GROWING WATER SMART

U.S.–MEXICO BORDER ASSESSMENT

Final Report

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BABBITT CENTER
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BACKGROUND

The Sonoran Institute, with support from the Babbitt Center for Land and Water Policy, is assessing shared water and associated land use challenges for communities along the US-Mexico border. The assessment is intended to develop recommendations for a training and assistance program, modeled along the lines of Growing Water Smart, to improve integration and collaboration around water and land use planning between "sister cities" along the border.[1] While the ultimate design of the training and assistance program has yet to be determined, this report describes opportunities and challenges in developing such a program and suggests possible program initiatives designed to build local capacity around planning and policymaking, binational collaboration, and border-wide learning with an initial focus on green infrastructure.

Over the past seven years, the Sonoran Institute and Babbitt Center have offered Growing Water Smart, a training, technical assistance, and peer-to-peer networking program, to more than 50 communities in Colorado and Arizona. This award-winning program[2] is offered on a competitive basis to communities that have demonstrated a commitment to more effectively integrating local water and land use planning to address gaps in water supply and demand. Each participating community puts together a team of five-to-seven members representing the local water provider or utility, land use planning authority, other government agencies, and non-governmental organizations. These teams attend a three-day training workshop, which has been offered in-person and online, to develop specific actions to integrate water conservation into local land-use plans and policies. Teams are then eligible to apply for technical assistance to implement these actions, which often involve the adoption of new plans and policies. Participating communities are subsequently able to share and learn from each other through exclusive webinars, presentations, and online forums.

Sonoran Institute and Babbitt Center are now exploring opportunities to bring Growing Water Smart to other communities, including U.S.–Mexico border communities. As part of this assessment, we have interviewed more than 30 individuals with knowledge and expertise in cross-border water issues, as well as reviewed relevant studies. A convening of U.S.–Mexico experts is planned for April 2022 to review and affirm the opportunities and challenges we have identified, various approaches to design and implementation of a training and assistance program, and next steps toward development of the program.

[1] The term "sister city" refers to the 15 urbanized areas that span the US-Mexico border. While each city's jurisdiction is limited to its own country, the pair of metropolitan areas are functionally interdependent. These include San Diego/Tijuana, Calexico/Mexicali, Yuma-San Luis / San Luis Rio Colorado, Nogales/Nogales, Naco/Naco, Douglas/Agua Prieta, Columbus/Puerto Palomas, El Paso/Ciudad Juarez, Del Rio/Ciudad Acuna, Piedras Negras/Eagle Pass, Laredo/Nuevo Laredo, Mc Allan/Reynosa, Brownsville/Matamoros.

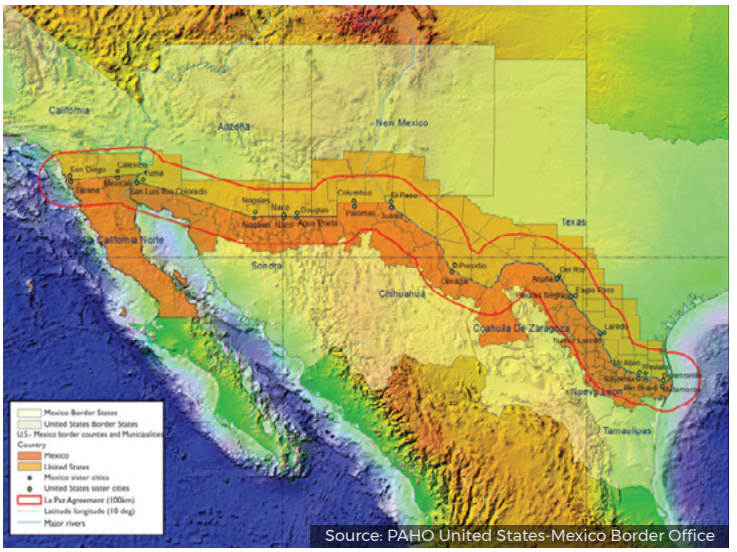
[2] Colorado American Planning Association Honor Award for Environmental Sustainability, 2019.

