"ONE TEAM, ONE MISSION"

CARIBBEAN DISTRICT

U.S. ARMY

US Army Corps of Engineers®

GOBIERNO DE PUERTO RICO

DRNA

DEPARTAMENTO DE RECURSOS NATURALES Y AMBIENTALES

RIO PUERTO NUEVO PROJECT – CIAM 8990 COURSE

Virtual
Date: 8 October 2024

San Juan, Puerto Rico

Rio Puerto Nuevo, Contract 2 – Roosevelt Avenue Bridge Replacement

U.S. ARMY

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GOBIERNO DE PUERTO RICO DRNA DEPARTAMENTO DE RECURSOS NATURALES Y AMBIENTALES

AGENDA

- ❖ WELCOME AND INTRODUCTIONS
- ❖ PROJECT BACKGROUND AND OVERVIEW
- ❖ EXISTING CONDITIONS & IMPACTS
- ❖ DESIGN EVOLUTION AND NATURE BASED SOLUTIONS
- ❖ DESIGN REQUIREMENTS CONSIDERATIONS AND UPDATES
- ❖ OTHER ANALYZED DESIGN ALTERNATIVES
- ❖ PUBLIC INFORMATION / COMMUNICATIONS
- ❖ MOVING FORWARD WITH CHANGE
- ❖ QUESTIONS

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT PROJECT BACKGROUND AND OVERVIEW

RÍO PUERTO NUEVO

Flood Risk Management Project Timeline

DEPARTAMENTO DE RECURSOS NATURALES Y AMBIENTALES DRNA

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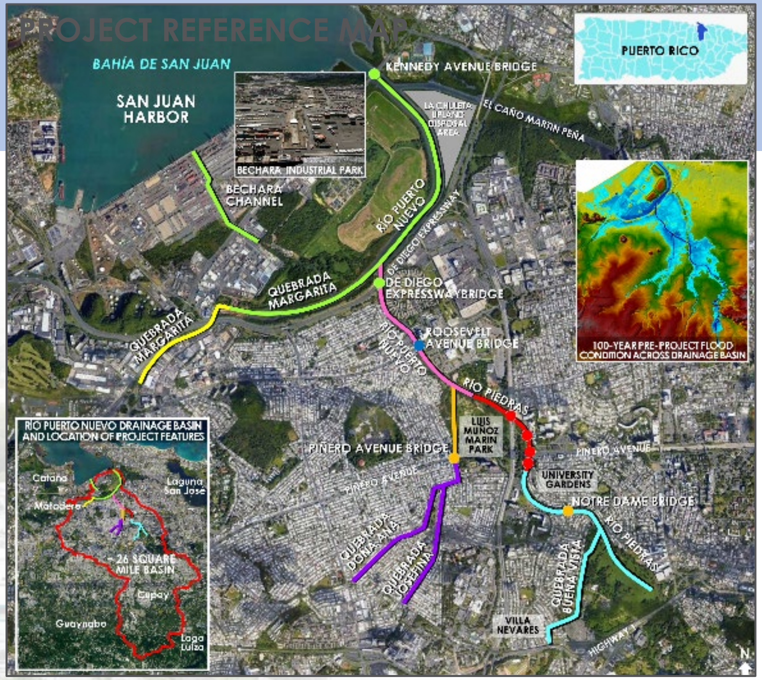


ORIGINAL PLANNING PHASE (FULL PROJECT)

1978
FEASIBILITY STUDY
"Río Puerto Nuevo Survey Investigation" initiated at the request of the Commonwealth of Puerto Rico.

1984
ENVIRONMENTAL IMPACT STATEMENT (EIS)
prepared and completed in October.

1986
CHIEF OF ENGINEERS REPORT
signed April 25 with a final Benefit Cost Ratio (BCR) of 2.6 to 1.

1992
GENERAL DESIGN MEMORANDUM (GDM) AND ENVIRONMENTAL ASSESSMENT (EA)
completed. A Finding of No Significant Impact (FONSI) was signed July 30.

1993
WATER QUALITY CERTIFICATION
issued by the Puerto Rico Environmental Quality Board (EQB) with no expiration. Water Quality remains in conformity with section 401(a)(1) of the Clean Water Act.

LOWER PUERTO NUEVO PROJECT IMPLEMENTATION (1993-2022)

Puerto Nuevo Channel, Margarita Channel, Bechara Channel, De Diego Bridge Retrofit, Upper Margarita Stilling Basin and 2D walls construction. All construction has been completed.

1993
FIRST CONSTRUCTION PROJECT AWARDED:
Puerto Nuevo Channel, Miramar Trunk Sewer Siphon, Kennedy Avenue Bridge Retrofit.

2002
UPDATED EA AND FONSI
Bechara Channel Project Industrial Area design changes and realignment of the Margarita Levee. FONSI signed March 29.

2010
WETLAND MITIGATION PLAN
completed in March.

2013-2014
UPDATED ENDANGERED SPECIES ACT (ESA) SECTION 7 INFORMAL CONSULTATION
(USFWS, NMFS*) for remainder of project; consultation addressed endangered species that may occur within the project area.

Wetland Mitigation Plan Revised.

2015
ESSENTIAL FISH HABITAT CONSULTATION WITH NMFS

2015
WETLAND MITIGATION
completed, and requirements met April 2015. Planted over 25 acres along Margarita Channel.

UPPER PUERTO NUEVO PROJECT IMPLEMENTATION (2017 - PRESENT)

2017
HURRICANE MARIA
makes landfall in Puerto Rico.

2018
BIPARTISAN BUDGET ACT OF 2018 (BBA-18)
(P.L. 115-123) (BBA-18) signed.

2019
SUPPLEMENTAL CONTRACTS 1- 3 DESIGNS FOR CONSTRUCTION INITIATED:
Upper Margarita Channel, Roosevelt Avenue Bridge Replacement, and Rio Piedras main channel construction up to Luis Muñoz Marin Park.

2019-Present
USACE working with the non-federal sponsor, the Department of Natural and Environmental Resources (DNER), to coordinate with all external stakeholders, including meetings with the public to provide project information and updates.

2020
CONTINUING CONSTRUCTION VALIDATION REPORT
signed in March recommending to proceed with implementation of the project under BBA-18 within Chief's Authority.

2022
SECTION 106, HISTORIC PRESERVATION ACT (54 USC 300101)
and its implementing regulations (36 CFR 800) consultation will be completed prior to construction. Anticipated date is October 2022.

2024
CONTRACT 2 IS AWARDED:
Roosevelt Avenue Bridge replacement is awarded on 9 April 2024 for \$150.7M. <u>This is the first major project awarded in Puerto Rico as part of BBA-18.</u>

* USFWS: U.S. Fish and Wildlife Service
* NMFS: National Marine Fisheries Service

RIO PUERTO NUEVO OVERVIEW





COMPLETED (COST SHARED)

CONTRACTS 1, 1A, 2A/AR, 2AA, 2C1, 2D WALLS

STATUS: 2D Walls, last completed, was May 2022

AMOUNT: $470M

- Kennedy Bridge seismic retrofit; 36-inch water line
- First 1.3 miles of channel improvements
- Quebrada Margarita channel excavation and confluence wall; lower Puerto Nuevo channel dredging
- Bechara Channel secant pile wall box culvert; 90-inch sewer line modification; open channel work
- De Diego Expressway Bridge abutments; east and west pier drill shaft reinforcement
- Quebrada Margarita Stilling Basin
- Construction of 350-foot left channel wall and 750-foot right channel wall at channel confluence.

ONGOING (SUPPLEMENTAL) CONSTRUCTION

CONTRACT - LA CHULETA

- Upland Material Management Area (future capacity of ~350,000 cubic yards of material)

REMAINING (SUPPLEMENTAL) CONSTRUCTION

CONTRACT 1 | UPPER MARGARITA CHANNEL

- Sewer line relocation
- Construction of .63 miles of channel improvements at Upper Quebrada Margarita

CONTRACT 2 | ROOSEVELT BRIDGE

- Roosevelt Avenue Bridge replacement

CONTRACT 3 | MAIN CHANNEL (RIO PIEDRAS)

- Channel walls
- 1.1 miles of Main Channel improvements

CONTRACT 4 | LAS AMERICAS BRIDGES

- Channel, Stilling Basin and Bridge Replacements
  - 4A-1: Las Americas Expressway Bridge
  - 4A-2: Piñero Avenue Bridge East
  - 4A-3: Northeast Access Ramp Bridge
  - 4A-4: Southeast Access Ramp Bridge

CONTRACT 5 | NOTRE DAME & W. PIÑERO BRIDGE

- 5A: Notre Dame Bridge replacement
- 5B: Piñero Avenue Bridge West replacement; Quebrada Josefina downstream to Río Piedras

CONTRACT 6 | MAIN CHANNEL / BUENA VISTA

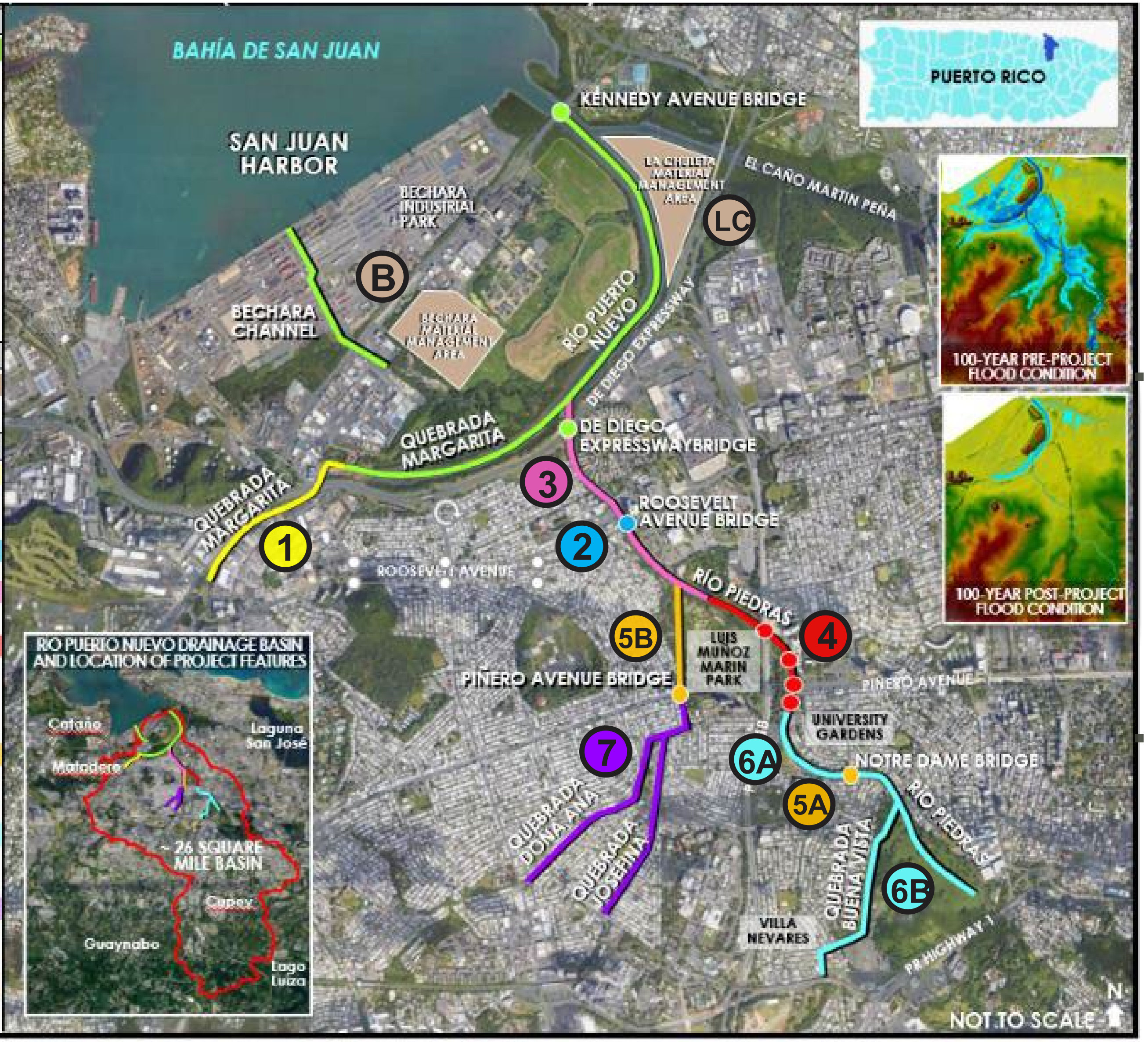
- 1.75 miles of Rio Piedras channel improvements
- 4 bridges (2 new; 2 replacements)
- .80 miles channel diversion at Quebrada Buena Vista

CONTRACT 7 | JOSEFINA & DOÑA ANA CHANNEL

- 10 bridge replacements
- 5000 LF. of Quebrada Josefina and 4400 LF. of Quebrada Doña channel improvement

CONTRACT - BECHARA

- Upland Material Management Area (future capacity of ~600,000 cubic yards of material)



Sponsor: PR Department of Natural and Environmental Resources (DNER)

Funding: Approved Current Working Estimate $1,584,982,000 (funds available at HQUSACE),

Description and Status:

- Construction will be accomplished in 17 contracts. Six contracts have been completed and ten contracts are currently in design. Upcoming contracts to be awarded are Contract 2 in March 2024 and Contract 3 in Winter 2024. The project's construction completion is expected in 2033.
- This project was fully funded by the Bipartisan Budget Act of 2018 (BBA 2018), however current cost estimates exceed approved funding levels.

Updates:

- Team continues working with communities along Rio Piedras and Reparto Metropolitano. There has been significant progress made, with more to come.
- There is a heavy emphasis of Engineering with Nature on the design, collaboration with ERDC and continuing input from communities that is resulted in meaningful change to project.
- Reduction of >30 acres of concrete from the project!

Construction Temporary Impacts:

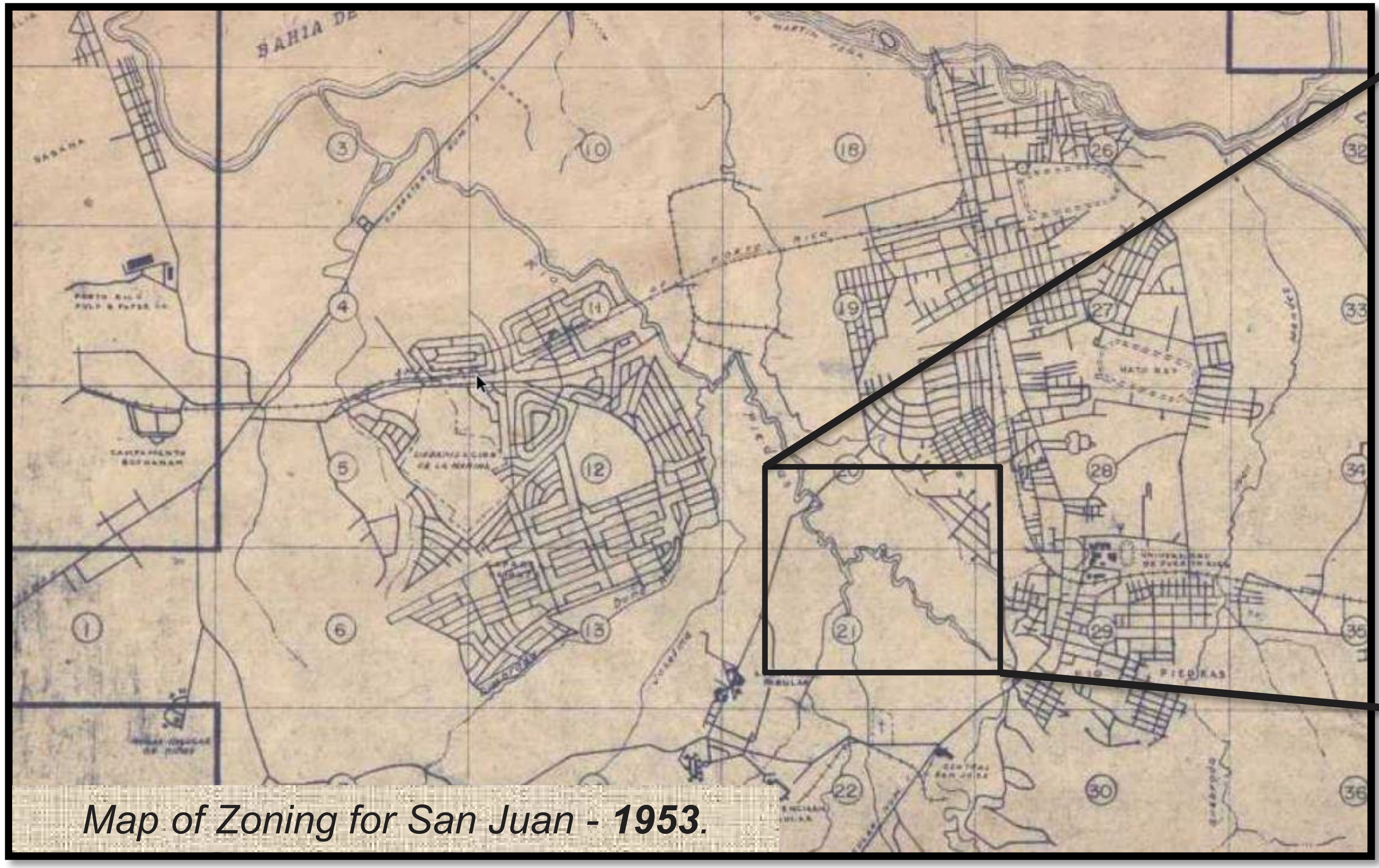
- Temporary impacts to environment; typical during construction
- Removal of trees to allow construction access
- Maintenance of traffic
- Temporary Inconvenience (fencing, dust, noise, etc.)

RIO PIEDRAS – EXISTING CONDITIONS & IMPACTS

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

BACKGROUND

- Río Piedras was channelized in the 1950's – 1960's
- Twenty-six square miles of highly urbanized, densely populated flood basin
- Existing channel overflows when heavy rain events
- Bank full flows tend to occur frequently, every two years on average



*Map of Zoning for San Juan - **1953**.*

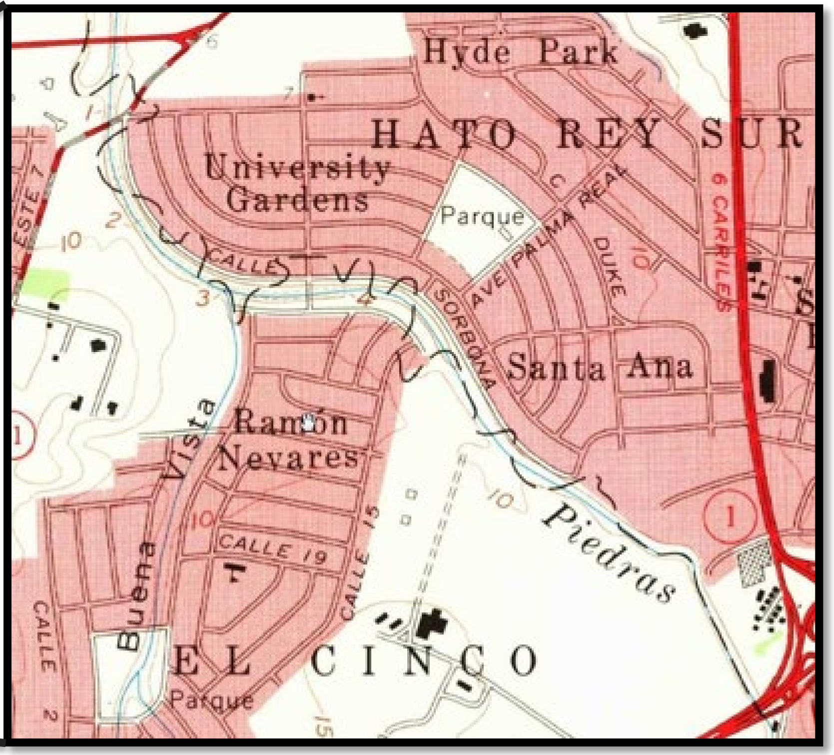
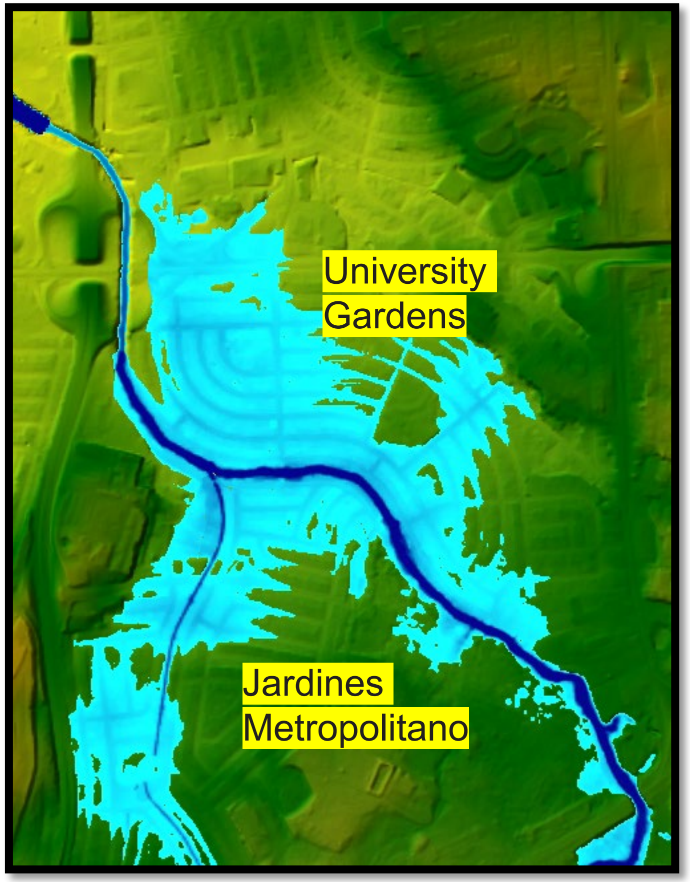
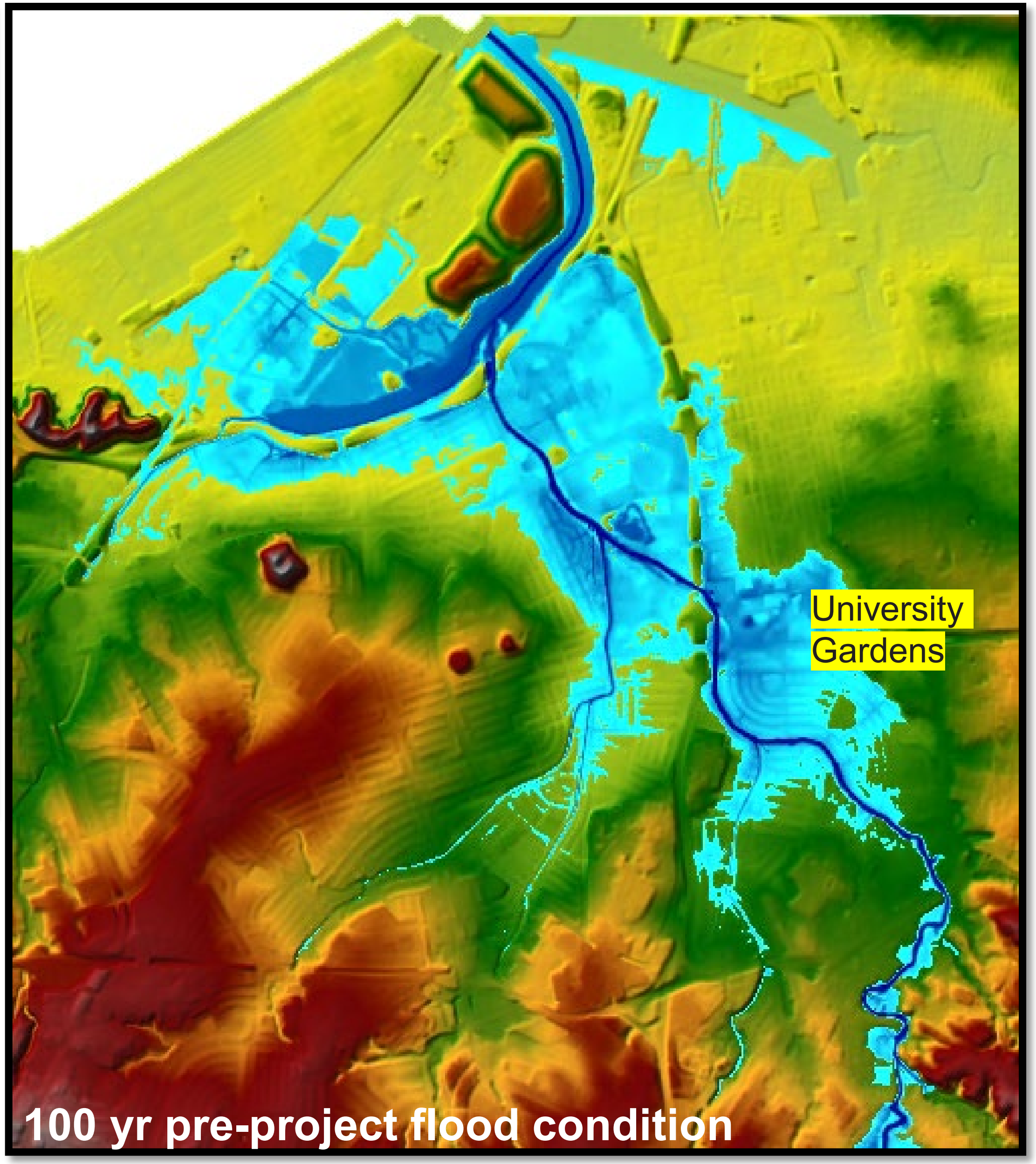


