Early Phase Watershed Planning for Baffin Bay

Final Report

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Sea Grant Texas
AT TEXAS A&M UNIVERSITY

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Due July 30, 2021

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Executive summary

The Baffin Bay watershed is 2,177,965 acres, contains three tributaries, supports some of the highest recreational and commercial fishery landings, and contains critical habitat for migratory birds and other wildlife. There are currently water quality impairments on two tributaries that feed into Baffin Bay and ongoing water quality degradation has been documented in the bay itself, including high nutrient concentrations and prolonged brown tide events. This has resulted in adverse health effects to Black Drum and other marine populations. Protection of Baffin Bay and its watershed is imperative, ensuring that this bay system continues to be an asset to current and future generations and support the local, regional, & state economy.

The purpose of this project is to develop an Early-Phase Baffin Bay Watershed Plan that would expand the watershed protection efforts of the local Baffin Bay Working Group (BBWG), further characterizing watershed needs to support a full Watershed Protection Plan (WPP). The BBWG, consisting of researchers, commercial and recreational fishermen, landowners, ranchers, business owners, local governments, and federal and state agencies, has identified various watershed protection needs which require the development of a plan and funding to address. The WPP would serve as a means for identifying locally driven mechanisms for voluntarily addressing complex water quality and land use issues across multiple jurisdictions, promoting unified approaches to seek funding. Texas Sea Grant is a member of the BBWG and was approached to work on extension efforts to gather community historical knowledge, improve participation and local buy-in, and develop an Early-Phase Baffin Bay Watershed Plan. The objectives of this project are: 1) further characterize Baffin Bay watershed concerns; 2) establish a Task Force composed of local stakeholders based on concerns; and 3) compile site specific best management practice guidance and resources to assist with voluntary implementation.

Throughout the course of this project, Texas Sea Grant hosted a kickoff meeting and four workshops in the Baffin Bay watershed, engaging 181 stakeholders. A “Task Force” consisting of 15 stakeholders was formed and met four times to help further characterize the concerns and needs within the watershed, conduct a needs assessment, set goals, and develop project ideas that address the watershed needs/issues. A “Core Team” consisting of 5 of stakeholders was formed and met a few times to help establish new relationships, provide guidance on next steps and assist with plan development.

In response to the COVID-19 pandemic and subsequent travel restrictions and limitations on in person meetings, Texas Sea Grant adapted their outreach approach and hosted several virtual workshops and meetings and gathered feedback via mailers and online questionnaires.

The result of these efforts is the development of the Early-Phase Watershed Plan (Appendix G), which will support future watershed stewardship and the development of a full Watershed Protection Plan for the Baffin Bay watershed.

Introduction

The EPA defines a watershed as the “land area that drains rainfall through a stream, lake or river to a common outfall”. Baffin Bay is a narrow bay 70 miles south of Corpus Christi that is fed by small intermittent streams that empty into one of three fingers of the bay. The bay has a low circulation rate, emptying itself into the Upper Laguna Madre, a body of water that lies between the Texas Coast and its barrier islands. It is well known for its natural beauty and some of the highest commercial and fishing landings in Texas. A Baffin Bay study group was formed by the local community to bridge together local and scientific knowledge to resolve Baffin Bay water quality and biological productivity concerns. The group first met in August 2012 in response to recent fish kills observed at the mouth of the bay where it meets the Upper Laguna Madre. Representatives from the local community as well as Coastal Bend Bays & Estuary Program, Texas Parks & Wildlife Department, Texas A&M University- Corpus Christi and the Harte Research Institute were all in attendance to discuss the fish kills, food web changes and water quality issues in the watershed. This initial meeting, and subsequent meetings to follow, set the stage for identifying needs of the bay and spurring research efforts forward.

Texas Sea Grant joined the group now identified as the Baffin Bay Stakeholder Group in 2018 and was approached to help lead efforts to engage and educate the community about what is happening in the watershed and get buy-in for a full watershed protection plan (WPP). The BBWG identified various watershed protection needs which require the development of a plan and funding to address. This Plan would serve as a means for identifying locally-driven mechanisms for voluntarily addressing complex water quality & land use issues across multiple jurisdictions, promoting unified approaches to seek funding. WPP are not regulatory documents and therefore it is imperative that local stakeholders in the watershed support efforts to create a plan and implement strategies from that plan. The BBWG provided a great start for getting local buy-in but before the area could receive funding for a full WPP, it needed to be demonstrated that the communities that made up the watershed would support the effort.

As stated in the executive summary, the objectives of the Early Phase Watershed Planning for Baffin Bay Project are: 1) further characterize Baffin Bay watershed concerns; 2) establish Task Force based on concerns; and 3) compile site specific best management practice guidance and resources to assist with voluntary implementation. To accomplish these objectives the following tasks were carried out during the project: Task (a) establish a small core team that would guide development of the plan and create a task force with representatives from local residents, agencies, academic and businesses in the watershed, Task (b) organize workshops that engage the larger public and provides useful information and resources while also gathering feedback that can be incorporated into the planning process, and Task (c) compile all gathered observation and feedback to create an early phase watershed planning document that would set the foundation for a future full Watershed Protection Plan.

The next section of this report will outline how each of these tasks were completed and the resources that were employed.

Task (a) – Establishment of Task Force & Core Team

To enhance crucial local buy-in and engagement a Task Force composed of local stakeholders was formed to assist Texas Sea Grant in further characterizing the concerns and needs within the watershed through assessing the information compiled from public engagement and using it to set goals for the plan, then develop project ideas that address the identified watershed needs/issues. A Core Team was informally organized early on in the project with high level individuals that were already involved in planning and research efforts in the bay and were intimately aware of the ongoing water quality issues.

To set the stage for the Kickoff meeting, Texas Sea Grant along with the Core Team engaged a variety of stakeholders in the Baffin Bay Watershed throughout September 2019 via informal meetings to also begin building relationships, conduct a needs assessment, collect suggestions on workshop venues, gather guidance on other stakeholder groups to include, and later advertise the Kickoff Meeting. Stakeholder groups engaged included agencies, local government, landowners, ISDs, and researchers. Locally involved agencies included Nueces River Authority, Texas Parks and Wildlife, Kleberg-Kenedy AgriLife Extension, Kenedy Groundwater Conservation District, and the Conservation District. Local governments included the City of Bishop and City of Kingsville. Academic entities included Texas A&M University Kingsville and Riviera ISD.

A Kickoff Meeting was held on October 16, 2019 as an opportunity to recruit individuals to join the Task Force, elicit more community feedback, participation, and to provide information on current research efforts in Baffin Bay to attendees. The event attracted around 54 stakeholders, and we received a fair amount of feedback regarding needs and concerns with the watershed. This meeting also provided the opportunity for attendees to volunteer for the Task Force or the various Baffin Bay Working Group (BBWG) subcommittees. The Task Force was later strengthened by additional stakeholders who learned about the project during the first two workshops and by word of mouth.

The following entities were represented on the Task Force: City staff for City of Bishop, Celanese Corporation, King Ranch, Kenedy-Kleberg Agrilife Extension Services, Local Landowner and Rancher, Texas Parks and Wildlife Department, Texas Water Resources Institute, Texas State Soil and Water Conservation Board, Harte Research Institute, Coastal Conservation Association, Kleberg-Kenedy Soil Water Conservation District, Texas A&M University-Kingsville staff, Natural Resources Conservation Service, City of Kingsville staff and Jim Wells Soil and Water Conservation District.

Kenedy-Kleberg AgriLife Extension Service volunteered to allow Texas Sea Grant to host all Task Force meetings at their facility. Below are details for each of the Task Force meetings held on December 11, 2019, February 25, 2020, May 26th, 2020 and February 3rd, 2021.

Task Force Meeting #1:

The first Task Force meeting took place on December 11, 2020 at the Kleberg County Agrilife Extension office in Kingsville, Texas. This meeting was attended both in person and virtually by representatives from Coastal Bend and Bays Estuaries Program, Texas Parks and Wildlife, Harte Research Institute, City of Kingsville, Kleberg-Kenedy AgriLife Extension, Kleberg- Kenedy Soil and Water Conservation District, King Ranch, Celanese, a local landowner and environmentalist, Texas Water Resources Institute, Nueces River Authority, City of Bishop, an student at Texas A&M University Kingsville, Friends of Baffin, Texas State Soil and Water Conservation Board.

Texas Sea Grant overviewed how the mission and focus areas of Texas Sea Grant provide the unmet need of an extension component to support the larger Baffin Bay Stakeholder Group to more comprehensively increase stewardship of Baffin Bay watershed's ecosystem and water quality. We also provided an overview of the project, successful community participation at the Kickoff Meeting, as well as the Riparian and Stream Ecosystem Workshop in the Fall.

Task Force discussed and recorded ongoing and ideal projects matching up with the priorities and goals feedback gathered from stakeholders at the above mentioned events. They also provided feedback and expertise on the layout and components for the draft plan.

Task Force Meeting #2:

The second task force meeting took place on February 25th, 2020, at the Kleberg County Agrilife Extension office in Kingsville, Texas. The meeting was held during lunch hours, 11:30am-1pm, to accommodate busy schedules. Many of the agencies mentioned in the first Task Force meeting joined or reached out to have a follow up if they could not make it. New additions to the Task Force included City of Kingsville, Nueces and Kleberg counties, USDA, Coastal Conservation Association, and a private consultant.

Texas Sea Grant led the conversation by having all attendees go around the room and introduce themselves before starting the presentation. For the purposes of this meeting, Texas Sea Grant presented on the status of the grant up until this point, summarizing previous workshops and going over the minutes of the first task force meeting that took place in December 2019. The purpose of the second task force meeting was to receive feedback about a proposed Report Draft outline created by Texas Sea Grant and to elicit help from the task force members to better advertise upcoming events. The team leads compiled documents into folders to disperse to the attendees that included all previous workshop documentation, draft plan outline and a collection of feedback about focus areas that was collected during the Kickoff Meeting and subsequent workshops. There was a productive conversation among the project leaders and the Task Force members about additions to the plan outline, and the focus areas. For example, Brenda Ballard, President of the Coastal Conservation Association was able to provide some key insights about the next workshop that, at the time, was scheduled to be held in April 2020 and focus on Water Quality and Fisheries. As a reminder the team leads reiterated the funding mechanism for the grant and outlined the expected duties of the Task Force members. Adrien Hilmy, Project Manager with Coastal bend Bays and Estuaries Program discussed the justification for the grant and outlining the differences between the Baffin Bay Working Group as a long-term group, and the Early Phase Watershed Planning for Baffin Bay Project to fill a needed gap in prioritizing community needs of all stakeholders living in and/or working in the Baffin Bay watershed.

Task Force Meeting #3:
The third Task Force meeting took place virtually on May 26, 2020 due to continued COVID-19 restrictions prohibiting in person meetings. This meeting was attended virtually by representatives from Coastal Bend and Bays Estuaries Program (CBBEP), Harte Research Institute (HRI), Texas A&M University Kingsville, Kleberg-Kenedy AgriLife Extension, Kleberg- Kenedy Soil and Water Conservation District, a local landowner/environmentalist, Texas Water Resources Institute, Nueces River Authority, Texas State Soil and Water Conservation Board, and a consultant for Kenedy and Nueces counties.

These meetings served as a way to update the Task Force members on the status of the project and solicit guidance for next steps. In this case Texas Sea Grant was struggling with how to continue planning for the third and fourth workshops. COVID-19 challenges were overviewed and updates provided on communications with CBBEP on two options to move forward with the 1) current deadline of August 31, 2020 and 2) project extension deadline of August 31, 2021.

The Task Force continued to develop the Early Phase Plan by 1) expanding on existing/ongoing efforts; 2) proposing projects and best management practices aligning with the priorities and goals gathered from stakeholders from engagement efforts; and 3) spatial and funding matrix components. Additionally, Texas Sea Grant solicited assistance from Task Force members to expand engagement and feedback opportunities for Baffin Bay stakeholders through mail out packets that include a questionnaire. There was productive conversation among the project leaders and the Task Force about additions to the plan outline, engagement efforts, and upcoming workshop development.

Task Force Meeting #4: This meeting was also hosted in virtual format on February 3, 2021 and included 13 attendees. The agenda for the third workshop on Green Infrastructure was discussed as well as mapping and next steps for the watershed plan. Texas Sea Grant had been distributing mail out questionnaires to a number of mail list servers but was struggling to get responses. For this meeting, the major focus was working with Task Force members to distribute more Resident and Resource Manager Questionnaires to particular individuals and addresses in the watershed that they felt would respond. Since COVID was still an issue and had prevented a lot of activities, this task force meeting was short and covered a few items before being dismissed.

Task (b) – Workshops:

Texas Sea Grant hosted a kickoff meeting and four workshops to connect and engage with stakeholders in the Baffin Bay Watershed. The kickoff meeting provided an opportunity to highlight efforts that were underway within the watershed and to discuss the needs that have already been identified through ongoing research efforts. It also offered the opportunity to begin setting local goals and developing activities/projects that will address current and future watershed needs/issues. The meeting also served as a means to identify volunteers for the Task Force and Core Team. The four workshops were designed to engage stakeholders by sharing information and resources and, just as importantly, played a crucial role in gathering community stakeholder feedback that was incorporated throughout the planning process. Each workshop was targeted at a particular watershed issue and stakeholder group. Descriptions of the four workshops are provided below:

1. Riparian & Stream Ecosystem Workshop: Workshop was hosted in conjunction with the Texas Water Resources Institute and designed to increase citizen awareness, understanding, and knowledge about the function of riparian zones, their benefits, and BMPs to protect them and minimize nonpoint source pollution. A presentation on a Baffin Bay watershed riparian evaluation by the Nueces River Authority was provided. Attendees spend the second portion of the day's workshop in the field assessing a riparian area at Dick Kleberg Park.

2. Soil Health Short Course: hosted in in partnership with local Kleberg-Kenedy Soil water and Conservation District (SWCD) to include agency and producer speaker panels and a field trip that highlighting good soil health management practices

3. Water Quality and Fisheries Workshop: Engaged the recreational and commercial fisheries that utilize Baffin Bay for information sharing on water quality and fisheries issues and strategies for addressing these issues. Presentations focused on providing updates on recent/ongoing studies/monitoring programs and initiatives in Baffin Bay. Breakout sessions to gather community feedback followed.

4. Green Infrastructure for Texas: Workshop was hosted in conjunction with the Texas Coastal Watershed Program to provide information on wetland restoration, green infrastructure, and stormwater management to urban and rural populations and improve protection of water quality.

Kickoff Meeting (October 16, 2019,Dick Kleberg Park, Kingsville Texas, 54 attendees)

The Community Kickoff meeting attracted a decent sized group of 54 individuals from the Baffin Bay watershed and surrounding communities. We received a fair amount of feedback regarding needs and concerns with the watershed and project. The team also received positive affirmation from attendees in regards to the panel session which offered science-based information regarding Baffin Bay research and data about water quality and degradation issues. To ensure that participants felt heard and to garner discussions, we separated the participants into four groups that were led by Texas Sea Grant, Coastal Bend Bays and Estuaries Programs, Kleberg-Kenedy SWCD and Kenedy-Kleberg AgriLife Extension Service. The participants in each break-out group were highly engaged throughout the entirety of the session, voicing their concerns, needs, and assets in a constructive and collaborative way while looking over a map of the watershed. The group leads recorded their responses on huge sheets of paper that was used to summarize and group responses later.

Overview of Feedback:

Participants in the community kickoff meeting had many great questions. Some of the concerns regarding Baffin Bay or the project were workshop locations, plugging old wells, and point and nonpoint sources of Nitrogen and other nutrient pollution. The community expressed the shared thought that many forums and meetings pertaining to the bay are usually held outside of the watershed. It was consistently mentioned that workshops and research presentations should happen within the Baffin Bay area (referring to the Coastal Issues Forum held in Corpus Christi). Given the economic aspect of the project, citizens seem most concerned with funding needed for special projects and addressing the issues that are of great importance within the watershed using effective and locally-driven strategies.

Examples of Breakout Group Feedback:

Throughout the break-out group session, each of the groups had great feedback. For example, the participants in Morgen and Adrien's group were outspoken and forthcoming with local knowledge about the region. The main concerns were with existing wastewater treatment plants and improvement of on-site facility monitoring, septic systems and the subsequent funding needed to repair those, the small amount of recreational activity access on the bay, flooding, and concerns within the agriculture sector. The Baffin Bay watershed is a large area made up of huge swaths of open land that are affected by multiple environmental influences.

In other groups, the need for improvements and updates to wastewater treatment plants that serve the area was a major concern that came up more than once. There are numerous wastewater treatment plants in the Baffin Bay region with several of them located at close proximity to tributaries and creeks. The community seemed to recognize and agree that many, if not all, will need some serious upgrades in the coming year and expressed concern about finding funding to support that endeavor. Briefly discussed in the Kickoff meeting, and later expanded in the task force meetings was the topic of privately owned septic systems. There is a need for education and programs for homeowners in regards to upkeep and recognizing when a septic system is not working properly. Wastewater Treatment Plants treat a huge amount of water but there are a large number of private lands with septic systems in the Baffin Bay that have just as much of an effect on water quality. The feedback from this meeting was compiled by Texas Sea Grant and five major themes were identified that were then carried over into future workshops. These themes are; Riparian & Habitat Restoration and Enhancement, Community Outreach, Wastewater & Septic Mitigation, Fishery Sustainability, and Landowner Incentive Programs.

Improvements:

In the future, we would like to have a sign in sheet for each breakout and allow time for introductions before the discussion begins; this would better enable us to reach out for follow up discussions and answer questions as needed. For future workshops we would like to refine the polling segment in presentations.

Workshop #1: Riparian and Stream Ecosystem Workshop (November 6th, 2019 /Bishop, Texas /35 attendees)

Texas Sea Grant planned and advertised for the first workshop throughout October alongside Texas Water Resources Institute. Local partners disseminated the agenda throughout their networks. On November 6, 2019 we co-facilitated Workshop 1: Riparian and Stream Ecosystem Workshop in cooperation with Texas Water Resources Institute and partners. Texas Sea Grant intentionally targeted a town with a prominent tributary for Baffin Bay and that has previously not been targeted before in order to engage and promote ownership for upland stakeholders in the watershed. The workshop attracted a crowd of about 35 participants to include landowners, local government, university students, and agencies. We received a helpful amount of feedback between the Texas Sea Grant forms and the needs/concerns feedback corner. Texas Water Resources Institute also conducted pre and post knowledge tests. The participants were grateful for the knowledge shared by multiple partner speakers covering a variety of streams, vegetation, soil, wildlife, general impacts, and best management practices. The expertise helped the audience learn about different aspects of importance in the Baffin Bay watershed that encourage practices to protect natural resources, reduce pollution and take ownership in their watershed. Texas Sea Grant feels that a significant amount of science-based information was transferred to the intended target audience for the purposes of our project: Early Phase Watershed Planning in Baffin Bay.

Overview of Feedback:

The most enjoyable parts of the workshop to participants were the individual presentations given from experts with different perspectives as well as the afternoon field session. The presentations were comprehensive and information rich. The

pamphlets and manuals provided by Texas Water Resources Institute and Texas Parks and Wildlife, detailing riparian ecosystems and the organizations involved in the program, were largely appreciated by the participants.

Interactive Corner Feedback:
The following five priority goals identified by participants during the Kickoff Meeting breakout sessions were placed on a board for ranking during the Riparian and Stream Ecosystem Workshop. Each person was allowed three votes. The following rankings were determined by eleven attendees who chose to participate:

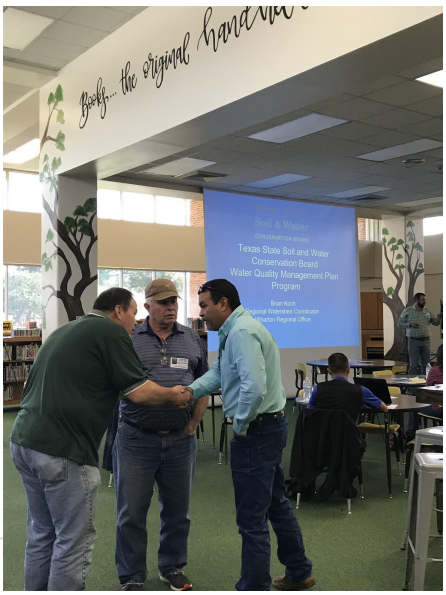
- Increase landowner incentives and/or implementation of best management practices regarding impacts to water quality (9 votes)
- Reestablish riparian habitats (9 votes)
- Mitigate septic and wastewater (6 votes)
- Community education (5 votes)
- Improve fisheries sustainability (4 votes)

Workshop #2: Soil Health Workshop (January 9, 2021/Riviera, Texas / 20 attendees)
Texas Sea Grant planned and advertised for this workshop throughout December and early January. Local partners disseminated the agenda throughout their networks. The workshop attracted a crowd of 20 participants and took place on January 9, 2020, in Riviera, Texas at the local High School Library. Riviera, Texas is a small, rural town with a small population that consists largely of ranch and farmland. Riviera is located in proximity to the Los Olmos headwater that drains into Baffin Bay. The course ran from 8:30am until 3:30pm and consisted of presentations from Raul Hinojosa from the Natural Resources Conservation Service (NRCS) talking about Soil Health Principles, Tracy Litle a local landowner and representative from Holistic Management International talking about Regenerative Grazing practices, and Brian Koch from Texas State Soil Water Conservation Board (TSSWCB) talking about resources available through the agency. An agency panel discussion consisted of: Brian Koch from TSSWCB, Robert Schmidt with the Kleberg-Kenedy SWCD, Frank Escobedo with Kleberg-Kenedy AgriLife Extension Service, Richard Gonzales from the Science and Spanish Network, and Raul Hinojosa from NRCS. The workshop concluded in field demonstrations that featured a rainfall simulator and a soil pit demonstration led by Gary Harris, MLRA Soil Survey Leaders and Sol Scientist with the United States Department of Agriculture (USDA) and Dennis Brazina with NRCS. The purpose of the Rainfall Simulator is to show how water will either runoff and/or infiltrate through different mediums (grass &

concrete) and soil types. The visual component of the demonstration was enlightening for the attendees.

For the second demonstration, a 5ft deep pit was dug up using a back-hoe to allow attendees to actually see and touch different soil types and learn about their properties. Gary spoke from inside the pit while attendees stood around. He identified different layers, spoke to the different influences of the loss of topsoil and organic matter in the soil and the benefits of conservation and no-till practices. The demonstration concluded with an infiltration test and an informal Q&A session. A brief overview of next steps concluded the day and attendees departed for home from the field.

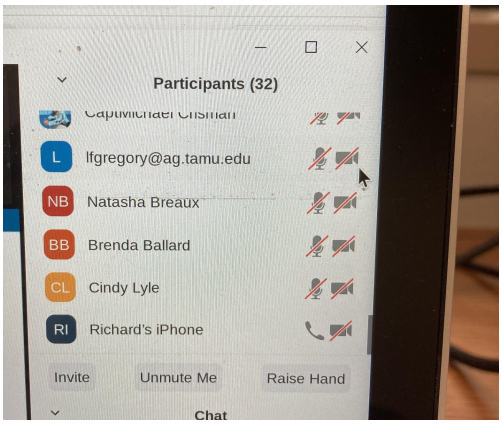
The event drew individuals from around the area with the furthest attendees coming from Brownsville, Texas. The planning team was able to acquire donations for both breakfast and lunch from: Kleberg-Kenedy Soil Water Conservation District, Goliad Soil Water Conservation District and Texas Farm Credit. The workshop was modeled after the Texas Soil Health Short Course arranged by the Natural Resources Conservations Service and the Texas State Soil and Water Conservation Board. Usually the course is a two-day presentation style and field demonstration event that invites local land owners, farmers, ranchers to learn about leading dynamic soil properties, regenerative grazing



management and research and technical information to implement new strategies to improve soil health and alleviate negative effects of runoff and nutrient loading. The workshop for the Baffin Bay Early Phase Watershed Planning Project was condensed into a 1-day workshop based on partner feedback. The five themes identified in the kickoff meeting were also present on big whiteboards and attendees were provided stickers to vote on what they saw as a top priority in the watershed. The following rankings were determined by 9 of the attendees who chose to participate during this Baffin Bay Soil Health Workshop (some of them had voted during the previous workshop so they did not vote again):

- Increase landowner incentives and/or implementation of best management practices regarding impacts to water quality (6 votes)
- Reestablish riparian habitats (9 votes)
- Mitigate septic and wastewater (3 votes)
- Community education (8 votes)
- Improve fisheries sustainability (1 vote)

Workshop #3: Water Quality and Fisheries (March 3rd, 2021/Virtual workshop/32 attendees)



Texas Sea Grant planned and advertised for this workshop throughout February and March 2020. The event was originally scheduled for April 7, 2020 when **COVID-19 restrictions were set in place, requiring the postponement of the workshop for a later date.** Texas Sea Grant talked more extensively about this workshop during the third Task Force meeting. Adrien Hilmy, CBBEP, and Dr. Mike Wetz, HRI, provided insight and feedback on potential speakers and options on organizing the workshop should the funding sponsor grant the extension request. After receiving notification on June 4, 2020 that the no cost project extension had been granted by EPA, Texas Sea Grant extension planning team made the call to move forward with the Task Force and key stakeholders to finalize the agenda.

The number of attendees including guest speakers was 32, which was ideal for having meaningful feedback conversation after the presentations. The presentations consisted of a project introduction by Texas Sea Grant, followed by a series of researcher presentations listed below covering ongoing studies, monitoring and initiatives related specifically to water quality and fisheries:

- **Dr. David McKee,** retired TAMUCC Center for Coastal Studies-History of salinity and freeze events in Baffin & Laguna Madre
- **Dr. Greg Stuntz**, Endowed Chair for Fisheries and Ocean Health and Director for Center for Sportfish Science and Conservation, Harte Research Institute- recap of previous results for ecosystem study on Black Drum
- **Natasha Breaux & Jenni Pollack** -- Research Specialist, Harte Research Institute- Serpulid reefs & availability of prey & isotope food web study
- **Dr. Michael Wetz** did not present a PowerPoint but is a leading researcher in Baffin Bay and served on the Researcher Panel.

<u>Local Panel Representatives</u>

- John Thornberry, recreational guide
- Richard Unterbrink, retired Commercial Fisherman
- Sam Sugarek, Director of Water Quality, Nueces River Authority
- Ethan Getz, Upper Laguna Madre Ecosystem Leader Texas Parks and Wildlife
- Brenda Ballard-Brush Country Chapter Coastal Conservation Association

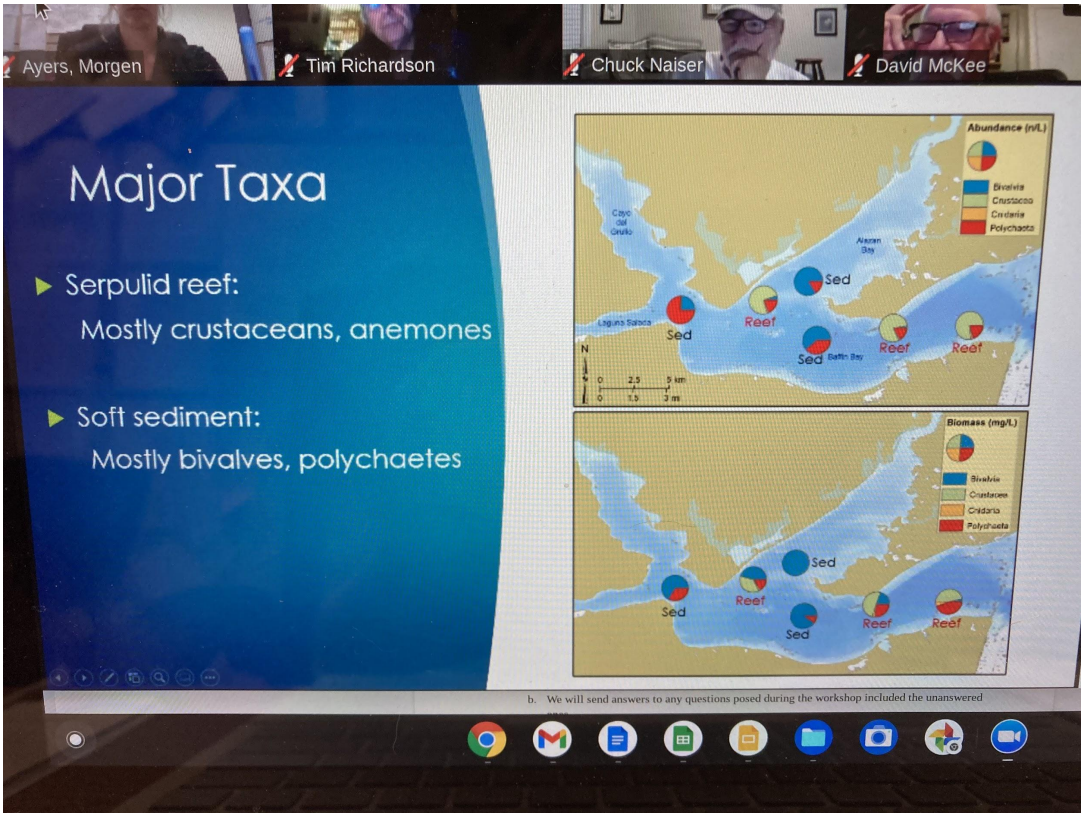


Image shows an excerpt from Dr. Jenni Pollack's presentation on Availability of Prey around the serpulid reefs in BAffin Bay.

Following the researcher presentations and introductions of local fishermen, a thoughtful and productive conversation was had. The intention was to do Zoom breakout rooms to have smaller discussion groups but the larger group ended up having such a productive discussion that we decided it would be disruptive to interrupt and break everyone up. We are thankful to have made that choice at the moment as everyone could hear the great feedback received by the presenters and panelists.

The Q&A panel touched on a variety of topics from strategies for reducing nutrient loads in the bay, an update on how the Freeze that occurred in February 2021 affected marine life, research data gaps and discussion from Dr. Jenni Pollack on ways to protect and ensure survival of the serpulid reefs. Through each of the topic areas the theme of gaps in the data to move forward with change is a major obstacle. A few examples of that are; in response to questions about the freeze, Dr. Stunz expressed that the effects are the most important next research step, specifically the top-down impacts, excess nutrients, water quality, and food web effects. Dr. Jennifer Pollock added that Dr. Mike Wetz has pushed for a lot of research to occur in Baffin Bay and the most significant needs are continuation of the recent research developments.

A number of best management practices were provided to the attendees through Texas Sea Grant as the Q&A panel. Below are some of the highlights:

1) Upland protection examples were also provided to the audience such as protecting riparian areas, green infrastructure adoption, constructed wetlands, small-scale green spaces.
2) Specific education efforts for reef protection but safe boating practices and ways to preserve benthic habitats (serpulids, seagrass) would be beneficial. Texas Sea Grant responded that locals have inquired about educational signage and next steps are being brainstormed.

    a. I.e. Signs at ramps, "If it looks wrong- report it!", “if you see something, say something”.

Texas Sea Grant followed up discussions with the core team to brainstorm a way to provide a survey for regular users of the bay to interact with. These discussions are still ongoing but we were able to collect more Stakeholder Bay Observations (outlined below):

- less (or more sporadic) rain than usual; creeks haven’t run in a while- loss of freshwater inflow.
- High tides correlate to the black drum coming in.
- Erosion and water quality are 2 biggest issues.
- Reefs are being broken down and filled in with sediment..
- Black drum was really bad again last season.
- ‘jelly belly’ condition in black drum has been occurring again recently

Local Fishery and Agency Q&A

The consensus for most urgent need according to the for hire and commercial fishermen and public was a single avenue for reporting change in bay conditions and other water quality related information to researchers and agencies in order to better help with data gaps and management decisions for Baffin Bay's health. There is opportunity to get information from commercial fishermen who work near the bay who are seeing changes, but often they don't know who to inform. They asked what data would be most useful. Below outlines some of the researcher's feedback:

- Mike Wetz- look for discolored water conditions for possible brown tide
- Greg Stunz:
    - what are guides catching and what areas are they visiting
    - Have catch rates suffered?
- Fireside chats suggested by audience as an easy way to get fishing guide population participation
- Long-term goal/desire voiced by participants was to create an app
    - I.e. Galveston Bay Action Network (GBAN) app, iSnapper
- Dr. Natasha Breaux is looking to collect small amounts of Black Drum tissue for analysis: interested stakeholders were invited to please reach out if they catch any and are willing to freeze and coordinate with Harte Research Institute

Texas Sea Grant explained that long-term efforts that stakeholders can be involved in are participation in any of the four sub-committees led by the Baffin Bay Stakeholder Group to include the Science and Technical Advisory Committee, the Citizens Advisory Committee, the Watershed Restoration and Management Committee, and the Local Governments Committee. At least one attendee expressed that they want to be involved with the Management Committee.

