

Promote a Culture of Integrated Stewardship of the Estuarine System, Its Watershed, and Related Ecosystems

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32 **Community Engagement In Restoration and Conservation**

33 **Baseline**

34 Community engagement is fundamental to the long-term success of conservation, restoration,
35 reconstruction, and/or remediation in the San Juan Bay Estuary (SJBE). Restoration projects deliver
36 the greatest ecological and social returns when local people are meaningfully involved. Residents
37 contribute labor and local ecological knowledge, schools supply steady streams of youth participants
38 and future practitioners, and community groups sustain stewardship and advocacy long after initial
39 project funding ends. Estuario has a documented history of outreach including visitor center
40 exhibits, public campaigns, large-scale planting events with volunteers, and multi-sector
41 consultation, which provides a tested institutional foundation on which to build a more systematic
42 suite of engagement programs. The 2016 Estuario Plan describes these prior public participation
43 efforts and recommends longitudinal methods for measuring and expanding knowledge about the
44 estuary and its ecosystems (Estuario, 2016).

45 To transform engagement into measurable conservation outcomes, program design must
46 intentionally connect education, volunteer opportunities, and technical support. Outside-of-school
47 Science, Technology, Engineering, and Mathematics (STEM) programs offer hands-on, flexible
48 environments where students can develop confidence, deepen STEM skills, and explore career
49 pathways in natural-resource fields. Research and practitioner reports show that out-of-school time
50 STEM learning increases interest and attainment in STEM, particularly for girls and youth of color,
51 while also addressing learning time constraints faced by traditional classrooms. Barriers to STEM
52 programs exist, limiting access to these programs for many young people (Neitzey, 2021). Increasing
53 access to STEM programs for all youth in the SJBE is key for the success of these programs. The
54 Forbes analysis of outside-of-school and summer STEM programming underscores the role these
55 settings play in building STEM identities and preparing students for careers that may not yet exist.
56 This flexibility is crucial for training youth in emerging tools and techniques used in contemporary
57 restoration science (Ottinger, 2024).

58 While classroom lessons can introduce essential scientific concepts, outside-of-school programs
59 such as summer camps, guided field visits, and internships also give students hands-on
60 opportunities to practice monitoring and restoration techniques. Estuario's existing education
61 initiatives demonstrate how curriculum materials and volunteer training can be designed so that
62 learning produces tangible contributions to restoration work and creates pathways to further
63 engagement (Estuario, 2025). These experiences help students move from awareness to applied
64 skills and prepare a local pool of volunteers, citizen scientists, and future practitioners.

65 Citizen science, which creates and applies scientific methods through collaborative models between
66 professional scientists and the general public, and structured volunteer monitoring, in which
67 community members collect and analyze data, can supply high-value ecological data and broaden
68 the base of active stewards in the community. The National Oceanic and Atmospheric
69 Administration's (NOAA) community science and restoration guidance highlights how volunteer
70 programs, when paired with standardized methods and technical oversight, produce data useful for
71 adaptive management while engaging thousands of volunteers and generating substantial in-kind
72 contributions to restoration work (NOAA, 2024).

73 Estuario has a Citizen Scientist certification that allows interested participants the opportunity to
 74 train in one of four modules: (1) Water Quality Monitoring, (2) Participatory Bird Censuses, (3)
 75 Characterization and Reduction of Microplastics, and (4) Coastal Resilience. Each module includes
 76 both virtual workshops and field experiences that must be completed to receive a certification. A
 77 participant can become certified in one or more modules by successfully completing all
 78 requirements of each module. This existing certification can be expanded to include an engagement
 79 strategy for K-12 students by providing out-of-school programming with field experiences,
 80 workshops, or other educational activities. These elements reinforce one another, because youth
 81 who develop skills in out-of-school programs may eventually become certified citizen scientists and
 82 later serve as volunteer leaders or restoration technicians, which produces both ecological benefits
 83 and local workforce development.

84 By embedding accessibility, data rigor, and career pathways into engagement programming,
 85 Estuario can convert community energy into measurable action, improved water quality monitoring
 86 coverage through citizen scientists, and a resilient local team of restoration professionals and
 87 stewards.

88 Objectives

- 89 • Ensure opportunities for communities to engage in restoration and conservation efforts.

90 Actions

91 *PI-03, PI-04, PI-06 Establish long-term education and outreach programs to provide the public with*
 92 *effective and organized volunteer opportunities to further conservation, restoration,*
 93 *reconstruction, and/or remediation efforts.*

94 Activities

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Strengthen and expand K-12 education and out-of-school learning pathways focused on conservation, restoration, reconstruction, and/or remediation of ecosystems.	Increase participation rates in K-12 programming.	Created at least one out-of-school educational program focused on conservation, restoration, reconstruction, and/or remediation.	Lead: Estuario Implementing partners: Puerto Rico Department of Education (PRDE), community stakeholders and organizations	Pending	5+ years	TBD	USEPA, PRDE
2. Create youth-to-career experiential programs that connect students with professional practice.	Increase collaboration with community stakeholders that provide career programming and/or mentorship	Collaborated with academia and organizations to develop the program framework.	Lead: Estuario Implementing partners: PRDE, community stakeholders and organizations, academia	Pending	5+ years	TBD	USEPA, PRDE

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
	opportunities for students.						
3. Strengthen and expand the citizen science certification.	Increase the number of citizen scientists undertaking conservation, restoration, reconstruction, and/or remediation projects and identify their impacts.	Increased the number of certified citizen scientists.	Lead: Estuario Implementing partners: Puerto Rico Department of Natural and Environmental Resources (DNER), PRDE, academia	Pending	0-2 years	TBD	USEPA, PRDE, DNER
4. Promote professional development through seminars, conferences, and collaboration.	Measure enrollment and participation in ongoing programs and expand network of opportunities.	Created new seminars, conferences, and collaborative opportunities.	Lead: Estuario Implementing partners: PRDE, academia	Pending	5+ years	TBD	USEPA, PRDE
5. Provide equitable access and sustained participation through financial support and inclusive outreach.	Measure enrollment and participation in ongoing programs and identify gaps in geographic and socioeconomic groups.	Created an inclusive outreach strategy to identify participants.	Lead: Estuario Implementing partners: PRDE, academia	Pending	5+ years	TBD	USEPA, PRDE