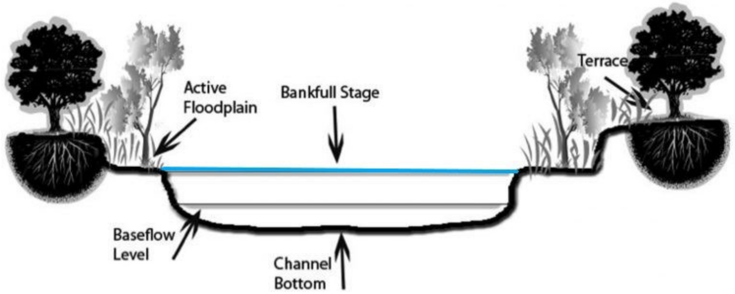
*Image of the existing channel in **1963**.*

RIO PUERTO NUEVO – PRE PROJECT CONDITIONS

- 26 square miles of highly urbanized, densely populated flood basin
- Existing channel overflows above 2-year storm event (bank full)
- Bank full refers to the water level stage that just begins to spill out of the channel into the floodplain.
- Bank full flows tend to occur frequently, on the average every two years (50% chance each year), its how the river form its channel; natural river process.







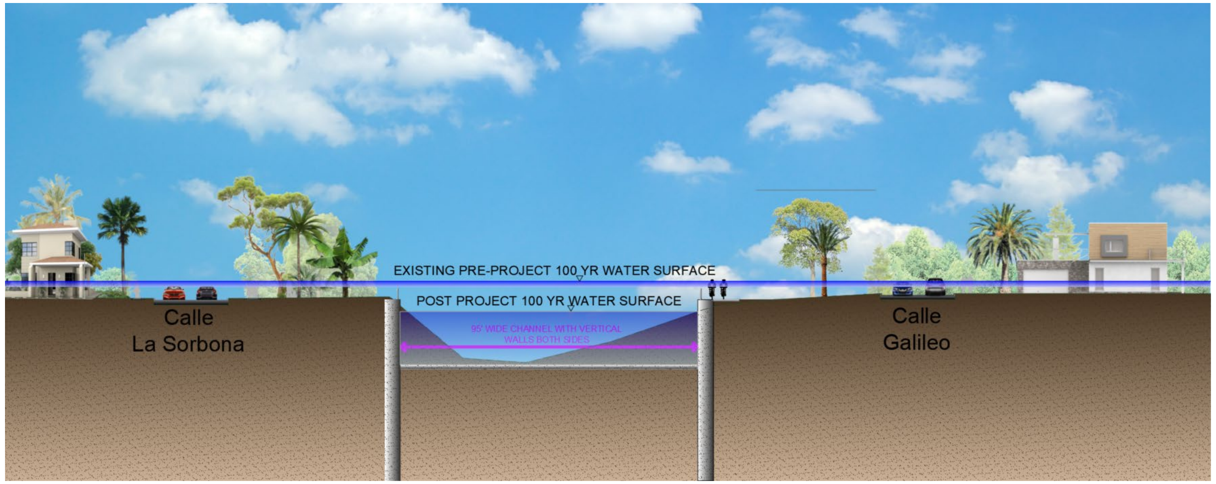
	Low lying areas
	High lying areas (above flood area)
	Higher elevated area
	Highest elevation in basin
	Shallow flooding area
	Heavier flooding area

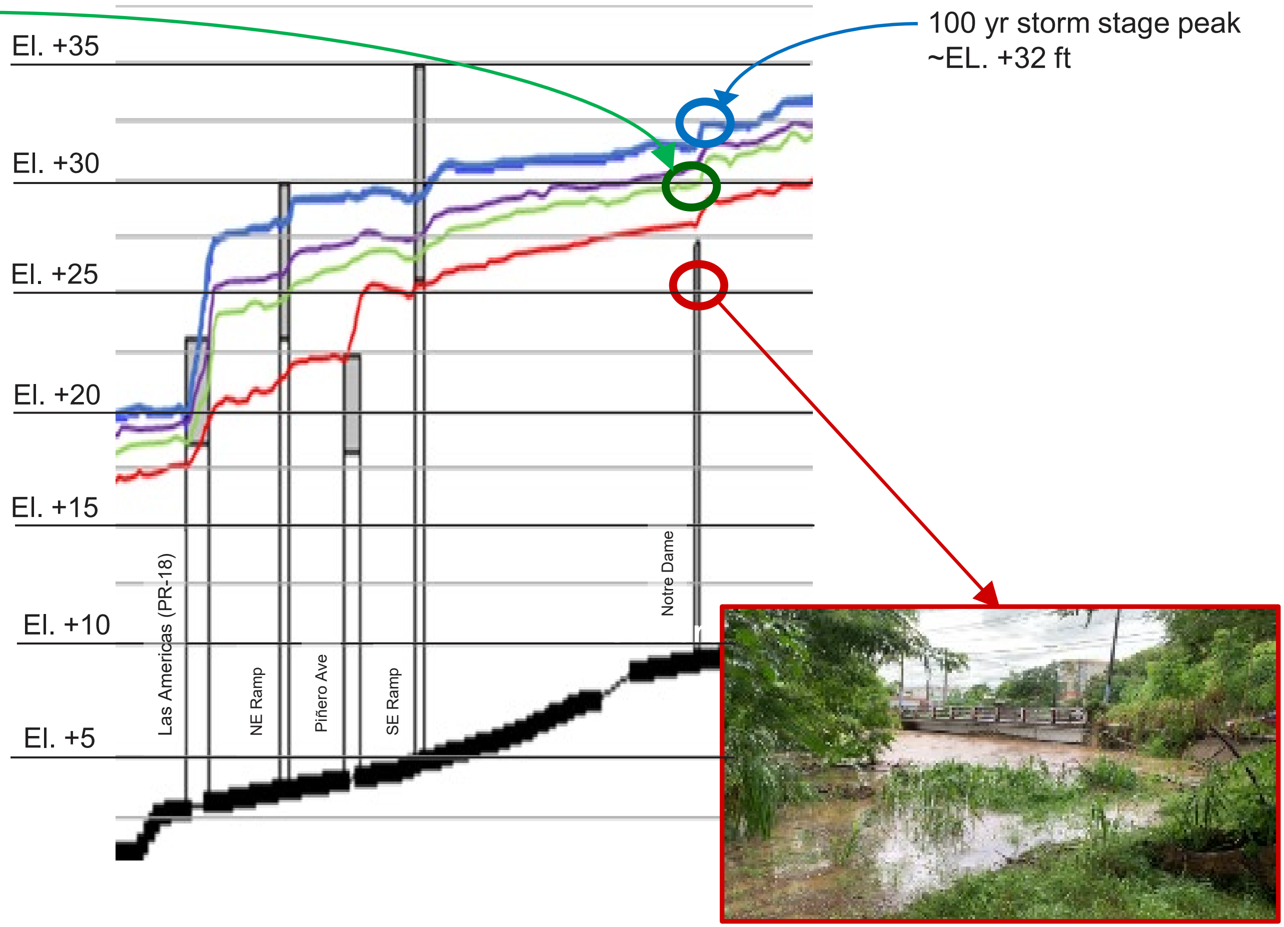
SAN JUAN BASIN FLOODING EXAMPLES & HISTORY

RIO PUERTO NUEVO – IMPORTANCE OF PROJECT

Note: Video taken on corner of Calle Interamericana and Calle Oxford showing flooding of Rio Piedras during a 5 to 10-yr storm event on November 15-19, 2009.

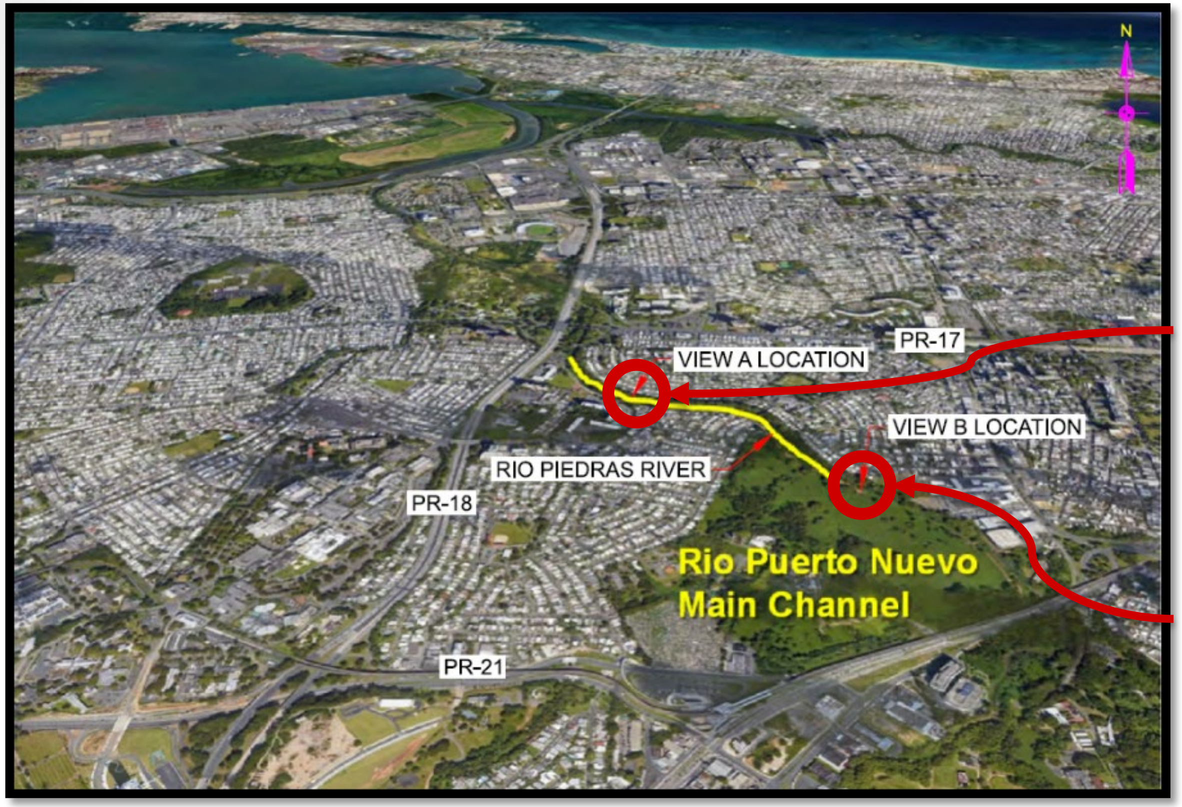
Credit: https://www.youtube.com/watch?v=T_osfiDlaqA

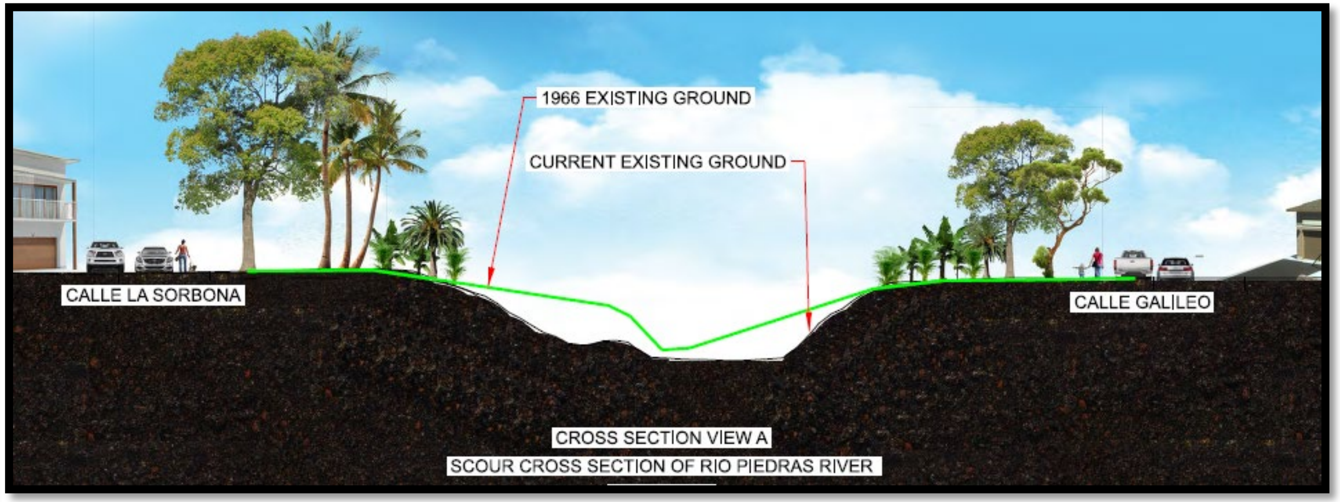


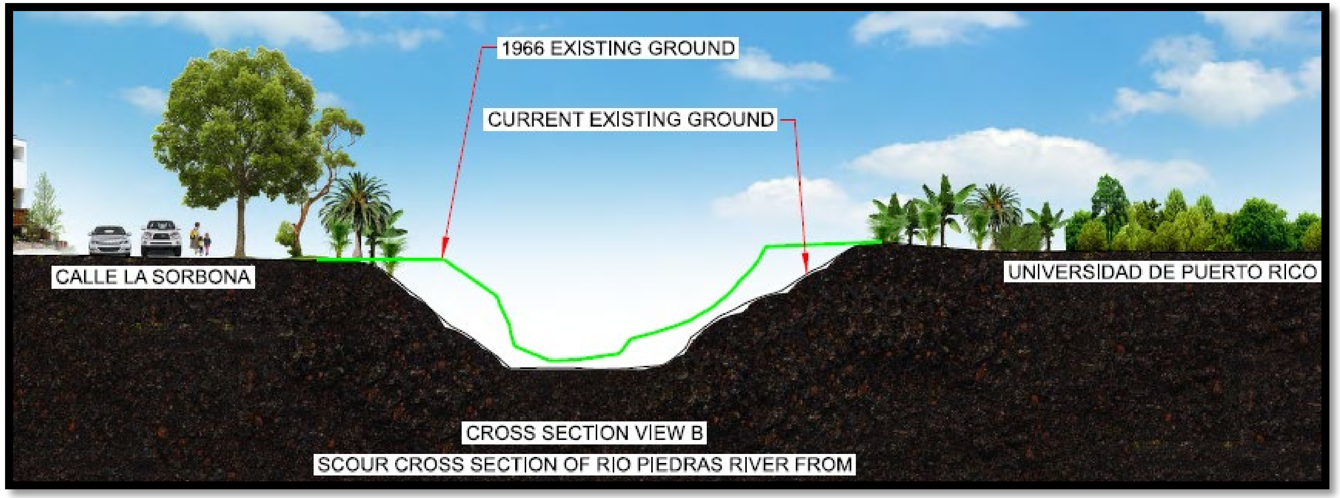


Note: Profile above highlights Notre Dame Bridge flooding between recently seen 1-yr event (~25-ft water elevation & 15-ft above existing grade) and a 100-year storm event which would increase flooding by an additional ~8-ft.

RIO PIEDRAS – HISTORICAL EROSION CONTRACT 6A







RIO PIEDRAS – HISTORICAL EROSION CONTRACT 6A

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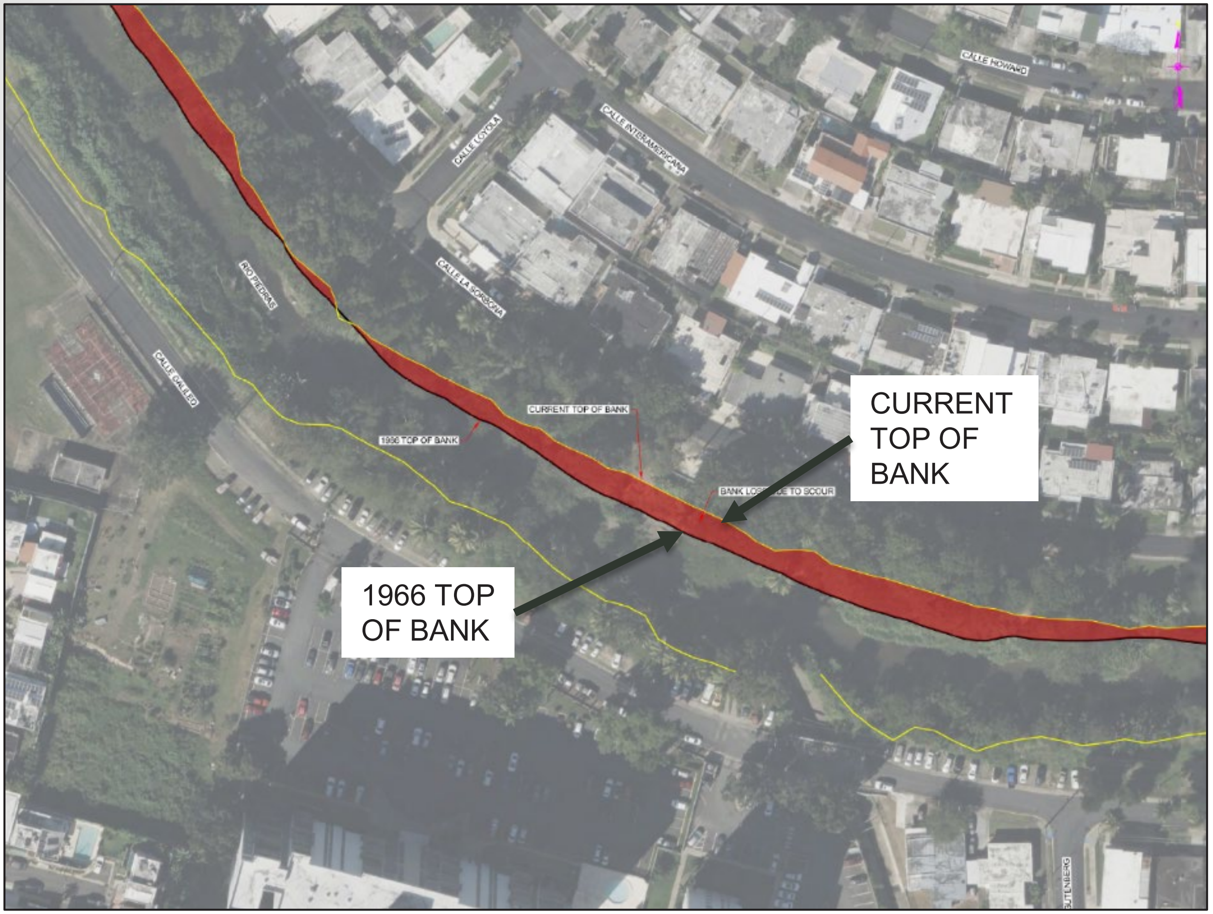
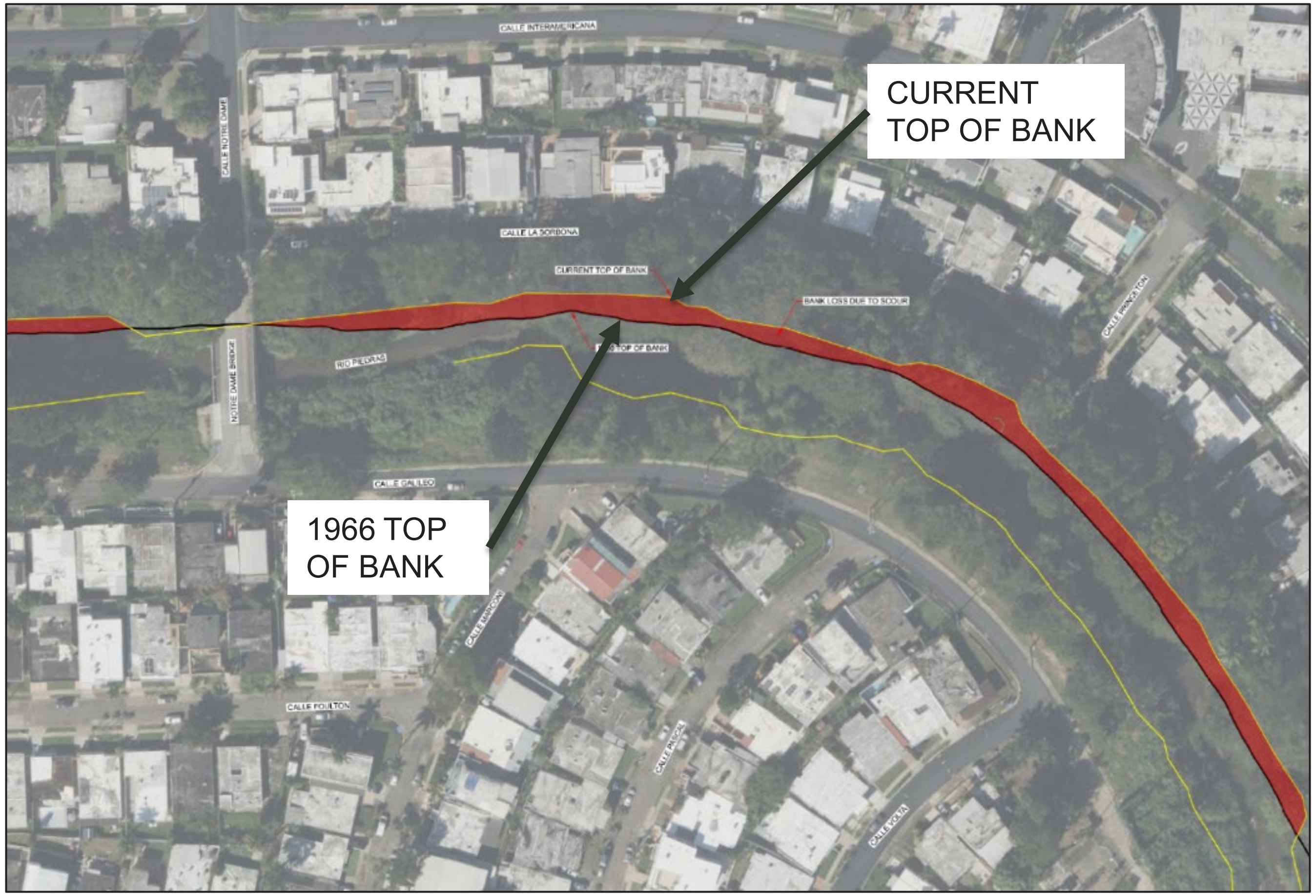




