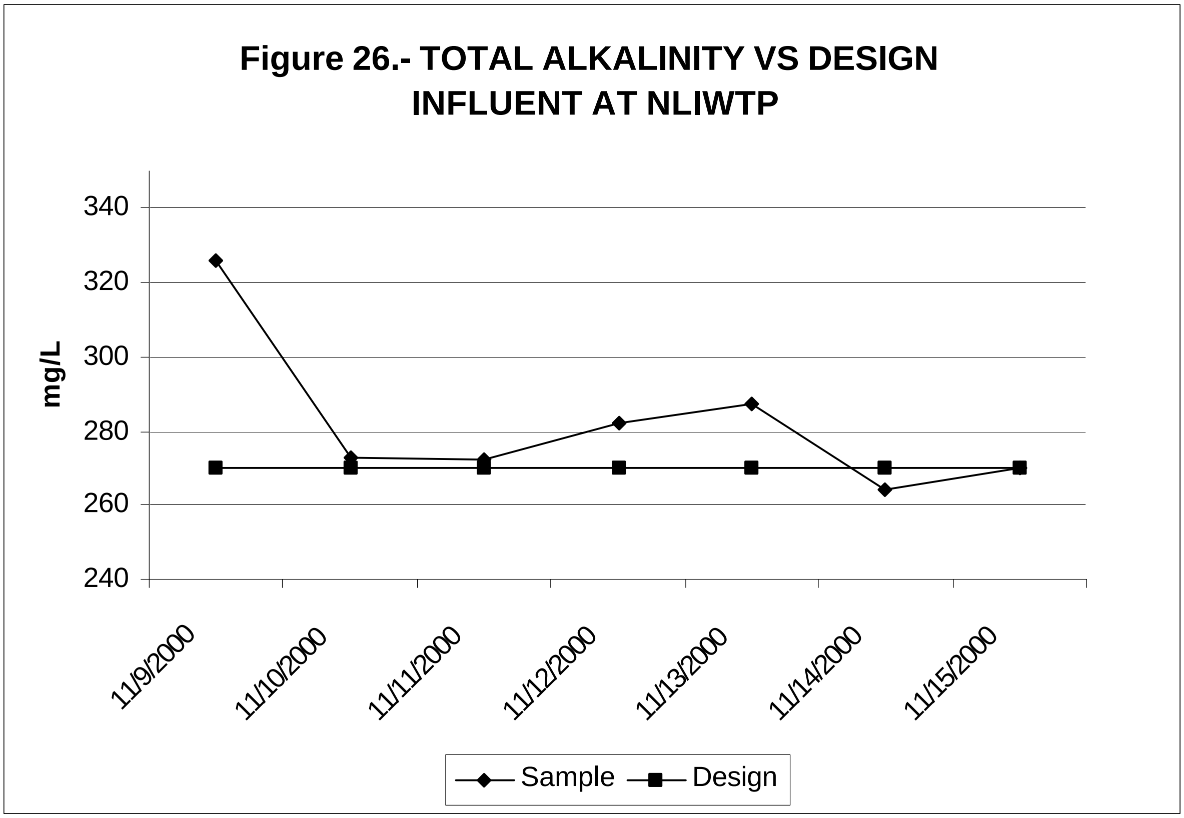
Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max	Min	Std. Dev.	Average	Minute 279
Sample time	7:40	8:35	9:35	6:00	11:09	12:06	12:40					
P-Alkalinity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total Alkalinity	326.00	273.00	272.00	282.00	287.00	264.00	270.00	326.00	264.00	20.86	282.00	
Chloride	202.40	205.00	207.50	206.70	212.90	202.52	193.78	212.90	193.78	5.89	204.40	
Conductivity, uS/cm	1739.00	1750.00	1776.00	1831.00	1878.00	1772.00	1782.00	1878.00	1739.00	48.66	1789.71	
Biochemical Oxygen Demand, mg/l	166.50	70.28	110.64	107.53	139.91	109.42	133.93	166.50	70.28	30.49	119.74	220
Chemical Oxygen Demand, mg/l	776.00	441.00	262.00	269.00	336.00	232.00	318.00	776.00	232.00	189.02	376.29	
Total Hardness, mg/l as CaCO3	373.00	370.00	366.00	371.00	382.00	386.00	377.00	386.00	366.00	7.07	375.00	
Calcium Hardness, mg/l as CaCO3	271.00	269.00	271.00	268.00	256.00	261.00	207.00	271.00	207.00	22.99	257.57	
Magnesium Hardness, mg/l as CaCO3	102.00	101.00	95.00	103.00	126.00	125.00	170.00	170.00	95.00	26.18	117.43	
Total Phosphates, mg/l	18.394	9.575	8.889	8.832	9.506	7.154	8.345	18.39	7.15	3.75	10.10	
Oil and Grease, mg/l	4.50	10.80	16.20	15.20	21.40	22.00	7.20	22.00	4.50	6.73	13.90	
Nitrate Nitrogen, mg/l	0.129	0.168	0.134	0.119	0.142	0.121	0.500	0.50	0.12	0.14	0.19	
Nitrite Nitrogen, mg/l	0.010	0.009	0.015	0.017	0.027	0.012	1.095	1.10	0.01	0.41	0.17	
pH, SU	7.05	7.14	7.07	7.26	7.17	7.25	7.21	7.26	7.05	0.08	7.16	7.3
MBAS, mg/l	0.775	1.461	3.521	2.846	3.403	3.892	4.033	4.03	0.78	1.26	2.85	
Total Suspended Solids, mg/l	290.00	221.00	304.00	386.00	199.00	124.00	163.00	386.00	124.00	90.68	241.00	220
Fixed Suspended Solids, mg/l	147.00	79.00	140.00	152.00	90.00	81.00	145.00	152.00	79.00	33.85	119.14	
Volatile Suspended Solids, mg/l	143.00	142.00	164.00	234.00	109.00	43.00	18.00	234.00	18.00	73.46	121.86	
Total Dissolved Solids, mg/l	981.00	973.00	1077.00	1082.00	1065.00	1048.00	994.00	1082.00	973.00	47.25	1031.43	
Sulfate, mg/l	264.00	288.00	301.00	310.00	315.00	316.00	334.00	334.00	264.00	22.61	304.00	
Aluminum, mg/l	15.90	8.20	<2,2	5.30	7.10	2.40	<2.2	15.90	2.40	5.04	7.78	
Arsenic, mg/l	<0.005	<0.005	<0.005	<0,005	<0.005	<0.005	<0.005	0.00	0.00			
Cadmium, mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.00	0.00			
Total Chromium, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00			
Copper, mg/l	0.20	0.49	<0.12	<0.12	<0.12	<0.12	<0.12	0.49	0.20	0.21	0.35	
Lead, mg/l	0.16	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.16	0.16		0.16	
Mercury, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			
Nickel, mg/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.00	0.00			
Silver, mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.00	0.00			

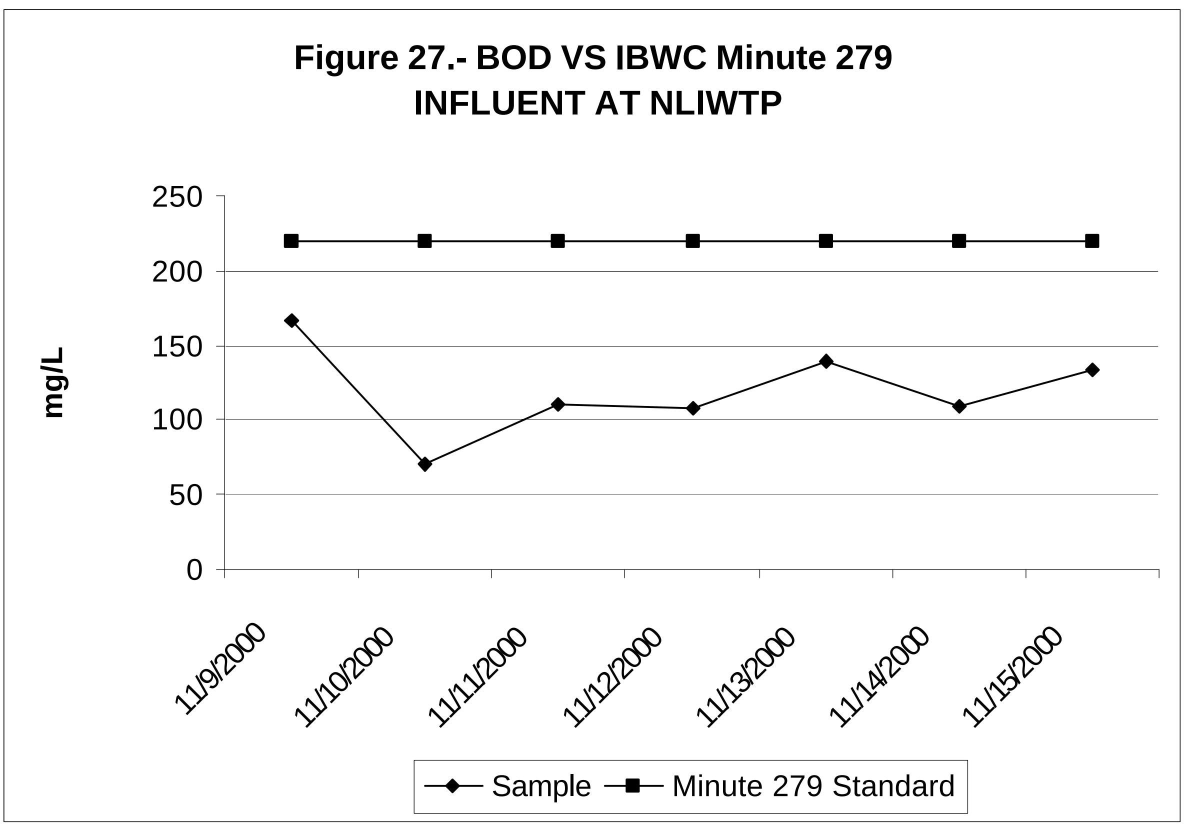
Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max	Min	Std. Dev.	Average	Minute 279
Zinc, mg/l	1.220	0.56	0.27	0.31	0.27	0.11	0.24	1.22	0.11	0.38	0.43	
Calcium, mg/l	143.60	110.97	103.13	91.38	110.97	94.00	95.30	143.60	91.38	17.96	107.05	
Magnesium, mg/l	30.44	26.5	27.02	26.16	27.34	26.27	26.16	30.44	26.16	1.53	27.12	
Benzene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.00	0.00			
Bromochloromethane, mg/l	ND	ND	ND	<0.09	<0.09	<0.09	ND	0.00	0.00			
1,2 Dichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			
1,1 Dichloroethylene, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			
Hexachloro 1,3 Butadiene, mg/l	<0.08	<0.08	<0.08	<0.08	**0.2473**	**0.2932**	**0.4496**	0.45	0.25	0.11	0.3300	
Hexachloroethane, mg/l	ND	<0.08	ND	ND	<0.08	**0.1367**	<0.08	0.14	0.14		0.1367	
Methylene Chloride, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.00	0.00			
Ethylmethylacetone, mg/l	<0.04	ND	ND	ND	ND	ND	ND	0.00	0.00			
Pyridine, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			
Carbon tetrachloride, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.00	0.00			
Chlorobenzene, mg/l	<0.05	<0.05	ND	ND	<0.05	<0.05	<0.05	0.00	0.00			
Chloroform, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.00	0.00			
1,4-dichlorobenzene, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	**0.1208**	**0.0863**	0.12	0.09	0.02	0.1036	
Toluene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.00	0.00			
1,1,1-trichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			
Trichlorethylene, mg/l	<0.07	<0.07	ND	ND	ND	<0.07	ND	0.00	0.00			
1,2-dichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND	0.00	0.00			
Bromodichlorobenzene, mg/l	<0.06	<0.06	ND	<0.06	ND	<0.06	<0.06	0.00	0.00			
Total Trihalomethane, mg/l	<0.2	<0.2	<0.20	<0.2	<0.20	<0.20	<0.20	0.00	0.00			

ND = Not determined

IBWC Minute No. 279- Standards developed for the NLIWTP Influent and Effluent.

Graph 5. Graphs produced by Mexico for data collected at the NLIWTP Influent site.





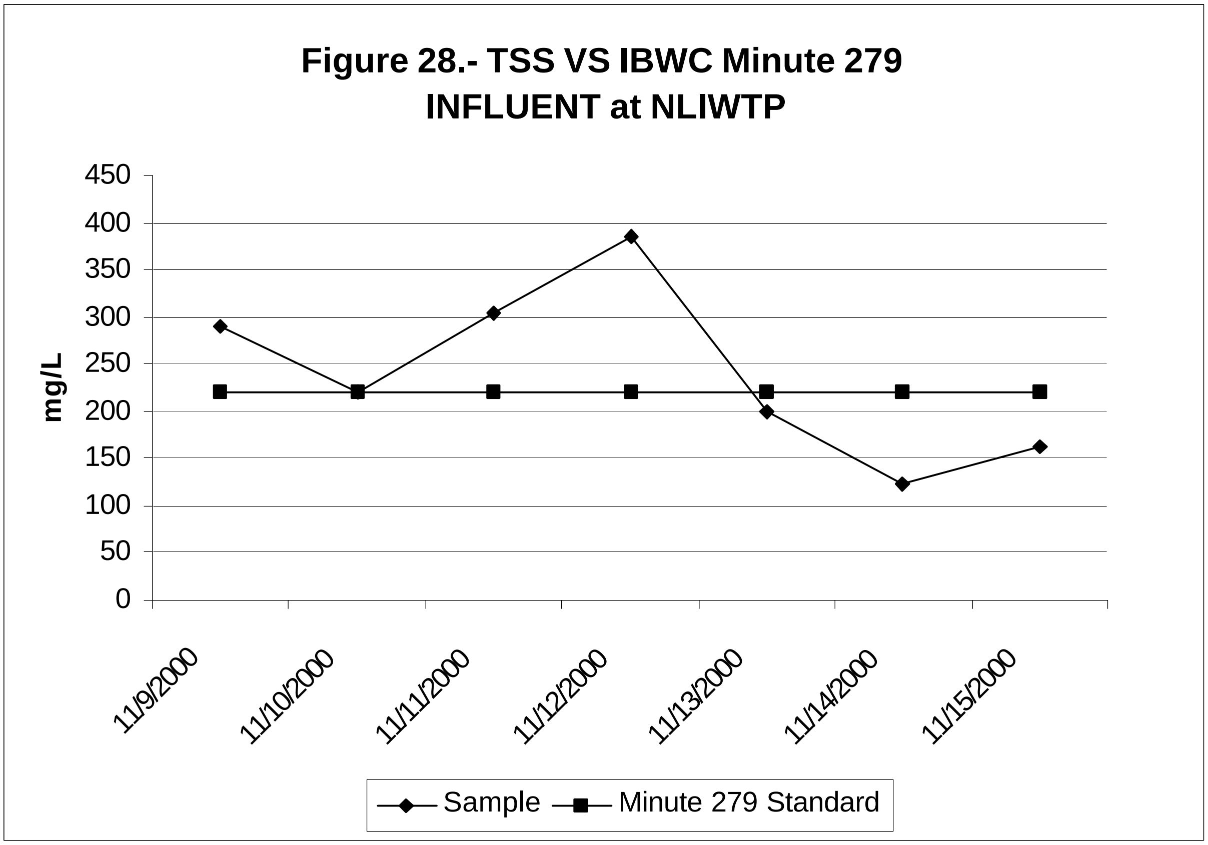


Figure 28.- TSS VS IBWC Minute 279
INFLUENT at NLIWTP
mg/L
450
400
350
300
250
200
150
100
50
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Minute 279 Standard

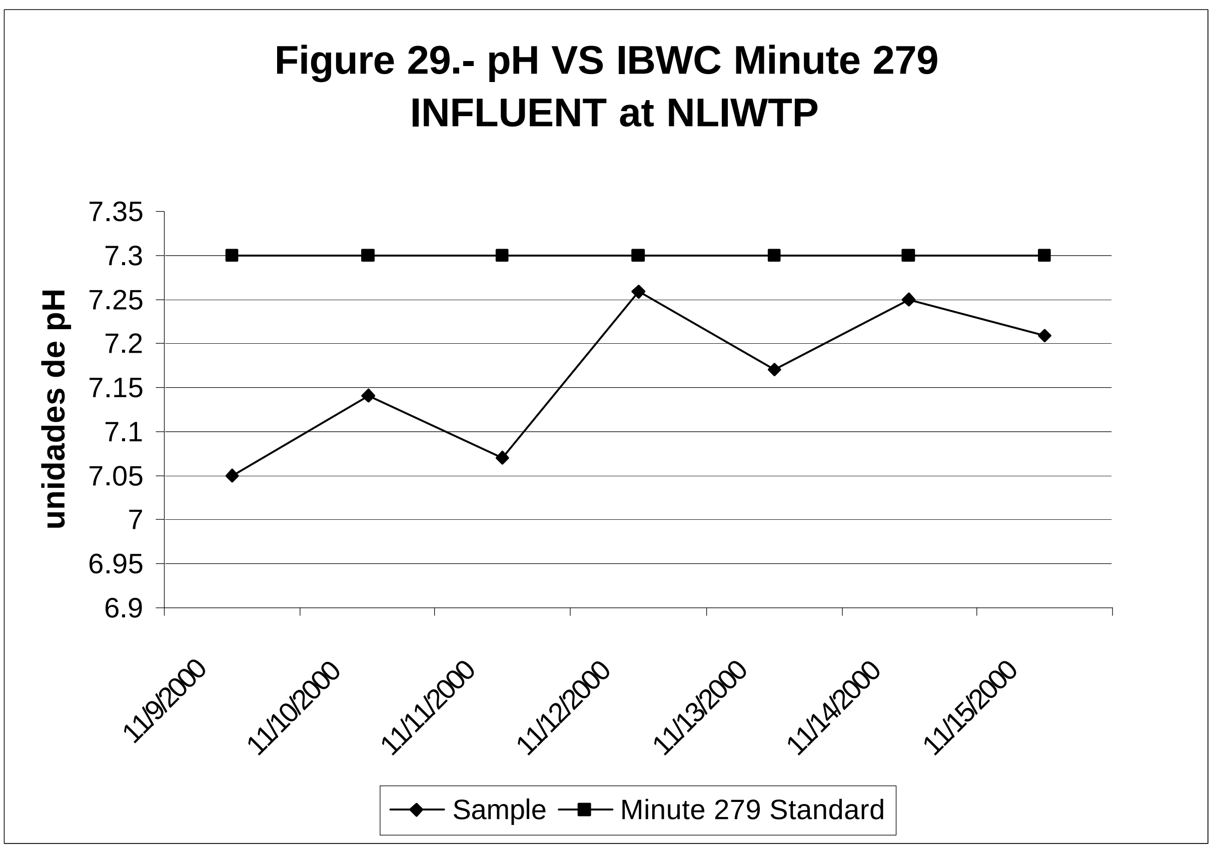


Figure 29.- pH VS IBWC Minute 279
INFLUENT at NLIWTP
unidades de pH
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Minute 279 Standard

SITE 4- NUEVO LAREDO INTERNATIONAL WASTEWATER TREATMENT PLANT EFFLUENT (NLIWTP).

