United States Section
International Boundary and Water Commission

Directives Management System

Volume II : Engineering
Part 0100 : Engineering Management
Chapter 0103 : Construction Management
Directive 01031 : Design and Construction Requirements for Work within USIBWC Jurisdiction
Citation: : SD.II.01031
Proponent: : Construction Management Division
Effective Date: : December 6, 2023

1. **Purpose.** The purpose of this document is to present policy, criteria and guidelines for the review, approval, and inspection of construction activities not performed by or for the United States Section, International Boundary and Water Commission (USIBWC) when within the limits of USIBWC flood protection works, international reaches of the Rio Grande and Colorado River, the international land border between the United States and Mexico, as well as any other property which is owned or controlled by the USIBWC.

2. **Authority.**

   A. The USIBWC is required by the 1970 Boundary Treaty (23 UST 371), Article IV, between the United States and Mexico, to join the Mexican Section of the IBWC in reviewing any activities within the channel of the Rio Grande and Colorado River or their floodplains from the design flood to determine whether they will cause deflection or obstruction of the normal or flood flows of these international boundary rivers and to prohibit the construction of such works. The Article IV prohibition provision of the 1970 Boundary Treaty is implemented by 22 USC §277d-34 which allows the USIBWC to condemn land and remove such obstructions.

   B. Further, the IBWC under provisions of the 1944 Water Treaty (59 Stat 1219) between the United States and Mexico must be assured that the construction will not result in problems with water allocation and that the activities will not interfere with the operation of IBWC flood control projects.

   C. Statutory authority of the USIBWC for carrying out actions in the United States is provided in 22 USC §277 a-d.

   D. Executive Order 13337, Issuance of Permits with Respect to Certain Energy-Related Facilities and Land Transportation Crossing on the International Boundaries of the United States.

3. **Applicability.** This Directive applies to all USIBWC employees to include its field offices and to any government agency, individual, corporation, or organization that wishes to construct improvements on land in which USIBWC holds a property interest (hereinafter

"USIBWC-controlled property"). Insofar as there are private inholdings within USIBWC projects, some, but not all, portions of this Directive will apply to the private inholdings as indicated throughout this Directive, its manuals, and its appendices.

4. Policy.

A. The USIBWC retains right of approval of all improvements located on USIBWC-controlled land. USIBWC will issue a letter of no-objection for projects on private property within USIBWC's projects.

B. Approval must be received from the USIBWC prior to commencement of construction of any facility which passes over, under, or through the floodwalls, levees, and improved channel or floodways that are USIBWC-controlled property in the following USIBWC river reaches:

(1) Rio Grande from Percha Dam, New Mexico to Box Canyon, Hudspeth County, Texas.

(2) Rio Grande within the Presidio-Ojinaga Valley, Texas

(3) Rio Grande from Falcon Dam to the Gulf of Mexico

(4) Colorado River from Imperial Dam on the California-Arizona border to the US-Mexico border

(5) Tijuana River from the US-Mexico border to Dairy Mart Road

(6) Arroyo Colorado and emergency floodways in the Lower Rio Grande

C. Approval must be received from the USIBWC prior to commencement of construction of any facility on USIBWC-controlled property which passes over, under, or within the floodplain of the international reaches of the Rio Grande and Colorado River. Where the floodplain contains private inholdings, then USIBWC may issue a letter of objection or no-objection; however, its enforcement and regulatory authority is limited to that set-forth in 22 USC §277d-34 and USIBWC must condemn the private land or otherwise turn to judicial intervention to address a structure to which USIBWC objected.

D. Approval must be received from the USIBWC prior to commencement of construction of any facility which passes over, under, or within the international land boundary between the United States and Mexico.

E. In addition, approval must be received from the USIBWC prior to commencement of construction of any facility which passes over, under, or within the boundary of any USIBWC-controlled property and facilities. USIBWC facilities include, but are not limited to:

(1) South Bay International Wastewater Treatment Plant

(2) Morelos Dam

(3) Nogales International Wastewater Treatment Plant

(4) American Dam and Canal

(5) International Dam

(6) Rio Grande American Canal Extension (RGACE)

(7) Amistad Dam and Powerplant

(8) Falcon Dam and Powerplant

(9) Anzalduas Dam

(10) Retamal Dam

(11) USIBWC Field Offices

F. All approvals shall be provided in writing by the USIBWC in the form of an outgrant, a memorandum of agreement/understanding, or a letter of no-objection.

5. Responsibilities.

A. Commissioner. The USIBWC Commissioner provides ultimate oversight for USIBWC-controlled property and directs the support and funding to maintain a professional, trained, and equipped staff in support of the USIBWC mission.

B. Principal Engineer (PE), Engineering Department. The PE for Engineering provides program guidance and helps to develop policy for the criteria and guidelines for the review, approval, and inspection of construction activities not performed by or for the USIBWC.

C. Principal Engineer (PE), Operations Department. The PE for Operations ensures that this Directive is followed by Operations & Maintenance (O&M) activities. Additionally, O&M personnel shall notify the Realty Office whenever they observe activities which violate this Directive.

D. Supervisory Engineer, Construction Management Division (COND). The Supervisory Engineer, COND, will identify the specific requirements for construction activities addressed herein.

E. Supervisory Engineer, Engineering Services Division (ESD). The Supervisory Engineer, ESD, will identify the specific requirements for design activities addressed herein.

F. Supervisory Program Analyst, Master Planning Division (MPD). The Supervisory Program Analyst, MPD, will ensure this Directive, including any manual(s) or handbook(s) that may be issued or authorized for use, is the basis for processing outgrant requests.

G. USIBWC Employees. Complete all reviews, approvals, and inspections assigned consistent with this Directive, including any manual(s) or handbook(s) that may be issued or authorized for use.

H. All USIBWC Divisions and Project Field Offices have a duty to review and approve proposed construction activities not performed by or for the USIBWC, and are responsible for applying the criteria within this Directive, including any manual(s) or handbook(s) that may be issued or authorized for use.

I. The recipients of this Directive, including any manual(s) or handbook(s) that may be issued or authorized for use, shall be responsible for applying the criteria when

applying for construction within the limits of USIBWC flood protection works, international reaches of the Rio Grande and Colorado Rivers, as well as any USIBWC-controlled property. This Directive sets forth design requirements for projects on private inholdings.

6. **Dissemination.** This document, including any manual(s) or handbook(s) that may be issued or authorized for use, shall be shared with the public to the full extent required to ensure that construction activities within the limits of USIBWC flood protection works, international reaches of the Rio Grande and Colorado Rivers, as well as any other property which is owned or controlled by the USIBWC meet these requirements.

7. **Supersession.** This Directive supersedes Directive SD.III.01012 dated July 27, 2000.

Approved:

MARIAELENA GINER Digitally signed by MARIAELENA GINER Date: 2023.12.06 15:46:25 -07'00'

Dr. Maria-Elena Giner, P.E.
Commissioner

12/06/2023
Date

United States Section
International Boundary and Water Commission

Directives Management System

Volume II	:	Engineering
Part 0100	:	Engineering Management
Chapter 0103	:	Construction Management
Directive 01031	:	Design and Construction Requirements for Work within USIBWC Jurisdiction
Manual	**:**	Design and Construction of Work within USIBWC Jurisdiction Manual
Citation:	:	SD.II.01031-M-1
Proponent:	:	Construction Management Division
Effective Date:	:	

1. Purpose. The purpose of this document is to present criteria and guidelines for the application, review, approval, and inspection of construction activities not performed by or for the United States Section, International Boundary and Water Commission (USIBWC) when on USIBWC-controlled property and when within the limits of USIBWC flood protection works, international reaches of the Rio Grande and Colorado River, the international land border between the United States and Mexico.

2. Applicability.

A. This Manual applies to all USIBWC employees to include its Field Offices.

B. This Manual applies to any entity (Federal, state, local, or private) who wishes to construct or modify any feature which is located on upon USIBWC-controlled property and within international reaches of the Rio Grande and Colorado River, the international land border between the United States and Mexico. Portions of this manual will apply to private inholdings within USIBWC projects.

3. Application Request.

A. An outgrant is required from the USIBWC for any proposed construction or modification of an existing feature which is located upon USIBWC-controlled property or which is located within international reaches of the Rio Grande and Colorado River, the international land border between the United States and Mexico, as well as any other property which is owned or controlled by the USIBWC. Letters of no-objection must be sought for projects on private inholdings surrounded by USIBWC projects.

(1) In some cases, issuing an outgrant will require the Proponent or Owner to enter into a memorandum of agreement with the USIBWC in regards to operations and maintenance of the structure(s) in question.

B. To obtain an outgrant or a letter of no-objection from the USIBWC, the Proponent, Sponsor, or Owner (hereafter referred to as Proponent) must meet the requirements set forth in this document and its referenced appendices and must also submit to the USIBWC all

appropriate permits, environmental studies, and documents as required to assure adherence to all environmental laws and regulations for the proposed work.

C. The Proponent's project is required to comply with Directives SD.II.03011 and SD.II.03031 to ensure proper environmental oversight.

D. The Proponent is strongly encouraged to consult with the USIBWC sufficiently in advance of a proposed project construction start date to discuss site conditions and other issues which may require specific requirements.

E. Coordination with USIBWC shall be through our Realty Office (realty@ibwc.gov). The Realty Office schedule discussions between the Proponent and relevant USIBWC personnel.

F. Construction shall not start until final drawings and specifications have been approved in writing by the USIBWC. In addition, final construction drawings and specifications shall be stamped and signed by a professional engineer licensed in the state where the work will be performed prior to USIBWC approval.

4. Definitions

A. Easement. USIBWC easement refers to land whereby USIBWC holds a legal interest or easement for flowage, flood control, or other use.

B. Floodplain. The floodplain encompasses all land between two levees or when no levees are present that is locally adjacent to a river that the Federal Emergency Management Agency (FEMA) indicates as Zones A, AO, AH, A1-A30, AE, A99, AR, AR/AE, AR/AO, AR/A1-A30, AR/A, V, VE, or V1 through V30.

C. Levee. Levee is an embankment built to prevent the overflow of a river. A levee is typically earthen but also includes floodwalls, floodgates, and all other similar and appurtenant structures. The term "levee" shall not exclude these other structures but shall be all inclusive to any structure that provides flood protection.

D. Longitudinal. Running along the structure, e.g. parallel to the centerline.

E. Outgrant. A grant of interest or right to one to use government real property by a lease, easement, license, or permit. It is an agreement whereby a third party may, depending on the type of real estate instrument issued, enjoy an interest in or use of real property.

F. Pipeline. Pipeline includes pipelines, pipes, utility conduits, and culverts. Pipelines may be round, oblong, arches, square, or rectangular. Pipelines do not include irrigation and stormwater structures within levees.

G. Property. USIBWC property is USIBWC deeded land, land transferred to USIBWC from another Federal agency, or land transferred to USIBWC via Federal, state, or local law/ordinance.

H. Proponent. The Proponent is the Owner of the project or the company/person who submits application for an outgrant on behalf of the Owner. Once an outgrant is issued, Proponent refers only to the Owner.

I. Transverse. Running across the structure, e.g. perpendicular to the centerline.

J. USIBWC-Controlled Property. All property for which USIBWC holds a property interest including, but limited to, USIBWC property and land for which USIBWC holds an easement.

K. Utility. These include privately, publicly, or cooperatively owned lines, wires, pipelines, facilities, and systems for producing, transmitting, or distributing communications, power, heat, gas, oil, water, waste, stormwater, or irrigation water.

5. Policy

A. It is the USIBWC's policy to only allow utilities and pipelines within USIBWC-controlled property when no other option is available.

(1) Utilities and pipelines within, under, or crossing levees shall be minimized at all times.

B. Previous USIBWC policy allowed placement of utilities and pipelines within the USIBWC-controlled property. As these facilities are impacted by USIBWC projects, they are being relocated whenever possible.

(1) Proponents cannot assume that approval of a past project will automatically allow approval of their new or modified project.

(2) Utilities and pipelines within USIBWC levees shall be removed whenever possible.

C. Proponents with current USIBWC outgrants who wish to upgrade, change, or otherwise modify their licensed or permitted works must submit an application for these changes. If the project is allowed to remain within USIBWC-controlled property, any portions modified will be required to be brought up to these standards.

D. All outgrants will have established general conditions. Key items to note for all outgrants include:

(1) All outgrants are revocable by the USIBWC.

(2) If revoked, all facilities shall be removed and the site restored to pre-project conditions by the Proponent at their expense and subject to the approval of the USIBWC.

(3) If the USIBWC requires a modification of the outgrant work, the Proponent is required to make the modification at their expense.

E. Failure of Proponents to follow this Directive is justification for rejection of their outgrant application or revocation of their issued outgrant.

F. Approval or a letter of no-objection must be received from the USIBWC prior to commencement of construction of any facility is on USIBWC-controlled property and passes over, under, or within the floodplain of the international reaches of the Rio Grande and Colorado Rivers. USIBWC may require concurrence from the Mexican Section of the IBWC.

G. Approval must be received from the USIBWC prior to commencement of construction of any facility which passes over, under, or within the Rio Grande American Canal or the Rio Grande American Canal Extension (RGACE) in El Paso, TX. Such project may also require the approval from the El Paso County Water Improvement District Number 1.

H. Approval must be received from the USIBWC prior to commencement of construction of any facility which passes over or under the land border between the United States and

Mexico from El Paso, TX to San Diego, CA. USIBWC reviews the project to ensure that there are no adverse hydraulic and erosional impacts to either the United States or Mexico and to maintain the structural integrity of the boundary monuments, intermediate markers, and visibility between the adjacent monuments, as well as maintaining access to these monuments per 22 USC §277a and §277d-34. Typically, such projects have a proponent on the Mexican side who will be responsible for coordinating with the Mexican Section of the IBWC.

I. Approval must be received from the USIBWC prior to commencement of construction on any USIBWC-controlled property.

6. Standard Drawings. USIBWC is developing standard drawings. Work on USIBWC structures must follow these drawings. The Proponent's may download them at www.ibwc.gov/resources-info/.

7. Specific USIBWC Construction and Design Requirements.

A. Attached as appendices are individual requirements and guidance addressing specific requirements. They are available for download at www.ibwc.gov/resources-info/.

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. The table below provides a general outline of which documents govern work on what type of projects.

Project Location	Appendix A *(all)*	Appendix B *(land)*	Appendix C *(flood Control)*	Appendix D *(levee Testing)*	Appendix E *(design report)*	Appendix F *(hyd model)*	Appendix G *(reseeding)*	Appendix H *(floodplain)*
On USIBWC Property (*)	X	As applicable	As applicable	As applicable	As applicable	As applicable	X	As applicable
On USIBWC Easement (*)	X	As applicable	As applicable	As applicable	As applicable	As applicable	As applicable	As applicable
On Rio Grande Floodplain (*)	X		As applicable	As applicable	As applicable	As applicable	As applicable	X
On Colorado River Floodplain (*)	X		As applicable	As applicable	As applicable	As applicable	As applicable	X
On CA/AZ/NM Land Boundary	X	X			As applicable	As applicable	As applicable	

(*) See Section 4 for definitions of property, easement, and floodplain

C. These appendices hold the same regulatory authority as this Directive, however, the Commissioner has delegated approval authority to the Principal Engineer, Engineering Department. Routing/approval procedures remain unaffected by this delegation.

8. Minimum Time for USIBWC Reviews.

A. Proponent shall provide all documents to USIBWC allowing a minimum of 30 days for review. Projects requiring the approval of MXIBWC will require longer periods of time.

B. If comments are generated during USIBWC's review, the revised and/or missing documents shall be resubmitted, allowing another review by USIBWC.

9. Dissemination. This document and all appendices shall be shared with the public to the full extent required to ensure that construction activities within the limits of USIBWC flood protection works, international reaches of the Rio Grande and Colorado Rivers, as well as any other property which is owned or controlled by the USIBWC meet these requirements.

Approved:

MARIAELENA GINER Digitally signed by MARIAELENA GINER Date: 2023.12.06 15:43:54 -07'00'

Dr. Maria-Elena Giner, P.E.
Commissioner

12/06/2023
Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Design and Construction Requirements for All Projects

USIBWC Directive SD.II.01031-M-1 Appendix A

Table of Contents

The purpose of this document is to present criteria and guidelines for the application, review, approval, and inspection of design construction activities not performed by or for the United States Section, International Boundary and Water Commission (USIBWC) when within the limits of USIBWC flood protection works, within the limits of international reaches of the Rio Grande and Colorado River, within the limits of the international land border between the United States and Mexico, as well as any other property which is owned or controlled by the USIBWC.

1. General Conditions for all Projects.

A. All materials used within any structure that will be in water, convey water, or be adjacent to any rivers, drains, canals, or arroyos shall have National Science Foundation (NSF) 61 rating. Metals, concrete, rocks, and soil are not required to meet this requirement.

B. Levees (floodwalls, etc.) have specific design and construction requirements. See "*Appendix C-Requirements for Projects On or Affecting a USIBWC Flood Control Structure*" and "*Appendix D-Minimum Levee Embankment Testing Requirements*" for guidance. For project considerations, levee height shall be the higher of the existing ground surface or the calculated design flood water surface plus a minimum of 3 feet. Levee freeboard is the height of the top of levee above the design flood water surface elevation. Refer the 44 CFR 65.10 for additional information on the required levee freeboard. The levee freeboard does not include settlement, which must be separately

accounted for in the design. Levee may mean earthen levee, concrete floodwall, floodgates, stoplogs, sluice/slide gates, or any combination of such which acts as a flood control structure as well as all appurtenances.

C. All reports, drawings, specifications, and test results shall be signed and sealed by a professional engineer licensed to practice in the state where the work will be performed.

D. In USIBWC areas with gated access (e.g. levees in the El Paso, TX and Las Cruces, NM areas), Proponent must design all project public access points to be less than 30 inches in width or provide chicanes which prevent the passage of small ATVs.

(1) USIBWC Standard Drawing 26741 is available for construction of typical chicanes.

2. Design Report.

A. A Design Report shall be provided demonstrating that Proponent's work will not negatively affect USIBWC structures (including levees) or property. See "*Appendix E-Design Report Requirements*" for guidance on Design Reports.

B. If project, or part of project, is within a river floodplain, a Drainage Report is required describing hydraulic modeling and results to show that the water surface elevation from the design flood does not increase above the threshold limits established by the USIBWC and that the maximum deflection of flood flows by the project is not more than +5% towards either the U.S. or to Mexico.

C. Work within the Rio Grande and Colorado River floodplain based on the design flood requires review and concurrence from the Mexican Section in accordance with the 1970 Boundary Treaty. This review and concurrence may require weeks or months of communications. Design work may continue during this period, but in no instance, shall construction proceed until concurrence is reached with Mexico.

D. USIBWC will use sound engineering judgment to determine which reports are required. For example, if a Proponent wishes to place a conduit 5 feet below the bed of the Rio Grande, a scour analysis will be required. But if the Proponent wishes to place a conduit 25 ft under the Rio Grande, it is unlikely a scour analysis will be required because that amount of scour is not usually seen. Now if the conduit will be 15 feet below the surface in a very narrow section of the river, a scour analysis will probably be likely, but if the same conduit is placed in a very wide section of the river, then a scour analysis may not be required. Every situation is evaluated individually to ensure that USIBWC structures are protected while minimizing the work required by Proponents.

E. See "*Appendix B-Land Boundary Project Requirements*" and "*Appendix F-Hydraulic Modeling Methodology*" for guidance on Hydraulic Modeling Reports and hydraulic modeling. See "*Appendix H-Requirements for Projects On the Rio Grande and Colorado River Floodplains*" for required design flood flows for each reach of the Rio Grande and Colorado River.

3. Drawings.

A. USIBWC-controlled property boundary shall be clearly shown on Proponent's drawings.

(1) USIBWC-controlled property includes all property for which USIBWC holds a property interest including, but limited to, USIBWC property and land for which USIBWC holds an easement for flowage, flood control, or other use.

B. Project coordinate system, survey units used, datum, and grid to ground conversion shall also be shown.

C. Drawings shall be of sufficient details to determine exactly what is proposed, how it is to be constructed, and by whom.

D. In any operation involving earthwork, such as an excavation, drilling or boring, cross sections and profile of the proposed works must be furnished.

E. Any drawings showing project or project component interaction with USIBWC structures shall be drawn to scale.

F. Drawings must be signed and sealed by a professional engineer duly licensed in the state(s) where the project is to be constructed.

