Hurricane Alex Flood Operations
Lower Rio Grande Flood Control Project

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Lower Rio Grande Citizens Forum

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PRESENTATION OUTLINE

- History of Lower Rio Grande Flood Control Project
- Lower Rio Grande Flood Control Project Features
- Design Flood and Historic Flows
- Flood Forecasting
- 2010 Flood Operations
  - Contractor Actions
  - Diversions into the Floodway
  - Levee Performance
  - Peñitas Pump House
  - Irrigation and Drainage Structures
- Communications

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

- **Early 1900s – Levees constructed by private landowners/farmers were not effective**
- **1920s – Hidalgo and Cameron Counties constructed levees and interior floodways**
- **1932 – U.S. and Mexico agree to a coordinated plan proposed by the International Boundary Commission with a design flood of 187,000 cfs at Rio Grande City**

Gateway Bridge, Brownsville 1932

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

Harlingen, 1967 Flood

- **1967 – Hurricane Beulah caused widespread flooding**
  - **Flooding at McAllen Airport and Harlingen; levees protected other communities**
  - **Over 20,000 acres of farmland flooded; over 700,000 saved**

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

- **1968-1970 – IBWC plan developed for improvements in U.S. and Mexico**
  - **Design flood of 250,000 cfs at Rio Grande City**
  - **U.S. levees with 2-5 feet of freeboard**
- **2007-present – construction of levee improvements in the U.S. to ensure 3 feet of freeboard**

Recovery Act levee construction in 2009

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

- **No IBWC levees constructed upstream from Peñitas**
- **Presumably the area was considered rural and levees not considered necessary or cost-effective**

Receding Rio Grande following flooding at Los Ebanos

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

Areas upstream from IBWC flood control project

Rio Grande at Roma 8/15/10

Rio Grande at San Juan River

HISTORY OF LOWER RIO GRANDE FLOOD CONTROL

Areas upstream from IBWC flood control project

Rio Grande at Rio Grande City 8/15/10

Rio Grande at Los Ebanos 8/15/10

LOWER RIO GRANDE FLOOD CONTROL PROJECT FEATURES

- 180 river miles from Peñitas to the Gulf; includes features in Hidalgo, Cameron, and Willacy Counties
- 270 miles of U.S. levees along the river and floodways
- U.S. floodway system includes Banker Floodway, Main Floodway, North Floodway, and Arroyo Colorado
- Retamal Dam – diverts Mexico's share of floodwaters into Mexico's interior floodway system

