Appendix A

Reconnaissance Trip Reports

JULY 31, 2016

8 April 2016

MEMORANDUM

To: **Peter Ilieve (RTI)**
CC:
From: Chris Heider

Subject: USVI-EPA TMDL & Implementation Support: Field Reconnaissance March 2016

Purpose & Objectives

The purpose of this document is to provide an overview of activities and key findings associated with the first of two planned field reconnaissance missions to the US Virgin Islands. WPN staff Chris Heider and Rikki Dunsmore conducted the field mission with a focus on the islands of St. Thomas and St. John between the dates of 29 February and 9 March 2016. The targeted watersheds included Fish Bay & Coral Bay (St. John) and St. Thomas East End Reserve (STEER).

The overall objectives of the mission were to:

- **Conduct a physical overview of the key watersheds**, including road networks, topography and ghut (intermittent stream) systems, houses/buildings/infrastructure, water outlets, culverts, and other features that have an effect on water quality and are relevant for the technical aspects of the TMDL modeling effort.

- **Conduct interviews with resident stakeholders** that live or work within the watersheds to identify key stakeholder groups, general awareness about water quality, water quality enhancement projects currently underway, adherence to BMPs within the construction industry, and general network of stakeholders *within* the key watersheds.

- **Conduct interviews with island-scale stakeholders**, including government officials and other professionals that have perspectives that extend beyond the key watersheds. Examples include capacity among the professional community to address water quality issues, permitting and regulatory infrastructure, capacity to design, implement and monitor site-specific projects, and the construction trade among others. An objective also included interviews with the live aboard yachting community.

- **Conduct interviews and information exchange at the territorial level**, including meetings with CZM, regulators, and the University of Virgin Islands personnel involved in both community outreach and research.

- **Obtain any additional GIS or reporting information** that stakeholders are willing to share.

Summary of Outcomes

Outcomes of the field reconnaissance included a rapid survey and familiarization of the culvert and road systems (where safety allowed), overview of reef health, site visits into mangrove, salt marsh/ coastal wetland, forest and strand ecosystems, a review of the road and track systems, housing developments/ construction sites, the garbage dump, marinas, and storage yards (e.g. concrete, asphalt, etc.).

Through stakeholder interviews and site visits, there was opportunity to visit past projects aimed at improving water quality, including the establishment of a wetland agricultural site at the confluence of road networks that allowed for water to be directed into the ghut system in Coral Bay, and awareness of infrastructural changes that occurred to redirect stormwater runoff to avoid potential contamination at the outlets – these are particularly important for the TMDL modeling effort.

The project team was fortunate with stakeholder interviews, as all parties were very willing to participate and offer their insights to water quality concerns in the key watersheds and in general, and how particular actions or inactions are potentially contributing to pollutant loads. These stakeholder groups included:

- CZM officials acting at the Territorial scale
- Permitting officials/ inspectors for CZM at the island scale
- Organized community groups focused on environmental concerns
- Community members, residents and small businesses within the targeted watersheds and also those with a more island perspective
- Professionals engaged in other natural resource project interests, including private sector
- University researchers and community engagement staff (e.g. EPSCoR implementers)
- Members of the design and construction trade (architects, builders, trade craftsmen)
- Live aboard community members

As outlined in the overall objectives, interviews were conducted with stakeholders with interests in key watersheds, at the island-scale, and territory-wide. As part of the interviews, we were asked and encouraged people to contribute by recognizing their anonymity – as such no opinions or information provided by a specific person or persons is quoted.

Summary of Potential Implementation Activities

The following represent a summary of potential implementation activities to improve water quality, as analyzed by WPN (RTI Team), based on stakeholder interviews and observances while in the field. This represents a working list of potential activities that have been identified, but are currently not attributed to any reduction in pollutant load.

In general, implementation options span the following categories:

- Technical assistance capacity & training
- Infrastructural improvements & planning
- Policy & governance

This section describes an overall summary for each potential implementation strategy. No prioritizations have been made, nor has any analysis yet been completed as to how a particular strategy or strategies would mitigate pollutant loading. This list represents a composite of findings developed during the 9 day field mission. Outcomes presented here are in the process of being vetted as part of the TMDL & Implementation planning process through formal draft releases.