4. Land Boundary Monuments.

A. No Design Report is required showing impact to USIBWC structures if the only structure is IBWC's Land Boundary Monuments.

B. Gate access is required at each Land Boundary Monument.

C. A minimum of 3 feet of clearance between the base (footing) of each Land Boundary Monument and any Proponent structure (above or below ground) is required.

D. Specifics for land boundary projects is provided in "*Appendix B-Land Boundary Project Requirements*."

5. Utility Crossings.

A. Utilities include privately, publicly, or cooperatively owned lines, wires, pipelines, facilities, and systems for producing, transmitting, or distributing communications, power, heat, gas, oil, water, waste, or storm or irrigation water.

B. In no instance shall a utility hinder or impair USIBWC's ability to perform maintenance or flood operations.

C. The Proponent shall install and maintain suitable markers or signs indicating the location of the utility where it crosses the levee, pilot channel, and/or river and where the utility changes direction within USIBWC-controlled property. The markers or signs shall be a minimum of 5 feet high. No markers are to be installed on the levee slopes or 15 feet from the toe of the levee.

D. Sewer and petroleum pipelines shall be doubled lined.

E. Criteria for Overhead Wire Utility Crossings.

(1) The overhead transmission lines shall be constructed and maintained in such a manner as to provide a minimum vertical clearance (at the temperature of 60°

Fahrenheit) of not less than 28 feet above the levee height and at least 22 feet above the floodway water surface elevation from the design flood.

(2) No structure (poles or guy wires) shall be located closer than 35 feet from the toes of any levee. No structure (poles or otherwise) shall be located closer than 15 feet from the top of any channel bank.

(3) Guy wires may be anchored within the USIBWC-controlled property and shall be installed in such a manner that they do not interfere with the operation and/or maintenance of the channels, levees, or related structures. A witness post, not less than 5 feet high, shall be installed by each anchor or the cable shall be wrapped up to a point at least 5 feet above the ground with a brightly colored material to make it obviously visible.

(4) It shall be the Proponent's responsibility to maintain the areas clear of brush within a 10 foot radius of each pole, under the guy wires, and around the anchors on both sides of the levee and within USIBWC-controlled property.

F. Criteria for Other Overhead Utility Crossings.

(1) Where a utility crosses over a river, the utility shall be placed on piers (the piers must not obstruct flood flows of the river).

(2) Pipes crossing over the Rio Grande and Colorado River shall require a Department of Transportation permit (U.S. Coast Guard). Clearances and requirements shall be as directed by the U.S. Coast Guard.

(3) These utilities shall meet requirements for Non-International Bridges outlined below.

G. Utilities under River.

(1) The Proponent shall determine the minimum cover required under the bed of the maintained river channel and shall submit plans for review and approval. USIBWC requires depths of at least 10 feet in the Upper Rio Grande and 20 feet in the Lower Rio Grande. However, the actual depth shall be determined by scour analysis, required protection of utility, and normal USIBWC maintenance operations in the area. Depth shall also be deep enough to ensure that blowouts of pressurized drilling fluid during drilling operations cannot occur.

(2) When utility installation is under both levees and the river or pilot channel, the entry and exit location, when located landside of a levee, shall be set back sufficiently from the landside levee toe to ensure that: (a) the utility reaches its maximum depth, and (b) the utility is no less than 300 feet landside from the levee centerline. The utility shall be constructed in a straight alignment for a minimum distance of 15 feet beyond the landside of the levee toe. See "*Appendix C-Requirements for Projects On or Affecting a USIBWC Flood Control Structure*" for additional requirements when utilities pass under a levee or other flood control structure.

(3) For installation under river or pilot channel only, the utility entry or exit location, when located on the riverside of the levee, shall be located at least 35 feet from the riverside levee toe.

(4) When installing utilities by drilling, the Proponent shall furnish information addressing the following concerns and give specific dimensions, distances, pressures, weights, and all other pertinent data.

(a) Comprehensive understanding of the subsurface soil and groundwater conditions to a minimum depth of 20 feet below the lowest pipe elevation

(b) Locations of the pipe penetration entry and exit

(c) Allowable uplift pressures

(d) Drilling procedures and onsite quality control monitoring during drilling operation

(e) Grouting of the pipe annulus, backfilling of any excavated areas, and repair of the construction-staging areas

H. Utilities Crossing Under Pilot Channels or Drainage Ditches. The utility shall be installed with a minimum cover of 5 feet under the channel side slopes and bed of the pilot channel or drainage ditch. However, the Proponent shall submit to the USIBWC scour calculations to justify depth.

6. Non-International Bridges.

A. The Proponent shall submit drawings and Hydraulic Modeling Report to indicate the effects the proposed project would have on flows and floodway capacity. The plans shall include cross and transverse section drawings covering the floodplain bound by levees or high ground and reasonable distances up (minimum of 500 feet) and downstream of the proposed structure. The drawings shall have sufficient detail on existing vegetation, roads, and structures along with proposed improvements.

B. A Design Report and scour calculations are required for all bridges.

C. Minimum Requirements for Replacement of Existing Bridges.

(1) Old bridge piers must be removed to an elevation at least 2 feet below the maintained invert of the channel and at least 1 feet below ground level in the floodplain. USIBWC will provide the maintained invert elevation of the channel at the bridge location.

(2) For replacement of an existing bridge, the proposed bridge length shall be no shorter than that of the existing bridge. Abutments shall be moved out of the floodplain and shall avoid levees.

(3) The bottom chord of the new bridge shall be higher than *xx* feet above the top of the levee to allow for flood fighting operations by USIBWC. USIBWC's O&M Department shall provide the distance required above the top of the levee. The bottom chord of the new bridge shall be no lower than the height of the levee(s) in the vicinity of the proposed bridge site. If levee does not exist, the bottom chord shall be at least 1 foot higher than the water surface elevation from the design flood.

D. Minimum Requirements for New Bridges.

(1) The bottom chord of the new bridge shall be higher than *xx* feet above the top of the levee to allow for flood fighting operations by USIBWC. USIBWC's O&M Department shall provide the distance required above the top of the levee. The bottom chord of the bridge shall be no lower than the height of the levee(s) in the vicinity of the proposed bridge site.

(2) The bridge structure shall be designed to pass the project design flood at the bridge site without causing an obstruction to normal flows or flood flows, without increasing the flood stage.

(3) Piers and bents are to be aligned with the river flow in order to present the least obstruction area to the path of flood waters and floating debris. Piers must be sufficiently founded to preclude scour failure. For parallel bridge crossings, piers and bents shall be placed adjacent to each other and in alignment with the river flow, however, piers and bents shall be spaced to the maximum distance as practical.

(4) Proponent shall locate bridge abutments outside USIBWC-controlled property whenever possible.

(5) If bridge abutments are within any part of USIBWC's levee(s), Proponent shall ensure that bridge design meets 44 CFR §65.10(b).

(6) If bridge or connecting roadways block access to USIBWC levee, Proponent shall provide USIBWC access from one side to the other that is at least 3 feet above the water surface elevation from the design flood. Access may be on the landside of the levee or may be created via floodwall replacement of the levee under the new bridge as long as the access road has a minimum vertical clearance of 16.5 feet.

(7) If bridge or connecting roadways block access to USIBWC levee, ramps shall be constructed on the levee, both upstream and downstream of bridge along with a graveled portion of the floodway connecting the two ramps. This graveled connecting road shall have a minimum vertical clearance of 16.5 feet above the floodplain to allow for the safe passage of heavy equipment under the bridge.

E. For bridges crossing over levees, a minimum vertical clearance of 16.5 feet shall be provided above the levee height to allow for the safe passage of heavy equipment.

F. International Bridges. International bridges have significant project requirements. Contact USIBWC for details and coordination of your project.

7. Vegetative Restoration or Planting.

A. Planting of trees and groups of bushes in existing floodways is not encouraged and shall be permitted only where additional levee freeboard is available to permit an increase in water surface elevation. Only native plants with deep-type root systems may be planted in selected areas of existing or approved floodways.

B. The planting shall be a minimum of 20 feet from the toe of the levee and the top of the channel bank unless otherwise directed by the USIBWC.

C. Trees shall be planted at an average spacing of no closer than 100 feet, center to center, unless a Hydraulic Modeling Report with full flood modeling is provided showing trees do not raise the water surface elevation of the design flood.

D. Appropriate protection against rodents or beavers shall be provided and each tree shall be carefully located to prevent damage while mowing operations are conducted.

E. Trees shall be pruned by the Proponent to allow mowing with tractor type mowers. No vine plants will be permitted.

F. The Proponent is responsible for performing watering and maintenance on planted vegetation until such time as it is self-supporting. Any plants or poles that die before this time period shall be removed by the Proponent.

G. The Proponent shall provide drawings indicating planting locations and plant type along with a coordinated planting plan with Hydraulic Modeling Report for review and approval.

H. After planting is completed, drawings shall be provided showing exact location of each plant. The depth of planting, plant variety, plant source, and planting date shall also be provided.

I. Seeding of vegetation shall be per "*Appendix G-Reseeding USIBWC Property*."

8. Minimum Design Requirements.

A. All concrete items within USIBWC-controlled property involved with water, stormwater, or wastewater are designed per American Concrete Institute (ACI) 350, "*Code Requirement for Environmental Engineering Concrete Structures*"; changes or repairs to these structures shall also be designed per ACI 350.

(1) Office buildings, residential buildings, and warehouses may meet the current edition of ACI 318, Building Code Requirements for Structural Concrete, instead of ACI 350.

B. Bridges and public roadways shall be designed to meet the current edition of American Association of State Highway Transportation Officials' (AASHTO) Standard Specifications for Highway Bridges.

C. Loads not specifically identified in ACI 350/318 or AASHTO's standards shall meet the current edition of American Society of Civil Engineer's (ASCE) Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7).

D. Any construction within the floodplains of the Tijuana, Rio Grande, or Colorado Rivers or along the land border between the United States and Mexico, whether on USIBWC controlled property or not, must meet the following requirements:

(1) In river reaches without levees, threshold limits for maximum water surface elevation (WSE) increases are a maximum of 3 inches in urban areas and 6 inches in rural areas. WSE increase is the difference between the proposed and existing condition WSE.

(2) In all reaches, the proposed project cannot change flood flow deflections by more than 5%.

(3) Work within the floodplain may require concurrence with Mexico. This concurrence may require weeks or months of communications. Design work may continue during this period, but in no instance, shall construction proceed until concurrence is reached with Mexico.

(4) A Hydraulic Modeling Report meeting "*Appendix F-Hydraulic Modeling Methodology*" using the design flows indicated in "*Appendix H-Requirements for Projects On the Rio Grande and Colorado River Floodplains*" is required indicating that the design flood water surface does not exceed these requirements.

9. General Construction Requirements.

A. During non-flood seasons, river constrictions or diversions shall not exceed 50% of the river channel width. Any temporary embankments or similar constructions to divert water from a portion of the river channel must be limited to an elevation of 1 foot lower than the overbank floodway surface.

B. River diversions or constrictions shall be restricted to a period not to exceed 45 days.

C. As much construction work as possible shall be performed during the "non-irrigation" season that usually extends from mid-October to mid-January.

D. Restrictions must be placed on all construction activities involving levee breaks, temporary water diversions or constrictions placed in the river channel. No levee breaks, river channel constrictions, or river diversions are usually allowed during the flood seasons listed below:

(1) Upper Rio Grande Flood Control Project: June 1 through October 15

(2) Presidio Flood Control Project: June 1 through October 15

(3) Lower Rio Grande Flood Control Project: June 1 through October 31

(4) Tijuana River Flood Control Project: November 1 through March 31

(5) **Note:** Flood conditions may exist before or after these flood seasons that would require restrictions.

(6) In order to perform work during these flood seasons, the following conditions must be met:

(a) The Proponent shall maintain equipment and personnel capable of restoring the levee within 24 hours. The Proponent will be required to take immediate action upon notification by USIBWC to backfill and compact all excavated trenches and to reconstruct the levee to its original condition to prevent any flooding.

(b) The Proponent will also be required to remove all excess material from the floodplain and levees.

(c) The Proponent shall furnish to the USIBWC, the names and telephone numbers of 2 persons responsible for initiating this emergency service.

(d) Any damages and cost associated with such, to person(s) or property resulting from the Proponent's failure to conduct the necessary emergency measures, will be the Proponent's responsibility.

E. Proponent's program of work shall be such as to have the minimum impact on river flows.

F. The river channel, river banks, floodplains, and levees must be restored to their original condition promptly in the event of unexpected high river flows and prior to the next flood season whichever occurs first.

G. Stockpiling of materials within the floodway or on the floodplain is not permitted.

H. Approval of the project by USIBWC does not permit the Proponent to work in Mexico.

I. Safety to the Public. The Proponent shall provide, erect, and maintain all necessary barricades, suitable and sufficient flasher lights, :flagmen, danger signals, and signs,

and shall take all necessary precautions for the protection of the work and the safety of the public. Roads closed to traffic shall be Protected by effective barricades on which shall be placed acceptable warning and detour signs. All barricades and obstructions shall be illuminated at night by lights kept burning from sunset until sunrise.

J. Landscape Preservation. The Proponent shall exercise care to preserve the natural landscape and shall conduct construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent work, for approved construction roads and for excavation operations, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage which may be caused by the Proponent's construction operations and equipment. Movement of crews and equipment within USIBWC-controlled property and over routes used for access to the work shall be performed in a manner to prevent damage to USIBWC's facilities.

K. The Proponent will be responsible for obtaining other permits as may be required (i.e. 404 permits, etc.) for the subject work and for complying with restrictions of the same.

L. Prevention of Water Pollution.

(1) The Proponent shall comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution.

(2) The Proponent's construction activities shall be performed by methods that will prevent entrance, or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into the river/channel, flowing or dry watercourses, and underground water sources. Such pollutants and wastes include, but are not restricted to refuse, garbage, cement, concrete, sewage effluent, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution. Sanitary wastes shall be disposed of in accordance with State and local laws and ordinances.

(3) Dewatering work for structure foundations or earthwork operations near streams or watercourses shall be conducted in a manner to prevent excessive muddy water and eroded materials from entering the river or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Mechanized equipment shall not be unnecessarily operated in flowing water.

(4) Any discharges, including dewatering, into streams or watercourses must meet state surface water quality standards. The Proponent may be required to take water quality samples.

M. Abatement of Air Pollution.

(1) The Proponent shall comply with applicable Federal, State, interstate, and local laws and regulations concerning the prevention and control of air pollution.

(2) While conducting construction activities and operation of equipment, the Proponent shall utilize such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants. Equipment and vehicles that show excessive emissions shall not be operated until corrective repairs or adjustments are made.

(3) The Proponent's methods of storing and handling cement shall include means of controlling atmospheric discharges of dust.

(4) During the performance of the work required or any operations appurtenant thereto, whether on right of-way provided by the United States or elsewhere, the Proponent shall furnish all of the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from their operations from damaging crops, lands, and dwellings, or causing a nuisance to persons. The Proponent will be held liable for any damage resulting from dust originating from their operations on United States property or elsewhere.

N. Temporary Erosion Control. Erosion and sedimentation control devices shall be constructed or installed as needed based upon site conditions during construction activities. These preventive measures are required to minimize the potential for soil erosion or sedimentation of streams and rivers and to restore the construction site. Temporary erosion control measures should be in accordance with any applicable Stormwater Pollution Prevention Plans and General Construction Permits.

O. Final Erosion Control. Erosion control techniques may be vegetative or physical. Vegetative techniques including reseeding with native grasses shall abide by "*Appendix G-Reseeding USIBWC Property*."

P. USIBWC does not allow the use of slag (material left over or separated from metals during smelting) as aggregate material. Ground granulated blast-furnace slag conforming to ASTM C989 is allowable in concrete mixes.

10. Completion of Construction.

A. Upon completion of any construction with USIBWC-controlled property, the worksite area shall be left in a clean and neat condition with all debris and excess material removed from the site.

B. Upon completion of the construction, complete surveys, signed and stamped by a registered surveyor, shall be provided to USIBWC. Survey data shall be provided in pdf format with supporting data in a comma delimited ASCII file. Data shall be identified by point number, northing, easting, elevation, and description. The survey units used, coordinate system, datum, name of the individual/company who performed the survey, and date of survey shall be noted in both the pdf and ASCII file. Survey boundaries, breaklines, and other relevant data shall be exported from an AutoCAD Civil 3D file to an xml file.

C. Upon completion of construction, as built (record drawings) shall be provided for the whole project. Drawings shall be in Adobe pdf and shall be sized to at least ANSI B (11"x17") although fullsize drawings (ANSI D 22"x34") are preferred. Drawings shall be provided at a resolution not less than 300 dpi.

D. Upon completion of construction work, a copy of all completed tests in Adobe pdf shall be provided to USIBWC. Tests shall be provided at a resolution not less than 300 dpi.

11. Conditions.

A. Proponent's project shall not hinder or impair USIBWC's ability to perform maintenance or flood operations.

B. The USIBWC does not assume any responsibility or liability regarding damages that could be caused to the work, property, or persons in the project area as a consequence of river flood flows or the surface conditions of USIBWC-owned property. The USIBWC does not warrant that any of its property is suitable for any type of work or activity and project proponents are responsible for assessing the condition of the land before commencing work.

C. Any damage caused by the proposed works to either the banks of the river, USIBWC's structures, or USIBWC's property shall be repaired by Proponent, at the Proponent's cost, to the USIBWC's satisfaction.

D. The USIBWC will not alter its normal or flood operations criteria as a result of the proposed works.

E. Proponent is responsible for keeping their structures free of debris accumulation at all times. Proponent shall dispose of all debris in accordance with all applicable environment laws and regulations. In addition, Proponent is responsible for all costs associated with debris removal.

F. Proponent shall finalize and submit to the USIBWC an Operation and Maintenance (O&M) Plan for their project. It should be noted that the USIBWC will not be the agency responsible for performing operations and maintenance of the Proponent's project.

12. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

Digitally signed by RAMON MACIAS
Date: 2024.01.30 16:46:17 -07'00'

January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Land Boundary Project Requirements

USIBWC Directive SD.II.01031-M-1 Appendix B

Table of Contents

This document outlines the hydrologic and hydraulic modeling, erosion protection and additional documents to be submitted to the United States Section of the International Boundary and Water Commission (USIBWC) in advance of projects along the land boundary between the United States and Mexico. Additional requirements related to boundary delineation and demarcation are also described. Examples of these projects include the U.S. Customs and Border Protection (CBP) border fence projects constructed within the Roosevelt Easement (within 60 feet of the border), access roads, the U.S. General Services Administration (GSA) Port of Entry facilities, and related projects.

The purpose of these requirements is to avoid adverse hydraulic and erosional impacts to either the United States or Mexico and to maintain the structural integrity of the boundary monuments and visibility between the adjacent monuments, as well as maintaining access to these monuments per 22 USC §277a and §277d-34. The requirements are also intended to maintain the integrity of any existing intermediate markers between the boundary demarcation. The procedures outlined below are intended to prevent inadvertent encroachment or construction in the territory of Mexico.

1. Drainage Analysis.

A. The extent of the analysis required shall depend upon the complexity of the project. The methods used for the analysis shall be consistent with established engineering practice. In many cases, local municipalities have detailed criteria especially suited for local conditions, and these shall also be used.

B. Hydrology.

(1) For projects along the land boundary where rivers or washes flow from either the United States to Mexico or vice versa, the 100-year 24-hour discharges for the washes shall be determined from the upstream contributing watershed.

(2) Depending upon the nature of the project, discharges of additional return periods such as the 25-year or the 50-year may also need to be analyzed as determined by the USIBWC or for meeting local municipal drainage or other agency requirements. Analysis of lower return-period discharges may be necessary if there are clear adverse hydraulic impacts or erosional impacts anticipated from site conditions such as existing scour holes.

(3) The discharges are estimated using various methods such as the rational method, the Natural Resources Conservation Service (NRCS) TR-55 method and the U.S. Geological Survey (USGS) regression equations. The discharges may also be obtained by developing detailed hydrologic models using, for example, the U.S. Army Corps of Engineers (USACE) HEC-1 and HEC-HMS (version 4.8 or latest) software. For sites with flat terrain where clearly defined washes are not identifiable, two-dimensional software such as USACE HEC-RAS (version 6.1 or latest) or FLO-2D may also be used to generate hydrographs. Suitable design rainfall values may be obtained from sources such as the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Data Server. The design rainfall depths are combined with hydrograph transform methods (for example, Snyder, Clark, Soil Conservation Service [SCS], User Specified hydrograph), loss parameters (for example, Green-Ampt, SCS, initial and uniform), and reservoir and channel routing procedures (for example Modified Puls, Muskingum-Cunge) to develop the hydrologic model. For large watersheds, estimates of discharges obtained for tributary washes shall be checked for reasonableness by comparison with regional envelope curves, historical storms, and discharge per unit area values reported in the literature.