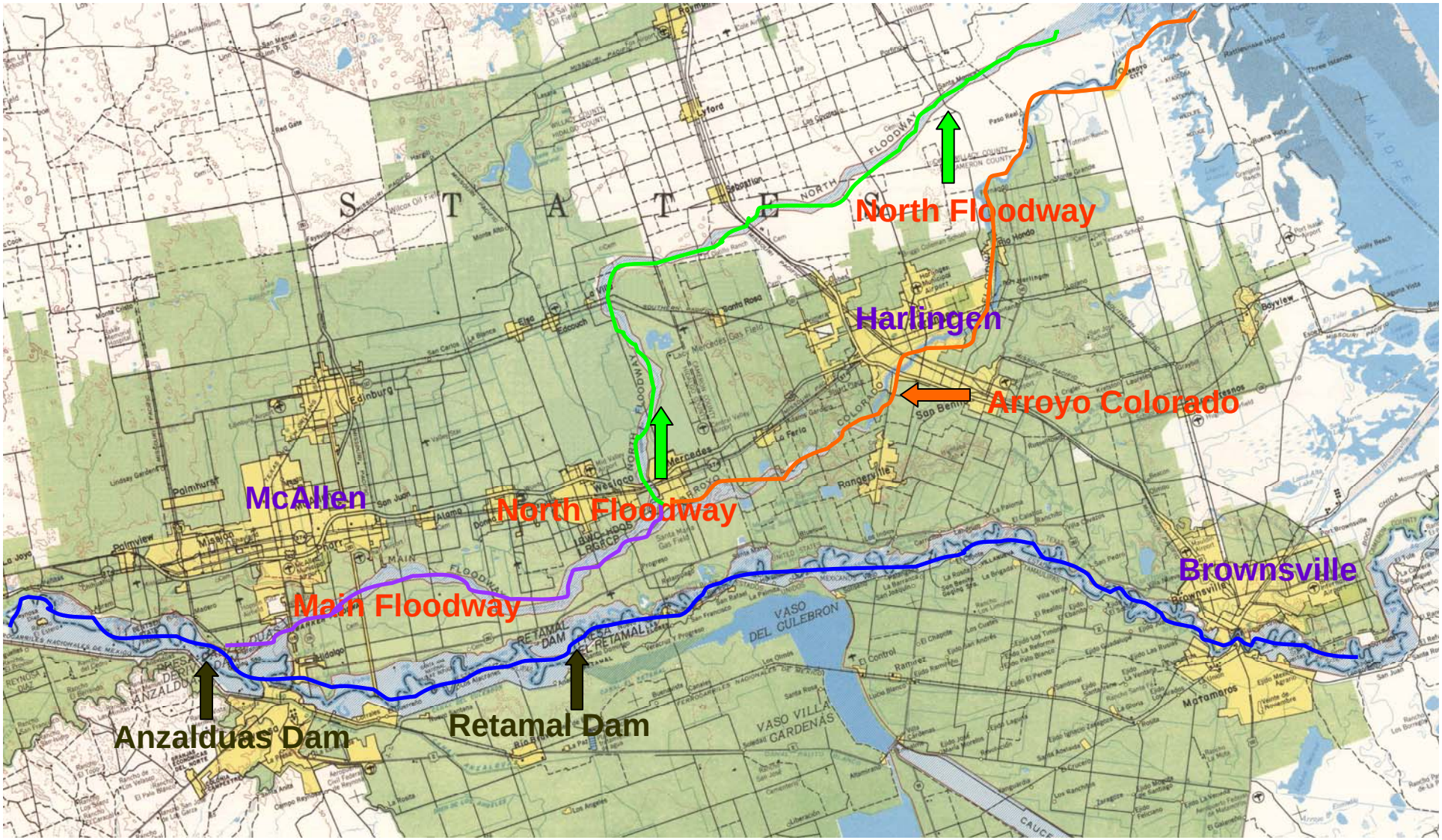
Retamal Dam

LOWER RIO GRANDE FLOOD CONTROL PROJECT FEATURES

Gaging station at Banker Weir Inlet

- Anzalduas Dam – diverts U.S. share of floodwaters into the U.S. interior floodway system
- Diversion of floodwaters into the U.S. interior floodways allows Commission to control flows in the Rio Grande at Brownsville-Matamoros
- 420 drain structures and 180 irrigation structures cross the levees
- Gaging stations to measure water flow

LOWER RIO GRANDE FLOOD CONTROL PROJECT



DESIGN FLOOD AND HISTORIC FLOWS

- Post-Beulah Design Criteria
  - 250,000 cfs at Rio Grande City
  - 105,000 cfs into the U.S. floodway at Anzalduas Dam
    - 21,000 cfs in the Arroyo Colorado
    - 84,000 cfs in the North Floodway
  - 105,000 cfs in the Mexican floodway at Retamal Dam
  - Limit flows to 20,000 cfs at Brownsville-Matamoros

Arroyo Colorado

Harlingen, TX 8/18/10

DESIGN FLOOD AND HISTORIC FLOWS

- Historic Flows (2010 data is provisional)
  - 104,000 cfs at Rio Grande City - 1958
  - 220,000 cfs at Rio Grande City -1967 (Beulah)
  - 53,500 cfs at Rio Grande City - 1988 (Hurricane Gilbert)
  - 124,660 cfs at Rio Grande City - July 11, 2010

Rio Grande City
8/18/10

DESIGN FLOOD AND HISTORIC FLOWS

- Historic Flows (2010 data is provisional)
  - 32,000 cfs at Brownsville - 1945
  - 16,000 cfs at Brownsville - 1967
  - 6,600 cfs at Brownsville - 2010
  - 11,000 cfs diversion into U.S. floodway - 1971
  - 2,720 cfs diversion into the U.S. floodway - 1973
  - 11,200 cfs diversion into U.S. floodway - 1988
  - 43,000 cfs diversion into U.S. floodway - Jul 19, 2010

Gateway Bridge 1988

FLOOD FORECASTING

- National Weather Service is the agency that is responsible for Rio Grande flood forecasts
- USIBWC provides our gaging station data, dam release information, and Mexican data for use in flood forecasting
- National Weather Service issues flood advisories, warnings, and forecasts
- IBWC does not do flood forecasting