Technical Assistance Capacity & Training

- **Laboratory and training to conduct basic water quality sampling on St. John; Certified lab at UVI on St. Thomas.** Stakeholders identified a bottleneck with conducting water quality monitoring with no laboratory and training support on St. John. The most active areas are in Coral Bay with an established volunteer community and organized events. Interviews at UVI on St. Thomas indicated their water lab is not certified, which also presents issues associated with long-term water quality monitoring and research and development at UVI.

- **Certified wastewater engineer workshops & trainings pertaining to residential wastewater systems.** There is currently some knowledge about different systems, although much of the technical detail is being provided by vendors. Having a third-party, certified engineer to work with the construction trade, homeowners/ developers, and CZM has been identified as a means to properly size and equip new construction (and retrofit existing systems). The prospects of workshops and trainings were generally well received among the trade, community groups and government officials.

- **Workshops and trainings to identify wetland areas to provide proper setbacks to construction.** Stakeholders in the community, trades and government all identified the need to better inspect and review planning services associated with new construction projects. In particular, identifying wetland areas for setbacks to construction (and land suitability to build), as well as increasing or enhancing wetland functions as part of new construction projects (e.g. bioswales, etc.).

- **Increase in integration/ extension with University Research & USVI Management.** There are active programs at the UVI that address water quality concerns, with an approximate student population of approximately 20 post-graduate students that share water quality as a focus. Research work funded by EPSCoR, EPA and other sources is focusing on biotic communities, mangroves, water quality/ contaminants, community outreach/citizen science, and watershed-based approaches. There appears to be

opportunity to increase the Research-Management interaction through "Research Extension" or similar approaches to have management questions inform research, and convey research findings to improve management in a collaborative manner.

- **Increase in capacity among local students with emphasis on West Indian community.** Stakeholders have indicated that approximately 10% of natural resource professionals are part of the West Indian community. Increases in opportunities to increase locally sourced capacity among the youth, students and graduate-level degrees is a potential avenue to increase the distribution of water quality awareness in the territory.

Infrastructure Projects & Planning

- **Road and culvert assessment.** There is no known comprehensive road survey including surface, drainage, cross-road drainage or stormwater assessment for the Territory (or within key watersheds). It was clear that some culverts were manually cleaned out, while many others were either plugged with sediment, or the downhill drainage was not sufficient to divert water (i.e. water and sediment back-filled the culvert). There are several available protocols to conduct such a survey and would assist with long-term planning, maintenance, and infrastructure improvements.

- **BMP Effectiveness monitoring.** There appears to be a consensus among stakeholders in Fish Bay and Coral Bay, that water quality has improved since implementation of stormwater BMPs and specialized projects (e.g. road paving) has been on the rise (~2012). While this consensus is due to the appearance of the waterbodies as less turbid, there is no known consistent time series data that specifically tracks the effectiveness of BMPs, or the implementation rate of BMPs in the key watersheds. Some anecdotal evidence suggests that construction has slowed – particularly in Fish Bay – and as such it is not known if the perception of improved water quality is from a decline in construction, or an improvement in BMP implementation/ effectiveness, or both. Establishment of long-term implementation and effectiveness monitoring of BMPs territory-wide will provide input to planners to set, enforce, and refine BMPs to improve water quality.

- **Specific questions pertaining to Section 319-H funding.** Given construction costs are very high in USVI (and St. John in particular), there is a need for fiscal support to pave, grade, and improve road surfaces. Due to the high relief and topographical challenges in USVI, stakeholders have estimated that road paving costs nearly $1 million per mile. This is unconfirmed, but underscores the need for non-point source programs that will fund larger-cost construction projects. There appears to be good local capacity to manage these projects and conduct the work, though the barrier is funding – this is especially true on St. John where there is no active concrete facility, and all concrete must be trucked in by small barge.

- **Post-storm event road and infrastructure repair on private lands.** Stakeholders identified that approximately 70% of the road network are private roads. As such, it is difficult to obtain funds to repair roads and infrastructure following storm events (such as FEMA funds). A pathway for maintenance and repair of private roads is needed to ensure that even damage minor storm events (e.g. clogged culverts, landslides) can be repaired on these private roads. Potential programs that target funding for community groups to obtain support for annual maintenance and construction would appear to facilitate minimizing many of the more degraded roads in the systems affecting Fish Bay/ Coral Bay and STEER.