(4) Drainage areas less than 1 square mile may be analyzed using the rational method or TR-55. For drainage areas greater than 1 square mile up to 10 square miles, the TR-55 method may be used. For drainage areas larger than 10 square miles, discharges may be calculated using the HEC-1 or HEC-HMS software or the USGS regression equations.

C. Hydraulics.

(1) Washes along the land boundary flow either south into Mexico or north into the United States. The hydraulic analysis and impact calculations are intended to assure that there are no adverse hydraulic impacts or adverse erosional impacts to either country resulting from a proposed project.

(2) Hydraulic analysis shall be conducted for sizing drainage structures such as low water crossings, roadside ditches, culverts, bridges, and gates and for generating water surface profiles.

(3) For smaller projects across tributary washes such as a minor culvert, nomographs and/or simpler models may be used for the analysis. For most projects, a steady state hydraulic analysis using the latest version of the public domain USACE HEC-RAS software shall be used for the analysis. It is preferable to develop georeferenced hydraulic models which permit display of cross-sections on aerial images and GIS-based floodplain mapping.

(4) For border fence projects or similar types of projects obstructing transboundary flows, existing (natural, without fence) and proposed (with fence) condition one-dimensional (1D) steady state hydraulic models shall be developed for existing and proposed conditions to evaluate the hydraulic impacts along the modeled reach. The latest version of the USACE HEC-RAS software shall be used for the analysis. Flood flows generate debris. Therefore, blockage due to debris at or above 20% shall be included by reducing the opening size between the bollards representing the fence in the proposed condition model. As part of the hydraulic calculations such as normal depth calculations and sizing of culverts, software such as the U.S. Federal Highway Administration (FHWA) HY-8 and similar public domain and proprietary software may be used.

(5) In particular situations, 1D unsteady flow analysis or two-dimension (2D) modeling may also be required. One-dimensional unsteady flow analysis can be useful in describing the passage of a flood through a structure and can be used in situations where it is important to know how long high water surface elevations would last. The unsteady analysis also helps in optimizing the sizing of hydraulic structures such as detention basins and channels, resulting in cost savings. Two-dimensional modeling may be required in locations where there are no distinct washes and flow is predominantly sheet flow. Two-dimensional modeling may be conducted using software such as HEC-RAS or FLO-2D. The project Proponent is strongly encouraged to meet with the USIBWC in advance of projects to discuss site conditions and other issues which may necessitate specific modeling requirements.

(6) Additional guidance on hydraulic modeling is available in "*Appendix F-Hydraulic Modeling Methodology*."

D. Data Collection.

(1) The hydraulic model extent shall cover the project area and cover a reach sufficiently upstream and downstream from the project area. This ensures that the hydraulic results in the project area are not impacted by the boundary conditions. This also ensures that the water surface elevations for the existing and proposed conditions are the same at the upstream and downstream ends of the model. LiDAR data shall be collected to cover this extent. The LiDAR data shall also cover sufficient width to include the width of the floodplain due to the design flow in this reach. Because the LiDAR data does not capture the geometry of the main channel below the water, cross-section surveys shall be conducted. For smaller projects, cross section surveys may be sufficient to define the geometry.

(2) All data shall be referenced to the horizontal North American Datum (NAD) of 1983 and the North American Vertical Datum (NAVD) of 1988.

E. Hydraulic Impact Calculations - Water Surface Elevation Increases.

(1) The hydraulic impact calculations are intended to assure that there are no adverse flooding impacts to the United States or to Mexico due to the proposed project. Water surface elevations (WSE) along the modeled reach typically increase due to the proposed project near the location of the project. At locations further upstream and downstream, the WSE values from the proposed condition gradually approach those of the existing condition values until there are no differences in the WSE values between the existing and proposed conditions.

WSE values shall be evaluated all at cross sections/locations along the modeled reach and the differences tabulated.

(2) For 1D hydraulic models, threshold limits for water surface elevation increases are a maximum of 3 inches in urban areas and 6 inches in rural areas. WSE increase is the difference between the proposed and existing condition WSE. Both existing and proposed condition hydraulic models shall have similar cross sections. WSE increases shall be calculated at each cross section of the hydraulic model. Tabulated hydraulic impact calculations shall also be provided in Excel spreadsheet to facilitate easier review. Threshold value of WSE rise shall not be exceeded along the entire modeled reach. If WSE increases are above the threshold limits, gates shall be included in the proposed structure and represented as openings in the hydraulic model to mitigate the impacts and lower them to below threshold levels. For project location within USIBWC levee, WSE increase shall be zero to have no impacts on the available freeboard.

(3) For hydraulic impact calculations for 2D modeling, "*Appendix F-Hydraulic Modeling Methodology*" shall be consulted.

(4) An example of how data should be presented in an Excel spreadsheet is provided on the last page of "*Appendix F-Hydraulic Modeling Methodology.*" Calculation of percent deflects are only required for the Rio Grande and Colorado River. They are not required for land boundary washes and the Tijuana River.

F. Additional Analysis for Projects Seeking Waiver from Meeting Hydraulic Impact Thresholds.

(1) Meeting the hydraulic impact thresholds noted in these requirements sometimes requires a large number of gates or culverts which may not be practical from a project operations standpoint or from severely elevated construction costs. An example of a large number would be 40 gates or culverts where it is not practical to open all these gates in the event of a flood.

(2) The following procedures shall be used if the Proponent wishes to seek a waiver for cases where a large number of gates or drainage structures are required to meet the threshold limits in rural areas and in cases for gates or culverts in remote locations which are difficult to access and open in a timely manner during a flood. The threshold limits for urban areas remain unchanged.

(3) Waiver from the 6-inch WSE requirement in rural areas may be sought in the following cases:

(a) In cases where a large number of gates or culverts are required to meet the hydraulic impact thresholds for rural areas.

(b) In cases where the gates or culverts are in a remote location and the remote location creates operational challenges with regard to opening the gates during flood events and/or regular maintenance of the gates.

(4) In cases where a waiver from the 6-inch WSE requirement is sought in rural areas, the following 3 hydraulic models shall be developed by the Proponent at its sole expense and effort:

(a) An existing condition (no-structure/project) HEC-RAS hydraulic model shall be developed.

(b) A proposed (with structure/project) condition model shall be developed with gates or culverts included to reduce WSE increases to below threshold limits. This would be the model with the large number of gates or culverts.

(c) A second 'cost or operationally effective' proposed condition model shall be developed with a minimum of 3 plans. The plans shall show successively reduced numbers of gates or culverts. Each plan will therefore result in WSE elevations which are higher than the threshold limit by a certain amount. The maximum WSE increase shall be 1 foot, similar to the concept of the U.S. Federal Emergency Management Agency (FEMA) floodway mapping.

(5) The 3 plans in the second 'cost or operationally effective' model shall not result in WSE increases that result in upstream flooding of properties in the U.S. or in Mexico. They shall also not result in adverse erosional impacts. Any erosional impacts shall be mitigated by including erosion protection in the proposed condition models above.

(6) The results of the above analysis shall be documented in a technical report. Hydraulic impact calculations shall be tabulated. The floodplain widths and lengths upstream for the conditions for which WSE differences are seen from the existing condition model shall be tabulated. "Upstream" can be located in either Mexico or the United States depending upon the flow direction. The name of the owners whose land is being impacted by WSE changes and/or erosion upstream shall be documented. The report and the digital hydraulic models shall be submitted for USIBWC review.

G. Erosion Protection. Suitable erosion protection shall be provided for the proposed structures to prevent the development of scour holes and erosion. Such protection shall be based on guidelines provided in technical engineering manuals and include surface treatments such as loose riprap, grouted riprap, concrete, and energy dissipaters, among others based on soil types, flow velocities and other factors. Components of scour in bridge structures can be determined using the HEC-RAS software.

H. Sediment Transport. The potential of projects to change the sediment transport characteristics may need to be evaluated in some cases. An example would be a project causing a change in the flow regime resulting in sediment deposition or removal. This requires sediment transport modeling using software such as HEC-RAS. The modeling will provide an insight into the changes in sediment deposition and aggradation patterns between existing and proposed conditions. Where impacts are considered to be excessive, suitable measures must be adopted to minimize changes to sediment transport behavior along a wash or river. For sediment-laden flows, the discharge for each basin shall be increased appropriately using sediment bulking factors.

I. Drainage Report.

(1) The report is intended to be a stand-alone technical document that can be referred to in the future, for example, to mitigate adverse impacts. The Drainage Report shall address items 1.A. through 1.H.

(2) The report shall contain the following information:

(a) Contact Information. Include either a cover letter or section in the report that contains contact information (name, phone number, and/or email).

(b) Purpose of Study.

(c) Location.

(d) Site Description. Include offsite and onsite drainage conditions, prominent drainage features such as levees, FEMA floodplains, etc.

(e) Proposed Conditions.

(f) Methodology. Include hydrologic and hydraulic analysis for existing and proposed conditions with list of software used with version numbers.

(g) Results and Discussion. Discuss hydraulic impacts, compliance with criteria from relevant agencies, etc.

(h) Conclusions.

(i) List of References.

(3) Appendices Containing the Following:

(a) Figures.

1. Relevant figures such as vicinity map, soils maps, land use maps, drainage basin maps, floodplain maps, or FEMA FIRM.
2. Figures should be in color, legible, and convey technical information with prominent features labeled. Include multiple figures to convey information clearly if needed.
3. Include relevant engineering drawings describing the proposed project.

(b) Model Outputs.

1. Calculation tables including WSE difference, hydrologic model outputs, and hydraulic model outputs.
2. HEC-RAS Standard Table 1, profile plots, cross-section plots, and HEC-RAS generated report.
3. Storm drain calculations along with scour and sediment calculations.

(c) Reference Material. Include relevant documents such as portions from criteria manuals, FEMA FIRM, FEMA FIS table for discharges, geotechnical reports, and earlier drainage reports.

(4) Electronic Files. Provide readme file describing all files provided, hydrologic models, hydraulic models, spreadsheet calculations, effective FEMA models, GIS and CADD files (AutoCAD preferred), reference studies, etc.

(5) Final 100% Document. The final Drainage Report shall be signed and stamped by a professional engineer licensed to practice in the state where the work will be performed.

2. Boundary Monuments.

A. In order to ensure U.S. Government's compliance with Minute No. 244 entitled "*Maintenance of the International Land Boundary Monuments (Minute 244)*" dated December 4, 1973, both sections of the IBWC are required to perform maintenance of the monuments that mark the international boundary to assure their permanence and visibility. Both the United States and Mexican Sections of the IBWC maintain 276 international monuments, 259 principal monuments and 18 intermediaries. To assure compliance to Minute 244, and to maintain the integrity of the International Boundary Line, all projects relating to the area in and around the monuments must be coordinated with the USIBWC.

B. The proposed project shall not impact the structural integrity of the boundary monuments and the visibility between adjacent monuments. The United States and Mexico have agreed that the international boundary on the western boundary (the land boundary) will be demarcated with monuments and that a line of sight between monuments must be maintained. The countries have agreed that maintenance of the monuments includes ensuring that the monuments are not damaged and that there is visibility of and between the monuments. The countries share the obligation of maintaining the monuments.

C. It shall be ensured that all portions of work, including footings and subgrade structures, are set at a minimum of 3 feet away from the footing of all existing monuments. There shall be no physical alteration or dislocation of a boundary monument without prior consultation with the USIBWC.

D. Any intermediate boundary markers placed by the IBWC between adjacent monuments shall also not be impacted by the proposed project. Some intermediate boundary monuments have been placed that are 30 feet tall. The top of these monuments shall not be blocked from view. No structure higher than 25 feet shall be placed within 50 feet of these monuments.

E. At no point will any work begin that will affect the International Boundary Line, monuments and/or the characteristics of the landscape. The Proponent shall perform no work on the monuments. Access to the monuments and intermediate boundary markers must not be adversely impacted.

F. Any damage to a monument shall be promptly reported to the IBWC.

3. Boundary Delineation and Demarcation.

A. The proposed project shall not impact the boundary delineation markers. These markers are set in accordance with Minute 302 entitled "*Enhanced Demarcation and Monumentation of the International Boundary at International Boundary River Bridges and Land Boundary Ports of Entry*."

B. The project Proponent shall reach out to the USIBWC in advance of the project construction for the international boundary delineation at the location of the project. The USIBWC survey team together with representatives from the Mexican Section of the IBWC shall perform the international boundary delineation along the reach of the project. The survey team shall also verify the construction stake outs of the proposed project. In situations where the USIBWC survey team is not able to be physically present to perform the border delineation and verification of construction stake outs, the project Proponent shall contact the USIBWC surveyor on how to proceed.

C. It shall be ensured that all portions of the proposed project structure, including footings and subgrade structures, are set at a minimum of 3 feet away from the border on the U.S. side. Specific situations may require an offset greater than 3 feet. These procedures shall ensure that there are no encroachments of the proposed construction into the country of Mexico and ensure that IBWC can access the International Boundary Line to survey and ensure concurrence with the Treaties of 1848, 1853, and 1882.

(1) For Ports of Entry, in cases where the 3 foot offset cannot be met due to the proponents responsibilities and project requirements, the 3 foot offset may be modified, as determined on a case-by-case basis. Proponent shall provide a

construction plan that reflects how construction can and shall be implemented without encroaching into Mexico. All construction and operations requirements regarding avoiding encroachments into the territory of Mexico shall be observed.

D. Proponent shall address all comments generated during USIBWC's review and shall resubmit project documents incorporating required revisions.

E. The USIBWC shall share details of any boundary plaques to be placed and the style of the demarcation markers along the international boundary. The Proponent shall include these details in their project drawings. The Proponent shall purchase the boundary plaques for the project.

F. In Port of Entry projects, the boundary delineation shall also help determine the alignment of the boundary markers and location of the boundary plaques to be installed upon the completion of the project. The project Proponent is responsible for the maintenance of the boundary plaques and boundary demarcation markers over the life of the project.

4. Construction Considerations. The project Proponent shall assure that they take construction means and methods and site conditions, such as subsurface soil conditions, into account in determining the alignment/location of a project. During construction of the proposed project, no equipment, personnel, or material shall cross the International Boundary Line. All construction shall occur on the U.S. side of the International Boundary Line. After construction, operations such as repairs and debris removal shall not result in personnel, equipment and construction material encroaching into the territory of Mexico.

5. Maintenance Considerations. IBWC may routinely maintain areas near or on the international boundary. The proposed project shall not impact IBWC operations unless previously agreed to between the cooperating agencies and/or as provide herein. IBWC will not be liable for any damage that may occur to the proponent’s project as result of these operations or agreements.

6. Summary. The Proponent is strongly encouraged to consult with the USIBWC sufficiently in advance, recommended at least 4 months, of a proposed project construction start date to discuss site conditions and other issues which may require specific modeling requirements. The requirements described in this document shall be followed in preparing submittals for review and in site work. The documents shall be submitted at least 2 months in advance of any proposed construction start date. Any significant review comments shall be addressed before the start of construction. For detailed 2D modeling, waivers, and complex projects, a complete package shall be submitted at least 3 months before the proposed construction start date.

7. References.

A. The following list of references is intended to be a guide and should not be considered a comprehensive list of technical resources. References may be updated or revised after compilation of this list. Use of a newer version is not prohibited since it should offer better engineering and analysis data.

(1) Arizona Department of Transportation, *Highway Drainage Design Manual, Hydraulics, Final Report*, Phoenix, Arizona, January 2007.

(2) Asquith, W. H., and Roussel, M. C., *Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas*, U.S. Geological Survey Scientific Investigations Report 2004-5041, 2004.

(3) Asquith, W. H., *Depth-Duration Frequency of Precipitation for Texas*, U.S. Geological Survey Water Resources Investigations Report 98-4044, Austin, Texas, 1998.

(4) California Department of Transportation, *Highway Design Manual*, May 2012.

(5) Chang Consultants, *FLUVIAL-12 Mathematical Model for Erodible Channels, User's Manual*, Rancho Santa Fe, California, January 2006.

(6) Federal Emergency Management Agency (FEMA), *Guidelines and Specifications for Flood Hazard Mapping Partners*, 2012.

(7) Federal Highway Administration, *Debris Control Structures, Evaluation and Countermeasures*, Third Edition, Hydraulic Engineering Circular No. 9, October 2005.

(8) Federal Highway Administration, *Design of Riprap Revetment*, Hydraulic Engineering Circular No. 11, March 1989.

(9) Federal Highway Administration, *Hydraulic Design of Energy Dissipators for Culverts and Channels*, Hydraulic Engineering Circular No. 14, Third Edition, July 2006.

(10) Federal Highway Administration, *Hydraulic Design of Highway Culverts*, Hydraulic Design Series No. 5, May 2005.

(11) FEMA: Hydraulic Numerical Models Meeting the Minimum Requirement of the National Flood Insurance Program (NFIP), www.fema.gov/flood-maps/products-tools/numerical-models/hydraulic (last accessed 8/10/2023).

(12) FLO-2D Software, Inc. www.flo-2d.com.

(13) Frederick, R. H., V. A. Meyers, and E. P. Auciello, *Five- to 60-Minute Precipitation Frequency for the Eastern and Central United States*, NOAA Technical Memorandum NWS HYDRO-35, National Weather Service, Silver Spring, MD, June 1977.

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(16) Maidment, D. R., Editor, *Handbook of Hydrology*, McGraw Hill, 1993.

(17) National Weather Service, *Point Precipitation Frequency Estimates from NOAA ALTAS 14*, *Precipitation Frequency Data Server*, National Oceanic and Atmospheric Administration. hdsc.nws.noaa.gov/hdsc/pfds/ (last accessed 8/10/2023).

(18) Natural Resources Conservation Service, *Computer Program for Project Formulation Hydrology*, Technical Report No. 20, Washington D.C., February 1992

(19) Natural Resources Conservation Service, *Urban Hydrology for Small Watersheds*, Technical Report No. 55, Washington D.C., June 1986.

(20) Pima County Roadway Design Manual, Fourth Edition, 2013.

(21) Texas Department of Transportation, *Hydraulic Design Manual*, September 2019. onlinemanuals.txdot.gov/txdotmanuals/hyd/index.htm (last accessed 8/10/2023).

(22) U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package,* Davis, California, 1990.

(23) U.S. Army Corps of Engineers, *Hydrologic Engineering Center - Hydrologic Modeling System (HEC- HMS)*, Version 4.8,April 2021.

(24) U.S. Army Corps of Engineers, *Hydrologic Engineering Center - River Analysis System (HEC-RAS),* Version 6.1, September 2021.

8. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

Digitally signed by RAMON MACIAS
Date: 2024.01.30 16:47:14 -07'00'

January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Requirements for Projects On or Affecting a USIBWC Flood Control Structure

USIBWC Directive SD.II.01031-M-1 Appendix C

Table of Contents

The purpose of this document is to present additional criteria and guidelines for the application, review, approval, and inspection of construction activities not performed by or for the United States Section, International Boundary and Water Commission (USIBWC) which affects USIBWC flood control structures. See "*Appendix A-Design and Construction Requirements for All Projects*" for general requirements covering all projects including those affecting flood control structures.

1. General Conditions for all Projects.

A. Within this document, levee is used to cover all flood control structures. Levee may mean earthen levee, concrete floodwall, floodgates, stoplogs, sluice/slide gates, or any combination of such which acts as a flood control structure as well as all appurtenances.

B. All materials used shall have National Science Foundation (NSF) 61 rating. Metals, concrete, rocks, and soil are not required to meet this requirement.

C. All reports, drawings, specifications, and test results shall be signed and sealed by a professional engineer licensed to practice in the state where the work will be performed.

D. Licenses will not be issued for use of levees and O&M roads as trails or parks except for minimal lengths at bridge crossings. Trails and parks are allowed on river floodplains as long as the improvements do not cause the water design flood water surface elevation to increase above threshold limits. Additionally, for the Rio Grande and Colorado River, the maximum deflection of design flood flows by the project is 5% or less to either the U.S. or to Mexico. For additional details, refer to "*Appendix E-Design Report Requirements*" and "*Appendix F-Hydraulic Modeling Methodology*."

