



Binational efforts to improve water quality along the U.S – Mexico border

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Abstract: Water quality issues in the world's freshwater resources is a growing dilemma. With fewer freshwater sources, growing demand, and historical pollution affecting many water bodies, this issue is a daunting challenge. When that water body is shared by more than one country, the challenge is even greater. For the United States and Mexico, the Rio Grande/Rio Bravo represents just such a challenge. This challenge is being addressed by the two countries in a landmark initiative that couples science and politics by gathering data, performing model analysis, and implementing and enforcing improvement strategies together.

Introduction: The Rio Grande/Rio Bravo marks the border between the state of Texas in the United States and the states of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas in Mexico for a length of 1,255 miles. The river is used by both countries as a source of freshwater for agriculture, ranching, recreation, and most importantly as a potable water source. Increasing population growth along the border has also increased the amount of pollution reaching the river. Many stretches of the river are listed as impaired and are in need of restoration. With both countries having different laws, standards, and uses for the river, finding a solution requires a cooperative approach to identify problems and joint solutions for recovery.

In an effort to address these concerns, federal, state, and local entities from both countries conducted many meetings hosted by the International Boundary and Water Commission, United States and Mexico (IBWC) to discern how to tackle the issue of water quality and still follow their respective laws and standards.

Because the IBWC is a binational, federal government agency with established methods for addressing such issues through its execution of treaties and minutes, the IBWC developed a proposal and a terms of reference document that was amenable to both countries. These documents provided the authority of each country to jointly perform the necessary scientific work and to ultimately provide the framework policies that both governments could implement.

Binational Framework:

Terms of Reference (TOR):

The framework for the development of a binational agreement was to use the existing treaties between the countries, which allows for the two countries to develop studies and further agreements as amendments to the treaties (called minutes). The treaties specifically call out water quality issues and sanitation to be addressed binationally as noted in Article 3 of the 1944 Treaty Relating to Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande authorizes the International Boundary and Water Commission (IBWC), which states “to give preferential attention to the solution of all border sanitation problems...” Article 24 authorizes the Parties “to initiate and carry on investigations and develop plans for the works which are to be constructed or established” dealing with transboundary waters.

Due to the complexity and the numerous stakeholders involved, both sections of the Commission established the necessary framework to allow for the joint evaluation of proposed cooperative measures that could benefit both nations.

The terms of reference was signed by the core agencies in both countries setting up the authority and agreement to implement the binational proposal as described below. The Terms of Reference serves as the framework used by all entities participating in the joint cooperative process. It includes a process for dissemination of information and direction of the initiative. The framework developed a U.S. and Mexican core group made up of the leadership of the representative agencies who provide direction to the initiative and can make agreements for the countries and agencies.

Below the core group was the development of the Binational technical work group. This group is the primary working group that developed and conducted the special studies, assessed the historical data, agreed on technical approaches, is running water quality models, and will develop the recommendations for improvement strategies in the basin.

General Objective of the TOR

The objective of the joint cooperative process was to establish, under the auspices of the International Boundary and Water Commission, a group of representatives from the United States and Mexico to explore border sanitation issues and water quality management with potential binational benefits. Any joint cooperative projects and measures must be consistent with the 1944 Treaty, which authorizes the initiative.

Specific Objectives of the TOR

- a. Address current and future water quality issues of the Lower Rio Grande/Río Bravo.
- b. Implement management procedures and programs that enable affected parties to manage wastewater discharges and improve water quality conditions.
- c. Evaluate current wastewater discharge infrastructure and management strategies for the potential for improving the quality of effluent discharges into the Lower Rio Grande/Río Bravo.

- d. Evaluate new mechanisms and strategies for system operations that could improve ambient water quality and address border sanitation concerns.
- e. Improve salinity management for return flows into the Lower Rio Grande/Río Bravo.
- f. Based on the results of the evaluations carried out, implement programs and projects to meet these objectives as appropriate, and result in measurable and sustainable improvements in the ambient water quality of the Lower Rio Grande/Río Bravo.

Organization and Management

The IBWC, acting under the foreign policy guidance respectively of the U.S. Department of State and the Mexican Foreign Ministry, is the lead in the joint cooperative process.