- **Simplified pump stations & shoreline wastewater improvements for live aboard yachting community.** There is a wide difference in opinions among stakeholders regarding the impact and behavior of the yachting community on water quality. Many sailboats in moorings in Coral Bay/ Coral Harbor do not have engines and as such would not be able to safely utilize a local pump station. There have been service providers (at least one) that have used a barge to pump alongside the moorings, and CZM has been investigating the potential to have pumping stations that would service such businesses. However, many boats do not have storage tanks and as such occupants use facilities at local restaurants and bars. Consideration should be given to evaluate and upgrade the wastewater treatment at the local restaurants and bars that accommodate the live-aboard community – this may be done in combination of a feasibility of pumping stations, or as a stand-alone project. For areas like Coral Harbor, which is a protected harbor and does not readily mix with water outside the bay, wastewater enhancement for facilities at the shoreline would be an advantage. Funding that would incentivize such restaurants/ bars or other <u>small</u> potential facilities (e.g. onshore toilet/shower building) appears to be well received. However, current planning to accommodate <u>large</u> marinas or resorts is and has been a long contentious and unpopular issue among stakeholders within Coral Bay/Fish Bay.

- **Increasing the continuous gauging network.** There are relatively few continuous climate and water monitoring systems available for conducting long-term analyses and planning. One such need is to monitor rainfall and best understand the trends in different regions of the Territory. Development is occurring at a relatively rapid rate, and all buildings are required to utilize water catchment as part of the design. Water is very expensive and sustained development will require better understanding and coordination with climatic conditions and what building infrastructure can be supported, especially in the more arid areas of the territory.

<u>Policy & Governance</u>

- **Corrective action & penalty assessment authority.** Many identified the need for additional empowerment by on-the-ground inspection officials to conduct inspections on building sites and have the authority to write violations for construction workers not following BMPs. This has come from interviews with CZM officials as well as the trade

industry. Current methods involve 1-2 steps of field-based officials filing reports to St. Thomas, followed by a review and decision. Some felt this was not an efficient process and favored an inspector to directly work with construction workers and homeowners to be in compliance.

- **Additional support from CZM to enforce BMPs.** Similar to the above, interviews from design & construction tradespeople have noted a gap in the capacity for inspections at job sites. This appears to have emerged within the past several years when government staffing was cut substantially. As such, many tradespeople who wish to follow BMPs have noted that there is no incentive – and in effect a disincentive – for construction crews and homeowners to spend the extra time, materials and expense to properly follow BMPs (silt fences, removal of sediment, driveway swales, etc.). While construction tradespeople acknowledged that inspections would potentially increase the difficulty of completing projects, they were making the clear recommendations that inspections would "separate the pack" from "reputable and non-reputable workers and homeowners" (as described by stakeholders).

- **Review of assessment of pollutants & potential listings by EPA.** The current list of 303(d) listed impairments for STEER include dissolved oxygen, bacteria, and turbidity. However, research from UVI has shown there are other pollutants to consider, including heavy metals (Ni and Cu at a minimum) associated with the municipal dump in and around Mangrove Lagoon and paint scrapings containing TBT (tributyltin oxide, a tin-derived paint) from boat bottom paint serviced at the water's edge in the Benner Bay Lagoon Marina. It is not clear if the loads warrant listing, though this may be a priority for EPA to be made aware of, with developing containment mechanisms and other BMPs.

- **UVI "first right of refusal" provision for environmental change program.** As stated above with increasing interaction between management and research, there is an existing program for UVI to have a veto on potential projects that qualify under the Territory's Earth Change Program. In talking with stakeholders, the functionality and effectiveness of this mechanism may need review to increase the exchange between research and management to modify project designs in a collaborative way, rather than issuance of a "right of refusal" to a given project. This may be conducted through back-and-forth workshops involving research and management, where a potential protocol can be developed to review such projects in a collaborative manner. It is not known if this is currently a functioning process.