Workshop Improvements:
In the future, we would like to have a series of in person workshops that allow for breakout session conversations that proved successful in our previous workshops.

Workshop # 4 Green Infrastructure for Texas (May 4th, 2021/Virtual Workshop/41 attendees)

Texas Sea Grant planned and advertised for this workshop throughout Spring 2020. The original event was scheduled for May 7, 2020. Final details were in process with workshop partner Texas Coastal Watershed Program when **COVID-19 restrictions were set in place, requiring the postponement of the workshop for a later date**. The merits of this workshop are found in its use of live demonstrations and field visits to convey the positive benefits of Low Impact Development, for this reason we held off planning this workshop for as long as possible in the hopes we would be able to hold it

in person. Unfortunately the restrictions did not lift in time and we made the decision to move the workshop to a virtual format.

The Green Infrastructure of Texas Workshop was held virtually on May 4, 2021 from 12:00-2:00 in collaboration with the Texas Coastal Watershed Program and a representative from AquaStrategies. We had 65 individuals register and 41 participants in attendance. The participants covered a wide spectrum with landowners, residents, ranchers, business owners and agency representatives all in attendance. There were four great presentations that are outlined below.

1. **Green Stormwater Infrastructure**
   Charriss York, GIFT Programs Director, Texas A&M AgriLife Extension Service
   Texas Coastal Watershed Program

2. **Stormwater wetlands as Green Infrastructure: Nature-based solutions for stormwater issues**
   Christie Taylor, Texas A&M Agrilife Extension Service

3. **Wetlands for Water Quality Improvement**
   George Collins, AquaStrategies

4. **Conservation and Restoration of Large Landscapes**
   Colleen Ulibarri, Texas A&M AgriLife Extension Service

The participants were grateful for the knowledge shared by the presenters, covering a variety of strategies for working with natural landscapes to address nonpoint source pollution through slowing, spreading and sinking water. Texas Sea Grant targeted a wide audience as the material covered rural, suburban, and urban solutions. A private firm, AquaStrategies, was invited to present on a local example that helped to connect the concepts in the Agrilife presentations with the local region. Texas Sea Grant feels that a significant amount of science-based information was transferred to the intended target audience for the purposes of our project: Early Phase Watershed Protection Planning for Baffin Bay.

<u>Discussion Feedback:</u>
The following focus area goals identified to date by local stakeholders were shared with the participants to prompt any elaboration or new feedback on needs. Examples of best management practices for the following topics were provided in response to audience questions: Increase landowner incentives and/or implementation of best management practices regarding impacts to water quality, Reestablish riparian habitats, Mitigate septic and wastewater, Community education, Improve fisheries sustainability, and Wildlife water quality impacts.

There was interest in receiving resources about using air conditioning condensate for small scale low impact development. A follow-up email was sent to attendees that included resources related to that and design blueprints from the CLCWA Detention Facilities, an example that was covered in Christie Taylor's presentation.

We had a follow-up survey to collect more information and received 14 responses. Many individuals that attended were interested in learning about green infrastructure and other best management practices and did not live in the watershed. Among the responses for what was valued most included the natural resources of the region and the Baffin Bay watershed. Pollution and nutrient runoff affecting the watershed were the biggest concerns. The following questions were asked to workshop participants:

- Do you live in the region? If so, for how long?
- Which of the following best describes you? (Resident, Landowners, Absentee Landowner, Commercial Fishing, Recreational Fishing Guide, Rancher, Farmer, Business Owner, Agrilife Extension, Other)
- What do you value most about living in the Baffin Bay Watershed?
- What are your biggest concerns related to water quality and/or fisheries habitat in Baffin Bay?

<u>Workshop Improvement</u>

The ability to hold the workshop in person is the biggest improvement we would implement if given the opportunity to do it again. Locating and securing a field trip to a LID example site would have been a great way to provide a visual demonstration of LID in action. Using a local private consultant to speak about a local example was a new addition to the workshop line-up that just happened to work out. The Texas Community Watershed Partner representatives enjoyed this aspect of the workshop and are thinking of adding this type of connection as a permanent fixture to this workshop when applicable.

Task (c) – Development of Early Phase Watershed Plan

The need for an Early Phase Watershed Protection Plan was expressed by the local Baffin Bay Stakeholder Group in order to address water quality degradation issues. It was determined that a combination of educational workshops and engagement of local stakeholders was necessary to best inform this plan which can be found in full in Appendix H.

Feedback for this plan was gathered beginning in 2019 at informal meetings, the Kickoff Meeting, first workshop and continued in the Spring of 2020 for the second workshop. In light of COVID-19 restrictions that prevented Texas Sea Grant from holding workshops with community groups for a significant portion of the project period beginning in March 2020, we generated a mail-out survey Summer 2020. Beginning in the early Fall of 2020, Texas Sea Grant disseminated a mail-out questionnaire to residents, landowners, commercial fishermen, and for hire fishermen to expand engagement in the watershed. This questionnaire is also available on our project website page at: https://texasseagrant.org/programs/baffin-bay-early-phase-wpp/index.html.
This allowed for more representative feedback from the communities within the Baffin Bay watershed on needs. This allowed the planning team to expand on a comprehensive outline of how identified best management practices can be used and where landowners can go for resources and implementation assistance.
The last two workshops were held virtually in the Spring of 2021. Development also incorporated feedback from other opportunities to engage stakeholders throughout the project period. This multifaceted approach laid a solid foundation for the purpose of capturing a comprehensive outline of how identified bmps can be used and where landowners can go for resources and implementation assistance. The Core Team was an integral part of helping to establish connections with the local community and provided recommendations for the outline of the report. They also were a huge help in developing the questions for the questionnaire and providing more resources to help complete the report.

Additional efforts:
On July 25, 2020 Hurricane Hanna made landfall on Padre Island before moving further inland to affect western regions of Kleberg County and parts of Kenedy County. Local residents and County Commissioner Roy Cantu reached out to Texas Sea Grant to seek help with recovery. Due to this request, Texas Sea Grant was able to connect with more coastal property owners and get onto private lands to speak with residents and take pictures of their properties. A damage assessment map was created as a direct result of this trip. A workshop was held September 2, 2020 in Riviera, Texas to talk about hurricane recovery. Information about the Early Phase Watershed Planning

project was disbursed, including the landowner questionnaire. Texas Sea Grant was able to collect a number of completed questionnaires from the residents.
We received more localized spatial feedback through the questionnaires and were used to create maps of various inputs and features of the watershed.

Problems/Corrective Actions

During the first few months of the project, problems encountered were minor complaints about event facility and clarification requests regarding certain aspects of the project, which were addressed in future strategies.

With the second workshop occurring shortly after Christmas and New Year holidays, along with a few sectors of the watershed not receiving the event advertisement the second workshop's attendance was lower than expected. The corrective actions were discussed and addressed with the Task Force and Core Team for future workshop planning.

COVID-19 Pandemic:

The workshop deliverables were delayed due to COVID-19 but Texas Sea Grant worked closely with CBBEP on solutions and a revised plan and timeline for completing the project. The revised plan was approved and extended the project to July 31, 2021. In order to continue community engagement with stakeholders while unable to meet in person, a mailout packet was created to target fishermen and more residents/groups. Project information including past workshop agendas and upcoming workshops were included in the packet. The mail out packets were also used as an opportunity to educate the community about the project and efforts in the watershed to date. Along with questionnaires for the Public and another version for Resource Managers there was also project and workshop information as well as links to more details. Questionnaires have been disseminated to a total of 429 recipients that either work or live in the Baffin Bay Watershed. Commercial and for-hire fishermen were the largest group of recipients, followed by residents, landowners, and local groups like churches and academic institutions who reside in the Baffin Bay watershed or depend on Baffin Bay for their livelihood. We received 30 mailed responses, making the response rate 7 percent. The number of returned packets that bounced back was 12, making the rate 2.8 percent. The number of online questionnaires sent directly by Texas Sea Grant was approximately 130 email recipients. We received 26 responses, making the approximate response rate 20 percent. The questionnaire remained open from September 2020 to June 2021.

Responses reflected community investment and concern for the Baffin Bay system and watershed. The questionnaires were also posted online from September 2020 until July 2021. Strategies to promote the awareness of the questionnaire included having the link provided during the last two workshops, sending a follow up email to participants with the link, and utilizing the Task Force to share with their networks.

The response rate of mailed project packets and questionnaires was low. Addresses were found using Appraisal district data for Kenedy, Kleberg and Jim Wells. Recipients of the packet were most likely not aware of the project and not familiar with our group which probably affected response rate. Other reasons are likely due to 1) the number of pages of the project section in the mailout. Next time we would recommend condensing those into less pages and more of a summary, 2) many of the commercial fishermen not being residents of the bay and therefore possibly less invested in providing feedback, and 3) recipients that are absentee landowners.

Texas Sea Grant engaged with attendees through an online meeting platform and solicited feedback by sharing documents from the project's Google Drive folder during late Spring.

Additionally, the project region was affected by Hurricane Hanna, a category 1 hurricane. Overall questionnaire distribution was slowed as recovery efforts were a priority. The community continued to engage Texas Sea Grant regarding needs for debris removal post hurricane. Resources continued to be provided to stakeholders as well as guidance on Debris pick up services. Texas Sea Grant continued to utilize recovery effort opportunities to target the dissemination of questionnaires to the affected communities.

In mid-February a Severe Winter Storm (Uri) significantly impacted this region along with the entire state. This crisis did impact engagement with the community as they were dealing with power outages and loss of water services. Texas Sea Grant passed along resource assistance to farmers in the community and checked in with stakeholders.

Overall the questionnaire and randomization of the mail out packets were able to capture a wider audience that may not otherwise have been involved but there are a few changes Texas Sea Grant could pursue in the future in the event another type of survey is dispersed. This includes going in person to businesses and other organizations to engage with them and solicit them to share with their networks. Attend community based meetings and events and work with organizations to get time to introduce the project and request feedback. Lessen the amount of information and documents included in mail out packets so as to not overwhelm the recipient with too many details.

Although our summary shows a more successful online response, we feel that under non-pandemic conditions we would have been able to acquire a significant number feedback responses in-person during workshops that we had to hold virtually during this pandemic.

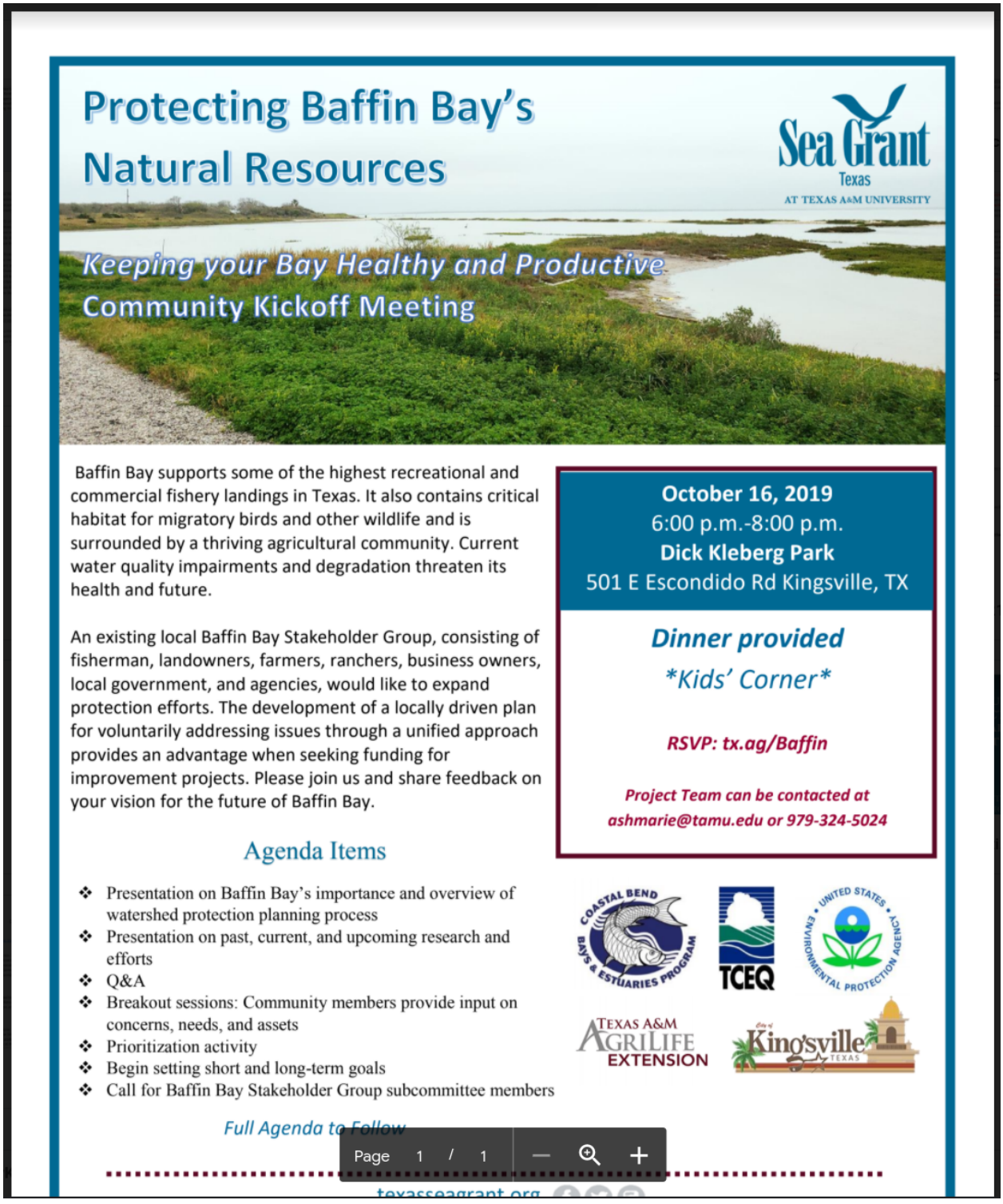
Conclusion:

Local feedback from the workshop participants, panelists, task force members, and other community stakeholders throughout the project process was invaluable. The information gathered on local concerns fell into six focus areas for addressing the water quality issues.

Those focus areas were Riparian and Shoreline Habitat Enhancement, Wastewater and Septic Mitigation, Landowner Incentives, Fisheries Sustainability, General Community Outreach, Wildlife Inputs, and a Miscellaneous Other WQ category. An Early Phase Plan reflecting strategies to address these needs were finalized and submitted to the Coastal Bend Bays and Estuaries Program as an appendix in this report.

Additionally this Early Phase project's efforts laid a good foundation and community support for more funding for the Baffin Bay system's watershed protection--Texas Water Resources Institute at Agrilife was able to apply for and receive TSSWCB 319 grant funding for a San Fernando and Petronila Watershed Protection Plan, which is underway with participation from partners to include Texas Sea Grant. Additionally, Texas Sea Grant is continuing to engage the community and open up discussions with the Judge Madrid from Kleberg County and commissioners about using GLO CDBG funds to address water quality on top of flooding issues in the county, rather than traditional grey infrastructure.Other funding sources can be pursued from potential management strategies outlined in this Plan from small to larger efforts in a collaborative manner due to expansion of support in the Baffin Bay watershed. A recommendation for additional needs is the hiring of a Watershed Protection Coordinator for future Watershed Protection Plans in the remaining watershed, including the bay proper.

Appendix A
Kickoff Meeting



Protecting Baffin Bay's Natural Resources

Sea Grant Texas
AT TEXAS A&M UNIVERSITY

Keeping your Bay Healthy and Productive
Community Kickoff Meeting

Baffin Bay supports some of the highest recreational and commercial fishery landings in Texas. It also contains critical habitat for migratory birds and other wildlife and is surrounded by a thriving agricultural community. Current water quality impairments and degradation threaten its health and future.

An existing local Baffin Bay Stakeholder Group, consisting of fisherman, landowners, farmers, ranchers, business owners, local government, and agencies, would like to expand protection efforts. The development of a locally driven plan for voluntarily addressing issues through a unified approach provides an advantage when seeking funding for improvement projects. Please join us and share feedback on your vision for the future of Baffin Bay.

October 16, 2019
6:00 p.m.-8:00 p.m.
Dick Kleberg Park
501 E Escondido Rd Kingsville, TX

Dinner provided
Kids' Corner

RSVP: tx.ag/Baffin

Project Team can be contacted at ashmarie@tamu.edu or 979-324-5024

Agenda Items

- Presentation on Baffin Bay's importance and overview of watershed protection planning process
- Presentation on past, current, and upcoming research and efforts
- Q&A
- Breakout sessions: Community members provide input on concerns, needs, and assets
- Prioritization activity
- Begin setting short and long-term goals
- Call for Baffin Bay Stakeholder Group subcommittee members

Full Agenda to Follow

Coastal Bend Bays & Estuaries Program · TCEQ · United States Environmental Protection Agency · Texas A&M AgriLife Extension · City of Kingsville Texas

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texasseagrant.org

Appendix B
Riparian and Stream Ecosystem Workshop Agenda

Texas Riparian & Stream Ecosystem Training

Petronila and San Fernando Watersheds

Agenda ~ November 6, 2019

8:00 Meeting Registration
8:15 Welcome & Introductions
- Jason Ott, Nueces County AgriLife Extension

8:30 Program Overview, Watershed Management and Water Quality
- Clare Entwistle, Texas Water Resources Institute (TWRI)

9:20 How Creeks Function & Bear Creek Example
- Melissa Parker, Texas Parks and Wildlife Department (TPWD)

10:10 Break
10:25 Riparian Vegetation
- Tony Falk, South Texas Natives – Caesar Kleberg Wildlife Center

11:15 Management Practices, Local Resources and Photo Monitoring of Streams
- Clare Entwistle, TWRI

12:05 Lunch
12:20 Lunchtime Presentation: Baffin Bay Project Overview
- Morgen Ayers & Ashley Bennis, Texas Sea Grant

12:50 Riparian Flyover
- Sky Lewey, Nueces River Authority (NRA)

1:20 Trip to the Creek
- Creek Walk & Riparian Bullseye Demonstration, NRA
- Soil Sample Demonstration: Shanna Dunn, USDA NRCS
- Feral Hog Education: Dustin Windsor, TPWD

4:30 Wrap up and Head for Home!

http://texasriparian.org/ and https://www.facebook.com/TexasRiparianAssociation

Texas Water Resources Institute make every drop count
Texas A&M AgriLife Research Extension
Texas A&M NRI Natural Resources Institute
Texas A&M Forest Service
Coastal Bend Bays & Estuaries Program
Sea Grant Texas at Texas A&M University
Texas Riparian Association
Texas State Soil & Water Conservation Board
Texas Parks & Wildlife
Life's better outside.
USDA NRCS
TCEQ
Caesar Kleberg Wildlife Research Institute Texas A&M University-Kingsville

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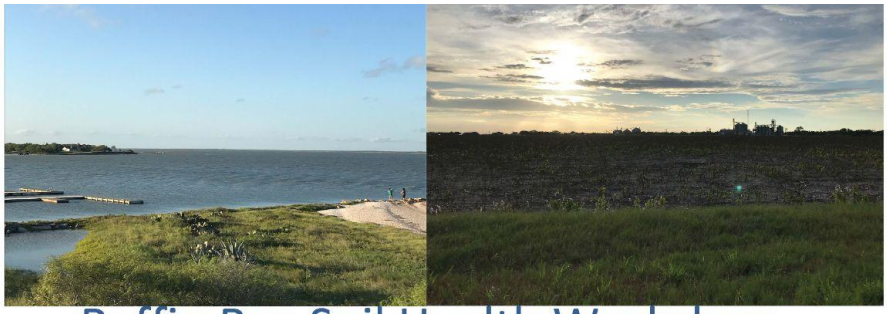
Appendix C
Soil Health Workshop Agenda



Baffin Bay Soil Health Workshop

Riviera ISD- January 9th, 2020

8:00 Registration & Breakfast
8:30 Welcome & Introductions
- Commissioner Roy Cantu

8:35 Project & Agenda Overview
- Morgen Ayers & Ashley Bennis, Texas Sea Grant

8:55 Soil Health Principles
- Ray Hinojosa, USDA Natural Resource Conservation Service

9:40 Break
9:50 Regenerative Grazing
- Tracy Litle, Holistic Management International

10:45 Agency Resource Panel Discussion
- Representatives from different Agencies

12:00 Lunch

1:00pm Leave for Field Demonstrations

1:10 Rainfall Simulator
- Nathan Hale, USDA Natural Resource Conservation Service

2:20 Discussion around Soil Pit
- Soil Scientist from Robstown, TX

3:30 Wrap up and Next Steps

Appendix D
Water Quality and Fisheries Workshop Agenda

Agenda

Welcome and Partner Introductions

Presentations

Texas Sea Grant- Overview of the Project, Upcoming Workshops, Feedback

Greg Stuntz Sportfish Center HRI- Black Drum and Ecosystem based approach

Natasha Breaux & Jenni Pollack- Serpulid Reefs & Availability of prey & Isotope Food Web Study

Dr. David McKee, retired TAMUCC Center for Coastal Studies-History of salinity and freeze events in Baffin & Laguna Madre

Q&A with Panel of Specialists

Texas Parks & Wildlife, Harte Research Institute, TAMUCC, Flatsworthy, Fshing Guide, Texas A&M Kingsville

Breakout Session Part I: Prioritizing Needs for the Watershed

Adjorn

Texas A&M AgriLife Extension · Texas Parks & Wildlife · Texas A&M University Corpus Christi Harte Research Institute for Gulf of Mexico Studies · Sea Grant Texas at Texas A&M University · Coastal Bend Bays & Estuaries Program · TSSWCB · TCEQ · Texas A&M University Corpus Christi Center For Water Supply Studies

Appendix E
Green Infrastructure for Texas- Baffin Bay Workshop Agenda

Green Infrastructure for Texas (GIFT)

Tuesday May 4th, 2021

12:00PM-2:00PM

12:00 Welcome

12:05 **Project & Agenda Overview**

-Morgen Ayers & Ashley Bennis, Texas Sea Grant

12:10 **Green Stormwater Infrastructure**

-Charriss York, GIFT Programs Director, Texas A&M AgriLife Extension Service

12:50 **Stormwater wetlands as Green Infrastructure: Nature-based solutions for stormwater issues**

-Christie Taylor, Texas A&M Agrilife Extension Service

1:10 **Wetlands for Water Quality Improvement**

-George Collins, AquaStrategies

1:30 **Conservation and Restoration of Large Landscapes**

-Colleen Ulibarri, Texas A&M AgriLife Extension Service

1:45 **Q&A with Presenters**

With: TCWP, AquaStrategies, TXSG

1:55 **Wrap up and Next Steps**

Appendix F
Questionnaire for Public

Baffin Bay Watershed Questionnaire for the Public:
Prepared by TX Sea Grant for the CBBEP funded project, “Early Phase Watershed Planning for Baffin Bay”

The purpose of the following survey is to reach out to individuals and groups in the community and give them the opportunity to provide anonymous feedback and insight in regards to the health of Baffin Bay. The answers will be used to help the project planning team continue to prioritize local concerns and align best management practice solutions to meet local community needs. If you do not feel comfortable or do not have an answer for a particular question, feel free to leave it blank. Any information gathered is helpful. We thank you for your participation! These questions are also available to be answered online at: tx.ag/BaffinQuestionnaire

General Questions:

- Which of the following best describes you?

❏ Resident ❏ Landowner ❏ Absentee Landowner ❏ Commercial Fisherman ❏ Recreational Fishing Guide	❏ Farmer ❏ Rancher ❏ Farmer & Rancher ❏ Business Owner ❏ Other-_____

- What is your town/city of residence?_____
- What do you enjoy/value most about Baffin Bay and/or the land you own around Baffin Bay?

_____

- Do you have concerns about the health of Baffin Bay (i.e. water quality, fisheries, habitat)?

_____

- What major changes have you noticed about Baffin Bay, its surrounding habitats, and land use?

  _____

- Have any of these changes affected your wellbeing or livelihood (i.e., ability to generate income)?

  _____

- Who do you look to as a community leader/citizen scientist for natural resource stewardship or otherwise? What is their role or title?

  _____

- Where do many large community events take place in your area?

  _____

- Do you have a favorite public park or segment of the bay? If so, what do you enjoy about it/them?

  _____

- Do you want to know more about resources/funding opportunities on protecting the health of Baffin Bay and its surrounding lands? If so, please provide specific issues/topics. If you would like to receive this information directly, please contact either Ashley Bennis at ashmarie@tamu.edu or Morgen Ayers at (979-324-5024).

  _____

_____

Water Quality-specific Questions:

- What sources (avian wildlife, livestock, septic, terrestrial wildlife, wastewater treatment facilities) in the watershed do you think contribute most to high bacteria levels in Baffin Bay and its tributaries?

_____

- What sources (wastewater, agricultural runoff, urban stormwater,) in the watershed do you think contribute most to high nutrient levels in Baffin Bay and its tributaries?

_____

- What management practices (vegetative buffers, septic assistance, cover crops, alternate water sourcing for livestock) could/would you personally be willing and able to implement to reduce bacteria or nutrient loading into the watershed in the **absence** of financial assistance?

_____

- What management practices (vegetative buffers, septic assistance, cover crops, alternate water sourcing for livestock) could/would you personally be willing and able to implement to reduce bacteria or nutrient loading into the watershed **provided that financial assistance were available to you**?

_____

Appendix G
Questionnaire for Resource Managers

Baffin Bay Watershed Questionnaire for Resource Managers:

Prepared by Texas Sea Grant and Core Team for the CBBEP funded project, “Early Phase Watershed Planning for Baffin Bay”

The purpose of the following survey is to reach out to individuals and groups in the community and give them the opportunity to provide anonymous feedback and insight with regard to the health of Baffin Bay. The answers will be used to help inform the project planning team in prioritizing local concerns and align best management practice solutions to meet local community needs. All questions are voluntary. We thank you for your participation! These questions are also available to be answered online at tx.ag/BaffinResourceManager

.

- What is your town/city of residence?_____
- What is most unique about Baffin Bay and/or surrounding habitats?

  _____

  _____
- Which habitats in Baffin Bay need more protection (i.e. specific shoreline segment, upland areas, contributing streams, etc.)?

  _____

  _____
- In your opinion, what segments of Baffin Bay are healthy, and what segments are unhealthy?

  _____

  _____
- Do you have questions/concerns about the quality of the water in Baffin Bay (i.e. nutrients, bacteria, dissolved oxygen, etc).? If so, please elaborate:

  _____

  _____

- Are there occurrences in Baffin Bay that you think citizens could mistake as human impacts as opposed to natural trends? What specific information are you basing your assessment on?

  _____

  _____

- Is illegal dumping a concern in and around Baffin Bay (i.e. animal carcasses, chemicals, tires, etc.)? What specific information are you basing your assessment on?

  _____

  _____

- Is waste management (municipal/industrial treatment plants or agricultural) a concern around Baffin Bay? What specific information are you basing your assessment on?

  _____

  _____

- Where are the most obvious vegetation disturbances on public lands around Baffin Bay and what are likely sources (i.e. from human use, invasive plants or animals, etc.)?

  _____

  _____

- Are there barriers such as sediment accumulation, improperly sized culverts, debris, etc. that are obstructing freshwater inflow into Baffin Bay? What specific information are you basing your assessment on (road construction, development, drainage alterations, land use changes, etc.)?

  _____

  _____

- What have been the most helpful natural resource protection community programs and/or training for professionals in Baffin Bay or elsewhere?

_____

- Are there unaddressed assistance/needs related to Baffin Bay, fisheries, habitats, wildlife productivity, and overall health?

  _____

- Please detail any funding sources that could support projects related to the following watershed protection items. The bullets in bold were locally identified. The others are commonly named in other watershed based plans.

  - **Habitat enhancement (riparian/creek, shoreline, etc.)**:_____
  - **Wastewater & Septic Mitigation:_____**
  - **Community Outreach:** _____
  - **Landowner Incentive Programs:_____**
  - **Fishery sustainability:_____**
  - Illegal dumping:_____
  - Wildlife conservation:_____
  - Invasive species (plant and animal):_____
  - Urban (stormwater runoff, low impact development, etc.):_____
  - Others: _____

- Does your organization/agency have/know of local work groups and nonprofits who might be interested in participating or learning more about this project?

_____

Water Quality-specific Questions:

- What sources (avian wildlife, livestock, septic, terrestrial wildlife, wastewater treatment facilities) in the watershed do you think contribute most to high *bacteria* levels in Baffin Bay and its tributaries?

_____

- What sources (waste water, agriculture runoff, urban stormwater) in the watershed do you think contribute most to high *nutrients* in Baffin Bay and its tributaries?

_____

- What management practices (vegetative buffers, septic assistance, cover crops, alternate water sourcing for livestock) could/would your community be willing and able to implement to reduce bacteria or nutrient loading into the watershed in the **absence** of financial assistance?

_____

- What management practices (vegetative buffers, septic assistance, cover crops, alternate water sourcing for livestock) could/would your personal community be willing and able to implement to reduce bacteria or nutrient loading into the watershed **provided that financial assistance were available**?

_____

Appendix H

Early Phase Watershed Protection Plan for Baffin Bay

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c. **Kenedy Ranch and Los Olmos Creek**
d. **Kingsville & Naval Air Station**
e. **Kingsville Drainage way**
f. **San Fernando Creek and Celanese Complex**
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h. **Carreta Creek Discharge and Bishop Drainage Way**
i. **Driscoll and Chapman Ranch**
j. **Banquete Creek and Agua Dulce**
k. **King Ranch**

Figure 23. Baffin Bay Working Group in Action

Chapter 1: Watershed Management

Watershed definition

Figure 1

The EPA defines a watershed as the "land area that drains rainfall through a stream, lake or river to a common outfall".[1] We all live on an area of land, therefore we all live in a watershed. What separates one watershed from another is change in elevation, which varies from extremely gradual slopes in coastal regions and plains, to rolling hills and mountain peaks for example. Land use characteristics (impervious and pervious) are also important to consider, because they dictate how the water interacts once it makes surface contact which ultimately determines water quality.

Watersheds can be organized within the major river basins, which is helpful in order to understand and better protect water quality and quantity from a larger-scale perspective. The Baffin Bay watershed falls within the larger Nueces-Rio Grande River Basin[2]. To understand and identify solutions to regional water quality and water quantity concerns/needs, watersheds can also be further parsed out into river or bay-sized watersheds. Scaling down further into a creek-sized watershed allows for water quality and water quantity concerns/needs to be assessed from a community-based level.

Sub watersheds of the Baffin Bay watershed are delineated within the light yellow area on the map to the right.[3] Precipitation that falls within these areas ultimately end up in the Baffin Bay system whether through stormwater runoff, subsurface recharge to the waterbody, or via groundwater connectivity to the surface water body.

Figure 2

Watershed and Water Quality

[1] Healthy Watersheds Protection: Basic Information and Answers to Frequent Questions

[2] The State of Water. Texas Parks and Wildlife: River Basins Major Bays and Streams.

[3] Texas Coastal Waters: Nutrient Reduction Strategies Report. Parsons. 2019. page

“A waterbody is impaired if it does not attain the water quality criteria associated with its designated use(s). Those uses are categorized as-- aquatic life, contact recreation, public water supply, or fish consumption. The criteria for evaluating whether standards meet aquatic life use could include the amount of dissolved oxygen in the water along with the diversity of aquatic organisms. Threatened waters are those that meet standards but exhibit a declining trend in water quality such that they will likely exceed standards in the near future” (EPA Quick Guide. May 2013).