95 **Regulatory and Policy Requirements**

96 None.

- 97 ****NEW-1* Identify and develop conservation, restoration, reconstruction, and/or remediation***
 98 ***projects in the SJBE that can be community-led and organized.***

99 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Work with community leaders and/or members to identify areas that need conservation, restoration, reconstruction, and/or remediation and have the potential for community-led efforts.	Determine community interest and willingness to engage in conservation, restoration, reconstruction, and/or remediation efforts.	Performed detailed ecological assessments of potential conservation, restoration, reconstruction, and/or remediation areas with community members.	Lead: Estuario, municipalities Implementing partners: PRDE, community stakeholder groups, DNER	Pending	0-2 years	TBD	USEPA, DNER, municipalities
2. Work with community leaders and/or members to develop proposals for conservation, restoration, reconstruction, and/or remediation projects.	Measure community member participation in proposal efforts.	Drafted proposals for conservation, restoration, reconstruction, and/or remediation projects in communities.	Lead: Estuario, municipalities Implementing partners: PRDE, community stakeholder groups, DNER	Pending	3-5 years	TBD	USEPA, DNER, municipalities
3. Engage and empower community leaders to organize and activate their local community to participate in conservation, restoration, reconstruction, and/or remediation projects.	Establish targets for the number of recruited volunteers for conservation, restoration, reconstruction, and/or remediation projects.	Organized community members that meet regularly to discuss Estuario's projects and the community's active participation.	Lead: Estuario, municipalities Implementing partners: PRDE, community stakeholder groups, DNER	Pending	0-2 years	TBD	USEPA, DNER, municipalities

100 **Regulatory and Policy Requirements**

101 None.

102 **References**

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117 [and-summer-stem-programs-for-the-future-workforce/](https://www.forbes.com/sites/forbesnonprofitcouncil/2024/01/22/the-importance-of-after-school-and-summer-stem-programs-for-the-future-workforce/).

118 Education

119 Baseline

120 Education underpins Estuario’s ability to sustain conservation, restoration, reconstruction, and/or
121 remediation into the future. To achieve this goal, a strategic education program is essential, as it
122 builds local knowledge about how the estuary works, explains human influences on ecological
123 processes, and creates the skills needed for community members to lead and take part in
124 restoration projects. Estuario’s prior planning and outreach work provides a foundation for
125 expanding education across the watershed and aligning materials and programs with restoration
126 goals (Estuario, 2016).

127 One effective approach to engage the community is through place-based interpretation and signage,
128 which serve as practical starting points for reaching a broad audience. Well-sited educational signs
129 and a coordinated wayfinding system at bridges, parks, marinas, ports, waterfronts, and other
130 locations make the estuary visible in everyday life. This visibility helps residents and visitors
131 recognize the SJBE boundaries and understand its functions. Long term research on interpretive
132 signs shows that messages tied to local context increase understanding and repeated exposure can
133 prompt people to seek further information or participate in on-site activities (Cagle, 2025). When
134 signs are integrated with visual art, historic storytelling, or interactive elements they can also reflect
135 community identity and attract interest from people who might not otherwise engage with
136 environmental topics (Cagle, 2025).

137 Moreover, public materials and communications must be designed for accessibility and continuity.
138 Handbooks, brochures, and infographics should use clear language and be available in Spanish and
139 English. While printed materials can work well for distribution at community centers and schools, a
140 coordinated communications plan can extend reach through social media, local media partnerships,
141 and on-site programming. In-person activities, such as conferences, volunteer trainings, educational
142 fairs, and festivals, can also be opportunities for education. Estuario can serve as a convening
143 organization to coordinate these channels and to help municipalities, schools, and community
144 groups share consistent messages across the watershed (Estuario, 2016).

145 Finally, it is vital to incorporate evaluation and adaptive improvement into every educational activity.
146 Simple metrics such as the number of participants, repeat attendance, materials distributed, guided
147 tours conducted, increased public understanding and student projects completed will indicate
148 whether programs are achieving their goals. Collecting feedback from teachers, students, and
149 community members will help Estuario refine content and delivery and will support efforts to secure
150 sustained funding.

151 By combining place-based interpretation, scaffolded learning pathways, accessible materials, and
152 regular evaluation, Estuario’s education program can expand public understanding, create practical
153 skills for restoration, and increase community capacity to care for the estuary for years to come.

154 Objectives

- 155 • Build capacity for communities to lead and participate in restoration and conservation
156 projects.

157 **Actions**158 ***PI-02 Post educational and interpretive signs at highly visible, heavy traffic areas throughout the***159 ***SJBE watershed (bridges, roads, parks, marinas, ports, waterfronts) to educate the public on the***160 ***system's components, functions, and values.***161 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Develop a wayfinding project in strategic locations using billboards, road signs, and other methods that increase spatial awareness about the SJBE and show how the public engages with and lives within the SJBE.	Install way-finding elements within the SJBE watershed.	Identified key locations for wayfinding installations.	Lead: Estuario Implementing partners: community stakeholders, DNER, DTO, municipalities, Puerto Rico Ports Authority	Pending	3-5 years	TBD	USEPA, municipalities
2. Implement innovative approaches to educate and raise awareness about the evolution of the estuary.	Increase in community participation in educational programs.	Identified key themes to include in educational opportunities for the public.	Lead: Estuario Implementing partners: local artists and organizations, municipalities	Pending	0-2 years	TBD	USEPA, municipalities, community stakeholders
3. Design and offer supplementary workshops, guided tours, and on-site lectures that supplement and strengthen existing educational and interpretive signs.	Increase attendance and participation in supplementary educational activities.	Created promotional materials and outreach strategies to inform the community about new programming.	Lead: Estuario Implementing partners: community stakeholders, municipalities	Pending	3-5 years	TBD	USEPA, municipalities, community stakeholders