Falcon Dam, 53,000 cfs release

2010 FLOOD OPERATIONS CONTRACTOR ACTIONS

- Several levee segments were under construction when Hurricane Alex approached
- Contractors required to have flood protection plans to restore levees to pre-construction status prior to landfall
- Plans were activated as Alex neared
- Construction typically occurs on small segments to limit risk

Levee construction pre-hurricane

2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY

- Per Minutes, each country to divert equally into its floodway
- Mexico advised it was unable to convey the design flood at Matamoros without damaging the potable water intake there
- To protect Matamoros, Mexico diverts water before the U.S. does
- Mexico's diversions are made at Retamal Dam; Mexico can also divert into its irrigation canal at Anzalduas Dam

Mexican floodway

2010 FLOOD OPERATIONS
DIVERSIONS INTO THE FLOODWAY

Retamal Dam

2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY

- U.S. diversions are made at Anzalduas Dam
- Diversions into U.S. interior floodway occurred July 8 to August 9
- First U.S. diversions in 22 years
- No operational problems experienced at the diversion dams

Anzalduas Dam on 7/8/10

2010 FLOOD OPERATIONS
DIVERSIONS INTO THE FLOODWAY

Anzalduas Dam 8/15/10

2010 FLOOD OPERATIONS
DIVERSIONS INTO THE FLOODWAY

Banker Weir before diversion

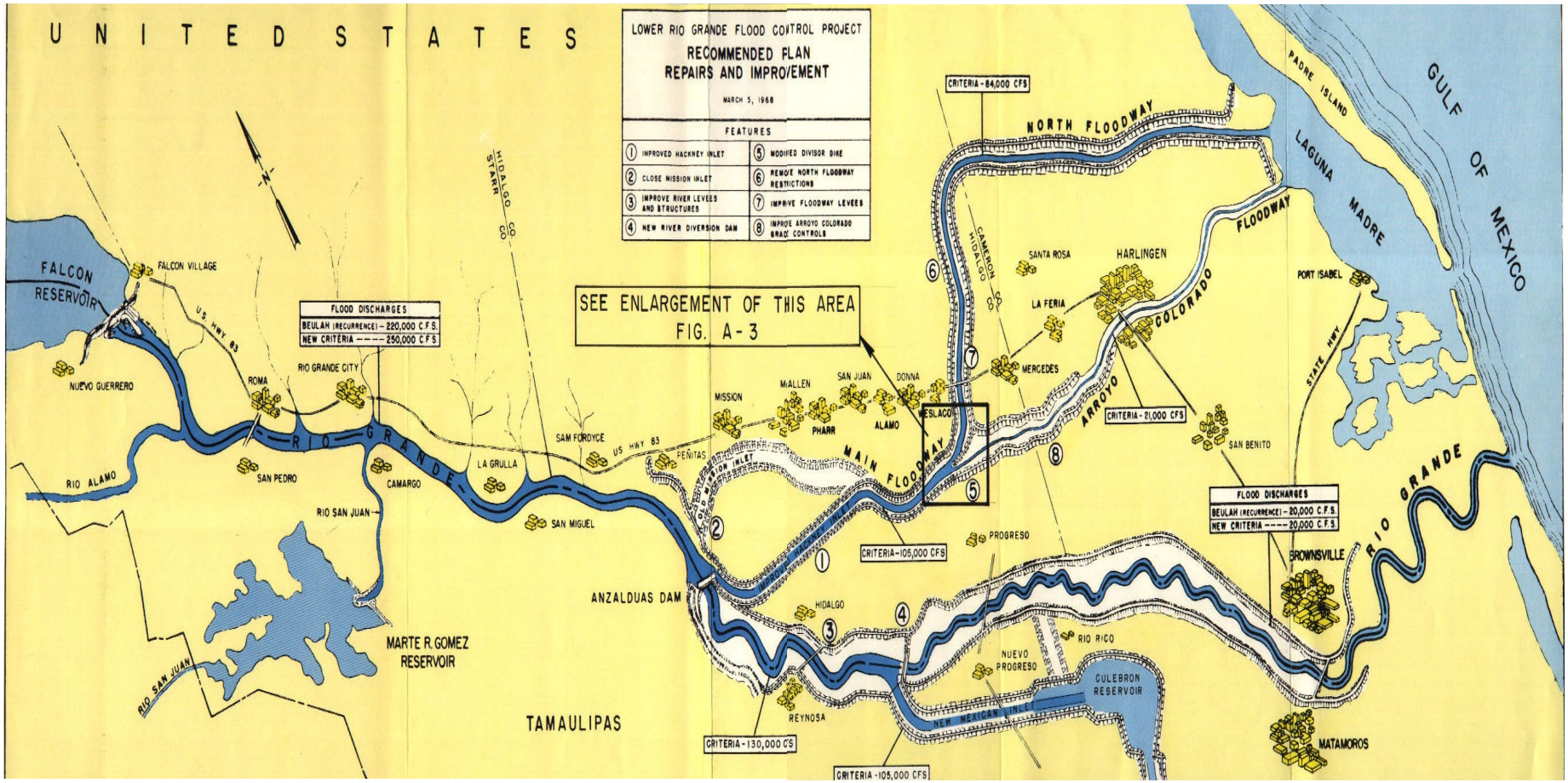
Banker Weir on July 8, 2010

2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY

- At low flows, a gated structure can be used to control the split somewhat at the North Floodway and Arroyo Colorado
- At higher flows, divisor dike automatically splits the flow (80% North, 20% Arroyo)

