

SAVAN GUT Phase II

ST. THOMAS, U.S. VIRGIN ISLANDS

FLOOD RISK REDUCTION STUDY

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CAP CONVERSION STUDY

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Executive Summary

Background The purpose of this report is to reaffirm the economic justification, environmental acceptability and engineering feasibility of the plan previously identified in the Savan Gut Detailed Project Report and Environmental Assessment completed in 1982. Phase-I of the project was completed in 1989 but the remainder of the project is not, causing significant flooding impacts in Charlotte Amalie, the capital city of the US Virgin Islands on St Thomas.

Study Location The study area is within the Central Business District of Charlotte Amalie, the capital and largest city of the U.S. Virgin Islands. Charlotte Amalie is on the southern shore of the island of St. Thomas. Savan Gut is located in the highly developed urbanized area of Charlotte Amalie. The Gut's headwaters begin in the mountainous and heavily vegetated region north of the Charlotte Amalie harbor.

Authorization

- Section 205 of the 1948 Flood Control Act
- Bipartisan Budget Act of 2018 (Public Law 115-123)
- Section 209 of the Flood Control Act of 1966 (Public Law 89-789)

Project Changes There are no proposed changes to the previously authorized NED plan; Construction of a concrete box culvert, catchment basin, drop structures and gabion channel. Ancillary work includes recreation areas, historical documentation and mitigation, utility relocation, and paving and storm drainage.

Project Costs and Benefits The updated Certified Project Cost for Savan Gut P-II is \$69.8 M not including sunk costs from construction of Phase I. When both costs are combined and compared to the benefits determined in the 1982 study the BCR is 3.94.

Compliance with USACE Quality Control Standards The Savan Gut P-II project is fully compliant with current USACE Quality Control Standards.

Recommendation It is recommended that the Savan Gut Phase II flood risk management project should be should be approved and proceed to the Preconstruction, Engineering and Design Phase.

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1 STUDY OVERVIEW

1.1 Introduction

The purpose of this report is to reaffirm the economic justification, environmental acceptability and engineering feasibility of the plan previously identified in the Savan Gut Detailed Project Report and Environmental Assessment (See Attachment A) completed in 1982. This is an expedited review of the previously approved plan without additional plan formulation, hence this is not a stand-alone report but instead a supplement to the previous 1982 Feasibility Report. Phase I of the project was completed in 1989. Bids for Phase II exceeded the government estimate in 1999 and again in 2000 after project revisions. The sponsor requested the Phase II construction effort be delayed until the bidding climate improved and the project was suspended due to project costs exceeding the Continuing Project Authorities funding limits. Due to the impacts of Hurricanes Irma and Maria in 2018 and sponsor request, the project was selected in the Supplemental Appropriations Bill, P.L. 115-123, to be converted to a specifically authorized project through the Investigations account.

1.2 Study Location, Purpose and Need

The study area is within the Central Business District of Charlotte Amalie, the capital and largest city of the U.S. Virgin Islands. Charlotte Amalie is on the southern shore of the island of St. Thomas (See Figure 1.). Savan Gut provides the drainage for a watershed area of approximately 260 acres, flowing thru densely developed Charlotte Amalie to St. Thomas Harbor in a constructed channel.

Savan Gut (known locally as Deyoung Gut) is located in the highly developed urbanized area of Charlotte Amalie, St. Thomas, USVI. The gut's headwaters begin in the mountainous and heavily vegetated region north of the Charlotte Amalie harbor. The gut drains directly into the harbor via a combination of a natural gut from the vegetated area, to a combination of a intermixed lined and unlined degraded concrete channel from the Jane E. Tuitt Elementary School (flowing under the school and the schools' basketball court) to the intersection of Guttets Gade and Norte Gade; where the culvert is then inaccessible and flows underneath business and roads of downtown Charlotte Amalie until it exits into St Thomas Harbor.