- **Issuance of per visitor tax increase.** A potential mechanism for funding smaller projects or staffing needs could be supported by levying an airport and shoreline tax on visitors to be applied for environmental purposes. The territory has between 2 and 2.6 million visitors per year, spending nearly $1.5 billion per year[1]. A levy of $1 to $3 dollars per

[1] http://www.usviber.org/pdfs/tour09.pdf

tourist would allow for between $2 and $7 million per year in operating budget to support many of the trainings and soft infrastructure planning projects mentioned in these recommendations.

Appendix

The following represent particular areas of interest and photographs of the current conditions in the key watersheds. These organized for reference.

Coral Bay

The team was stationed in a rental house in the upper Coral Bay watershed and was able to have a good vantage of most of the Coral Bay watershed. Most of the roads driven were paved with weather resistant concrete, though roads were very steep, with many interconnected driveways at near 100% slopes.

Figure 1. Vantage point of Coral Bay looking southeast, with Coral Harbor most visible.

We conducted a rapid road and drainage survey for all intersecting roads near the outlets to Coral Bay (Coral Harbor and Round Bay in particular). Overall road conditions appeared to be concrete paved in most areas with a side ditch network built into the road system to divert water to a culvert at the bottom of a grade.

Figure 2. Typical grade of main road along Coral Bay (waterbody is to the left of the picture). Note the ditch network next to the road to collect and channel runoff.

Figure 3. Collection point at bottom of grade for runoff.

Figure 4. Culvert in relatively good condition (though apparently undersized) at base of grade.

Figure 5. Culvert intake at bottom of Hwy 108, undersized and filled with debris, Coral Bay.

There were a few projects that have been implemented on the ground to improve stormwater runoff into Coral Harbor. One project on King Hill Ghut (main stream system into Coral Harbor) conducted by the Coral Bay Community Council (CBCC) that focused on the diversion of stormwater from two roads into the ghut system. At the intersection point, the community built a garden to slow water flow and use wetland plants to trap sediments.

Figure 6. Constructed garden/ wetland to mitigate stormwater runoff from roads into the ghut system in Coral Bay. Water flows from two roads intersecting behind the camera to the paved chute in the bottom of the image. Water collects in the garden and meadow in the center of the image at high flows.

A second project was located lower in the watershed, where water was slowed by a large sedge meadow and then channeled through a silt fence through a double culvert crossing the main highway. On the far edge of the culvert there is a healthy mangrove stand that is approximately 50-100 ft thick in some areas.

Figure 7. Sedge meadow/ brackish marsh creation to slow water flow approximately 300 ft upstream of a mangrove inlet to Coral Harbor. Note silt fence is fortified with boulders.

Figure 8. Culvert directly downstream of brackish marsh, crossing Hwy 107 near King Hill Road, Coral Bay.

Figure 9. Undersized culvert leading into mangroves from a large ghut system, Coral Bay.

Figure 10. Salt pond with mangrove remnants just outside of Coral Harbor (southern inlet of Coral Bay).

A salt pond was located with mangrove remnants at the southern edge of Coral Bay. There appears to be a sandbar that may have interrupted wave/tidal flux within the mangroves, although we did not have access to investigate. Water flowing to this mangrove began upslope with reinforced retaining walls (with drainage outlets) and road fill. Silt fences did not appear to be maintained.

Figure 11. Drainage outlets for a new construction immediately across the road from the salt pond, Coral Bay.

Figure 12. Failed silt fence facing downstream from new construction, approximately 150 ft from Coral Bay outlet/ salt pond.

Figure 13. Unimproved culvert, Coral Bay.

Figure 14. Marine structure mostly seagrass beds, with rock reef, Coral Bay.

Figure 15. View of current water clarity in Coral Harbor. Some seagrass is evident on the silt substrate.

Figure 16. Feral goats throughout Coral Bay and Round Bay.

Figure 17. Damaged culvert en route to Round Bay. Culvert was cemetnted on downstream side to bay.

Figure 18. Typical view of road system with interspersed development, St. John.

Figure 19. Newly installed road in new development. Road cuts directly uphill, St. John.

Fish Bay

Figure 20. View looking up into Fish Bay. Major ghut is left in the image.