The Commission formed a binational Core Group of members representing each Section of the IBWC, other federal agencies, and the States of Tamaulipas and Texas. Other stakeholders, which may include local government officials or non-governmental organizations (NGOs), may be invited to participate in the Core Group. To enhance the availability of information to all parties, any U.S. or Mexican Core Group member may invite a technical expert to advise the Core Group with approval from IBWC, as there can be a benefit from utilizing research or outreach efforts of other organizations and agencies.

The composition of the U.S. Core Group will be as follows:

- U.S. Section, International Boundary and Water Commission (USIBWC)
- U.S. Environmental Protection Agency (EPA)
- Government of Texas, through the Texas Commission on Environmental Quality (TCEQ)

U.S.-based non-governmental organizations or local government institutions may participate if invited by the Core Group, but not as members of the U.S. Core Group.

The composition of the Mexican Core Group will be as follows:

- Mexican Section, International Boundary and Water Commission (MxIBWC)
- National Water Commission (CONAGUA)
- Government of the State of Tamaulipas, through the State Water Commission of Tamaulipas (CEAT)

Mexican-based non-governmental organizations or local government institutions may participate if invited by the Core Group, but not as members of the Mexican Core Group.

The binational Core Group formed technical work groups to work on specific issues, measures and projects selected by the binational Core Group. Each binational Technical Work Group is composed of a representative from each Section of the IBWC and members from each country with the required knowledge and expertise to work on specific issues related to the objectives. A group leader from each country is selected by the binational Core Group members from that country. To enhance the availability of

information to all parties, any member of the U.S. or Mexican Core Group may invite a technical expert to advise the Core Group with approval from IBWC. The BECC and NADB representatives also may be helpful when binational work groups meet.

Conduct of Meetings under the TOR

Each nation's Core Group meetings will be conducted as necessary and as determined by each delegation. Each nation's Core Group will be free to schedule and conduct its meetings.

Binational meeting minutes will be exchanged between U.S. and Mexican Core Group delegations following each meeting that takes place. The binational Core Group meetings will be conducted as follows:

- Meetings will be convened by the U.S. and Mexican Commissioners of the IBWC or their designated representatives and will be held, as required, at alternating meeting sites in the United States and Mexico if possible. When a Core Group member or stakeholder is unable to attend a meeting in person, other methods of participation are made available.
- Binational Core Group meetings are chaired jointly by the U.S. and Mexican Principal Engineers of the IBWC or by their designated representatives. The binational Core Group can establish work groups to undertake specific tasks or projects under the direction of the binational Core Group and then present the results to them. These work groups will not have decision-making authority.
- The binational Core Group will develop joint work plans and meeting agendas. The agendas will, to the extent practical, be shared in advance of the meetings.
- The co-chairing Principal Engineers will make every effort possible to achieve a consensus among the binational Core Group for all those activities under consideration.
- The binational Core Group will strive to ensure that the principal points of the presentations and dialogue at the meetings and events are documented in summary reports in the English and Spanish languages. All binational meetings will have professional simultaneous interpretation support furnished by the country hosting the meeting and/or event. To the extent possible each Section will provide its presentation documents to the other Section prior to binational Core Group meetings so that the documents can be translated. Also, to the extent possible, each Section will provide presentation documents in the primary language of the country to its Core Group committee members 48 hours prior to the meeting.

- Every effort will be made to convene meetings at times and places where all members can be present. In the event that a designated primary Core Group member is not able to be present, the designated alternate person may represent the primary person. In extraordinary circumstances, accommodations may be made for group members to participate by telephone or video conference; however, the availability of simultaneous interpretation cannot be guaranteed for remote participants.
- Other personnel of the government and non-government organizations and agencies, including consultants, personnel involved in presentation of information studies and progress reports, may participate in support of work groups as established in the work plan and meeting agendas. The binational Core Group must approve their participation. Representatives of the U.S. Department of State and the Mexico's Secretariat of Foreign Relations may attend national and binational Core Group meetings at their discretion. The two Principal Engineers or their designees must approve the participation of other personnel who are not members of the Core Group.

