

**GOVERNMENT OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU**

NEPR

Received:

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IN RE: REVIEW OF THE PUERTO RICO
ELECTRIC POWER AUTHORITY'S 10-
YEAR INFRASTRUCTURE PLAN –
DECEMBER 2020

CASE NO.: NEPR-MI-2021-0002

SUBJECT: Motion to Submit Scope of Work
for Guayabal Dam Seismic Retrofit and
Hurricane Maria Repairs

**MOTION TO SUBMIT SCOPE OF WORK FOR GUAYABAL DAM SEISMIC
RETROFIT AND HURRICANE MARIA REPAIRS**

COMES NOW the Puerto Rico Electric Power Authority (PREPA), through its counsel of record, and respectfully submits and requests as follows:

1. On March 26, 2021, the Puerto Rico Energy Bureau of the Public Service Regulatory Board (the “Energy Bureau” or “Bureau”) entered Resolution and Order (the “March 26 Order”) requiring PREPA to, among other things:

submit to the Energy Bureau each new capital investment project. For projects to be funded with the [Federal Emergency Management Administration “FEMA”] fund and/or any other federal funds, PREPA shall submit the specific projects to the Energy Bureau at least thirty (30) calendar days prior to its submittal to the [Central Office for Recovery, Reconstruction and Resiliency “COR3”], FEMA and/or any other federal agency.

March 26 Order at pp. 18-19, ¶ 10.

2. Thereafter, on November 18, 2021, the Honorable Energy Bureau entered a *Resolution and Order* (“November 18 Order”), which further stated that “[a]ll [of] PREPA’s capital projects expenses require the Energy Bureau’s approval.”

3. In compliance with the March 26 and November 18 Orders, PREPA herein submits for the review and approval of the Energy Bureau the scope of work (SOW) for permanent repairs to be performed on the Guayabal Dam, located on the Rio Jacaguas. This dam was constructed to provide water through the Juana Diaz Irrigation Canal for the irrigation of croplands in the southern

coastal plains of Puerto Rico, currently the Guayabal Dam provides irrigation for local crops, as well as potable water for approximately 7,500 residents in the Municipalities of Villalba and Juana Diaz (the “Project”). The works to be performed in the Project target the repair of damages that the Dam suffered as a consequence of the direct hit of Hurricane Maria. PREPA has also identified it needs to perform works of conservation, repairs, and retrofitting of its units and their auxiliary equipment. The structural retrofit of the Guayabal Dam is necessary to meet current U.S. Bureau of Reclamation risk safety guidelines for dam operation.

4. Pursuant to the above, PREPA hereby details the works needed to repair damages sustained by the Guayabal dam as well as necessary works to restore the facility and the dam as well as reduce the risk of catastrophic failure and/or potential uncontrolled release of reservoir storage during similar extreme rain events that could result in flooding of downstream communities and submits them to the Energy Bureau for evaluation and approval. For these works PREPA will seek reimbursement from the Federal Emergency Management Administration (“FEMA”). The damage that the Project suffered, and the permanent works required to address and repair the dam are listed below.

a. Guayabal Dam Seismic Retrofit and Hurricane Maria Repairs (Dams/Hydro)

(Exhibit A). The facilities description and deficiencies of the Guayabal Dam are listed in Sec. 2.2 and the damages and permanent works to be performed are listed in Sec. 3.1. The works performed aimed to restore the facilities to pre-disaster function and to approved codes/standards. The codes and standards are detailed in Section 4. The Project’s total estimated costs to be incurred in the permanent repair works are at \$1.81 million, while the preliminary cost estimate of the proposed mitigation measures is \$297,463,328. With the Energy Bureau’s leave, PREPA will

submit to FEMA a request for reimbursement of the entire amount spent under the Public Assistant program, pursuant to Section 406- Hazard Mitigation.

5. The above-listed projects are aligned with the operative IRP and Modified Action Plan approved by the Energy Bureau on August 24, 2021. *See Final Resolution and Order on the Puerto Rico Electric Power Authority's Integrated Resource Plan* entered in case no. CEPR-AP-2018-0001, *In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan*.

6. However, the SOW presented contains critical energy infrastructure information (CEII) that cannot be disclosed to the public. The CEII included in the SOW are global positioning system (GPS) coordinates of the power plant.