Figure 21. Erosion improvements in Fish Bay, upstream from improved culvert.

Figure 22. Downstream from improvements in Fish Bay (previous picture). Stormwater flows directly into the major ghut system.

Figure 23. Ghut system, Fish Bay.

Figure 24. Looking northwest at Fish Bay ghut. Mangroves are approximately 20 ft thick.

Figure 25. Area identified by stakeholders as needing road drainage improvements, Fish Bay.

STEER, St. Thomas

Figure 26. Dry dock/ hull maintenance facility in STEER. Effluent runs directly into marina.

Figure 27. Example of unpaved surfaces immediately adjacent to waterbody, STEER.

Figure 28. Example of dense development, STEER.

Figure 29. Roadside along the main road connecting to STEER.

Figure 30. Mangrove within STEER.

Figure 31. Major ghut flowing into STEER.

Figure 32. Paved channels leading from concrete/asphalt site to ghut, STEER.

Figure 33. Garbage dump, St. Thomas. Note trees seen in center of picture are directly above mangrove lagoon, STEER.

Other Features

Figure 34. Construction project, St. John.

Figure 35. Construction project, St. John.

Figure 36. Silt fence installed by construction contractor. Sediment was trapped on right side of image. Workers removed all sediment by truck.

Figure 37. Typical view of unpaved road during light rain.

23 May 2016

MEMORANDUM

To: **Peter Ilieve (RTI)**
CC:
From: Chris Heider

Subject: USVI-EPA TMDL & Implementation Support: Field Reconnaissance April 2016

Purpose & Objectives

This document outlines the key activities conducted as part of the second and final field reconnaissance mission to the US Virgin Islands, in support of TMDL and implementation plan options for the EPA in the region. This mission was focused on the Salt River watershed and the East End Marine Park (STXEEMP) area of St. Croix. Travel occurred between 16 and 22 April 2016.

Overall objectives included:

- **Conduct a physical overview of the key watersheds**, including road networks, topography and gut (intermittent stream) systems, houses/buildings/infrastructure, water outlets, culverts, and other features that have an effect on water quality and are relevant for the technical aspects of the TMDL modeling effort.

- **Conduct interviews with resident stakeholders** that live or work within the watersheds to identify key stakeholder groups, general awareness about water quality, water quality enhancement projects currently underway, adherence to BMPs within the construction industry, and general network of stakeholders *within* the key watersheds.

- **Conduct interviews with island-scale stakeholders**, including government officials and other professionals that have perspectives that extend beyond the key watersheds. Examples include capacity among the professional community to address water quality issues, permitting and regulatory infrastructure, capacity to design, implement and monitor site-specific projects, and the construction trade among others. An objective also included interviews with the live aboard yachting community.

- **Conduct interviews and information exchange at the territorial level**, including meetings with CZM, regulators, University, territorial and Federal agencies, and personnel involved in both community outreach and research.

- **Obtain any additional GIS or reporting information** that stakeholders are willing to share.

Summary of Outcomes

Meetings were held with Natural Resource Conservation Service (NRCS), National Park Service (NPS), CZM, Territorial park service, St. Croix Environmental Association (SEA), and the University of the Virgin Islands. In EEMP, field days were spent with CZM personnel on inspections and patrols, traversing nearly all roads within the park. Access was limited for some areas of Salt River watershed though vantage points were available to view potential issues and ongoing activities.

In general, there is a strong community of professionals working on water quality concerns on St. Croix. While both Salt River and EEMP are priorities within this community, the majority of the population on St. Croix lives elsewhere and many non-point source pollution (NPS) issues linked to stormwater routing from roads (including flooding) have been identified as priority concerns.

Within Salt River, there are several areas of current and past activities that affect water quality; the following highlight the major potential issues:

- **Salt River Marina.** This area is highly sheltered from ocean flushing and is surrounded by unpaved roads and a commercial marine construction yard. Paved roads moderate road cuts also surround the marina. The number of personnel or wastewater treatment mechanisms are not known, though activities (including use of volatile organic compounds) are within 30 ft of the waterbody.