162 **Regulatory and Policy Requirements**

163 None.

164 ***PI-07 Expand the scope of Estuario's public education and outreach activities.***165 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Create a network of stakeholders to coordinate actions related to community education and outreach.	Increase collaboration on initiatives and projects launched within the network that address community education and outreach needs.	Identified needs within communities such as out-of-school programs and summer camps.	Lead: Estuario Implementing partners: municipalities, community organizations, academia	Pending	0-2 years	TBD	USEPA, municipalities

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
2. Collaborate with private sector groups such as hotels, restaurants, and port facilities on community education and outreach opportunities.	Increase collaboration with the private sector that addresses community education and outreach needs.	Created a signed memorandum of understanding that supports the collaboration.	Lead: Estuario Implementing partners: private sector, Puerto Rico Ports Authority, community organizations, municipalities	Pending	0-2 years	TBD	USEPA, private sector companies

166 **Regulatory and Policy Requirements**

167 None.

168 ***PI-13 Develop a series of handbooks, brochures, infographics, and other educational materials, resources, and tools for the public to educate on the importance of the entire SJBE system and factors that affect water quality.***

169

170

171 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Collaborate with scientists, educators, and local stakeholders to gather insights and expertise on the content of educational materials.	Collect feedback from stakeholders.	Communicated with stakeholders and discussed the goals of the educational materials.	Lead: Estuario Implementing partners: PRDE, academia, local stakeholders	Pending	0-2 years	TBD	USEPA
2. Develop educational materials in various formats to provide proper accessibility and visibility.	Measure the reach of the materials across different formats.	Created visually appealing educational materials that are engaging and easy to understand.	Lead: Estuario Implementing partners: PRDE, academia, local stakeholders	Pending	3-5 years	TBD	USEPA
3. Develop a distribution plan for the educational materials.	Include sectors from across the entire SJBE watershed in the distribution plan.	Created a distribution plan that targets a variety of audiences.	Lead: Estuario Implementing partners: PRDE, local stakeholders	Pending	0-2 years	TBD	USEPA

172 **Regulatory and Policy Requirements**

173 None.

174 **References**

175 Cagle, N. 2025. Long-term research on interpretive signs. Nicholas School of the Environment, Duke University. <https://sites.nicholas.duke.edu/nicolettecagle/cagle-lab/environmental-education-identity/long-term-research-on-interpretive-signs/>.

176

177

178 Estuario. 2016. First Update: Comprehensive Conservation and Management Plan for the San Juan Bay Estuary (Chapter 7: Citizen Participation and Education).

179

180 **Raising Awareness**

181 **Baseline**

182 Raising public awareness is a critical step toward changing everyday behaviors that affect the SJBE.
183 Increased awareness helps people understand how individual choices contribute to stormwater
184 pollution, habitat degradation, and marine debris, and supplies clear, actionable steps that
185 residents, businesses, and visitors can take to reduce harm. The 2016 CCMP recognizes public
186 outreach and education as cornerstones of community stewardship, and it documents Estuario's
187 past efforts to inform and involve citizens across the watershed (Estuario, 2016). Building on that
188 foundation, a targeted awareness program can move people from passive knowledge to active
189 responsibility.

190 Beyond information, awareness activities should make it easy for people to act. Tools that translate
191 concern into concrete reporting and response pathways can increase civic participation and reduce
192 the lag between observation and official action (Brown, 2025). A public reporting platform where
193 residents can submit observations about pollution, illegal dumping, and/or habitat damage helps
194 document problems and connects community members to the right agencies for response. When
195 designing such a system, it is important to align reporting channels with municipal procedures and
196 set clear expectations about response times and priorities so users know how reports will be
197 managed. Evidence from municipal reporting platforms shows substantial public uptake but also
198 highlights the need to manage legal and administrative implications and to coordinate protocols
199 among agencies that will receive reports (Brown, 2025).

200 Effective awareness work must also be culturally relevant, accessible, and evaluated. Messaging
201 should be developed with input from local communities so that content reflects place-based
202 experiences and language preferences. Materials should be available in Spanish and English and
203 distributed at venues where people already gather. Evaluation should track both reach and
204 outcomes, including metrics such as number of reports submitted through the public reporting
205 system, number of pledges taken, participation in related events, and qualitative feedback from
206 community partners. Regular review of these metrics will allow Estuario to refine messages and
207 channels and to demonstrate progress to partners and funders.

208 Finally, awareness programs should be integrated into Estuario's broader education and
209 engagement efforts so that learning, volunteering, and reporting reinforce each other. Clear signage
210 and wayfinding can raise curiosity that is then satisfied by workshops, internships, and volunteer
211 conservation, restoration, reconstruction, and/or remediation projects. A public reporting system
212 can surface local problems that become the focus of community cleanups and education
213 campaigns. When used together, these elements translate increased awareness into measurable
214 actions that reduce pollution, restore habitat, and strengthen stewardship of the SJBE.

215 **Objectives**

- 216 • Transform population behaviors to take responsibility for the estuarine system.
- 217 • Embrace a variety of mediums for communicating and raising awareness about the
- 218 importance of restoring and conserving the estuarine system.