Framework of Activities

The binational Core Group will conduct its activities in accordance with work plans that cover the following framework:

- Definition of objectives and selection of binational items to be evaluated.
- Selection and establishment of binational work groups that will be working on the topics for which binational data gathering, analysis and other work can be advanced through work groups.
- Identification of tours and field visits necessary to initiate dialogue and enhance understanding of U.S. and Mexican objectives.
- Definition of obligations for Core Group and work group members and definition of the required progress reports and work products for presentation by binational work groups at binational Core Group meetings.
- Provide advice and guidance to each work group in reference to assignments.
- Establishment of deadlines for exchange of information required for binational review.
- Recommendation of projects for binational implementation.

Binational work groups will conduct their activities in accordance with the guidance provided by the binational Core Group. National work groups will conduct their activities

in accordance with the guidance provided by each country's Core Group. The binational technical work groups will be responsible for the following activities:

- Evaluation of assigned issues to include feasibility, cost and potential benefit for both nations.
- Arrangement of tours and field visits.
- Preparation of reports outlining findings and recommendations.
- Presentation of reports.

Unofficial interaction between U.S. and Mexican interest groups is encouraged in order to have a creative environment, foster better relations and promote productive dialogue that could lead to the generation and/or positive evaluation of joint cooperative measures and projects that could be beneficial to both nations. Any formal discussions and evaluations of any proposal will follow the Terms of Reference established for the "United States-Mexico Joint Cooperative Actions in the Lower Rio Grande/Río Bravo River Basin."

Funding and cost share decisions will be made on a case-by-case basis and are subject to appropriations. All projects and measures considered under this joint cooperative process are subject to the availability of funds. Any agreement to pursue the evaluation of a specific project or measure does not commit any of the parties to provide funding for the execution of projects and measures.

Core group members and work group members participating in this process will not be compensated by either Section of the Commission, nor will participants' travel expenses related to this process be reimbursed by either Section.

Communication and Use of Information

The two Sections of the IBWC will be the official repository of records generated by the national or binational Core Group and work groups, at meetings, studies, and any information exchanged and/or presented to the Core Group.

Credit shall be given to those who provide information.

Outcomes and Performance Measurement

The United States and Mexican Sections of the IBWC will prepare reports on the progress of United States-Mexico joint cooperative actions in the Lower Rio Grande/Río Bravo. Each report will include results from monitoring of ambient water quality within the Lower Rio Grande/Río Bravo. This effort seeks significant and sustainable improvements in ambient water quality within the main stem of the Lower Rio Grande/Río Bravo from the Falcon Reservoir to the Gulf of Mexico. This project will be considered a success if it has demonstrated that:

1. Opportunities to improve water quality have been identified, and
2. Implementation of these opportunities improves water quality in the Lower Rio Grande/Río Bravo.

The Binational Proposal:

Goals of the Proposal

The Mexican partner agencies (International Boundary and Water Commission, Mexican Section (CILA), the Mexican National Water Commission (CONAGUA), and the Tamaulipas State Water Commission (CEAT)) and the U.S. partner agencies (International Boundary and Water Commission, U. S. Section (USIBWC), the U.S. Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ)) agreed that the goal was to create a pilot project to restore, protect, and improve the water quality in the Lower Rio Grande/Río Bravo. The Lower Rio Grande is defined as the length of the river below the Falcon International Dam to the confluence of the river with the Gulf of Mexico. (Figure 1 and 2). This pilot project would be called the Lower Rio Grande Water Quality Initiative (LRGWQI) Specific water quality targets are to be agreed-upon through a binational consultation and deliberation processes conducted under the auspices of the IBWC.

Scope of the Proposal

The focus of the LRGWQI pilot project is on water quality management in the Lower Rio Grande/Río Bravo. This effort is a pilot project and the Lower Rio Grande/Río Bravo is a good starting point; success here may serve as a model for other segments along the river.