EXISTING CONDITIONS – BUENA VISTA CHANNEL CONTRACT 6 – VILLA NEVARES

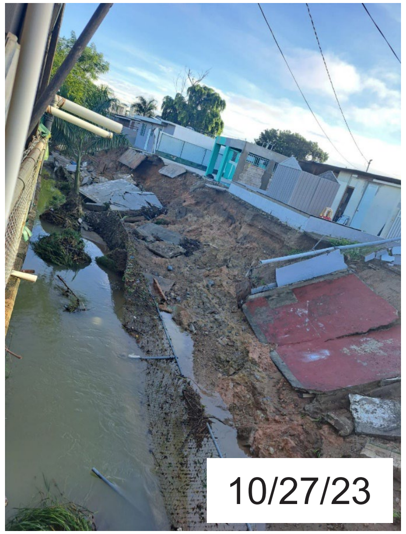





EXISTING CONDITIONS - DOÑA ANA & JOSEFINA CHANNEL CONTRACT 7 – REPARTO METROPOLITANO

8/17/24

9/3/24



10/27/23

10/27/23

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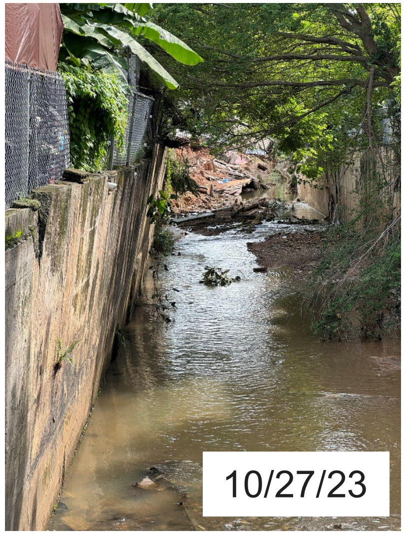
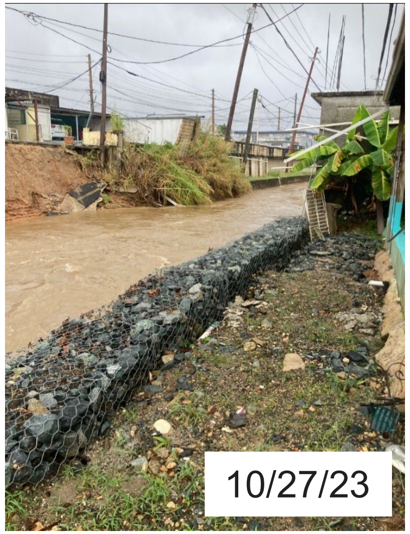


10/27/23

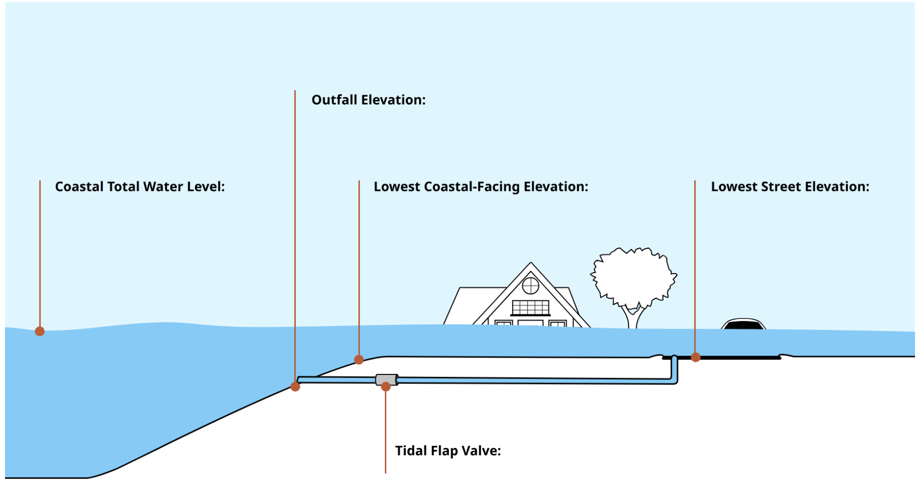
5/3/24

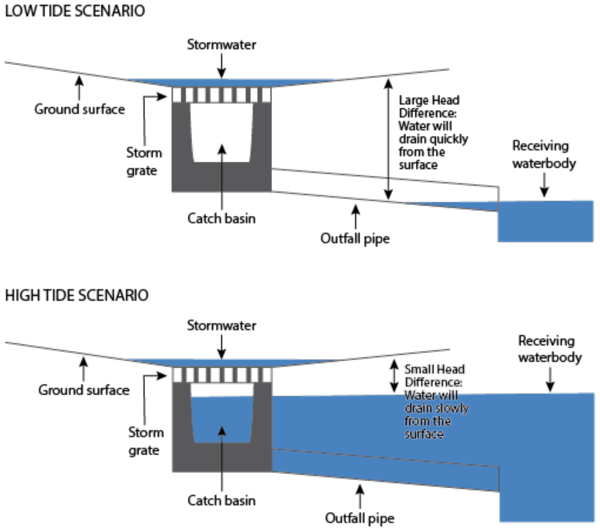


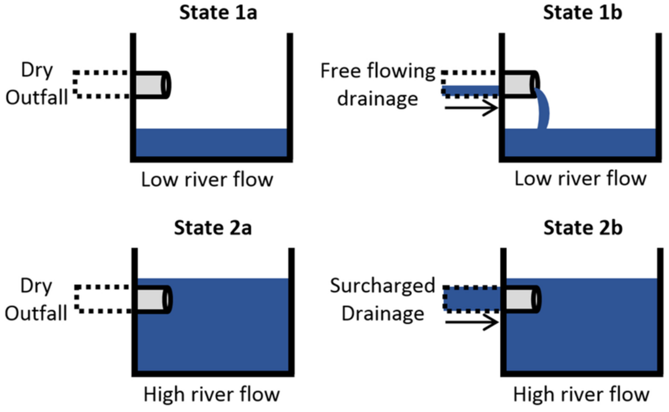
10/27/23

SECONDARY DRAINAGE

- The proposed RPN project will decrease the water surface elevation in the Rio Piedras channel during storm events.
- Tailwater conditions for the secondary drainage will improve and stormwater drainage pipes will discharge freely to the river without backwater into the system.
- Stormwater system pipes are generally designed with a conveyance for 5 to 10 years storms events, per local standards.
- Excess runoff should flow through the streets to the river.
- Streets should be graded towards the river so street runoff can discharge into the river.
- Local water ponding can occur on improper graded locations.
- If tailwater conditions are not improved (water surface elevation in the river) secondary drainage will not improve.





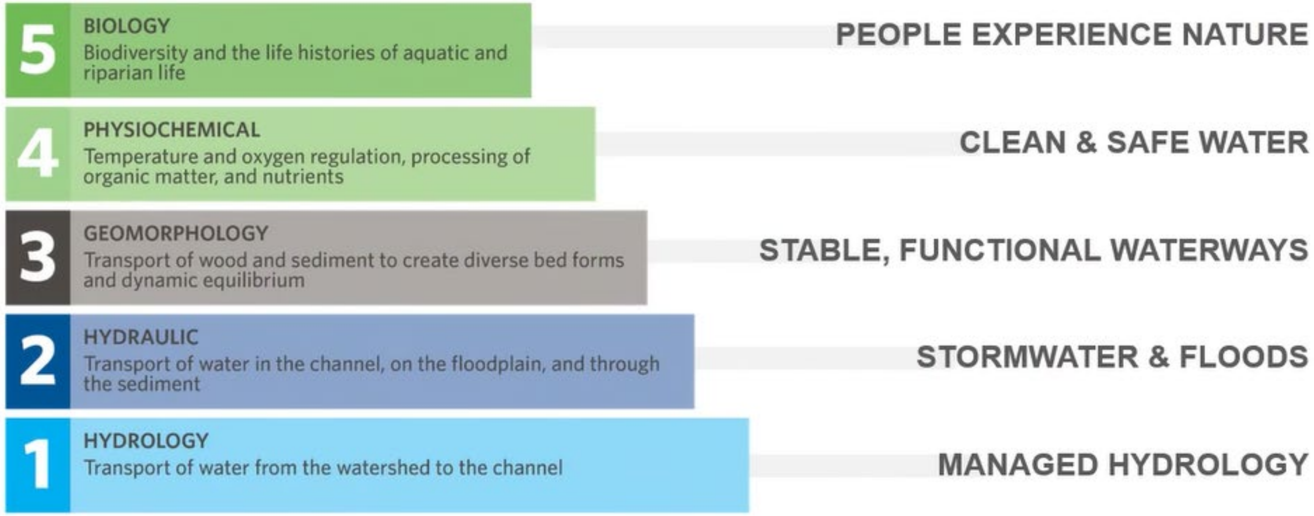


DESIGN EVOLUTION AND NATURE BASED SOLUTIONS

ENGINEERING WITH NATURE EFFORT

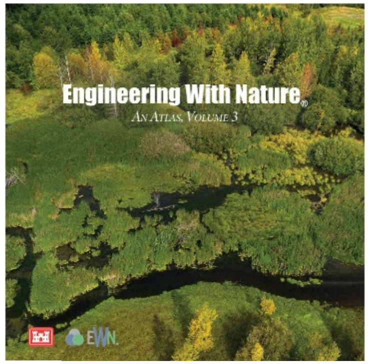
WHAT HAS BEEN IMPLEMENTED?

- Significant updates to old GDM design
- Removal of over 30 acres of Concrete from the channel construction
- Removal of adjacent existing structures along the project footprint allows for more greenspace and NB initiatives
- Several design ideas within the Contract 6 Rio Piedras area looking at Grade Control Structures to dramatically improve and sustain the environment.
- New Design updates could continue to minimize impacts to the green corridor and river
- Completed section of the project has a thriving ecosystem in the lower basin (Puerto Nuevo & Margarita Channel)
- Project also includes improvements to utilities/infrastructure (reducing sewage spillage into river/bay)



The way people experience the restoration will be closely tied to these natural functions.

ENGINEERING WITH NATURE – CHALLENGES/REALITIES



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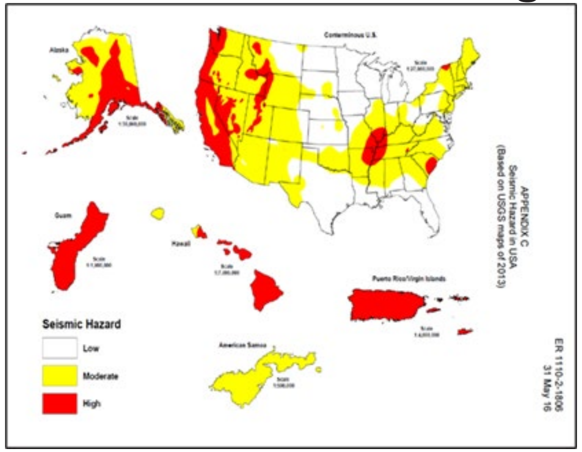
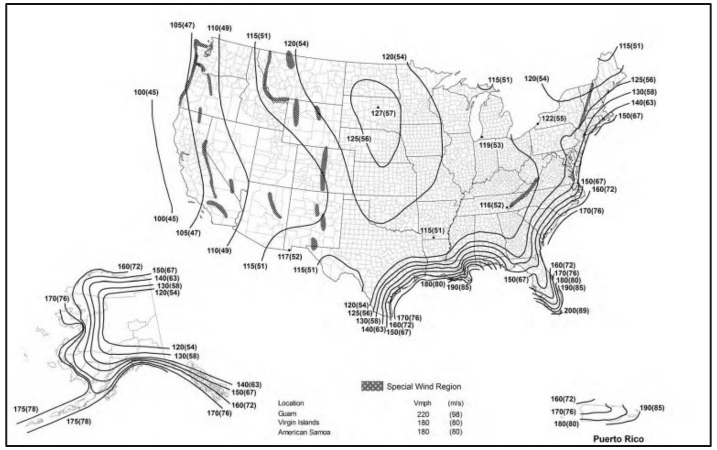
Rio Piedras