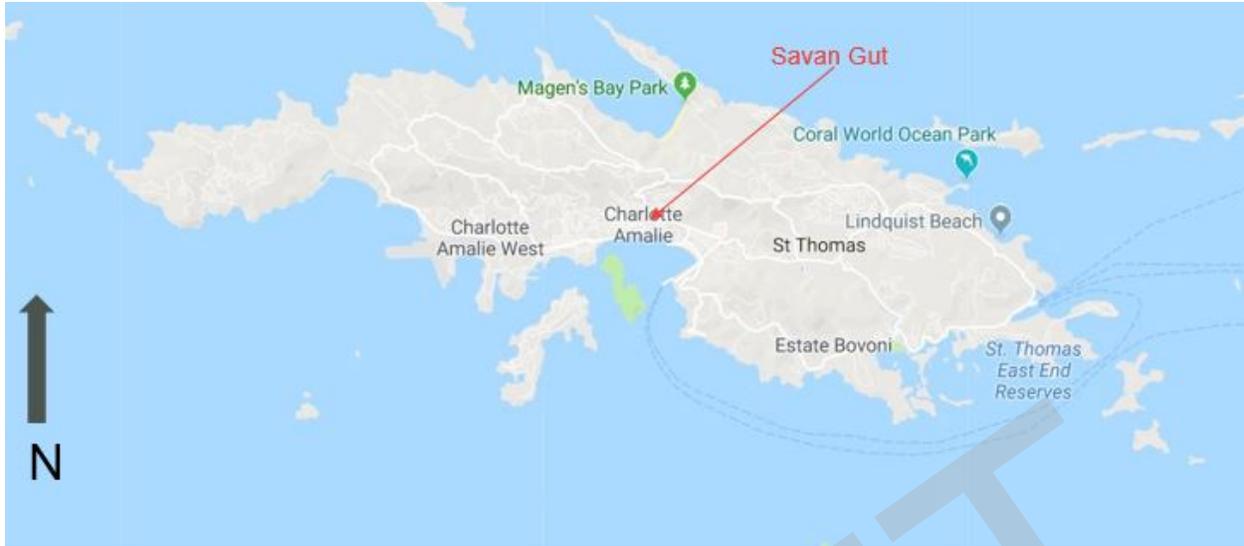


Figure 1 – Savan Gut Project Location

1.3 Authorization and Prior Reports

The Savan Gut, Section 205 Detailed Project Report (DPR) and Environmental Assessment (EA) was completed in 1982 under authority provided by Section 205 of the 1948 Flood Control Act, as amended;

Section 205 of the 1948 Flood Control Act, as amended, which states: "The Secretary of the Army is hereby authorized to allot from any appropriations heretofore or hereafter made for flood control, not to exceed \$40,000,000 for any one fiscal year, for the construction of small projects for flood control and related purposes not specifically authorized by Congress, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when in the opinion of the Chief of Engineers such work is advisable. The amount allotted under this Section for a project shall be sufficient to complete Federal participation in the project. Not more than \$5,000,000 shall be allotted for a project at any single locality. The provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936 as amended, shall apply. The work shall be complete in itself and not commit the United States to any additional improvements to insure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports."

The Savan Gut DPR and EA was completed and approved in 1982 with an estimated construction cost of \$6.3 M and benefit to cost ratio of 11.4 to 1.

The Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV;

Title IV of the Bipartisan Budget Act of 2018 states: "For an additional amount for " Investigations" for necessary expenses related to the completion, or initiation and completion, of flood and storm damage reduction, including shore protection, studies which

are currently authorized or which are authorized after the date of enactment of this subdivision, to reduce risk from future floods and hurricanes, at full Federal expense, \$135,000,000, to remain available until expended: Provided, That of such amount, not less than \$75,000,000 is available for such studies in States and insular areas that were impacted by Hurricanes Harvey, Irma, and Maria: Provided further, That funds made available under this heading shall be for high-priority studies of projects in States and insular areas with more than one flood-related major disaster declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) in calendar years 2014, 2015, 2016, or 2017: Provided further, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251 (b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985: Provided further, That the Assistant Secretary of the Army for Civil Works shall provide a monthly report to the Committees on Appropriations of the House of Representatives and the Senate detailing the allocation and obligation of these funds, including new studies selected to be initiated using funds provided under this heading, beginning not later than 60 days after the enactment of this subdivision.”

Section 209 of the Flood Control Act of 1966 (Public Law 89-789);

The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the localities specifically named in this section. After the regular or formal reports made on any survey authorized by this section are submitted to Congress, no supplemental or additional report or estimate shall be made unless authorized by law except that the Secretary of the Army may cause a review of any examination or survey to be made and a report thereon submitted to Congress, if such review is required by the national defense or by changed physical or economic conditions.

Watersheds and streams of Puerto Rico and the Virgin Islands with respect to a framework plan for developing water resources of the region.

