MAJOR LAND PERMIT APPLICATION

Environmental Assessment Report

Applicant: Government of the US Virgin Islands – Dept. of Public Works
Project: VI ST ER STX(003): Storm Damage Repair to Roadways, Culverts, Embankments, Bridges, and Other Roadway Features on St. Croix, USVI

Site: Rt. 78 – West Scenic Road

JULY 2022

Prepared by: Tysam Tech, LLC

Tysam Tech, LLC

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1.00 NAME AND ADDRESS OF APPLICANT

Government of the US Virgin Islands
Department of Public Works

Mailing Address:
6002 Annas Hope
Christiansted, VI 00820

Physical Address:
6002 Annas Hope
Christiansted, VI 00820

2.00 LOCATION OF PROJECT

The project is located at the following physical address:

Rt. 78 West Scenic Road
St. Croix, VI 00840

The Rt. 78 West Scenic Road Project site is located in St. Croix, southwest of Davis Bay. The project site is located at 17°45'13.9"N, 64°50'14.0"W, along Route 78, Scenic Road West. The Location and Agency Review Map in Figure 2.00.1 below and Figure 2.00.2 establishes the areas of Coastal Zone Management (CZM) first tier jurisdiction.

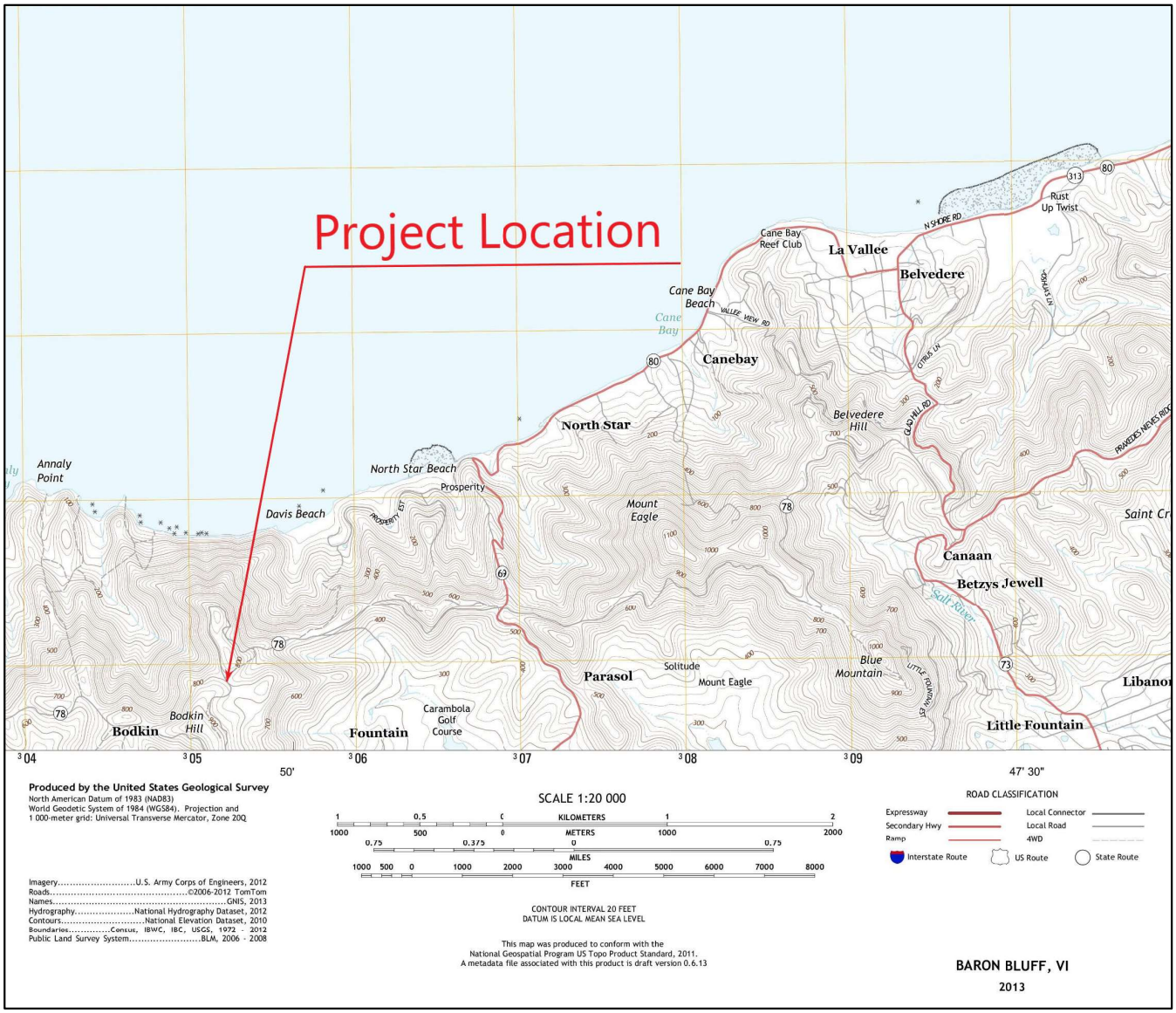


Figure 2.00.1 – Location and Agency Review Map (USGS Quadrangle Map, Baron Bluff, 2013)

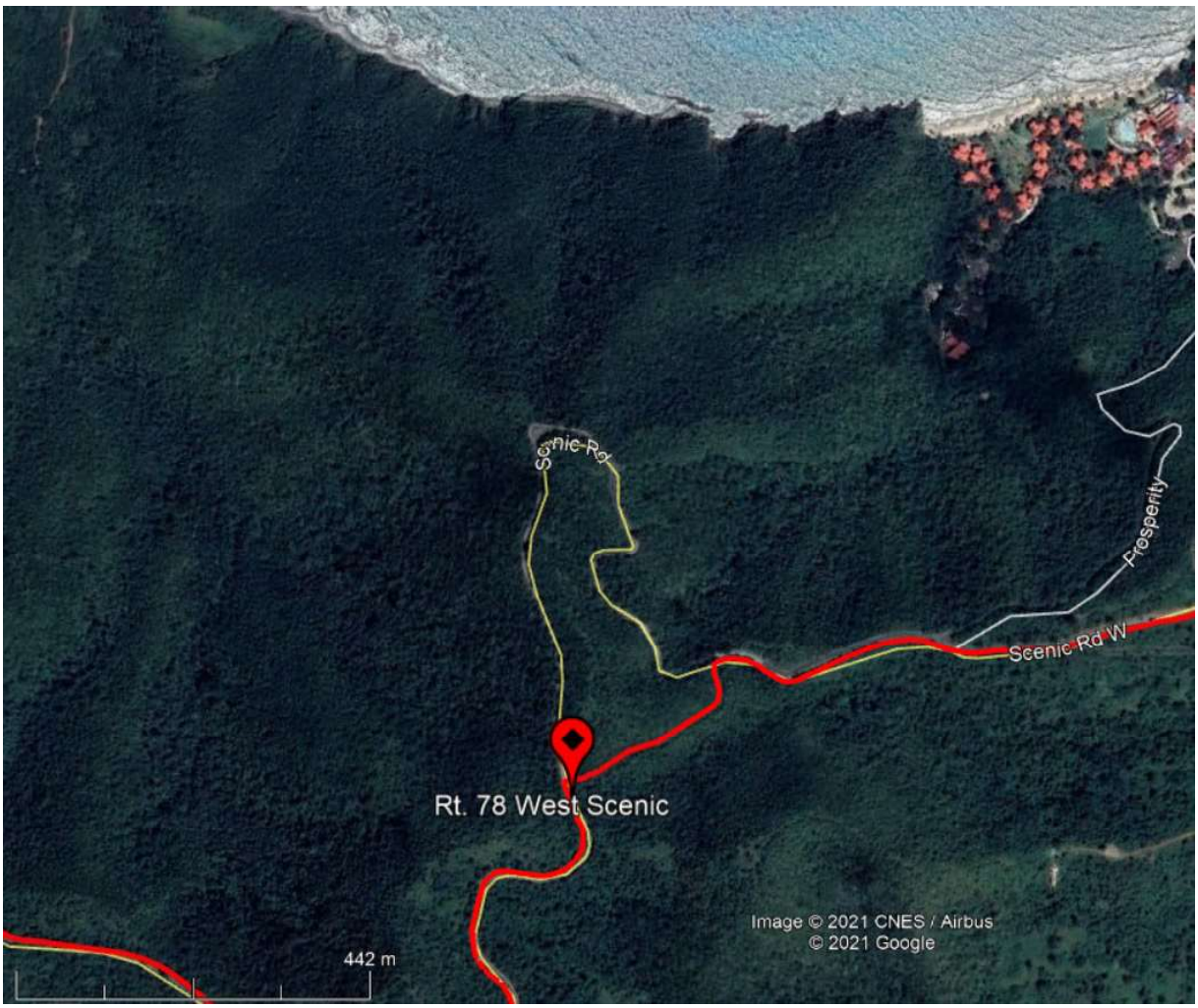


Figure 2.00.2 –Vicinity Map Showing Location of Facility within Tier 1 Territory (Google Earth).

3.00 ABSTRACT

Significant damage to roads, gut crossings and bridges occurred as a result of the landfall of Hurricane Maria in 2017 to the island of St. Croix, USVI. To provide the necessary repair to the damaged infrastructure, the USVI Department of Public Works (DPW) has contracted VI Paving, Inc. (VIP) to undertake the repairs at 15 different sites around St. Croix. These sites consist of different types of rehabilitation work, and different project scale. Of the 15 sites, there are 3 Bridge Rehab Sites, 7 Culvert Rehab Sites, and 5 Roadway Rehab Sites. This project is funded through the US Department of Transportation (USDOT), Federal Highway Administration, Eastern Federal Lands Highway Division and is in partnership with the USVI Department of Public Works (DPW).

The project consists of the removal of damaged asphalt and concrete pavement, pipe culverts, guardrail, retaining walls, embankment material, utility lines and poles, bridges, and other debris; and the installation of aggregate base, asphalt pavement, concrete pavement, pipe culverts, guardrail, gabion or concrete retaining wall, embankment stabilization, riprap, paved waterway, headwall, drainage inlets, cleaning drainage structures, reconditioning shoulders and ditches, replacing bridges, culvert, and utilities to provide fully functional roads, drainage systems, bridges, and utilities, complete and in place.

For this particular site under project VI ST ER STX(003), 120 linear feet of West Scenic Road, Route 78 will be rehabilitated. The West shoulder of the roadway suffered severe washout and will have to be rebuilt with gabion baskets to the roadway surface level where the wash-out occurred. The west area will be cleared of trees and brush. The washout will be cleared of loose subgrade and material, shored up and geotextile laid down. Gabion basket will be installed along with replacement of the washed out culvert with a 30” HDPE Culvert Pipe. Concrete headwalls will be installed on both shoulders, backfill added and compacted, and a base asphalt layer along with surface layer will be applied with a crown profile. Additional Rip Rap will be installed at the spillway to further stabilize the culvert outlet.

Project Assurances

- Employees’ and the public’s health and safety are protected with the best available systems and technologies.
- Environmental impact is considered at all times.
- No significant negative impact to environment.
- Air quality is protected.
- Stormwater quality is protected.
- Nearshore water quality is protected.

4.00 STATEMENT OF OBJECTIVES SOUGHT BY THE PROPOSED PROJECT

VIP seeks to repair and rehabilitate the referenced section of roadway which was compromised due to storm damage from Hurricane Maria. In order to prevent future damage to the roadway and related infrastructure, the existing culvert will be replaced, resulting in an increased area for stormwater drainage, and the western shoulder will be protected from future flooding events by installation of gabion basket and rip rap structures.

5.00 DESCRIPTION OF PROJECT

5.01 SUMMARY OF PROPOSED ACTIVITY

a) Purpose of Project

The purpose of the project is to rehabilitate a 120 foot section of roadway which was damaged from Hurricane Maria in 2017. The location is along West Scenic Road, Route 78. The West shoulder of the roadway suffered severe washout and will have to be rebuilt with gabion baskets to the roadway surface level where the wash-out occurred. The west area will be cleared of trees and brush. The washout will be cleared of loose subgrade and material, shored up and geotextile laid down. Gabion basket will be installed along with replacement of the washed-out culvert with a 30" HDPE Culvert Pipe with slope adjusted to provide adequate drainage. Concrete headwalls will be installed on both shoulders, backfill added and compacted, and a base asphalt layer along with surface layer will be applied with a crown profile. Additionally, Rip Rap will be installed at the spillway to further stabilize the culvert outlet.

b) Presence and Location of any Critical Areas and Possible Trouble Spots

The project area is in a very rural section along the northwest shore of St. Croix, with few developed properties in the area. The road is approximately a half mile from the shoreline, with the closest open water being Davis Bay. Due to the undeveloped nature of the area, the clearing of debris and repair of the roadway must not cause any impact to the immediate surrounding areas or wildlife.

Site slope is primarily steep slopes, between 40-90% with an average of 60%, outside of the flat profile of the road section. Elevation varies from 790 to 800 feet above sea level.

A review of Endangered Species in the area, using the USFWS Information for Planning and Consultation (IPaC) Tool, indicates there are no endangered terrestrial species within the proposed project site but identifies two federal endangered sea turtle species that are known to swim in the offshore waters north of the project area. These include: hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*) turtles. In addition, the West Indian Manatee (*Trichechus manatus*) has also been found in the offshore water near the project site and are a threatened species. Due to the significant distance from shore (over one half mile), there are no anticipated negative impacts to the migratory activities of these species.

In review of the 2018 VI DPNR Integrated Report, water quality in the area has been designated as currently Unknown due to lack of sampling stations in the area.

Due to the nature of the project scope of road rehabilitation, there exists potential for sedimentation and erosion during project activities. However, appropriate protective Best Management Practices (BMPs) will be employed through the entire project timeline in accordance with minimum requirements of the VI Environmental Protection Handbook (2002), and as the project footprint is essentially identical to the existing infrastructure, there are no anticipated impacts to stormwater and air quality.

These BMPs chosen will meet the minimum standards of the VI Environmental Protection Handbook (2002).

c) Proposed Method of Land Clearing

The brush and debris will be removed by cutting and staging vegetation as a brush berm on the downslope west side of the project area, and eventually will be removed off-site as green waste for disposal at the Waste Management Authority Transfer Station. Earth work will be limited to scraping road surface, excavating the culvert, and grading the washed out road shoulder.

d) Plans for Topsoil and Site Disturbance Provisions

Topsoil and site disturbance will be minimized during the construction timeline. The project will focus within the existing footprint of the road along the 120 foot length as depicted in the site drawings.

Some soil removal and compaction will occur at the west edge of the road, to stabilize for geogrid and riprap placement, and shoulder grading and shaping will occur to achieve correct profile for culvert and headwall construction and long-term drainage.

The site will otherwise see no topsoil or site disturbance, and compaction of subbase will occur before asphalt layers are placed down.

A Storm Water Pollution Prevention Plan (SWPPP) complying with the Department of Planning and Natural Resources' Construction General Permit requirements will be implemented during project activities.

e) Erosion and Sediment Control Devices to be Implemented

The following Best Management Practices (BMPs) will be implemented on the site to control runoff and protect natural resources:

Silt Fence – Due to the steep slopes and working in a drainage route, silt fencing shall be used to protect the downstream vegetated areas and control runoff and sediment loss on the west outlet side of the road.

Containment Berms– A containment berm will be constructed if needed to support silt fencing in containing stormwater.

Design of these BMPs will follow the minimum standards of the VI Environmental Protection Handbook (2002).

f) Schedule for Earth Changing Activities & Implementation of Erosion/Sediment Control Measures

No earth change activities will take place until the BMPs are installed at the site. Erosion and Sediment control for the Site Project construction will be managed as follows:

1. Ensure silt fencing and other BMPs are setup before work begins.

2. Minimize earth work in the vegetation removal and excavation of the west shoulder and protect any stockpiles with silt fencing.

3. Minimize re-stabilization time for shoulder to install geogrid, gabion baskets and riprap, as well as replace the existing pipe with a new one.

