INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT FOR THE

RAYMONDVILLE DRAIN PROJECT HIDALGO AND WILLACY COUNTIES, TEXAS

SUBMITTED BY:

HIDALGO COUNTY DRAINAGE DISTRICT NO. 1
RANCHO VIEJO, TEXAS

PREPARED UNDER THE AUTHORITY OF:
SECTION 203 OF WRDA 1986, AS AMENDED

SUBMITTED TO:
U.S. ARMY CORPS OF ENGINEERS

PUBLIC REVIEW DRAFT
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CONTENTS

EXECUTIVE SUMMARY

This Integrated Feasibility Report and Environmental Assessment (EA) presents the formulation, evaluation, and recommendation for the modification and extension of the existing Raymondville Drain in a project corridor that traverses Hidalgo and Willacy counties located in the Lower Rio Grande Valley (LRGV) of South Texas, as shown in Figure ES-1. The Recommended Plan reduces flood risk and flood damages, limits the potential for the loss of life, reduces public health risks, supports Administration Priorities (including Border Security and Oil and Gas Production), and promotes community resilience and economic growth within the study area.

Figure ES-1 Hidalgo and Willacy Counties Location Map

This report was completed by the non-federal sponsor of the proposed project, Hidalgo County Drainage District #1 (HCDD1), under the authority of Section 203 of the Water Resources Development Act (WRDA) of 1986, Public Law 99-662, as amended (33 U.S.C. 2231). This report is being submitted to the Office of the Assistant Secretary of the Army for Civil Works (ASA(CW)) for review, with the goal of a recommendation for Congressional Authorization. While this is a stand-alone SMART (Specific, Measurable, Attainable, Risk Informed, Timely) Planning Feasibility Study, it follows several previous studies and investigations recommending implementation of a drainage improvement project for this area.

The initial study area encompassed approximately 2,500 square miles, including most of Hidalgo and Willacy counties north of the Arroyo Colorado and Rio Grande Watersheds. The entire study area ,with the exception of several small census tracts near Edinburg and Mission, is designated as an "Economically Disadvantaged Community," as defined in Section 160 of WRDA 2020. The study area is shown in Figure ES-2, and includes (moving from south to north) the International Boundary and Water Commission (IBWC) Floodway System watershed, the HCDD1 North Main Drain (NMD) System watershed (shaded in orange), the Raymondville Drain System watershed (shaded in yellow and greens), and the rural northern watershed portions of Hidalgo and Willacy counties. The Recommended Plan identifies a feasible solution that ultimately focused on the more developed areas of Hidalgo and Willacy counties within the Raymondville Drain and North Main Drain watersheds. Improvements to the IBWC Floodway System and the rural northern portions of Hidalgo and Willacy counties were not included as components of the Recommended Plan

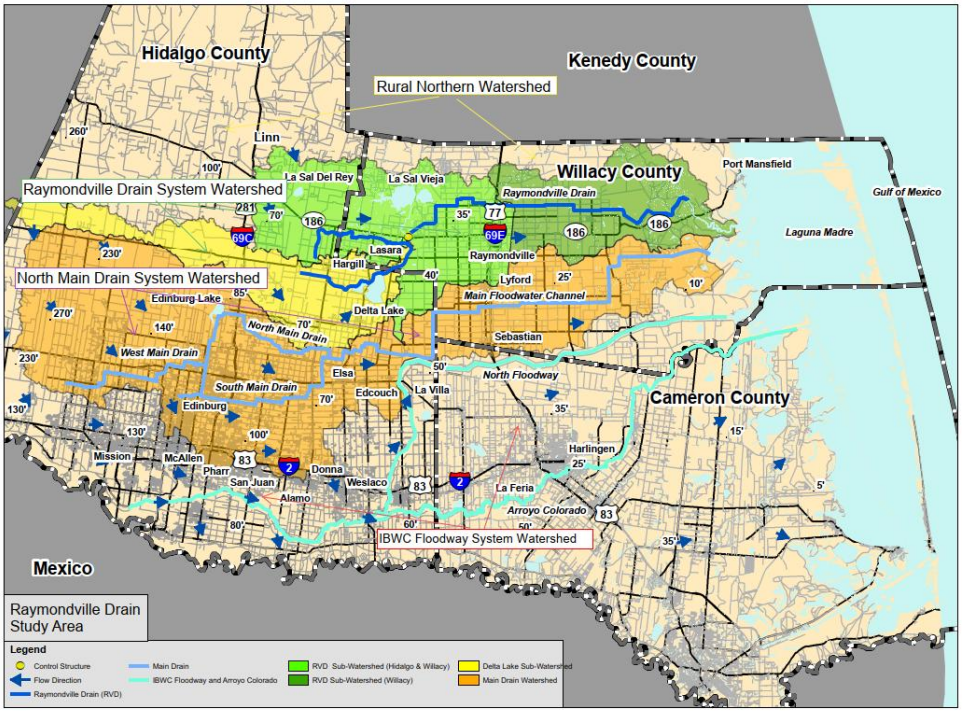

Figure ES-2 Study Area

PURPOSE AND NEED

The purpose of this study is to identify and recommend a technically feasible, implementable, cost-effective, and environmentally and socially acceptable solution to the current and future flood risk reduction needs of the study area (single purpose flood risk management). The study area generally drains from the west to the east. The blue arrows in Figure ES-2 indicate the general flow direction with reference ground elevations. Existing manmade drains and floodways within the study area intercept stormwater through a system that canalizes the flows through low-lying areas to the Laguna Madre. The existing and future projected development and urbanization of this relatively flat region exacerbates flooding.

The planning objectives of this study are to: (1) Reduce flood risks and damages to residential, commercial, industrial, and agricultural properties in the study area; and (2) Minimize floodwater disruption to roadways that provide local, regional, national, and international access to goods and services, enable local and regional emergency response and lifeline services, and provide regional emergency evacuation routes.

The project is needed due to the rapid and continuing economic and population growth in the region, adjacent to the United States-Mexico border. Land development activities occurring within Hidalgo and Willacy counties in recent years continue to place pressure on the existing drainage system and exacerbate flooding. The aging, inadequately sized drainage infrastructure was not designed to handle the increased stormwater runoff from new development.

PLAN FORMULATION

This study assessed a variety of potential solutions to address the regional drainage inadequacies within the study area, with an emphasis on improving the existing drainage infrastructure and minimizing possible environmental and social impacts. Three stages of plan formulation were conducted. The first stage evaluated potential conceptual measures (including non-structural measures and the No Action Alternative) for meeting the project objectives and constraints. Screening criteria in the first stage included land requirements, technical complexity, effectiveness, environmental concerns, distribution of benefits, Comprehensive Benefits, resilience considerations, and public support. The first stage eliminated several possible conceptual solutions (construction of levees/berms in populated areas, improvements to the IBWC Floodway System, some non-structural measures, and some nature-based solutions), and enabled a focus in the second stage on alternatives to increase the capacity of drains (flow-through and in-line channel storage) to efficiently move floodwater east to the Laguna Madre.

The second stage developed an initial array of risk management Alternatives to accomplish the concept of increasing the eastward flow capacity. The second stage further examined the opportunities to expand capacity and relieve flooding in additional areas of Hidalgo and Willacy counties. Alternatives in the second stage included options to improve the existing North Main Drain System, the existing Raymondville Drain, combinations of both; a regional bypass; acquisition (buyout) options; and the No Action Alternative. Screening criteria in the second stage included estimated costs and benefits, potential environmental concerns, Comprehensive Benefits, resilience considerations, public support, attainment of planning objectives, and the Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) criteria. The second stage recommended the alternative of improving the North Main Drain and Raymondville Drain Systems as best meeting the study objectives.

The third stage refined the final array of alternatives consisting of a combination of potential structural measures, and included a required non-structural (buyout) alternative. Two structural Alternatives were ultimately assessed based on USACE planning criteria, including the P&G, the Four Accounts (National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), & Other Social Effects (OSE)), resilience considerations, and finally the attainment of objectives. The NED Plan was forwarded as the Recommended Plan, the structural Alternative providing the greatest net economic benefit, and an equitable distribution of those benefits throughout the study area, including significant Comprehensive Benefits.

RECOMMENDED PLAN

The Recommended Plan would accomplish the study objectives by improving the existing regional stormwater drainage system in the Raymondville Drain and North Main Drain watersheds. The recommended plan includes widening selected drains (large diversion channels are locally referred to as “drains”) and constructing new drainage system elements in Hidalgo and Willacy counties. The drainage improvements would provide an array of Comprehensive Benefits including:

- Providing additional regional drainage capacity in flood-prone, poorly drained, flat areas.
- Reducing flood-related damage to residential, commercial, and agricultural areas, and reducing health risks, particularly following significant rainfall events (including tropical storms and hurricanes).
- Maintaining access to transportation corridors to support economic growth in this area of critical national economic importance.

- Providing life safety benefits through improved local availability of lifeline services and regional hurricane evacuation routes.
- Reducing flood-related risk and improving access to regional healthcare, correctional, and juvenile facilities.
- Reducing flood-related risk and improving access to facilities supporting Border Security and Immigration Enforcement.
- Reducing flood-related risk for employees of regional energy production facilities, and improving access routes for petroleum-related products.
- Alleviating drainage problems related to inadequate drainage outlets, high concentrations of soil salinity, pollution, and high-water tables, to improve farmland availability and quality.
- Supporting economic development opportunities in urban and rural census tracts identified as Economically Disadvantaged Communities, including areas of limited English language proficiency.

The Recommended Plan, shown in Figure ES-3, generally consists of approximately 13.8 miles of new diversion drain in Hidalgo County, approximately 43 miles of drain improvements in Hidalgo and Willacy counties, an approximately 270-acre detention pond in Hidalgo County, and five control structures (three located at the junction of the Raymondville Drain with other existing drains, one at the detention pond, and one at the Hidalgo-Willacy County line). The plan also includes the replacement or new construction of approximately 69 bridge structures or culvert crossings. The project would be constructed within a 350- or 450-foot-wide right-of-way (ROW), depending on location.

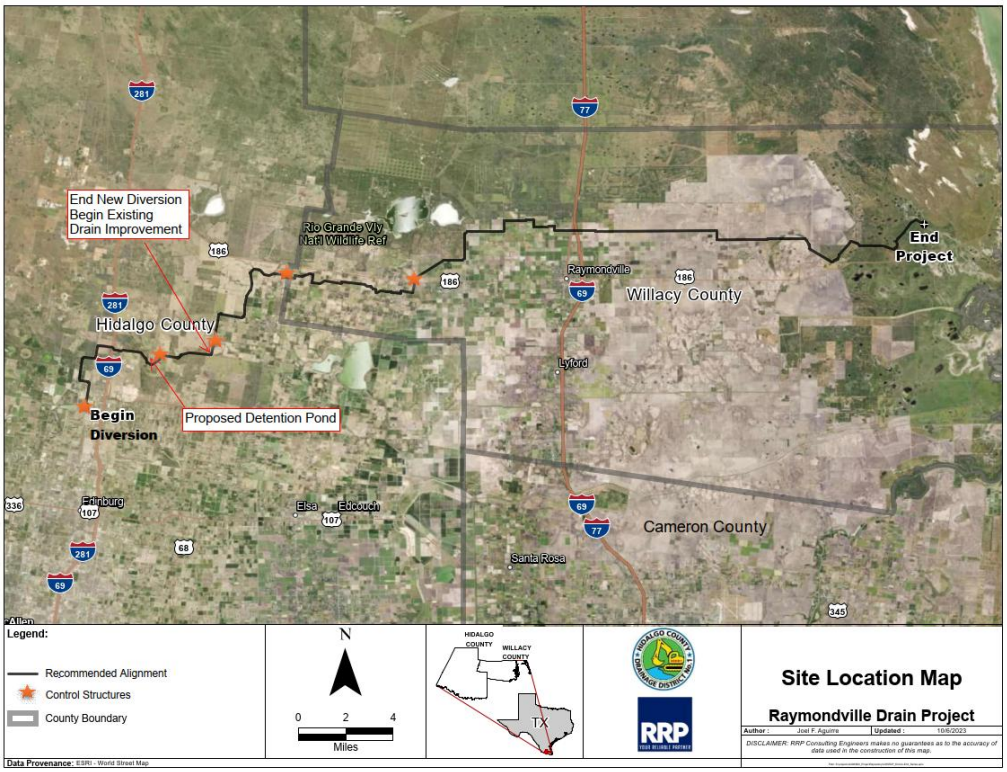

Figure ES-3 Recommended Plan

The proposed diversion transfers flows from the North Main Drain to a new extension of the Raymondville Drain at a new control structure near Edinburg Lake. The transferred North Main Drain System flow originates from more developed areas generally north and west of Edinburg. Reducing flow upstream in the North Main Drain System improves regional stormwater capacity, significantly reducing damages in Hidalgo County in the vicinity of the diversion and reducing flooding downstream in the North Main Drain watershed. The Recommended Plan also provides relief along the Raymondville Drain in Hidalgo and Willacy counties simultaneously through increased in-channel storage capacity throughout the system, increased through flow capacity, and controlled flow from Hidalgo County to Willacy County. The Recommended Plan would significantly reduce flood damage and flood risk in portions of the LRGV, benefiting over 38,000 structures, including structures in at-risk low-income communities. The project estimated first cost (2025 dollars) is $838,622,000 with a benefit/cost ratio (BCR) of 1.39, and provides approximately $38,393,000 in average annual benefits from flood damage reduction (Table ES-1). The economically disadvantaged nature of the region and associated relatively low property values artificially lower the flood damage reduction values, and the recommended project provides significant benefits not captured in an NED analysis alone.

Recommended Plan	Estimated Costs
Total Estimated Project Cost	**$838,622,000**
Average Annual Const. Cost	$25,670,000
Average Annual Incremental O&M	$1,898,000
Total Average Annual Cost	**$27,568,000**
Total Average Annual Benefits	**$38,393,000**
Net Excess Annual Benefits	**$10,825,000**
B/C Ratio	**1.39**

Table ES-1 Recommended Plan (2025 Dollars)

While the vast majority of quantified dollar benefits accrue in the upstream Hidalgo County portions of the project, the Raymondville Drain channel improvement continues the length of the project, through the less developed portions of Willacy County. This channel expansion through these downstream rural communities is necessary to safely and effectively convey the upstream flows diverted from the North Main Drain system through to the Laguna Madre. Project implementation would provide significant Comprehensive Benefits, including the added benefit of flood relief for downstream rural communities, and enabling future economic development. The project would also reduce agricultural damages, and enable the potential for land value increases over a long project reach (Location and Intensification Benefits). Because of the uncertainty related to the quantitative analysis of future Location and Intensification Benefits, they were not included in the BCR nor economic calculations, but are a qualitative and social benefit further justifying the project.

SIGNIFICANT RESOURCES/ENVIRONMENTAL CONSIDERATIONS

The Recommended Plan could have potential impacts to physical resources, biological resources, and cultural resources. For physical resources, the conversion of prime farmland areas to areas within the Raymondville Drain ROW could create potential impacts to agricultural areas. Such impacts are not anticipated to be so severe as to require mitigation.

For biological resources, potential habitat impacts to the federally-listed endangered Northern Aplomado Falcon (*Falco femoralis septentrionalis*), ocelot (*Leopardus pardalis*), and Gulf Coast jaguarundi (*Herpailurus (=Felis) yagouaroundi cacomitli*) may occur as a result of the implementation of the Recommended Plan. Such impacts were coordinated with the U.S. Fish and Wildlife Service (USFWS). Consultation under Section 7 of the Endangered Species Act was required for the ocelot, the Gulf Coast jaguarundi, the Northern Aplomado Falcon, the Cactus Ferruginous Pygmy-Owl (*Glaucidium brasilianum cactorum*) and the tricolored bat (*Perimyotis subflavus*), a species proposed to be federally-listed as endangered as of September 14, 2022 (Federal Register, Vol. 87, No. 177). A Biological Assessment was prepared to fulfill the requirements of Section 7 consultation. To minimize potential disturbance to ocelot, Gulf Coast jaguarundi, and tricolored bat habitat, the length of the proposed project has been reduced in sensitive areas; channel improvements would be designed to end approximately two miles upstream of the State Highway (SH) 186 bridge over the existing Raymondville Drain, southwest of Port Mansfield. Potential impacts to waters of the U.S. would be coordinated with the USACE Galveston District, as appropriate. The Biological Assessment determined that the Recommended Plan may affect, but is not likely to adversely affect, the species for which consultation was required. USFWS issued a concurrence with this determination on December 16, 2025.

For cultural resources, Section 106 of the National Historic Preservation Act (NHPA) would be addressed for any archeological and/or historic resources identified within the Raymondville Drain ROW. Field investigations for cultural resources, including testing and data collection, were conducted from May to September 2024. All cultural resource considerations are being coordinated with the Texas Historical Commission. Additional agency coordination, in collaboration with the USACE and other resource/regulatory agencies, is ongoing.

PLAN IMPLEMENTATION

Project implementation for the Recommended Plan is initially scheduled to take approximately 10 years, using a reasonable construction schedule consisting of a minimum of two concurrent contracts (lines of construction) – one for Willacy County, and one for Hidalgo County. An accelerated construction schedule could be implemented utilizing additional simultaneous construction lines (contracts), provided the sponsor and government agree to a more aggressive funding timeline. The Project Delivery Team (PDT) developed a construction sequencing plan and included a control structure at the Hidalgo-Willacy County line to manage flows, so no induced downstream flooding from the North Main Drain diversion would occur during construction. While the proposed construction activities are not technically complex, the project size and scope (including the relocation of numerous utilities, and addition or replacement of road crossings / bridges) results in a sizable logistical challenge related to the movement, transportation and relocation of a significant volume of excavated materials. The design of the proposed project is mature, and a significant amount of engineering work has been completed. The scope and quantities are well defined, and the cost estimate has a high level of confidence.

VIEWS OF THE PUBLIC, AGENCIES, STAKEHOLDERS, AND TRIBES

This study and associated investigations were initially scoped as an Environmental Impact Statement (EIS), however, following the evaluation of potential project-related impacts to the human and natural environment, it was determined that no significant impacts would occur and that an EA with a Finding of No Significant Impact (FONSI) would represent the appropriate level of environmental review under NEPA. The NEPA public review process for this project was initiated in 2004 with the publication of a Notice of Intent in the Federal Register, followed by a series of public scoping meetings and town hall meetings. Interagency coordination was initiated through meetings starting in 2016.

The project is strongly supported by the non-federal sponsor, HCDD1, and has been endorsed by officials at the Texas Water Development Board. No substantive issues have been raised by the public or resource agencies at this point. The Recommended Plan is a solution that was generally supported by the public during the public hearing coordination efforts in 2019. Additional opportunities for public comment were offered by HCDD1 as part of the process for development of the *2023 Regional Flood Plan - Region 15 Lower Rio Grande*, published in January 2023, and through a series of pop-up public outreach meetings held within the study area in July 2023.

REVIEWS

Previous iterations of this study have received public review, and an initial policy review assessment was provided by the Office of the ASA(CW) and the staff of the USACE Headquarters in 2020. This report has undergone Independent Technical Review (ITR) by USACE, an Independent External Peer Review (IEPR) by an Outside Eligible Organization (OEO), and Public Review is ongoing.

UNRESOLVED ISSUES/AREAS OF CONTROVERSY

No unresolved issues or areas of controversy have been identified at this point. Coordination is ongoing with federal and state resource / regulatory agencies to identify and resolve any remaining issues.

SECTION 1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

The Hidalgo County Drainage District No. 1 (HCDD1) prepared this integrated Feasibility Report (FR) and Environmental Assessment (EA) as the non-federal sponsor for the proposed Raymondville Drain (RD) Project, to analyze and address flood risk and damage concerns in Hidalgo and Willacy counties located in the Lower Rio Grande Valley (LRGV) of South Texas.

A requirement of the Assistant Secretary of the Army for Civil Works (ASA(CW)), the U.S. Army Corps of Engineers (USACE), and the National Environmental Policy Act of 1969 (NEPA) is to make a report available for public review that describes the analysis, risks, assumptions, and decisions made by the Project Delivery Team (PDT) during the project planning process.

The Federal Objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment pursuant to national environmental statutes, applicable executive orders, and other federal requirements. Federal water and related resources projects are formulated to alleviate specific local or regional problems and take advantage of opportunities in ways that contribute to the Federal Objective. Pursuant to this objective, this report:

- Summarizes the problems, needs, and opportunities for flood risk mitigation in the designated Study Area within the LRGV.
- Presents and discusses the results of the plan formulation for the proposed Raymondville Drain Project.
- Identifies specific details of a Recommended Plan, including inherent risks.
- Links the proposed Plan to Administration and other National Priorities.
- Provides a basis for confirming federal interest and local support for the Recommended Plan.

1.2 REPORT OVERVIEW

1.2.1 REPORT OUTLINE

This report, including the appendices and supporting documentation, has been organized into the following sections so that readers who prefer to review individual project considerations may find the information easily accessible. Note that the figures and tables in this PDF report are in high-quality format, so the reader can zoom in to provide additional detail or increase readability as necessary.

Executive Summary

The Executive Summary presents a summary of the Main Report, focusing on the key concepts of the planning process, decisions, and recommendations.

Main Report

The Main Report consists of an integrated FR and EA. The Main Report presents a summary of the study background, risks, assumptions, technical analyses, and the decision-making processes that are important to the study and to the recommendations made.

- Section 1: Introduction. This section provides an overview of the study scope, authority, purpose, need, and opportunities, as well as information regarding the public and agency engagement process.

- Section 2: Existing and Future Without Project Condition. This section presents a summary of the existing conditions within the study area. This section is organized by providing the Period of Analysis, the General Setting, and by describing the extent of the resources located within the study area for the 1) Natural Environment, 2) Physical Environment, 3) Human Environment (Demographics and Socioeconomics), and 4) Built Environment (Infrastructure). This section also summarizes the future condition of the study area without the implementation of the proposed project (No Action Alternative), including assumptions and trends to create a baseline to which other alternative plans are compared.
- Section 3: Plan Formulation and Evaluation. This section summarizes the planning process used to develop, evaluate, and refine alternative plans, including management tools, assumptions, and the process in which risks are identified and documented throughout the planning process.
- Section 4: Environmental Effects and Consequences. This section summarizes the impacts and information collected during the evaluation of the study, including reports, models, and surveys that are pertinent in determining the overall effect that the proposed project or any component of the considered plan may have on the study decision process. This section also includes a summary of mitigation, monitoring and adaptive management measures made to proposed project components to avoid and minimize any potential environmental effects.
- Section 5: Plan Comparison and Selection. This section describes the process in which the PDT developed, evaluated, and selected the Recommended Plan.
- Section 6: The Recommended Plan. This section describes the Recommended Plan, which is the proposed project subject to further refinement, including technical details, costs, benefits, risks, and uncertainties. This section also summarizes the project implementation on the future condition of the study area with respect to the four resources described in Section 2 (Natural Environment, Physical Environment, Human Environment, and Built Environment).
- Section 7: Environmental Compliance. This section summarizes consistency and compatibility with federal environmental compliance laws and guidance, and a summary of public coordination activities and viewpoints. This section also includes a summary of comments received during the previous public review period for this study.
- Section 8: Sponsor Recommendation. This section summarizes the Recommended Plan, key considerations and concludes with the official recommendation of HCDD1.
- Section 9: List of Preparers. This section presents a list of report preparers, their titles, and their contributions.

Appendices: Multiple technical appendices present more in-depth information about engineering, costs, environmental and public involvement, real-estate, and economics. This supporting documentation also includes pertinent correspondence submitted by the public, federal and state regulatory/resource agencies, and other stakeholders. Additional information includes summaries of the risk register, and references and acronyms. Review documentation will be added to the final report following completion of the review process.

1.2.2 PLANNING PROCESS

This integrated report was completed as a streamlined and risk-informed SMART (Specific, Measurable, Attainable, Risk Informed, Timely) Planning study, following the USACE "Feasibility Report Content and Format Guide" Version 1.0, dated October 2021. The development of this proposed project followed the Six-Step Planning Process used for all planning studies conducted by the USACE as defined in the Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) and further detailed in the "Policy for Conducting Civil Works Planning Studies," Engineer Regulation (ER) 1105-2-103. The planning process development activities focus on flood risk and damage reduction within populated

portions of the study area and for agricultural lands. These six steps, and the report sections where the steps are discussed are shown in Figure 1-1.

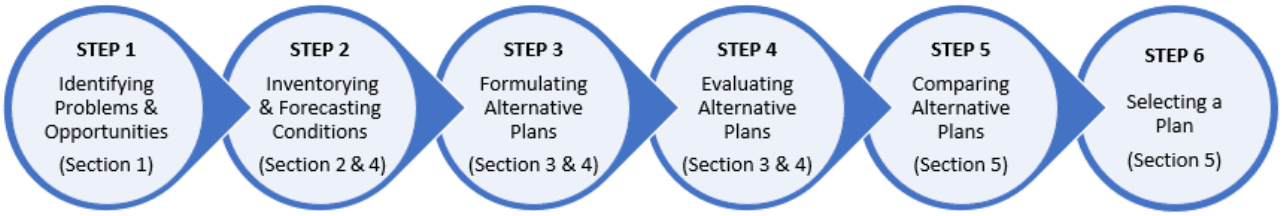

Figure 1-1 Six Step Planning Process

1.3 STUDY AUTHORITY

The *Lower Rio Grande Project for Flood Control* was identified in Section 68 of the Water Resources Development Act (WRDA) 1974, authorizing a Design Memorandum Study to address drainage issues following regional flood-related damage resulting from Hurricane Beulah (1967). In 1982, USACE completed a General Design Memorandum (GDM) and Environmental Impact Statement (EIS) recommending the construction of a three-phased plan to address stormwater damage, which was authorized by Section 401(a) of WRDA 1986.

Section 3150 of WRDA 2007 modified the drainage project for flood control purposes in the LRGV Basin as authorized by Section 401(a) of WRDA 1986. This modification included rerouting drainage to the Raymondville Drain as part of the project flood protection works, if determined to be feasible. The legislation also allowed a determination as to whether the cost of planning, design, and construction work carried out by the non-federal interest before the date of the partnership agreement for the project could be credited toward the non-federal share of the cost of the project.

This Feasibility Study is being conducted by HCDD1 (non-federal interest) under Section 203 of WRDA 1986, Public Law 99-662, as amended (33 U.S.C. 2231), which reads in part:

> *"A non-Federal interest may undertake a feasibility study of a proposed water resources development project and submit the study to the Secretary [of the Army]."*

Section 161 of WRDA 2020 enables swift action on the Raymondville Drain Project with its "hold harmless" language. Despite changes to the Section 203 authority in Section 161 of WRDA 2020, the Raymondville Drain Project was "grandfathered" as an in-progress project and is not subject to the additional requirements imposed by Section 161, including the requirement to complete all of the federal-related analyses, reviews, and compliance processes under NEPA prior to submission to Congress by the Secretary of the Army. The Raymondville Drain Project is the only study specifically listed by Congress as an example of a grandfathered project under Section 161, as documented in the Congressional Record (Volume 166, Number 207, 8 December 2020, page H6979).

1.4 STUDY AREA (PLANNING AREA)

Hidalgo and Willacy counties are in the LRGV of South Texas, as shown in Figure 1-2. The approximately 2,500 square mile study area is shown in Figure 1-3, and primarily consists of the vast majority of Hidalgo and Willacy counties north of the Arroyo Colorado and Rio Grande watersheds.

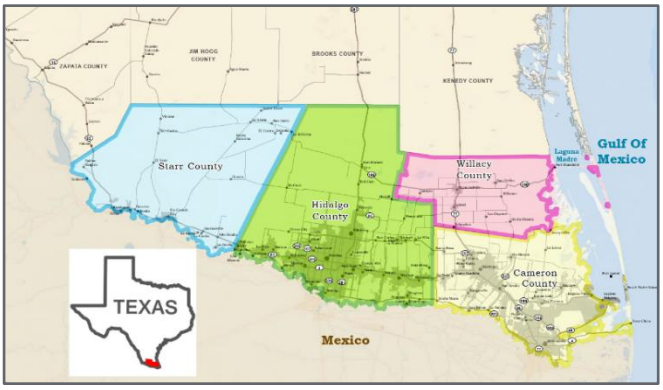

Figure 1-2 LRGV Region of Texas

The four main watersheds within the study area (listed from south to north) include (approximate area): (a) the International Boundary and Water Commission (IBWC) Floodway System watershed at 268 square miles, or 11% of the study area; (b) the HCDD1 North Main Drain (NMD) System watershed (shaded in orange) at 592 square miles, or 24% of the study area; (c) the Raymondville Drain watershed (shaded in yellow and greens) at 625 square miles, or 25% of the study area; and (d) rural land north of the Raymondville Drain watershed in Hidalgo and Willacy counties that does not depend on a primary drainage system, which accounts for 1,025 square miles, or 40% of the study area. These watersheds generally flow from west to east and discharge into the Laguna Madre. For the purposes of this report, the HCDD1 North Main Drain System is defined as the drainage network south of the Raymondville Drain, consisting of the West Main Drain, the North Main Drain, and the South Main Drain, which all flow into the Main Floodwater Channel. The developed portions of the study area are primarily within the 60% of the study area that are served by the IBWC Floodway System, the North Main Drain system, and the Raymondville Drain, while the remaining 40% in the northern part of the study area primarily consists of sparsely developed unincorporated farm and ranch land.

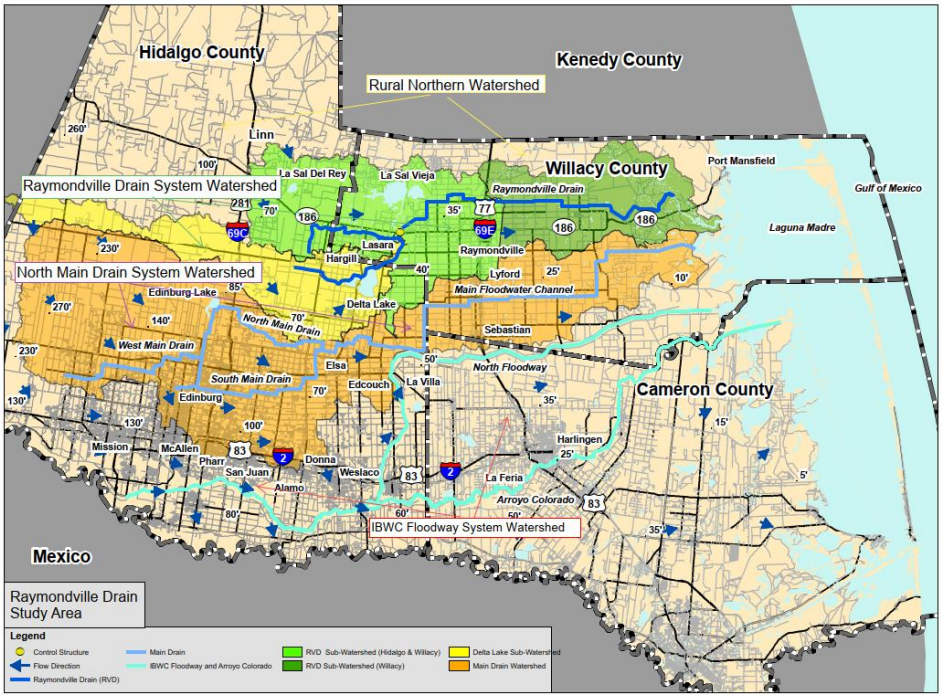

Figure 1-3 Study Area

Critical infrastructure in the study area includes the following major roadways: I-69C/US 281, I-69E/US 77, and I-2/US 83. Other major geographic features within the study area include the manmade Edinburg and Delta Lakes, and the Sal del Rey and La Sal Vieja Lakes which are located on the Department of the Interior U.S. Fish and Wildlife Service (USFWS) Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR). The study area includes the following towns (or portions of towns) from west to east (by drainage system): Donna and Weslaco, in Hidalgo County (IBWC Floodway system watershed); Mission, McAllen, Edinburg, San Juan, Alamo, Elsa, and Edcouch in Hidalgo County, and Lyford in Willacy County (North Main Drain system watershed); Hargill and Lasara in Hidalgo County, and Raymondville and San Perlita in Willacy County (Raymondville Drain watershed).

1.5 BACKGROUND AND HISTORY

1.5.1 PREVIOUSLY CONDUCTED STUDIES

The need for a water resource management project within the study area was first identified in 1962 by the Texas Water Development Board (TWDB), Texas Water Rights Commission, and the Texas State Soil and Water Conservation Board, with a request to conduct a Type IV Comprehensive Study under the authority of Public Law 83-566. The result of that four-year study was the 1969 report entitled "Comprehensive Study and Plan of Development, Lower Rio Grande Basin, Texas," by the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS). The study included a three-phased approach to address the water and related land resource development needs of the agricultural, rural, and urban areas of the basin. Phase I recommended the construction of three major floodwater channels, Phase II recommended approximately 1,400 miles of flood prevention and agricultural management channels to provide for more rapid removal of local floodwaters into the IBWC Floodway System, and Phase III included voluntary land treatment measures on cultivated lands and pastures supporting the conservation, utilization, and disposal of water.

Section 68 of WRDA 1974 (Public Law 93-251) authorized a study which enabled USACE to reevaluate Phase I of the SCS plan. Since each phase of the project was required to achieve adequate drainage benefits, USACE evaluated the entire system to determine the engineering, economic, and environmental feasibility of Phases II and III. The 1982 GDM and Final EIS, "Lower Rio Grande Basin, Texas Flood Control and Major Drainage Project" recommended a comprehensive plan with mitigation. USACE divided the comprehensive project described in the 1982 GDM into three projects for construction: (1) the Arroyo Colorado section, (2) the IBWC section, and (3) the Raymondville Drain section.

In August 1998, USACE published "Lower Rio Grande Basin, Texas Flood Control and Major Drainage Raymondville Drain, Limited Reevaluation Report (LRR) and Appendices." The 1998 LRR was limited to the reevaluation of the Raymondville Drain section of the 1982 GDM. The scope was limited to the enlargement of the Raymondville Drain from State Highway 186 (SH 186) westward to Farm-to-Market Road 88 (FM 88) near Delta Lake, with additional widening of the approximately six miles of the main Raymondville Drain channel to provide capacity for 100-year flood protection (risk reduction for the one-percent annual chance flood) for the City of Raymondville. At the time, Willacy County did not have the resources to further pursue that project.

In 2001, HCDD1 took over as the non-federal sponsor for the Raymondville Drain Project in a group effort with the USACE Galveston District. WRDA 2007 amended the authorized project to include a diversion channel from the North Main Drain near Edinburg Lake to the Raymondville Drain. Subsequently, HCDD1 assumed responsibility for all activities for the development of the project.

In September 2012, the LRGV Development Council published the "*Lower Rio Grande Valley Regional Economic Adjustment Plan (EAP) for Building Disaster Resilient Communities*" (LRGV Regional EAP). The purpose of the study was to outline a plan for all of Cameron, Hidalgo, and Willacy counties, and a portion of Starr County, to ensure

economic growth and economic recovery following natural disasters. The study coordinated with over 200 entities and identified and ranked 418 projects to address the needs of the region. The LGRV Regional EAP identified and ranked the "Raymondville Drain and Connecting Laterals" as Number 1 in regional Large Project needs.

In 2019, the Texas Legislature authorized the development of the first State Flood Plan and assigned responsibility to the TWDB. In January 2023, the Lower Rio Grande Region 15 Regional Flood Planning Group published the "2023 Regional Flood Plan, Region 15, Lower Rio Grande, Volume 1." The Plan includes (among other topics): flood risk analyses for existing and future conditions; floodplain management practices and flood protection goals (regional); assessment and identification of flood mitigation needs; and administrative, regulatory, and legislative recommendations. The TWDB Plan was completed after much of the analysis documented in this FR was initiated, however, the Raymondville Drain Project Feasibility recommendations are consistent with the TWDB Plan. The TWDB Plan describes 85 ongoing Flood Mitigation Projects in the LRGV, including 77 structural projects. These projects are primarily concentrated in Hidalgo, Willacy, and Cameron counties. The ongoing projects within the FR study area are considered part of the future without project condition, and the TWDB projects depend on the North Main Drain System, so such projects did not change the analysis or recommendations for the Raymondville Drain Project Recommended Plan.

1.5.2 IMPACTS AND LIMITATIONS OF PREVIOUSLY CONDUCTED STUDIES

The above-listed reports and documents are mentioned to provide the background on the proposed project and further document its need, and are intended to be utilized for reference purposes only. The 1982 Phase I GDM and EIS included a larger study area and more comprehensive regional drainage solutions, and the 1998 LRR was more limited in scope than the current drainage study. This Feasibility Study developed alternatives with a more focused study area compared to what was considered in the previous studies. The Feasibility Study evaluates the current conditions of each alternative and the stated goals (purpose and need) of this proposed project.

The GDM was completed over 40 years ago, and the LRR 25 years ago. The drainage conditions and development have significantly changed over this period resulting in a need for the current effort in flood management for Hidalgo and Willacy counties. The proposed project has a materially different scope (more limited) than the projects proposed in the GDM. Furthermore, the Record of Decision (ROD) for the 1982 Phase I EIS could not be located, and as a result could not be formally used in the decision-making process of this report. Therefore, this stand-alone Feasibility Study and EA will serve to: 1) reevaluate previously identified impacts; 2) revisit some previously considered measures in the plan formulation process; and 3) update project information considering current engineering design standards and NEPA requirements.

1.6 PURPOSE AND NEED

The purpose of the Feasibility Study is to identify and recommend a technically feasible, implementable, cost-effective, and environmentally and socially acceptable solution to manage the current and future flood damage risk in the study area, while supporting economic growth and community resilience (single purpose flood risk management). The need for the study comes from the significant and widespread damage to communities, infrastructure, and the economy caused by storm events (primarily tropical storms and hurricanes). Section 1.7.1.3 documents notable storm and flood events impacting the LRGV. Back-to-back June floods in 2018 and 2019 (not related to a tropical cyclone or hurricane) set single one-day rainfall records in the study area, resulting in significant flooding, damage, and travel disruption in the study area. More recently, storms in March 2025 caused devastating flooding and set new rainfall records in various locations the region.

Based on the latest U.S. Census Bureau data, the study area continues to experience substantial population and development growth exceeding previous government projections. Flood damages are expected to continue to

increase in the future due to an increase in residential, commercial, and industrial development throughout the study area, and the resultant increase in extent and depth of flood inundation. An analysis of Census variables including socioeconomic status, household characteristics, racial and ethnic minority status, housing type, and transportation availability indicate that the citizens of Willacy and Hidalgo counties are highly vulnerable to disasters including flooding.

The entire study area (with the exception of several small census tracts near Edinburg and Mission) is designated as an "Economically Disadvantaged Community," as defined in Section 160 of WRDA 2020. The study area traverses low-income communities, and includes areas of limited English language proficiency (LEP) consisting of predominantly Hispanic communities. Property values and income levels in the study area are below national and Texas averages, and are lowest in the downstream rural Willacy County communities. Implementing solutions to the flood risk challenges within the study area would provide benefits to these at-risk communities by supporting economic development, improving access during flooding, and reducing flood damages and community disruption.

The existing manmade drainage systems in the study area include the IBWC Floodway System, the North Main Drain System, and the Raymondville Drain. The primary purpose of the IBWC Floodway System (conveying runoff from the southern portion of the study area) was to provide an additional drainageway to convey stormwater flows to the Laguna Madre, reducing flood risks along the Rio Grande. The IBWC Floodway includes levees and requires pumps to convey water into the floodway during significant storm events. The North Main Drain System was constructed with the intent to convey stormwater runoff from the developed portions of Hidalgo County (generally the southern portions of the study area) to the Laguna Madre. The existing Raymondville Drain System, including connecting drains, was designed in the late 1960s and was originally intended to convey agricultural runoff (from generally the northern portions of the study area) from a 9.5-year storm event to the Laguna Madre.

Due to the development of the LRGV region over the last 50+ years, these systems do not have enough capacity to protect the local population and infrastructure from the threat of flood waters following significant storms. The existing outdated drainage systems are currently insufficiently sized to effectively contain current stormwater runoff resulting from increased urban development in Hidalgo and Willacy counties.

Multiple investigations have been undertaken through the years identifying the need for regional drainage improvements, however no major federal action has yet been fully studied with a specific, implementable recommendation until now. This Feasibility Study describes the problems and opportunities within the LRGV and details the alternatives analyzed which would support the purpose and need for the proposed project.

1.7 PROBLEMS AND OPPORTUNITIES

Recurrent flooding causes damages to property, infrastructure, and provision of services in the study area, and poses inherent health and life safety risks to the residents and visitors. The study area is a growing region with national significance due to its role in international trade, border security, and energy production.

As documented in the 2023 Regional Flood Plan Region 15, Lower Rio Grande, Volume 1, population growth in the LRGV continues to increase each year. Population growth and related residential and business developments have largely occurred in Cameron, Hidalgo, and Willacy counties. Hidalgo County represents the largest county in the study area, with a population of nearly 1,000,000 in 2020, and a projection of over 70% growth by 2050 according to the Texas Demographic Center. Land once utilized for cropland or grazing has decreased within the region. As shopping centers occupy former pastures, and row crops are replaced by residential subdivisions, the increase in paved surfaces reduces overall soil permeability and increases stormwater runoff. Population growth

and the outward expansion of metropolitan areas (e.g., Edinburg) into former agricultural areas/open spaces increases the pressure on the region's flood risk reduction infrastructure.

Identified problems associated with the study area include:

- Continued population growth.
- Residential, commercial and industrial development in areas vulnerable to flooding.
- Seasonal threats of severe weather (including tropical depressions/cyclones and hurricanes).
- Existing drainage infrastructure inadequacies.

These identified problems expose an increasing number of residents and businesses to flood risks following storm events as the flat regional topography is not conducive to the rapid recession of flood waters. Floodwaters inundate large agricultural areas, improved pastures, and urban areas for prolonged periods of time, resulting in extensive damage to properties, structures and crops.

1.7.1 PROBLEMS

1.7.1.1 Continued Population Growth

The four largest urbanized areas within the study area include the cities of McAllen, Edinburg, Pharr, and Mission. Analyses of anticipated population growth within the study area are documented in Appendix A-1. The PDT analyzed population data from the U.S. Census Bureau and projected populations in and around these major urban areas to obtain an understanding of the future conditions analysis within the study area. This analysis indicated that the population growth estimates utilized by the PDT in previous drafts of this Feasibility Study were within 5% of U.S. Census Bureau data and exceeded government estimates, confirming growth assumptions used in the analysis.

1.7.1.2 Residential, Commercial, and Industrial Development, and Government Facilities in Areas Vulnerable to Flooding

Within the study area, infrastructure exists in flat flood-prone areas and continues to expand into downstream rural communities. In the absence of comprehensive solutions, this infrastructure remains at risk without expensive and unsustainable measures at a structure-by-structure or neighborhood-by-neighborhood level. Increased population and development in the study area continues to increase regional vulnerability to flood events. A large-scale regional approach would provide an effective, more comprehensive, and long-term solution.

The Edinburg area has developed significantly in recent years with the expansion of the University of Texas Rio Grande Valley (UTRGV) campus as well as the construction of the Doctors Hospital at Renaissance and the Bert Ogden Arena. Hidalgo County changed in terms of growth strategies following the introduction of the North American Free Trade Agreement (NAFTA) in 1994, transforming many of the primarily agricultural communities in the county into areas supporting a more diverse economy with the development of international trade-related industries (e.g., warehouses, short-haul trucking, etc.). The resulting transportation infrastructure improvements supported NAFTA as multiple International Port of Entry facilities were designed and constructed along the U.S.-Mexico border with easy access to I-69C, US 281 and other roadways (e.g., US 83, US 77, etc.). After the passage of NAFTA, commercial vehicle traffic increased across all Texas commercial border crossings, and freight exchange between the U.S. and Mexico is expected to continue to increase in the future resulting from the 2020 implementation of NAFTA's successor, the US-Mexico-Canada Agreement (USMCA). A total of 10 international bridges are located south of the study area in Hidalgo and Cameron counties, of which five were constructed after the passage of NAFTA. I-69C/US 281 and I-69E/US 77 are the largest north-south highways in Hidalgo and Willacy counties, respectively, and are anticipated to transport most of the vehicle traffic to and from the international bridges. As international traffic increases in response to the USMCA initiatives, traffic along I-69C/US 281 and I-

69E/US 77 is anticipated to increase as well as increased development on land adjacent to each highway, as development away from urban areas continues to sprawl.

The study area is strategically important for Border Security and Enforcement activities by the Department of Homeland Security (DHS). DHS operates two Immigration and Customs Enforcement (ICE) detention facilities within the final project area, including the El Valle Detention Facility in Raymondville, and the East Hidalgo Detention Center in La Villa. The DHS utilizes the South Texas International Airport in Edinburg for tactical operations. The Harlingen Field Office is located south of the study area. Flood risk reduction in the region would ensure access to these facilities, and support employees who live in the region.

Energy infrastructure in the study area has also expanded, and there are hundreds of wind turbines in the study area, primarily in several wind farms in eastern Hidalgo County and central Willacy County. During periods of inundation and flooding following storm events, flood waters may impact wind turbines within the study area by damaging ground-level infrastructure and by limiting maintenance access to the turbines. The greatest vulnerability is for the Willacy County wind farms, located mostly in downstream portions of the study area. Additionally, oil and gas-related production and transportation facilities are located in the region, and employees live in the study area.