The NLIWTP effluent sample was collected in the channel after the final disinfection unit and just upstream of the Parshall flume. A refrigerated ISCO™ sampler was placed close to the effluent channel to collect the composite sample. Samples affected by the chlorine residual, such as toxicity, organics, and bacteria, were collected downstream of the composite sampler at the confluence of the outfall with the Arroyo Coyote (Table 14).

Conventional Parameters. Effluent limits for a number of parameters were established by the IBWC under IBWC Minute No. 279. The parameters include DO, pH, BOD, TSS, and fecal coliform. During the study period, the only parameter that exceeded limits under IBWC Minute No. 279 was fecal coliform. The limit for fecal coliform is 200 CFU/100 mls. The concentration of sample 1, collected on 11/09/00, was 470 and sample 2, 300 CFU/100mls. The limit for fecal coliform is established as a monthly geometric mean and the average for samples collected in November 2000 met the limit of 200 CFU/100 mls. The probable cause for the increase in fecal coliform concentrations for both days could have been the previously mentioned rain event.

Estimation of the efficiency of the treatment process was done using TSS, BOD, and ammonia-nitrogen values obtained during the study. The efficiency was calculated taking the average effluent concentration for the parameter, subtracting the average concentration obtained in the influent sample, dividing by the influent concentration, and multiplying by 100, resulting in the percentage removal of the constituent. The efficiency calculated for TSS was 98%, BOD 97%, and ammonia-nitrogen 99%, indicating the NLIWTP was providing a very good quality effluent. Other parameters that decreased in concentration compared to the influent included alkalinity, total-phosphorus, ortho-phosphorus, and COD. Parameters that showed little change include chloride, sulfate, pH, and TDS.

Trace Elements. Aluminum and zinc had the highest concentration in the influent sample. In the effluent samples, the concentration for aluminum dropped from an average of 1511 to 137 µg/l and zinc decreased from 261.2 to 28.6 µg/l. As a point of reference, the concentration of trace elements analyzed for the effluent were below the acute and chronic standards for the protection of aquatic life under the TSWQS. Only one sample analyzed for dissolved silver exceeded the level for protection of aquatic life. The reporting limit for total mercury was 2.0 µg/l and could not be compared to the acute limit of 1.3 µg/l, which is lower than the reporting limit.

Organic Compounds. The organic compounds detected in the effluent were VOC constituents; none of the semi-volatile compounds were detected. Concentrations of chloroform in the effluent were comparable to influent concentrations. The increase in VOC concentration can be seen in the Total Trihalomethane (THM) constituents, bromodichloromethane and dibromochloromethane. Increased concentrations are most likely due to the reaction of the THM forming units with the chlorine added for disinfection.

Toxicity. Samples collected for toxicity (using *C. dubia* and *P. promelas*) passed the 48-hour acute test. There was no statistical difference between the control and effluent samples used during the test(s).

SAMPLES ANALYZED BY MEXICAN LABORATORIES

Table 15 shows that, of the concentrations reported for the 52 NLIWTP effluent parameters analyzed, none exceeds the maximum permissible limits of NOM-001-ECOL-1996 which establishes the concentrations of contaminants in the wastewater discharges and national property. Concentrations also did not exceed the criteria of IBWC Minute No. 279 which establishes the joint measures to improve the quality of the waters of the Rio Grande in the Laredo, TX-Nuevo Laredo, Tamaulipas area. The lack of exceedances indicates that the NLIWTP treatment process is efficient and adds good quality water to the channel of the Rio Grande at the confluence with the Arroyo Coyotes.

In Figure 30, concentrations of the biochemical oxygen demand presented a homogeneous behavior during the five sampling days and averaged 1.44 mg/L. This concentration does not exceed the CECA for any use, or IBWC Minute No. 279.

The behavior of pH during the sampling was homogeneous (Figure 31) and concentrations are within the intervals permitted by the CECA for agricultural irrigation and IBWC Minute No. 279.

Table 15 and Figure 32 show concentrations of TSS in the NLIWTP effluent. The maximum concentration detected was 20 mg/L and the minimum of 2.0 mg/L. These concentrations do not exceed the CECA limits for uses in protection of aquatic life, public water supply and irrigation; nor do they exceed the permissible limits established in IBWC Minute 279.

The effluent of the Nuevo Laredo International Wastewater Treatment Plant meets the limits for fecal coliform established in IBWC Minute No. 279, with the exception of the first sampling day when the reported concentration was 430 MPN/100mL. This exceedance is associated with the presence of rainfall at the beginning of the monitoring which caused an increase in the flow of water to be treated and in the chlorine demand (Figure 33).

Table 15, shows concentrations of hexachloro 1,3 butadiene and 1-4 dichlorobenzene found in the NLIWTP effluent. Current legislation in national territory does not consider it and, as such, the reported concentration cannot be compared with any legislative limit.

Photos 8 & 9. Site 4- NLIWTP effluent composite sample using an ISCO^{TM} refrigerated sampler and grab sample collection at the confluence of the NLIWTP effluent with the Arroyo Coyotes.

Table 15. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 4.

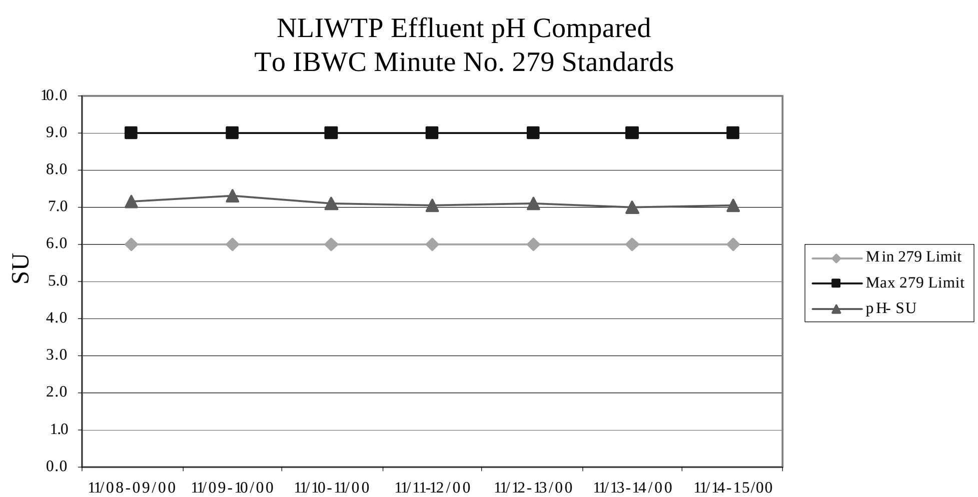
Parameter	Date							max	min	std dev	mean	Min 279
	11/08-09/00	11/09-10/00	11/10-11/00	11/11-12/00	11/12-13/00	11/13-14/00	11/14-15/00					
Dissolved Oxygen- mg/l	8.46	8.15	8.50	9.22	8.46	8.60	8.59	9.2	8.2	0.3	8.6	>2
pH- SU	7.17	7.31	7.13	7.05	7.08	6.99	7.04	7.3	7.0	0.1	7.11	6-9
Alkalinity- mg/l	98.8	96.8	92.4	97.6	97.6	93.2	96	98.8	92.4	2.4	96	
Tot. Cyanide- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02					
Fluoride- mg/l	0.54	0.53	0.54	0.56	0.57	0.57	0.61	0.6	0.5	0.0	0.6	
TDS-mg/l	972	976	759	989	1010	999	1050	1050.0	759.0	94.5	965	
Chloride- mg/l	207	205	205	207	209	220	221	221.0	205.0	6.9	211	
Chlorophyll a- ug/l	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3					
Sulfate- mg/l	309	304	302	306	309	315	315	315.0	302.0	5.1	309	
NO3+NO2- mg/l	12.8	14.4	15.4	15.8	15.7	18.1	18.3	18.3	12.8	1.9	15.8	
COD- mg/l	9.2	3.6	19.8	6.5	3	3.3	3	19.8	3.0	6.1	6.9	
Tot-Phosphorus- mg/l	3	5.2	4.9	4.25	5.6	4.7	5.4	5.6	3.0	0.9	4.7	
o-Phos.- mg/l	2.88	3.08	2.99	3.5	3.51	3.93	4.04	4.0	2.9	0.5	3.4	
BOD- mg/l	<3	<3	<3	<3	<3	<3	<3					<20
TKN - mg/l	0.1	1.23	0.78	1.12	1.23	1.12	0.62	1.2	0.1	0.4	0.9	
NH3-Nitrogen- mg/l	0.05	0.04	0.05	0.02	0.04	0.03	0.05	0.1	0.0	0.0	0.0	
Total Hardness- mg/l	284	333	313	341	351	351	362	362.0	284.0	26.9	334	
TOC- mg/l	6.57	6.33	6.49	5.4	7.31	<1	6.82	7.3	5.4	0.6	6.5	
TSS- mg/l	<4	4	<4	9	4	7	8	9.0	4.0	2.3	6.4	<20
VSS- mg/l	<4	<4	<4	<4	<4	<4	4	4.0	4.0		4.0	
MBAS- mg/l	0.13	0.1	<.1	0.1	0.1	0.1	<.1	0.1	0.1	0.0	0.1	
F. Coliform- CFU/100 ml	**470**	**300**	<10	<10	<10	30	20	470.0	20.0	219.2	96	**<200**
E. Coli.- MPN/100 ml	378	722	2	1	2	30	26	722.0	1.0	280.8	19	
C. dubia- acute	pass	pass	pass	pass	pass	pass	pass					
P. promelas- acute	pass	pass	pass	pass	pass	pass	pass					
Tot. Aluminum- ug/l	172	207	101	133	113	<50	98.3	207.0	98.3	43.6	137	
Tot. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10					
Tot. Cadmium- ug/l	<.2	<.2	<.2	<.2	<.2	<.2	<.2					
Tot. Calcium- mg/l	77.1	93.2	86.6	100	103	101	106	106.0	77.1	10.3	95	
Tot. Chromium- ug/l	<10	<10	<10	38.3	<10	<10	<10	38.3	38.3		38	
Tot. Copper- ug/l	<5	<5	<5	13.7	<5	<5	<5	13.7	13.7		14	
Tot. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2					
Tot. Magnesium- mg/l	22.3	24.3	23.3	22.1	23.1	23.9	23.3	24.3	22.1	0.8	23.2	
Tot. Mercury- ug/l	<2	<2	<2	<2	<2	<2	<2					
Tot. Nickel- ug/l	<15	<15	<15	24.7	<15	<15	<15	24.7	24.7		24.7	
Tot. Selenium- ug/l	<2	<2	<2	3.6	<2	<2	<2	3.6	3.6		3.6	

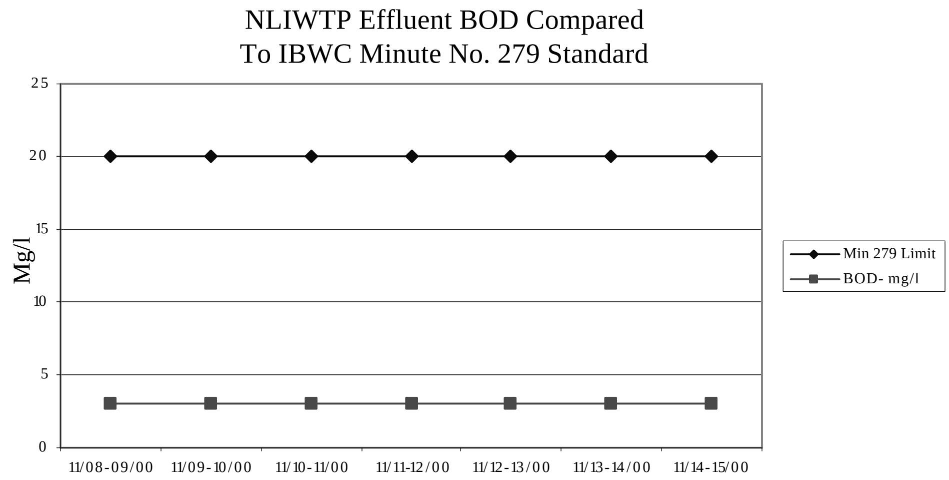
Parameter	Date							max	min	std dev	mean	Min 279
	11/08-09/00	11/09-10/00	11/10-11/00	11/11-12/00	11/12-13/00	11/13-14/00	11/14-15/00					
Tot. Silver- ug/l	<2	<2	<2	8.9	<2	<2	<2	8.9	8.9		8.9	
Tot. Zinc- ug/l	26.7	28.8	27.2	41	25.6	25.2	25.9	41.0	25.2	5.6	28.6	
Benzidine- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3					
Bis (Chlormethyl) Ether- ug/l	<4	<4	<4	<4	<4	<4	<4					
Bis (2-Ethylhexyl) Phthalate- ug/l	<10	<10	<10	<10	<10	<10	<10					
Cresols- ug/l	<6	<6	<6	<6	<6	<6	<6					
Hexachlorobenzene- ug/l	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1					
Hexahlorbutadiene- ug/l	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2					
Hexachloroethane- ug/l	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6					
Nitrobenzene- ug/l	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8					
n-Nitroso-Di-n-Propylamine- ug/l	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6					
Pentachlrobenzene- ug/l	<4	<4	<4	<4	<4	<4	<4					
Pentachlorophenol- ug/l	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2					
Phenanthrene- ug/l	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7					
Phenol- ug/l	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3					
2,4,5-Tetrachlorobenzene- ug/l	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2					
Pyridine- ug/l	<10	<10	<10	<10	<10	<10	<10					
1,2,4,5-Tetrachlorobenzene- ug/l	<4	<4	<4	<4	<4	<4	<4					
p-Dichlorobenzene- ug/l	<2	<2	<2	<2	<2	<2	<2					
Hexachlorohexane- ug/l	<4	<4	<4	<4	<4	<4	<4					
n-Nitrosodiethylamine- ug/l	<4	<4	<4	<4	<4	<4	<4					
O & G mg/l	3.8	2.5	1.9	3.3	<.9	0.9	3.7	3.8	0.9	1.1	2.7	
1,1,1-Trichloroethane- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3					
1,1-Dichloroehtane- ug/l	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9					
1,2-Dibromoethane- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5					
1,2-Dichloroethane- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5					
1,4-Dichlorobenzene- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5					
2-Butanone (MEK)- ug/l	<62	<62	<62	<62	<62	<62	<62					
Bezene- ug/l	<.4	<.4	<.4	<.4	<.4	<.4	<.4					
Bromodichloromethane- ug/l	22.1	39	37.8	55.3	45.3	23.6	18.6	55.3	18.6	13.6	34.5	
Carbon tetrachloride- ug/l	<.8	<.8	<.8	<.8	<.8	<.8	<.8					
Chlorobenzene- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3					
Chloroform- ug/l	4.45	6.3	5.65	13.6	14.2	4.05	<.7	14.2	4.1	4.6	8.0	
Dibromochloromethane- ug/l	67.9	133	128	113	75.9	66.2	66.7	133.0	66.2	30.4	93.0	
Methylene chloride- ug/l	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3					
Tetrachloroethene- ug/l	<.5	<.5	<.5	<.5	<.5	<.5	<.5					
Toluene- ug/l	<.3	<.3	<.3	<.3	<.3	<.3	<.3					
Trichloroethene- ug/l	<.6	<.6	<.6	<.6	<.6	<.6	<.6					