4. Compact and re-asphalt the road before removing silt fencing and/or berms.

g) Maintenance of Erosion and Sediment Control

Sediment control devices, such as dikes, swales, outlets and other BMPs will be inspected every 14 calendar days and after all heavy rainfall of 0.25 inches or more. If defects or damage are noted in the measures, the defect or damage will be immediately reported and repaired. If the measures prove to be inadequate to control erosion, changes will be made to the design and additional measures will be added as necessary.

Accumulated sediment will be removed when it reaches 40% of the height of the silt fencing. Worn, torn or otherwise damaged silt fencing will be fixed or replaced.

The site will be cleaned on a daily basis of litter, debris and materials such as paper, wood, concrete, etc.

h) Stormwater Management

No proposed changes to stormwater flows, quantities or direction is proposed for this project.

Management of stormwater for the duration of the project will be limited to ensuring no discharge of contaminated stormwater from the site boundaries, and prevention of erosion of project areas through controlled release from site discharge points.

All stormwater control devices will be inspected every 14 calendar days and after all heavy rainfall of 0.25 inches or more. If defects or damage are noted in the measures, the defect or damage will be immediately reported and repaired. If the measures prove to be inadequate to control stormwater flow, changes will be made to the design and additional measures will be added as necessary.

i) Maintenance Schedule of Stormwater Facilities

Sediment control devices, including dikes swales, and outlets, will be inspected every 14 calendar days and after any heavy rainfall of 0.25 inches or more. If defects or damage are noted in the measures, the defect or damage will be immediately reported and repaired. If the measures prove to be inadequate to control erosion, changes will be made to the design and additional measures will be added as necessary.

Accumulated sediment will be removed when it reaches 40% of the height of the silt fencing, and in accordance with the approved SWPPP requirements. Worn, torn or otherwise damaged silt fencing will be fixed or replaced. The site will be cleaned on a daily basis of litter, debris, and materials such as paper, wood, concrete, etc.

j) Sewage Disposal

Project sewage management will be limited to maintaining portable restrooms on site, and ensuring they are emptied by a qualified waste management company at an appropriate frequency to minimize spills or discharges from the site.

There are not any existing sewer lines (either private or municipal) in the area. The proposition of the installation of sewage system, units or piping is outside of the scope of this project.

5.02 SITE PLANS (See Attached Drawings)

5.02.01 Lot Layout (See Attached Engineer/Surveyor drawings)

5.02.02 Road Layouts (See Attached Engineer/Surveyor drawings)

5.02.03 Position of Structures (See Attached Engineer/Surveyor drawings)

5.02.04 Septic System/wastewater Treatment (Not Applicable)

5.02.05 Stormwater Drainage (See Attached Engineer/Surveyor drawings)

5.02.06 Stormwater Facilities (See Attached Engineer/Surveyor drawings)

5.02.07 Erosion and Sediment Control Plan (See Attached Spec Sheets)

5.02.08 Landscaping Plan (Not Applicable)

5.02.09 Other Required Drawings (See Attached Engineer/Surveyor drawings)

5.02.10 Required Maps (See Attached: Official Zoning Map, Parcel Map, FIRM)

5.03 PROJECT WORKPLAN

The project is proposed to be performed as 4 Phases, in sequential order with some overlapping tasks. It will entail Site preparation and mobilization, demolition and earth work, construction and finally demobilization and cleanup.

Phase 1 – Site Preparation

This phase will consist of mobilization and initial survey and staking. After layout determination and establishment, Erosion & Sediment control will be set up, along with Traffic and Pedestrian Control Plan that will follow Maintenance of Traffic (MOT) requirements set forth by USDOT. Mobilization of machinery and equipment will follow proper site setup for safety and protection of workers and environment.

Approximate Timeline – 48 days

Phase 2 – Demolition

This phase will begin with initial site clearing and basic grubbing to prepare for demolition. Vegetation will be removed and sent to the WMA Transfer station for green waste. Demolition of the culvert, headwall and existing damaged road structure will occur next, with C&D waste disposed of in the Anguilla Landfill via permitted dump trucks. After full demolition and removal of C&D waste, grading and excavation of soil and substrate will commence to prepare new structures for installation.

Approximate Timeline – 10 days

Phase 3 – Earth and Culvert Construction

This phase will entail construction and installation of gabion baskets, embankment shaping and setting, culvert installation and headwall casting. Inlet and Outlet modification and installation will complete the infrastructure layout.

Approximate Timeline – 24 days

Phase 4 – Roadway Construction

This final phase will focus on roadway construction and profile. Aggregate base will be laid over newly installed infrastructure. New safety guardrails will be installed according to included site plan drawings, and final asphalt layers will be applied per road construction specifications, to provide correct profile for safe driving conditions and to allow for proper drainage and storm resistance. Finally, installation of signage and pavement markings will complete the construction work, and the site will be stabilized and closed through any necessary landscaping and site cleanup as required by environmental standards and regulation.

Approximate Timeline – 16 days

All work on this road project will follow Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, as well as local building, environmental and safety regulations.

Total estimated time for construction completion is estimated at 98 days.

6.00 ECOLOGICAL SETTING AND PROBABLE PROJECT IMPACT ON THE NATURAL ENVIRONMENT

6.01 CLIMATE AND WEATHER

Prevailing Winds

The Virgin Islands lie in the "Easterlies" or "Trade Winds" that traverse the southern part of the "Bermuda High" pressure area, and the predominant winds are usually from the east-northeast and east (IRF, 1977). These trade winds vary seasonally and are broadly divided into 4 seasonal modes: 1) December to February; 2) March to May; 3) June to August; and 4) September to November. Below are the characteristics of these modes as taken from Marine Environments of the Virgin Islands Technical Supplement No. 1 (IRF, 1977), and based on U.S. Naval Oceanographic Office data.

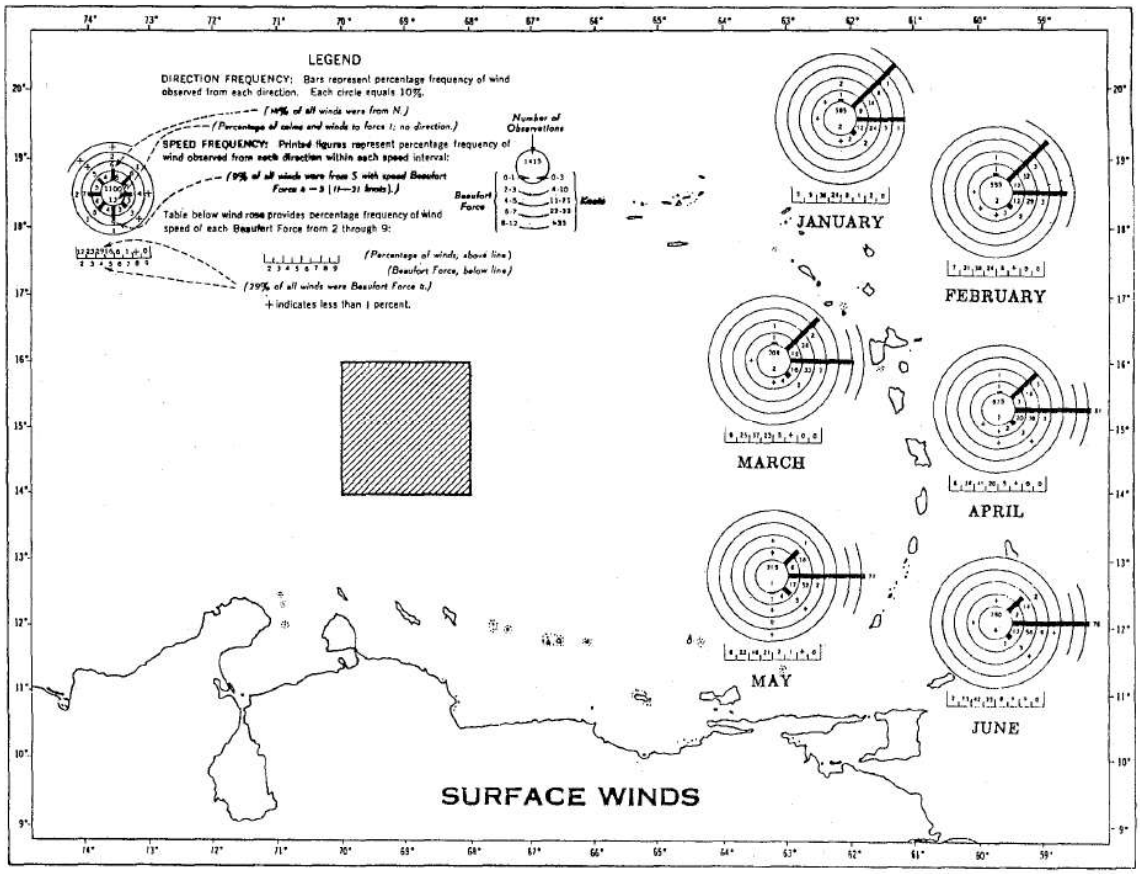


Figure 6.01.1 –Wind Direction and Speed Frequency, Central Caribbean, January – June.

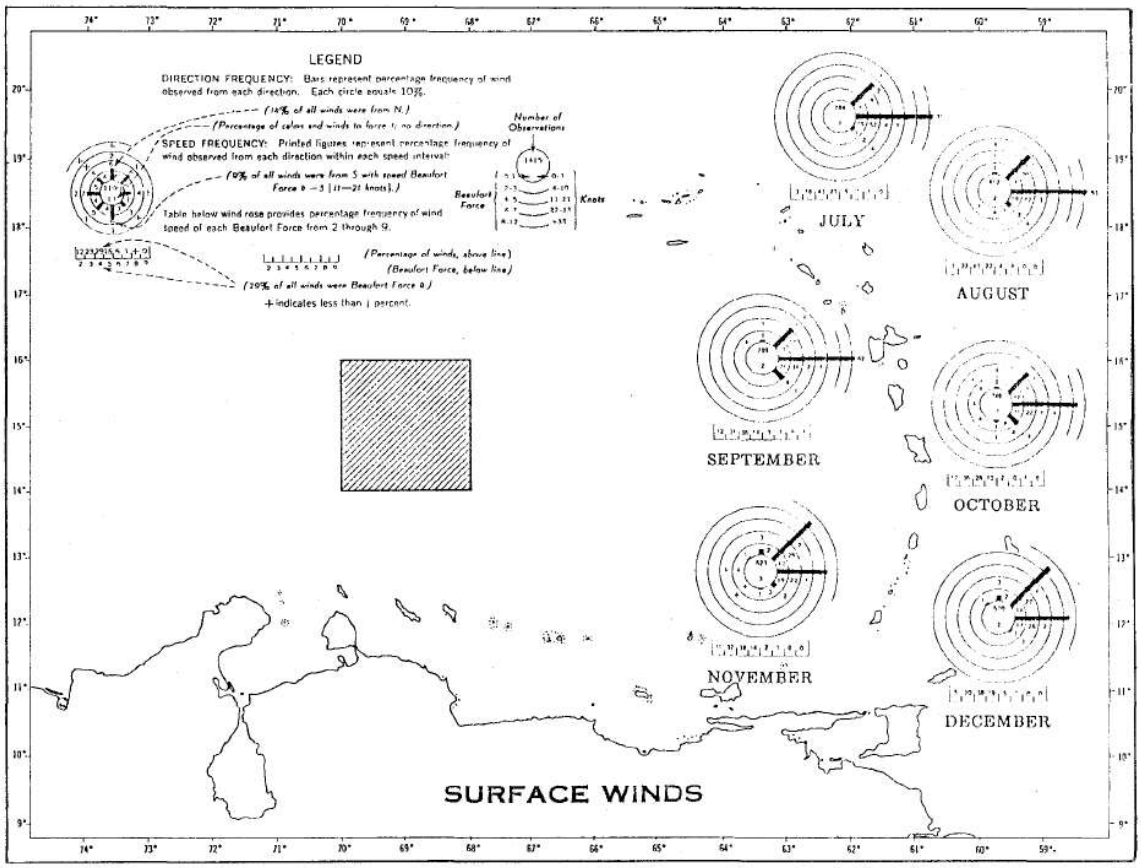


Figure 6.01.2 –Wind Direction and Speed Frequency, Central Caribbean, July – December.

December - February

During the winter, the trade winds reach a maximum and blow with great regularity from the east-northeast. Wind speeds range from eleven to twenty-one knots about sixty percent of the time in January. This is a period when the Bermuda High is intensified with only nominal compensation pressure changes in the Equatorial Trough. The trade winds during this period are interrupted by "Northerners" or "Christmas Winds," which blow more than twenty knots from a northerly direction in gusts from one to three days. Such outbreaks average about thirty each year. They are created by strengthening of high-pressure cells over the North American continent, which, in turn, allow weak cold fronts to move southeastward over the entire Caribbean region. These storms are accompanied by intermittent rains, clouds and low visibility.

March - May

During the spring, the trade winds are reduced in speed and blow mainly from the east. Winds exceed twenty knots only thirteen percent of the time in April. The change in speed and direction is the result of a decrease of the Equatorial Trough.

June - August

Trade winds reach a secondary maximum during this period and blow predominantly from the east to east-southeast. Speeds exceed twenty knots twenty-three percent of the time during July. The trend for increasing winds results from the strengthening of the Bermuda High and a concurrent lowering of the pressure in the Equatorial Trough. Trade winds during this period are interrupted by occasional hurricanes.

September - November

During the fall, winds blow mainly from the east or southeast and speeds reach an annual minimum. Only seven percent of the winds exceed twenty knots in October. The low speeds result from a decrease in the Equatorial Trough. During this period, especially during late August through mid-October, the normal trade wind regime is often broken down by easterly waves, tropical storms and hurricanes.

Storms and Hurricanes

There are numerous storm events each year, from squalls and thunderstorms to hurricanes. Standard rain events occur most frequently during the summer, lasting only a few hours and causing no pronounced change in the trade winds.

A tropical cyclone whose winds exceed 74 miles per hour is termed a hurricane in the northern hemisphere and can range in strength from causing little to no damage, to destroying. These hurricanes occur most frequently between August and mid-October with their peak activity occurring in September.

Figure 6.01.3 depicts NOAA data on historic Hurricanes and Tropical Storms in the vicinity of St. Croix.

Figure 6.01.3 – Historic Tracks of Hurricanes and Tropical Storms for St. Croix

Climate

The climate of St. Croix, as well as that of the Territory, is characterized by generally fair, tropical weather, with usually consistent wind speed and direction. Temperature swings are narrow, both seasonally and diurnally.

The closest weather station to the facility is located at the Henry E. Rohlsen Airport. Climate data from this station is found below in Table 6.01.1.

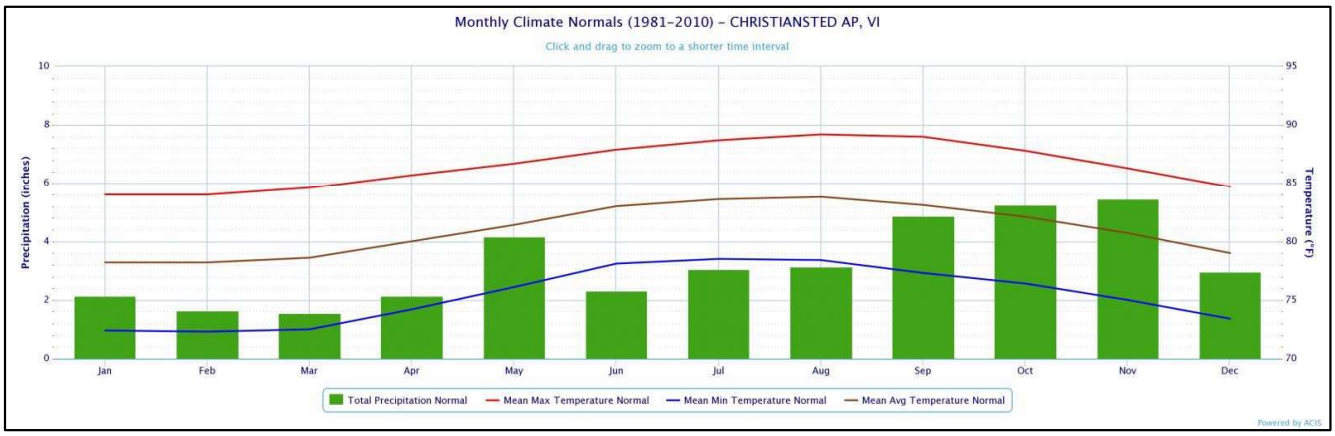


Table 6.01.1 –Average Temperatures in Christiansted, St. Croix

The nearest NOAA National Ocean Service Weather Station is located in Christiansted Harbor, St. Croix.