2. Work on Levees.

A. Work impacting USIBWC levees and appurtenant structures cannot negatively affect their flood control abilities. Proponents are not required to analyze our levees beyond their project and its impacts, but work must ensure that USIBWC's levee meets and/or exceeds all of the requirements of the Federal Emergency Management Agency's (FEMA) 44 CFR §65.10(b) for levee accreditation and of the US Army Corps of Engineers' Engineering Manual (EM) 1110-2-1913 entitled "*Design and Construction of Levees*."

B. The entire levee portion impacted by Proponent's project shall be analyzed for concurrence with 44 CFR §65.10(b). All instances where Proponent's project causes or modifies a "break" in the levee caused by a bridge, roadway, or similar structure, Proponent shall certify in their design report that this break has been analyzed and will meet all 44 CFR §65.10(b) requirements.

(1) If the "break" will not meet 44 CR §65.10(b) requirements, then modifications shall be designed to ensure compliance. These modifications shall be coordinated with the owner of said "break."

C. All concrete structures in USIBWC levees or acting as a flood control structure shall be designed per American Concrete Institute (ACI) 350, Code Requirement for Environmental Engineering Concrete Structures.

D. Structures shall not be placed within 15 feet (or USIBWC's-controlled property boundary whichever is smaller) from the levee toe.

E. A minimum of 15 feet (or USIBWC's-controlled property boundary whichever is smaller) from the levee toe shall slope away from the levee to prevent ponding of water against the levee. Please note that it is not USIBWC's intention to create a "toe road" on the riverside of the levee.

F. The Proponent project must meet and/or exceed all of the requirements of the US Army Corps of Engineers' Engineer Pamphlet (EP) 1110-2-18, "*Guidelines for Landscaping Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*."

G. Wherever work disturbs the levees, the levees side slopes shall be capped with 6 inches of topsoil. The topsoil shall be of sufficient quality to promote growth of native grasses.

H. All areas disturbed by construction shall be revegetated. The areas shall be watered to ensure germination and to maintain vegetative growth until the plants have reached their full height or 6 inches, whichever is smaller. See "*Appendix G-Reseeding USIBWC Property*" for details on required seed mixes and planting guidelines.

3. Minimum Height of Levee.

A. USIBWC will provide the design flood elevation for the levee impacted by the Proponent's project. See "*Appendix F-Hydraulic Modeling Methodology*" for required design flows.

B. The top of the levee's impervious section shall be the higher of the existing ground surface or the calculated water surface elevation from the design flood (WSE) plus a minimum of 3 feet freeboard. The freeboard is measured after settlement is taken into account. Refer to 44 CFR §65.10(b) for additional information on freeboard requirements.

C. Hard structures such as floodwalls that cannot be raised if the WSE changes, must be set at least 4 feet above the calculated WSE.

D. The gravel O&M road material shall not be considered as part of the impervious section, but shall be considered as part of the levee height when calculating overhead clearances.

4. Levee Closure Structures.

A. All levee openings shall be designed to meet 44 CFR §65.10(b). Culverts, pipes, utility crossing, road crossing, and bridges are considered levee openings. Design checks/reviews shall be included in the Design Report.

B. All structures that pass through or under the levee shall be evaluated to determine if structure and closure device meets 44 CFR §65.10(b). If any closure device requires maintenance or rehabilitation, it shall be included in the construction documents.

C. All closure devices must be able to be safely operated when water is at the design flood elevation. If modification is required, it shall be included in the construction requirements.

D. Closure devices must be provided on pipelines on the landside of each levee.

E. If any pipes or boxes that cross the levee require new closure devices, only slide/sluice type gates shall be used. Flap gates are not acceptable.

5. Levee Side Slopes.

A. The angle of the levee side slopes shall be determined by the design, but site constraints in some sections of the project must be taken into account. For maintenance, USIBWC prefers slopes 3H:1V or flatter. Slopes steeper than 3H:1V shall be minimized.

B. USIBWC equipment cannot mow a slope steeper than 2.5H:1V. Proponent shall take this into account when designing the levee slopes. If slopes are steeper than 2.5H:1V, measures shall be taken whereby the slope does not require mowing.

6. Levee Alignment.

A. The levee may not be moved closer to the river without approval of USIBWC.

B. Relocating the levee will require Proponent to provide a Drainage Report indicating the design flood water surface elevation increase and percent deflection values are within threshold limits. Refer to "*Appendix E-Design Report Requirements*" and "*Appendix F-Hydraulic Modeling Methodology*" for additional information.

C. If USIBWC agrees with the proposal to relocate the levee, concurrence with Mexico must be reached if the work is along an international reach of the levee. This concurrence may require weeks or months of communications. Proponent may continue working on the design during this period, but in no instance, shall construction proceed until concurrence is reached with Mexico.

7. Utilities.

A. Utilities include privately, publicly, or cooperatively owned lines, wires, pipelines, facilities, and systems for producing, transmitting, or distributing communications, power, heat, gas, oil, water, waste, stormwater, or irrigation water.

B. In no instance shall a utility hinder or impair USIBWC's ability to perform maintenance or flood operations.

C. Transverse utilities may be routed on top of the levee. A utility on top of the levee shall be designed to withstand AASHTO HS25 loading and shall be protected from damage from grading and other levee maintenance. The utility or its associated cover must be shaped to allow passage of a loaded lowboy semi trailer. The Proponent must acknowledge that they will be required to raise their utility if the USIBWC raises the levee.

D. Pipeline utilities crossing the levee shall include closure devices on the landside of each levee.

E. Utility excavations shall meet the design and construction requirements for levees including the minimum testing requirements.

F. Utilities shall not remain within the levee prism after construction. Proponent shall design for relocation of utilities including coordination with utility owners. The levee prism includes all components above the floodplain elevation as well as the floodplain/landside toe (can be assumed to be 15 feet from levee toe) and subsurface that carries flood seepage under the levee.

(1) USIBWC may make rare exceptions when placement of the utility does not affect USIBWC's ability to operate, maintain, and raise the levee. In these instances, the utilities shall be located in the landside half of the levee, preferable above the design flood elevation, or completely under the levee.

(2) Utility must meet requirements of USACE's EM 1110-2-191 Chapter 8.

(3) In no instances shall the utility be "plowed" into levee.

(4) Installation by tunneling or jacking is only allowed when utility is placed so deep under the levee that subsurface flow conditions are not changed by installation.

(5) The Design Report, including a seepage analysis, shall certify that the utilities within the levee do not expose the levee to any risks associated with 44 CFR §65.10(b)(3) and (4).

G. Utilities running parallel to the levee shall be set at least 15 feet off of the existing levee toe. This includes underground utilities.

H. Relocated utilities shall be completely removed from USIBWC-controlled property instead of being abandoned in place.

(1) USIBWC only leaves abandoned utilities within levees if they provide no risk to the levee and are extremely difficult to remove. If utility is abandoned in place, Design Report shall certify that the utility does not expose the levee to any risks associated with 44 CFR §65.10(b). Proponent may need to design changes to utility prior to abandonment (e.g. fill structure with flowable fill).

I. The Proponent shall install and maintain suitable markers or signs indicating the location of the utility where it crosses the levee, pilot channel, or river and where the utility changes direction within USIBWC-controlled property. The markers or signs should be a minimum height of 5 feet. No markers are to be installed on the levee slopes or within 15 feet from the toe of the levee.

J. See "*Appendix A-Design and Construction Requirements for All Projects*" for bridge and additional utility crossing requirements.

K. Overhead Wire Utility Crossings

(1) The overhead transmission lines shall be constructed and maintained in such a manner as to provide a minimum vertical clearance (at the temperature of 60° Fahrenheit) of not less than 28 feet above the levee height and at least 22 feet above the floodway BFE.

(2) No structure (poles or guy wires) shall be located closer than 35 feet from the toes of any levee. No structure (poles or otherwise) shall be located closer than 15 feet from the top of any channel bank.

(3) Guy wires may be anchored within the USIBWC-controlled property and shall be installed in such a manner that they do not interfere with the operation and/or maintenance of the channels, levees, or related structures. A witness post, not less than 5 feet high, shall be installed by each anchor or the cable shall be wrapped up to a point at least 5 feet above the ground with a brightly colored material to make it obviously visible.

(4) It shall be the Proponent's responsibility to maintain the areas clear of brush within a 10 foot radius of each pole, under the guy wires, and around the anchors on both sides of the levee and within USIBWC-controlled property.

L. Utilities Crossing Under Levees.

(1) The Design Report, including a seepage analysis, shall certify that the utilities below the levee do not expose the levee to any risks associated with 44 CFR §65.10(b)(3) and (4).

(2) When installing utilities by directional drilling, the Proponent shall furnish information addressing the following concerns and give specific dimensions, distances, pressures, weights, and all other pertinent data.

(a) Comprehensive understanding of the subsurface soil and groundwater conditions to a minimum depth of 20 feet below the lowest pipe elevation

(b) Locations of the pipe penetration entry and exit

(c) Allowable uplift pressures

(d) Drilling procedures and onsite quality control monitoring during drilling operation

(e) Grouting of the pipe annulus, backfilling of any excavated areas, and repair of the construction-staging areas

(3) When utility installation is under both levees and the river or pilot channel, the entry and exit location, when located landside of a levee, shall be set back sufficiently from the landside levee toe to ensure that: (a) the utility reaches its maximum depth, and (b) the utility is no less than 300 feet landside from the levee centerline. The utility shall be constructed in a straight alignment for a minimum distance of 15 feet beyond the landside of the levee toe.

8. O&M Road on top of Levee.

A. The finished gravel O&M road shall be at least 16 feet wide. The O&M road shall be on top of any earthen levees or on the landside of any floodwalls as well as on all ramps.

B. The gravel surface of the O&M road shall be a minimum of 6 inches thick and be designed as an aggregate roadway surface (i.e., gravel road), not as general flexbase below asphalt. USIBWC can provide our standard specifications for this gravel but use of this specification is not required.

C. The finished gravel road shall slope 2% toward the riverside if on an earthen levee and 2% toward the landside if behind a floodwall. A consistent cross slope is preferred to a crown since the crown is not maintained during grading.

D. Geotextile cannot be placed between the levee's impervious section and the gravel O&M road material.

E. No structure may end within or adjacent to the edge of the O&M road unless it is safe for passing traffic (e.g. headwall parallel to levee) and can be regularly graded with a motor grader. USIBWC may require signs or reflectors (e.g. OM4-3, OM2-2V, or OM3) meeting Federal Highway Administration's (FHWA) Manual of Uniform Traffic Control Devices (MUTCD) adjacent to any such structures.

9. Ramps. Riverside ramps along the levee shall be designed as sections cut out of the levee instead of as roads skewed away from the levee. See USIBWC Standard Drawing SD-25084 for reference. Some ramps adjacent to structures will have different geometry

due to site conditions. Outgrant permitted landside ramps shall be designed to meet the site conditions but in no way shall negatively affect the levees.

10. Minimum Soil Requirements.

A. Project designers may establish more stringent standards, but soil (clay) used in construction or repair of the levees shall meet these minimum requirements:

(1) Soils - Clay (CL or CH per ASTM D2487)

(2) Flowable fill (controlled low strength materials, CLSM, flowfill, and soil cement) may be used as backfill as long as the Design Report evaluates the seepage through the levee around the flowable fill and placement of flowable fill will not affect USIBWC's operations and maintenance of the levee.

(3) Crumb Test (ASTM D6572) - Grade 1 (non-dispersive)

(4) Pinhole Test (ASTM D4647) - ND1 or ND2

(5) Double Hydrometer (ASTM D4221) - Percent dispersive less than 30

(6) At least 60% passing a US Standard No. 200 sieve

(7) One hundred percent (100%) of the dry material passing the 1 inch sieve

(8) Borrow source in situ clay shall not be blended with any other material if it meets USIBWC's minimum requirements.

(9) All material placed at or greater than optimum moisture content

11. Required Reports.

A. A Design Report shall be provided demonstrating that this project meets 44 CFR §65.10(b) and USACE EM 1110-2-1913 and that it will not negatively affect any USIBWC structures. See "*Appendix E-Design Report Requirements*" for guidance on Design Reports.

B. If project, or part of project, is within a river floodplain, a Drainage Report is required describing hydraulic modeling and results to show that the water surface elevation from the design flood does not increase above the threshold limits established by the USIBWC and that the maximum deflection of flood flows by the project is not more than +5% towards either the U.S. or to Mexico. Refer to "*Appendix H-Requirements for Projects On the Rio Grande and Colorado River Floodplains*" for additional information.

C. Work within the floodplain may require concurrence with Mexico if work is on an international reach of a river. This concurrence may require weeks or months of communications. Design work may continue during this period, but in no instance, shall construction proceed until concurrence is reached with Mexico.

D. USIBWC will use sound engineering judgment to determine which reports are required. For example, if a Proponent wishes to place a conduit 5 feet below the our levee, a seepage analysis will be required. But if the Proponent wishes to place a conduit 25 ft under the levee, it is unlikely a seepage analysis will be required because seepage caused by the conduit at that depth would be minimal. Now if the conduit will be 15 feet below the foundation of the levee, a seepage analysis may be required based on site and project conditions. Every situation is evaluated individually to ensure that USIBWC structures are protected while minimizing the work required by Proponents.

E. See "*Appendix F-Hydraulic Modeling Methodology*" for guidance on hydraulic modeling and the required report.

12. Drawings.

A. USIBWC-controlled property boundary shall be clearly shown on Proponent's drawings.

(1) USIBWC-controlled property includes all property for which USIBWC holds a property interest including, but limited to, USIBWC property and land for which USIBWC holds an easement for flowage, flood control, or other use.

B. Project coordinate system, survey units used, datum, and grid to ground conversion shall also be shown.

C. Drawings shall be of sufficient detail to determine exactly what is proposed, how it is to be constructed, and by whom.

D. In any operation involving earthwork, such as an excavation, drilling or boring, cross sections and profile of the proposed works must be furnished.

E. Any drawings showing project or project component interaction with USIBWC structures shall be drawn to scale.

F. Drawings must be signed and sealed by a professional engineer, duly licensed in the state(s) where the project is to be constructed.

13. Geotechnical Testing/Boreholes in Levees.

A. All boreholes within USIBWC levees shall be backfilled with a bentonite slurry.

B. Other geotechnical sampling locations shall be backfilled with existing levee material but Proponent shall remember than levees are topped with a gravel O&M road.

C. If new material is required for backfill, it shall meet USIBWC's minimum soil requirements

14. Construction/Materials Testing.

A. Minimum Levee Testing Requirements are available in "*Appendix D-Minimum Levee Embankment Testing Requirements.*" These requirements are the minimum; if the project designer determines that more frequent testing or more stringent requirements are necessary, they shall govern. All tests shall be signed and stamped by a registered engineer licensed in the state where work is being completed. Upon completion of the construction, a copy of all completed tests and associated forms shall be provided to USIBWC.

B. USIBWC has found that the lifts of levee earthen embankments form significantly better bonds and the soil is easier to work with when a Standard Proctor is used.

C. Method B shall be used on all Proctors (D698 and D1557).

D. Grain Size Analysis (ASTM D7928) shall use sieves sized 2 inch, 1 inch, 3/8 inch, 4, 10, 20, 40, 60, 140 and 200 at a minimum.

E. Grain size analysis (ASTM D7928) includes hydrometer testing of material below 200 sieve.

15. Levee Construction or Repair.

A. Construction shall be performed by excavating into the existing levee to create a series of keys and benches with the bench placed within the slope rather than constructed at the toe of the slope. Benches shall not exceed a two (2) foot high vertical section.

B. Fill shall be placed in horizontal layers only. The levee embankment is to be raised in 8 inch loose (6 inch compacted) lifts. The fill material placed within the levee embankment slopes shall be compacted as required. If the minimum compaction is not achieved, the lifts shall be reworked. To ensure proper compaction of the sides of the levee, the compacted fill for the levee embankment is to be overbuilt a minimum of 2 feet past the final slopes and grades and then trimmed to the finished grade. The overbuild is not required within 4 feet of any structure.

C. Surfaces to receive fill shall be monitored for moisture content. Whenever the surface to receive fill is either too dry or too wet, the moisture content of the surface shall be appropriately adjusted prior to placing the next fill lift. Once the levee has been placed to required lines and grades and has passed all required soils and density tests, the material shall be allowed to dry out. Levee slopes shall be trimmed to final slopes and grades while clay is still within allowable moisture content for placement. To ensure a competent finished top lift, the completed top lift shall be at least 3 inches thick after compaction. If the final cut reduces the thickness of the top lift to less than 3 inches, re-scarify the top lift to a depth of at least 6 inches and then re-compact the section.

D. Ramps shall be constructed in the same manner as the levee. Unauthorized ramps or ramps that do not meet design and construction standards must be removed or modified at the cost of the ramp-owner.

E. The clay may not be covered until the surface has dried and a USIBWC representative has ensured that the requirements listed below are met:

(1) The levee shall be cut, graded, and/or finished to a smooth plane surface. The finished levee embankment shall be a hard, competent, solid soil mass. The dried clay shall not be brittle, crumbly, or friable. The final product shall be a hard, competent, solid soil mass. There are some clayey materials that even though they fulfill the levee soil requirements, do not hold together after 24 to 36 hours of drying time. If the levee material becomes soft and/or friable after drying, it shall be removed and replaced with material that produces a hard, competent, solid soil mass.

(2) The levee typical sections shall be maintained throughout the work zone. No deviations in cross section shall be greater than 3 inches longitudinally unless shown on the drawings. The sides of the levee shall not have a wavy appearance.

(3) Placement practices throughout each fill zone of the levee shall be such that the embankment will be free from lenses, pockets, streaks, and layers of material differing in texture, gradation, or classification from surrounding material of the same material type. If within the same material type lenses, pockets, streaks, or layers are encountered, the clay shall be reworked in order to form a homogeneous blend of the materials.

(4) The finished levee embankment shall be homogenous in material and compaction characteristics. No evidence of placement layers/lifts shall be visible in the final

product. Each lift of fill shall be thoroughly bounded to the prior lift/subgrade. In no instance shall any two lifts be able to be easily separated.

(5) No holes, pop-outs, pockmarks, grooves, depressions, or other voids greater than ½ inch in depth normal to the slope face shall be permitted. Separation of two lifts shall not be allowed. Pop-outs formed during cutting of the levee slope when there is nonuniform compaction of the levee embankment. Areas of holes, pop-outs, pockmarks, grooves, depressions, or other voids less than ½ inch in depth normal to the slope face that are numerous or frequent (longer than one foot or common across the slope) shall also be repaired. Cracking of clay is normal, however, cracking into small fragments that can easily be removed by hand from the levee are not acceptable. Acceptable clay embankment shall crack in a manner that "locks" the cracked pieces together.

F. During ASTM D6938 nuclear density tests, the probe shall extend through both the newly added lift and the scarified prior lift (e.g., 6" lift plus 3" scarification equals probe of 9", minimum). Tests into scarified and compacted subgrade shall be taken at a 12 inch depth. Include IBWC Forms 241 for all days when nuclear density tests are performed.

G. Excess fill brought on site, contaminated material, and material that does not meet requirements shall be hauled away from the project site and disposed of per Federal, state, and local requirements.

(1) No soil or other material shall be left in the floodplain.

16. Completion of Construction.

A. Upon completion of any construction with USIBWC-controlled property, the worksite area shall be left in a clean and neat condition with all debris and excess material removed from the site.

B. Upon completion of the construction, complete surveys, signed and stamped by a registered surveyor, shall be provided to USIBWC. Survey data shall be provided in pdf format with supporting data in a comma delimited ASCII file. Data shall be identified by point number, northing, easting, elevation, and description. The survey units used, coordinate system, datum, name of the individual/company who performed the survey, and date of survey shall be noted in both the pdf and ASCII file. Survey boundaries, breaklines, and other relevant data shall be exported from an AutoCAD Civil 3D file to an xml file.

C. Upon completion of construction, as built (record drawings) shall be provided for the whole project. Drawings shall be in Adobe pdf and shall be sized to at least ANSI B (11"x17") although fullsize drawings (ANSI D 22"x34") are preferred. Drawings shall be provided at a resolution not less than 300 dpi.