North Floodway

2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY



2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY

- About 2 weeks for flow to reach Gulf of Mexico
- Diversions into the U.S. and Mexican floodways allow the Commission to control flow in the Rio Grande downstream from Retamal Dam
- Flows in the Brownsville-Matamoros area were relatively stable due to upstream diversions

Rio Grande at Brownsville-Matamoros 8/15/10

2010 FLOOD OPERATIONS
DIVERSIONS INTO THE FLOODWAY

Rio Grande near Brownsville, 7/19/10

Rio Grande at Los Indios 8/15/10

Upstream diversions limit flows in the Rio Grande

2010 FLOOD OPERATIONS DIVERSIONS INTO THE FLOODWAY

FM 507 at North Floodway

- Floodway is designed to convey flood flows even though there is some development in it
- Flood flows affected:
  - Roads across the floodway
  - Homes and businesses in the floodway
  - Parks, golf courses
  - Crops
- Entities with structures in the floodway are well aware of flood risks

2010 FLOOD OPERATIONS
DIVERSIONS INTO THE FLOODWAY

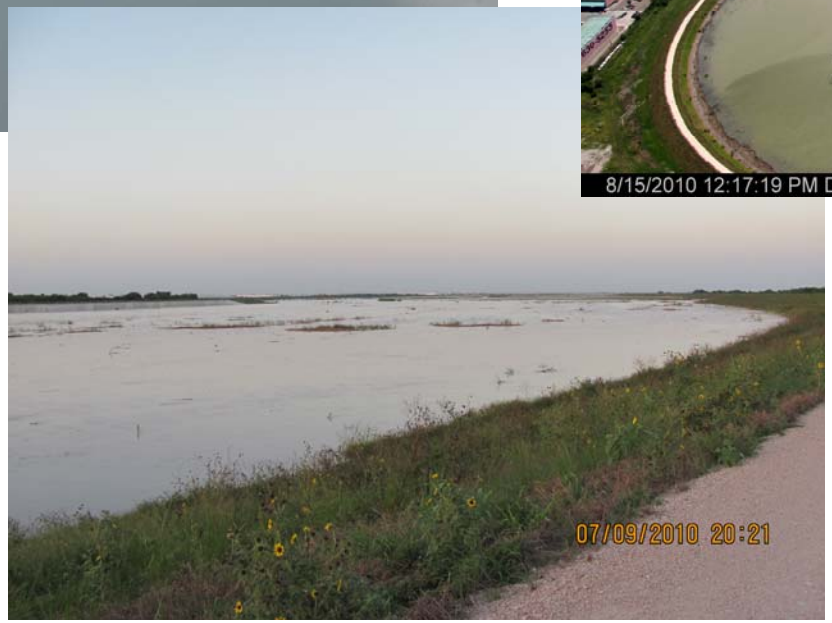
North Floodway near Sebastian 8/15/10

Arroyo Colorado at Harlingen 8/15/10

2010 FLOOD OPERATIONS LEVEE PERFORMANCE

- Levees performed very well
- Recent improvements ensured levees were in the best condition in years

2010 FLOOD OPERATIONS
LEVEE PERFORMANCE



2010 FLOOD OPERATIONS
LEVEE PERFORMANCE

N. Floodway near Weslaco & Mercedes

North Floodway near La Villa

2010 FLOOD OPERATIONS LEVEE PERFORMANCE

- Minor problems experienced
  - Erosion – Vegetation in recently-completed Banker Floodway levee was not well established, some erosion occurred