7. The following is a detailed list of the information that PREPA asserts is confidential and must be kept under seal.

Exhibit	Description	Confidential Information	Request for Confidentiality
Exhibit A	Guayabal Dam Seismic Retrofit and Hurricane Maria Repairs (Dams/Hydro)	GPS Location Page 4, Sec. 2.1	CEII

8. Article 6.15 of the *Puerto Rico Energy Transformation and RELIEF Act*, Act no. 57 of 2014, as amended (“Act 57”)¹, provides that “any person who is required to submit information to the Energy [Bureau] believes that the information to be submitted has any confidentiality privilege, such person may request the [Bureau] to treat such information as such[.]” *Id.* at Sec. 6.15. “If the Energy [Bureau], after the appropriate evaluation, believes such information should be protected, it shall grant such protection in a manner that least affects the public interest, transparency, and

¹ *Puerto Rico Energy Transformation and RELIEF Act*, Act no. 57 of May 27, 2014, 22 L.P.R.A. §§ 1051-1056.

the rights of the parties involved in the administrative procedure in which the allegedly confidential document is submitted.” *Id.* at Sec. 6.15(a). If the Energy Bureau determines that the information is confidential, “the information shall be duly safeguarded and delivered exclusively to the personnel of the Energy [Bureau] who needs to know such information under nondisclosure agreements.” *Id.* at Sec. 6.15(b). “The Energy [Bureau] shall swiftly act on any privilege and confidentiality claim made by a person subject to its jurisdiction by means of a resolution to such purposes before any allegedly confidential information is disclosed.” *Id.* at Sec. 6.15(c).

9. Pursuant to its vested powers, the Energy Bureau approved the *Regulation on Adjudicative, Notices of Compliance, Rate Review and Investigations Proceedings* (“Regulation 8543”).² Regarding the safeguards that the Energy Bureau gives to confidential information, Regulation 8543 provides that:

[i]f in compliance with the provisions of [Regulation 8543] or any of the Energy Bureau’s orders, a person has the duty to disclose to the Energy Bureau information considered to be privileged pursuant to the Rules of Evidence, said person shall identify the allegedly privileged information, request the Energy Bureau the protection of said information, and provide supportive arguments, in writing, for a claim of information of privileged nature. The Energy Bureau shall evaluate the petition and, if it understands the material merits protection, proceed according to what is set forth in Article 6.15 of Act No. 57-2014, as amended.

Regulation 8543 at Sec. 1.15.

10. Federal and Puerto Rico law protect the confidentiality of CEII, the public disclosure of which may pose a security threat in that the information could be useful to a person or group in planning an attack on critical infrastructure. *See, e.g.*, 18 C.F.R. § 388.113, as amended by Federal Energy Regulatory Commission (FERC) Order No. 683, *Critical Energy Infrastructure*

² Energy Bureau, *Regulation on Adjudicative, Notices of Compliance, Rate Review and Investigations Proceedings*, No. 8543 (December 16, 2015).

Information (issued September 21, 2006); *USA Patriot Act of 2001*, § 1016, creating the *Critical Infrastructures Protection Act of 2001*, including 42 U.S.C. § 5195c(e) (defining Critical infrastructure). FERC regulations subject such information to limitations on use and disclosure to “ensure that information deemed CEII stays out of the possession of terrorists.” 18 C.F.R. § 388.113(d)(4). *Off. of People's Counsel v. Pub. Serv. Commn.*, 21 A.3d 985, 991, Util. L. Rep. P 27157, 2011 WL 2473405 (D.C. App. 2011).

11. Under the Critical Infrastructures Protection Act of 2001, the term “critical infrastructure” means “systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.” 42 U.S.C. § 5195c(e).

12. In 2006, FERC Order no. 683 amended the regulations for gaining access to CEII and simplified procedures for obtaining access to CEII without increasing vulnerability of the energy infrastructure and ensuring that access to CEII does not facilitate acts of terrorism.

13. A utility is not required to obtain FERC or other federal government approval in order to designate information as CEII. For example, information required by FERC’s Annual Transmission Planning and Evaluation Report, Form No. 715, (“FERC No. 715”), is *de facto* considered CEII and is automatically afforded the heightened protections. FERC No. 715 requires that any transmitting utility that operates integrated (non-radial) transmission facilities at or above 100 kV must annually submit information including but not limited to: Power Flow Base Cases, Transmitting Utility Maps and Diagrams, Transmission Planning Reliability Criteria, Transmission Planning Assessment Practices, and Evaluation of Transmission System Performance. Any utility that submits the required transmission information pursuant to FERC

No. 715 does so with the knowledge that, as stated in the Form's Instructions, FERC "considers the information collected by this report to be CEII and will treat it as such." *See also* 18 C.F.R. § 141.300(d) relating to the Form and CEII.