(Station CHSV3 – 9751364; ndbc.noaa.gov/station_page.php?station=chsv3).

Climate data from this station is found below in Tables 6.01.2 and 6.01.3 below.

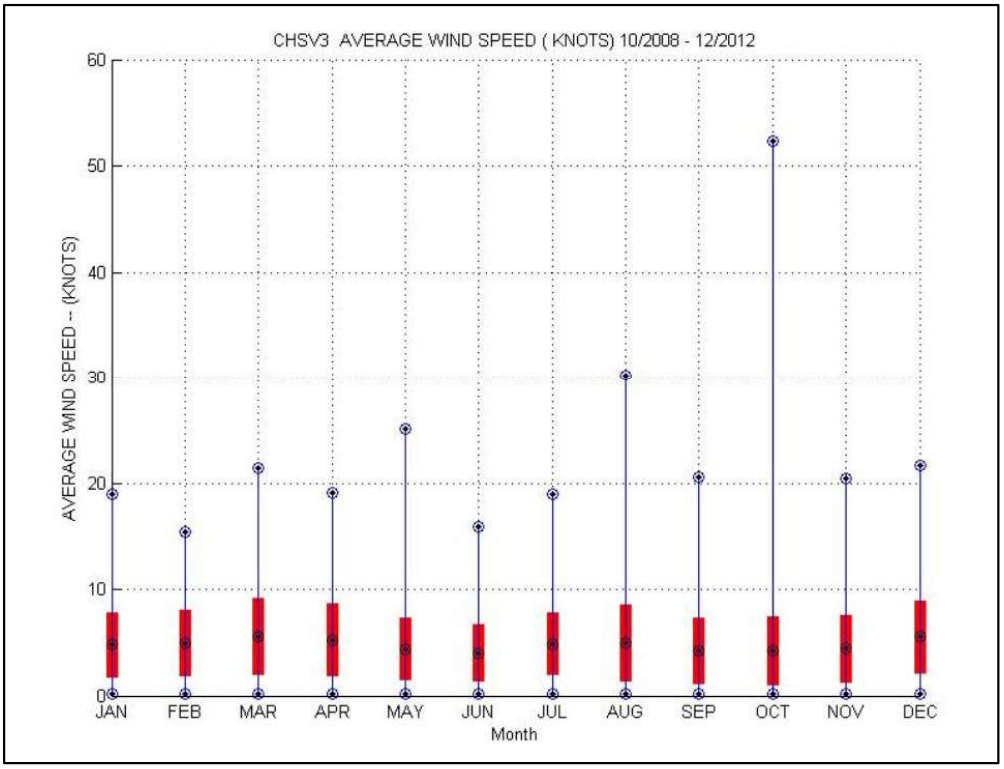


Table 6.01.2 – Average Wind Speed, St. Croix

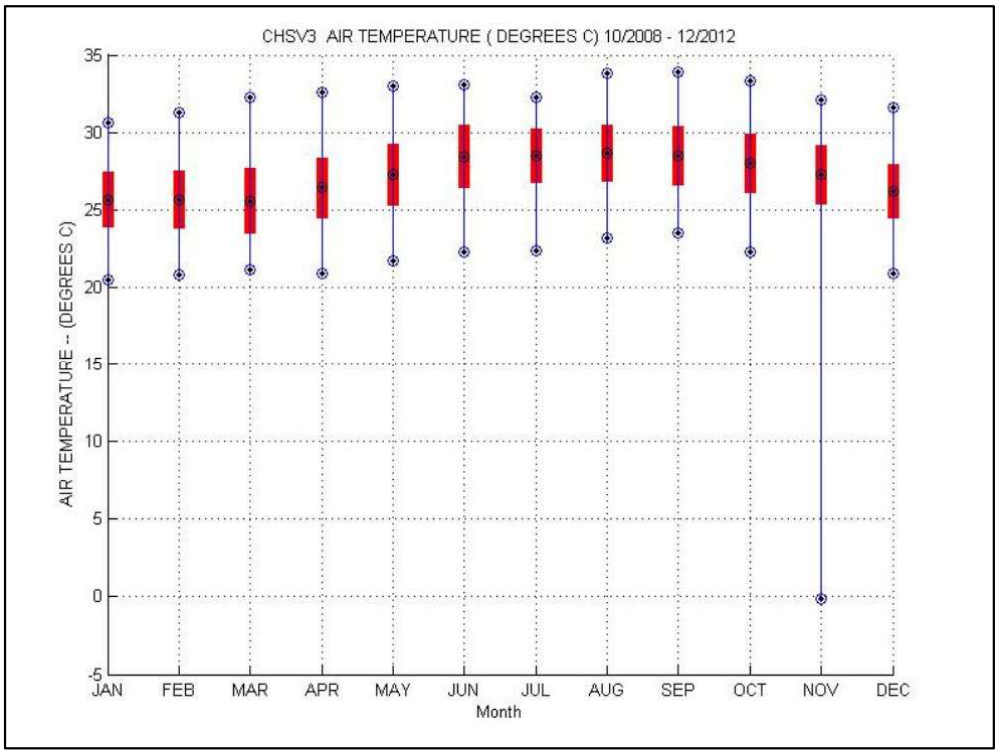


Table 6.01.3 – Average Air Temperature, St. Croix

The average annual rainfall on St. Croix is about 40 inches, ranging from about 30 inches in the east to more than 50 inches in the mountains of the northwest. Average annual temperature is a moderate 79°F, with an average low in winter of 76°F and an average high in summer of 84°F; temperatures are 2 to 3 degrees lower at altitudes of 800 to 1,000 feet. Occasionally maximum daily temperatures will exceed 90°F and minimum temperatures will be less than 70°F. Prevailing wind direction is from the east or northeast.

Rain generally occurs in brief, intense showers of less than a few tenths of an inch. Rains exceeding 1 inch in 48 hours occur about 7 or 8 times a year in the central part of the island; they are slightly more frequent in the mountains of the northwest and less frequent in the eastern part. February and March are the driest months and September is the wettest. Nearly half the average annual rain falls from August through November. Large storms can occur in any month although more likely during July to November, the hurricane season. (Jordan, 1975).

Impact on the Proposed Project

The applicant has carefully analyzed both climate and weather. The project and road rehabilitation have been designed to withstand Category V hurricane events and prevailing climate.

6.02 LANDFORM, GEOLOGY, SOILS AND HISTORIC LAND USE

Geology of St. Croix

St. Croix is the southernmost island of the U.S. Virgin Islands, lying 40 miles south St. Thomas and separated from it by an ocean trench 3,600 meters deep. It lies about 95 miles southeast of San Juan, Puerto Rico. St. Croix is the largest island in the USVI, with a total area of 82 square miles. The island is approximately 22 miles long, east to west and is about 7 miles in width. St. Croix is geographically located in the Lesser Antilles and lies completely within the Caribbean Sea.

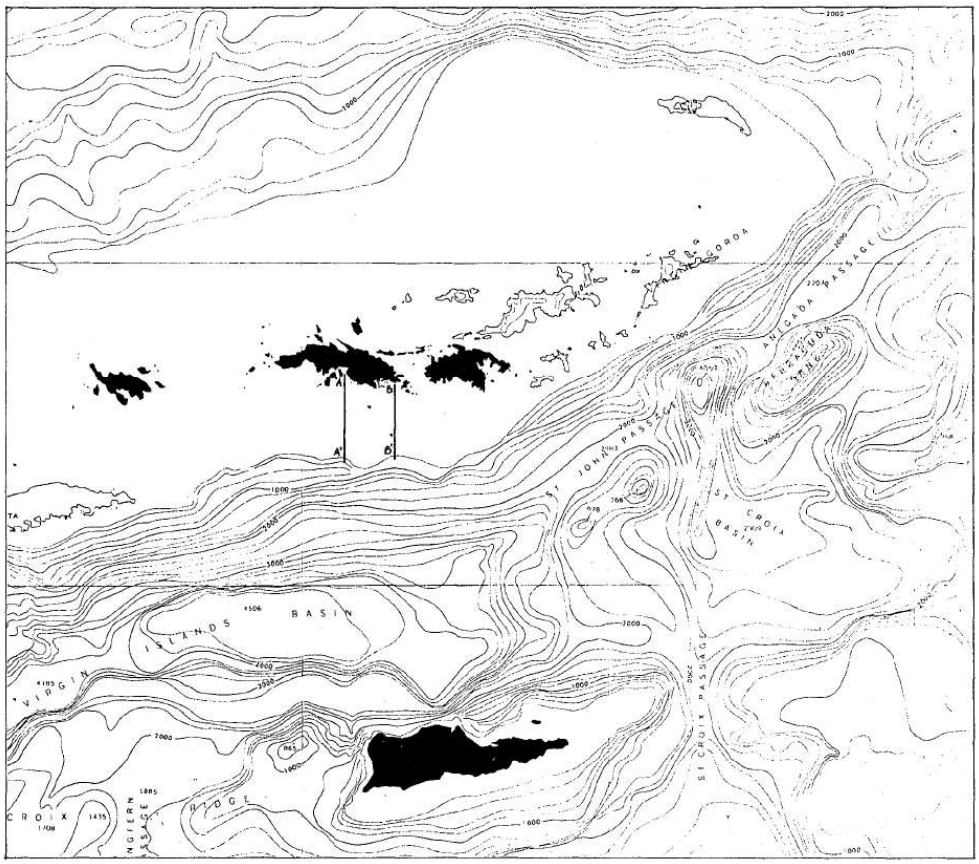


Figure 6.02.1 – Bathymetry of USVI basins and plateaus. From van Eepoel, et al, 1971.

The Virgin Islands are near the northeastern corner of the present Caribbean Plate, a relatively small trapezoidal-shaped plate which is moving eastward relative to the North and South American continents carried on the American Plate. The arc of the Lesser Antilles is an active volcanic arc above a subduction zone in which Atlantic oceanic crust of the American Plate is carried downward under the Caribbean Plate. The Caribbean Plate is sliding past North and South American plates along east-west trending northern and southern boundaries. The western boundary is a subduction zone in which the Cocos Plate is being driven northeastward and down under the edge of the Caribbean Plate west of Central America (Rogers, 1988).

St. Croix lies on a somewhat isolated, submerged ridge separated from the Puerto Rico Bank by the Virgin Islands Basin. Geologically it is related to the islands of the Puerto Rico Bank. If St. Croix was ever connected to the northern Virgins, it may have been separated from that group by either block (Meyerhoff 1927, Whetten 1966) or shear faulting (Adey 1977, Turner 1971).

The oldest rocks exposed on St. Croix are epiclastic volcanic sandstone and mudstone of the Caledonia Formation (Whetten 1966). These weakly metamorphosed, uplifted, folded and faulted rocks were derived from volcanic and other narrow-trench sediments originally

deposited by turbidity currents on the deep ocean floor about 70 to 80 million years ago (Adey 1977). Buck Island is an emergent part of the St. Croix shelf.

Somewhat later in the Cretaceous, one or more volcanoes formed on the sea floor to the south or southeast of St. Croix. Volcanic debris was shed northward to form the Judith Fancy formation, composed of tuffaceous sedimentary rocks, which occur on St. Croix but not on Buck Island.

St. Croix was uplifted above sea level in the Oligocene (Whetten 1974), originally as two islands. The East End Range (including proto-Buck Island) and the Northside Range were separated by a trough several miles wide. The trough was subsequently filled in by the deposition of the Kingshill marl formation. There then followed a period of mild deformation, post-Miocene uplift, and erosion to form the present-day topographic features (Rogers and Teytaud, 1988). Therefore, the island of St. Croix consists geologically of two predominant mountainous areas (the North side and the East End ranges), with a central sediment filled valley in between.

The limestone and marls that overlay the Jealousy formation are known as the Kingshill formation. After these formations were deposited, the area underwent another period of uplifting, the two islands became connected by the newly emergent filled-in area, and the island of St. Croix was formed. Since that time, geologic activity has been limited primarily to the erosion of sediments and the formation of ponds, beaches, reefs, and beach rock coast.

Two large basins, the Virgin Islands Basin and the St. Croix Basin, separate St. Croix from the other Virgin Islands. Within the distance between St. Croix and St. Thomas, about 40 nautical miles, hydrographic charts show that the ascent from the sea floor north of St. Croix is as much as 70º. Frasetto and Northrop (1057) indicate that this northern topographic slope extends downward to the Virgin Islands Basin at a gradient up to 43º. There is an ascent of 13,656 feet within a horizontal distance of 25,800 feet, terminating with the steep north coast in the vicinity of Hams Bluff.

The area has been described as the south side of the Anegada Trough and its related fault scarp (Taber 1922). Meyerhoff (1927) suggested that this block faulting took place during the late Pliocene or early Pleistocene, prior to which St. Croix was physically attached to the northern Virgin Islands.

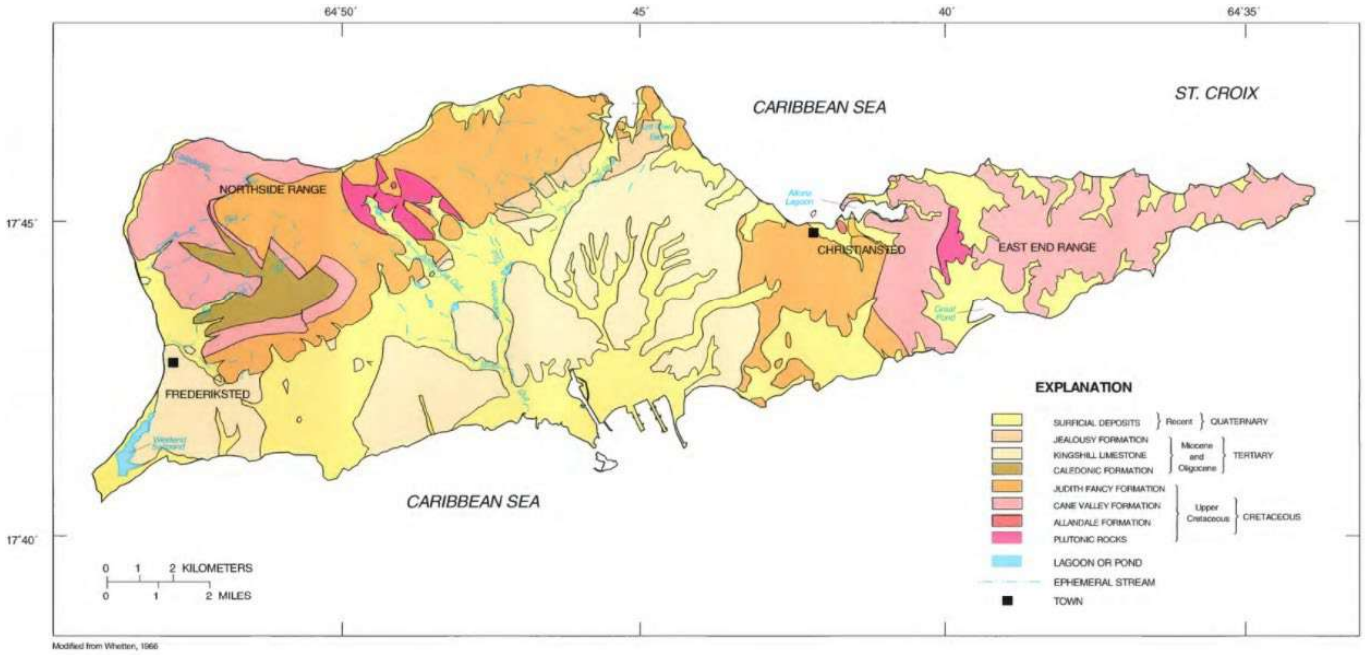
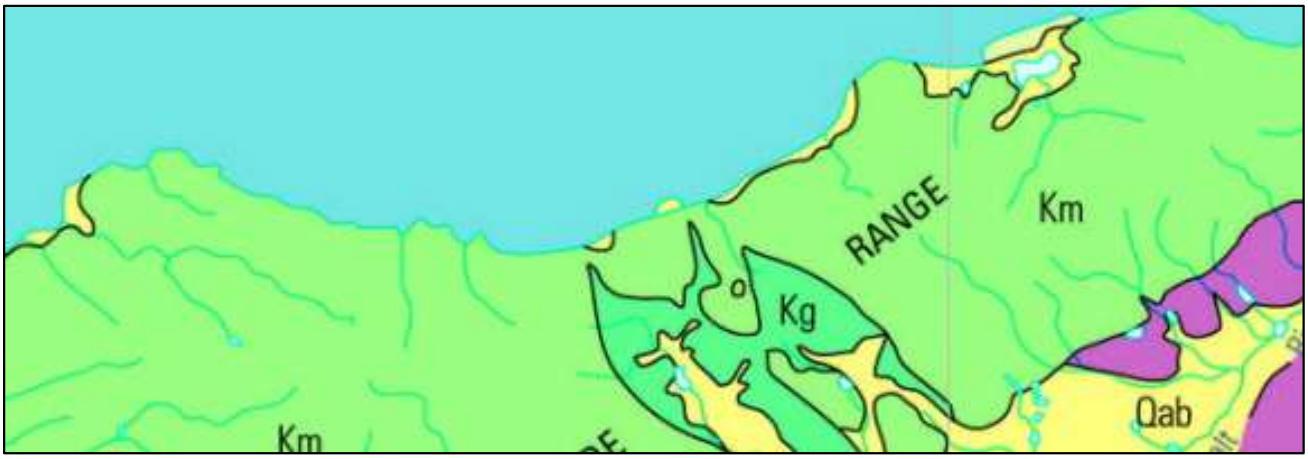


Figure 6.02.2 – General Geological formations of St. Croix. Atlas of Ground-Water Resources in Puerto Rico and the U.S. Virgin Islands



EXPLANATION

Quaternary deposits
- Qab — Alluvium, minor beach deposits
- Qr — Reef

Pliocene rocks
- Tbf — Blessing Formation

Miocene rocks

Kingshill Limestone
- Tmb — Mannings Bay Member
- Tlr — La Reine Member

Cretaceous rocks

Igneous intrusive rocks
- Kg — Gabbro
- Kd — Diorite
- Km — Mt. Eagle Group
- ---- Contact—Dashed

Figure 6.02.3 –Geological formations in vicinity of project site, St. Croix. Donnelly, 1959.