Technical Approach

The set of technical tasks for the LRGWQI project includes:

1. Historical data review
2. Identification of data gaps
3. Data collection
4. Data analysis and modeling



Figure 1: Study area of the LRGWQI

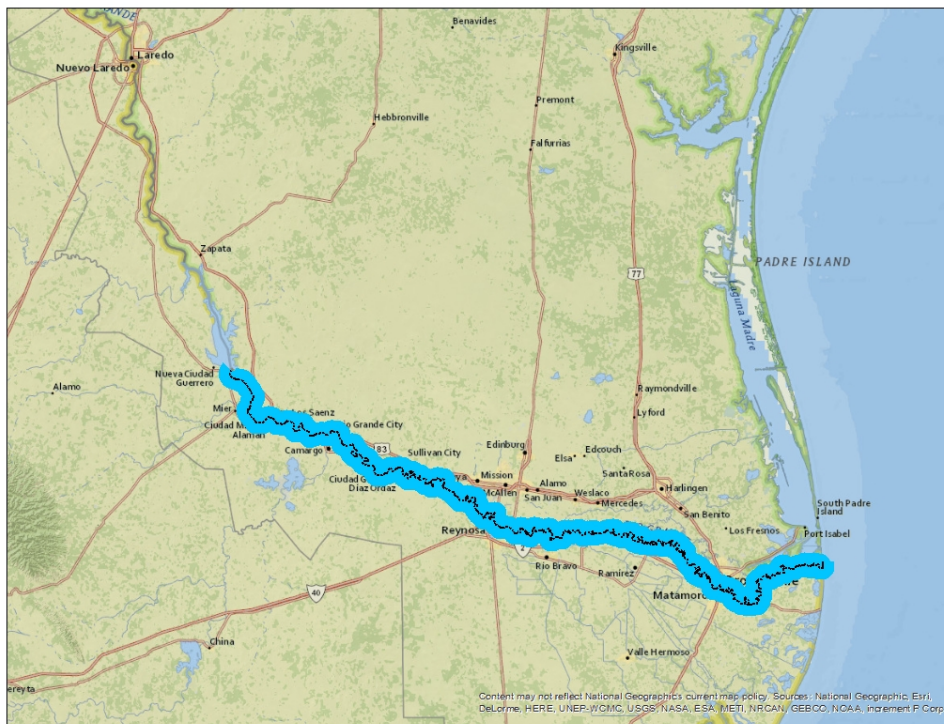


Figure 2: Study area of the LRGWQI

The analysis for the modeling efforts included point and steady-state nonpoint sources of pollution. The first phase of analysis focused on characterizing and modeling water quality under steady state conditions. The technical work associated with the LRGWQI was and is being conducted through cooperation between Mexico and the United States by the development of binational technical work groups.

Identifying Feasible Options to Improve Water Quality

A goal of this initiative is to identify potential feasible pollution prevention and control options that will result in the restoration, conservation, and improvement of the water quality in the Lower Rio Grande/Río Bravo through a facilitated stakeholder process that includes the participating agencies, stakeholders from both sides of the river and representatives of the local binational community of water users. The options will be incorporated into a binational water quality improvement plan along with the technical analysis justifying their selection, including estimation of option costs.

Legitimizing the Analysis

The official mechanism for obtaining binational concurrence on technical aspects of the plan is the IBWC process. Once completed, the binational water quality plan resulting from the LRGWQI effort would be incorporated as an agreement approved through the IBWC, US and Mexico.

Institutionalizing the Agreement(s)

The 1944 Water Treaty between the U.S. and Mexico was the most appropriate institutional mechanism for reaching a binational agreement on the elements of any binational water quality plan resulting from the LRGWQI. This allows both countries to legitimately implement and enforce in both countries any binationally approved and developed environmental protection plans that can set reasonable and attainable goals for improving water quality in the river.

Plan Development and Implementation

The LRGWQI pilot project is proceeding in three stages:

- The **first stage** included initial binational discussions and development of a binational study plan. The first stage also included initial historical data review, identification of key stakeholders, and development of a stakeholder participation strategy.
- The **second stage** is currently in progress and includes binational data collection, technical analysis/modeling, and stakeholder involvement. The second stage of the LRGWQI will result in a binational water quality improvement plan for presentation to both countries for review and possible adoption.
- The **third stage** would assess implementation and would result in a report(s) evaluating the progress achieved under the LRGWQI.

Implementation and Monitoring

Two (2) types of monitoring associated with the LRGWQI pilot project, programmatic monitoring and ambient monitoring are envisioned:

- Programmatic Monitoring - the project will develop a plan to monitor the progress of implementation of the measures and solution strategies detailed in the binational water quality plan.
- Ambient Monitoring - the project will also develop a plan for each nation to monitor the progress in achieving the water quality goals specified in the plan.