1.7.1.3 Seasonal Threats of Severe Weather (Tropical Depressions/Storms, Cyclones and Hurricanes)

The largest and most destructive storms affecting the LRGV are tropical cyclones; however, large non-tropical storms also occur annually between June 1st and November 30th along the Texas Gulf Coast. Forty-one hurricanes, tropical storms, and tropical depressions have passed within 50 miles of Hidalgo County since 1854, and 19 have traversed the study area in that period (see Figures 1-4 and 1-5). Due to the large area that hurricanes affect, the LRGV has also been affected by storms which did not traverse the study area, such as Hurricanes Gilbert and Alex in 1988 and 2010, respectively, both of which made landfall in Mexico but resulted in heavy rainfall in the LRGV.

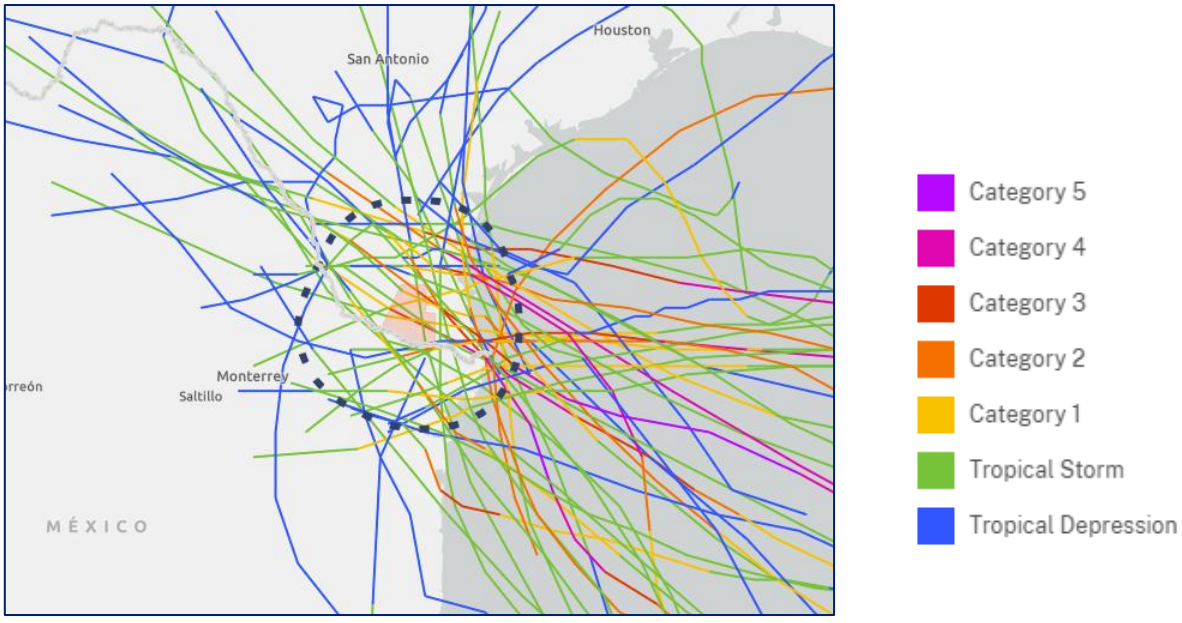

Figure 1-4 Tropical Cyclones Passing Within 50 miles of Hidalgo County, TX, 1854-2025. (Source: NOAA 2026)

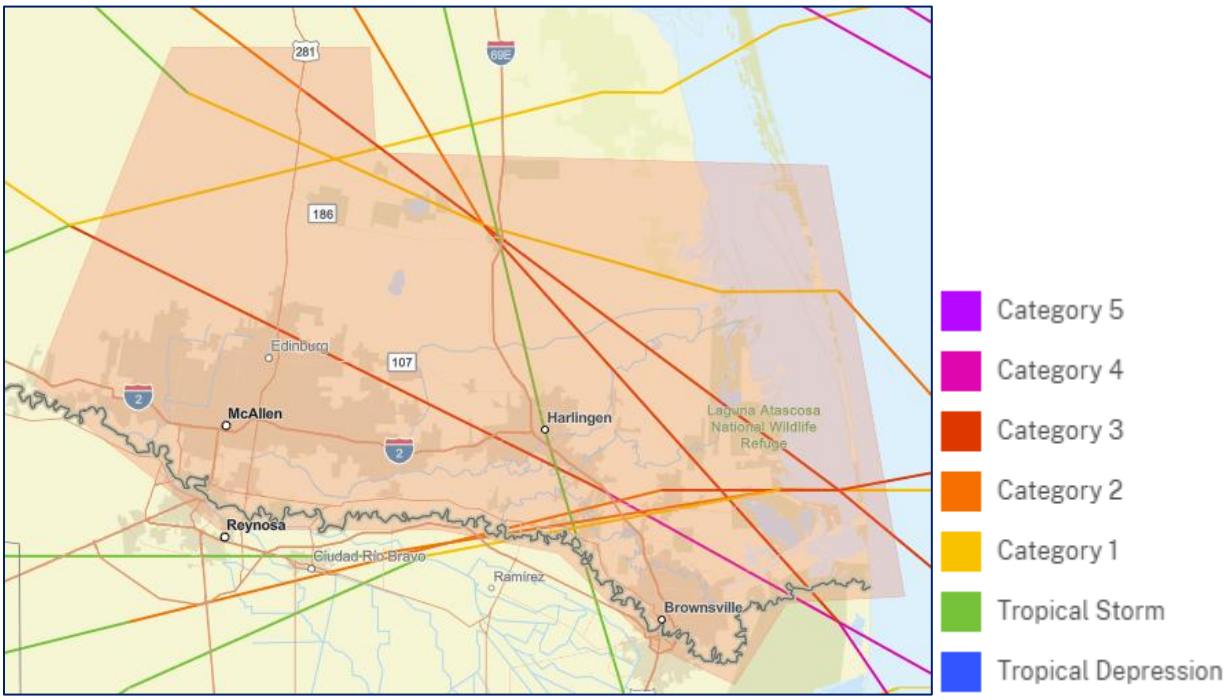

Figure 1-5: Tracks of hurricanes, tropical storms, and tropical depressions that have traversed the study area. (Source: NOAA 2026)

Additional flooding has occurred due to atmospheric events other than tropical cyclones. Table 1-1 provides a summary of notable storm and flood events that have affected communities in the study area.

Table 1-1: Notable Storms and Flood Events in the LRGV

Name of Event	Date	Notes
Hurricane Beulah	September 1967	Earliest named storm to strike the LRGV.
Hurricane Caroline	August 1975	Struck Mexico; heaviest rainfall occurred in the LRGV.
Tropical Storm Amelia	July 1978	No Disaster Declaration
Hurricane Allen	August 1980	Made landfall in the LRGV as Category 3.
Hurricane Gilbert	September 1988	Struck Mexico 60 miles south of the border and spawned tornadoes in the LRGV region.
Tropical Storm Arlene	June 1993	Appeared poorly organized before landfall, but caused torrential rainfall and significant agricultural damage in the region.

Hurricane Bret	August 1999	Made landfall in Kenedy County before moving south through the LRGV.
Hurricane Dolly	July 2008	Resulted in rainfall totals of 10+ inches in the Raymondville Drain Project study area.
Hurricane Alex	June 2010	Struck Mexico; northern bands of the storm affected the LRGV.
Tropical Storm Hermine	September 2010	Developed from tropical depression to tropical storm in approximately 15 hours.
Great June Flood of 2018	June 2018	Caused by a slow-moving tropical wave which passed through the region from June 18-22, 2018.
Great June Flood of 2019	June 2019	Caused by multiple simultaneous atmospheric events.
Hurricane Hanna	July 2020	Made landfall at South Padre Island as a Category 1 storm.
Historic Rainfall	March 2025	Historic rainfall from a QLCS (Quasi-Linear Convective System) in the LRGV caused widespread devastation

Source: National Weather Service, National Oceanic and Atmospheric Administration, January 2026.

The most significant flooding in the LRGV in modern history occurred during Hurricane Beulah in September 1967. Rainfall of 10 to 20 inches over a watershed already saturated by heavy rains the previous August resulted in thousands of acres of agricultural land and several communities being flooded. Property damage and crop losses were estimated to be in tens of millions of dollars (over $1 billion in current dollars). Hurricane Beulah is the first named storm to affect the study area following the construction of the Raymondville Drain, followed by Hurricane Caroline in August 1975, Tropical Storm Ameila in 1978, and Hurricane Allen in August 1980.

In September 1988 Hurricane Gilbert struck Mexico 60 miles south of the border and spawned tornadoes in the LRGV region, and in August 1999 Hurricane Bret produced minor flooding in the Rio Grande Valley near the Gulf of Mexico. During that time there were nine additional Disaster Declarations in Texas for severe storms, flooding, and tornadoes.

Between 1982 and 1999, there were three Federal (Presidential) Disaster Declarations in Texas resulting from hurricanes and one Disaster Declaration for a tropical storm, but no significant flooding was reported in the study area from those events. Significant flooding was reported, however, due to Tropical Storm Arlene in 1993. Between 2000 and 2021, Hidalgo County experienced 14 Federal Emergency Declarations and Major Disasters for flooding with a property damage value of $201,492,500 reported to the National Oceanic and Atmospheric Administration (NOAA). In that same timeframe, Willacy County experienced 11 total declared events with a NOAA reported property damage value of $24,246,500. Over the last eight years alone, Hidalgo County has experienced six FEMA disaster declarations due to flooding.

Two recent major flooding events, not related to a tropical cyclone or hurricane, resulted in significant flooding, damage, and travel disruption in the study area. The National Weather Service (NWS) reported that a “confluence of atmospheric events” occurred on June 24, 2019, in what is known as the Great June Flood of 2019 (FEMA-DR-4454). The 2019 storm released over 12 inches of rainfall in six hours, with more than 15 inches of rainfall

occurring along the Hidalgo/Cameron County line, and setting new single-day rainfall records at multiple locations in Hidalgo and Willacy counties. One year earlier, another significant flooding event occurred, known as the Great June Flood of 2018 (FEMA-DR-4377). The 2018 event released as much as 18.3 inches of rainfall in Hidalgo County, and as much as 13.5 inches in Willacy County.

Spring 2025 saw another devastating non-tropical flood in the Lower Rio Grande Valley. From 26-28 March 2025, record rainfall of nearly 20 inches (measured) and potentially just over 21 inches (radar-estimated) pummeled much of the Rio Grande Valley, from eastern Starr County through southern Hidalgo County and into northern Cameron County. The rainfall crushed prior daily, multi-day, and (March) monthly records at many locations, and rivaled all-time two-day records in a few locations. For most of this region, the event was rated a "100-year" (1%) to "200-year" (0.5%) probability event, with a few areas estimated at "500-year" (0.2%). More than 5,000 structures were impacted, with more than 2,000 having major damage or destruction. The floods devastated dozens of neighborhoods across the Valley, with the most notable damage centered on northern Cameron County, where the heaviest rains fell. A Texas disaster declaration was made for the four-county Rio Grande Valley region. Preliminary reports suggested that this event rivaled that of the Great June Flood of 2018, and damage and recovery totals from the flood were likely to exceed $100 million. Additionally, there were several local wind damage events across the region. Six known fatalities were documented directly or indirectly from the storm. (https://www.weather.gov/media/bro/wxevents/2025/pdf/Spring2025RioGrandeValleySummary.pdf)

Cropland is the predominant use of working lands in Hidalgo and Willacy counties, and the northern portion of Hidalgo County and northwest portion of Willacy County additionally have working lands classified as ranch lands. These counties are home to some of the most fertile farmlands in the LRGV, so protection of farmland and ranchland from flood events is regionally important as significant agricultural damage continues to occur because of inundation from storms. Typical commodities which are produced on working lands in Texas include food, fiber, timber, and other crops, as well as livestock. The NOAA National Centers for Environmental Information reported Hidalgo County as having the largest number and value of flood-related crop damage incidents in the LRGV between 2000 and 2021 (61 events for $163,000,000), with Willacy as second (31 events for $137,200,000).

1.7.1.4 Existing Drainage Infrastructure Inadequacies

Flooding within the LRGV is primarily driven by high intensity rainfall events, falling on relatively flat, slow-draining terrain, overburdening the aging and inadequate drainage system in place throughout the study area. As a result of the flat topography of the LRGV, the resultant flooding is typically shallow but spread over a large region, and most LRGV communities are affected by flooding to some degree. Communities within the study area that are particularly vulnerable to floods include McAllen, Edinburg, Lull, San Carlos, La Blanca, Elsa, Edcouch, La Villa, Raymondville, Lyford, Sebastian, and San Perlita. Other smaller rural communities are also affected. Often, flooding is compounded in Willacy County by surface runoff from Hidalgo County which must flow overland to the Laguna Madre. In Willacy County, significant overland flow from rural areas to the west passes through both Raymondville and Lyford, causing flooding for several days after flood producing storms occur in Hidalgo County.

Existing drainage conditions in the basin are generally inadequate, despite the number of surface drains and underground drains which have been constructed. The existing drainage network has two major deficiencies that prevent the proper drainage of the region: 1) the lack of drainage outlets in much of the area; and 2) inadequate capacity in existing drains. The current network of ditches and drains provides only partial drainage because of its insufficient depth (limited by topography) and capacities. Most of the smaller drains in the irrigated areas were excavated to obtain material to construct elevated irrigation canals, resulting in multiple existing drains with inadequate grade and drains that do not tie into outlet facilities.

Historically, irrigation and drainage districts constructed and operated irrigation and drainage facilities

independently of one another, with little consideration given to the other districts. Each district primarily focused on the needs and development trends of their area. As a result, numerous irrigation and drainage channels cross the study area. This issue has been compounded by the exponential residential, commercial and industrial growth the area has experienced.

The floodwaters block transportation arteries causing interruption of economic activities, tourism, school attendance, and utility services, and increases the efforts of repair crews. Interruption of transportation routes: 1) limits the movement of nationally important goods and services throughout the LRGV; 2) increases loss of life risks due to limited egress/escape once flooding occurs; and 3) reduces access to critical emergency and rescue services.

The major transportation routes traversing the proposed project area have considerable economic impact on the nation. The US 281 (I-69 C) and US 77 (I-69 E) both traverse the Raymondville Drain Project area and allow for the transportation of products to and from Reynosa and Matamoros, Mexico, respectively. As documented in the December 2020 Texas Department of Transportation (TxDOT) "Rio Grande Valley Freight and Trade Transportation Plan," movement of goods by border crossings and the highway network in the Rio Grande Valley contributed $22 billion to the U.S. Gross Domestic Product (GDP) in 2019, supporting 180,000 jobs. These crossings also supported an additional $18.1 billion in GDP on the Mexican side of the border supporting 1.5 million jobs. This economic contribution highlights the national and international importance of maintaining and improving the reliability of transportation routes in the region.

The inadequate drainage infrastructure also adversely impacts farming. In addition to the direct flood damage to crops described in section 1.7.1.3, salinity problems, which restrict production on fertile soils in many areas, are aggravated by inadequate surface and subsurface drainage, high-water tables, and the excessive use of variable quality irrigation water. The lack of adequate drainage channels prevents installation of on-farm systems for surface and subsurface drainage, thereby restricting farming efficiency.

1.7.2 OPPORTUNITIES

Population growth and related residential, commercial and industrial development continue to increase the risk of, and vulnerability to, flooding in the LRGV. Flooding hinders the economic growth needed to support the local economy in this region of national trade and economic importance. Opportunities exist to enable improved economic development in the region by reducing the frequency and intensity of flooding. Due to the international trade importance of the region, improved regional economic growth and reliable transportation access would support the national economy, and improve the conditions for populations throughout the study area.

Drainage improvements to reduce flooding risk would reduce flood damages, support property values, reduce community disruption, reduce public safety threats, improve community resilience, improve economic opportunities and growth, and reduce the need for Federal Emergency Management Agency (FEMA) assistance following storm events in this rapidly growing, yet low-income region. This could be accomplished by improving and expanding the existing drainage network, in combination with other measures, to increase the efficiency of drainage to the Laguna Madre, providing flood risk reduction benefits to communities within the LRGV, expanding economic opportunities. A reduction in the frequency and severity of flooding of streets, major highways, and access roadways would maintain the reliability of internationally critically commerce activities between the U.S. and Mexico. Improved agricultural drainage would protect farming opportunities and production rates, and farmland availability and quality.

1.8 OBJECTIVES AND CONSTRAINTS

As stated previously, the Federal Objective of water and related land resources planning is to contribute to National Economic Development consistent with protecting the nation's environment pursuant to national environmental statutes, applicable executive orders, and other federal requirements. The planning objectives of the Raymondville Drain Project are to:

- Reduce flood risks and damages to residential, commercial, industrial, and agricultural properties in the study area.
- Minimize floodwater disruption to roadways that provide local, regional, national, and international access to goods and services, enable local and regional emergency response and lifeline services, and provide regional emergency access routes.

This report will calculate flood damage reduction benefits for communities within the basin and compare alternatives. Communities throughout the basin will be evaluated for potential improvements as part of this study.

Study constraints include:

- Respecting legal and policy constraints related to the study area with regards to the U.S.-Mexico border, and the IBWC drainage infrastructure and operational policies.
- Avoiding solutions that depend on infrastructure controlled by other entities to increase the reliability of the drainage system.
- Avoiding induced flooding in downstream communities. The most significant flood damages within the basin occurs in the more populated and more developed upstream communities in Hidalgo County. From west to east, the existing drainage systems flow from Hidalgo County through at-risk communities in rural Willacy County and eventually discharge into the Laguna Madre. Drainage solutions must consider all impacts and avoid imposing additional burdens on these rural downstream communities.
- Utilizing existing drainage infrastructure to the extent possible, to reduce costs and minimize potential impacts to the human and natural environment.
- Protecting the environment, wildlife habitat, and archeological resources, consistent with appropriate federal and state environmental regulations.
- Minimizing impacts on productive farmland and ranch lands.

1.9 STUDY SCOPE

As previously stated, the purpose of this study is to determine a technically feasible, environmentally and socially acceptable, and economically justified plan for the study area to manage flood damage risk while supporting the region's economic and community resilience. Due to the large study area, for efficiency, this study will build on previous investigations and analysis by USACE and HCDD1, with the goal of finally getting to an implementable and supported solution to provide flood relief to the citizens of Hidalgo and Willacy counties after many years of study.

As a SMART Planning study in accordance with Congressional intent of efficient and timely studies, the Recommended Plan will be sufficiently refined to provide a solution consistent with the planning objectives, and to provide a practical and socially equitable way to reduce flood risks in the study area. To accomplish this purpose, this Feasibility Study will evaluate the existing condition of the study area and evaluate a future without project condition to serve as a baseline (the No Action Alternative), develop project alternatives including structural and non-structural options, evaluate the identified alternatives, and select a Recommended Plan based on the four evaluation accounts as outlined in ER 1105-2-103. The four accounts include the NED Account, the Environmental Quality (EQ) Account, the Regional Economic Development (RED) Account, and the Other Social

Effects (OSE) Account. Due to the economic and social conditions in many parts of the study area and low property values in this region of South Texas, OSE and Comprehensive Benefits will be a significant consideration in the justification. Following the presentation of the Recommended Plan, the study will outline the proposed impacts of the Recommended Plan, including cost and property impacts, and proposed plan-specific information such as cost sharing and construction schedule.

SECTION 2.0 EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

2.1 PURPOSE OF THIS SECTION

The purpose of this section is to provide both the existing conditions (a baseline), and a forecast of the "Future Without Project (FWOP)" conditions, which together provide the basis for plan formulation. The existing conditions provide a description of the human environment. The FWOP conditions are defined as those conditions that would exist within the study area during the 50-year period of analysis if the Raymondville Drain Project is not constructed. The expected FWOP condition is the same as the "No Action" Alternative and is therefore a projection of how these conditions are expected to change over time if the Recommended Plan is not implemented.

A qualitative and quantitative description of resources within the study area is defined for both existing and future conditions as the first step. The second step of plan formulation and the starting point in USACE analysis is to develop an accurate picture of the existing and FWOP conditions for the four resource types in the study area; such resources include: 1) Natural Environment; 2) Physical Environment; 3) Human Environment (Demographics and Socioeconomics); and 4) Built Environment (Infrastructure). Forecasts extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis.

The FWOP condition forms the basis, or benchmark, against which plans are developed, evaluated, and compared. Proper definition and forecasting of the expected FWOP condition are critical to a successful planning process.

While the initial study area is a large portion of the LRGV and overall conditions were assessed and considered throughout the study area to get to the Recommended Plan, this section primarily focuses on the final study corridor established by the team associated with the final alternatives. Figure 1-3 indicates the entire study area considered at the beginning of the study process. The final focused study corridor that was investigated in-depth is located within the Raymondville Drain watershed, shaded as green in Figure 2-1 (a more detailed map is provided in Appendix A-3, Attachment A, Exhibit 8 – Watersheds Map).

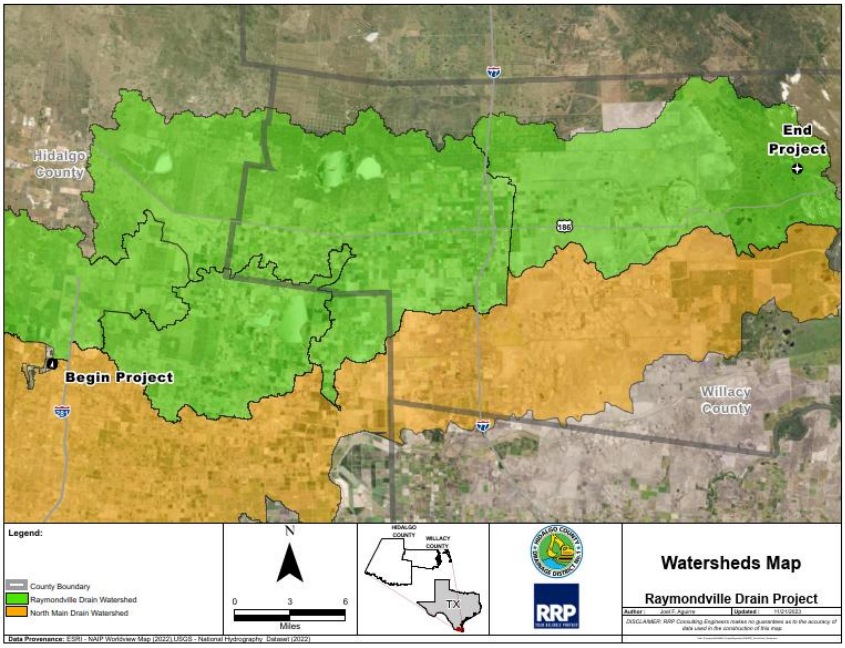

Figure 2-1 Focused Study Corridor

The general setting is not expected to change under the Future Without Project condition. The resource descriptions generally apply to both existing and Future Without Project conditions (the No Action Alternative discussed in Chapter 4).

2.2 PERIOD OF ANALYSIS

The period of analysis for the proposed project is 50 years, from 2034 to 2084. The Hydraulics and Hydrology (H&H) and economics analyses were initially completed earlier in the study process (circa 2011) and have been updated for this report. Switching the base year from 2011, as documented in earlier study iterations, to the current base year of 2034 (10 years after anticipated project authorization) was adjusted in the economic computations, was evaluated in the risk register and does not impact selection of the Recommended Plan.

2.3 GENERAL SETTING

The general character of the landscape within the Raymondville Drain Project study area is that of a rural, agricultural region located near the Texas Gulf Coast and the U.S.-Mexico border. Undeveloped areas predominately consist of row crop farms or ranchland; east of Raymondville, wind turbines are numerous and are frequently located within agricultural fields. Approximately 35 percent of the land in Hidalgo County and 39 percent of the land in Willacy County is used as cropland or pasture (see Appendix A-3, Figure 1). Notable developments and land use near the northern portion of the Raymondville Drain Project study area include the South Texas International Airport and the Lopez State Jail-Segovia Unit in Edinburg, the City of Raymondville, the City of San Perlita, unincorporated communities (Hargill and Lasara), parks, and multiple tracts of the LRGV National Wildlife Refuge. The southern portion of the initial study area includes towns in Hidalgo County including Mission, McAllen, San Juan, Alamo, Donna, and Weslaco, Edinburg, Elsa, and Edcouch.

The Recommended Plan would be generally implemented in a proposed 350- or 450-foot-wide Right-of-Way (ROW) within the 600-foot-wide study corridor, which allows for design flexibility within the corridor to avoid and minimize impacts to the human and natural environment. The Raymondville Drain Project study corridor extends from a point approximately 0.4 mile east of Edinburg Lake in Hidalgo County and proceeds generally eastward for approximately 57 miles to a point approximately 2 miles upstream of the SH 186 bridge over the RD in Willacy County (see Appendix A-3, Attachment A, Exhibit 1 – Vicinity Map and Exhibit 2 – Site Location Map). The surface topography along the Raymondville Drain corridor is generally flat, with elevations ranging from 80-85 feet above mean sea level (AMSL) near the upstream (western) end of the proposed project to approximately 5 feet AMSL near the eastern project terminus. Detailed topographic maps are provided in Appendix A-3, Attachment A, Exhibit 3 – Topographic Map (2022).

The Raymondville Drain Project study corridor is characterized by the existing Raymondville Drain, multiple other drainage channels which flow into the RD, and roadways and petroleum pipelines of varying sizes which cross the RD throughout the project limits. Major highways that traverse the Raymondville Drain Project study corridor include, from west to east: I-69C/US 281, Farm-to-Market Road (FM) 490, SH 186, US 77 Business, and I-69E/US 77.

2.4 NATURAL ENVIRONMENT

2.4.1 WATERS OF THE U.S.

Potential waters of the U.S. have been identified during delineation activities conducted in accessible areas. Where property owners did not grant access for delineation, potential waters of the U.S. were identified via desk-based research using the USFWS National Wetlands Inventory (NWI) database. The NWI classifies potential wetland areas and deepwater habitats based on the analysis of aerial imagery conducted by the USFWS as well as various partner organizations. The NWI data classifies the existing Raymondville Drain as an excavated riverine habitat; potential freshwater emergent wetlands and freshwater forested/shrub wetlands are mapped at various locations along the existing Raymondville Drain Project within the study corridor (see Appendix A-3, Attachment A, Exhibit 11 – National Wetlands Inventory Map).

Wetland delineation activities were conducted from April through August 2024 to create a detailed inventory of potential waters of the U.S. (WOTUS) within the Raymondville Drain Project study corridor. Delineated waters of the U.S, were identified as jurisdictional or non-jurisdictional according to current Federal definitions and regulations in place at the time of analysis.

The existing Raymondville Drain and the North Main Drain, as well as certain unnamed drains which flow into them, consist of artificial drainage ditches with a relatively permanent and continuous flow of water, and were excavated primarily in dry land. They both flow into the back bays of the Laguna Madre south of Port Mansfield. The Laguna Madre is currently used for interstate and foreign commerce via the Gulf Intracoastal Waterway (GIWW) and is subject to the ebb and flow of the tide; therefore, it is anticipated that the USACE will exercise jurisdiction over the existing Raymondville Drain and North Main Drain, as well as certain unnamed drains which flow into them, as WOTUS. Wetland delineation activities and the associated report were completed prior to recent changes in federal regulations regarding WOTUS. The jurisdictional status of all identified water bodies and wetland areas will be re-assessed prior to the implementation of any required mitigation.

2.4.2 VEGETATION AND WILDLIFE HABITAT

The existing Raymondville Drain lies within the Tamaulipan Biotic Province, which consists of thorny brush and shrub species. According to *The Vegetation Types of Texas, Including Cropland* (McMahan *et al.* 1984), the three primary vegetation types within the Raymondville Drain Project study area include: 1) Crops, within most of Hidalgo and Willacy counties; 2) Mesquite-Granjeno Parks, in a relatively small area of Hidalgo County; and 3) Other Native and/or Introduced Grasses (see Appendix A-3, Attachment A, Exhibit 12 – EMST Map). The Raymondville Drain Project traverses two ecoregions, as defined by the Texas Parks and Wildlife Department (TPWD), which include the 1) South Texas Plains, and 2) Gulf Prairies and Marshes (see Appendix A-3, Attachment M – Supporting Documentation). Most of the Raymondville Drain Project study area lies within the South Texas Plains ecoregion, which consists of a near level to rolling plain that is slightly to moderately dissected with watercourses (Hatch *et al*. 1990).

Vegetation and habitat data was collected within the Raymondville Drain Project study corridor in April 2023. Row crops and disturbed grasslands (including cattle pasture) were observed to be the dominant types of vegetation within the Raymondville Drain Project study corridor, followed by shrubland. Shrubland consisted of dense areas of thornscrub to areas sparsely covered in scrub/shrub vegetation. Scrub-shrub upland areas are typically covered by woody vegetation (woody shrubs and small trees) less than 20 feet tall, often interspersed with grasses, herbs, cactus, and geophytes (plants which store food in bulbs, corms, rhizomes, tuberous roots and tubers).

The TPWD, in cooperation with private, state, and federal partners, produced a 398-class, 10-meter spatial resolution land and vegetation classification map known as the Ecological Mapping Systems of Texas (EMST). See Appendix A-3, Figures 5 and 6, Tables 12 and 13, and Attachment A, Exhibit 12 – EMST Map for a summary and illustration of the EMST land classes that occur within the 600-foot-wide Raymondville Drain Project study corridor for each alternative. Row crops and disturbed grasslands (a land class which includes pastures) comprise the dominant type of vegetation within the Raymondville Drain Project study corridor, with shrubland areas reported to a lesser degree.

2.4.3 THREATENED AND ENDANGERED SPECIES

A Biological Assessment was conducted to assess the potential habitat impacts for species that are Federally-listed, or proposed for listing, as threatened and endangered and that may occur in the study corridor (see Appendix A-3, Attachment D – Endangered Species Act Compliance). A total of 11 species were assessed:

- Eastern Black Rail (*Laterallus jamaicensis jamaicensis*)
- Ocelot (*Leopardus (=Felis) pardalis*)
- Tricolored bat (*Perimyotis subflavus*)
- Gulf Coast jaguarundi (*Herpailurus (=Felis) yagouaroundi cacomitli*)
- Cactus Ferruginous Pygmy-owl (*Glaucidium brasilianum*)
- Northern Aplomado Falcon (*Falco femoralis septentrionalis*)
- Piping Plover (*Charadrius melodus*)
- Red Knot (*Calidris canutus rufa*)
- Star cactus (*Astrophytum asterias*)
- Texas ayenia (*Ayenia limitaris*)
- Walker's manioc (*Manihot walkerae*)

The purpose of the Biological Assessment was to gather information on the species-specific habitat types located within the Raymondville Drain Project study corridor. The majority of land within the study corridor consists of cropland and pastureland; however, a large area of undeveloped land on two large properties which overlap the easternmost approximately 6.8 miles of the study corridor consists of relatively undisturbed woodlands and grassland meadows. The two large properties are the El Sauz Ranch and a property owned by the nonprofit East Foundation. Although the East Foundation also refers to its property in Willacy County as El Sauz Ranch, for the sake of clarity it is referred to in this integrated FR and EA only as the East Foundation property.

One of the two known breeding populations for the ocelot in the U.S. is maintained on the East Foundation property. The exact size of this population is not available. The other known breeding population of ocelots is located in the Laguna Atascosa NWR in Cameron County, approximately 17 miles south of the Raymondville Drain Project ROW. Small areas of potential ocelot habitat were observed in other areas of the study corridor; however, these areas are not anticipated to be able to support ocelots for an extended period of time due to their small size and isolation from other areas of potential habitat.

Potential habitat was observed within the study corridor for the ocelot, the Gulf Coast jaguarundi, the tricolored bat, and the Northern Aplomado Falcon. No Federally-listed threatened, endangered, or candidate species were observed within the Raymondville Drain Project study corridor during the field investigations associated with the Biological Assessment. The USFWS has not designated any critical habitat areas for federally-listed species within the study corridor; the nearest USFWS critical habitat is for the piping plover located approximately four miles to the east of the study corridor.

2.4.4 ESSENTIAL FISH HABITAT

According to the Essential Fish Habitat (EFH) Mapper on the NOAA website, no EFH areas are located within the Raymondville Drain Project study corridor. There are four designated EFH areas near the outfall of the Raymondville Drain into the Laguna Madre outside of the focused corridor. Marine mammals are not known to occur within the Raymondville Drain or in the Lower Laguna Madre and were not investigated for this integrated FR and EA.

Healthy seagrass beds, such as those which occur in the Laguna Madre, are a critical component of EFH. A seagrass survey was commissioned to identify and describe the presence of seagrass over a 1,200-acre study area in the part of the Lower Laguna Madre which receives the combined flow from the existing Raymondville Drain and the North Main Drain system. The seagrass study area is located approximately six miles east-southeast of the eastern project terminus. Seagrass surveys were conducted on April 19 and 20, 2023. During the seagrass surveys, data was collected from 84 sample points. Data collected included variables pertaining to seagrass growth and water quality. Seagrass was observed at 54 of the 84 sample points. Three species of seagrass were observed in the seagrass study area: shoal grass (*Halodule wrightii*), star grass (*Halophila engelmannii*), and turtle grass (*Thalassia testudinum*). Water quality variables were generally within ranges tolerable for the observed seagrass species (see Appendix A-3, Attachment E – Magnuson-Stevens Fishery Management Act Compliance, Seagrass Survey Draft Report).

2.4.5 PROTECTED RESOURCES/LANDS

The Raymondville Drain Project study corridor traverses El Sauz Ranch and the East Foundation property, each of which is managed for a specific purpose; El Sauz Ranch is managed for guided hunting activities while the East Foundation property is managed for ecological research. The study corridor additionally traverses areas adjacent

to, but outside of, the LRGV National Wildlife Refuge. No other protected lands, including parks or other refuges, are located within the study area.

2.4.6 MIGRATORY BIRDS

The vegetation adjacent to the proposed Raymondville Drain Project primarily consists of farmland and pastureland. In certain sections, there may be a narrow strip of thornscrub habitat acting as a buffer between the farmland and pastureland. This area could potentially offer habitat for migratory birds that visit the region. Private ranches near the eastern proposed project terminus, namely the East Foundation property and El Sauz Ranch, predominantly consist of undeveloped land with an abundance of trees. These tree-rich areas have the potential to serve as habitats for diverse populations of migratory birds. Migratory birds observed within the study corridor during field investigations include the Common Grackle (*Quiscalus quiscula*), Red-winged Blackbird (*Agelaius phoeniceus*), the Northern Mockingbird (*Mimus polyglottos*), and the Blue-winged Teal (*Spatula discors*). Rookeries for migratory shorebirds have been mapped in various locations in the Laguna Madre by the National Audubon Society, as part of a project funded by a grant from the Texas General Land Office (GLO). No rookeries have been mapped within the Raymondville Drain Project study corridor; however, during field investigations of the study corridor, shorebirds were observed using sparsely-vegetated areas adjacent to standing and relatively permanent water. Neither Bald Eagles nor Golden Eagles are anticipated to occur within the study corridor, based on the known habitat ranges of these species (see Appendix A-3, Figure 2).

2.5 PHYSICAL ENVIRONMENT

2.5.1 GEOLOGY AND SOILS

The geology of the Raymondville Drain Project study area consists of multiple lithological units (e.g., bodies of rock defined and characterized based on the physical properties of the rock). The Raymondville Drain Project would traverse five lithological units: Stabilized Quaternary Sand Dune Windblown Deposits; the Tertiary Goliad Formation; the Quaternary Lissie Formation, Undivided; the Quaternary Sand Sheet Windblown Deposits; and the Quaternary Beaumont Formation (USGS 2023). The Tertiary Goliad Formation is comprised of clay, sand, sandstone, marl, caliche, limestone and conglomerates up to 600 feet thick. Stabilized Quaternary Sand Dune Windblown deposits are intermixed with the Tertiary Goliad Formation at and near the western project terminus. Immediately east of the Tertiary Goliad Formation, the Raymondville Drain Project traverses two small sections of the Quaternary Lissie Formation, Undivided, and a small portion of the Quaternary Sand Sheet Windblown Deposits. The Quaternary Lissie Formation, undivided, consists of clay, silt, sand, gravel, and caliche. The Quaternary Sand Sheet Windblown Deposits consist of stabilized sand dune deposits and sparse grass. The remainder of the study corridor, including the eastern project terminus, is underlain by the Quaternary Beaumont Formation; this lithological unit consists of sand sheet deposits and sparse grass that are similar to stabilized sand dunes.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was used to evaluate the potential presence of prime farmland within the Raymondville Drain Project study area. The Raymondville Drain Project would traverse a total of 39 soil map units identified by the NRCS; 11 map units are found only in Hidalgo County, 17 are found only in Willacy County, and 11 are found in both counties (see Appendix A-3, Table 3 and Attachment A, Exhibit 10 – Soils Map). A total of 18 soil map units within the study corridor are designated as prime farmland by the NRCS; of the 18 prime farmland map units, two are only considered prime farmland if drained and 12 are considered prime farmland if irrigated. Two soil map units are designated as farmland of statewide importance.

The Texas Department of Agriculture generally defines a soil as being farmland of statewide importance if it satisfies specific physical and chemical criteria including access to a sufficient water supply, sodium content favorable to the production of crops, and the presence of few or no rocks.

2.5.2 WATER QUALITY

The existing Raymondville Drain (comprised of Stream Segment 2491C) is listed as impaired in the Texas Commission on Environmental Quality (TCEQ) Draft 2026 Texas Integrated Report due to bacteria. Additionally, the existing Raymondville Drain flows into the Laguna Madre (Reservoir Segment 2491), which is listed as impaired due to bacteria and low levels of dissolved oxygen. The Laguna Madre is considered by the TCEQ as impaired for two existing uses, aquatic life use and primary recreation/swimming, while the existing Raymondville Drain is considered impaired for recreation. Probable sources of pollution contributing to the impairment are non-point sources, upstream sources, and urban runoff/storm sewers. The TCEQ maintains two surface water quality monitoring stations (Station IDs 22004 and 22404) along the existing Raymondville Drain, located approximately one mile northwest of San Perlita at the County Road 445 bridge. The effects of fertilizers on water quality in the Laguna Madre are currently unknown. State and federal governments have been working to encourage voluntary adoption of resource management systems implemented by the NRCS and the Texas State Soil and Water Conservation Board.

According to a UTRGV researcher (personal conversation with Nicole Lass, August 12, 2019), salinity levels in the Laguna Madre have dropped from the 1960s from approximately 65 parts per thousand (PPT) to an estimated 35 PPT. During the seagrass survey on April 19 and 20, 2023, water quality parameters including salinity were measured using water column samples collected in the field. The salinity levels recorded during the seagrass survey varied between 27.7 and 29.8 PPT.

Previous studies and historical data indicate that the existing Raymondville Drain and lateral ditches have not experienced significant erosion or sedimentation within the study corridor.

2.5.3 HYDROLOGY AND FLOODPLAINS

The North Main Drain System consists of artificial drainage ditches located south of the Raymondville Drain, and is owned and maintained by HCDD1. The North Main Drain System flows generally eastward into the back bays of the Laguna Madre, ending at a point approximately 6.5 miles south of Port Mansfield.

The Raymondville Drain similarly collects storm runoff via a network of ditches and canals, which eventually make their way into the drain. This stormwater then flows generally eastward until it discharges into the same back bay network of the Laguna Madre, about 1.5 miles north of the North Main Drain discharge.

In many flood-prone areas, FEMA develops maps and designates a “100-year floodplain,” which is the area that is inundated by a flood with a one-percent probability of occurring in any given year. As the floodplain in the Raymondville Drain corridor has not been mapped by FEMA, a flooding envelope was modeled using the USACE program HEC-RAS. The existing flooding envelope developed for this study is comprised of land that is subject to inundation as a result of a 10-day storm event with a one percent chance of occurring in any given year (commonly known as the “100-year storm”); i.e., a flood caused by 10-days of rainfall with a one-percent annual chance of occurrence. (Appendix A-1 documents that the 10-day one-percent event has larger runoff than a 24-hour or 4-day event in this large watershed.) Based on data from NOAA, 10 days of one-percent probability rainfall in the Raymondville Drain Project study area would be expected to produce 15.0 to 17.6 inches of rain. This represents an extreme storm event more severe than would be represented in FEMA Flood Insurance Rate Maps (FIRMs)

since these maps represent flooding from a 24-hour event. The 24-hour rainfall for this area is 10.5 to 11.2 inches, which is about one-third less than the 10-day storm event. Developed areas within the existing flooding envelope include the northern outskirts of Edinburg, portions of Hargill and Lasara, Raymondville, and San Perlita.

The existing condition mapped flooding envelope for the 10-day one-percent chance storm event is shown in green in Figure 2-2. Note that this is identified as the "mapped flooding envelope" because this representation was created from the existing conditions rainfall-runoff model (HEC-HMS) developed for the project, and therefore does not fully depict flooding in the agricultural areas in northern Hidalgo County that would receive benefit from the extra conveyance of the proposed project. Detailed maps are included in Appendix A-3, Attachment A, Exhibit 9 – Flooding Envelope Map. Section 2.7 describes the analysis used to determine future changes in hydrology.

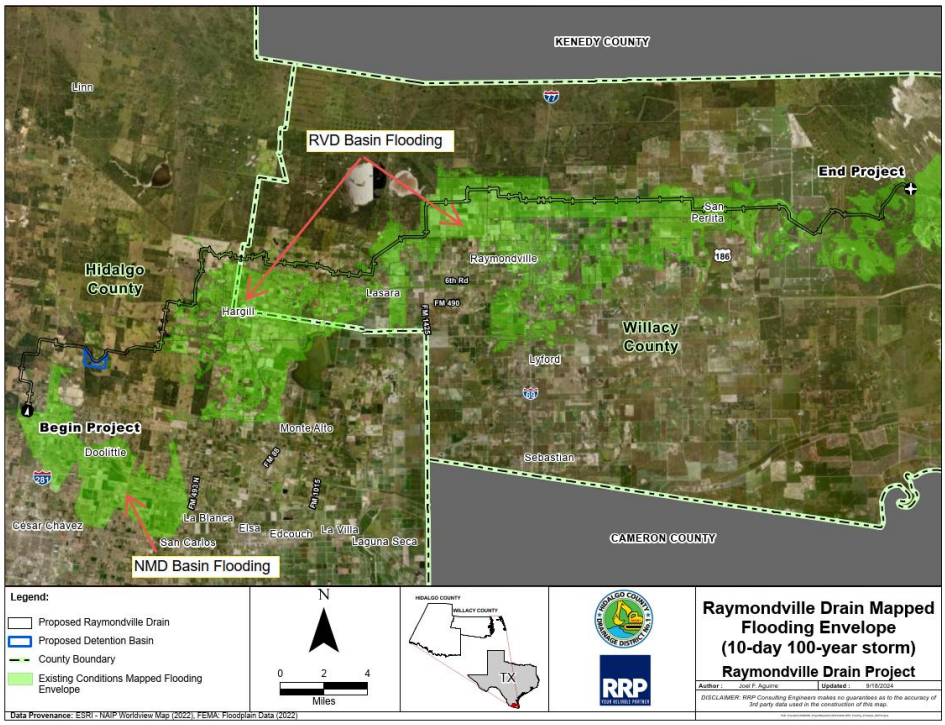

Figure 2-2 Existing Conditions One-percent chance ("100-year") Mapped Flooding Envelope

2.5.4 AIR QUALITY

The area surrounding the Raymondville Drain Project study area is rural; air quality is primarily affected by dust from local agricultural plowing, highway and off-highway vehicle emissions, and commercial, manufacturing, and industrial activities. The major producers of carbon monoxide (CO) emissions include highway and off-highway vehicles. Nitrogen oxide (NOx) emissions are attributed to point sources such as fuel combustion equipment at industrial facilities. The majority of particulate matter (PM) emissions include area non-point source emissions from agricultural activities. Major sources of volatile organic compound (VOC) emissions include off-highway gasoline vehicles and oil and gas production facilities. Potential sources of air contaminant emissions associated with the proposed project activities would include air emission sources, derived from machinery used during construction, and airborne (fugitive) dust.

As of January 2026, Hidalgo and Willacy counties are considered attainment areas for all National Ambient Air Quality Standards (NAAQS) set by the EPA (see Appendix A-3, Table 4, for a summary of the current NAAQS). An attainment area means that the air quality in that region meets or surpasses the established standards for all applicable pollutants set by the NAAQS. A November 2024 interoffice memorandum from TCEQ reported that PM levels in Hidalgo County exceeded the NAAQS, but attributed the exceedance to exceptional events and recommended that Hidalgo County be designated an attainment area.

2.5.5 RESILIENCE TO CHANGING CONDITIONS

An assessment was performed to highlight existing and future challenges facing the study area and consider changing conditions over time (including extreme weather), to improve resilience. This evaluation identifies potential vulnerabilities for communities in the Raymondville Drain Feasibility Study area. This analysis indicated that predicted changes in future conditions are not expected to significantly change flows, nor impact study recommendations. The assessment document is included as an attachment to the Engineering Appendix (A-1).