Geology of the Facility/Site

The project site is located at 17°45'13.9"N, 64°50'14.0"W, along Route 78, Scenic Road West. The Custom Soil Survey by the National Resource Conservation Service (NRCS) identifies the soil type for the project area as Annaberg-Cramer complex (Ac), extremely stoney.

The site is solely Annaberg-Cramer complex (Ac), but with varying slopes of between 12 to 90 percent slope. These extremely stoney, well-drained soils are made up of approximately 10 inches of gravelly loam, after which it turns to weathered and unweathered bedrock.

Elevation at the site varies from 790 to approximately 800 feet above sea level.

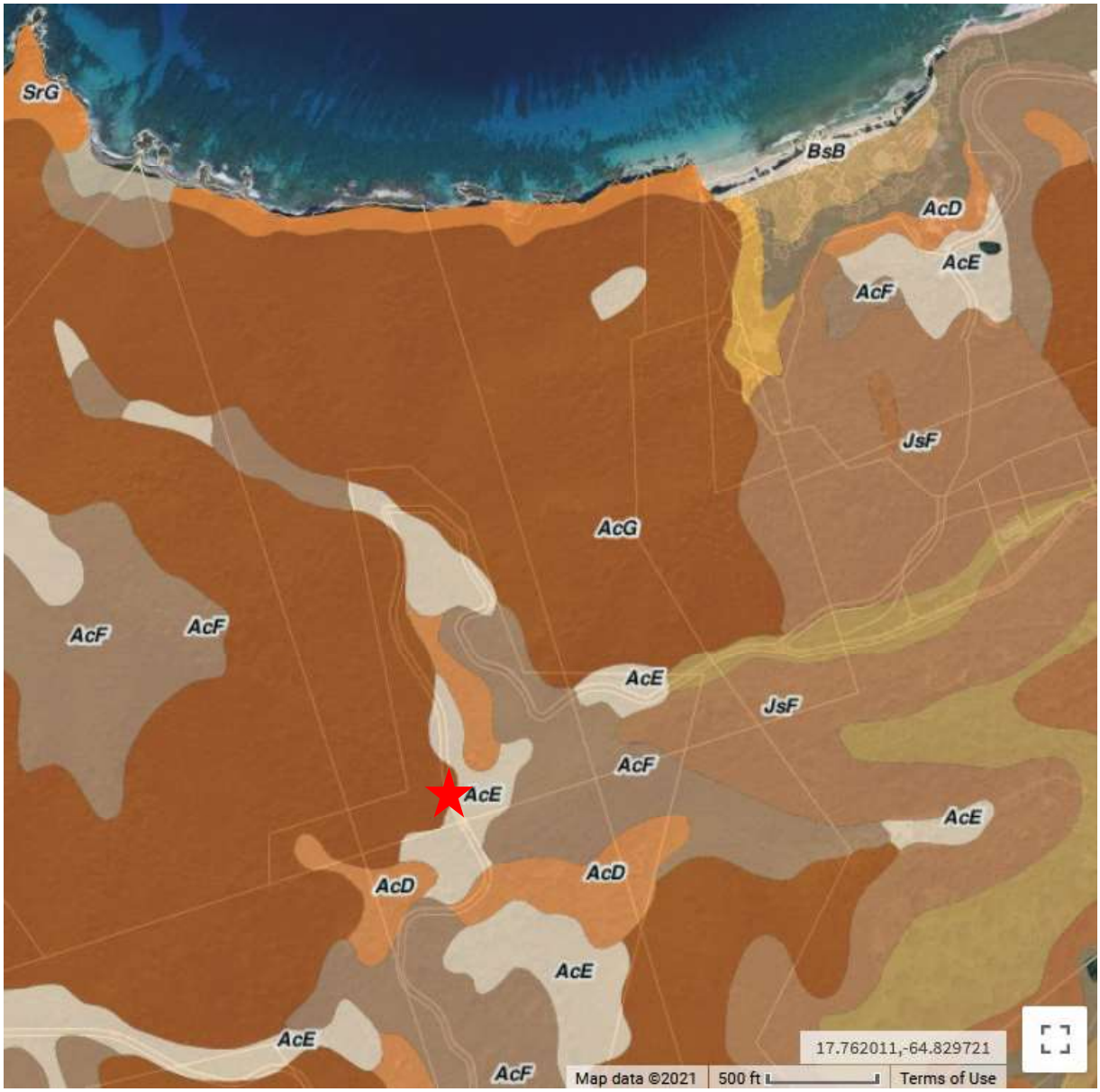


Figure 6.02.4 – MapGeo Soil Type Map

Historic Use

The land has been used as a transportation parcel for as long as records have been kept on historic uses.

Seismic Activity

The project will be built to meet or exceed the Standard Specifications for the Construction of Roads and Bridges on Federal Highway Projects requirements for Risk Category IV.

The Puerto Rico/Virgin Islands region is located at the northeastern corner of the Caribbean plate where motions are complex. The westward-moving North American plate is being driven under the Antilles Arc where volcanism is active. On the north side of the plate corner, the North American plate slides past the Caribbean but irregularities in the plate boundaries cause stresses that result in a complicated under thrusting of plate fragments. The interaction of plates causes the volcanism of the Antilles Arc on the eastern boundary of the Caribbean plate and creates major stresses all along the northern boundary (Nealon & Dillon, 2001).

Since the 1867 quake, there has been continuous low intensity activity all below 6.0 Richter. Over the last several years, numerous minor tremors have been felt on the island. This increased activity is associated with the volcanic eruptions that have been occurring to the southeast on the island of Montserrat.

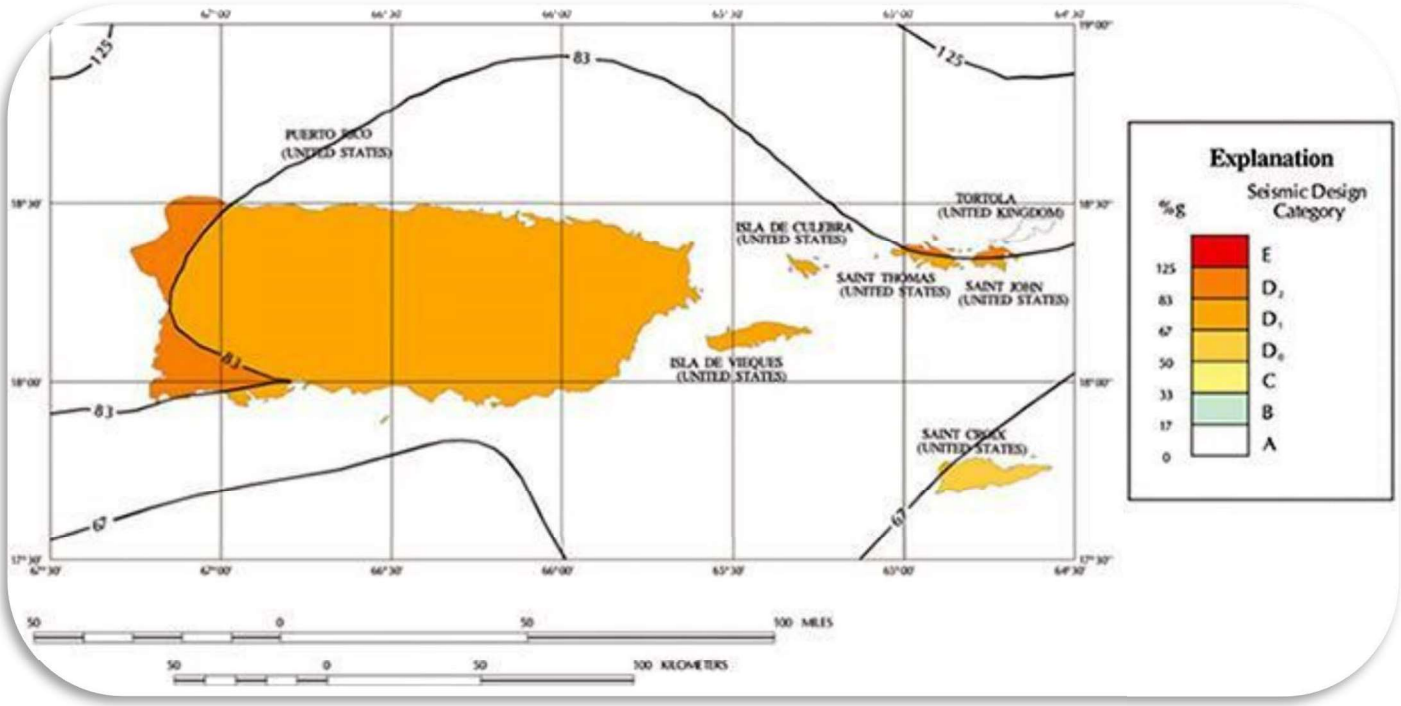


Figure 6.02.5 – FEMA Seismic Design Category Map

Impact of Geology on Proposed Project

The applicant has carefully considered landform, geology, soils and historic land use. The project has been designed consistent with these conditions, to improve the landform as it exists now and will cause minimal to no impact on the surrounding area and geology.

6.03 DRAINAGE, FLOODING AND EROSION CONTROL

a) Drainage Patterns

The road is located in relatively hilly terrain (most slopes between 40-90% slope). Stormwater flows along the road cut profile, running along the shoulder both from the north and south to converge at the culvert and box inlet, where it drains into the culvert and continuous north along the valley gut toward Davis Bay.

Washout occurred on the western shoulder where the outlet spilled into the receiving spillway and eventually continued into the gut/swale.

b) Proposed Alterations to Drainage Patterns

There are no proposed alterations to drainage patterns. The only change to drainage and storm water flow is to reinforce the spillway and outlet structure to ensure washout does not occur in the future.

c) Relationship of Project to Coastal Floodplain

The project area is outside of Coastal Floodplain borders, with the closest flood zones rated at Zone VE located approximately one half mile away.

See below in Figure 6.02.4 - Flood Insurance Rate Map Panel 67 of 94, April 16, 2007.

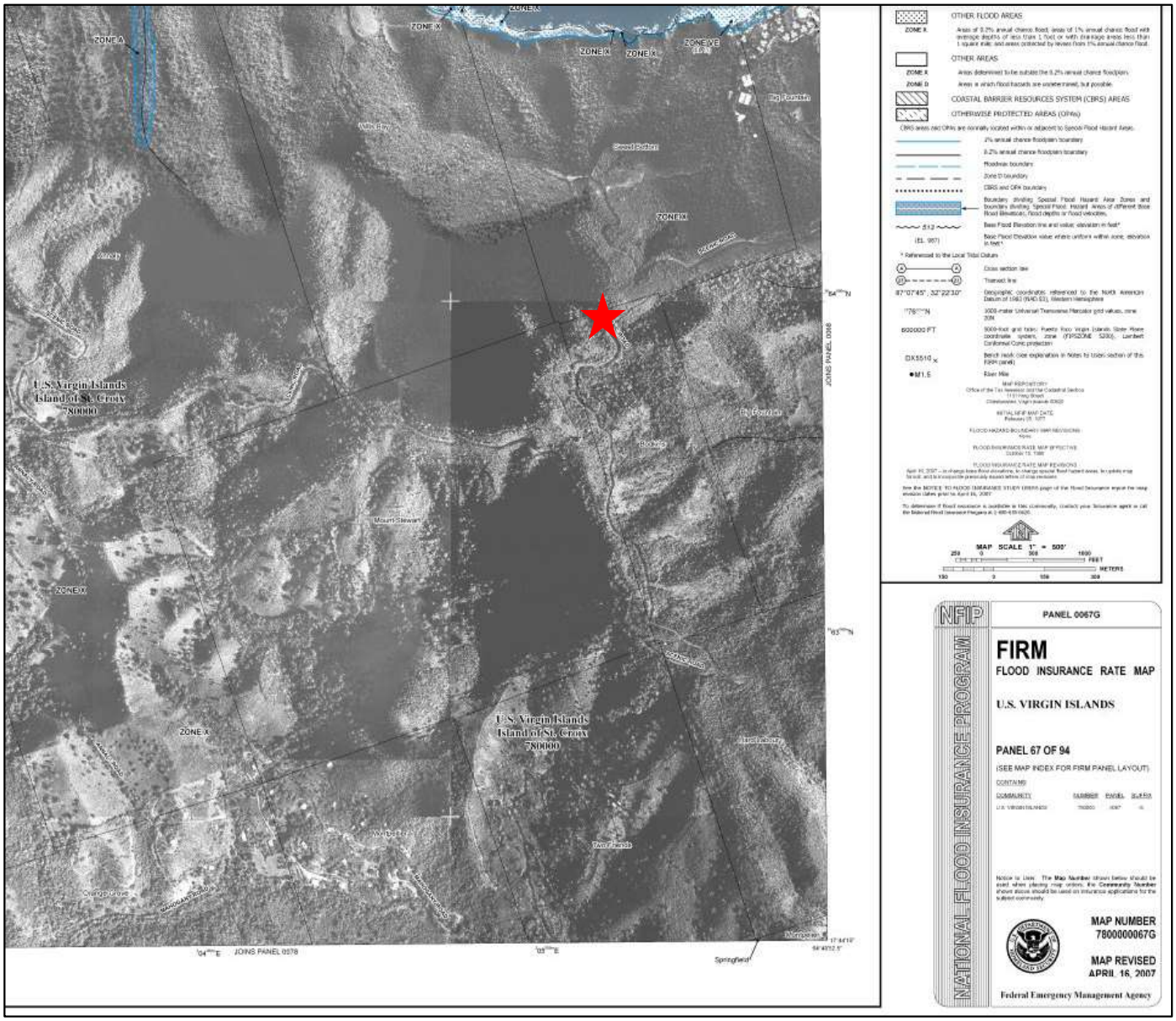


Figure 6.03.1 – Flood Map 7800000067, April 2007.

d) Peak Stormwater Flow Calculations

As the project proposes only to replace the existing culvert with an equivalently sized culvert, no hydrology report was prepared. No anticipated changes to peak stormwater flow rates or volumes will occur due to the proposed project work.

e) *Existing Stormwater Disposal Structures*

The existing stormwater disposal structures entail a culvert box inlet and single culvert that was washed out during Hurricane Maria. There are no documents showing the original sizing, but its lack of an adequate spillway caused the washout to occur.

f) *Proposed Stormwater Control Facilities*

This project proposes to remove the existing culvert and a new culvert installed with reinforced headway and culvert box inlet. The project itself will allow for improved performance during flood conditions, as a strengthened shoulder will be installed, improved subbase laid down and asphalt layers applied with a crown profile for improved drainage.