U.S.–MEXICO BORDER WATER CHALLENGES AND OPPORTUNITIES

The US-Mexico border region is described as the area 100km north and south of the international border, as defined by the 1983 La Paz Agreement. It is comprised of 10 states, 15 sister cities, as well as numerous native nations and tribal lands. Approximately 15 million people live in the border region (PAHO, 2012), many of whom are characterized as primarily Hispanic, and with a per capita income level "well below" the US average (GNEB, 2016). While urbanized areas tend to sustain higher standards of living compared to rural areas, informal settlement and access to affordable housing has left many of the urban poor vulnerable to the effects of climate change (Zuniga, 2020).

Observed temperature increases, changing precipitation patterns, inundation, and exposure to extreme heat events are a few trends expected to continue in the Southwest. The average annual temperature is projected to increase by 2-7 degrees Fahrenheit by mid-century, with some projections showing temperature increases of up to 9.5 degrees by the end of the century (GNEB, 2016). This has critical implications for an already arid region.

Intensified, prolonged, and more frequent droughts and heat waves are projected, along with "decreased precipitation and increased evapotranspiration, contributing to an estimated 700,000 acre-feet per year surface water shortage by 2060" (GNEB, 2016). Decreased snowpack in the upper Rio Grande and Colorado



Source: PAHO United States-Mexico Border Office

River basins will cause downstream surface water shortages, impacting surface water supply, ground water recharge, food and energy productivity, and ecosystem stability. Increasingly intense precipitation events will cause extreme flooding, particularly in urbanized areas with little permeable surfaces for localized stormwater infiltration.

Climate change will have a disproportionate impact on disadvantaged populations who have limited financial and institutional capacity to plan and respond. "Low-income rural and urban residents of border communities, especially communities of color, are more vulnerable to climate risks" (GNEB, 2016, pg. 6). Due to the tendency for more affordable housing to be located in sub-optimal locations, these populations may be more greatly exposed to substandard housing, flood risk, extreme heat,

drought, and poor air quality, while at the same time they may have substandard infrastructure, public health services, planning, and disaster response services.

Population growth will amplify these trends with increased water demand for energy generation, agriculture, manufacturing, drinking water, and sanitation services. Representatives of border communities interviewed commonly report a positive population growth rate, with international commerce, manufacturing jobs, and the possibility of improved livelihoods driving economic activity and in-migration. Despite their unequivocal impact on water demand, Maquiladoras, commercial farms, mining industries, and housing developers are scarcely involved in discussions about water management.[3]

Access to potable water and sanitation services is a prevalent issue, with underinvestment in infrastructure maintenance and operation leading to water loss and contamination. Water supply in sister cities is primarily sourced from transborder aquifers and shared surface water. Re-use of stormwater, treated wastewater, and agricultural return flows are less common and generally underutilized.[3]

Despite being inextricably interconnected economically, socially, and physically, sister cities typically address their water supply and water quality issues unilaterally. Differing levels of infrastructure standards and water management authority on either side of the border, in addition to the physical border wall, create barriers to comprehensive watershed management. Administrative turnover, lack of political will, lack of regulation and enforcement, limited funding, and lack of continuity in planning present challenges to institutionalization and enforcement of water management policy and best practices. A culture of mistrust exacerbates these issues. Conventional border water infrastructure improvement projects tend to be large in scope and focus on surface water supply and water quality issues (i.e., wastewater treatment, agricultural irrigation efficiency).[3]

While already scarce water resources will face increasing competition due to these trends, a history of collaboration around water resource management exists across jurisdictions and scales:

- Minutes of the **1944 International Boundary Waters Commission (IBWC) Treaty** have long been used to negotiate shared water management challenges. For example, in 1958, IBWC Minute 206 established the joint construction and operation of the Nogales International Wastewater Treatment Plant in Ambos Nogales (Petersen-Perlman, 2019). Minutes 227 and 276 determined the water rights and allotted volume of water each country could deliver to the plant (Petersen-Perlman, 2019). Although the IBWC statute formally applies only to surface water, Minute 242, which limited groundwater extraction in Yuma, suggests opportunity for broader application of Minutes (Sanchez & Eckstein, 2017 pg 497). Thus, Minutes may be a