1.4 Project Design

The 1982 DPR and EA identified the NED plan to construct 2,300’ covered concrete channel from the harbor upstream, terminating at a velocity check dam just above the Jane E. Tuitt school, replacement of three bridges with sections of covered channel, and the construction of a velocity check dam and debris trap. The recommended plan provided for flood damage reduction benefits to the Standard Project Flood level. See Figure 2.



Figure 2: Savan Gut P-II Plan View

1.5 Construction Status

Phase I construction was completed in 1989. Phase II of the project was advertised in 1999 with bids exceeding the government estimate and the capacity of the Continuing Authorities program.

2 OVERVIEW OF CHANGED CONDITIONS FROM AUTHORIZATION

2.1 Economic conditions

Population - According to the USVI Bureau of Economic Research, the population of the US Virgin Islands had been increasing from 1990 to 2000, an increase of 6.7 percent for the ten year period. However, from 2007 to 2017 the Islands have experienced a decline in population at the rate of 1.9 percent every five years or -0.6 percent annually. As of 2010 Census, the population of Saint Thomas was 51,634 compared to 48,166 in 1990, an increase of 7 percent growth over the ten year period. However, the current population is very similar to those that existed when the

original benefits were evaluated so it is reasonable to assume that the benefits would be at least similar in scale to those calculated in 1982. Table 1 presents the population of US Virgin Islands and St. Thomas for selected years since 1990.

Table 1¹: Population of US. Virgin Islands and St. Thomas

	1990	2000	2007	2008	2009	2010	2017	Annual Percent Change	
								5-year	1-year
US Virgin Islands	101,809	108,612	114,743	115,852	107,343	106,405	96,815	1.9	0.6
St. Thomas	48,166	51,181	54,070	54,592	50,583	51,634	46,600	1.5	0.6

Socio-Economic Assessment – Tourism, trade, and other services are the primary economic activities, accounting for nearly 60% of the USVI’s gross domestic product (GDP) and about half of total civilian employment². Close to two million tourists per year visit the islands. The government is the single largest employer. In 2016, government spending (both federal and territorial together) accounted for about 27% of GDP while exports of goods and services, including spending by tourists, accounted for nearly 47%. The agriculture sector is small, with most food being imported. The manufacturing sector consists of rum distilling, electronics, pharmaceuticals, and watch assembly. Rum production is significant. Shipments during a six-month period of fiscal year 2016 totaled 8,136.6 million proof gallons.

The DPR & EA divided the study area into 44 blocks with 379 structures identified. The existing development was surveyed to determine structure type, value, size, location and commercial content value. Ground elevations and flood frequency elevations were interpreted and flood depths were calculated for each structure for the flood frequencies evaluated. Structures were separated into 41 commercial and two residential damage relationship classifications and damages estimated by applying depth damage relationships to each structures’ content and physical value for all flood frequencies.

The structure inventory does not appear to have changed since the 1982 report. A majority of the structures appear to be inhabited and all show considerable signs of aging. There are numerous vehicles on every street in the study area. Savan Gut flows thru the main tourist area in Charlotte Amalie which is undergoing a significant revitalization with decorative paver streets and expansion of the main route to a multi-lane highway. Since the previous report was completed, the cruise ship industry has seen a dramatic increase in visitation.

Regional Economic Development - Temporary closure of the roads and bridges during construction may lead to temporary impacts on local business in the vicinity of the construction. The cruise industry based shopping district in Charlotte Amalie are likely large sources of tax revenue and employment for the USVI.

¹ U.S. Virgin Islands Annual Economic Indicators, Bureau of Economic Research

² U.S. Virgin Islands Economic Review, VI Bureau of Economic Research. May 15, 2016.

Other Social Effects - Current enrollment³ at the Jane E Tuitt School is 172 students plus additional teachers and staff. This school is the primary public school for elementary aged children in the Savan Area of Charlotte Amalie. The risk of life to students in the school is still of paramount importance to the justification of the project.

2.2 Engineering conditions

Preliminary review of the current conditions from areal imagery, a PL 84-99 assessment made on 31 Oct 2017 following Hurricane Maria and a more recent site visit on 9 Nov 2018 suggests that the project features would be valid as designed.