Each nation agreed to share Mexican and US information sources so that each side and its citizens have confidence regarding sources of effluents and the ambient quality of the river.

Sustaining the Effort

The LRGWQI pilot project should develop consensus procedures for Mexico and the U.S. to cooperate in future water quality planning beyond the scope of the initial plan(s). Each party should officially acknowledge their interest in a long-term effort to improve ambient water quality within the Lower Rio Grande/Río Bravo.

Stakeholder Involvement

Each of the binational partner agencies involved in water quality (TCEQ, EPA, IBWC-U.S. and Mexico, CONAGUA, and CEAT) will determine their appropriate stakeholder involvement. There can be a benefit from utilizing research or outreach efforts of other organizations and agencies from both countries. The stakeholder involvement processes will rely as much as possible on existing public and stakeholder outreach forums and mechanisms such as EPA's Border 2020 efforts, IBWC's Citizen Forums and the TCEQ and IBWC's Clean Rivers Program Basin Steering Committee meetings in the United States, as well as other efforts led by Mexican organizations such as Basin Councils.

Schedule

The development of the binational water quality plan resulting from the was proposed as follows:

- Stage 1 – 12 months, which began in early 2014;
- Stage 2- up to two years, which is currently on going; and
- Stage 3- 12 months.

Initiative Progress

Historical Data Review

Both the U.S. and Mexico already had a robust sampling program in place to test for chemical constituents in the Rio Grande and the tributaries and outfalls in each respective country. The IBWC collected data from both countries and shared the data with the technical committee for review. The data analyzed was all available data from 2000 to the most current available at the time, which was October 2014. The data was combined from both countries and analyzed spatially and temporally to determine pollutants of concern and to identify trends in the data. Trends both in time but also coincident with discharges to the river.

Data showed that several pollutants of concern were present in the river at levels higher than either country deemed allowable based on their regulations but also based on scientific and public opinion. (See figure 3 for an example of the data analysis) Data also showed many of the pollutants demonstrated increasing trends in pollutant values. (See figure 4 for an examples trend analysis.) The primary pollutants that the technical committee viewed as priority were bacteria, total dissolved solids, and nutrients such as ammonia but data was also analyzed for in-situ parameters, metals, organics, oxygen demand, and toxicity. These pollutants indicate anthropogenic impacts to the natural system. Many pollutants are also present to indicate industrial and urban impacts as well.