2010 FLOOD OPERATIONS LEVEE PERFORMANCE

- Minor problems experienced
  - Sand boils - Near McAllen and Santa Monica.
  - Seepage - Santa Monica area
  - Cracks - near Donna, Santa Rosa, and Sebastian

- Levee-Wall
  - Cracks - downstream of the Edinburg (Peñitas) Pump House on the river levee

2010 FLOOD OPERATIONS
LEVEE PERFORMANCE

Sand boil at Santa Monica

2010 FLOOD OPERATIONS LEVEE PERFORMANCE

- Most levee segments conveyed flood flows with adequate freeboard
- Water surface elevations were higher than expected at:
  - Arroyo Colorado @ Harlingen – reasons under investigation.

McKelvey Park, Arroyo Colorado, Harlingen

2010 FLOOD OPERATIONS LEVEE PERFORMANCE

- Water surface elevations were higher than expected at:
  - Santa Monica
- Areas upstream of Peñitas do not have levees

Rio Grande at Los Ebanos, upstream from levee

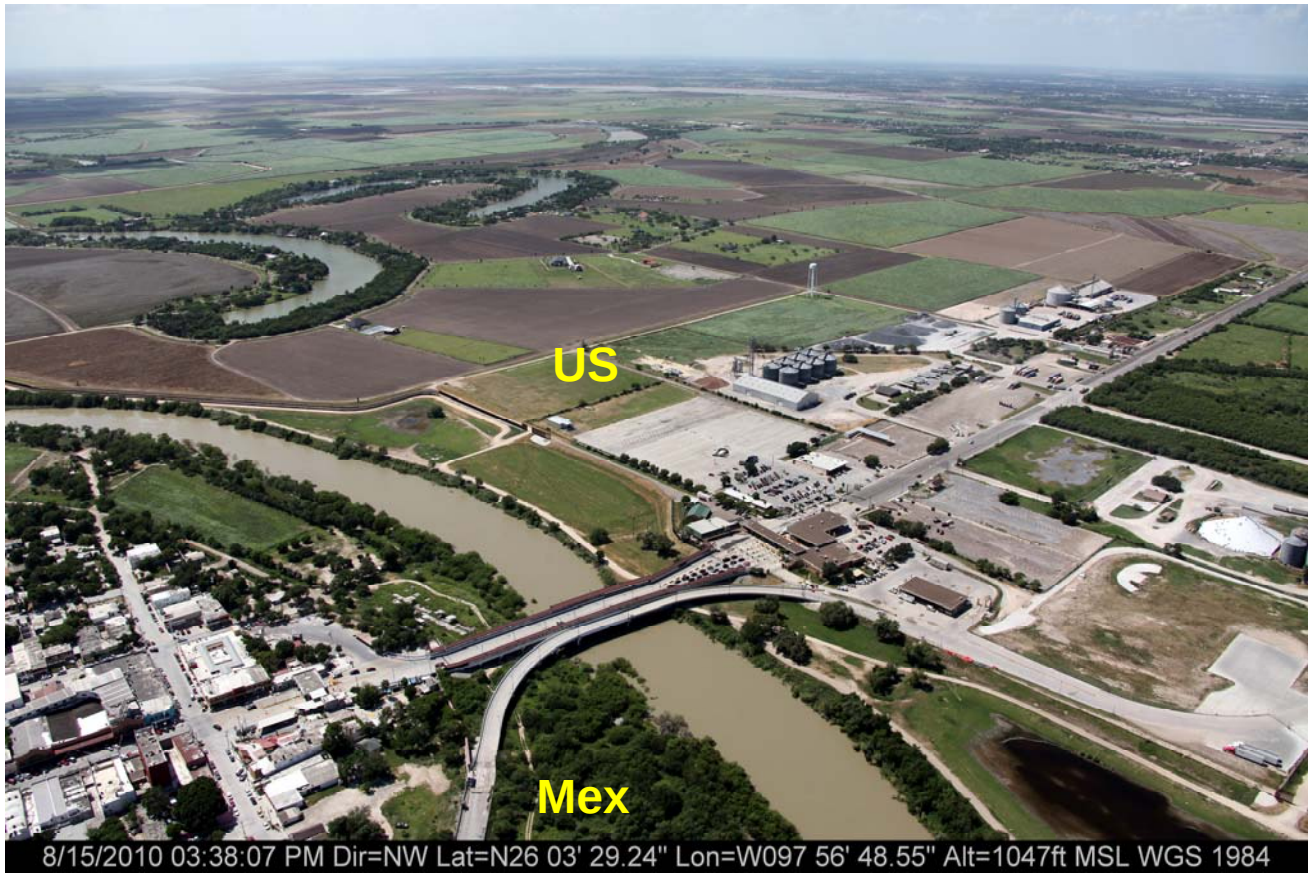
2010 FLOOD OPERATIONS LEVEE PERFORMANCE

Floodway downstream from Granjeno summer 2009

Floodway downstream from Granjeno July 2010

2010 FLOOD OPERATIONS
LEVEE PERFORMANCE

2010 FLOOD OPERATIONS
LEVEE PERFORMANCE



Progreso Bridge

2010 FLOOD OPERATIONS
LEVEE PERFORMANCE

2010 FLOOD OPERATIONS EDINBURG PUMPING PLANT

- Pumping plant located at Peñitas
  - Constructed in 1925
  - Still used by the irrigation district
  - Considered a historic structure
- Concrete floodwall attached to the pumping plant provided flood protection in the past

2010 FLOOD OPERATIONS EDINBURG PUMPING PLANT

- Due to the age of the structure, concern that it could fail under flood conditions
- USIBWC and Hidalgo County coordinated to construct an earthen berm behind the pump house to provide emergency protection

2010 FLOOD OPERATIONS EDINBURG PUMPING PLANT

- USIBWC awarded a $5 million Recovery Act contract prior to Hurricane Alex to construct a new levee there
- New levee segment around the pump would include a gated crossing at the pump's intake channel
- Construction will begin once conditions allow

2010 FLOOD OPERATIONS
IRRIGATION & DRAINAGE STRUCTURES

- Some flooding occurred due to problems with irrigation and drainage structures that pass through the levees
- Approx. 600 structures in the project
- 90 licensed structures are maintained by private landowners, drainage and irrigation districts