The project was designed for the Standard Project Flood (SPF) which is defined as fifty percent of the Probable Maximum Flood (PMF) occurring from the Probable Maximum Precipitation (PMP) rainfall event. The PMP rainfall event has not changed over time. As a result, updating of the hydrologic analysis of the rainfall used in the previous design is not warranted. A new Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) model would need to be developed for this analysis. The hydraulic model used in the past design is superseded by the Hydrologic Engineering Center – River Analysis System (HEC-RAS) analysis model. An HEC-RAS model of the project does not exist. The validity of the design has not changed over time. Since the hydrologic runoff is the same as the previous analysis, the design would be valid and an HEC-RAS model is not anticipated unless alternatives or a Value Engineering proposal would require the development of a HEC-RAS hydraulic model of the project.

2.3 Environmental conditions

Pursuant to the National Environmental Policy Act of 1969, as amended, the Corps assessed the effects of the proposed action in the Savan Gut, St. Thomas, U.S. Virgin Islands, Detailed Project Report and Environmental Assessment (EA), dated March 1982. The 2019 draft EA updates the 1982 EA analysis and adopts the 1982 EA, by reference, where the information is valid and applicable.

Few changes in the environmental conditions of the project area have occurred. The ongoing erosion and scouring of gut bed and banks have continued to degrade the streambank vegetation. The 1982 project did not include mitigation; however, debris and vegetation would be removed during the channelization, clearing, and grubbing activities and construction of the debris basin. If effects to wetlands require mitigation, a plan will be developed, proposed, and refined during the project's PED phase. Pursuant to the Endangered Species Act of 1983 (16 U.S.C. §1531 *et seq.*), coordination with National Marine Fisheries Service and U.S. Fish and Wildlife Service ongoing. Construction activities may affect, but are not likely to adversely affect, the Virgin Island tree boa (*Epicrates monensis granti*). Standard protection measures for the boa will be implemented to protect any boas that may be in the area (See Attachment E).

³ USVI Department of Education Enrollment Figures

2.4 Cultural Resources

The channel alignment as proposed does not conform exactly to the existing gut alignment. The proposed alignment would require the removal or relocation of eight structures that are located within the Charlotte Amalie Historic District which is listed on the National Register of Historic Places. The U.S. Virgin Islands SHPO would be involved in the determination of effects to historic properties regarding relocation or removal.

Consultation and re-evaluation of historic properties within the footprint is needed. Archaeological monitoring of the project area of potential effect will be required during PED. Additional HABS/HAER documentation and archaeological testing may be required for historic properties identified within the project footprint. The Jacksonville District is currently coordinating a programmatic agreement with U.S. Virgin Islands SHPO to conduct a phased identification and evaluation of historic properties in PED.

2.5 Impacts of Maria

Site Inspection after Hurricane Maria on 31 Oct 2017 revealed Savan Gut overtopped its banks causing debris and sediment accumulation throughout the gut. Channel wall and soil erosion (1 to 2-ft) was observed downstream of the low- water crossing on Gamble St. A collapsed channel wall approximately (approx.15-ft), near the damaged road was also noted. Heavy and sustained rain over multiple days will cause the Savan Gut to flood in its current condition if protective measures are not in place, causing more damage to property owners. See Figure 3 thru Figure 6.



Figure 3 – Sediment Buildup

Figure 4 – Channel Wall damage and erosion



Figure 5 – Debris accumulation



Figure 6 – Collapsed Channel Wall

In coordination with the Territory, the Federal Emergency Management Agency (FEMA) is executing a long term recovery and resilience program in the USVI following the damaging 2017 hurricane season. The 1982 DPR&EA note the presence of utility lines that occur in or cross the gut that will need to be relocated and or considered during this construction project. The FEMA recovery mission may include upgrades and repairs of some of these utility lines. Full coordination during the PED phase of this project with the Dept. of Public Works and Waste Management Authority to avoid potential conflicts during construction.

3 VALIDATION OF AUTHORIZED/MODIFIED PROJECT

3.1 Project Design Components

The Savan Gut Phase II project will begin where the Savan Gut Phase I project left off north of Back Street. Construction of the Savan Gut Improvements Phase II shall be carried out in four main phases: concrete box culvert, catchment basin, drop structures and gabion channel. Ancillary work includes recreation areas, historical documentation and mitigation, utility relocation, and paving and storm drainage.

Concrete box culvert - Concrete Box Culvert shall be constructed from Station 0+00 (end of existing Box culvert for Savan Gut Phase I) to Station 15+62. The culvert will be constructed in

15 phases and contain a trash rack at its upstream end. The sequence of construction for each culvert phase shall be broken down into the following 4 stages.

Stage 1 - Remove existing surface material. Excavate as required to locate and mark all sewer laterals and existing utilities prior to installation of cofferdam.