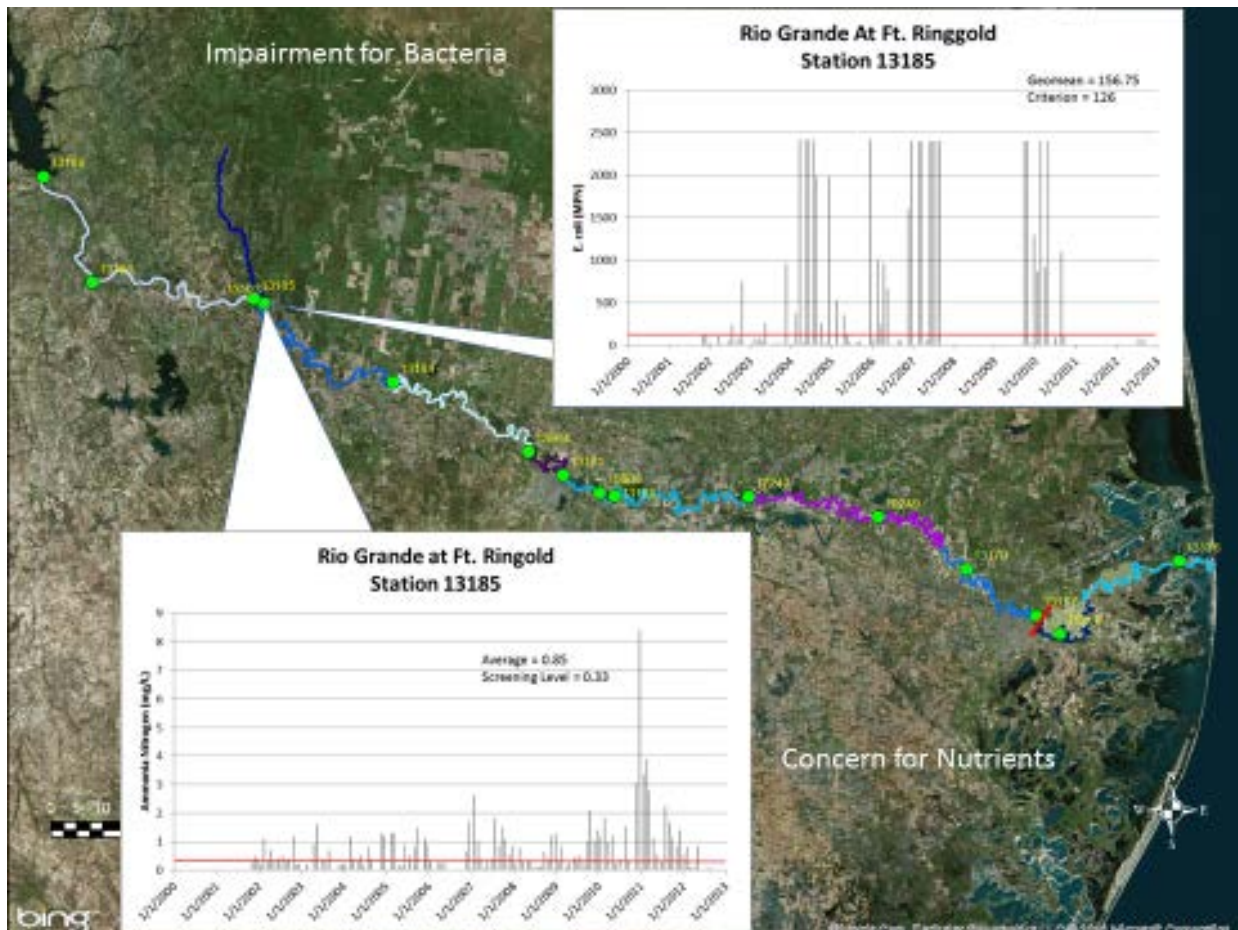


Figure 3. Historical data analysis.