219 **Actions**220 ***PI-11 Create a long-range communications project, including social media and a method for***221 ***measuring knowledge about the ecosystem.***222 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Assess the current communication conditions and identify gaps as well as existing communication channels.	Inventory existing communication channels.	Analyzed data on engagement metrics from existing communication channels.	Lead: Estuario Implementing partners: community stakeholders	Pending	0-2 years	TBD	USEPA
2. Implement a strategic approach that includes traditional media, digital platforms, and community engagement.	Increase the variety of communication channels used.	Created a comprehensive outreach strategy that outlines objectives and desired outcomes for each channel.	Lead: Estuario Implementing partners: community stakeholders	Pending	3-5 years	TBD	USEPA
3. Collaborate with local media outlets to feature stories and updates about Estuario's efforts.	Grow partnerships with local media representatives and outlets.	Increased media features highlighting Estuario and ongoing work.	Lead: Estuario Implementing partners: media outlets	Pending	0-2 years	TBD	USEPA
4. Develop social media campaigns to raise awareness about Estuario and its efforts to achieve its mission.	Increase in social media followers and engagement on Estuario's accounts and content.	Developed a detailed campaign plan that outlines goals, messages, and timelines for the social media campaign.	Lead: Estuario Implementing partners: community organizations, municipalities	Pending	0-2 years	TBD	USEPA
5. Incorporate strategies for content creation to increase viewership and public engagement through a variety of platforms such as Instagram, Facebook, LinkedIn, YouTube, and Estuario's website.	Increase in public engagement with Estuario's social media platforms.	Created content on a variety of platforms that increases public engagement, which may include support from influencers focused on environmental issues.	Lead: Estuario Implementing partners: community stakeholders	Pending	0-2 years	TBD	USEPA
6. Implement metrics and evaluation tools to track the effectiveness of communication efforts.	Collect feedback from stakeholders, via surveys or other methods, on their awareness and perceptions of communication efforts.	Established a schedule for regular monitoring of communication metrics.	Lead: Estuario Implementing partners: community stakeholders	Pending	0-2 years	TBD	USEPA

223 **Regulatory and Policy Requirements**

224 None.

225 **NEW-1* Create a public system for community members to report environmental concerns and*
 226 *direct them to correct resources.*

227 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Design a platform where community members can easily report concerns.	Increase in community members reporting environmental concerns, especially through the platform.	Engaged with community members to determine the needs on a reporting platform.	Lead: DNER Implementing partners: Estuario, municipalities, local community stakeholders	Pending	3-5 years	TBD	USEPA, DNER, municipalities
2. Create clear guidelines that outline the types of concerns that can be reported, and the process for escalating reports to the proper authorities.	Determine what types of concerns can be reported.	Drafted guidelines for the reporting platform.	Lead: DNER Implementing partners: Estuario, municipalities, local community stakeholders	Pending	3-5 years	TBD	USEPA, DNER, municipalities
3. Partner with environmental agencies, municipalities, and organizations to ensure that reported concerns are directed to the right departments.	Increase in partnerships established to facilitate the reporting process.	Established protocols for how reported concerns will be tracked and escalated.	Lead: DNER Implementing partners: Estuario, municipalities, local community stakeholders	Pending	3-5 years	TBD	USEPA, DNER, municipalities

228 **Regulatory and Policy Requirements**

229 None.

- 230 ****NEW-2* Update Current Citizen's Guides and create a toolkit for community members and general***
 231 ***public that includes resources, tips, and strategies for responsible behaviors that support the***
 232 ***SJBE system.***

233 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Identify key topics and content areas as well as current gaps that can be included in a toolkit.	Assess community interest and needs that can be included.	Collaborated with academia and community stakeholders to identify essential knowledge areas.	Lead: Estuario Implementing partners: academia, DNER, municipalities, community stakeholders	Pending	0-2 years	TBD	USEPA, DNER, municipalities
2. Compile a directory with local resources and programs that support efforts that benefit the SBJE.	Develop a user-friendly format for the resource directory.	Defined key categories of resources and programs to include in the directory.	Lead: Estuario Implementing partners: academia, DNER, municipalities, community stakeholders	Pending	3-5 years	TBD	USEPA, DNER, municipalities
3. Gather input from community members on what is missing from current guides and what would be beneficial to include in a toolkit.	Collect feedback on the stakeholder engagement process.	Developed tools to facilitate input collection.	Lead: Estuario Implementing partners: academia, DNER, municipalities, community stakeholders	Pending	0-2 years	TBD	USEPA, DNER, municipalities

234 **Regulatory and Policy Requirements**

235 None.

- 236 ****NEW-3* Increase the involvement of sectors that highly impact the SJBE, such as hotels, port***
 237 ***facilities, and restaurants.***

238 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Create a program where high-impact sectors can adopt a monitoring station and recruit their own volunteers to carry out monitoring activities.	Total number of monitoring stations adopted by high-impact sectors.	Implemented a recruitment campaign targeting high-impact sectors.	Lead: Estuario Implementing partners: High-impact sectors, Puerto Rico Ports Authority, DNER, municipalities	Pending	3-5 years	TBD	DNER, municipalities, high-impact sectors

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
2. Encourage high-impact sectors to make a pledge to protect a nearby waterbody or ecosystem.	Evaluate specific actions that high-impact sectors have committed to.	Developed a clear framework for the pledge program, outlining the purpose, benefits, and expected commitments.	Lead: Estuario Implementing partners: DNER, high-impact sectors	Pending	3-5 years	TBD	DNER, high-impact sectors
3. Create a special fund that supports Estuario's efforts and is backed by high-impact sectors.	Develop mechanisms to ensure ongoing contributions to the special fund.	Creation of a clear governance structure for managing the special fund.	Lead: Estuario Implementing partners: High-impact sectors, DNER, municipalities	Pending	3-5 years	TBD	DNER, municipalities, high-impact sectors

239 **Regulatory and Policy Requirements**

240 None.

241 **References**

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245 Estuario. 2016. First Update: Comprehensive Conservation and Management Plan for the San Juan

246 Bay Estuary (Chapter 7: Citizen Participation and Education).

247 **Recreation and Other Uses of Resources**

248 **Baseline**

249 Recreation and other sustainable uses of natural resources are both a cultural legacy and an
250 economic opportunity for communities around the SJBE. For centuries people have drawn food,
251 materials, and meaning from the island's waters and uplands. As our world has become more
252 developed, natural areas have become a place for recreation and wonderment, but also a place for
253 an industry known as ecotourism. The climate, beaches, biodiversity, mangroves, and reefs in the
254 SJBE watershed make it an ideal destination for ecotourism, and these water-based resources are
255 enhanced by unique urban upland environments surrounding the SJBE, such as San Patricio State
256 Forest, Piñones State Forest, National Park Julio Enrique Monagas, Arboretum Park Doña Inés, and
257 Luis Muñoz Rivera Park.