Stage 2 - Install cofferdam and Install pipe support members. Install 36" diameter corrugated steel by-pass pipe suspend pipe from struts with hangers. Transition flow from existing culvert into the 36" diameter pipe using sand bags. Excavate between cofferdam walls to the bottom of the new culvert mud slab and drainage blanket stone. Divert existing utilities for removal of existing systems.

Stage 3 - Install bedding material and dewatering system (stages 1 thru 3 only). Place concrete mud slab. Construct the bottom slab of the concrete box culvert. Install new sewer lines, connect existing laterals when existing sanitary line is removed.

Stage 4 - Install storm drain pipe fittings and construct concrete box culvert wall placements. Install precast manholes as required. Construct top slab placements. Backfill along new concrete box culvert walls. Remove Cofferdam.

Catchment Basin - Catchment Basin shall be constructed from Station 15+62 to Station 18+00. The trapezoidal catchment basin consists of a gabion bottom mat and soil nailed tie back retaining walls. The retaining walls contain bench planters and stone facing.

Drop Structures - Drop structures shall be constructed from Station 18+00 to Station 19+91. The U-framed concrete drop structure contains a series of 6 foot elevation drops along its reach, concrete retaining wingwalls on the upstream end, and a new Antoni Strade bridge crossing.

Gabion Channel - Gabion Channel shall be constructed from Station 19+91 to Station 23+19. The gabion channel consists of a gabion mat and a series of 3'x3' gabion basket channel walls. The channel also contains a series of 3 foot elevation drops along its reach and a debris barrier located upstream of the Antoni Strade Bridge.

Recreation Areas - The top of the concrete box culvert will serve as a linear park for the project. Seven pocket parks (Alley Plaza, Sore Strade Plaza, Rosen Gade Plaza, Brodenes Gade Plaza, General Gade Plaza, Banaba's Well Plaza and Playground Area) will be constructed along the linear park. Parks involve landscaping including hardscape, vegetation, and lighting. Project includes Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) documentation of existing historic structures, demolition and reconstruction work for Oven - Alley Plaza, Oven - Store Strade Plaza, Bridge - General Gade Plaza, Residential Wall and Banaba Well.

Utility Relocation - Utility relocations (sewer, water and electric) within the project footprint shall be performed concurrently with each phase of construction.

Miscellaneous Work - Miscellaneous work includes grading, paving, and storm drainage along the new box culvert alignment.

3.2 Cost Update

The total estimated cost of the authorized project has increased significantly since the project was authorized in March 1982. Main factors contributing to the cost increase includes but not limited to the following: 1) rising costs in materials, 2) rising costs in labor rates, 3) changes in design criteria. Recently, the island was devastated by hurricane(s) and is undergoing reconstruction with substantial government investment on the island. Therefore, it is anticipated that there will be other risk factors that affect the cost of the project such as: 1) availability of skilled labor on the island, 2) availability of local and/or worldwide contractors to perform all the work needed on the island, 3) availability of material, 4) future funding stream, and 5) acquisition strategy. The current total cost of the project (\$69,845,000) which does not include approximately \$7,403,200 in sunk costs from the construction of the Phase-I project (See Attachment B).

3.3 Economic Update (Level 1 update)

Previously Approved Benefits - Flood Control prevention benefits from the March 1982 DPR were calculated at a discount rate of 7.625% based on the October 1981 price levels. Table 1 presents initial costs, interest during construction and amortization, total cost, total benefits and a benefit cost ratio of 11.40.

Current Project Cost Estimate FY19 Price Level - Total project cost estimates for the CAP Conversion study were used for the evaluation. To be consistent with the benefit stream of the last approved report (March 1982), the current cost of Phase II, \$68,845,000, was normalized to October 1981 price levels using the Civil Works Construction Index System quarterly cost index from March 30, 2018 report. Deflated cost were annualized at the FY19 interest rates, 2.875 percent, over the 50-year period of analysis. The benefit cost ratio (BCR) was updated following the Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV. The current discount rate 2.875 percent (FY19) was used along with the last approved report discount rate of 7.625 percent (FY81) used for benefit calculation, since the benefits are derived from the last approved report. A benefit to cost ratio for the total project was computed for the economic update costs estimates provided by USACE Cost Engineer.

An element of the Savan Gut project (Phase I) was previously constructed in the 1989. Therefore, only a portion of the benefits was claimed at the time of construction. The proper way to establish the benefits realized by construction of Phase I would be to use a hydrologic and hydraulic model. Neither models exist; so best engineering judgment based on experience will be used to derive an estimate.