[3] Findings synthesized from municipal planning documents, journal articles, and interviews with border experts, land use planners, and water authorities.

mechanism for addressing both surface water and groundwater demand at the local level.[4]

- The **Transboundary Aquifer Assessment Program (TAAP)** is a groundwater data-gathering partnership between the US Geological Survey, the International Boundary and Water Commission (IBWC), and the Water Resources Research Institutes of Arizona, New Mexico, and Texas (U.S. Geological Survey, 2017). The program addresses the critical importance of understanding aquifer conditions to the survivability of sister communities and produces data and analysis to inform groundwater management on both sides of the border. In 2016, Arizona-Sonora's San Pedro Aquifer became the first joint binational study completed under the agreement. Similar studies were initiated on the Santa Cruz River Basin in Ambos Nogales and the Mesilla and Hueco Bolson Aquifers in El Paso/Ciudad Juarez but have not been completed due to lack of funding.
- The US-Mexico joint environmental program, **Border 2025**, aims to address environmental and public health risks that disproportionately impact disadvantaged populations through bottom-up approaches. Binational funding from the International Boundary and Water Commission (IBWC) and federal agencies Environmental Protection Agency (EPA) and Secretaria de Medio Ambiente y Recursos Naturales, (SEMARNAT) is disbursed through the North American Development Bank in the form of grants, low interest loans, technical assistance, and capacity building (Border 2025, 2021).

Flooding and stormwater management are challenges frequently reported through interviews.[5] In urbanized areas where soils have been paved and natural drainages have been piped and channelized, stormwater cannot infiltrate soil. Water rushes through hardened conveyances with increasing speed and volume causing damage to property and loss of life. Many sister cities are addressing these hazards though localized, cost-effective, green infrastructure techniques. Green infrastructure methods can mitigate flood impacts by mimicking natural hydrological processes and capture stormwater for beneficial use. Permeable materials, soil stabilization, and localized small-scale catchment basins built of natural materials slow stormwater, capture it, and may allow it to be absorbed into the earth (Giner et al, 2019).

Many of these stormwater catchment techniques are ancient, being practiced by Native and Indigenous populations prior to European colonization and have long been practiced informally throughout the Southwest and Mexico. In recent years the terms Green Infrastructure (GI), Low Impact Development (LID), and Nature-Based Solutions have emerged to encompass city-scale application of these practices to address myriad water issues including flood hazard mitigation,

[4] These findings were validated through an interview with former CILA commissioner Roberto Salmón in November 2020.

[5] Other challenges cited by interviewees included the need for new infrastructure investments to increase water and wastewater access for existing and new development, upgrades to aging infrastructure to reduce system loss, and investments in conventional infrastructure to address flooding and other water-related hazards. While historically underfunded, these investments are being addressed through other border programs.

soil stabilization, supply for outdoor irrigation, tree canopy to reduce urban heat island, and pre-treatment of agricultural return flows.[6]

A remarkable amount of programming and promotion of green infrastructure has occurred throughout the border region in the last decade likely due to the low-cost, small-scale, and simple nature of interventions. Also, numerous opportunities exist within Mexico's legal framework for promoting green infrastructure locally[7] (Vera Morales, L., & Peñaloza Horta, M., 2015). A major program was carried out under Border 2025's predecessor, the Environmental Border Cooperation Commission/La Comisión de Cooperación Ecológica Fronteriza from 2014-2017. The Border Green Infrastructure Initiative engaged border communities to partake in training, receive technical assistance, and funding for pilot projects. The outcomes were hydrological models that informed green infrastructure suitability; demonstration of GI benefits for development of best practices; adjustments of state legal frameworks to enable local GI adoption; development of model design manuals and technical standards; and incorporation of GI into municipal ordinances and enforceable land use policies (Giner et al, 2019). These and other local initiatives, on both sides of the border, provide case studies, best practices, and lessons learned that have the potential for scaling up GI across the border.

