Fisher Industries
1302 W Drivers Way | Tempe, AZ 85284-1048
(877) 796-9238 | (480) 730-1033 | Fax: (480) 730-1264 | www.fisherind.com

Fisher Sand & Gravel Co.
Arizona Drilling & Blasting
Fisher Grading & Excavation
Fisher Ready Mix
Southwest Asphalt
Southwest Asphalt Paving
Fisher Sand & Gravel - New Mexico, Inc.
General Steel and Supply Company
Southwest Concrete Paving Co.

October 28, 2019

Analysis of the lateral flow rates and volumes from floodway to floodplain

This is for the segment of the Rio Grande below Bentsen Rio Grande Valley State Park. This is from 6.3 miles to 3.3 miles upstream from Anzalduas Dam which spans the Rio Grande between McAllen, TX and Reynosa, Mexico.

- 18 foot tall bollards will be installed along 15,600 feet of riverfront approximately 10 feet outside of the floodway.
- The area of floodplain behind the bollards will be 863 acres.
- Depth of inundation for delineated floodplain ranges from 3' to 15'. Average depth is estimated at 7'.
- The average depth of water at the bollards during this event will also be 7'.
- Therefore the volume of water to fill the floodplain will be 263 million CF
- Additional tributary inflow from adjoining land is expected to generate up to 20% of the flow onto the floodplain for a local storm.
- Time to fill from start of event is 10-12 hours. Total width of 13,867 openings equals 5,778 feet.
- Average velocity of floodwater passing through is about 0.3 feet/sec. due to some flow at the peak of the event passing "over" the peninsula thereby running through the row of opening twice.
- Calculations with a supporting schematic for the flow rates and sequence are included herewith. The alignment of the bollards will present no obstruction to the Floodway and the velocities parallel to the alignment will help keep debris from "hanging up" on it.

General Statements and Conclusions

Extensive areas of floodplain border both sides of the Rio Grande throughout the lower segment from Falcon Dam to the Gulf of Mexico.
Many of the widest areas are situated where tributaries bring additional runoff into the Flood zone while the Rio Grande is flowing full. Much of the floodplain area is flooded initially by large tributary flows which are relatively unmitigated due to the shorter time of concentration.
The addition of dams on the Rio Grande has reduced the overall footprint of the floodplain over the years and consequently the amount of lateral flow needed to fill the floodplains.
The installation of bollard fence close to the bank of the Rio Grande and situated outside of the Floodway will have no significant detrimental effect on the performance of the Floodway channel. The cleanup and maintenance of the banks will reduce the overall boundary restrictions to the flow.
Lateral flow outward through the bollards during the rising portion of the hydrograph and the subsequent lateral flow from the floodplain back into the main channel is essentially unrestricted since there are 5" openings on either side of every bollard. These lateral flows are slow due to the gentle profile of the river channel which will prevent any rapid rise and fall in the peak flow.
Flow rates on the floodplain are less than 1 foot/sec and generally parallel to the river. Transverse (lateral) flow rates at the bollard fence are also low and are only the result of rebalancing the flood elevation during the event. Flow rates through the 5" gaps should be assumed to be less than about 0.5 feet per second.
The concrete surfaced road will prevent erosion at the bollards during all stages of these events.

Please contact me if there are any questions or additional information that could be considered.

Regards,

(b) (6) [redacted]

Greg Gentsch, Civil Engineer
TGR Construction, Inc. Fisher Industries