14. Mainland regulators typically do not require a utility that designates material as CEII to follow any process before the federal government in order to make or support such a designation, and, further, that the regulator, in its informed discretion, can establish limits on how information that it considers CEII can be accessed.

15. Furthermore, and regarding the argument made by PREPA, FERC has ruled on several occasions that global positioning system (GPS) coordinates of any project features "qualify as CEII because it provides more than just location." *See e.g.* Final Rule, Docket Nos. RM02-4-000, PL02-1-000; Order No. 630, Note 31, entered on February 21, 2003 (ruling that FERC considered the global positioning system coordinates of any project features (precise surveyed or GPS coordinates at or above two decimal points of accuracy of equipment and structures) gas information to qualify as CEII because it provides more than just location).³

16. The Energy Bureau, in prior dockets has accepted the Authority's designations of material as CEII, recognizing that both federal law and Puerto Rico law support such designations when applicable.⁴ Accordingly, and pursuant to the above, it is respectfully requested that the Honorable Energy Bureau find that the information categorized by PREPA as CEII is confidential and that the Secretary of the Energy Bureau be directed to keep the confidential CEII under seal.

³ Federal Register: March 3, 2003 (Volume 68, Number 41); Rules and Regulations, pp. 9857-9873.

⁴ *See e.g. Resolution and Order* entered on August 27, 2019, in case no. CEPR-AP-2018-0001, *In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan*.

WHEREFORE, PREPA respectfully requests the Energy Bureau to approve the above-listed Project, find that the information categorized by PREPA as CEII is confidential and order the Secretary of the Energy Bureau to keep the confidential CEII under seal.

RESPECTFULLY SUBMITTED.

In San Juan Puerto Rico, 18th day of May 2023.

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CERTIFICATE OF SERVICE

It is hereby certified that I have filed the foregoing with the Clerk of the Energy Bureau using the electronic filing system using <https://radicacion.energia.pr.gov/login> and also, that I have served a copy on LUMA Energy, LLC and LUMA Energy ServCo, LLC through their counsel of record at laura.rozas@us.dlapiper.com and margarita.mercado@us.dlapiper.com.

In San Juan Puerto Rico on this 18th day of May 2023.

/s Joannely Marrero Cruz
Joannely Marrero Cruz

Exhibit A

Government of Puerto Rico

Puerto Rico Electric Power Authority (000-UA2QU-00)



4339DR-PR Hurricane Maria

FEMA Public Assistance

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Guayabal Dam Seismic Retrofit and
Hurricane Maria Repairs
(Dams/Hydro)***

GM #TBD

4/24/2023



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Guayabal Dam Seismic Retrofit and Hurricane Maria Repairs (Dams/Hydro)
PREPA Project Number	

Federal Information

(provided by FEMA)

Damage Number(s)	
Damaged Inventory/Asset Category	Island Wide Dams and Hydroelectric Power Plants
FEMA Project Number (formerly Project Worksheet)	TBD
Amendment Number	0

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	Damage Inventory Number	GPS Location
Guayabal Dam Office / Facility	TBD	
Guayabal Dam Structure	TBD	

2.2. Facilities Description

The Guayabal Dam, located on the Rio Jacaguas, was constructed in 1913 to provide water through the Juana Diaz Irrigation Canal for the irrigation of croplands in the southern coastal plains of Puerto Rico. Guayabal Dam is a buttress dam comprised of 73 buttresses and a structural wall as a method to hold the impounded water in the Guayabal reservoir. The dam measures 129.90 FT high and 1,977.90 FT long with 18 FT buttress widths. The spillway located on the north side of the dam is a hollow-core concrete structure and discharges are controlled by 21 automated flashboards measuring 33 FT wide by 10 FT high. The spillway discharge capacity is approximately 608,917 gallons per minute.

Guayabal Dam provides irrigation for local crops, as well as potable water for approximately 7,500 residents of Villalba and Juana Diaz Municipalities. Guayabal Dam also serves as the sole discharge retention support for Tao Vaca Dam and Reservoir located approximately one mile upstream within the same watershed which discharges solely into Guayabal reservoir.