No proposed changes to stormwater flows, quantities or direction are proposed for this project, with the exception of the above reinforcement and repair work. Management of stormwater for the duration of the project will be limited to ensuring no discharge of contaminated stormwater from the site boundaries, and prevention of erosion of project areas through controlled release from site discharge points.

g) *Maintenance Schedule for Stormwater Facilities*

During construction, sediment control devices, including dikes swales, and outlets, will be inspected every 14 calendar days and after any heavy rainfall of 0.25 inches or more. If defects or damage are noted in the measures, the defect or damage will be immediately reported and repaired. The designs of any measures that prove to be inadequate to control erosion, will be changed and additional measures will be added as necessary.

Accumulated sediment will be removed when it reaches 40% of the height of the silt fencing, and in accordance with the approved SWPPP requirements. Worn, torn or otherwise damaged silt fencing will be fixed or replaced. The site will be cleaned on a daily basis of litter, debris and materials such as paper, wood, concrete, etc.

After construction is complete, a maintenance schedule will be prepared and submitted to the VI Department of Public Works for use in their routine O&M plan for stormwater infrastructure.

h) *Proposed Method of Land Clearing*

The brush and debris will be removed by cutting and staging vegetation as a brush berm on the downslope west side of the project area. Earth work will be limited to scraping road surface, excavating the culvert, and grading the washed out road shoulder.

i) *Provisions to Preserve Topsoil and Limit Site Disturbance*

Topsoil and site disturbance will be minimized during the construction timeline. The project will focus within the existing footprint of the road along the 120 foot length.

Some soil removal and compaction will occur at the west edge of the road, to stabilize for geogrid and riprap placement, and shoulder grading and shaping will occur to achieve correct profile for culvert and headwall construction and long-term drainage.

The site will otherwise see no topsoil or site disturbance, and compaction of subbase will occur before asphalt layers are placed down.

A Storm Water Pollution Prevention Plan (SWPPP) will be implemented during project activities.

j) Critical Areas and Possible Trouble Spots

The project area is in a very rural section along the northwest shore of St. Croix, with few developed properties in the area. The road is approximately a half mile from the shoreline, with the closest open water being Davis Bay. Due to the undeveloped nature of the area, the clearing of debris and repair of the roadway must not cause any impact to the immediate surrounding areas or wildlife.

Site slope is primarily steep slopes, between 40-90% with an average of 60%, outside of the flat profile of the road section. Elevation varies from 790 to 800 feet above sea level.

A review of Endangered Species in the area, using the USFWS Information for Planning and Consultation (IPaC) Tool, indicates there are no endangered terrestrial species within the proposed project site but identifies two federal endangered sea turtle species that are known to swim in the offshore waters north of the project area. These include: hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*) turtles. In addition, the West Indian Manatee (*Trichechus manatus*) has also been found in the offshore water near the project site and are a threatened species. Due to the significant distance from shore (over one half mile), there are no anticipated negative impacts to the migratory activities of these species.

In review of the 2018 VI DPNR Integrated Report, water quality in the direct receiving area is currently Unknown due to lack of sampling stations in the area.

Due to the nature of the project scope of road rehabilitation, there exists potential for sedimentation and erosion during project activities. However, appropriate protective Best Management Practices (BMPs) will be employed through the entire project timeline in accordance with minimum requirements of the VI Environmental Protection Handbook (2002), and as the project footprint is essentially identical to the existing infrastructure, there are no anticipated impacts to stormwater and air quality.

k) Erosion and Sediment Control Devices to be Implemented

The following Best Management Practices (BMPs) will be implemented on the site to control runoff and protect natural resources:

Brush Berm – A brush berm will be constructed initially as clearing occurs, to protect against sediment loss until silt fencing can be installed.

Silt Fence – Due to the close proximity to the shoreline, silt fencing shall be used to protect the shoreline and surface water from runoff and sediment loss on the north side along the beach/sand line.

Containment Berms – A containment berm will be constructed if needed to support silt fencing in containing stormwater.

All BMPs will be installed and maintained to the minimum standards found in the VI Environmental Protection Handbook (2002).

l) Maintenance of Erosion and Sediment Control

Sediment control devices, such as dikes, swales, outlets and other BMPs will be inspected every 14 calendar days and after all heavy rainfall of 0.25 inches or more. If defects or damage are noted in the measures, the defect or damage will be immediately reported and repaired. If the measures prove to be inadequate to control erosion, changes will be made to the design and additional measures will be added as necessary.

Accumulated sediment will be removed when it reaches 40% of the height of the silt fencing. Worn, torn or otherwise damaged silt fencing will be fixed or replaced.

The site will be cleaned on a daily basis of litter, debris and materials such as paper, wood, concrete, etc.

m) Impacts to Terrestrial and Shoreline Erosion

The project area is in a very rural section along the northwest shore of St. Croix, with few developed properties in the area. The road is approximately a half mile from the shoreline, with the closest open water being Davis Bay. The near-distance watershed terrain is hilly with steep slopes, but is well vegetated, and has very little exposed soils. The project site boundary itself, which is essentially the road section, is fully developed consisting of 95% of either impervious asphalt or flat packed earth surface.

The proposed development will not alter the existing drainage patterns of the site. Stormwater flows along the road cut profile, running along the shoulder both from the north and south to converge at the culvert and box inlet, where it drains into the culvert and continuous north along the valley gut toward Davis Bay. Washout occurred on the western shoulder where the outlet spilled into the receiving spillway and eventually continued into the gut/swale. Silt Fencing will be set up with reinforcing berms as needed to ensure catchment of direct runoff from the project area, thereby minimizing potential impact to the

shoreline and receiving waters. These discharges eventually enter Davis Bay, classified as Class B waters.

All standard sediment and erosion control devices and Best Management Practices (BMPs) will be implemented when performing any site work and will be maintained throughout the life of the facility. Permanent BMPs shall be maintained by DPW according to standard practices on a regular schedule and after storm events.

These erosion control devices, combined with the receipt of a VI CGP storm water coverage and routine inspections, maintenance and repairs, will ensure no impact to either terrestrial or shoreline erosion.

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6.04 FRESH WATER RESOURCES

St. Croix, USVI is limited in the amount of freshwater resources to a few wells located around the island and mostly intermittent and ephemeral streams and ponds which dry up during periods of limited rainfall. Some perennial streams and freshwater ponds/basins do exist, but not as a reliable source of freshwater. The majority of potable water is either captured by rooftops and stored in cisterns or is desalinated seawater. The project will use freshwater only for grading, compaction and general dust control needs. The project will have no negative impact on the availability of freshwater resources.

6.05 OCEANOGRAPHY

a) Seabed Alteration

No alteration or impact to the existing seabed is anticipated as part of this project and operation.

b) Tides and Currents

The surface currents throughout the Caribbean are driven by the North Equatorial Current that runs through the islands west-northwest and then joins the Gulf Stream (Figure 6.05.a-F.2). These currents change very little from season to season with the currents coming more from the south during the summer months. Because of the shallowness of the Caribbean basin, less than 3200 feet, mainly surface water from the Atlantic flows through the islands (Figure 6.05.1). Currents have been observed at Christiansted Harbor ranging between 1 and 3 knots, depending on weather conditions (IRF 1977).

St. Croix's tides typically exhibit two (bi-modal) 'peaks' during the diurnal period (24-hour day), with the second (lesser) 'peak' with relatively small ebbs and flows. The mean tides range from 0.8 feet to 1.0 feet and the spring tidal ranges reach up to 1.3 feet (IRF 1977).

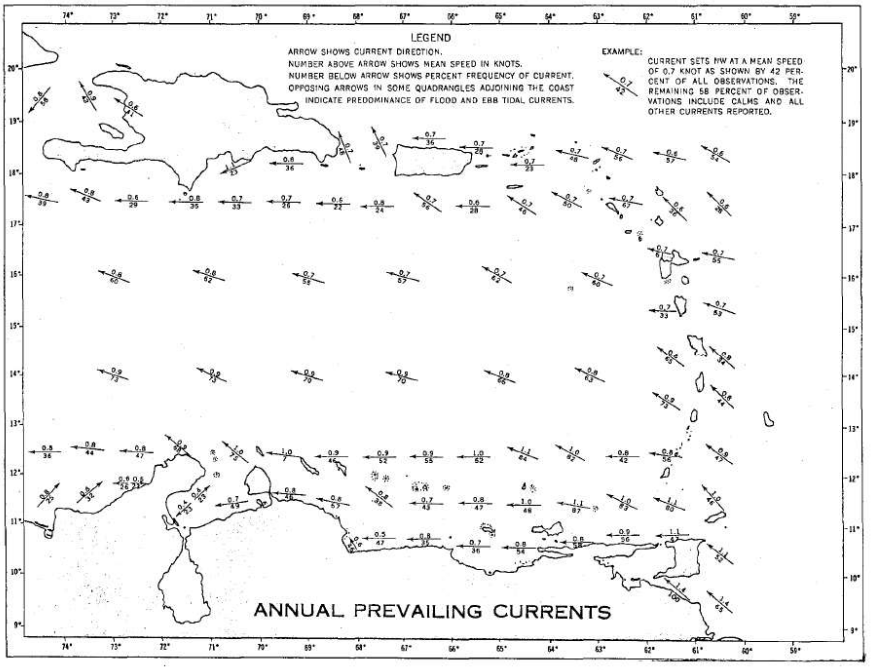

Figure 6.05.1 – Annual prevailing currents in the Caribbean. US Naval Oceanographic Office (1963)

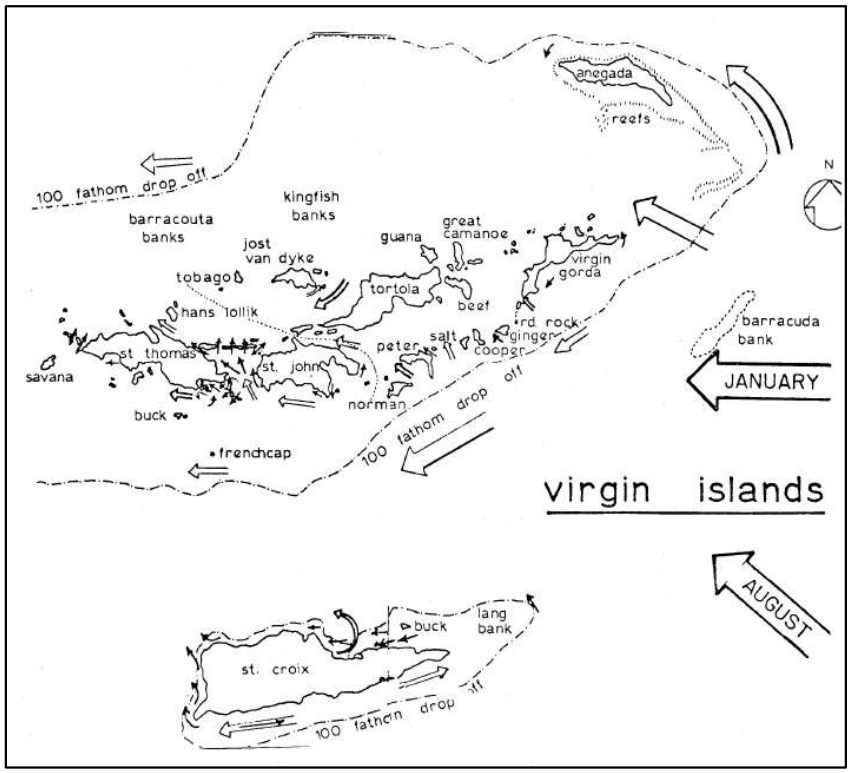

Figure 6.05.2 – General current patterns on the island platforms. From Dammann, et al (1969)

In the Virgin Islands, tidal ranges are not great, and tidal currents, except in some inshore localities, are not significant. The small islands, lacking complex shoreline physiography, do not restrict changes in water level. The sea flows around the islands relatively unimpeded, resulting in tidal fluctuations of only a few inches to a foot. Further, the steep slopes of the islands rising out of the water means that the intertidal zone – the part of the shoreline regularly covered and uncovered by the tides - is very narrow. We therefore do not have large areas of tidal flats uncovered at low tides as in other places in the world, especially along continental coastal zones.

One of the consequences of this small tidal action is that water exchange in bays due to tidal action is usually very small. For example, it is estimated that 24 to 40 tidal cycles alone would be necessary to exchange all the water in the main part of St. Thomas harbor (Percious, et al, 1972). Fortunately, waves, swells and oceanic currents usually do a good job of flushing most bays. However, these forces are considerably reduced by the time they reach the heads of deep embayments.

As a result, circulation may be poor in the inner reaches of some of our larger embayments. The innermost portions of the mangrove lagoon on St. Thomas, of Salt River, St. Croix and of Coral Bay, St. John are like this. To a lesser extent, similar conditions have been observed at the head of Vessup Bay (Redhook), St. Thomas and Cruz Bay, St. John, and probably occurs in other similar locations (IRF, 1977).

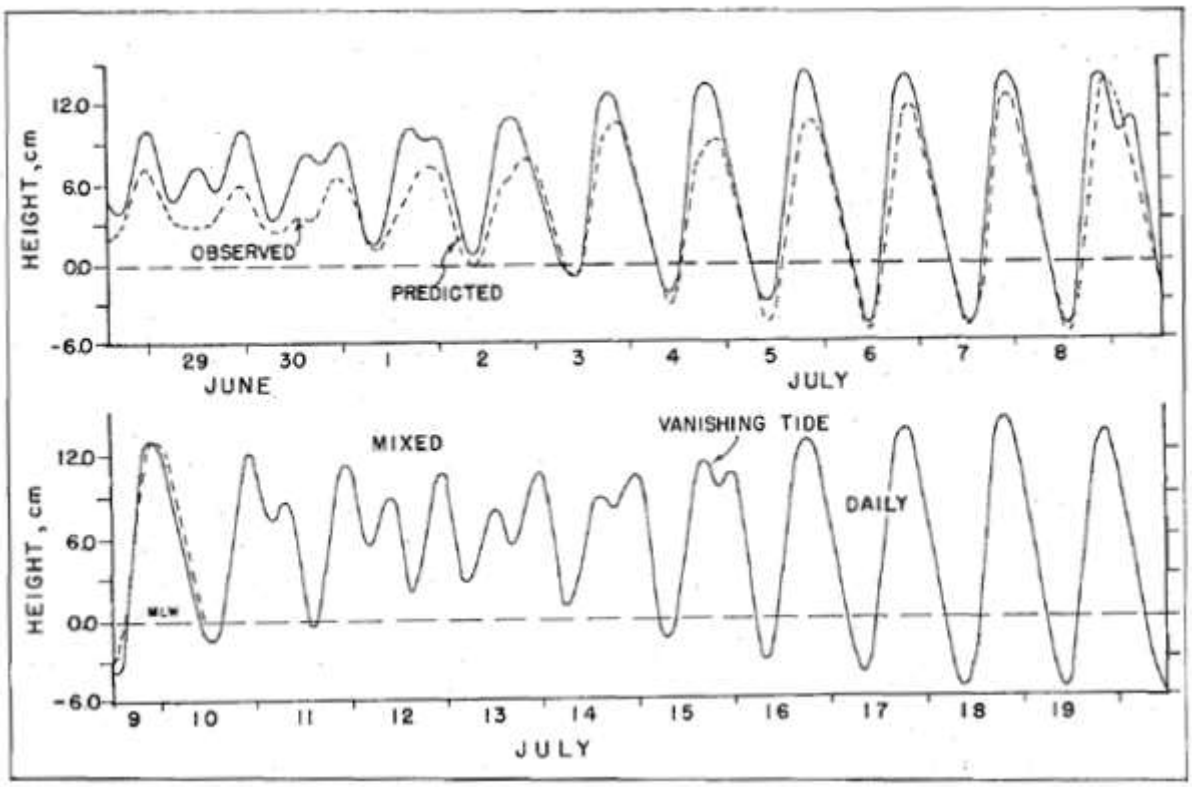

Figure 6.05.3 – Variations in the character of the tide displayed in time-height curves, from predicted tables and from observed tides in Christiansted harbor, June 29 - July 19, 1971. From Nichols, et. at, 1972.