Technical Design Requirements / Challenges

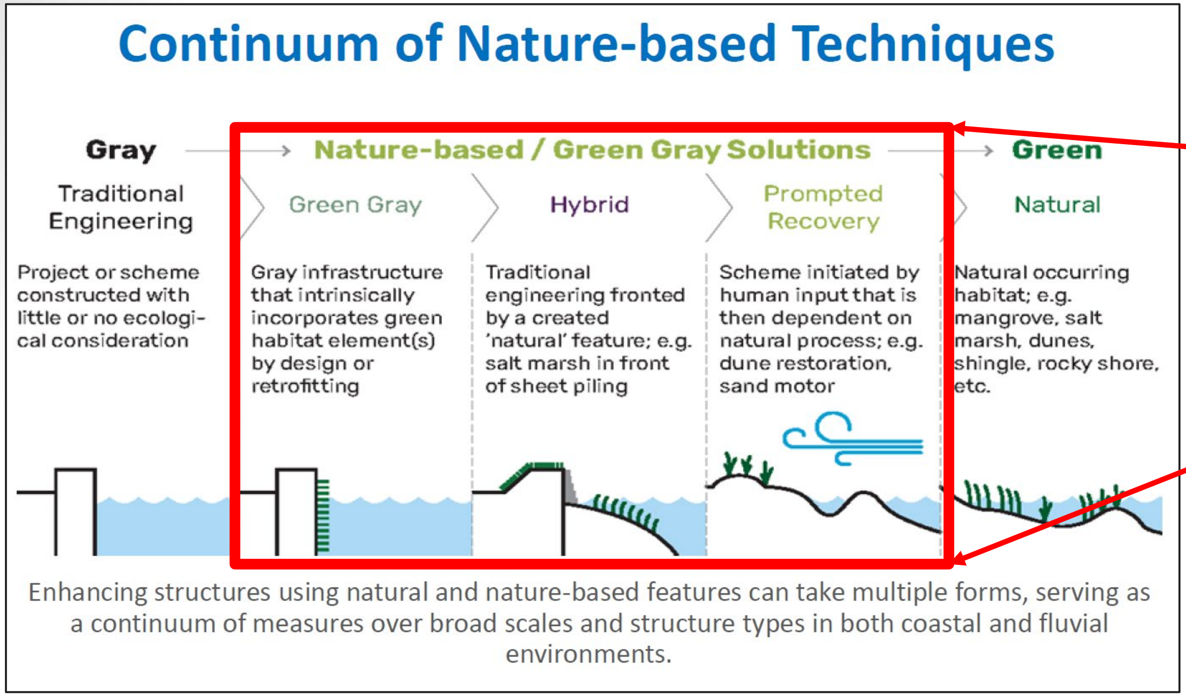


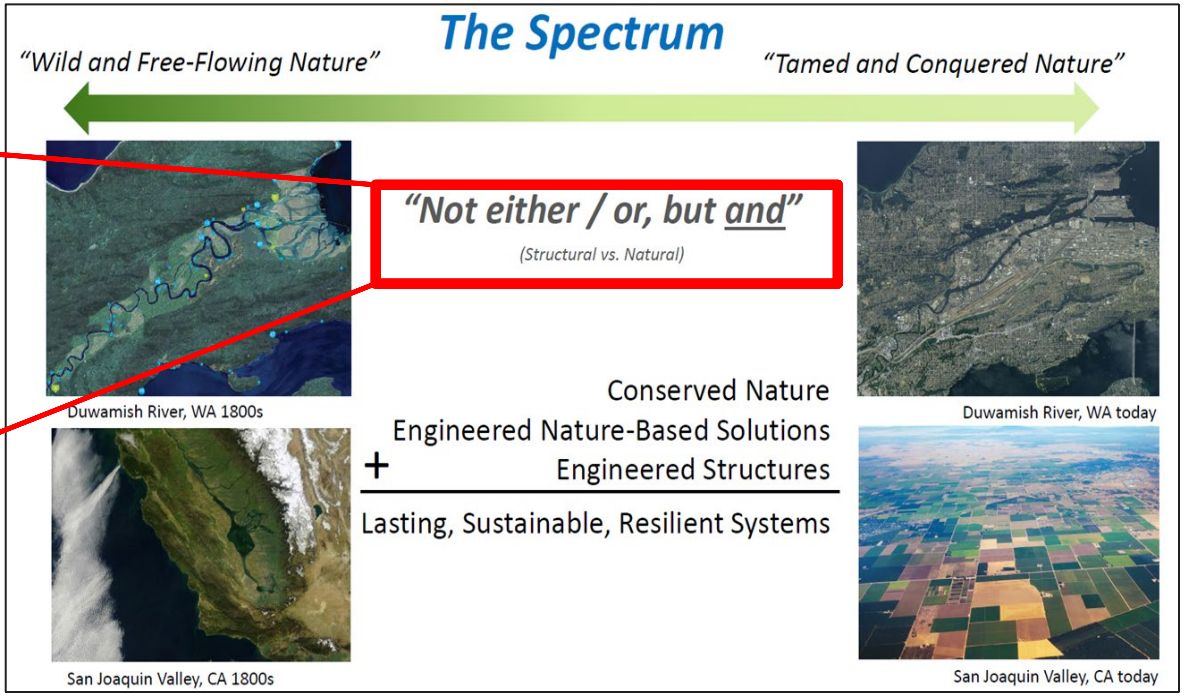
Puerto Rico – **High** Seismic Hazard



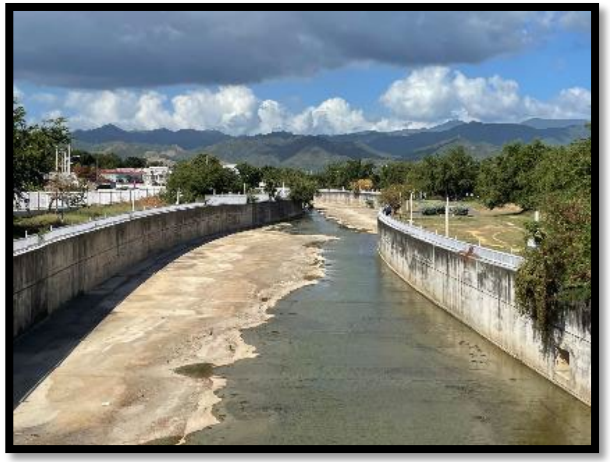
Puerto Rico – Wind Design **Zone III**

NATURE-BASED TECHNIQUES

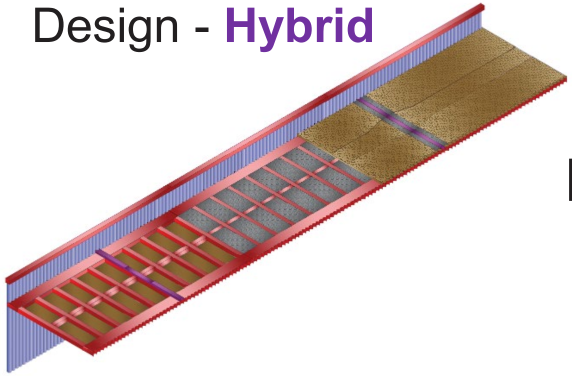


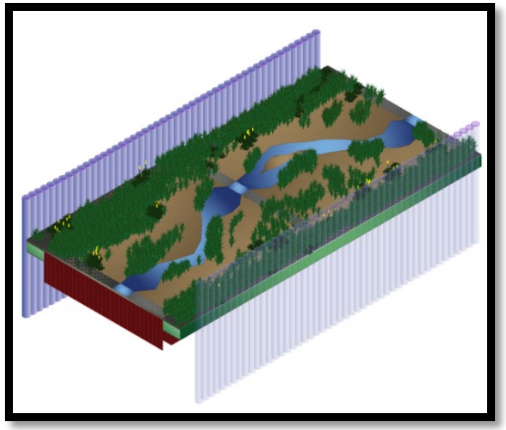


Contract 6A 1991
Design - **Gray**



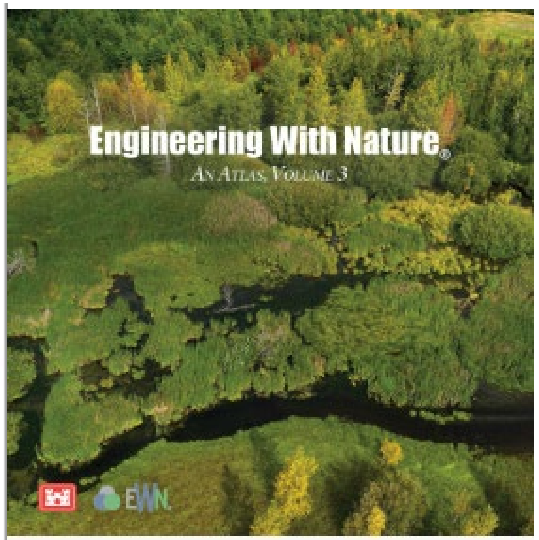
Contract 6A 2024
Design - **Hybrid**





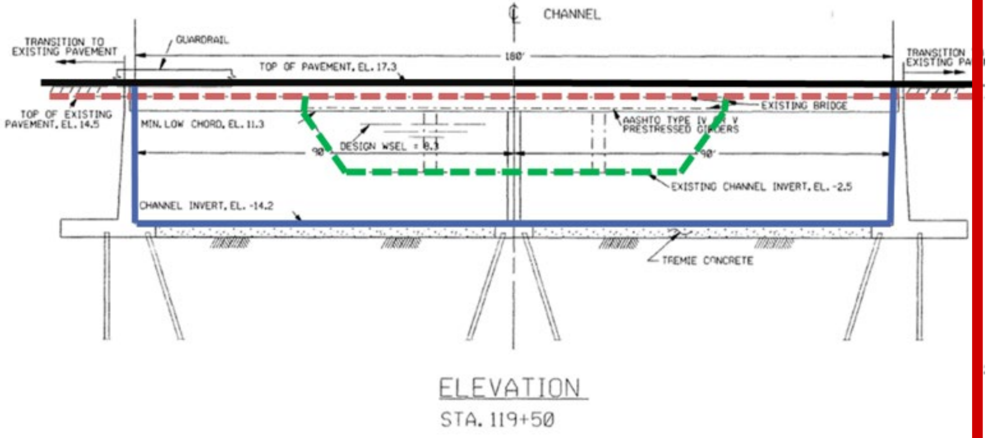
NATURE-BASED TECHNIQUES WITHIN CHANNELS

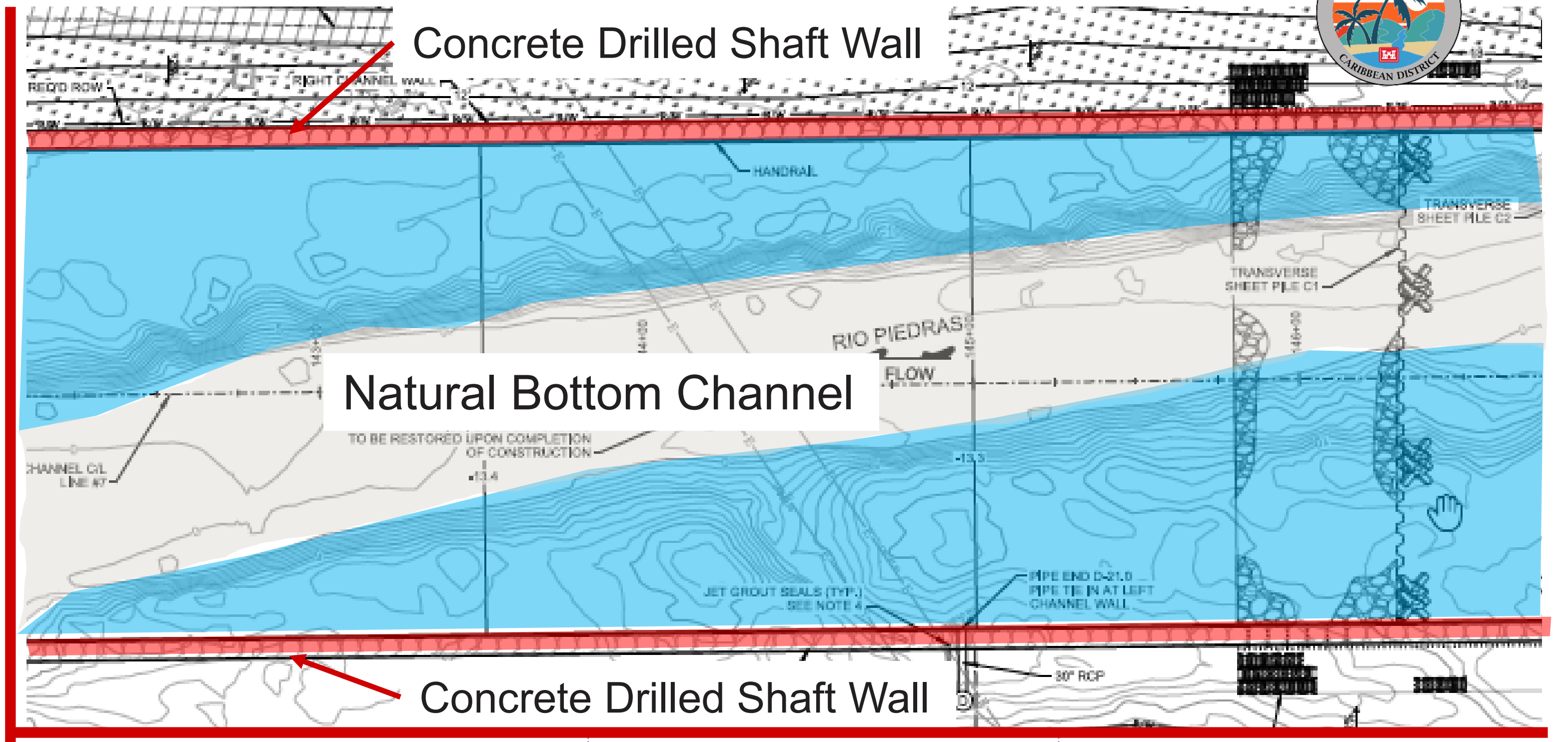
Subtidal, intertidal, supratidal: Enhanced seawall material (wall fabric composition or surface texture) (Photos: Burton Suedel)

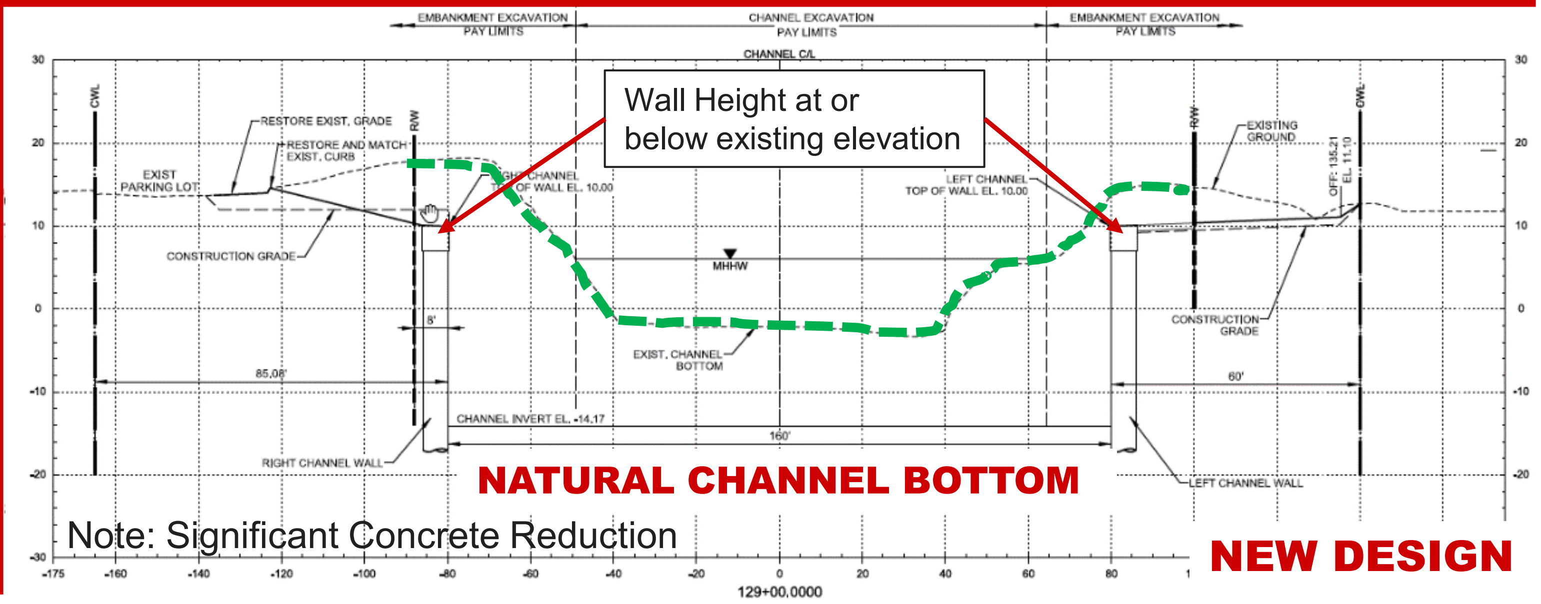


Credit/Photo by ECOncrete

DESIGN UPDATES CHANGES TO CONTRACT 3







RPN CNT-6A/6B

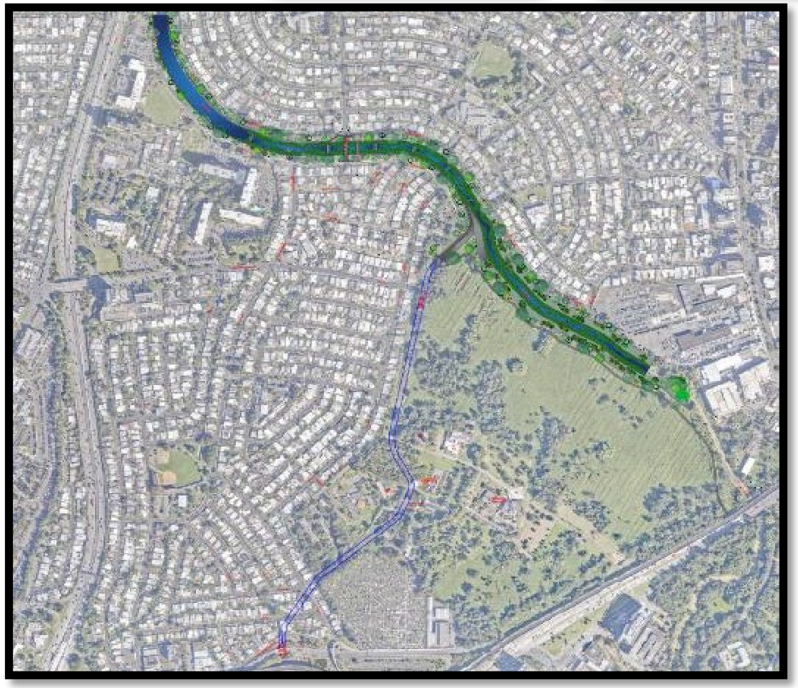
RIO PIEDRAS/MAIN CHANNEL

< 1-year storm event

13 Oct 2021 Notre Dame Bridge during flood waters from Rio Piedras. This is less than a 1-year (100% chance of occurring in a given year) storm event.

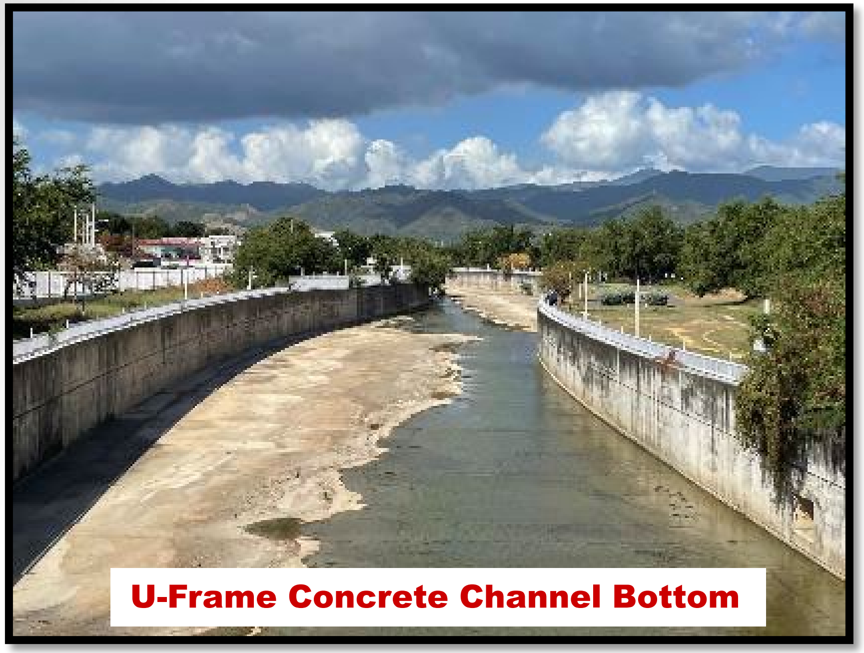
5-10-year storm event

Note: Video taken on property immediately south of Notre Dame Bridge showing flooding of Rio Piedras during a 5 to 10-yr storm event on November 15-19, 2009.

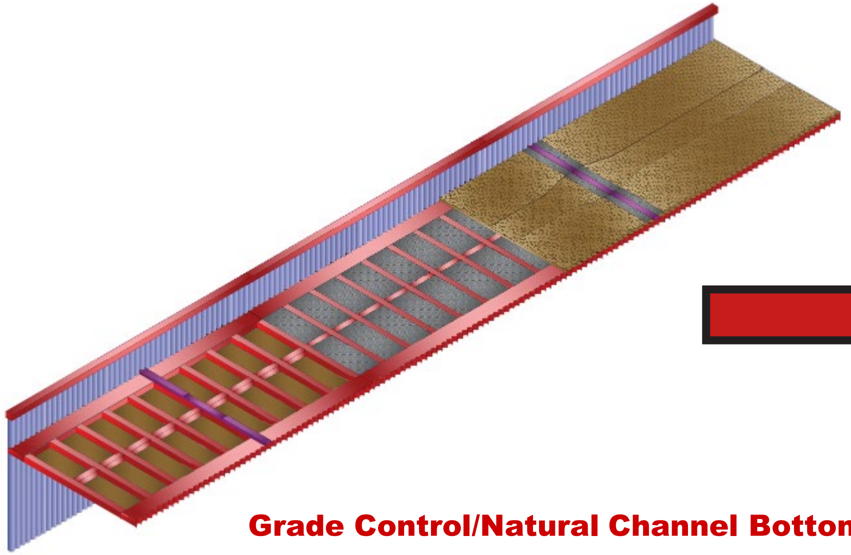


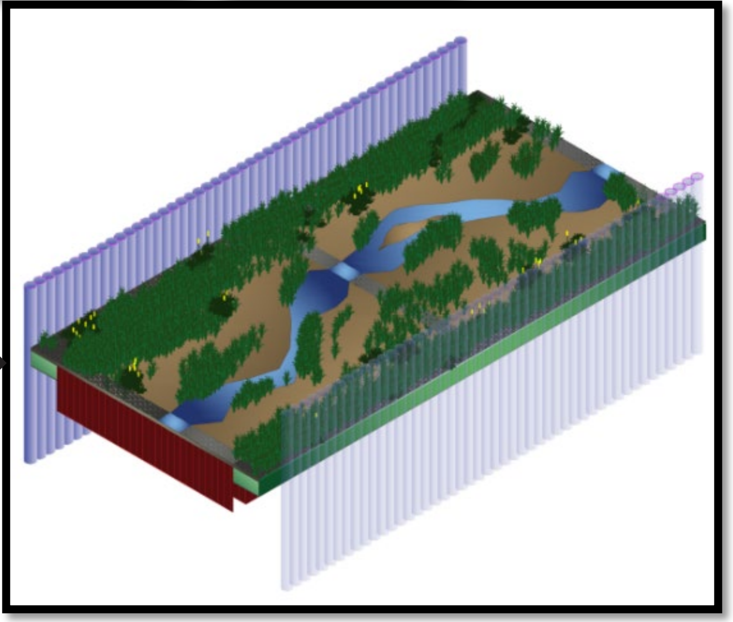
- Team has recommenced work on CNT-6A as it is not affected by ecological corridor law.
- CNT-6B is critical and has approximately 11-13% of the overall project benefits in this area. Significant protection to Villa Nevares community.
- Areas that will be constructed in UPR land will have MINIMAL environmental impact and is being design to work WITH NATURE.
- Trees are currently falling in to Rio Piedras due to erosion and expected to continue.

RPN CNT-6A/6B
RIO PIEDRAS/MAIN CHANNEL

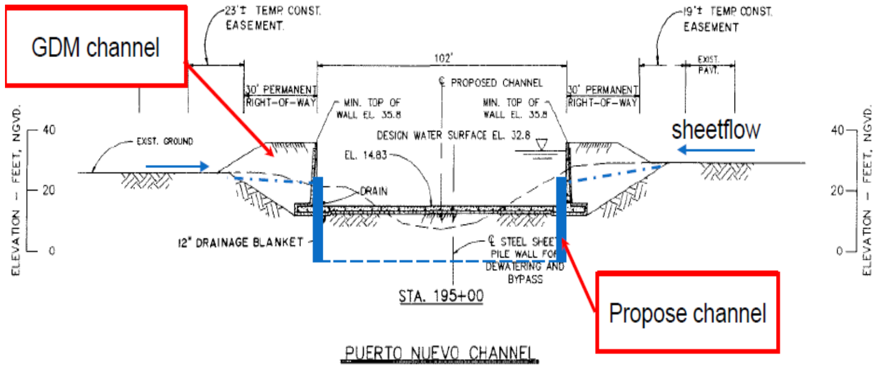


U-Frame Concrete Channel Bottom





Grade Control/Natural Channel Bottom



NEW DESIGN - 2024

RPN CNT-7

JOSEFINA/DOÑA ANA CHANNEL

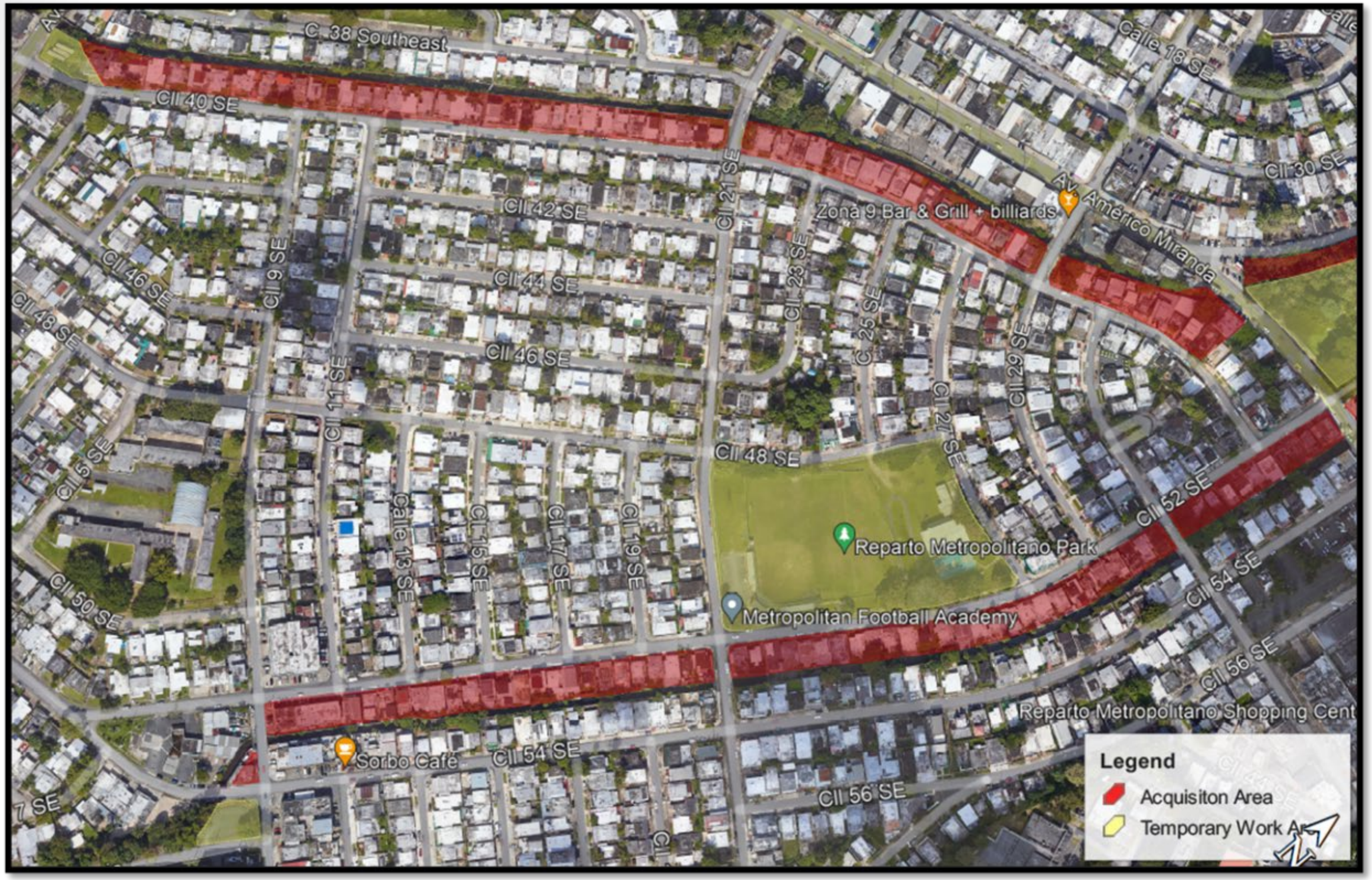


Figure 1. Project are south of Americo Miranda

Figure 2: Rendering showing what new channel and new linear green belt/park will look like once construction completed in this area.

Figure 3: Example of actual construction similar to what the Josefina and Doña Ana Channels will look like upon completion.

Challenges: To successfully design our project, the channel must be constructed in the dry alongside the existing channel. This unfortunately necessitates the properties on one side of channel.