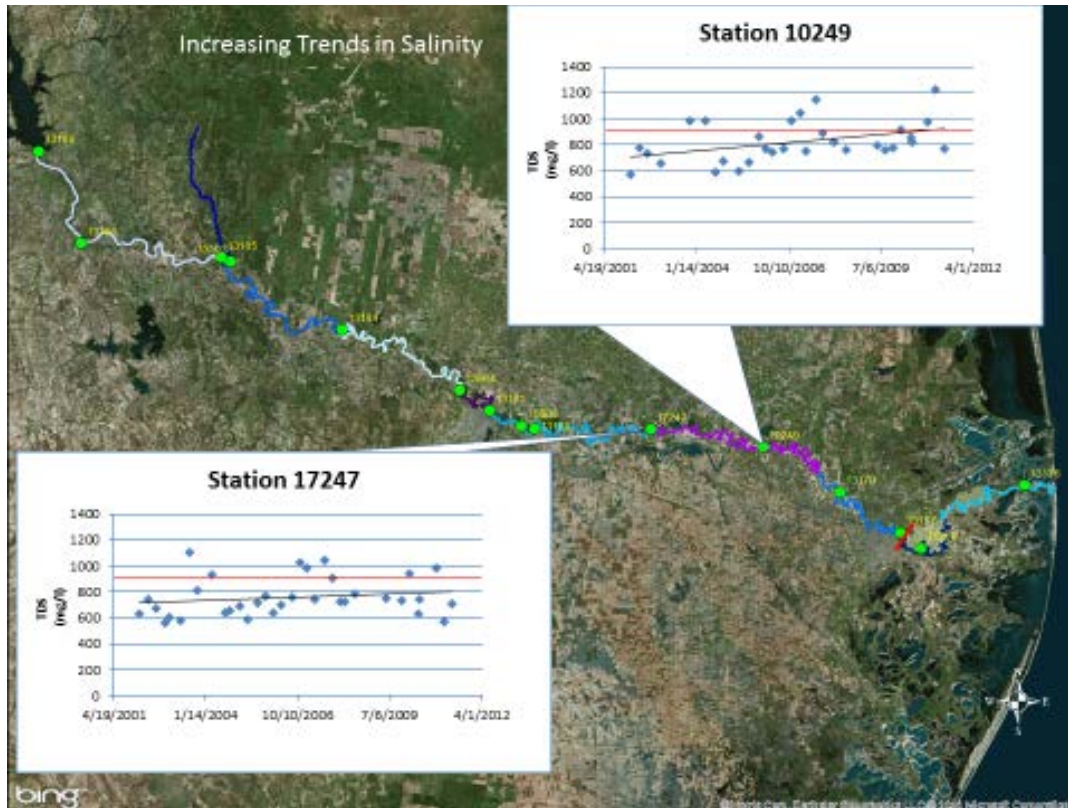


Figure 4. Historical trends analysis

Synoptic Surveys and Water Quality Modeling

The next step in the process was to collect steady state, current data along the main stem of the river and to collect data from known discharge points and tributaries. Four sampling events were planned and conducted during a one-year period to represent seasonal changes in the steady state of the river. The sampling events were performed by several teams comprised of members from both countries. The teams used academia students to gather samples and in-situ data and was assisted and supervised by the binational technical committee members. The samples collected in the main stem and the sampling points in Mexico were sent to a certified laboratory in Mexico and the samples collected in the U.S. were sent to a certified lab in the U.S. The final laboratory data from the labs was then sent to the technical committee members for review.

The primary purpose of collecting the synoptic data was to provided steady state conditions throughout the project area to act as calibration for the model. The model chosen by the technical committee to model the rivers conditions and responses was the LaQual water quality model from the state of Louisiana. This model is very similar to the U.S. Environmental Protection Agency model called Qual2K but simplified to allow for easier modeling of impacts to water bodies. Both countries developed in binational workshops, all of the necessary input and schematics for the model to run and determined which parameters would be modeled.

This is the current stage of the project to date. Four iterations of the model were run using the seasonal synoptic data. The initial runs show well the impacts to the river from

the pollutants but also shows the need for additional information to increase the confidence and response of the model.

Initiative Future

Modeling changes

When the model is fully calibrated and verified, the technical committee will use the final model to test various watershed improvement strategies to determine the effect. Stakeholders from both countries are being polled to provide input into the watershed strategies by describing their priorities and their suggestions. Along with already established strategies; such as improved wastewater treatment, wastewater reuse, improved irrigation techniques, the technical committee will produce outputs of the various strategies and provide that information to the binational core group. The core group will then determine which of the strategies are feasible for implementation given available resources, size of the effect of the strategy, policy and politics.

Binational Watershed Protection Plan

The next step in the initiative will be to take the guidance and strategies from the core group and develop a binational watershed protection plan (WPP). This plan will comprise strategies for reducing the pollutant loadings from multiple sources to the river that are practical, feasible, and hopefully economically viable. The WPP will then be reviewed by stakeholders and leadership for final blessing.

For the plan to be effective, governments and stakeholders have to buy into the strategies and implement them throughout the watershed. Since the WPP will be based on joint data and not based on any countries laws or policies but instead will be based on joint goals that are backed by each country. To further authorize and solidify the WPP as a binational decision, the plan will undergo an adoption by both countries in either a treaty minute, a binational agreement, or formal declaration signed by both countries. This can then also further the request and movement of resources to assist in the implementation of the strategies.

Conclusion

The Lower Rio Grande Water Quality Initiative was born from the recognition of scientists, engineers, and policy makers from both affected countries to the growing degradation of the mutually shared waters of the Rio Grande/Rio Bravo watershed. Many attempts to jointly address the issue failed to move due to the primary sticking point of whose laws and policies would be used to set the standards and to implement the needed changes. Through the efforts of many, the countries realized that not setting standards or policies based on any country but rather setting mutually agreed goals for improvement would remove the burden of compliance to either countries laws. The initiative then set out to agree on the best science and engineering approaches to gather the necessary data to establish these goals. By setting achievable goals and substantiating those goals through science, the initiative was able to successfully gain the cooperation of many governments and the resources to move forward with the project. The initiative was established through the mechanisms of the country's foreign affairs and technical committees were formed to implement the proposal. To date, the

initiative has gathered data and developed water quality models with very few hurdles to the satisfaction of all involved. Future goals are to establish working strategies to improve water quality in the watershed and solidify the goals in a binational agreement.