Water quality in a given watershed is impacted by both natural storms and climate conditions as well as the degree of human activity. The surface type (land use) determines whether the rainfall soaks in or runs off. Pervious surfaces allow water to pass through as opposed to impervious surfaces that do not allow water to pass through. Grassy areas are a type of pervious surface and are able to slow, filter and absorb a certain amount of water into the soil. This can help with flooding issues by increasing water storage and help improve water quality in the watershed by filtering the runoff through complex root systems. An impervious surface such as concrete does not allow water to move through it, so it moves horizontally as runoff. Rainfall runoff will pick up and carry what it comes into contact with (such as pollutants) as it passes over the land surfaces on its way to a water body. Watersheds with a high degree of human influence often have significant impervious surface coverage (i.e., streets, sidewalks, concrete drainage channels) that can lead to negative impacts on water quality. Pollutants that enter into a waterbody from runoff are categorized as Nonpoint Source Pollution as it “originates from multiple locations”[4].

Pollution that originates from a specific location such as industrial operation or a wastewater treatment facility is called Point Source Pollution. Watersheds with a high degree of human population often have significant quantities of treated wastewater that discharge to local waterbodies. The impact on water quality depends on if the facility is up to date and how well the wastewater is treated to remove pollutants.

Benefits of a Watershed Approach

A watershed approach is the coordinating framework for identifying locally-driven mechanisms to all stakeholders for voluntarily addressing complex water quality and environmental issues “within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow” (Browner, 1996), ultimately promoting unified approaches to seek funding.

Utilization of a watershed approach has been proven successful, measurably improving water quality for decades throughout the State of Texas and beyond. The watershed approach is voluntary, science-based, adaptable to site-specific needs, and inclusive of all stakeholders with varying interests. Stakeholders are individuals residing within the watershed or individual’s dependent on the natural resources for their livelihoods. Because of this collaborative approach, strategies are often multifaceted,

[4] Texas Commission on Environmental Quality. “PRESERVING AND IMPROVING WATER QUALITY” September 2006. https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/08twqi/pollution_control.pdf

and partnerships allow leveraging of resources, expertise, as well as increased likelihood of funding for efforts and projects to achieve the desired water quality improvement(s). The success of watershed partnership efforts relies on the collective historical knowledge of local stakeholders in order to determine the best strategy(s) moving forward. Stakeholder knowledge often fills data gaps in understanding long-term water quality trends, potential sources of pollution, past projects, and identification of educational strategies most suited for their community members to name a few.

Watershed Protection Planning

There are no one size fits all approach to addressing watershed protection needs. Watersheds are unique in their characteristics as well as their communities. Site specific and targeted actions are crucial. Below are the six basic steps outlining how to develop and implement an effective watershed plan. These steps provide a road map for you to follow to achieve your watershed goals.[5]

Figure 3

The nine elements (shown to the right) fit within the six steps of the watershed planning process. These elements are the components of the watershed planning process that EPA believes are the most critical to preparing effective watershed plans and are generally required for watershed projects funded under section 319. [6] This *Early Phase Watershed Protection Planning for Baffin Bay* project focused on 1 through 3 of the six basic steps.

a. Identify causes and sources of pollution
b. Estimate pollutant loading into the watershed and the expected load reductions
c. Describe management measures that will achieve load reductions and targeted critical areas
d. Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan
e. Develop an information/education component
f. Develop a project schedule
g. Describe the interim, measurable milestones
h. Identify indicators to measure progress
i. Develop a monitoring component

Figure 4

[5] A QUICK GUIDE to Developing Watershed Plans to Restore and Protect Our Waters. EPA. pg. 6. May 2013
[6] A QUICK GUIDE to Developing Watershed Plans to Restore and Protect Our Waters. EPA. pg. 3. May 2013

Figure 5 a.

Figure 5 b.

Figure 5 c.

Building partnerships is the key to successfully protecting a watershed. Texas Sea Grant engaged local stakeholders by meeting with people that work and live in the watershed. Through these relationships, we were able to expand our reach to more individuals and groups in the watershed. Partnerships and engagements further developed into a local Task Force, made up of local stakeholders that live and work in the watershed, that helped contribute to characterizing the watershed, as well as developing and facilitating workshops with panels and breakout sessions. Figure 5 a. b. and c. were taken at the Kickoff Meeting, Riparian Workshop and Soil Health Workshop by project staff.

Partnerships with local stakeholders in Baffin Bay contributed to providing input on the character of the watershed, identifying data and knowledge gaps with their historical knowledge of the bay and region, and ultimately driving the process of setting goals for improving watershed health. The creation of this Task Force also allowed different stakeholders who may not have previously been involved in this effort to have a seat at the table. One major example of this was the inclusion of local industrial partners. **The identification of locally-defined goals and solutions options are outlined in Chapter Six.**

Supporting Continued Efforts in Protecting Baffin Bay!

This effort's partnership building and local feedback resulting in this Plan will be used for the *San Fernando and Petronila Watershed Protection Plan* led by Texas Water Resources Institute and partners including Texas Sea Grant. The project will run from August 2020-August 2022. For More information visit: https://twri.tamu.edu/our-work/restoring-

Chapter 2: Characterization of Baffin Bay and its Watershed

History

Baffin Bay is one of six hypersaline coastal lagoons worldwide and home to a number of vulnerable species and habitats. Baffin Bay was formed during the Pleistocene period as the upper part of a small river valley that flooded due to a rise in sea level during the mid-Holocene.[7] During those earlier periods you could find abundant oysters and other shellfish populations. Conditions changed as the South Padre barrier island formed approximately 3,000 years ago. A much different bay system developed as the former open bay gained significant sediment from the formation of the island as well as separation from Gulf waters, resulting in the shallow hypersaline conditions we see today. In turn, bay system productivity shifted significantly to favor certain fin fish species that tolerate the high saline conditions that remain today.[8]

Natural characteristics

Baffin Bay is located 50 miles south of Corpus Christi within the Nueces-Rio Grande Coastal Basin that covers approximately 10,400 square miles in South Texas. The watershed courses through multiple jurisdictions including Kleberg, Kenedy, Jim Wells and Nueces County collectively. It is a part of the Laguna Madre System, a 225-km-long hypersaline lagoon extending from Mexico to Corpus Christi. Padre Island, a narrow coastal barrier island, separates the lagoon from the Gulf of Mexico. (Tolan et al.,1997)
The Laguna Madre and Baffin Bay systems are relatively unaffected by daily tides that average only a few centimeters. Residence time of water in Baffin Bay typically exceeds 1 year due to minimal tidal influence and

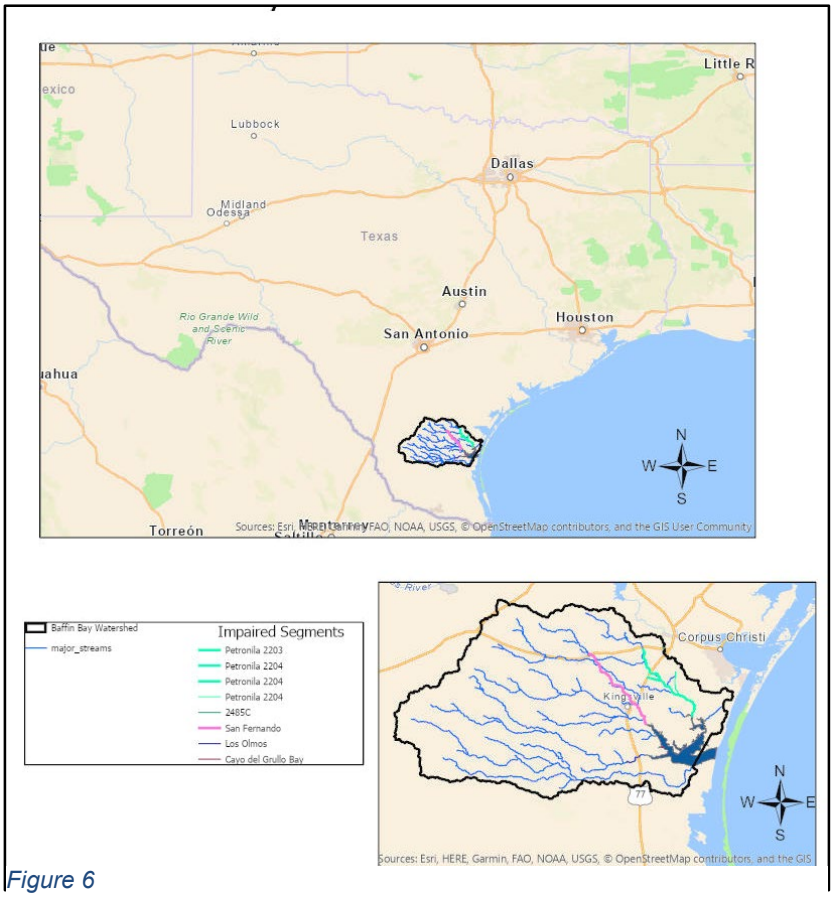

Figure 6

[7] Livsey, Daniel; Simms, Alexander R. Episodic flooding of estuarine environments in response to drying climate over the last 6,000 years in Baffin Bay, Texas. University of California at Santa Barbara. September 2016.

[8] Baffin Bay. Texas Beyond History. https://texasbeyondhistory.net/coast/images/ap6.html

freshwater inflows, and due to the fact that evaporation exceeds precipitation, the system continues to be prone to hypersaline conditions.[9]

Baffin Bay is considered one of the jewels of the Texas coast because of its tremendous fishing and recreation potential, as well as its positive economic impact on the surrounding communities. It supports some of the highest recreational and commercial fishery landings, and contains critical habitat for migratory birds and other wildlife.

The Baffin Bay watershed is 2,177,965 acres of primarily rural lands and contains a very diverse collection of wildlife. The land is a nearly level, fairly smooth coastal terrace that, on average, ranges in elevation from sea level to 50 feet in some parts with most residents residing at around 4 feet of elevation. Any water that falls on the land makes its way down the tributaries and empties into one of the branches of Baffin Bay.[10] The three branches or fingers as they are referred to are; Alazan Bay, Cayo del Grullo and Laguna Salada. The largest of these branches, Alazan, extends out from Baffin Bay to the northeast and is fed by Petronila Creek. San Fernando Creek feeds into the northwestern extension of Cayo del Grullo while the smallest of the subsidiary bays, Laguna Salada is fed by Los Olmos creek.[11] The low inflow plays a major role in the high salinity of the bay. With little freshwater inflow and high evaporation rates due to shallow waters and warm temperatures most of the year, Baffin Bay's salinity levels regularly reach 45-55 parts per thousand or higher - twice as salty as lower Galveston Bay and saltier than the 35 ppt salinity of the Gulf of Mexico.[12] In times of drought, the salinity of the bay in some parts have been known to hit 95 ppt or more. Since the bay is right on the coast of the mainland of Texas it is vulnerable to tropical storms and storm surge which can drastically alter the hydrology of the system (Bartlett).

Petronila Creek (segments 2204 and 2203) primarily contributes to the Alazan Bay and runs mostly through ranch and farmland of Kleberg and Nueces counties. According to TCEQ, Petronila is a 44-mile freshwater stream that is known to have an excess of chloride, sulfate, and total dissolved solids.

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[9] Shormanna, DE. 1992. The effects of freshwater inflow and hydrography on the distribution of brown tide in South Texas. MA. thesis, University of Texas at Austin, 112 pp.

[10] Soil Survey of Kenedy and Kleberg Counties

[11] Beyond Texas History. Baffin Bay. Accessed March 31, 2021.

[12] Thompkins, Shannon; Salty Bay water doesn't mean bitter fishing experience. Sep. 18, 2013Updated: Sep. 19, 2013. Houston Chronicle.

San Fernando Creek (segment 2492A) contributes to the Cayo del Grullo Bay section of Baffin Bay. The 42-mile-long tributary has had a record of bacterial impairment for contact recreation since 2006 as well as excessive levels of nitrates, chlorophyll-a, and total phosphorus (Lewey, 2019). The streams flow through the City of Alice, Kingsville and other rural areas in the watershed. It receives discharge from multiple wastewater treatment plants.

Los Olmos feeds into the Laguna Salada section of Baffin Bay and is an unclassified stream. This means that little is known about the water quality of the stream but it is known that much of the three tributaries flow through private swaths of land. There are many opportunities for education and enhancing the riparian function and off-channel wetland treatment to improve water quality through private land stewardship (Lewey, 2019).

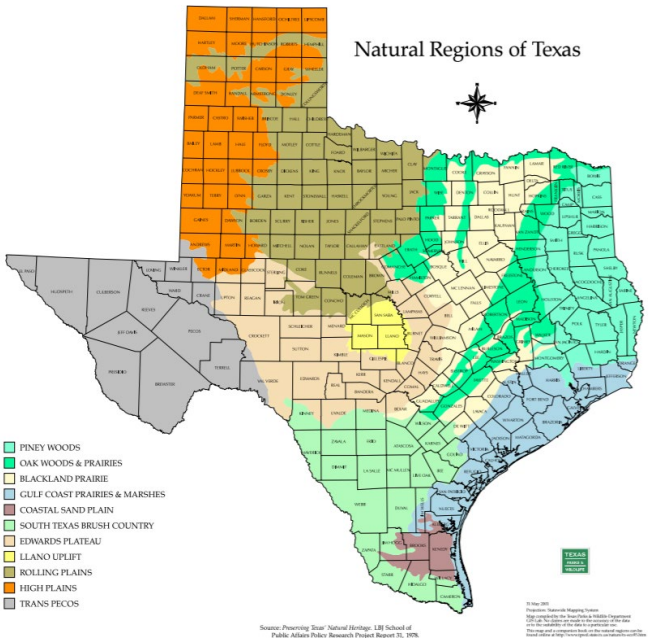

Figure 7

The Baffin Bay watershed resides in the western end of the Texas Coastal Plains region. This region is generally characterized by prairies and bushlands. Along with the majority of the Texas coast, this region is part of the Gulf Coast Aquifer. The soil is largely heavy clay with other types intermixed, which makes for poor percolation of any water that falls on the land. The ecoregions that make up this part of Texas are South Texas Brush Country, Coastal Sand Plain Gulf prairies and Marshes ecoregion and a portion of the South Texas Plains ecoregion as shown in the map.[13]

Geology

Kenedy County, located in the south of Baffin Bay is in the central Rio Grande region of Texas. This area is known for its low rainfall, high rate evaporation and a persistent southeasterly wind. [14] These winds have a major influence on the topography of the land as seen in the gently undulating eolian sand plain and a surface that is hummocky or has elongated ridges and swales, aligning from southeast to northwest. Kenedy County has small, localized and unconnected drainage systems that are unable to deal with a huge influx of rain from events such as storms or hurricanes. Due to this, areas of the county can be underwater for weeks following an event with Los Olmos creek serving as the only open drainage system that flows to Baffin Bay. The county does not have any significant elevation changes, deviating about 50 feet from the eastern part of the county towards the western part.

[13] Texas: The State of Water. Maps. Natural Regions with County Lines Map

[14] Soil Survey of Kenedy and Kleberg Counties

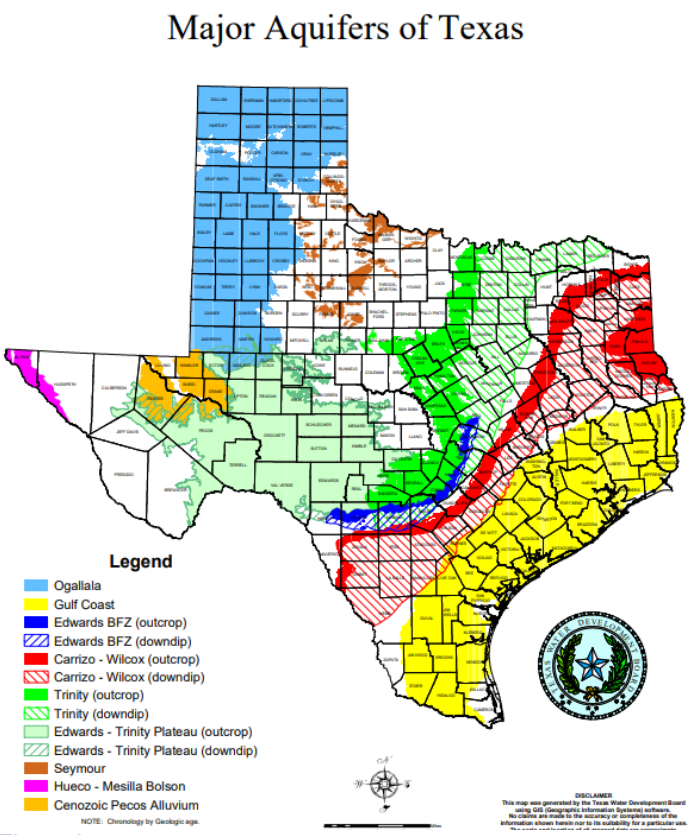

Figure 8

The major uses in this county include agriculture and cattle ranching. Soil can have a significant influence on the agricultural uses that the region can sustain. The soils in Kenedy County formed under grass vegetation and are dominantly light colored, sandy and dry which affects erosion, salinity, wetness and natural fertility. [15]

Kleberg County is about 30 miles wide and is part of a nearly level coastal plain composed of clayey, blackened soils. The uses of the agricultural land that comprises the county includes cattle production, wildlife habitat, and row crops such as cotton and grain sorghum.

There are two types of hard bottoms in Baffin Bay itself, serpulid reefs and beach rocks. The beach rock is found mainly from Penascal Point south, on the western shoreline of the Laguna Madre. An image from google maps, highlighting the location of penascal point is provided below. Using radiocarbon dating, it is estimated that the reefs are around 3000 years old.[16] The beach rocks are 20,000 to 30,000 years old and are composed of coquina shell fragments, sand and clay bound together. Because these rocks were once the Gulf of Mexico shoreline, before the formation of Padre Island, they are called beach rocks. The serpulid reefs are much younger than the beach rocks and are found in Baffin Bay and its tributaries.[17] The reefs are built by millions of tiny (<2 cm) Serpulid worms. Serpulid worms settle on natural and man-made hard substrates and, except for one Sabellid genus, are the only polychaete family to secrete a calcareous tube (usually calcite and/or aragonite)

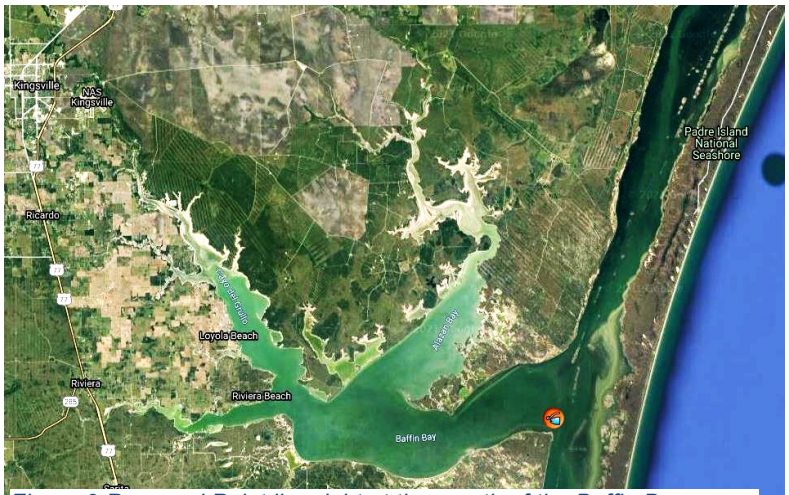

Figure 9 Penascal Point lies right at the mouth of the Baffin Bay designated by an orange symbol on this map

[15] Soil Survey- Kenedy and Kleberg Counties

[16] Valastro, S. Jr., E.M. Davis, and A.G. Varela. 1972. University of Texas Radiocarbon Dates IX. Radiocarbon 14: 461-485.

[17] The Rocks of Baffin Bay. Texas Saltwater Fishing Magazine. *Amy Larimer. September 2009*

around themselves as they grow (Bastida-Zavala 2017)[18] which in turn creates the extensive and exquisite reef we see today.

Climate

The climate is characterized by semi-arid, sub humid or subtropical with varying degrees of precipitation. The defining feature of the region is the episodic high rainfall that happens during El Nino years followed by prolonged drought in non-El Nino years. This cycle controls the overall hydrology of the system, as well as evaporation.

The plains within the watershed are typified by high temperatures and low rainfall. The limited freshwater inflow means that evaporation far exceeds precipitation which is how this system became known as the most saline bay in Texas. During prolonged periods of droughts, the salinity level can spike to over 100 parts per thousand (the average for seawater is around 35 ppt).[19]

The agricultural economy along the Texas coast, including livestock, rice, cotton, and citrus cultivation, is threatened by the combination of salt or brackish water from sea-level change and reduced freshwater levels from changes in temperature and precipitation. [20] Texas coastal areas are predicted to experience heavier runoff from inland areas, with the already observed trend toward more intense rainfall events continuing to increase the risk of extreme runoff, flooding, and possibly creating safety issues.[21]

[18] Pollack, Jennifer; Palmer, Terry; Breaux, Natasha; Assessment of Baffin Bay Serpulid Reef Communities as Critical Habitat for Black Drum prey Resources. August 2019.

[19] https://texasbeyondhistory.net/coast/images/ap6.html

[20] United States Army Corps of Engineers. Climate Change and Sea Level Rise Effects for HSC ECIP Feasibility Study. October 2019.

[21] Climate Change in Coastal Texas

The Texas coast experiences frequent tropical storms and hurricanes. In July 2020, Hurricane Hanna developed into a Category 1 storm and came ashore twice, first in Kenedy County and second at Willacy County, causing destruction to coastal infrastructure. The wind speed was measured at around 100 mph in some parts and the surge pushes water up onshore about 6 feet in Baffin Bay, destroying 80% of all docks and water related structures. There are no hard structures along the coast of Baffin Bay protecting the land from surge, providing an opportunity to install other types of structures such as wetlands and living shorelines that can help with water quality issues as well as absorb water that would otherwise cause coastal flooding issues.

Land Use

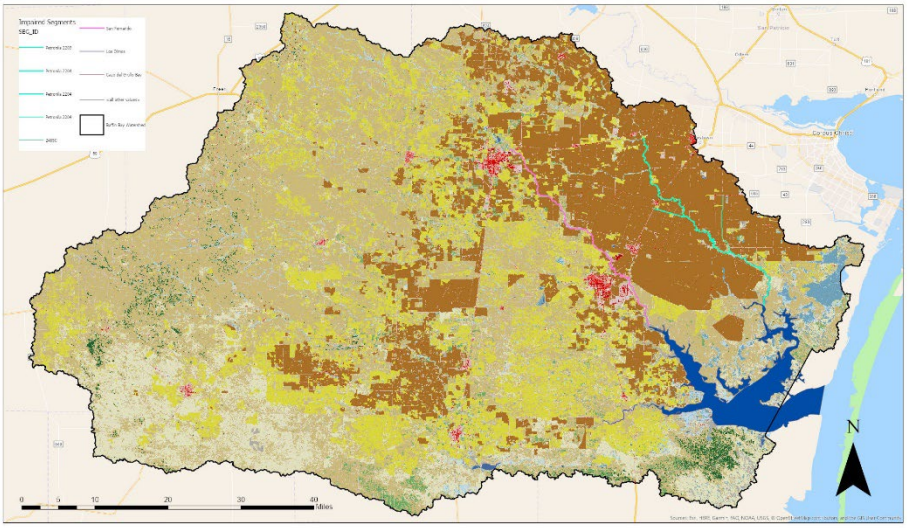

Figure 10 Land Use Map of Baffin Bay Watershed with legend. Impaired Segments are shown in green and pink.

The region is dominated by agricultural uses such as row crops like cotton and grain sorghum and ranching fields with very little slope towards the bay. The short grasses that grow here support the densest cattle population in Texas. King Ranch, Kenedy Ranch and *Chapman* Ranch are located within the watershed boundaries providing shrub land and open space for critical habitats. A small portion of the watershed is developed for urban uses, including the City of Kingsville and the City of Alice. Wastewater treatment plants are found throughout the watershed, with many residing adjacent to a tributary. Table 1 shows the 32 wastewater treatment related infrastructure in the watershed. Information about type of discharge and amount of permitted discharge are provided. Figure 11 shows the spatial distribution of the WWTPs. Other than the wastewater treatment plants, there are few industrial facilities but the watershed does contain a number of wetlands near the shorelines as well as a small area adjacent to a segment along the San Fernando Creek. Unconsolidated shorelines are found near the mouths of the three branches.

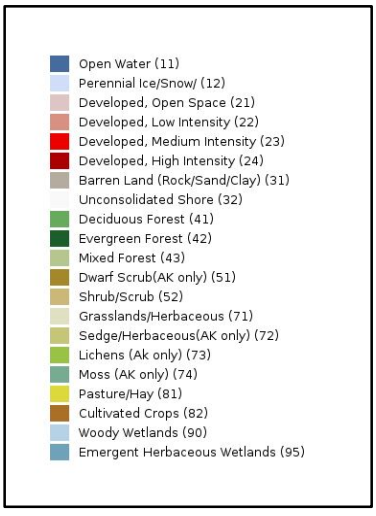

Table 1

SEGMENT	PERMIT_NUM	OUTFALL	NPDES_NUM	PERMITTEE	Permitted Discharge	STATUS	DTYPE	COUNTY
2204	02888-000	001	0104400	US ECOLOGY TEXAS LP	Stormwater - intermittent and flow variable	C	S	NUECES
2204	02888-000	002	0104400	US ECOLOGY TEXAS LP	Stormwater - intermittent and flow variable	C	S	NUECES
2204	02888-000	003	0104400	US ECOLOGY TEXAS LP	Stormwater - intermittent and flow variable	C	S	NUECES
2204	02888-000	004	0104400	US ECOLOGY TEXAS LP	Stormwater - intermittent and flow variable	C	S	NUECES
2204	10140-001	001	0033367	CITY OF AGUA DULCE	Treated Domestic wastewater - 160,000 gpd	C	D	NUECES
2204	10592-001	001	0020397	CITY OF ORANGE GROVE	Treated Domestic wastewater - 200,000 gpd	C	D	JIM WELLS
2204	11541-001	001	0094145	CITY OF DRISCOLL	Treated Domestic wastewater - 100,000 gpd	C	D	NUECES
2204	11583-002	001	0054291	NUECES COUNTY WCID 5	Treated Domestic wastewater - 100,000 gpd	C	D	NUECES
2204	11754-001	001	0069884	BISHOP CONSOLIDATED ISD	Treated Domestic wastewater - 8,000 gpd	C	D	NUECES
2204	14802-001	001	0129607	LCS CORRECTIONS SERVICES INC	Treated Domestic wastewater - 150,000 gpd	C	D	NUECES
2204	14981-001	001	0132756	TEEN CHALLENGE OF TEXAS	Treated Domestic wastewater - 9,000 gpd	C	D	NUECES
2492	04761-000			EI PASO MERCANT ENERGY-PETROLEUM CO	Treated Groundwater 7,2000 gpd via evaporation			JIM WELLS
2492	04819-000			SNBL USA, Ltd	Commingled animal washdown water, utility wastewater, and domestic wastewater - 55,000 via evaporation			JIM WELLS
2492	10067-002	001	0127205	DUVAL CO CONSERVATION AND RECLAMATION DIST	Treated Domestic wastewater - 40,000 gpd	C	D	DUVAL
2492	10253-001			City of Premont	Treated Domestic wastewater - 350,000 gpd via subsurface irrigation			JIM WELLS
2492	11515-001			Riviera ISD	Treated Domestic wastewater - 16,000 gpd via subsurface irrigation			KLEBERG
2492	13361-002			Kenedy County	Treated Domestic wastewater - 44,000 gpd via evaporation			Kenedy
2492	13374-001	001	0102857	KLEBERG COUNTY	Treated Domestic wastewater - 33,000 gpd	C	D	KLEBERG
2492	13374-002	001	0112763	RIVIERA WCID	Treated Domestic wastewater - 60,000 gpd	C	D	KLEBERG
2492	13374-003	001	0113981	KLEBERG COUNTY	Treated Domestic wastewater - 48,500 gpd	C	D	KLEBERG
2492	14808-001			King Ranch	Treated Domestic wastewater - 25,500 gpd via evaporation			KLEBERG
2492A	00579-000	002	0006025	TICONA POLYMERS INC	Stormwater, hydrostatic test water, utility wastewater, and construction-area stormwater - intermittent and flow variable	C	W	NUECES
2492A	00579-000	001	0006025	TICONA POLYMERS INC	Reverse osmosis reject, cooling tower blowdown, hydrostatic test water, stormwater, and construction-area stormwater 3,500,000 gpd	C	W	NUECES
2492A	04589-000	001	0125636	COIL TUBING SERVICES LLC	Treated truck wash water - 1,000 gpd	C	W	JIM WELLS
2492A	10067-001			DUVAL CO CONSERVATION AND RECLAMATION DIST	Treated wastewater - 200,000 gpd vis subsurface irrigation			
2492A	10270-001	001	0023361	SAN DIEGO MUD 1	Treated Domestic wastewater - 750,000 gpd	C	D	DUVAL
2492A	10427-001	001	0023019	CITY OF BISHOP	Treated Domestic wastewater - 320,000 gpd	C	D	NUECES
2492A	10536-002	001	0034002	CITY OF ALICE	Treated Domestic wastewater - 2,600,000 gpd	C	W	JIM WELLS
2492A	10536-004	001	0091219	CITY OF ALICE	Treated Domestic wastewater - 2,020,000 gpd & treated domestic waste via irrigation	C	W	JIM WELLS
2492A	10696-001	001	0023418	CITY OF KINGSVILLE	Treated Domestic wastewater - 3,000,000 gpd	C	W	KLEBERG
2492A	10696-004	001	0117978	CITY OF KINGSVILLE	Treated Domestic wastewater - 1,000,000 gpd & treated domestic waste via irrigation	C	W	KLEBERG
2492A	12035-001	001	0033201	US DEPT OF THE NAVY	Treated Domestic wastewater - 400,000 gpd	C	D	KLEBERG

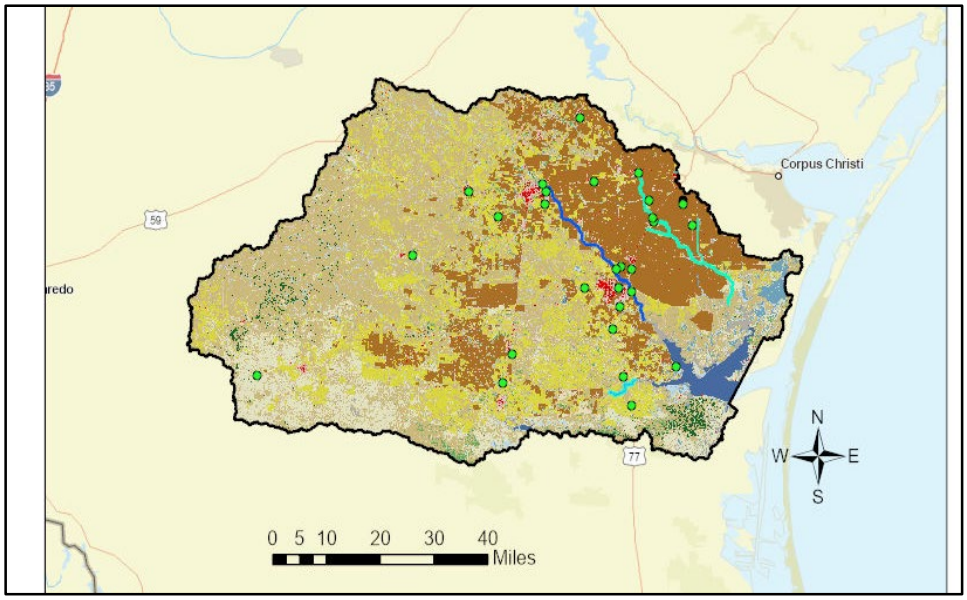

Figure 11 Spatial distribution of wastewater treatment plants (green dots) in the Baffin Bay watershed. The data was collected from the Nueces River Authority and transferred into ArcGIS mapping platform.

Population distribution

The majority of this region is sparsely populated with large open tracts of land including the King and Kenedy Ranch. The cities of Kingsville and Alice are the cities with the largest populations.

Kingsville has a population of 25,203, and is the urban community and county seat within Kleberg County, which has an estimated population of 30,680 people. Alice has a population of 18,662, and is the largest city in Jim Wells County that has a total population of 40,482 people. [22]

Between 1950 and 2020, around 100 hours were added to the shoreline of Baffin Bay in between the Cayo Del Grullo and Laguna Salada branches of the bay. All of these homes include their own septic tank as the county does not have sewer lines that service this area. This region is home to many shoreline properties, farm and ranching land as well as some Recreational Vehicle communities. The King Ranch borders a significant portion of the shoreline along the Alazan branch.