H&H DESIGN STANDARDS

- **Channel Design**
  - ✓ EM 1110-2-1601 Hydraulic Design of Flood Control Channels
  - ✓ ER 1110-2-1405 Hydraulic Design for Local Risk Management Projects

- **Stilling Basin Design**
  - ✓ EM 1110-2-1602 Hydraulic Design of Reservoir Outlet Works
  - ✓ EM 1110-2-1603 Hydraulic Design of Spillways

- **Climate and Sea Level Change**
  - ✓ ECB 2018-14 Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects
  - ✓ EP 1100-2-1 Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation
  - ✓ ER 1100-2-8162 Incorporating Sea Level Change in Civil Works Programs

STRUCTURAL DESIGN STANDARDS

- Structural design must be in compliance with Engineering Manuals, Regulations and Design Codes.

EM 1110-2-2100
1 December 2005

US Army Corps
of Engineers

ENGINEERING AND DESIGN

STABILITY ANALYSIS OF CONCRETE STRUCTURES

ENGINEER MANUAL

EM 1110-2-2104
30 November 2016

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ENGINEERING AND DESIGN

STRENGTH DESIGN FOR REINFORCED CONCRETE HYDRAULIC STRUCTURES

ENGINEER MANUAL

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

ER 1110-2-1806

CECW-CE

Regulation
No. 1110-2-1806

31 May 2016

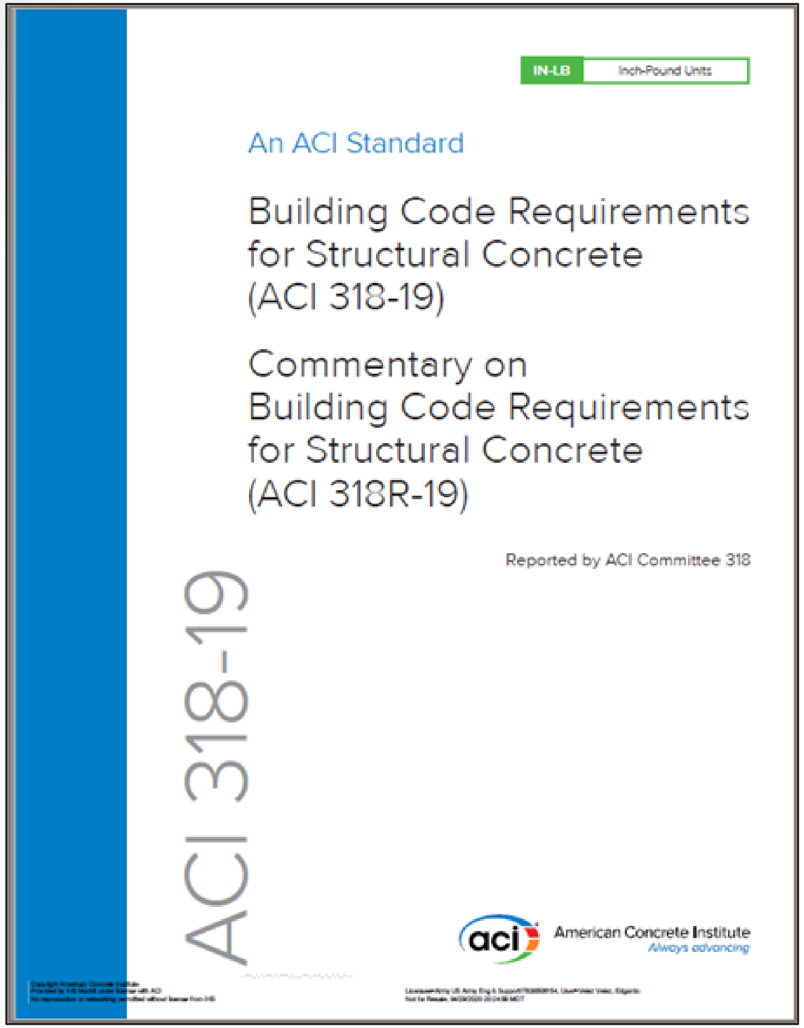
Engineering and Design
EARTHQUAKE DESIGN AND EVALUATION FOR CIVIL WORKS PROJECTS

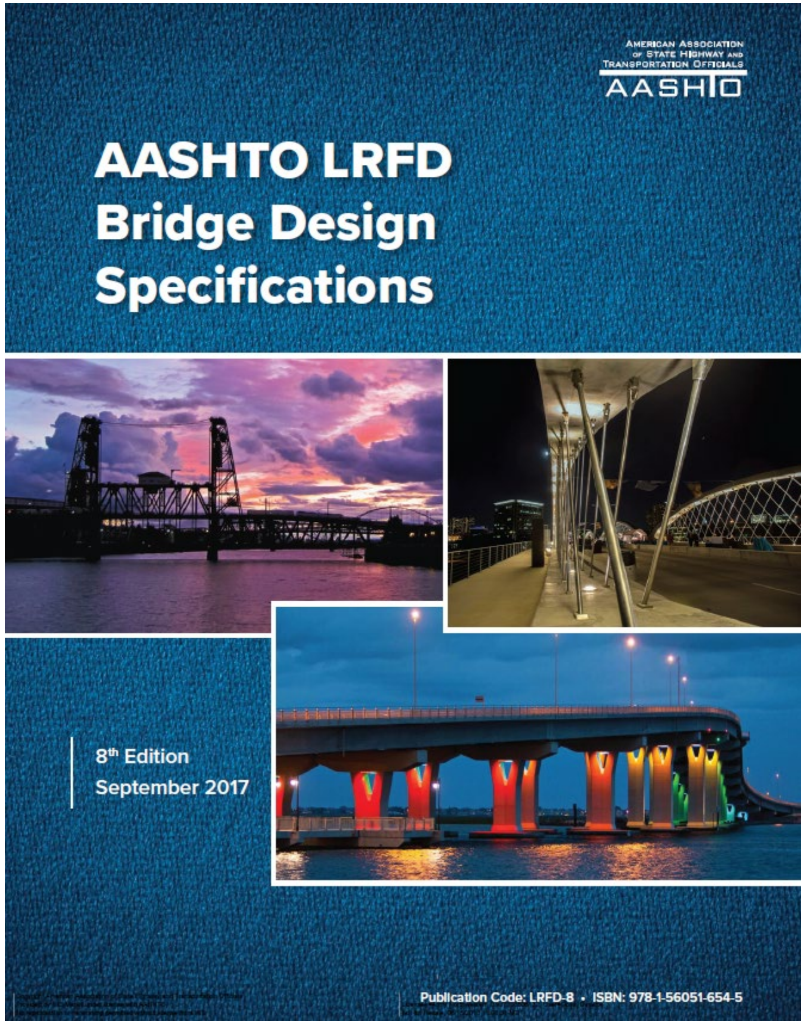
TABLE OF CONTENTS

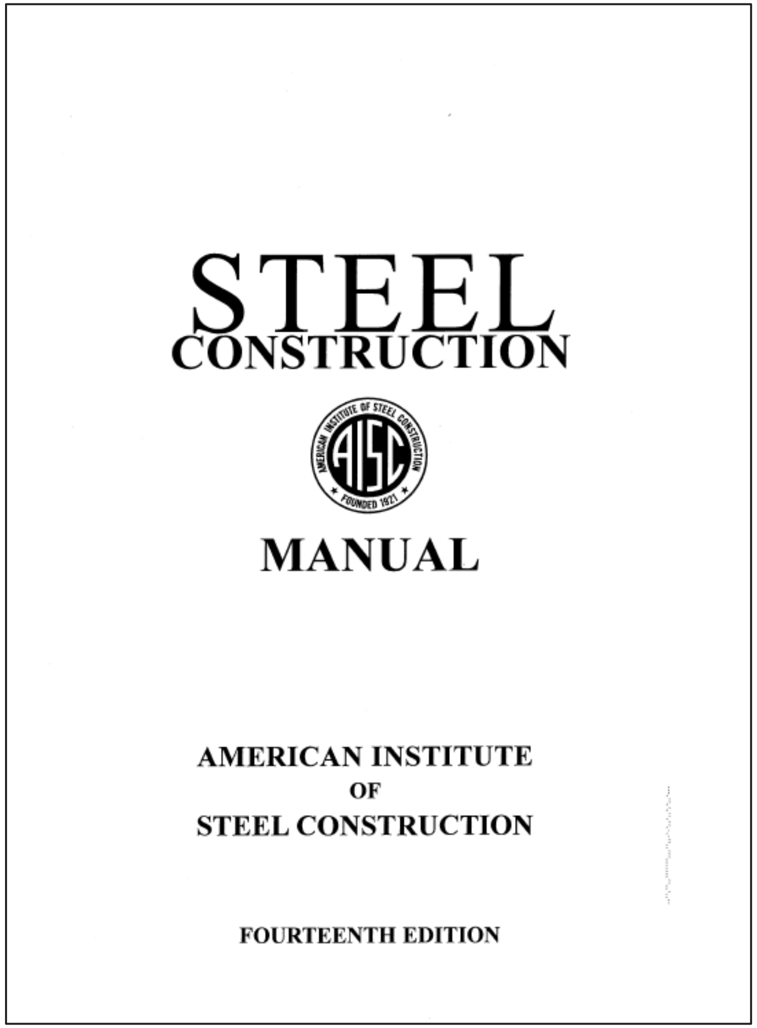
This engineer regulation supersedes ER 1110-2-1806, dated 31 July 1995

STRUCTURAL DESIGN STANDARDS

Structural design must be in compliance with Engineering Manuals, Regulations and Design Codes.







EWN POTENTIAL COLLABORATION WITH UPR

Develop Living Laboratory Concept alongside the terminus channel of Contract 6 within UPR Experimental Station:

- Enhance UPR research opportunities by using project features.
  - Environment
  - Engineering
  - Education
  - Social Sciences / Recreation

San Juan Aqueduct Restoration
Credit: Aldayjover Architecture And Landscape/Para la Naturaleza

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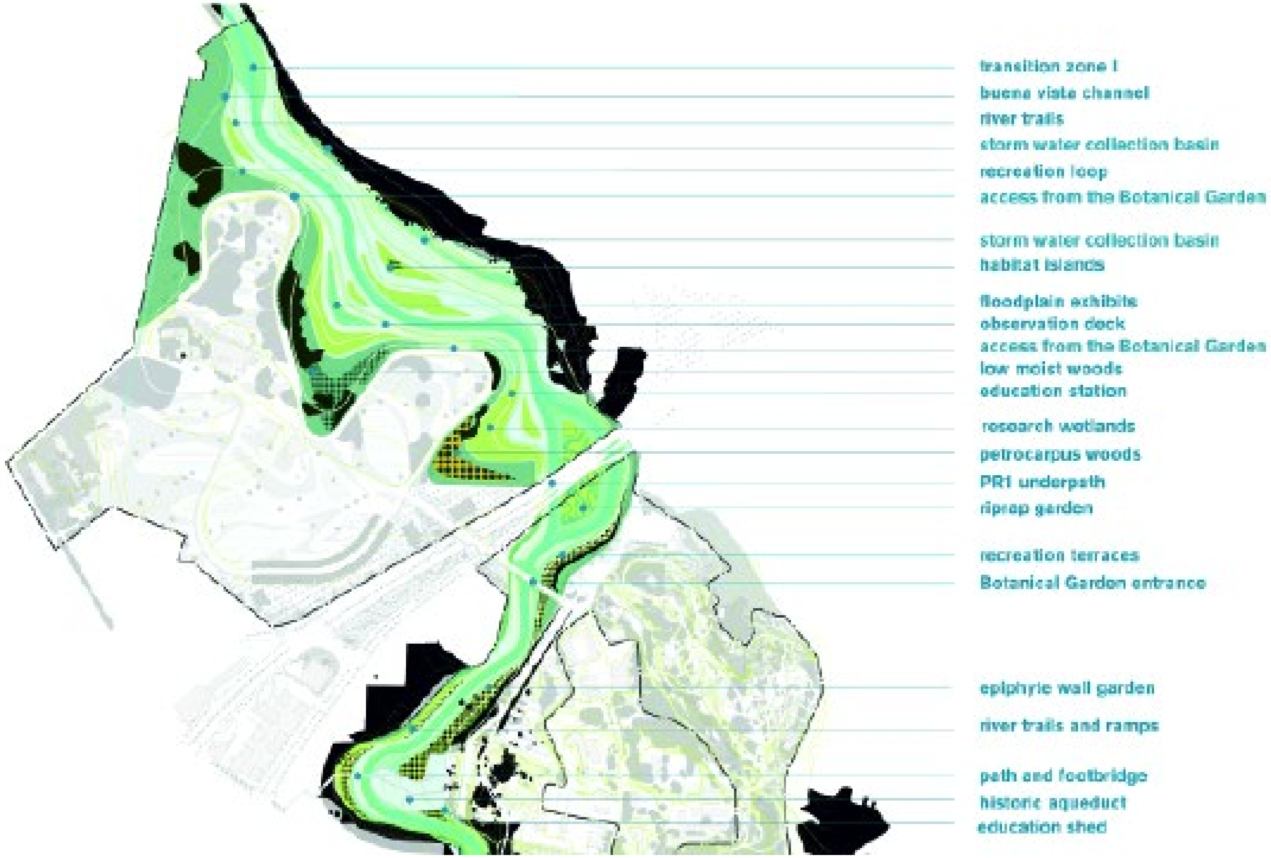
EWN BEST PRACTICE - PUERTO RICO

Enhancing Existing Flood Infrastructure – Living Laboratory Concept for the Ajíes Dam

- Develop living laboratory to maintain & enhance primary flood risk management mission
  - Environment (increase water levels to enhance aquatic habitat)
  - Engineering (enhance flood risk management; water recharge)
  - Education (school children; citizen scientists; universities)
  - Social/recreation (ecotourism; trail system; interpretive signs)
- Collaboratively engage stakeholders so that the concept can serve both community and environment

Left: Existing Ajíes Dam and related flood control structure. Right: Rendering showing possible environment/ human interactions through a trail, interpretative signage, floating dock to enhance fishing access, native wildflower plantings, increased bird and other wildlife usage, elevated water levels to promote boat access, and locally sourced building materials.

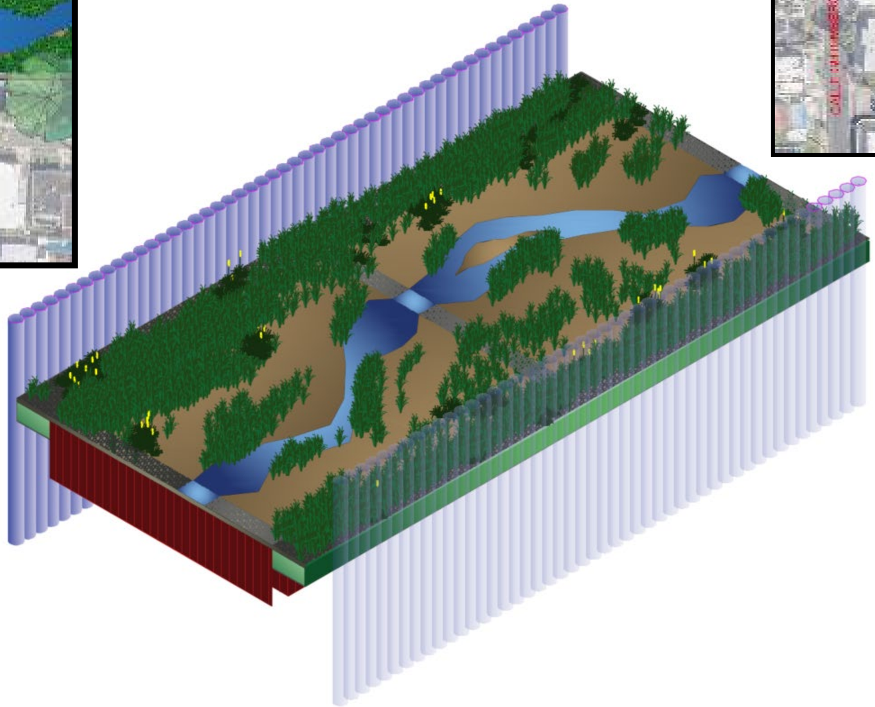
UPR RIO PIEDRAS RESTORATION PROJECT MASTER PLAN (TAMIR)



RIO PUERTO NUEVO – (CNT-6) RIO PIEDRAS DESIGN

CONCEPTUAL DESIGN

RIO PUERTO NUEVO – (CNT-6) RIO PIEDRAS DESIGN



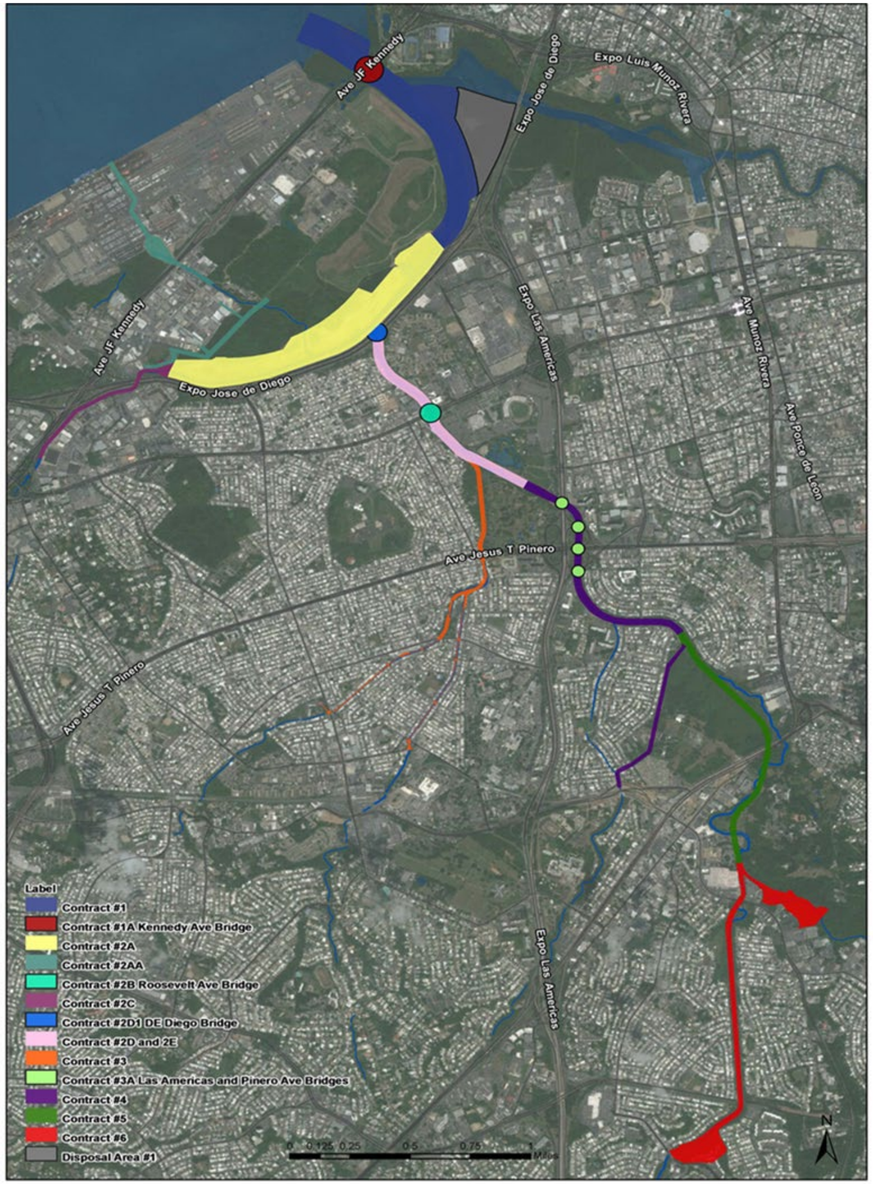
CONCEPTUAL DESIGN
URBAN COORIDOR

RIO PUERTO NUEVO – (CNT-6) RIO PIEDRAS DESIGN

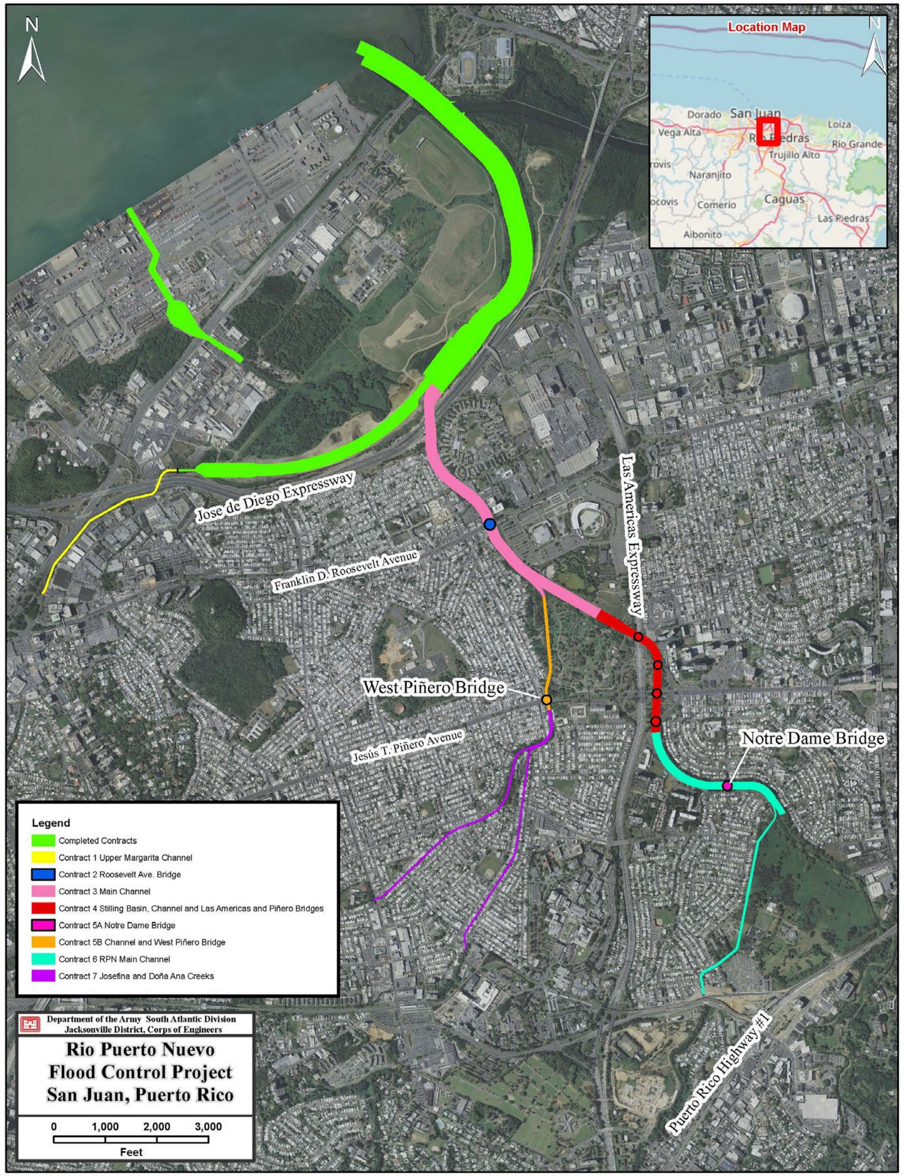
CHANNEL TRANSITION DESIGN ON UPR EXPERIMENTAL STATION