Recent studies have determined that the Guayabal Dam can potentially fail if subjected to seismic accelerations and sudden stress condition changes such as liquefaction. Specifically, the dam is deficient in its ability to sustain potential critical seismic loads in the cross-canyon direction, and the structural connection between the buttress head and buttresses is under-reinforced. Therefore, structural retrofit of the Guayabal Dam is necessary to meet current U.S. Bureau of Reclamation risk safety guidelines for dam operation.

In addition, the outlet gate and discharge channel structures of the Guayabal Dam, as well as supporting facility infrastructure, office, and maintenance buildings were damaged because of Hurricane Maria. Repair of these components is necessary to restore the facility and the dam as well as reduce the risk of catastrophic failure and/or potential uncontrolled release of reservoir storage during similar extreme rain events that could result in flooding of downstream communities.

Section 3. Scope of Work

3.1. Scope of Work Description (e.g., Plan for Repair)

All work will be designed and completed in accordance with locally adopted codes and standards, FEMA-approved industry standards, and Federal EHP regulations, laws, and Executive Orders. PREPA is the agency that provides electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are



eligible as critical services facilities as defined in the FEMA Section 428 PAAP and 2018 BBA guidance documents.

Guayabal Dam Office/Facility

A. Access Road/Parking Pavement

The existing access road and parking pavement (3-inch-thick asphalt) were washed out by excess rainwater from Hurricane Maria. Proposed SOW for road/pavement repairs is as follows:

1. Demolish and remove damaged asphalt road and parking areas (approximately 445 square yards).
2. Dispose of excess debris.
3. Prepare and grade the subbase to ensure proper drainage. Consideration will be given to extra drainage and modifications necessary to mitigate future damage.
4. Repave the road and parking area with in-kind asphalt pavement.

B. Fencing, Swing Gates

Approximately 450 LF of five-strand barbed wire fence and 135 LF of 6-FT high chain-link fence were damaged by the storm. Two swing gates (15 FT long x 8 FT high) and a galvanized pipe dual swing gate (7.5 FT x 6 FT) were damaged. Proposed SOW for fence repairs is as follows:

1. Remove and dispose of existing damaged chain-link fence, 450 LF of five-strand barbed wire fence and 135 LF of 6-FT high chain-link fence, and two swing gates and a dual swing gate, including posts, barbed wire, concrete footing, and cross pieces.
2. Install new swing gates and chain-link fencing including posts, concrete footings, cross pieces, 5-strand barbed wire, and supports.
3. Install grounding as appropriate (if required) by using a bare, solid copper riser conductor (minimum #2 gauge) every 3 LF of fencing, connecting the fence to the underground grounding grid.
4. All materials will be commercial grade or better. All installations will be in accordance with PREPA codes and standards and any other applicable building codes including U.S. Department of Agriculture RUS-1724E-300 Design Guide for Rural Substations Section: 9.10.10.1 and Appendix C.

C. Steel Arch Shed Building

The south wall of a steel arch shed, 29 FT long x 16 FT wide x 18 FT high, was damaged by high winds and debris impact. Damage also includes erosion of fill material (undermined) under one corner of the shed's concrete slab foundation (approximately 1 CY). Proposed SOW for the steel arch shed is as follows:

1. Remove existing 29 FT x 16 FT x 18 FT high steel building and dispose.
2. Replace steel building with in-kind material per industry code and standards.
3. Inject a grout mixture, at least 1 CY, beneath the concrete slab. Fill the voids to reestablish the strength of the slab.

D. Concrete Office Building



The interior walls, ceilings, exterior walls, and windows of the concrete office building sustained damages due to excessive rain and high winds. Proposed SOW for the building repairs is as follows:

1. Ceiling – remove/scrape paint as required, patch and repair plaster surface (approximately 390 SF). Apply a minimum of two coats of epoxy and polyurethane paint.
2. Interior walls – remove/scrape paint as required, patch and repair concrete surface (approximately 1,615 SF). Apply a minimum of two coats of epoxy and polyurethane paint.
3. Exterior walls – remove/scrape paint as required, patch and repair concrete surface (approximately 895 SF). Apply a minimum of two coats of epoxy and polyurethane paint.
4. Steel plate windows – remove and replace two 36-inch x 38-inch steel plate windows with new in-kind windows.