[22] U.S. Census Bureau Quick Facts

Water Quality

Water quality determines the overall health of coastal ecosystems and affects their ability to support fisheries. In Texas, the Texas Commission for Environmental Quality (TCEQ) monitors and sets standards for a variety of parameters including bacteria, dissolved oxygen, sulfates, chlorophyll a, total dissolved solids, etc. Nutrient criteria is more complicated when it comes to impairment decisions due to a reliance on "on narrative water quality standards" rather than numeric.[23] There is ongoing work by TCEQ to develop a Nutrient Criteria Development Plan.[24]

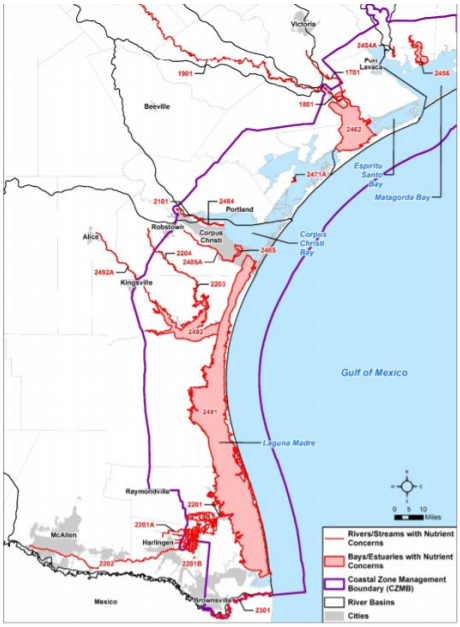

Figure 2-3 Texas Lower Coast Segments with Significant Nutrient Concerns (n=58)

Figure 12

The figure to the left from Nutrient Reduction Damage Assessment (Parsons 2019) depicts a regional look at water quality in lower coast segments for nutrient concerns. Nitrogen inputs are of significant concern for the San Fernando and Petronila Creeks, Baffin Bay, and the Laguna Madre. Locally, the Nueces River Authority began adding nutrient sampling to their routine water quality monitoring in 2020 with funding from Coastal Bend Bays and Estuaries Program. According to a study's synthesis report led by Dr. Michael Wetz of Harte Research Institute, "Using data obtained primarily from TCEQ quarterly sampling, Montagna and Palmer (2012) documented a long-term increase in Kjehldahl nitrogen, nitrate and phosphate in Baffin Bay. Ammonium, chlorophyll a and nitrate also regularly exceeded state screening levels in a number of years...Prevalence of high concentrations of reduced nitrogen such as ammonium and DON are important because they have been implicated as potentially favoring dominance by the brown tide organism over other healthy phytoplankton (Gobler et al. 2013).[25]

Bacteria Impairments in Baffin Bay Watershed
Segment 2204 & 2203- Petronila creek winds its way towards the Alazan branch of Baffin Bay through multiple counties, in predominantly agricultural and ranching land. It is impaired by bacteria through pathogens that get into the water system through nonpoint source pollution. SegID: 2203 Petronila Creek **Tidal** from the confluence of Chiltipin Creek in Kleberg County to a point 1 km (0.6 mi) upstream of private road crossing near Laureles Ranch in Kleberg County Impairment Description(s) Category Year Segment First Listed Bacteria in water (Recreation Use) 5c 2010 2203_01 From the confluence with Tunas Creek and Alazan Bay to a point 11 mi upstream. SegID: 2204 Petronila Creek **Above Tidal** From a point 1 km (0.6 mi) upstream of private road crossing near Laureles Ranch in Kleberg County to the confluence of Agua Dulce and Banquete Creeks in Nueces County Impairment Description(s) Category Year Segment First Listed Bacteria in water (Recreation Use) 5b 2016

[23] Impaired Waters and Nutrients. EPA.

[24] Nutrient Criteria Development. TCEQ. Last Modified 2020-11-30

[25] Baffin Bay Volunteer Water Quality Monitoring Study: Synthesis of May 2013-December 2019 Data. Wetz. March 2020.

2204_01 From downstream end of segment to the confluence with 2204A, unnamed drainage ditch tributary to Petronila Creek at N-97.7, W27.65 approximately 32.5 km (20.2 mi) upstream 2204_02 From the confluence with 2204A, unnamed drainage ditch tributary of Petronila Creek at N-97.7, W27.65 to the upstream end of segment at the confluence with Agua Dulce and Banquete Creeks approximately 31.6 km (19.6 mi) upstream[26]
Segment 2492A- San Fernando empties into the Cay Del Grullo confluence in Kleberg County. This creek is impaired for bacteria and was first listed impaired in 2005 by TCEQ. San Fernando winds through agricultural and ranching land as well as urban areas like Kingsville and the city of Alice. San Fernando Creek From the Cayo Del Grullo confluence in Kleberg County upstream to the confluence with Chiltipin Creek and San Diego Creek in Jim Wells County Impairment Description(s) Category Year Segment First Listed Bacteria in water (Recreation Use) 5c 2006 2492A_01 From the Cayo Del Grullo confluence in Kleberg County upstream to the confluence with Chiltipin Creek and San Diego Creek in Jim Wells County[27]

A Coastal Bend Bays and Estuaries report concluded that “overall, chlorophyll a exceeded TCEQ screening levels for impairment throughout much of the study period and was frequently at levels that would be considered excessive by National Coastal Condition Report (EPA, 2012) standards” (Wetz, 2020).

Monitoring and Management:

Petronila Creek Tributary is designated as Segment 2204 and has been monitored by Texas Commission for Environmental Quality and Nueces River Authority since 2013-2014. Monthly water quality sampling is conducted to identify chloride, sulfate and TDS contributions from Petronila Creek and its tributaries. Currently there are thirteen monitoring sites, four sites are located on the main stem of the creek while other sites monitor incoming water. Note: Figure # is referring to the time period of December 2019 to February 2020.

A study completed by Nueces River Authority and funded by Coastal Bend Bays and Estuaries Program was able to conduct sampling along Petronila Creek from January 2020 to December 2020. The nutrient parameters analyzed for the study included ammonia, nitrate nitrogen, chlorophyll-a and pheophytin. Some highlights from the study are that ammonia concentrations were very low during the study period, nitrate nitrogen concentrations rose in the spring from March to May, regardless of the stream flow rates while nitrite nitrogen levels remained consistently at or near the lower detection limits (Sugarek 2021). Total phosphorus (TP) concentrations were generally moderate with occasional screening level exceedances but worth noting that the highest concentrations of total phosphorus were recorded in the upper portion of the study area just downstream from the Driscoll WWTP outfall (Sugarek 2021). The TP concentrations decreased downstream but it was found that chlorophyll *a* concentrations remained high throughout the system even under a variety of flow conditions.

[26] 2020 Texas Integrated Report - Texas 303(d) List (Category 5). Page 95

[27] 2020 Texas Integrated Report - Texas 303(d) List (Category 5). Page 114

The 2019 Texas Coastal Resiliency Master Plan addresses the management of natural and man-made coastal environments in the state, recommending 123 projects along the coast. The list of projects was compiled by TX GLO and vetted with input from the Technical Advisory Committee.

The Baffin Bay region has been included in this list with a proposed Watershed Monitoring and Management Plan. This would guide restoration efforts aimed at reducing pollutants to the watershed streams and bay and support all phases of plan development: bay and watershed data collection; land use and load modeling; outreach to landowners and businesses and improvement of stewardship practices.

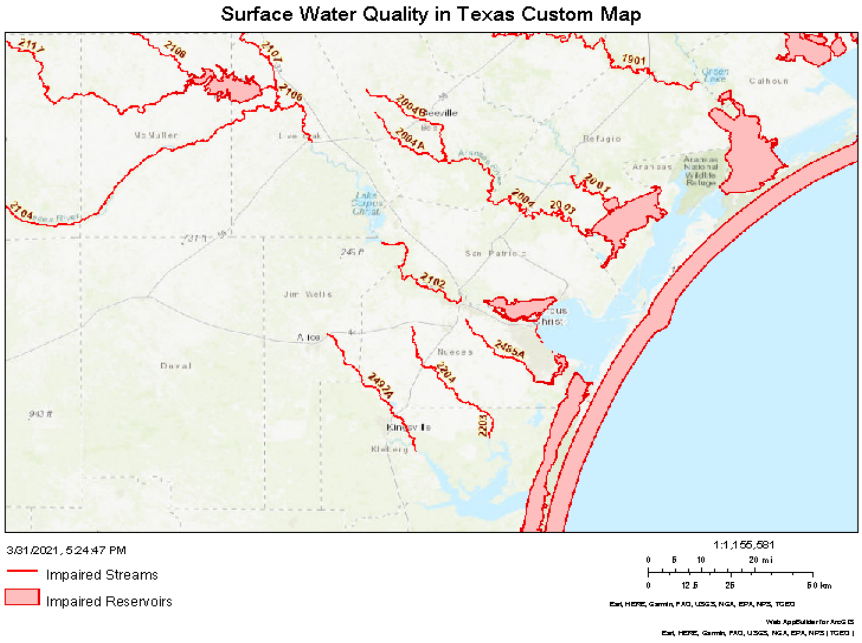

Figure 13 Regional Depiction of Water Bodies Impaired for Nutrients:

Local Past funded water quality research by Coastal Bend Bays and Estuaries Program:
Water Quality:

- Water Quality Monitoring Program in Baffin Bay- Dr. Michael Wetz, Harte Research Institute at Texas A&M University- Corpus Christi
- Continuous Water Quality Monitoring Network in Baffin Bay- Dr. Michael Wetz, Harte Research Institute at Texas A&M University- Corpus Christi

“The volunteer-led study has yielded important clues as to the cause of brown tide in the system, and also drivers of water quality change in the system,” Dr. Michael Wetz said. “For example, we have found that organic nitrogen is two-to-three fold higher in Baffin Bay than other bays along the Texas coast. This form of nitrogen has been shown to favor brown tide in other systems, and overall, the system has become enriched over many decades with nutrients that support brown tide and other algal growth. These conditions of excessive algal growth, especially brown tide, can have negative consequences for the ecosystem.”

Other water quality related studies:

- Baffin Bay Sediment Core Profiling for Historical Water Quality- Dr. Mark Besonnen, Texas A&M University- Corpus Christi
- Mechanistic Modeling of Bottom Water Dissolved Oxygen Dynamics in Baffin Bay- Dr. Xinping Hu, Texas A&M University- Corpus Christi
- Investigating Reactive Nitrogen Sources that Stimulate Algal Blooms in Baffin Bay- Dr. J. David Felix, Texas A&M University- Corpus Christi
- Quantifying Septic Effluent Nitrogen Loading and Processing the Baffin Bay Watershed- Drs. J. David Felix and Dorina Murgulet, Texas A&M University- Corpus Christi
- Nutrient Sampling in the Petronila Creek Watershed- Rocky Freund, Nueces River Authority

Nonpoint Sources (NPS) and permitted discharges:

Nonpoint source pollutants originate from collective runoff across the watershed. Runoff from urban watersheds can deliver a variety of pollutants from roadways and grassy areas, and rural stormwater runoff can transport significant pollutant loads from cropland, pastures, and livestock operations. Natural background sources like wildlife or geology (e.g., soils high in iron) can also contribute to loadings and might be particularly important in forested or less-developed areas of the watershed. Additional nonpoint sources include on-site wastewater systems (septic tanks, cesspools) that are poorly installed, faulty, improperly located, or in close proximity to a stream and illicit discharges of residential and industrial wastes. [28]

Permitted Discharge effluent are classified as Point Sources. The National Pollutant Discharge Elimination System (NPDES) is a program to control discharges of pollutants to surface waters. The state of Texas assumed the authority to administer this program in 1998. The TCEQ Texas Pollutant Discharge Elimination System (TPDES) program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. The discharge of pollutants from point sources, such as pipes, outfalls, and conveyance channels is generally regulated through National Pollutant Discharge Elimination System (NPDES) permits.[29] Examples of permitted discharges include, wastewater treatment plants (WWTP), industrial sites, certain municipal separate storm sewer systems (MS4), and concentrated animal feeding operations. Figure 14 is from the Parson's 2019 NRDA report and shows industrial outfalls (purple triangles), municipal outfalls (green outfalls), concentrated feeding operations (red) and TCEQ segments (blue lines).

[28] Handbook for Developing Watershed Protection Plans to Restore and Protect our Waters. EPA. pg. 5-31

[29] Handbook for Developing Watershed Protection Plans to Restore and Protect our Waters. EPA. pg. 5-30

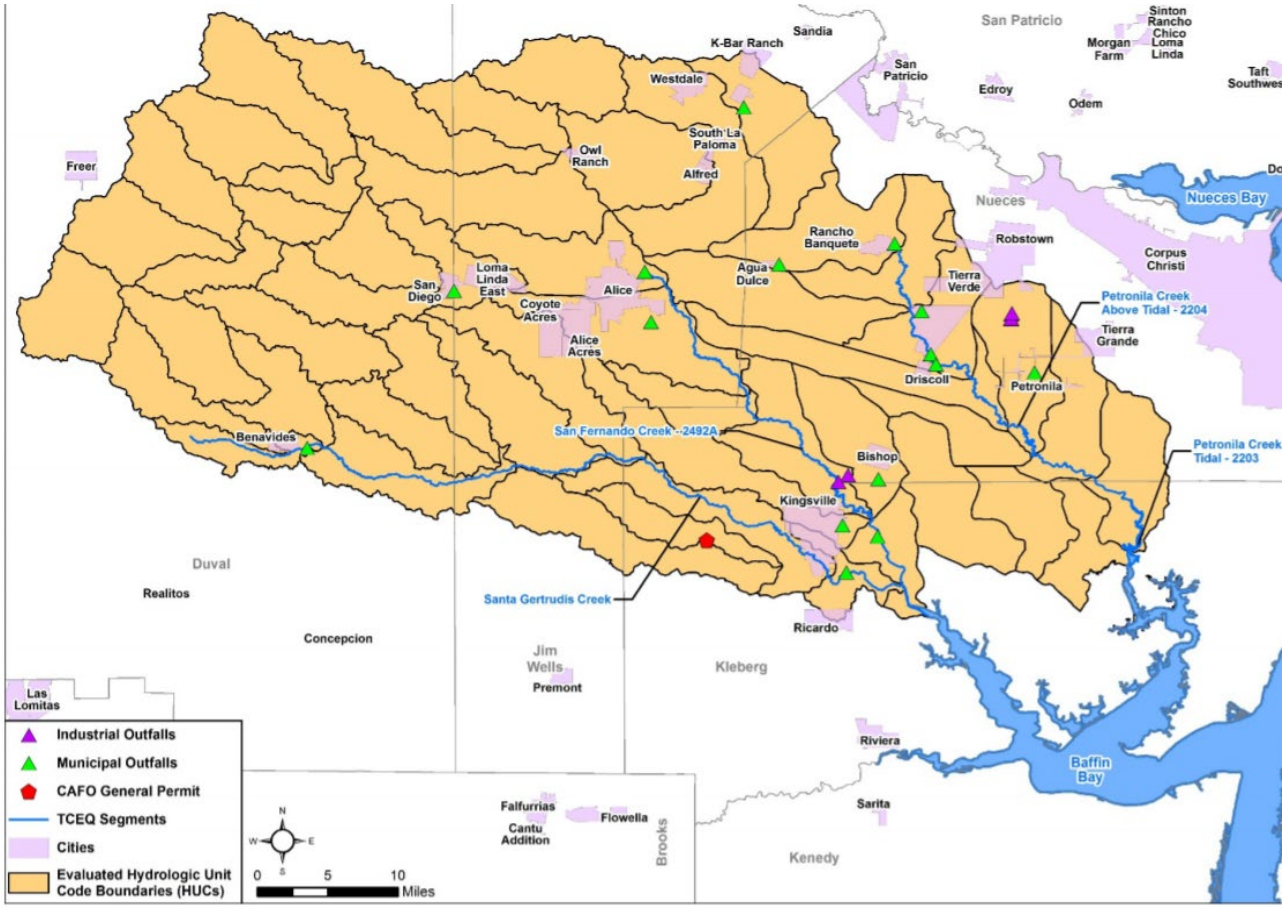

Figure 14. Parson's 2019 NRDA Report: Permitted Dischargers in the San Fernando Creek and Petronila Creek Watersheds

Permitted Discharges within the 5 counties of the Baffin Bay watershed include:

- Cities--Agua Dulce, Orange Grove, Driscoll, Alice (4), Premont, Kingsville (3), Bishop (2)
- US Department of the Navy
- School Districts-- Bishop Consolidated ISD, Riviera ISD
- County Buildings--Kenedy, Kleberg
- Water Control and Improvement Districts-- Nueces County WCID 5, Riviera WCID:
- Industry-- El Paso Merchant Energy-Petroleum Co, SNBL USA, Ltd, Ticona Polymers Inc (2), Coil Tubing Services LLC
- King Ranch
- Duval County Conservation and Reclamation District
- Other-- US Ecology Texas LP, LCS Corrections Services INC, Teen Challenge of Texas

Economic Reports on Baffin Bay Fisheries

Commercial: (Ropicki, 2016)	Recreational: (Ropicki, 2016)
The Upper Laguna Madre system accounts for over 50% of all commercial finfish landings in Texas (TPWD, 2012) and is the focal point of the black drum fishery. The 5-year average (2015-2019) of Texas black drum landings: Over 1.8 million pounds by weight and worth $2.2 million; (40-75% of annual black drum landings are upper Laguna Madre)	Upper Laguna Madre Recreational Fisheries Economic Impact: -Over 500 jobs supported - $21 million in labor income -Contributes $33 million to the Texas GDP -$58 million in 'economic activity' (Sales-lodging, food, supplies, charters) -300,000 angler trips/year (one person/one day of fishing) Over 95% of anglers fishing this area are Texas residents; Shore-based- 64% private vessel- 9%; charters- 7%[30]

Agricultural Production

Figure 15 depicts the concentration of sorghum (a.), cotton (b.), corn (c.) and livestock (d.) across Texas. The data for these maps is sourced from USDA's National Agricultural Statistics Service. It is interesting to note that The King Ranch operates approximately 60K acres in Kleberg and Kenedy Country with the primary crops being cotton and milo. Today it is one of the largest cotton producers in the world. Whereas Kenedy County and the Kenedy Memorial Ranch are leaders in cattle production in south Texas.

[30] Ropicki, A., D. Hanselka, and R. Dudensing. *The Economic Impacts of Recreational Fishing in the Upper Laguna Madre Bay System*. November 14, 2016. TAMU-SG-16-513. https://texasseagrant.org/programs/economic-impacts/index.html

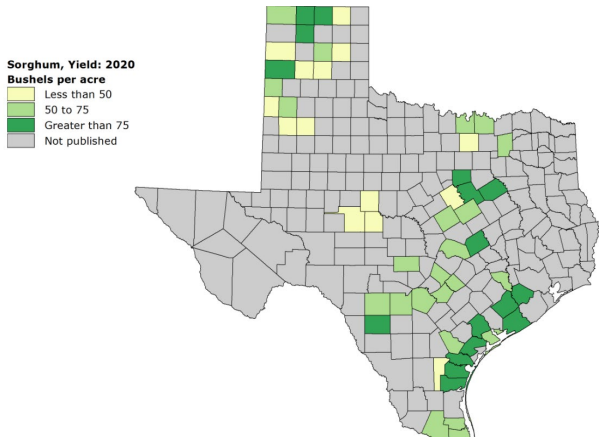

Figure 15 a: County Estimate Map- Sorghum

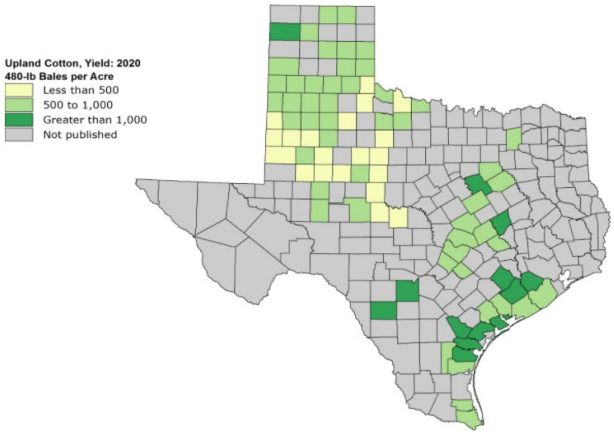

Figure 15 b: County Estimate Map- Cotton

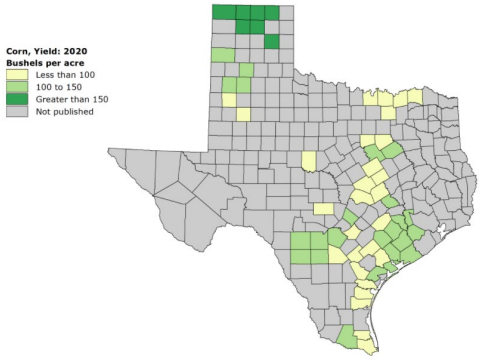

Figure 15 c: County Estimate Map- Corn

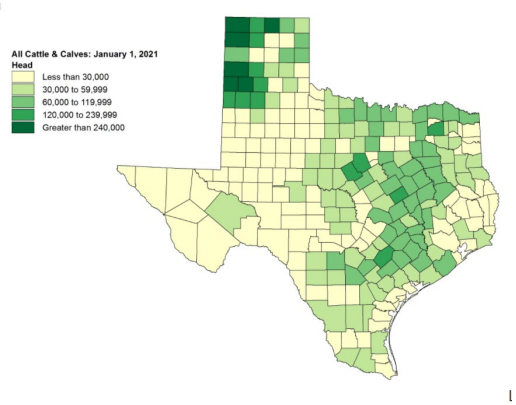

Figure 15 d: County Estimate Map- Cattle

Energy

The growth of renewable energy production in the Region has come mainly from the construction of large-scale wind farms since 2008. The Gulf Wind project and Peñascal Wind

Farm are located in Kenedy County. The proposed wind farm in Kleberg County will have 150 wind turbines.[31]

Habitat, Wildlife and Ecotourism

The lands around the bay are flat and dominated by grassland and oak savanna. Common tree and plant species include southern live oak (*Quercus virginiana*), prickly pear (*Opuntia spp.*), lime prickly-ash (*Zanthoxylum fagara*), greenbriar (*Smilax spp.*), sunflowers (*Helianthus spp.*), tanglehead (*Heteropogon contortus*), crinkleawn (*Trachypogon spicatus*), gulf dune paspalum (*Paspalum monostachyum*), fringed signalgrass (*Urochloa ciliatissima*), shrubby oxalis (*Oxalis frutescens angustifolia*), dayflower (*Commelina spp.*), Texas lantana (*Lantana urticoides*), Texas bullnettle (*Cnidoscolus texanus*), silverleaf nightshade (*Solanum elaeagnifolium*), crotons (*Croton spp.*) and Lindheimer tephrosia (*Tephrosia lindheimeri*) (Bartlett, 2002, 42).

The three species that make up most of the commercial and/or recreational fishing in the area are black drum, red drum, and spotted seatrout. Black drum, *Pogonias cromis,* are found throughout the upper Laguna Madre, with greatest abundance in Baffin Bay. They thrive in unvegetated areas where they feed on small mollusks (e.g., clams) and crustaceans (e.g., shrimp, crabs) that live in the sediment. Black Drum have been found to spawn throughout the Laguna Madre and do particularly well in Baffin Bay, where unvegetated bay bottom habitat is more abundant. Another trophy species is Red Drum, also called Redfish, found in seagrass beds, which provide habitat and protection for juveniles. By age three, most adults move offshore, but return to Gulf passes, such as Packery Channel, to spawn in the fall. Spotted Seatrout is also a trophy species, spending the full life cycle in estuarine systems, feeding on shrimp, Pinfish, and menhaden.[32]

The US Fish & Wildlife Service recorded a staggering 2.4 million Redheads on the coast of south Texas in 1997-1998, with an estimated 75% of the global Redhead population wintering in the Laguna Madre annually. The presence of healthy Shoal Grass makes this area a wintering hotspot for Redheads and other waterfowl.[33] The Kingsville area of the watershed is a birder's paradise, having five kinds of orioles known to nest in the area and twenty-five different raptor species recorded. It is among the largest count of Harris' Hawks, White-tailed Hawks and Crested Caracara, and has the nation's largest population of nesting Tropical Parula. This region falls within the two greatest flyways of Western Hemisphere and is a primary funnel for migratory wildlife Coastal Migration Corridor for neotropics. It is a route for Circum Gulf migrants as well as a stopover for Trans Gulf migrants. At least twelve specialty birds are seen in summer months. South Texas bird species count (450) rates second to Sonora Desert (500). You can observe the Vermilion Flycatcher in winter and see scissor-tailed Flycatchers in the summer. The Green Jay on the Christmas Bird Count is usually highest and the area is one of the

[31] Coastal Bend Council of Governments. 2016 Comprehensive Economic Development Strategy. Revised January 2019.
[32] TPWD. Upper Laguna Madre- Fish and Waterfowl. https://tpwd.texas.gov/landwater/water/habitats/bays/ulm/ulm_index.phtm
[33] Upper Laguna Madre: Fish and Wildlife.

highest Christmas Bird Count areas without significant coastline, ranking in the top 50 out of 800 in Christmas Bird Count.[34] The King Ranch offers tours for birding, wildlife, with a reputation from the famed conservationist Aldo Leopold “one of the best jobs of wildlife restoration on the continent”. With over 370 bird species on record it has been designated as an internationally Important Bird Area. Dick Kleberg Park, Kaufer-Hubert Memorial Park, Santa Gertrudis Creek, and Santa Gertrudis Creek Bird Sanctuary are also some of the sites included in the **Great Texas Coastal Birding Trail**.[35]

Four sections make up The Kenedy Foundation Ranch. Diverse landscapes of native prairie, brush country, marshes, woodlands and beach, sand dunes that migrate across the prairie, surrounded by flat land. Birds, small mammals, and large game animals call this area home. A spread of mud flats lie in the southeast area.[36]

Other animals native to the area include White-tailed deer, javelina, wild turkeys, feral hogs, Bobwhite quail, ducks, mourning doves, geese, coyotes, etc. Several species are popular to hunt and important to the local economy including the exotic species Nilgai.[37]

[34] The Last Great Habitat: Kingsville Area Fast Facts for Birders. City of Kingsville
[35] The Last Great Habitat: King Ranch. City of Kingsville.
[36] Kenedy Ranch. Kenedy Memorial Foundation.
[37] Kenedy Ranch. Kenedy Memorial Foundation.

Chapter 3: Baffin Bay Stakeholder Working Group

Background

The documentation of Baffin Bay's ongoing water quality degradation is due to events like prolonged dense blooms of brown tide that cause hypoxia, resulting in fish kills. The bay had a fish kill event as recent as 2010. These observations have led to increased nutrient input concerns. Not only are nutrients a concern, but surface water quality monitoring data exceeds the Texas Commission on Environmental Quality's screening levels for several water quality parameters. This degradation highlights a need in the bay for continued characterization and supports research and community participation to identify land areas and practices in the watershed that could result in water quality improvement. Local stakeholders have a vested interest in their bay system and have contributed to helping protect it.

Stakeholder Group Formation and Mission

In 2018 a group was created from the grassroots effort to understand concerns and better characterize this watershed and its bay system. The Baffin Bay Stakeholder Group is currently led by the Coastal Bend Bays and Estuaries Program (CBBEP) and the Harte Research Institute for Gulf of Mexico Studies (HRI). It encompasses a variety of stakeholders types, including researchers, commercial and recreational fishermen, landowners, farmers, ranchers, business owners, representatives from state and local governments, agencies, conservation organizations and other local stakeholders.

What started out as small coffee shop talks between local fishermen expressing water quality and fisheries degradation grew into a larger group now known as the Baffin Bay Stakeholder Group. Dr. Michael Wetz said he first became involved in the project seven years ago, when poor environmental indicators led residents to become concerned about the health of Baffin Bay. There had been a number of fish kills; brown tide, an overgrowth of algae species that can harm sea grasses; and people were noticing popular sportfish like black drum were not healthy.[38]

Group Structure

As the group increased in members, the group restructured to a formal Management Committee and four subcommittees that people can volunteer to participate in. The subcommittees are: (1) Citizens Advisory, (2) Watershed Restoration and Management, (3) Science and Technical Advisory, and (4) Local Governments. The Chair of each committee serves on the Management Committee. This formalized structure will help to effectively integrate input and prioritize implementation actions based on technical merit and benefits to Baffin Bay as well as promote a unified approach to seeking funding over a long-term period.

The Baffin Bay Management Committee consists of six individuals and holds the designation of the

[38] https://www.tamucc.edu/news/2019/04/040919_hri_baffin_bay_watershed_project.html#.XozteohKiUk

official decision-making body for the Baffin Bay Stakeholder Group. Through this model they will provide a formalized approach to public participation and inputs as planning and implementation actions are carried out in the watershed. The four subcommittees will work directly with the Management Committee to provide input and recommendations for the Bay and its watershed. The acting chairs of the four subcommittees will be official members of the Management Committee, while the remaining two seats of the Management Committee will be filled by the acting Nueces County Judge and Kleberg County Judge.

Citizen Advisory

This committee focuses on highlighting citizen concerns about the bay, its watershed, scientific studies, restoration and protective activities while also providing guidance on outreach and education. Protecting a watershed takes a group effort and this committee will help to build a constituency that supports the implementation of restoration and protection efforts in collaboration with the other subcommittee members.

Watershed Restoration and Management

The members of this committee will monitor and coordinate implementation actions of watershed restoration partners and report on these to the management committee. It is composed of engineers, scientists, landowners and representatives from non-profits, government agencies, academia and industry. In collaboration with the other subcommittees, it will recommend best management practices that strengthen protection of the watershed.

Science & technical Advisory

The focus of this committee will be to provide objective scientific and technical guidance to the Management Committee. Committee members will represent a cross section of individuals with diverse backgrounds and areas of expertise and comprise of engineers, scientists, representatives from non-profits, industry, government agencies, academia and private organizations. They will identify, track and report on any established environmental performance indicators/metrics to measure success/impacts of implementation actions.

Local Governments

The committee members will help to vocalize the local government concerns regarding Baffin Bay, its watershed and other restoration and protection activities to the Management Committee. This adds an important layer of advising how issues and implementation actions might pertain to county, city or other government structures and/or their operations. It will be composed of elected officials and/or county/city staff.

Works Cited

Bartlett, R. C. (2002). *The Laguna Madre of Texas and Tamaulipas*. Texas A&M University Press. ISBN 1-58544-133-3.

Browner, C. M. (1996, June). Watershed Approach Framework. *Office of Water*, *EPA 840-S-96-001*, 15. https://www.epa.gov/sites/production/files/2015-06/documents/watershed-approach-framework.pdf

Gobler CJ, and 8 others. 2013. Expansion of harmful brown tides caused by the pelagophyte Aureoumbra lagunensis DeYoe et Stockwell, to the US east coast. Harmful Algae 27: 29-41

Lewey, S. J. (2019, August 1). Riparian Evaluation Report: Tributaries of Baffin Bay August 30, 2019. (CBBEP 2907). https://www.cbbep.org/manager/wp-content/uploads/1907-Final-Report-9.11.19-Reduce.pdf

Sugarek, S. (2021, January). Nutrient Sampling in Petronila Creek. *Coastal Bend Bays and Estuaries Program*. CBBEP-143. https://www.cbbep.org/manager/wp-content/uploads/2003-Final-Report-FINAL.pdf

Tolan, J.M., Holt, S.A., Onuf, C.P., Distribution and community structure of ichthyoplankton in Laguna Madre Seagrass meadows: Potential impact of seagrass species change. *Estuaries* **20,** 450 (1997). https://doi.org/10.2307/1352357

Wetz, M. (2020, March). *Baffin Bay Volunteer Water Quality Monitoring Study: Synthesis of May 2013-December 2019 Data* (138). CBBEP Publication.