Impacts of sea level change on the Raymondville Drain Project were assessed in accordance with ER 1100-2-6162, "Incorporating Sea level Change in Civil Works Programs." The "USACE Sea Level Change Curve Calculator" (Version 20122.72) was used to project the rise in sea level in the Laguna Madre at Port Mansfield TX, the nearest tide gage location. Under the USACE intermediate scenario, sea level is expected to rise by approximately 2.6 feet by 2134, 100 years after the project base year (see Appendix A-3, Figure 3). While sea level rise (SLR) will increase vulnerability of low-lying coastal areas in Willacy County, Hidalgo County and areas of Willacy County that are further inland and upstream would not be directly impacted by SLR. The eastern project terminus, located approximately two miles upstream of SH 186 and approximately nine miles upstream of the Laguna Madre, remains outside of tidal influence under the intermediate scenario, so SLR is not anticipated to impact the Raymondville Drain Project.

An analysis of changing conditions and extreme weather indicated that predicted changes in precipitation patterns are not expected to affect study recommendations. The NWS has updated precipitation frequency estimates for the region (NOAA Atlas 14). As documented in the Engineering Appendix (A-1), the update does not significantly increase precipitation expected in the study area from previous data sources. While there is uncertainty as to future precipitation trends due to changing conditions, the minor changes in the updated Atlas 14 data for the study area provides an indication that additional attempts to quantify or describe this uncertainty would add little value.

2.5.6 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

In accordance with the ASTM International *E 1527-21: Standard Practice for Environmental Site Assessments – Phase I Environmental Site Assessment Process*, an environmental investigation was conducted for the potential occurrence of HTRW within the Raymondville Drain Project study corridor. This investigation involved a comprehensive analysis and review of federal and state databases through a commissioned Government Records Report, a Topographic Maps Report, and an examination of aerial photography data of the study corridor over a 67-year period (see Appendix A-3, Attachment A, Exhibits 4A through 4F – Aerial Photographs). A field investigation was conducted in April and September 2023 to thoroughly assess the proposed Raymondville Drain Project alignment for recognized environmental conditions (RECs), and potential environmental risk. Adjoining properties were visually assessed to determine the potential use of hazardous materials.

The government records report, obtained from Envirosite Corporation, identified nine reported sites within a one-mile radius of the Raymondville Drain Project ROW that are listed in government hazardous materials databases

(see Appendix A-3, Attachment A, Exhibit 15 – Potential Hazardous Materials Sites). All accessible reported sites, as determined by right-of-entry permissions from landowners, were visually inspected and photographed during the field investigation (see Appendix A-3, Table 5).

Infrastructure associated with Reported Site 5, North Alamo Water Supply Company Lasara Reverse Osmosis Wastewater Treatment Plant, is located on both sides of the existing Raymondville Drain channel.

In addition to the reported sites identified in the government records report, seven unreported sites which could potentially contain HTRW were identified during the field investigation (see Appendix A-3, Table 6). Unreported Sites 2, 4, and 7 were inaccessible due to a lack of right-of-entry permissions. All other unreported sites were visually inspected and photographed. None of the unreported sites that were investigated in the field exhibited any indications of leaks, spills, discolored soil, odors, or other signs of contamination.

During field investigations conducted from the Raymondville Drain Project ROW, Unreported Site 4 was observed to be omitting a faint gas-like odor from the facility. Unreported Site 7 is adjacent to the study corridor and was observed from the Raymondville Drain ROW. Aerial photography of the area reveals several large tanks and farming equipment. No other unreported sites showed any signs of spills, odors, or other signs of contamination.

A review of Geographic Information Systems (GIS) data from the Railroad Commission of Texas (RRC) identified several oil field pads, wells, and facilities within 0.1 mile of the project study area. Additionally, multiple natural gas pipelines intersect the Raymondville Drain Project ROW (see Appendix A-3, Attachment A, Exhibit 16 – Oil & Gas Wells and Pipeline Map).

2.5.7 CULTURAL RESOURCES

Numerous small playa lakes are evident on the topographic maps of the Raymondville Drain Project study area. Previous surveys near these lakes have encountered archaeological sites. Abbott's 2021 Archeological Predictive Model (APM) was reviewed to evaluate the study corridor prior to the submittal of an Antiquities Permit Application. Based on the results of the APM review, there is a low to moderate probability of encountering archaeological sites along proposed Raymondville Drain Project design features that have not been previously surveyed.

An archeological constraints analysis was conducted which consisted of a background cultural resources and environmental literature search of the Area of Potential Effects (APE) for the Raymondville Drain Project. The APE was defined as a 600-foot corridor around the center line of the Raymondville Drain Project (300 feet on each side) and encompasses a total area of approximately 2,675 acres. Archaeologists reviewed the Texas Archeological Sites Atlas online database maintained by the Texas Archeological Research Laboratory and Texas Historical Commission for any previously recorded surveys and historic or prehistoric archaeological sites located in or near the APE. Archaeologists also examined soils data from the NRCS. No Registered Texas Historic Landmarks, Official Texas Historical Markers, State Archeological Landmarks, or local historic landmarks were recorded within the APE.

Eight previous archeological surveys were found to intersect the APE. The previous archeological surveys identified three cultural resource sites within the APE, including two archeological resources and a historic district that is listed in the National Register of Historic Places (see Appendix A-3, Table 7). Field investigations for cultural resources, testing, and data collection were initiated in May 2024. In accordance with the Texas Administrative Code (TAC), 13 TAC 26.3 and 13 TAC 26.10–26.18, field investigations consisted of manual shovel tests, mechanical auger bores, and mechanical trenching as appropriate for local conditions; special attention was paid

to creek crossings, potential archeological sites, and previously recorded sites. Archeological field investigations were completed in September 2024 for all areas where right-of-entry was granted by property owners, accounting for approximately 50% of the APE. During the archeological field investigations, two previously-identified archeological deposits were surveyed, and two isolated finds were encountered.

2.5.8 AESTHETICS AND NOISE

The aesthetic character of the Raymondville Drain Project study corridor varies greatly depending on the land use in place. The visual character in agricultural areas is defined by row crops, pastures, roadways of varying size, and large-lot residences; in the eastern extent of the study corridor, the visual character is mainly defined by scrubland interspersed with meadows and other grassy areas. Interstate highways which traverse the study corridor (I-69C and I-69E) include bridges over the existing Raymondville Drain that are visible at great distances. The existing Raymondville Drain consists of a drainageway constructed below the ground surface and is not visible except within close distance.

The existing noise environment in the Raymondville Drain Project study corridor is relatively quiet. The main sources of noise are vehicles traveling along major roadways near the existing and proposed Raymondville Drain Project including I-69E/US 281, FM 490, and I-69C/US 77. Other sources of noise include agricultural activities that use heavy machinery, as well as occasional aircraft flying to or from the South Texas International Airport at Edinburg. Rarely, the study corridor may be exposed to noise from the SpaceX Boca Chica Launch Facility in Cameron County, Texas.

2.5.9 DATUMS

The horizontal datum used for this study was NAD 83, South Zone. The vertical datum used was NAVD 88. All additional survey data used to supplement the existing H&H models was based on the above horizontal and vertical datums.

2.6 SOCIO-ECONOMIC AND ECONOMIC ENVIRONMENT

The incorporated cities of Edinburg (Hidalgo County seat), Raymondville (Willacy County seat) and San Perlita overlap or are in close proximity to the study area. Census Designated Places (CDPs) located near the study area include, from west to east: Faysville, Hargill, and Lasara. A CDP is a statistical equivalent of an incorporated city used by the U.S. Census Bureau to provide meaningful statistics for well-known, unincorporated communities.

The Raymondville Drain Project would traverse an area that contains low-income at-risk communities. Based on 2024 estimates from the U.S. Census Bureau, every block group which encompasses the study corridor (see Appendix A-3, Attachment A, Exhibit 13 – Census Block Map) reports a population between 75% - 98% Hispanic or Latino, far exceeding the Texas state average of approximately 40% (see Appendix A-3, Table 8). A large portion of the resident population lives below the poverty threshold, far exceeding the Texas state average of approximately 14% (see Appendix A-3, Table 9). Many households report having limited English proficiency (LEP) status (see Appendix A-3, Table 10), exceeding the Texas state average of approximately 13%. Incorporating the needs and considerations of all populations was taken into consideration during public involvement activities (see Section 7.2), and in the Plan Formulation process (see Section 3).

Agriculture is the dominant industry in both Hidalgo County and Willacy County. Other major industries in Hidalgo County include trade-related industries, healthcare, soft drink bottling, meat packing, frozen food processing and canning, tourism, construction, and oil and gas field services. Willacy County currently has few significant industries other than agriculture.

The population of Hidalgo County increased from 181,535 in 1970 to 870,781 in 2020. The population of Willacy County increased from 15,570 in 1970 to 20,164 in 2020. Population projections indicate continued growth in both counties from 2020 to 2050, with the highest increases expected between 2020 and 2030. During this period, Hidalgo County and Willacy County are projected to grow by 14.1 percent and 9.4 percent, respectively. The population growth is anticipated to put additional stress on the drainage infrastructure of the region, as more land is developed and converted to residential and commercial use.

2.7 BUILT ENVIRONMENT

Federal and local projects in the area generally consist of roadways which traverse the existing Raymondville Drain and the proposed new areas of the Raymondville Drain Project. These roadways provide local access to emergency services and community facilities throughout the study area, and include the major north regional hurricane evacuation route (I-69C/US 281). Some roadways and ramps in the study area are currently vulnerable to flooding. The study corridor is intersected by transportation facilities consisting of concrete bridges, culvert crossings, road bridges, one railroad crossing, one control structure, and four highway crossings that include US 281, SH 186, Business Highway 77, and US 77. The Raymondville Drain Project would require replacing or modifying bridges which traverse the existing Raymondville Drain, and the conversion of roadways to bridges where new drainage would be constructed. The segment of I-69C/US 281 that is traversed by the Raymondville Drain Project ROW currently consists of four bridge structures (southbound frontage road, southbound mainlanes, northbound mainlanes, and northbound frontage road) that allow water to flow northeast to southeast underneath the roadway. The bridge structures at this location were constructed in 2014 and include piers that are of sufficient size and span to accommodate the depth and width of the proposed diversion channel.

A variety of utility crossings, above and below ground, are also present throughout the study area. The Raymondville Drain is not a navigable waterway, and there is no boat traffic.

Maintenance of the Raymondville Drain Project, including areas within the drain, would be accomplished using the unpaved maintenance access roads that would be constructed on both sides of the drain. The maintenance roads would be maintained by HCDD1; adjacent areas would be vegetated after construction to prevent erosion.

The PDT conducted a comprehensive review of data and assumptions, and performed computations to estimate the future flow rates used in this study. The analysis was based on anticipated population growth and development patterns, and their impacts on impervious cover and ultimately hydrology. This project is located in South Texas, an area with less restrictive zoning policies than more urbanized and populated locations. The Raymondville Drain is not located in a FEMA mapped floodplain, so minimal development restrictions apply. The vast majority of the drainage area and the project footprint is outside of incorporated areas, so zoning is not a factor. This analysis determined that population growth will result in additional development in the form of additional residential subdivisions, commercial developments, and infrastructure improvements. The analysis concluded that additional development and overall impervious cover increases are expected to result in an average 35% increase in flows for the 50-year analysis period. Additional development is anticipated whether or not the proposed project is built. The specific location of future development cannot be accurately predicted with the information available, although past trends suggest that the majority of future development will occur near existing developed upstream areas like Raymondville and Edinburg rather than in the more rural eastern (downstream) areas. However, the flows were determined not to be sensitive to assumptions of growth in the downstream areas since the majority of runoff entering the drain will come from upstream portions of the basin. This analysis is documented in detail in Appendix A-1.

The personal health and safety of residents is an additional concern for South Texas communities subject to frequent flooding, and is jeopardized by high water each time floodwaters rise into the communities. Along with high water comes the threat of disease-bearing waterborne substances and vectors, and damage and debris from floodwaters. These present both immediate and lasting threats to residents, continuing throughout cleanup and rebuilding efforts. All residents are affected as well by the abrupt interruption of governmental and utility services - potable water, sewage disposal and treatment, trash removal, and electric power – which are critical for community health and safety.

SECTION 3.0 PLAN FORMULATION AND EVALUATION

This section describes the plan formulation process used in identifying and evaluating alternatives that meet the planning objectives and avoid planning constraints to lead to selection of the Recommended Plan. It includes a summary of problems and opportunities, inventory and forecast, and plan formulation, evaluation, comparison, and selection. It describes each step of the planning process, including data sources, considerations, and assumptions that informed identification of the Recommended Plan.

With continued population growth and residential, commercial, and industrial development in areas vulnerable to flooding, the existing drainage infrastructure is inadequate at reducing flooding threats associated with severe seasonal weather (including tropical depressions/ cyclones and hurricanes) resulting in excessive property damage. Summarizing information from Section 1:

Opportunities exist to:

- Improve and expand the existing drainage network.
- Improve the efficiency of drainage to the Laguna Madre.
- Provide flood damage risk reduction benefits to the community, supporting economic development.
- Support all low-income and at-risk populations in the region.
- Enable improved drainage to support farmland availability and quality.
- Support community resilience, economic growth, and property values.

The objectives of this feasibility study are to:

- Reduce flood damages and risks to residential, commercial, industrial, and agricultural properties.
- Minimize floodwater disruption to roadways.

Constraints of this feasibility study include:

- Respecting legal and policy constraints related to the U.S.-Mexico International Border.
- Avoiding solutions that depend on infrastructure controlled by other entities.
- Avoiding induced flooding in downstream communities.
- Utilizing existing drainage infrastructure to the extent possible.
- Protecting the environment, wildlife habitat, and archeological resources.
- Minimizing impacts on productive farmland and ranch lands.

Additional considerations of this planning process include:

- Local sensitivity to certain measures (e.g., acquisition of real estate, unintended adverse impacts to the community and/or the environment).
- Understanding regional economic conditions and development patterns.
- Enhancing sustainability and resilience to changing conditions.
- Reduction of limitations imposed by external factors, (e.g., policies of external agencies limiting access to flood risk reduction infrastructure or additional burdens).

3.1 PLANNING FRAMEWORK

The PDT utilized the USACE Civil Works planning process which follows a standard approach to identifying and evaluating water resource solutions to ensure potential federal projects comply with applicable laws and guidance. This process is outlined in ER 1105-2-103 and the "Planning Manual Part II: Risk-Informed Planning" which lays out the iterative planning process used for all USACE Civil Works studies in developing and evaluating alternative plans.

The Six-Step Planning process outlined in those documents include identifying problems and opportunities (Step 1), inventory and forecast of existing and future conditions (Step 2), plan formulation (Step 3), plan evaluation (Step 4), plan comparison (Step 5), and plan selection (Step 6). Additional complementary tasks are conducted throughout the process, including evidence gathering, risk management, and stakeholder involvement. The planning process is shown graphically in Figure 3-1.

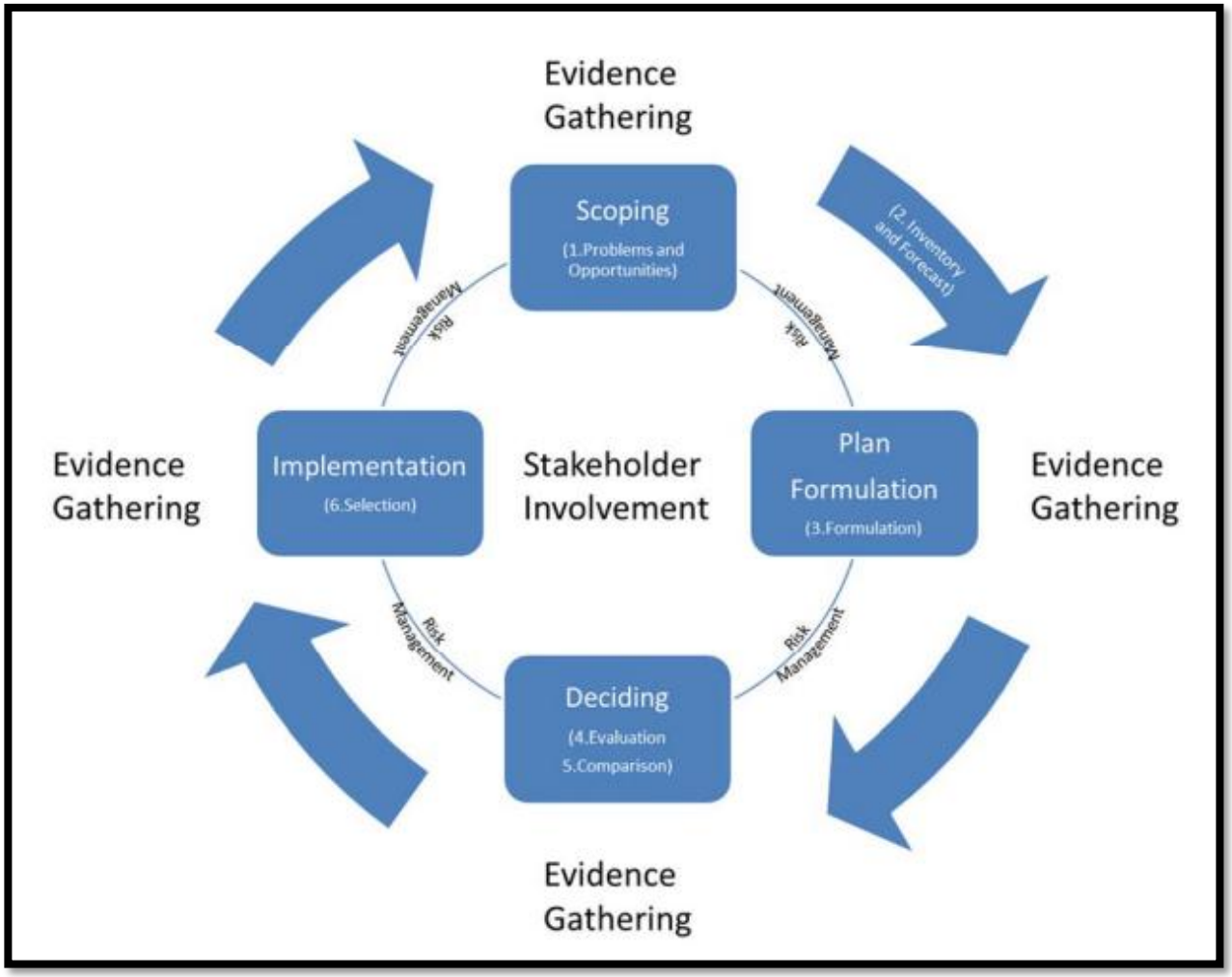

Figure 3-1 USACE Risk-Informed Planning Process (From IWR 2017-R-03)

3.1.1 THE PLANNING PROCESS AND NEPA

The non-federal sponsor understands that NEPA requires federal agencies to consider the potential environmental impacts of proposed actions and any reasonable alternative plans before undertaking major federal actions, as defined by 40 Code of Federal Regulations (CFR) 1508.18. The procedures outlined in the P&G, ER 1105-2-103, and the "Planning Manual Part II" complement and are consistent with USACE NEPA guidance, including ER 200-2-2, "Procedures for Implementing NEPA." This feasibility study is consistent with these procedures and requirements, and the environmental investigations completed for this study meet or exceed what USACE would do for a feasibility study accomplished in-house.

3.2 ASSUMPTIONS

The principal assumptions for the planning process center upon future economic and demographic growth conditions. More information about specific assumptions, their application, and justification can be found in the appropriate report sections and appendices.

The study area has been experiencing significant growth, exceeding official government estimates. Economic growth and associated employment create the need for more housing and service facilities that increase impervious surfaces. The development has long since overcome the existing infrastructure capacity and continues to overburden the system, resulting in flooding. While some areas within the basin have zoning restrictions which deal with stormwater runoff from frequent events, these requirements do not reduce flooding from larger events. For example, HCDD1 currently requires design to only account for analysis and mitigation of the proposed 10-year (10% annual chance) flow after development. The Raymondville Drain modeling and feasibility study is based on a much larger one-percent annual chance ("100-year") storm event. Additionally, many portions of the basin include rural, unincorporated, and agricultural areas without zoning controls. This results in significant future flow increases as described and documented within this report.

The ASA(CW) issued a Policy Directive on the consideration of "Comprehensive Benefits" in project justification for project studies. Consistent with the memorandum dated January 5, 2021, Subject: "POLICY DIRECTIVE – Comprehensive Documentation of Benefits in Decision Documents," the PDT included a broad range of benefit categories as criteria in the Plan Formulation process. Because of the relatively low property values in the study area, the PDT assumed that Comprehensive Benefits would be a significant justification factor, in addition to traditional economic benefits.

The majority of flood reduction benefits accrue within the areas of greatest development in the upstream areas of each watershed. The floodwaters flow eastward and ultimately pass through low-income at-risk downstream communities in Willacy County prior to discharge in the Laguna Madre. This study considers impacts on these more rural Willacy County communities, to support community resilience, economic and educational opportunities, while supporting the physical and mental health of the citizens.

Technical assumptions include the desire to have a reliable and low maintenance system. The terrain is very flat to flat, and slow draining. Expansion of the existing drainage systems is preferred where practicable for efficiency, cost effectiveness, and minimal environmental disruption. Solutions that require pumping of floodwater were considered but would raise cost, and may add maintenance and reliability concerns.

A risk register was used to identify, analyze, and manage study risks and technical risks. The risk register is summarized in Appendix A-6. This study was accomplished by the non-federal sponsor, the organization most familiar with the needs, requirements, and details of the region, utilizing engineers familiar with the area and existing infrastructure. To additionally reduce risk associated with decision-making consistent with SMART Planning principles, the team utilized national and regional experts including the non-federal sponsor, model development teams, consultants, and resource agencies. Engagement of the non-federal sponsor (responsible for watershed management for the Raymondville Drain and its tributaries), as well as numerous other floodplain managers from the communities surrounding the study area occurred on a regular basis as potential solutions were formulated. USACE experts on modeling, as well as resource agency representatives with vast knowledge of the habitats in the watershed, were part of the team evaluating impacts and potential mitigation.

To increase accuracy and reliability, the rainfall-runoff model (the USACE Hydrologic Engineering Center's Hydraulic Modeling System software (HEC-HMS)) and hydraulic model (the Hydrologic Engineering Center's River Analysis System software (HEC-RAS)) for the study were created using updated data. These models benefit from modern technologies such as GIS, Global Positioning System (GPS) surveys, and improved modeling software. This information is fed into the economic model (the Hydrologic Engineering Center's Flood Damage Analysis software (HEC-FDA)) which is used to determine damages for different flood levels. For this study, real estate values and damage curves were updated to reduce uncertainty about benefits and results. This level of analysis is appropriate for a feasibility study, and supports a good planning recommendation.

Rainfall patterns due changing conditions are discussed in Section 2.4.5 and Appendix A-1, and are assumed not to change significantly. The team considered doing sensitivity analyses to capture possible variability in rainfall depths/storms over the next 50 years but ultimately did not quantify such changes as the additional effort was judged to not improve the plan selection process. Additional analyses would be accomplished as appropriate during the design phase.

3.3 MANAGEMENT MEASURES

Measures are features or actions that contribute to the planning objectives. Project-specific measures were developed to address problems and to capitalize on opportunities. They were derived from a variety of sources and prior studies, as well as community feedback, standard community practices and other technical or non-technical flood mitigation measures. The different management measures are categorized as either structural or non-structural measures.

3.3.1 STRUCTURAL MEASURES

Structural measures reduce flood risk by modifying the characteristics of the flood. They are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Structural measures are often employed to reduce peak flows (flood storage), direct floodwaters away from flood prone property (flood barriers) or facilitate the flow of water through or around an area (drain/channel modifications or diversions). They may be used alone, or in combination with other flood management measures. The following structural measures were considered individually or in combination during the development of potential solutions.

Drain (Channel) Improvements / Alternative Conveyance Drains (Channels)

Drain improvements or the construction of new alternative conveyance drains are structural measures which would provide both in-line storage, and a means to convey floodwater out of developed areas to a reasonable discharge point. Both measures are designed to safely convey flood flows away from an area and provide relief,

either through providing additional capacity (in-channel storage and flow) or providing a new outlet for stormwater for an area.

Drain/Channel improvements (CH) are the modification of existing drains, either by adjusting the cross-sectional geometry, expansion, or through modification of the lining. Adjusting the flow line depth of existing drains was not considered during the development of this feasibility study because the flat topography makes it technically infeasible. Any flow line deepening would need to be extended all the way to the final outfall of any improvements, increasing construction costs, and adding additional environmental impacts including potentially making the drain tidally influenced.

Alternative conveyance (AC) drains are new drains designed to divert stormwater from existing systems or intercept overland sheet flow away from developed areas. This type of measure would involve the acquisition of additional ROW and verifying sufficient downstream system capacity for diverted or intercepted flows.

Multiple drain configurations with AC and CH measures were considered by the PDT. One of the major considerations for the cross-section configuration was to develop a single profile for consistency throughout the system, which met operational, hydraulic design, and environmental considerations. The typical drain cross-section used by the non-federal sponsor consists of a pilot channel, maintenance benches, raised access roads, and field drains. The purpose of the pilot channel is to keep the drains wet, even during low flow conditions; the maintenance bench is for the characteristically large drains present in the study area to be maintained properly and provide flood capacity; the access roads enable the drain to be inspected and operated during flood events; and the field drains exist so the raised access roads do not impact overland sheet flow into the channel, and so flows entering the drain do not erode the slide slopes.

Detention / Retention Ponds

The construction of new detention or retention ponds as a structural measure could be used to detain or retain (store) stormwater generated by storm events. Storage ponds are typically land intensive and require significant ROW near impacted areas to create benefit. When selecting the size and location of potential ponds, the PDT considered undeveloped areas of adequate size appropriately connected to existing or proposed conveyance drains that are natural low spots (to avoid unnecessary additional construction costs or environmental impact). Maps and aerial photography were used by the PDT to identify potential ponds. Properties which included large tracts of undeveloped land near proposed AC and CH measures located at localized depressions within the topography were ideal for the selection as potential locations. The area of a proposed detention pond measure would be determined by overall area available for use, as the required volume of a potential pond had yet to be determined. Expansion or utilization of existing detention or retention features in the basin (i.e., Edinburg Lake, Delta Lake, Hargill Lake, and La Sal Vieja) was initially considered in the development of proposed flood management plans. Since storage ponds only reduce risk to downstream areas, the PDT focused on upstream locations. Due to the relatively flat topography and project length, detention / retention ponds were not considered to be stand-alone measures.

Levees / Berms

Levees and berms are earthen structures that are wide at the base and tapered toward the top, made of compacted soil with grassy vegetation on the surface to resist erosion. Levees are typically larger engineered structures constructed parallel to waterways often to prevent the overflow of the waterway, while berms are generally smaller versions of levees often used to divert overland sheet flow.

Control Structures

Control structures are a management method used in conjunction with other structural features, such as drains, detention ponds/offline storage, and diversion channels and levees. Control structures can restrict or otherwise modify the flow of water into or out of a feature, and can include gates and weirs. Control structures were not considered to be stand-alone measures.

Nature Based Solutions / Engineering With Nature

USACE defines Engineering With Nature® (EWN) as the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaboration. The four key elements of the EWN approach are: 1) using science and engineering to produce efficiency; 2) using natural processes to maximum benefit; 3) diversifying and expanding the benefits and value of infrastructure; and 4) using collaboration and partnering to make it happen. Nature based features may include measures like natural or man-made wetlands, which can provide benefits like attenuation and storage of floodwater, flow velocity reduction, and water quality improvement.

3.3.2 NON-STRUCTURAL MEASURES

Non-structural management measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Non-structural measures differ from structural measures in that they focus on reducing the consequences of flooding instead of focusing on reducing the probability of flooding.

These measures can be broken into two categories, either physical or non-physical measures. Physical measures are those that take physical action to implement, such as removing a structure from the floodplain, modifying a structure, or raising it above the flood elevation. Non-physical measures do not modify individual structures but focus on behaviors and plans that reduce flood risk, such as evacuation plans, flood warning systems, flood insurance, emergency preparedness plans, and land use regulations and zoning laws.

The PDT reviewed and inventoried the non-physical non-structural measures within the study area as part of the planning process, and considered flood warning systems. The addition of new or modification of existing non-physical (regulatory or insurance) measures was not included as part of the planning process. It was concluded that the non-physical measures in place are consistent with local, state, and federal guidelines and new non-physical measures would not significantly reduce flood risks and damages to existing structures, which would not meet the objectives of this planning study.

Advance Warning Systems

Advance warning, or flood forecast and warning systems, generally consist of a stream gauge and rain gauge network, monitored via telemetry, to enable advance warning response to potential flood hazards. Advance warning systems are primarily used to reduce the risk to loss of life.

Elevation (Raising) and Floodproofing

Elevation involves raising the lowest finished floor of a building to a height that is above the flood level. This non-structural technique lifts an existing structure to limit floodwaters from reaching living areas. Due to the construction types in the region, including many older homes, large-scale raising of structures was not considered, but was discussed for some communities. Long duration flooding characteristic of the region limits access even to elevated buildings, reducing effectiveness of this measure.

Floodproofing is defined as any combination of structural or non-structural changes or adjustments incorporated in the design, construction, or alteration of individual buildings or properties that will reduce flood damages. Flood proofing includes any effort property owners may take to reduce flood damage to buildings and their contents. Dry flood proofing involves sealing building walls with waterproofing compounds, impermeable sheeting, or other materials and using shields for covering and protecting openings from floodwaters. If dry floodproofing is not possible or too costly, another option is wet flood proofing, which allows the structure to flood inside, while ensuring that there is minimal damage to the building and contents.

Elevation and floodproofing were eliminated from consideration as they were considered to be technically and administratively infeasible, and do not support the Planning Objectives. They are not alternatives the nonfederal sponsor is willing to pursue, and they were not favored by the public. The proposed Raymondville Drain extends approximately 57 miles, so this method would be complex and impact many structures of different types and in different communities. Elevation of geographically distributed properties in this long corridor (especially in the more rural areas) with slow-moving flows would not significantly reduce flood elevations. Additionally, due to the long duration flooding, those methods do not support the transportation planning objective.

Acquisition (Buyout)

Acquisition involves the purchase and elimination of flood damageable structures, and allows for inhabitants to relocate to locations away from flood hazards. Lands can then be preserved for open space, recreation, or other uses. USACE policy requires that acquisition recommendations become mandatory and include the potential use of condemnation if necessary.

3.3.3 TECHNICAL CRITERIA

The following general technical criteria were adopted for use in developing plans.

Structures

Structural measures for flood risk reduction should be designed to provide an optimum degree of protection consistent with safety of life and property, acceptable residual hazards, and cost.

Agriculture

The agricultural development of the cropland areas does not require the high degree of protection associated with urban flood risk reduction. The optimum level of water control required by the kind of agriculture to be protected dictates the conditions which must exist in a particular area. These criteria consist of:

- The maximum duration and frequency of surface ponding.
- The minimum rate of water removal necessary to provide the required degree of crop protection.
- The optimum elevation of the water table.

Therefore, primary agricultural benefits attributable to the drainage function are obtained when excess surface water is removed within a relatively brief period so that waterlogging of the soil and damage to plant growth does not occur. The length of time required for appreciable crop damage to occur from standing water or from severe interference with field operations varies with the crops and with the degree of maturity of the crops. For high value crops with a low tolerance to excess water, protection from the 10-year frequency storm may be desirable. For general farm-crops, protection from a storm with a frequency of occurrence from 2 to 5 years is generally adequate. Based on an analysis of land use, desires of local residents, and experience in design of drainage systems, the NRCS determined the aggregate protection required for agricultural areas would include removal of runoff from a 24-hour, 5-year frequency storm in 24 to 36 hours. Examination of the land use and the drainage

formula determined that these criteria are suitable for the studies presented in this report. While the project will not be formulated or designed specifically for agricultural damage prevention, benefits will be evaluated based on meeting these minimum requirements.

The major outlets must also be designed with sufficient depths to permit construction of laterals and on-farm drains of adequate depth to lower water tables to prevent harmful increases in soil salinity and flooding of crop root zones. For the Lower Rio Grande area, previous drainage investigations have determined that the desirable minimum depth of ground water is 8 feet for deep-rooted crops such as citrus, 6 feet for medium-rooted crops, and 4 feet for shallow-rooted crops. The effectiveness of an agricultural drainage system depends also upon an adequate system of contributing lateral channels and on-farm drains. The on-farm drains are the responsibility of the local interests.

3.4 PLAN FORMULATION PROCESS

The PDT utilized an iterative planning process, repeating the formulation and evaluation steps to develop plans for comparison and selection. The PDT conducted the plan formulation and plan evaluation in three stages with increasing detail, each with their own limits and goals for what should be developed and carried into subsequent stages. The FWOP was carried forward through all stages of the planning process, and non-structural measures were also considered where appropriate during the selection of the recommended alternative.

The first stage assessed Conceptual Measures and was used to examine the study area to determine the nature of the proposed flood risk mitigation project. The second stage developed an Initial Array of Risk Management Alternatives and was used to develop the plans which would be evaluated environmentally and economically. Flood risk reduction alternatives were developed from combinations of management measures that work together to reduce risk and provide benefits. The third stage developed a Final Array of Alternatives which used the narrowed output from the second stage to identify the selected alternative. Over the many years of study of this project, numerous combinations of measures have been considered and eliminated by planners and engineers. For the purposes of clarity and conciseness, consistent with SMART Planning, this discussion has been simplified and streamlined to document the most promising alternatives and explain the formulation process.

3.5 CONCEPTUAL MEASURES (STAGE 1)

The goal of the Stage 1 screening was to determine how to best address the flooding problem and to develop possible solutions to meet each possible stormwater mitigation method. The initial set of risk management measures developed and evaluated during the first stage were called Conceptual Measures, which helped narrow the range of potential solutions. These conceptual solutions consist of one or a combination of structural measures listed in section 3.3.1 or non-structural measures listed in 3.3.2.

3.5.1 PLAN FORMULATION STRATEGY

The strategy for Stage 1 is to identify alternative measures to enable the PDT to consider stormwater mitigation methods at a large scale, and the specific scope, alignments, and measures would then be addressed at a later round of evaluation. As a result, the measures assessed at this stage do not include specific details. The PDT examined the study area to identify:

- The existing stormwater drainage infrastructure.
- How it is used.

- What assets are protected by the existing infrastructure.
- What assets in the study area need additional risk reduction.
- The location and path of existing or potential downstream waters.

The PDT held conversations with stakeholders, and their input was used in the conceptual measures development process. Workshops were hosted with local leadership in the study area, including Willacy and Hidalgo counties, most of the cities, as well as the public of both counties. The stakeholders identified two main concerns that the PDT carried forward beyond the simple desire of the community for a flood mitigation solution. The first concern the stakeholders voiced is that while there is a clear need that a drainage project is needed to reduce risks to the community, it should not limit the possible future development of the community (consistent with existing local, state, and federal development restrictions). The second concern the stakeholders cited is the economic and development disparity between some communities, and the desire that any flood mitigation solution would be equitable and provide relief to more than just the more affluent and developed portions of the study area.

The measures would be rated on reliability, scalability, flexibility, and completeness. Due to the widespread nature of the study area, the PDT recognized that a combination of smaller measures that each utilize a different methodology may be refined during future rounds of evaluation. Due to the high-level nature of this round of development, the PDT did not set a limit to how many Conceptual Measures were developed at this stage.

3.5.2 CONCEPTUAL ALTERNATIVE MEASURES

This section describes reasonably implementable Conceptual Alternative Measures that the PDT considered during this planning stage, and identifies impacts that would affect the reliability, scalability, flexibility, and completeness of the proposed alternative. This report lists previous studies that have been accomplished over the past 40 years. While these studies had different scopes and were accomplished under different population and development conditions within a larger study area, some measures considered in previous reports have been revisited to help inform this evaluation. Conceptual Measures include:

- Increasing capacity (in-channel storage and flow) of drains (channels) flowing east (CA1).
- Construction of levees / berms in populated areas (CA2).
- Diversion to the IBWC Floodway System (CA3).
- Improvements to the IBWC Floodway System (CA4).
- Non-structural measures (CA5).
- Nature Based Solutions / Engineering With Nature (CA6).
- FWOP (No Action) Alternative (CA7).

3.5.3 SCREENING CRITERIA

Consistent with SMART Planning principles, this high-level screening evaluation was based on analysis and engineering judgment and informed by previous studies over the past 40 years. The measures were screened based on the following evaluation criteria considering a comprehensive array of benefits:

- Need For Additional ROW. For the sake of cost efficiency and minimizing environmental disruption, priority was given to solutions that required less additional real estate. This was also favored by the public as it minimized the impact of a project to individuals.
- Technical Complexity and Effectiveness. Priority was given to more straightforward solutions. Solutions that would be difficult to implement would increase operational risk and reduce reliability, and were given

lower priority. How effective the solution was in meeting objectives is critical, consistent with P&G criteria.

- **Distribution of Benefits.** Solutions that benefit a wider range of communities in the study area were given preference to those that exhibited more focused benefits, including consideration for low-income at-risk communities.
- **Environmental Concerns.** Consistent with project constraints, solutions with less environmental impact were preferred.
- **Resilience.** Preference was given to solutions reducing vulnerability, supporting community resilience despite uncertain future conditions.
- **Public Support.** Public involvement meetings have strong implementation correlation and have helped shape the array of measures. Solutions with greater public support were preferred.

Furthermore, additional empirical factors were considered during the evaluation of the above criteria:

- **Reliability**. Is this solution dependable, regardless of external forces, external agencies and operational policies, or available resources.
- **Scalability.** Can the proposed solution be expanded and can it provide benefits for multiple communities.
- **Flexibility.** Does the proposed solution have multiple options to accomplish the goal.
- **Completeness.** Completeness is defined as the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. For the purposes of this initial round, we consider whether the proposed solution effectively meets the study objectives, evaluating the above empirical factors.

3.5.4 SUMMARY OF CONCEPTUAL MEASURES

Increasing Capacity (in-channel storage and flow) of Drains (Channels) Flowing East (CA1)

This concept would consist of a combination of structural measures described in section 3.3.1. By improving channels, adding appropriate detention, and installing control structures, proposed projects can be constructed to increase flow throughput to the Laguna Madre, providing economic and social benefits. The criteria were evaluated as follows:

- **Need for Additional ROW.** Any new or expanded drains or detention pond would need additional ROW to be constructed. However, the drains could be routed around structures and through undeveloped land to minimize adverse impact to developed communities.
- **Technical Complexity and Effectiveness**. The use of conveyance drains is the primary methodology used by communities within the study area to reduce flooding. The primary complexity lies within the intersection of roadways or other utilities during implementation, or from maintenance during operation. These drains have the potential to be highly effective, depending on the specifically implemented alternative.
- **Distribution of Benefits.** The distribution of benefits is limited by the distance from the Laguna Madre and the ability to drain floodwater at a consistent rate. In its current state, the study area is drained by the existing drains generally flowing east to the Laguna Madre, providing the most scalable and flexible of the Conceptual Alternatives. Improvements could be made in one watershed or multiple watersheds**.** This alternative has the potential to enable benefits for at-risk Willacy County communities.

- Environmental Concerns. The necessary ROW for any new or expanded channels could result in environmental concerns that must be addressed for a project to be implemented. These concerns can be reduced by taking reasonable steps during project development to avoid environmentally sensitive areas.
- Resilience. Increased drain capacity supports community resilience.
- Public Support. Because the use of conveyance drains is the primary existing methodology, this concept is well received by the community under the assumption that additional ROW could minimize impacts on socially or environmentally sensitive locations.
- Completeness. Depending on the specific measures applied, this concept has the potential to meet the planning objectives by effectively providing a reliable, scalable, and flexible method of reducing flood damage and minimizing disruption to roadways throughout the study area.

Construction of Levees / Berms in Populated Areas (CA2)

Levees can be used to contain flows within a channel. Berms can also be used as low-level levees, to potentially divert flows from developed areas. The criteria were evaluated as follows:

- Need for Additional ROW. The construction of levees or berms to contain or redirect flows would require additional ROW, however the amount needed would scale depending on the areas to be protected. Due to the flat nature of the study area, significant ROW could be required to design high-ground levee tie-outs, or to create functional open-ended levees.
- Technical Complexity and Effectiveness. Levees and berms are used in some parts of the study area, including critical locations such as the IBWC Floodway. The flat topography of the study area would make levees more difficult to implement in specific communities. In many communities within the study area, there is not enough elevation drop to construct cost efficient high-ground tie-outs or open-ended levees, which could lead to extensive levee lengths compared to the areas protected. There are multiple feeder drains in many areas, which could require significant additional levee length. Additionally, multiple drainage structures to allow overland flow and existing drainage ditches to discharge into the drain from the leveed area would add cost, technical, complexity, and could introduce reliability issues. Induced flooding could also be a concern in un-leveed nearby upstream or downstream areas. Construction of levees could also increase life risk compared to channel alternatives, as overtopping or levee failure risk could be introduced.
- Distribution of Benefits. Benefits from the construction of levees would be focused on the location where they would be implemented, and careful implementation would be necessary to ensure they did not adversely affect surrounding communities. Distribution of benefits would be flexible and scalable depending on the areas chosen to be protected by the project, however diversifying the locations on a level needed to evenly distribute it across the study area would result in discreet sections which would affect the completeness of the most cost-effective alternative relying on this concept. Levees would likely be targeted in more populated areas, and could induce downstream flooding to at-risk areas where such improvements could not be economically justified.
- Environmental Concerns. Converting land into levees could be less intrusive than the construction of conveyance channels, but could still result in environmental concerns related to the acquisition of ROW and vegetation disturbance. These concerns can be reduced by taking reasonable steps during the project development to avoid environmentally sensitive areas. Levees could impact the viewshed in nearby communities.

- Resilience. Increased channel capacity supports community resilience, however levee overtopping potential may be introduced.
- Public Support. It is anticipated that public support for this alternative would vary by location. Projects that rely on levee construction typically face disagreement related to the alignment, as the land on both sides of the levee may have significantly different value moving forward and landowners could constantly advocate for further development within the leveed area, potentially resulting in a more impervious cover within the leveed area to accumulate runoff. Concerns about the significant ROW acquisition would likely create additional opposition
- Completeness. This measure would not meet the planning objectives of providing a reliable method of reducing flood damage and minimizing disruption to roadways throughout the study area. It could not reduce risk in a large portion of the study area, and would be considered only for more populated areas, leaving rural areas and roadways vulnerable.

Diversion to the IBWC Floodway System (CA3)

The primary purpose of the IBWC Floodway System is to provide relief to the Rio Grande. The IBWC Floodway drains areas in the southern portion of the study area, and discharges into the Laguna Madre. Improvements to the existing infrastructure could include utilization of the Floodway to divert water from other overtaxed watersheds to the north. Diverting water to the Floodway from other drainage systems would require additional channels to convey flow into the Floodway and would require closure structures and pumps to convey water into the leveed floodway during storm events. The criteria were evaluated as follows:

- Need for Additional ROW. Any new or expanded channel or detention pond to support the connection to the IBWC Floodway would require additional ROW for the new construction. However, the channels could potentially be routed through less developed land to minimize adverse impact to developed areas.
- Technical Complexity and Effectiveness. Depending on the design and implementation, this has the potential to be a partially effective solution. The use of connections to the IBWC Floodway is a regular method of dealing with stormwater in the area. Coordination with IBWC and approvals would need to be addressed. The main complexity for this concept is that IBWC limits when the flood gates can release water into the channel, requiring active operation during flood events. Furthermore, because the control structures are closed during flood events, pumps must be used to convey floodwater into the Floodway, increasing operation and maintenance costs for this alternative. The Floodway is controlled by IBWC in accordance with international agreements, and capacity is limited. Therefore, IBWC approval to discharge into the Floodway during any given storm event could not be guaranteed, so it would not provide reliable flood capacity. If expansion of Floodway capacity was required to accommodate additional flow, it could have international treaty implications as it could impact operations along the Rio Grande.
- Distribution of Benefits. The limitation of the distribution of benefits comes from the distance from the IBWC Floodway where water can be reliably conveyed into the Floodway. By bypassing improvements in rural downstream areas, this concept may not enable improved conditions in at-risk Willacy County communities.
- Environmental Concerns. The necessary ROW for any new or expanded channels could result in environmental concerns that must be addressed for a project to be implemented. These concerns can be reduced by taking reasonable steps during project development to avoid environmentally sensitive areas.
- Resilience. Increased drainage capacity could support community resilience, however technical complexity could impact reliability.

- Public Support. Because of the regular use of drainage into the floodway, this concept should be well received by the community under the assumption that ROW heavy components of the project avoid socially sensitive locations. However, the international nature of the system would require complex coordination and could require treaty changes.
- Completeness. This concept would not meet the planning objectives of providing an effective method of reducing flood damage and minimizing disruption to roadways throughout the study area. Due to the constraints on discharge into the IBWC floodway, this concept is not a reliable solution.