258 There are multiple benefits of ecotourism. Financial benefits are realized in the local community by
259 creating accommodations, facilities, and shops and increasing jobs for local workers. Education and
260 appreciation for the natural systems promote preservation and a more complete understanding of
261 the importance of the ecosystem. Ecotourism success requires not only unique natural systems, but
262 infrastructure and access, best practices employed by purveyors, marketing, and government
263 support (World Tourism Organization, 2013).

264 In 2012, Puerto Rico passed the ecotourism law (Title 23, Part VI, Chapter 151 of the Laws of Puerto
265 Rico). The law seeks to protect natural, environmental, historical, and cultural resources, and
266 includes specific regulations and guidelines for tourists participating in ecotourism activities,
267 ensuring that ecotourism is practiced responsibly and sustainably. Numerous government agencies
268 are mandated to participate, including the Puerto Rico Tourism Company, DNER, and municipal
269 governments. The law mandated the creation of a Master Plan for Sustainable Tourism and
270 coordination across multiple state and local agencies as well as the private sector. The Tourism
271 Company is also required to promote Puerto Rico as an environmentally responsible destination,
272 prioritizing ecotourism and adapting marketing to global trends. The ecotourism law and the growth
273 of the ecotourism industry align directly with the goals and objectives of Estuario.

274 Data-driven planning and coordinated governance are necessary for scaling recreation responsibly.
275 Inventories of access, ecological sensitivity assessments, and number of visitors will guide where
276 new facilities are appropriate and what mitigation is required. A central, searchable repository of
277 site evaluations, permitting records, and zoning designations will reduce duplication and support
278 evidence-based decisions. Performance indicators such as visitor counts, amount of time that
279 volunteers spend on maintenance tasks, number of locally owned recreation businesses that
280 promote ecotourism and low-impact recreation, and measures of ecological condition will enable
281 adaptive management and demonstrate whether recreation is contributing to conservation and
282 local prosperity.

283 When planned and managed well, recreation and ecotourism can strengthen the social and
284 economic case for conserving the SJBE watershed. By combining habitat-sensitive infrastructure,
285 support for local businesses, accessibility planning, and shared data systems, Estuario and partners
286 can expand low-impact recreational opportunities that generate local benefits and foster long-term
287 stewardship of natural resources.

288 **Objectives**

- 289
- Promote environmentally responsible actions in all sectors of society.

290 **Actions**291 ****NEW-1**** *Ensure that all visitors in the SJBE are informed about and have access to bicycle trails*292 *and greenway spaces.*293 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Conduct an accessibility audit to identify barriers and areas that require improvements.	Improve accessibility identified for alternative transportation corridors.	Finalized accessibility audit.	Lead: Puerto Rico Department of Transportation and Public Works (DTPW) Implementing partners: Metropolitan Bus Authority, Transit Safety Commission, municipalities, local advocacy groups	Pending	0-2 years	TBD	DTPW, Metropolitan Bus Authority, Transit Safety Commission, municipalities
2. Engage with local advocacy groups and community members to gather input on needs and preferences for access.	Improve accessibility identified for alternative transportation corridors.	Collected feedback on preferences for access from local advocacy groups and community members.	Lead: DTPW Implementing partners: Metropolitan Bus Authority, Transit Safety Commission, municipalities, local advocacy groups	Pending	0-2 years	TBD	DTPW, Metropolitan Bus Authority, Transit Safety Commission, municipalities
3. Create an outreach program and/or campaign to inform the community about accessible trails and green spaces.	Improve access identified throughout the watershed.	Adopted an outreach program.	Lead: DTPW Implementing partners: Metropolitan Bus Authority, Transit Safety Commission, municipalities, local advocacy groups	Pending	3-5 years	TBD	DTPW, Metropolitan Bus Authority, Transit Safety Commission, municipalities

294 **Regulatory and Policy Requirements**

295 Modifications to local development codes and regulations may be required to incorporate

296 accessibility requirements into alternative transportation infrastructure.

- 297 **GI-03 Promote the use of alternate means of transportation, such as bicycles, in the context of**
 298 **smart growth.**

299 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Collaborate with partners to offer educational bicycle tours in the SJBE watershed.	Provide educational bicycle tours throughout the SJBE watershed.	Increased the number of educational bicycle tours.	Lead: Municipalities Implementing partners: DNER, local organizations	On Track	3-5 years	TBD	DTOPW, municipalities, DNER
2. Identify and highlight bicycle rentals and bicycle-sharing projects in the SJBE watershed.	Increase use of bicycles throughout the SJBE watershed.	Added bicycle users.	Lead: Municipalities Implementing partners: local organizations	Pending	3-5 years	TBD	DTOPW, municipalities, DNER
3. Create a campaign to encourage installation of bike racks at strategic points to allow use of bicycles throughout the SJBE watershed.	Implement an education campaign to support a bicycle friendly watershed.	Educated citizens and visitors about the use of bicycles.	Lead: Municipalities Implementing partners: DTOPW, Puerto Rico Tourism Company	Pending	3-5 years	TBD	DTOPW, municipalities, DNER