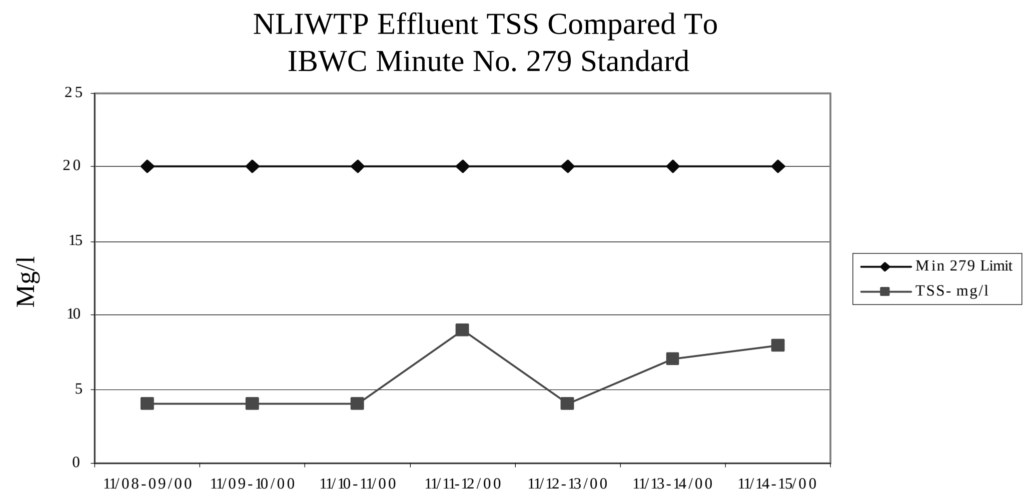
Parameter	Date							max	min	std dev	mean	Min 279
	11/08-09/00	11/09-10/00	11/10-11/00	11/11-12/00	11/12-13/00	11/13-14/00	11/14-15/00					
Total Trihalomethanes-ug/l	97.5	178	171	182	135	93.9	85.5	182.0	85.5	42.6	134.7	
Vinyl chloride- ug/l	<.7	<.7	<.7	<.7	<.7	<.7	<.7					

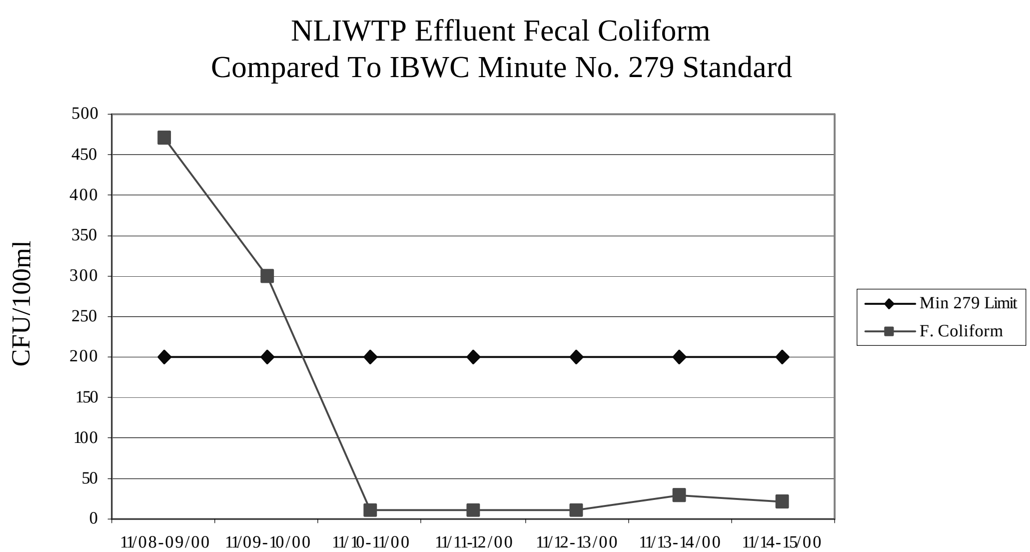
Concentrations in **bold** indicate values that exceeded the standard.

Graph 6. Graphs produced by the United States for data collected at the NLIWTP Effluent.






NLIWTP Effluent TSS Compared To
IBWC Minute No. 279 Standard
Mg/l
25
20
15
10
5
0
11/08-09/00
11/09-10/00
11/10-11/00
11/11-12/00
11/12-13/00
11/13-14/00
11/14-15/00
Min 279 Limit
TSS- mg/l


NLIWTP Effluent Fecal Coliform
Compared To IBWC Minute No. 279 Standard
CFU/100ml
500
450
400
350
300
250
200
150
100
50
0
11/08-09/00
11/09-10/00
11/10-11/00
11/11-12/00
11/12-13/00
11/13-14/00
11/14-15/00
Min 279 Limit
F. Coliform

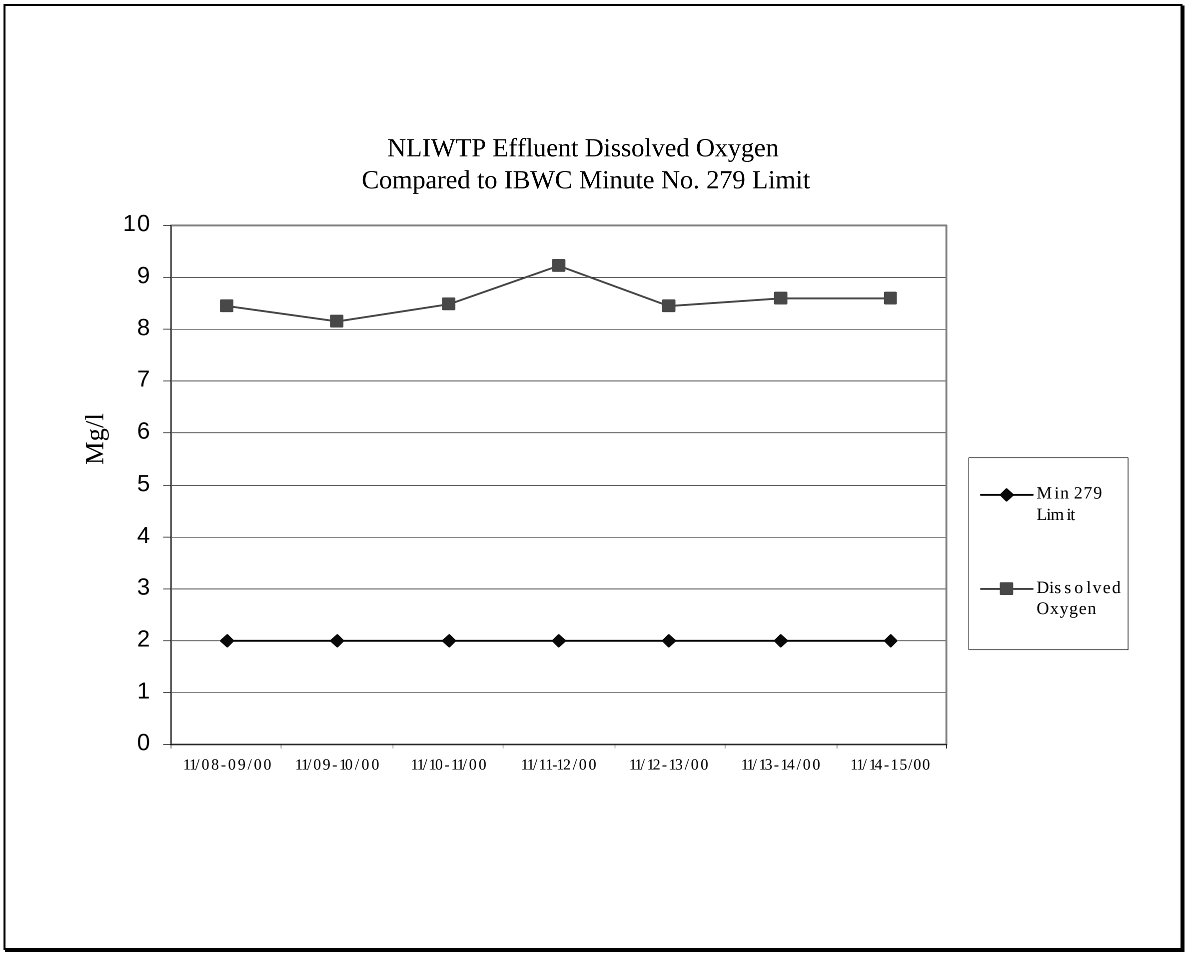

NLIWTP Effluent Dissolved Oxygen
Compared to IBWC Minute No. 279 Limit
Mg/l
0
1
2
3
4
5
6
7
8
9
10
11/08-09/00
11/09-10/00
11/10-11/00
11/11-12/00
11/12-13/00
11/13-14/00
11/14-15/00
Min 279 Limit
Dissolved Oxygen

Table 16. Results for the parameters analyzed by Mexico during the Intensive Monitoring Study at Site 4.

Parameter	11/09/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	Max.	Min.	Std. Dev.	Average	NOM-001-ECOL-1996	Minute 279
Sample time	12:00	12:00	12:32	10:00	14:47	15:15	16:25						
P-Alkalinity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	
Total Alkalinity	109.00	104.00	100.00	103.00	108.00	102.00	105.00	109.00	100.00	3.21	104.43	NA	
Chloride	193.40	193.10	195.10	197.00	197.18	197.34	154.44	197.34	154.44	15.63	189.65	NA	
Conductivity, uS/cm	1588.00	1615.00	1623.00	1656.00	1645.00	1672.00	1658.00	1672.00	1588.00	29.36	1636.71	NA	
Biochemical Oxygen Demand, mg/l	2.51	1.50	1.46	1.76	0.36	1.58	0.93	2.51	0.36	0.67	1.44	150/75/30	20
Chemical Oxygen Demand, mg/l	19.00	16.00	30.00	14.00	14.00	13.00	20.00	30.00	13.00	5.92	18.00	NA	
Total Hardness, mg/l as CaCO3	365.00	354.00	358.00	362.00	365.00	367.00	375.00	375.00	354.00	6.73	363.71	NA	
Calcium Hardness, mg/l as CaCO3	272.00	264.00	274.00	261.00	258.00	246.00	260.00	274.00	246.00	9.35	262.14	NA	
Magnesium Hardness, mg/l as CaCO3	93.00	90.00	84.00	101.00	107.00	121.00	115.00	121.00	84.00	13.56	101.57	NA	
Total Phosphates, mg/l	3.344	3.556	3.289	3.498	3.717	3.879	3.997	4.00	3.29	0.27	3.61	NA	
Oil and Grease, mg/l	5.60	8.50	8.40	8.90	11.40	10.10	11.20	11.40	5.60	1.99	9.16	15	
Nitrate Nitrogen, mg/l	10.341	12.609	14.754	13.007	14.836	17.296	16.676	17.30	10.34	2.42	14.22	NA	
Nitrite Nitrogen, mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.00	0.00			NA	
pH, SU	7.42	7.43	7.48	7.38	7.46	7.24	7.42	7.48	7.24	0.08	7.40	5 - 10	6 - 9
MBAS, mg/l	0.142	0.152	0.119	0.132	0.138	0.280	0.120	0.28	0.12	0.06	0.15	NA	
Total Suspended Solids, mg/l	20.00	6.00	8.80	14.00	7.00	4.00	2.00	20.00	2.00	6.23	8.83	150/75/40	20
Fixed Suspended Solids, mg/l	15.00	1.80	4.40	4.00	2.00	1.00	1.00	15.00	1.00	4.96	4.17	NA	
Volatile Suspended Solids, mg/l	5.00	4.20	4.40	10.00	6.00	3.00	1.00	10.00	1.00	2.79	4.80	NA	
Total Dissolved Solids, mg/l	974.00	1025.00	1025.00	1035.00	1055.00	1004.00	1066.00	1066.00	974.00	30.85	1026.29	NA	
Sulfate, mg/l	301.00	312.00	285.00	288.00	308.00	327.00	326.00	327.00	285.00	16.67	306.71	NA	
Fecal Coliform, MPN/100 ml	**430**	70	21	75	9	93	150	430	9	143.97	66.83	1000	**200**
Aluminum, mg/l	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	0.00	0.00			NA	
Arsenic, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.2/0.1/0.1	
Cadmium, mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.00	0.00			0.2/0.1/0.1	
Total Chromium, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00			1/0.5/0.5	
Copper, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00			4.0/4.0/4.0	
Lead, mg/l	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.00	0.00			0.5/0.2/0.2	
Mercury, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.01/0.005/0.005	
Nickel, mg/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.00	0.00			2/2/2	
Silver, mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.00	0.00			NA	

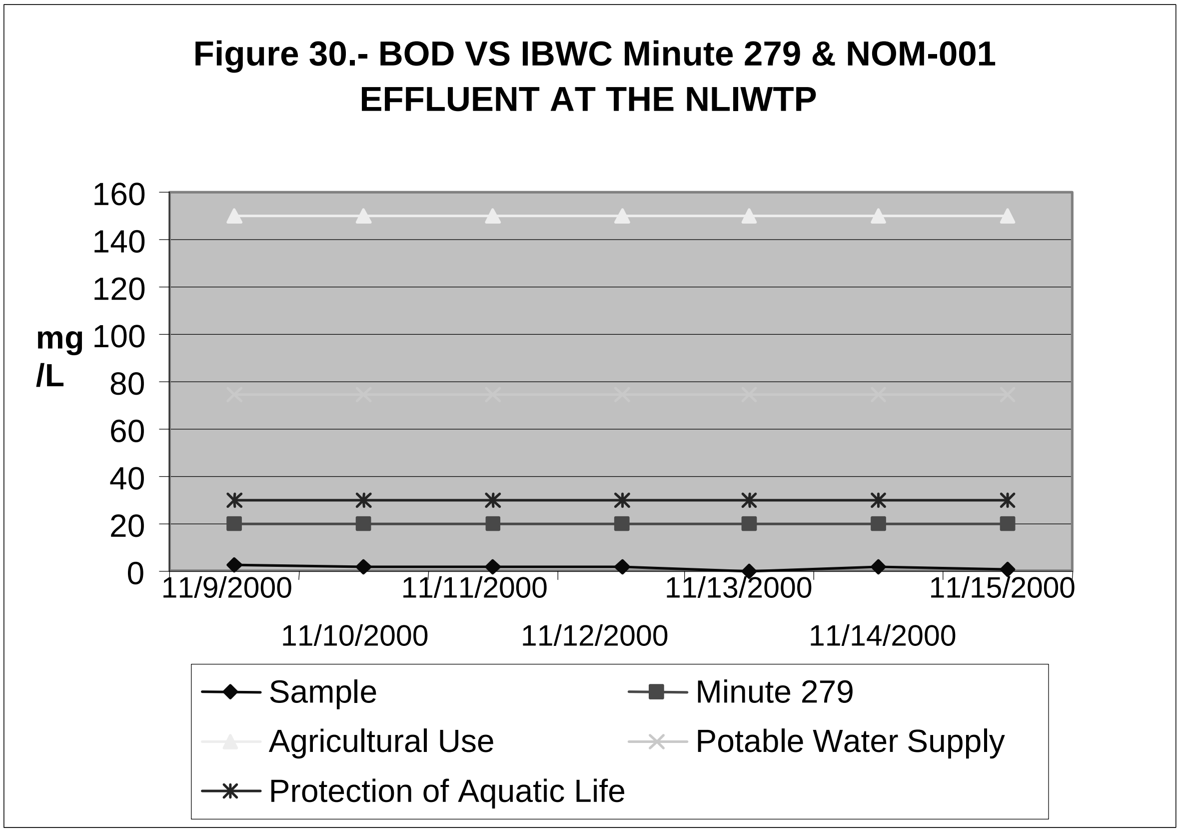
Parameter	11/09/00	11/10/00	11/11/00	11/12/00	11/13/00	11/14/00	11/15/00	Max.	Min.	Std. Dev.	Average	NOM-001-ECOL-1996	Minute 279
Zinc, mg/l	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.03	10/10/10	
Calcium, mg/l	90.08	92.69	86.16	107.05	87.47	86.16	100.52	107.05	86.16	8.03	92.88	NA	
Magnesium, mg/l	24.34	21.9	22.8	23.7	24.0	26.7	25.63	26.70	21.88	1.62	24.16	NA	
Benzene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					NA	
Bromochloromethane, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
1,2 Dichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
1,1 Dichloroethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
Hexachloro 1,3 Butadiene, mg/l	<0.08	<0.08	**0.2466**	<0.08	**0.3292**	<0.08	<0.08	0.33	0.25	0.06	0.29	NA	
Hexachloroethane, mg/l	<0.08	ND	<0.08	ND	<0.08	ND	ND					NA	
Methylene Chloride, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06					NA	
Ethylmethylacetone, mg/l	ND	ND	ND	<0.04	ND	ND	ND					NA	
Pyridine, mg/l	ND	ND	<0.05	ND	ND	ND	ND					NA	
Carbon tetrachloride, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07					NA	
Chlorobenzene, mg/l	<0.05	ND	<0.05	<0.05	<0.05	<0.05	ND					NA	
Chloroform, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	ND					NA	
1,4-dichlorobenzene, mg/l	<0.07	<0.07	<0.07	<0.07	**0.0807**	<0.07	<0.07	0.0807	0.0807	0.0807	0.0807	NA	
Toluene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					NA	
1,1,1-trichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
Trichlorethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
1,2-dichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND					NA	
Bromodichlorobenzene, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06					NA	
Total Trihalomethane, mg/l	<0.20	<0.2	<0.20	<0.20	<0.20	<0.20	<0.20					NA	

ND = Not determined

NA = Not applicable
Official Mexican Standard NOM-001-ECOL-1996 Established the maximum permissible limits of contaminants that can be discharged into Mexico's national waters.
The values under the NOM-001-ECOL-1996 correspond to a Type A river (As defined under Federal Rights Law) for the uses of Agriculture, Public use (urban) and protection of aquatic life, respectively.