The box culvert feature in Phase I is located at the downstream end of the project. As a result, this feature can have no effect on out of bank flood damages occurring further upstream of Phase I. In addition, Phase II box culvert and lateral inflow points are designed to efficiently as possible collect and route rainfall runoff through the box culvert and out to tide. As a result of Phase II features not yet constructed, an unknown amount of this rainfall runoff will bypass the inlet where Phase I begins causing damages beyond that location.

Based on a best engineering judgment estimate, 25% of total project benefits are realized by Phase I construction alone. Completing Phase II would realize the remaining 75% benefits.

The current cost estimates in Table 2 represent the remaining cost to complete the project in Phase II. Table 2 presents total project cost, interest and amortization, operation maintenance and replacement cost, total annualized remaining costs, and remaining annualized benefits (75% of annualized benefits) from the 1982 approved report.

The average annual benefits are divided by the average annual costs to calculate the Remaining Benefit Remaining Cost Ratio (RBRCR) for the project. The updated RBRCR is estimated at 3.94, which is derived from \$3,939,000 in remaining annual average benefits divided by \$999,381 in average annual remaining costs. The average annual net benefit is \$2,939,619. Hence the results affirm that construction of Phase II is economically justified.

Table 1: Savant Gut RBRCR Update

Savant Gut Project	1982 DPR (Discount Rate 2.875%)	Current Costs Certified Phase II (Discount Rate 2.875%)
Total Project Cost	\$ 6,260,000	\$ 69,845,000
Interest & Amortization	\$ 452,500	\$ 976,551
Operation Maintenance & Replacement Costs	\$ 8,500	\$ 22,830
Total Annual Cost (AAEQ) (Remaining Costs)	\$ 461,000	\$ 999,381
AAB from 1982 Approved Report	\$ 5,252,000	\$ 3,939,000
Net Benefits	\$ 4,791,000	\$ 2,939,619
Remaining Benefit Remaining Costs Ratio	11.4	3.94

4 RISK AND UNCERTAINTY

Site conditions and other characteristics detailed in the original planning report may have changed over the ensuing years. This expedited review of the project suggests that changes in the physical conditions, watershed hydraulics, and design standards and practices that have changed over time are potential risks that can be addressed if this project is moved into the

design phase for eventual authorization and construction. See the attached Savan Gut Phase II Risk Register (Attachment F).

5 COMPLIANCE WITH USACE QUALITY CONTROL STANDARDS

This report addendum is prepared in accordance with the Savan Gut P-II Project Management Plan, ER 1105-2-100, Planning Guidance, and will undergo feasibility phase reviews in accordance with EC 1165-2-214. These reviews include District Quality Control, Agency Technical Review, and Mission Subordinate Command reviews of the project report and design. Since there are no changes proposed to the project design for this previously authorized project, a request for exclusion from completing a Type I Independent External Peer Review was submitted on November 16, 2018.

6 IMPLEMENTATION STRATEGY/RECOMMENDATIONS

Hurricanes Irma and Maria in 2017, and previous storm events have caused multiple damaging flooding events in Charlotte Amalie, the capital and largest city in the U.S. Virgin Islands. This review of the previously recommended project to reduce adverse impacts due to flooding remains a viable project. There are identified risks as discussed above, but those risks can be adequately managed during the design process.

It is recommended that the Savan Gut Phase II flood risk management project should be approved at a total Federal Cost of \$81.807 M (FY19 price level) and proceed to the Preconstruction, Engineering and Design Phase.

The project is in compliance with NEPA and USACE regulation ER-200-2-2 for implementing NEPA on Civil Works actions. Coordination with resource agencies concerning project revisions will be conducted and included in the Finding of No Significant Impact that will be completed for this project. Finally, this 2019 CAP Conversion Addendum will require approval at the MSC and approval of the associated Chief's Report for appropriations in order to initiate the design and implementation phase of the project.

Andrew D. Kelly, Jr.
Colonel, U.S. Army
District Commander

Attachments

- A) Savan Gut Detailed Project Report and EA, 1982
- B) Savan Gut P-II Total Project Cost Summary
- C) Savan Gut P-II Cost Estimate Abbreviated Risk Analysis
- D) Cost PCX TPCS Certification
- E) NEPA Documents
- F) Savan Gut P-II Risk Register

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