Photo by Alejandro Hernández Ortiz

HERMOSILLO – When the city's Urban Planning Institute, Instituto Municipal de Planeación Urbana (IMPLAN), conducted growth scenario studies to identify strategies for managing its urban expansion, it realized the potential application of GI to address urban heat, walkability, and flooding (Peñúñuri, 2021). In collaboration with Watershed Management Group, IMPLAN developed Green Infrastructure

[6] For examples, see:

www.epa.gov/green-infrastructure/what-green-infrastructure

www.epa.gov/nps/urban-runoff-low-impact-development#:~:text=The%20term%20low%20impact%20development,quality%20and%20associated%20aquatic%20habitat

www.gob.mx/cms/uploads/attachment/file/394115/Hoja_de_ruta_IV_Infraestructura_Verde.pdf

www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions#:~:text=Nature%2Dbased%20Solutions%20(NbS),%2Dbeing%20and%20biodiversity%20benefits%E2%80%9D

www.colef.mx/noticia/ecoparque-laboratorio-de-resiliencia-urbana

[7] A 2015 study of Mexico's legal framework by Vera & Asociados for the Border Environmental Cooperation Commission identifies opportunities and constraints for the inclusion of green infrastructure in border municipalities. The study reveals the ample authority municipalities have to capture stormwater.

Design Guidelines in 2017—a model and the first of its kind in Latin America (Giner et al, 2019). A study and adjustment of state law enabled a local ordinance which now mandates GI in new public spaces and commercial development. Numerous projects throughout the city demonstrate the successful scaling of GI pilots into policy (Peñúñuri, 2021).

TUCSON – In 2020, the City of Tucson adopted a new Green Stormwater Infrastructure fee levied on water utility customers. The fee is expected to raise about $3M annually to build and maintain hundreds of green infrastructure features across the city. This effort builds on more than 20 years of increased city-wide commitments that encourage the capture of rain and stormwater, led largely by neighborhood activists and non-governmental organizations, like Watershed Management Group (Gerlak, A., et al. 2021).

JUAREZ – The State of Chihuahua has been driving the integration of green infrastructure into the built environment to address flooding. Various state laws and city policies addressing climate change and urban ecology enable green infrastructure (Giner et al, 2019). In 2017, a pilot project retrofitted Avenida Valle del Sol with natural stormwater catchment features. Now the state is leveraging an International Bridge Trust Fund to incorporate GI into eight "mega" infrastructure projects, including a major renovation of the city's Parque Central. The park includes storage capacity of adjacent street runoff of around 227 acre-feet through various infiltration basins (Cambio.gob.mx, 2021).

AMBOS NOGALES – Transboundary collaborations have emerged in Ambos Nogales to strategically address flooding and stormwater management from top down and bottom up. While grassroots organizations and universities team up to prioritize and implement localized stormwater catchments with green infrastructure, city planning institutions, county governments, and state environmental officers are partnering to leverage EPA funding to implement a strategic stormwater management plan across both cities (Lara-Valencia, 2022; Lara-Valencia, et. al., 2022; and Gill, 2021).

MEXICALI FLUYE – The community-driven effort focuses on the drains that carry runoff from farmlands and help prevent flooding in Mexicali. Local neighborhoods helped clean up these ditches, turning them into green corridors. With assistance from the Sonoran Institute, more than 200 school children and local residents removed more than 4,000 cubic meters of trash, built a community park, and organized educational activities to prevent illegal dumping and promote recycling of solid waste. The Sonoran Institute hopes to expand the program to other drainages in Mexicali and eventually to Calexico (Sonoran Institute, n.d.).