D. Upon completion of construction work, a copy of all completed tests in Adobe pdf shall be provided to USIBWC. Tests shall be provided at a resolution not less than 300 dpi.

17. Conditions.

A. Proponent's project shall not hinder or impair USIBWC's ability to perform maintenance or flood operations.

B. The USIBWC does not assume any responsibility or liability regarding damages that could be caused to the work, property, or persons in the project area as a consequence of river flood flows or the surface conditions of USIBWC-owned property. The USIBWC does not warrant that any of its property is suitable for any type of work or activity and project proponents are responsible for assessing the condition of the land before commencing work.

C. Any damage caused by the proposed works to either the banks of the river, USIBWC's structures, or USIBWC's property shall be repaired by Proponent, at the Proponent's cost, to the USIBWC's satisfaction.

D. The USIBWC will not alter its normal or flood operations criteria as a result of the proposed works.

E. Proponent is responsible for keeping their structures free of debris accumulation at all times. Proponent shall dispose of all debris in accordance with all applicable environment laws and regulations. In addition, Proponent is responsible for all costs associated with debris removal.

F. Proponent shall finalize and submit to the USIBWC an Operation and Maintenance (O&M) Plan for their project. It should be noted that the USIBWC will not be the agency responsible for performing operations and maintenance of the Proponent's project.

18. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

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(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

Digitally signed by RAMON MACIAS
Date: 2024.01.30 17:12:57 -07'00'

January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Minimum Levee Testing Requirements

USIBWC Directive SD.II.01031-M-1 Appendix D

Established by Design Engineer	USIBWC Minimum	ASTM	Test Name	REQUIREMENT	Minimum Frequency	IBWC Required Forms
X	X	D698 D1557	Proctor	Required for quality control of construction	2,000 cy	
	X	D6913	Grain Size Analysis	≥ 60% passing 200, 100% < 1"	1,000 cy	
	X	D6572	Crumb	Grade 1	1,000 cy	
	X	D4647	Pinhole	ND1 or ND2	1,000 cy	
	X	D4221	Double Hydrometer	Less than 30	1,000 cy	
	X	D2487	USCS	CL or CH only *(CL-ML or any soils other than clay not allowed)*	1,000 cy	
	X	D4318	Atterberg Limits	PI ≥ 15 *(PI and LL range set by Design Engineer)*	1,000 cy	
	X	D6938	Field Density Measurement	Minimum of 95% of max dry density for D698. Minimum of 92% of max dry density for D1557.	2 per day or 1 per every 250 cy placed, whichever greater	
	X	D6938	Field Moisture Content	Minimum at optimum. Usually moisture content between optimum and +2 of optimum.	Whenever field density is taken	
	X	D6938	Nuclear Gauge Standard Count	Verify nuclear gauge readings/stability.	Prior to use of each gauge, each day onsite	Form 241
	X	D2216	Lab Moisture Content	Verify nuclear gauge readings	Every 20 ASTM D6938 tests	Form 240

1. Design Engineer shall increase USIBWC minimum requirements and frequency as required for their project. Requirements can not be reduced.
2. Method B shall be used on all Proctors (D698 and D1557). Use of ASTM D698 or ASTM D1557 shall be determined by Design Engineer. USIBWC prefers ASTM D698.
3. Grain Size Analysis shall use sieves sized 2 inch, 1 inch, 3/8 inch, 4, 10, 20, 40, 60, 140 and 200 at a minimum. **Includes hydrometer testing of material below 200 sieve.**
4. Clay used shall not be blended with any other material if it meets these requirements.
5. Minimum frequency assumes a large project. Small projects shall increase frequency appropriately.
6. The most recent version of ASTM standards shall be used.
7. Forms are available at www.ibwc.gov/resources-info/.

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Ramon Macias, III, P.E. Engineering

for Dr. Maria-Elena Giner, P.E., Commissioner

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Design Report Requirements

USIBWC Directive SD.II.01031-M-1 Appendix E

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The purpose of this document is to present criteria and guidelines for design reports submitted to USIBWC. Whenever construction is on, next to, or can negatively affect a USIBWC structure, a Design Report that addresses the following for the design of the project is required. Each design discipline shall have a different section in the Design Report.

1. Required Reports.

A. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct you project to finally contact USIBWC. Contact us well in advance so we can discuss our requirements.

B. Design reports may include a general design report, drainage report, geotechnical report, hydraulic report, hydrology and hydraulic report, seepage report, etc.

C. USIBWC will use sound engineering judgment to determine which reports are required. For example, if a Proponent wishes to place a conduit 5 feet below the our levee, a seepage analysis will be required. But if the Proponent wishes to place a conduit 25 ft under the levee, it is unlikely a seepage analysis will be required because seepage caused by the conduit at that depth would be minimal. Now if the conduit will be 15 feet below the foundation of the levee, a seepage analysis may be required based on site and project conditions. Every situation is evaluated individually to ensure that USIBWC structures are protected while minimizing the work required by Proponents.

D. See "*Appendix F-Hydraulic Modeling Methodology*" for guidance on Hydraulic Modeling Reports and hydraulic modeling.

2. General Information.

A. Description of project

B. Explanation of project purpose

C. Map showing project area

D. Coordinates of project location

E. Project background information

3. Calculations.

A. Manual and/or computer based calculations shall accompany narratives to support technical analyses. Each set of calculations shall start with a summary sheet, which shows all assumptions, referenced applicable codes and standards, and lists the results and conclusions.

B. Calculations shall include engineering sketches as an aid to understanding by reviewers.

C. The calculations for each submittal shall be cumulative, so that the final submittal contains all calculations for the project.

D. Calculations submitted at early stages of the project must be revised appropriately to reflect the final design.

E. Calculations shall clearly show the factors of safety achieved with the design.

F. Calculations must refer to code, paragraph of code used, standards, and reference books used for specific portion of calculation. Refer to drawing number where the results of the calculations have been used. Example: number and sizes of rebar used in reinforced concrete members.

4. Design Loads.

A. Final design criteria.

B. Final loads.

C. Loading conditions and critical cases.

5. Structural Analysis.

A. Provide structural analysis of all structural components either within or affected by the final design elements.

B. Embankment Protection.

(1) Demonstrate that no appreciable erosion of the structure can be expected.

(2) Demonstrate that anticipated erosion will not result in failure of the structure directly or indirectly through reduction of the seepage path and subsequent instability.

(3) The factors to be addressed in such analyses include, but are not limited to: expected flow velocities (especially in constricted areas), expected wind and wave action, impact of debris, slope protection techniques, duration of flooding at

various stages and velocities, embankment and foundation materials, alignment, bends, and transitions, and side slopes.

C. Foundation and Structural Stability.

(1) Demonstrate that the structure is stable with anticipated design loading.

(2) Slope stability analysis during dry periods, flood periods, and rapid draw down must be addressed.

D. Seepage Analysis.

(1) The analyses provided shall evaluate expected seepage during loading conditions associated with the design flood and shall demonstrate that seepage into, through, or under the foundation or structure will not jeopardize structural or levee stability.

(2) The factors that shall be addressed in the analyses include: depth of flooding, duration of flooding, foundation/structural geometry and length of seepage path at critical locations, foundation/structural materials, subgrade compaction, other design factors affecting seepage (such as drainage layers), and any other design factors affecting foundation/structural stability.

E. Settlement.

(1) This analysis must address subgrade loads, compressibility of subgrade soils, age of the structure, and construction compaction methods. Identify if settlement of the structure will negatively affect the adjacent structure's stability or the levee's ability to protect from floods.

(2) Detailed settlement analysis using procedures such as those described in U.S. Army Corps of Engineer's EM 1100-2-1904 must be submitted.

F. Geotechnical Test Results. Provide copies of all geotechnical testing performed.

G. Geotechnical Bore Logs.

(1) Maps must be provided showing the location of all boreholes and sampling.

(2) Provide copies of all bore logs.

H. Interior Drainage. When the possibility exists for water to exist on the landside of the levee, analysis must be provided ensuring that embankment protection as well as embankment and foundation stability are not affected with 1 foot of water standing or flowing. If there is an adjoining canal or similar drainage feature, the structural analysis shall take into account the different flow conditions in the canal or drainage feature in the analysis.

6. Assumptions. The Design Report shall clearly detail all assumptions made by the designers.

7. Certification.

A. The Design Reports shall contain a certification stating that the project will not negatively affect any USIBWC structure.

B. If project encompasses, impacts, or in any way affects a USIBWC levee or other flood control structure, the Design Report shall contain a certification stating that these portions of the project work meet 44 CFR §65.10(b).

8. Final 100% Document. The final Design Report shall be signed and stamped by a professional engineer licensed to practice in the state where the work will be performed.

9. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

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January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Hydraulic Modeling Methodology

USIBWC Directive SD.II.01031-M-1 Appendix F

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The following methodology shall be adopted to develop georeferenced two-dimensional hydraulic models of the existing site condition and the proposed project condition, and to analyze the hydraulic impacts. Situations where hydraulic modeling is not required and where one-dimensional modeling is sufficient are also described.

1. General.

A. The Proponent is strongly encouraged to share preliminary drawings and project description, and meet with the USIBWC in advance to discuss site conditions, and their proposed project.

B. Depending upon the project, the modeling requirements may be less detailed than what is described in this section and advance discussions can help in saving significant costs and resources.

C. Minor projects such as towers or similar structures with a small footprint in a wide floodplain defined by the design flood are anticipated to have minor hydraulic impacts such as water surface elevations and flow deflections to the US or to Mexico. This may also be the case with small collapsible structures. For some projects such as aligned bridge piers, a one-dimensional (1D) hydraulic analysis may be sufficient to evaluate hydraulic impact.

D. For significant projects within the Rio Grande and Colorado River floodplains, Proponents shall demonstrate through detailed 1D/2D or 2D hydraulic modeling that the projects do not cause any adverse hydraulic impacts to either the United States or to Mexico, consistent with Article IV-B of the 1970 Boundary Treaty (*Treaty to Resolve Pending Boundary Difference and Maintain the Rio Grande and Colorado River as the International Boundary*).

E. Although not covered by this Treaty, Proponents shall demonstrate there are no adverse hydraulic impacts from projects at other locations such as Tijuana River, Nogales Wash and land boundary washes. See "*Appendix B-Land Boundary Project Requirements*" for guidance on determining the hydraulic impact on land projects.

2. Software. The latest version of the US Army Corps of Engineers (USACE) HEC-RAS software shall be used for the analysis. This is a free, public domain software and an industry standard.

3. Data Collection.

A. The model extent shall cover the project area and cover a reach sufficiently upstream and downstream from the project area. This ensures that the hydraulic results in the project area are not impacted by the boundary conditions. LiDAR data shall be collected to cover this extent. The LiDAR data shall also cover sufficient width to include the width of the floodplain due to the design flow in this reach. An estimate of the extent of the floodplain due to the design flow in the project reach may be obtained from existing one-dimensional HEC-RAS models, if they are available. In areas without levees, it is recommended that additional width be included, to be conservative.

B. Because the LiDAR data does not capture the geometry of the main channel below the water surface, cross-section surveys shall be conducted from bank to bank of the main channel. Cross-section surveys shall be conducted at a maximum spacing of 1,000 feet, with closer spacing at locations of curvature, urbanization and changes in geometry. Alternately, a bathymetric survey shall be conducted.

C. All data shall be referenced to the horizontal North American Datum (NAD) of 1983 and the North American Vertical Datum (NAVD) of 1988.

4. One-Dimensional (1D)/Two-Dimensional (2D) Model Development.

A. A 1D/2D hydraulic model shall be developed for the analysis. The 1D portion includes the main channel and the 2D portion include the floodplains. Alternatively, full 2D modeling can also be done, provided the main channel is represented with the proper grid size. The description below also applies for a full 2D modeling except for the main channel which would be represented by the smaller grid size. HEC-RAS supports multiple computational meshes of variable grid sizes within the two-dimensional modeling domain. A maximum 150-foot base grid size shall be used for

the model. Break lines shall be added to locations where there is a barrier to the flow or controls to flow direction. They shall be placed inside a 2D flow area to align the mesh to geometric features such as road and levees, and along the main channel banks, among others.

B. A bathymetry surface shall be generated with the surveyed main channel cross sections. This surface shall be used to cut cross sections where necessary for the main channel for a 1D/2D model. Because the Rio Grande consists of many tight meanders, the 1D channel shall be simulated using cross-sections at a maximum 600-foot interval, and their width would represent the active main channel.

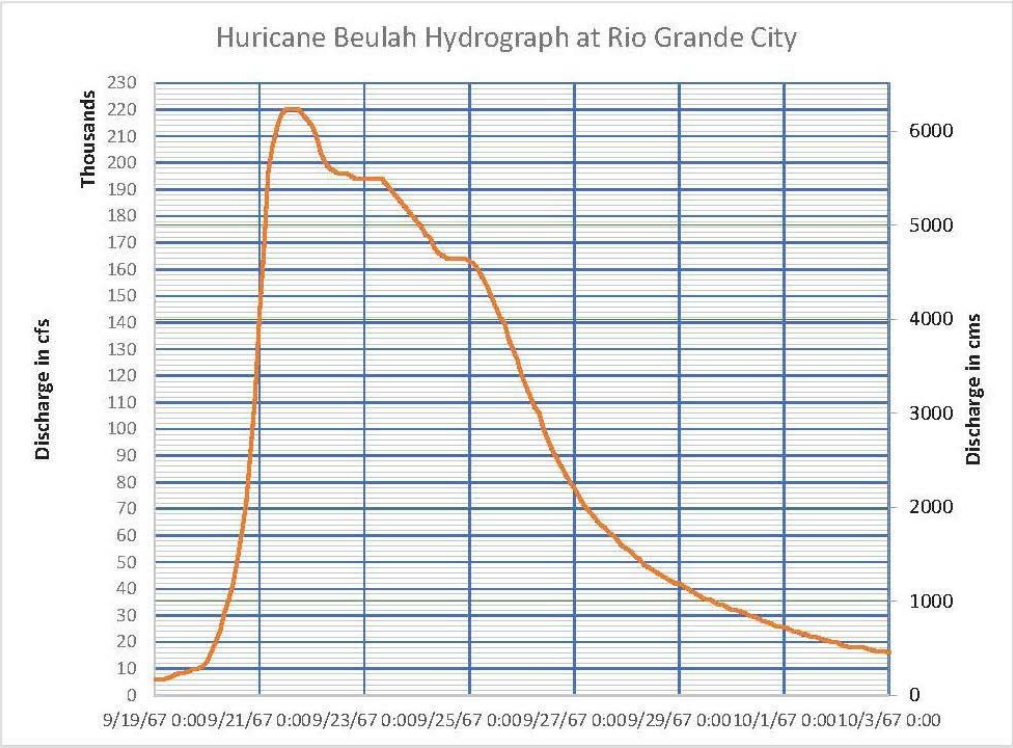
C. There shall be a mesh on each side of the river's floodplain. The connection between the 1D main channel and 2D flow area mesh shall be implemented according to the HEC-RAS guidelines using features such as the lateral weir.

D. Alternately, a full 2D hydraulic model may be developed. For the full 2D model, finer size grid cells shall be used for the main channel portion to adequately represent the geometry.

E. Break lines and finer grid elements shall be added around the proposed project alignment. The final geometry shall consist of two identical meshes for the "Existing Condition" and "Proposed Condition" models, allowing comparisons between them.

5. Inflow Hydrograph. A suitable inflow hydrograph based on the design flood shall be adopted in consultation with the USIBWC. For example, for the Lower Rio Grande during Hurricane Beulah, a peak discharge of 220,000 cfs was recorded at midnight of September 22–23, 1967 at Rio Grande City as shown in Figure 1. The IBWC design flow at Rio Grande City of 250,000 cfs is based on the peak flow from Hurricane Beulah. See "*Appendix H-Requirements for Projects On the Rio Grande and Colorado River Floodplains*" for the magnitude of the design flow at various locations along the Rio Grande and in the Colorado River.

Figure 1: Hurricane Beulah Hydrograph, September 22-23, 1967



6. **Roughness Coefficients.** Manning's roughness coefficients (n-values) for the main channel may be used similar to those in previous HEC-RAS models at the project reach if they exist. The floodplain roughness coefficients (2D areas) shall be developed using land use Geographic Information System (GIS) datasets from the US Geological Survey (USGS) and Instituto Nacional de Estadistica y Geografia (INEGI) data webservices. The land use types in the US and Mexican sides of the floodplain shall be noted for selecting the roughness coefficients. Example values for n-values include: main channel and open water = 0.05; developed open space = 0.03; developed low and medium intensity = 0.068; barren land (bare ground) = 0.03; deciduous forest = 0.08; evergreen forest = 0.10; mixed forest = 0.12; shrub/scrub = 0.10; herbaceous = 0.07; hay/pasture = 0.05; cultivated crops = 0.05; woody wetlands = 0.20; emergent wetlands = 0.20. Values from HEC-RAS manuals and the literature shall also be consulted. However, n-values may be suitably modified using engineering judgment and consistent with values in the engineering literature to address modeling issues such as numerical stability and volume conservation. ArcGIS shapefile of land use polygons may be created and associated with the corresponding roughness coefficients for use in the HEC-RAS model.

7. **Boundary Conditions.** The boundary conditions are applied upstream and downstream. As explained above, the modeling domain shall extend sufficiently upstream and downstream of the project extent to ensure that the boundary conditions do not impact the hydraulic variables at the project location.

8. **Modeling Approach.** The hydraulic modeling shall use the Full Momentum (Saint Venant) equations for the computations. These equations provide accurate solutions in situations such as highly dynamic flood waves, tight bends as seen in the meanders of the Rio Grande, and detailed water surface elevations and velocities at structures, among other situations as described in the HEC-RAS 2D Modeling Users Manual. Guidelines for grid size and timestep provided in the manual shall be followed to ensure that the model runs meet the Courant condition guidelines, exhibit good stability and excellent volume conservation.

9. **Numerical Stability Tolerance Values.** The following 1D and 2D settings (Figure 2, Figure 3, and Figure 4) are example recommendations for the computation of the models. Settings may be adjusted depending on the performance of the models to address issues such as model instability. The cross-section hydraulic table parameters shall be modified as necessary to improve model stability. The unsteady hydraulic models shall demonstrate excellent volume conservation results and have numerical instabilities eliminated or minimized.

10. **Existing Condition Model.** An existing condition 1D/2D or 2D HEC-RAS model shall be developed using the above elements.

11. **Model Calibration.** The existing condition HEC-RAS 1D/2D or 2D model shall be calibrated to match the water surface elevations from nearby gaging stations and historical highwater marks. The model needs to simulate the design flow elevation or higher by adjusting input parameters within a reasonable range. For example, the values of historical flood elevation values from Hurricane Beulah, Hurricane Alex, and similar events in the Lower Rio Grande or floods at the modeling reach may be used for the calibration. It should be recognized, however, that site conditions may have changed over time from features such as sediment and vegetation, limiting calibration efforts.

