Historical Flood Summary for Select USGS Gage Records

U.S. Geological Survey (USGS) gage information was used to identify historical flood stages located along the major rivers and tributaries within the basin. The date, peak flow, peak stage, and expected consequences during these historic flood events at several key locations throughout the basin are summarized in Table B-1. USGS gage locations are also viewable at Region 13 Nueces (arcgis.com).

Table 1. USGS Historical Flood Summary

River Gages	Flood Date	Peak Flow (cubic feet per second)	Peak Stage (feet)	Expected Consequence
Nueces River				
Calallen	9/15/2002	47,800	13	Widespread long-lived residential flooding of hundreds of homes above Calallen occurs. This requires residents to be evacuated. Roads into the flood-prone areas flood for miles, cutting off large residential areas for weeks. Massive flooding of roads near and around Calallen.
Three Rivers	9/12/2002	48,500	44.4	Boats needed in downtown area of Three Rivers. Water is over the County Road 151 bridge south of George West.
Tilden	10/16/2003	31,000	23.1	Moderate flooding occurs. The flow is to the slab elevation of the lowest businesses and homes in Tilden. Numerous roads and low bridges flood and become very dangerous to motorists. Hundreds of livestock are trapped and potentially drowned in the flood plain, below Derby to the Choke Canyon Reservoir.
Cotulla	7/15/2002	18,700	21.6	Major and massive lowland flooding occurs. Evacuations of livestock and a few residential properties along the river required. Many roads near the river will flood, including FM 3408 from I-35, Valley Wells Road, the frontage road near mile marker 67. Flooding also occurs on Dobie Road including in and around Highway 624. FM 624 also floods south of Highway 97 toward Fowlerton.
Uvalde	10/27/1996	201,000	24.9	Residents of many low lying homes in Crystal City flood in less than a day from a crest in Uvalde. Roads and bridges are damaged above Barksdale to below Carrizo Springs. Flow ranges from one half mile to four miles wide in the flood plain, trapping livestock and destroying equipment in the flood plain.
Mission River				
Refugio	8/31/2001	46,900	Missing	Missing
Frio River				
Concan	6/21/1997	56,200	24.4	Disastrous life-threatening flooding destroys anything in the flood plain from the headwaters to below Concan. Homes are flooded and a few washed downstream below Leakey to below Rio Frio. Up to and over 15 feet of turbulent flow is life threatening in campgrounds above Rio Frio to Concan.

River Gages	Flood Date	Peak Flow (cubic feet per second)	Peak Stage (feet)	Expected Consequence
Tilden	7/10/2002	33,000	30.1	Major flooding occurs. Disastrous flooding of commercial and residential buildings in Tilden. Restaurant on the right bank of the Frio River had 3 to 4 feet of water in it.

Historic Flood Events

Past flood events provide insight on where flood-prone areas are located within the basin. Table B-2 provides a list and brief description of historical events within the basin.

Table 2. Listing of Historical Flood Events

Flood Event	Description
2017 Hurricane Harvey	Hurricane Harvey is the most expensive storm on record, costing an estimated $4.28 billion dollars in damages to Region 13 counties. Aransas county experienced the most extensive damages with an estimated cost totaling $1.75 billion. Nueces, San Patricio, and Refugio counties saw losses of $1.32 billion, $520 million, and $520 million respectively. The National Weather Service (NWS) reports that 64 injuries and 2 fatalities were caused in Region 13 by Hurricane Harvey.
2003 Flash Floods	In late June and early July of 2003, flash floods hit the northwestern counties of Region 13 after a hurricane turned tropical storm blew across the coastal counties.
2002 Frio River Flood	In July and September of 2002, Frio River saw record stages near Tilden. The July storm represents the flood of record for parts of the middle basin. The tributaries of the complex northwestern portion of the basin see peak stages in different storm events.
1998 Flash Flood Real County	The deadliest floods in these records are the flood of August 1998, which took four lives in Real County.
1997 Flash Flood in Medina, Bandera, and Goliad Counties	The flood of June 1997 which took four lives across Medina, Bandera, and Goliad Counties.
1996 Nueces Flood	The Nueces near Uvalde saw its record peak stage in 1996.
1971 Hurricane Edith and Fern	The combination of Hurricanes Edith and Fern caused only a slightly higher stage on the Mission River in 1971. These two storms represent the largest storms in the lower counties of the Nueces Basin, at the time of occurrence.
1967 Hurricane Beulah	In 1967, Hurricane Beulah set the record for highest stage in the Nueces River at gages in Tilden, Three Rivers, and Calallen. Beulah also set the record for highest recorded stage in the Atascosa at Whitsett and caused the second highest stage recorded in the Mission River at Refugio. National Oceanic and Atmospheric Administration (NOAA) reports that 41 lives were lost in Hurricane Beulah and an estimated 1 billion dollars of damage was done to property. Beulah is reported to have left thousands of people homeless as well.
1935 Nueces and West Nueces Flood	The earliest major flood in the Nueces River Basin regularly referenced in literature is the flood of 1935. This historic flood affected the Nueces River and its tributaries in the early weeks of June. The Nueces River and many of its tributaries saw record stages with some like the West Nueces River breaking their prior stage records by over ten feet. This storm caused the largest peak stage in the Nueces River at Cotulla and in the West Nueces River.
1932 Frio and Nueces Flood	There was a 1932 storm that caused the highest peak stage in the Frio River at Concan and the second highest recorded peak stage in the Nueces River at near Uvalde.