E. Facility Site/Grounds

Damages to the facility site and grounds include a 3/16-inch steel plate (96 SF) covering steel pipes, three 2 FT x 2 FT signs, two 3 FT x 3 FT signs, one 8 FT x 4 FT sign, 40 LF of 1.5-inch diameter safety railing for walkway (bottom row), and 16 LF of 3/4-inch EMT electrical conduit. Proposed SOW for the facility site/grounds repairs is as follows:

1. Steel plate – remove and replace 96 SF steel plate with new 3/16-inch steel plate.
2. Signage – remove and dispose of three 2 FT x 2 FT, two 3 FT x 3 FT, and one 8 FT x 4 FT damaged signs, replace signs in-kind.
3. Railing – remove and replace 40 LF of 1.5-inch railing with in-kind railing.
4. Electrical conduit – remove and replace 16 LF of 3/4 -inch EMT conduit with in-kind conduit.

Guayabal Dam Structure

The storm also damaged discharge structures on the Guayabal Dam, including 10 concrete counterweight adjustment blocks, 10 floodgate counterweight devices, 12 floodway splitter angles, and the spillway chute concrete slab.

Proposed SOW for the dam structure repairs is as follows:

1. Counterweight adjustment block – 10 each at 150 pounds each. Remove and replace concrete blocks in-kind.
2. Floodgate's counterweight structure – damaged structures at #1, #5, #6, #7, #8, #9, #12, #14, #18, and #21 (10 total). Total dimensions: 4 FT deep x 3.5 FT wide x 33 FT long, total weight 64,800 pounds. Remove and replace counterweight structures in-kind.
3. Floodgate leaf's splitter angles – each floodgate leaf has three splitter angles welded to the upstream face at the top edge. About 3 FT of the angle's total length projects above top of leaf. Damaged floodgate leaf's splitter angles at #1, #2, #4, #5, #6, #7, #11, #12, #15, #16, #17, and #18 (12 total). Dimensions: 4-inch-wide x 4-inch-high x 4 FT long, 3/8 inch thick. Remove and replace metal floodgate leaf's splitter angles in-kind.
4. Spillway chute concrete apron (slab) – the ogee crest spillway, controlled by floodgates, discharges over the apron of a naturally-adopted terrain surface. This surface was retrofitted by filling up the depressions and tying the rock outcrop surfaces and varying irregular areas with concrete, thus creating a better level surface spillway elevation conforming to the downstream slope topography. Approximately 40%, or 68,000 SF of the total area of the apron (170,000 SF) was damaged. Most affected chutes are #12 to #21. The thickness of the apron varies and the scope of repairs include:



- i. Remove damaged concrete material from spillway chutes.
- ii. Clean excess debris from spillway area and dispose.
- iii. Repair chutes with concrete. Restoration will include 100% of spillway chute apron re-engineered and constructed with 406 hazard mitigation scope of work. See Section 5 below.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If 30% A&E work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed 30% A&E work.

3.3. 30% Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

Yes

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes. If yes, describe how incorporated below.

Yes, applicable codes and standards will be identified and incorporated into the plans and specifications.

4.2. Industry Standards



Yes. If yes, describe how incorporated below.

Yes, applicable industry standards will be identified and incorporated into the plans and specifications.

Section 5. Cost Estimates

Cost estimates to complete the work have been generated at a class 5 level, which is between -50% and +100% of the final project cost. The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. **For the engineering estimates provided, the preliminary A/E design estimate is a subset of the final design and engineering subtotal, which is a subset of the total cost.**

Note that cost estimates presented herein are order-of-magnitude estimates only. Cost estimates are anticipated to be revised once additional information is available. Costs will be adjusted to current dollars based on appropriate escalation factors.

Cost Type	Guayabal Dam Facilities Amount (\$M)
Preliminary Architectural & Engineering Design	\$0.15
Final Design and Engineering	\$0.37
Construction	\$1.44
Total Project Estimated Cost	\$1.81

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

PREPA intends to develop 406 Hazard Mitigation proposals for the Guayabal Dam Structure to harden the facilities and prevent future similar damage, reduce the risk of future catastrophic failure due to seismic activity or during extreme flooding events. These improvements may include, but are not limited to:

- Perform H&H study to understand flow and discharge characteristics of Rio Jacaguas from the Guayabal Dam spillway to the river discharge into the Caribbean Sea. Emphasize downstream impact of the proposed project including a comprehensive analysis of impacts to the Special Flood Hazard Area (SFHA) for 500-yr critical facility.
- Complete A&E study to determine impacts of the proposed mitigation measures on the facility, ensure consideration for hardening to 500-yr flood impact for critical facility.
- Access road: Stabilize shoulders and embankments with geotextile fabric or revetments. Use geotextile blankets between pavement section and subbase. Provide concrete swales along roadway to manage drainage.



