EARLY ACTION PROJECTS FOR THE CABO ROJO PRIORITY MANAGEMENT AREA

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The Cabo Rojo watershed is located in SW Puerto Rico and historically the nearshore coastal waters were a very important coral reef ecosystem. Significant degradation has occurred on these nearshore coral reefs similar to the decline in much of the Caribbean where 80-90% of the population of threatened Acropora species has been lost. Much of these decline is due to the increases in land based sources of pollution (LBS) from population growth. The Cabo Rojo watershed is emblematic of many coastal watersheds across the Caribbean -- poorly planned coastal development and persistent land based sources of pollution have severely impacted the nearshore coral reefs. Initial early action projects are needed to begin to coalesce Inter-Agency participation in coral reef protection/restoration in this jurisdictional Priority Watersheds in Puerto Rico especially where limited restoration activities have occurred thus far.

This project will focus on initial project development in the Cabo Rojo watershed to begin to identify key early action projects and potential local or federal sponsors in order to begin to move implementation efforts forward. Ideally early action projects will represent the efforts needed to reduce key stressors in these watersheds. In this case we have chosen a green infrastructure bioretention project for early implementation (Appendix I) due to it representing an early action project that its effectiveness at reducing stormwater pollution and the need for many such projects in the developed areas of the Cabo Rojo watershed. Due to budget limitations -- this initial project is a summary of fieldwork for a relatively small portion of the overall watershed specifically parts of two subwatersheds: the Combate subwatershed and the Joyuda lagoon watershed. This should not be considered a more extensive and thorough investigation that would occur as part of a full watershed plan. Our tasks and overall budget are summarized in Table 1 below.

Table 1. Tasks to develop early action projects

Task	**Lead**
1. Initial GIS data gathering and identification of potential project areas by evaluating aerial photography including coastal sediment plumes, areas of bare soil and dense development. Several focus areas were identified for further field investigation.	Protectores de Cuencas (PC), Ridge to Reefs (RTR), TNC
2. Initiation of Fieldwork Efforts – Stream and Upland Sources of Pollution ID	RTR, PC, DNER, TNC
3. Creation of a Short Technical Memo of Proposed Early Action Projects, Estimated Costs and Potential Sponsor Agencies -- Targets will include NRCS, NOAA, EPA and PRASA -- this includes the detailed identification of one early action project that can be used as a demonstration project and to help instigate more actions	RTR, PC, DNER, TNC
Total	$5000

Introduction

Puerto Rico and the wider Caribbean have suffered major declines in live coral reefs especially of sensitive and threatened species of *Acropora palmata*. Much of the decline has been linked to increasing land based sources of pollution. A number of sources of contamination have been identified previously in Cabo Rojo including poorly regulated coastal development, unregulated outfall pipes, sewage contamination, and exposed sediment in areas draining to the coast. Declines in the Cabo Rojo area coral reef assemblages have been particularly severe with historically healthy reefs including Joyuda being devastated in the last 20-30 years in large part to a large degree due to impacts from land based sources of pollution. As a result initial work is needed to begin establish a restoration strategies and early action projects to combat land based sources of pollution (LBSP) in the Cabo Rojo priority watershed.

Initial Identification of Early Action Projects

Two field visits were made to the Cabo Rojo area in July 2013 to identify early action projects. The initial fieldwork was completed by Paul Sturm, Ridge to Reefs, Roberto Viqueira of Protectores de Cuencas and Idelfonso Ruiz the Reserve Manager at the DNER Cabo Rojo Wildlife Refuge. Idelfonso was able to provide us with a good context and insight into the area as well as the share with us ideas and examples of restoration work at the Refuge. We have summarized potential projects identified in Table 1.