SANTA CRUZ RIVER, LAS ARENITAS TREATMENT WETLANDS, AND ECOPARQUE TREATMENT WETLANDS – These various examples show how treated effluent can sustain flowing river stretches in the US and MX, recharge aquifers, create wetlands that improve wastewater treatment capacity, and provide for wildlife habitat and recreational opportunities.

As these and other case studies attest, there is an opportunity to leverage and scale up these successes and reinforce collaborations through direct training and assistance, building frameworks for continuity of action, peer-sharing networks for lesson sharing, and reframing the border mindset to a wholistic watershed/aquifer culture.

To summarize:

Faced with ongoing drought, climate impacts, and population growth, border communities will continue to face climate-related water vulnerabilities that in numerous instances transcend jurisdictional and national boundaries.

In both the US and MX, local jurisdictions have significant authority to influence water resource and land use decisions that address these climate-related vulnerabilities. However, collaboration and continuity in planning and policymaking, and funding and resource constraints will remain challenges. Any training and technical assistance program targeting border communities must address these challenges.

We believe advancing further implementation of green infrastructure is an appropriate area of focus for such a training and assistance program because of its:

- Successful application in border communities in the US and MX, albeit at a modest scale.
- Relative low-cost compared to conventional infrastructure in increasing community climate resilience.
- Reliance on an underutilized set of water resources, including stormwater, treated wastewater, and agricultural return flows.
- Potential adoption through local water management and land use policies.

Green infrastructure offers multiple benefits to communities, including:

- Encouraging water reuse.
- Improving water quality and enhancing aquifer recharge.
- Maintaining and restoring wildlife habitat and providing outdoor recreational opportunities.
- Addressing multiple climate impacts such as flooding and urban heat island.

RECOMMENDATIONS FOR A PROPOSED BORDER GROWING WATER SMART PROGRAM

Three program opportunities are presented in this report designed to advance implementation of green infrastructure in border communities. Each could serve as a stand-alone program or could be developed in combination with one or both other initiatives. We describe each briefly and highlight questions that we hope to discuss at our April convening.

PROGRAM OPPORTUNITY #1: Training and assistance program

Develop a training and technical assistance program designed for individual jurisdictions (municipalities and counties) along the U.S.–Mexico border around the integration of water and land use planning to advance green infrastructure implementation.

This proposed program would follow the approach taken in developing our Growing Water Smart Program, including the following key features:

- a competitive application process;
- multi-disciplinary teams representing participating communities; and
- a multi-day training workshop followed by technical assistance to achieve project implementation.

Prior to offering the program, we would develop a strategic step-by-step approach to green infrastructure integration that builds on the comprehensive strategic framework resulting from the Border Environment Cooperation Commission's four-year Green Infrastructure Forum. This updated strategic framework would help guide development of training materials and workshop curriculum focused on best practices and lessons learned around green infrastructure planning and policymaking. (*See Appendix A for a preliminary description of the strategic framework.*)

A binational advisory committee, drawn from border experts and local authorities we have interviewed, would provide input on development of the strategic framework and program resources. These resources will include a bilingual guidebook describing the strategies and actions that comprise each step and case studies of best practices and lessons learned, a training workshop agenda, and a request for applications to participate in the program.

We note that our proposed comprehensive strategic framework focuses on green infrastructure using not only stormwater but also treated wastewater and agricultural return flows. We believe all three sources of water are

PROGRAM OPPORTUNITY #1, *CONT.*

underutilized to support green infrastructure and acknowledge that no one source of water or strategy to deploy green infrastructure will be applicable to all border communities.

Possible outcomes resulting from participation in the program

- Research or data collection that identifies specific opportunities to advance green infrastructure or demonstrate the benefits of green infrastructure.
- Development and adoption of jurisdictional plans (municipal, comprehensive, or general plans, etc.) describing the integration of water and land use planning to advance green infrastructure with detailed implementation strategies.
- Development and adoption of specific jurisdictional policies to integrate water and land use plans to advance green infrastructure, including design standards, water use ordinances, or land use zoning, with specific enforcement strategies.
- Development and adoption of funding mechanisms or other programs that mandate or incentivize the integration of green infrastructure in water infrastructure or land development.