- **Salt River Bay National Historical Park & Ecological Preserve.** There are current activities conducted by NPS to construct a marine ecological research station near "Bio Bay" (eastern part of bay) on a legacy, dredged landform that formerly held a failed hotel construction. There is a wide spectrum of opinions regarding the biology, ecology, cultural resources, and associated impacts of the proposed research station construction and operation. Many documents exist that support the NEPA process conducted by the Park. The review process has been completed with CZM and identified issues affecting water access have been made. There is stark political fracturing over this issue among stakeholders.

- **Judith's Fancy Development.** Immediately upslope from the east side of the bay there are many roads associated with a gated housing development. While not directly observed or interviewed with community members, there are the typical issues associated with house construction that inspections could increase BMP compliance and effectiveness.

- **Mt. Eagle Watershed (Mon Bijou) flood mitigation project.** There is a large-scale flood mitigation project in the upper reaches of Salt River that have resulted in re-routing of river and stormwater flows. Constructions include gabion to mitigate the potential of very large-scale flood events. The effectiveness and secondary consequences of the

construction were not directly determined in this study, though remains a priority for any future watershed assessment.

The East End Marine Park is a large area with lower rainfall and contains several housing developments. There is a very high and capable level of monitoring and compliance support conducted by CZM and the Park – patrols are conducted on average of three times per week, where BMP compliance and permitting is inspected along with illegal uses (e.g. fishing protected areas, etc.). The following are key observations for EEMP:

- **Road surfaces.** The main roads are well surfaced with some drainage issues observed elsewhere in the USVI. Primarily culverts are undersized and plugged with sediment— routine maintenance prior to storm events is required to improve stormwater diversions. Secondary roads are generally in a poor state of repair or are unpaved. It is clear that heavy rainfall events have damaged road surfaces; in many cases the paved road surface extends to all but the "last mile", and surface erosion coupled with stormwater is creating large plumes near to the bays.

- **Water treatment facilities.** There are six known small water treatment facilities that service mostly vacation homes and hotels in the EEMP. In some areas the gut system was used as part of the facility; it is not known if this was intentional, though human feces was observed on the beach by CZM the week before in one site. In addition for vacation homes that may remain vacant much of the time, the cost of electricity ($0.50 per kilowatt hour) creates a fiscal barrier to maintain the electric pump system in the aerated septic tank systems. As such homeowners turn the systems off when not in use, and rainfall events compound the leaching of untreated wastewater into the bays.

- **Restoration & conservation activities.** Organized groups have been working on lands to improve water quality concerns. It appears there is good capacity support from both non-profit and government groups in areas within and immediately outside of the EEMP. There are some landowners (private and commercial) that contribute to the NPS issues (primarily from unpaved or maintained roads) – incentivizing paving and repairs, along with features such as rain gardens (bio-swales) will directly reduce loading.

Summary of Potential Implementation Activities

The following represent a summary of potential implementation activities to improve water quality based on stakeholder interviews and observances while in the field. This represents a working list of potential activities that have been identified, but are currently not attributed to any reduction in pollutant load.

This section describes an overall summary for each potential implementation strategy. No prioritizations have been made, nor has any analysis yet been completed as to how a particular

strategy or strategies would mitigate pollutant loading. This list represents a composite of findings developed during the field mission. Outcomes presented here are in the process of being vetted as part of the TMDL & Implementation planning process through formal draft releases.

Many similar territory-wide findings identified in the first field trip report (March 2016) apply to St. Croix. This list represents items specific to St. Croix key watersheds:

Salt River Priorities Recommendations (St. Croix)

1. **Protection of Salt River Canyon Gut** from upland stormwater and waste water runoff from urban development and housing projects. See territorial recommendations for stormwater runoff and wastewater treatment facilities.

2. **Protect shoreline mangrove lagoon and salt ponds.** This applies to features within Salt River watershed; however there is some debate as to the status of Bio Bay and the relationship of the bioluminescent bacteria with water quality that remains *outside* of the scope of this analysis.

3. **Incentivize improvements of marina and waterfront area in Salt River Lagoon** where commercial boat building and ocean recreation businesses operate. Surface roads accessing the marina and just above on public road are sources of runoff. Inspect wastewater system in local businesses, located very close to the lagoon.

4. **Enforce permitting and earth change for new construction** and development including in Judith's Fancy to eat of Salt River Lagoon.