Table 1. Initial early action restoration projects

Project	Description	Potential Sponsors	Initial Ranking/ Cost
1. Stabilization of riding areas for 4 track (all-terrain vehicles)	Limiting the amount of disturbance in some key areas and construction of at least one sediment basin to reduce sediment losses into the nearshore marine environment	NRCS/ FWS/ DNER	Very high but very complex $100k-$500k
2. Stabilization of several dirt roads that transport sediment into urbanized areas then through streets and culverts to the nearshore marine environment	Stabilize wide dirt roads by reducing the width by demarcation of road and plantings to stabilize areas adjacent to roads, addition of cross-swales and sediment traps to reduce transport of sediment (the stretch of road in Figure 3 is roughly 1800ft x 22-30ft	Municipality of Cabo Rojo, NRCS, DNER, NFWF, NOAA	High $50k-$100k

Table 1. Initial early action restoration projects			
Project	**Description**	**Potential Sponsors**	**Initial Ranking/ Cost**
3. Bioretention Green Infrastructure project to treat stormwater runoff from town before it enters nearshore waters	Address stormwater runoff from a busy street by creating a bioretention facility next to a parking area for a vacation resort area to treat stormwater runoff before it flow into coastal waters	Municipality of Cabo Rojo, NRCS, DNER, NFWF, NOAA	High, Very High for a demonstration project visible by many visitors and residents $25k - $30k
4. Connect the town to an advanced sewerage system	Connect the town to an advanced sewerage system to limit nutrient and other contamination of nearshore waters -- this may include a well functioning PRASA plant or a treatment wetland or pump and treat landscaping/garden area	PRASA, EPA, USDA Rural Dev	Very high but very complex and expensive >$1M
5. Cliff and highly erodible soil erosion at Joyuda subwatershed neighborhood	Extremely extensive erosion occurring adjacent to a residential community and putting lives and property at risk	Developer/ NRCS/ FWS/ DNER	Very high but extremely complex and potentially expensive $100k - $1M
6. Stabilization of bare / degraded upland soils	Area above the eroding cliffs in generating runoff the impacts the cliff but also contributes to downstream channel erosion and re-establishment of native forest or species that help restore the soil and improve infiltration	Developer/ FWS/ NRCS/ NFWF	Very high $50k -$100k

Table 1. Initial early action restoration projects			
Project	**Description**	**Potential Sponsors**	**Initial Ranking/ Cost**
7. Stream stabilization of a highly eroding ravine	Area downstream of the eroding cliffs and runoff generating area (5 & 6) plus significant amounts of impervious cover from high density development. Volume control of stormwater runoff (reuse) etc and potential to create a regenerative stormwater conveyance	Developer/ FWS/ NRCS/ NFWF	Very high but very complex -- source control is critical $500k-$1M