Chapter 4: Analyzing Land Use in the Watershed

Land Use Classifications

Land uses are an important factor influencing the physical conditions of the watershed, as well as an indicator of the sources of pollution active in the watershed. Understanding the current land uses and cover within the watershed as well as projected trends of population growth and development can help inform strategies for protecting water quality. Targeting resources in high-priority areas and coordinating the implementation of nutrient reduction efforts at a watershed level along with other habitat and resource restoration approaches will help provide ecosystem-scale benefits to the nearshore Gulf Coast (Parsons, 2019, p.1). This chapter takes a closer look at current land use trends in the region and Chapter 5 will dive into how land use characteristics can influence water quality in the streams and bay. Figures 16 display the land cover of the Baffin Bay (a.), Petronila (b.), and San Fernando (c.) watersheds respectively. As previously outlined, the watershed consists mainly of cultivated cropland (brown) and pasture/hay lands (yellow) with the few urban areas denoted in red. Blue circles represent outfalls and black squares are monitoring stations. One Concentrated Animal Feeding Operation (CAFO) located within the watershed boundary in Kenedy County is denoted by a red triangle.

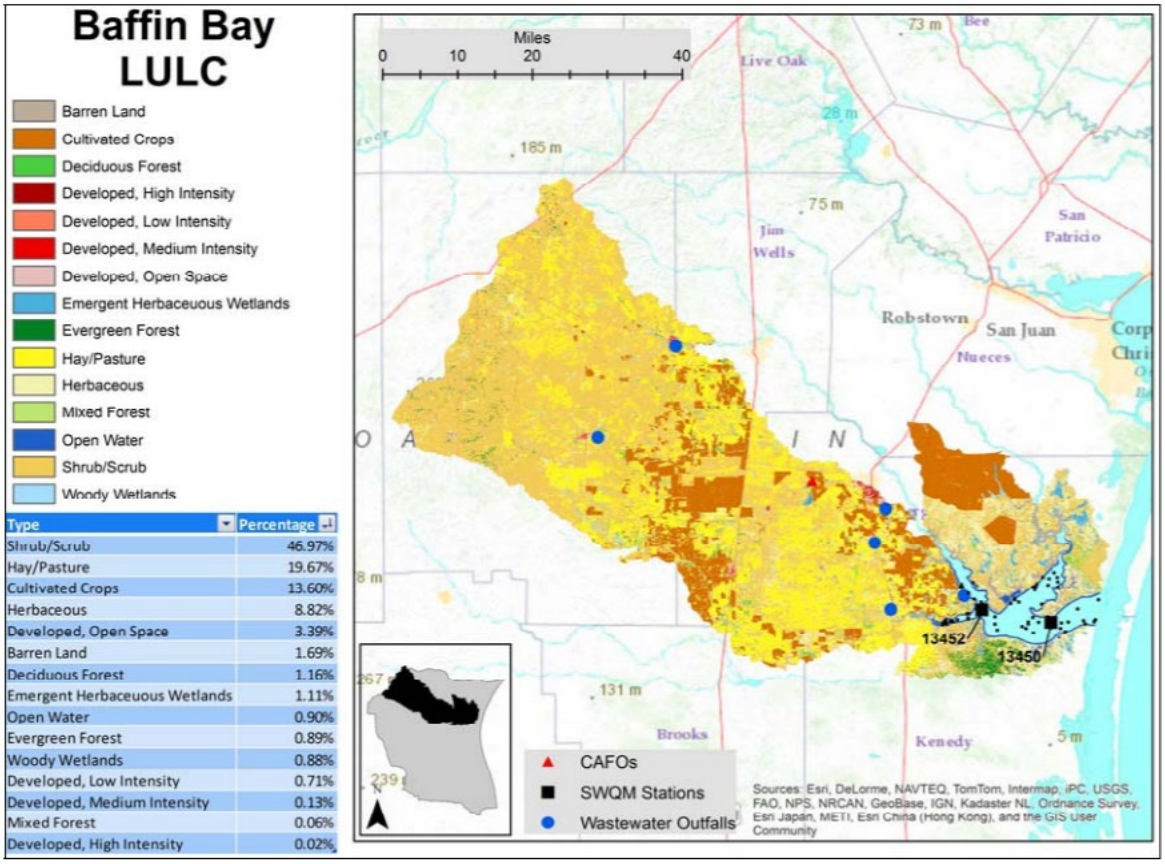

Figure 16 a. Baffin Bay/Alazan Bay/Cayo Del Grullo/Laguna Salada watershed – SEGMENT 2492 (Nueces River Authority 2013 Basins Report page 183)

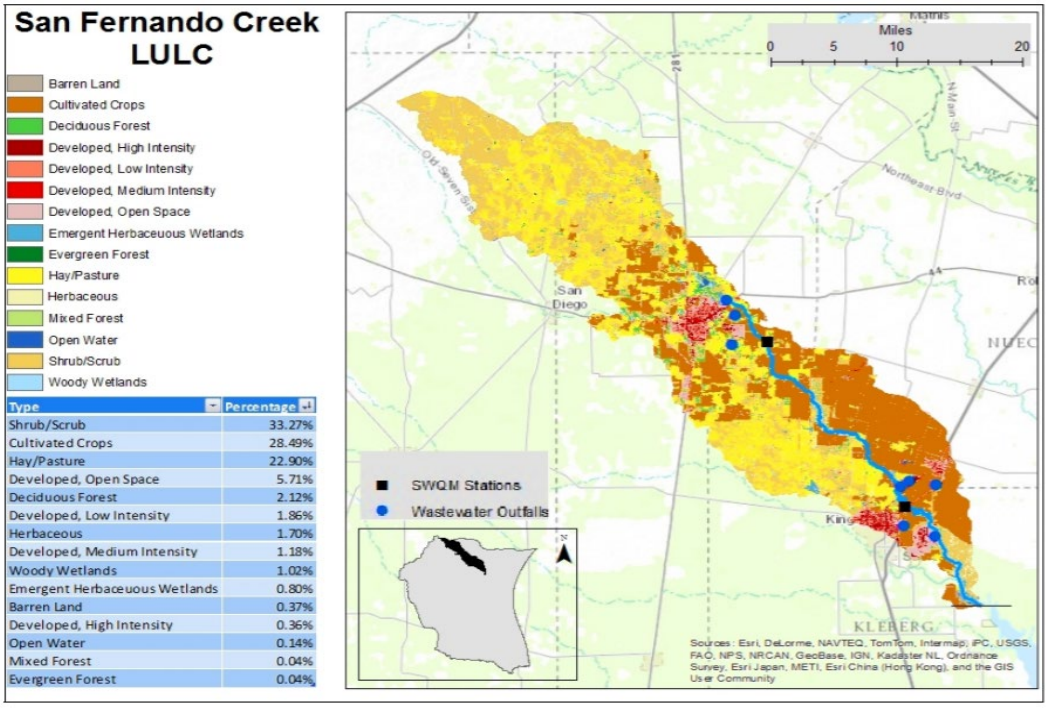

Figure 16 b. delineating Petronila Creek watershed is from the Nueces River Authority 2013 Basins Report page 183

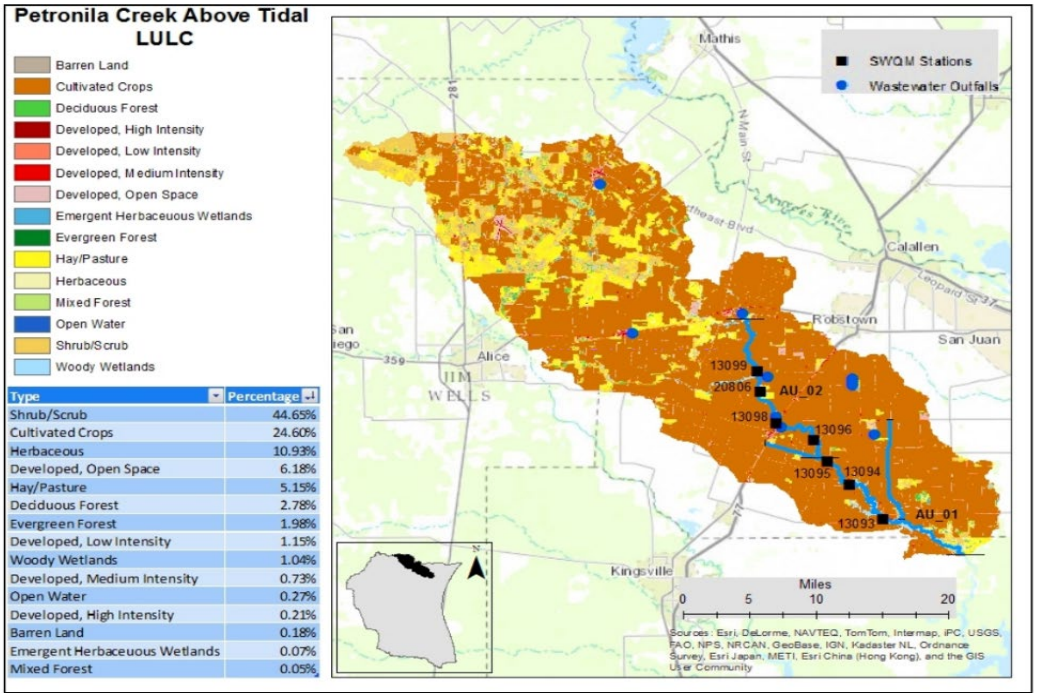

Figure 16 c. below delineating San Fernando Creek watershed is from the Nueces River Authority 2013 Basins Report page 186

Agricultural and Ranching Operations in the Watershed

A significant amount of land in the watershed is designated for cultivating crops with some operations focusing on monoculture while others may have multiple operations on their land. Agricultural operations include cultivating the soil, producing crops for human food, animal feed, or planting seed or for the production of fibers, floriculture, viticulture, horticulture. Activities can also include raising or keeping livestock, raising exotic game for commercial use, participation in government programs, wildlife management, and beekeeping operations.[1] Information about the different types of agriculture is provided below.

Cropland

Cropland operations are classified as either dry or irrigated agriculture. The most common cropland operations in the watershed are dry sorghum and cotton. Petronila Creek has approximately 25% of its land designated as cropland while San Fernando Creek has 28% (Nueces River Authority, 2013). Depending on the practices of landowners, runoff from croplands can contain traces of fertilizer and pesticide pollutants. Riparian boundaries that border streams can also be converted to cropland to increase production but can have major effects on water quality, sediment loading and erosion. Figure X displays the amount of cropland in acres in Kleberg, Kenedy and Jim Wells County.

[1] "KLEBERG COUNTY APPRAISAL DISTRICT." http://www.kleberg-cad.org/data/_uploaded/file/Forms/DEGREE%20OF%20INTENSITY%20STANDARDS.pdf. Accessed 18 Jul. 2021.

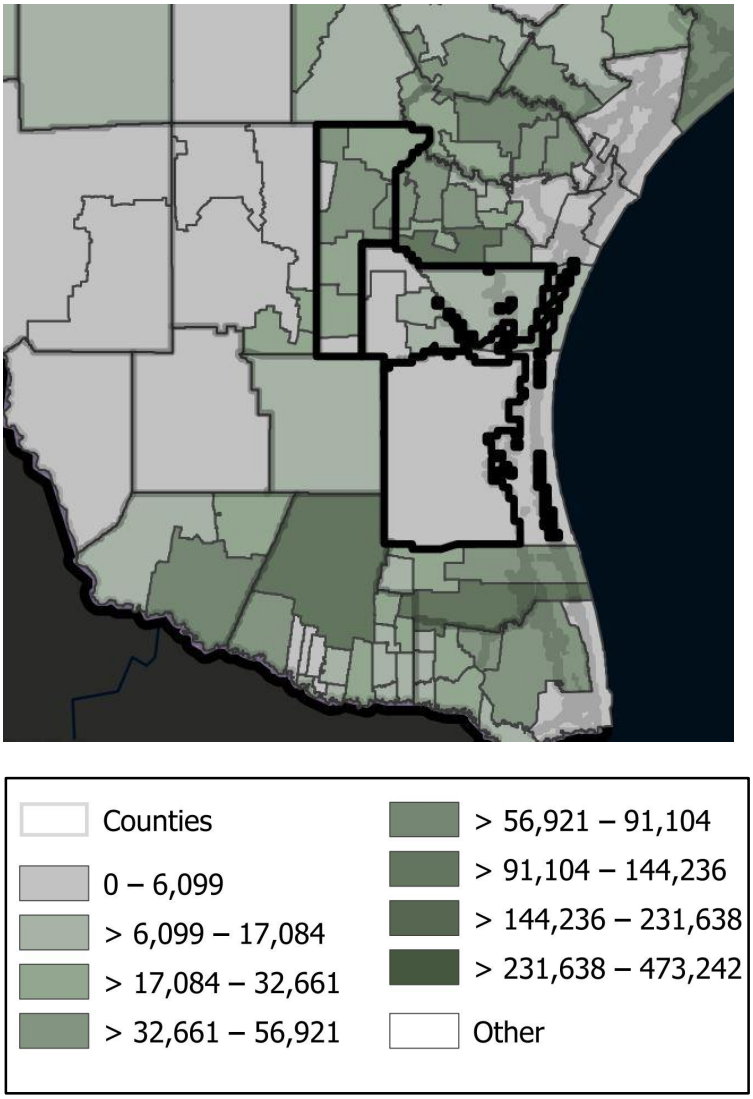

Figure 17. Amount of cropland in Kleberg, Kenedy and Jim Wells in acres in 2017. Note: Much of the cropland resides in Kleberg and Jim Wells County with less than 6,099 acres devoted to cropland in Kenedy.

Pasture /Hay Operation

Improved pasture land is usually improved with a permanent grass such as Coastal Bermuda or Klein Grass. This type of land is usually baled in the spring and early summer and can feel effects of too much or too little precipitation. Baffin Bay watershed has approximately 20% of the Petronila creek and 23% of the san Fernando creek designated as hay and/or pasture land (Nueces River Authority, 2013).

Cattle Grazing

This type of operation is the most commonly found agricultural operation in the Kleberg County Appraisal District with King Ranch and Kenedy Ranch well known for their large cattle operations. A typical operation in Kleberg County will include a minimum of three cows or five calves with Kleberg County's typical herd size being 3 animal units. It can be difficult to precisely pinpoint the number of cattle in the watershed but the number of acres designated as grazing land is 1.3 million acres (Texas Land Trends, 2017).

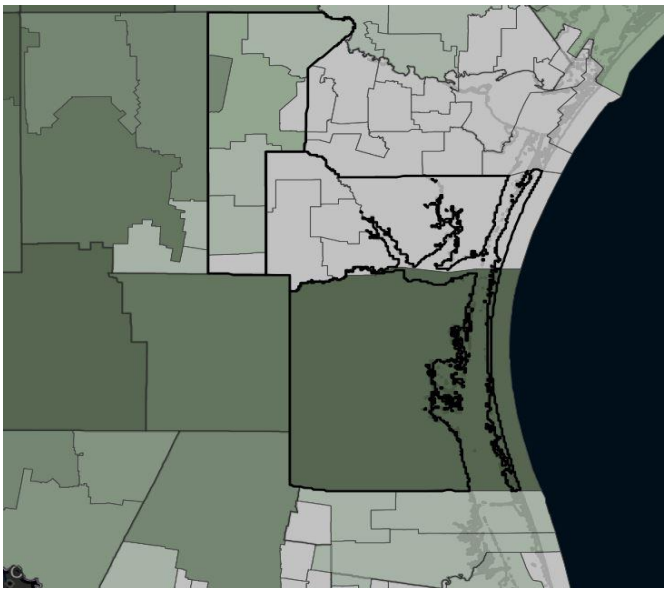

Figure 18 Amount of land available for grazing measured in acres in 2017. Kenedy Ranch in Kenedy County is known for their ranching operations as can be seen on this map. Jim Wells County has anywhere from 30,000 acres to 365,000 acres while Kleberg county has less than 30,000 acres of land designated for grazing practices.

Land Use Trends in Kleberg and Kenedy County

The next section will delve into how the land uses have changed. To ensure clarity about the different uses, undeveloped, developed and working lands are defined in the following sentences. When referring to undeveloped land, it is defined as an area of land that has no utilities, no structure or pre-defined building site or intra-parcel roads, lacking all of the components we associate with urban development.[2] Developed land is essentially the opposite with components of utilities infrastructure, homes, buildings, and roads present. Developed land has been subject to Development or Subdivision requirements.[3] For the purposes of this report, working lands refers to landscapes that have natural resources and work for biodiversity and people.[4] Forests, ranches, and farms fall into this category and make up a huge percentage of the land in the watershed as can be seen previously in Figures 17 & 18.

The following tables display land use trends in Kleberg and Kenedy County from 1997 to 2017. Since 1997, the Texas A&M Natural Resources Institute has been providing Texans with land use trends to understand the status of working lands. Censuses of Agriculture datasets by the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service's (NASS) have been used to gather this information so it can be used to inform conservation efforts and natural resource policy development. Population trends in the region are considered because it can inform and help predict future development, growth and water needs. Increases in population can result in land fragmentation and land use changes from natural open spaces to developed spaces and in increase in impervious surfaces. As shown in Table 3, the Baffin Bay region has seen a near 10% increase in population from 1997 to 2017.

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[2] Land Century. Benefits and Drawbacks Associated with Undeveloped Land Investments. February 26, 2018. https://www.landcentury.com/articles-news/benefits-and-drawbacks-associated-with-undeveloped-land-investments

[3] Law Insider. Developed Lands. https://www.lawinsider.com/dictionary/developed-land

[4] National Audubon Society. Working Lands. 2018. https://www.audubon.org/conservation/working-lands

Year	Population
1997	71,724
2002	71,936
2007	71,985
2012	75,201
2017	78,328
Change	6,604 (9.2% increase)

Table 3 Population trend in Kleberg, Kenedy and Jim Wells Counties between 1997-2017. Source: Texas Land Trends 1997-2017. https://data.txlandtrends.org/trends/county/Kleberg,Kenedy,Jim-Wells

Developed land does not necessarily always have a negative effect on the watershed, depending on how land use changes are implemented and managed. For instance, smart growth and development is a concept in urban planning that prioritizes efficient and sustainable land development, incorporates redevelopment patterns that optimize prior infrastructure investments and consumes less land that can otherwise be occupied by agriculture, open space, natural systems and rural lifestyles (American Planning Association, 2012). When communities emphasize a smaller footprint and mix uses to integrate living, working and playing, they can effectively protect working lands for future generations. Incorporating flood mitigation and water quality practices into development, i.e. permeable pavement and bioswales, they can also offset negative effects of taking natural land out of production. Considering policies that encourage this is important because taking working lands out of production often results in less permeable surfaces that can absorb and slow down surface runoff to not only reduce flooding impacts, but also provide water quality benefits. In undeveloped lands (areas with high permeability), aggregates in the soil and root systems can help capture nutrients, sediments, and other pollutants in the water as it passes through. However, in developed areas where land has transitioned from permeable to non-permeable (roads, parking lots, buildings, etc.), this natural filtration does not occur and results in urban

runoff, a major source of nonpoint source pollution. Urban runoff typically consists of rainwater or waste water that flows from urban landscapes into storm drain systems that lead to tributaries or directly into the bay. Within the Baffin Bay watershed, developed land accounts for less than 8% of the total land cover. The specific sources of the pollutants within a developed area can range from domestic pets, wildlife to use of detergents, use of fertilizers, chemicals, leaf litters and vegetative detritus from urban lawn clippings. More often, developed areas have stormwater and sewage infrastructure that supports dense housing development. Alternatively, homes that are located outside of the developed regions are more likely to have OSSFs, and if they are not up to date on maintenance checks or have failing infrastructure, it can contribute to nutrient loading. Chapter 6 identifies resources and funding for homeowners that may have compromised or failed OSSFs.

However, data from the Texas Commission on Environmental Quality (TCEQ) assesses that the San Fernando and Petronila creek both exhibit high nutrient loads without a discernible urban influence. An estimated 85% to 92% of the nutrient loading in the San Fernando Creek watershed and an estimated 98% in the Petronila Creek watershed comes from sources associated with pasture/grassland and cropland (Parsons, 2019, p. 3). Tables 4 and 5 outline just the working lands within the watershed and show that around 4% of the land has changed since 1997 with most changes happening to large acreage properties of 1000-2000 acres. This is likely a result of owners subdividing their properties and either selling them as small acreages to still be used as working lands or, selling the land to developers for new subdivisions to house the growing population. Recommendations for strategies that can address issues related to this can be found in Chapter 6 of this report.

Land Use

Acres

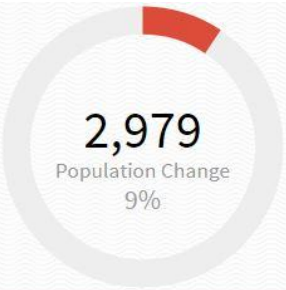
Year	Cropland	Grazing Land	Other	Timber	Wildlife Management
1997	96,251	1,397,304	1,082	0	0
2002	86,074	1,390,750	1,407	0	0
2007	32,849	997,969	1,125	0	410,311
2012	31,208	993,130	1,003	0	416,067
2017	29,656	986,270	993	0	416,368
Change	-66,595	-411,034	-89	0	416,368

Market Value per Acre

Year	Cropland	Grazing Land	Other	Timber	Wildlife Management
1997	$706	$338	$400	$0	$0
2002	$898	$392	$662	$0	$0
2007	$1,369	$552	$574	$0	$992
2012	$1,526	$1,021	$941	$0	$935
2017	$2,124	$1,118	$983	$0	$1,398
Change	$1,418	$780	$583	$0	$1,398

Table 5 a. showing how land in the region has changed between 1997-2017, measured in acres, as well as how market value of the land has increased with less and less working land available. As can be seen by the bottom row of the tables, much of the cropland and grazing land in the three counties have been altered from their original uses. With the significant increase in the amount of acres dedicated to wildlife management, it is possible that cropland and grazing land have been transitioned to this purpose.

Source: Texas Land Trends 1997-2017. https://data.txlandtrends.org/trends/county/Kleberg,Kenedy,Jim-Wells



Ownership - Farms

Year	1-99 ac.	100-499 ac.	500-999 ac.	1000-1999 ac.	2000+ ac.
1997	192	107	29	14	26
2002	214	90	24	16	32
2007	212	100	15	14	33
2012	258	105	22	20	24
2017	329	104	22	10	24
Change	137	-3	-7	-4	-2

Ownership - Acres

Year	1-99 ac.	100-499 ac.	500-999 ac.	1000-1999 ac.	2000+ ac.
1997	5,624	23,684	17,542	17,703	548,081
2002	6,931	10,943	16,734	19,229	467,428
2007	5,527	19,520	7,968	17,249	1,353,457
2012	7,451	11,281	11,878	30,286	902,468
2017	8,223	21,072	13,402	6,594	859,411
Change	2,599	-2,612	-4,140	-11,109	311,330

Table 15 b. displays changes in just farm lands between 1997-2017. The table on the left shows the changes in the number of farms and the table of the right measures the change using

acreage. The bottom row of each table tabulates the change over those 10 years. While ownership of land 2000+ acres has increased significantly, many of the mid-range farms have seen a decrease which could mean land has transitioned to other purposes or have been compounded into a bigger property. Source: Texas Land Trends 1997-2017. https://data.txlandtrends.org/trends/county/Kleberg,Kenedy,Jim-Wells

Estimate of Pollutant Loads and Load Reductions

This Early Phase Watershed Planning for Baffin Bay project was not tasked with analyzing and estimating pollutant loading, however local feedback did discuss pollutant sources and highlighted data gaps which need to be addressed to estimate pollutant loads and the needed load reductions in future projects. For example, the Texas Water Resources Institute was awarded NPS 319 funding to develop a full watershed protection plan for San Fernando and Petronila Creeks and will be using relevant local feedback from this project to support analysis.

Pollutant Loading and Load Duration Curves

Based on the complexity of a water system and its degradations, method analyses vary. One strategy for understanding how flow rates, different climate conditions and inputs affect water quality is employing Load Duration Curves.

Load Duration Curves (LDC)s are a widely accepted methodology in Watershed Protection Plans used to characterize water quality data across different flow conditions in a watershed. An LDC provides a visual display of streamflow, load capacity and water quality exceedance. LDCs were first developed by constructing a flow duration curve (FDC) using historical streamflow data. An FDC is a summary of the hydrology of the stream, indicating the relative percentage of time (i.e. a year) that a given stream flow exceeded a designated flow level. An FDC is constructed by ranking flow measurements from highest to mid-range to lowest and determining the frequency of different flow measurements at the sampling location. To construct an LDC, an

FDC is multiplied by the allowable pollutant concentration minus a margin of safety (typically 5%) to identify the maximum acceptable pollutant load across all flow conditions. Using existing water quality and stream flow measurements, pollutant loads are plotted on the same figure. Points above the curve are out of compliance while points below the curve are within compliance. The goal for any watershed is to have more points below the curve. The difference between the predicted load and the allowable load is the estimated load reduction required to achieve the water quality standard. Standard Flow Categories are:

–High flows: 0 to 10% exceedance

–Moist conditions: 10 to 40% exceedance

–Mid range flows: 40 to 60% exceedance

–Dry conditions: 60 to 90% exceedance

–Low flows: 90 to 100% exceedance[5]

Additional guidance and information on LDCs are available in EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA 2007)." (Lavaca Watershed Protection Plan 2018)

[5] Texas Water Resources Institute & Biological and Agricultural Engineering TAMU. Introduction to Load Duration Curves. http://watershedplanning.tamu.edu/media/674986/12-w-ldc-presentation.pdf.

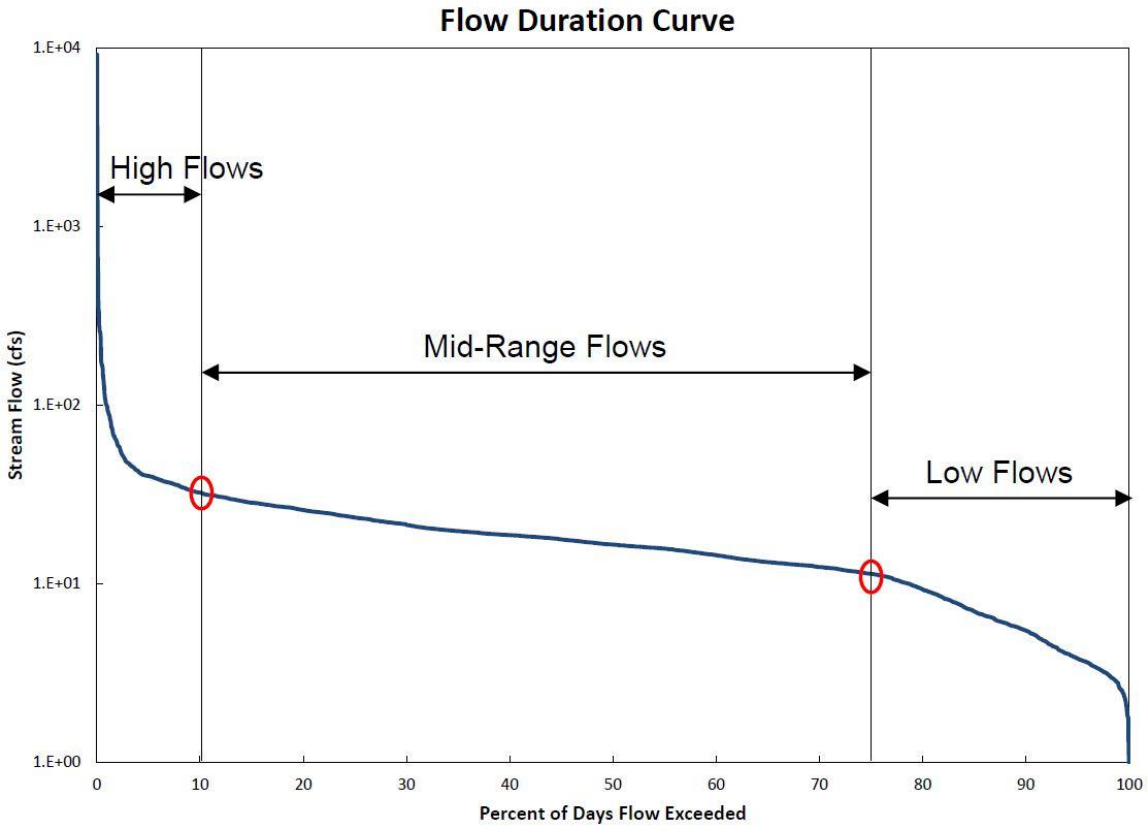

Flow Duration Curve
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
Stream Flow (cfs)
High Flows
Mid-Range Flows
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Percent of Days Flow Exceeded

Figure 19

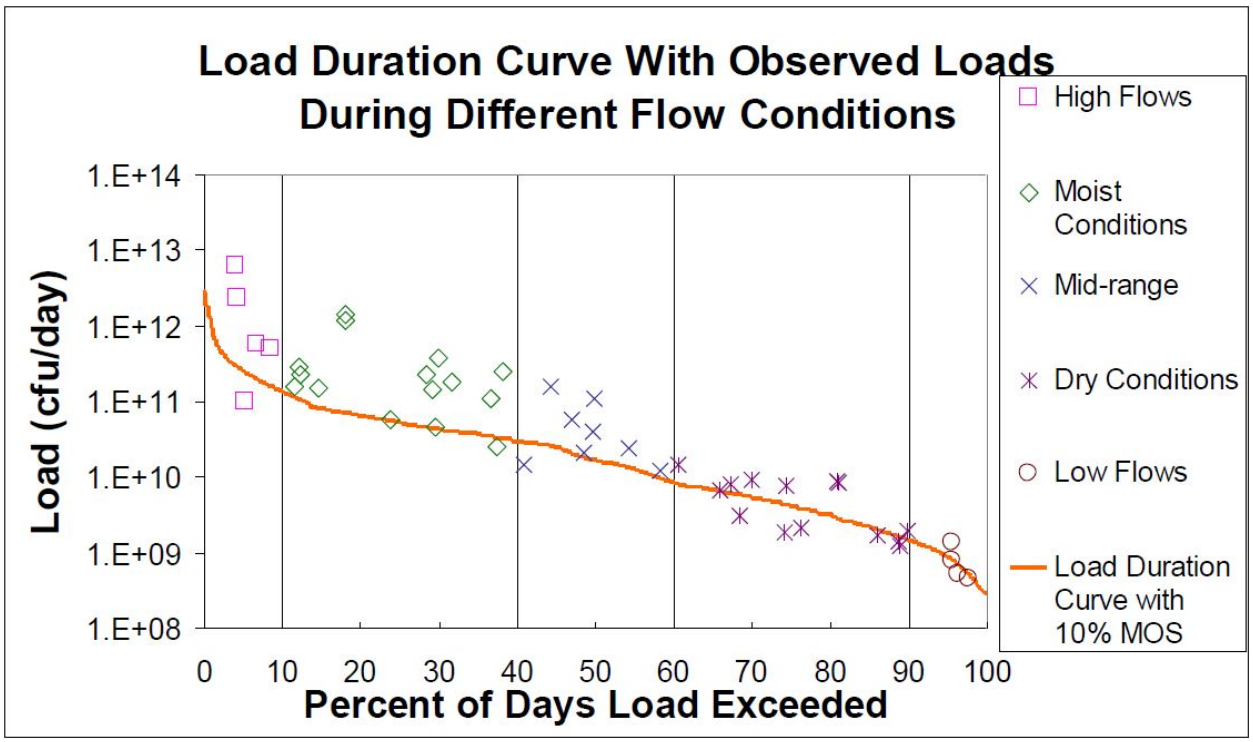


Figure 20 Figure 19 and 20 are examples of how a Flow Duration Curve and Load Duration Curve may be depicted in a Watershed Protection Plan to explain different loadings across different flow rates. The first graph shows what it looks like and how each of the sections are defined. The second graph illustrates what it looks like when pollutant sources are added. These curves can tell us the type of pollution source that is influencing the water quality (i.e. nonpoint source and point source are present depending on if it is a high flow event or midrange flow conditions). Source: Biological and Agricultural Engineering Department, Texas A&M University. http://watershedplanning.tamu.edu/media/674986/12-w-ldc-presentation.pdf

Works Cited

American Planning Association. 2012. APA Policy Guide on Smart Growth. American Planning Association Policy and Advocacy. https://www.planning.org/policy/guides/adopted/smartgrowth.htm.