Improvements to the IBWC Floodway System (CA4)

As described above, the IBWC Floodway System provides relief to the Rio Grande, south of the study area. It also provides flow capacity for local drainage, so the Floodway potentially could also be used to further reduce flooding within the southern portions of the study area. Improvements to the existing infrastructure could include modifications to the existing system to improve interior drainage or increasing the capacity of the Floodway. The criteria were evaluated as follows:

- Need for Additional ROW. Any new or expanded channel width, connections, or detention ponds to support flow into the IBWC Floodway could require additional ROW. Existing development along the Floodway could make expansion more complex and costly.
- Technical Complexity and Effectiveness. Depending on the design and implementation, this concept has the potential to be a partially effective solution. Increased channel capacity could reduce flooding in the study area. The use of connections to the IBWC Floodway is a regular method of dealing with stormwater in the area. Coordination with IBWC and approvals would need to be addressed. The main complexity for this concept is that IBWC limits when the flood gates can release water into the channel, requiring active operation and management during flood events. Furthermore, because the control structures are closed during flood events, pumps must be used to convey floodwater into the Floodway, increasing operation and maintenance costs for this alternative. Significant modification to existing infrastructure may be needed. The Floodway is controlled by IBWC in accordance with international agreements, therefore, IBWC approval to discharge into the Floodway during any given storm event could not be guaranteed, even with capacity increases. Expansion of Floodway capacity could have international treaty implications as it could impact the Rio Grande. Improvements to the IBWC Infrastructure are the responsibility of the IBWC and would not be undertaken solely as a USACE project.
- Distribution of Benefits. The distribution of benefits would depend on the designed configuration, based on how, when and where water can be reliably conveyed into the Floodway. By bypassing improvements in rural downstream areas, this concept may not enable improved conditions in at-risk Willacy County communities.
- Environmental Concerns. The necessary ROW for any expanded channels could result in environmental concerns that must be addressed for a project to be implemented. These concerns can be reduced by taking reasonable steps during the project development to avoid environmentally sensitive areas.
- Resilience. Increased drainage capacity could support resilience, however technical complexity could impact reliability.
- Public Support. Because of the regular use of drains into the Floodway, this concept should be well received by the community under the assumption that ROW heavy components of the project avoid socially sensitive locations. However, the international nature of the system would require complex coordination and could require treaty changes.

- **Completeness.** This concept would not meet the planning objectives of providing an effective method of reducing flood damage and minimizing disruption to roadways throughout the study area. Due to the constraints on use of the IBWC infrastructure, this concept is not a reliable solution.

Non-Structural Measures (CA5)

Non-structural measures are described in section 3.3.2. Non-structural measures must be considered in a USACE Planning study. Two measures are being considered for this study.

Advanced Warning System (CA5.a)

- **Need for Additional ROW.** None.
- **Technical Complexity and Effectiveness.** There is no existing comprehensive stream gage network in the study area, and no historical gage data, so it would be difficult to develop. Floods are slow moving due to the flat topography, and life safety is less of a concern, so advance warning systems would provide minimal benefit.
- **Distribution of Benefits.** Would provide more benefits to the less populated downstream areas. Would not improve overall community flooding conditions, nor improve access.
- **Environmental Concerns.** None.
- **Resilience.** Does not necessarily support community resilience.
- **Public Support.** Unlikely to receive broad support due to minimal benefit.
- **Completeness.** This measure would not meet the planning objectives of reducing flood damage or minimizing disruption to roadways throughout the study area.

Acquisition Alternatives (CA5.b)

Due to the widespread nature of the location of damages in the study area, acquisitions (buyouts) were added to the list of potential conceptual solutions.

- **Need for additional ROW.** Acquisition is essentially a real estate intensive action to buyout / relocate residents.
- **Technical Complexity and Effectiveness.** Low technical complexity due to the nature of buyouts, however may present social and logistical challenges. Effectiveness is entirely dependent on the impacts to the community and the property owners directly impacted by the buyout. If implementable and justified, could potentially provide an effective solution.
- **Distribution of Benefits.** Easy to focus where benefits would be since they are entirely located on the properties to be acquired, but would provide minimal benefits to any surrounding structures or to the community at large. Buyouts in at-risk downstream communities would not provide the same qualifiable economic benefits as more affluent upstream areas, and low property values in the region could make it difficult for some residents to be able to afford to relocate. This alternative is likely to cause significant disruption and impacts in low-income communities. This alternative would also reduce economic opportunities by eliminating existing homes, school, and businesses.
- **Environmental Concerns**. Unlikely to have negative impacts to natural resources (wildlife, vegetation, etc.).
- **Resilience.** Removal of structures from the floodplain would reduce community vulnerability.
- **Public Support.** No matter what degree of risk reduction this would offer the community, it is anticipated that buyouts or relocations would be met with resistance from the community. Obtaining

consensus would be extremely difficult. Selection of where to implement these buyouts could be criticized due to the widespread nature of the study area. As discussed by the community feedback, any flooding solution would need to benefit as much of the study area as possible.

- **Completeness.** This measure has the potential of partially meeting the planning objectives by reducing flood damage in areas where properties are acquired. It would have limited benefit on roadways throughout the study area. It could possibly reduce the need for regular access to acquired areas, but through transportation routes would likely still be impacted by long-duration flooding.

Nature Based Solutions / Engineering With Nature (CA6)

An EWN-related concept of large-scale natural flow attenuation by use of upstream wetlands was considered to leverage natural processes to reduce flooding frequency and intensity in the study area.

- **Need for additional ROW.** Natural flood attenuation would require significant land acquisition.
- **Technical Complexity and Effectiveness**. Due to the size (and width) of the watersheds upstream of the largest damage centers, it would be difficult to effectively significantly attenuate flows, and simultaneously provide capacity through to the Laguna Madre.
- **Distribution of Benefits.** Natural flood attenuation uses land-based measures that need to be located upstream of the areas to be benefited. Attenuation focused on upstream communities may not provide significant benefits to downstream communities without downstream channel expansion. Upstream focus may limit benefit to at-risk low-income downstream communities.
- **Environmental Concerns.** Dependent on measures implemented.
- **Resilience.** If flood attenuation could be effectively achieved, it would contribute to community resilience.
- **Public Support.** Unlikely to garner public support because of limited apparent benefits.
- **Completeness.** This solution would not meet the planning objectives of providing a reliable method of reducing flood damage and minimizing disruption to roadways throughout the study area. It is not a feasible stand-alone solution, and could not provide significant risk reduction over the large study area. However, certain aspects could be applied to other solutions.

No Action Alternative (CA7)

The No Action Alternative is defined by the present and future conditions in the study area that are reasonably anticipated to exist should there be No Action as an outcome of the study. It is also known as the FWOP condition. It is carried forward through the planning process as a baseline but does not meet the objectives of the planning study.

- **Need for additional ROW.** No additional ROW would be needed for a No Action Alternative.
- **Technical Complexity and Effectiveness**. Little additional technical complexity would be involved in a No Action Alternative, except repeated need for flood recovery. This alternative does not provide an effective solution.
- **Distribution of Benefits.** No benefits would be created by a No Action Alternative. Communities would continue to face flooding risks and bear the associated costs and impacts. No benefit to low-income at-risk communities.
- **Environmental Concerns.** Continued flood damages could affect habitat.
- **Resilience.** Does not contribute to community resilience nor reduce vulnerability.

- **Public Support.** There is a public demand for a flood risk reduction solution, and a No Action Alternative does not provide a solution to any extent requested by the community.
- **Completeness.** Does not contribute to the planning objectives.

3.5.5 EVALUATION OF CONCEPTUAL MEASURES

Table 3-1 summarizes the conceptual measures and evaluation criteria considered in the initial round. Increasing the capacity of channels flowing east (CA1) was determined to be feasible. At the conceptual level, it has the potential of meeting the reliability, scalability, flexibility, and completeness factors. Solutions combining the measures outlined in section 3.3.1 were considered by the PDT in the subsequent formulation rounds.

Conceptual Measures Considered	Description	Need for additional ROW	Technical Complexity & Effectiveness	Distribution of Benefits	Environmental Concerns	Resilience	Public support	Reliability	Scalability	Flexibility	Completeness / Meets Planning Objectives	Comments	Merits Additional Consideration ?
Increasing Capacity of Channels Flowing East (CA1)	Combinations of improvements to Raymondville Drain and North Main Drain, including combinations of channel modifications and detention basins.	Mainly expanding existing ROW, mixture of suburban and farmland.	Moderate complexity. High effectiveness possible (alternative dependent)	Reduces flooding with channel improvements for entire length and all communities.	Minor. Additional overbank disturbance.	Supports	Yes	High, depending on specific solution.	Yes - dependent on measures applied.	Yes - dependent on measures applied.	Yes - dependent on measures applied.	Enables options for further consideration.	Yes
Construction of Levees / Berms in Populated Areas (CA2)	Establishment of levees at population centers.	Additional ROW width required, with structure removal likely.	High complexity due to flat topography. Unlikely to be effective.	Could induce downstream flooding. Unlikely to support low-income at-risk communities.	Viewshed changes, additional overbank disturbance.	Generally supports, but levees may introduce overtopping risk.	Unknown	Low due to technical concerns, and difficulty justifying projects for less affluent communities.	Yes - different communities can be selected.	Yes - dependent on measures applied.	No - cannot reduce risk throughout basin.	Not technically feasible due to flat topography. No high-ground tie-in, and insufficient grade for open-ended levees. High cost for control structures.	No
Diversion to IBWC Floodway System (CA3)	Divert storm water southward into the existing IBWC Floodway, and pump over the levee.	Acquisition of mixture of urban / suburban and farmland.	Would require pumping over levees. Effectiveness limited by release limitations to IBWC Floodway.	Increases flow in floodway. Could benefit downstream communities in southern basins. No support for low-income at-risk communities in rural Willacy County.	None identified.	Generally supports, but increased complexity.	Yes	Low, as ability to release controlled by IBWC.	No. Use controlled by IBWC and depends on flows elsewhere in region.	No. Limited control.	No - does not provide a reliable solution.	Not feasible. Requires pumping, and would not be reliable due to limitations on releases into floodway.	No
Improvements to IBWC Floodway System (CA4)	Improve Floodway capacity or local interior drainage.	Acquisition of mixture of urban / suburban and farmland.	Would require pumping over levees. Effectiveness limited by release limitations to IBWC Floodway.	Would benefit communities in IBWC Floodway basin, but not low-income at-risk communities in rural Willacy County.	None identified	Generally supports, but increased complexity.	Yes	Low, as ability to release controlled by IBWC.	No. Use controlled by IBWC and flows elsewhere in region.	No. Limited control.	No - does not provide a reliable solution.	Not feasible. Requires pumping, and may not be reliable due to limitations on releases into floodway. Also not USACE responsibility.	No
Advanced Warning System (CA5.a - Non-Structural)	Network of stream and rain gages to monitor water levels, and enable warning if flooding is detected or predicted.	None	No existing gage network in basin. Floods slow moving so life safety less of a concern.	More benefit downstream. Unlikely to support more populated areas.	None identified	Minimally supports. Does not significantly prevent flood damage to property.	Low	Low, since it would not reduce flood risk to property.	No.	No.	No - does not reduce flood risk to property.	Flat terrain and slow moving flood flows limit benefits.	No
Acquisition Alternatives (CA5.b - Non-Structural)	Purchase of properties in the floodplain (various alternatives)	Purchase of many structures	Significant political implications and implementation difficulties.	Dependent on application and communities selected. Likely to significantly disrupt at-risk low-income communities.	None identified	Supports.	Low	Varies	Yes	Yes - dependent on properties acquired.	Potentially, based on application.	Concerns with political and social acceptability.	NS Alternative forwarded for inclusion / evaluation in Final Array per USACE policy.
Nature Based Solutions / Engineering With Nature (CA6)	Utilize large-scale stormwater attenuation to reduce flooding.	Acquisition of mixture of urban / suburban and farmland.	Difficult to locate to effectively provide widespread benefits.	Upstream focus on more developed areas. Unlikely to benefit low-income at-risk downstream communities.	None identified	Supports.	Low	Low, dependent on location (s),	Yes	Yes - dependent on measures applied.	No - does not provide a reliable solution.	Not a feasible stand-alone solution.	Not as stand-alone solution. Consider other EWN concepts in future alternatives.
No Action Alternative (CA7)	No changes to existing condition.	None	Increased flood recovery need.	No benefits.	Continued flooding, and environmental, economic, and social disruption.	No	No	No - provides no flood relief.	Not applicable.	Not applicable.	No - does not meet risk reduction objectives.	Previously considered and eliminated in 1982 USACE study.	Required alternative to be included in final array.

Table 3-1: Conceptual Measures Analysis Summary

Construction of levees/berms (CA2) was determined to not be feasible due to significant technical issues, imbalance of benefits (ability to reduce risks only for limited areas), lack of support, and anticipated high implementation and maintenance costs. This concept was not forwarded to the subsequent round.

Diversion to the IBWC Floodway System (CA3) was determined to be not feasible. Consistent with the constraints which include respecting IBWC international agreements, use of the floodway as a diversion would not provide a

dependable discharge pathway, therefore not meeting the reliability factor. This concept was not forwarded to the subsequent round. This alternative was previously considered and eliminated in the 1982 GDM.

Improvements to the IBWC Floodway System (CA4) was determined to be not feasible as part of this project. Because of usage restrictions, the Floodway may not provide a reliable option for flood relief. Improvements to or expansion of the IBWC Floodway System would be the responsibility of the IBWC and would not be appropriate as a USACE undertaking under this study.

Non-Structural measures (CA5) were considered. Due to the flat terrain and slow-moving floodwaters, an Advance Warning System (CA5.a) was determined to not provide benefit, and was therefore not forwarded to the subsequent round. Acquisition / Buyouts (CA5.b) is the non-structural measure identified for consideration in the formulation process, and was forwarded to the subsequent rounds.

Nature Based Solutions / EWN (CA6) is an emerging field which is often aligned with coastal and environmental restoration projects. The inland nature of the project, length of the channel, and its use of existing drain alignment ultimately limited traditional EWN opportunities at this time. While EWN concepts as a primary solution would not prevent the nature and magnitude of flooding experienced in the LRGV, the concept of EWN elements and principles will be considered as part of the design for any ultimately recommended alternative. Should environmental mitigation be required as part of the recommended plan, the design would also consider EWN principles and concepts.

Based on outcome of the analysis, the PDT determined that “increasing the capacity of channels flowing east” (CA1) was the only structural solution that would meet the study objectives, and therefore was forwarded to the second formulation round. Acquisition (buyout) is forwarded as the non-structural measure (CA5.b). By default, the “No Action” (CA7) is also forwarded. The results of this conceptual measures evaluation were generally consistent with the recommendations of the 1982 GDM and the 1988 LRR.

3.6 INITIAL ARRAY OF RISK MANAGEMENT ALTERNATIVES (STAGE 2)

The goal of Stage 2 was to determine how to create Alternative Plans using the Stage 1 concept to increase capacity (in-channel storage and flow) of drains (channels) flowing east into the Laguna Madre to address the stormwater problems. The plans developed and evaluated during this Stage 2 are considered the initial array of alternatives. The buyout alternative was also analyzed for cost effectiveness.

3.6.1 PLAN FORMULATION STRATEGY

The strategy for Stage 2 was to identify specific Alternative Plans to address the planning objective in the study area, while considering opportunities for non-structural alternatives to be implemented as components of the proposed project. When compared to the Conceptual Measures (Stage 1), this initial array has more specific approaches to flood risk management for affected parts of the study area. The PDT examined the study area again, this time focusing on land use, impacted areas, and available space for the implementation of proposed risk management measures.

During the plan formulation process for this step, it was determined by the preliminary H&H analysis that a channel width of about 280’ (to allow for a pilot channel and maintenance benches) was needed to reliably contain an assumed 1% annual exceedance chance flood. For the purpose of evaluation during this second round, all alternative conveyance measures (new drains) proposed as a part of this analysis were designed to this approximate channel width. Furthermore, drain / channel improvement measures, which are generally downstream, would inherit this channel dimension to enable sufficient throughput capacity.

The plans were evaluated based on the criteria described below. In this round of plan formulation, the PDT focused the structural alternatives on modifying existing systems, and included one other alternative that did not depend on the existing outfalls.

3.6.2 INITIAL ARRAY

The PDT developed an array of reasonably implementable Alternative plans for further evaluation. The PDT identified the beneficially impacted area, estimated project costs, and how well the alternative addresses the study goals, constraints, opportunities, and considerations. Four preliminary structural Alternatives (PA1 - PA4) to increase the capacity of the drains flowing east were developed, along with a non-structural Alternative and the No Action Alternative:

- Improvements to the existing North Main Drain System (PA1).
- Improvements to the existing Raymondville Drain System (PA2).
- Improvements to both the North Main Drain and Raymondville Drain Systems (PA3).
- Construction of a Regional (Northern) Bypass (PA4).
- Non-structural Alternative – Acquisition / Buyout (PA5).
- No Action Alternative (PA6).

3.6.3 EVALUATION CRITERIA

Consistent with SMART Planning principles, this second round screening evaluation was based on analysis and engineering judgment, and informed by previous studies, investigations, and community feedback over the past 40 years. A comprehensive array of benefits was considered in this evaluation. In this assessment the P&G Evaluation Criteria were considered as follows:

- **Acceptability.** This is the workability and viability of the alternative plan with respect to acceptance by federal and non-federal entities and the public, and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction. This criterion is covered in the "*Public Support*" criterion below.
- **Completeness.** This is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This criterion is considered in the *"Attains Planning Objectives*" criterion below.
- **Effectiveness.** This is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. An effective plan is responsive to the identified needs and makes a significant contribution to the solution of some problem or to the realization of some opportunity. It also contributes to the attainment of planning objectives. This criterion is covered in the "*Estimated Costs and Benefits*" criterion below.
- **Efficiency.** This is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the environment. This criterion is also covered in the "*Estimated Costs and Benefits*" criterion below.

The following more specific criteria were used, incorporating the P&G criteria above:

- **Estimated Costs and Benefits.** Consistent with planning objectives and to contribute to NED and provide an effective solution, a preliminary benefit analysis was done utilizing a preliminary cost estimate based

on estimated cost to design, construct, operate and maintain the proposed project, primarily based on overall length of the project and cross section configuration. While a BCR was not computed for this round, the identification of benefits was correlated to the number of structures in the watershed, allowing ranking of potential solutions to enable an effective and efficient solution. For this purpose of this evaluation, the PDT assumed the following costs: an all-inclusive (Utility Adjustments, Excavation, Control Structures, etc.) average cost of $11,500,000 per linear mile of new drains, and $9,000,000 per linear mile of expansion of drains; $800,000 per bridge to be installed across the new drain, and $1,200,000 per existing bridge to be replaced across an improved drain; ROW and Relocations at $3,500,000 per mile of channel within urbanized areas, and $1,500,000 per mile of channel in rural areas; and $500,000 per acre for detention/retention ponds. Annual costs for Operations, Maintenance, Repair, Replacement, & Rehabilitation (OMRR&R) were estimated to be 2% of the estimated construction cost (Efficiency and Effectiveness). Additionally, relative (qualitative) comparisons of NED and RED benefits between alternatives have been made in the evaluation matrix (Table 3-3).

- Potential Environmental Concerns. Consistent with project constraints, solutions with less environmental impact were preferred. This is also a proxy for ROW requirements utilized in the first round. (Completeness) While this is not an environmental project, a relative (qualitative) comparison of EQ benefits between alternatives have been made in the evaluation matrix (Table 3-3).
- Distribution of Benefits. By evaluating benefits on a structure count basis (rather than specific property damage values) in this round, the PDT is making a conservative estimate that puts the low-income at-risk downstream communities on a more equal footing with relatively more affluent upstream areas. (Completeness) These benefits fall into the OSE category.
- Resilience. Preference was given to solutions reducing vulnerability and supporting more complete community resilience. (Effectiveness) These benefits also fall into the OSE category.
- Public Support. This criterion is based on how well supported the proposed solution is with the community and with the non-federal sponsor, based on feedback received during this and previous rounds of alternative development. (Acceptability)
- Attains Planning Objectives. Considering all of the criteria above, this assesses whether the proposed alternative effectively meets the planning objectives of reducing flood damages and minimizing roadway disruption. (Completeness)

3.6.4 SUMMARY OF INITIAL ALTERNATIVES

The initial array of Structural Alternatives are shown with respect to the study area in Figure 3-2. (A larger scale map is provided in Appendix A-3, Attachment A, Exhibit 5 – Preliminary Alternatives.) They are further described with respect to their features and the evaluation criteria in this section.

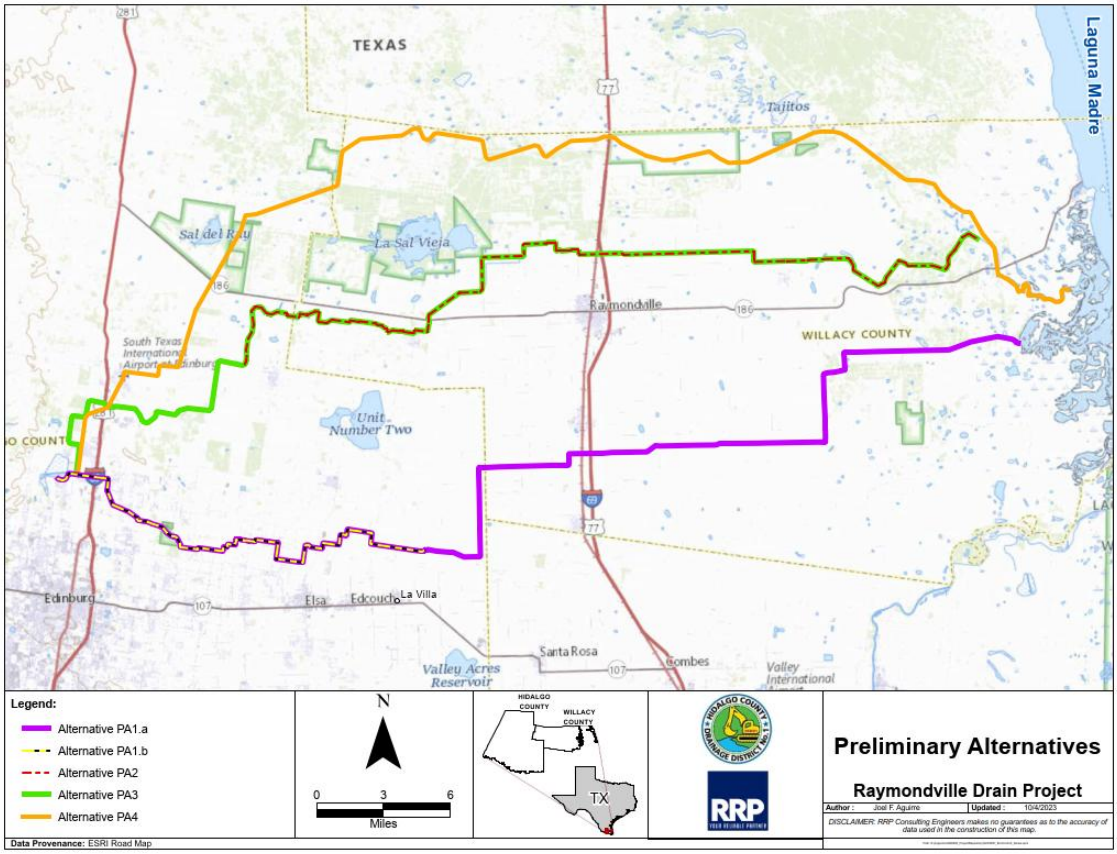

Figure 3-2 Initial Array of Structural Alternatives

Improvements to the Existing North Main Drain System (Alternatives PA1)

The PDT considered drain improvements, detention features, control structures, and other structural measures along the existing North Main Drain System, with the evaluated limits from Edinburg Lake, a manmade lake in North Edinburg, to the outfall into the Laguna Madre located south of for a total evaluation length of approximately 57 miles. The existing North Main Drain System Watershed is approximately 592 square miles, or 24% of the study area. A proposed project limited to this watershed would benefit (at least portions of) the communities of Mission, McAllen, Edinburg, Pharr, Cesar Chavez, San Carlos, La Blanca, Elsa, Edcouch, La Villa and Lyford, communities predominantly located in Hidalgo County. For this evaluation, to provide the level of coverage from flooding, it was assumed the project would improve the full length of the channel to its outfall (PA1.a – 57 miles), or construct improvements to the channel from Edinburg Lake to a point north of the city of La Villa, (PA1.b - approximately 38 miles) and construct detention pond(s), either at one or multiple locations.

- Estimated Costs and Benefits.
    - Alternative PA1.a: The preliminary cost estimate for PA1.a is based on 57 miles of drain expansion, the replacement of 75 bridges, 30 miles of Urban ROW, and 27 miles of Rural ROW. The estimated cost is $748.5 Million for construction and $15.0 Million annually for OMRR&R.

- Alternative PA1.b: The preliminary cost estimate for PA1.b is based on 38 miles of channel expansion, the replacement of 50 bridges, 30 miles of Urban ROW, 8 miles of Rural ROW, and 400 acres of detention pond(s). The estimated cost is $719.0 Million in construction and $14.4 Million annually for OMRR&R.
- A preliminary benefits analysis was made by counting the number of structures in each community that benefits from the project, both Alternative PA1.a and PA1.b would benefit the communities along the North Main Drain System. The structure inventory shows that these two Alternative Plans would benefit approximately 35,000 structures.

- **Potential Environmental Concerns.** Both options for Alternative PA1 are expected to have similar environmental concerns. Expanding the channel would have a similar level of impact along the common 38 miles where the two plans are proposing expansion. The downstream portion of the channel in this area is predominantly farmland, gradually becoming more developed as it gets closer to the eastern (upstream) limits of the evaluation length. Relocations would be required in certain places but would not disproportionately affect one community over another. The main difference environmentally is that Alternative PA1.a includes channelization through the 11 miles of coastal uplands near the outfall to the Laguna Madre and would likely affect the flow discharge velocity into the Laguna Madre, leading the environmental concerns that would favor PA1.b over PA1.a. Assumptions of equal property value provides a conservative estimate.
- **Distribution of Benefits.** By focusing on the North Main Drain only, PA1 Alternatives would not enable improved conditions in low-income at-risk downstream Willacy County communities.
- **Resilience.** Increased drain capacity supports resilience for communities along the North Main Drain only.
- **Public Support.** This Alternative does not provide flood risk reduction to at-risk Willacy County communities along the Raymondville Drain system. Both options for Alternative PA1 are anticipated to have an approximately even level of public support among the population within the North Main Drain Watershed, however a significant number of properties in the more developed portions of the study area could be impacted by the channel widening. Communities in the Raymondville Drain basin would likely request additional improvements for their communities. The main difference between the options is that the location of the detention pond(s) would require concentrated acquisition of ROW, so a small number of landowners would likely be concerned about Alternative PA1.b depending on the location(s) selected for the detention facilities.
- **Attains Planning Objectives.** This Alternative partially meets the planning objectives of reducing flood damages and minimizing roadway disruption. By focusing on the North Main Drain system, this alternative does not provide flood risk reduction to impoverished communities along the Raymondville Drain, nor improve roadway disruption in the RD basin.

Improvements to the Existing Raymondville Drain System (Alternative PA2)

The PDT considered drain improvements, detention features, control structures, and other structural measures along the existing Raymondville Drain System, with the considered limits from western-most headwaters west of Hargill to the outfall at the Laguna Madre, for a total evaluation length of approximately 50 miles. The existing Raymondville Drain Watershed is approximately 625 square miles, or 25% of the study area. A proposed project limited to this watershed would benefit the communities of Hargill, Lasara, Raymondville, and San Perlita, communities are predominantly located in Willacy County. For this evaluation, to provide the level of coverage from storms and to avoid significant environmental impacts in the coastal uplands, it was estimated that the PDT could improve the drains from their headwater to a point approximately two miles north of SH 186, where the

original manmade Raymondville Drain improvement ends. Moving the project terminus to two miles upstream of SH 186 (approximately seven miles upstream of the Laguna Madre) significantly reduces environmental impacts. This results in a total project length of 43 miles.

- Estimated Costs and Benefits.
    - The preliminary cost estimate for PA2 is based on 43 miles of channel expansion, the replacement of 30 bridges, and 3 miles of Urban ROW and 40 miles of Rural ROW. The estimated cost is $493.5 Million for construction and $9.9 Million annually for OMRR&R.
    - A preliminary benefits analysis was made by counting the number of structures in each community that would benefit from the project. Alternative PA2 would benefit only the communities along the Raymondville Drain System. The structure inventory shows that this Alternative would benefit approximately 3,300 structures.
- Potential Environmental Concerns. Expanding the channel would have a moderate level of impact along the limits of improvements, mainly due to the removal of farmland to expand the existing drain. Due to the reduction of length in the coastal uplands, environmental impacts are expected to be minimized but further evaluations would be necessary to determine the full extent.
- Distribution of Benefits. This Alternative would support at-risk low-income downstream Willacy County communities, but not the more populated NMD basin.
- Resilience. Increased drain capacity supports resilience for communities along the Raymondville Drain only.
- Public Support. PA2 is anticipated to be one of the favored alternatives by the communities immediately adjacent to the existing Raymondville Drain because it is the easiest for the community to understand. The notable exception for this Alternative could be the landowners to either side of the existing channel, as it would inevitably result in one or both losing property to the channel improvements should they include expansion. However, from the perspective of the study area as a whole, this Alternative would provide no benefits by itself to the communities along the North Main Drain (a far more populated area), who would expect other projects to accompany this Alternative for a large-scale drainage solution.
- Attains Planning Objectives. This Alternative does not fully meet the planning objectives of reducing flood damages and minimizing roadway disruption. By focusing on the Raymondville Drain system, this alternative does not provide flood risk reduction to communities along the North Main Drain, nor improve roadway disruption in the NMD basin. Since the North Main Drain experiences the bulk of the flood damages, this alternative has significantly less economic benefits.

Improvements to Both the North Main Drain System and Raymondville Drain Systems (Alternative PA3)

The PDT considered hydraulically connecting both the North Main Drain and Raymondville Drain Systems through the construction of a new diversion drain from the NMD, to provide benefits to both watersheds. The considered limits for this Alternative would be from Edinburg Lake near Edinburg, downstream to the outfall of the Raymondville Drain into the Laguna Madre, approximately 57 linear miles. The PDT determined that this Alternative would require the construction of new drains and the expansion of existing drains, control structures, and detention ponds. This Alternative is consistent with the goals of the preferred plans of the 1982 GDM, 1998 LRR, and the WRDA 2007 authorized project. The existing combined watershed is approximately 1,220 square miles, or 49% of the study area, focusing flood risk reduction on a geographically broad area covering many of the most vulnerable communities in the region. This proposed project would benefit (at least portions of) the communities of Mission, McAllen, Edinburg, Pharr, Cesar Chavez, San Carlos, La Blanca, Elsa, Edcouch, La Villa, Lyford, Hargill, Lasara, Raymondville, and San Perlita. For this evaluation it was estimated that the project would

divert flow from the North Main Drain System by constructing approximately 14 miles of new drain from the NMD near Edinburg Lake to the headwaters of the Hargill Drain located west of Hargill, then improve approximately 43 miles of the existing Raymondville Drain downstream to a point approximately two miles north of SH 186 where the existing manmade Raymondville Drain currently ends. Ending two miles north of SH 186 reduces potential habitat impacts closer to the Laguna Madre. To control the rate of flow into Willacy County and prevent induced flooding due to the flow transferred from the North Main Drain System, a detention pond would be located upstream of the Hidalgo-Willacy County line along the new drain.

- Estimated Costs and Benefits.
    - The preliminary cost estimate for PA3 is based on 14 miles of new channel, 43 miles of channel expansion, the construction of 35 bridges and the replacement of 30 bridges, 5 miles of Urban ROW and 52 miles of Rural ROW, and approximately 250 acres of detention pond(s). The estimated cost is $832.5 Million for construction and $16.7 Million annually for OMRR&R.
    - A preliminary benefits analysis shows that Alternative PA3 would benefit the communities along the North Main Drain System by diverting water, and along the Raymondville Drain by increasing capacity to accommodate overland sheet flow. The structure inventory shows that this Alternative would benefit approximately 38,000 structures.
- Potential Environmental Concerns. Expanding and creating new channels would have a moderate level of impact along the limits of improvements, mainly due to the removal of farmland to expand the existing drain.
- Distribution of Benefits. This Alternative would support all communities, including at-risk low-income downstream Willacy County communities.
- Resilience. Increased drain capacity supports resilience for communities along the North Main Drain and Raymondville Drain.
- Public Support. This Alternative is similar to the previously identified plan based on the initial agreement when HCDD1 agreed to become the non-federal sponsor for the Raymondville Drain Project in 2001. This Alternative has been supported by the communities of Hidalgo and Willacy counties to provide flood risk reduction to a broad range of communities the watershed.
- Attains Planning Objectives. This Alternative fully meets the planning objectives of reducing flood damages and minimizing roadway disruption. By providing a solution that improves both the Raymondville Drain and North Main Drain systems, this alternative provides significant economic and Comprehensive Benefits.

Construction of a Regional (Northern) Bypass (Alternative PA4)

The PDT considered the construction of a new drainage bypass, based on an alternative initially identified during the 1982 GDM. The new drain would be constructed from Edinburg Lake near the NMD, proceeding north through farmlands and ranchlands within Hidalgo and Willacy counties, avoiding the developed areas and ultimately tying back into the existing Raymondville Drain near the end of the outfall of the manmade Raymondville Drain north of SH 186. The new drain would intercept overland sheet flow and provide a significant amount of inline storage, and would provide flood relief to both counties through diversion and interception. Communities receiving benefit include (at least portions of) Mission, McAllen, Edinburg, Pharr, Cesar Chavez, San Carlos, La Blanca, Elsa, Edcouch, La Villa, Lyford, Hargill, Lasara, Raymondville, and San Perlita, benefiting approximately 1,080 square miles, or 43% of the study area. To enable the bypass drain to allow for the diversion, interception, and flow throughput, the PDT assumed construction of approximately 69 miles of new channel, through native brushland in northern part of Willacy County and the coastal uplands near the Laguna Madre.

- Estimated Costs and Benefits.
    - The preliminary cost estimate for PA4 is based on 69 miles of new channel, the construction of 30 new bridges and the replacement of 10 bridges, and 5 miles of Urban ROW and 60 miles of Rural ROW. The estimated cost is $919.5 Million for construction and $18.4 Million annually for OMRR&R.
    - A preliminary benefits analysis shows that Alternative PA4 would benefit the communities along the North Main Drain System by diverting water away, and the Raymondville Drain by intercepting overland sheet flow. The structure inventory shows that this Alternative would benefit approximately 38,000 structures.
- Potential Environmental Concerns. Construction of a new bypass drain through primarily undeveloped land to capture overland flow from affecting developed communities would pose environmental concerns, including the removal of native brushland and rangelands. Depending on the final alignment, it could create a new outlet into the Laguna Madre, and potentially impact environmentally sensitive areas such as the coastal uplands and dunes near the Laguna Madre in Northern Willacy County. Additionally, this route intercepts overland sheet flow that currently enters the salt lakes of La Sal Vieja, north of Lasara.
- Distribution of Benefits. This Alternative would support all communities including low-income at-risk downstream Willacy County communities by intercepting upstream flows, but would not improve local drainage in downstream communities.
- Resilience. Increased drain capacity supports resilience for many basin communities, with a focus on upstream communities.
- Public Support. Outreach with the community regarding the implementation of projects focused on drains north of the Raymondville Drain System was met with mixed feedback. Community members were concerned about how a project focused on the rural parts of Hidalgo and Willacy counties would benefit the heavily developed parts of Hidalgo County, such as the cities of Mission, McAllen, Edinburg, Pharr, and Weslaco. At the same time, members of the community who lived in those rural areas were concerned about the impact that it would have on farmland. Numerous landowners objected to the proposed alignment. The proposed alignment would have emptied several large stock tanks that were actively used on private ranches. Due to the alignment, the proposed channel would have cut a large swath through existing ranchland such that ranch management actions would have been disrupted or eliminated. The alignment also would have land-locked large portions of existing ranches, leaving these areas with no access to public roadways without additional crossings being constructed along the proposed channel. It would be difficult for the community to understand how the proposed plan would generate significant benefits given its distance from development and cost.
- Attains Planning Objectives. While this Alternative generally meets the planning objectives of reducing flood damages and minimizing roadway disruption, it presents significant environmental concerns, and violates constraints.

Acquisition / Buyout Alternatives (Alternative PA5)

The PDT considered the acquisition of properties in the floodplain as the non-structural Alternative. The initial analysis was done at the 25-year (4% annual chance) level and 100-year (1% annual chance). Properties identified for acquisition had finished floor elevations lower than the 25-year and 100-year flooding envelope. As the remaining non-structural Alternative, this will be forwarded to the final array for comparison.

- Estimated Costs and Benefits. Costs are analyzed and discussed in section 3.7.6 below.

- **Potential Environmental Concerns.** Unlikely to have negative impacts to natural resources (wildlife, vegetation, etc.). Removal of structures may have beneficial impact, depending on subsequent land use.
- **Distribution of Benefits.** This Alternative could benefit some properties throughout the study area, however it would cause significant disruption and impacts in low-income at-risk communities by eliminating a significant portion of housing stock, and damaging the integrity of, or eliminating, entire communities.
- **Resilience.** Removal of structures from the floodplain would reduce vulnerability and increase community resilience.
- **Public Support.** Large-scale buyouts were not supported by the communities and local stakeholders and are considered to have deleterious impacts on communities, especially those in disadvantaged areas.
- **Attains Planning Objectives.** This alternative partially meets the planning objectives. While it would reduce flood damages to properties, it would not reduce roadway disruption. However, it does not meet acceptability, efficiency, or effectiveness criteria and does not avoid constraints.

No Action Alternative (Alternative PA6)

The No Action Alternative is defined by the present and future conditions in the study area that are reasonably anticipated to exist should there be No Action as an outcome of the study. It is also known as the FWOP condition. It is carried forward through the planning process as a baseline but does not meet the objectives of the planning study. It continues to place the basin residents at risk and does not support economic development in a growing area. It does not attain the planning objectives.

3.6.5 EVALUATION OF INITIAL ARRAY OF ALTERNATIVES

Table 3-2 summarizes the estimated costs of the (structural) Preliminary Alternatives, and Table 3-3 summarizes the analysis (of all alternatives).

Project Element	Unit Cost (Million $)	PA1.a	PA1.b	PA2	PA3	PA4
Approximate structures benefitted		35,000	35,000	3,300	38,000	38,000
New Drain (miles)	$11.50	0	0	0	14	69
Drain Expansion (miles)	$9.00	57	38	43	43	0
New Bridge (each)	$0.80	0	0	0	35	30
Bridge Replacement (each)	$1.20	75	50	30	30	10
Urban ROW (miles)	$3.50	30	30	3	5	5
Rural ROW (miles)	$1.50	27	8	40	52	60
Detention Pond (Acres)	$0.50	0	400	0	250	0
Acquisition Cost incl relocation (each)	$.408	N/A	N/A	N/A	N/A	N/A
Demolition and Restoration Cost (each)	$.0616	N/A	N?A	N/A	N/A	N/A
Estimated Cost (Million $)		**$748.5**	**$719.0**	**$493.5**	**$832.5**	**$919.5**
OMRR&R (Million $ per Year)		$15.0	$14.4	$9.9	$16.7	$18.4
Est. Cost per Structure (Thousand $)		$21.4	$20.5	$149.5	$21.9	$24.2

Initial Array Cost Analysis – Table 3-2

Initial Array of Alternatives	Description	Estimated Costs and Benefits	Potential Environmental Concerns	Distribution of Benefits (OSE)	Resilience (OSE)	Public Support	Contributes to NED	Contributes to EQ	Contributes to RED	Acceptability	Completeness	Effectiveness	Efficiency	Attains Planning Objectives	Avoids Constraints	Comments	Merits Additional Consideration?
Improvements to the Existing North Main Drain System (PA1.a and PA1.b)	Channel improvements, detention features, control structures, and other structural alternatives along the existing North Main Drain system (two possible lengths).	Higher cost and moderate benefits.	Less channel improvement means less ground disturbance.	L	M	L	M	L	M	L	M	M	M	M	Y	Limits area of benefits. Does not provide flood risk reduction in downstream Willacy County communities along the RD.	No
Improvements to the Existing Raymondville Drain System (PA2)	Channel improvements, detention features, control structures, and other structural alternatives along the existing Raymondville/Hargill Drain system	Lower cost and less benefits.	Less channel improvement means less ground disturbance.	L	M	L	L	L	L	L	L	L	L	L	Y	Limits area of benefits	No
Improvements to both the North Main Drain System and Raymondville Drain System (PA3)	Hydraulically connecting both the North Main Drain and Raymondville Drain systems through the construction of a new diversion drain	Higher cost and higher benefits.	Reduced environmental concerns by ending channel 2 miles upstream of SH 186.	H	H	H	H	L	H	H	H	H	M	H	Y	Recommendation consistent with previous studies.	Yes
Construction of a Regional Northern Bypass (PA4)	New channel from Edinburg Lake near the North Main Drain, proceeding north to farmlands within Hidalgo County and rangelands within Willacy County.	Highest structural costs and less benefits	Highest. All new channel. Impacts ranchland. Removes native brushlands near Laguna Madre.	M	M	L	H	L	M	L	M	M	L	M	N	No significant additional benefits for more costly plan. Previously considered and eliminated in 1982 USACE study.	No
Acquisition (Buyout) Alternatives (PA5)	Purchase of properties in the 25-year or 100-year floodplain	Highest overall cost, and highest cost per structure benefitted	Minimal risks to natural environment.	L	H	L	L	M	L	L	M	M	L	L	N	Significant community concerns. Limited public support.	NS Alternative forwarded for inclusion / evaluation in Final Array.
No Action Alternative (PA6)	No changes to existing condition	N/A	Continued losses and environmental damage due to flooding.	No	No	No	No	No	No	No	No	No	No	No	N	Does not support risk reduction objectives.	Required alternative to be included in Final Array.

Initial Array Analysis Summary – Table 3-3

Alternatives PA1 (PA1.a and PA1.b, Improvements to the Existing North Main Drain System) were determined to provide only a partial solution. While they appear to be slightly more cost efficient than PA3 in a rough cost comparison, implementation would be more difficult and would have significant community impacts due to acquisitions and channel modifications in more populated upstream areas. These Alternatives do not provide a good distribution of benefits because flood relief is primarily provided to relatively more affluent upstream urbanized communities, and may result in induced flooding of downstream communities. By not addressing concerns in Willacy County, public support would be lower. The PA1 Alternatives do not fully meet the project objectives or effectiveness criteria.

Alternative PA2 (Improvements to the Existing Raymondville Drain) was determined to provide only a partial solution providing benefits to limited areas. It does not fully meet project objectives, nor provide a cost-effective solution despite lower costs, as it provides benefits only to a relatively small number of structures in Willacy County. This Alternative does not provide benefits to the more developed upstream communities in the North Main Drain basin, thereby limiting its value. Alternative PA2 does not meet the efficiency or effectiveness criteria.

Alternative PA4 (Construction of a Regional Bypass) is the costliest structural alternative, and has the largest environmental impacts. Its route is through undeveloped rangeland and farmland, and it would impact inflow into the two salt lakes located north of SH 186. It would have significant impact on existing ranches and their operation. It does not provide additional capacity for local stormwater runoff along the existing Raymondville Drain. It is also the alternative with the largest amount of excavation and does not leverage existing infrastructure. Alternative PA4 was not publicly supported, nor does it meet the efficiency or effectiveness criteria.

Alternative PA5 (Acquisition / Buyout) would impose significant social costs. Acquisition of properties within the 25-year floodplain would benefit only a small portion of affected properties, and larger buyouts are even more costly and more disruptive. Acquisition was not publicly supported and does not meet the acceptability, efficiency or effectiveness criteria. However, it is forwarded as the non-structural alternative required for comparison in the final array, consistent with Engineer Regulation (ER) 1165-2-26.

Based on this analysis, the PDT determined that Alternative PA3 (Improvements to both the NMD and Raymondville Drain Systems) is the plan that best achieves the goals of the study and provides wide-ranging and equitable benefits in the region, including providing the most effective support of Comprehensive Benefits, and resiliency considerations. While it is more costly than the PA1 Alternatives, it provides benefits to more structures, increasing its efficiency. PA3 is therefore moved forward to the final array as the structural alternative. PA5 is moved forward to the final array as the required non-structural Alternative. By default, the "No Action" Alternative is also forwarded to the final array. Moving forward with Alternative PA3 is consistent with the recommendations of the 1982 GDM and 1998 LRR.

3.7 FINAL ARRAY OF ALTERNATIVES (STAGE 3)

The goal of the third stage of evaluation was to refine the proposed structural plan into a final array of alternatives and compare them to the non-structural and No Action Alternatives. The final structural Alternatives were developed and refined based on the more general Alternative PA3, "Improvements to both the North Main Drain and Raymondville Drain Systems."

3.7.1 PLAN FORMULATION STRATEGY

The strategy for the formulation of the final array was to identify a combination of specific structural measures to accomplish the study's goals The structural plans developed as a part of this round would affect a combined watershed of approximately 1,220 square miles and benefit approximately 38,000 structures spread across five hydraulic reaches, with the structures predominantly located in the North Main Drain System. A preliminary analysis of the H&H models showed that the most hydraulically effective means of improving both drain systems is to divert water from the North Main Drain with the construction of a new diversion drain and simultaneously increasing the capacity (in-channel storage and flow) of the existing Raymondville Drain. Preliminary analysis also showed that diverting water away from the NMD System further upstream would provide increased benefits, as the bulk of the flows within the channel came upstream of Edinburg Lake from the heavily urbanized Mission-McAllen-Edinburg area. By diverting water from the North Main Drain to the Raymondville Drain, the downstream parts of NMD System would have additional capacity, avoiding the need to expand the NMD in more developed downstream areas.