5. **Conduct full-scale watershed assessment for Salt River.** Linkages between the large-scale flood control project near Mon Bijou and Libannon Hill areas and the hydrology of Salt River Bay needs to be better understood. In addition, there is a high rate of change in the land-based resources of the area with no clear assessment of hydrology, sediment, and vegetation in the area.

St. Croix East End Marine Park Recommendations

1. **A fairly low-density urban and residential community resides on the East End of St. Croix,** therefore the implementation strategy would be to prioritize a few key problem sources locations for stormwater and wastewater pollution. In each subwatershed a few strategic problem areas can be identified, and best management practices for addressing each typically already exists. There is a high level of engagement with on-site inspection and patrol in the area by personnel shared by the Park and CZM.

2. **Erosion control measures on private and public roads, cutslopes, construction sites etc.** are strongly recommended for a few key roads in each subwatershed.
    a. Pave South Gate marina road
    b. Enforce or incentivize stormwater best management practices for South Gate marinas
    c. Pave the last mile of Grapetree Bay road to Turner Hole. Pave gravel steep roads in the Tuner Bay watershed.

3. **Enforce holding tank dumping regulations in South Gate marina.** Incentive use of holding tank pumpout facilities or fund a mobile holding tank disposal system.

4. **Support St. Croix Environmental Association projects in Southgate Gut.** Restoring connectivity with the Southgate pond to mitigate flooding and other priorities addressing non-point source pollution.

5. **Enforce, incentivize and improve wastewater treatment facilities.** Some are currently using Gut system as cesspools; others are functioning well. Incentivize and assist with engineering and fiscal resources to ensure treatment facilities are up to par and are being properly maintained.

6. **Pave roads above Teague Bay** and install culverts, erosion control BMPs, etc. for earth change areas near Teague Bay.

7. **Retrofit or make improvements to wastewater treatment facilities** and incentive switch to better systems for failing overstressed septic systems. Conduct assessments of the following:
    a. Divi Casino Bay Resort
    b. St Croix Yacht Club marina complex area
    c. Target failing overburdened septic systems for retrofit in private homes
    d. Teague Bay commercial and residential properties
    e. Reef Golf Condos
    f. Chenay Beach Resort

8. **Incentivize or support paving of "last mile" on all road networks (private and public).** The major issue associated with sediment delivery from stormwater stems from unpaved sections of roads. In one case near the Divi Casino, erosion-derived sediment originates from ~0.25 mi of unpaved road, which immediately continues downslope to private properties and enters the bay. Incentives to divert stormwater (rain gardens) and pave small sections of roads on private lands will make a major reduction in sediment delivery to waterbodies. CZM has identified ALL of these areas and can

directly assist in prioritizing and deploying resources to “shovel ready” projects.

9. **Support community-driven projects.** There is currently a NOAA Coral Management Fellow in place and has been working with community members on watershed enhancement. CZM/Park personnel has been very active in monitoring problem areas. With this capacity in place, along with the community response to better understanding non-point source pollution issues, the area is ideal for designing and implementing projects to reduce non-point source pollution.

Photo Gallery

The following represent particular areas of interest and photographs of the current conditions in the key watersheds. These organized for reference.

Figure 1. Typical water routing (EEMP, photo by John Farchette)

Figure 2. Looking upslope at Casino at ~0.25 mi unpaved road (Photo by John Farchette).

Figure 3. Water traveling from unpaved road in prior photo across main road into private driveway (Photo by John Farchette).

Figure 4. Water continuing from unpaved road surface down road embankment (Photo by John Farchette).

Figure 5. Water continuing to oceanside property through silt fence and gabion wall. Note delivered sediment plume. (Photo by John Farchette).

Figure 6. Stormwater event, EEMP. (Photo by John Farchette).

Figure 7. Stormwater flow routed over streets (Photo by John Farchette).

Figure 8. Stormwater delivered to bay, EEMP (Photo by John Farchette).

Figure 9. View from dock, facing west, Salt River Marina Lagoon.

Figure 10. Marine manufacturing business, Salt River Marina. Waterbody is to the immediate left of the image.