300 **Regulatory and Policy Requirements**

301 None.

- 302 **PI-01 Develop low-impact recreational activities within selected areas of the SJBE.**

303 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Identify, evaluate, and enhance existing recreational facilities located within the SJBE to promote ecotourism, low-impact activities, and recreational uses. Ecologically sensitive areas not compatible with recreational uses will be identified.	Identify recreational and ecotourism resources.	Developed an interactive map that shows recreational spaces within SJBE that allow/offer ecotourism activities.	Lead: DNER Implementing partners: Department of Sports and Recreation (DSR), Puerto Rico Planning Board (PRPB), municipalities, local organizations	Ongoing	3-5 years	TBD	DSR, municipalities, DNER

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
2. Survey and identify appropriate areas for the development of new recreational facilities that can accommodate passive and low-impact recreational uses. Ecologically sensitive areas not compatible with recreational uses will be identified.	Identify potential recreational facilities and opportunities.	Developed a plan for proposed recreational spaces within SJBE that allow/offer ecotourism and low-impact recreational uses.	Lead: DNER Implementing partners: Estuario, DSR, PRPB, United States Fish and Wildlife Service (USFWS), Puerto Rico Tourism Company, tour operators, landowners, municipalities, local organizations	Ongoing	3-5 years	TBD	DSR, municipalities, DNER
3. Design and develop plans for recreational facilities for low-impact and nature-oriented activities within selected sites of the SJBE. Suggested recreational facilities include waterfront linear parks, mangrove fringed boardwalks, docks, interpretative trails, fishing facilities, visitor centers, bike trails, and birdwatching towers.	Create recreational facilities within SJBE that allow/offer ecotourism, low-impact and nature-oriented activities.	Designed and planned recreational facilities and opportunities.	Lead: DNER Implementing partners: DSR, PRPB municipalities, local organizations	Ongoing	5+ years	TBD	DSR, municipalities, DNER
4. Build incentives for and encourage development of local businesses based on recreation-oriented activities, such as but not limited to bicycle, kayak, and sailboat rentals, bioluminescent, and ecotourism-based boat tours.	Identify incentives and grants with municipalities, local businesses, and organizations.	Implemented incentives to increase recreation-based activities in development.	Lead: DNER Implementing partners: DSR, PRPB, Department of Economic Development and Commerce (DEDC), Puerto Rico Tourism Company, tour operators, municipalities, local organizations	Ongoing	0-2 years	TBD	DSR, municipalities, DNER

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
5. Promote the use of existing facilities and low-impact recreational activities in accordance with each site's potential. Suggested activities include birdwatching, hiking, bicycling, kayaking, fishing, sailing, swimming, snorkeling, bioluminescent and sightseeing by boat.	Increase the number of people who use existing facilities and engage in low-impact recreational activities.	Developed a comprehensive engagement plan to promote the proper use of facilities and encourage low-impact recreational activities.	Lead: DNER Implementing partners: DSR, PRPB, municipalities, developers, local organizations	Ongoing	0-2 years	TBD	DSR, municipalities, DNER

304 **Regulatory and Policy Requirements**

305 Support legislation to promote and fund low-impact and ecologically friendly development of new
306 facilities and expansion of existing facilities.

307 *PI-05 Develop an ecotourism program to promote sustainable, low-impact enjoyment of SJBE's*
308 *natural resources to further their conservation.*

309 **activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Establish zoning for potential ecotourism projects or activity areas. These zones should be evaluated on a yearly basis as indicated in Article 5, Section E of the Ecotourism Law.	Assess potential ecotourism areas to include in zoning.	Established zoning rules for ecotourism areas and reviewed and amended annually.	Lead: Puerto Rico Tourism Company Implementing partners: DNER, PRPB, Puerto Rico Ports Authority, Estuario, municipalities	Pending	0-2 years	TBD	DNER, municipalities
2. Require that all environmental impact statements for development projects in areas of potential ecotourism include the alternative of establishing ecotourism projects and recreational attractions, as required law.	Evaluate current compliance with regulations on environmental impact statements.	Developed guidelines detailing what must be included in an environmental impact statement regarding ecotourism projects and environmental education components.	Lead: DNER Implementing partners: Puerto Rico Tourism Company, PRPB, Puerto Rico Ports Authority, Estuario, municipalities	Pending	3-5 years	TBD	DNER, municipalities

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
3. Design ecotourism activities and provide the necessary infrastructure at chosen sites (such as but not limited to docks, trails, signs, and observation platforms).	Plan, design, and provide docks, trails, signs, observation platforms, and other access points and coordinate ground and aquatic transportation.	Completed plans, designs, and grants.	Lead: DNER Implementing partners: Puerto Rico Tourism Company, DSR, Puerto Rico Ports Authority, Estuario, tour operators, municipalities	Ongoing	3-5 years	TBD	DNER, municipalities
4. Develop educational materials (e.g., websites, social media posts, informational packets) to bring ecotourists to the area and promote recreational and educational opportunities.	Increase ecotourism and use of low-impact recreational and education opportunities.	Worked with local businesses, organizations, municipalities, and academia to create ecotourism content for Estuario.	Lead: Puerto Rico Tourism Company Implementing partners: DNER, Puerto Rico Ports Authority, Estuario, municipalities, academia	Pending	3-5 years	TBD	DNER, municipalities
5. Provide training to local guides to promote ecotourism within the SJBE system and its watershed.	Increase in provided training to local guides.	Used guides from the National Association for Interpretation (NAI), or similar resources, to develop trainings.	Lead: Puerto Rico Tourism Company Implementing partners: DNER, Estuario, municipalities, academia, NAI	Pending	3-5 years	TBD	DNER, municipalities

310 **Regulatory and Policy Requirements**

311 Coordination with local, state, and federal organizations to provide grant opportunities and ensure
 312 low-impact and eco-friendly recreational activities are compliant with ecotourism laws.