The objective was to identify how to improve the net benefits (including a comprehensive range of benefits), reduce project costs, and minimize or mitigate the environmental impacts of the plans proposed during this stage

of evaluation. The final array of Alternatives would be similar in concept to the Initial Array, but would have a more refined evaluation, including environmental impacts, costs, and benefits.

For comparison, a non-structural alternative (Acquisition / Buyout, PA5 in the previous round) is included as an alternative to the proposed action in the floodplain required by EO 11988. The No Action alternative (PA6 in the previous round) was also included.

The final array would be evaluated based on the estimated cost of the proposed plan, including the estimated cost of ROW, Construction, Operations and Maintenance, and Mitigation; how well the Alternative addresses the study goals in the form of assessing flood damages; and how well the Alternatives avoided the study constraints. The Alternatives being developed at this stage were consistent with the community goals and the feedback received during previous rounds of public involvement.

3.7.2 USACE PLANNING CRITERIA

USACE Planning Criteria were considered in this round as follows.

- Attainment of Objectives. This was a primary consideration in the development of plans.
- Four Accounts.
    - National Economic Development. The NED Account displays changes in the economic value of the national output of goods and services.
    - Environmental Quality. The EQ Account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans.
    - Regional Economic Development. The RED Account displays the regional and localized economic impacts surrounding a federal project..
    - Other Social Effects. The OSE Account displays plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts (e.g., community impacts, health and safety, displacement, energy conservation, life safety). This includes a comprehensive array of benefits (Comprehensive Benefits).

The P&G evaluation criteria (Acceptability, Completeness Effectiveness, and Efficiency) were also assessed in this round, as were Risk and Uncertainty considerations. Further, the PDT evaluated the Federal Objective, by evaluating costs and benefits for NED, and ensuring solutions contribute to project objectives, while avoiding constraints.

3.7.3 DEVELOPMENT OF FINAL ARRAY

The final structural Alternatives considered by the PDT in this round of combined measures outlined in section 3.3.1. The PDT developed 17 potential alternatives from combinations of structural measures including 11 potential detention ponds, 9 alternate conveyance drains, 10 drain improvement options, and multiple weir control structures. After several iterations which ruled out infeasible or impractical solutions or combinations, and ruled out alternatives that did not accomplish the objective of improving the North Main Drain and Raymondville Drain systems, the PDT identified four hydraulic Alternatives associated with the RD and NMD Systems that could accomplish the flood reduction goal. All plans ultimately included one detention pond, as described below. Hydraulic models were run for the four Alternatives; however, two Alternatives were eliminated on a technical basis because they provided limited conveyance improvement while causing additional new land disturbance and additional construction and real estate costs. The additional considered Alternatives are

described in Appendix A-1, but are omitted from this main report, and only the final two Alternatives considered are described below consistent with SMART Planning principles.

Objectives of the plans included minimizing disruptive additional ROW requirements and reducing overall costs, while still providing flood risk reduction to both Hidalgo and Willacy County communities. The PDT determined that detention / retention upstream of the Hidalgo-Willacy County lines would reduce the required downstream channel capacity, enabling a smaller overall channel width, reducing environmental impacts, reducing construction and real estate costs for the entire Willacy reach, and reducing impacts on communities. (As described in section 3.3.1, detention / retention ponds were not considered to be stand-alone measures.) In the evaluation process, the PDT identified 11 potential detention pond locations. Four existing reservoirs were considered in the 11; however, these were all eventually ruled out as unreliable – three due to restrictions by owners due to their water supply purpose (i.e., Edinburg Lake, Delta Lake, Hargill Reservoir), and the fourth for environmental restrictions (i.e., La Sal Vieja). Consistent with SMART Planning, six of the remaining seven possible locations were eliminated by using engineering judgement based on technical and logistical factors including: not being in a location that would provide benefits; the inability to use gravity flow for inflow and discharge; inadequate storage to provide sufficient benefits for the anticipated cost, and general acquisition concerns and costs. The PDT ultimately recommended one detention pond from the original list - a property owned by the non-federal sponsor near the South Texas International Airport in Edinburg that could provide adequate storage volume. It is located along the identified channel expansion route, and at a location that did not raise significant environmental concerns. Additionally, since the sponsor owns the land, there would be limited opposition or acquisition issues. Preliminary analysis indicated an approximately 270-acre detention pond would reduce the overall cost of the proposed project and enable control of the flow rate at the Hidalgo-Willacy County line.

3.7.4 FINAL ARRAY OF ALTERNATIVES

The PDT considered two structural Alternatives to be reasonably implementable based on improving both the North Main Drain and Raymondville Drain Systems. The PDT identified the beneficially impacted area, estimated project costs, and how well each Alternative addresses the study goals, constraints, opportunities, and considerations. Alternative Plans (shown in Figure 3-3) to increase the capacity of the drains flowing east include:

- Constructing a Bypass from the North Main Drain to West Hargill Lateral 5, and improving the Hargill and Raymondville Drains to the outfall North of SH 186 (Alternative 1 – shown as black line).
- Constructing a Bypass from the North Main Drain to the Delta Lake Drain, and improving the Delta Lake Drain and Raymondville Drains to the outfall North of SH 186 (Alternative 2 – shown as purple line).

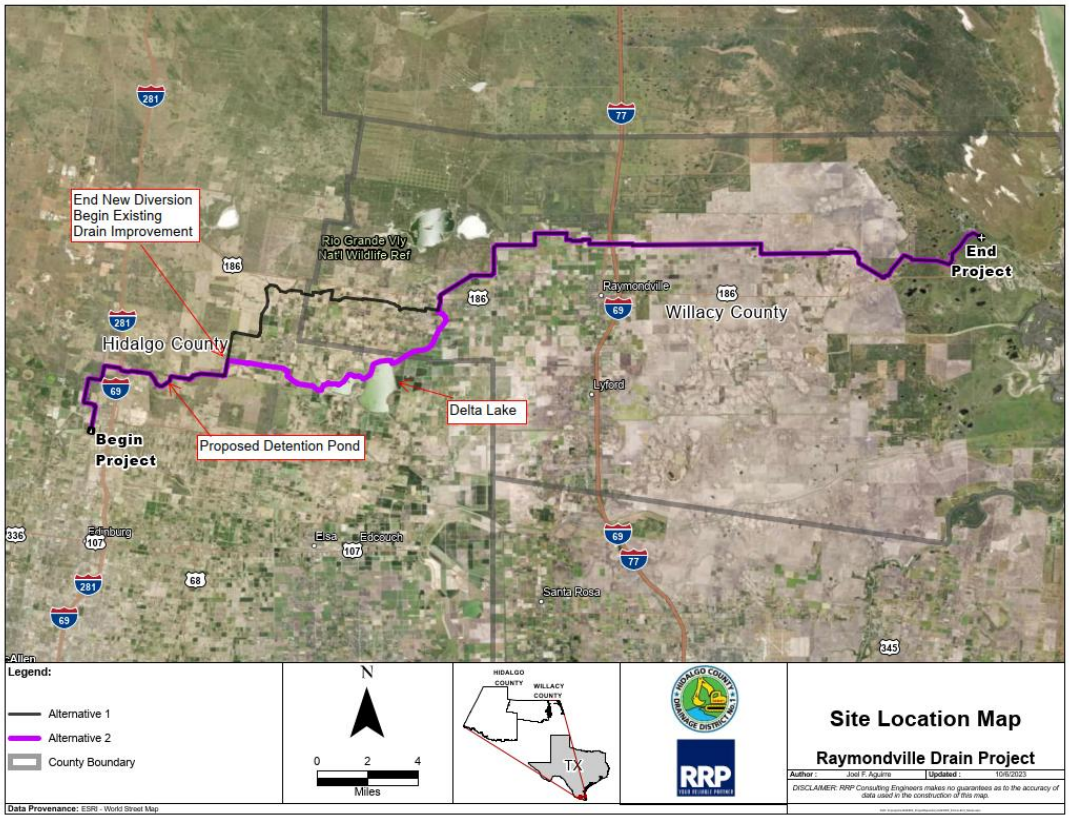

Figure 3-3 Final Array of Alternative Plans (structural)

Nature-based EWN considerations were also included in the final array. Due to the relative simplicity of the Alternatives (primarily excavated earthen channels), EWN-related considerations include maintainability, efficient flood conveyance, and minimizing environmental impacts. A detention basin would be utilized as part of the design to attenuate flows; however, due to waterfowl concerns at the nearby airport, development of wetlands would not be encouraged. Wetland areas located downstream of the project terminus would be preserved to provide additional environmental benefit using EWN-based solutions.

Additionally, the non-structural and No Action Alternatives are included as part of the evaluation process. The evaluation criteria are described in Section 3.7.2, and include the overall estimated costs and benefits through a detailed cost breakdown and flood damage assessment, and overall environmental impacts. This also includes the cost of acquisition of Real Estate Lands, Easements, Rights-Of-Way, Relocations and Disposal Areas (LERRDs), Utility Adjustments, and Environmental Mitigation costs as appropriate. Public and sponsor support was also considered in the selection of the Recommended Plan. This evaluation is documented in Section 5, Plan Comparison and Selection.

Note that a partial downstream buyout or elevation of Willacy County properties along the Raymondville Drain corridor was briefly considered as a potential component of these two plans to reduce costs, but determined not to be technically viable. The majority of benefits for the structural Alternatives accrue in the more developed upstream portions of Hidalgo County. The proposed channel expansion continues the length of the Raymondville Drain, through the less developed portions of Willacy County to safely and effectively convey the upstream flows

diverted from the North Main Drain system through to the Laguna Madre. A partial buyout or raising of just the rural downstream Willacy properties would not eliminate the need for the entire Raymondville Drain channel expansion through Willacy County, to enable adequate channel carrying capacity to generate upstream benefits.

3.7.5 VALUE ENGINEERING EVALUATION

Due to the nature of the USACE plan formulation process, a formal Value Engineering (VE) study is not normally a part of the Feasibility process. However, in the analysis of final Alternatives, the PDT brainstormed ideas to reduce costs of the two final Alternative structural plans while maintaining project functionality in a VE-based process. The main recommendation adopted from this process was the addition of 100' wide spoil berms / banks along the banks of the drain in areas where a wider ROW would not have environmental or social impacts. By reusing additional excavated material for larger spoil berm construction within the project ROW, the PDT reduced the material hauled offsite by approximately 15%, representing a significant reduction in project construction costs.

3.7.6 SUMMARY OF FINAL ALTERNATIVES

Alternative 1 ("Hargill connection"- new drain and increased capacity in the existing Raymondville Drain in the vicinity of Hargill)

Alternative 1 consists of a new diversion drain that connects the existing North Main Drain System and the Raymondville Drain, improvements along the RD, a detention pond located in Hidalgo County, and five control structures to regulate the flow of water. The proposed typical section of the new drain and existing drain improvements generally includes a 450' wide ROW consisting of 15' of vegetative buffers and 20' of access roads on both sides, in-channel maintenance benches, and a 60' wide 5' deep pilot channel, and 100' wide spoil berms. In environmentally sensitive downstream areas, including areas of thornscrub vegetation, the spoil berms would be omitted, and the ROW would be limited to 350' wide.

The diversion channel would start approximately 0.4 miles east of Edinburg Lake with a control structure along the North Main Drain and proceed generally north before crossing I-69C/US 281 approximately 0.7 miles north of El Cibolo Road. From there, the drain proceeds generally eastward toward Brushline Road, with the detention pond and control structure located in-line with the pilot channel; from Brushline Road the drain proceeds north until it is 0.4 miles north of FM 490 where it turns east and connects to the existing Raymondville Drain (locally known as West Hargill Drain Lateral 5); a second control structure is located south of 12th Street before FM 490 to divert water toward Delta Lake for the irrigation purposes (Delta Lake Irrigation District). The proposed new diversion drain from the start to this point is approximately 13.8 miles long, with an approximately 270-acre detention pond.

The proposed project continues with drain widening to match the proposed diversion drain's cross section and continues from the start of the Raymondville Drain (West Hargill Lateral 5) approximately 2.7 miles north; and then proceeds west along the RD (West Hargill Drain) approximately 7.8 miles, and then flows into the RD (North Hargill Drain), with a control structure located at the county line between Hidalgo and Willacy counties. The drain improvements continue along the existing drain in a northeasterly, then east, direction past I-69E/US 77 approximately 30.2 miles to an unnamed private bridge, approximately 2 miles north of the drain's intersection with SH 186. An existing control structure between the drain and its connection to La Sal Vieja, north of SH 186, would be replaced due to the channel widening. The length of the channel improvements is approximately 43 miles, and the overall length of the proposed project is approximately 56.8 miles. This Alternative would replace an estimated 56 bridge structures or culvert crossings, and construct 13 new bridges so that existing roadways

can cross the proposed diversion drain. The Alternative 1 alignment is shown in Figure 3-4, and the typical channel profile is shown in Figure 3-5.

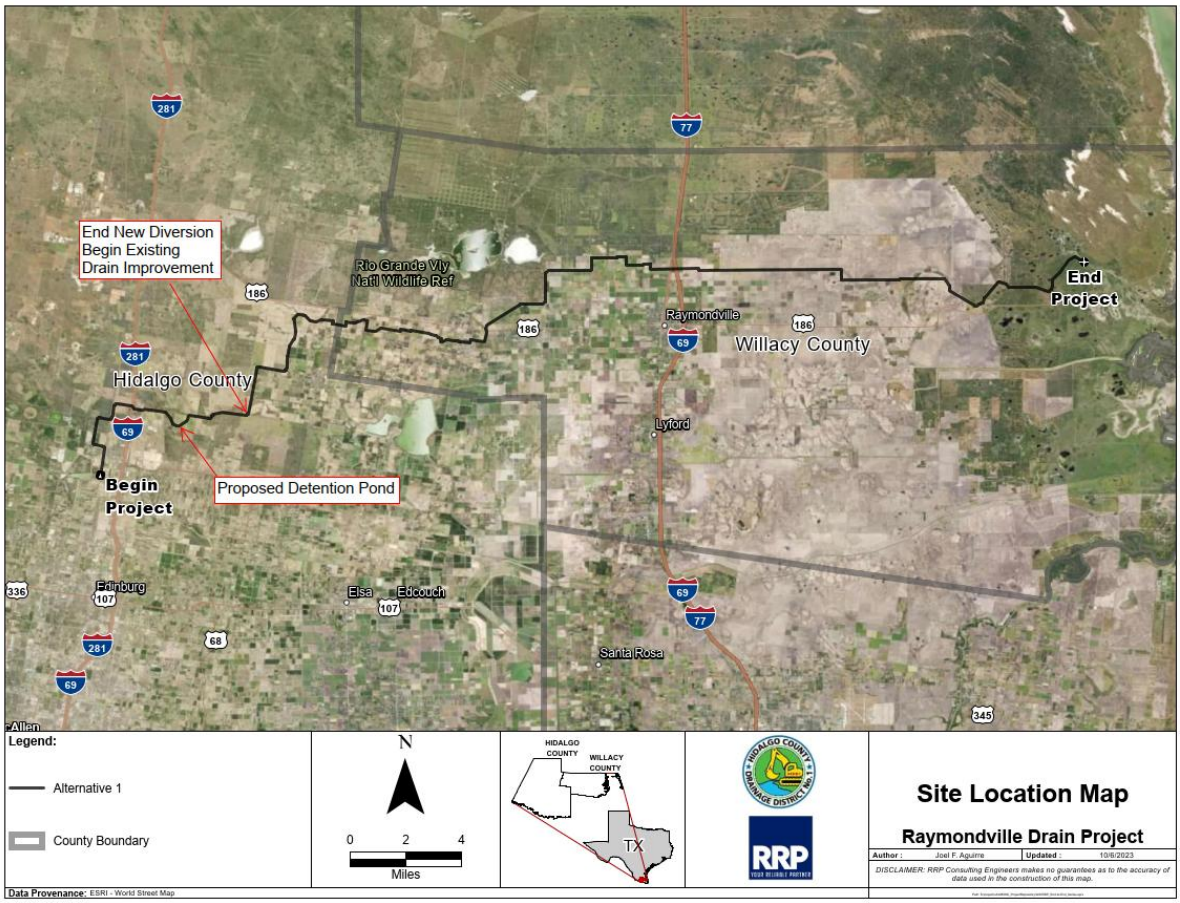

Figure 3-4 Alternative 1 Alignment

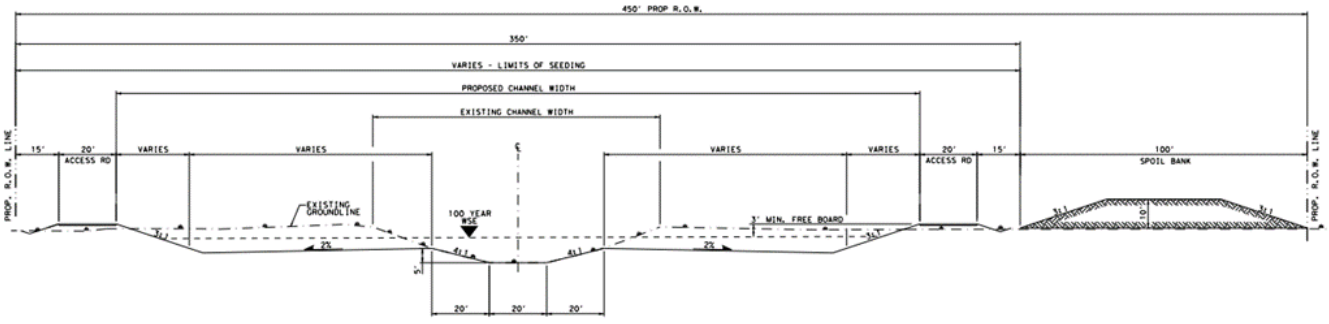

Figure 3-5 Typical Channel Profile

For this analysis, the PDT prepared a preliminary detailed cost estimate for Alternative 1, based on construction plans, detailed schematics, and other considerations applicable to the implementation of the proposed Alternative. A summary of the Alternative 1 total first cost of construction is included in Table 3-4. A breakdown of these preliminary costs is included in Appendix A-2: Cost Engineering.

Alternative 1	Estimated Costs
Construction Cost	$586,870,000
Contingency (5%)	$ 29,344,000
Design During Construction	$ 7,042,000
Overhead (SIOH)	$ 44,015,000
Real Estate Cost	$ 20,773,000
Utility Relocation	$ 29,000,000
Design Fee (6%)	$ 38,212,000
First Cost of Construction	$755,257,000

Table 3-4 Alternative 1 Cost

Alternative 2 ("Delta Lake Connection" - new drain and increased capacity south of Hargill in the vicinity of Delta Lake)

Alternative 2 consists of a new diversion drain that connects the existing North Main Drain System and the Raymondville Drain, improvements along the RD, a detention pond located in Hidalgo County, and four control structures to regulate the flow of water. The proposed typical section of the new drain and existing drain improvements would generally include a 450' ROW consisting of 15' of vegetative buffers and 20' of access roads on both sides, in-channel maintenance benches, and a 60' wide 5' deep pilot channel, and 100' wide spoil berms. A 350' ROW without spoil berms would be used in sections of the drain along the Delta Lake reach due to space constraints, and in environmentally sensitive downstream areas including areas of thornscrub vegetation.

The diversion channel would start approximately 0.4 miles east of Edinburg Lake with a control structure along the North Main Drain and proceed north before crossing I-69C/US 281 approximately 0.7 miles north of El Cibolo Road. From there, the drain proceeds eastward toward Brushline Road, with the detention pond and control structure located in-line with the pilot channel; from Brushline Road the channel would proceed north and then turn towards the existing Delta Lake South Main Drain south of 12th Street. The proposed new diversion channel from the start to this point is approximately 11.5 miles long, with an approximately 270-acre detention pond.

The proposed project would continue with drain widening to match the proposed diversion channel's cross section, and would continue from the start of the Delta Lake South Main Drain east around the existing Delta Lake, widening to the north to accommodate existing irrigation channels, to its junction with the North Hargill Drain northeast of Lasara, approximately 13.3 miles, with a control structure located at county line between Hidalgo and Willacy counties. This Delta Lake reach would include areas excluding the 100' spoil berm. The channel improvements would continue along the existing channel in a north easterly then east direction past I-69E/US 77 approximately 30.2 miles to an unnamed private bridge, approximately 2 miles north of the channel's intersection with SH 186. An existing control structure between the drain and its connection to La Sal Vieja, north

of SH 186, would be replaced due to the channel widening. The length of the channel improvements is approximately 43.9 miles, and the overall length of the proposed project is approximately 55.4 miles. This Alternative would replace an estimated 51 bridge structures or culvert crossings, and construct 13 new bridges so that existing roadways can cross the proposed diversion drain.

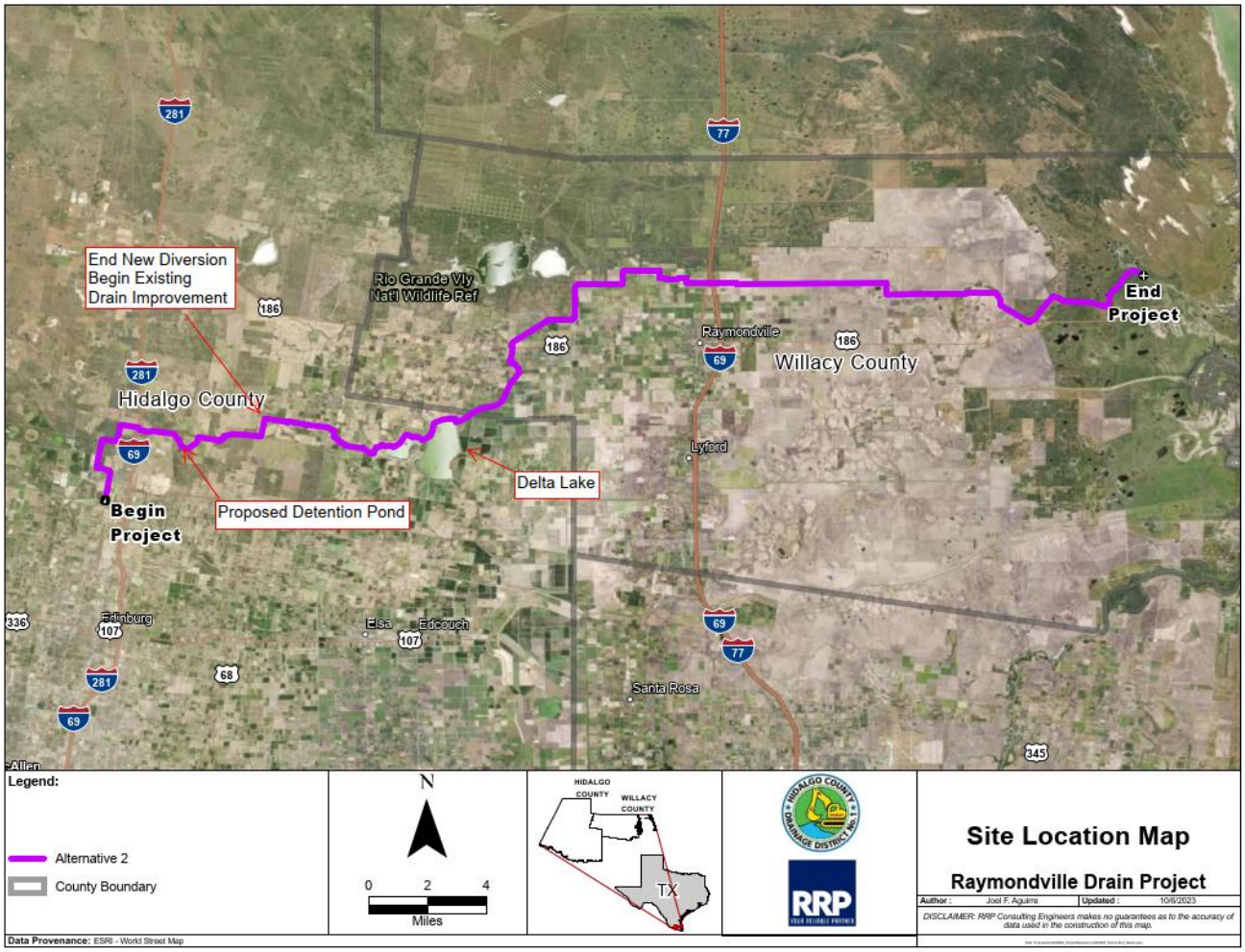

Figure 3-6 Alternative 2 Alignment

The Alternative 2 alignment is shown in Figure 3-6, and the typical channel profile is shown in Figure 3-5. The primary difference between the two Alternatives is that starting downstream of the proposed detention pond and east of the airport, this Alternative conveys diverted flow into the Delta Lake Drain, a more southerly route passing along the north side of Delta Lake, while Alternative 1 continues northward to connect to the West Hargill Drain, with both Alternatives connecting to the Raymondville Drain northeast of Lasara.

For this analysis, the PDT prepared a preliminary detailed cost estimate for Alternative 2, based on construction plans, detailed schematics, and other considerations applicable to the implementation of the proposed Alternative. A summary of Alternative 2 costs, including first construction cost, annual OMRR&R, and real estate

costs are included below in Table 3-5. While the channel length of Alternative 2 is not significantly different than Alternative 1 and many segments of the project are the same, Alternative 2 would be a more costly plan. Increased costs along the Delta Lake Drain reach include additional hauling because existing development limits the use of overbank areas for spoil disposal, more valuable real estate, and more complex channel crossings. A breakdown of these preliminary costs is included in Appendix A-2: Cost Engineering.

Alternative 2	Estimated Costs
Construction Cost	$646,809,000
Contingency (5%)	$ 32,340,000
Design During Construction	$ 7,762,000
Overhead (SIOH)	$ 48,511,000
Real Estate Cost	$ 22,537,640
Utility Relocation	$ 29,000,000
Design Fee (6%)	$ 41,809,000
First Cost of Construction	$828,768,000

Table 3-5 Alternative 2 Cost

Alternative 3 – (Acquisition / Buyout Alternatives)

The PDT considered the acquisition of properties in the floodplain as the non-structural Alternative. This analysis was done at the 25-year level (4% annual chance) and 100-year (1% annual chance) level. Properties identified for acquisition had finished floor elevations lower than the 25- and 100-year flooding envelope.

The estimated total number of acquisitions for the 25-year buyout is approximately 4320 structures (4018 residential, 250 commercial, and 52 public), and 12,105 structures for the 100-year buyout (11,140 residential, 808 commercial, and 157 public). Detailed data is in Appendix A-5, Economics, and acquisition costs were based on values documented in Appendix A-4, Real Estate. A summary of Alternative 3 costs, including administrative costs, acquisition / relocation, demolition / restoration, and condemnation costs, are included in Table 3-6.

The total cost for the 25-year buyout was estimated at $2.03 billion, and for the 100-year buyout at $5.58 billion. Compared to the per-structure cost documented in Table 3-2, this Alternative was shown to be the least cost-effective solution overall. The cost of this Alternative per-structure receiving benefit is approximately 20 times greater than PA3 (the basis for the final array of structural plans), a more comprehensive structural plan. Acquisition of properties within the 25- or 100-year floodplain additionally benefits only a portion of affected properties, and does not support the objective of minimizing floodwater disruption to roadways. As summarized in section 3.6.5, acquisition was not publicly supported, raises significant social concerns, and does not meet the acceptability, efficiency or effectiveness criteria.

Based on this analysis, the PDT forwarded the 25-year buyout as the preferred non-structural alternative required for comparison in the final array, consistent with Engineer Regulation (ER) 1165-2-26. This alternative was chosen

because it has a lower implementation cost, would impact a smaller number of individuals and businesses while still reducing more frequent flooding, and would therefore be more beneficial and cost effective than a more comprehensive buyout at the 100-year level.

Alternative 3	Unit Cost	Alt 3- 25-year Buyout	Alt 3- 100-year Buyout
Approximate structures impacted		4,320	12,105
Admin costs (Public relations, Survey, Title, appraisal, ROW) per structure	$7,750	$33,480,000	$93,810,000
Property Acquisition and relocation per structure	$400,000	$1,728,000,000	$4,740,000,000
Demolition and Restoration Cost per property	$61,500	$265,680,000	$729, 145,000
Condemnation costs (Total - assume 15% of properties)		$6,480,000	$18,158,000
Estimated Cost		**$2,034,000,000**	**$5,581,000,000**
OMRR&R		N/A	N/A
Est. Cost per Structure Benefitted		$471,000	$461,000

Table 3-6 Alternative 3 Cost

SECTION 4.0 ENVIRONMENTAL EFFECTS AND CONSEQUENCES

Section 4 describes the effects to the existing condition (affected environment) in areas that are expected to be influenced by the proposed Raymondville Drain Project. Additionally, this section provides an analysis of the potential environmental consequences that may arise from the implementation of the proposed Project.

A study area was established to assess the environment (natural, physical, built, and human) which may be affected by the two final Alternatives for the Raymondville Drain Project. The study area is located within a 600-foot-wide corridor that allows for design flexibility as well as avoidance and minimization of impacts to the affected environment within the corridor. During plan implementation, project construction activities would ultimately occur within a 350- or 450-foot ROW. The two final structural Alternatives, the acquisition / buyout Alternative, and the No Action Alternative (described in Section 2) were evaluated for the proposed project.

4.1 NATURAL ENVIRONMENT

4.1.1 WATERS OF THE U.S., INCLUDING WETLANDS

A delineation of waters of the U.S. (WOTUS), (see Section 2.4.1) identified 78 aquatic features encompassing approximately 458 acres within the Raymondville Drain Project study corridor. Aquatic features within the study corridor that are anticipated to be jurisdictional include eight wetlands encompassing approximately 60 acres, as well as 13 tributaries encompassing approximately 299 acres and 225,550 linear feet. Wetland delineation activities and the associated report were completed prior to changes in federal regulations regarding WOTUS. The jurisdictional status of all identified water bodies and wetland areas will be re-evaluated prior to the implementation of any required mitigation. Implementation of Alternative 3 (non-structural) would not be expected to impact any waters of the U.S.

Non-wetland WOTUS would be excavated to expand the existing Raymondville Drain. The excavation of non-wetland WOTUS would result in the conversion of one upland drainage ditch into another upland drainage ditch which conveys a relatively permanent flow of water. Consequently, these excavations are not anticipated to adversely affect the physical, biological, or chemical integrity of the overall water system in the LRGV and are not considered impacts for the purposes of this integrated FR and EA.

Wetlands within the Raymondville Drain Project ROW would be permanently impacted by excavation (i.e., construction of the new and expanded channel) and by fill (i.e., construction of the proposed access roads and spoil berm). The proposed project is water-dependent, and as a channelization project in an existing drainage system, no practical alternatives exist. Efforts have been made during the design phase to avoid and minimize wetland impacts to the extent practicable; an estimated total of 25 acres of potentially jurisdictional wetlands are anticipated to be permanently impacted. Temporary impacts to wetlands may additionally occur as a result of the construction of temporary construction roads which would remain in place for no longer than three months. With the inclusion of any mitigation determined to be necessary, the impacts to wetlands would not be considered to be significant. The modification of the proposed project to terminate channel improvements two miles upstream of SH 186, as mentioned previously, also enabled the avoidance of potential impacts on downstream wetlands adjacent to the existing Raymondville Drain in the vicinity of the Laguna Madre.

No indirect impacts to wetlands are anticipated to occur as a result of alterations to groundwater flow patterns in the immediate vicinity of the new and expanded channel. Soil boring data indicates that groundwater in the project area generally occurs beginning at a depth greater than 14 feet below the existing ground surface, which is deeper than the proposed bottom of the new and expanded channel. Groundwater at a depth less than 12 feet from the surface was observed in one location along the Raymondville Drain Project study corridor, at a naturally low spot near the Delta Lake diversion drain. Wetland areas were identified and delineated near this location; however, based on observed conditions, the wetland areas are not anticipated to be jurisdictional.

Current research indicates that changes in wetland productivity in response to changes in water table depth are highly site-specific. The variables that determine the changes in productivity include the hydraulic conductivity of the underlying soil, the composition of the plant community, and the degree to which the water table depth changes. Indirect impacts to wetlands resulting from changes in subsurface groundwater flow cannot be accurately quantified at this stage of the project and are considered too speculative for meaningful consideration in this integrated FR and EA.

4.1.2 VEGETATION AND WILDLIFE HABITAT

Ecological Mapping Systems of Texas (EMST) data was used to evaluate the types of vegetation that may be directly impacted by Alternative 1 and Alternative 2 (see Appendix A-3, Figures 5 and 6, Tables 12 and 13, and Attachment A, Exhibit 9 – EMST Map). Implementation of Alternative 3 (non-structural) is not expected to significantly impact vegetation.

The Raymondville Drain Project would result in temporary and permanent effects on wildlife habitat. Temporary effects would occur only during construction activities and include increased noise levels, air emissions, and soil compaction. Increased noise levels could potentially disturb the daily activities of species inhabiting the study corridor. Effects to wildlife from air emissions and fugitive dust are expected to be minimal. The use of heavy machinery may cause soil compaction, which would adversely affect fossorial animals (i.e., animals that live underground).

Permanent effects primarily include the loss of potential habitat which would be converted to drainage ROW. The Biological Assessment indicated that most areas of wildlife habitat in the Raymondville Drain Project study corridor are of poor quality, consisting of small patches fragmented by agricultural fields, roadways, and other forms of development. Wildlife habitat in the East Foundation property and El Sauz Ranch, which was considered moderate to high quality, represents approximately 6.1 miles (10.7%) of the study corridor. Conservation measures would be implemented during construction to minimize direct impacts on vegetation and wildlife habitat (see Section 4.1.3 and Appendix A-3, Attachment D – Endangered Species Act Compliance). Aside from the removal of some areas of potential wildlife habitat (e.g., dense thornscrub) associated with the implementation of the Raymondville Drain Project, the general vegetation community surrounding the project would not change.

Indirect impacts to wildlife habitat are anticipated to result from new development induced by the decreased risk of flooding. Induced development is mostly likely to occur close to existing businesses, services, and infrastructure in areas that are already developed (i.e., near Edinburg and Raymondville) and where wildlife habitat is already fragmented or of low quality. Indirect impacts to wildlife habitat resulting from induced development are therefore anticipated to be minimal or negligible. Overall, project-related impacts to vegetation and wildlife habitat would not be significant.

4.1.3 THREATENED AND ENDANGERED SPECIES

The construction of Alternatives 1 or 2 of the Raymondville Drain Project has the potential to permanently impact areas of thornscrub habitat, which may serve as a transportation corridor for the ocelot (*Leopardus pardalis*). The ocelot is listed as endangered by USFWS and TPWD. Their preferred habitat includes dense thornscrub with a 90% canopy cover. In addition, impacts to neighboring farmland, pastureland, and potential nesting habitat for migratory birds may result from the construction of the Raymondville Drain Project. Implementation of Alternative 3 (non-structural) is not expected to impact habitat or threatened and endangered species.

HCDD1 environmental contractors conducted field investigations associated with a Biological Assessment in April 2023 to assess the potential impacts to the ocelot, jaguarundi (*Puma yagouaroundi*), Eastern Black Rail (*Laterallus jamaicensis jamaicensis*), and tricolored bat (*Perimyotis subflavus*) as well as other threatened and endangered species. The purpose of the field investigations was to gather information on the habitat types within and adjacent to the Raymondville Drain Project ROW, including threatened and endangered species-specific habitat requirements.

The construction of the Raymondville Drain Project has the potential to permanently impact potential travel corridors used by ocelots. Apart from areas near the eastern project terminus, the surrounding areas in Willacy County primarily consist of farmland or pastureland. Large portions of natural thornscrub habitat have been converted to agricultural use over the past few decades. This conversion has limited the travel capabilities of ocelots and isolated them to private ranches, e.g. the East Foundation property and El Sauz Ranch, which are traversed by the Raymondville Drain Project. These remaining thornscrub habitats are crucial not only for the ocelot but also for the endangered Gulf Coast jaguarundi. Both species rely on these habitats for movement and survival. The loss or fragmentation of these habitats due to agricultural development and the construction of the Raymondville Drain Project could further restrict their travel abilities and increase their isolation within private ranchlands. The design of the proposed Raymondville Drain Project was modified to terminate channel improvements two miles upstream of the Raymondville Drain crossing with SH 186 to minimize potential impacts on ocelot critical habitat.

A total of 23 species that are listed, or are proposed for listing, by the USFWS or TPWD as threatened or endangered have suitable habitat within the Raymondville Drain Project study corridor and may be affected by the proposed project (see Appendix A-3, Table 2).

The impacts to wildlife habitat were quantified using the USFWS' Habitat Evaluation Procedures (HEP). HEP is used as a way to measure a habitat's carrying capacity by analyzing representative species' needs and calculating a Habitat Suitability Index (HSI) for a studied area by use of a published model which analyzes abiotic and biotic metrics. The HSI quantifies changes in wildlife habitat by calculating cumulative habitat units (CHUs) for selected representative species. Overall, an estimated 13,700 CHUs (2.0 CHUs per acre) are anticipated to be lost in the implementation of Alternative 1 while 9,960 CHUs (2.3 CHUs per acre) are anticipated to be lost in the implementation of Alternative 2. The estimated loss associated with Alternative 1 is equal to approximately 4.4% of the total CHUs available over the course of the 50-year study in a FWOP and equates to an average annual loss of approximately 270 CHUs per year. The estimated loss of HUs associated with Alternative 2 is equal to approximately 3.9% of the total CHUs available and equates to an average annual loss of approximately 200 CHUs per year. The HEP analysis indicates that small and large mammals would be adversely affected by the Raymondville Drain Project, while birds and aquatic fauna would be beneficially affected (see Appendix A-3, Table 14).

The Biological Assessment concluded that the proposed project "may affect, but is not likely to adversely affect," five federally listed or proposed for listing species as threatened or endangered under the ESA: the ocelot, the tricolored bat, the Gulf Coast jaguarundi, the Cactus Ferruginous Pygmy-owl (*Glaucidium brasilianum cactorum*), and the Northern Aplomado Falcon (*Falco femoralis septentrionalis*). Effects to these species would occur due to the conversion of potential habitat to drainage ROW. The highest-quality habitat for the ocelot, the Tricolored Bat, the Cactus Ferruginous Pygmy-owl, and the Gulf Coast Jaguarundi in the Raymondville Drain Project study corridor is located near the eastern project terminus, in the El Sauz Ranch and the East Foundation property. This habitat consists of dense mesquite woodlands interspersed by grassy meadows. Approximately 148 acres of this habitat would be cleared to expand the existing Raymondville Drain (see Appendix A-3, Attachment A, Exhibit 17 – Constraints Map).

Ocelots and Gulf Coast Jaguarundis are not anticipated to inhabit the Raymondville Drain Project study corridor continually, as the canopy cover was generally observed to be less than 95% during field investigations and the understory in most areas was open enough for an adult human to walk through. Habitat in the El Sauz Ranch and East Foundation property (inclusive of the study corridor) is therefore anticipated to be used by ocelots and Gulf Coast Jaguarundis in a temporary manner, such as for hunting and dispersal.

Conservation measures, including Best Management Practices (BMPs) recommended by TPWD, would be implemented before, during, and after construction activities, as needed, to prevent or minimize adverse effects to protected species. Conservation measures would include practices designed to minimize harm to wildlife generally, as well as practices that are specific to particular taxa or species.

General BMPs and other conservation measures, not specific to any species or other taxon, prescribed by USFWS that would be implemented include the following:

1. Prior to any construction activities, a kick-off meeting will be scheduled. One of the primary purposes will be to discuss the BMPs and education training for all on-site workers.
2. Individual Federally listed animals found in the project area will not be harassed and will be allowed to leave on their own volition. An individual with the authority to stop construction activities will be on-site during construction activities, and will halt all activities immediately upon report of an ocelot or Jaguarundi sighting. Contact USFWS immediately at (956) 354-6125 or (956) 784-7520 if a federally listed animal is seen in the project vicinity during normal business hours. After hours, please call (956) 784-7520 (Refuge Dispatch).
3. During construction activities, a biological monitor, with authority to temporarily suspend construction at any time the appropriate BMPs are not being properly implemented, will be present on site. Duties of the monitor will include ensuring that activities stay within designated project areas, evaluating the response of individuals that come near the project site, and implementing the appropriate BMP.
4. Vegetation clearing beyond the design parameters needed for construction and maintenance and use will be avoided. The perimeter of all construction or maintenance areas will be clearly demarcated using flagging or temporary construction fence, and no disturbance outside that perimeter will be authorized.
5. Materials such as sand will be obtained from existing developed or previously used sources, not from undisturbed areas adjacent to the project area.
6. If new or improved access is needed, plans will be coordinated with USFWS.
7. Tree and brush removal would be minimized, and permanent loss will be restored with native vegetation.

8. Dispose of all food related trash items such as wrappers, cans, bottles, and food scraps in closed containers and remove daily from the project site to eliminate attraction of predators.
9. All equipment, materials, and vehicles will be staged in designated areas that are currently cleared and covered with aggregate.
10. Construction and maintenance activities will be conducted only during daylight hours to avoid noise and lighting issues at night. Noise levels would be minimized, and all generators would be in baffle boxes (a sound-resistant box that is placed over or around a generator), have an attached muffler, or use other noise-abatement methods in accordance with industry standards.
11. Vehicle traffic associated with the project will remain on established roads and reduce speeds to the maximum extent practicable.
12. No fences or barriers should bisect or fragment jaguarundi or ocelot dispersal corridors or prevent access to fresh water.
13. All herbicides will be applied in the presence of an herbicide applicator who is licensed in the State of Texas.
14. Waste water (water used for project purposes that is contaminated with construction materials or water used for cleaning equipment and thus carries oils or other toxic materials or other contaminants in accordance with state regulations) would also be stored in closed containers on-site until removed for disposal.
15. The project management plan will provide for a report describing the implementation of the BMPs and their effectiveness. All personnel involved with the on-the-ground construction or maintenance for the proposed action will receive training in the affected species, the agreed upon BMPs, and the role of the construction monitor.

Conservation measures specific to the ocelot and Gulf Coast Jaguarundi prescribed by USFWS that would be implemented include the following:

1. During construction, a biological monitor with authority to temporarily suspend construction when appropriate BMPs are not being properly implemented will be present on site.
2. Removal of wetland habitat or riparian vegetation beyond the design parameters will be avoided. Removal of dense thorn scrub will be minimized and restricted to the design parameters. When removing scrub habitat, root systems will be left intact where possible.
3. Documentation of observed ocelots and Jaguarundi in the project and activity areas will be reported to USFWS.
4. No restoration activities, including monitoring, will occur between November and December to avoid the peak reproductive season of the Jaguarundi.
5. In order to minimize potential loss of felid prey species, the use of herbicides will be limited to the minimum amount necessary to achieve adequate control of Carrizo Cane.
6. Down shield lighting to illuminate facility or parking areas and do not shine on surrounding vegetated areas as the ocelot and jaguarundi are usually active at night or at dawn and dusk.

7. Protect riparian areas or canals from construction and/or use, as these are areas that are used as travel corridors for cats; maintain a vegetative buffer.

Additional general and taxon-specific conservation measures that would be implemented during the construction of the Raymondville Drain Project are provided in the Biological Assessment (see Appendix A-3, Attachment D – Endangered Species Act Compliance). The implementation of conservation measures is anticipated to prevent impacts to threatened, endangered, and candidate species from rising to an intensity that would be considered significant.

4.1.4 ESSENTIAL FISH HABITAT

Following coordination with the USFWS and the National Marine Fisheries Service (NMFS), it was determined that the proposed project would not have any significant impacts on any Essential Fish Habitat (EFH) in the Laguna Madre. The proposed project would not impact ongoing or any planned seagrass restoration efforts by USACE or others in the Laguna Madre.

The seagrass survey (see Section 2.4.4) concluded that seagrass exhibited no more than 25% cover of areas in the Laguna Madre immediately downstream of the existing Raymondville Drain outfall. Direct impacts to seagrass beds resulting from construction activities are not anticipated, as the Raymondville Drain Project ROW would terminate at a point approximately 7 miles upstream of the Laguna Madre. Impacts to seagrass resulting from freshwater inflow are also not anticipated. Because the RDP would divert water from the North Main Drain, any additional water that would flow into the Laguna Madre from the RD during flood events would, under the Future Without Project condition, flow into the Laguna Madre from the NMD. The outfall of the NMD flows into the Laguna Madre at approximately the same location as the outfall of the existing RD. Additionally, these relatively minor flow changes from operation of the RD would only occur during significant runoff events, when additional large inflow volumes would likely be entering the Laguna Madre from other sources.

4.1.5 PROTECTED RESOURCES/LANDS

Alternative 1 would widen the Raymondville Drain in the vicinity of the Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR) northeast of Lasara. However, direct impacts to the LRGVNWR are not anticipated as construction activities would avoid LRGVNWR lands (see Appendix A-3, Attachment A, Exhibit 6 – National Wildlife Refuge Tracts). No other protected lands, including parks or other wildlife refuges, are located within the study corridors of Alternative 1 or 2; therefore, no impacts to protected lands are anticipated. In a letter dated September 10, 2012, the Texas General Land Office (GLO) determined that the Raymondville Drain Project is not likely to have adverse impacts on Coastal Natural Resource Areas. Implementation of Alternative 3 (non-structural) is not expected to impact protected resources/lands.