The closest NOAA tidal station is located in Christiansted Harbor, St. Croix, VI and is Station ID: 9751364. The NOAA tidal station is located at Latitude: 17° 44.9' N and Longitude: 64° 41.9' W. The mean range is 0.69 ft. and the diurnal range is 0.74 ft. Tidal data from the station is shown below.

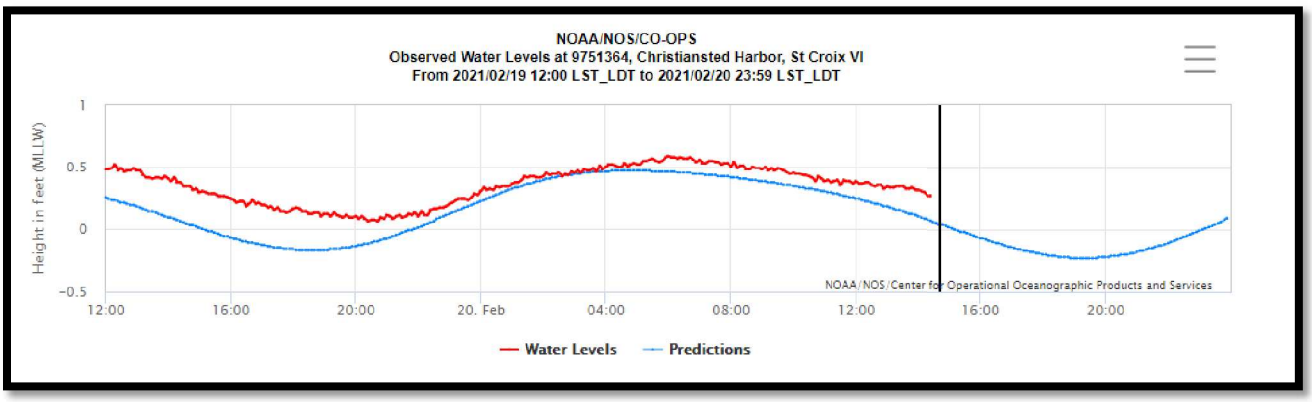

Figure 6.05.4 – Observed Water Levels in Christiansted, St. Croix

c) Wave and Wind Impacts

Due to the location and elevation, there are no anticipated wave or wind impacts for this project or operation.

d) Marine Water Quality

The water surrounding the site is classified as Class B which includes uses such as the propagation of desirable species of marine life and primarily contact recreation such as swimming, water skiing, etc.

The waterbody to the North is Davis Bay, a Class B Water. Water quality criteria, noted in 12 VIRR 186, include dissolved oxygen not less than 5.5 mg/l from other than natural conditions. The pH must not vary by more than 0.1 pH unit from ambient, and at no time may the pH be less than 7.0 or greater than 8.3. Bacteria (enterococci) cannot exceed 30 CFU/100ml (30-day geometric mean), turbidity readings cannot exceed 3 NTUs, and clarity may not exceed a level where a Secchi disc cannot be visible at a minimum depth of one meter.

VI DPNR performs routine water quality measurements around the U.S. Virgin Islands. However, this particular water body is not sampled as part of the testing programs managed at VI DPNR:

Waterbody	Location	Sample Station Number
VI-STC-09	Davis Bay	None

In VI DPNR's 2018 Integrated Report (IR), which entails CWA Section 305(b) water status report and the CWA 303(d) list, the Davis Bay Assessment Unit is listed as "Unknown" for Water Quality status.

A Total Maximum Daily Load (TMDL) for this waterbody has **not** been established for this waterbody.

Impact of the Proposed Project

The applicant has carefully considered operations onsite and how it would affect water quality. Existing operations has been setup carefully to control storm water runoff from the site, and direct all of it to regulated and controlled discharge points.

A stringent sedimentation and erosion control plan will be implemented and monitored during the life of the operation. As discussed in Section 5.01, storm water both during construction and after construction will be strictly managed and discharged pursuant to a TPDES storm water permit requiring regular monitoring and reporting to ensure permit compliance.

6.06 MARINE RESOURCES AND HABITAT ASSESSMENT

Existing shoreline near the site is composed of solely exposed rocky cliffs with small stoney beach coves. The project site is located on the north shore of the island of St. Croix. The north shore is more rural, with lower development and fewer anthropogenic sources of pollution.

NOAA and DPNR have established the Cane Bay as an Area of Particular Concern (APC) and designated it as a protected area in the 2020-2025 United States Virgin Islands' Coral Reef Management Priorities document. Figure 6.06.1 below depicts the mapped AOC within the Cane Bay area.

This area abuts the Cane Bay APC, and has similar characteristics in terms of water quality, marine life, resources and watershed development type. It's considered a very minimally impacted location, both in terms of watershed and waterbody, and similar concerns and protective goals are set by regulatory agencies.

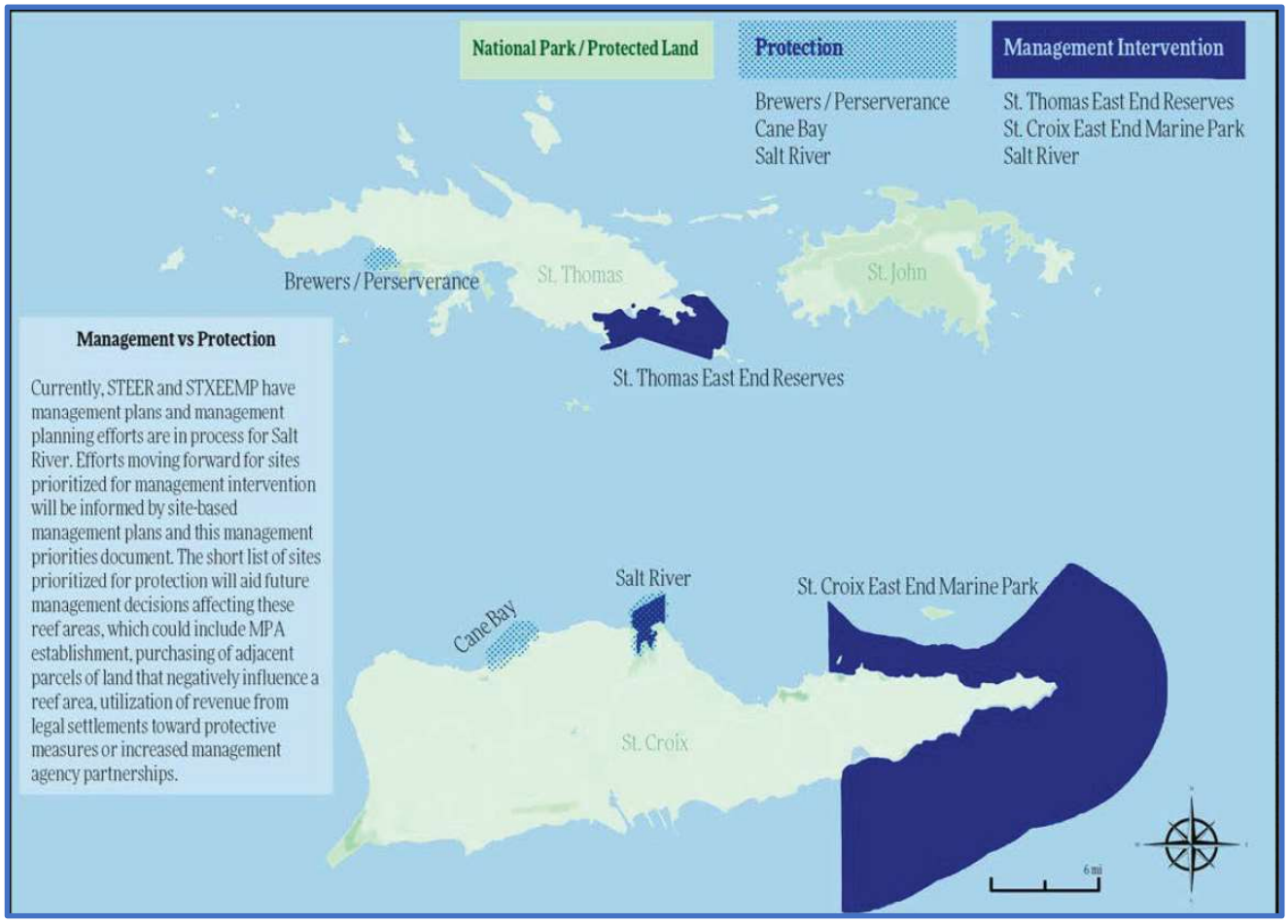

Figure 6.06.1 – Cane Bay APC, NOAA

A review of the 2002 NOAA Benthic Habitat Maps shows the majority of the surrounding habitat is either Reef/Colonized Bedrock, Reef/Colonized Pavement with Channels, or Reef/Linear Reef

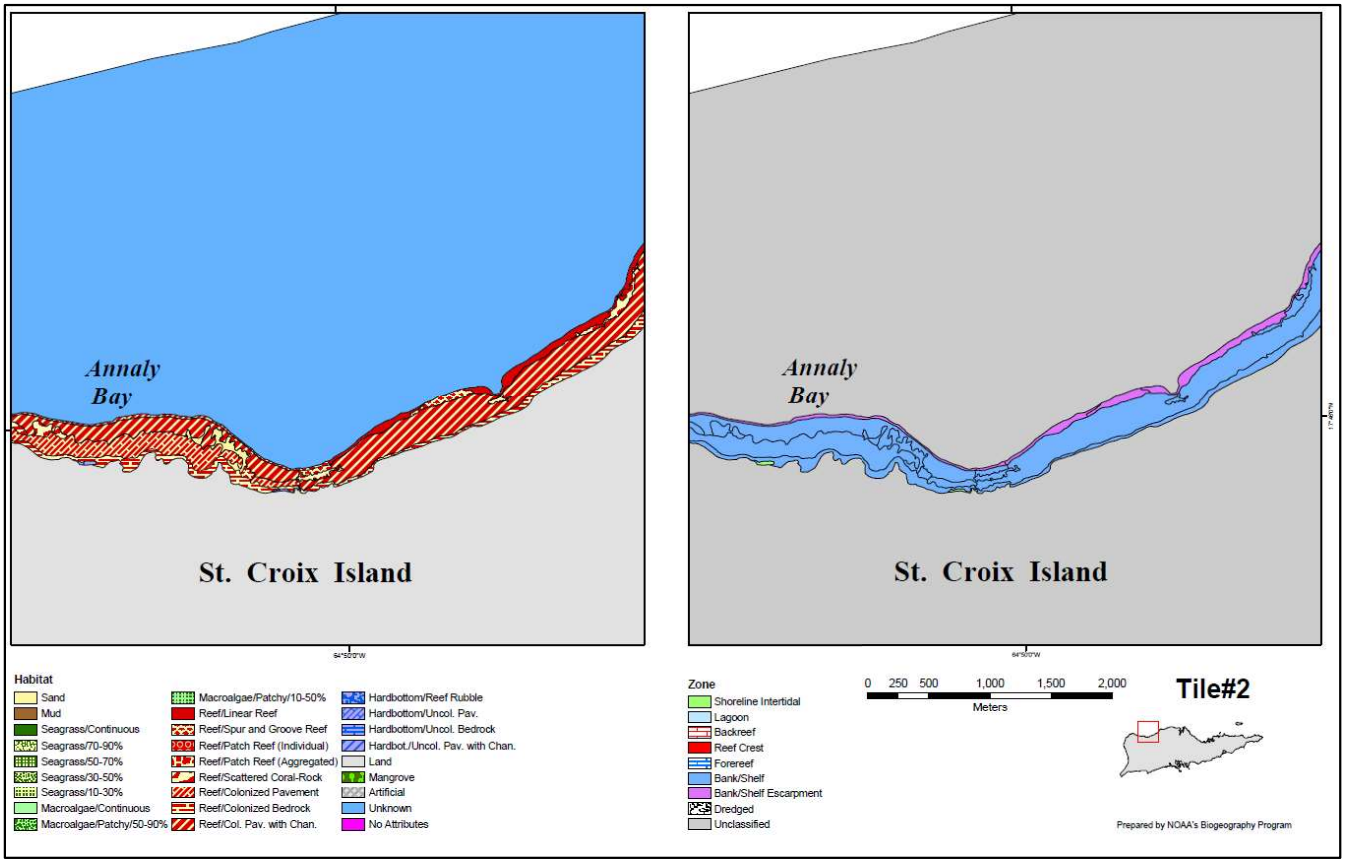

Figure 6.06.2 – 2002 NOAA Benthic Habitat Maps, North Shore St. Croix, USVI.

A review of Endangered Species in the area shows no listed or nominated coral species in the nearshore area. Two federal rare and endangered sea turtle species are known to swim in the offshore waters south of the project area. These include: hawksbill (*Eretmochelys imbricata),* and leatherback (*Dermochelys coriacea*) turtles.

6.07 TERRESTRIAL RESOURCES

An assessment by Horsley Witten's Senior Ecologist at the site showed no specific species or habitat of particular concern in the project area or in any close proximity.

The Environmental Sensitivity Index (ESI) Map for the St. Croix island does note a threatened species of plant, *Erythrina eggersii*, has been observed and documented in the area, as shown in Figure 6.07.1 below.

Erythrina eggersii is a vine or tree in the family Fabaceae which is commonly known as cock's-spur, espuelo de gallo, or pinon espinoso. It is native to Puerto Rico, the British Virgin Islands and the U.S. Virgin Islands, where it is threatened by the act of habitat loss.

As noted above, during the terrestrial ESA review, no such plant was observed; however, should any *Erythrina eggersii* or other threatened plant or animal be encountered, staff at VI DPNR – DFW will be contacted immediately at (340) 773-1082.

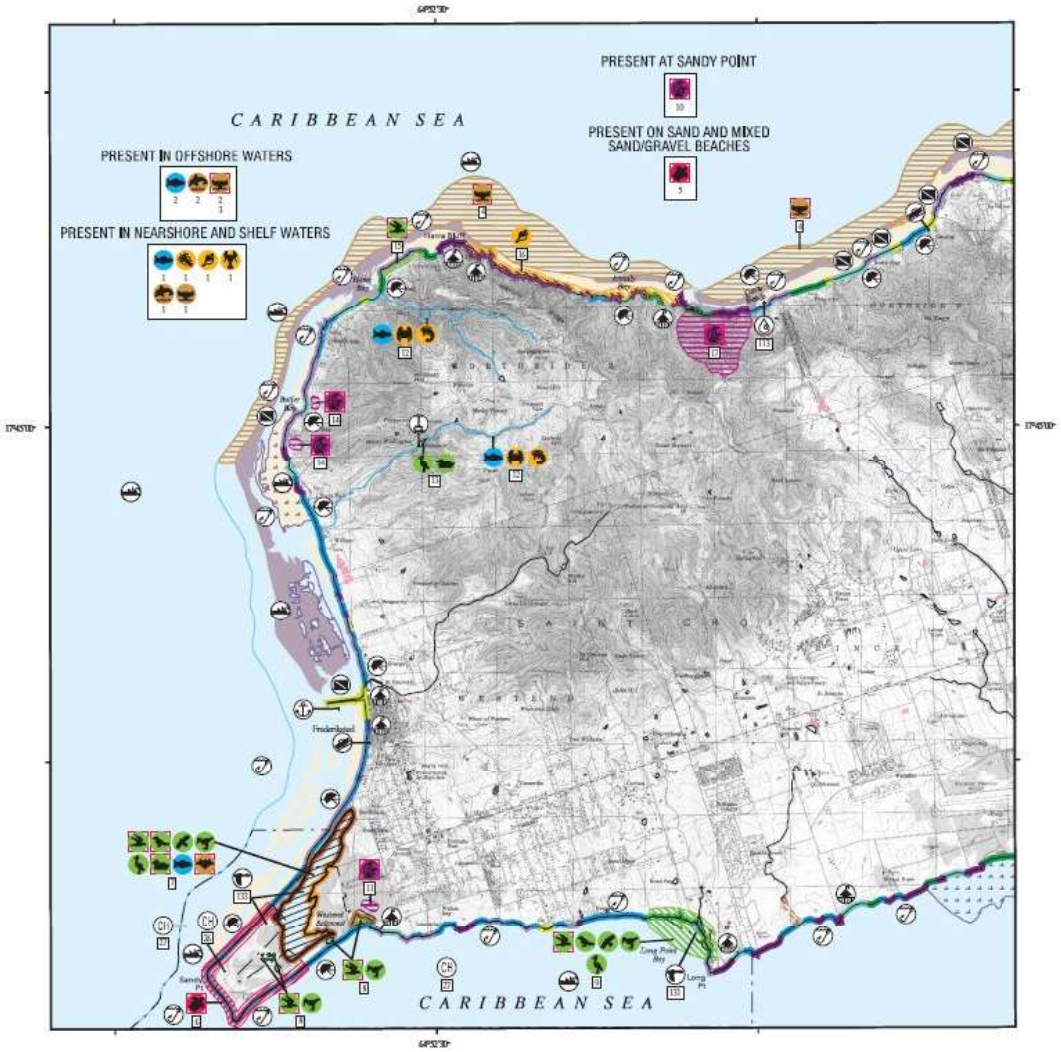

Figure 6.07.1 – Environmental Sensitivity Index Map, St. Croix, USVI.