EPA. (2013, July). *Literature Review of Contaminants in Livestock and Poultry Manure and Implications for Water Quality.*

Nueces River Authority. (2013). *2013 Basin Summary Report* [San Antonio-Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin].

Parsons. (2019, August). TEXAS COASTAL WATERS: NUTRIENT REDUCTION STRATEGIES REPORT. https://www.gulfspillrestoration.noaa.gov/sites/default/files/Task%205_FNLWatershed%20Assessment_August2019_FINAL.pdf

TCEQ. (2009, July 9). *General Permit to Discharge Wastes, General Permit No. TXG920000.* Office of Permitting and Remediation.

Texas Water Resources Institute. (2018, April). Lavaca River Watershed Protection Plan. College Station.

Chapter 5: Pollutant Sources

The previous chapter outlined land use classification and changes, while this chapter will discuss in more detail the specific pollutant sources associated with those land uses. Major sources of water quality contamination include failing or compromised wastewater treatment plants and septic systems, cropland and livestock inputs, wildlife, invasive species, urban stormwater runoff, illegal dumping, and more. Table 6 below outlines well known sources of water pollutants, the type of pollutant, and potential water quality impacts.

Source/Activity	Bacteria/Nutrient/Parameter	Point (P) or Nonpoint Source (NP)	Impacts
Channel Modification	DO, Nutrients, Bacteria	P and NP	Modifications can reduce or increase the stream flow velocity, disrupt natural erosion and deposition, and affect circulation of oxygen in the system
Illegal Dumping	Bacteria, DO, Phosphorus and Nitrogen	P and NP	Any type of waste, including chemicals, tires, carcasses, and trash that end up in the water ways.
Livestock/CAFO***	Bacteria	NP and P	If not property maintained, fecal matter can runoff into the water system.
Cropland	Bacteria, DO, Ammonia, Phosphorus, Nitrogen	NP	Runoff from cropland can contain excess nutrients if fertilizer is used in excess or applied before a rain event*
Industrial Activity	DO, Phosphorus, Nitrogen	P	Runoff and/or possible onsite treatment source input from Manufacturing Industry, chemical plant, etc.
Pets	Bacteria	NP	Fecal deposits on land
Urban Stormwater	Bacteria, DO	NP	Rain falls on the land, gathers materials and drains into waterways i.e. wildlife/pets fecal

			matter, eroded soil, organic matter, fertilizer, oil, etc.
Wildlife and Feral Hogs**	Bacteria	P and NP	Fecal matter deposits, also feral hogs can destroy riparian habitat.
Wastewater Treatment Facilities	Ammonia, Bacteria, DO	P	Improperly maintained infrastructure, large flood events can cause elevated discharge
Sanitary Sewer Overflow	Bacteria, DO	NP	Leaking sewer lines but also extreme flood events
On-site Sewage Facilities	Bacteria, DO	NP	Septic systems that treat sewage on private land

Table 6: Outline of pollutant sources and activities that contribute.

*****The impact of runoff on water quality can be more significant depending on proximity of the land to a tributary or shore, the intensity and duration of the rain event, the health of the soil, the presence or absence of vegetation between croplands and water bodies, etc. When the erosion occurs via water, the runoff can take excess nutrient loading or bacteria into the bay which can be a result of the following or a combination of over application of fertilizer, lack of vegetative buffers between croplands/ranchland and tributaries and drainage ways, continually farmed acreage, continually grazed acreage etc.

**Feral Hog in Texas are an invasive species with populations estimated at over 2 million head (Texas A&M AgriLife Extension Service 2012). The combination of hogs' preferences for rivers, creeks and drainage swales, their high rate of reproduction and destructive rooting activities make them a particular threat to water quality in any region they live. They tend to concentrate in areas with dense cover and accessible food in the form of nut-producing trees and agricultural crops. Their tendency to destroy riparian corridors can be a cause of significant sediment loads to streams (Parsons, 2019).

***There is one known CAFO within the San Fernando Creek watershed. It is a permitted operation and operates in accordance with the requirements and BMPs prescribed in the TCEQ General Permit to Discharge Wastes, General Permit Number TXG920000 (TCEQ 2009) (Parsons, 2019). CAFOs are known to be sources of phosphorus and ammonia (EPA 2013).

Recent Trends in Texas Bays

Across the country and especially in Texas, it is recognized that there are some substantial and persistent threats to the coastal zones resulting in a growing expression of symptoms such as persistent algal blooms, hypoxia/anoxia formation, and microbial pathogen growth (Nixon 1995; Boesch 2002; Rabalais et al. 2009; Wetz 2014). The consequences of these symptoms include fish kills and alteration of food webs resulting in economic losses (Diaz and Rosenberg 1995; Boesch 2002; Wetz 2014). A lack of sampling efforts and data coverage in estuary environments like Baffin Bay have resulted in less information about the state of the

environment (Wetz, 2019). Nonetheless, there is growing concern fueled by public observations and recent scientific assessments that several systems in South Texas are indeed undergoing eutrophication (Bugica et al. 2020; Wetz, 2019). There has been a growing expression of symptoms of eutrophication such as hypoxia and dense algal (phytoplankton) blooms have been noted in Baffin Bay over the past 3 decades (Wetz, 2019). Recently, the bay experienced a persistent algal bloom in 2013 in the form of a microscopic brown tide alga known as Aureoumbra lagunensis[1]. Initial concerns from local citizens and individuals that worked in the bay that brought awareness to a growing threat. Local stakeholders are the cornerstone of sounding the alarm and bringing awareness to possible water quality issues and it is this particular group that we targeted to seek input on what and where the concerns are for water quality.

Eutrophication is a result of increased input of nutrients such as nitrogen (N) and phosphorus (P) into water systems can cause a feeding frenzy among the life forms that reside in the water such as algae or plankton (Rabalais et al., 2009, 2010; Paerl et al., 2014). The result is an acceleration of growth and reproduction of these organisms that forms an algal bloom, disrupting the natural balance of the system. Blooms increase turbidity which impacts seagrasses ability to photosynthesize. When the nutrients that have fed this bloom naturally run out, this mass of life begins to die off, striping the water of its oxygen levels as it begins to decompose (also known as hypoxia), creating a dead zone that kills fish and other life forms residing in the water. Hypoxia has been linked to several large fish kills in Baffin Bay over the past 12 years (unpubl. Texas Parks & Wildlife Spills & Kills Team reports) which has led to more interest by outside stakeholders to conduct research to better understand the system. The simultaneous instances when phytoplankton blooms and hypoxia happen at the same time have been noted in Baffin Bay as well (unpubl. Texas Parks & Wildlife Spills & Kills Team reports; Walker and Wetz, unpubl. data), and overall phytoplankton biomass frequently exceeds state screening levels, raising concerns about the potential role of nutrient-laden runoff (Montagna and Palmer 2012; Wetz, 2014).

Additionally, patterns can also be attributed to seasonal temperatures and the amount of precipitation. For example, high chlorophyll levels are often found between spring to summer months when temperatures are higher. However, according to the Baffin Bay Volunteer Water Quality Monitoring Study 2013-2019, several heavy precipitation events created lower salinity conditions temporarily and lower levels of chlorophyll in the spring months. Despite there being more nutrients available, a significant amount of flushing and high turbidity that reduced light penetrating the water could contribute to the low chlorophyll levels (Cira, unpubl. Data; Wetz 2014). This highlights the need for comprehensive study and broad monitoring across the watershed to understand current conditions and how it can influence levels of contaminants in the bay.

[1] Brown Tide in Texas. Texas Parks and Wildlife.
https://tpwd.texas.gov/landwater/water/environconcerns/hab/brown_tide/faq.phtml

The next section describes some of the leading causes of nutrient, bacteria and pollution influx in the water system to help us understand where best management practices and funding should be targeted.

Point and Nonpoint Source Pollution

There are a number of sources that can contribute to degraded water quality issues in a watershed. Sources are often organized based on whether they are a Point Source or a Non-Point Source. Point source is any discernible conveyance of water through a pipe, ditch, tunnel, channel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or floating vessel (US Environmental Protection Agency). Simply put, a single source is inputting the contaminants into a water body, is easier to detect and is permitted and regulated by the National Discharge Pollutant Elimination System, a TCEQ run program. Nonpoint source pollution comes from many different sources such as land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification (US EPA). Any substance that resides on the land when a precipitation event occurs, can wash off into water systems including fertilizer and pesticides from agricultural lands and residential property, oil and gasoline from vehicles and bacteria and nutrients from livestock, pet waste or poorly maintained septic systems.

Nonpoint source (NPS) pollution is the leading cause of water quality issues in the world because it is widespread, difficult to pinpoint and can often be hard to address with one or two management practices. Region wide strategies that look at multiple sources and causes is the most successful way to improve water quality issues caused by NPS. Establishing regional partnerships that cross jurisdictions and sectors is the best way to ensure widespread protection of the bay system.

Common Nutrients & Parameters

Dissolved Oxygen (DO): A concentration that conveys the presence of oxygen-demanding substances and living organisms in the water. Concentrations fluctuate throughout the day with higher levels observed in the afternoon, at the height of photosynthetic activity, and the lower levels occurring in the early morning when algal oxygen consumption is at its maximum (Flores et al. 2017).

Nitrogen: A primary nutrient that aquatic vegetation and algae require to thrive. Nitrogen is a limiting factor in the watershed and an influx of nitrogen from natural sources of pollution can increase instream productivity.

Phosphorus: An important aspect of controlling aquatic vegetation and algal growth due to it naturally occurring in short supply in the freshwater aquatic environment (Flores et al. 2017). This nutrient typically enters the water through direct discharge, stormwater runoff or irrigation return flows.

Chlorophyll-a: is a measure of the amount of algae growing in a waterbody. This photosynthetic pigment can help with estimating phytoplankton biomass (Flores et al.2017). Waters with high levels of nutrients from fertilizers, septic systems, sewage treatment plants and urban runoff may have high concentrations of chlorophyll *a* and excess amounts of algae (United States Environmental Protection Agency).

Total Suspended Solids (TSS): This measurement is used to estimate the amount of suspended particles in water which includes sediment, organic matter and plants like algal. TSS can also be a primary transport for pollutants into water bodies. Phosphorus is known to have a strong affinity to soil particles that are commonly associated with TSS.

Bacteria: Is a measurement tool used to determine if a water body can support recreation uses. For freshwater, Escherichia coli is used while Enterococcus is used as an indicator in tidal waters (Flores et al. 2017). If humans use a water body with high bacteria count, it can lead to gastrointestinal illness and other complications.

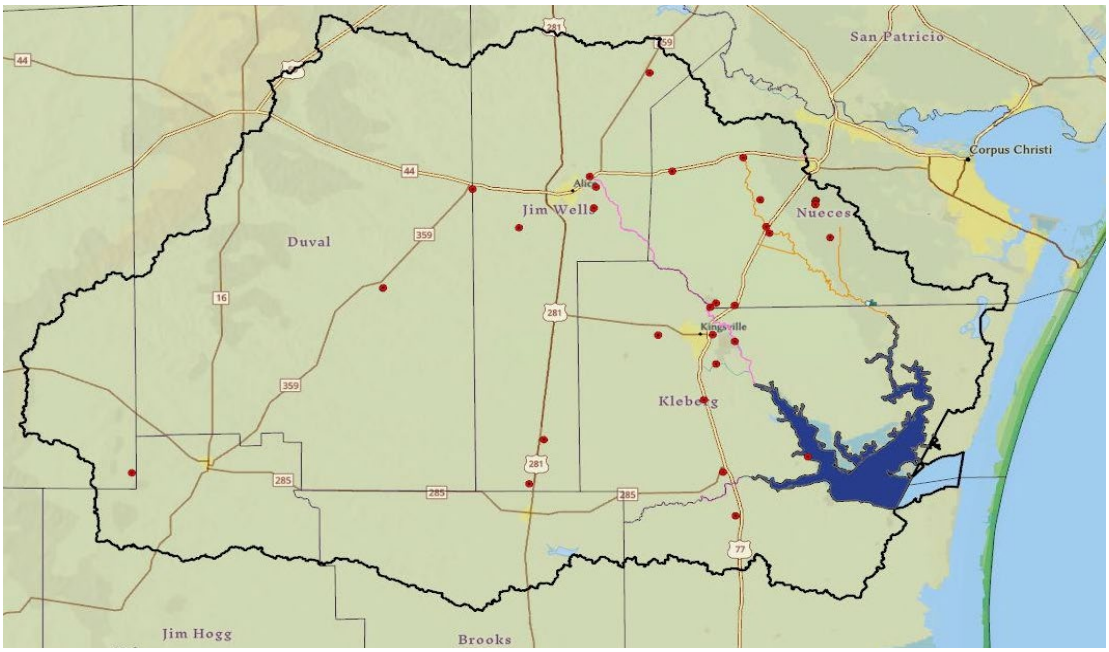


Figure 21 Map displays the locations of the Wastewater Treatment Plant in the watershed as well as highlights the impaired tributaries Petronila (orange) and San Fernando (pink).

The map above illustrates the number and location of WWTP in the watershed. As stated previously in the report, WWTPs are permitted point sources of pollution under a program administered by TCEQ. When operated efficiently and properly, the effluent they discharge should not have a significant level of nutrient loads. When a water system is seeing heightened levels of nutrients, this could be a sign that the WWTP needs upgrades to continue to run properly. Exceptions to this are in the case of excessive infiltration/inflow to the system that can overwhelm WWTP and result in the release of untreated water.

Chapter 6: Potential Management Strategies

Management strategy identification and prioritization of sources contributing to water quality impairments allows for more effective allocation of resources to address issues. Local concerns gathered throughout the project period in the Baffin Bay watershed fell into the following focus areas:

- Riparian and habitat restoration and enhancement
- Increased Community outreach
- Wastewater and septic mitigation
- Fishery sustainability
- Landowner operations--landowner incentive program efforts
- Wildlife- adverse impacts from both invasives and natives

Management strategies to address these water quality concerns within each theme are outlined below, including some in spatial format. Other relevant strategies outside this bulleted list are included in this chapter as well.

Opportunity Maps

The workshop, task force meetings, mail-out questionnaires and one-on-one meetings with stakeholders were conducted with the goal of collecting as much localized information to further characterize Baffin Bay. Through the process, another use for the valuable information was to depict feedback into spatial form for inclusion into the final report. An opportunity map outlining where specific and targeted bmps could be implemented to improve the overall quality of the watershed was created. Following the tables that cover management strategies for a specific focus area, there will be excerpts from maps with suggestions created using the spatial and qualitative feedback that was received through each of the outreach methods.

Riparian and habitat restoration and enhancement

Source: NPS runoff (nutrient and bacteria sources)
Problem: degraded vegetation buffers along tributaries, stream bank erosion, bacteria and chlorophyll impairments
Goal: -implement outreach campaigns and practices targeting stakeholders that interact most with these systems to increase adoption of BMPs -Reduce nutrient loadings and promote practices to enhance water quality in tributaries
Description: Outreach campaigns, Lunch and Learns, Field training, Planning

Potential Participation	**Recommendations**	**Period**	**Costs/Funding Source**
Local Governments collaborate with local agency	Host Lunch & Learns with Local Governments/commissioners court members- to learn priority public un-grassed drainage ways/degraded riparian areas to better identify funding and resource allocation	Voluntary basis	Minimal- cost of prep, space and food
Public Works Departments	Field Training; Riparian field visits using Nueces River Authority's Remarkable Riparian Manual to encourage bmp adoption	Every two years	TBD
ISDs, Nueces River Authority	Promote Nueces River Authority's Remarkable Riparian Manual in middle school and high school classes		SWCDs, TPWD,
TWRI and Texas Sea Grant	Host a Riparian and Stream Ecosystem Workshop in Jim Wells County	Next two years	Venue and food cost; local sponsor
Landowners, producers	Continue promoting existing conservation plans if possible in partnership with local SWCD and local landowners already utilizing plans to speak on their experiences and answer questions other landowners may have		Financial Assistance – USDA-NRCS – RCPP – TSSWCB – SWCDs – TPWD
SWCD, Nueces River Authority	Education on how to: 1) Remove hindrances, allowing poor functioning areas to improve, and 2)Protect high functioning areas from degradation.	Every 2 years	N/A
Collaboration with	Explore Dune restoration with recycled	N/A	Check with

Kenedy Ranch and Master Naturalists	Christmas trees		county rules
Master Naturalist with Local Governments	Draft a plan to create monarch butterfly way stations in targeted public parks	annually	AgriLife, non-profits, Keep Texas Beautiful

Table 7

Shoreline habitat restoration and enhancement

Source: NPS runoff (nutrient and bacteria sources)
Problem: degraded vegetative buffers along Baffin Bay shorelines and water quality concerns
Goal: Work with local universities and extension services to hold workshops on living shorelines to promote strategies to improve water quality in the bay. -Provide GLO's stakeholder geared one-pagers to community --Encourage local government to collaborate with local universities for example to acquire funding for on the ground projects -Reduce nutrient loadings attributed to non-point source runoff from various land uses
Description: Living shorelines are recommended to be promoted via outreach efforts to encourage implementation of BMPs that reduce water quality impacts from eroding shorelines, shorelines with poor vegetation, etc. Education and outreach efforts will support and promote the adoption of these practices.

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Texas Sea Grant	Partner with GLO to distribute Living Shorelines one-pagers to bait *shops, businesses, local government offices*	Every 1 to 2 years	Minimal; travel and printing (certain number might be free); approximately < $2000
Harte Research Institute collaboration with local commissioners courts	Host Living Shorelines Workshops in Baffin Bay Watershed (TAMUK, local gov. Commissioners courts)	Every 3-5 years	See cost of 2019 Workshop at HRI
TAMUK, TAMUCC, HRI, Texas Sea Grant, Kleberg, Kenedy, Jim Wells, Nueces counties	Encourage local government to collaborate with local universities for example to acquire funding for living shoreline projects	Next funding cycle ideally	NOAA Coastal and Marine Habitat Restoration Grants

Table 8

Wastewater and septic mitigation

Source: P and NP bacteria and nutrient inputs from municipal WWTP and OSSF
Problem: improperly maintained wastewater and septic systems, failing infrastructure, flooded systems
Goal: -Reduce nutrient and bacterial loadings and promote practices to minimize adverse water quality conditions
Description: -Educate watershed stakeholders on systems, resources, and water quality impacts

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Residents, Landowners	Promote participation in more financial assistance opportunities, i.e. USDA provided assistance of $50K for low income families in Kenedy County to purchase septic systems @ $10K per system, five families qualified and applied for and received a septic system in the Riviera and Ricardo, TX area.	2019 or 2020	-USDA -CWA 319 funding:i.e. Lower San Antonio Watershed Protection Plan
AgriLife, TWRI	Deliver OSSF operations and maintenance workshops	Every 2 years	N/A
Local governments, AgriLife	Send OSSF webinar opportunities to stakeholders via internal listservs and provide information to homeowners	Annually	N/A
Local agency collaborate with TCEQ at Local government buildings	Facilitate meetings to educate local government on TCEQ SEP options for water quality and waste mitigation	Every 2 years	N/A
Local government	Apply for EPA 319 funds or other septic assistance funds to inspect, repair/replace systems		
Residents, Landowners, local government	A program that engages communities in addressing and protecting water quality in Baffin Bay could result in the funding and	Annually	NRCS

	development of off-channel wetland/riparian tertiary treatment for wastewater discharges to ensure water quality entering Baffin Bay tributaries is compatible with the quality of the receiving water.[2]		
NRCS, AgriLife, SWCDs	Promote CLEAR30 via mailers or listservs to Landowners and agricultural producers currently enrolled in the Conservation Reserve Program (CRP)--now have a wider opportunity to enroll in a 30-year contract – a water-quality focused option available through CRP Interested producers with CRP contracts expiring September 30, 2021, should sign up by August 6, 2021.	ASAP- time sensitive	USDA https://www.fsa.usda.gov/news-room/news-releases/2021/usda-opens-signup-for-clear30-expands-pilot-to-be-nationwide
Consulting group, agency	Hold workshop or webinar on Wastewater discharges- off-channel wetland/riparian tertiary treatment for wastewater discharge	Every 2-3 years	N/A

Table 9

[2] Rocky Freund. Riparian Evaluation. 2019

Fishery Sustainability

Source: P and NPS runoff (nutrient sources)
Problem: prolonged brown tide; algal blooms; fish kills; smaller catches;
Goal: -Provide convenient citizen science opportunity and platform for bay users to report observations and issues -Educate the public on threatened serpulid reefs as well as water quality via signage campaign **-**Reduce nutrient loadings and promote practices to enhance bay habitat health
Description: Citizen science and outreach campaigns will support reduced nutrient loading into Baffin Bay and adoption of best management practices.

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Fishermen (commercial and for-hire), residents	Provide convenient citizen science opportunity to report adverse water quality conditions and other observations via a link on local fishing social media and commonly used sites	2021	Low cost; just a matter of someone from HRI or other willing agency to check the entries
Collaborate with Flatsworthy on Lower Laguna Madre effort to emphasize Baffin concerns	Education and Outreach to help anglers/boaters understand serpulid reef importance and how to avoid damaging them.	2022	Flatsworthy Model- City of Rockport, TX
Local government, Master Naturalists, local TxDOT office, ISDs; TAMUK	Estuarine Ecosystem Health and Serpulid Reef Signage at select Boat Ramps	Next funding cycles for relevant funding	-Keep Texas Beautiful local chapter - Don't mess with Texas TxDOT

Table 10

Landowner incentive program efforts

Source:NPS runoff (nutrient sources)
Problem: Minimal buffer between edge of field and stream or drainage, eroded stream banks, nutrient inputs
Goal: -Facilitate field/crop tours to promote soil health best management practice adoption -Educate the public and teachers on agency programs -Reduce nutrient loadings and promote practices to enhance watershed health
Description: Landowner targeted management practices and plans will lead to reduced nutrient loading into Baffin Bay and adoption of best management practices.

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Farmers, ranchers, Local SWCD, AgriLife	Promote WQMP strategies** and increase landowner adoption via success story highlight campaign (mailers, workshops with CEUs)	biannually	TBD
Farmers, ranchers, Texas Sea Grant, Local SWCD, AgriLife	Facilitate field/crop tours of local landowners and include adopted nutrient management plans as component	Every 2-3 years	Local sponsors such as in AgriLife's 2021 Crop Tour
NRCS, South Texas Natives, AgriLife	Educational program series on opportunities for unproductive lands to be planted with native grasses for buffers, put into easements, etc.	Every 2-3 years	Local sponsorship USDA-Conservation Reserve Program ten year set-aside program
Landowners, residents, producers, Realty Groups for urban residents	Soil Testing Event with presentation and kit handouts (first come first serve receive kits and return to AgriLife)	Biannually	<$3000; for soil tests; for speaker if necessary and print outs

Teachers, Residents	Look to facilitate Texas Farm Bureau (TFB) Summer Ag Institute in Baffin Bay watershed-- Teachers increase knowledge and cultivated techniques to incorporate agriculture into the classroom	Every 3-4 years	https://texasfarmbureau.org/summer-ag-institute-brings-agriculture-to-teachers/ See link for inquiry on workshop details and costs

Table 11

Nutrient management strategies to consider in Petronila Creek are numerous and should be evaluated on a case-by-case basis depending on cost effectiveness, landowner willingness, soil type, topography, crop type, agribusiness market conditions, planting and harvesting methods, livestock type, size of operation, annual precipitation, and other field specific factors (Parsons Report).

****Some recommended strategies include:**

- Cover crops
- Reduced tillage and no-till management
- Filter and/or contour buffer strips
- Grassed waterways
- Conservation cover (land retirement)
- Crop rotations
- Field borders
- Farm-based nutrient management plans
- Controlled drainage structures
- Herbaceous and forested riparian zones
- Mulching
- Streambank and shoreline protection
- Strip cropping
- Terracing
- Vegetative and herbaceous wind barriers
- Wetland creation and restoration
- Fencing livestock and rotation[3]

[3] Parsons. Nutrient Reduction Restoration Strategies Report. Aug 2019. Austin, TX.

Community outreach efforts

Source: NPS runoff
Problem: water quality degradation; watershed health concerns
Goals: -Outreach campaigns for addressing urban stormwater -Increase citizen scientist monitoring in the surrounding watershed via TX Stream Team -Reduce nutrient loadings and promote practices to enhance bay habitat health
Description: Various community watershed management education and practices will lead to improved watershed health and improved water quality .

Potential Participation	Recommendations	Period	Capital Costs/Funding Source
Local government, groups, agency collaboration	Labelling stormwater drains in urban area ("This drains to the Bay")		U.S. EPA
Residents, landowners, anglers (future program TX State is developing now)	Explore BBSG members getting trained to join Texas Stream Team program for San Fernando/Petronila WPP or future WPP efforts	Next two years	N/A
Educators, agencies, school kids, parents	Promote more robust science and natural resource School programs to ISDs in the watershed	Annually	See example A.D Harvey Elementary School (Kingsville ISD)
Texas Sea Grant, TWRI	engage each commissioners court for feedback on preferred watershed outreach programs	Every 2 years	N/A
Agency, organization, ISD,	Pursue funding for a Watershed model	ASAP	$15,000-$18,000 watershed-size dependent

Table 12

Wildlife and Invasive Species

Source: Bacterial loading from wildlife
Problem: degradation of water quality and habitat buffers
Critical Areas: high importance placed on cropland properties for feral hogs; stream sites for

avian inputs
Goal: -Implement best management practices to reduce bacterial loading and habitat degradation from feral hogs -Implement best management practices to reduce bacterial loading from avian sources including bats in Los Olmos -Implement best management practices to reduce bacterial and sediment loading from invasive species Arundo donax along tributaries
Description: Voluntary implementation of management practices

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Landowners, managers, lessees	Voluntarily construct fencing around deer feeders to prevent feral hog use	Annually	$200/feeder[4]
Landowners, managers, lessees	Voluntarily trap/remove/shoot feral hogs to reduce numbers	Annually	USDA- Feral Swine Eradication and Control Pilot Program (FSCP)
Landowners, producers, TPWD, NRCS, TSSWCB	Develop and implement wildlife habitat management plans*** and wildlife management practices in conservation plans and WQMPs[5]	Annually	N/A
Local government, TxDOT, River authority	Install bird exclusion/deterrent devices at targeted tributary crossings/bridges	Next 5 years	See example from UGRA
TPWD and River Authorities partner with landowners	Look into *Arundo donax* invasive reed management program-- all along San Fernando Downstream of Carreta Creek at Bishop City Park (across the road beginning on county property)	Next 5 years	See examples in Sabinal and Medina Rivers (Nueces River Authority; Bandera County River Authority and Groundwater District)
Local Government, USDA, AgriLife	Provide education and outreach to the community about best practices for trapping and/or removing feral hogs from the watershed.	Annually	

[4] Source Lavaca River Watershed Protection Plan
[5] Source Lavaca River Watershed Protection Plan

Table 13

*****Wildlife Management Operations**

In 1991 the first wildlife management law was passed which allowed productivity appraisal for land used to manage indigenous wildlife[6]. Tracts of land that are designated as open space, and actively being used as a place to manage wildlife can take advantage of the law. These types of operations often have a wildlife management plan that includes information about the owner and property, goals and objectives for the land as well as outlines best management practices to be implemented in support of the specific indigenous wildlife species targeted for management. Property owners that are actively implementing at least 3 of the 7 wildlife management practices can also qualify. Management practices include: Habitat control, Erosion control, Predator control, providing supplemental supplies of water, providing supplemental supplies of food, providing shelters and, making of census counts to determine population. It should be noted by landowners that if the use of land having 1-D-1 Productivity Value is changed to a nonagricultural use then a roll back tax may be imposed.[7] The rollback tax is a penalty for taking the land out of agricultural production.

Illegal Dumping and Litter Mitigation

Source: Debris containing bacteria and sometimes pollutants and/or harmful to wildlife
Problem: Illegal Dumping, debris, and fishing line
Goal: Reduce debris and harmful inputs into bay system
Description: Facilitate clean ups and educational programs with local entities and volunteer groups

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
County government	Facilitate clean ups at Site 55, Los Olmos Creek at Hwy 77, and Drum Point.	2x per year	-Don't mess with Texas water TCEQ -Keep Texas Beautiful Keep the sea free of debrisNOAA
Public works, Master	Install Monofilament Recovery and Recycling	Routine emptying required by	Low startup cost to build bin; mailing

[6] "KLEBERG COUNTY APPRAISAL DISTRICT." http://www.kleberg-cad.org/data/_uploaded/file/Forms/DEGREE%20OF%20INTENSITY%20STANDARDS.pdf. Accessed 18 Jul. 2021.

[7] "KLEBERG COUNTY APPRAISAL DISTRICT." http://www.kleberg-cad.org/data/_uploaded/file/Forms/DEGREE%20OF%20INTENSITY%20STANDARDS.pdf. Accessed 18 Jul. 2021.

Naturalists, TAMUK student groups or FSA chapter	Bins at select boat ramps	volunteer group	collected line to designated company; see Texas Sea Grant MRRP webpage: https://texasseagrant.org/programs/mrrp/index.html

Table 14

Other Water Quality or Watershed Management Strategies

Problem: Watershed health concerns
Goal: -Provide additional flood gauges and additional water quality monitoring sites -Reduce nutrient loadings and promote practices to enhance water quality in tributaries
Description: outreach campaigns

Potential Participation	**Recommendations**	**Period**	**Capital Costs/Funding Source**
Commissioners Courts, River Authority, City government, USGS	Apply for funding to secure an early flood warning system to dually inform monitoring/modeling for water quality purposes	Next funding cycle	TWDB grants
NRA	Add CRP or volunteer water quality monitoring sites to the San Fernando Creek	2023	Staff time and sampling equipment/ maintenance

Table 15

Opportunity Maps

Riviera/San Fernando Creek Inlet/Cayo Del Grullo/Laguna Salada

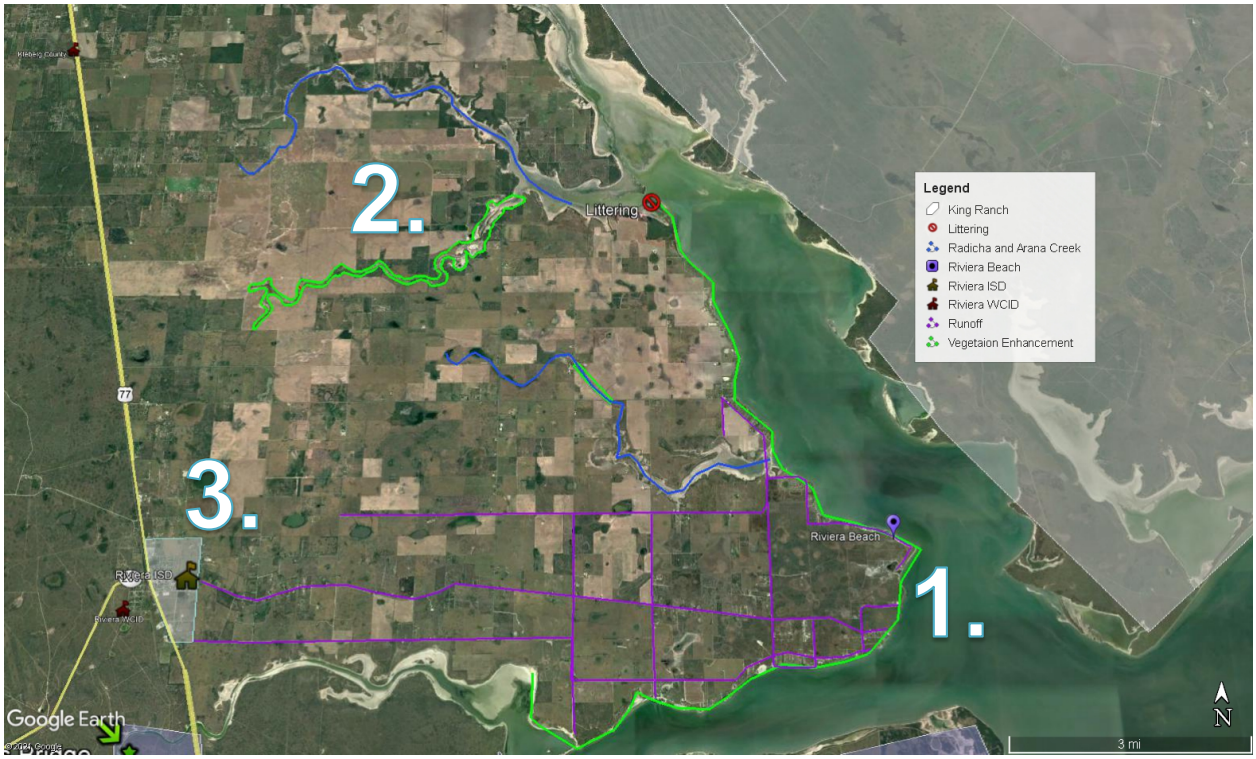


Figure 22 a.