4.1.6 MIGRATORY BIRDS

The Raymondville Drain Project ROW would be surveyed for evidence of migratory birds prior to construction. To avoid impacts to migratory birds which may be in the ROW, vegetation clearing activities would be scheduled to occur outside of the general bird nesting season (March 15 through September 15). If disturbance must be scheduled during the nesting season, areas of vegetation and bare ground to be impacted would be surveyed for active nests by a qualified biologist prior to clearing; surveys would be conducted no more than five days prior to clearing activities. If active nests are encountered, a buffer would be established in a 100-foot radius around the active nests until eggs have hatched and the young birds therein have fledged. Buffers would be established in a 325-foot radius around observed raptor nests and would remain in place during the raptor nesting period

(February 1 through July 15). The size of buffers around individual nests may be adjusted following coordination with the USFWS and TPWD. No significant impacts on migratory birds are anticipated.

The runway of the South Texas International Airport at Edinburg is located approximately 4,000 feet (0.75 mile) north of the proposed diversion drain and approximately 4,760 feet (0.8 mile) northwest of the proposed location of the detention pond. To avoid attracting waterfowl or other potentially hazardous wildlife to the airport's area of operations, the design of a proposed detention pond within 10,000 feet of the South Texas International Airport would incorporate, to the extent practicable, the recommendations in the Federal Aviation Administration (FAA) Advisory Circular on Hazardous Wildlife Attractants on or near Airports (AC 150/5200-33B). To discourage waterfowl and other potentially hazardous wildlife from using the diversion drain and detention pond in a similar manner, physical barriers (e.g., wire grids) could be installed over the detention pond and the side slopes of the proposed diversion drain and the detention pond could be vegetated with a species of grass that is not used as forage or cover by waterfowl. The proposed detention pond would be designed to retain water for no longer than 48 hours following storm and flood events; between storms, the bottom of the detention pond would be dry. Additionally, the side slopes of the proposed detention pond would have a slope of 8.7% to 9.4%. A narrow, linear shape for the proposed detention pond in this location was not feasible due to land ownership restrictions; however, by implementing the other recommendations in AC 150/5200-33B, the Recommended Plan is anticipated to avoid attracting waterfowl or other potentially hazardous wildlife to the South Texas International Airport area of operations.

No significant impacts on airport operations are anticipated. Coordination with the management of the South Texas International Airport was conducted in March 2024, and management replied in an email on April 11, 2024, expressing concurrence with the determination of no significant impacts.

4.2 PHYSICAL ENVIRONMENT

4.2.1 GEOLOGY AND SOILS

It is not anticipated that the geology within the Raymondville Drain Project study area would undergo significant changes. The excavation of soils to expand the drain may disturb the surface soil but is not expected to affect the general geological conditions at deeper levels. The proposed project's activities are not projected to result in alterations or disruptions to the overall geological characteristics of the study area.

Alternative 1 and Alternative 2 are each anticipated to remove areas of prime farmland and farmland of statewide importance (see Appendix A-3, Table 15). The severity of impacts to farmland was assessed using the Farmland Conversion Impact Rating Form (NRCS-CPA-10). Alternatives 1 and 2 received scores of 78 and 79, respectively, out of a possible 160 points for the site assessment (see Appendix A-3, Attachment H – Farmland Protection Policy Act (FPPA)Compliance). Under Federal regulations for the implementation of the FPPA (7 CFR 658), sites receiving a total score of less than 160 are not required to receive further consideration for protection; direct impacts to soils are therefore not anticipated to be considered significant. Implementation of Alternative 3 (non-structural) is not expected to adversely impact farmland.

Indirect impacts to prime farmland soils and farmland of statewide importance may occur in the form of additional development induced by the anticipated reduction of flood risk associated with the Raymondville Drain Project. At this time, no information is available with which to predict where induced development would occur; therefore, indirect impacts to prime farmland soils and farmland of statewide importance are considered too speculative for meaningful consideration in this integrated FR and EA.

4.2.2 CULTURAL RESOURCES

Archeological and historic resources have been assessed using remote sensing methods (see Section 2.5.7). Surveys for archeological and historic resources within the Area of Potential Effect (APE) for the Raymondville Drain Project were conducted in accessible areas from May to September 2024. Cultural resources surveys included database searches of documented historic and archeological sites, pedestrian field surveys (i.e., shovel testing), and systematic mechanical trenching throughout the Raymondville Drain Project ROW.

The review of the Texas Archeological Sites Atlas identified two recorded archeological sites and one National Register Historic District within the APE. Archeological field investigations conducted within accessible areas of the study corridor identified an additional two isolated finds. Additional field investigations of the study corridor will be accomplished as properties become accessible. Prior to the initiation of construction activities, coordination would be initiated with the Texas Historical Commission (THC) and the State Historic Preservation Office (SHPO) for the relocation of the archeological resources at the recorded archeological sites, as well as any other archeological resources encountered during the upcoming cultural resources survey. In the event that any additional archeological resources are encountered during construction activities, work in the immediate vicinity would cease and HCDD1 and the USACE would be contacted immediately. HCDD1 and the USACE would then initiate any required coordination with the THC and SHPO.

The identified National Register Historic District consists of a portion of the historic King Ranch which was cultivated or settled between 1850 and 1924. This portion of the historic district overlaps the Raymondville Drain Project study corridor, as well as areas beyond, from County Road 445 eastward to the eastern project terminus. The expansion of the existing Raymondville Drain in this location is not anticipated to diminish or adversely affect the characteristics which qualify this portion of the King Ranch as a National Register Historic District. Overall, no significant impacts to cultural resources are anticipated.

Implementation of Alternative 3 (non-structural) is not expected to impact cultural resources. Demolition would occur only in areas already disturbed by previous construction, and would be limited to that footprint.

4.2.3 WATER QUALITY

Through the construction of the proposed diversion drain as part of Alternatives 1 or 2, the proposed project would create a direct hydrological connection between the North Main Drain and the existing Raymondville Drain. Implementation of Alternative 3 (non-structural) is not expected to impact water quality.

Both the North Main Drain and the existing Raymondville Drain are listed as impaired water bodies by the Texas Commission on Environmental Quality (TCEQ); therefore, the proposed project would not create a hydrological connection between an impaired water body and an unimpaired water body. Best Management Practices (BMPs) would be implemented during construction to prevent or minimize impacts to water quality resulting from construction activities. BMPs to control sedimentation of water in the Raymondville Drain would include silt fencing, sediment control logs, and the revegetation of disturbed ground. A Spill Prevention, Control, and Countermeasure (SPCC) plan would be implemented to prevent or minimize the release of petroleum products or other foreign chemicals into surface waters within the Raymondville Drain Project ROW. The SPCC plan would be completed and provided to construction crews prior to the initiation of construction activities and would be maintained on site throughout construction activities. The SPCC plan would consider the equipment to be used in construction activities as well as potential hazardous materials sites that were identified during the associated field investigation conducted in April and September 2023 (see Section 2.5.6).

Manmade ditches are considered jurisdictional waters of the U.S. if they convey a relatively permanent flow of water into other waters of the U.S. (33 CFR 328.3). Based on a review of the USGS National Hydrography Dataset (NHD), approximately 26 drainage or irrigation ditches flow into the existing Raymondville Drain along the Alternative 1 ROW and approximately 29 drainage ditches flow into the existing Raymondville Drain and Delta Lake Drain along the Alternative 2 ROW. No ditches are identified in the NHD in the location of the proposed new diversion channel. Impacts to ditches would result from the conversion of the downstream extent of each ditch channel to new or expanded drainage ROW. Ditches would be identified and mapped during wetland delineation activities (see Section 2.4.1); ditches which convey a relatively permanent flow of water would be identified and assessed among project-related impacts to waters of the U.S., including wetlands.

Impacts to waters of the U.S., including wetlands, would be minimized to the extent practicable by realigning the Raymondville Drain Project ROW within the study corridor. If necessary, a compensatory mitigation plan for the Raymondville Drain Project would be developed and implemented to ensure that impacts do not rise to significant levels.

4.2.4 HYDROLOGY AND FLOODPLAINS

As a flood risk management project, Alternatives 1 or 2 would be anticipated to affect the hydrology in Hidalgo County and Willacy County during flooding events, when significant natural disturbance to the environment would occur. Changes to flow in the Raymondville Drain would only occur during high-flow periods such as floods (see Appendix A-3, Tables 16 and 17). During normal operations, there would be no diversion of water from the North Main Drain to the Raymondville Drain, nor change in flow. Implementation of Alternative 3 (non-structural) is not expected to significantly impact hydrology due to the sparse nature of development in the downstream portion of the study corridor.

The Raymondville Drain has not been studied in a FEMA Flood Insurance Rate Map (FIRM) study, and has not been identified as a FEMA floodplain. Therefore, floodplain and development restrictions, such as EO 11988, do not currently apply throughout the study area. Within the study area, FEMA has identified some limited areas of the one-percent annual chance ("100-year") and 0.2-percent annual chance ("500-year") floodplains in its published FIRMs, primarily along the coast, outside of the area that would have reduced risk from the proposed project (see Appendix A-3, Attachment A, Exhibit 9 – Existing FEMA Floodplains). Future floodplain and development restrictions, such as EO 11988, are anticipated to apply to the Raymondville Drain Project following project construction.

The results of the modeling for the 10-day one-percent ("100 year") storm indicate that the flooding envelope in the Raymondville Drain Project study area would be substantially reduced in size following the construction of the proposed project (Figure 4-1). Areas of Edinburg, Lasara, and Raymondville which are currently located in the existing flooding envelope would be located outside the proposed flooding envelope. Areas that would no longer at risk from the 10-day one-percent storm are shown in green, and remaining (residual) flooding is shown in hatched red. Detailed flooding envelope maps are included in Appendix A-3, Attachment A, Exhibit 9 – Flooding Envelope Map.

As noted in Section 2.5.3, the "mapped flooding envelope" for the 10-day one-percent storm event was created from the existing conditions rainfall-runoff model (HEC-HMS) developed for the project, and therefore does not fully depict flooding in the agricultural areas in northern Hidalgo County that would receive benefit from the extra conveyance of the proposed project. This was done because it was not necessary to fully hydraulically model the sparsely populated agricultural areas to determine property damage benefits. However, the hydrology model

(HEC-HMS) for the proposed project includes the entire drainage area and therefore enables accurate calculation of inflows and therefore project benefits in the economics model (HEC-FDA).

During high-flow events, the proposed Project would divert a portion of the North Main Drain's flow into new and existing drainageways of the Raymondville Drain. The proposed project would not increase the total volume of water flowing into the Laguna Madre, nor change the entry point; rather, it would enhance the flow capacity, more efficiently diverting floodwater away from the developed portions of Hidalgo and Willacy counties towards the Laguna Madre during periods of heavy runoff. Due to the flat nature of the area and no change to channel grades, flow velocities in the Raymondville Drain are not expected to substantially change after the project is constructed. The Raymondville Drain and the North Main Drain currently discharge into the same back bay system south of Port Mansfield which feeds into the Laguna Madre. Ultimately, all of the runoff from the two watersheds would enter the Laguna Madre at the same location, possibly with slightly different arrival timing. Diversions to the RD would only occur at high flow periods when there would also be substantial runoff into the Laguna Madre from other much larger tributaries; therefore, project-related impacts to hydrology in the Laguna Madre would not be significant.

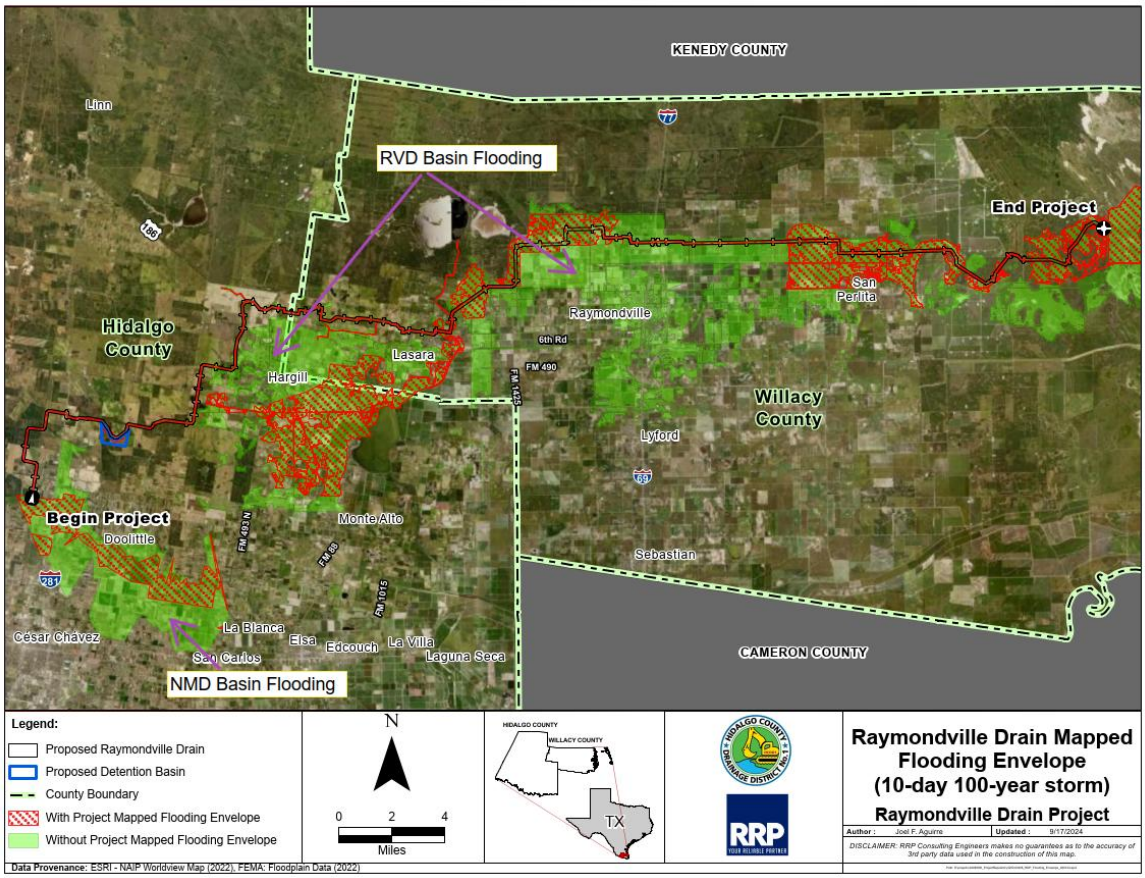

Figure 4-1 With Project one-percent ("100-year") Mapped Flooding Envelope

4.2.5 AIR QUALITY, NOISE, AND AESTHETICS

The Raymondville Drain Project is located in an area currently designated by the EPA as an attainment area for all National Ambient Air Quality Standards. Air quality may be temporarily impacted during construction activities, but no long-term effects to air quality in the area are anticipated. With the implementation of BMPs, air quality impacts as a result of construction are anticipated to be minimal, temporary, and localized.

An analysis of estimated Greenhouse Gas (GHG) emissions from the construction of the proposed project was made utilizing an analysis of the construction process, including an inventory of expected construction equipment, construction materials (concrete and asphalt), and estimated construction employee commutes. The expected GHG emissions from the project are estimated to be within the allowed limits set by the state.

The standard operation of the Raymondville Drain Project would not generate additional noise; therefore, any noise-related impacts would be temporary and would occur only during construction. Noise associated with construction activities is difficult to predict. Heavy machinery, the major source of noise in construction, would move in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. No potential noise receivers (homes, parks, etc.) in the study corridor are expected to be exposed to construction noise for a long duration; therefore, noise is not anticipated to cause any extended disruption of normal activities for either people or wildlife.

The generation of ground-borne vibrations from construction activities is similarly difficult to predict due to the heterogeneous nature of the soil within the Raymondville Drain Project study corridor (see Section 2.5.1). However, construction activities that generate the highest levels of ground-borne vibrations involve percussive pile driving, demolition, and other activities that require the strong compaction of soils or backfill (impulse noises). The proposed project would not require such percussive activities; therefore, significant impacts from ground-borne vibrations are not anticipated.

Project-related impacts to the aesthetic and scenic character of the project area are anticipated to be minimal. The proposed new and expanded drainage infrastructure would be constructed below ground level, and the proposed spoil berm would be vegetated with native grasses, thereby making the project visually consistent with the surroundings.

4.2.6 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

A field investigation for HTRW was conducted in April and September 2023. The field investigation was conducted to confirm and investigate sites identified in the Envirosite Corporation Government Records Report, dated March 21, 2023. The investigation revealed various natural gas pipelines that intersect the Raymondville Drain Project ROW. Additionally, crude petroleum and natural gas extraction facilities were identified near the Raymondville Drain Project ROW. These oil and gas facilities and pipelines would be avoided during construction activities to the extent practicable. Every effort would be made to prevent the release of hazardous and/or toxic materials (see Section 4.7.8). The use of radioactive materials is not proposed as part of the Raymondville Drain Project, and no radioactive waste is expected to be generated by construction activities.

Reported Site 5, North Alamo Water Supply Company Lasara Reverse Osmosis Wastewater Treatment Plant, (see Section 2.5.6) is located within the 600’ study corridor. Routine design measures will be used to reduce channel width in the immediate vicinity of the plant (e.g., flat bottomed section, elimination of the spoil berm, reducing vegetative buffer) to avoid significant impacts to the plant. Construction efforts in the area will be coordinated

with the site operators to prevent the release of untreated wastewater or other contaminants into the environment.

The normal operation of the Raymondville Drain Project would not produce any HTRW. The SPCC plan implemented during construction activities would guide construction crews to avoid, minimize, and/or mitigate the accidental release of petroleum products or other potential hazardous substances during the implementation of the Raymondville Drain Project. If maintenance activities are required for the completed channel following construction, those activities would be conducted in accordance with a similar SPCC plan. No impacts to the human or natural environment involving HTRW are anticipated.

4.2.7 RESILIENCE TO CHANGING CONDITIONS

As discussed in Section 2.5.5, the proposed project is not anticipated to be impacted by sea level change nor likely precipitation pattern changes. Despite the uncertainty in the impact of changing conditions, the additional drain flow capacity provided by the proposed project would provide additional regional resilience against future flooding events and extreme weather.

4.3 BUILT ENVIRONMENT

Federal and local projects in the area generally consist of roadways which traverse the existing Raymondville Drain and the proposed new areas of the proposed Project. Alternatives 1 or 2 would require replacing bridges which traverse the existing Raymondville Drain, and the conversion of roadways to bridges where new drains would be constructed. Implementation of Alternative 3 (non-structural) is not expected to further impact the built environment following implementation.

In the new diversion channel, an estimated 13 new bridge structures would be constructed to replace the sections of existing roadways which traverse the channel. All of these proposed new transportation crossings would be located in Hidalgo County. Each new bridge structure along the proposed diversion channel would be of equal width, and include the same number and configuration of travel lanes, as the roadway it would replace.

An estimated 56 additional transportation crossings would be constructed or replaced if Alternative 1 is implemented (see Appendix A-3, Attachment A – Exhibit 14, Alternative 1 Existing and Proposed Transportation Crossings). New transportation crossings that would be installed include seven culvert crossings, one control structure, thirty-eight concrete bridges, five road bridges, one railroad crossing, and four highway bridges at I-69E/US 77. An estimated 51 additional transportation crossings would be constructed or replaced if Alternative 2 is implemented (see Appendix A-3, Attachment A – Exhibit 14, Alternative 2 Existing and Proposed Transportation Crossings). New transportation crossings that would be installed in Alternative 2 include eleven culvert crossings, twenty-seven concrete bridges, six road bridges, one railroad crossing, and four highway bridges at I-69E/US 77. Under each Final Alternative, four existing culvert crossings in Willacy County would be replaced with bridge structures, and the channel under the four existing highway bridges at I-69C/US 281 would be excavated (the heights and lengths of the existing highway bridges at I-69C/US 281 are sufficient to accommodate the proposed diversion channel beneath).

Existing travel patterns temporarily disrupted by the construction of the proposed diversion channel would return to their existing condition following the completion of construction activities. Traffic patterns on I-69C/US 281 would not be interrupted during construction activities.

There are approximately 59 utility crossings along the alignment of either Alternative 1 or Alternative 2. These utility crossings include both above and below ground crossings, of which there are more subsurface crossings. Existing utilities have been documented in the Real Estate Appendix (A-4), and would be replaced in-kind, as appropriate. The real estate generally required for the implementation of the Recommended Plan is primarily undeveloped rangeland or agricultural farmland along the alignment of the proposed new channel in Hidalgo County and along the banks of the existing channel in Hidalgo and Willacy counties. Impacts to existing structures would be minimized, and no significant relocation of residences is expected.

One wind turbine is located within the Raymondville Drain Project study corridor (see Appendix A-3, Figure 7). No relocations of wind turbines are anticipated; however, if necessary, such relocations would be coordinated with the owners of the affected wind turbines. Unpaved roads used to access wind turbines for maintenance are also present in the study corridor and may be converted to drainage ROW as a result of the implementation of the proposed project. Overall, no significant adverse impacts to the built environment of the Raymondville Drain Project study area are anticipated.

The proposed project would have a significant beneficial impact on transportation corridors and access in Hidalgo and Willacy counties. Reduced flooding would support public safety by minimizing floodwater disruption to roadways that provide north-south travel routes, hurricane evacuation, and access to emergency services, and would prevent disruption to regional jail (Lopez State Jail-Segovia Unit in Edinburg) and juvenile detention facilities.

4.4 SOCIOECONOMIC ENVIRONMENT

A quantitative population assessment for the Raymondville Drain Project study area was conducted as part of the H&H efforts (see Section 2.7). The quantitative population assessment used the most recent data available from the U.S. Census Bureau. Minority, low-income, and Limited English Proficiency (LEP) populations are present throughout the study area.

Socioeconomic impacts of Alternatives 1 and 2 would include the loss of cropland that is converted to drainage ROW; however, the Raymondville Drain Project is anticipated to have predominantly beneficial effects to the social and economic environment in Hidalgo County and Willacy County, providing substantial comprehensive benefits. Beneficial effects would include reduced property damage from flooding, which would enable economic growth, increase property values, and reduce flood insurance premiums for residents, including the minority, low-income, at-risk and LEP populations. Implementation of Alternative 3 (non-structural) is anticipated to have negative community impacts due to the elimination of low-income housing, and community disruption.

Impacts to agricultural land would not be significant. Based on data obtained from the U.S. Department of Agriculture's 2022 Census of Agriculture, the estimated acreage of agricultural land (row crops and pasture) that would be impacted by the proposed represents less than one percent of all agricultural land in Hidalgo and Willacy counties. Additionally, the conversion of agricultural land would be accompanied by a reduction in flood risk; therefore, the proposed project is not anticipated to represent a significant adverse impact to the human environment.

4.5 CUMULATIVE IMPACTS

For the purposes of this integrated FR and EA, cumulative effects are defined as effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions.

Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. To assess the cumulative impacts related to Alternatives 1 or 2 of the proposed Raymondville Drain Project, various parameters were analyzed for past, present, and reasonably foreseeable future projects which may affect the future condition of the study area. Parameters included the ecological, physical, chemical, socioeconomic, and cultural attributes of these projects. Implementation of Alternative 3 (non-structural) is not expected to result in negative cumulative impacts to the natural environment in combination with other past, present, and reasonably foreseeable future projects.

4.5.1 PAST AND PRESENT ACTIONS

Past and present actions in the study corridor which may add to the effects of the Raymondville Drain Project Alternatives 1 and 2 were identified through a review of historical topographic maps and aerial photography, as well as other records as needed. Actions that were initiated in the past may have ongoing environmental consequences in the present; therefore, past and present actions were analyzed together.

Wind Farms. The US Energy Information Administration describes three main adverse environmental effects of wind farms: noise, bird and bat strikes, and service roads. The normal operation of the Raymondville Drain Project would not produce additional noise in combination with wind farm projects. Maintenance activities would be periodically conducted on the Raymondville Drain Project channels and detention pond. As with the noise levels associated with construction activities, the noise levels associated with maintenance activities are difficult to predict and would vary with the nature and extent of the maintenance to be conducted, as well as the equipment to be used. Noise produced by maintenance activities would be temporary and cease when the activities are complete. Cumulative impacts from wind turbine-related noise are not anticipated.

Birds and bats that are struck by the turning blades of a turbine can be injured or killed, thereby contributing to the decline of bird and bat species in the region. The proposed diversion channel and expanded Raymondville Drain may attract additional waterfowl, and the longer bridge structures that would traverse the proposed project are anticipated to provide suitable habitat for bats, including the Tricolored Bat. However, available research indicates that both birds and bats generally avoid wind farms when practicable (Hötker 2006, Roekele 2016); therefore, it is anticipated that most birds and bats attracted to the Raymondville Drain Project channel would use the portions of the channel that are far from wind turbines. The proposed new diversion channel portion of the project would be located at least 17 miles west-southwest of the existing wind farms, thereby creating potential habitat for waterfowl that would not present the risk of collision with wind turbine blades. Cumulative impacts to bird and bat populations are not anticipated.

Individual wind turbines must be serviced periodically, which requires the construction and maintenance of service roads that vehicles can use to access each turbine. The primary environmental concern with service roads is the fragmentation of wildlife habitat. However, service roads associated with the wind turbines in Willacy County are unpaved and are primarily sited adjacent to, and between, fields of row crops which are not anticipated to provide significant habitat for wildlife. As wind farm development is still expanding in Willacy County, the Raymondville Drain Project is not anticipated to induce the development of additional wind farm projects. Additionally, as wind farms in Willacy County are sited in cropland with little to no value as wildlife habitat, the expansion of the existing Raymondville Drain would not contribute to the habitat fragmentation caused by service roads and thus would not contribute to the environmental impacts thereof. Overall, the Raymondville Drain Project is not anticipated to contribute to the cumulative environmental impacts of wind farms in the study area.

Residential, Commercial, and Industrial Development. A review of historical aerial photography indicates that the majority of development in Hidalgo and Willacy counties since 1982 has occurred near existing towns and metropolitan areas south of the Raymondville Drain Project study corridor, with most development located in northern Edinburg. Development may result in the removal and fragmentation of wildlife habitat, an increase in impermeable ground cover, and the removal of prime farmland and soils of statewide importance. Ecological research suggests that the fragmenting effect of waterways is most pronounced on non-avian arboreal species which have a high site fidelity to tree canopies (Yokochi et al 2016). For other species of wildlife, drainage ditches act as important travel and dispersal corridors that maintain connections between habitat patches in areas dominated by agricultural land use (Herzon and Helenius 2008, Favre-Bac et al 2016). The Raymondville Drain Project is therefore not anticipated to result in cumulative habitat fragmentation effects in combination with past development actions.

The Raymondville Drain Project is not anticipated to result in cumulative impacts associated with an increase in impermeable ground cover, as the main environmental consequence of this effect is an increased risk of flooding. By collecting overland sheet flow and increasing drain capacity, the Raymondville Drain Project would reduce the risk of flooding in the study area.

Farmland and pastureland would be directly converted to drainage ROW, and is anticipated to be indirectly converted to new residences and businesses constructed in response to the decreased risk of flooding. However, as noted previously, past and present patterns of development are associated with areas adjacent to existing developments. Cumulative impacts to farmland, pastureland, and soils are therefore anticipated to be negligible.

Raymondville Drain RESTORE Act Project. In 2022, HCDD1 initiated a maintenance project for the existing Raymondville Drain, Delta Lake Drain, and La Sal Vieja Drain. This maintenance was executed under the "Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012," known as the RESTORE Act. The Raymondville Drain RESTORE Act Project restored the existing drainage channels to the original as-built condition. The Raymondville Drain RESTORE Act Project specifically included: 1) removal of refuse and debris such as tires, mattresses, old appliances, and household trash; 2) removal of sediment that had accumulated in the Raymondville Drain or against the debris disposed into the Raymondville Drain; and 3) clearing and grubbing of vegetation within the ROW of each drain. The environmental consequences of the Raymondville Drain RESTORE Act Project were evaluated in multiple review documents, including a Biological Assessment. The environmental impacts of the Raymondville Drain RESTORE Act Project occur within the proposed Raymondville Drain Project ROW; therefore, the implementation of the Raymondville Drain Project would result in the same environmental impacts regardless of any impacts resulting from the Raymondville Drain RESTORE Act Project. Cumulative impacts in combination with the Raymondville Drain RESTORE Act Project are not anticipated.

Roadway Construction and Maintenance. Environmental impacts resulting from the construction and expansion of roadways are similar to those resulting from residential and commercial development, i.e., the removal and fragmentation of potential wildlife habitat. Based on a comparison of historical aerial photography with current road maps, as well as a review of TxDOT highway designation files, all major roadways (i.e., state highways and farm-to-market roads) which currently traverse the Alternative 1 and Alternative 2 ROWs have been in place since 1982. The Raymondville Drain Project is not anticipated to induce the construction or expansion of roadways in Hidalgo County or Willacy County. Any roadway development induced by the Raymondville Drain Project is anticipated to occur adjacent to existing communities. As all existing communities in the region are located south of the Raymondville Drain Project ROW, no new traffic patterns would emerge that would traverse the study

corridor; north-south traffic is not anticipated to increase to a level that would require the expansion of existing roadways in the study corridor.

Port Mansfield Channel Dredging Project. In 2022, the USACE completed a project to dredge the Port Mansfield Channel, located approximately 8 to 14 miles northeast of the eastern project terminus. This dredging project increased the depth of the Port Mansfield Channel from 3 feet to 17 feet, which is sufficiently deep to be navigated by barges and tugboats. The Willacy County Navigation District anticipates that the completion of this dredging project would allow Port Mansfield to accommodate $250-300 million in trade by 2027. The Port Mansfield Channel dredging project is anticipated to induce additional vessel traffic in Willacy County, which may have adverse effects on water quality, aquatic fauna, and EFH in the Laguna Madre. As the Raymondville Drain Project would not result in any impacts to these resources, the Raymondville Drain Project and the Port Mansfield Channel dredging project would not combine to produce cumulative impacts on the environment in the Laguna Madre.

Lower Rio Grande Valley Flood Control Project. The LRGV Flood Control Project consists of the improvement and rehabilitation of levee systems in the LRGV, which are located south of the Raymondville Drain Project study area. No new drainageways would be constructed as part of the levee improvement and rehabilitation project. The geographic extent of environmental impacts of this project are limited to the existing easements in which construction activities would take place. The reduced flood risk to residents and businesses in the LRGV associated with the LRGV Flood Control Project, when complete, may induce additional development. However, the intensity of the development to be induced cannot be accurately predicted from available information. Patterns of development in the LRGV have been concentrated near previous developments in or adjacent to incorporated cities. Rural portions of southeast Willacy County have little existing development; therefore, induced development in this area is anticipated to be limited and the Raymondville Drain Project is not anticipated to produce cumulative environmental impacts in combination with the LRGV Flood Control Project.

Faysville Drain. The Faysville Drain project is currently approximately 0.9 miles in length, beginning at a point approximately 280 feet west of US 281 and flowing generally westward. Construction activities for the Faysville Drain were completed in the first half of 2023; the Faysville Drain would be extended to outfall into the proposed Raymondville Drain Project diversion drain at a point approximately 0.9 mile west of US 281. Due to the similarity of their respective natures, the Raymondville Drain Project and the Faysville Drain project are anticipated to result in similar direct and indirect environmental impacts. Potential cumulative effects for the Faysville Drain project, in combination with the Raymondville Drain Project, would be limited to the area of northern Edinburg near US 281 and are not anticipated to be significant. Implementation of Alternative 3 would conflict with the proposed extension of the Faysville Drain, as Alternative 3 would not provide a new outfall channel for the existing Faysville Drain reach.

4.5.2 REASONABLY FORESEEABLE FUTURE ACTIONS

For this cumulative impacts analysis, future actions were considered to be reasonably foreseeable if they were confirmed to be funded and were announced in publicly available media. Information was obtained from local news sources, commercial and residential real estate brokers, TxDOT Pharr District, and local government entities such as the Hidalgo County Planning Department.

Future Residential and Commercial Development. The combined total population of Hidalgo and Willacy counties is expected to grow through 2054 (see Appendix A-3, Figure 8). The increase in population is anticipated to be accompanied by additional residential and commercial developments. Multiple new residential communities are platted for development in Hidalgo County and Willacy County. Most new residential development is generally

located within or near the metropolitan areas of Edinburg, Weslaco, and Harlingen in Cameron County. The Raymondville Drain Project may encourage additional residential and commercial development in Hidalgo and Willacy counties by making areas less susceptible to flooding, and therefore more desirable to prospective residents. Based on past trends, any induced development is anticipated to occur in close proximity to existing communities, mainly Edinburg and Raymondville.

Roadway Projects. Future maintenance actions on roadways which would traverse the Raymondville Drain Project were identified by reviewing the TxDOT Project Tracker (https://www.txdot.gov/projects/project-tracker.html). The majority of planned roadway projects in Hidalgo County and Willacy County consist of roadway rehabilitation, safety improvements, or surface maintenance projects.

One new freeway location, SH 68, is proposed for construction north and east of Edinburg and south of the Raymondville Drain Project ROW. SH 68 would include four travel lanes (two in each direction) with the possibility of adding future mainlanes and overpasses. The project limits for SH 68 extend from I-2 near Donna (southeast of Edinburg) to I-69C/US 281. SH 68 would intersect I-69C/US 281 at a point approximately 2.8 miles north of the point at which the Raymondville Drain Project would flow underneath I-69C/US 281. TxDOT released a draft EIS for the SH 68 project in March 2018; a public meeting for the SH 68 project was most recently held on February 22, 2023. SH 68 represents a segment of the proposed Hidalgo County Loop, a planned 102-mile roadway project sponsored primarily by the Hidalgo County Regional Mobility Authority. The Hidalgo County Loop would be a tolled facility which would be constructed in phases over an estimated 25-30 years. The proposed ultimate facility would be completed in segments. In September 2019, TxDOT awarded the Rio Grande Valley Metropolitan Planning Organization $274 million in funding for the Hidalgo County Loop; as of January 2026, SH 68 is the only segment of the Hidalgo County Loop included on the TxDOT Project Tracker whose limits overlap with those of the Raymondville Drain Project. SH 68 would be constructed through or adjacent to areas that are already developed; therefore, this project is not anticipated to combine with the Raymondville Drain Project to produce cumulative impacts to wildlife habitat.

South Texas International Airport Improvements. In an email on April 11, 2024, the management of the South Texas International Airport informed HCDD1 of their intention to construct drainage improvements. The drainage improvements would include a lift station to convey water from an existing detention pond located at the airport, a concrete-lined drainage ditch, a new detention pond located north of and adjacent to the proposed diversion drain, and an outfall structure that would allow water to flow into the proposed diversion drain. The proposed drainage improvements are not anticipated to affect the feasibility of Alternative 1 or 2 of the Raymondville Drain Project if constructed. Cumulative impacts to vegetation and wildlife habitat are anticipated to occur in combination with the drainage improvements to the South Texas International Airport, as the proposed drainage improvements would be constructed on undeveloped land and the concrete-lined drainage ditch would present a more formidable barrier to wildlife crossing than vegetated ditch. However, cumulative impacts would be limited to the immediate area in which the proposed drainage improvements would be constructed. Implementation of Alternative 3 may adversely affect the feasibility of the proposed improvements as it would not provide an improved outfall location; therefore, no cumulative impacts are anticipated in combination with Alternative 3.

2023 Drainage Bond Program Projects. In March 2023, HCDD1 and the Hidalgo County Commissioners Court put forth a proposal for a $195 million bond issuance to fund 26 proposed drainage infrastructure projects, including the Raymondville Drain Project. The 2023 drainage bond program was approved by Hidalgo County constituents during the election on May 6, 2023. Projects that would be located adjacent to the Raymondville Drain Project

include improvements to the North Main Drain and the construction of a 67.8-acre regional stormwater detention facility east of and adjacent to Lake Edinburg, approximately 360 feet west of the western project terminus (see Appendix A-3, Figure 9). The proposed regional stormwater detention facility would be constructed on undeveloped land that is densely vegetated by trees and shrubs. Cumulative impacts to vegetation and wildlife habitat are anticipated to occur in combination with this project, limited to the area of northern Edinburg. The remaining 2023 drainage bond program projects generally consist of the maintenance or expansion of existing drainage infrastructure in developed areas; therefore, cumulative impacts are not anticipated in combination with the remaining 2023 drainage bond program projects. Alternative 3 is not anticipated to result in cumulative impacts in combination with any 2023 Drainage Bond Program Projects.

Limited, localized cumulative impacts on air quality may additionally occur if the timing and location of construction activities associated with other projects coincides with the construction of the Raymondville Drain Project; however, such impacts would be temporary and would cease following the completion of construction. The overall magnitude of cumulative impacts to the human and natural environment is anticipated to be minor.

4.6 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments of resources are those resulting from impacts to resources which cannot be completely restored to their original condition. The labor, capital, and material resources expended in the planning and construction of the Raymondville Drain Project represent irreversible and irretrievable commitments of human, economic, and natural resources.

Energy resources used by construction equipment (fuel, electrical capacity, etc.) for Alternatives 1 or 2, or demolition equipment for Alternative 3, would be irretrievably committed during construction and maintenance activities. The energy resources committed cannot be accurately quantified at this time as the type and amount of energy used for construction purposes would vary according to the equipment used, the duration of their use, and the conditions (e.g., weather) in which equipment is used.

The construction of Alternatives 1 or 2 within the Raymondville Drain Project ROW would permanently remove thornscrub vegetation which may provide habitat for a managed population of ocelots. Conservation measures would be implemented during construction to mitigate the impacts associated with this removal (see Section 4.1.3).

Permanent structures in the Raymondville Drain Project ROW that could not be avoided by shifting the project alignment of Alternative 1 or 2 could potentially be displaced. Detailed maps are provided in Appendix A-3, Attachment A, Exhibit 7 – Structures Within Study Corridor. Mobile homes which cannot be avoided would also be displaced but, due to their mobility, could remain available for residents' continued use in new locations.

4.7 MITIGATION, MONITORING, AND ADAPTIVE MANAGEMENT

As the locations and quantity of impacts have not yet been conclusively identified, the extent to which mitigation may be required has not been fully identified or coordinated with the appropriate resource agency. Certain resources within the Raymondville Drain Project study area are reasonably likely to be affected by Alternatives 1 or 2, based on the nature of the proposed construction activities. Mitigation requirements, as well as options to fulfill such requirements, have been identified and developed to the extent feasible at the current point in the progress of the proposed project. Estimated costs for anticipated mitigation requirements are included in the project cost estimate and Cost and Schedule Risk Analysis (CSRA). Implementation of Alternative 3 (non-structural) is not expected to require mitigation, monitoring, or adaptive management.

4.7.1 WATERS OF THE U.S

Wet ditches within the project ROW would be converted to a drainage channel. This is not anticipated to result in adverse impacts to the physical, biological, or chemical integrity of the water system in the study area; therefore, no mitigation is anticipated to be necessary for project-related impacts to wet ditches.

Project-related impacts to potentially jurisdictional wetland areas typically require dedicated mitigation. An appropriate mitigation plan, if necessary, would be developed in accordance with Section 404 of the Clean Water Act. Off-site mitigation options for wetland impacts, if available, would be assessed. Preference would be given to wetland mitigation banks whose primary service area encompasses the Raymondville Drain Project study corridor. If mitigation banks are not available, other options for off-site mitigation would be assessed. Cost estimates for the Raymondville Drain Project were developed with the assumption that mitigation would be necessary for impacts to up-to 60 acres of jurisdictional wetlands. As no more than 25 acres of impacts to jurisdictional wetlands are anticipated (see Section 4.1.1) and included in the project estimate, this could be effectively mitigated without affecting the feasibility of the Raymondville Drain Project.

4.7.2 VEGETATION AND WILDLIFE HABITAT

To minimize impacts on vegetation and wildlife habitat, the contractor would revegetate temporarily disturbed areas with seed suitable for the site conditions and land use. During construction, efforts would be taken to avoid and minimize disturbance of vegetation and soils. Vegetation would only be cleared when and where necessary to complete construction activities. All areas disturbed during construction would be re-vegetated as soon as practicable to prevent the establishment of invasive plant species in the Raymondville Drain Project ROW. Native seed would be used for re-vegetation when available.

4.7.3 THREATENED AND ENDANGERED SPECIES

Impacts to threatened and endangered species would be mitigated during the construction phase of the proposed project through the implementation of BMPs and conservation measures (see Section 4.1.3) that have been identified through coordination with the USFWS and TPWD. BMPs may be general in purpose or specific to species. The Biological Assessment (see Appendix A-3, Attachment D – Endangered Species Act Compliance) includes a detailed description of the BMPs and other conservation measures to be implemented for the purpose of avoiding, minimizing, and mitigating impacts to threatened and endangered species. A biological monitor would be present on-site during construction and would be granted the authority to temporarily suspend construction if conservation measures or BMPs are not being implemented correctly.

4.7.4 MIGRATORY BIRDS

Areas to be cleared of vegetation would be surveyed in advance for the presence of migratory bird nests (see Section 4.1.6). If active nests are identified, a vegetation buffer would be established and clearly marked around each active nest in which no construction or clearing activities would occur until the eggs therein have hatched and the young have fledged (i.e., until the nest is no longer active). Whenever practicable, the contractor would avoid clearing vegetation during the nesting period (March 15 to September 15). If migratory birds are encountered during construction activities, every effort would be made to avoid the take of protected birds, their nests, parts, eggs, and/or young.

4.7.5 CULTURAL RESOURCES

If unanticipated archeological deposits are encountered during construction, work in the immediate area would cease and archeological authorities would be contacted to initiate the appropriate discovery procedures. All construction personnel would leave the area, while vehicles and equipment would be left in place until a qualified archaeologist identifies a safe path out of the area. The on-site supervisor would flag or otherwise mark the location of the find and keep all foot and vehicle traffic away from the encountered resource. The on-site supervisor would additionally notify USACE within 24 hours of the find.

Upon cessation of work and notification of responsible parties, USACE would determine whether the resource can be avoided. If avoidance is feasible and impacts on the cultural resource have not occurred, the project can proceed in accordance with recommendations from USACE in coordination with HCDD1. If the resource cannot be avoided or has already been affected by construction, treatment of the find would comply with the discovery procedures of Section 106 of the National Historic Preservation Act (NHPA) of 1966, 36 CFR 800.13. These procedures consist of a determination of significance; consultation among USACE, HCDD1, other consulting parties, and the SHPO; and, if the resource is determined to be significant, suitable implementation of mitigation, in consultation with the SHPO. Additionally, if human remains are discovered the local police would be notified in accordance with state law.

4.7.6 WATER QUALITY

A Stormwater Pollution Prevention Plan (SWPPP) would be developed by a qualified engineer or erosion control specialist and implemented prior to construction. The objectives of the SWPPP would be to (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity, and (2) identify, construct, and implement prevention measures to reduce pollutants in stormwater discharges during and after construction. The complete SWPPP would be provided to the construction crews before any groundbreaking or surface-disturbing activities begin. The SWPPP would be maintained on site throughout construction activities. The SWPPP would include the following items:

- Description of potential pollutants of storm water from erosion.
- Description of the management of dredged sediments and hazardous materials present on site during construction (including vehicle and equipment fuels).
- Details of how the sediment and erosion control practices would comply with state and federal water quality regulations.

The SWPPP would be developed in accordance with current USACE guidance and would comply with applicable state and federal regulations. As wastewater is not anticipated to be generated by the proposed project or construction activities, the SWPPP is not proposed as part of the Raymondville Drain Project's compliance with Section 402 of the Clean Water Act. An NPDES (National Pollution Discharge Elimination System) permit is required under Section 402; however, it is anticipated that the activity would fall under a general construction permit from the Texas Commission of Environmental Quality.

4.7.7 AIR QUALITY AND NOISE

Additional BMPs would be implemented during construction activities to minimize the effects of fugitive dust emissions and noise generated by construction equipment. Air pollution would be minimized by implementing construction-related air quality measures, including watering areas of bare ground to prevent and/or minimize fugitive dust emissions.

Noise impacts resulting from construction/demolition would be minimal, as the Raymondville Drain Project would be constructed in a sparsely populated area in which there are few residents to be adversely affected by construction noise. Contractors would minimize construction noise through abatement measures such as work-hour controls (e.g., scheduling construction activities, to the extent practicable, for times when most residents of the Raymondville Drain Project study corridor are not in their homes) and the proper maintenance of muffler systems.

4.7.8 HAZARDOUS MATERIALS

Contractors would develop and implement the SPCC plan to prevent and/or minimize spills of hazardous, toxic, or petroleum substances during construction. As with the SWPPP, the completed SPCC plan would be provided to construction crews prior to the initiation of construction activities and would be maintained on site throughout construction activities. The SPCC plan would consider the equipment to be used in construction activities as well as potential hazardous materials sites that were identified during the associated field investigation conducted in April and September 2023. Unanticipated hazardous materials, petroleum products, or sources of contamination encountered during construction, or spills of such materials, would be handled according to the SPCC plan and applicable laws, regulations, and ordinances.

SECTION 5.0 PLAN COMPARISON AND SELECTION

5.1 PLAN COMPARISON

The two structural Alternatives in the final array (Alternatives 1 and 2) were compared to the non-structural Alternative (Alternative 3) and the No Action Alternative (Future Without Project - FWOP) with respect to the Planning Objectives and the four accounts: the National Economic Development (NED) Account, the Environmental Quality (EQ) Account, the Regional Economic Development (RED) Account, and the Other Social Effects (OSE) Account. Risk and uncertainty were also considered. Each Alternative was analyzed in the same manner as the No Action Alternative condition.