The concentrations under the NOM-001-ECOL-1996 correspond to monthly averages.

Graph 7. Graphs prepared by Mexico using data collected at the NLIWTP Effluent site.



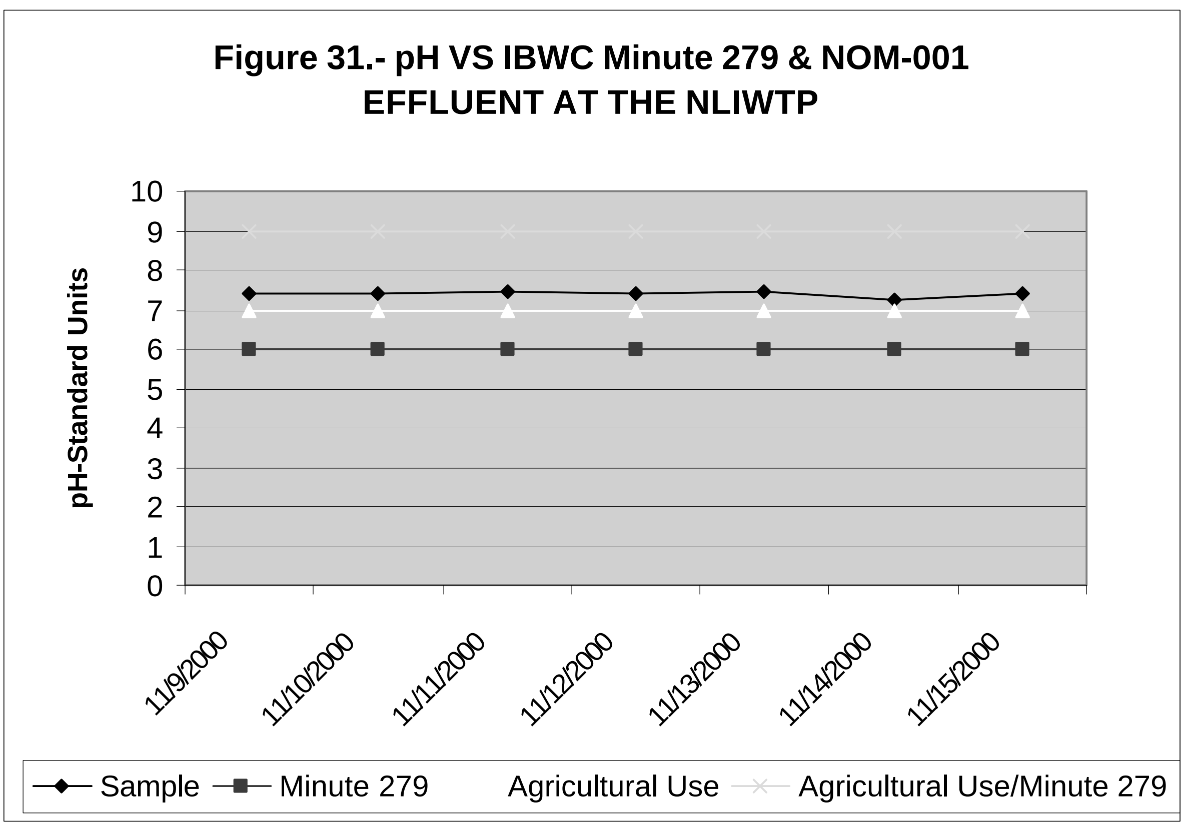


Figure 32.- TSS VS IBWC Minute 279 & NOM-001 EFFLUENT AT THE NLIWTP

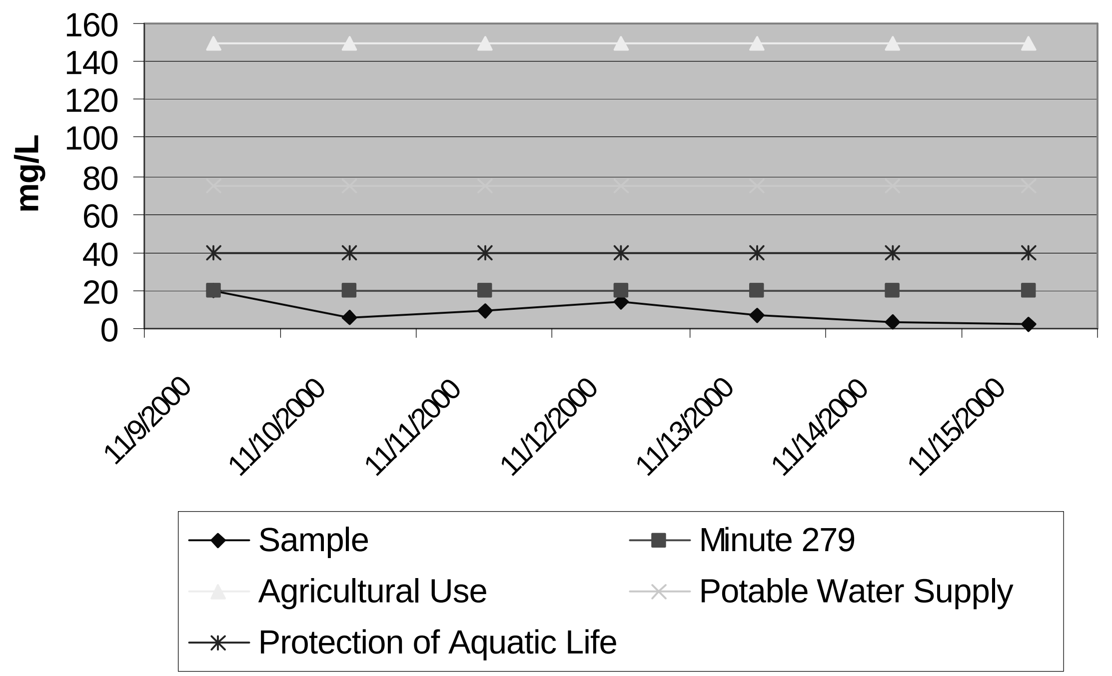
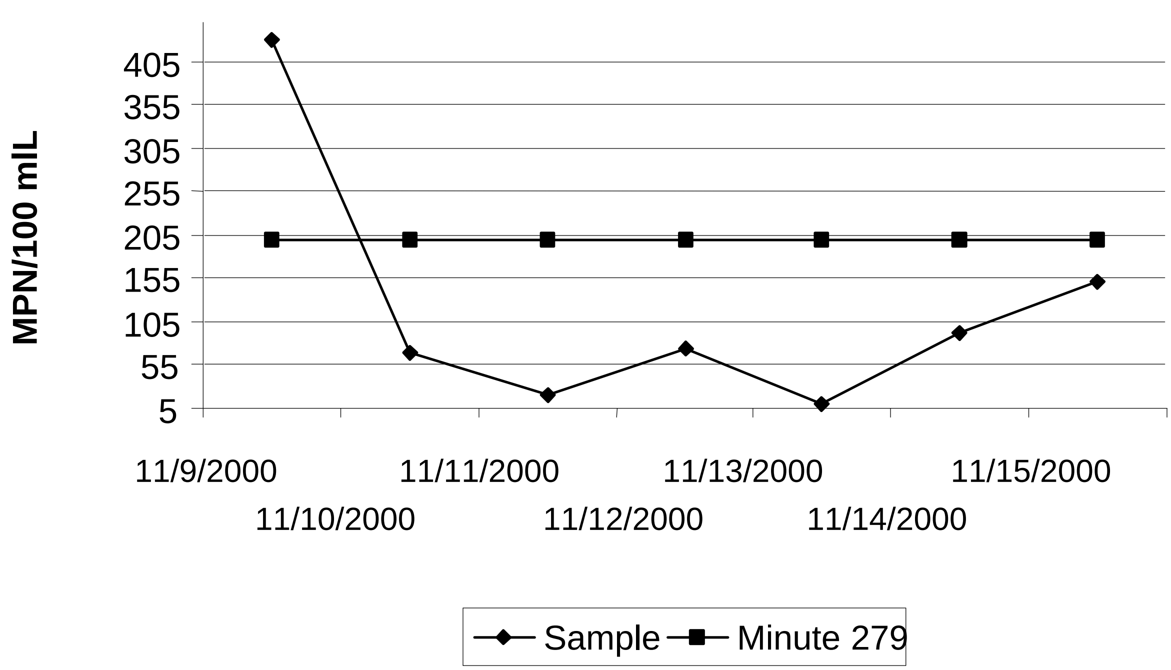


Figure 33.- FECAL COLIFORM VS IBWC Minute 279 EFFLUENT AT THE NLIWTP



SITE 5- RIO GRANDE ONE MILE (1.6 KM) BELOW THE ARROYO COYOTES (TNRCC STATION 13196)

This site is located on the main channel of the Rio Grande downstream of the populated areas of both cities and the Arroyo Coyotes. Habitat at this site is similar to Site 2 and the water is primarily used for the irrigation of agricultural fields. Site 5 had the highest concentrations of fecal coliform and *E. coli.* bacteria. Overall water quality remained consistent with Site 1 & 2 and most sampling parameters meet the TSWQS for Segment 2304, with the exception of bacteria (Table 16).

Contact Recreation- The average concentration for fecal coliform was 2248 CFU/100 mls, which exceeded the average of 200 CFU/100mls. The individual grab limit of 400 CFU/100 mls was also exceeded for all days sampled. The minimum *E. coli.* concentration observed was 602 MPN/100 mls with a maximum concentration of 1012 MPN/100 mls compared to the TSWQS of 126 and 394 MPN/100 mls respectively.

Public Water Supply- The concentration of dissolved salts met the TSWQS for drinking water. No significant changes in the concentration between Site 1, 2, or 3 were observed during the study period.

Protection of Aquatic Life- The concentration of metals analyzed were found to be below the chronic and acute levels of toxicity. The only sample that exceeded the criteria was Sample 4 collected on 11/12/00 for dissolved silver with a concentration of 7.1 µg/l compared to the acute limit of 0.92 µg/l. All other samples for silver were below the reporting limit. The sample collected on the same day for analysis with the EPA 1600 series methods, clean metals techniques, reported values below reporting limits for silver on the same day. See Appendix A for additional information on trace elements. The 48-hour acute toxicity tests conducted using *C. dubia* and *P. promelas* at this site passed with no significant difference between the sample and control.

General Use Criteria- The parameters in this category indicate that overall water quality is being met at Site 5. No samples exceeded the TSWQS for general parameters at this site.

SAMPLES ANALYZED BY MEXICAN LABORATORIES

The rainfall event that occurred during the first two days of sampling (09-Nov-01 and 10-Nov-01) influenced the results obtained. Water quality at this site is acceptable for livestock, but not so for potable water supply, agricultural irrigation and protection of aquatic life as described below:

Potable Water Supply- This use is restricted because concentrations of total phosphates reported exceed the CECA value of 0.1 mg/l. On average, the concentrations of total phosphates at this site were 0.38 mg/L (Table 17 and Figure 34).

Table 17 and Figure 35 show the presence of greases and oils with concentrations ranging from 7.0 to 17.1 mg/L. The CECA does not specify a limit for this parameter.

In Table 17, concentrations of TDS average 611.63 mg/L. This value exceeds the CECA, which allow a concentration of 500 mg/L for this use as observed in Figure 36.

Concentrations of aluminum ranging from 2.9 to 4.7 mg/L, were reported, which exceed the CECA limits of 0.02 mg/L as observed in Figure 37.

Figure 38 summarizes concentrations of coliform bacteria, which for all sampling days exceed the maximum limit established in the CECA of 1000 MPN/100mL.

With regard to organic compounds, average concentrations of hexachloro 1-3 butadiene of 0.30 mg/L at the beginning and at the end of sampling (09-Nov-01, 11-Nov-01 and 15-Nov-01) (Figure 39), and average concentrations of hexachloroethane of 0.18 mg/L on the last day of sampling (15-Nov-01) were reported. These values exceed the CECA for this use (0.004 and 0.02 mg/L respectively) (Table 17 and Figures 40 and 41). There were no reported concentrations of hexachloroethane in the first five days of sampling (Table 17).

Agricultural Irrigation-Concentrations of TDS averaging 611.63 mg/L were reported, which exceeds the levels permitted in the CECA of 500 mg/L (Figure 36).

Figure 38 summarizes the concentration of coliform bacteria, which for all sampling days exceeded the maximum limit established in the CECA of 1000 MPN/100mL.

Also, concentrations of TSS ranging from 41 to 481 mg/L exceeded the CECA limit of 50 mg/l for this use (Table 17 and Figure 42).

Also, the maximum concentration for electrical conductivity of 1055 µmhos/cm restricts this use according to the permissible reported values of the CECA (1000 µmhos/cm). The maximum values reported towards the end of the sampling coincide with rainfall that occurred at the beginning of the sampling. This rainfall caused a greater dilution of solids and consequently an increase in conductivity as observed in Figure 43.

Concentrations of sulfates for all sampling days ranged from 166 to 197 mg/L. These concentrations exceed the values reported in the CECA of 130 mg/L (Table 17 and Figure 44).

Livestock Use- The standards used to support this designated use were met at this monitoring site.

Protection of Aquatic Life (surface water)- Table 17 illustrates concentrations of aluminum ranging from 2.90 to 4.70 mg/L, restricting at this station use for protection of aquatic life, because the permissible reported value in the CECA is 0.05 mg/L (Figure 37).

Figure 38 summarizes concentrations of coliform bacteria, which for all sampling days exceeded the maximum limit established in the CECA of 200 MPN/100mL

Also, average concentrations of hexachloro 1-3 butadiene of 0.30 mg/L were reported on three of the seven days sampled (09-Nov-01, 11-Nov-01 and 15-Nov-01) (Table 17) and average concentrations of hexachloroethane of 0.18 on the last day of sample collection (15-Nov-01) (Table 17). The values reported exceed the concentrations permissible by the CECA (0.0009 for hexachlorine1-3 butadiene and 0.01 for hexachloroethane) (Figures 39 and 40).

Concentrations of 0.19 mg/L of 1-4 dichlorobenzene were reported on the last day of sampling (15-Nov-01). These values exceed the CECA permissible value of 0.01 mg/L for this use (Table 17 and Figure 41).

The values reported for sulfate (Figure 44) exceed the maximum permissible limits of the CECA for protection of aquatic life (0.005 mg/L surface water). Average concentrations of 177.75 mg/L (Table 17) were found at this site. Wastewater discharges coming from industry could increase concentrations of this compound, which could be used as a source of oxygen by certain bacteria that convert it into hydrogen sulfide under anaerobic conditions.

Photo 10 & 11. Site 5- Rio Grande 1 mile below Arroyo Coyotes.

Table 17. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 5, Rio Grande below the Arroyo Coyotes.