313 *PI-09 Promote public access to the SJBE’s bodies of water and sandy beaches.*

314 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Inventory existing access to the beach and rivers as well as existing projects and proposals that offer access or limit access to waterbodies and beaches within the SJBE watershed.	Identify water access and proposals and projects with access features to beaches and waters of the SJBE watershed.	Created a database and map of all water access, existing and proposed.	Lead: Estuario Implementing partners: DNER, Permits Management Office, DOTPW	Pending	0-2 years	TBD	DNER, DOTPW, municipalities

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
2. Based on the inventory, identify priority areas in the SJBE watershed where new access to waterbodies or alternatives for existing access can be developed through alliances with the public and private sectors.	Identify areas for new and improved access to waters in the SJBE watershed.	Established alliances with the public and private sectors to plan, design, and develop new and improved access to waters in the SJBE watershed.	Lead: Estuario Implementing partners: DNER, Permits Management Office, DOTPW, academia	Pending	3-5 years	TBD	DNER, municipalities
3. Examine the possibility of rebuilding the dock at the Piñones se Integra Corporation (COPI), and building or rebuilding other docks to increase access to SJBE areas.	Engage with DNER and COPI to redevelop the COPI and other dock sites.	Rebuilt the COPI dock and increased public access.	Lead: Estuario Implementing partners: DNER, COPI	Pending	0-2 years	TBD	DNER, municipalities
4. Design activities to provide more opportunities for access to the SJBE's waterbodies and beaches.	Increase access to SJBE's waterbodies and beaches.	Worked with local businesses, organizations, municipalities, and academia to design activities.	Lead: Estuario Implementing partners: DNER, Puerto Rico Tourism Company, DSR, Puerto Rico Ports Authority, Estuario, tour operators, municipalities	Ongoing	3-5 years	TBD	DNER, municipalities

315 **Regulatory and Policy Requirements**

316 None.

317 **References**

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319 Tourism Development, Subchapter V. Sustainable Tourism Development.

320 2023 Laws of Puerto Rico Title Nine - Highways and Traffic (§§ 1-8 — 5725) Chapter 6 - Complete
321 Streets (§§ 146 — 151) § 147 - Declaration of public policy.

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325 **Collaborative Governance and Compliance**

326 **Baseline**

327 Collaborative governance and strong enforcement are essential if Estuario is to move from planning
328 to measurable conservation outcomes. The estuary's mixture of jurisdictions, institutions, and
329 stakeholders means that no single entity can implement conservation, restoration, reconstruction,
330 and/or remediation measures alone. A deliberate model of shared responsibility, routine
331 communication, and accessible information strengthens enforcement, reduces duplication, and
332 improves the speed and quality of decision making.

333 A resilient and collaborative governance model combines clear institutional roles with processes
334 that support learning, accountability, and adaptation (Emerson, Nabatchi & Balogh, 2012). Theory
335 and comparative research show that governance arrangements which create regular forums for
336 cross-sector dialogue, clarify decision rules, and invest in shared data and analytical tools produce
337 better coordination and higher performance on environmental goals (Emerson, Nabatchi & Balogh,
338 2012). For Estuario this means formalizing partnership structures that include municipal officials,
339 DNER, regulatory agencies, community groups, academia, and the private sector. Regular
340 interagency workshops, an annual data brief for elected officials, and standing technical working
341 groups focused on enforcement and permitting will reduce confusion at the project level and create
342 predictable pathways for escalations and dispute resolution.

343 Capacity building for regulatory and enforcement personnel must be practical and problem
344 oriented. Producing a concise document that explains SJB ecology, relevant statutes, permitting
345 pathways, and common compliance scenarios that staff might face will allow municipal enforcement
346 officers and agency staff to apply standards consistently across jurisdictions. Hands-on training that
347 couples legal concepts with field skills, communication strategies, and incident documentation
348 strengthens collaborative governance capacity by improving stakeholder's coordination and ability
349 to take joint action (Emerson, Nabatchi & Balogh, 2012). Embedding these materials in an accessible
350 online library further supports continuity as personnel turn over and institutional memory fades
351 (Estuario, 2016).

352 Transparent, discoverable data and document repositories are central to collaborative governance.
353 A searchable digital archive that houses environmental impact statements, enforcement records,
354 monitoring datasets, and legislative analyses reduces the transaction costs of collaboration and
355 supports evidence-based decision making. Federal agency guidance underscores the value of formal
356 data management planning and commonly accepted metadata standards to ensure data are
357 searchable, usable, and verifiable over time (U.S. Geological Survey [USGS], 2025). Implementing
358 data stewardship roles, formal data sharing agreements, and routine metadata standards will allow
359 Estuario and partners to integrate monitoring results with permitting and enforcement workflows so
360 that decisions rest on current, high-quality information.

361 Accountability and performance measurements keep collaborations productive. Establishing a set of
362 jointly agreed upon performance indicators for governance and compliance, such as the number of
363 inspections completed, time from report to agency response, proportion of enforcement cases
364 resolved, and frequency of cross-agency training, creates a basis for evaluation and learning.
365 Emerson, Nabatchi & Balogh (2012) emphasize that collaborative governance models become more

366 effective when participants use shared performance information to adapt processes and priorities.
 367 Implementing a transparent reporting cadence, including an annual Estuario governance and
 368 compliance bulletin for officials and the public, will document progress and provide a forum for
 369 course corrections.

370 Finally, legal and administrative reform may be needed to remove structural barriers to
 371 coordination. Where statutes, permitting rules, or institutional incentives create misaligned
 372 responsibilities, those gaps should be documented to develop targeted policy proposals or
 373 interagency memoranda of understanding to create clearer lines of responsibility. Institutionalizing
 374 routines for joint inspections, shared evidence chains, and common sanctioning practices will
 375 improve fairness and predictability while strengthening community confidence that violations
 376 receive consistent treatment.