5.1.1 PLANNING OBJECTIVES

Alternatives 1 and 2 both fully meet the Planning Objectives of reducing flood risks and damages to residential, commercial, industrial, and agricultural properties in the study area; and minimizing floodwater disruption to roadways that provide local, regional, national, and international access to goods and services, enabling local and regional emergency response and lifeline services, and providing regional emergency evacuation routes. Alternative 3 is not a comprehensive solution, only partially meeting the planning objectives by reducing flood risks and damages to a limited number and types of properties, but not reducing floodwater disruption to roadways.

5.1.2 ECONOMIC ANALYSIS OF ALTERNATIVES

The evaluation of the final array of Alternative plans was conducted via a comparison of FWOP versus the future with each of the proposed Alternatives. The comparison was conducted on the basis of the four accounts, to facilitate the evaluation and display the effects of the Alternative Plans. These accounts include two required accounts, NED and EQ, and two discretionary accounts, RED and OSE. Each account is related to the following components with regards to the overall impact of the project:

- The NED Account, which displays the changes in the economic value of the national output of goods and services.
- The EQ Account, which displays the non-monetary effects on ecological, cultural, and aesthetic resources, including the positive and adverse effects of ecosystem restoration plans.
- The RED Account, which displays the changes in the distribution of regional economic activity (e.g., income and employment).
- The OSE Account displays effects on social aspects such as community impacts, health and safety, displacement, energy conservation and other components.

For this analysis, the PDT focused primarily on the NED Account. The EQ, RED, and OSE Accounts for the Alternatives are compared to the No Action Alternative during the final analysis prior to the selection of the Recommended Plan and are discussed below; however, the benefits of the two final structural Alternatives are similar in these three accounts and were not a factor in plan selection.

In analyzing the NED Account, the PDT utilized the USACE program HEC-HMS for all hydrologic analysis to determine the peak flow rates for the individual frequency events detailed in this study. The USACE program HEC-RAS was used for hydraulic modeling to determine water surface elevations for the North Main Drain System and Raymondville Drain watersheds for each flood frequency event. The hydrologic and hydraulic models were used to determine the base conditions and post-project conditions for the two Alternative Plans in the Final Array to determine the effectiveness of each Alternative plan. The full Hydraulic Analysis for the Alternative Plans is documented in Appendix A-1 (Engineering), and the development of the estimated project costs, including first construction cost and annual OMRR&R costs are described in Appendix A-2 (Cost Engineering).

A flood assessment of pre-project (without improvements) conditions was compared against the evaluation of post-project Alternative Plans (with improvements) conditions for the Raymondville Drain and North Main Drain Systems in Hidalgo and Willacy counties. This study was prepared by HCDD1 with guidance from USACE. A part of this evaluation was a determination of the effectiveness of the proposed Alternative Plans in reducing flood damages to properties and structures (inundation reduction benefit - B_{IR}). This was accomplished by preparing a flood damage assessment using the HEC-FDA model of the pre-project and the proposed Alternative Plans to determine the reduction in flood damage due to the proposed improvements. The structural inundation reduction benefit computed by HEC-FDA was increased by 39% to account for non-structural damages including emergency costs, transportation costs, utility costs, and non-physical damages. Agricultural benefits were increased by a smaller non-structural factor of 15%, due to a difference in impacts. Documentation on the development of these additional benefits is included in Appendix A-5, Attachment B, Section 5. This analysis is based upon the hydrologic and hydraulic assessment information provided in Appendix A-1 for flood damage, risk based with uncertainty. The analysis details the delineation of study area for with- and without-project conditions, the configuration of the study areas, the hydrologic and hydraulic data utilized, and the economic analysis prepared to determine the monetary damages within the planning area and the NED Benefits and costs associated with each of the proposed Alternative Plans.

The Raymondville Drain itself is not identified as a FEMA floodplain, therefore EO 11988 considerations do not apply to existing structures, nor do benefit computation limits. While many USACE projects do not consider Location Benefits (B_L) nor Intensification Benefits (B_I), the Raymondville Drain Project is different than most USACE studies. The 57-mile-long project would provide significant flood relief along a substantial reach, reducing potential flood damage risk to adjacent land, therefore increasing total value and potential uses of the land. Rapid growth in the region continues to force development farther into rural areas. While this project will not encourage development in a floodplain, it will improve access and mobility, enabling the conversion of lands adjacent to previously flood vulnerable lands into more valuable potentially developable lands. This theoretically provides Location and Intensification Benefits from the Raymondville Drain Project. Due to the uncertainty of these future benefits, Location and Intensification Benefits were not quantified in the NED Benefit computations used in this report; however, they should be qualitatively considered for the positive impact this project would have for the growth of the region and economy.

Based on the HEC-FDA analysis, Table 5-1 shows the combined NED Annual Benefit, and is detailed in Appendix A-5, Economics. The NED Benefit (NB) is a measure used to determine each individual Alternative Plan's net benefit in terms of flood damage reduction. The NED Benefit is a combination of the four variables as shown below.

$NB = (B_L + B_I + B_{IR}) - C$

B_L Location benefit: The value of making existing floodplain land available for new economic uses.*

B_I Intensification benefit: The value of intensifying the future use of the land such as increasing the land value.*

B_{IR} Inundation-reduction benefit: the value of reducing or modifying the flood losses to economic activity using the floodplain land in absence of any further action or plan.

C Total Cost of Operation, Maintenance, Repair, Replacement, & Rehabilitation (OMRR&R).

NB NED Benefit.

(* Not quantified in this analysis, as described above.)

	Equivalent Annual Structural Damage	Structural & NS Damage Reduced*	Agricultural Damage Reduced	B_{IR}	OMRR&R (C)	NED Benefit (NB)
FWOP	$65,653,000	0	0	0	N/A	0
Alternative 1	$41,845,000	$33,093,000	$5,300,000	$38,393,000	$1,761,000	$36,632,000
Alternative 2	$39,910,000	$35,782,000	$5,300,000	$41,082,000	$1,940,000	$39,142,000
Alternative 3 (Non-structural - 25-yr buyout)	$15,516,000	$69,690,000	0	69,690,000	0	$69,690,000

**Computation includes non-structural benefits derived from the alternative*

Table 5-1 NED Annual Benefits

5.1.3 COMPARISON OF THE NED ACCOUNT

The costs, benefits, and BCR of each plan, as described in Section 5.1.2, are included in Table 5-2. This comparison of damage reduction, net benefits, and the BCR between the two hydraulically viable plans and the future without project were used to analyze the plans. Alternative 1 has the highest net benefits, while Alternative 2 has the highest total benefits. The economic benefits not included in the BCR computation (B_I, B_L) would be similar for the two structural Alternatives and do not impact plan selection. Alternative 3 (nonstructural) has negative net benefits and a BCR below unity.

	Alternative 1	Alternative 2	Alternative 3 (Non-structural)
First Cost of Construction	$ 755,256,000	$ 828,768,000	$2,033,830,000
Interest During Construction	$ 99,247,000	$ 108,907,000	$267,263,000
Total Investment	**$854,503,000**	**$ 937,675,000**	$2,301,097,000
Average Annual Construction Cost	$ 30,128,000	$ 33,061,000	$71,709,000
Avg Annual Incremental O&M	$ 1,761,000	$ 1,940,000	0
Total Average Annual Cost	**$ 31,889,000**	**$ 35,001,000**	**$71,709,000**
Total Average Annual Benefits ($B_{IR}+B_L+B_I$)	**$ 38,393,000**	**$ 41,082,000**	**$69,690,000**
Net Benefits	**$ 6,504,000**	**$ 6,081,000**	**-$2,019,000**
BCR	**1.38**	**1.34**	**0.97**

Table 5-2 Costs, Net Benefits, and BCR

5.1.4 COMPARISON OF THE EQ ACCOUNT

The EQ Account displays the non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The structural plans provide indirect environmental benefits in upstream areas by minimizing damage to communities and habitats from flooding. Based on advice from environmental resource agencies, the proposed project alignment has been modified to mitigate impacts on fish and wildlife, including ending the project improvements two miles upstream of SH 286 to minimize wetland impacts and provide an additional environmental buffer before waters enter the Laguna Madre.

Resources Potentially Affected by the Final Alternatives				
Resource	Alternative 1		Alternative 2	
	Qualitative	Quantitative	Qualitative	Quantitative
Physiography	Flat to gently rolling terrain	5-95 ft above mean sea level (AMSL)	Mostly flat to gently rolling terrain, small rise observed on topographic map between Brushline Road and FM 493	5-95 feet AMSL
Adjacent Sensitive Land Uses	Lower Rio Grande Valley National Wildlife Refuge, El Sauz Ranch	2 sites	Lower Rio Grande Valley National Wildlife Refuge, El Sauz Ranch, Delta Lake Park, private cemetery	4 sites
One-percent annual chance ("100-Year") Floodplain*	Low-lying areas near the western and eastern project termini, and in San Perlita	493.6	Low-lying areas near the western and eastern project termini and Delta Lake, and in San Perlita	445.2 acres
0.2-percent annual chance ("500-Year") Floodplain*	Near eastern project terminus	96.2 acres	Near eastern project terminus	96.2 acres
Adjacent Coastal Resources	None	0 coastal areas	None	0 coastal areas
Adjacent Air Pollutant Sources	Kenaf 2 Treating Plant northwest of ROW, north of Lasara	1 site	Kenaf 2 Treating Plant northwest of ROW, north of Lasara	1 site
Prime or Unique Farmland	Located throughout study corridor, not concentrated in any one area	3,525 acres	Located throughout study corridor, not concentrated in any one area	5,8567 acres
Water Resources	Lake Edinburg, existing	2 waterbodies	Lake Edinburg, existing Delta Lake Drain and Raymondville Drain, Delta Lake, existing drainage/irrigation ditch	5 waterbodies
Potential Wetland Areas (National Wetlands Inventory)	Most designated areas located north of Hargill & near eastern project terminus	112 acres	Most designated areas are located near eastern project terminus	111 acres
Potential Ocelot Habitat	Near eastern project terminus only	294 acres	Near eastern project terminus only	294 acres
Potential Tricolored Bat Habitat	Bridges, few areas of mature trees	54 bridges	Bridges, few areas of mature trees	41 bridges
Potential Northern Aplomado Falcon Habitat	Few areas of pasture and grassland which contain scattered trees	25.6 acres	Few areas of pasture and grassland which contain scattered trees	25.6 acres
Adjacent Cultural Resource Sites	None	0 sites	None	0 sites
Socio-economic Conditions	Eight out of 10 Census Block Groups with above-average poverty rates	10 geographies	Eight out of 10 Census Block Groups with above-average poverty rates	10 geographies
Adj. Community Facilities (e.g., schools, hospitals)	None	0 facilities	None	0 facilities

Resources Potentially Affected by the Final Alternatives				
Resource	Alternative 1		Alternative 2	
	Qualitative	Quantitative	Qualitative	Quantitative
Transportation Infrastructure	Approx. 46 minor & private roads, seven highways, one railroad	54 facilities	Approx. 32 minor & private roads, eight highways, one railroad	41 facilities
Adjacent Sensitive Aesthetics/Noise Receivers	Two residential neighborhoods (northern Edinburg, Lasara)	2 receivers	Two residential neighborhoods (northern Edinburg, Lasara), one private cemetery east of Lasara	3 receivers
Adjacent Recreation Facilities	Lower Rio Grande Valley National Wildlife Refuge	2 facilities	Lower Rio Grande Valley National Wildlife Refuge, Delta Lake Park	3 facilities
Adjacent Oil/Gas Infrastructure	Seven oil pipelines, 17 natural gas pipeline crossings, 65 total oil/gas wells, 22 dry holes, 27 inactive, and 16 active oil/gas wells located within 0.1 mile	24 pipelines 16 active wells	Seven oil pipelines, 11 natural gas pipeline crossings, 66 total oil/gas wells, 23 dry holes, 28 inactive, and 15 active oil/gas wells located within 0.1 mile	18 pipelines 15 active wells
*A data gap was identified for the 100-year and 500-year floodplain; most of the RD has not been designated as FEMA floodplain (see Section 2.5.3).				

Table 5-3 Resources Potentially Affected by Final Alternatives

Table 5-3 summarizes resources potentially impacted by the two final structural alternatives, described in detail in Section 4. Alternative 3 (non-structural) is considered to have minimal impacts on resources, and is therefore not included in the comparison table. This comparison concludes that Alternative 1 is expected to have less resource impacts among the structural alternatives, except with regards to transportation infrastructure and oil/gas facilities. Impacts to transportation would be temporary, and appropriate coordination would be accomplished with local highway authorities and the Union Pacific Railroad to schedule construction to minimize impacts. The majority of impacted roadways are classified as minor and private roads that are not heavily used. Other alternatives for all roadways exist for use during construction detours. Impacts to oil/gas infrastructure can be avoided during construction by implementing BMPs that would prevent damage to wells or pipelines.

While Alternative 3 has less environmental impacts by avoiding additional new construction, it is not defined as practicable because the cost per structure benefitted (Table 3-6) is considered to be unreasonably expensive, compared to the structural alternatives. Alternative 1 is therefore identified as the Least Environmentally Damaging Practical Alternative (LEDPA).

5.1.5 COMPARISON OF THE RED ACCOUNT

By implementing a large regional project, the structural plans bring well paid short-term jobs to the area, increase demand for restaurants, entertainment, and housing for temporary workers, and increase sales of equipment and materials during construction. In the intermediate- and long-term, the project also enables increased regional economic growth over time as populations grow due to decreased flooding concerns in urbanized and rural areas. As an engine of short- and long-term economic development in this low-income at-risk region, the recommended plan would enable significant regional economic benefits by enabling growth and related increase in income. Due to the similar cost and scope of the two final structural Alternatives, the RED Benefits are similar, and are therefore not a consideration in the plan selection process. Alternative 3 would have a generally negative impact on RED because of removal of existing housing, businesses, and public buildings.

5.1.6 COMPARISON OF THE OSE ACCOUNT / COMPREHENSIVE BENEFITS

In accordance with the January 5, 2021, Policy Directive Memorandum from the ASA(CW) on the Comprehensive Documentation of Benefits in Decision Documents, the PDT fully considered a broad range of benefits throughout the process. The three rounds of Plan Formulation each considered Comprehensive Benefits in the evaluation criteria, as documented in Section 3. The ultimate result was the two refined Alternative structural plans that provided significant OSE and RED Benefits in addition to NED economic benefits.

Both final structural Alternatives considered and provided similar benefits in the categories of urban, rural, and community impacts, including supporting mental and physical health of the population by reducing flood risks and damages, preventing community displacement, and enabling long-term economic productivity. By providing a solution with minimal structural impacts to the communities (mainly channel expansion), the recommended flood risk reduction solution improves economic and social conditions and enables continued community stability and growth for all urban and rural communities in the North Main Drain and Raymondville Drain basins.

Although life safety was considered, both structural Alternatives share similar below-grade drains with relatively low velocities. Flooding in the basin does not impose significant life safety risk, and implementation of the project does not increase risks beyond the FWOP. This factor was equal for all Alternatives. The proposed project does provide life safety benefit by reducing flood risk to residential, commercial, and agricultural properties, minimizing floodwater disruption to roadways that provide hurricane evacuation, maintaining access to emergency and lifeline services, and preventing disruption to the jail (Lopez State Jail-Segovia Unit in Edinburg) and juvenile detention facilities. The proposed structural Alternatives also reduce public health risks by preventing floodwaters from inundating communities, reducing the threat of disease-bearing waterborne substances and vectors, and preventing the interruption of governmental and utility services (potable water, sewage disposal and treatment, trash removal, and electric power) critical for community health and safety.

Due to the nature of the proposed project and communities along the Raymondville Drain, distribution of benefits was considered in the plan formulation process, to ensure selection of a comprehensive solution to provide benefits throughout the basin, not just in the more intensively developed upstream communities in the North Main Drain. Both Alternatives minimize community displacement and enable stability and community well-being. This factor was equal for both Alternatives. Additionally, as documented in the economics sections, the proposed project supports the productivity of the communities, which will be critical as the region grows and development expands, providing additional opportunities to low-income at-risk communities.

By reducing flooding and improving conveyance in both the North Main Drain and Raymondville Drain basins, the proposed structural Alternatives provide benefits in two basins representing a significant geographic area. Increased drain capacity supports resilience and reduces vulnerability for communities in both basins.

A wide variety of OSE factors are documented in this section and throughout the report. While these OSE factors improve the justification of the proposed project, they provide similar benefits in both structural Alternatives, and are therefore not a major consideration in the plan selection process.

Alternative 3 would not provide the same OSE / Comprehensive Benefits as the structural Alternatives. By not improving the drainage infrastructure and limiting the number of properties acquired, the overall project benefits are limited. Properties not acquired, and roadways in the region would not receive benefits. Significant disruption to low-income at-risk and minority communities due to large-scale acquisition would present significant social concerns.

5.1.7 RISK AND UNCERTAINTY

Reasonable risk and uncertainty was factored into the economic analysis through the use of statistical risk-based models to formulate and evaluate the structural Alternatives. HEC-FDA, a probability based economic model was used to compute stage-damage curves and equivalent annual damages (with and without project) based on water surface profiles by flood event probability, asset (structure) inventory and damage relationship functions. Uncertainty or error distributions associated with estimating the depth damage functions, structure values, content value ratios, other value ratios and first flood stage were used to develop the total aggregated stage damage-uncertainty functions by damage categories for the damage reach to identify the NED Plan.

Risk and Uncertainty in the study process is summarized in the Risk Register, Appendix A-6, and in the Economics Appendix A-5. Uncertainty was considered throughout the analysis, and is consistent with SMART Planning. Risk and uncertainty for the two final Alternatives was similar and did not affect plan selection.

Potential Intensification and Location Benefits were not quantified in the benefit computations, and property values in the LRGV are well below Texas and national averages, so benefits are conservative, ensuring that the project is economically justified. As described in Section 5.1.6, project implementation does not impose life safety risks, nor create risks different than the pre-project condition.

5.2 IDENTIFICATION OF THE NED PLAN

Alternative 1 was identified as the NED Plan. It is the reasonable Alternative included in the Final Array that meets the planning objectives of the project and maximizes the net NED Benefits.

5.3 PLAN SELECTION

The PDT determined when evaluating and comparing the Alternatives developed during the plan formulation process that Alternative 1 was the Recommended Plan. This plan was selected because it fully meets the objectives of the planning study, maximizes net NED Benefits, and is the LEDPA, while producing similar positive results in the RED, and OSE Accounts. The non-federal sponsor concurs with the selection of Alternative 1 as the Recommended Plan for further development and implementation.

SECTION 6.0 THE RECOMMENDED PLAN

6.1 PLAN ACCOMPLISHMENTS

The Recommended Plan consists of improvements to the existing Raymondville Drain and a new diversion drain. The proposed diversion transfers flows from the North Main Drain to a new extension of the Raymondville Drain at a new control structure near Edinburg Lake. The transferred North Main Drain System flow comes from heavily developed areas generally north and west of Edinburg. Reducing flow upstream in the North Main Drain System improves regional stormwater capacity, significantly reducing damages in Hidalgo County in the vicinity of the diversion, and reducing flooding downstream in the watershed. The Recommended Plan also provides relief along the Raymondville Drain in Hidalgo and Willacy counties simultaneously through increased in-channel storage capacity throughout the system, increased through flow capacity, and controlled flow from Hidalgo County to Willacy County. The Recommended Plan would significantly reduce flood damage and flood risk in portions of the LRGV, benefiting over 38,000 structures.

A detailed total project cost estimate (see Section 6.3) was developed for the Recommended Plan, and the estimated construction cost is included in Table 6-1. (NOTE: project costs will be updated upon completion of the ongoing USACW Cost Certification process.) The Recommended Plan is the NED Plan and is estimated to reduce the equivalent annual damages in the Raymondville Drain basin in Hidalgo County by approximately 59%, and in Willacy County by 84%, and by 26% within the North Main Drain basin, with estimated annual net benefits of approximately $38.4 million. HCDD1 is responsible for maintaining the existing project, which is a key component to reduce region-wide flood risk.

Cost Category	Recommended Alternative
Contract Cost	$562,097,000
Construction Contingency (5%)	$30,092,000
Design During Construction	$6,730,000
Overhead (SIOH)	$41,075,000
Real Estate Cost	$21,398,000
Utility Relocation	$29,872,000
Design Fee (6%)	$36,817,000
Construction Cost Estimate	**$728,079,000**

Table 6-1 Recommended Plan Construction Cost Breakdown (2025 dollars)

Item	Recommended Plan
Construction Cost Estimate	$728,079,000
Interest During Construction	$95,676,000
Total Investment	**$823,755,000**
Average Annual Construction Cost	$25,670,000
Average Annual Incremental O&M	$1,898,000
Total Average Annual Cost	**$27,568,000**
Total Average Annual Benefits	**$38,393,000**
Net Excess Benefits	**$10,825,000**
BCR	**1.39**

Table 6-2 Recommended Plan BCR Computation (2025 Dollars)

Table 6-2 summarizes the BCR for the project. In addition to the quantified economic benefits, there are additional economic benefit categories not included in the BCR computation. The proposed project would also enable the potential for land value increases over a long project reach (Location and Intensification Benefits). Because of the uncertainty related to the qualitative analysis of these future benefits, Location and Intensification Benefits were not included in the economic calculations, but are an additional qualitative benefit further justifying the project.

The proposed project provides significant Comprehensive Benefits in accordance with the January 5, 2021, Policy Directive from the ASA(CW). As detailed throughout the report and summarized in Section 5.1.5, the project provides a comprehensive variety of total project benefits, including economics (NED and RED), life-safety, and social categories. Benefits include, but are not limited to: improving emergency access on local roadways and major hurricane evacuation routes through the study area; protecting public health by reducing risk to sanitation infrastructure; maintaining access to lifeline services including multiple fire stations and hospitals; reducing risk to regional correctional facilities (Lopez State Jail-Segovia Unit in Edinburg) and juvenile halls within in the basin; and supporting Border Patrol facilities and operations.

While the vast majority of quantified dollar benefits accrue in the upstream Hidalgo County portions of the project, the Raymondville Drain channel expansion continues the length of the project, through the less developed portions of Willacy County. This channel expansion through these downstream rural communities is necessary to safely and effectively convey the upstream flows diverted from the North Main Drain system to the Laguna Madre. The additional capacity from project implementation would provide significant flood risk reduction benefits to low-income at-risk downstream rural communities, enabling future economic development.

6.2 PLAN COMPONENTS

The Recommended Plan is shown in Figure 6-1, and generally consists of approximately 13.8 miles of new diversion drains in Hidalgo County, approximately 43 miles of drain improvements in Hidalgo and Willacy counties, an approximately 270-acre detention pond in Hidalgo County, and five control structures (three located at the

junction of the Raymondville Drain with other existing drains, one at the proposed detention pond, and one at the Hidalgo-Willacy County line).

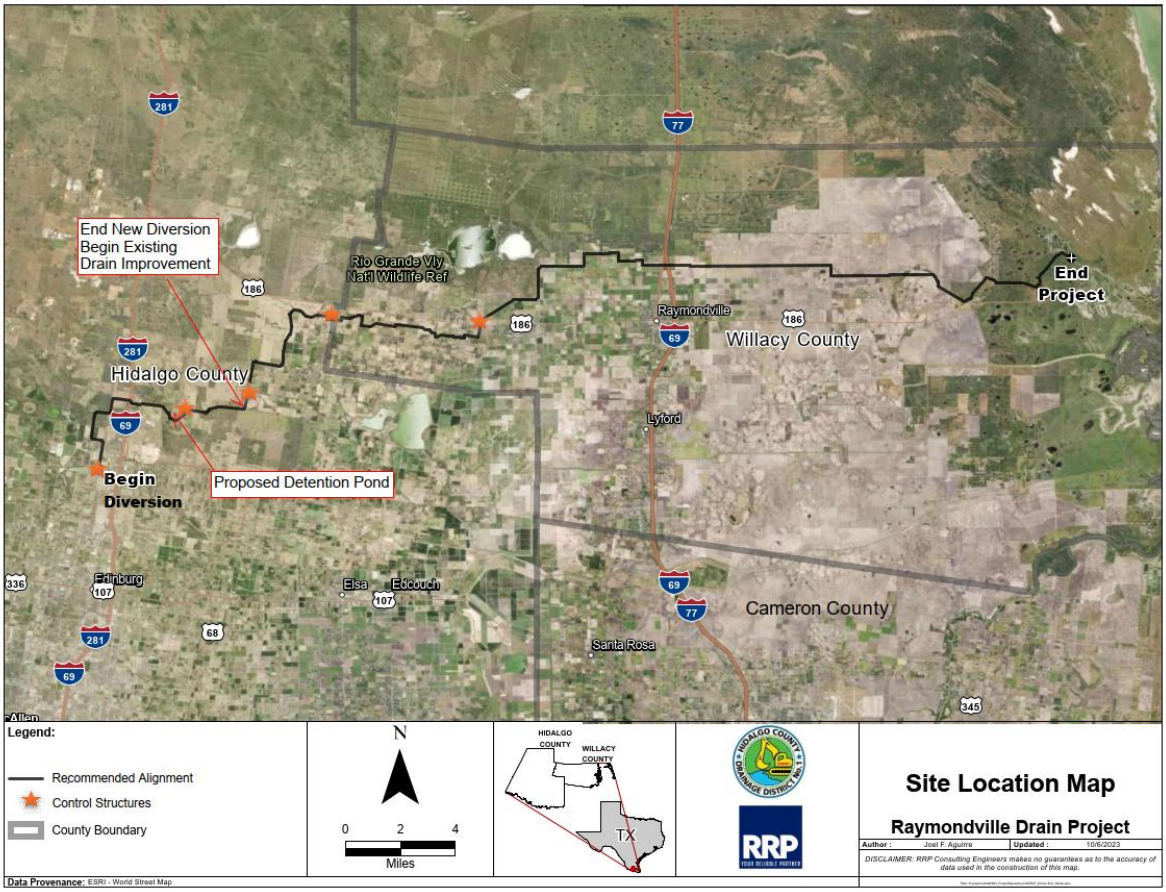

Figure 6-1 Recommended Plan

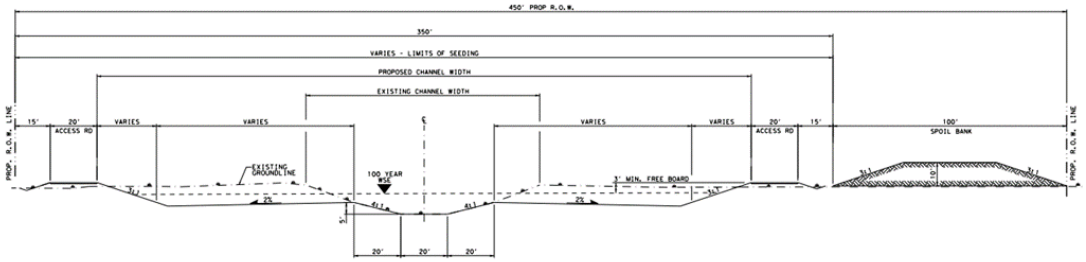

Figure 6-2 Section Profile

The typical section of the Recommended Plan is shown in Figure 6-2, and consists of a 450-foot-wide total ROW for the proposed diversion drains and drain expansion. The typical section consists of a 280-foot-wide drain with 3:1 side slope down to a maintenance bench that varies in width to a 60-foot wide, 5-foot-deep pilot channel with 4:1 side slopes; outside of the drain are 20-foot-wide access roads with a 15-foot-wide vegetative buffer from the edge of the ROW to the access roads. The project would additionally include 100-foot-wide spoil berms constructed of soil excavated from the drain in most areas to reduce off-site hauling. The berms were preliminarily designed to be 10' tall with 3:1 side slopes and openings at regular intervals to enable interior drainage, similar to other projects in the region constructed by the non-federal sponsor. The spoil berms will be fully designed in the PED phase including maximum height, side slopes, and appropriate distance between breaks, to ensure they will not unintentionally function as levees. In environmentally sensitive downstream areas, the spoil berms would be omitted, and the ROW would be limited to 350 feet. The proposed access roads are raised to allow the non-federal sponsor to travel and move equipment along the length of the drain during storm events, and field drains would be installed at regular intervals to allow collected flows to enter the channel. These field drains, as detailed in Figure 6-3, would be designed at appropriate locations to discharge into the pilot channel to protect the side slopes. They would also include backflow protection to prevent water from escaping the channel.

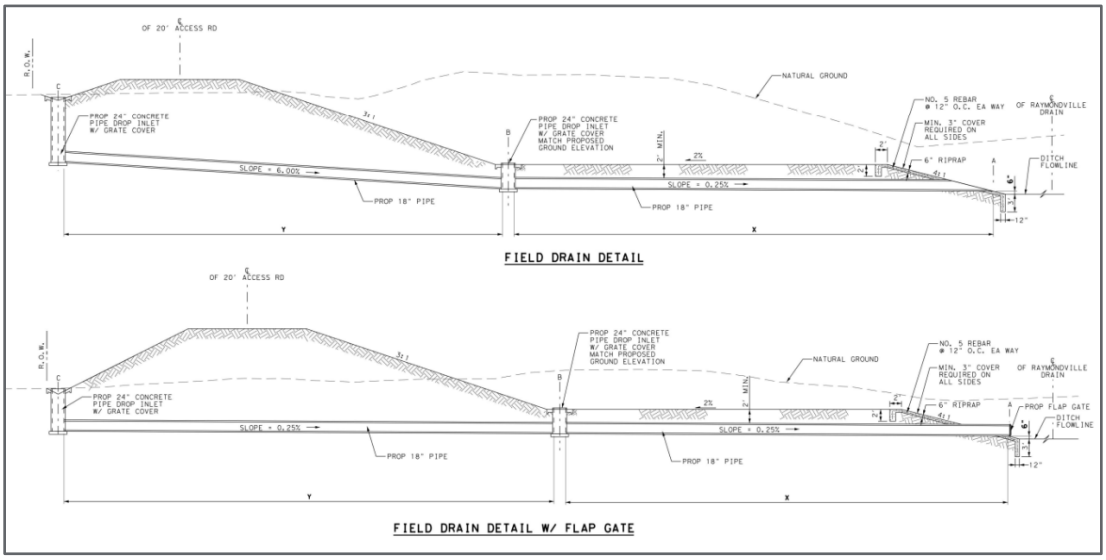

Figure 6-3 Field Drain Details

The five proposed control structures in the channel are below the surrounding grade. There will be downstream tailwater in the drain, therefore the structures will have little-to-no hydraulic head. The surrounding terrain is flat, therefore these structures would not present a life safety risk in the event of failure or misoperation. Any water overtopping the structure would flow around it and return to the channel downstream with relatively low velocity.

The upstream control structure is a gated weir located at the headwater of the bypass channel to divert water from the North Main Drain. It consists of multiple concrete box culverts, with a manually operated sluice gate upstream of each box culvert opening. The second control structure has four ungated concrete box culverts and a simple overflow weir located at the downstream end of the in-line detention pond. The detention pond will be

excavated, and the water surface in the pond will remain at or below the surface of the surrounding ground area. The third control structure is at the bypass channel intersection with the existing Delta Lake Drain, and enables release of water to the Delta Drain channel to supply water to Delta Lake for irrigation purposes. This structure is located in the right overbank, and contains several box culverts with manual sluice gates. The fourth control structure is located in-channel at the county line between Hidalgo and Willacy counties. A plan, profile, and elevation of this structure are shown in Figures 6-4 through 6-6, respectively. It contains five box culverts and sluice gates. This structure enables the control of flow into the downstream Willacy County channel portion, and will always be at least partially open. The final control structure is located at the intersection with the La Sal Vieja Drain channel. This is a replacement for an existing control structure, and is located in the left overbank. It consists of box culverts with sluice gates to enable flow into and from La Sal Vieja Lake. The sluice gates will normally be closed, and will be operated for environmental purposes under an agreement with the owner of La Sal Vieja (U.S. Fish and Wildlife Service).

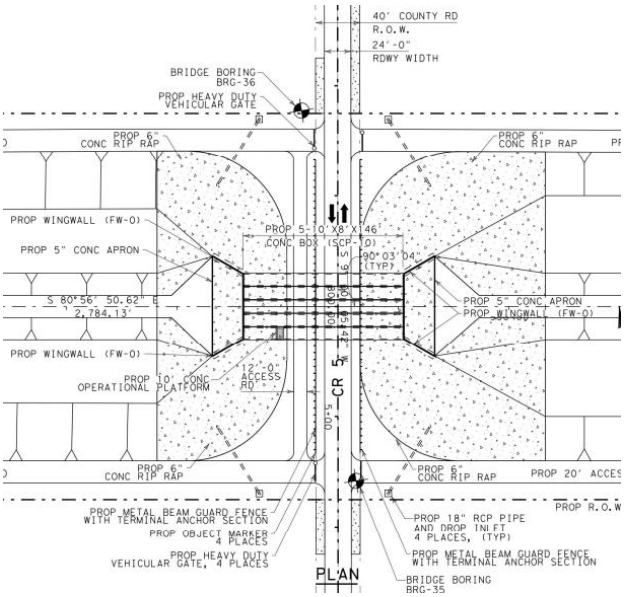

Figure 6-4 Hidalgo-Willacy County Line Control Structure – Plan

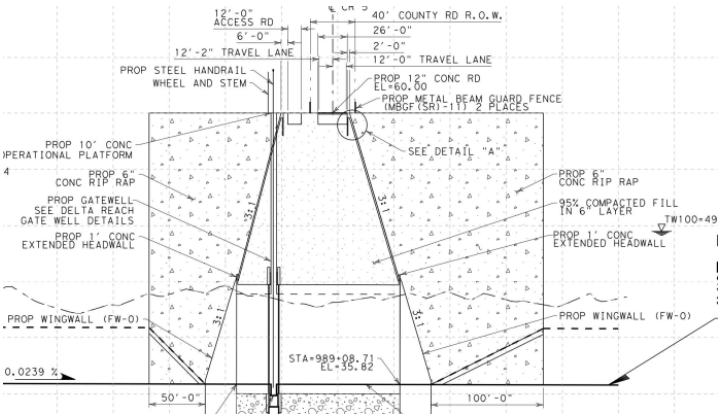

Figure 6-5 Hidalgo-Willacy County Line Control Structure – Profile

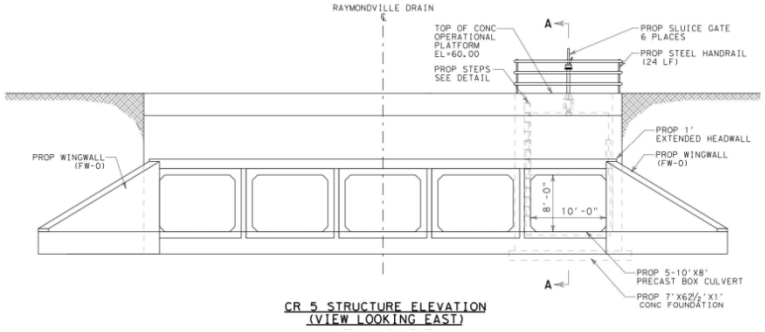

Figure 6-6 Hidalgo-Willacy County Line Control Structure – Elevation Looking East

Based on the evaluation of the recommended plan alignment, the PDT determined that one upstream location in the bypass section of the channel was naturally low-lying and therefore required additional capacity to keep water within the channel. The PDT designed an alternate flat bottom trapezoidal drain cross section design, as shown in the lower half of Figure 6-7, which would be incorporated to accommodate this hydraulic concern in this low-lying location. This allows the drain to maintain the raised access roads, vegetative buffers, and field drains in these sections without significantly increasing cost or ROW requirements.

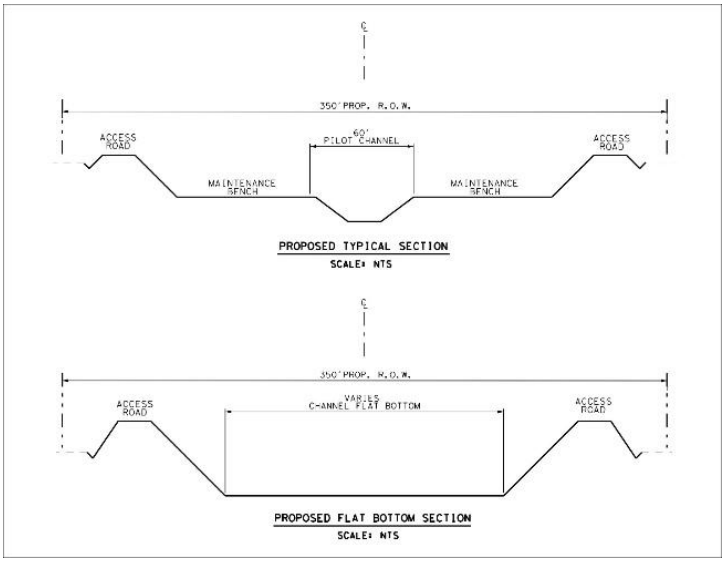

Figure 6-7 Flat Bottom Section Detail

The diversion channel would start approximately 0.4 miles east of Edinburg Lake with a control structure along the North Main Drain, and proceed generally north before crossing I-69C/US 281 approximately 0.7 miles north of El Cibolo Road. From there, the project would proceed eastward toward Brushline Road, with the detention pond and control structure located in-line with the pilot channel. From Brushline Road the channel would proceed north to approximately 0.4 miles north of FM 490 where it would turn east and connect to the existing West Hargill Drain Lateral 5. A second control structure would be constructed south of 12th Street before FM 490 so that water could be diverted toward Delta Lake Irrigation District for irrigation purposes. The proposed new diversion drain from the start to this point is approximately 13.8 miles long, including an approximately 270-acre detention pond with a control structure.

The proposed project would continue with channel widening to match the proposed diversion channel's cross section, and would continue from the start of the West Hargill Lateral 5 approximately 2.7 miles north, and then proceed west along the Raymondville Drain West Hargill Drain approximately 7.8 miles and flowing into the RD North Hargill Drain, with a control structure located at the county line between Hidalgo and Willacy counties. The channel improvements would continue along the existing channel in a north easterly then east direction past I-69E/US 77 approximately 30.2 miles to an unnamed private bridge, approximately 2 miles north of the channel's intersection with SH 186. An existing control structure where the Raymondville Drain connects to La Sal Vieja drain, near the point where the drain crosses north of SH 186, would be replaced due to the channel widening. The length of the channel improvements is approximately 43 miles, and the overall length of the proposed project is approximately 56.8 miles.

The Recommended Plan includes the replacement of an estimated 56 bridge structures or culvert crossings to ensure adequate size to span the proposed drain, and construction of an estimated 13 new bridges so that existing roadways can cross the proposed diversion drain. This includes the corridor for the United States Interstate System I-69E located north of Raymondville, and one railroad bridge north of Raymondville. The I-69C corridor bridges in Edinburg will not be replaced, but a new channel will be established under the existing bridge.

6.3 COST ESTIMATE

An MCACES (Micro-Computer Aided Cost Estimating System) detailed cost estimate, and a formal Cost and Schedule Risk Analysis (CSRA) were developed for the Recommended Plan. The project quantities were developed by the PDT, and the cost estimate and CSRA were prepared by MOCA Systems under subcontract. The estimate is currently being reviewed by the USACE Cost Engineering Mandatory Center of Expertise (MCX) to obtain a Cost Certification. Project costs will be updated upon completion of the Cost Certification. Quantities for the Hidalgo County portion of the project were based on Plans and Specifications level of detail. The total estimated project cost (2025 dollars) is $838,622,000. Details on the cost estimate development are included in Appendix A-2. A breakdown of the estimated total project cost is shown in Table 6-3.

Project Element	Estimated Cost
Contract Cost	$527,923,000
Escalation	$73,910,000
Design During Construction	$6,730,000
Overhead (SIOH)	$41,075,000
Real Estate Cost	$21,398,000
Utility Relocation	$29,872,000
Design Fee	$36,817,000
Cost and Schedule Risk Analysis	$34,175,000
Construction Contingency	$30,092,000
Design Contingency	$30,092,000
Fish and Wildlife Facilities	$5,008,000
Cultural Resource Preservation	$1,484,000
HRTW	$52,000
Estimated Total Project Cost	$838,622,000

Table 6-3 Total Project Costs for Authorization

6.4 LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS, AND DISPOSAL (LERRDS)

The Recommended Plan for the Raymondville Drain Project would require a total of an estimated 3,285 acres of ROW, 1,296 acres located in Hidalgo County and 1,989 acres in Willacy County. Of the total acreage, approximately 1,468 is currently owned by the non-federal sponsor and its project partners, 404 acres in Hidalgo County and 1,064 acres in Willacy County, requiring approximately 892 acres of new ROW in Hidalgo County and 925 acres of new ROW in Willacy County.

In Hidalgo County, approximately 774 acres of new ROW are required for new conveyance channel to connect the North Main Drain to the West Hargill Drain segment of the Raymondville Drain, and approximately 128 acres to widen the existing channel. The proposed detention pond would use approximately 272 acres of land currently owned by the Sponsor. In Willacy County, all 925 acres would be used to expand the existing channel to accommodate additional conveyance and to expand the ROW from a typical 100' ROW to a 350' or 450' ROW. Additional permanent ROW for borrow material is not expected to be required, nor lands for the disposal of excavated material (however, obtaining disposal easements is anticipated). A portion of excavated material would be used to construct the proposed spoil berm located adjacent to the Raymondville Drain Project channel, thereby minimizing the length of haul routes for disposal purposes. Any surplus excavated material would be disposed of in a facility permitted for this purpose, or investigated for suitability for alternative uses. Compliance with any environmental laws or regulations which apply to disposal or borrow activities would be documented as appropriate.

The real estate generally required for the implementation of the Recommended Plan is primarily undeveloped rangeland or agricultural farmland along the alignment of the proposed new channel in Hidalgo County and along both banks of the existing channel in Hidalgo and Willacy counties. Privately owned land would be acquired by HCDD1 utilizing appropriate estates with proper compensation as negotiated during the acquisition process. The Real Estate Plan, including a detailed description of the necessary ROW requirements, can be found in Appendix A-4. LERRDs are approximately 6% of project cost.

6.5 OPERATIONS, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION (OMRR&R)

The proposed project primarily consists of the improvement of existing channels and the construction of a new bypass channel. Five relatively simple control structures would also be constructed. The bulk of the OMRR&R cost is maintenance of the channels. This would be accomplished by HCDD1 using in-house staff, who are experienced in this type of maintenance work. HCDD1 currently maintains approximately 600 miles of similar channel, and OMRR&R costs were estimated based on extrapolation of the HCDD1 budgeted and actual historical costs to maintain and rehabilitate their current projects. In 2023, HCDD1 had an OMRR&R budget of $18.0 million for bi-annual regular maintenance, as well as larger rehabilitation projects on a case-by-case basis. This translates to approximately $30k per mile of drainage system. OMRR&R costs for the proposed project are estimated at $1,898,000 (2025 dollars).

The operations process for this gravity flow project is relatively straightforward. The three man-made offline water storage reservoirs in the Raymondville Drain basin (Edinburg Lake, Delta Lake, and Hargill Reservoir), and the salt lake in the LRGV National Wildlife Refuge (La Sal Vieja), are not operated as part of the system for flood damage reduction. A detailed Operations and Maintenance (O&M) manual would be developed in the Preconstruction Engineering and Design (PED) Phase cooperatively by HCDD1 and USACE. The O&M manual would establish operational rules and procedures for the completed project based on flow rate triggers in the North Main Drain basin, storage levels in the detention pond, and operational rules for the drainage system. Flows from the North Main Drain would not be diverted into the Raymondville Drain until the Willacy County channel expansion construction is complete and downstream capacity is increased. Once the project is complete, diversion from the North Main Drain to the Raymondville Drain would only occur when North Main Drain flows approach damaging levels, and the project would be operated to avoid induced flooding downstream in Willacy County.

The five control structures are described in more detail in Section 6.2. The upstream control structure located at the start of the proposed bypass channel where it intersects with the existing North Main Drain, will be operated to enable excess floodwaters to be released into the Raymondville Drain. The second control structure located at the downstream end of the proposed in-line detention pond, will enable controlled outflow of water stored during storm events, and will be designed to minimize the length of time water is stored to discourage use of the detention pond by waterfowl. The third control structure at the intersection of the proposed bypass channel with the upstream end of the existing Delta Lake Drain, will be operated as necessary to divert water toward Delta Lake for irrigation storage. The fourth control structure at the Hidalgo-Willacy County line, will be operated to ensure flows do not exceed the capacity of the Raymondville Drain in Willacy County (during construction and after completion of the channel expansion). And the final control structure will replace an existing control structure at the intersection of the existing Raymondville Drain with the La Sal Vieja drain channel, to enable diversion of fresh water into the salt lake if requested by the USFWS.

HCDD1 currently operates their inventory of control structures by monitoring water levels and sending crews to manually open or close gates as needed. This is typically accomplished by utilizing the raised access roads along the channels to access the control structures, and then using handheld tools to raise or lower the gates. During normal (non-flooding) flow conditions, a portion of the gates at each structure would remain open. In preparation for significant predicted weather events, the non-federal sponsor would open additional gates or close selected gates on a structure-by-structure basis in accordance with the operating rules in the O&M Manual, then make changes as needed during and after the storm until water levels return to non-flooding levels.