Figure 11. Storage area at Salt River Marina Lagoon. Waterbody is 15 ft beyond the mangroves.

Figure 12. View from Salt River Bay Historic Park building, facing southeast.

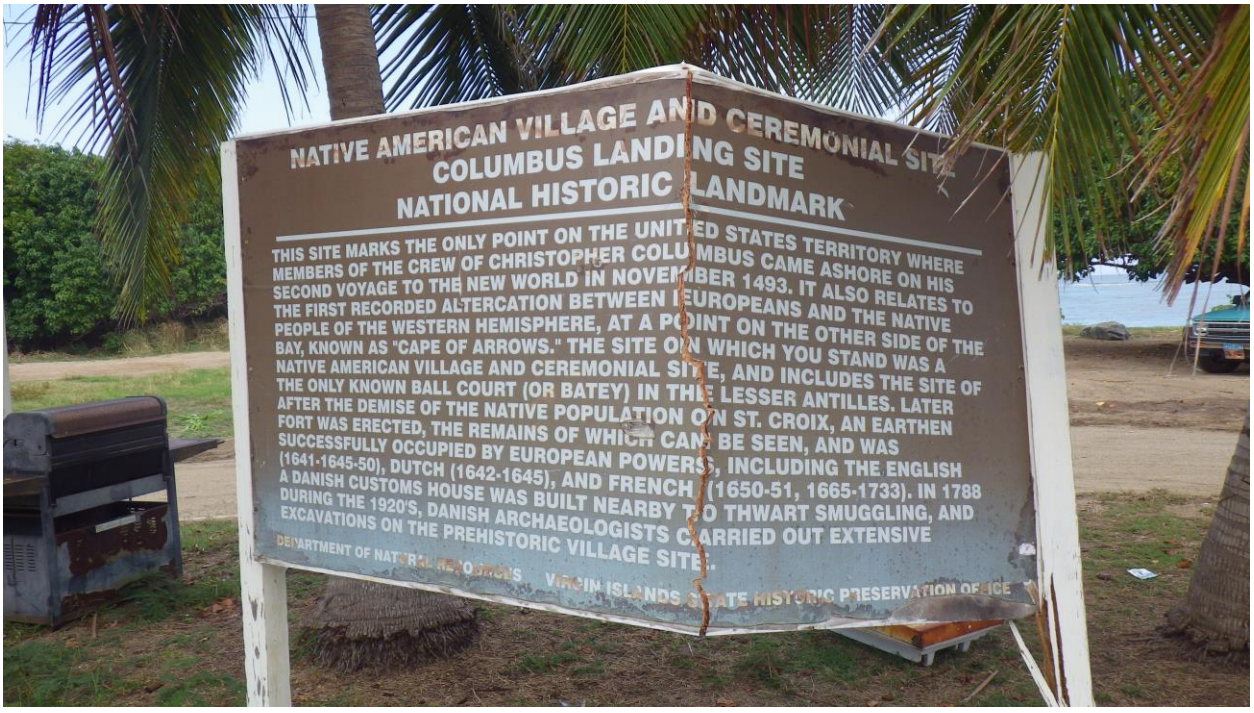

Figure 13. Columbus landing site, where camping is a local practice.

Figure 14. Campsite area at Columbus Landing Site.

Figure 15. Drainage area above Rod Bay, EEMP.

Figure 16. Culvert crossing road above Rod Bay filled with sediment, EEMP.

Figure 17. Soil profile, EEMP.

Figure 18. Close-up image of soil profile, EEMP.

Figure 19. Typical of where private roads are not paved except where absolutely necessary (e.g. steep curve).

Figure 20. An example of shear stress caused by stormwater.

Figure 21. Elevated road bed isolating Southgate Pond (right) from Southgate Reef (aka Tamarind Reef, left) Lagoon & marina, EEMP.

Figure 22. Example of small wastewater treatment facility, EEMP.

Figure 23. Typical of secondary (private) road condition.

Figure 24. Solid waste dumpsite for East End. Note it was very recently emptied.

Figure 25. Destroyed culvert near dump site.

Figure 26. Wooden bridge suspended ~20 ft over gut. School busses access daily.

Figure 27. Cross island road -- unpaved and drains directly to both sides of the island.