Impact of the Proposed Project

As part of recommendations set by the Section 7 CWA Endangered Species Act consultation with USFWS, VIP will minimize the footprint of work to the greatest extent possible and is not expected to extend farther than necessary beyond the road shoulder to complete repairs.

As the site will not see expansion beyond the existing footprint with the exception of shoring up the west shoulder, and compliance with both stormwater and air pollution permits will be ensured through the life of the facility, there are no anticipated negative impacts to these species or their habitat, neither in the nearshore waters nor on land.

6.08 WETLANDS

The U.S. Army Corps of Engineers defines wetlands as "those areas that are periodically inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, bogs, marshes and similar areas." (U.S. Army Corps of Engineers, 1986).

There are no terrestrial wetlands within the project area and is over one half mile from any open waterbodies.

6.09 RARE AND ENDANGERED SPECIES

There are no rare or endangered species observed on the site, though the site is noted in ESI Maps as habitat for the threatened species *Erythrina eggersii*. The construction and operation of the project, however, will have no anticipated impact to this or other rare or endangered species.

The two above listed turtle species do travel in waters off-shore of the site, but no rare and endangered species, or any species for that matter, use Davis Bay as an exclusive habitat. The permitting of this facility will not displace any rare, endangered, or threatened species from any critical habitat.

As part of recommendations set by the Section 7 CWA Endangered Species Act consultation with USFWS, VIP will minimize the footprint of work to the greatest extent possible and is not expected to extend farther than necessary beyond the road shoulder.

This will ensure minimal to no impact to the threatened plant species that may be in the area, or to any nearshore species in the area.

6.10 AIR QUALITY

No air quality issues are anticipated for this project. A minimum of soil exposure and earth movement will occur at the site, only to shore up the shoulder. Stockpiling will be protected and kept to a minimum. If work is done during particularly dry and/or windy conditions, a water truck can be used to wet down the area to prevent fugitive dust from leaving the site. These water trucks will bring water from the VIP asphalt plant location, or from a commercial water provider. Dust control measures to ensure no air quality issues arise are outlined in the Storm Water Pollution Plan for this project.

7.00 IMPACT OF THE PROPOSED PROJECT ON THE HUMAN ENVIRONMENT

7.01 LAND AND WATER USE PLANS

The property is a Right of Way (ROW) zoned plot, designated for transportation, which permits the rehabilitation project proposed for this site.

The project will not change the current use of the property as an ROW.

7.02 VISUAL IMPACTS

The property is proposed for an existing road and will improve the contour and quality of the road in this section. The project will not change the visual character of the area.

7.03 IMPACTS OF PUBLIC SERVICES AND UTILITIES

Water

As noted in Part 6.04, the project will not use or affect significant amounts of water, either from public supply or otherwise. The project will have no negative impact on the availability of freshwater resources.

Sewage Treatment and Disposal

There will be no flow to the municipal sewerage system or required sewer disposal resulting from this project's implementation. As previously referenced, project sewage management will be limited to maintaining portable restrooms.

Solid Waste Disposal

Domestic solid waste will be managed with onsite waste bins. It will be trucked out by VIP as necessary and disposed of in accordance with solid waste requirements.

Roads, Traffic and Parking

The project will affect traffic as the scope of work is to rehabilitate a 120-foot section of the road. Traffic will be minimized with the use of traffic guidance, shoulder passing and a short work schedule. This particular road is less traveled than most, and little to no traffic delays are expected due to the ongoing project activities.

Electricity

The property will not have any electricity needs related to existing infrastructure.

Schools

There are no anticipated adverse effects on the local educational system.

Fire and Police Protection

Any nighttime work will provide adequate lighting for worker safety. In case of emergency, the site is accessible by the same route.

Health

The property will not have any adverse effect on the public health, nor increase the use of public health facilities. The facility will follow all air permit requirements to ensure air pollution is minimized and does not affect any neighboring properties or businesses.

7.04 SOCIAL IMPACTS

There are no anticipated negative social impacts to the area. The north shore is one of the more popular areas for social gatherings, and social activities such as hiking, swimming and scuba diving. This road is part of the Scenic Road route, but due to low use, should not pose any social impact or deterrence from its use by tourists or locals alike.

The rehabilitation will address a potentially dangerous collapse of this road, which will ensure access and travel through this popular north shore nature route and tourist location.

7.05 ECONOMIC IMPACTS

There are no anticipated negative economic impacts.

7.06 IMPACTS ON HISTORICAL AND ARCHAEOLOGICAL RESOURCES

This project site shows no indication of historical resources or any historical structures. A clearance was provided to the USDOT by DPNR-SHPO for this project site and the other 14 as part of this overall project scope, and found that no impact to historical resources was anticipated, based on the proposed scope of work and rehabilitation methods.

7.07 RECREATIONAL USE

The project will have no impact on the recreational uses within the area. As noted above, traffic to areas in the vicinity will be slowed, but will not be prevented, for the project duration. The project will ensure unimpeded use of the area after the project is complete, to allow for continued recreational activities in the area.

7.08 WASTE DISPOSAL

Domestic solid waste will be managed with onsite waste bins. It will be trucked out by VIP as necessary and disposed of in accordance with solid waste requirements.

Chemicals inherent to the asphalt and road construction business will be used daily on site. They will be kept in protected areas and any hydrocarbons will be kept within secondary containment (such as hydraulic or motor oil for machinery).

Any unused or contaminated chemicals or materials, including oily rags or contaminated material, will be disposed of in accordance with waste handing regulations.

The project will have no significant impact on solid waste disposal.

7.09 ACCIDENTAL SPILLS

Spills are not anticipated during construction; however, any spills onsite will be cleaned up immediately. Any contaminated soil will be put into approved containers for eventual disposal by a licensed waste handler.

7.10 POTENTIAL ADVERSE EFFECTS WHICH CANNOT BE AVOIDED

The project does not involve any potential adverse effects that may not be avoided. The project has been designed to avoid sensitive areas to the greatest extent possible. Potential impacts have been minimized through the development of a stringent sedimentation and erosion control plan which will be implemented during construction and during the life of the site operations.

8.00 MITIGATION PLANS

No mitigation plans are needed for this project and operation.

9.00 ALTERNATIVES TO PROPOSED ACTION

If the operation does not move forward, the project site and road length will continue to degrade and will create extremely unsafe conditions for drivers, eventually cutting off access through this roadway.

There is no alternative location option, as the damaged section must be repaired, and there are no easy alternative roadways in the area to traverse the length of the scenic road along the north shore.

10.00 RELATIONSHIP BETWEEN SHORT & LONG TERM USES OF MAN'S ENVIRONMENT

Any minor potential impacts associated with this project in the short term are far outweighed by the environmental and economic benefits provided in the long-term to repairing this section of road.

11.00 REFERENCES

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NOAA Historical Hurricane Tracks https://coast.noaa.gov/hurricanes

FEMA Flood Map Service Center: https://msc.fema.gov/portal/home

NOAA Tides and Currents: https://tidesandcurrents.noaa.gov/map/index.shtml?id=9751364

U.S. Annual/Seasonal Climate Normals (1981-2010) NCEI Climate Data Online Data Search https://www.ncei.noaa.gov/metadata/geoportal

NOAA National Data Buoy Center https://www.ndbc.noaa.gov/

2020-2025 United States Virgin Islands' Coral Reef Management Priorities, USVI DPNR-CZM

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GEOTECHNICAL REPORT
ROUTE 78 WASHOUT REPAIR
ESTATE SWEET BOTTOM
FREDERIKSTED, ST CROIX, USVI
(VTE21-01.1097)

Prepared for

Virgin Islands Paving, Inc
P.O. Box 4720
Kingshill, St Croix VI 00851

Submitted By

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June 25, 2021

Virgin Islands Paving, Inc
P.O. Box 4720
Kingshill, St Croix VI 00851

Attention: Mr. Daniel Schierloh, P.E.

Subject: **GEOTECHNICAL REPORT, ROUTE 78 (WEST SCENIC ROAD) WASHOUT REMEDIATION, ESTATE SWEET BOTTOM, ST CROIX, USVI (VTE21-01.1097)**

Dear Mr. Schierloh:

VITEST Engineers is pleased to submit this geotechnical engineering report for the repair of the washout on West Scenic Road in Frederiksted on St Croix, in the US Virgin Islands.

The proposed project will include the design and construction of a slope repair and drainpipe across the existing road. Our geotechnical scope of work included a subsurface soil investigation, evaluation of soil conditions and slope stability analysis of retaining wall configurations for the support of the road and pipe. The attached report provides the results of our analysis and our recommendations.

We appreciate the opportunity to provide our services on this project and trust that the data and recommendations are clear and understandable. Should there be any questions on the report content or if we can be of further assistance, please call.

Very truly yours,

VITEST Engineers
Improving the Quality of Island Life

Donald S. Law, P.E., MBA
President
VI Registration No. 1088E

Introduction

During the last hurricanes, a portion of Route 78, aka, West Scenic Road, was washed out at the location of a storm drain crossing. The drain pipe and head wall were dislodged and pushed down the steep slope. This report was prepared to assist in restoring the road and the drainage structure. It presents the work performed, an evaluation of the soil conditions at the edge of the slope and provides geotechnical recommendations for the restoration of the slope and drain pipe.

Project Description

West Scenic Road crosses River Road at "the Beast" area in Estate Fountain. It continues through Estate Fountain and into Estate Sweet Bottom. The washout area is approximately xx miles west of the intersect with River Road. The elevation of the road in the area of the washout is at +800.0 feet MSL. There is a 30 inch HDPE pipe which crosses the road at the washout. A headwall exists on the east or uphill side of the road, but the west head wall slipped down the slope after the soil support was lost. The pipe is broken and the piece that is under the remaining portion of the road is suspended in midair on the failed slope. A portion of the pavement was also lost and the width of the asphalt at the washout is approximately 13.5 feet.

Purpose & Scope of Work

The purpose of our services was to explore the soils beneath the top of the slope and provide recommendations for the reconstruction of the slope and the drain pipe. We drilled and sampled a Standard Penetration Test Boring on the edge of the road to the rock layers below. The approximate location of the boring is shown on Sheet 1 attached to this report. The idealized soil profile is presented also on Sheet 1. The data was used to evaluate the location for a new retaining wall that will be installed to restore the slope and support the drain pipe. We conducted a retaining wall design and slope stability analysis to provide recommendations of wall configuration and construction.

Drilling Methods - The Standard Penetration Test borings were sampled in general accordance with the procedures of ASTM D-1586 using the open-hole rotary drilling method. The borehole advancement was achieved using 3-1/4 inch diameter hollow stem augers with a rock cutting bit. Soil samples and corresponding SPT penetration resistance (N-values) were obtained throughout the profile using a split-

barrel sampler driven by a 140-pound hammer, falling 30 inches. The soil samples recovered from the borings were visually examined in the field with representative samples sealed in airtight containers and transported to our laboratory for further soil classification by a geotechnical engineer.

Laboratory Testing

The soil samples were classified in accordance with the Unified Soil Classification System (USCS), ASTM D-2288 and AASHTO guidelines. The laboratory testing included the determination of the natural moisture content in accordance with ASTM D-2216 and the percent passing the No 200 sieve ASTM D-1140. The results and the classification of the soils at the bridge are indicated on the Soil Profiles in Appendix A. The laboratory test results reveal that the soil profile is a fine sand and silty sand underlain by weathered rock.

Evaluation of Subsurface Conditions

USDA SCS Soil Survey – The soils in the vicinity of the washout were mapped by the USDA Soil Conservation Service and published in the Natural Resources Conservation Service (NRCS) Reports. This survey reports that the soil types across the area is Annaberg-Cramer 20-40% slopes (AeC). A brief description of these soils is presented below.

Annaberg-Cramer (20-40%Slopes)(AeC): This soil type is found on summits da side slopes of volcanic hills and mountains. The soil profile in the upper 60 inches is comprised of grayish brown gravelly loam. Followed by weathered igneous rock and unweathered igneous rock. It is well drained with a moderate permeability. The depth to the seasonal high water table is more than 6 feet and is not flooded. It is in Hydrologic Soil Group D. The risk of corrosion on uncoated steel and concrete is moderate.

Soil Stratigraphy – The soil at the boring location is comprised of approximately 2 feet of a gravelly clay fill. Between 2 and 11 feet it is a light grayish-brown gravelly clay. The underlying material to approximately 22 feet is a weathered silty rock. Below 22 feet is hard unweathered rock.

The SPT below counts (N-values) measured in the upper approximately 11 feet are representative of a loose to medium dense condition with N-values between 4 and 34 blows per foot (bpf). The weathered and

unweathered rock below 11feet is in a very dense consistency with blowcounts exceeding 50 blows for zero inches of penetration. The blowcounts per foot are shown on the Soil Profile in Appendix A.

Groundwater Conditions **-** The ground water table was not encountered in the boring. The water table will fluctuate in response to the rainfall conditions. However, we do not expect that the normal groundwater table will impact the slope. Runoff may penetrate the upper layer of the profile and soften the gravelly clay.

Engineering Evaluations and Analysis

General Discussion – The design of a repair of the washout involved plotting the surface profile of the washout area and the lower slopes below the washout. This was done by conducting a topographic survey of the washed out slope. This survey was conducted by others and the AutoCAD drawings were used to evaluate the existing conditions. The cross section along the approximate centerline of the washout was used to layout a retaining structure and conduct engineering analyses to determine a suitable wall configuration and stability of the repair.

The cross section of the washout area is shown on Sheet 2 in Appendix A. Based upon the survey, the road elevation is +800.13 feet MSL. The bottom of the washout is about +787.0 feet MSL and is at a horizontal distance of approximately 17 feet from the edge of the asphalt pavement. The slope at the bottom of the washout is approximately 5H:1V. From the preliminary design of the retaining structure, it is preferred to construct a gabion basket wall at the bottom of the slope and a concrete retaining wall near the top. The new drain pipe will extend through the concrete retaining wall and out fall down the gabion wall.

Wall Configuration- We have analyzed this configuration to determine the number of layers of baskets and basket size needed. We also analyzed the concrete retaining wall height and embedment depth, as well as the over stability of the combined retaining structure. Prior to construction of the wall, we recommend that the loose material on the washed out slope be removed to expose the natural soils. All exposed slopes should be protected as required by OSHA.