Figure 2: General 1D Unsteady Numerical Control Values

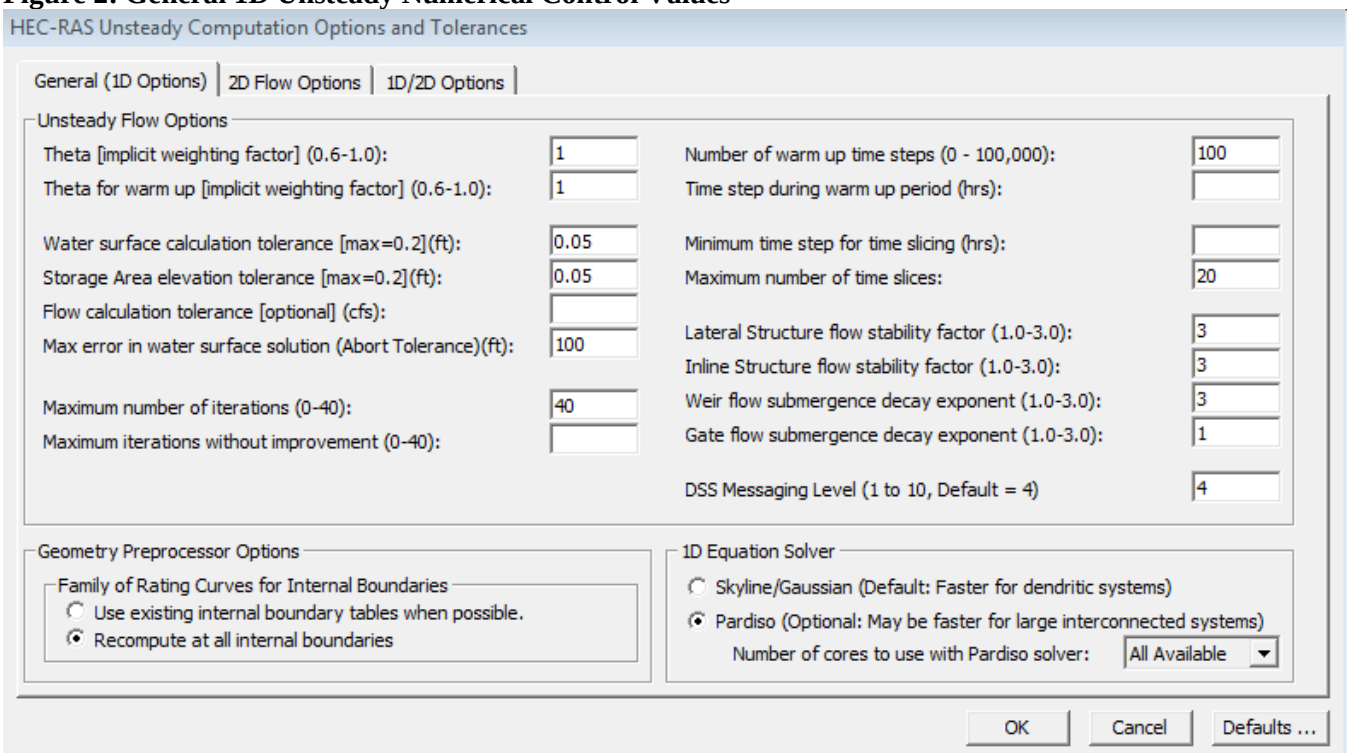
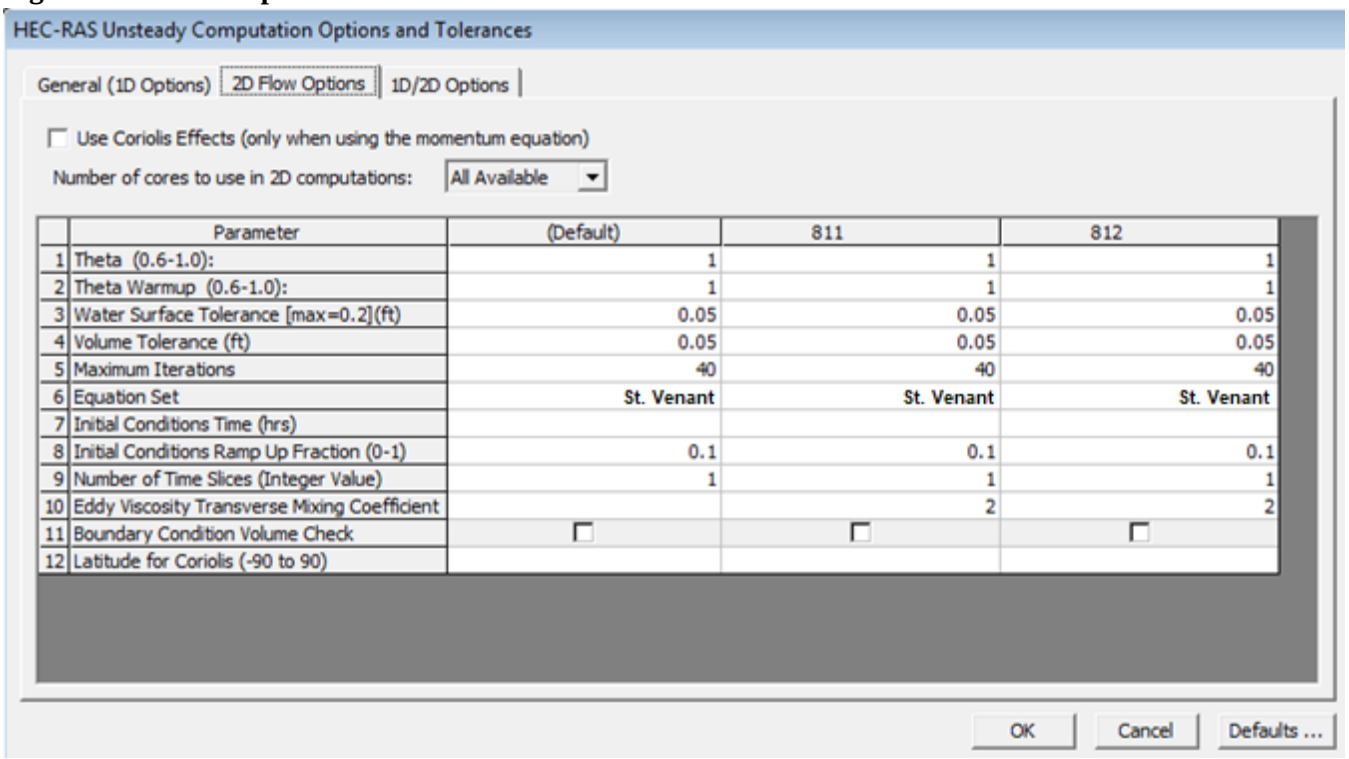
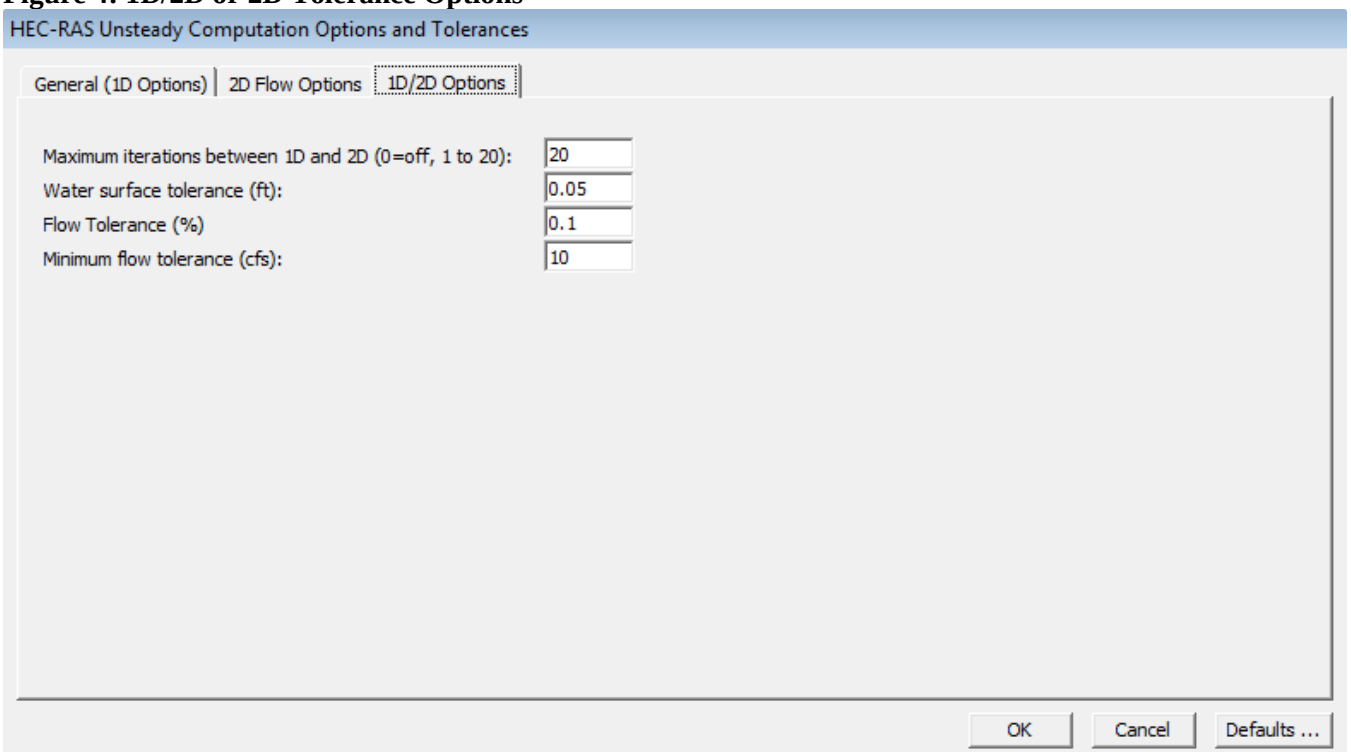


Figure 3: 2D Flow Options Tolerance Values



	Parameter	(Default)	811	812
1	Theta (0.6-1.0):	1	1	1
2	Theta Warmup (0.6-1.0):	1	1	1
3	Water Surface Tolerance [max=0.2](ft)	0.05	0.05	0.05
4	Volume Tolerance (ft)	0.05	0.05	0.05
5	Maximum Iterations	40	40	40
6	Equation Set	St. Venant	St. Venant	St. Venant
7	Initial Conditions Time (hrs)			
8	Initial Conditions Ramp Up Fraction (0-1)	0.1	0.1	0.1
9	Number of Time Slices (Integer Value)	1	1	1
10	Eddy Viscosity Transverse Mixing Coefficient		2	2
11	Boundary Condition Volume Check	☐	☐	☐
12	Latitude for Coriolis (-90 to 90)			

Figure 4: 1D/2D or 2D Tolerance Options



12. Proposed Condition Model.

A. Detailed examination of the impacts of the proposed project shall be facilitated using break lines within the 2D modeling domain. The project may be represented by a shapefile imported into HEC-RAS and break lines within the HEC-RAS break line module. Break lines force a finer computational grid within the 2D area.

B. In the existing condition, the break lines represent the existing terrain. In the proposed condition, the break lines are converted to interior 2D connections using the existing terrain stations and elevations. The stations and elevations shall be processed to generate the stations and elevations to the height of the project works at the existing ground.

C. For example, a proposed bollard fence shall be included in the existing condition model geometry by features such as a lateral weir using the HEC-RAS 2D Internal Hydraulic structures component. The lateral weir internal cross-section captures the terrain profile for the existing conditions, and for the proposed condition the bollard fence shall be represented by modifying the internal cross-sections. Software limitations shall be addressed as needed. The 2D Internal Hydraulic structure uses the “Normal 2D Equation” or the “Weir Equation” to compute the exchange of flows across a structure. Since each lateral weir segment can only accommodate a maximum of 500 stations, multipliers (example 8 to 10) may be used to combine the features of the proposed projects. It is preferable to represent the structures as they are and avoid using multipliers. To represent a long, linear feature such as a long length of a proposed bollard fence, multiple segments of lateral weirs may be required.

D. Flood flows generate debris, therefore, blockage due to debris shall be evaluated. For structures such as bollard fences, blockage at or above 30% along the length of the proposed bollard fence shall be evaluated. For other structures, the percentage of

debris blockage shall be discussed with the USIBWC. The Proponent shall also discuss with the USIBWC in advance whether to model the blockage for individual element or for a group of elements together or other means.

13. Interim Condition Model. In case the project is constructed in multiple phases, interim condition hydraulic modeling is required for each phase. These models would be developed similar to the proposed condition model described above. The first interim condition model would use the existing condition model as a starting point and input the interim construction project. The next interim condition model would use the first interim condition model as the starting point and add the next phase of the project. The proposed condition model would represent the full build out condition of the project. Project segments that are not physically contiguous but are in close proximity to other segments may be considered as one project. Coordination with the USIBWC is recommended to determine if non-contiguous segments must be considered as one project. The succession of hydraulic models from the existing condition model to the proposed condition model shall show the cumulative infrastructure development within the floodplain.

14. Hydraulic Impact Calculations - Water Surface Elevation Increases.

A. For 2D hydraulic models, water surface elevations (WSE) shall be compared by developing existing and proposed condition maximum WSE rasters using the HEC-RAS Mapper tools. The existing condition raster shall be subtracted from the proposed condition raster in ArcGIS tools to develop a third raster showing the difference. This new raster shows the increase in maximum WSE between the existing and proposed conditions. The raster can identify regions or clusters of changes in WSE. A map showing these WSE increases, with a legend on the magnitude of these increases, shall be prepared and included in the technical report. The map shall be of sufficient size to clearly identify the WSE differences and the legend indicating the values shall be legible. Spikes in WSE values attributable to localized numerical instability may exist in the raster files and these shall be documented and discussed with the USIBWC.

B. For 1D hydraulic models, threshold limits for WSE increases are a maximum of 3 inches in urban areas and 6 inches in rural areas. WSE increase is the difference between the proposed and existing condition WSE. See page 12 for an example showing WSE increase calculations.

C. These thresholds are valid, however, only in reaches of the Rio Grande without flood control levees. In leveed areas, any increase in WSE represents a decrease in the levee freeboard and an increase in the flood risk to landside communities in the US and Mexico. Therefore, there shall be no increase in the WSE values in the proposed condition in leveed areas.

D. For WSE increases, spikes in WSE increases above threshold limits may not be considered as hydraulic impacts as they may be introduced by artifacts in numerical modeling such as a localized instability in some cell locations. Also, localized areas of WSE increases that are limited in extent and do not impact features such as levees or river banks may not be considered adverse hydraulic impacts. Where such increases occur, they shall be discussed with the USIBWC.

15. Hydraulic Impact Calculations - Percent Flow Deflections.

A. There are several ways to calculate percent deflections. However, the following procedures shall be used.

B. For 1D models, the hydraulic impacts due to increases in percent deflection of flows are calculated as follows. Looking downstream, the flow in the US portion is the flow in the left half of the main channel and the left floodplain. The flow in the Mexican portion is the flow in the right half of the main channel and the right floodplain.

C. These flows can be obtained for each cross section from the 1D HEC-RAS model output using the HEC-RAS variables 'Q Left,' 'Q Channel,' and 'Q Right' which represent the left overbank, main channel, and right overbank flows, respectively. For example, the proposed condition flow on the Mexican side, QMXproposed, is calculated as half the proposed condition flow in the main channel (because the centerline of the main channel is the boundary between US and Mexico) plus the total proposed condition flow in the right overbank (Mexico). This calculation is repeated for the existing condition flow in Mexico, QMXexisting. Similarly, the proposed condition US flow, QUSproposed, and existing condition US flow, QUSexisting, are calculated. To calculate the deflection of flows towards Mexico, QMXexisting is subtracted from the QMXproposed, and the difference is divided by QMXexisting. This is then expressed as a percentage. This process is repeated to calculate the percent deflection of flows towards the US

D. The flows in the 1D/2D model can be analyzed for deflection impacts in an equivalent manner using profile lines, or profile cross-sections, within HEC-RAS Mapper. The various flows are represented by the 2D mesh in the US (left overbank), the 1D channel component (the channel), and the 2D mesh in Mexico (right overbank). The profile cross-sections are drawn left to right across the 2D mesh as extensions of the 1D channel component cross-sections at intervals of 1,000 feet. The percent deflections of flow are calculated similar to the 1D models, using the maximum peak discharge, an optional output variable in HEC-RAS Mapper for the profile lines. For full 2D hydraulic models, the percent deflections are calculated similarly. Because of the flow direction variations throughout the reach, these profile lines are drawn perpendicular to the general flow direction in the floodplain at the prescribed locations. A figure of the cross-section locations for impact calculations shall be submitted in advance for review. The USIBWC may require impact calculations at additional cross sections at locations of interest.

E. At each cross section, the percent deflection of flow to either the US or to Mexico shall not exceed +5%. The results shall be presented in a spreadsheet showing the calculations explained above. See page 12 for an example of this spreadsheet showing percent deflection calculations.

16. Hydraulic Modeling Report.

A. The hydraulic modeling and results shall be documented in detail in a technical report.

B. The report is intended to be a stand-alone technical document that can be referred in future, for example, in case modifications to the Proponent's project are required based on observed adverse hydraulic impacts to flood events.

C. The report shall contain the following information:

(1) Contact Information. Include either a cover letter or section in the report that contains contact information (name, phone number, and/or email).

(2) Purpose of Study.

(3) Study Area.

(4) Modeling Methodology and Model Development.

(5) Results and Discussion. The results shall discuss the hydraulic impacts resulting from the proposed project.

(6) Conclusions.

(7) List of References.

D. Appendices Containing the Following:

(1) Figures.

(a) Relevant figures such as vicinity map, floodplain maps, and WSE difference rasters.

(b) Figures should be in color, legible, and convey technical information with prominent features labeled. Include multiple figures to convey information clearly if needed.

(c) Include relevant engineering drawings describing the proposed project.

(2) Model Outputs.

(a) WSE difference calculation tables.

(b) Deflection calculation tables.

(c) Hydraulic model outputs.

(d) HEC-RAS Standard Table 1, profile plots, cross-section plots, and HEC-RAS generated report.

(3) Reference Material. Include relevant documents such as portions from criteria manuals, FEMA FIRM, FEMA FIS table for discharges, geotechnical reports, and earlier hydraulic and hydrologic reports.

E. Electronic Files. Provide readme file describing all files provided, hydraulic models, spreadsheet calculations, GIS and CADD files, digital model files, impact calculations, reference studies, etc.

F. Final 100% Document. The final Hydraulic Modeling Report shall be signed and stamped by a professional engineer licensed to practice in the state where the work will be performed.

17. References.

A. The following list of references is intended to be a guide and should not be considered a comprehensive list of technical resources. References may be updated or revised after compilation of this list. Use of a newer version is not prohibited since it should offer better engineering and analysis data.

(1) S&B Infrastructure, Ltd., *Lower Rio Grande Flood Control Project, HEC-RAS Hydraulic Model Update and Validation (Peñitas to River Mile 28 and Off-River*

Floodways in Texas and Mexico), prepared for the International Boundary and Water Commission, July, 2008.

(2) S&B Infrastructure, Ltd., *Lower Rio Grande Flood Control Project, FLO-2D Simulation (Peñitas to River Mile 28 and Off-River Floodways in Texas and Mexico)*, prepared for the United States International Boundary and Water Commission (USIBWC), March 2009.

(3) U.S. Army Corps of Engineers (USACE), *Phase I Hydrology, Floodplain and Sediment Transport Report, Final. Tijuana River, United States-Mexico International Border to the Pacific Ocean, San Diego, California*, prepared for the City of San Diego. September 2018.

(4) U.S. Army Corps of Engineers, *Hydrologic Engineering Center - River Analysis System (HEC-RAS)*, Version 6.1, September 2021.

(5) U.S. Army Corps of Engineers, *Hydrologic Engineering Center - River Analysis System (HEC-RAS), 2D Modeling User's Manual*, Version 6.0, May 2021.

(6) U.S. Army Corps of Engineers, *Hydrologic Engineering Center - River Analysis System (HEC-RAS), HEC-RAS Mapper User's Manual*, Version 6.0, December 2020.

(7) U.S. Geological Survey, *Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains*, Water-Supply Paper 2339.

(8) U.S. Section International Boundary and Water Commission, *Flood Frequency Study for the Rio Grande between El Paso, Texas/Juarez Chihuahua and Brownsville, Texas/Matamoros, Tamaulipas*, September 2003.

(9) U.S. Section International Boundary and Water Commission, *Hydraulic Model of the Rio Grande and Floodways Within the Lower Rio Grande Flood Control Project*, El Paso, Texas, June 2003.

18. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

Digitally signed by RAMON MACIAS
Date: 2024.01.30 17:14:22 -07'00'

January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Example Spreadsheet - Calculation of Hydraulic Impacts.