- Spillway chute concrete apron: Remove 170,000 SF, redesign and replace based on A&E study. Ensure resiliency to 500-yr flood impact.
- Seismic retrofit, infill buttresses: Excavate in between each buttress bay approximately 8-feet. Wash existing concrete surfaces, place HDPE pipe to relieve upward pressure and use formwork to place aggregate concrete to fill buttresses to make a gravity-type structure. See “Appraisal Design Risk Analysis” prepared by U.S. Bureau of Reclamation, October 9, 2020.
- Dam crest spillway: Install automatic and independently operated gates, controls and hardware so that gates can be operated independently.
- Backup power: Install 1250-1500 kW prime generator to maintain dam operation during extended power outages.

The following mitigation items will be evaluated during the A&E to determine quantities and cost:

- Spillway surface: Extend the lateral and interior spillway wingwalls to protect embankments and direct discharge. Add rip rap to the toes and lateral medial wingwalls. Install terracing through the inclined spillway surface using rip rap and crib wall framing. Install boulder sieves in the thalweg using rip rap to roughen and armor the thalweg. Install reinforced hydraulic holes at the discharge base of each terrace to absorb energy and prevent scour and erosion. Install and anchor hydroseeded geotextile fabric over eroded fill areas.
- Downstream Conveyance Corridor (Rio Jacaguas): Following guidance derived from the A&E and H&H studies and in an effort to protect the downstream population from dam failure, install terracing in steeper sections of the corridor using crib wall framing, and rip rap. Install boulder sieves in the thalweg using rip rap to roughen and armor the thalweg and increase the number of smaller sluices. Install reinforced hydraulic holes at the discharge base of each terrace to absorb energy and prevent scour and erosion. Install and anchor hydroseeded geotextile fabric over eroded embankment fill areas. In the slower, less steep sections of the corridor, direct discharge by installing stone spurs and rootwads to create back marshes and relief eddies. Install xerophytic wetland vegetation to help reduce discharge energy, provide water filtration, trap sediment, and create a natural habitat. Install sediment basins to reduce discharge energy and allow sediment to settle out of the water column. Install multiple outlets from the sediment basins into the main conveyance corridor. Armor the basin outlets using natural stone rip rap.
- Downstream Embankments – Install rip rap to armor the toe of the embankments. Install brush mattresses, rootwads, and live crib walls on embankments that are high risk for erosion and cutting. Focus the mitigation on areas within the river meander where heavy flow in the thalweg threatens to cut the embankment. Install and anchor hydroseeded geotextile fabric to harden the embankments, crib walls, and highly eroded areas.

6.2. 406 Mitigation Opportunity Cost Estimate

Cost effectiveness will be determined during the preliminary engineering phase to document the benefits of these proposals. PREPA will provide cost information and BCAs for 406 Hazard Mitigation proposals submitted for this project.



The preliminary cost estimate of the proposed mitigation measures is \$297,463,328. A comprehensive mitigation proposal, final cost estimate, and cost effectiveness will be developed after an A&E study is completed. **For the engineering estimates provided, the preliminary A/E design estimate is a subset of the final design and engineering subtotal, which is a subset of the total cost.**

Cost Type	Guayabal Dam 406 Hazard Mitigation Proposal (\$M)
Preliminary Architectural & Engineering Design	\$15.58
Final Design and Engineering	\$30.78
Construction	\$266.68
HMP Estimated Cost	\$297.46

Section 7. EHP Requirements

EHP considerations will be identified and evaluated during the preliminary engineering (30% design) phase and submitted to FEMA for review. Requirements will be incorporated into the final design and construction documents approved by FEMA prior to construction activities.



Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

PREPA Project Sponsor Comments

Comments

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 8. Attachments

8.1. Project Detailed Cost Estimates



Guayabal Dam -
4.24.23.xlsx

8.2. Engineering Studies and Designs



Guayabal Dam -
Appraisal Design Risk

8.3. Location Maps and Site Pictures



Photo Set - Guayabal
Dam 2019.pdf

8.4. Other: (Please Describe)