The height of the gabion baskets analyzed is 3 feet, filled with rocks weighing 130 pounds per cubic foot. The initial layer or bottom gabion basket is 6 feet wide and was set at an elevation of +785.4 feet MSL. A total of three layers were analyzed. The other two layers can also be 6 feet wide but may be as narrow as 3 feet wide. The gabion basket wall should be sloped at a 5 percent to the vertical toward the retained earth. The top of the gabion wall will be +794.4. The concrete retaining wall will sit in the backfill near the top of the gabion wall. The bottom elevation should be +795.8. The width of the footing should be 6.25 feet and height of the wall should be 6.8 feet above the top of the footing. The top width of the wall may be 8 inches. A 30-inch diameter hole should be created in the retaining wall to accommodate the HDPE drainpipe.

Suitable Fill - Fill required to backfill the wall should be comprised of clean, non-plastic gravel-silt-sand mixtures containing less than 20 percent passing the U.S. No. 200 Sieve and meeting the AASHTO requirements for fill. The fill should be free of topsoil, roots, organic material, rocks larger than 2 inches, debris, trash, or other objectionable material that may be compressible, degradable or which cannot be compacted properly. The fill should be placed in relatively level lifts, beginning with the placement of the first gabion basket, dried or wetted as needed, and then compacted to a minimum density of 95 percent of the Modified Proctor Maximum dry density (ASTM D-1557) unless otherwise specified. The lifts should not exceed 12 inches in loose thickness if compaction is performed by a heavy vibratory roller and 6 inches if an approved hand-operated compaction plate is used.

Pavement Support- Once the area is backfilled and the drain pipe is installed, the pavement can be rebuilt to the desired width. The road embankment material should be as recommended earlier in this report. Following the embankment construction, the flexible pavement section can be constructed. The proposed pavement will be subjected to a combination of heavily and lightly loaded vehicles. An approved aggregate base course is recommended for the pavement. The base material should be compacted to a 98 percent of the maximum modified proctor value and should have a minimum California Bearing Ratio (CBR) of 100. The minimum thickness of the base should be 8 inches. Alternative materials may be used, if it meets the specifications for base course and that the thickness, strength, and compaction are considered in the pavement design. We recommend a Hot Mix Asphalt for the wearing surface of the flexible pavement. The

mix design selected for the HMA should be stable, weather-resistant, wear-resistant, waterproof, and non-slippery. We recommend a minimum thickness of 2 inches of compacted pavement wearing surface. The surface smoothness shall have a maximum deviation of 1/4 inch. The minimum Structural Number of 2.7 should be used in the design of the pavement section The actual pavement section should be designed for the actual equivalent 18 kip single axle load anticipated over the life of the pavement.

Conclusion,

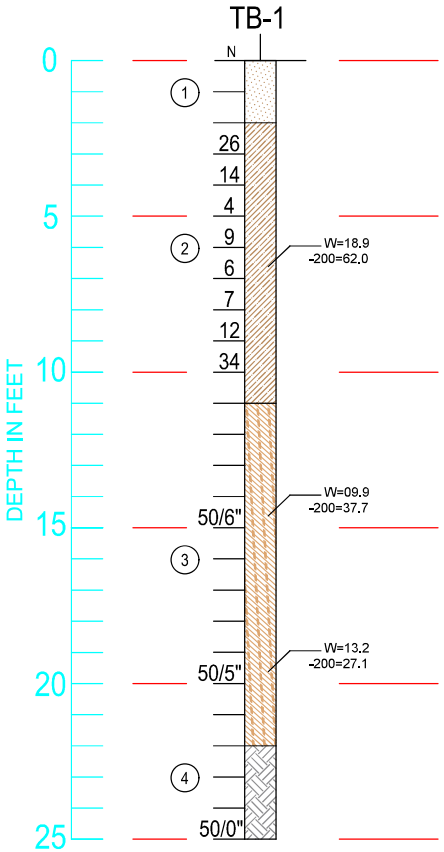
Based upon our evaluation and analysis, we are of the opinion that the retaining structure shown on sheet 2 will provide the required support for the slope, drain pipe and roadway. The analysis indicated that the factor of safety against overturning and sliding of the reconstructed slope is more than 2.0. The width of the repair along the slope should be sufficient to provide long-term protection for the area. In addition, the outfall of the drainpipe should be designed to reduce the outfall velocity to prevent erosion of the gabion basket support and the down slope soils.

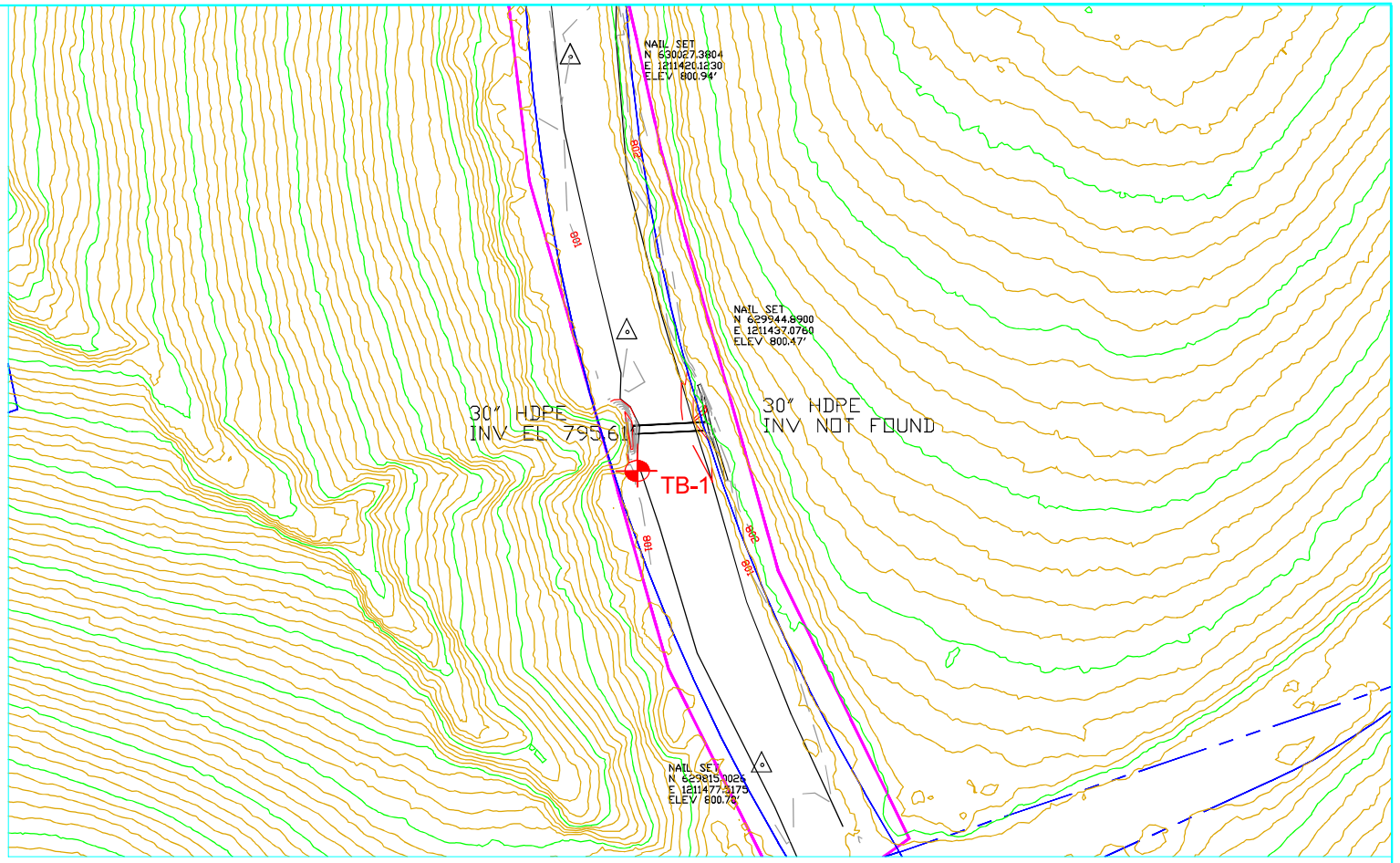
Limitations

This report was prepared in accordance with commonly accepted geotechnical engineering practices for the exclusive use of our client only for the subject project. No other warranty, expressed or implied, is made. It should be noted that scour was not considered in this report since a scour analysis was not available. The analyses and recommendations presented herein were based on the results of our limited subsurface exploration, the survey provided by others, available information about the subject site and the proposed site improvements. The foundation recommendations are subject to change, depending on the results of the structural analysis and modeling and the effect that modeling, and analysis has on foundation types, locations, sizes, and depths. If significant changes in the final site grades, locations, or foundation loads other than those described herein, or if subsurface conditions different from those encountered in the borings become evident prior to, or during, site preparation or construction, VITEST Engineers should be immediately notified so that we may review and, if necessary, modify our analyses and recommendations.

APPENDIX A

SOIL PROFILE





APPROXIMATE BORING LOCATION

LEGEND

1. BROWN GRAVELY CLAY (FILL)
2. LIGHT GRAYISH BROWN GRAVELLY CLAY (CL)
3. WEATHERED ROCK WITH LIGHT BROWN SILT
4. UNWEATHERED ROCK

- 30' — GROUNDWATER TABLE MEASURED 01/26/22
- N — N-VALUE (BLOW COUNTS PER FOOT)
- W — NATURAL MOISTURE CONTENT IN PERCENT
- -200 — PERCENT PASSING THE NO. 200 SIEVE
- TB-1 — APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

GEOTECHNICAL INVESTIGATION
RTE 78 (WEST SCENIC ROAD)
R.O.W. WASHOUT REMEDIATION
ESTATE SWEET BOTTOM ST CROIX, USVI

VITEST Engineers
Civil & Geotechnical Engineering, Materials Testing & Environmental Services

Scale:	NTS	Approved By:	DSL
Date:	03-22-2022	Project No:	VTE21-01.1097
Drawn By:	DSL	Sheet:	1 of 2

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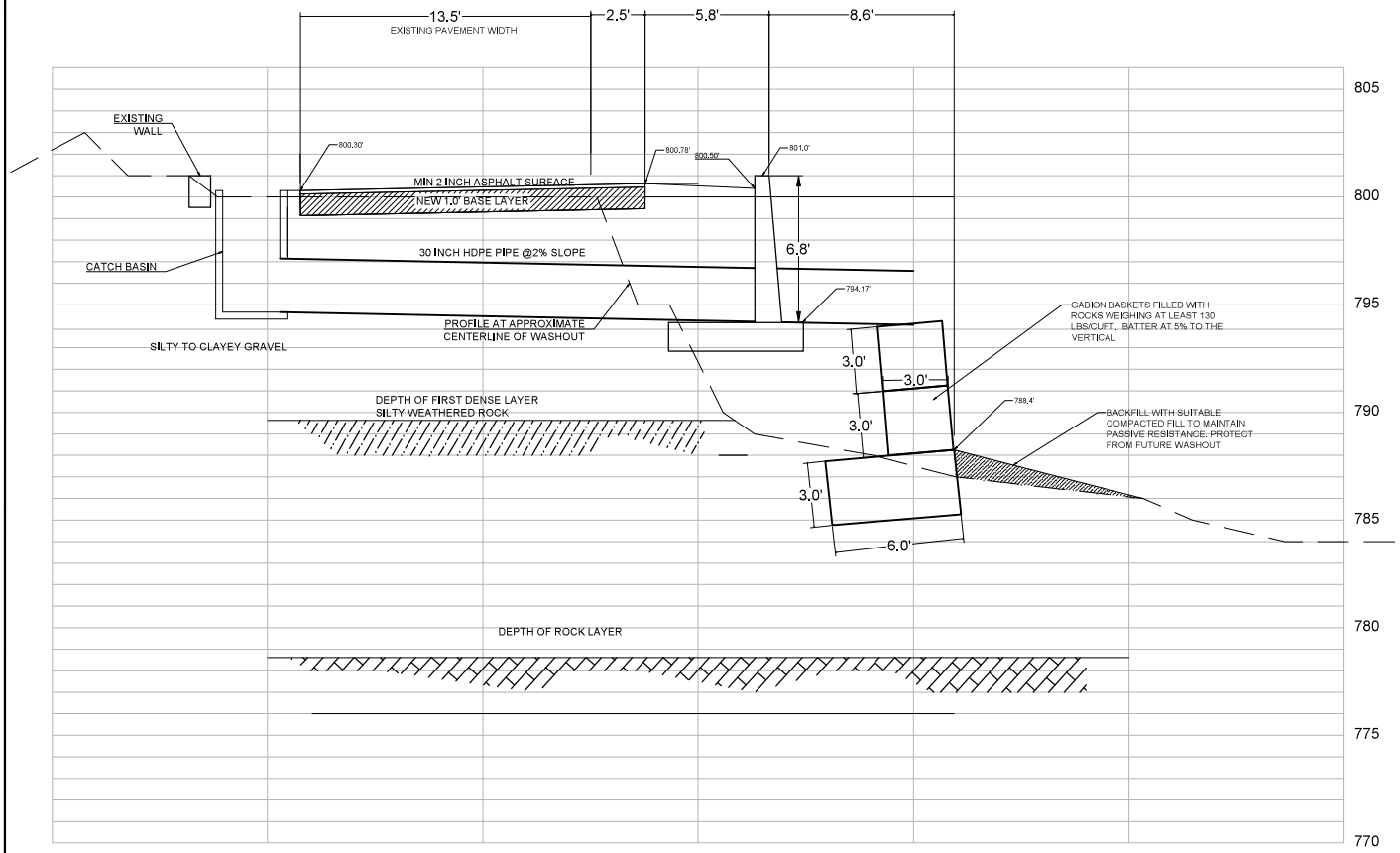
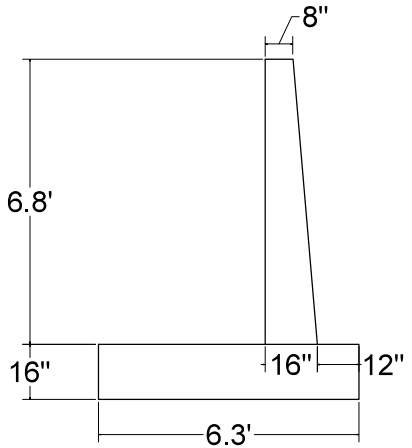


SLOPE REPAIR CONFIGURATON



RETAINING WALL DIMENSIONS

NOTE: RETAINING WALL REINFORCEMENT SHALL BE DESIGNED BY A STRUCTURAL ENGINEER.

GEOTECHNICAL INVESTIGATION
RTE 78 (WEST SCENIC ROAD)
R.O.W. WASHOUT REMEDIATION
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Date:	03-08-2022	Project No:	VTE21-01.1097
Drawn By:	DSL	Sheet:	2 of 2

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (More than 50 % larger than #200 sieve)	GRAVEL AND GRAVELLY SOILS (More than 50% of coarse fraction retained on #40 sieve)	CLEAN GRAVELS (Little or no Fines)	GW	Well-graded gravels, gravel-sand mixtures, little to no fines
			GP	Poorly graded gravels, gravel-sand mixtures, Little to no Fines
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS (More than 50% of coarse fraction Passing #4 sieve)	CLEAN SANDS (Little or no Fines)	SW	Well-graded sands, gravelly sands, little to no fines
			SP	Poorly graded sands, gravelly sands little to no fines
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures
			SC	Clayey sands sand-clay mixtures
FINE GRAINED SOILS (More than 50 % Smaller than #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays,silty clays Lean Clays
			OL	Organic silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS (Liquid Limit greater than 50)		MH	Inorganic silts, Micaceous or Diatomaceous Fine sandy or Silty soils, Elastic Silts
			CH	Inorganic clays of High Plasticity
			OH	Organic Clays of medium to high Plasticity
HIGHLY ORGANIC SOILS			PT	Peat, Humus, Swamp soils with high organic contents

RELATIVE DENSITY vs N-Value

COHESIONLESS SOILS	
DENSITY	N-value (bpf)
Very Loose	0 to 5
Loose	10 to 30
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	over 50

CONSISTENCY vs N-Value

COHESIVE SOILS	
Consistency	N-Value (bpf)
Very Soft	0 to 2
Soft	2 to 4
Medium Stiff	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	Over 30

SITE CLASS

Site Class	Soil Profile	N (bpf)
A	Hard Rock	
B	Rock	
C	Very Dense Soil and Soft Rock	>50
D	Stiff Soil Profile	15-50
E	Soft Soil Profile	<15
F	Requires Further Site Evaluation	