Parameter	Date							max	min	std dev	mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Dissolved Oxygen- mg/l	7.86	8.52	9.13	8.68	8.79	8.84	8.89	9.13	7.86	0.40	8.67	5	
pH- SU	8.10	8.31	8.30	8.24	8.31	8.34	8.21	8.34	8.10	0.08	8.26	6-9	
Conductivity- umhos/cm	853	832	924	867	926	946	983	983	832	54.84	904		
Flow Severity	2	2	2	2	2	2	2	2	2	0	2		
Flow (cms)	37.9	37.3	36.2	36.2	41.3	37.9	32.8	41.3	32.8	2.6	37.1		
Water Temp.- deg C	18.50	17.00	17.50	18.60	18.30	16.80	15.90	18.60	15.90	1.01	17.51	>35	
Chlorophyll-a, ug/l	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3						13.7
Chloride- mg/l	96.1	89.9	113.0	95.9	113.0	119.0	126.0	126.0	89.9	13.6	107.6	200	
Sulfate- mg/l	165.0	161.0	182.0	165.0	178.0	181.0	192.0	192.0	161.0	11.4	174.9	300	
TSS- mg/l	102.0	92.0	53.0	67.0	67.0	58.0	57.0	102.0	53.0	18.8	70.9		
VSS- mg/l	19.0	14.0	16.0	16.0	19.0	5.0	<4	19.0	5.0	5.2	14.8		
TDS- mg/l	488	461	548	555	603	601	625	625.0	461.0	61.5	554	1000	
Fluoride- mg/l	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.62	0.52	0.03	0.57		
Alkalinity- mg/l	124	118	126	122	126	128	127	128.0	118.0	3.5	124		
Total Hardness- mg/l	223	267	281	266	300	314	279	314.0	223.0	29.0	276		
TOC- mg/l	2.91	2.82	3.03	3.43	3.19	<1	2.40	3.43	2.40	0.35	2.96		
Tot. Phosphorus- mg/l	0.36	0.33	0.05	0.46	0.41	0.59	0.45	0.59	0.05	0.17	0.38		1.1
Ortho-Phos. - mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01						0.9
BOD- mg/l	<3	4.5	<3	<3	<3	<3	<3	4.50	4.50		4.5		
COD- mg/l	<3	8.5	<3	<3	<3	4.9	<3	8.50	4.90		6.7		
NH3-Nitrogen- mg/l	0.16	0.09	0.08	0.11	0.08	0.17	0.19	0.19	0.08	0.05	0.13		0.16
Nitrate+Nitrite- mg/l	1.22	1.03	1.21	1.16	1.06	1.25	1.16	1.25	1.03	0.08	1.16		3.5
TKN- mg/l	<.1	1.57	0.78	0.78	0.90	0.67	0.67	1.57	0.67	0.34	0.90		
F. Coliform- CFU/100 ml	**1770**		**800**	**2240**	**1100**	**8400**	**4400**	8400	800	2883.6	2248	**200**	
E. Coli.- MPN/100ml	**1012**	**913.9**	**629.4**	**960.6**	**601.5**	**1011**	**1011**	1012	602	182.4	858	**126**	
C. dubia	pass	pass	pass	pass	pass	pass	pass						
P. promelas	pass	pass	pass	pass	pass	pass	pass						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1	<.1						
Oil & Grease- mg/l	2.7	3	<.9	3.2	3.1	2.2	<.9	3.20	2.20	0.40	2.84		
Tot. Cyanide- mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02						
Tot. Silver- ug/l	<2	<2	<2	8.7	<2	<2	<2	8.70	8.70		8.70		
Diss. Silver- ug/l	<2	<2	<2	**7.1**	<2	<2	<2	7.10	7.10		7.10	**0.92**	
Tot. Aluminum- ug/l	610	715	434	530	529	460	531	715.0	434.0	94.3	544		
Diss. Aluminum- ug/l	270	407	164	118	333	122	73.3	407.0	73.3	125.5	212	991	
Tot. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10						
Diss. Arsenic- ug/l	<10	<10	<10	<10	<10	<10	<10					360	190
Tot. Cadmium- ug/l	<.2	<.2	<.2	<.2	0.2	<.2	<.2	0.2	0.2		0.2		

Parameter	Date							max	min	std dev	mean	Standards	
	11/9	11/10	11/11	11/12	11/13	11/14	11/15					TSWQS 1	TSWQS 2
Diss. Cadmium- ug/l	<.2	<.2	<.2	<.2	<.2	<.2	<.2					43	1.3
Tot. Chromium- ug/l	<10	22.6	<10	31.6	<10	<10	<10	31.6	22.6	6.4	27.1		
Diss. Chromium- ug/l	<10	<10	<10	30.9	<10	<10	<10	30.9	30.9		30.9	2071	247
Hex. Chromium- ug/l	<5	<5	<5	<5	<5	<5	<5						
Tot Calcium- mg/l	57.2	76.2	79.9	79.6	89.9	94.1	82.7	94.1	57.2	11.8	79.9		
Diss. Calcium- mg/l	48.1	70.8	68.5	72.7	87.4	83.3	73.5	87.4	48.1	12.6	72.0		
Tot. Copper- ug/l	<5	13	<5	12.7	<5	<5	<5	13.0	12.7	0.2	12.9		
Diss. Copper- ug/l		<5	<5	11.8	<5	<5	<5	11.8	11.8		11.8	24	15
Tot. Nickel- ug/l	<15	15.5	<15	27.5	<15	<15	<15	27.5	15.5	8.5	21.5		
Diss. Nickel- ug/l	<15	<15	<15	24.8	<15	<15	<15	24.8	24.8		24.8	1701	189
Tot. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2						
Diss. Lead- ug/l	<2	<2	<2	<2	<2	<2	<2					107	4
Tot. Selenium- ug/l	<2	3.9	<2	2.1	<2	2.4	2.1	3.9	2.1	0.9	2.6	20	5
Diss. Selenium- ug/l	<2	<2	<2	<2	<2	<2	<2						
Tot. Zinc- ug/l	10.5	14	6.8	11.6	6.2	8.6	<5	14.0	6.2	3.0	9.6		
Diss. Zinc- ug/l	7.1	8.4	<5	11.2	<5	<5	<5	11.2	7.1	2.1	8.9	140	127
Tot. Mercury- ug/l	<2	<2	<2	<2	<2	<2	<2					2.4	1.3
Tot. Magnesium- mg/l	19.5	18.7	19.8	16.4	18.3	19.3	19.7	19.8	16.4	1.2	18.8		
Diss. Magnesium- mg/l	19.4	18.1	20.5	15.9	18.3	19.1	19.6	20.5	15.9	1.5	18.7		

TSWQS 1- State of Texas Primary Standards. For metals, protection of Aquatic Life, Freshwater Acute criteria.
TSWQS 2- Nutrient Screening Levels are provided for reference only. For metals, protection of Aquatic Life, Freshwater Chronic criteria.

Graph 8. Comparison of bacterial concentrations compared to TSWQS at Site 5.

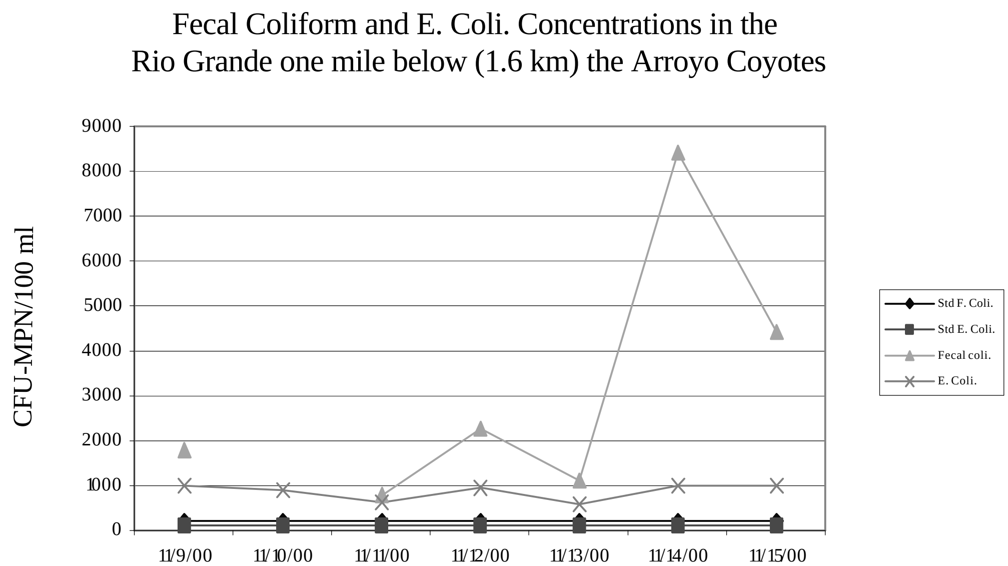


Table 18. Results for the parameters analyzed by the United States during the Intensive Monitoring Study at Site 5, Rio Grande below the Arroyo Coyotes.

Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max.	Min.	Std. Dev.	Average	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Sample time	17:34	16:10	13:15	9:55	12:20	7:25	9:40								
P-Alkalinity	1.00	4.00	4.00	3.00	6.00	6.00	6.00	6.00	1.00	1.89	4.29	-	-	-	-
Total Alkalinity	131.00	124.00	135.00	129.00	138.00	138.00	137.00	138.00	124.00	5.34	133.14	400	-	-	-
Chloride	104.80	96.20	109.60	102.60	108.95	111.38	114.94	114.94	96.20	6.24	106.92	250	147.5	-	250
Conductivity, uS/cm	974.00	885.00	**1035.00**	959.00	**1003.00**	**1023.00**	**1055.00**	1055.00	885.00	57.37	990.57	-	**1000**	-	-
Biochemical Oxygen Demand, mg/l	12.00	10.83	23.32	11.40	2.28	2.07	-	23.32	2.07	7.82	10.32	-	-	-	-
Chemical Oxygen Demand, mg/l	18.00	16.00	15.00	9.00	13.00	14.00	10.00	18.00	9.00	3.21	13.57	-	-	-	-
Total Hardness, mg/l as CaCO3	280.00	281.00	309.00	287.00	296.00	309.00	305.00	309.00	280.00	12.76	295.29	-	-	-	-
Calcium Hardness, mg/l as CaCO3	206.00	202.00	212.00	209.00	215.00	222.00	217.00	222.00	202.00	6.82	211.86	-	-	-	-
Magnesium Hardness, mg/l as CaCO3	74.00	79.00	97.00	78.00	81.00	87.00	88.00	97.00	74.00	7.76	83.43	-	-	-	-
Total Phosphates, mg/l	**0.420**	**0.436**	**0.371**	**0.377**	**0.332**	**0.347**	**0.368**	0.44	0.33	0.04	0.38	**0.1**	-	-	-
Oil and Grease, mg/l	**7.00**	**8.00**	**9.70**	**17.10**	**12.60**	**9.60**	**8.50**	17.10	7.00	3.46	10.36	**Absent**	-	-	-
Nitrate Nitrogen, mg/l	0.892	0.796	0.933	1.569	0.802	0.860	0.753	1.57	0.75	0.28	0.94	5	-	90	-
Nitrite Nitrogen, mg/l	0.014	0.014	0.012	0.017	0.012	0.019	0.017	0.02	0.01	0.00	0.02	0.05	-	10	-
pH, SU	8.01	8.03	8.00	8.03	8.02	8.06	8.02	8.06	8.00	0.02	8.02	5-9	4.5-9.0	-	-
MBAS, mg/l	0.069	0.081	0.103	0.066	0.061	0.115	0.108	0.12	0.06	0.02	0.09	0.5	-	-	0.1
Total Suspended Solids, mg/l	**481.00**	**95.50**	**66.50**	**64.00**	56.00	50.00	43.00	481.00	43.00	159.06	122.29	500	**50**	-	-
Fixed Suspended Solids, mg/l	418.00	26.00	18.50	11.50	5.00	3.00	6.00	418.00	3.00	153.80	69.71	-	-	-	-
Volatile Suspended Solids, mg/l	63.00	69.50	48.00	52.50	50.00	47.00	37.00	69.50	37.00	10.77	52.43	-	-	-	-
Total Dissolved Solids, mg/l	**550.00**	**584.00**	**633.00**	**585.00**	**619.00**	**651.00**	**640.00**	651.00	550.00	36.70	608.86	**500**	**500**	1000	-
Sulfate, mg/l	**167.00**	**166.00**	**175.00**	**167.00**	**173.00**	**188.00**	**189.00**	189.00	166.00	9.81	175.00	500	**130**	-	**0.005**
Fecal Coliform, MPN/100 ml	**15000**	**9300**	**9300**	**9300**	**7500**	**24000**	**9300**	24000	7500	5808	11056.40	**1000**	**1000**		**200 XVIII**
Aluminum, mg/l	**4.70**	**4.70**	**3.50**	**2.90**	**2.90**	<2.2	**2.90**	4.70	2.90	0.88	3.60	**0.02**	5	5	**0.05**
Arsenic, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.05	0.1	0.2	0.2
Cadmium, mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.00	0.00			0.01	0.1	0.2	XIII
Total Chromium, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00				0.01	0.02	-
Copper, mg/l	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	0.00	0.00			1	0.2	0.5	XVII
Lead, mg/l	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.00	0.00			0.05	5	0.1	XXXIV
Mercury, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	0.00			0.001	-	0.003	0.00001
Nickel, mg/l	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.00	0.00			0.01	0.2	1	XXVII

Parameter	11/9	11/10	11/11	11/12	11/13	11/14	11/15	Max.	Min.	Std. Dev.	AVG	Drinking Water Supply	Agricultural Use	Livestock Use	Surface Water
Silver, mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.00	0.00			0.05			XXXIII
Zinc, mg/l	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.02			5	2	50	XXXVI
Calcium, mg/l	119.15	71.80	75.72	77.02	78.33	<0.30	107.05	119.15	71.80	19.80	88.18	-	-	-	-
Magnesium, mg/l	26.91	20.81	21.02	20.00	21.34	0.07	22.95	26.91	0.07	8.66	19.01	-	-	-	-
Benzene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					0.01	-	-	0.05
Bromochloromethane, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
1,2 Dichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					0.005	-	-	1.20
1,1 Dichloroethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.0003	-	-	0.116
Hexachloro 1,3 Butadiene, mg/l	**0.2775**	<0.08	**0.2443**	<0.08	<0.08	ND	0.3894	**0.39**	0.24	0.08	0.30	**0.004**	-	-	**0.0009**
Hexachloroethane, mg/l	<0.08	ND	ND	ND	ND	ND	0.18	**0.18**	0.18		0.18	**0.02**	-	-	**0.01**
Methylene Chloride, mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06					0.002	-	-	-
Ethylmethylacetone, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Pyridine, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Carbon tetrachloride, mg/l	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07					0.004	-	-	0.30
Chlorobenzene, mg/l	<0.05	ND	<0.05	ND	ND	ND	<0.05					0.02	-	-	-
Chloroform, mg/l	<0.07	ND	<0.07	<0.07	ND	ND	ND					-	-	-	-
1,4-dichlorobenzene, mg/l	<0.07	<0.07	<0.07	ND	<0.07	<0.07	**0.1898**	0.19	0.19		0.19	0.4	-	-	**0.01**
Toluene, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					14.3	-	-	0.20
1,1,1-trichloroethane, mg/l	ND	ND	ND	ND	ND	ND	ND					18.4	-	-	0.20
Trichlorethylene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.03	-	-	0.01
1,2-dichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND					0.4	-	-	0.01
Bromodichlorobenzene, mg/l	ND	ND	ND	ND	ND	ND	ND					-	-	-	-
Total Trihalomethane, mg/l	<0.20	ND	<0.20	<0.20	ND	ND	<0.20					-	-	-	-

ND = Not determined

NA = Not applicable

XIII = The average concentration of cadmium over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.7852(ln(hardness))*3.490)

XVII = The average concentration of copper over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8545 (ln(hardness))*3.490)

XVIII= The number of organisms should not exceed 200 as Most Probable Number/100 ml in surface water and no more than 10 % in monthly samples should exceed 400 MPN/100 ml.

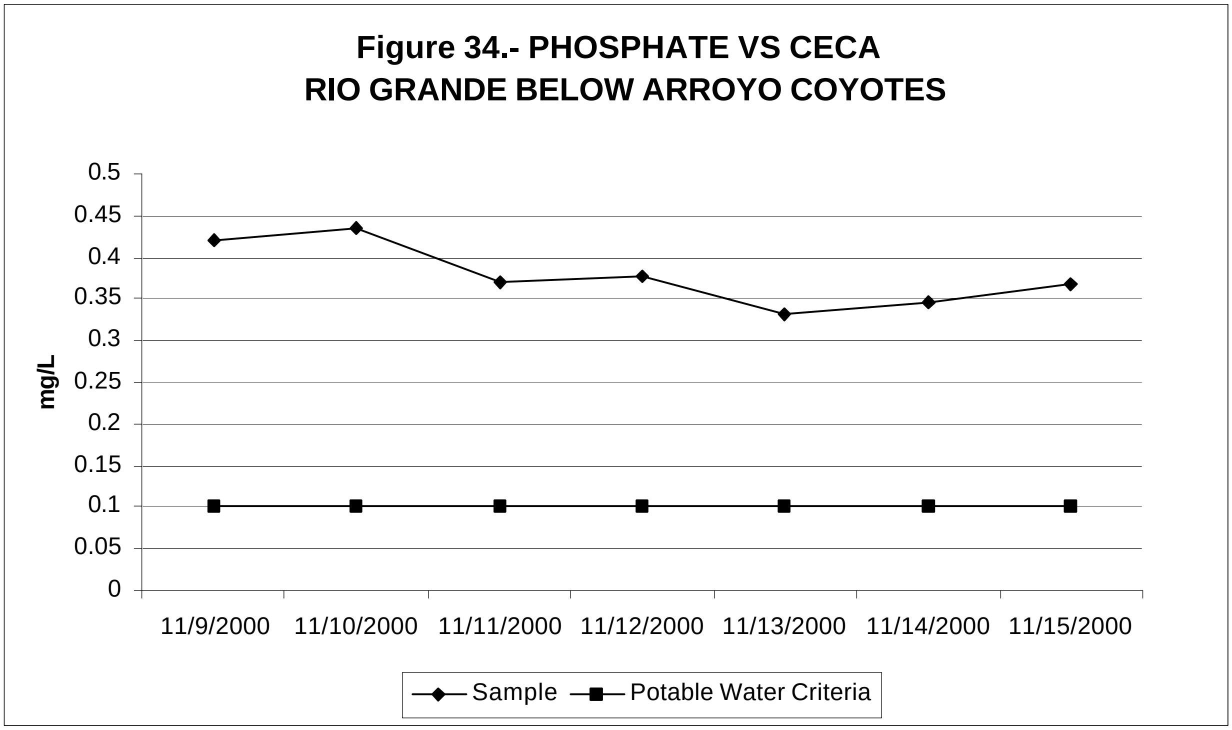
XXVII = The average concentration of nickel over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8460 (ln(hardness)+1.1645). Hardness= mg/l as CaCo3.