2010 FLOOD OPERATIONS
IRRIGATION & DRAINAGE STRUCTURES

- During flood operations, USIBWC controls the structures
  - Gates are closed to prevent floodwaters from leaving the river and floodway
  - When gates are closed, drainage on the landside must be pumped over the levee

2010 FLOOD OPERATIONS
IRRIGATION & DRAINAGE STRUCTURES

- USIBWC began effort in 2008 to work more closely with licensees to ensure proper O & M
- Problems occur when vandals damage structures or unauthorized individuals open or close them
- Tampering with gates is a criminal offense

2010 FLOOD OPERATIONS
IRRIGATION & DRAINAGE STRUCTURES

2010 FLOOD OPERATIONS
IRRIGATION & DRAINAGE STRUCTURES

- Sometimes there is leakage even when gates are closed
- Structure problems occurred:
  - D/S of 23rd St. and Alamo Rd on north levee of the Main Floodway
  - D/S of FM 88 on the south levee of the Main Floodway
  - 9 structures in Peñitas and Mission levees
  - Some problems with structures where Recovery Act construction was underway

2010 FLOOD OPERATIONS PUMP OPERATION

- USIBWC assisted local communities with pumping floodwaters from the land side at:
  - Peñitas
  - Pharr
  - Mercedes
  - Weslaco
  - La Villa
  - Santa Monica
- Pumps used for floodwater seepage and precipitation runoff

COMMUNICATIONS

- USIBWC closely coordinated with the TCEQ and the Texas Division of Emergency Management State Operations Center (SOC), which have established communications protocols
- USIBWC information routed to local officials via the SOC and TCEQ
- SOC provided e-mail updates to communities
- SOC conducted conference calls twice daily at which USIBWC provided briefings; some calls had over 500 participants
- USIBWC provided updates on the agency web page and via news releases (24+)
- NWS communicates flood advisories, forecasts, warnings

COMMUNICATIONS

- Annually, prior to flood season, USIBWC distributes flood warning notices to all the post offices in the municipalities that are adjacent or near our levees and floodways advising of risk of flood.
- Flood warning notices are also printed in local newspapers
- Regular communication with Hidalgo County EOC and TCEQ.
- TCEQ assisted IBWC in levee patrols.

INTERNATIONAL BOUNDARY AND WATER COMMISSION, UNITED STATES AND MEXICO
UNITED STATES SECTION

www.ibwc.gov