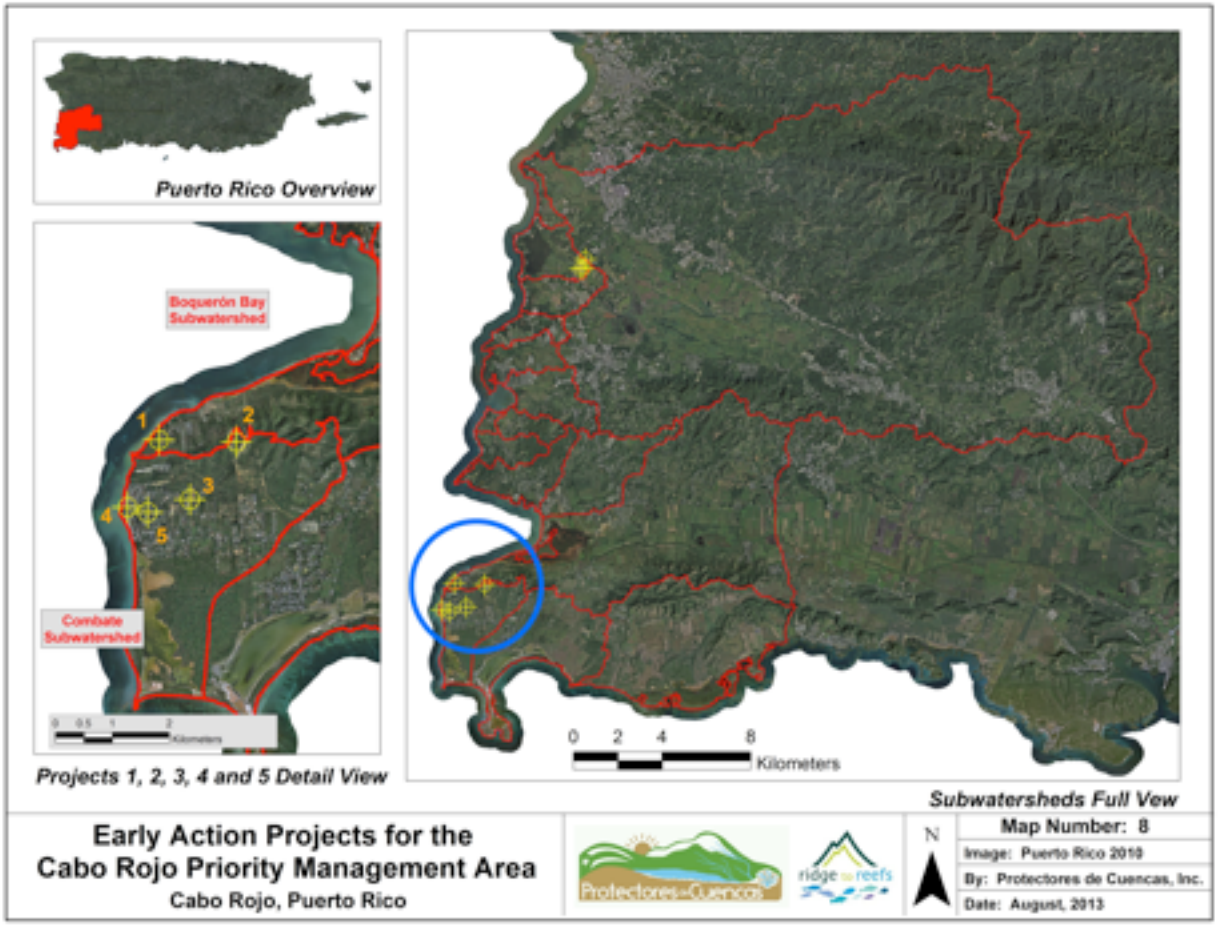


Figure 1. Project locations in and around the Combate subwatershed

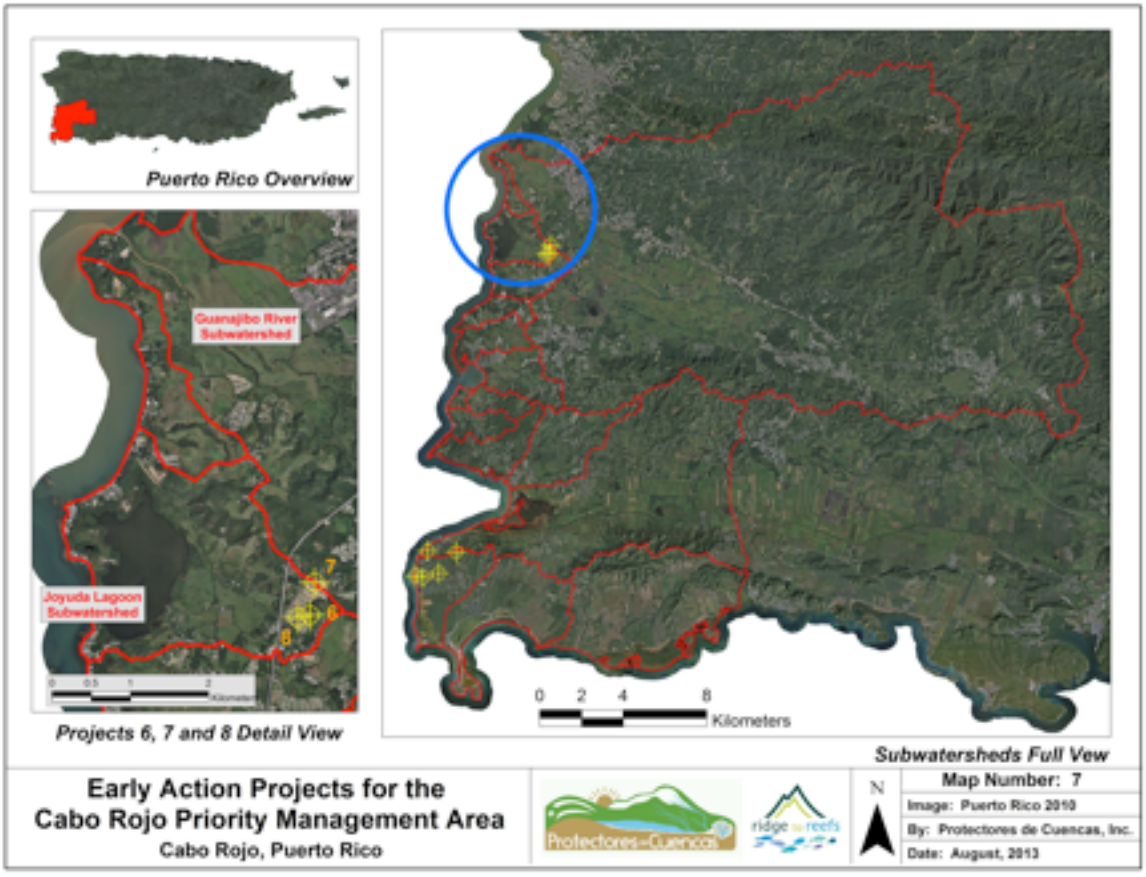


Figure 2. Project locations in the Joyuda Lagoon watershed

Figure 3. Unpaved road in Cabo Rojo used for both car traffic and 4 track (all-terrain vehicles) (Projects #1 and #2) - this is typical of other areas impacted by 4 tracks

Figure 4. 4-track impact area (Source: (Google Earth)

Figure 5. Aerial view of a major impact and usage area (note quebrada and depositional area) (Source: Google earth)

Figure 6. Extensive gully erosion and sediment transport from the hillside (Project #5)

Figure 7. View from the top of the hill

Figure 8. Shows the extensive nature of Project # 5

Figure 9. Project #6 top of the hill stabilization areas

Figure 10. Extensive gully erosion causing sediment transport and infrastructure risk (#7)

Conceptual Plan for Project #3 Bioretention Green Infrastructure Project

This Bioretention/ Green infrastructure project is a logical early action project due to its location in a very visible public area and because it is a green infrastructure project critical in Cabo Rojo with its extensive coastal development and no stormwater controls. The site also has only one owner and they are interested in the project. The site is a coastal tourism community near Cabo Rojo not far from Combate beach, a highly visited local area.

The project is located in a complex with rental cottages and is one of the few properties that have effective waste management as the sewage is pumped out of holding tanks and taken to the nearby sewage treatment plant. Most of the adjacent properties and the properties are on septic systems in fairly high density and prone to failure, underperformance, and high nitrogen export to the coastal system. The bioretention facility would be located next to the parking area and entrance to the cottages and adjacent to the waterfront road -- where signage could be educational signage could be placed. It is estimated that the bioretention facility would treat between 2-3 acres of impervious cover. It will treat the runoff just prior to it being conveyed to coastal waters.