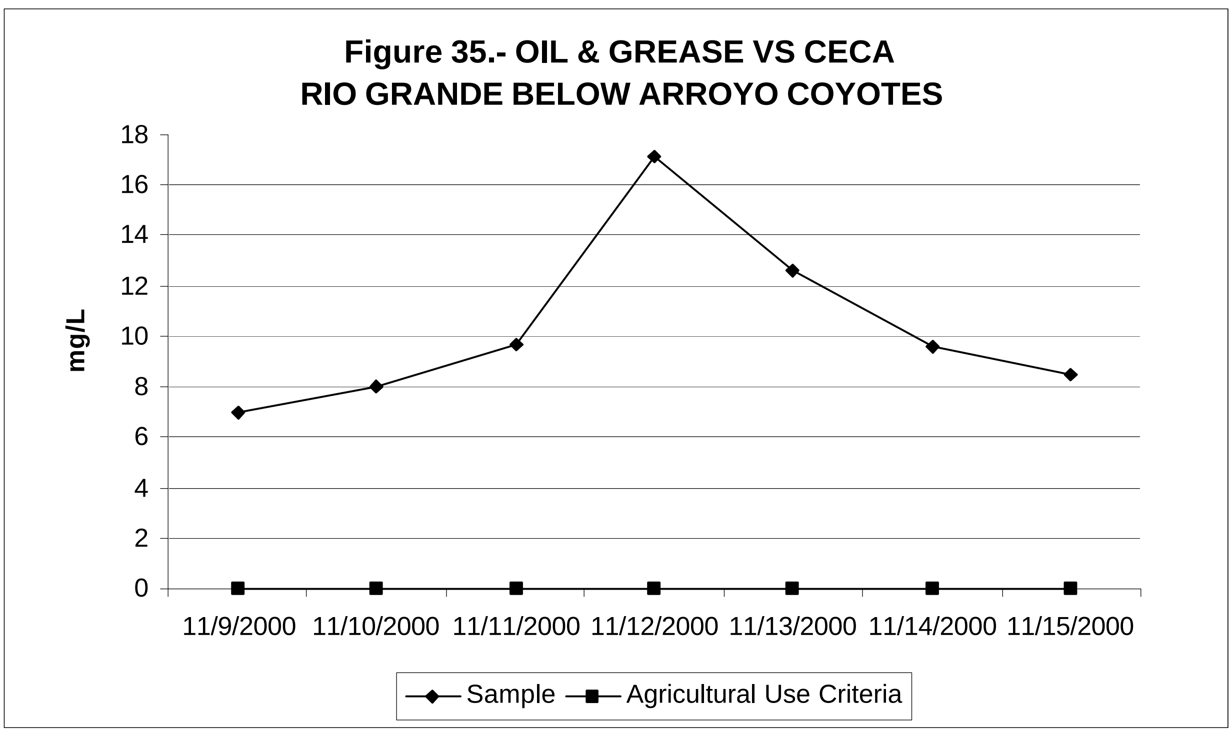
XXXIII= The concentration of silver (in ug/l) should not exceed the value calculated using the following equation (1.27 (ln (hardness))* 6.52). hardness= mg/l as CaCo3.

XXXIV = The average concentration of lead over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (1.273 (ln(hardness)* 4.705). Hardness= mg/l as CaCo3.

XXXIV = The average concentration of zinc over 4 days (in ug/l) should not exceed more than once in three years, the value calculated using the following equation (0.8473 (ln(hardness)+ 10.3604). Hardness= mg/l as CaCo3.

Graph 9. Graphs created by Mexico for data collected at Site 5.





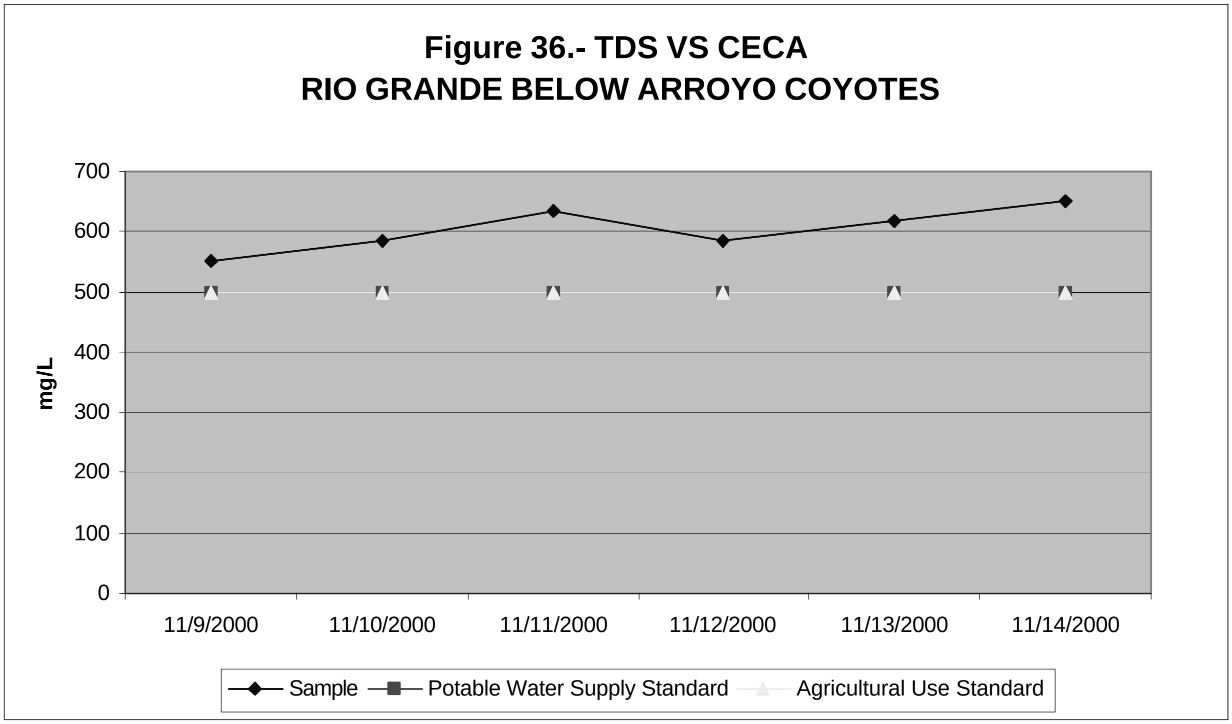


Figure 36.- TDS VS CECA
RIO GRANDE BELOW ARROYO COYOTES
700
600
500
400
300
200
100
0
mg/L
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
Sample
Potable Water Supply Standard
Agricultural Use Standard

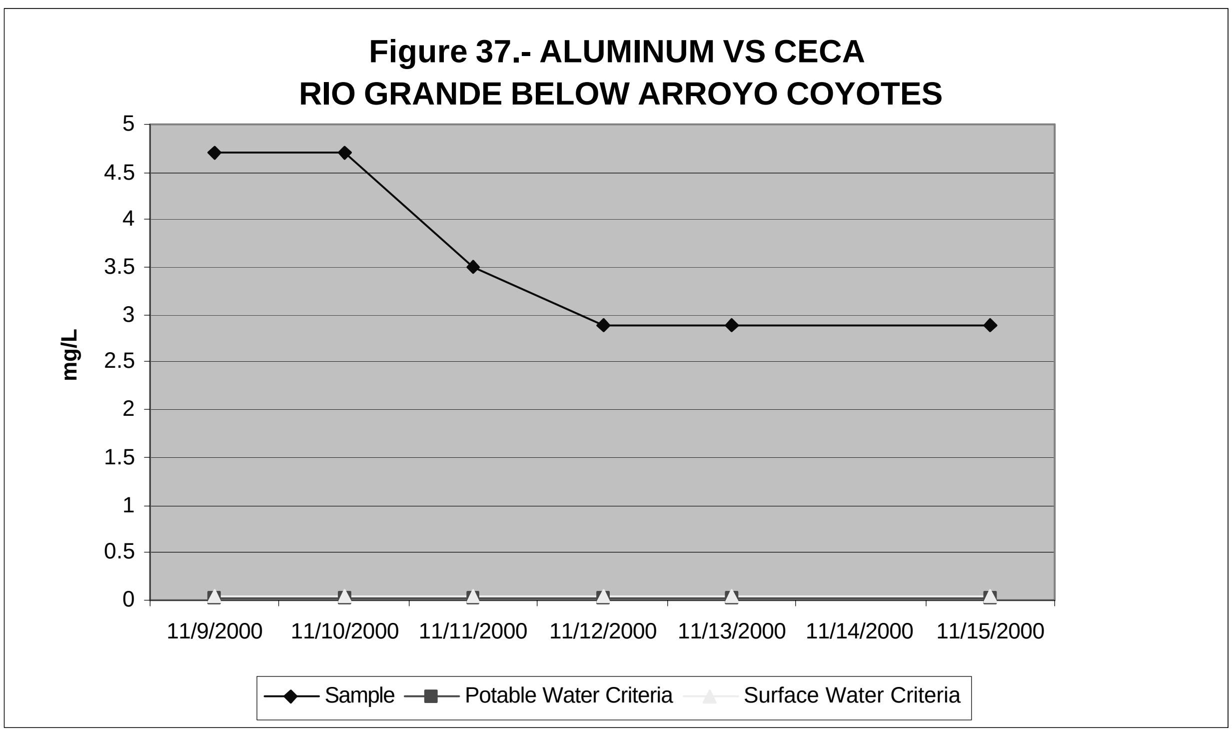


Figure 37.- ALUMINUM VS CECA
RIO GRANDE BELOW ARROYO COYOTES
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Surface Water Criteria

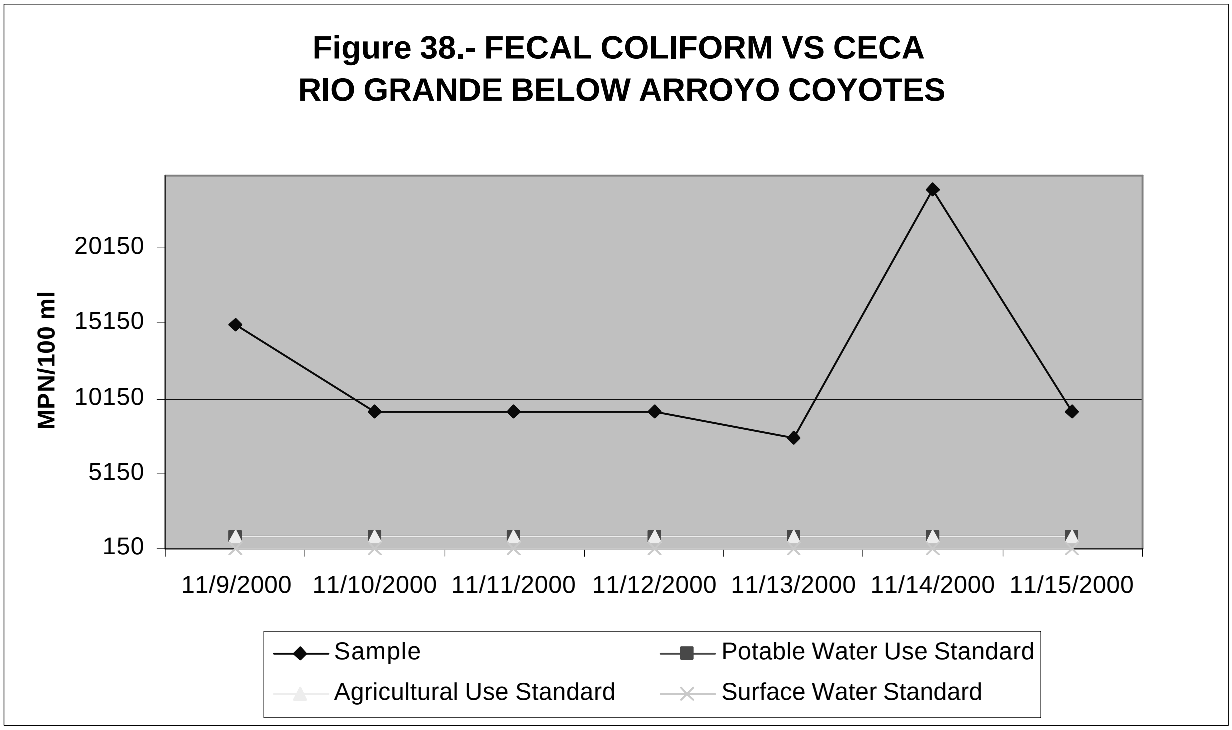


Figure 38.- FECAL COLIFORM VS CECA
RIO GRANDE BELOW ARROYO COYOTES
MPN/100 ml
20150
15150
10150
5150
150
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Use Standard
Agricultural Use Standard
Surface Water Standard

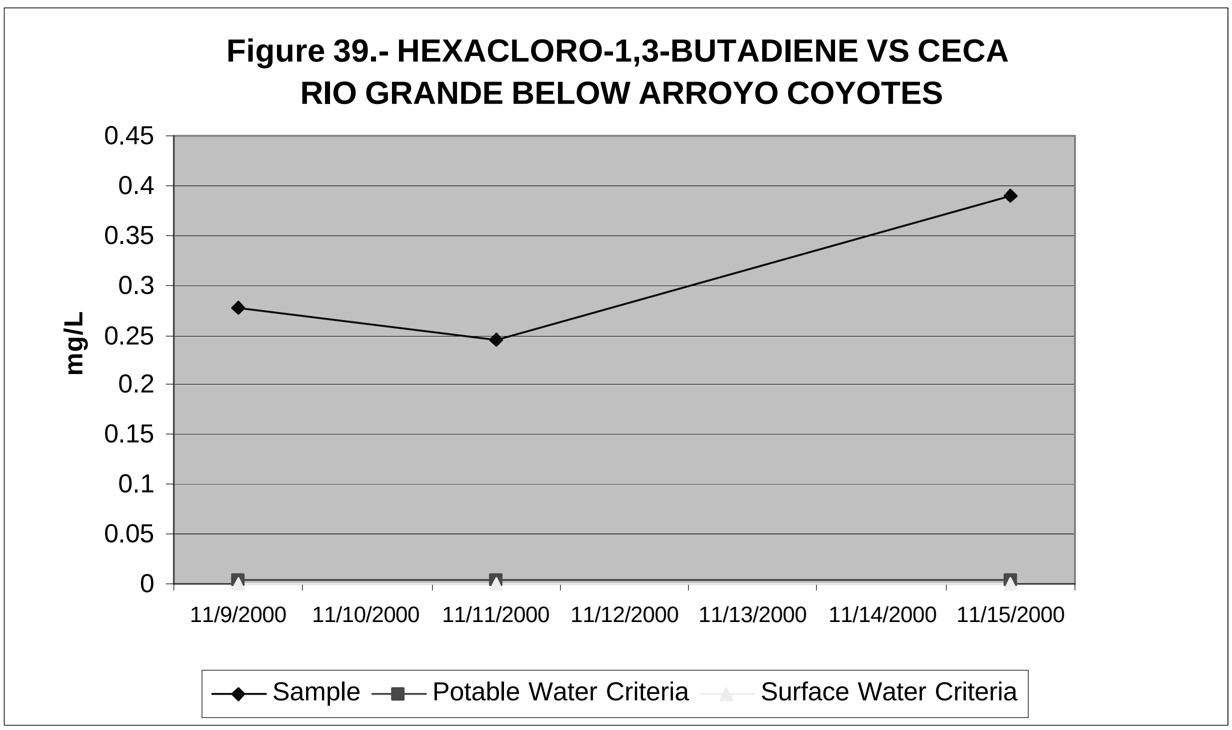


Figure 39.- HEXACLORO-1,3-BUTADIENE VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mg/L
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Surface Water Criteria

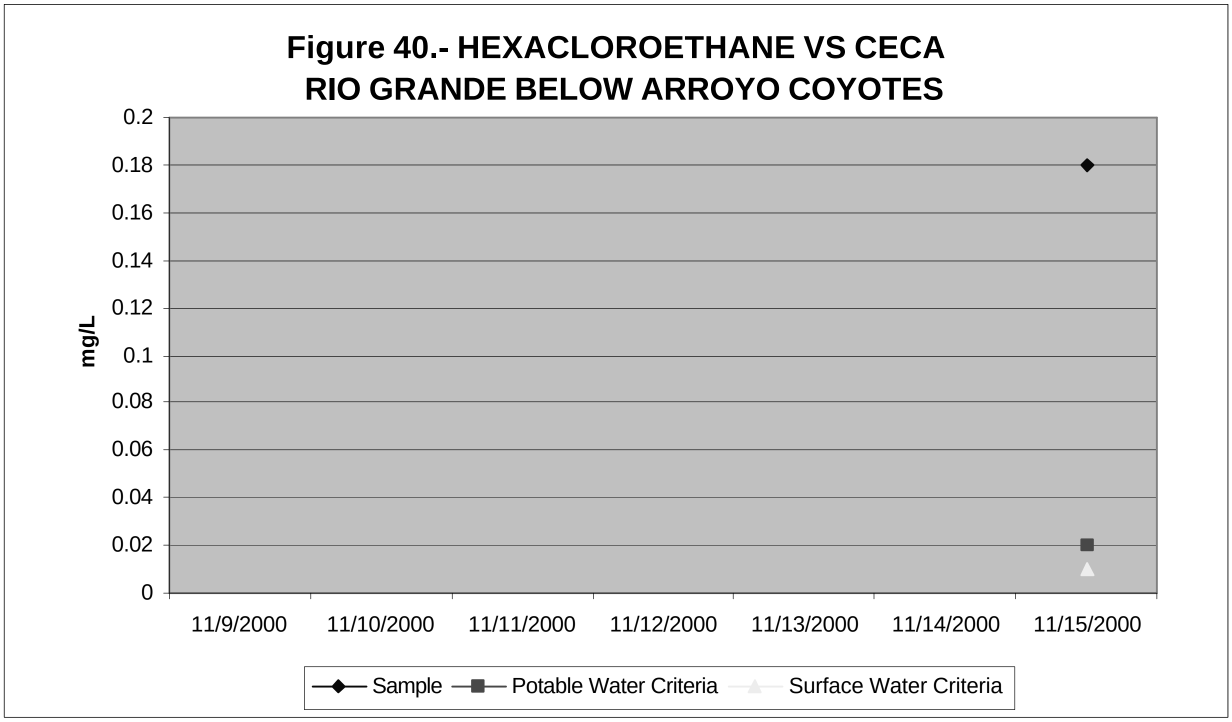


Figure 40.- HEXACLOROETHANE VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mg/L
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Potable Water Criteria
Surface Water Criteria