377 By investing in clearly defined partnership roles, practical training and teaching materials, a robust
 378 digital repository, routine performance measures, and targeted policy fixes, Estuario can strengthen
 379 both governance and compliance. Those steps will reduce delays, improve enforcement outcomes,
 380 and ensure that conservation, restoration, reconstruction, and/or remediation actions are
 381 implemented effectively and equitably across the watershed.

382 Objectives

- 383 • Strengthen the Partnership and its capacity to restore and conserve the estuarine system.

384 Actions

385 *PI-08 Improve regulatory and enforcement processes by supporting capacity building for*
 386 *municipalities, agencies and the general workforce.*

387 Activities

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Identify the essential concepts needed to understand the ecology of the SJBE system and the legal components established for resource protection.	Document key legal components pertaining to resources protection within the SJBE.	Determined essential concepts and legal components.	Lead: Estuario Implementing partners: academia, DNER	Pending	0-2 years	TBD	USEPA, DNER
2. Produce a teaching/learning resource guide and instructional materials on estuarine concepts for key stakeholders such as rangers, policy makers, heads of agencies, and other enforcement personnel.	Develop educational materials and offerings, such as handbooks, workshops, publications, and symposiums.	Collected feedback from implementing partners on the content and messaging of educational materials.	Lead: DNER Implementing partners: Estuario, academia	Pending	3-5 years	TBD	DNER, USEPA

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
3. Conduct training workshops on estuarine concepts, legal frameworks that support estuarine ecosystems, communication skills, and other relevant concepts/information for key stakeholders in the SJBE system as well as other sensitive areas in Puerto Rico.	Develop a training curriculum based on developed materials and stakeholder feedback.	Organized training sessions for key stakeholders with developed educational materials.	Lead: DNER Implementing partners: Estuario, academia	Pending	3-5 years	TBD	DNER, USEPA

388 **Regulatory and Policy Requirements**

389 None.

390 ***PI-12 Ensure that elected officials, heads of agencies, and general public are part of Estuario's***391 ***decision making process.***392 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Send officials, heads of agencies, and others in Estuario an annual report with relevant data on the condition of the SJBE, events held, results of scientific research, main needs of the program, and any other information that contributes to decision making.	Ensure that reports are sent out in a timely and reoccurring manner.	Monitored how the distributed report influences decision-making and community engagement.	Lead: Estuario Implementing partners: elected officials, other key stakeholders	Ongoing	3-5 years	TBD	USEPA
2. Create and update a list of officials who are interested in keeping up to date with the progress towards SJBE conservation, restoration, reconstruction, and/or remediation efforts.	Complete an up-to-date list on a regular basis.	Implemented a feedback mechanism for officials to express interest, preferences, and suggestions regarding the updates they receive.	Lead: Estuario Implementing partners: elected officials, other key stakeholders	Ongoing	0-2 years	TBD	USEPA

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
3. Develop alliances with volunteers and university entities interested in the decision-making process for Estuario.	Increase in levels of volunteer participation in Estuario-related decision-making activities, such as meetings, workshops, and advisory committees.	Developed a framework outlining the roles, responsibilities, and expectations for collaboration between Estuario stakeholders, volunteers, and university entities	Lead: Estuario Implementing partners: academia, community stakeholders	Ongoing	0-2 years	TBD	USEPA
4. Offer workshops about Estuario, its importance, governance structure, and progress in the conservation, restoration, remediation, and reconstruction of the SJBE system and its watershed.	Assess the relevance and quality of the workshop content based on participant feedback,	Created engaging and informative materials for the workshops.	Lead: Estuario Implementing partners: regulatory agencies	Ongoing	0-2 years	TBD	USEPA

393 **Regulatory and Policy Requirements**

394 None.

395 ***PI-14 Restructure the website as a repository for information and make it available via alternatives***396 ***such as the web atlas and Estuario library.***397 **Activities**

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
1. Compile and integrate environmental impact statements, bills, location queries and investigations in the Estuario database.	Evaluate the quality and accuracy of collected documents.	Developed a plan to determine how documents will be integrated into the digital database.	Lead: Estuario Implementing partners: academia, DNER, community stakeholders	Ongoing	0-2 years	TBD	USEPA. DNER
2. Recruit contractors, university students, or other volunteers to conduct a literature review and create an annotated bibliography for the Estuario website.	Increase in recruitment and volunteer efforts to participate in the literature review process.	Organized collected literature and the creation of an annotated bibliography for the website.	Lead: Estuario Implementing partners: academia, DNER, community stakeholders	Ongoing	0-2 years	TBD	USEPA. DNER

Activity	Performance Measures	Milestones	Responsible Stakeholder(s) and Partner(s)	Status	Timeframe	Estimated Costs	Potential Funding Sources
3. Hire librarians and university volunteers to create a digital database and to search for bills and location queries to complement and strengthen Estuario's current Public Policy Library.	Complete functional digital database.	Implemented an orientation and training session for volunteers to discuss goals and objectives for the project.	Lead: Estuario Implementing partners: academia, community stakeholders	Ongoing	0-2 years	TBD	USEPA
4. Place the electronic database and the studies digitized on the Estuario website.	Integrate the electronic data on the Estuario website.	Conducted testing to ensure that all files are accessible and properly formatted for digital use.	Lead: Estuario Implementing partners: community stakeholders	Ongoing	3-5 years	TBD	USEPA
5. Create formal agreements with academic institutions, government agencies, and community organizations to keep the database updated and to be informed about each investigation, location consultation, or bill related to the SJBE.	Increase in library users through metrics such as but not limited to number of downloads and site traffic.	Established regular communication channels among partners to facilitate coordination.	Lead: Estuario Implementing partners: academia, DNER	Ongoing	0-2 years	TBD	USEPA, DNER

398 **Regulatory and Policy Requirements**

399 None.

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