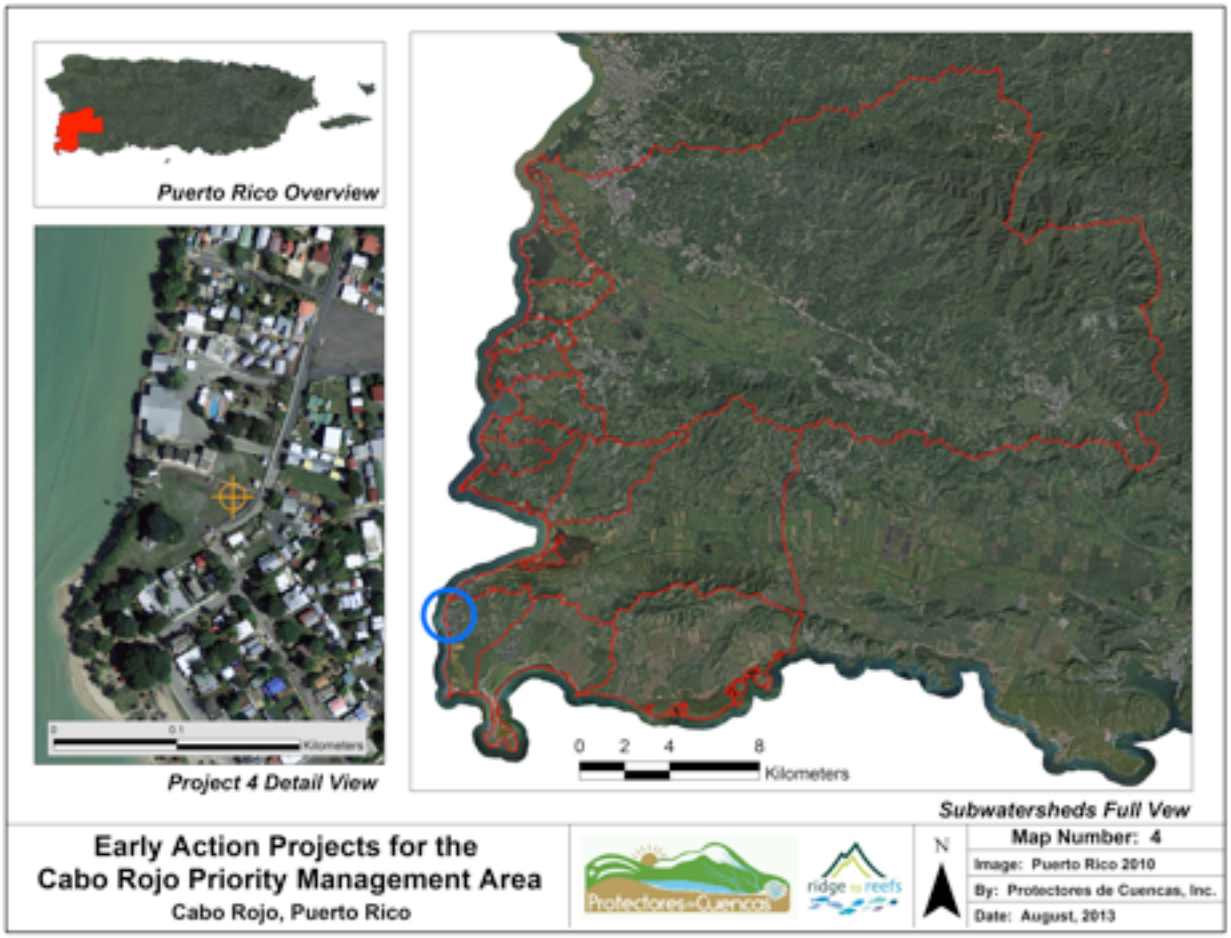


Figure 11. Site #3 Project Location within the Cabo Rojo watershed

Figure 12. Location for proposed bioretention green infrastructure project

Cost Estimate

The project is anticipated to cost approximately $25,000 which would include design, permitting, materials -- biosoils, excavation, signage, plants and all labor and construction. The project would involve local contractors for excavation and labor and would also involve the municipality of Cabo Rojo thereby beginning to transfer knowledge and expectations for green infrastructure for both new and existing development in order to protect the resources being lost.

Table 1. Project Cost Estimate		
Project	**Assumption**	**Cost Estimate**
Green Infrastructure Bioretention	**Construction, design and all necessary materials including bio-soils, plants, sand, concrete etc**	$25,000
Total $25,000		

Summary

Seven projects have been identified from two priority subwatersheds Combate Beach and Joyuda lagoon. The projects differ in levels of complexity from the very complex to relatively straightforward. More complex projects require a multi-agency and multi-stakeholder approach including landowners and agencies with specific technical expertise. We have chosen one as an early implementation project as it is representative of an important type of green infrastructure project and it has less complexity of the more challenging projects that would take much longer to develop and fund. That said all these projects are critical for implementation and meet the intention of the NOAA Coral Reef Conservation Program (CRCP) and the PR Department of Environmental Resources (PR DRNA) in terms of jurisdictional priorities and addressing land-based sources of pollution. Specifically sources of sediment and stormwater runoff carrying nutrients, bacteria and sediment are called out for treatment in the projects in this memo.