This region of the bay lies southeast of Kingsville and encompasses land in between the Cayo Del Grullo and Laguna Salada. The blue lines represent the path of creeks that flow through the land into the bay. Along US Highway 77, a red icon represents Riviera Water Control Improvement District and a goal icon represents the Riviera Independent School District. The small, rural town of Riviera has a population of just under 700 and has its own water treatment system and a thriving independent school system.

1. Along the shoreline is a green line that displays a location for an opportunity to enhance the vegetation and seek out erosion and flood control strategies such as a living shoreline. On July 25th, 2020, the region was affected by Category 1 Hurricane Hanna. The worst of the storm was felt further south in Willacy County but Kleberg and Kenedy County received a significant amount of rain and water from the bay was measured to peak at around 6 feet. According to an instrument that measures wind speed on Kenedy Ranch property, the highest wind speeds experienced were around 100 mph. Due to the storm surge and high winds, much of the coastal infrastructure (island cabins, bulkheads, docks, boat launch) was completely destroyed. This is especially true for the residents of Riviera Beach, a small community along the shoreline at the location of the purple icon. The bulkheads that had kept the land from

eroding and protecting property were washed out and compromised in many areas along the shore (as can be seen in the images below). Hard infrastructure such as bulkheads can help the loss of land and protect properties against flooding, but if flood heights are higher than the bulkhead, they can compromise the structure and accelerate erosion.

Implementing living shorelines is a strategy that is gaining popularity around the Gulf of Mexico for its relatively simple installation and multitude of benefits including; habitat restoration, flood mitigation, erosion control and water quality. A professor from Texas A&M University- Kingsville, Dr. Kim Jones, received grant funds to install a pilot project living shoreline near the Kaufer-Hubert Memorial park demonstrating that possibility of pursuing this type of strategy for more areas along the shoreline of the bay to not only enhance the ecosystem and habitat for the animals that reside in the watershed but also help clean runoff before entering the bay. To help the community understand the benefits, local leaders and stakeholders can partner with TAMUK and Texas Sea Grant to provide some targeted educational workshops that could be held at Kaufer-Hubert Memorial park. Signage can be created tat outline the benefits and school field trips can help educate younger generations.

Figure 22 b. The following pictures were taken by Ashley Bennis, Texas Sea Grant during a trip she took to Riviera Beach to meet with homeowners and assess damage along the coast. August 2020.

2. Riparian Enhancement: Some feedback collected from County Commissioners identified this region as an area that needs more riparian enhancement along the river to reduce the nutrients and bacteria running off from surrounding lands. A Riparian Evaluation Report was completed on the Tributaries of Baffin Bay in August 2019 and

provided many fantastic aerial shots of the tributaries to determine which areas need enhancement. The map is showing Radicha Creek, a small tributary that winds through rural farmland before emptying into Baffin Bay. The riparian buffer within the green lines is not very robust with farmland encroaching closely, making it difficult for riparian vegetation to properly thrive. Along the banks one can see scouring and a lot of erosion resulting in dissolved solids filling up the creek. This location would benefit from riparian enhancement and education about providing enough of a buffer from farmland to stream.

3. Flood Control: The cities of Riviera and Ricardo have experienced more rain in a few months of 2021 than the region usually gets in a year. Due to the recent rains, many properties in this region experienced flooding, leading to a lot of runoff from the land, ending up in Baffin Bay. Drainage ditches (purple lines) that are filled with debris from grass clippings and litter has been cited by many residents as a continued issue in the region. Also, County Commissioner Rossi expressed that there are drainage creeks but the land is not properly laid out to allow for drainage. Targeted conversations with the local County Commissioner as well as with landowners about proper ditch maintenance and strategies to deter litter should be incorporated into future plans. If ditches are upgraded, a hybrid of hard and green infrastructure should be explored to not only address the flooding but also water quality. Working with the landowners to recognize drainage patterns and implement better drainage practices can alleviate flooding for the residents, while also providing water quality benefits for the bay.

Kenedy Ranch and Los Olmos Creek

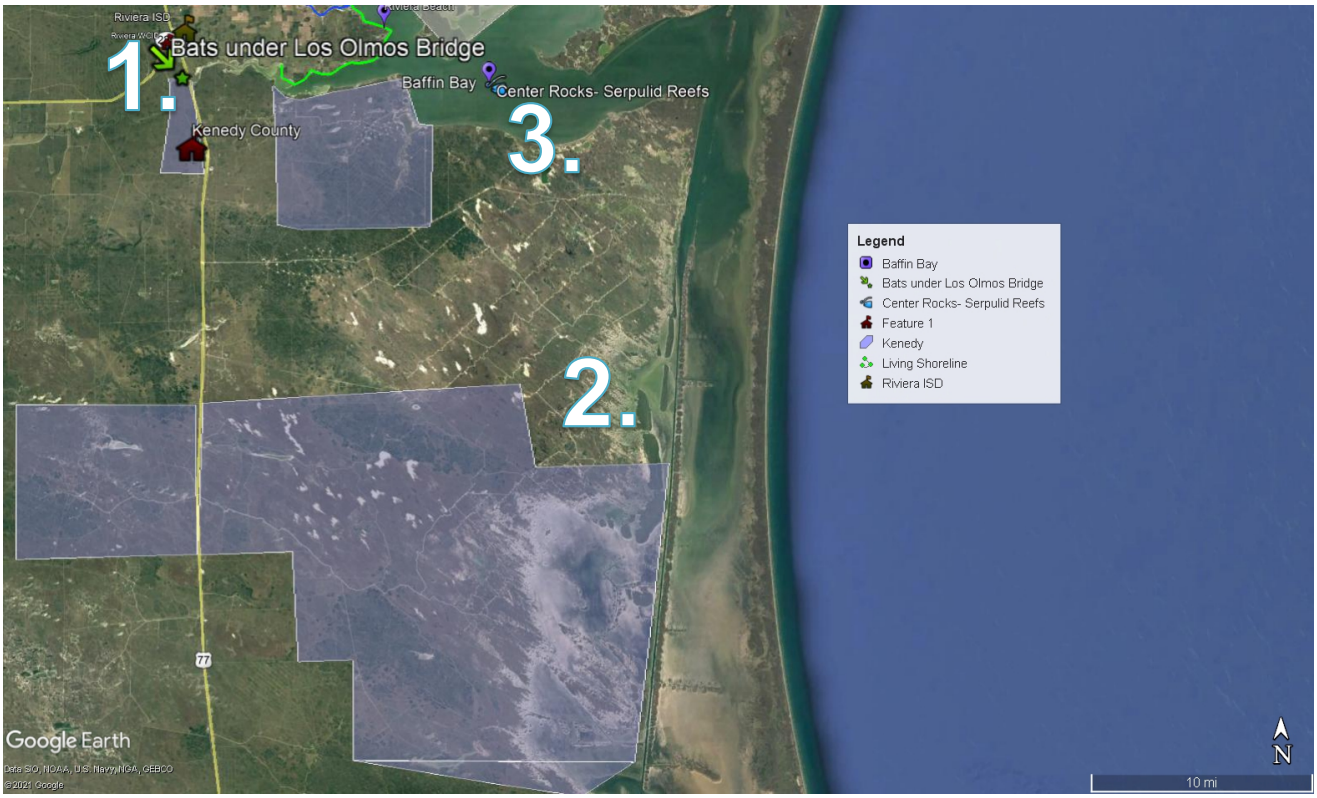


Figure 22 c.

The following map comprises Kenedy Ranch (2. light purple polygons), Serpulid Reefs (3.) and the location of a bat colony under a bridge over Los Olmos Creek (1.).

1. Bats Under Los Olmos Bridge: It was discovered that a large colony of Brazilian free-tailed bats has taken up residence under US 77 bridge that provides passage over Los Olmos Creek. The presence of such a large colony has introduced some bacteria problems as waste from the bats is entering the water. More monitoring and testing is needed in the Los Olmos creek to identify other possible contributions but there is certainty that this colony is increasing loadings to the bay. Bat droppings can be dangerous to humans as they carry a fungus that lives in the soil and causes the infection Histoplasmosis. Consulting professionals on the best course of action will be key.
2. This region of the watershed is dominated by Kenedy Foundation Ranch with a total of 235,000 acres owned by The John G. and Marie Stella Kenedy Memorial Foundation. These acres are maintained as natural assets to conserve and enhance wildlife habitat in South Texas. The four sections above encompass diverse landscapes rich in natural diversity of native prairie, brush country, coastal marshes, woodlands with shaded ponds and a coastline along the Laguna Madre with serene beaches (The John G. and Marie Stella Kenedy Memorial Foundation, 2021). The Laguna Madre also serves as a conduit of the ship traffic that makes up the Gulf Intracoastal Waterway of Texas. Wave action from ships can contribute to erosion on the shoreline and with the prevailing southeast wind of the area,

dunes can migrate and dramatically change. Providing support to the Kenedy Memorial Ranch to understand best practices including which type of vegetation is best to establish habitats on the dunes and if recycled trees can be used to enhance the dunes will help to ensure the natural landscapes continue to be assets in the future.

3. The serpulid reefs of Baffin Bay are a natural, unique structure that is only found in one other place in the world. Serpulid reefs are created by millions of tiny (<2cm) Serpulid worms that settle on hard substrates secrete a calcareous tube around themselves as they grow (Bastide-Zalvala 2017; Pollack, Palmer, & Breaux, 2019). The reefs provide diverse fauna and flora, forming a unique ecosystem that provides food for the fish that reside in Baffin Bay and is a favorite visiting spot for fishermen (Pollack, Palmer, & Breaux, 2019). The reefs have been known to sustain damage from boats and overfishing, likely due to a lack of awareness about their purpose. More education on the shore through signage, and workshops with fishing guides can help to mitigate damages to the reefs. More research is being done by researchers at the Harte Research Institute in Corpus Christi to understand the role of the reefs in the bay and how we can better protect them.

Kingsville & Naval Air Station

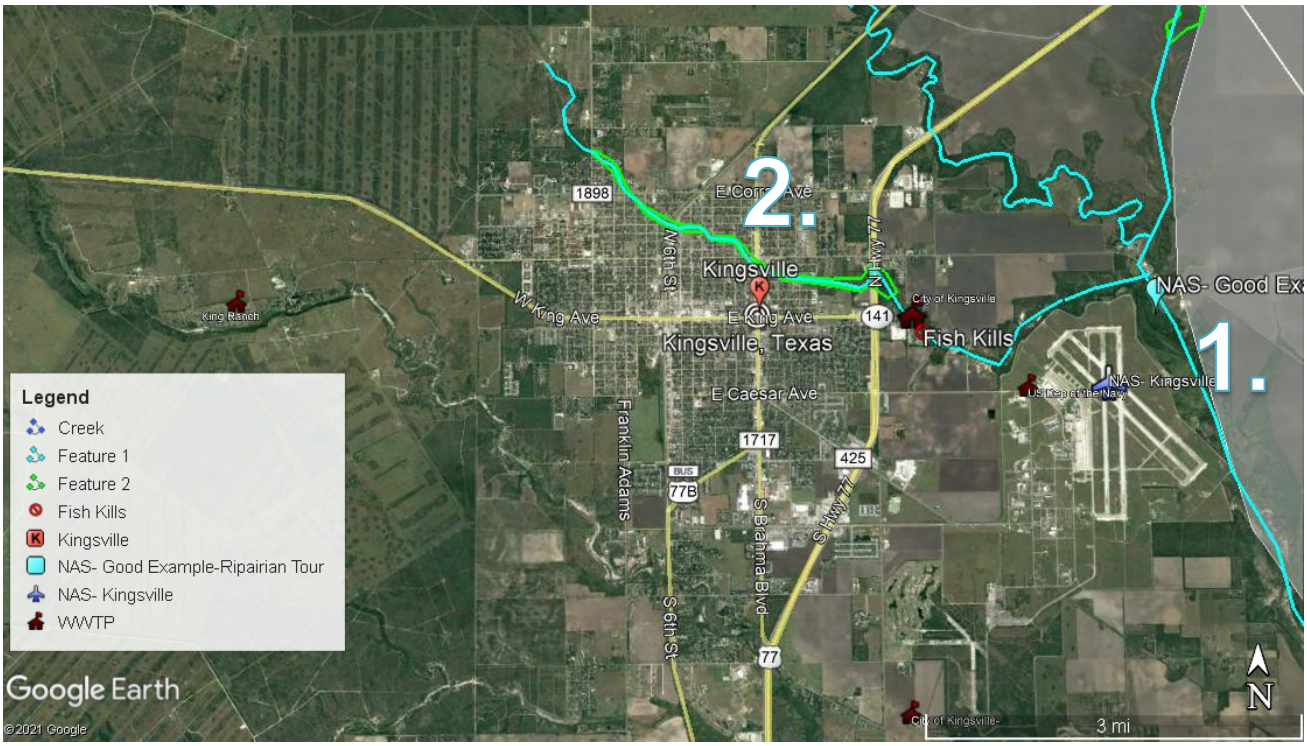


Figure 22 d.

The city of Kingsville is the largest city in the watershed with a population of around 25,000 and covers 13 square miles of land in the watershed. The Naval Air Station resides within Kingsville and occupies land East of the city. The city also experienced significant flooding in 2021 with an emergency declaration in May due to the level of damage the rains wrought.

1. The blue lines on the map designate Petronila Creek, the natural feature that separates NAS and King Ranch (white polygon). Many private landowners reside around the NAS but these two features have a lot of influence on Petronila Creek. Both King Ranch and the NAS are great examples of providing enough of a buffer between a tributary and the surrounding land uses. According to a report on the state of riparian vegetation in the watershed, “The creek’s riparian area is well buffered with wide flanks of well- vegetated highly functional riparian areas throughout the reach. Overall, the lower reach of San Fernando Creek is a benchmark for high function” (Lewey, 2019).
2. At the point where the tributary splits off just north of NAS, the riparian buffer shrinks as the water makes its way through the middle of Kingsville. A wastewater treatment plant resides along the tributary on the east side of Highway 77 which was identified as a location of multiple fish kills by resource managers that completed our survey. This waterway is known as Tranquitas Creek through Kingsville and once the tributary loops under Highway 77, the stream flows through a concrete drainage feature that channels the water and increases velocity. Overall the creek has a highly functional riparian buffer, except for this portion through Kingsville. The city has recently been applying for grants to help with drainage and mitigating floods. This 2.3-mile section of the creek would be a prime location for implementing setbacks, widening the channel and introducing vegetation that could absorb more water and dissipate wave energy. The channel is currently constructed in a way that acts as a floodplain but does not regard erosion/deposition balance.

Figure 22 e. Source: Riparian Evaluation Report: Tributaries of Baffin Bay. August 2019. Sky Jones Lewey.

San Fernando Creek and Celanese Complex

Figure 22 f.

Just north of the city of Kingsville along Highway 77, lies the city of Bishop, a town of around 3,100. This portion of the map depicts where Carreta Creek meets up with San Fernando before continuing to Baffin Bay. This region is home to some decent size industries, including Celanese and Ticona Polymers, Inc., located just off BUS 77. The community has its own treatment plants for water, a school district and is surrounded by farmland.

1. Ticona Polymer Inc., BASF & Celanese Corporation, Bishop Facility: This location houses three different companies. Celanese Corporation is one of the leading chemical producers, recently adding production of ultra-high molecular weight polyethylene to their line-up. Ticona Polymers is part of the resin, synthetic rubber and artificial, synthetic fibers and filaments manufacturing industry. BASF is a pharmaceutical company that produces products such as Ibuprofen and Albuterol & Atenolol to name a few. Combined, these industries create products for commercial industry and consumer applications. The purple line in the map just south of Celanese denotes a drainage channel from the facilities directly into San Fernando Creek. This drainage way is mowed and unable to grow a variety of plants to help absorb and clean any runoff from the surrounding properties and roads before entering the creek. Working with the company to come up with workable solutions such as enhancing vegetation or creating wetlands could help reduce runoff to the creek.
2. Chemcel Park and Golf Course: Within the red boundary is a park provided to the employees of Celanese, Ticona and BASF. The creek runs through the park and has been altered by human practices such as clear cutting and mowing too closely to the creek. Working with the landowners to set a buffer around the creek and prevent mowing of vegetation so it can get established would go a long way to cleaning any runoff. This could also qualify as

beautification and provide a pleasing aesthetic for park goers and golfers. The lower reach of the creek downstream from the park has a decent riparian buffer that maintains all the way down to Kingsville and NAS.

The City of Bishop

Figure 22 g.

1. Carreta Creek: Near the creek's crossing with U.S. Hwy 77, discharge from Bishop's wastewater treatment plant enters the creek and water clarity and color noticeably change (Lewey, 2019). The riparian buffer for this 7.7 miles is high functioning but due to this discharge, an algal bloom has been observed previously in this area with observation of fish downstream hitting the surface. This could indicate that the fish are stressed for oxygen and trying to alleviate their distress. Since the riparian buffer is seemingly high functioning, there could be issues with outdated equipment at the plant causing these algal bloom issues. Reaching out and working with the plant owners directly to assess and identify if a problem exists is the best way to try and address the water quality issues on this stretch of creek. Updating the plant or installing wetlands along the creek to clean the water are possible solutions. This image was taken during a flyover to assess the riparian function. A noticeable color change and seeming algal bloom was observed downstream from the

outfall.

Figure 22 h. Source: Riparian Evaluation Report: Tributaries of Baffin Bay. August 2019. Sky Jones Lewey.

2. Bishop Tributary A2: As in Kingsville, the creek's path through the town has been visibly altered and seems to be a popular location for dumping. This confluence meets with San Fernando Creek just south of the city. For the most part this part of the stream also has a wide functioning riparian buffer along the creek, but moving upstream it quickly becomes fully dysfunctional with mostly non-riparian vegetation that is being mowed, farming too close, and alteration of the floodplain (Lewey, 2019). Along this stretch there is higher than average trash/debris littering the shorelines and obvious natural drainage channels created as a result of runoff from surrounding farms. The red outline on the map is where the creek becomes a wide, grassy drainage way with not a lot of diversity in vegetation and patterns of frequent mowing. Urban runoff can enter along this stretch and would not encounter any vegetative buffer to clean the water. Outreach to local city staff that maintain these drain ways and local landowners in the form of education and addressing the dumping issues. Setbacks from mowing too close to the water should be encouraged, along with signage in well-known dumping spots and holding workshops on best practices from fertilizer and pesticide use are some opportunities to enhance water quality upstream.

Figure 22 h. Source: Riparian Evaluation Report: Tributaries of Baffin Bay. August 2019. Sky Jones Lewey.

3. Bishop City Park: Open and recreational space provided by the city for citizens to use for sports, bird watching and other recreational activities. A 0.6 mile hiking trail surrounds a 9.1. acre lake that is frequently visited by waterfowl and other types of migrating birds. This is also a site that has been mentioned as a dumping ground for tires and other types of debris in a questionnaire received by a stakeholder, and is downstream from the WWTP outfall. Any upstream maintenance on the WWTP will benefit the lake and park overall. Signage and education about keeping the park clean, as well as organizing park clean up may help to maintain this public space for all visitors and keep species of birds coming back to nest.

Driscoll and Chapman Ranch

Figure 22 i.

Driscoll is a small rural community in Nueces county with a population of under 800 with a portion of the Petronila Creek flowing just north of the city. The city has its own police department, school district and wastewater treatment system. The small community is surrounded by farmland. Directly downstream along the Petronila Creek resides more farmland and a collection of properties designated as Chapman Ranch.

1. There are 5 WWTPs and 1 waste management facility that provides treatment, disposal and recycling options for commercial entities. Four outfalls take runoff and waste from the site, in-between farmlands before releasing into Petronila Creek (pink line). This drain way is a narrowly constructed path with very little vegetation and patterns of mowing right up to the shoreline. Working with the waste management facility and landowners in this area, riparian enhancement practices could enhance water quality before entering the bay system. As the drainage path meets up with Petronila Creek, a constructed wetland could be placed to further clean the water before it enters the stream and subsequently the bay.
2. This green line around two sections of the creek represents a manmade drain way that winds through farmland and wind farms before draining into Petronila Creek just downstream from Bishop. The drainage ditch itself has little to no vegetation along it's tract with visible signs of landowners mowing and planting very close to the water edge. Working with landowners to ensure proper setbacks and maintaining a strong vegetative buffer would help clean the water before entering the stream. Texas Sea Grant and

other groups could work with Agrilife Extension Staff and local community champions to target education through workshops and materials in these areas.

3. 420 Tract of Land for Constructed Wetlands on Chapman Ranch: The lower reach of Petronila creek winds through grazing and farm lands and has a relatively high function riparian buffer. A land owner with a tract of land in Chapman Ranch, backing up to Petronila creek would like to help maintain water quality of the tributary. They are working with a private firm from Austin to consider constructing a series of wetlands that would take the water out of the stream, cycle it through the wetlands to be cleaned, and release it back cleaner than it went in. This type of strategy can be tricky and very personal for landowners as a project like this would take some grazing and/or farming land out of production. Working with land owners, farmers and ranchers to identify site specific practices and ensuring they have access to resources is very important as much of the land adjacent to the tributaries are private property. This project is currently underway and may reveal some interesting results once it is completed and the water has been tested multiple times.

Banquete Creek and Agua Dulce

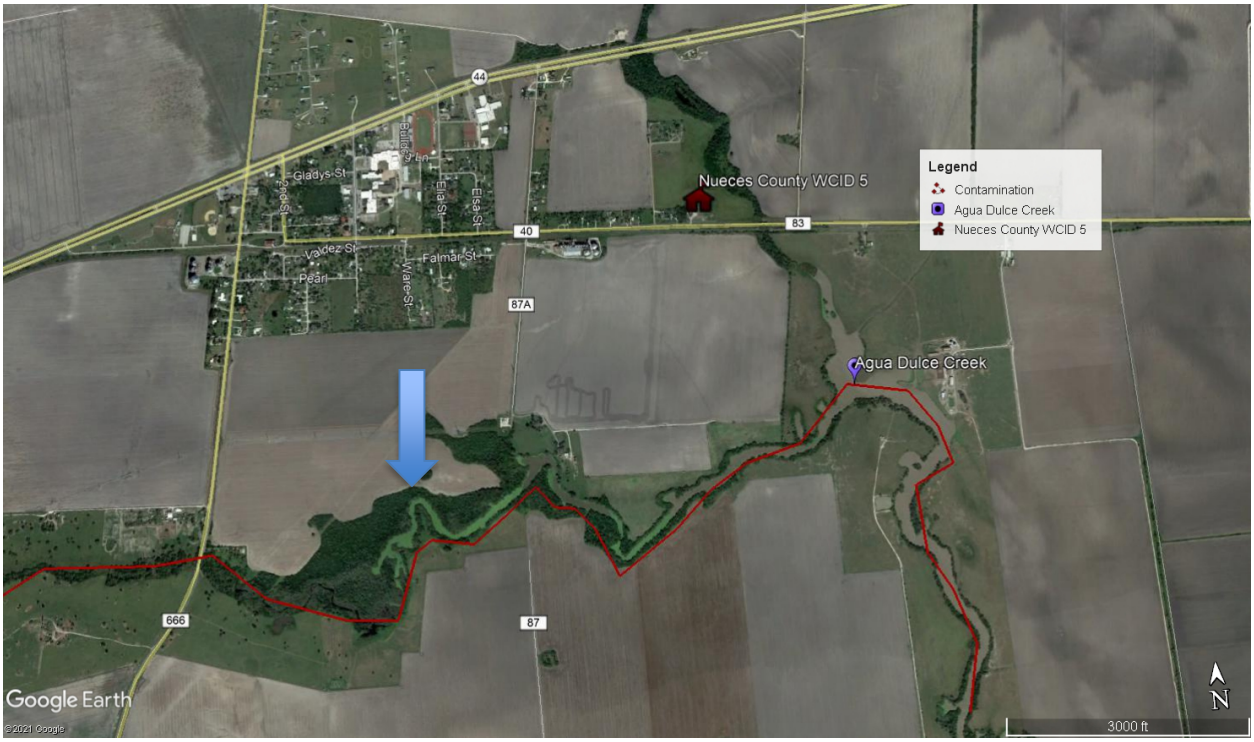


Figure 22 j.

This map depicts the confluence of Banquete Creek and Agua Dulce Creek (purple icon) where an unusual phenomenon with water color is being observed. Right below the white number 1 you can see the water color has completely changed to green, likely due to Duckweed. Duckweed is a type of plant that grows in low energy water that is not affected by wave action, most often seen in backyard ponds. Duckweed itself is not toxic and can have many benefits including providing food for fish and waterfowl and provides habitat but it can grow quickly and its presence can block sunlight and deplete oxygen which can lead to fish kills and decreasing the variety of plants that live in the water (Texas A&M AgriLife Extension, 2020). Duckweed also

thrives in nutrient rich environments and could be indicative of nutrients present in the system. The duckweed can be managed by using raking or seining the surface, using natural control methods or chemicals. A minor amount of duckweed on the surface is manageable, but problems can start to present if the duckweed covers a large surface area and prevents plants from getting sunlight.

King Ranch

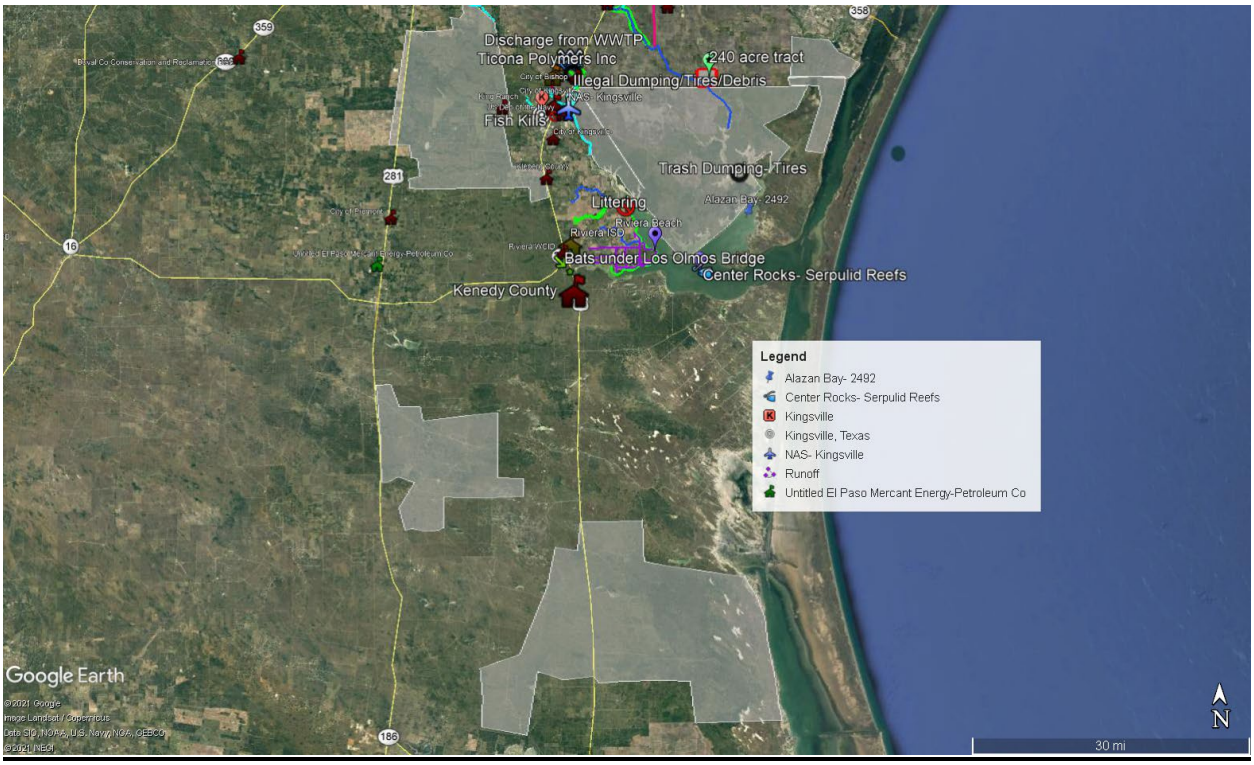


Figure 22 k.

The infamous King Ranch (areas shaded in white on the map) was founded in 1853 as a creek-fed oasis in southern Texas to raise cattle. The current operations cover over 825,000 acres. The ranch is known for its innovation and development of unique breeds of cattle including Santa Gertrudis and Santa Cruz as well as breeding of the finest quarter hour and champion Thoroughbreds. Currently, King Ranch is involved in agribusiness providing cattle, farm products (citrus, grain, sugar cane, and turfgrass) luxury retail goods and recreational hunting.[8] The ranch has a long standing commitment to protect and conserve the natural beauty of the land, undertaking some of the first models for land management and conservation in the country, to preserve the pasture grassland as well as brush land for their ecosystem benefits. The ranch tries to maintain 65% of the pasture to be open grassland and 35% to remain in brush, meeting wildlife needs for concealment, browse and edge while also improving forage production for cattle.[9] The project team reached out to King Ranch and was able to sign up one of their operations managers to be on the Task Force. Continuing to foster and build on this relationship will be crucial to monitoring and enhancing water quality in the watershed as King

[8] King Ranch Legacy. https://king-ranch.com/
[9] Brush Management on King Ranch. https://king-ranch.com/stewardship-education/brush-management/

Ranch holds a significant portion of the land. If possible, working with King Ranch management on sharing conservation practices with the surrounding farming community could have a positive influence on how locals manage their farm and ranch lands.

Works Cited

Boesch, D. (2002). Challenges and opportunities for science in reducing nutrient overenrichment of coastal ecosystems. *Estuaries*, *25*, 886-900.

Diaz, R., & Rosenberg, R. (1995). Marine benthic hypoxia: A review of its ecological effects and the behavioural responses of benthic macrofauna. *Oceanography and MArine Biology- an Annual Revoew*, *33*, 245-303.

Flores, J., Wagner, K., Gregory, L., Benavides, J., & Cawthon, T. (2017, August). *Arroyo Colorado Watershed Protection Plan*. Texas Water Resources Institute Technical Report.

King ranch. “The King Ranch Legacy.” https://king-ranch.com/. Accessed 2021.

United States Environmental Protection Agency. “Indicators: Chlorophyll a.” *National Aquatic Resource Surveys*, https://www.epa.gov/national-aquatic-resource-surveys/indicators-chlorophyll. Accessed July 2021.

Lewey, S.J. (2019, August). Riparian Evaluation Report: Tributaries of Baffin Bay. Nueces River Authority. CBBEP 1907.

Nixon, S. (1995). Coastal marine eutrophication – a definition, social causes, and future concerns. *Ophelia*, *41*, 199-219.

Paerl, H. W., Hall, N. S., Peierls, B. L., & Rossignol, K. L. (2014). Evolving paradigms and challenges in estuarine and coastal eutrophication dynamics in a culturally and climatically stressed world. *Estury Coasts*, (37), 243-258. 10.1007/s12237-014-9773-x

Rabalais, N., Turner, R., Diaz, R., & Justice, D. (2009). Global change and eutrophication of coastal waters. *ICES Journal of Marine Science*, *66*, 1528-1537.