We propose "pilot testing" the program with U.S.–Mexico border communities that have demonstrated a willingness to advance green infrastructure through integration of water and land use planning, policymaking, or pilot projects. An evaluation of this pilot program would allow for additional improvements to the program before offering it widely to border communities. This would likely take two years to pilot, from program development through evaluation.

Ultimately, communities along the entire U.S.–Mexico border would be eligible to apply to participate in the training and assistance program. Typically, five to seven communities are selected to participate in each round of training and assistance.

Questions we have

1. Are the key features of the Growing Water Smart Program applicable to a binational program?
2. Is it realistic to offer this program simultaneously to US and MX communities? What modifications to the program would be required?
3. Which border communities have advanced green infrastructure implementation that would make them good candidates for the pilot program?
4. What are appropriate metrics to evaluate the effectiveness and impact of this program?

PROGRAM OPPORTUNITY #2: "Sister city" collaboratives

Support "sister city" collaboratives around green infrastructure planning and decision-making that are enduring despite turnover in federal, state, and local leadership.

This proposed program addresses the challenge that leadership continuity and turnover pose to binational collaboration to address specific shared water issues among "sister cities." These collaboratives may be locally focused but because of the binational nature of the issues being addressed require engagement of both state and federal officials in the US and MX. This program seeks to define the level of process and technical support required to ensure that these binational collaborations are enduring despite changes in leadership.

Prior to offering the program, we would review current and past binational collaborations to determine best practices and lessons learned from these efforts, particularly around the resources needed, support provided, and the roles and responsibilities of key stakeholders.

We propose "pilot testing" the program with a pair of sister cities that have demonstrated a willingness to collaborate around a particular issue (stormwater management, re-use of treated wastewater, river restoration, etc.). An evaluation of this pilot program would determine what would be the most effective way to support multiple binational collaboratives (direct support, a border-wide training and assistance program, peer networking, etc.). This program would likely take two years to implement and assess the level of support needed over the long term.

We note that there is overlap between this and the first program opportunity, in that communities trained and assisted in the integration of water and land use planning within individual jurisdictions may also identify a need for collaboration across jurisdictions including cross-border collaboration.

Possible outcomes resulting from participation in the program

- Shared research or data collection that identifies specific opportunities for sister cities to collaborate to advance green infrastructure or demonstrate the benefits of green infrastructure.
- Development and adoption of binational plans, frameworks, or agreements describing the integration of water and land use planning to advance green infrastructure with detailed implementation strategies.
- Development and adoption of specific complimentary policies between sister cities that integrate water and land use plans to advance green infrastructure, including design standards, water use ordinances, or land use zoning, with specific enforcement strategies.

PROGRAM OPPORTUNITY #2, *CONT.*

- Development and adoption of joint funding mechanisms or other programs that mandate or incentivize the integration of green infrastructure in water infrastructure or land development.

Questions we have

1. What kinds of support (technical, stakeholder facilitation, etc.) would be needed? What is a reasonable timeline to assess impact and sustainability of such a framework?
2. Which "sister cities" have demonstrated a willingness to collaborate around water issues that would make them good candidates for the pilot program?
3. What are appropriate metrics to evaluate the effectiveness and impact of this program?

PROGRAM OPPORTUNITY #3: Peer learning network

Develop a border-wide peer-to-peer learning network around green infrastructure to share new, innovative plans, policies, and programs.

There has been considerable work and resulting accomplishments in border communities around green infrastructure since the conclusion of BECC's four-year Border Green Infrastructure Forum. Our proposed training and assistance program would allow for some deep learning around these efforts but with only a small group of communities on an annual basis. This program opportunity would be designed to reach as a wide an audience as possible, targeting (but not necessarily limited to) water providers or utility managers and land use planners in the US and MX.