Project Purpose and link to PR DRNA and CRCP Goals and Objectives*:* Local and NOAA Goals: Cabo Rojo is a priority watershed with limited planning and implementation efforts thus far.
NOAA Climate Change Goal 4: Increase reef resilience and develop and test methods to reduce stress from climate change. Woodridge (2009) suggests that reducing watershed land based nitrogen (DIN) levels by 50 - 80% could counter a 2 – 2.5 degree Celsius increase in temperature. Highlighting the importance of reducing LBSP / nutrients for coral reef resilience.

Impacts of Land Based Sources of Pollution (LBSP) Goals 1 and 3: Reduce pollutant loading from watersheds to priority coral reef ecosystems; Build and sustain management capacity at various levels and institutions to reduce and prevent the impacts of LBSP. Actions will be identified for the reduction of sediment, nutrients and bacteria (Objectives 3.1 build capacity, 3.2 partnerships, and 3.3 awareness).

Appendix I Restoration Concept

Cabo Rojo

Watershed Plan

RETROFITS

Site Name/ID: Project #3 - P3 **Watershed:** Cabo Rojo

Date: Aug 5, 2013 (Form) **Assessed by:** PES/RVR

EXISTING SITE/STORMWATER MANAGEMENT

Site Contact Info: Mojacasabe Villas - Combate Beach
Phone 787 254-4888

Land Use: ☐ Public ☒ Private ☐ Unknown:

☐ Single Family Residential ☒ Multi-Fam. Residential ☐ School ☐ Golf Course ☐ Park ☐ Agricultural ☐ Road
☐ Commercial/Industrial ☒ Resort ☐ Marina ☐ Other: _____

Is the site a hotspot? ☒ Yes ☐ No ☐ Unknown:
Sources/pollutants observed? ☐ No ☒ Sediment ☒ Nutrients/organics ☐ Oil/grease ☒ Trash/Floatables Adjacent Streets

Existing Stormwater BMP on site? ☐ Yes ☒ No ☐ Unknown:

Soils: ☒ Unknown ☐ poor infiltration ☐ good infiltration

Describe Existing Stormwater Conditions, Including Existing Site Drainage and Conveyance:
No existing treatment - road + dense development in drainage area - convey stormwater to the site - stormwater passes thru the site + into coastal waters

PROPOSED RETROFIT CONCEPT *(CONT. ON BACK)*

Proposed Retrofit Practice(s): ☐ existing BMP upgrade ☒ new BMP

☒ island bio/rain garden ☐ swale ☐ planter ☐ tree pits ☐ infiltration ☐ permeable paver ☐ sand filter ☐ pond
☐ constructed wetland ☐ proprietary practice ☐ soil amendments ☐ reforestation ☐ impervious cover removal
☐ rainwater harvesting ☐ disconnection ☐ Other (describe):

Area Draining to Retrofit
☐ Hotspot ☐ Individual rooftop
☐ Parking Lot ☐ other small impervious area
☒ Streets ☐ Pervious area
☐ Other (describe): dense residential

Drainage Area to retrofit ≈ 2 acres/sq ft
Imperviousness ≈ ____ %
Impervious Area ≈ ____ acres/sq ft

Benefits of Retrofit (primary & secondary): ☐ Storage ☒ Water Quality ☐ Recharge ☐ Gut Protection ☐ Demonstration / Education ☐ Repair ☐ Other: _____

Possible Conflicts due to: ☒ Soils ☐ Access
☐ Adjacent Land Use ☒ Existing Utilities
☐ Contamination ☐ High water table
☐ Limited access to water ☐ Other:

Describe conflicts:

NEXT STEPS

Candidate for pilot project ☒ yep, love it ☐ OK ☐ undecided ☐ no, but keep listed ☐ no way

Follow-up needed to Complete Field Concept
☐ Confirm property ownership
☒ Confirm drainage area/impervious cover
☒ Confirm volume computations
☐ Complete concept sketch
☐ Obtain existing as-builts/site plans
☐ Obtain detailed topography
☐ Confirm storm drain invert elevations
☐ Other:
☒ Obtain utility mapping
☐ Confirm soil types

Site ID P3

☐ SITE AERIAL INCLUDED

PROPOSED RETROFIT CONCEPT (CONT.)