DESIGN REQUIREMENTS, CONSIDERATIONS AND UPDATES

DESIGN REQUIREMENT CONSIDERATIONS AND UPDATES



1991 Authorized Project



2018 Supplemental Program

DESIGN CONSIDERATIONS AND HYDROLOGIC UPDATES

- **Design Considerations – General Design Memorandum (GDM) 1991**
  - Comply with applicable Federal flood plain management (100-year flood frequency, Annual Exceedance Probability 0.01)
  - Comply with Federal Flood Insurance
  - Section 402 Public Law 99-662

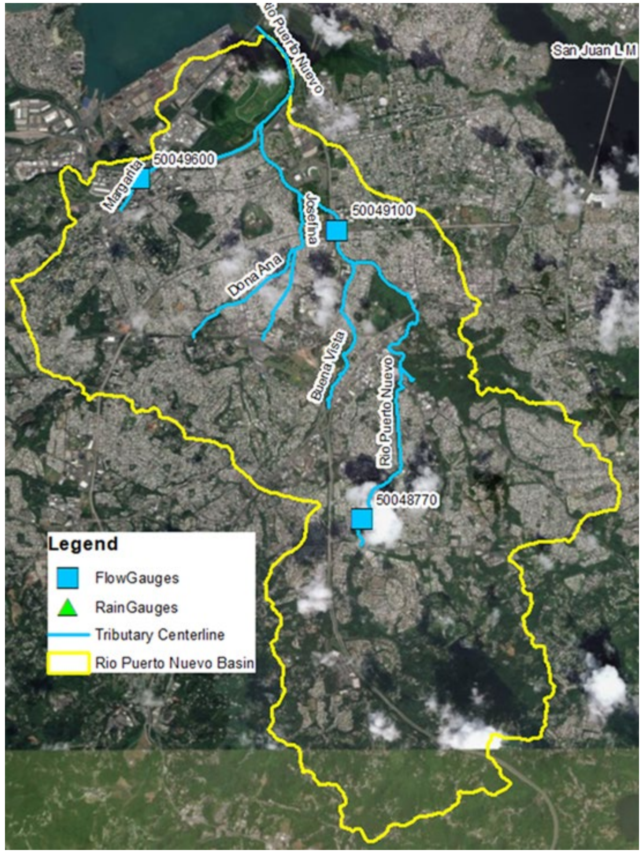
General Design Memorandum (GDM)

- Rainfall Frequency: TP-42
- 10.4 inches for 0.01 annual exceedance probability (AEP)
- Curve Number methodology
- SCS Type II distribution
- 24-hour rainfall distributed into a 4-2-1-3 balanced storm six-hour distribution
- HEC-1

2019 Supplemental Update

- Rainfall Frequency: NOAA Atlas 14
- 13.3 inches basin average of approximately (11.9-14.7 in. spatially varying rainfall).
- Curve Number methodology
- NRCS Incremental Intensity Local Temporal Distribution
- HEC-HMS

USGS Station	Location	0.01 AEP Design Storm Flow Comparison (cfs)			
		2019 HMS Model USACE	1986 Survey Report 1985 condition	1986 Survey Report 2035 condition	2009 FEMA
50049100	Rio Piedras at Hato Rey (at Pinero Bridge)	25,150	28,390	35,700	25,380
50048770	Rio Piedras at El Señorial	13,774	16,490	22,700	13,941



HYDRAULIC STUDIES AND PHYSICAL MODELS

- HEC-RAS
  - ✓ USACE developed
  - ✓ Free to download and use
  - ✓ Industry standard

- Hydraulic 1D/2D & full 2D Models
  - ✓ Existing condition model
  - ✓ Proposed conditions
  - ✓ Construction sequence
  - ✓ Diversion during construction

- Computational Fluid Dynamics 3D Hydraulic Model (CFD)

- Channel Sediment Transport
  - ✓ To evaluate the scour potential on the channel bottom

- Bridge scour analysis
  - ✓ To evaluate scour potential on bridge piers

Roughness Flume

Project Reach Flume

CLIMATE ASSESSMENT AND SEA LEVEL CHANGE

- Climate Assessment for Inland Hydrology

  ✓ The **climate assessment** for inland hydrology follows the USACE guidance of Engineering and Construction Bulletin (ECB) 2018-14, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects.

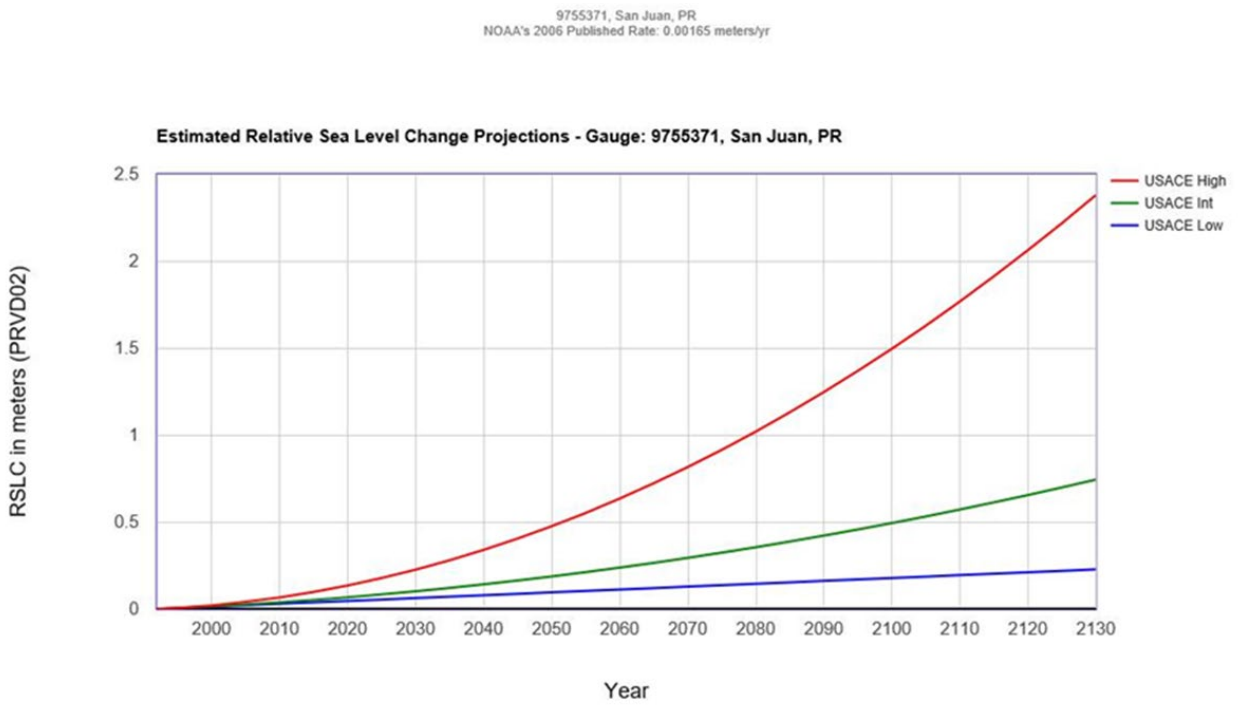
  ✓ The risk assessment identifies which project features may be at risk due to climate change and discusses potential future resiliency and adaptation measures that could be implemented.

- Sea Level Change

  ✓ The climate assessment for **Relative Sea Level Change** (RSLC) follows the USACE guidance of Engineer Regulation (ER) 1100-2-8162 (USACE 2013) and Engineer Pamphlet (EP) 1100-2-1 (USACE 2019).

  ✓ USACE developed SLC tools: Sea Level Change Curve Calculator and the Sea Level Tracker.

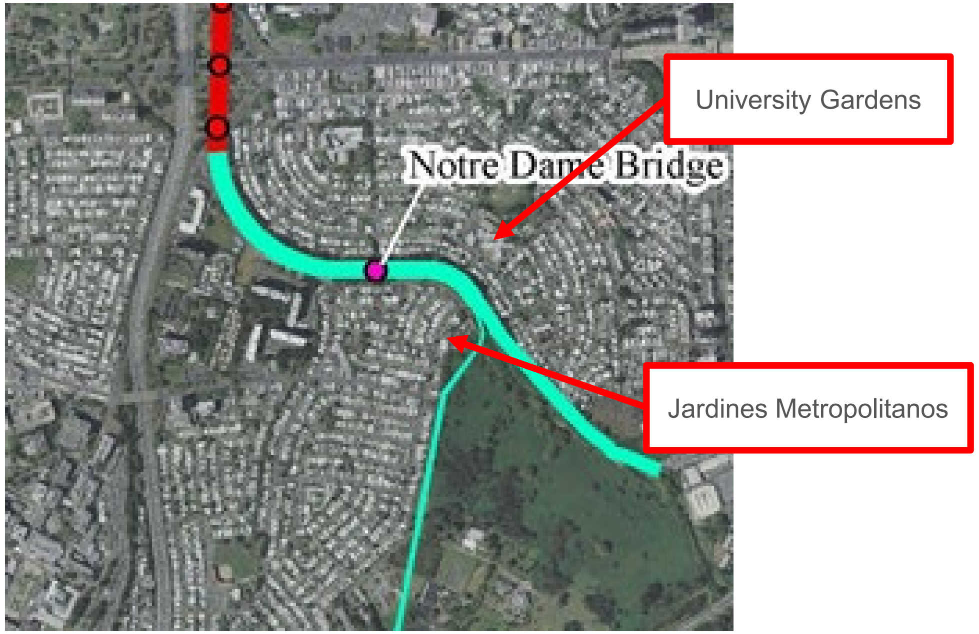
  ✓ SLC scenarios can align with existing and planned engineering efforts, estimating when and how the sea level may impact critical infrastructure and planned development activities.

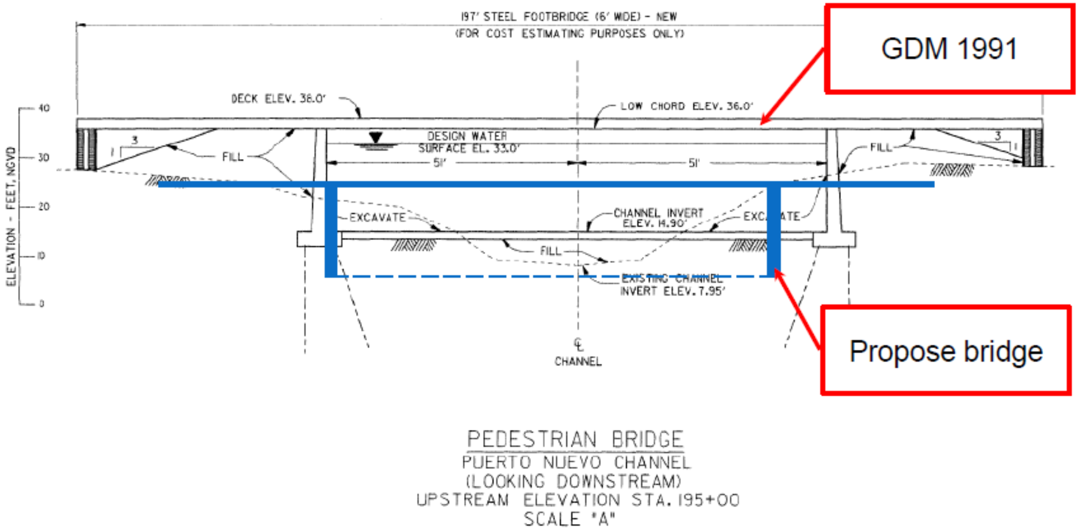


DESIGN EVOLUTION – CONTRACT 5A

- **GDM 1991**
  - ✓ 102 ft Wide Single Span Bridge
  - ✓ Bridge Low Chord: 36 ft
  - ✓ Super-Critical Flow Regime
  - ✓ Design Flow: 42,100 cfs
  - ✓ Average Channel Velocity: 34 ft/s
  - ✓ Channel Slope: 0.003
  - ✓ Channel Type:
    - ✓ Inverted Tee Channel Walls
    - ✓ Concrete Channel Bottom

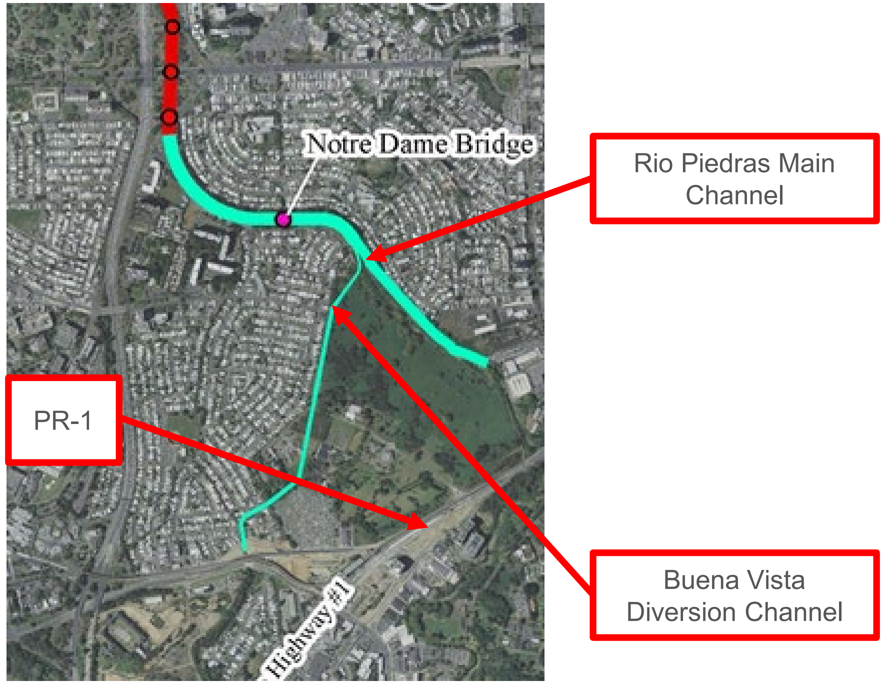
- **Current Design**
  - ✓ 95 ft Wide Single Span Bridge
  - ✓ Bridge Low Chord: 25.5 ft-PRVD02
  - ✓ Sub-Critical Flow Regime
  - ✓ Design Flow: 27,450 cfs
  - ✓ Average Channel Velocity: 16 ft/s
    - ✓ Average Existing Channel Velocity: 15 ft/s
  - ✓ Channel Slope: 0.0024
  - ✓ Channel Type:
    - ✓ Concrete Drilled Shaft Walls
    - ✓ Articulated Concrete Block Mats (ACBM) Channel Bottom or Natural Bottom with Armored Grade Control Structures



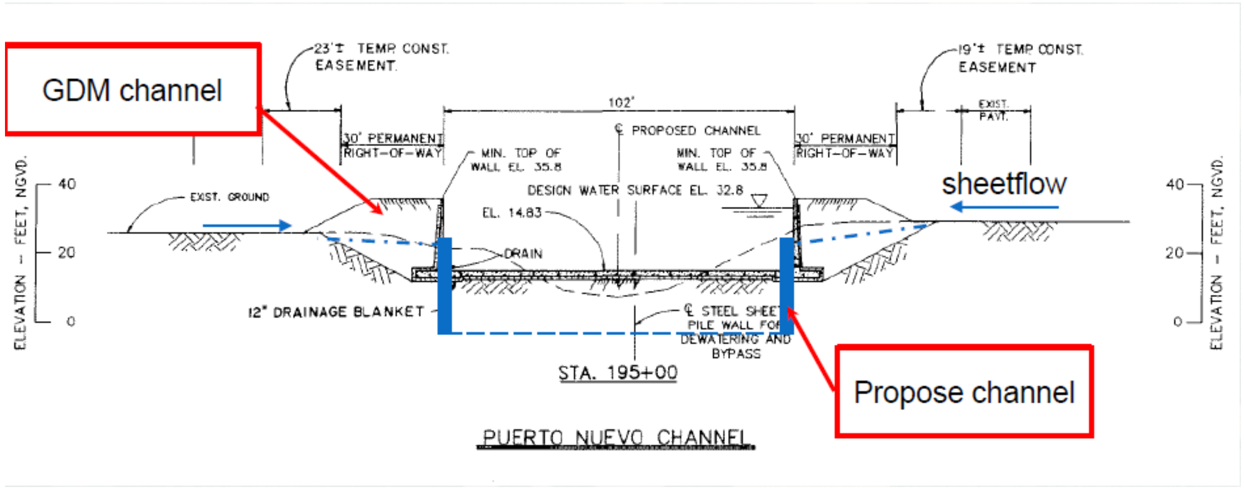


DESIGN EVOLUTION – CONTRACT 6A CHANNEL

- **GDM 1991**
  - ✓ Super-Critical Flow Regime
  - ✓ Design Flow: 38,000 cfs
  - ✓ Average Channel Velocity: 34 ft/s
  - ✓ Channel Slope: 0.003
  - ✓ Channel Type:
    - ✓ 113 ft Wide Trapezoidal with Pilot Channel to 88 ft wide rectangular channel at the upstream end
    - ✓ Concrete Channel Bottom
    - ✓ Above Grade Walls



- **Current Design**
  - ✓ Sub-Critical Flow Regime
  - ✓ Design Flow: 27,450 cfs
  - ✓ Average Channel Velocity: 16 ft/s
    - ✓ Average Existing Channel Velocity: 15 ft/s
  - ✓ Channel Slope: 0.0024
  - ✓ Channel Type:
    - ✓ 105 ft to 95 ft Wide Channel
    - ✓ Concrete Drilled Shaft Walls
    - ✓ Articulated Concrete Block Mats (ACBM) Channel Bottom or Natural Bottom with Armored Grade Control Structures.
    - ✓ Below Grade Walls



DESIGN EVOLUTION – CONTRACT 6B BUENA VISTA

- **GDM 1991**

  ✓ Channel continued upstream PR-1 crossing the UPR Botanical Gardens
  ✓ Sediment Basins proposed at the upstream end of the project
  ✓ Buena Vista Diversion to reduce discharge from Buena Vista Creek
  ✓ Buena Vista Diversion 36 ft Wide Channel

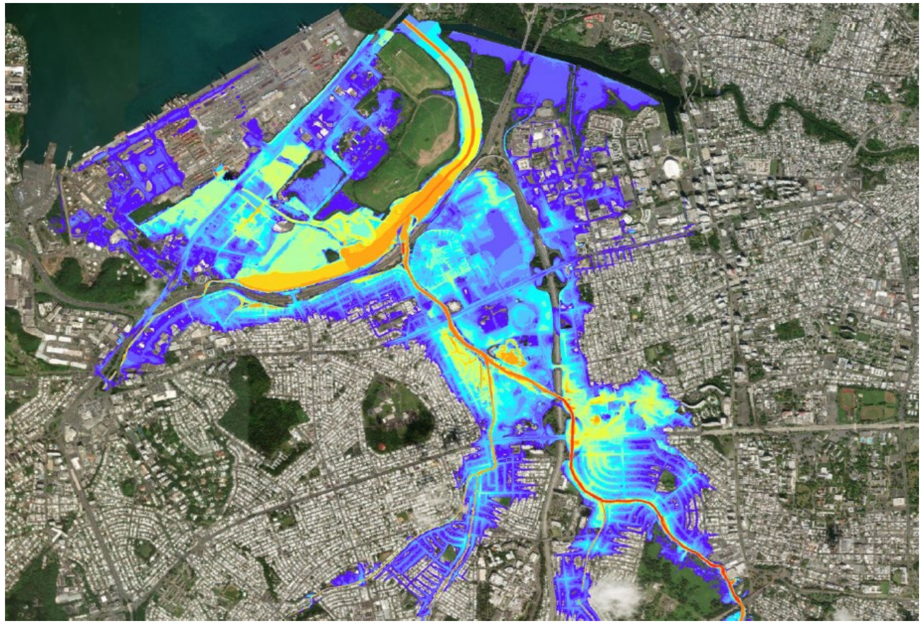
- **Current Design**

  ✓ Project finished approximately 1,700 ft downstream of PR-1
  ✓ Buena Vista Diversion to reduce discharge in Buena Vista Creek
  ✓ Alternatives considered for the channel upstream of the Buena Vista Diversion confluence: Articulated Concrete Block channel bottom, natural bottom with armored grade control structures, or trapezoidal earth channel.
  ✓ Other components still under design

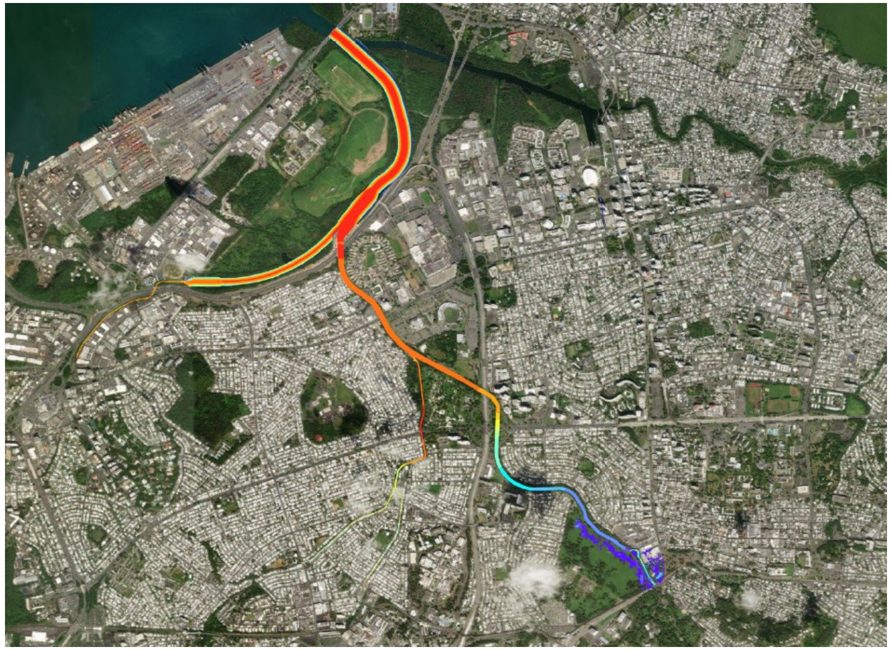
SUMMARY

- GDM 1991
  - ✓ Rainfall Frequency: TP-42
  - ✓ U-Frame Concrete Channels
  - ✓ Super-Critical Flow Regime
  - ✓ Higher than natural grade wall height
  - ✓ Steeper channel slopes