There is no shortage of information dissemination, learning opportunities (meetings, webinars, conferences, etc.), and professional associations related to water resource management and planning. However, most of these opportunities are organized for specific professions or areas of technical expertise that rarely extend across multiple disciplines. Additionally, most learning is passive, leaving a significant learning gap in communities of practice interested in integrating water into land use.

Sonoran Institute and Babbitt Center have experience in developing peer learning networks. For prior networks in the US, we have conducted surveys of potential participants, researched effective peer networks, and

PROGRAM OPPORTUNITY #3, *CONT.*

evaluated various platforms that host such networks. When we have surveyed land use planners and water resource managers on learning networks, we have heard that the most valuable features, according to participants surveyed, of such a network involve: 1) learning from peers, 2) opportunities for two-way communication, 3) balancing formal and informal learning, 4) strategic communications, and 5) provision of a clearinghouse of information.

We propose creating a peer network focused on strengthening professional knowledge and skills by providing opportunities to learn about green infrastructure initiatives and share individual experiences advancing green infrastructure, as well as access to resources, studies, and news related to green infrastructure plans, programs, and projects. As a possible binational network, there are some unique challenges that we will need to address in terms of overcoming language barriers, identifying topics that will be relevant to the widest audience on both sides of the border, how to structure discussion-oriented learning opportunities, and what platforms may be more effective.

As an alternative to surveying potential participants in designing the network, we suggest hosting an online conference in the spring of 2023 to feature much of the innovative work that has occurred in the last five years. The research undertaken as part of developing the training and assistance program would allow us to develop the content of this proposed convening, while the conference could help us assess level of interest in building a community of practitioners supported by a peer network.

Possible outcomes resulting from participation in the program

- Development of a research agenda that identifies specific opportunities for U.S.–Mexico border communities, academic institutions, and government agencies to collaborate to advance green infrastructure or demonstrate the benefits of green infrastructure.
- Development of training curriculum and other resources (webinars, speakers' bureau, etc.) around the adoption of binational plans, frameworks, or agreements describing the integration of water and land use planning to advance green infrastructure with detailed implementation strategies.
- Development of training curriculum and other resources around model policies, best practices, and lessons learned to integrate water and land use plans to advance green infrastructure.
- Development of training curriculum and other resources around funding mechanisms or other programs that mandate or incentivize the integration of green infrastructure in water infrastructure or land development.

PROGRAM OPPORTUNITY #3, *CONT.*

- New leadership at the local, state, and federal levels in the U.S.–Mexico who will advance integration of water and land use planning to advance green infrastructure.

Questions we have

1. Do we have the right target audience (water providers and land use planners in US and MX)? Are there other key audiences, like public works departments and floodplain managers, that we should target?
2. Are the most valuable features of a network identified by US land use planners and water resource managers also applicable in MX?
3. Is a virtual border-wide convening an effective way to launch or promote a peer network?
4. Are there existing online platforms or programs, possibly on other topics, that we should look at as models for designing a peer network?
5. What are appropriate metrics to evaluate the effectiveness and impact of this program?

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APPENDIX A: DRAFT/SAMPLE OF A COMPREHENSIVE GREEN INFRASTRUCTURE FRAMEWORK

Establish Strategic Partnerships

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Identify champions (federal, state, local, NGOs, universities) to create political will for GI • Develop targeted and sustained communications campaign that makes the case for GI	• Engage in public-private partnerships • Build coalitions or alliances • Earn trust and leverage long-established relationships	• CESPM-SI-TNC Partnership for Las Arenitas Wastewater Treatment Plant Upgrades • IMPLAN Hermosillo with the State of Sonora, IDB, NADB, Harvard, Watershed Management Group • Ambos Nogales Technical Working Group spanning state and local jurisdictions • Local grassroots organizations, Watershed Management Group, and City of Tucson	• Formalize agreements using a range of tools (MOUs, cooperative agreements, consulting contracts, grant agreements) • Create partnerships across jurisdictions to scale impact, aggregate financial resources, and leverage other funding sources • Support and invest in neighborhood groups and non-governmental organizations that can serve as early GI innovators and entrepreneurs and advocates for local policies that further advance GI