	Proposed Condition						Existing Condition					Diff	Diff	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
RS	Qleft (cms)	Qch (cms)	Qright (cms)	WSEL (m)	Vel (m/s)	Q Total (cms)	Qleft (cms)	Qch (cms)	Qright (cms)	WSEL (m)	Vel (m/s)	WSEL (m)	Vel (m/s)	QUS (cms)	QMX (cms)	QUS (cms)	QMX (cms)	US (cms)	MX (cms)	US	MX
1000	245.14	2149.5	1565.36	118.42	1.98	3960	245.13	2149.53	1565.34	118.42	1.98	0.00	0.00	1319.89	2640.11	1319.90	2640.11	-0.0050	0.0050	0.00%	0.00%
999	133.65	2353.06	1473.29	118.42	1.84	3960	133.65	2353.09	1473.27	118.42	1.84	0.00	0.00	1310.18	2649.82	1310.20	2649.82	-0.0150	0.0050	0.00%	0.00%
998	199.12	2088.92	1671.96	118.42	1.85	3960	199.11	2088.95	1671.94	118.42	1.85	0.00	0.00	1243.58	2716.42	1243.59	2716.42	-0.0050	0.0050	0.00%	0.00%
997	200.64	2040.62	1718.74	118.42	1.79	3960	200.63	2040.65	1718.72	118.42	1.79	0.00	0.00	1220.95	2739.05	1220.96	2739.05	-0.0050	0.0050	0.00%	0.00%
996	167.88	2068.23	1723.89	118.41	1.78	3960	167.88	2068.26	1723.86	118.41	1.78	0.00	0.00	1202.00	2758.01	1202.01	2757.99	-0.0150	0.0150	0.00%	0.00%
995	306.58	1875.76	1777.67	118.4	1.88	3960	306.57	1875.79	1777.64	118.39	1.88	0.01	0.00	1244.46	2715.55	1244.47	2715.54	-0.0050	0.0150	0.00%	0.00%
994	331.06	1921.45	1707.49	118.39	1.85	3960	331.05	1921.48	1707.47	118.39	1.85	0.00	0.00	1291.79	2668.22	1291.79	2668.21	-0.0050	0.0050	0.00%	0.00%
993	364.35	1851.4	1744.25	118.38	1.86	3960	364.34	1851.43	1744.22	118.38	1.86	0.00	0.00	1290.05	2669.95	1290.06	2669.94	-0.0050	0.0150	0.00%	0.00%
992	359.39	1821.38	1779.23	118.38	1.86	3960	359.39	1821.42	1779.2	118.38	1.86	0.00	0.00	1270.08	2689.92	1270.10	2689.91	-0.0200	0.0100	0.00%	0.00%
991	329.73	1973.87	1656.41	118.37	1.83	3960	329.72	1973.91	1656.38	118.37	1.83	0.00	0.00	1316.67	2643.35	1316.68	2643.34	-0.0100	0.0100	0.00%	0.00%
990	278.07	2204.54	1477.4	118.36	1.77	3960	278.06	2204.58	1477.37	118.36	1.77	0.00	0.00	1380.34	2579.67	1380.35	2579.66	-0.0100	0.0100	0.00%	0.00%
989	317.77	1942.69	1699.54	118.35	1.85	3960	317.76	1942.73	1699.51	118.35	1.85	0.00	0.00	1289.12	2670.89	1289.13	2670.88	-0.0100	0.0100	0.00%	0.00%
988	346.82	2174.23	1438.95	118.35	1.75	3960	346.81	2174.27	1438.92	118.35	1.75	0.00	0.00	1433.94	2526.07	1433.95	2526.06	-0.0100	0.0100	0.00%	0.00%
987	360	2040.92	1559.08	118.33	1.85	3960	359.99	2040.96	1559.05	118.33	1.85	0.00	0.00	1380.46	2579.54	1380.47	2579.53	-0.0100	0.0100	0.00%	0.00%
986	343.31	2252.41	1364.27	118.32	1.83	3960	343.3	2252.46	1364.24	118.32	1.83	0.00	0.00	1469.52	2490.48	1469.53	2490.47	-0.0150	0.0050	0.00%	0.00%
985	248.02	2338.05	1373.92	118.32	1.78	3960	248.01	2338.1	1373.89	118.32	1.78	0.00	0.00	1417.05	2542.95	1417.06	2542.94	-0.0150	0.0050	0.00%	0.00%
984	333.28	2163.23	1463.5	118.31	1.82	3960	333.26	2163.28	1463.46	118.31	1.82	0.00	0.00	1414.90	2545.12	1414.90	2545.10	-0.0050	0.0150	0.00%	0.00%
983	350.94	2255.25	1353.81	118.31	1.69	3960	350.93	2255.3	1353.77	118.31	1.69	0.00	0.00	1478.57	2481.44	1478.58	2481.42	-0.0150	0.0150	0.00%	0.00%
982	367.47	2166.44	1426.09	118.29	1.83	3960	367.46	2166.49	1426.06	118.29	1.83	0.00	0.00	1450.69	2509.31	1450.71	2509.31	-0.0150	0.0050	0.00%	0.00%
981	432.04	2200.52	1327.44	118.28	1.84	3960	432.02	2200.58	1327.4	118.28	1.84	0.00	0.00	1532.30	2427.70	1532.31	2427.69	-0.0100	0.0100	0.00%	0.00%
980	456.73	2116.6	1386.67	118.26	1.83	3960	456.71	2116.65	1386.64	118.26	1.83	0.00	0.00	1515.03	2444.97	1515.04	2444.97	-0.0050	0.0050	0.00%	0.00%
979	357.45	2295.83	1306.72	118.25	1.8	3960	357.44	2295.88	1306.68	118.25	1.8	0.00	0.00	1505.37	2454.64	1505.38	2454.62	-0.0150	0.0150	0.00%	0.00%
978	282.18	2514.17	1163.65	118.24	1.77	3960	282.17	2514.23	1163.61	118.24	1.77	0.00	0.00	1539.27	2420.74	1539.29	2420.73	-0.0200	0.0100	0.00%	0.00%
977	370.56	2092.11	1497.33	118.24	1.83	3960	370.55	2092.17	1497.29	118.24	1.83	0.00	0.00	1416.62	2543.39	1416.64	2543.38	-0.0200	0.0100	0.00%	0.00%
976	251.33	2312.56	1396.11	118.23	1.78	3960	251.32	2312.62	1396.06	118.23	1.78	0.00	0.00	1407.61	2552.39	1407.63	2552.37	-0.0200	0.0200	0.00%	0.00%
975	202.19	2507.1	1250.71	118.23	1.71	3960	202.18	2507.16	1250.67	118.23	1.71	0.00	0.00	1455.74	2504.26	1455.76	2504.25	-0.0200	0.0100	0.00%	0.00%
974	392.13	2492.52	1075.35	118.23	1.61	3960	392.1	2492.59	1075.31	118.23	1.61	0.00	0.00	1638.39	2321.61	1638.40	2321.61	-0.0050	0.0050	0.00%	0.00%
973	787.96	2033.87	1138.17	118.24	1.43	3960	788.21	2034.62	1137.17	118.24	1.43	0.00	0.00	1804.90	2155.11	1805.52	2154.48	-0.6250	0.6250	-0.03%	0.03%
972	1228.84	1870.49	860.68	118.25	1.35	3960	1228.55	1870.12	861.33	118.25	1.35	0.00	0.00	2164.09	1795.93	2163.61	1796.39	0.4750	-0.4650	0.02%	-0.03%
971	1265.63	1873.14	821.23	118.24	1.34	3960	1266.18	1874.04	819.78	118.24	1.34	0.00	0.00	2202.20	1757.80	2203.20	1756.80	-1.0000	1.0000	-0.05%	0.06%
970	1269.03	1915.06	775.92	118.24	1.3	3960	1268.83	1914.86	776.32	118.24	1.3	0.00	0.00	2226.56	1733.45	2226.26	1733.75	0.3000	-0.3000	0.01%	-0.02%
969	1256.22	1688.94	1014.84	118.23	1.4	3960	1256.09	1688.85	1015.07	118.23	1.4	0.00	0.00	2100.69	1859.31	2100.52	1859.50	0.1750	-0.1850	0.01%	-0.01%
968	1150.49	1976.81	832.7	118.22	1.38	3960	1150.48	1976.89	832.63	118.22	1.38	0.00	0.00	2138.90	1821.11	2138.93	1821.08	-0.0300	0.0300	0.00%	0.00%
967	1066.34	2046.61	847.05	118.21	1.4	3960	1065.51	2045.1	849.39	118.21	1.4	0.00	0.00	2089.65	1870.36	2088.06	1871.94	1.5850	-1.5850	0.08%	-0.08%
966	1128.56	1638.97	1192.47	118.21	1.46	3960	1128.84	1639.48	1191.68	118.21	1.46	0.00	0.00	1948.05	2011.96	1948.58	2011.42	-0.5350	0.5350	-0.03%	0.03%
965	1061.49	2079.2	819.31	118.21	1.26	3960	1061.18	2078.67	820.15	118.2	1.26	0.01	0.00	2101.09	1858.91	2100.52	1859.49	0.5750	-0.5750	0.03%	-0.03%
964	1152.89	1527.05	1280.07	118.2	1.36	3960	1153.22	1527.56	1279.22	118.2	1.36	0.00	0.00	1916.42	2043.60	1917.00	2043.00	-0.5850	0.5950	-0.03%	0.03%
963	1202.51	1477.97	1279.52	118.19	1.45	3960	1197.18	1471.4	1291.42	118.19	1.44	0.00	0.01	1941.50	2018.51	1932.88	2027.12	8.6150	-8.6150	0.45%	-0.42%
962	1021.46	2276.62	661.92	118.18	1.35	3960	1017.28	2267.22	675.5	118.18	1.34	0.00	0.01	2159.77	1800.23	2150.89	1809.11	8.8800	-8.8800	0.41%	-0.49%
961	951.21	2285.44	723.35	118.17	1.42	3960	947.78	2277.08	735.14	118.17	1.42	0.00	0.00	2093.93	1866.07	2086.32	1873.68	7.6100	-7.6100	0.36%	-0.41%
960	880.03	2285.36	794.62	118.16	1.46	3960	878.2	2280.56	801.24	118.16	1.46	0.00	0.00	2022.71	1937.30	2018.48	1941.52	4.2300	-4.2200	0.21%	-0.22%
959	803.26	2345.57	811.18	118.15	1.51	3960	800.91	2338.6	820.49	118.15	1.51	0.00	0.00	1976.05	1983.97	1970.21	1989.79	5.8350	-5.8250	0.30%	-0.29%
958	621.9	2457.31	880.79	118.13	1.56	3960	620.77	2452.78	886.44	118.13	1.56	0.00	0.00	1850.56	2109.45	1847.16	2112.83	3.3950	-3.3850	0.18%	-0.16%
957	840.17	2172.22	947.61	118.12	1.67	3960	838.73	2168.42	952.85	118.12	1.66	0.00	0.01	1926.28	2033.72	1922.94	2037.06	3.3400	-3.3400	0.17%	-0.16%
956	865.06	2008.1	1086.85	118.1	1.75	3960	864.28	2006.26	1089.46	118.1	1.75	0.00	0.00	1869.11	2090.90	1867.41	2092.59	1.7000	-1.6900	0.09%	-0.08%
955	982.51	1869.19	1108.3	118.1	1.67	3960	982.51	1869.19	1108.3	118.1	1.67	0.00	0.00	1917.11	2042.90	1917.11	2042.90	0.0000	0.0000	0.00%	0.00%
954	652	2342.03	965.98	118.08	1.7	3960	652	2342.03	965.98	118.08	1.7	0.00	0.00	1823.02	2137.00	1823.02	2137.00	0.0000	0.0000	0.00%	0.00%
953	673.2	2178.89	1107.91	118.06	1.84	3960	673.2	2178.89	1107.91	118.06	1.84	0.00	0.00	1762.65	2197.36	1762.65	2197.36	0.0000	0.0000	0.00%	0.00%
952	695.54	2129.33	1135.13	118.05	1.91	3960	695.54	2129.33	1135.13	118.05	1.91	0.00	0.00	1760.21	2199.80	1760.21	2199.80	0.0000	0.0000	0.00%	0.00%
951	709.85	2139.47	1110.68	118.04	1.92	3960	709.85	2139.47	1110.68	118.04	1.92	0.00	0.00	1779.59	2180.42	1779.59	2180.42	0.0000	0.0000	0.00%	0.00%
950	746.34	2123.97	1089.69	118.02	1.99	3960	746.34	2123.97	1089.69	118.02	1.99	0.00	0.00	1808.33	2151.68	1808.33	2151.68	0.0000	0.0000	0.00%	0.00%
949	503.34	2465.6	991.07	118.01	1.88	3960	503.34	2465.6	991.07	118.01	1.88	0.00	0.00	1736.14	2223.87	1736.14	2223.87	0.0000	0.0000	0.00%	0.00%
948	473.87	2493.72	992.4	117.98	1.97	3960	473.87	2493.72	992.4	117.98	1.97	0.00	0.00	1720.73	2239.26	1720.73	2239.26	0.0000	0.0000	0.00%	0.00%
												0.01	0.01					8.88	1.00	0.45%	0.06%
												0.00	0.00					-1.00	-8.88	-0.05%	-0.49%

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Reseeding USIBWC Property

USIBWC Directive SD.II.01031-M-1 Appendix G

Table of Contents

1. Project Seed Mixes.

A. All USIBWC-controlled property disturbed by construction activities shall be revegetated. Revegetation requires seeding and establishing vegetation growth through watering and maintenance.

B. Levee side slopes and area within fifteen (15) feet of the levee toe shall be seeded with grasses only.

C. All plants and seeds used shall be native to the United States. Plant varieties are not required to be native to the project area although that is preferred. Seeds shall be certified weed free and state seed laws shall be adhered to.

D. Executive Order (EO) 13751 establishes policy that the Government will "prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species." EO 13112 shall be followed, especially Sec 2.(b) which notes that Federal agencies shall "not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species."

E. Only fertilizers, herbicides, other materials noted as safe for use near lakes and in aquatic environments shall be used.

F. Herbicides used must be federally and locally registered and must be applied in accordance with authorized registered uses, directions on label, and other federal or state policies and requirements. Seeded species shall have three (3) to five (5) leaves per plant before herbicides are applied. Any herbicides used shall be certified as safe for use near lakes and in aquatic environments.

G. Mulch materials shall be free of disease, pesticides, chemicals, noxious weed seeds and/or parts, and other pests and pathogens.

2. Seeding.

A. Use the seed mix identified in Table 1 as applicable to the county where your work is located.

Table 1 Project Locations

State	Counties	Tables
CA	San Diego, Imperial †	Table 2
AZ	Yuma †, Pima, Santa Cruz, Cochise	Table 3
NM	Hidalgo, Luna, Doña Ana ∆	Table 3
NM	Doña Ana ∆, Sierra	Table 4
TX	El Paso, Hudspeth, Presidio, Jeff Davis, Brewster, Terrell, Val Verde, Kinney	Table 4
TX	Maverick, Webb, Zapata, Starr, Hidalgo, Cameron	Table 5

† Work along the Colorado River may use plants from Table 2 or Table 3 as appropriate to the area being reseeded.

∆ Doña Ana County west of Santa Teresa/Anapra area (i.e. away from the Rio Grande) should use Table 3 .

B. When work encompasses levees (e.g. Tijuana River, Colorado River, and Rio Grande) at least five (5) of the grasses listed in the applicable tables shall be used. Only grasses are allowed on levees and within fifteen (15) feet of the levee toe.

C. Work on the river floodplains, along the international border, or other USIBWC property, not within fifteen (15) feet of a levee shall be revegetated with at least five (5) grasses and at least eight (8) forbs/shrubs from the applicable tables.

D. While all plants listed in these tables are native, choose specific plants whose adaptations to soil, salinity, moisture, and location indicate that they will be successful in growing at your worksite.

3. Filler Grasses and Cover Crops.

A. Only grasses shall be used as cover crops.

B. Cover crops shall be native to area or shall be sterile.

4. Vegetation Maintenance Period.

A. Immediately after seeding has been sowed, begin to provide vegetation maintenance to include, but not limited to, mowing, edging, over-seeding, aeration, fertilizing, watering, weeding, and pruning for all newly seeded materials and at all areas inside or outside the limits of the construction that were disturbed by your operations.

B. Maintain the vegetated areas including all fertilizing, watering, mulches, and weed control until at least seventy percent (70%) of the prework vegetative coverage is established.

C. Slope Erosion Control Maintenance. Provide slope erosion control maintenance to prevent undermining of all slopes in newly seeded areas. Maintenance tasks include immediate repairs to weak spots where seeding will be installed, in order to intercept and direct water flow to prevent development of large gullies and slope erosion. Eroded seeded areas shall be backfilled with amended topsoil and replanted with the same plant species.

D. Water Restriction. Abide by state, local, or other water conservation regulations in force during the vegetation establishment period. Additionally, no water from rivers or reservoirs shall be used for vegetation maintenance activities unless a valid state water right or license is provided.

5. Seed Mixes. See Project Locations table to determine which table applies to your location.

Table 2 California Project Areas

California Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Grass	Alkali muhly	*Muhlenbergia asperifoliaa*	0.4	12.0
Grass	Alkali sacaton	*Sporobolus airoides*	0.5	2.0
Grass	Arizona cottontop	*Digitaria californica*	1.4	2.0
Grass	Beardless wildrye	*Leymus triticoides*	5.1	15.0
Grass	Big (Giant) sacaton	*Sporobolus wrightii*	0.4	1.0
Grass	Bottlebrush squirreltail	*Elymus elymoides*	4.5	7.0
Grass	Cane bluestem	*Bothriochloa barbinodis*	1.7	2.0
Grass	Indian ricegrass	*Oryzopsis hymenoides*	5.0	6.0
Grass	Inland saltgrass	*Distichlis stricta*	1.7	4.0
Grass	Little bluestem	*Schizachyrium scoparium*	3.4	4.0
Grass	Needle grama	*Bouteloua aristidoides*	2.1	5.0
Grass	Plains lovegrass	*Eragrostis intermedia*	0.3	2.0
Grass	Purple threeawn	*Aristida purpurea*	3.5	6.0
Grass	Sand dropseed	*Sporobolus cryptandrus*	0.2	1.0
Grass	Sideoats grama	*Bouteloua curtipendula*	4.6	5.0
Forb	Bitter rubberweed	*Hymenoxys oderata*	0.1	---
Forb	Bristly nama/Sand bells	*Nama hispidum*	0.1	---
Shrub	Burro weed	*Ambrosia dumosa*	0.1	---
Shrub	California buckwheat	*Eriogonum fasciculatum*	0.2	---
Forb	California poppy	*Eschscholzia californica*	0.4	---
Forb	Chia sage	*Salvia columbariae*	0.1	---
Shrub	Desert brickellbush	*Brickellia desertorum*	0.1	---
Forb	Desert globemallow	*Sphaeralcea ambigua*	0.3	---
Forb	Desert marigold	*Baileya multiradiata*	0.2	---
Forb	Desert twinbugs	*Dicoria canescens*	0.1	---
Forb	Evening primrose	*Oenethera sp.*	0.1	---
Forb	Fall tansyaster	*Machaeranthera asteroides*	0.2	---
Shrub	Four-wing saltbush	*Atriplex canescens*	0.4	---
Forb	Fringed spineflower	*Chorizanthe fimbriata*	0.1	---
Forb	Hairy sand verbena	*Abronia villosa*	0.1	---
Shrub	Mulefat (seep willow)	*Baccharis salicifolia*	0.2	---
Forb	Pebble pincushion	*Chaenactis carphoclinia*	0.1	---
Forb	Penstemon	*Penstemon sp.*	0.3	---
Forb	Pink evening primrose	*Oenothera speciosa*	0.2	---
Forb	Pink sand verbena	*Abronia umbellata*	0.1	---
Forb	Purple prairie verbena	*Glandularia bipinnatifida*	0.1	---
Forb	San Felipe dogweed	*Adenophyllum porophylloides*	0.1	---
Forb	Sanddune wallflower	*Erysimum capitatum*	0.1	---
Shrub	Shrubby brickellbush	*Brickellia frutescens*	0.1	---
Forb	Trailing windmills	*Allionia incarnata*	0.1	---

California Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Forb	Wild four o'clock	*Mirabilis multiflora*	0.3	---
Forb	Woodyaster	*Xylorhiza sp.*	0.3	---