There will be no induced flooding from the construction or operation of the proposed project. Diversion from the North Main Drain will not occur until the Raymondville Drain channel has the additional capacity to carry the diverted flow. The additional channel capacity throughout the project will ensure that flows will stay in the channel through a range of flows, and will not create adverse impacts. Once the construction is complete, diversion from the North Main Drain to the Raymondville Drain would only occur when North Main Drain flows approach damaging levels, and the project would be operated to avoid induced flooding downstream in Hidalgo and Willacy counties. This would be accomplished by controlled operation of the gated control structures at the headwaters of the project, and at the Hidalgo-Willacy line.

6.6 PROJECT RISKS

Overall implementation risks for this project are relatively low for the feasibility phase. While the proposed construction activities are not technically complex, the project size and scope (including the relocation of numerous utilities, and addition or replacement of numerous road crossings/bridges) results in a sizable logistical challenge related to the movement, transportation and relocation of a significant volume of excavated materials. This has been factored into the formal CSRA, performed to incorporate cost and schedule risks into the estimate.

The design of the proposed project is mature, and a significant amount of engineering and environmental work has been completed, beyond the normal scope for a USACE Feasibility Study. The project construction scope and quantities are well defined, and the cost estimate has a high level of confidence. Adequate construction duration has been factored into the project schedule.

The proposed project consists primarily of below-grade drains. Similar drain designs are used throughout the study area and perform effectively. Previous studies and historical data indicate that the existing Raymondville Drain and lateral ditches have not experienced significant erosion or sedimentation. The terrain in the project

area is flat, and flood flows are generally slow-moving. The project presents no incremental life risk above the without project flooding condition.

Figure 4-1 indicates the mapped flooding envelope, and the residual flooding (subject to the caveats in Sections 2.5.3 and 4.2.4, which explain the modeling focus on the more developed areas). The proposed project reduces flood damages to property and agriculture within the Raymondville Drain basin by an estimated 59% in Hidalgo County and 84% in Willacy County. Additionally, the proposed project reduces flood damages by an estimated 26% in the North Main Drain basin. As no flood risk reduction project can reduce risks to zero, residents of the basin will be regularly informed of residual flooding risks.

6.7 COST SHARING

The Recommended Plan is the NED Plan and is a single-purpose flood damage reduction project. It is the least costly acceptable plan with the highest net NED Benefits. The non-federal sponsor is required to contribute all costs associated with the acquisition of LERRDs, and a minimum of 5 percent of the construction cost, requiring a minimum contribution of 35 percent of the fully funded costs of the Recommended Plan. Based on the estimated project costs shown in Table 6-3 of this report, and the requirements of Cost Apportionment discussed, the non-federal sponsor has prepared the following distribution shown in Table 6-4 of total project first costs by both the non-federal and federal interests.

	Costs ($)	Percent
Estimated Total Project Cost	**$838,622,000**	**100%**
Federal Contribution	**$545,104,000**	**65.0%**
Non-Federal Sponsor's Contribution	**$293,518,000**	**35.0%**
LERRDs		
Real Estate Cost	$21,398,000	
Utility Relocations	$29,872,000	
Estimated First Cost of LERRDS	$51,270,000	6.1%
Non-Federal Sponsor's Additional Contribution	$242,248,000	28.9%

Table 6-4 Cost Sharing Summary

6.8 DESIGN AND CONSTRUCTION

Project components are described in Section 6.2. Implementation of the Recommended Plan is initially scheduled to occur over a 10-year period using a reasonable construction schedule with a minimum of two construction contracts. An accelerated construction schedule could be implemented utilizing additional simultaneous construction contracts, provided the non-federal sponsor and government agree to a more aggressive funding timeline, and environmental commitments (Section 6.9) can be accommodated. A detailed acquisition plan will be developed in the Preconstruction Engineering and Design (PED) phase.

Detailed investigations and surveys to enable project design are generally complete. Design concepts, details, coordination, layouts, and phasing for the project have been established. To construct the proposed project efficiently and to be technically sound, appropriate project phasing is imperative to avoid contributing to downstream flooding before the project is completed. Upstream portions would only be completed and put into operation after downstream sections have the capacity to convey the increased flow.

The proposed project has been subdivided into seven Segments in Hidalgo County and four Segments in Willacy County. Maps showing the construction Segments are included in the Real Estate Appendix A-4 (Hidalgo County Segments are shown in Figure 5, and Willacy County Segments are shown in Figure 6). Construction can take place on a minimum of two concurrent lines of construction – one for Hidalgo County, and one for Willacy County. Additional simultaneous construction lines (contracts), as mentioned above, could be pursued to reduce the construction duration pending funding availability. The construction sequencing plan will be refined in PED based on the acquisition plan, and will be designed to manage flows so no additional induced downstream flooding would occur during construction.

Construction line one, consisting of the Hidalgo County portion of the project, would require the acquisition of an estimated 66 parcels. Construction line two, consisting of the Willacy County portion, would require the acquisition of an estimated 111 parcels. Acquisition of the required LERRDs would be conducted in tandem with the construction activities, starting at the downstream limits of each construction line and moving upstream, reducing the impact of the implementation schedule.

Construction line one would start with Segment 7 at the Hidalgo-Willacy County Line and follow the project alignment upstream in Hidalgo County to connect to the North Main Drain near Edinburg Lake. Construction line two would start with Segment 11 at the downstream project limit in Willacy County approximately two miles north of SH 186 and would follow the existing channel upstream to the Hidalgo-Willacy County line. The existing Raymondville Drain channel is owned by the Delta Lake Irrigation District, and the use of the ROW, and the right to operate, maintain, and improve the existing channel has been acquired by HCDD1 through an Interlocal Agreement.

An additional initial bridge contract has been identified in Willacy County to include the Business Route 77 highway bridge, the Union Pacific Railroad Bridge, the 4 bridges of Interstate 69 E (main lanes and frontage roads), and drain widening in the vicinity of these bridges. This additional contract will be located near the transition between current Segments 9 and 10, and will consist of construction tasks removed from the Segment 9 contract. Bundling the largest bridge construction efforts in the project into a single more-specialized contract is expected to reduce costs, improve quality, and reduce coordination concerns. Phasing this effort as the first construction contract will provide additional time to prevent the railroad bridge from being on (or near) the critical path for project completion. Details for this additional contract will be developed in PED phase.

6.9 ENVIRONMENTAL COMMITMENTS

Specific actions and commitments must be taken prior to the implementation of the Recommended Plan and the initiation of construction activities. These actions include identifying and designing Best Management Practices (BMPs) that are appropriate to the natural resources to be protected, developing mitigation and monitoring plans, and securing necessary environmental permits. Environmental permits that may be required prior to project implementation include those associated with the Clean Water Act (CWA), Section 401 and Section 402.

Additional environmental permits may be identified when all environmental consequences associated with the Recommended Plan have been identified and quantified.

Appropriate BMPs for threatened and endangered species, including conservation measures (see Section 4.1.3), would be implemented in coordination with the USFWS and TPWD prior to project initiation. Mitigation plans (see Section 4.7) for potential impacts to natural resources which cannot be avoided or minimized would be submitted for regulatory agency approval prior to implementation of the proposed project.

6.10 PROJECT-SPECIFIC CONSIDERATIONS

In 2001, HCDD1 took over as the proposed non-federal Sponsor for the Raymondville Drain Project in conjunction with the USACE Galveston District. Following the enactment of WRDA 2007, which amended the authorized project to include a diversion channel from the North Main Drain near Edinburg Lake to the Raymondville Drain, HCDD1 assumed responsibility for all activities for the development of the project, culminating with this Section 203 Feasibility report. HCDD1 plans to continue to be closely involved with the implementation of the project following authorization, including contracting and managing the design and construction process, in collaboration with USACE. Specifics would be established in the Project Partnership Agreement (PPA).

6.11 ENVIRONMENTAL OPERATING PRINCIPLES

The USACE Environmental Operating Principles (EOPs) were introduced in 2002 to ensure that USACE missions include totally integrated sustainable environmental practices. USACE projects are expected to comply with the EOPs. Since their initial publication in ER 200-1-5, the EOPs were re-energized to include a renewed focus on sustainability and risk management in project implementation, and are as follows:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all USACE activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The Raymondville Drain study has included a comprehensive planning, public involvement, environmental, and risk management process, including assessment of varying conditions that may impact the project. Project formulation focused on a full range of Comprehensive Benefits. Implementation of this proposed project would enhance economic development, improve community resilience and sustainability, reduce flood risks, and reduce uncertainty in communities within the LRGV basin from flooding events. The proposed project demonstrates compliance with, and a clear commitment to, the EOPs.

6.12 VIEWS OF THE NON-FEDERAL SPONSOR

As the entity submitting this Section 203 Feasibility Report, HCDD1 fully supports the analysis and recommendations contained herein, and is prepared to execute a PPA and provide the required elements of local cooperation.

SECTION 7.0 ENVIRONMENTAL COMPLIANCE

7.1 ENVIRONMENTAL COMPLIANCE TABLE

Table 7-1 is a summary of relevant environmental laws, regulations, and EOs, as well as the compliance status with each.

Table 7-1: Environmental Compliance for the Recommended Plan

Laws, Regulations, Policies, and Guidance (Acts, Executive Orders, etc.)	Acts, as Amended	Compliance Status	Resource Unaffected by Recommended Plan	Insignificant Effects as a Result of the Recommended Plan	Insignificant Effects as a Result of Mitigation	Mitigation Required	Report Section(s)
Public Laws							
Archeological and Historic Preservation Act of 1974	☒	In Progress	☐	☒	☐	☐	4.2.2
Bald and Golden Eagle Protection Act of 1940	☒	In Progress	☒	☐	☐	☐	4.1.3
CEQ Memorandum on the Analysis of Impacts on Prime and Unique Farmlands	☐	In Progress	☐	☒	☐	☐	4.2.1
Clean Air Act of 1970	☒	In Progress	☒	☐	☐	☐	4.2.5, 4.7.7
Clean Water Act of 1972	☒	In Progress	☐	☐	☒	☒	4.1.1, 4.2.3, 4.7.6
Coastal Barrier Resources Act of 1982 amended by the Coastal Barrier Improvement Act of 1990	☒	N/A	☒	☐	☐	☐	4.1.5
Coastal Zone Management Act of 1972	☒	In Progress	☒	☐	☐	☐	4.1.5
Endangered Species Act of 1973	☒	In Progress	☐	☒	☐	☐	4.1.3, 4.7.3
Farmland Protection Policy Act of 1981	☒	In Progress	☐	☒	☐	☐	4.2.1
Federal Water Project Recreation Act of 1965	☒	N/A	☒	☐	☐	☐	N/A
Fish and Wildlife Coordination Act of 1934	☒	In Progress	☐	☒	☐	☐	4.1.3
Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act) amended by the Magnuson-Stevens Reauthorization Act of 2006	☒	In Progress	☒	☐	☐	☐	4.1.3, 4.1.4
Marine Mammal Protection Act of 1972	☒	In Progress	☒	☐	☐	☐	4.1.3
Marine Protection, Research, and Sanctuaries Act of 1972	☐	N/A	☒	☐	☐	☐	N/A
Migratory Bird Treaty Act of 1918	☒	In Progress	☐	☒	☐	☐	4.1.6, 4.7.4
Migratory Bird Conservation Act of 1929	☐	N/A	☐	☒	☐	☐	4.7.4
National Environmental Policy Act of 1969	☒	In Progress	☐	☒	☐	☐	4.0
National Historic Preservation Act of 1966	☒	In Progress	☒	☐	☐	☐	4.2.2, 4.7.5
Native American Graves Protection and Repatriation Act of 1990	☒	N/A	☒	☐	☐	☐	4.7.5
Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984	☒	In Progress	☐	☒	☐	☐	4.2.6, 4.7.8
Rivers and Harbors Act of 1899	☒	In Progress	☒	☐	☐	☐	N/A
Wild and Scenic Rivers Act	☒	N/A	☒	☐	☐	☐	N/A

Table 7-1: Environmental Compliance for the Recommended Plan							
Laws, Regulations, Policies, and Guidance (Acts, Executive Orders, etc.)	Acts, as Amended	Compliance Status	Resource Unaffected by Recommended Plan	Insignificant Effects as a Result of the Recommended Plan	Insignificant Effects as a Result of Mitigation	Mitigation Required	Report Section(s)
Executive Orders							
Protection and Enhancement of Environmental Quality (EO 11514)	☐	In Progress	☐	☐	☒	☐	4.0
Floodplain Management (EO 11988)	☐	In Progress	☐	☒	☐	☐	4.2.4
Protection of Wetlands (EO 11990)	☐	In Progress	☐	☐	☒	☒	4.1.1, 4.7.1
Protection of Children from Environmental Health Risks (EO 13045)	☐	In Progress	☒	☐	☐	☐	N/A
Responsibility of Federal Agencies to Protect Migratory Birds (EO 13186)	☐	In Progress	☐	☒	☐	☐	4.1.6
Invasive Species (EO 13112)	☐	In Progress	☐	☒	☐	☐	4.7.2
Other							
Hazardous Wildlife Attractants on or Near Airports (FAA AC 150/5200-33)	☐	In Progress	☐	☒	☐	☐	4.1.6
Note: Raymondville Drain Project compliance with the applicable law, regulation, policy, or guidance is specified in the EA section(s) noted.							

7.2 PUBLIC INVOLVEMENT

The NEPA environmental review process provides the public with an opportunity to participate in the project development process for federal-level projects. Public involvement activities conducted to date for the Raymondville Drain Project include public scoping meetings, public meetings, public hearings in both Hidalgo County and Willacy County as well as coordination with interested resource and regulatory agencies.

7.2.1 SCOPING

The Notice of Intent (NOI) for the Raymondville Drain Project initially appeared in the Federal Register on July 16, 2004. The stated intent for the proposed project was to prepare a Draft Supplemental Environmental Impact Statement (DSEIS) for the Raymondville Drain Project. All investigations and studies were scoped as EIS. Following the evaluation of potential project-related impacts to the human and natural environment as the investigations and coordination proceeded, it was determined that no significant impacts would occur and that an Environmental Assessment (EA) with a Finding Of No Significant Impact (FONSI) would represent the appropriate level of environmental review under NEPA for the Raymondville Drain Project.

From July 21, 2004, to March 23, 2006, a total of four public scoping meetings, organized by the USACE and HCDD1, were conducted in the Raymondville Drain Project study area. The public scoping meetings were attended by local landowners, personnel from public agencies, and other individuals interested in the proposed project.

- The first scoping meeting was held on July 21, 2004, in Hidalgo County. Approximately 30 individuals attended, including local landowners and interested parties. The main topics discussed were erosion control and the potential for property damage during flooding events and construction of the proposed project.
- The second public scoping meeting was held on July 22, 2004, in Willacy County, Texas. A total of 18 people attended, including property owners, public agencies, and other interested parties. The primary concerns raised were related to water quality, water supplies, and the potential impact of

the proposed project on Laguna Madre. The possibility of creating detention ponds was also discussed.

- The third public scoping meeting occurred on March 22, 2006, in Hidalgo County. A total of 18 individuals, including property owners, public agencies, and interested parties, participated in this meeting. The main topics of discussion included water quality, water supply, and the purpose and need of the proposed project.
- The fourth public scoping meeting occurred on March 23, 2006, in Willacy County. A total of 15 people attended, including property owners, public agencies, and other interested parties. The meeting focused on alternatives and plans for a socio-economic profile and impact assessment report.

In addition to the public scoping meetings, a series of town hall meetings were held in 2012 across Hidalgo County. A total of 12 meetings occurred between August and October 2012 in the areas of McAllen, Weslaco, Donna, Progreso, Alamo, Pharr, San Juan, Mission, Palmhurst, Sharyland, La Joya, Peñitas, Palmview, Sullivan City, Mercedes, and San Carlos. These town hall meetings provided residents of different areas with the opportunity to attend and participate in discussions for the proposed project.

Attendees of the public scoping meetings and town hall meetings expressed concerns on various matters including erosion control, potential property damage during construction, flooding, water quality and water supplies, and the potential impact on Laguna Madre. These concerns were taken into consideration during the Raymondville Drain Project plan formulation and alternatives analysis development process.

7.2.2 AGENCY COORDINATION

7.2.2.1 INTERAGENCY MEETINGS

In 2016, meetings were held with the Texas Water Development Board (TWDB) to explore funding options and allocations. In 2017, meetings were conducted with Texas Commission on Environmental Quality (TCEQ) to discuss funding and potential revenue sources. Additionally, interagency meetings involving USACE, TWDB, and TCEQ were held to coordinate efforts.

On November 9, 2016, the International Boundary and Water Commission (IBWC) conducted a public meeting which included discussions on vegetation management in the Arroyo Colorado aimed at restoring flood conveyance capacity. Furthermore, an overview of mussel species was provided during the meeting.

Continuing into 2019, numerous meetings took place between the USACE and HCDD1 to coordinate the proposed project implementation. On April 17, 2019, a meeting was conducted between HCDD1 and the USACE regarding changes to the Section 203 process outlined in the Water Resources Reform and Development Act of 2014 (WRRDA 2014). The primary focus of the meeting was to discuss the status of the draft Feasibility Study and Environmental Impact Statement. During the meeting, two main options related to the Section 203 process were discussed. Option 1 involved obtaining environmental clearance before receiving appropriations from Congress, while Option 2 involved initiating the environmental clearance process after receiving appropriations. Option 1 was agreed upon as the option to be advanced.

On April 13, 2023, a meeting was held between the PDT, the USACE, and the Texas Historical Commission (THC). The purpose of the meeting was to discuss the specific requirements and scope of cultural resources field investigations for the Raymondville Drain Project. Given the unique nature and scale of the Raymondville Drain Project, the THC considered various factors and concluded that a minimum of 20% of the typically required

intrusive work under current standards would be acceptable for field investigations. Additionally, the meeting participants agreed upon the minimum number of trenches to be included in the intrusive study. In summary, the scope of the cultural resources field investigations was determined and mutually agreed upon by the USACE, THC, and the PDT, considering the specific circumstances (e.g., project length, schedule, etc.) of the Raymondville Drain Project.

On April 28, 2023, a meeting was held between the PDT and the USACE. The meeting covered various topics, including environmental coordination and updates on ongoing and future field investigations. One of the topics discussed was the inclusion of greenhouse gases in the Feasibility Report. The meeting participants deliberated on how to incorporate information and analysis related to greenhouse gas emissions and their potential environmental impact within the project's documentation. Another topic addressed during the meeting was the consideration of social impacts, and consideration of Other Social Effects (OSE) benefits.

On May 11, 2023, a meeting was held between the PDT, the National Marine Fisheries Service (NMFS), the USACE, the US Fish and Wildlife Service (USFWS), and the Texas Parks and Wildlife Department (TPWD). The primary focus of the meeting was to review the project history and discuss the necessary requirements from the NMFS regarding an essential fish habitat (EFH) assessment. During the meeting, the participants thoroughly reviewed the project details. After consideration and discussion, the NMFS stated that a detailed EFH assessment would not be required for the Raymondville Drain Project. This decision was based on various factors, particularly the project-related avoidance and minimization of natural resource impacts which were recommended by the USFWS and advanced/implemented by the PDT for the proposed Raymondville Drain Project. Based on USFWS comments in 2020, the location of the project terminus was moved two miles upstream of the Raymondville Drain crossing of SH 186 to avoid wetlands and ocelot critical habitat. By moving the eastern terminus of the project upstream, impacts to EFH in the Laguna Madre were not anticipated as the eastern terminus would be located approximately 9.4 miles from the confluence of the Raymondville Drain with the Laguna Madre.

On May 17, 2023, a meeting was held with the PDT, USACE, and USFWS. The meeting focused on the Biological Assessment including the associated field investigations, the species to be investigated, the methodology to be employed, and the format of the report. The USFWS requested that particular emphasis be placed on the ocelot (*Leopardus pardalis*) and the Eastern Black Rail (*Laterallus jamaicensis jamaicensis*). Additionally, the USFWS highlighted the importance of considering the Tricolored Bat (*Perimyotis subflavus*) as the species was proposed to be federally listed as endangered as of September 2022. Additional discussions centered around developing a methodology for the field investigation that would effectively assess the potential impact of the Raymondville Drain Project on these identified species.

7.2.2.2 COORDINATION WITH FEDERAL, STATE, AND LOCAL AGENCIES

The Fish and Wildlife Coordination Act (FWCA), enacted in 1934, promotes coordination and cooperation among federal agencies and helps ensure that wildlife conservation concerns are incorporated into water resource planning and development processes. The FWCA aims to strike a balance between meeting water resource needs and safeguarding natural resources and ecosystems that support fish and wildlife populations. Under the FWCA, federal agencies involved in water resource projects are required to consult with the USFWS and/or the NMFS to provide expertise and guidance on the potential impacts of water projects on fish and wildlife species and their habitats. The FWCA mandates that federal agencies consider the recommendations and requirements of the USFWS and/or NMFS in the planning, design, construction, operation, and maintenance of water projects.

Various WRDA bills authorize the USACE to conduct civil works projects for flood risk management, environmental restoration and navigation. WRRDA 2014 Sections 1001 and 1005 play a vital role in streamlining the approval process of projects. Section 1001 emphasizes the importance of completing the final feasibility report within three years from project initiation, aiming to keep the federal cost under $3 million dollars, and providing for concurrent agency reviews. To ensure adherence to this timeline, Section 1005 offers the non-federal sponsor (HCDD1) guidance on engaging relevant agencies to ensure completion of the environmental review process in a timely, coordinated and environmentally responsible manner. Section 1005 also focuses on establishing an efficient and inclusive approach by requiring public involvement and/or outreach activities. Section 1005 additionally reflects the identification and invitation of all federal, tribal, state, and local government agencies that may have jurisdiction over the project to actively participate in the environmental review process.

In accordance with the FWCA, WRRDA 2014 Sections 1001 and 1005, and the laws, regulations, policies and guidance reflected in Table 7-1, early coordination letters (including a map of the Raymondville Drain Project limits) were mailed to federal, state, and local resource/regulatory agencies that may have jurisdiction over, or an interest in, the proposed Project. Contacted agencies/entities were invited to review and comment on the proposed Raymondville Drain Project. Table 7-2 provides a list of federal (non-USACE), state, and local agencies to which coordination letters were mailed on March 22, 2023.

Table 7-2: Agency Coordination Matrix

Agency/Entity	Contact Name & Address	Phone	Email Address
Federal Agencies			
U.S Department of Agriculture, Natural Resources Conservation Service	Kristy Oates 101 South Main Street Temple, TX 76501	(254) 742-9800	Kristy.Oates@usda.gov
U.S. Coast Guard Heartland District	Rear Admiral Richard V. Timme 500 Poydras Street New Orleans, LA 70130	(504) 671-2128	Douglas.A.Blakemore@uscg.mil
U.S. Department of Commerce NOAA, National Marine Fisheries Service	Charrish Stevens 4700 Avenue U Galveston, TX 77551	(409) 766-3699	Charrish.Stevens@noaa.gov
U.S. Department of Commerce, NOAA, National Marine Fisheries Service, Gulf of America Fishery Management Council	Rusty Swafford 4700 Avenue U Galveston, TX 77551	(409) 766-3699	rusty.swafford@noaa.gov
U.S. Department of Homeland Security, Federal Emergency Management Agency	Tony Robinson 800 North Loop 288 Denton, TX 76209	(940) 898-5399	Juan.Ayala@fema.dhs.gov
U.S. Department of the Interior Fish and Wildlife Service Texas Coastal Ecological Services Field Office	Ernesto Reyes 3325 Green Jay Road Alamo, TX 78516	(956) 784-7560	ernesto_reyes@fws.gov
U.S. Department of the Interior Fish and Wildlife Service	E. Dawn Gardiner 4444 Corona Drive, Suite 215 Corpus Christi, TX 78411	(361) 533-6765	Dawn_Gardiner@fws.gov
U.S. Environmental Protection Agency, Region 6	Earthea Nance 1201 Elm Street, Suite 500 Dallas, TX 75270	(800) 887-6063	Nance.Earthea@epa.gov
State Agencies			
Railroad Commission of Texas	Wei Wang 1701 Congress Avenue Austin, TX 78701	(512) 463-7068	Wei.Wang@rrc.texas.gov

Table 7-2: Agency Coordination Matrix			
Agency/Entity	Contact Name & Address	Phone	Email Address
Texas Commission on Environmental Quality	Peter Schaefer 1804 West Jefferson Avenue Harlingen, TX 78550-5247	(512) 239-4372	Peter.Schaefer@tceq.texas.gov
Texas Division of Emergency Management	Tony Pena 2525 North International Boulevard Weslaco, TX 78596	(956) 565-7120	Tony.Pena@tdem.texas.gov
Texas General Land Office	Amy Nunez 602 North Staples Street, Suite 240 Corpus Christi, TX 78401	(361) 825-3038	Amy.Nunez@glo.texas.gov
Texas Historical Commission	Mark Wolfe P.O. Box 12276 Austin, TX 78711	(512) 936-4323	Mark.Wolfe@thc.texas.gov
Texas Parks and Wildlife Department	Willy Cupit 985 Fish Hatchery Road Brownsville, TX 78520	(956) 350-4491	Willy.Cupit@tpwd.texas.gov
Texas State Soil and Water Conservation Board Harlingen Regional Office	Ricardo Chapa 1826 West Jefferson Avenue Harlingen, TX 78550	(956) 421-5853	Rchapa@tsswcb.texas.gov
Texas Water Development Board	William Alfaro 1828 West Jefferson Avenue Harlingen, TX 78550	(956) 421-3599	william.alfaro@twdb.texas.gov
Other Entities			
City of Edinburg	Mayor Ramiro Garza Jr. P.O. Box 1079 Edinburg, TX 78540	(956) 793-2871	RamiroGarza@cityofedinburg.com
City of Raymondville	Mayor Gilbert Gonzalez 142 South 7th Street Raymondville, TX 78580	(956) 689-2443 x1408	Mayor@raymondvilletx.us
Hidalgo County	County Judge Richard F. Cortez 100 East Cano Second Floor Edinburg, TX 78539	(956) 318-2600	Countyjudge@co.hidalgo.tx.us
Hidalgo County Historical Commission	Adella Ortega 1310 North Francisco Mission, TX 78572	(956) 458-9066	Aortega@mission.tx.us
Willacy County	County Judge Aurelio Guerra 576 West Main Avenue, Room 152 Raymondville, TX 78580	(956) 689-3393	aurelio.guerra@co.willacy.tx.us

As of January 2026, responses have been received from FEMA, USFWS, the Hidalgo County Historical Commission, the THC, and the TPWD. Comments received from responding resource and regulatory agencies have been incorporated and/or addressed in this integrated FR and EA.

7.2.3 TRIBAL CONSULTATION

The analysis of a proposed project's potential effect on Tribal lands, resources, or areas of historic significance is an important part of the NEPA process. Council on Environmental Quality (CEQ) regulations, Section 1501.2 and Section 1501.7, outline the involvement of Tribes that may be affected by a federal action and their participation

in the review of NEPA documents. Executive Order (EO) 13175, "Consultation and Coordination With Indian Tribal Governments" (November 6, 2000), outlines consultation requirements with tribal governments. Federal agencies additionally utilize policy documents that provide agency-specific provisions for coordination with tribal entities.

Native American tribes continue to have an inherent interest in the state's natural and cultural resources. The federal government recognizes tribes' inherent sovereign status, a unique relationship that is embodied in the U.S. Constitution, treaties, court decisions, federal statutes and EOs. Federal agencies consult with tribes on planning projects to listen to and address their concerns. Section 106 of the National Historic Preservation Act (NHPA), USC Title 54, requires tribal consultation in all steps of the process when a federal agency project or effort may affect historic properties that are either located on tribal lands or when any Native American tribe attaches religious or cultural significance to the historic property, regardless of the property's location.

Tribal consultation was initiated with letters from USACE dated November 8, 2023. As of March 2025, responses to the letters have been received from the Comanche Nation, as well as the American Indians of Texas at Spanish Colonial Missions on behalf of the Tap Pilam Coahuiltecan Nation. (The Comanche are a Federally recognized tribe; the Tap Pilam Coahuiltecan are not.) No Tribal comments received to date have expressed concerns that may require alterations to the proposed project. Tribal coordination will continue as the proposed project progresses.

7.2.4 LIST OF STATEMENT RECIPIENTS

Copies of the draft and final integrated FR and EA will be circulated to applicable federal, state, and local agencies. Interested organizations and individuals will be sent the draft and final integrated FR and EA along with instructions on how to access the documents online and/or request electronic copies. Agencies that will be sent access to electronic copies of the EA are listed in Table 7-2.

7.2.5 PUBLIC COMMENTS RECEIVED AND REPONSES

The public has been afforded the opportunity to comment on the proposed Raymondville Drain Project. The previous draft of the report was made available for public review and following the specified comment period, all comments submitted were evaluated, considered and incorporated into this document. The views and concerns were used to develop planning objectives, identify significant resources and issues, evaluate impacts of various alternatives, and identify a plan that is socially and environmentally responsible.

Two public hearings were held for the proposed project on June 11, 2019, and June 12, 2019. Notices of the public hearings were published approximately one month prior to the Hearing in the *Monitor,* the *Valley Morning Star, and El Herald* (Spanish newspaper) on May 11, 2019. A digital notice was published on May 10, 2019, on the *El Extra* (Spanish newspaper) website. Additionally, notices were sent to local, state, and congressional representatives with constituents in the area in which the Raymondville Drain Project is located. The first public hearing was held on June 11, 2019, at the Hidalgo County Precinct 4 Endowment Center in Edinburg, Texas with a

Figure 7-1, Attendees of Public Hearing held in Hidalgo County on June 11, 2019

total of 23 attendees, including four members of the public (see Figure 7-1). The second public hearing was held on June 12, 2019, at the Willacy County Safe Room in Raymondville, Texas with a total of 24 attendees, including one member of the public.

The purpose of the public hearings was to present the preliminary findings of the environmental review of the Raymondville Drain Project. Each public hearing commenced with a thirty-minute open house forum, allowing attendees to examine informational handouts available in both English and Spanish, exhibit boards, design schematics, and the DSEIS for the Raymondville Drain Project. The attendees were encouraged to engage in discussions with the project team to address any questions related to the proposed project design and environmental considerations. Each attendee received a comment form, a map of the Raymondville Drain Project location, and an informational handout providing details about the proposed project.

During the public hearings, attendees had the option to either speak at the hearing or submit written comments during the designated public comment period, which concluded on July 26, 2019. A court reporter was present to transcribe the hearing and record any verbal comments from the public.

Three public comments were received for the Raymondville Drain Project during the comment period. One comment was submitted in writing during the Willacy County public hearing, while two comments were received via email before the comment period ended. The comments focused on specific concerns related to the project's potential effects on the Laguna Madre ecosystem. One of the comments expressed concerns about the impact of the project's freshwater intake on the salinity levels, sedimentation, and turbidity of the Laguna Madre. Another comment expressed a concern about pollutants entering the Laguna Madre through surface runoff and a concern for the potential contamination of the ecosystem. The third comment specifically addressed the potential impact of the project's freshwater input and the disruption of seagrass habitats.

All comments received during the public hearings and the specified comment period were addressed in the Public Hearing Summary Report for the proposed project. Every effort has been made, and will continue to be made, to ensure that limited English proficiency Spanish speakers have equal opportunities to fully participate in the public involvement process.

To address the concerns regarding potential impacts on seagrasses and water quality in the Laguna Madre ecosystem, a seagrass survey was conducted. This survey gathered data on the existing seagrass populations and assessed potential construction-related impacts associated with the Raymondville Drain Project in the future. The findings from the seagrass survey contributed to the conclusion of no anticipated impacts on seagrasses in the Laguna Madre ecosystem, nor will the project impact any ongoing seagrass restoration efforts.

To enable additional public input into this report, the PDT conducted a series of Community Outreach Pop-Up Events in Lasara, Edinburg, Hargill, San Perlita, and Raymondville in late July 2023. The events are listed in Table 7-3. The pop-up events were designed to be more accessible to the public and were held in temporary locations to engage the public and solicit their feedback on the Raymondville Drain Project. To ensure effective communication with residents and property owners adjacent to the Raymondville Drain Project, a dedicated phoneline and email address were established, allowing property owners to easily reach out to the project team with any inquiries or requests for information about the proposed Project.

Table 7-3: Community Outreach Pop-Up Events	
Date & Time	Location
July 25, 2023, 4:00 pm – 6:00 pm	St. Patrick's Catholic Church, Lasara
July 26, 2023, 11:00 am – 1:00 pm	Jacob de la Garza Park North, Edinburg
July 26, 2023, 4:00 pm – 6:00 pm	P&L Service Grocery and Convenience Store, Hargill
July 27, 2023, 11:00 am – 1:00 pm	R2 Country Store, San Perlita
July 27, 2023, 4:00 pm – 6:00 pm	Veterans Park, Raymondville

SECTION 8.0 SPONSOR RECOMMENDATION

As the General Manager of the non-federal sponsor, Hidalgo County Drainage District #1 (HCDD1), I have considered all the significant aspects of this study including the environmental, social, and economic effects, the engineering feasibility, and the comments received from other resource agencies and the public, and have determined that the Recommended Plan presented in this report is in the overall public interest and a justified expenditure of local and federal funds.

I request that the Assistant Secretary of the Army for Civil Works (ASA(CW)) transmit a favorable recommendation to Congress to authorize a plan to reduce flood risk by the construction of the Recommended Plan. The proposed project would divert flows from the North Main Drain to a new extension of the Raymondville Drain at a new control structure near Edinburg Lake. The proposed project generally consists of approximately 13.8 miles of new diversion drains in Hidalgo County, approximately 43 miles of drain improvements in Hidalgo and Willacy counties, an approximately 270-acre detention pond in Hidalgo County, and five control structures. The plan also includes utility relocations and the replacement or new construction of approximately 69 bridge structures or culvert crossings. The proposed project would be constructed within a 350- or 450-foot-wide Right of Way.

Reducing flow upstream in the North Main Drain System improves regional stormwater capacity, significantly reducing damages in Hidalgo County in the vicinity of the diversion and reducing flooding downstream in the watershed. The Recommended Plan also provides flood relief along the Raymondville Drain in Hidalgo and Willacy counties simultaneously through increased in-channel storage capacity throughout the system, increased through flow capacity, and controlled flow from Hidalgo County to Willacy County. The Recommended Plan would significantly reduce flood damage and flood risk in portions of the Lower Rio Grande Valley, benefiting over 38,000 structures, including structures in economically disadvantaged communities.

(NOTE: Costs to be updated after completion of Cost Certification by USACE.) The Recommended Plan is the National Economic Development (NED) Plan and is estimated to reduce the equivalent annual damages in the Raymondville Drain basin in Hidalgo County by approximately 59%, and in Willacy County by 84%, and by 26% within the North Main Drain basin, with estimated annual net benefits of approximately $38.4 million. HCDD1 is currently responsible for maintaining the existing Raymondville Drain project, which is a key component to reduce region-wide flood risk.

HCDD1 would be the non-federal cost-sharing sponsor and primary execution organization for the authorized project, as would be established in the Project Partnership Agreement (PPA). The total estimated project cost of the NED flood risk management plan based on 2025 price levels is $838,622,000, with the federal and non-federal shares of total first cost estimated at $545,104,000 and $293,518,000, respectively. HCDD1 would also be responsible for the operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of the project after construction, a cost currently estimated at $1,898,000 per year. Based on a 2.75 percent discount rate and a 50-year period of analysis, the total equivalent annual costs of the project, including OMRR&R, are estimated to be $27,568,000. The equivalent average annual benefits are estimated to be $38,393,000, and the BCR is 1.39. In addition to quantified economic benefits, the proposed project provides significant additional Other Social Effects (OSE) benefits, including public health and safety, and support to low-income at-risk communities throughout the region.

Reasonable risk and uncertainty was factored into the economic analysis through the use of statistical risk-based models to formulate and evaluate the alternatives. HEC-FDA, a probability based economic model was used to compute stage-damage curves and equivalent annual damages (with and without project) based on water surface profiles by flood event probability, asset (structure) inventory and damage relationship functions. Development of the NED plan considered uncertainty and error distributions in the depth damage functions, structure values, content and other value ratios, and first floor flood stages. This uncertainty was applied by damage reaches and categories to develop the total aggregated stage damage-uncertainty functions. Potential Intensification, and Location Benefits were not quantified, so computed benefits have been conservatively estimated, ensuring that the project is economically justified.

My recommendation is that the plan to reduce flood damage in the Lower Rio Grande Valley be authorized at an estimated cost of $838,622,000, with such modifications as in the discretion of the ASA(CW) may be advisable. This recommendation is subject to cost sharing, financing, and other applicable requirements of federal laws and policies, including Section 103 of PL 99-662, Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2213).

I propose the following items of local cooperation from HCDD1, subject to additional conditions posted at the discretion of the ASA(CW):

a. Provide a minimum of 35 percent, but not to exceed 50 percent, of the total structural flood damage reduction costs as further specified below:
    i. Contribute a minimum of 35 percent, up to a maximum of 50 percent of construction costs, includes the requirement for the non-federal sponsor to provide 5 percent of construction costs in cash.
    ii. In providing in-kind contributions, if any, the non-federal sponsor will be required to obtain all applicable licenses and permits necessary for such work.
    iii. Contribute a minimum of 35 percent of design costs in accordance with the terms of a design agreement for the project, as appropriate.
    iv. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations, and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material as determined by the Federal Government to be required or to be necessary for the construction, operation, and maintenance of the project, all in compliance with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL. 91-646, as amended (42 USC 4601—4655) and the Uniform Regulations contained in 49 CFR Part 24; and
    v. Pay, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of total structural flood damage reduction costs.
    vi. The non-federal sponsor shall not use federal program funds to meet any of its obligations unless the federal agency providing the funds verifies in writing that the funds are authorized to be used for the project.
b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements and rights-of-way or the addition of facilities that might reduce the flood carrying capacities produced by the project or otherwise hinder operation and maintenance of the project.
c. Inform affected interests, at least yearly, of the extent of protection afforded by the flood risk

management features; participate in and comply with applicable federal floodplain management and flood insurance programs; comply with Section 402 of WRDA 1986, as amended (33 USC 701b-l2); and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the flood risk management features.

d. Operate, maintain, repair, rehabilitate and replace the project at no cost to the federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal laws and regulations and any specific directions prescribed by the federal government.
e. Give the federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating or replacing the project.
f. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors.
g. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601—9675, that may exist in, on, or under lands, easements, or rights-of-way that the federal government determines to be necessary for the construction or operation and maintenance of the project.
h. Assume, as between the federal government and the non-federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way required for construction, operation, maintenance, repair, rehabilitation or replacement of the project.
i. Agree, as between the federal government and the non-federal sponsor, that the non-federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate and replace the project in a manner that will not cause liability to arise under CERCLA.

My recommendation reflects the information available at this time, 2025 price levels, and current Departmental policies governing the formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program, nor the perspective of higher levels of review within the Executive Branch. Consequently, my recommendation may be modified before it is transmitted to the Congress as proposals for authorization and/or implementation funding. However, prior to transmittal to Congress, the states, interested federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Date

Raul E. Sesin, PE, CFM
Hidalgo County Drainage District No. 1
General Manager

SECTION 9.0 LIST OF PREPARERS

This report was prepared on behalf of HCDD1 by RRP Consulting Engineers, LLC / S&B Infrastructure, Ltd., and their subcontractors. Efforts included close consultation and collaboration with the USACE Galveston District. Preparers are listed in Table 9-1, and USACE consultants are listed in Table 9-2.

** NOTE: Individuals marked with an asterisk are no longer with the identified organization.*

Table 9-1: List of Preparers

Name/Title	Experience (Years)	Feasibility Report and EA Area of Responsibility
Hidalgo County Drainage District No. 1		
Raul Sesin, PE, CFM General Manager	30	Non-Federal Sponsor
Omar Anzaldua, PE, CFM, PMP Assistant District General Manager	23	Project Manager for Non-Federal Sponsor
RRP Consulting Engineers, LLC / S&B Infrastructure, Ltd.		
Daniel Garces, PE Project Manager	23	Client Representative, Project Management
Robert A. Bank, PE, F.ASCE Program Manager, Coastal Engineering	41	Project Management, Engineering and Planning Policy, QC Manager
James Kisiel, PE, PMP* Federal Program Manager	31	Project Management
Jonathan Prukop, PE Project Engineer	8	Planning, Engineering, Designs
Emily Hathoot, EIT Civil/Structural Specialist	24	Hydrology, Hydraulics Analysis, Economics, Design
Frank Duran, PE* Project Manager	21	Hydrology, Hydraulics Analysis, Economics, Design
Jose Salinas III Civil/Structural Designer	18	Hydrology, Hydraulics Analysis, Mapping
David Young Environmental Manager	32	NEPA Lead, Quality Control
Barbara Castille, ENV SP* Senior Environmental Scientist	36	NEPA Lead, Alternatives Analysis, Environmental Impacts/Compliance, Public Involvement
Thomas Fitzgibbons, CAE, ENV SP Environmental Scientist	8	Alternatives Analysis, Threatened/ Endangered Species, Wildlife,
Joseph Cortez, ENV SP* Environmental Scientist	7	HTRW, Threatened/Endangered Species, Wildlife, Public Involvement
Joel Aguirre* Senior GIS Analyst	31	GIS Data, Analysis and Mapping, Public Involvement

Table 9-1: List of Preparers

Name/Title	Experience (Years)	Feasibility Report and EA Area of Responsibility
Andres Hernandez, EIT Civil/Structural Specialist	3	Engineering, Cost, Designs
Mya Briones * Environmental Intern	1	Public Involvement
IEPR Contractor		
(Names withheld for confidentiality)		Independent External Peer Review
Freese and Nichols, Inc.		
David Buzan Ecologist/Environmental Scientist	46	Seagrass Survey; Lead Scientist, Data Collection, Report
Tom Dixon Ecologist/Environmental Scientist	20	Seagrass Survey; Coastal Ecologist and Project Oversight, Data Collection
Lisa Vitale Marine Biologist	29	Seagrass Survey; Report Quality Control)
Avery Mottet Environmental Scientist	2	Seagrass Survey; Data Collection
MOCA Systems, Inc.		
Lucas McGlone Senior Cost Estimator	26	Cost Estimate, Validations and Review
Thomas Sanders, Jr., CCEA, CBA* Chief Economist	40	Cost and Schedule Risk Analysis
Ben Cass, AEP Senior Cost Estimator	13	Cost Estimate, Validations and Review
Ken Kawasaki, CCP Principal Risk Analyst	28	Cost and Schedule Risk Analysis
Stantec, Inc.		
Walter Meitzen Senior Ecologist	15	Wetland Delineation Team Lead
Scotty Moore Senior Archaeologist	24	Cultural Resources Investigations
Diana Gonzalez-Tennant, MA, RPA Archaeologist	13	Cultural Resources Investigations

Justin Edgington Historian/Architectural Photographer	17	Cultural Resources Investigations
Emily Reed Architectural History Technical Area Leader	20	Cultural Resources Investigations
Star Geoenvironmental Services		
Aravind Marella, PE, PMP President/Principal Engineer	22	Socioeconomic Analysis, Hazardous Materials Investigations
Kim Credeur Principal Geologist	33	Quality control
Mike Johnston Environmental Scientist	31	Hazardous materials investigations
Mary Sisemore Environmental Scientist	11	Socioeconomic Analysis, Hazardous Materials Investigations
Holly Meier Environmental Scientist	3	Socioeconomic Analysis, Hazardous Materials Investigations

Table 9-2: List of USACE Consultants

Name/Title	Experience (Years)	Feasibility Report and EA Area of Responsibility
US Army Corps of Engineers, Galveston District (Consultation Only)		
Franchelle C. Nealy, PMP Senior Project Manager	20	USACE Project Management
Gretchen S. Brown* Senior Project Manager	16	USACE Project Management
Lisa McCracken-Mairs Senior Project Manager	20	USACE Project Management
Ryan Miranda, RPA Maritime Archaeologist	4	Archeology Review and Consultation
Philip Hejduk Planner	9	Planning Review and Consultation
Norm Lewis* Regional Economist	26	Economics Review and Consultation
Paul Hamilton, PhD Hydraulics & Hydrology	8	H&H Review and Consultation
US Army Corps of Engineers, Regional Planning and Environmental Center, Southwest Division (Consultation Only)		
Melinda Fisher* Environmental Planning Lead	20	Environmental impacts and environmental compliance
Corrine Rampaul Realty Specialist	4	USACE Project Coordinator
Christopher Wrbas Environmental Planning	23	Point of Contact to Consultants
Christopher Brandon Ford Biologist	10	Environmental Coordinator

APPENDICES

A-1 ENGINEERING

A-2 COST ENGINEERING

A-3 ENVIRONMENTAL & PUBLIC INVOLVEMENT

A-4 REAL ESTATE

A-5 ECONOMICS

A-6 RISK REGISTER (TO BE INCLUDED IN THE FINAL REPORT)

A-7 REVIEW DOCUMENTATION (TO BE INCLUDED IN THE FINAL REPORT)

A-8 ACRONYMS AND REFERENCES