- Current Design
  - ✓ Rainfall Frequency: NOAA ATLAS 14
  - ✓ Project resilience to climate change and sea level rise
  - ✓ Natural bottom channels or with scour protection
  - ✓ Sub-Critical Flow Regime
  - ✓ Walls below natural grade
  - ✓ Milder channel slopes



100-yr existing condition inundation map



100-yr post project inundation map

OTHER ANALYZED DESIGN ALTERNATIVES

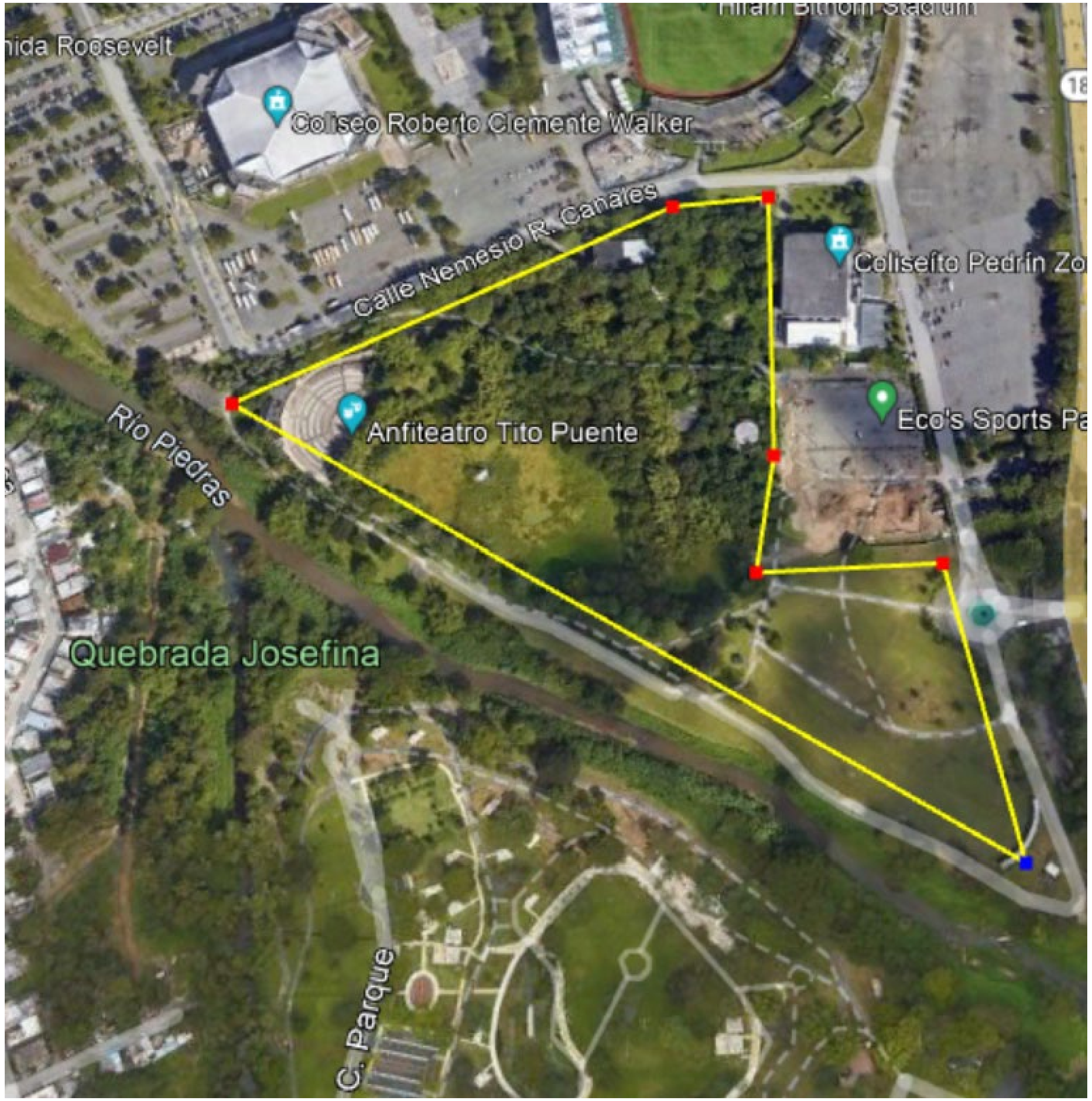
DETENTION BASIN VS FLOOD CONTROL RESERVOIR

- **Detention Basin**:
  - Manage stormwater runoff by storing it and releasing it gradually until completely drained.
  - Generally used to capture the difference in peak runoff on developed areas to account for the increase runoff due to the impervious areas compared to the pre-development runoff.

- **Flood Control Reservoir**:
  - Temporarily store flood water and release slowly at a safe rate after the floods, so that it may not cause any damage on the downstream side.

DETENTION BASIN CALCULATION EXERCISE

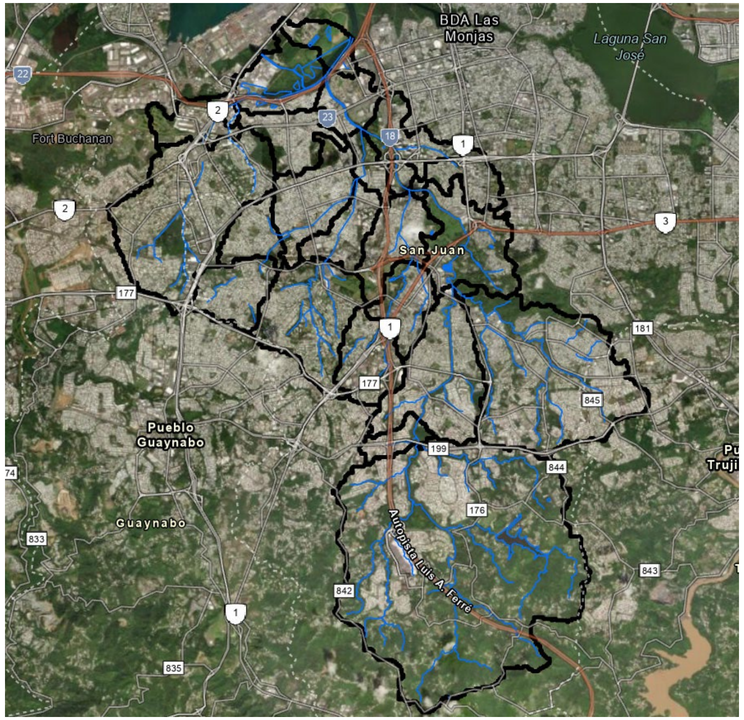
- Area = 879,000 ft^2
- Depth = 5 ft
- Volume = 4,395,000 ft^3 (assumes vertical walls)
- Bankfull flow: 8,100 cfs
- 100yr event: 37,350 cfs
- 1,200 cfs will fill the area in <u>one hour</u>



FLOOD CONTROL RESERVOIR COMPARISON

- **Portuguese Dam, Ponce**
  - Basin: 10.4 mi^2
  - 100yr 24hr precipitation: ~24 in
  - Dam Volume: 368,000 yds^3
  - Dam Height: 220 ft

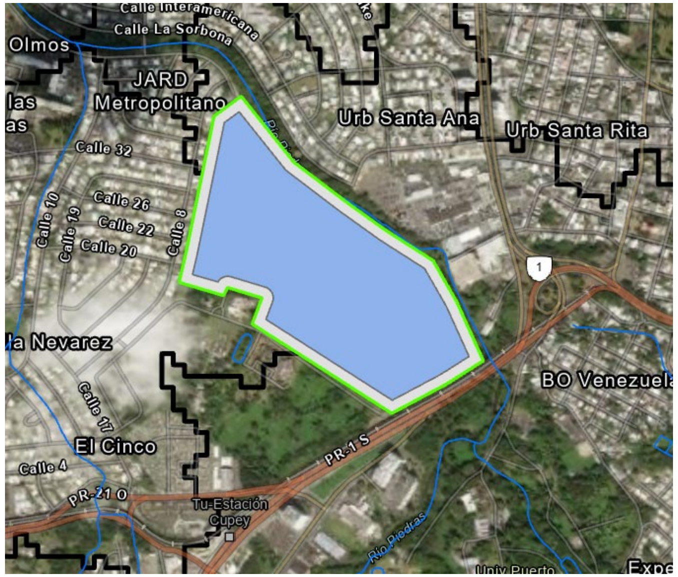
- **Rio Puerto Nuevo, San Juan**
  - Basin: 25 mi^2
  - 100yr 24hr precipitation: ~14 in



*Areas less developed are in the headwaters, too upstream to detain runoff to alleviate flooding downstream in basin.

RESERVOIR EXERCISE LOCATIONS

- Location #1:
  - Located immediately downstream of PR-1 and Rio Piedras Intersection
  - Surface Area: 64 acres
  - Volume: 1,400 acre-ft
  - Height: 25 ft



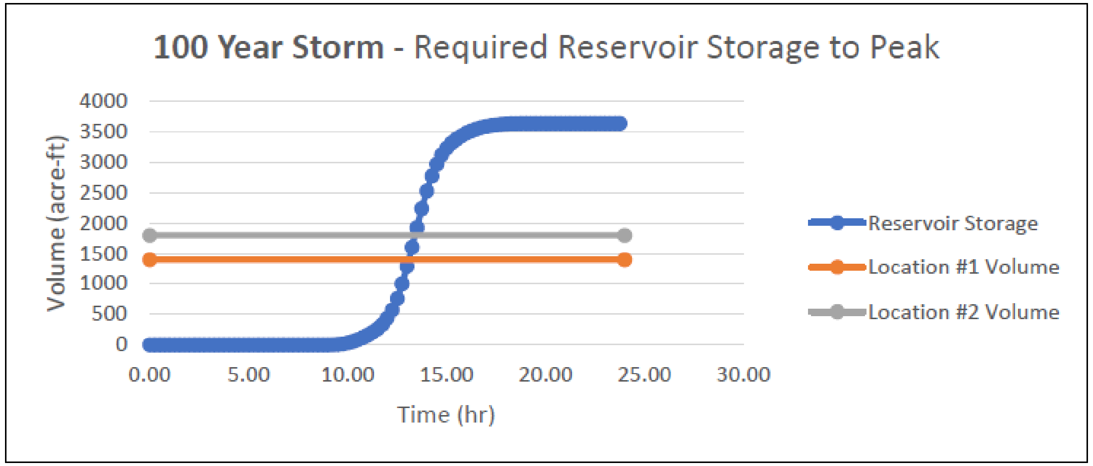
Legend

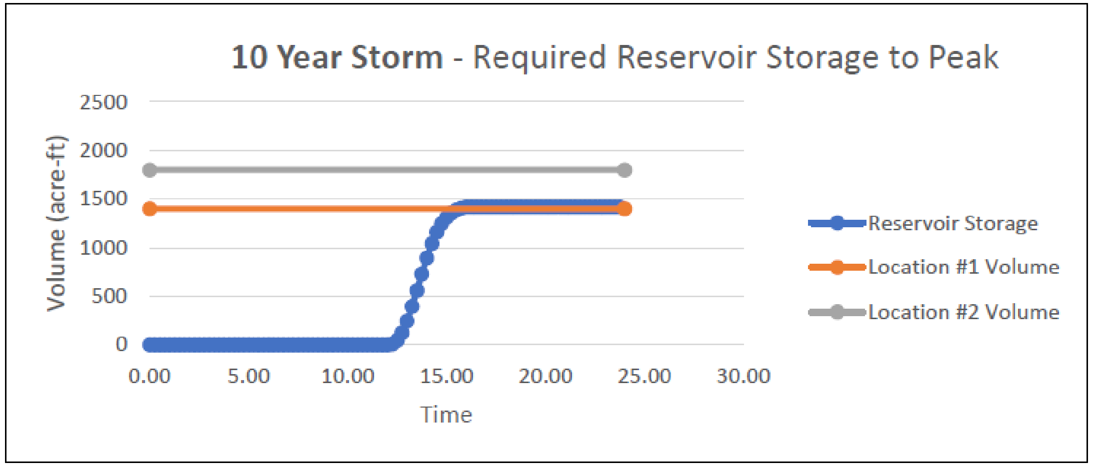
- Max Available Area
- Dam Location

- Location #2:
  - Located immediately upstream of PR-1 and Rio Piedras Intersection
  - Surface Area: 81 acres
  - Volume: 1,800 acre-ft
  - Height: 25 ft

RESERVOIR EXERCISE ASSESSMENT

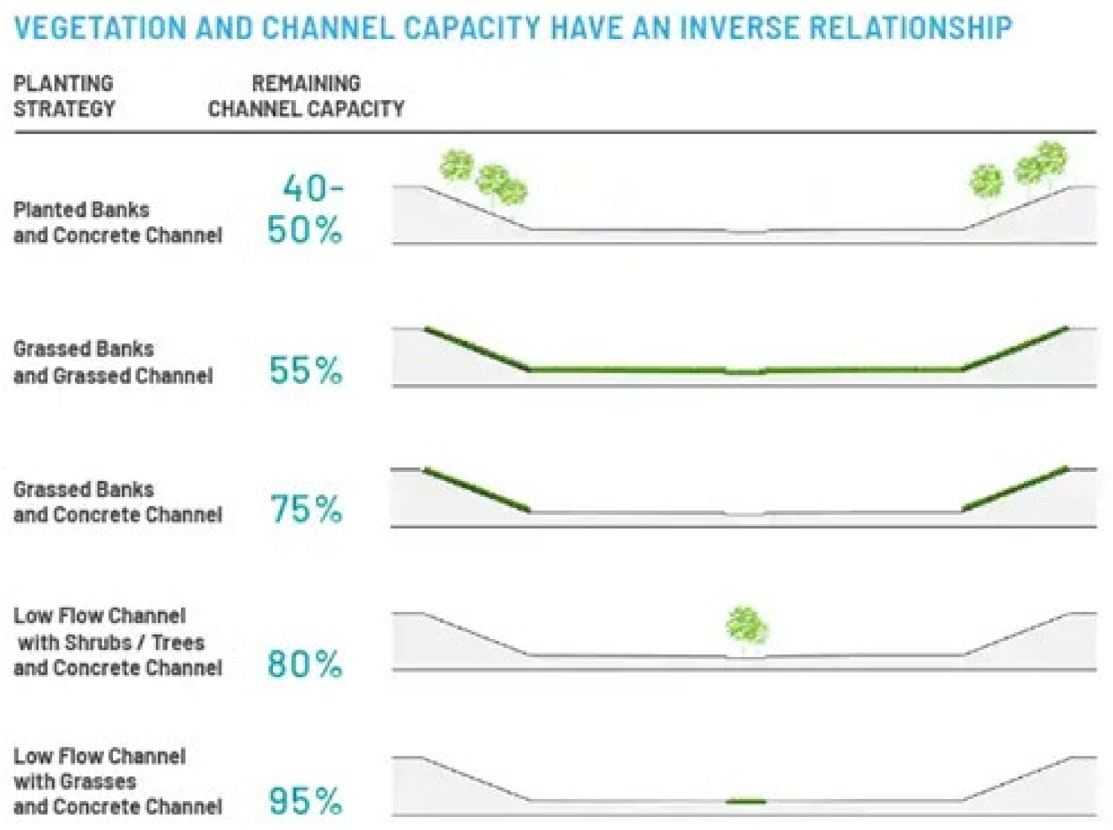
- Each reservoir location was analyzed to determine if peak flows could be contained while alleviating flooding downstream
- Bankfull flow: 5,900 / 6,900 cfs
- Reservoir release: 4,000 cfs
- 100-yr Excess Flow: 3,642 acre-ft
- 10-yr Excess Flow: 1,417 acre-ft





TRAPEZOIDAL CHANNEL OPTION

- Vegetation and flood capacity have an inverse relationship
- Vegetation increases friction and reduces velocities
- Vegetated channel need to be ~3x wider
- Requires additional acquisition of residential and commercial properties
- Bridges, expressways and infrastructure affected



PUBLIC INFORMATION / COMMUNICATIONS

RIO PUERTO NUEVO – COMMUNICATION STRATEGY

Project Implementation	TOPICS		TOOLS / METHODS	
	INFORMATIONAL	PARTICIPATORY	INFORMATIONAL	PARTICIPATORY
USACE Activities / Efforts				
Up to 60% Design (Intermediate Phase) - Contract 6A - Contract 6B - Contract 7 - Linear Parks	• USACE Limitations (Authority, Decisions, and Regulations) • Alignment and conceptual design • Overall status of the project and future activities • Ongoing investigations	• Design alternatives (provide details for USACE to evaluate) • Specific concerns about the proposed design • Values that the stakeholders believe should be considered in the design	• Status updates • Public announcements • Fact sheets	• Meetings with stakeholder and technical groups • NEPA meetings, scope notification, and comment period
60% Design – Contract Award - Contract 1 - Contract 3 - Contract 4 - Contract 5A - Contract 5B	• Design details and updates • Property acquisition and relocation status • Future activities	• Concerns in relation to property acquisitions and relocations	• Status reports • Public meetings • Updates to the website • Fact sheets	• CNT 4 - NEPA meetings, scope notification, and comment period, as applicable
Contract Award – Construction Completion - Contract 2	• Future activities • Contact information for reporting incidents and concerns.	• Report incidents during construction	• Business card • Project sign and permit information • Fact sheets	• Report incidents so that they can be addressed

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

ENGAGEMENTS WITH COMMUNITY MEMBERS

Date	Contract	Event
February 2020	Contract 1	Presentation to the Borinquen Community
November 2020	Contract 6	Community Meeting with University Gardens and Villa Nevarez Community
May 2022	Contract 5 and 6	Project briefing to HOA president – University Gardens
July 2022	Contract 6	Community Meeting for University Gardens, Jardines Metropolitanos and Villa Nevárez residents
January 2023	Contract 3	Public Meeting with Puerto Nuevo Norte
March 2023	Contract 3	Public Meeting with Puerto Nuevo Norte
May 2023	Contract 3	Follow Up with Puerto Nuevo Norte
June 2023	Contract 7	Meeting with communities close to Quebradas Josefina and Doña Ana
August 2023	Contract 1	Meeting with industrial area business owners
November 2023	Contract 7	Follow up meeting with communities close to Quebrada Josefina and Doña Ana
February 2024	All	Meeting with Director for PR & Territories in the White House, Principal Deputy Secretary of the Army for Civil Works, NGOs and community leaders

Sample of community meetings since 2020.

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

INTERAGENCY MEETINGS

Date	Event
July 2019	Project presentation to University of Puerto Rico
August 2019	Project presentation to Mayor of San Juan, Hon. Carmen Yulín
May 2022	Project presentation to Major of San Juan, Hon. Miguel Romero, Alianza and US EPA
August 2022	Project status meetings with DNER and DTOP
November 2022	Meeting with LUMA Energy executives to brief on PR projects
December 2022	Project briefing to Congresswoman Jennifer González Colón and participation in La Chuleta Placement Site Groundbreaking Ceremony
December 2022	Site visit with LUMA Energy
December 2022	Meeting with DNER and Public Buildings Authority
January 2023	Meeting with DNER/ECOMADD to discuss Contract 2.
March 2023	Meeting with Municipality of San Juan to present the proposed conceptual linear park as part of the recreation facilities included in the project
August 2023	Contract 6 briefing to Fortaleza, DNER, and UPR on design strategy
August 2023	Meeting with PR Public Service Regulatory Board to discuss concerns with project scope and telecommunication infrastructure
September 2023	Meeting with Municipality of San Juan to discuss municipality action items related to the project.
October 2023	Meeting with state and local Government on Contract 2
January 2024	Meeting with Governor’s Chief of Staff, DNER, and Department of Education to discuss potential school impacts
February 2024	Meeting with Governor to provide an update of the project
February 2024	Meeting with Municipality of San Juan to brief Mayor Romero to provide an update of the project

Sample of meetings with other agencies since 2019.









RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

MEETINGS WITH NON-GOVERNMENT ORGANIZATIONS

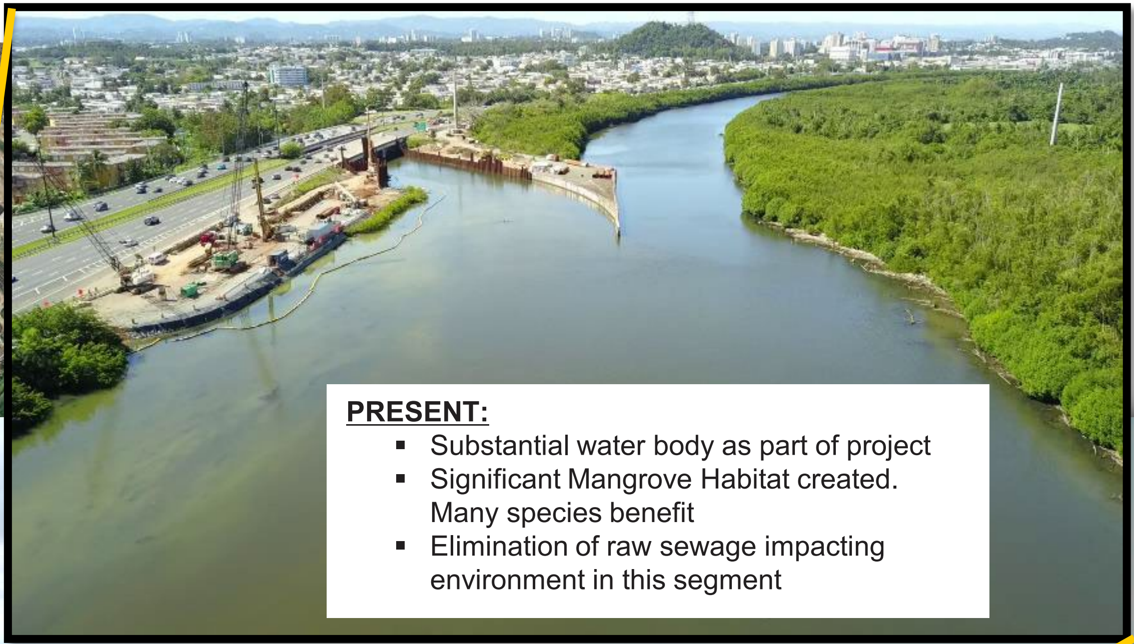
Date	Event
December 2018	USACE at UPR Mayaguez with Multiple Organizations on Engineering with Nature
December 2018	USACE presentation at the Comprehensive Management of Flood Prone Areas Seminar in San Juan, PR
December 2019	USACE presentation to Alianza and Para la Naturaleza
March 2020	Meeting with Alianza to discuss future engagements impacted by Covid
October 2020	USACE virtual presentation to Alianza and community members
November 2020	USACE meeting with Alianza to explain USACE process and needs from Alianza
February 2021	Conference call with Alianza to discuss challenges with having a steering committee
June 2021	Project presentation to Alianza
March 2023	Informational session with DNER, Municipality of San Juan, Alianza, Estuario and USDA forest service
January 2024	Meeting with Director for PR & Territories in the White House, Principal Deputy Secretary of the Army for Civil Works, NGOs and community leaders
March 2024	Community Meeting with Coalicion which includes members from Para la Naturaleza, Alianza and others

Sample of meetings held with non-government organizations since 2018.