Rabouille, C., Conley, D. J., Dai, M. H., Cai, W. J., Chen, C.T. A., & Lansard, B. (2008, July). Comparison of hypoxia among four river-dominated ocean margins: the Changjiang (Yangtze), Mississippi, Pearl, and Rhone Rivers. *Continental Shelf Research*, *28*(12), 1527-1537. 10.1016/j.csr.2008.01.020

Sugarek, S. (2021, January). Nutrient Sampling in Petronila Creek. *Coastal Bend Bays and Estuaries Program*. CBBEP-143. https://www.cbbep.org/manager/wp-content/uploads/2003-Final-Report-FINAL.pdf

US Environmental Protection Agency. (n.d.). *Basic Information about Nonpoint Source (NPS) Pollution*. Polluted Runoff: Nonpoint Source (NPS) Pollution. Retrieved June, 2021, from https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution

Wetz, M. (2014). Baffin Bay Volunteer Water Quality Monitoring Study: Synthesis of May 2013-July 2014 Data. *Coastal Bend Bays and Estuaries Program*, *95*(1413), 27. https://www.cbbep.org/manager/wp-content/uploads/Baffin-Bay-Volunteer-Water-Quality-Monitoring-Study-Synthesis-of-May-2013-July-2014-Data.pdf

Chapter 7: Education and Outreach

The Early Phase Watershed Planning for Baffin Bay project could not have been possible without the plethora of work previously and currently undertaken throughout the Baffin Bay region by a variety of individuals. Texas Sea Grant's introduction to Baffin Bay was through the Baffin Bay Working Group. This group slowly accumulated more and more voices since its creation in 2012 and laid a foundation for the early phase planning project. Texas Sea Grant was able to capitalize on the progress and with input from the working group identify where gaps existed and try to fill them. Inviting representatives from private industry and seeking out individuals in other jurisdictions yet to be represented in the stakeholder group are examples of areas that needed to be addressed.

Initially, Texas Sea Grant sought out other examples of local organizations or agencies in the watershed that were already working with the community in regards to outreach and education. A few sources were identified and joined the Task Force team to support efforts. The Kleberg-Kenedy Agrilife Extension Office has been a resource for both counties and has consistently been a fixture in the community for decades and a crucial partner in outreach efforts for the watershed. They focus on research based educational programming in the areas of agriculture, health, environmental stewardship, 4-H, youth and adult life skills, human capital and leadership, and community/ economic development. Agents of Agrilife are dually appointed with the county and the University and are stewards of their regions. Kleberg-Kenedy County AgriLife office runs the local 4-H club and puts on a number of events such as soil testing demos, a local crop tour and holds a Junior Livestock show every year. Their continued dedication to the communities in the Baffin Bay watershed will be monumental when it comes time to adopt and implement suggestions from the WPP.

As the Early Phase Watershed Planning evolves into the full Watershed Protection Plan project led by Texas Water Resources Institute, an education and outreach (E&O) campaign is going to be vital in order to implement the recommendations that will be outlined in the WPP. The E&O component will focus on keeping stakeholders informed of potential projects as well as ongoing project activities, provide information about appropriate management practices, highlight funding resources that come down the pipeline and assist in identifying and forming partnerships to lead project efforts.

Engaging with Local Stakeholders

Within the time frame of the project, the project team was able to build and foster relationships with community champions in hopes of instilling a system of active community members that will be a part of the implementation phase of the WPP. Community Champions are individuals in the community that take action and lead initiatives for social, psychological, economic and environmental change within their communities. For planning related projects, it is important to identify the community champions, or the individuals that will take up the mantle and help the

community through to implementation. The project team was able to interact with a few community champions that will be present to help bring to fruition concepts of the plan.

One such example is a landowner and rancher in Orange Grove that is a certified instructor for an organization known as Holistic Management International (HMI). Tracy Litle focuses on Regenerative Agriculture, Best Land Management Practices and Adaptive Grazing Management. Mrs. Litle is active with landowners in the area and interested in organizing reoccurring workshops for ranchers and farmers in the coastal bend either through her organization HMI or in collaboration with Texas Sea Grant.

A landowner with property in the Chapman Ranch region that straddles the county line between Nueces and Kleberg is exploring the benefits of changing land use of a tract of land for the benefit of improving water quality in Baffin Bay (Osting et al. 2019). Ms. Orr's property is ideally suited for beneficial impacts given its location off Petronila Creek at a segment that struggles with water quality issues. Currently the property is in agricultural production and the land owner has previously employed strategies to minimize runoff and erosion (Osting et al. 2019). The potential for off channel wetlands that would filter water flowing from upstream which includes a waste treatment site and agricultural runoff from Nueces farms has been discussed. The goal of the landowner is to create a Master Plan outlining a path forward including budgeting, steps, endpoint vision etc. Orr property is a gift to Baffin Bay and stakeholders, as it sets an example. Concern about landfill drainage ditch, could be improved upon with Orr property work. Any nutrient reductions near the tract of land has the possibility of contributing to lower algae levels in Petronila Creek and Baffin Bay, where current monitoring data for both water bodies shows algae production to be exceptionally high (Osting et al. 2019). According to a report completed by AquaStratgies, a firm that was hired to assist the landowner with planning for constructed wetlands, any improvements on the tract can have an effect on nutrient reduction through employing the following strategies:

1. Increased use of low-till agriculture methods and addition of filter strips;
2. Conversion of the site to native prairie;
3. Conversion of the site to no-till agricultural production;
4. Construction of a wetland complex, augmenting on-site hydrology using water from Petronila Creek.

Public Participation

To enhance crucial local buy-in and engagement a Task Force composed of local stakeholders was formed to assist Texas Sea Grant with further characterizing the concerns and needs within the watershed through assessing the information compiled from public engagement and using it to set goals for the plan which will lead to developing project ideas that address the identified watershed needs/issues. The goal was to engage as many different stakeholders representing a variety of sectors as possible because it will take a combined, coordinated effort to implement strategies across the watershed to enhance water quality.

The search for a task force began at the project kickoff meeting that took place in Fall 2019. Attendees from across the watershed attended and provided useful information to the project team about observations. At this meeting the role and responsibilities of the Task Force were first introduced and a sign-up sheet was provided for interested individuals. This opportunity garnered some interest but many sectors were yet to be represented. The project team followed up by reaching out to individuals via phone, email and in-person meetings to fill the gaps. Texas Sea Grant was able to gather a robust, diverse group of stakeholders representing different sectors in the watershed: City staff for City of Bishop, Celanese Corporation, King Ranch, Kenedy-Kleberg Agrilife Extension Services, Local Landowners and Rancher, Texas Parks and Wildlife Department, Texas Water Resources Institute, Texas State Soil and Water Conservation Board, Harte Research Institute, Coastal Conservation Association, Kleberg-Kenedy Soil Water Conservation District, Texas A&M University-Kingsville staff, Natural Resources Conservation Service, City of Kingsville staff and Jim Wells Soil and Water Conservation District.
The Task Force members were asked to attend at least 4 meetings, provide input on workshops and deliverables and help with outreach. To ensure that the project team captured local perspectives and activities, the Task Force Members participated in spatial identification activities and provided a lot of useful relevant information on problem areas and ongoing projects.

The members of our Task Force continue to be resources beyond this Early Phase project. Some of them have joined the Baffin Bay Stakeholder Group to continue watershed protection planning.

[anything more about what is going on?]

Moving forward, through local agency program planning and collaborations, the following statewide watershed programs are proven effective to educate and build community buy-in for watershed health.

AgriLife Extension Service

- Riparian and Stream Ecosystem Workshop
- Texas Well Owners Network
- OSSF Operation and Maintenance Workshop
- Feral Hog Programs
- Wildlife Management Workshops
- Lone Star Healthy Streams
- Livestock Shows
- Annual Crops Tour
- Crop Symposium, (The crops symposium has been in conjunction with Jim Wells county and hosted by Kleberg-Kenedy SWCD Chairman John Prukop at Prukop Farms west of Kingsville)
- Texas Community Futures Forum
- Earth Day Activities

- School Programs (Path to Plate)
- Soil Health Workshops and Coastal Bend Soil Sampling Campaign

Kleberg-Kenedy Soil Water Conservation District #356

The Kleberg-Kenedy Soil and Water Conservation District (SWCD) #356 promotes protection, conservation & sustainable uses of natural resources through education, awareness, leadership, technical, and financial assistance in cooperation with the public as well local, state, & federal agencies. This organization is very active in the community and promotes conservation through school contests, holding annual awards to recognize local conservationists and hosting and promoting educational workshops and webinars. The Kleberg-Kenedy SWCD supported Early Phase Planning Project Efforts by providing a platform for the project team to present, participate on the Task Force and support one of the workshops with funding for food.

In 2021, the board members worked with the Judges of Kleberg and Kenedy County to establish April 25 to May 2, 2021 as Soil and Water Stewardship Week to bring awareness to the need for fertile soil and clean water and encourage locals to get involved in conservation activities. The partners of this campaign included: Texas State Soil and Water Conservation Board, Association of Texas Soil and Water Conservation Districts, Texas A&M Forest Service, Texas Wildlife Association and Texas and Southwestern Cattle Raisers Association.

Recent History of Research & Engagement in Baffin Bay Watershed

Local residents in the watershed were leaders in bringing awareness to the issues they were experiencing in the region. In 2012, both recreational and commercial fishermen were catching Black Drum that exhibited abnormal physical characteristics including below average weights, transparent tissue morphology, and empty guts (Stuntz et al. 2015). This led to meetings and the creation of the Baffin Bay stakeholder group as explained in Chapter 3.

Image X: Baffin Bay volunteers trained as citizen scientists to help collect water quality data. The Baffin Bay Stakeholder group formalized in 2017 and held its first public meeting at Kaufer-Hubert park In Aug 2017. Subsequent meetings include March 28th 2018; June 14th 2018; December 3rd 2018 and March 2020.

The tireless work and effort of researchers at TAMU-CC, Harte Research Institute and TAMU-Kingsville have helped to bring awareness to the issues of the watershed and engaged with local stakeholders to get involved. Some previous research efforts are provided below.

Past Research and Educational Updates (by regional researchers and local agencies):

Jones, Kim. et al. “Multi-level assessment of ecological coastal restoration in South Texas.” Ecological Engineering, Kingsville, TX. 11, November, 2009.

Murgulet, D., Lopez, C. “Submarine Groundwater Discharge and Nutrient Input to a Semiarid and Hypersaline Estuary: Baffin Bay, Texas.” (2019).

Wetz, M. S., "Water quality sampling in Baffin Bay – what has been learned?" Texas Ag Industries Group Annual Meeting, Kingsville, TX. (October 2015).

Wetz, M. S., "Two years of water quality sampling in Baffin Bay… what have we learned?" Baffin Bay Science Symposium, Celanese Corp., Bishop, TX. (June 2015).

Wetz, M. S., "Key findings from the first 4 months of the Baffin Bay volunteer water quality monitoring program," Coastal Issues Forum, Corpus Christi, TX. (November 2013).

Wetz, Michael S (Principal), "Baffin Bay volunteer water quality monitoring program," Sponsored by Various (Coastal Bend Bays & Estuaries Program, Coastal Conservation Association, Saltwater Fisheries Enhancement Association,

Works Cited

Osting, Tim, et al. *Draft Petronila Property Hydrology and Wetland Benefits Study*. v2b, no. CBBEP 1930, AquaStrategies, 2 April 2019.

Stuntz, Greg, et al. *Ecosystem-Based Approach to Assess Black Drum in Baffin Bay*. no. CBBEP 98, Coastal Bend Bays & Estuaries Program, January 2015.

Chapter 8: Measures of Success

When watershed planning efforts beyond early phase planning have established pollutant loadings this chapter details the following aspects of measuring success of project implementation.

Adaptive management

A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards is key. These criteria can be expressed as indicators and associated interim target values. You can use various indicators to help measure progress. You'll want to select indicators that will provide quantitative measurements of progress toward meeting the goals and can be easily communicated to various audiences. It's important to remember that these indicators and associated interim targets will serve as a trigger, in that if the criteria indicate that you are not making substantial progress, you should consider changing your implementation approach. (USEPA 12-8)

Indicators

might reflect a water quality condition that can be measured (dissolved oxygen, nitrogen, total suspended solids) or an action-related achievement that can be measured (pounds of trash removed, number of volunteers, length of stream corridor revegetated). The criteria are interim targets in the watershed plan, such as completing certain subtasks that would result in overall pollutant reduction targets. The indicators and interim target values you select should reflect the performance of the management measures being implemented, the concerns identified early in the process by stakeholders, and the refined goals (USEPA 12-9)

Healthy Riparian Indicators example

1. Wetland: There are a number of plant species that live in a wetland each with its own function and preferred set of conditions. Wetland plants can even indicate to a researcher of the condition of the ecosystem merely by its presence or absence. For example, Obligate wetland plants (OBL) are those that require wet conditions and facultative wetland plants (FACW) are found in areas that are usually wet (Lewey, 2019). Facultative (FAC) plants can be found equally in wet and dry conditions and facultative upland (FACU) are usually found in drier upland areas. An abundance of OBL and FACW plants indicates that the riparian

area is storing water and maintaining a water table connection for much of the year which is sometimes referred to as the “riparian sponge” (Lewey, 2019).

2. Examples of a healthy riparian area can be found along the section of San Fernando creek that separates King Ranch and the NAS. This section of creek has been provided with enough of a buffer between a tributary and the surrounding land uses to thrive. According to a report completed by the Nueces River Authority on the state of riparian vegetation in the watershed, “The creek’s riparian area is well buffered with wide flanks of well- vegetated highly functional riparian areas throughout the reach. Overall, the lower reach of San Fernando Creek is a benchmark for high function” (Lewey, 2019). If possible, this would be a prime location to conduct healthy riparian tours and talk about water quality in this region.

Implementation Documentation

A full WPP element g will develop interim, measurable milestones to measure progress in implementing the management measures for your watershed plan. These milestones will measure the implementation of the management measures, such as whether they are being implemented on schedule, whereas element h will measure the effectiveness of the management measures, for example, by documenting improvements in water quality. h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards. As projects are implemented in the watershed, you will need water quality benchmarks to track progress. The criteria in element h (not to be confused with water quality criteria in state regulations) are the benchmarks or waypoints to measure against through monitoring. These interim targets can be direct measurements (e.g., fecal coliform concentrations) or indirect indicators of load reduction (e.g., number of beach closings). You should also indicate how you’ll determine whether the watershed plan needs to be revised if interim targets are not met. These revisions could involve changing management practices, updating the loading analyses, and reassessing the time it takes for pollution concentrations to respond to treatment. The watershed plan should include a monitoring component to determine whether progress is being made toward attaining or maintaining the applicable water quality standards. (USEPA. 2-17)

Monitoring and Water Quality Criteria

The monitoring program should be fully integrated with the established schedule and interim milestone criteria identified above. The monitoring component should be designed to determine whether loading reductions are being achieved over time and

substantial progress in meeting water quality standards is being made. Watershed-scale monitoring can be used to measure the effects of multiple programs, projects, and trends over time. (USEPA 2-17)

Works Cited

Lewey, S.J. (2019, August). *Riparian Evaluation Report: Tributaries of Baffin Bay*. Nueces River Authority. CBBEP 1907.

USEPA *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. vol. EPA 841-B-08-002, 2008)

Chapter 9: Sources of Funding

Chapter 6 provided some management strategies and associated funding resources that could support. This chapter provides a more comprehensive list of funding sources organized along the focus areas established during the Early Phase Planning process. The funding sources below are major sources of grant money, offered by state and federal agencies to specifically address ecosystem and conservation needs.

Texas General Land Office Coastal Management Program- The purpose of this funding source is to improve the management of the state's coastal resources and ensure long-term ecological and economic productivity of the coast. Many of the suggested management strategies in Chapter 6 could be funded through this initiative. Projects are considered under the following funding categories:

- Public Access Enhancement
- Data Collection
- Coastal Hazard and Resiliency Planning
- Coastal Resource Protection and Enhancements[1]

U.S. Environmental Protection Agency Nonpoint Source Management Program 319- States, territories and tribes receive grant money that supports activities related to water quality and nonpoint source. Specific activities supported under this funding are technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring to assess the success of implemented projects to address water quality.[2]

Agriculture and Ranching

1. NRCS
    a. Natural resource conservation programs offer agricultural producers and non-industrial private forest landowners both financial and technical assistance to conserve natural resources on privately-owned farm and ranch lands on a voluntary basis. More information can be found at:https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/ These programs include:
        i. CRP- Conservation Reserve Program

[1] Texas General Land Office. Texas Coastal Management Program GRant Application Guidance Grant Cycle 27. https://www.glo.texas.gov/coast/grant-projects/funding/files/cycle-27/cycle27---guidance_final_print.pdf

[2] U.S. Environmental Protection Agency. 319 Grant Program for States and Territories. **https://www.epa.gov/nps/319-grant-program-states-and-territories**

ii. CIG- Conservation Innovation grant
iii. EQIP- Environmental Quality Incentive Program
iv. CSP- Conservation Stewardship Program
v. CTA- Conservation Technical Assistance
vi. Senate Bill 503- State Water Quality Management Program
vii. Agricultural Water Enhancement Program
viii. Agricultural Conservation Easement Program (ACEP)
ix. Wetland Reserve Enhancement program (WREP) is a component of the ACEP through which NRCS enters into agreements with eligible partners to target and leverage resources to address high priority wetland protection, restoration, and enhancement activities and improve wildlife habitat on eligible lands.
x. Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand our collective ability to address on-farm, watershed, and regional natural resource concerns.[3]

2. NFWF National Coastal Resiliency Fund- invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities. More information: https://www.nfwf.org/programs/national-coastal-resilience-fund
3. EPA Healthy and Resilient Gulf of Mexico 2021-solicits applications from entities for projects to improve water quality, restore habitat, enhance community resilience, and increase environmental education in the Gulf of Mexico.
    a. E.1 Improving Community Health through Microbial Source Tracking (EPA-GM-2021-MiST)
    b. E.2 Trash Free Water – Preventing More, Picking Up Less (EPA-GM-2021-TFW)
    c. E.3 Building Community Resilience Through the Reduction and Prevention of Nonpoint Source Pollution (EPA-GM-2021-NPS)
    d. E.4 STEM Career Development for High School Aged Youth (on (EPA-GM-2021-HSCD)

4. Oaks & Prairies Joint Venture (OPJV)- Grassland Restoration Incentive Program (GRIP)
https://www.arcgis.com/apps/MapJournal/index.html?appid=e9a81828adb7405b842e28aa83943638
5. TPWD
    a. Landowner Incentive Program: This program is administered through TPWD and focuses on working with private landowners to implement conservation practices

[3] USDA-NRCS. Regional Conservation Partnership Program. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/

that benefit healthy aquatic and terrestrial ecosystems and create, restore, protect or enhance habitat for rare or at-risk species. https://tpwd.texas.gov/landwater/land/private/lip/#Statewide_LIP_Funding_Series

b. Lonestar Land Stewardship Program- The awards program is designed to educate landowners and the public and to encourage participation in habitat conservation https://tpwd.texas.gov/landwater/land/private/lone_star_land_steward/

6. USDA
    a. Texas Partners for Conservation for Texas partners to receive funding through agreements as part of the Texas Partners for Conservation Program. The program is designed to leverage NRCS resources, address local natural resource issues, encourage collaboration, and develop state and community level conservation leadership. Its purpose is to accelerate the development of conservation plans that will address environmental quality issues on agricultural lands within Texas and outreach to Historically Underserved producers and clients.
    b. USDA Conservation Reserve Program federal program allows producers to put cropland back into grassland and get financial compensation for it. Other governmental programs such as brush or cedar control or crop subsidies are normal and prudent ranch maintenance and those programs alone with no other agricultural use are not considered a qualifying use. For further information on Governmental Programs contact the Farm Service Agency (FSA) of Kleberg County.
    c. The Cooperative Conservation Partnership Initiative is a voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds of special significance and other geographic areas of environmental sensitivity.
        i. Under CCPI, the Natural Resources Conservation Service (NRCS) enters into partnership agreements with eligible entities that want to enhance conservation outcomes on agricultural and nonindustrial private forest lands.
    d. Pandemic Assistance Programs will establish new programs and efforts to bring financial assistance to a broad set of farmers, ranchers, and producers who felt the impact of COVID-19 market disruptions. https://www.farmers.gov/
    e. USDA Conservation Innovation Grants National Competition (CIG) projects inspire creative problem-solving that boosts production on farms, ranches, and private forests - ultimately they improve water quality, soil health, and wildlife habitat. Projects may be watershed-based, regional, multi-state or nationwide in scope.**https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial**
        i. Funding: The maximum CIG award is set annually by the NRCS Chief and historically has been a total of either $1 million or $2 million (up to 3 years). An applicant's CIG funding request must be matched at least 1:1

with non-federal funding. Through the NRCS CIG program, public and private grantees develop the tools, technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges.

Habitats/Wildlife Management

1. Feral Hog Abatement Program: The Texas Department of Agriculture (TDA) provides grant funding to governmental agencies (counties, cities, etc.) and Texas higher education institutions for practical and effective projects to develop and implement long-term feral hog abatement strategies. AgriLife Extension and TPWD currently receive funding through this program. More information is available: https://www.texasagriculture.gov/GrantsServices/TradeandBusinessDevelopment/FeralHogGrantProgram.
2. TAMUK Caesar Kleberg Wildlife Institute-South Texas Natives- to develop and promote native plants for restoration and reclamation of habitats on private and public lands and focusing on the development of locally adapted native plant seed for south Texas habitat. https://www.ckwri.tamuk.edu/research-programs/south-texas-natives
3. Texas Native Seeds Program- developing commercially available, locally adapted native seed sources for all areas of Texas, conducting applied restoration research to develop practical restoration methods, and disseminating findings and conducting educational activities in support of the restoration and conservation of native plant communities.https://www.ckwri.tamuk.edu/research-programs/texas-native-seeds-programs-tns
4. Living Shoreline Manual -- A Manual for Re-Engineering Living Shorelines to Halt Erosion and Restore Coastal Habitat in High-Energy Environments http://nerrssciencecollaborative.org/resource/manual-re-engineering-living-shorelines-halt-erosion-and-restore-coastal-habitat-high
5. NRCS- Plant Materials Center Resources for Coastal Restoration Efforts: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/plantmaterials/home/?cid=NRCSEPRD1658822
6. Coastal and Shoreline Gulf of Mexico https://www.nrcs.usda.gov/wps/portal/nrcs/detail/plantmaterials/technical/publications/?cid=stelprdb1044274

Water Quality

1. TCEQ- Clean Rivers Program: a state fee-funded program that provides surface water quality monitoring, assessment and public outreach. More information about the Clean Rivers Program is available at: http://www.lnra.org/programs/clean-rivers/.
2. National Coastal Wetlands Conservation Grant Program- restore and project wetlands and habitats. Priority is given to projects that: 1) support the goals of the National

Wetlands Priority Conservation Plan, 2) provide long-term conservation, 3) conserve maritime forest on coastal barrier islands, 4) benefit threatened and endangered species, 5) encourage public-private partnerships, and 6) complement other conservation projects.

3. Texas Department of Agriculture Community Development Block Grant (TxCDBG) Program for Rural Texas
    a. Community Development Fund-largest fund category in the TxCDBG Program
4. EPA's Clean Water State Revolving Fund (CWSRF)- funding for water quality improvement projects that implement section 320 National Estuary Program Comprehensive Conservation and Management Plans (CCMP)- Federal and state contributions are used to capitalize the programs. These assets are used to make low interest loans for important water quality projects, including projects located in and affecting estuaries. Funds are then repaid to the CWSRFs and are recycled to fund other water quality and public health projects.
5. Emergency Watershed Protection- a federal emergency recovery program, helps local communities recover after a natural disaster strikes. The program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms and other natural disasters that impair a watershed.https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
6. Bureau of Reclamation-Cooperative Watershed Management Program (CWMP) - contributes to the WaterSMART strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. Funding is provided on a competitive basis. https://usbr.gov/watersmart/cwmp/index.html
7. Texas State Soil and Water Conservation Board (TSSWCB) https://www.tsswcb.texas.gov/programs
    a. Soil and Water Conservation Assistance
    b. Flood Control Program
    c. Texas Nonpoint Source Management Program
        i. *The federal Clean Water Act (CWA) requires States to develop a program to protect the quality of water resources from the adverse effects of nonpoint source (NPS) water pollution*
    d. Water Quality Complaint Resolution
        i. *The TSSWCB is responsible for investigating and resolving water quality complaints resulting from agricultural or silvicultural nonpoint sources (unregulated)*
    e. Watershed Protection Plan Program
        i. Watershed planning is a locally-driven mechanism for voluntarily addressing complex water quality problems that cross multiple jurisdictions.
    f. Total Maximum Daily Load Program

i. The federal Clean Water Act (CWA) requires Texas to identify lakes, rivers, streams, and estuaries failing to meet or not expected to meet water quality standards and not supporting designated uses

g. Coastal Nonpoint Source Pollution Control Program
h. Water Quality Management Plan
    i. A water quality management plan (WQMP) is a site-specific plan developed through and approved by soil and water conservation districts for agricultural or silvicultural lands.
    ii. Environmental Data Quality Management

Septic & Wastewater

1. EPA- Technical Assistance and Training Grants for Rural Water and Waste Systems provides grants to non-profit organizations that offer technical assistance and training for water delivery and waste disposal.
2. USDA Repair and Rehabilitation Loans and Grants provides loans to very-low-income homeowners to repair, improve or modernize their homes or grants to elderly very-low-income homeowners to remove health and safety hazards. https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants
3. USDA Rural Utilities Service-Water and Waste Disposal-This program provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program
4. EPA Supplemental Environmental Program Examples https://www.epa.gov/enforcement/supplemental-environmental-projects-seps#policy
    a. Collection Events where local citizens they may bring items for proper disposal at no cost
    b. Cleanup of illegal dump sites, including tires:
        i. Eligible sites will be those where a responsible party cannot be found; or is unable to clean the site; and
        ii. where reasonable efforts have been made to prevent dumping.

Outreach

1. U.S. EPA Urban Waters Small Grants Program, is to fund projects that will foster a comprehensive understanding of local urban water issues, identify and address these issues at the local level, and educate and empower the community. More information about the Urban Waters Small Grants Program can be found at: https://www.epa.gov/urbanwaters/ urban-waters-small-grants.
2. USDA Awards Funds to Encourage Public Access to Private Lands to help state and tribal governments encourage private landowners to allow public access to their land for hunting, fishing and other wildlife-dependent. It will also provide new opportunities for the public to enjoy the outdoors and potentially generates new revenue streams for private

landowners, More Information can be found at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/releases/?cid=NRCSEPRD1555052

Flooding/Stormwater

1. Texas Water Development Board
    a. Flood Infrastructure Fund (FIF) for 2020: $793M in grants/loans made available to eligible political entities for structural and nonstructural projects (can include green and nature-based projects). Operates on an Annual Funding cycle. https://www.twdb.texas.gov/financial/programs/fif/index.asp
    b. Flood Intended Use Plan (FIUP):
        i. Category 1: flood protection planning for watersheds
        ii. Category 2: planning, acquisition, design, construction and rehabilitation (i.e. Sustainable infrastructure; nonstructural flood mitigation; permeable pavement; natural erosion and runoff control)
        iii. Category 3: Federal award matching funds (ex. to match FEMA or HUD funds)
        iv. Category 4: Projects immediately effective in protecting life and property (ex. warning systems; crossing barriers; and public education, outreach)
        v. Incentives for nonstructural, including Nature-based projects: https://www.twdb.texas.gov/financial/programs/fif/doc/Flood_Intended_Use_Plan_3_16_2020.pdf

Illegal Dumping/Debris Campaigns

1. Texas Department of Transportation Don't Mess with Texas
2. U.S. EPA Up 2 U Litter Prevention Campaign (Debris)
3. U.S. EPA Supplemental Environmental Program Examples
    a. Water and Waste Violations qualify
    b. Collection Events where local citizens they may bring items for proper disposal at no cost
    c. Cleanup of illegal dump sites, including tires:
        i. Eligible sites will be those where a responsible party cannot be found; or is unable to clean the site; and
        ii. where reasonable efforts have been made to prevent dumping.

Online Tools and Resources:

1. NRCS and the Farm Production and Conservation (FPAC) Business Center rolled out a new decision tool this year for producers on farmers.gov. The Conservation Concerns

Tool enables landowners to learn about conservation concerns that might impact their agricultural operations, then search for solutions targeted to fit their business needs.

2. Producers can also find a new video series, called Conservation at Work, that spotlights how producers are using key conservation practices. In addition to finding information, producers can also log into farmers.gov to manage their conservation business online. During the past year, key functions from NRCS's Conservation Client Gateway were moved to the farmers.gov portal to provide one place where producers can manage all of their USDA business online.
3. The Regional Conservation Partnership Program (RCPP) and Conservation Innovation Grants (CIG) Program continued to rally partners to help increase the reach of conservation and support the development of new tools, approaches, practices and technologies to further natural resource conservation on private lands. NRCS just closed the application period for RCPP, with plans to invest $360 million in projects that improve the nation's water quality, combat drought, enhance soil health, support wildlife habitat and protect agricultural viability. Additionally, NRCS invested $50 million in 10 conservation projects through RCPP Alternative Funding Arrangements, where partners are given the liberty to manage projects and the associated relationships with producers and landowners directly. In October, NRCS awarded more than $14.6 million in grants to 24 CIG projects. This USDA investment has generated more than $15.3 million in partner matching funds, resulting in almost $30 million for conservation innovation. Authorized in the 2002 Farm Bill, the CIG Program has awarded nearly $300 million to date.
4. NRCS made tremendous strides in implementing the 2018 Farm Bill in the past year. NRCS published final rules for EQIP and CSP this fall and is preparing to publish final rules for ACEP and RCPP. Additionally, completed and published updates to its set of National Conservation Practice Standards, which includes 58 standards. The 2018 Farm Bill required review of all 169 of its national conservation practices to seek opportunities to increase flexibility and incorporate new technologies.
5. NRCS Nueces River Authority Remarkable Riparian Manual http://www.nueces-ra.org/YRR/pdfs/yrr2.pdf
6. Texas Coastal Water: Nutrient Reduction Strategies Report 2019 https://drive.google.com/drive/u/1/folders/1PAcSPshLHvVSm-HlSzacH-Y3kxo_4swu

7. NRCS Texas Fact Sheets[4]
    a. Conservation Technical Assistance (PDF; 435 KB)
    b. Cultural Resources and Your Conservation Plan (PDF; 883 KB)
    c. DUNS and SAM Update (PDF; 1.07 MB)
    d. Establishing Eligibility for USDA Programs (PDF; 604 KB)
    e. Farmers' Guide to Farm Bill Programs - 2018 (PDF; 650 KB)
    f. Granicus/GovDelivery - Sign up (PDF; 4.87 MB)

[4] Publications & Fact Sheets / NRCS Texas Fact Sheets.
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/tx/newsroom/factsheets/?cid=nrcseprd1474015
Accessed 5/5/21

g. High Tunnel System Initiative (PDF; 720 KB)
h. Highly Erodible Land and Wetlands (PDF; 298 KB)
i. Landowner Preservation Incentives and Opportunities (PDF; 756 KB)
j. New Farmers - Getting Started (PDF; 4 MB)
k. NRCS Texas Partners for Conservation (PDF; 353 KB)
l. NRCS Texas Urban and Rural Conservation Project (PDF; 1.56 MB)
m. NRCS Program Assistance (PDF; 286 KB)
n. NRCS Program Assistance - Organic Farmers (PDF; 302 KB)
o. NRCS Program Assistance - Socially Disadvantaged Farmers and Ranchers (PDF; 286 KB)
p. NRCS - Who We Are and What We Do (PDF; 863 KB)
q. Pollinators (PDF; 707 KB)
r. Targeted Funding Categories (PDF; 850 KB)
s. Texas State Technical Committee (PDF; 1.14 MB)
t. Texas Water Action Collaborative (PDF; 299 KB)
u. NRCS Texas Fact Sheets – Spanish
v. 382 Fence Specification - Spanish (PDF; 496 KB)
w. Blank EQIP CCC1200 - Spanish (PDF; 232 KB)
x. Farmers' Guide to Farm Bill Programs - 2018 - Spanish (PDF; 838 KB)
y. FY21 Implementation Requirement - Fence 382 - Spanish (PDF; 1 MB)

8. NRCS Soils website: https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/
9. Regional Supplements to Corps Delineation Manual: https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/reg_supp/
10. National wetland plant list: https://www.nae.usace.army.mil/Missions/Regulatory/PublicNotices/Article/2570543/2020-update-of-national-wetland-plant-list-nwpl/
11. Field indicators of hydric soils of the United States (PDF)

Works Cited

USEPA *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. vol. EPA 841-B-08-002, 2008)