Table 3 Arizona and New Mexico Land Boundary Areas

Arizona and New Mexico Land Boundary Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Grass	Alkali muhly	*Muhlenbergia asperifoliaa*	0.4	12.0
Grass	Alkali sacaton	*Sporobolus airoides*	0.5	2.0
Grass	Arizona cottontop	*Digitaria californica*	1.4	2.0
Grass	Beardless wildrye	*Leymus triticoides*	5.1	15.0
Grass	Big (Giant) sacaton	*Sporobolus wrightii*	0.4	1.0
Grass	Black grama	*Bouteloua eriopoda*	0.7	2.0
Grass	Blue grama	*Bouteloua gracilis*	1.2	3.0
Grass	Bottlebrush squirreltail	*Elymus elymoides*	4.5	7.0
Grass	Buffalograss	*Buchloe dactyloides*	2.6	8.0
Grass	Canada wildrye	*Elymus canadensis*	7.6	11.0
Grass	Cane bluestem	*Bothriochloa barbinodis*	1.7	2.0
Grass	False rhodes grass	*Chloris crinita*	0.6	1.0
Grass	Green sprangletop	*Leptochloa dubia*	1.6	3.0
Grass	Hairy grama	*Bouteloua hirsuta*	0.8	2.0
Grass	Indian ricegrass	*Oryzopsis hymenoides*	5.0	6.0
Grass	Inland saltgrass	*Distichlis stricta*	1.7	4.0
Grass	Little bluestem	*Schizachyrium scoparium*	3.4	4.0
Grass	Needle grama	*Bouteloua aristidoides*	2.1	5.0
Grass	New Mexico feathergrass	*Hesperostipa neomexicana*	12.4	10.0
Grass	Plains bristlegrass	*Setaria vulpiseta*	3.0	5.0
Grass	Plains lovegrass	*Eragrostis intermedia*	0.3	2.0
Grass	Purple threeawn	*Aristida purpurea*	3.5	6.0
Grass	Sand dropseed	*Sporobolus cryptandrus*	0.2	1.0
Grass	Sideoats grama	*Bouteloua curtipendula*	4.6	5.0
Grass	Slender grama	*Bouteloua repens*	7.5	20.0
Grass	Spike dropseed	*Sporobolus contractus*	0.5	2.0
Grass	Switchgrass	*Panicum virgatum*	3.1	4.0
Grass	Whiplash pappusgrass	*Pappophorum vaginatum*	2.9	3.0
Forb	Bitter rubberweed	*Hymenoxys oderata*	0.1	---
Forb	Blackfoot daisy	*Melampodium leucanthum*	0.1	---
Forb	Blanket flower	*Gaillardia pulchella*	0.3	---
Forb	Bristly nama/Sand bells	*Nama hispidum*	0.1	---
Shrub	Burro weed	*Ambrosia dumosa*	0.1	---
Forb	California poppy	*Eschscholzia californica*	0.4	---
Forb	Chia sage	*Salvia columbariae*	0.1	---

Arizona and New Mexico Land Boundary Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Shrub	Desert brickellbush	*Brickellia desertorum*	0.1	---
Forb	Desert globemallow	*Sphaeralcea ambigua*	0.3	---
Forb	Desert marigold	*Baileya multiradiata*	0.2	---
Forb	Desert twinbugs	*Dicoria canescens*	0.1	---
Forb	Desert zinnia	*Zinnia acerosa*	0.2	---
Forb	Evening primrose	*Oenethera sp.*	0.1	---
Forb	Fall tansyaster	*Machaeranthera asteroides*	0.2	---
Shrub	Four-wing saltbush	*Atriplex canescens*	0.4	---
Forb	Hairy false goldenaster	*Heterotheca villosa*	0.2	---
Forb	Hairy sand verbena	*Abronia villosa*	0.1	---
Forb	Hairyseed bahia	*Bahia absinthifolia*	0.1	---
Forb	Mariola	*Parthenium incanum*	0.1	---
Forb	Mesa pepperwort	*Lepidium alyssoides*	0.1	---
Shrub	Mulefat (seep willow)	*Baccharis salicifolia*	0.2	---
Forb	Pebble pincushion	*Chaenactis carphoclinia*	0.1	---
Forb	Penstemon	*Penstemon sp.*	0.3	---
Forb	Prairie sunflower	*Helianthus petiolaris*	0.5	---
Forb	Purple prairie verbena	*Glandularia bipinnatifida*	0.1	---
Forb	San Felipe dogweed	*Adenophyllum porophylloides*	0.1	---
Forb	Sanddune wallflower	*Erysimum capitatum*	0.1	---
Shrub	Shrubby brickellbush	*Brickellia frutescens*	0.1	---
Forb	Spear globemallow	*Sphaeralcea hastulata*	0.3	---
Forb	Trailing krameria/Three fans	*Krameria lanceolata*	0.1	---
Forb	Trailing windmills	*Allionia incarnata*	0.1	---
Forb	Wild four o'clock	*Mirabilis multiflora*	0.3	---
Shrub	Winterfat	*Krascheninnikovia lanta*	0.2	---
Forb	Woodyaster	*Xylorhiza sp.*	0.3	---

Table 4 Upper Rio Grande Project Areas

Upper Rio Grande Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Grass	Alkali muhly	*Muhlenbergia asperifoliaa*	0.4	12.0
Grass	Alkali sacaton	*Sporobolus airoides*	0.5	2.0
Grass	Arizona cottontop	*Digitaria californica*	1.4	2.0
Grass	Beardless wildrye	*Leymus triticoides*	5.1	15.0
Grass	Big (Giant) sacaton	*Sporobolus wrightii*	0.4	1.0
Grass	Black grama	*Bouteloua eriopoda*	0.7	2.0
Grass	Blue grama	*Bouteloua gracilis*	1.2	3.0
Grass	Bottlebrush squirreltail	*Elymus elymoides*	4.5	7.0
Grass	Buffalograss	*Buchloe dactyloides*	2.6	8.0
Grass	Canada wildrye	*Elymus canadensis*	7.6	11.0

Upper Rio Grande Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Grass	Cane bluestem	*Bothriochloa barbinodis*	1.7	2.0
Grass	Green sprangletop	*Leptochloa dubia*	1.6	3.0
Grass	Hairy grama	*Bouteloua hirsuta*	0.8	2.0
Grass	Hooded windmill grass	*Chloris cucullata*	1.7	1.0
Grass	Indian ricegrass	*Oryzopsis hymenoides*	5.0	6.0
Grass	Inland saltgrass	*Distichlis stricta*	1.7	4.0
Grass	Little bluestem	*Schizachyrium scoparium*	3.4	4.0
Grass	Needle grama	*Bouteloua aristidoides*	2.1	5.0
Grass	New Mexico feathergrass	*Hesperostipa neomexicana*	12.4	10.0
Grass	Pink pappusgrass	*Pappophorum bicolor*	2.7	3.0
Grass	Plains bristlegrass	*Setaria vulpiseta*	3.0	5.0
Grass	Plains lovegrass	*Eragrostis intermedia*	0.3	2.0
Grass	Purple threeawn	*Aristida purpurea*	3.5	6.0
Grass	Sand dropseed	*Sporobolus cryptandrus*	0.2	1.0
Grass	Sideoats grama	*Bouteloua curtipendula*	4.6	5.0
Grass	Switchgrass	*Panicum virgatum*	3.1	4.0
Grass	Whiplash pappusgrass	*Pappophorum vaginatum*	2.9	3.0
Forb	Bitter rubberweed	*Hymenoxys oderata*	0.1	---
Forb	Blackfoot daisy	*Melampodium leucanthum*	0.1	---
Forb	Blanket flower	*Gaillardia pulchella*	0.3	---
Forb	Bristly nama/Sand bells	*Nama hispidum*	0.1	---
Forb	California poppy	*Eschscholzia californica*	0.4	---
Forb	Chia sage	*Salvia columbariae*	0.1	---
Forb	Climbing milkweed	*Funastrum cynanchoides*	0.2	---
Forb	Desert marigold	*Baileya multiradiata*	0.2	---
Forb	Desert zinnia	*Zinnia acerosa*	0.2	---
Forb	Evening primrose	*Oenethera sp.*	0.1	---
Shrub	Four-wing saltbush	*Atriplex canescens*	0.4	---
Forb	Hairy false goldenaster	*Heterotheca villosa*	0.2	---
Forb	Hairyseed bahia	*Bahia absinthifolia*	0.1	---
Forb	Illinois bundleflower	*Desmanthus illinoensis*	0.2	---
Forb	Maximilian sunflower	*Helianthus maximiliani*	0.2	---
Forb	Mesa pepperwort	*Lepidium alyssoides*	0.1	---
Forb	Pearl netleaf milkvine	*Matelea reticulata*	0.2	---
Forb	Penstemon	*Penstemon sp.*	0.3	---
Forb	Pink evening primrose	*Oenothera speciosa*	0.2	---
Forb	Plains fleabane	*Erigeron modestus*	0.1	---
Forb	Purple prairie verbena	*Glandularia bipinnatifida*	0.1	---
Shrub	Sand sage	*Artemisia filifolia*	0.1	---
Forb	Sanddune wallflower	*Erysimum capitatum*	0.1	---
Forb	Spear globemallow	*Sphaeralcea hastulata*	0.3	---
Forb	Trailing krameria/Three fans	*Krameria lanceolata*	0.1	---

Upper Rio Grande Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Forb	Wild four o'clock	*Mirabilis multiflora*	0.3	---
Shrub	Winterfat	*Krascheninnikovia lanta*	0.2	---
Forb	Woodyaster	*Xylorhiza sp.*	0.3	---

Table 5 Lower Rio Grande Project Areas

Lower Rio Grande Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Grass	Alkali sacaton	*Sporobolus airoides*	0.5	2.0
Grass	Arizona cottontop	*Digitaria californica*	1.4	2.0
Grass	Beardless wildrye	*Leymus triticoides*	5.1	15.0
Grass	Big (Giant) sacaton	*Sporobolus wrightii*	0.4	1.0
Grass	Cane bluestem	*Bothriochloa barbinodis*	1.7	2.0
Grass	False rhodes grass	*Chloris crinita*	0.6	1.0
Grass	Green sprangletop	*Leptochloa dubia*	1.6	3.0
Grass	Hairy grama	*Bouteloua hirsuta*	0.8	2.0
Grass	Hooded windmill grass	*Chloris cucullata*	1.7	1.0
Grass	Pink pappusgrass	*Pappophorum bicolor*	2.7	3.0
Grass	Plains bristlegrass	*Setaria vulpiseta*	3.0	5.0
Grass	Plains lovegrass	*Eragrostis intermedia*	0.3	2.0
Grass	Purple threeawn	*Aristida purpurea*	3.5	6.0
Grass	Sand dropseed	*Sporobolus cryptandrus*	0.2	1.0
Grass	Sideoats grama	*Bouteloua curtipendula*	4.6	5.0
Grass	Slender grama	*Bouteloua repens*	7.5	20.0
Grass	Texas grama	*Bouteloua rigidiseta*	8.4	15.0
Grass	Whiplash pappusgrass	*Pappophorum vaginatum*	2.9	3.0
Forb	Bitter rubberweed	*Hymenoxys oderata*	0.1	---
Forb	Black-eyed Susan	*Rudbeckia hirta*	0.2	---
Forb	Blanket flower	*Gaillardia pulchella*	0.3	---
Forb	Bristly nama/Sand bells	*Nama hispidum*	0.1	---
Forb	Climbing milkweed	*Funastrum cynanchoides*	0.2	---
Forb	Cutleaf daisy	*Erigeron compositus*	0.2	---
Forb	Evening primrose	*Oenethera sp.*	0.1	---
Forb	Giant coneflower	*Rudbeckia maxima*	0.2	---
Forb	Hairypod cowpea	*Vigna luteola*	0.2	---
Forb	Hairyseed bahia	*Bahia absinthifolia*	0.1	---
Forb	Illinois bundleflower	*Desmanthus illinoensis*	0.2	---
Forb	Littlehead gumweed	*Grindelia microcephala*	0.2	---
Forb	Maximilian sunflower	*Helianthus maximiliani*	0.2	---
Forb	Pearl netleaf milkvine	*Matelea reticulata*	0.2	---
Forb	Penstemon	*Penstemon sp.*	0.3	---
Forb	Pink evening primrose	*Oenothera speciosa*	0.2	---

Lower Rio Grande Project Areas				
Type	**Common Name**	**Scientific Name**	**Min Seed Rate Lbs Seed/Acre***	**Rec Seed Rate Lbs Seed/Acre****
Forb	Pitcher sage	*Salvia spathace*	0.2	---
Forb	Purple prairie verbena	*Glandularia bipinnatifida*	0.1	---
Forb	Rio Grande dewberry	*Rubus riograndis*	0.2	---
Forb	Spear globemallow	*Sphaeralcea hastulata*	0.3	---
Forb	Texas sunflower	*Helianthus praecox*	0.5	---
Forb	Trailing krameria/Three fans	*Krameria lanceolata*	0.1	---

* *Grass seeding rates shown are based upon NRCS recommended rates for drilled pure seed. Broadcast seeding will need at least double the seed rate. Rates below 100% pure seed must also be adjusted.*

** *Recommended seeding rates shown are based upon commercial suppliers or growers. Rates are not provided for flowers and shrubs.*

6. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

(4) Appendix D - Minimum Levee Testing Requirements

(5) Appendix E - Design Report Requirements

(6) Appendix F - Hydraulic Modeling Methodology

(7) Appendix G - Reseeding USIBWC Property

(8) Appendix H - Floodplain Requirements

B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct your project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS

Digitally signed by RAMON MACIAS
Date: 2024.01.30 17:14:49 -07'00'

January 30, 2024

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

Date

International Boundary and Water Commission

United States and Mexico

United States Section

4191 N. Mesa, El Paso, TX 79902

Requirements for Projects On the Rio Grande and Colorado River Floodplains

USIBWC Directive SD.II.01031-M-1 Appendix H

Table of Contents

The purpose of this document is to present additional criteria and guidelines for the application, review, approval, and inspection of construction activities not performed by or for the United States Section, International Boundary and Water Commission (USIBWC) which is located within the floodplain of any international reach of the Rio Grande or Colorado River. See "*Appendix A-Design and Construction Requirements for All Projects*" for general requirements covering all projects including those affecting floodplains.

Most of the land affected by this document is not owned or controlled by USIBWC but is instead owned privately.

1. General Conditions for all Projects.

A. The "*1970 Treaty to Resolve Pending Boundary Difference and Maintain the Rio Grande and Colorado River as the International Boundary*" (23 UST 371 and implemented by 22 YSC §277d-34) requires that both the United States and Mexico protect the other county against adverse hydraulic impacts (Article IV).

B. In river reaches without levees, threshold limits for maximum water surface elevation (WSE) increases are a maximum of 3 inches in urban areas and 6 inches in rural areas. WSE increase is the difference between the proposed and existing condition WSE. The WSE increases are determined for the IBWC design flood. In locations where the IBWC design flood is not defined, the 100-year WSE is used.

C. In river reaches with levees, there shall be no increase in the WSE values in the proposed condition.

D. Hydraulic modeling on the Rio Grande shall be based upon these design flows:

Caballo Dam to Trujillo Canyon (32°50'35"N 107°17'48"W)	5,000 cfs
Trujillo Canyon to Montoya Arroyo (32°49'39"N 107°18'18"W)	12,700 cfs
Montoya Arroyo to Green Canyon/Tierra Blanca Creek (32°48'15"N 107°18'15"W)	15,900 cfs

Green Canyon to Sibley Canyon (32°47'10"N 107°18'14"W)	15,800 cfs
Sibley Canyon to Jaralosa Arroyo (32°46'14"N 107°17'26"W)	24,300 cfs
Jaralosa Arroyo to Arroyo Cuervo (32°43'26"N 107°16'07"W)	25,200 cfs
Arroyo Cuervo to Placitas Arroyo (32°40'42"N 107°09'50"W)	24,300 cfs
Placitas Arroyo to Angostura Arroyo (32°39'20"N 107°05'46"W)	21,300 cfs
Angostura Arroyo to Rincon Arroyo (32°39'15"N 107°04'16"W)	19,500 cfs
Rincon Arroyo to Broad Canyon (32°32'11"N 106°59'08"W)	24,300 cfs
Broad Canyon to Faulkner Canyon (32°30'04"N 106°56'33"W)	20,800 cfs
Faulkner Canyon to Leasburg Dam	19,300 cfs
Leasburg Dam to Shalem Colony Bridge	19,200 cfs
Shalem Colony Bridge to Mesilla Dam	18,400 cfs
Mesilla Dam to Vinton Bridge	17,400 cfs
Vinton Bridge to Canutillo Bridge	14,600 cfs
Canutillo Bridge to Borderland Bridge	14,200 cfs
Borderland Bridge to Courchesne Bridge	13,400 cfs
Courchesne Bridge to American Dam	12,800 cfs
American Dam to Ft Quitman, TX	11,000 cfs
Ft Quitman, TX to above Rio Conchos	8,750 cfs
Rio Grande below Rio Conchos	82,500 cfs
Rio Grande at Johnson Ranch near Castolon, TX and Santa Elena, Chihuahua	82,900 cfs
Rio Grande at Foster Ranch near Langtry, TX and Rancho Santa Rosa, Coahuila	192,000 cfs
Rio Grande below Amistad Reservoir near Del Rio, TX and Cd. Acuna, Coahuila	81,500 cfs
Rio Grande at Del Rio, TX and Cd. Acuna, Coahuila	122,900 cfs
Rio Grande near Jimenez, Coahuila and Quemado, TX	139,000 cfs
Rio Grande at Eagle Pass, TX and Piedras Negras, Coahuila	280,000 cfs
Rio Grande at Laredo, TX and Nuevo Laredo, Tamaulipas	181,227 cfs
Rio Grande below Falcon Dam near Falcon, TX	113,000 cfs
Rio Grande at Rio Grande City, TX	250,000 cfs
Anzalduas Dam to Retamal Dam	130,000 cfs
Retamal Dam to the Gulf of Mexico	20,000 cfs

E. Hydraulic modeling on the Colorado shall be based upon the following design flow:

Colorado River at Morelos Dam, Yuma, AZ	140,000 cfs

2. Reports.

A. A Hydraulic Modeling Report is required indicating that the design flood water surface does not increase beyond the threshold limits and that the maximum deflection of flood flows by the project to either country shall not exceed +5%.

B. A Design Report may be required to prove that Proponent's work will not negatively affect USIBWC structures (including levees) or property. See "*Appendix E-Design Report Requirements*" for guidance on Design Reports.

C. Work within the floodplain may require concurrence with Mexico. This concurrence may require weeks or months of communications. Design work may continue during this period, but in no instance, shall construction proceed until concurrence is reached with Mexico.

D. See "*Appendix F-Hydraulic Modeling Methodology*" for guidance on Hydraulic Modeling Reports and hydraulic modeling.

3. Drawings.

A. USIBWC-controlled property boundary shall be clearly shown on Proponent's drawings.

(1) USIBWC-controlled property includes all property for which USIBWC holds a property interest including, but limited to, USIBWC property and land for which USIBWC holds an easement for flowage, flood control, or other use.

B. Project coordinate system, survey units used, datum, and grid to ground conversion shall also be shown.

C. Drawings shall be of sufficient detail to determine exactly what is proposed, how it is to be constructed, and by whom.

D. In any operation involving earthwork, such as an excavation, cross sections and a profile of the proposed work must be furnished.

E. Any drawings showing project or project component interaction with USIBWC structures shall be drawn to scale.

F. Drawings must be signed and sealed by a professional engineer, duly licensed in the state(s) where the project is to be constructed.

4. Conditions.

A. Proponent's project shall not hinder or impair USIBWC's ability to perform maintenance or flood operations.

B. The USIBWC does not assume any responsibility or liability regarding damages that could be caused to the work, property, or persons in the project area as a consequence of river flood flows or the surface conditions of USIBWC-owned property. The USIBWC does not warrant that any of its property is suitable for any type of work or activity and project proponents are responsible for assessing the condition of the land before commencing work.

C. Any damage caused by the proposed works to either the banks of the river, USIBWC's structures, or USIBWC’s property shall be repaired by Proponent, at the Proponent's cost, to the USIBWC’s satisfaction.

D. The USIBWC will not alter its normal or flood operations criteria as a result of the proposed works.

E. Proponent is responsible for keeping their structures free of debris accumulation at all times. Proponent shall dispose of all debris in accordance with all applicable environment laws and regulations. In addition, Proponent is responsible for all costs associated with debris removal.

5. USIBWC Resources and Information. Requirements for work, forms, and standard drawings are available on USIBWC's website at www.ibwc.gov/resources-info/.

A. The following documents are available for download on that site:

(1) Appendix A - Design and Construction Requirements for All Projects

(2) Appendix B - Land Boundary Project Requirements

(3) Appendix C - Requirements for Projects on or Affecting a USIBWC Flood Control Structure

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B. Please contact our Realty Office (realty@ibwc.gov) to discuss which requirements apply to your project. Do not wait until you are ready to construct you project. Contact them well in advance so they can discuss our requirements.

Approved:

RAMON MACIAS Digitally signed by RAMON MACIAS
Date: 2024.07.15 09:15:19 -06'00'

Ramon Macias, III, P.E. Engineering
for
Dr. Maria-Elena Giner, P.E.
Commissioner

July 15, 2024
Date