MOVING FORWARD WITH CHANGE

RIO PUERTO NUEVO:
REALIZED BENEFITS FROM COMPLETED PROJECT

2000-2015
- Note little vegetation and narrow creek that existed prior to project
- Leaking Sanitary Sewer spilling raw sewage into San Juan Bay



PRESENT:
- Substantial water body as part of project
- Significant Mangrove Habitat created. Many species benefit
- Elimination of raw sewage impacting environment in this segment

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) AND ENVIRONMENTAL CONSIDERATIONS

WE ARE HERE

RIO PUERTO NUEVO NEPA DOCUMENTATION

The required NEPA assessment, will have an associated NEPA document. There are three types of NEPA documents (CE, EA and EIS), which document is appropriate is dependent upon the level of potential environmental consequences of the action.

CE – Categorical Exclusion
EIS - Environmental Impact Statement
EA - Environmental Assessment
FONSI – Finding of No Significant Impact
MFR - Memorandum for Record
PAC – Post Authorization Change Report
LRR – Limited Re-evaluation Report
USACE – U.S. Army Corps of Engineers
EPA – U.S. Environmental Protection Agency
NE - No Effect
NLAA - May Affect, but Not likely to adversely affect
LAA - May Affect, Likely to Adversely Affect
LMM – Luis Muñoz Marin
USFWS – U.S. Fish and Wildlife Service
NMFS - National Marine Fisheries Services
DNER – P.R. Department of Natural and Environmental Resources

Opportunities for Public Review and Comment

1978
"Rio Puerto Nuevo Survey Investigation" initiated at the request of the Commonwealth of Puerto Rico

1984
Survey Report and EIS completed
Public scoping
Public meeting March 1984

1993
EA completed triggered by a change in the design including the avoidance of a significant cultural site (Old Aqueduct)
Finding: FONSI
- Public scoping (EA)
- Public Notice for the Water Quality Certification

2002
Updated EA triggered by changes in the design of the Bechara Channel and realignment of the Margarita Levee Finding: FONSI
Public coordination in 1999
Public scoping

2016
Updated ESA and EFH consultations

2017
MFR/CE for dredging in the Rio Puerto Nuevo (after De Diego Bridge) and the Margarita channels as an emergency restoration after Hurricane Maria.

2018
MFR for the Determination of Appropriate National Environmental Policy Act Compliance based on the project information available.

2021
MFR for the Determination of Appropriate National Environmental Policy Act Compliance for Supplemental Contracts 1, 2 and 3 because the scope of the projects remains essentially the same.

2023-2025
Contract 4 and Material Management Areas (Bechara and LMM Pond)
EA Draft - Ongoing
- Scoping letter : Public comments received
- Public scoping **Upcoming**
- Public meetings

2026-2027
Contract 6 and Contract 7 Scoping
EA Draft and Interagency meetings

Upcoming
- Scoping Letter

Upcoming
- Public scoping

Upcoming
- Public meetings

RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

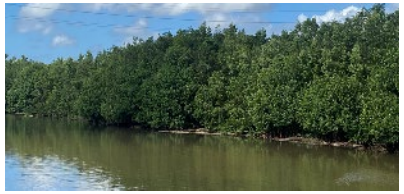
NATIONAL ENVIRONMENTAL POLICY ACT AND ENVIRONMENTAL CONSIDERATIONS

EFFORTS AND ACTIONS FOR NEPA COMPLIANCE

CLEAN WATER ACT	MAGNUSON – STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT	FISH AND WILDLIFE COORDINATION ACT	COASTAL ZONE MANAGEMENT ACT	MARINE PROTECTION RESOURCES AND SANCTUARIES ACT	NATIONAL HISTORIC PRESERVATION ACT	ENVIRONMENTAL JUSTICE EO 12898
SECTION 401	NMFS Essential Fish Habitat conservation comments were received in 2014, including specific requirements for protection of ESA	Coordination act report in 2001. In 2013 PAC the Service concurred with the determination that the proposed actions NLAA the species considered.	Determination of consistency of the project with Puerto Rico Management Program in 1998, 1993, and 2001.	**SECTION 103**	**SECTION 106**	EJ evaluation incorporated into report
Water Quality permit received in 1993 and 2001.				Material ineligible for offshore disposal will be deposited in upland material management areas (La Chuleta, Bechara and LMM Pond.	Completed 2001, Programmatic Agreement completed in 2023.	
SECTION 404 (B)1						
Finding of Compliance and No significant adaptations of the guidelines						

MITIGATION PLAN

- Plan submitted to DNER, EPA and NMFS in 1993 and successfully stablished in 2015
- Planting April 2013 – May 2014
- 28 acres of planted mangroves (mix of white, black and red mangroves) resulting in wildlife such as the Antillean Manatee, returning to completed sections of the project



RIO PUERTO NUEVO FLOOD RISK MANAGEMENT

NATIONAL ENVIRONMENTAL POLICY ACT AND ENVIRONMENTAL CONSIDERATIONS

ENDANGERED SPECIES ACT

Informal Consultations and Formal Consultations with Biological Assessments by USACE and Biological Opinions by the managing agency.

	Consulting Agency	Consultation Date	Effect Determination
Yellow Shouldered backbird	USFWS	1991, 2003	NE
Brown Pelican	USFWS	1991	NE
Sea turtles (green, hawshill and heatherback)	USFWS & NMSF	1992, 2002, 2010, 2013, 2014	NLAA
Whales (humpback, blue, fin, sei, sperm)	USFWS & NMSF	2010, 2013, 2014	NLAA
Puerto Rican Boa	USFWS	2013	NLAA
Corals	NMSF	2010, 2014	NLAA
Antillean Manatee	USFWS	2013	NLAA

To access official documentation, please scan the QR code.

EPA – U.S. Environmental Protection Agency
NE - No Effect
NLAA - May Affect, but Not likely to adversely affect
LAA - May Affect, Likely to Adversely Affect
USFWS – U.S. Fish and Wildlife Service
NMFS - National Marine Fisheries Services
USACE – U.S. Army Corps of Engineers

WHERE ARE WE NOW? / WHERE WILL WE BE?

PURPOSE: The primary purpose of the authorized project is to improve human health and safety, and to provide additional incidental economic benefits (recreation, redevelopment, etc.) through flood risk management and reduction in damages to structures, contents, and transportation infrastructure within the Río Puerto Nuevo Basin.

EXISTING IMPACTS:

- Continued risk to health and safety of communities
- Old, failing infrastructure, not to updated design codes & standards (channels, utilities, bridges)
- Impacts to environment, economy, infrastructure and personal property
- Trees along the bank will continue to fall in and block river flow

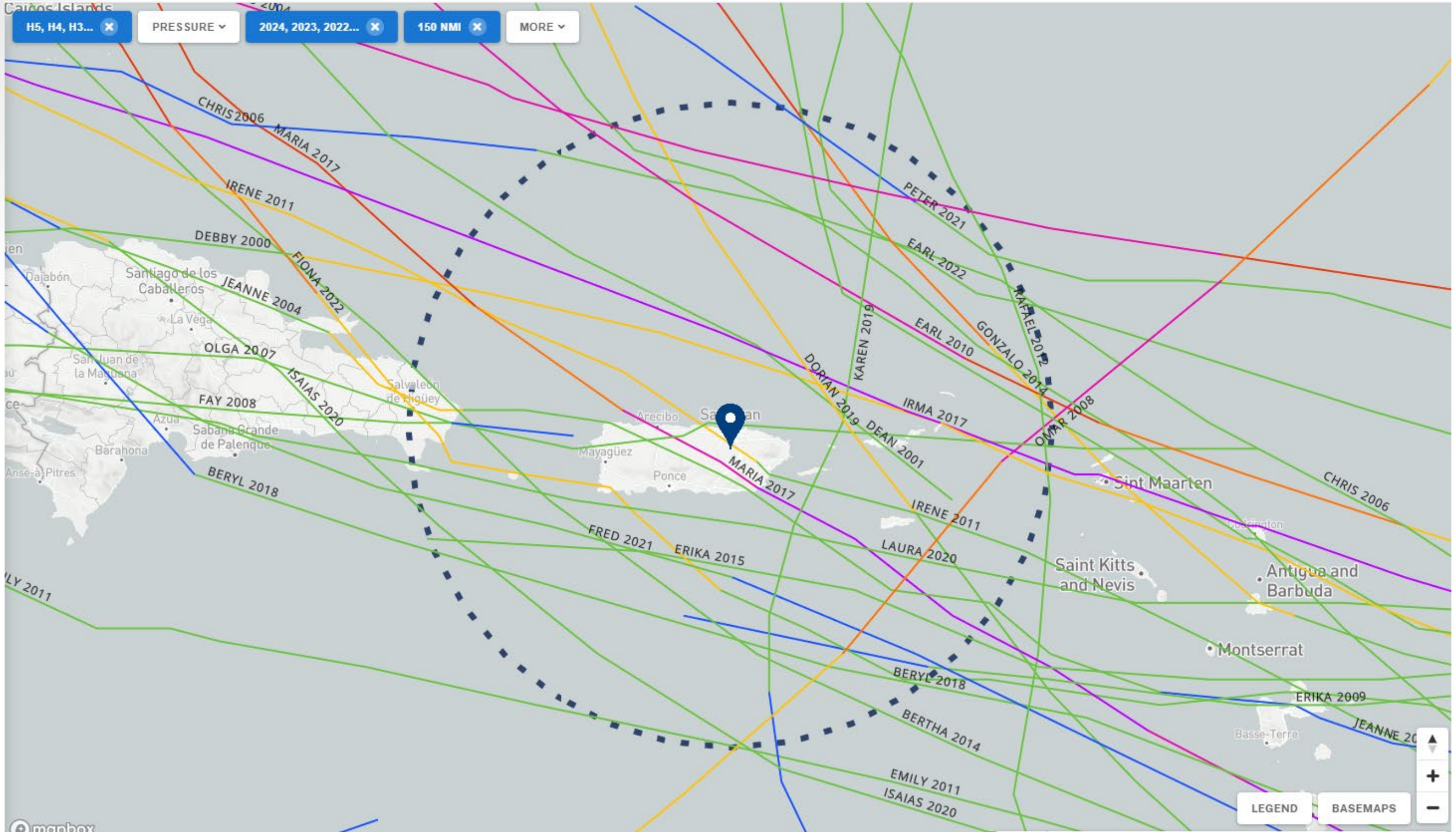
CONSTRUCTION TEMPORARY IMPACTS:

- Temporary impacts to environment; typical during construction
- Removal of Trees to allow construction access
- Maintenance of Traffic
- Temporary Inconvenience (fencing, dust, noise, etc.)

BENEFITS:

- Significant reduction of flood risk to San Juan and communities adjacent to project
- Improved Infrastructure (new utilities, replaced sanitary sewer and electrical)
- Robust new bridges and roadways that are alongside project
- New Linear Parks, green spaces and recreational areas within and adjacent to the project
- New landscaping and Native/non-invasive trees along project. Opportunities to tie in to wholistic nature-based, city approach

STORM ACTIVITY NEAR PUERTO RICO (2000-2023)



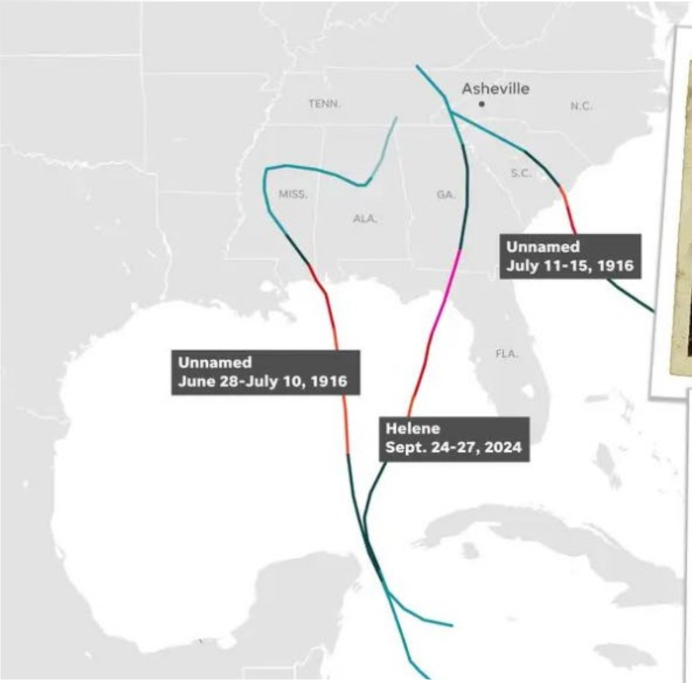
Historical Storms	
Category	**Quantity**
TS	11
H1	6
H2	1
H3	2
H4	6
H5	3
TOTAL	**29**

Landfall		
Storm	Year	Category
Jeanne	2004	H1
Olga	2007	TS
Irene	2011	H1
Maria	2017	H5
Fiona	2022	H1
TOTAL		**5**

Source: NOAA Historical Hurricane Tracks
Storm Criteria: H5, H4, H3, H2, H1, TS
Date Criteria: 2000 to 2023
Distance Criteria: 150 NMI from San Juan, PR

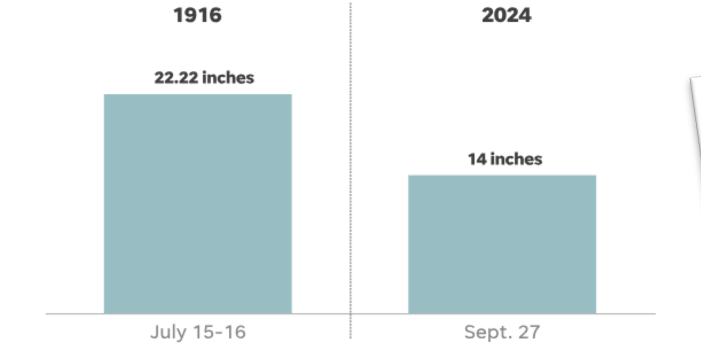
**Compared to 19 storms (same criteria) from 1976 – 1999. 152% increase last 24 years.*

HURRICANE HELENE – ASHEVILLE, NC



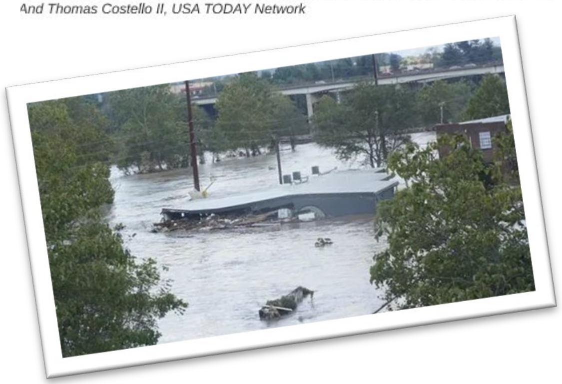
Rainfall

Reports state that between July 15-16, 1916, 22.22 inches of rain fell over parts of Western North Carolina. Versus Helene when Asheville received nearly 14 inches of rain through Friday, Sept. 27.



The National Weather Service released rainfall totals for the following areas through 8 a.m. local time on Saturday

rict in Asheville, N.C. along the French Broad River on Oct. 1, 2024 in the aftermath of
And Thomas Costello II, USA TODAY Network



HURRICANE HELENE – ASHEVILLE, NC

People moved to Asheville to escape extreme weather. They forgot its tragic history. | CNN

"If you live in a place that can rain, you live in a place that can flood," said Kathie Dello, North Carolina's state climatologist. The past week has shown that reality starkly.

Asheville has historically been susceptible to impacts from heavy rain, but the severity of Helene "seemingly caught people off guard," said Ed Kearns, chief data officer at First Street Foundation, a non-profit focused on weather risk research.

He attributed this to a tendency to rely on past experiences that are no longer relevant in a changing climate. "Risks are increasing more than we as humans can perceive," Kerns told CNN.

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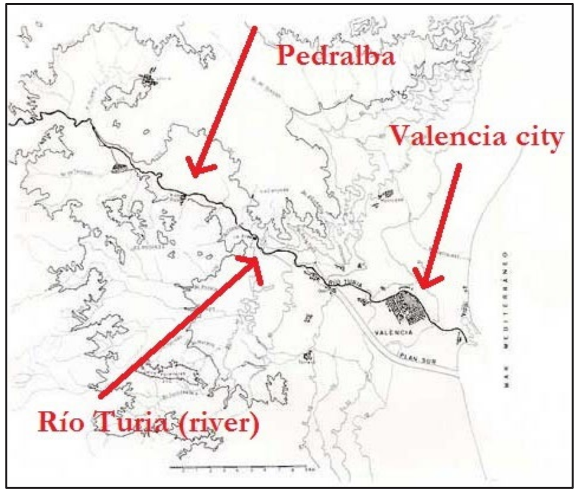
A recent First Street report found parts of North Carolina devastated by Helene could now experience a once-in-100 year flood every 11 to 25 years.

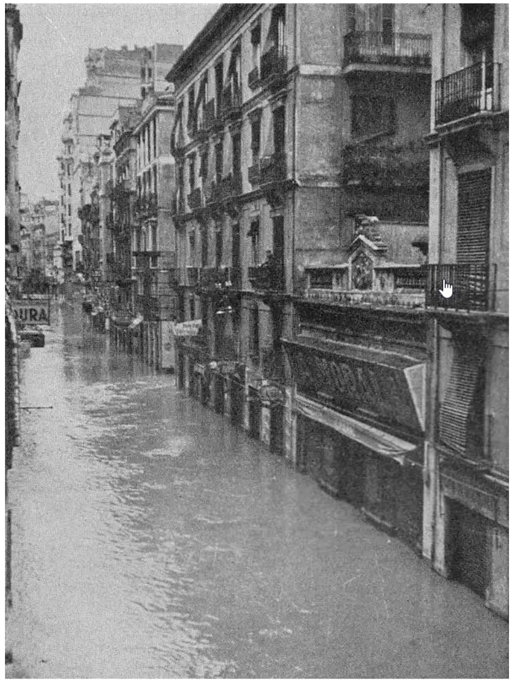
"People have pretty short memories on this stuff. There are always people who are willing to take a risk," he said. "This is the story of American post-disaster development."

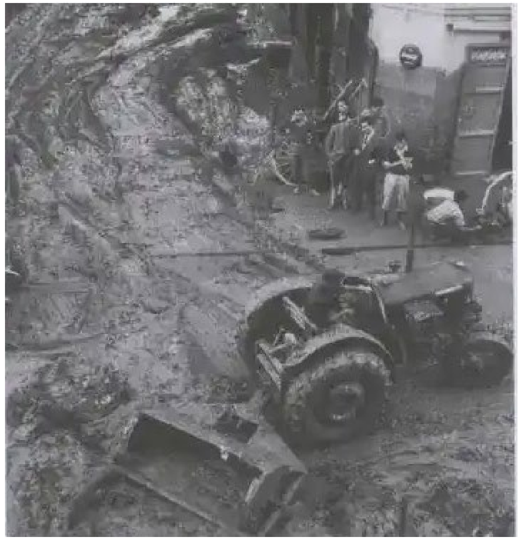
1957 VALENCIA FLOODING

‘LA RIUÁ’ October 14, 1957: The Flood That Changed Valencia Forever

PUBLISHED ON October 14, 2013 https://carolineangus.com/2013/10/14/la-riua-october-14-1957-the-flood-that-changed-valencia-forever/





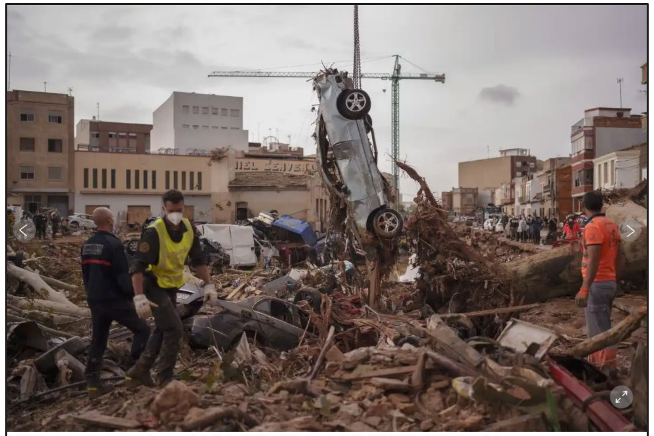


OCT. 29 2024 - VALENCIA FLOODING, SPAIN

https://www.youtube.com/watch?v=-Oam3r1OWLQ

2 of 83 | A "Falla" figure structure made of cardboard and other materials is damaged in an area affected by floods in Catarroja, Spain, on Monday, Nov. 4, 2024. (AP Photo/Manu Fernandez)

8 of 83 | Volunteers carry buckets of mud after floods in Paiporta, Spain, Sunday, Nov. 3, 2024. (AP Photo/Hugo Torres)



9 of 83 | Emergency services remove cars in an area affected by floods in Catarroja, Spain, on Sunday, Nov. 3, 2024. (AP Photo/Manu Fernandez)

83 | A soldier works in an area affected by floods in Catarroja, Spain, Sunday, Nov. 3, 2024. (AP Photo/Manu Fernandez)

11 of 83 | Emergency services remove cars in an area affected by floods in Catarroja, Spain, on Sunday, Nov. 3, 2024. (AP Photo/Manu Fernandez)

QUESTIONS?