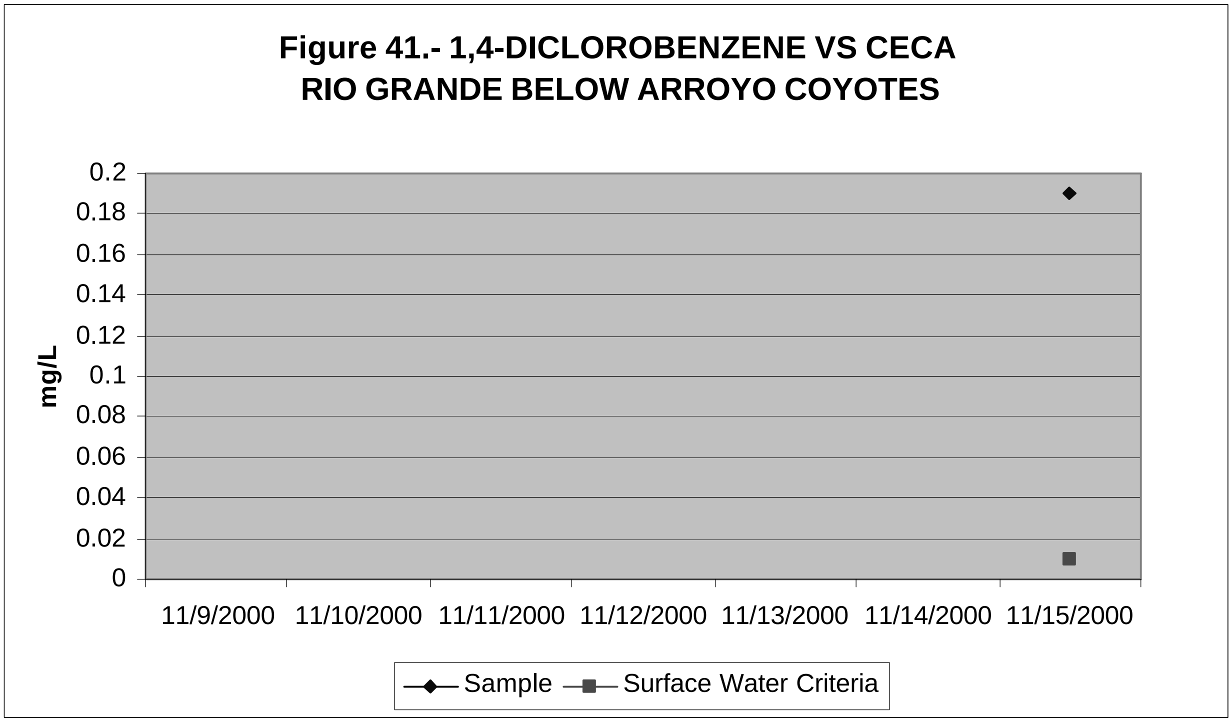


Figure 41.- 1,4-DICLOROBENZENE VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mg/L
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Surface Water Criteria

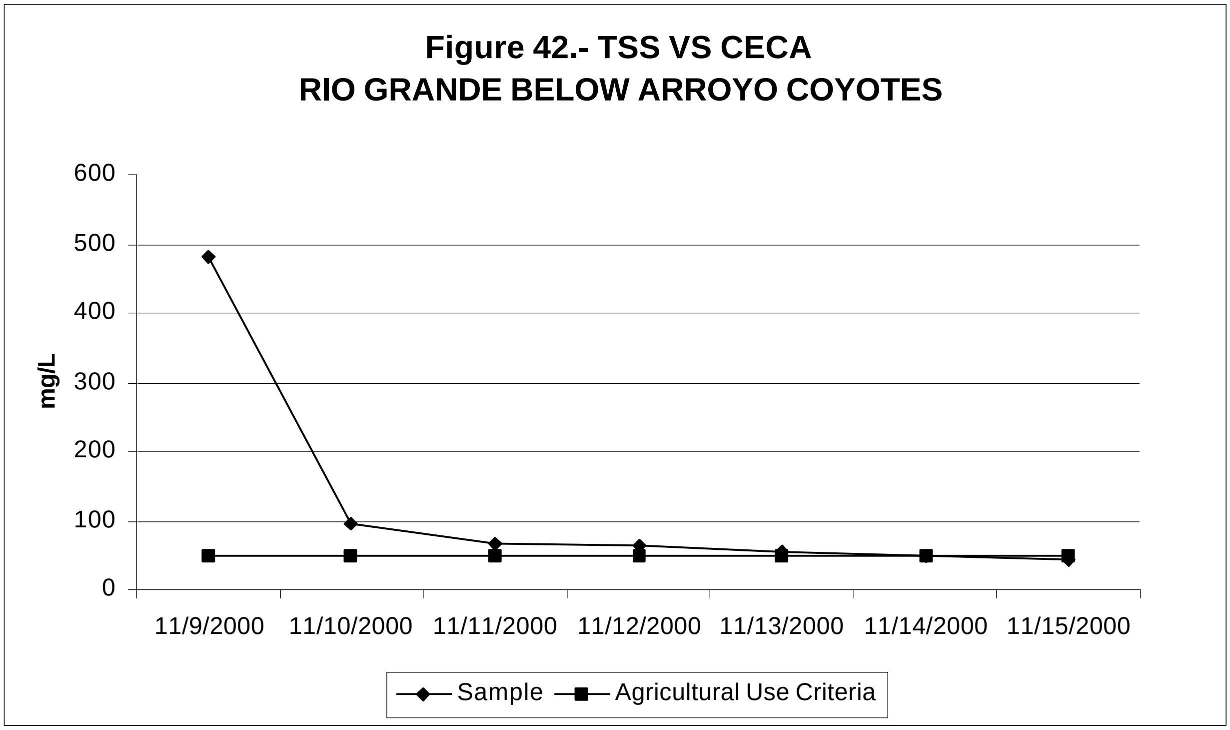


Figure 42.- TSS VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mg/L
600
500
400
300
200
100
0
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agricultural Use Criteria

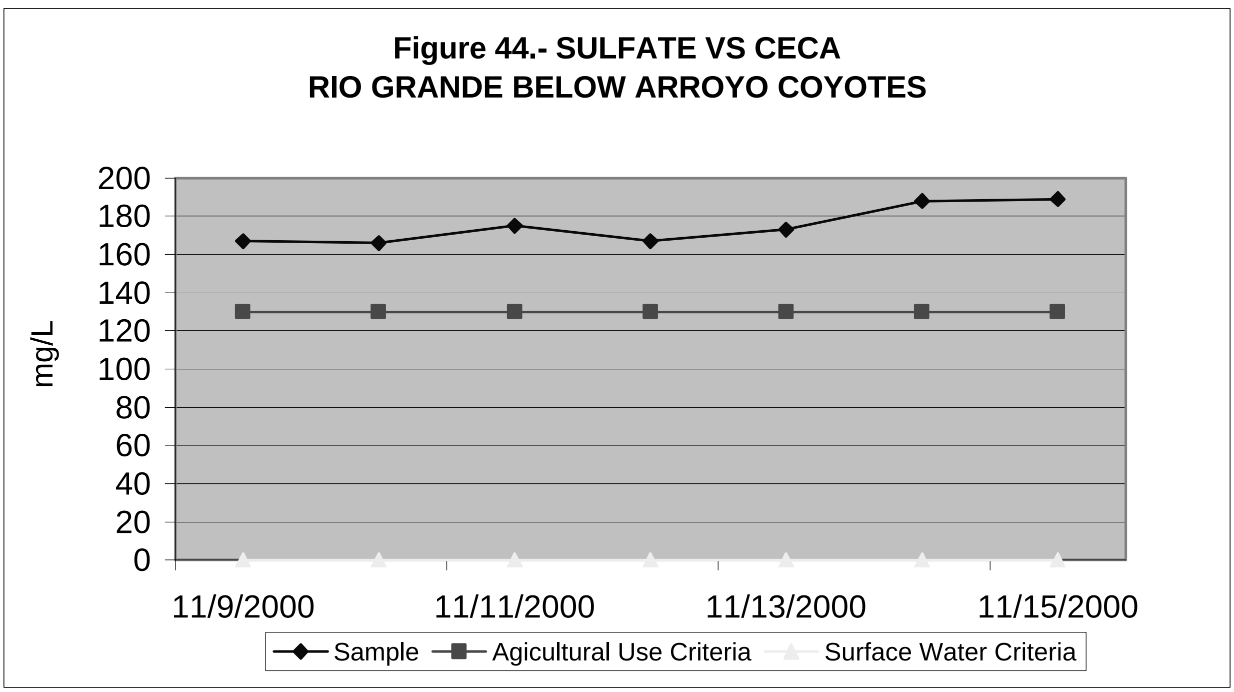


Figure 44.- SULFATE VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mg/L
200
180
160
140
120
100
80
60
40
20
0
11/9/2000
11/11/2000
11/13/2000
11/15/2000
Sample
Agicultural Use Criteria
Surface Water Criteria

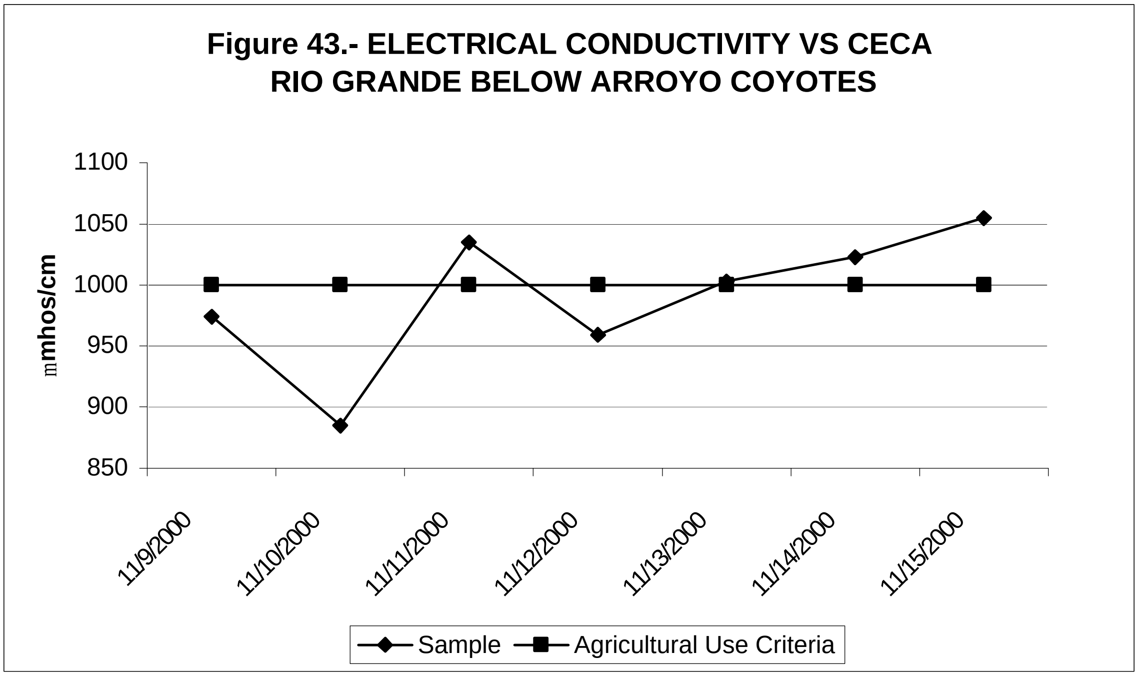


Figure 43.- ELECTRICAL CONDUCTIVITY VS CECA
RIO GRANDE BELOW ARROYO COYOTES
mmhos/cm
1100
1050
1000
950
900
850
11/9/2000
11/10/2000
11/11/2000
11/12/2000
11/13/2000
11/14/2000
11/15/2000
Sample
Agricultural Use Criteria

CONCLUSIONS AND RECOMMENDATIONS

United States

The three sites on the mainstem of the Rio Grande were selected to represent the condition of the river as it flows through the communities of Laredo, Texas and Nuevo Laredo, Tamaulipas. Previous studies indicated that additional monitoring was needed in this area to collect more information and because of the importance of the Rio Grande to both communities. This study had the objectives of:

1. Make a comparative analysis of water quality conditions since the NLIWTP went into operation and determine the water quality of the Rio Grande.
2. Provide information on the prevailing conditions at the NLIWTP.
3. Enhance permanent water quality monitoring programs using the information from this study.

Objective 1. For the two weeks that samples were collected, the information collected indicates that the waters of the Rio Grande as it flows through the Laredo/Nuevo Laredo area meet the majority of the water quality standards (used by the state of Texas) to assess water quality in Segment 2304. The one exception is bacteriological concentrations that increase as the river flows through both communities. High levels of bacteria make contact recreation such as swimming and wading unsafe as ingestion of water may result in illness. The Rio Grande met the public water supply criteria for dissolved solids, chloride, and sulfate. Protection of aquatic life was met according to analysis of samples for metals and acute toxicity (biomonitoring).

Levels exceeding the acute limit for dissolved silver on 11/12/00 appear to be a result of Type I error, or alpha error resulting in the determination that a constituent is present when it actually is absent (false positive). Samples collected to compare current methodologies with the newer USEPA 1600 series metals techniques showed levels of silver to be below the reporting limit of 0.03 µg/l for 11/12/00 at all three sites on the mainstem of the river.

Objective 2. Data collected at the NLIWTP shows the facility is operating properly and producing a good quality effluent. Two effluent samples, sample 1 & 2, exceeded the 200 CFU/100 mls limit established in IBWC Minute No. 279. A rain event prior to the collection of the samples may have caused the increase in concentration of bacteria. All other parameters were within normal ranges for domestic/industrial wastewater. Calculated efficiency at the NLIWTP using the data collected during the time of the study showed the treatment plant was operating at over 95% efficiency.

Objective 3. The data collected during this study shows that the designated use of contact recreation is not being met in the Rio Grande as it flows through this reach. Information from this study shows that additional monitoring needs to be conducted to identify sources of increased bacterial concentrations in the Laredo/Nuevo Laredo area.

Based on the information obtained from this study, the following recommendations are presented:

1. Continue to monitor the Rio Grande and its tributaries in this reach to identify the sources of bacterial contamination that continue to affect this portion of the river. The NLIWTP has improved the quality of water entering the Rio Grande by transforming untreated waste into a good quality effluent. Efforts to identify other sources of contamination should be considered under a joint, binational format.
2. Provide the means for the creation of a binational network for the timely exchange of water quality data between water quality monitoring entities in the Laredo/Nuevo Laredo area.

Mexico

Conclusions

Of the 52 physical and chemical analyses carried out on the samples from the channel of the Rio Grande, only the following parameters exceed the Ecological Criteria for Water Quality

- Electrical Conductivity
- Total Phosphates
- Greases and oils
- Total Suspended Solids
- Total Dissolved Solids
- Sulfates
- Aluminum
- Hexachloro 1-3 butadiene
- Hexachloroethane
- 1-4 Dichlorobenzene

Given the particular characteristics of each compound, they could pose a potential risk to the protection of aquatic life in fresh water, as well as to its use for potable water supply. Effects of these parameters could become additive and cause eutrophic conditions in the system, causing areas of anoxia and accumulation of organic material, and limiting the use of the water in the system.

The concentrations of aluminum detected at the three stations on the channel of the Rio Grande could be due to discharges from industries using aluminum in their processes and /or as a flocculent. The metals are found naturally in surface waters and are not degradable. They can be transferred or accumulated in water and can be considered available under appropriate conditions by means of mobilization from the sediments through a process of accelerated acidification and thus can be detected in surface waters.

In the samples taken at the NLIWTP influent, of the 51 parameters analyzed, the presence of aluminum, hexachloro 1-3 butadiene, hexachloroethane and 1-4 dichlorobenzene and total suspended solids was detected. These parameters are determining factors for the proper functioning of the treatment process of the NLIWTP. Nevertheless, the organic compounds detected are not currently legislated and the reported concentrations cannot be compared with legislative limits.

The presence of hexachloroethane in the NLIWTP influent indicates the application of a chlorination process in one of the wastewater discharges. Chlorination causes the formation of sub products, such as hexachloroethane, which are organic precursors.

Of the 52 parameters analyzed in the NLIWTP effluent, none shows a concentration above the maximum permissible limits of NOM-001-ECOL-1996 or IBWC Minute No. 279, meaning the NLIWTP operates at the expected design treatment efficiency.