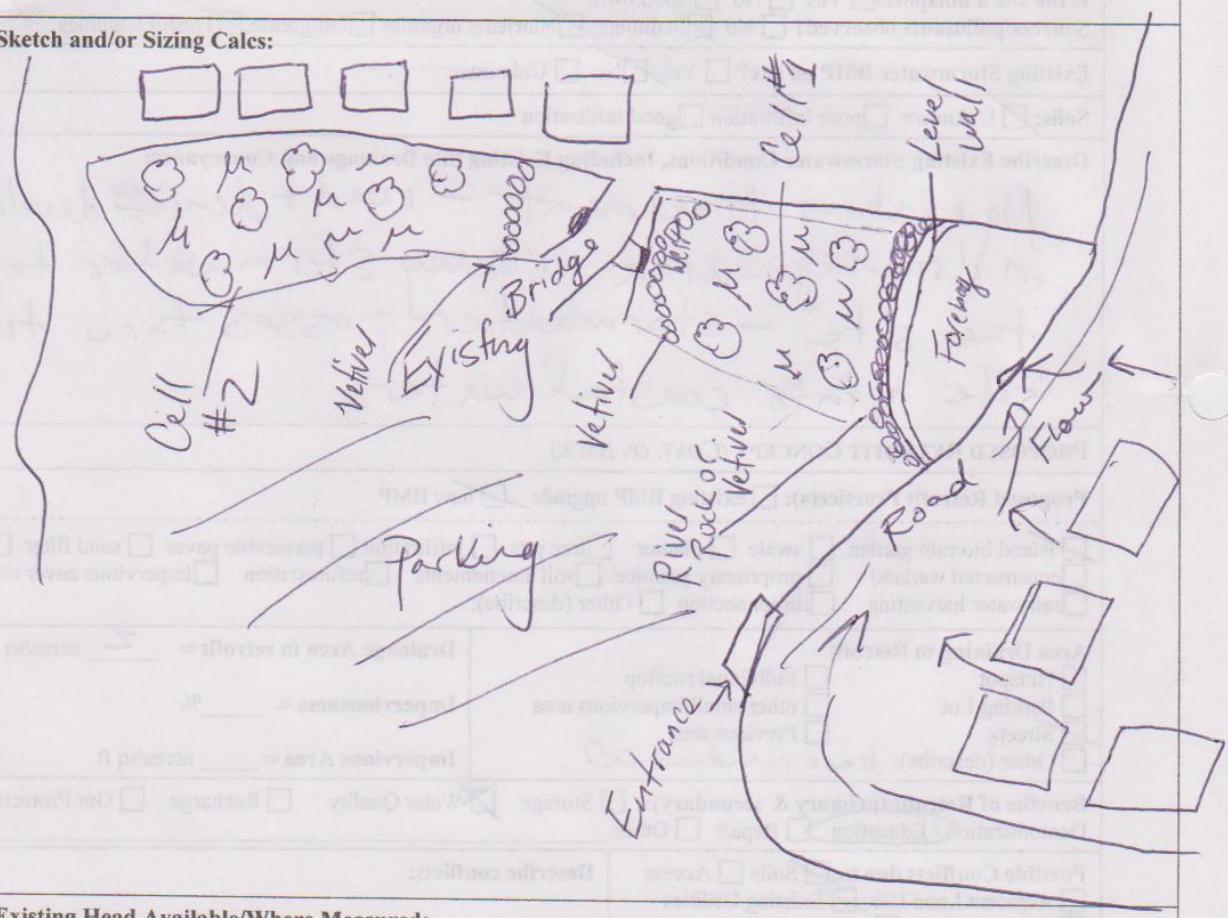
Narrative Description (Including key elements, aprox. surface area/ depth of treatment, conveyance structures):

Two cells - depth of treatment 6-12 inches

100 x 30 Upper Cell
100 x 20 Lower Cell

Coastal Waters

Sketch and/or Sizing Calcs:



Existing Head Available/Where Measured:

~ 1-2 ft

Initial Feasibility and Construction Considerations/ Design or Delivery Notes:

Important factor is soil permeability - should be sand since near beach but fill may have been used for parking lot

Fill - need underdrain

Thoughts on Maintenance Burden: ☐ Low ☒ Medium ☐ High

Site ID P3