Develop Technical Tools

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Develop guidelines to encourage best practices and innovation around GI • Generate information on the challenges and opportunities for the adoption of GI	• Hydrologic modeling • GIS/mapping • Design manuals and technical standards • Scenario development	• Tucson and Watershed Management Group's GI design manual • Hermosillo's technical GI design manual and native plant palette • Hermosillo's growth scenarios study, Rethinking Hermosillo • Arizona State University and Semillas use of USGS hydrologic modeling for GI prioritization in Nogales	• Design land suitability analyses to determine where GI may be best located so that it not only incorporates land use and physical landscape characteristics, but also broader ecological and social/equity considerations • Develop GI design manuals, programs, and policies that can be implemented simultaneously at various scales (individual lot/parcel, neighborhood/subdivision, and municipality/county)

Provide Legal Frameworks

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Establish state laws and municipal regulations to provide for GI • Adopt plans and policies that integrate water and land use planning • Ensure that the benefits of GI are equitably distributed within jurisdictions and across the border	• State enabling legislation • Local ordinances • General, comprehensive, or municipal plans • Climate adaptation, stormwater master plans • GI master plans	• Tucson's integration of GI into the development code • Hermosillo's mandatory GI ordinance • Modification of two state laws and a city law to enable GI in Nogales, Sonora	• Ensure that federal or state regulatory frameworks clearly designate authority and provide guidance to local jurisdictions around water re-use • Adopt local water management, municipal development, and comprehensive land use plans that identify specific GI goals and implementation strategies • Mandate that new development meet at least half of their landscaping water needs through rainwater harvesting

APPENDIX A, *CONT.*

Implement Pilot Projects

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Carry out site-specific projects that allow the public to experience and increase their awareness of GI • Engage the community in the planning and construction of pilot projects	• Public spaces and rights-of-way • Commercial and residential • Industrial • Riparian corridors • Agricultural drainages • Wastewater treatment plants • Schools	• Hermosillo adopt a median program • Juarez retrofit of Avenida Valle del Sol • Nogales sediment control in DIF Park and demonstrations in the Instituto Technológico de Nogales • Mexicali Fluye • Tucson's Dunbar Springs neighborhood	• Support neighborhood-driven efforts to implement GI pilot projects, providing resources to build and maintain such projects • Prioritize projects with high visibility to allow for broad public education on the benefits of GI and value of stormwater, treated effluent, and agricultural return flows • Initiate pilot projects in public spaces to demonstrate local government's commitment to GI

Build Capacity

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Institute programs that inform and build knowledge around GI	• Rainwater harvesting workshops and certification • Developer education and outreach	• BECC Green Infrastructure Initiative • Watershed Management Group trainings • GIZ and InterAmerican Development Bank • North American Development Bank's Utility Management Institute	• Respect sovereignty in data collection while encouraging broad dissemination of critical information to support decision making • Establish regular communication and formal consultations among jurisdictional departments around integration of water and land use planning • Target educational efforts around key professional groups, including architects, landscape architects, engineers, landscapers, developers, homebuilders, banks and lenders, and realtors

Create Sustainable Funding

STRATEGIES	ACTIONS	MODELS	BEST PRACTICES
• Establish long-term funding mechanisms to scale up, maintain, and monitor GI	• Utility customer charges • Earmark % of CIP projects	• Juarez's International Bridge Trust • Tucson's Green Stormwater Infrastructure Fund • World Resources Institute Ross Center's GI programs for Mexican Cities	• Build a case for funding GI that describes and quantifies its multiple benefits, as well as its cost-effectiveness relative to conventional infrastructure • Earmark a portion of flood mitigation funds for GI • Finance GI construction and maintenance through fees on water utility bill • Levy a local "green infrastructure tax" on specific economic activities that have a disproportionate impact on water resources (e.g., waste disposal, dirt and gravel operations, high water-use industries). • Facilitate investments in GI through the North American Development Bank's "Green Bond" program.