Recommendations

Given the above, continue the monitoring program at the NLIWTP Influent contemplated under IBWC Minute No. 297 to identify all those companies that discharge wastewater into the sewerage system with the objective of regulating these discharges and thus protecting the proper functioning of the Nuevo Laredo wastewater treatment process. For the Rio Grande, we suggest a systematic monitoring program to determine the sources of contamination for the purposes of regulating them and thus preclude the deterioration of the system.

The routine monitoring of the nutrients should be continued. The data collected in this study suggest that the concentrations of phosphorus (total phosphates) could occasionally exceed the criteria. More data is necessary to determine if this is a transitory problem, or a localized problem requiring regulatory supervision.

Total Dissolved Solids refer to the concentration of dissolved material in water where the principal anions are carbonates, bicarbonates, chlorides, sulfates, phosphates and nitrates, while the cations are calcium, magnesium, sodium, potassium and iron. The presence and abundance of TDS is affected by many factors, such as chemical composition of the influent, geo-chemistry of the area, atmospheric deposition, manmade effluents, and chemical and biological processes. Given the above, the best administrative practices in both countries should be used so that the sources that contribute dissolved solids be identified and, where possible, controlled. Data on the proportion and frequency of application of pesticides and fertilizers should be collected and distributed in both countries. Future monitoring programs should be designed to efficiently collect data, which will permit an evaluation of the effects of these applications on receiving bodies of water and their ecosystems.

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APPENDIX A- CLEAN METALS COMPARISON STUDY

INTRODUCTION

Water quality programs rely heavily on generating scientifically, valid data that can be utilized to make regulatory decisions, fulfill state and federal requirements, and establish limits that will be protective of rivers and streams while allowing for the multiple numbers of uses needed to support existing communities. Natural, ambient surface water concentrations for trace elements are generally found in low concentration(s) of less than 1 part per billion (ppb). Water quality and human health criteria are at, and in some cases below (such as Mercury), the reporting limits for the current analytical methods such as Cold Vapor Atomic Absorption (CVAA) used to analyze for mercury. Regulatory requirements and the need of river management agencies to provide data at these levels is leading to the use of alternative, more sensitive methods.

In the case of trace element analysis, commonly known as “metals” analysis, the focus has been on improving the instrument capabilities to detect lower levels more accurately. USEPA 1631 (b), Cold Vapor Atomic Fluorescence Spectrometry (CVAF), was developed to achieve levels required for mercury to assess the uses to protect aquatic life and address human health concerns with regards to fish consumption. USEPA 1638, Inductively Coupled Plasma/Mass Spectrometry (ICP/MS), can be used to analyze the priority pollutant metals at levels required to assess water quality in freshwater surface waters.

In addition to improved technologies, an improved understanding of sources of contamination in the collection and analysis of samples has led to improved methods for the collection and preparation of samples that minimize the chances of contaminating a sample. The collection of samples using USEPA method 1669 was developed in order to address issues of contamination in the collection and preparation of samples analyzed for mercury. The methods developed are now applied to other metals for the total and dissolved fractions.

Dr. Paul N. Boothe, Albion Environmental, College Station, Texas, provided the clean metals kits, instructions, and laboratory support for the analysis and interpretation of the USEPA 1600 series results.

SAMPLE COLLECTION

During this study, metals samples were collected side-by-side to evaluate and compare the current sample collection and analysis methodologies, USEPA 200 series (1), with the USEPA 1631(b) (2), 1669 (3), and 1638 (4) clean metals methods and techniques. Sample results were compared for dissolved metals and total mercury collected on 11/10-15/00. Samples for this comparison were collected at the three Rio Grande mainstem stations. Because of a delay in the shipment of the clean metals kits, samples for clean metals were not collected on the first sampling day. Personnel from the USIBWC and the TNRCC collected the clean metals samples for this portion of the study.

Currently, samples for metals analysis are collected using tubing and some type of pumping mechanism, usually a peristaltic pump to transfer water from the stream into the sample container. For the dissolved (soluble) portion of the sample, a filter is attached to the tubing to remove the insoluble fraction (suspended solids) from the sample. This method of collection, as with the clean metals sampling, is done using the clean hands/dirty hands technique. This technique requires usually two people, one assigned to handle only the clean materials such as containers, filters, and tubing. The person assigned as “dirty hands” handles the equipment, contact with receiving water, and spent materials. This is done to minimize contamination during the collection of the sample.

The Albion Environmental Clean Metals Sampling Kit (ACMSK) is designed for manual grab sampling of fresh surface waters and is fully compliant with USEPA 1669. Each sampling kit contained individually bagged sample containers (Teflon for mercury) with a unique identifying number. A triple bagged clean box was also provided for each days samples. With the exception of collecting the sample, all work was done inside the clean box to avoid contaminating the samples with airborne particulates and to minimize sample contact with contaminated surfaces. Personnel wore gloves, clean outer clothing, and utilized the clean hands/dirty hands technique during sample collection.

Total mercury samples were collected by submerging the container below the surface one foot and:

- Opening the lid underwater;
- Filling the container;
- Closing the container underwater; and
- Returning the container to its plastic bag.

Samples for dissolved metals were collected using a syringe and syringe filter (no pump tubing or pump are required). The syringe is filled with sample followed by attaching the syringe filter. About 5-10 mls of sample is filtered through the syringe to rinse the filter. The sample is then filtered into the appropriate sample container. After collection, the containers were returned to their original plastic bag, re-sealed, placed in ice and shipped overnight to the laboratory. Samples collected on the weekend (11/11-12/00) were refrigerated immediately but not shipped until 11/13/01. Manual grab field blanks were collected at a different station each day prior to the start of sampling.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Appropriate QA/QC samples were analyzed for both sets of samples; i.e. field blanks and field duplicates during sample collection, followed by laboratory blanks, laboratory duplicates, matrix spikes/duplicates, and laboratory control standards utilized by the contract laboratory and Albion Environmental.

Laboratory results were reviewed and any discrepancies were addressed with the appropriate laboratory director. QA/QC reports that accompanied all individual reports were also reviewed and verified with the laboratory.

ANALYTICAL METHODS

The methods used to analyze the samples have been approved for surface water in the state of Texas. The following table lists the methods used for each parameter with the corresponding reporting limit (Table 1). Appropriate sample preparation, such as digestion and pre-concentration, were conducted according to the method utilized in the analysis.

Table 1. List of methods used for metals analysis.

Parameter	Current Method	Reporting Limit (µg/l)	Clean Metals Method	Clean Metals Reporting Limit (µg/l)
Aluminum (d)	USEPA 200.7	50.0	USEPA 1638	1.0
Arsenic (d)	USEPA 206.2	10.0	USEPA 1638	0.5
Cadmium (d)	USEPA 213.2	0.20	USEPA 1638	0.03
Chromium (d)	USEPA 200.7	10.0	USEPA 1638	0.5
Copper (d)	USEPA 200.7	5.00	USEPA 1638	0.09
Lead (d)	USEPA 239.2	2.00	USEPA 1638	0.03
Mercury (t)	USEPA 245.1	2.00	USEPA 1631(b)	0.0005
Nickel (d)	USEPA 200.7	15.0	USEPA 1638	0.3
Selenium (d)	USEPA 270.2	2.00	USEPA 1638	1.0
Silver (d)	USEPA 200.7	2.00	USEPA 1638	0.03
Zinc (d)	USEPA 200.7	5.00	USEPA 1638	0.20

(d)- filtered sample, dissolved.
(t)- sample collected unfiltered, total.

DATA RESULTS

Site 1- Rio Grande at the Colombia Bridge, 20 miles (32 km) above Laredo and Nuevo Laredo (TNRCC station 15839).

Data collected using both techniques indicate the concentration of metals to be very low at this site, as should be expected in an area predominantly influenced by rangeland. When compared with the TSWQS for the protection of aquatic life, the data would support this designated use. Using current EPA methods, USEPA 200 series, the acute standard for mercury and silver would not be assessed because the reporting limits are greater than the standard. The only method available that can achieve the 0.012 µg/l human health standard for mercury is USEPA 1631 (b). As previously stated, the comparison with the TSWQS is only to establish a benchmark and should be not considered a true assessment. There are three differences in the data collected between the two techniques that should be mentioned.

1. Silver. One data point analyzed for silver exceeded the acute criteria of 0.92 µg/l on 11/12/00 with a concentration of 7.00 µg/l. The sample collected at the same time for clean metals analysis did not show any increase in silver, <0.03 µg/l, on that particular day. Analysis of the data may suggest the increase in concentration observed for 11/12/00 may be the result of sample contamination during the collection or preparation of the sample.

   One limitation of the current methodology is the reporting limit of 2.0 µg/l. The acute criteria for silver cannot be assessed using this method. Additionally, analyzing samples at the low range can introduce Type I error (false positives) if the instrument is not working optimally or an interference is encountered. All of these reasons, or none of them, could explain the increase in concentration. Collecting additional data for silver and the other metals would be the best way to determine ambient water concentrations.

2. Aluminum. Although the concentration of dissolved aluminum is well below the acute level of 991 µg/l, there is a significant difference between the current method compared to the clean metals method. There is a 4 to 15-fold increase in

the aluminum concentration when comparing the two methods at this site. The concentration of aluminum in the Rio Grande is near the reporting limit of the traditional method and account for the detection of aluminum at that concentration. The clean metals reporting limit of 1 μg/l does not come into play.

3. Copper. The concentration and detection of copper is very similar to that of silver. The sample collected on 11/12/00 showed a measurable level of copper, 11.9 μg/l, using the USEPA 200 series method. On the same day, the sample collected and analyzed using clean metals methods had a concentration of 0.86 μg/l.

Overall, when analyzing the data collected at Station 1, the number of non-detects for most parameters indicates low levels of metals in the Rio Grande during this time. The concentration of silver, aluminum, and copper may appear elevated as a result of the inherent limitations using the current, traditional methods used to analyze these constituents.

Table 2. Comparison of data collected using USEPA 200 methods versus USEPA 1600 series methods at Site 1.

Parameter							
Date	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Silver - ug/l 200.7	2.00	2.00	2.00	7.00	2.00	2.00	2.00
Silver - ug/l 1638		0.03	0.03	0.03	0.03	0.03	0.03
Aluminum - ug/l 200.7	275.00	308.00	50.00	157.00	117.00	91.50	69.60
Aluminum - ug/l 1638		23.60	11.60	10.00	30.00	7.50	12.20
Arsenic - ug/l 206.23	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Arsenic - ug/l 1638		2.70	2.80	2.70	2.90	2.80	2.70
Cadmium - ug/l 213.2	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium - ug/l 1638		0.03	0.03	0.03	0.03	0.03	0.03
Chromium - ug/l 200.7	10.00	16.00	10.00	30.70	10.00	10.00	10.00
Chromium - ug/l 1638		0.50	0.50	0.50	0.50	0.50	0.50
Copper - ug/l 200.7	5.90	5.00	5.00	11.90	5.00	5.00	5.00
Copper - ug/l 1638		0.92	0.88	0.86	0.92	0.88	0.95
Mercury- ug/l 245.1	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Mercury- ug/l 1631(b)		0.0034	0.0035	0.0049	0.0031	0.0036	0.0023
Nickel - ug/l 200.7	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Nickel - ug/l 1638		0.34	<0.3	0.31	0.40	0.50	0.46
Lead- ug/l 239.2	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lead - ug/l 1638		0.03	0.03	0.02	0.03	0.03	0.03
Selenium - ug/l 270.2	2.00	2.00	2.00	2.00	2.00	2.00	2.20
Selenium - ug/l 1638		1.20	1.10	1.30	1.30	1.20	1.20
Zinc - ug/l 200.7	7.40	8.80	5.00	7.00	5.00	5.00	5.00
Zinc - ug/l 1638		0.76	0.54	0.77	0.66	0.61	0.62

SITE 2- RIO GRANDE AT MASTERSON ROAD, ONE MILE (1.6 KM) ABOVE THE ARROYO COYOTES (NLIWTP OUTFALL) (TNRCC STATION 15815), AND

SITE 5- RIO GRANDE 1 MILE (1.6 KM) BELOW THE ARROYO COYOTES (NLIWTP OUTFALL) (TNRCC STATION 13196.

The NLIWTP is located in-between both of these two monitoring stations. The data at the two sites are very similar to each other and do not show a significant influence of the effluent discharge coming from the NLIWTP. There are discharges that can influence water quality in this area, such as the Southside Wastewater Treatment Plant in Laredo, along with creeks from the United States and Mexico that drain above the two sites. An increase in two of the metals (aluminum and zinc) was detected at both of these sites when compared to Site 1 at the Colombia Bridge. Water quality criteria would be met at these sites compared to the TSWQS acute and chronic screening levels.

The following differences were found between the current methods and the clean metals data (Tables 3 & 4):

1. An increase in silver, chromium, copper, and nickel were found at the two sites using the current USEPA 200 methods. There was no increase in these metals using the USEPA 1600 series metals. There is a difference in the concentration when comparing the two techniques because of the lower reporting limits for the clean metals methods. It should also be noted that the detection of metals using the current methods were all analyzed using USEPA 200.7 Inductively Coupled Plasma (ICP). The metals analyzed using other instrumentation such as Graphite Furnace Atomic Emission Spectrometry (GFAA) on the same day were non-detects. This may help support the inference that working at low levels close to the reporting limits may introduce, at times, a false positive result (Type I error).

2. The two monitoring sites also show a significant difference in the concentration of dissolved aluminum. This is the same pattern noted at Site 1.

Table 3. Comparison of data collected using USEPA 200 methods versus USEPA 1600 series methods at Site 2.

Parameter							
Date	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Silver - ug/l 200.7	<2.00	<2.00	<2.00	7.40	<2.00	<2.00	2.00
Silver - ug/l 1639		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Aluminum - ug/l 200.7	264.00	280.00	135.00	128.00	97.90	134.00	77.20
Aluminum - ug/l 200.8		45.30	21.80	24.30	55.80	15.00	17.80
Arsenic - ug/l 206.23	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Arsenic - ug/l 1632mod		2.60	2.90	2.80	2.70	2.90	2.90
Cadmium - ug/l 213.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium - ug/l 1638		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Chromium - ug/l 200.7	<10	<10	<10	32.10	<10	<10	<10
Chromium - ug/l 200.8		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper - ug/l 200.7	<5.00	<5.00	<5.00	12.40	<5.00	<5.00	<5.00
Copper - ug/l 1638		0.89	0.90	0.92	0.90	0.94	0.93
Mercury- ug/l 245.1	<2	<2	<2	<2	<2	<2	<2
Mercury- ug/l 1631 (b)		0.0049	0.0045	0.0178	0.0046	0.0037	0.0033
Nickel - ug/l 200.7	<15.0	<15.0	<15.0	30.20	<15.0	<15.0	<15.0
Nickel - ug/l 1638		<0.3	0.67	0.43	0.58	0.54	0.50
Lead- ug/l 239.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Lead - ug/l 1638		0.05	<0.03	<0.03	0.04	<0.03	<0.03
Selenium - ug/l 270.2	<2.0	<2.0	<2.0	<2.0	2.40	<2.0	2.10
Selenium - ug/l 1632-mod		1.10	1.20	1.20	1.30	1.20	1.20
Zinc - ug/l 200.7	7.80	8.90	<5.00	<5.00	<5.00	6.10	<5.00
Zinc - ug/l 1638		1.06	1.12	0.92	1.09	0.89	0.83

Table 4. Comparison of data collected using USEPA 200 methods versus USEPA 1600 series methods at Site 5.

Parameter/method Date	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Silver - ug/l 200.7	2.00	2.00	2.00	7.10	2.00	2.00	2.00
Silver - ug/l 1639		0.03	0.03	0.03	0.03	0.03	0.03
Aluminum - ug/l 200.7	270.00	407.00	164.00	118.00	333.00	122.00	73.30
Aluminum - ug/l 200.8		36.40	17.90	24.90	36.20	15.10	34.90
Arsenic - ug/l 206.23	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Arsenic - ug/l 1632mod		2.60	2.80	2.80	2.90	2.80	3.00
Cadmium - ug/l 213.2	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium - ug/l 1638		0.03	0.03	0.03	0.03	0.03	0.03
Chromium - ug/l 200.7	10.00	10.00	10.00	30.90	10.00	10.00	10.00
Chromium - ug/l 200.8		0.50	0.50	0.50	0.50	0.50	0.50
Copper - ug/l 200.7		5.00	5.00	11.80	5.00	5.00	5.00
Copper - ug/l 1638		0.88	0.93	0.93	0.92	0.97	0.93
Mercury- ug/l 245.1	<2	<2	<2	<2	<2	<2	<2
Mercury- ug/l 1631 (b)		0.0054	0.0043	0.0044	0.0045	0.0043	0.0046
Nickel - ug/l 200.7	15.00	15.00	15.00	24.80	15.00	15.00	15.00
Nickel - ug/l 1638		0.33	0.38	0.40	0.58	0.49	0.56
Lead- ug/l 239.2	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lead - ug/l 1638		0.03	0.03	0.03	0.04	0.07	0.03
Selenium - ug/l 270.2	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Selenium - ug/l 1632-mod		1.10	1.20	1.10	1.20	1.20	1.30
Zinc - ug/l 200.7	7.10	8.40	5.00	11.20	5.00	5.00	5.00
Zinc - ug/l 1638		1.22	1.42	1.27	1.22	2.18	1.20