National Weather Service Flood Data

The National Weather Service (NWS) has documented fatalities, injuries, and property damage as the result of past flood events since 1996 as shown in Figures B-1 through B-3.

A summary of flood damage data gathered from the NWS can be seen in Tables B-3 ad B-4. Table B-3 reports flood damage in dollars, injuries, and fatalities by year. Table B-4 uses the same base data as Table 3 but is divided based on counties. To generate Tables B-3 and B-4, raw yearly damage data in Texas was downloaded from NWS website. Then, a filter on counties is used so that only damage data of Region 13 counties remain in the dataset. Finally, types of damages that are non-essential to this study, such as wind and fire damage, were filtered out so that damages include only rain, storm and flood damages.

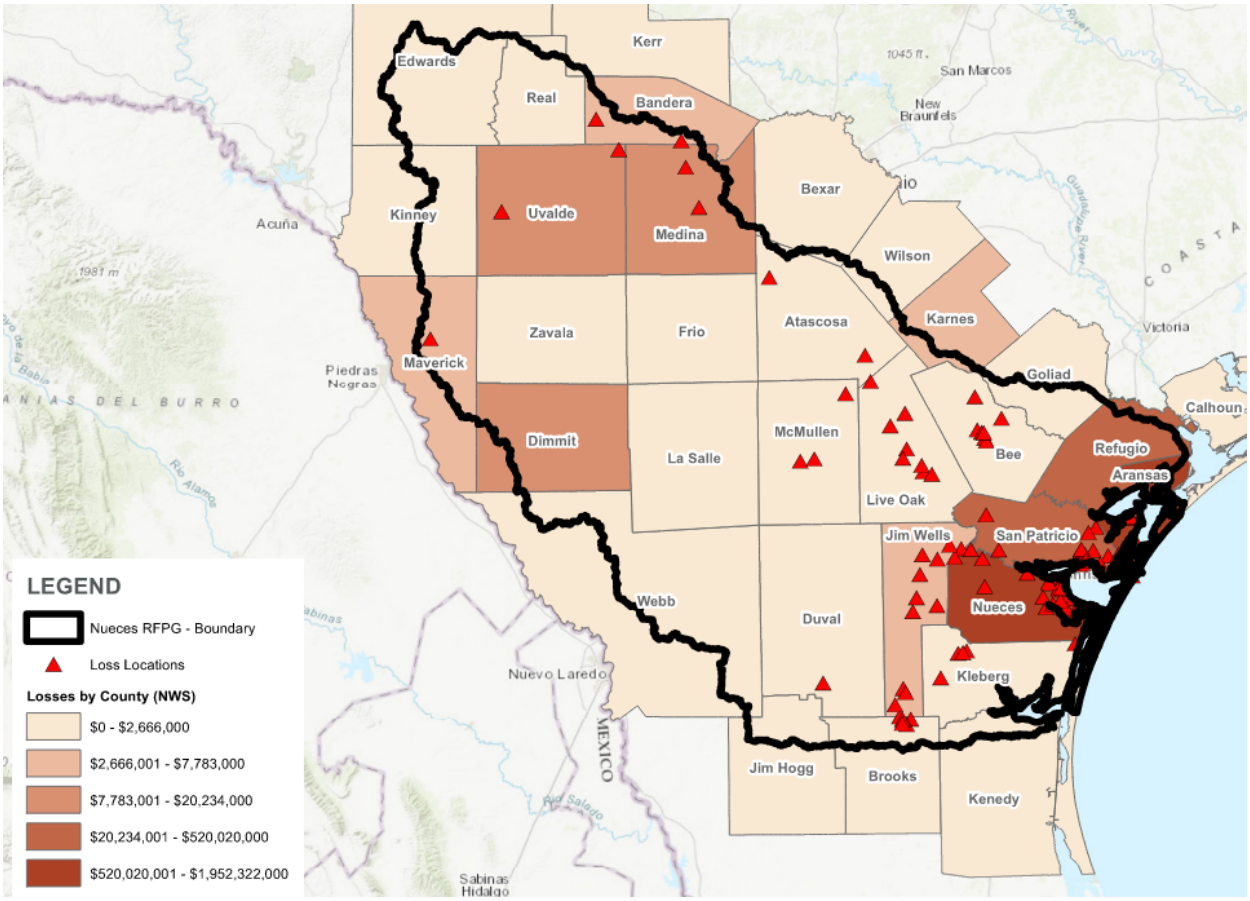

Figure 1. National Weather Service Property Damage from Flooding, since 1996

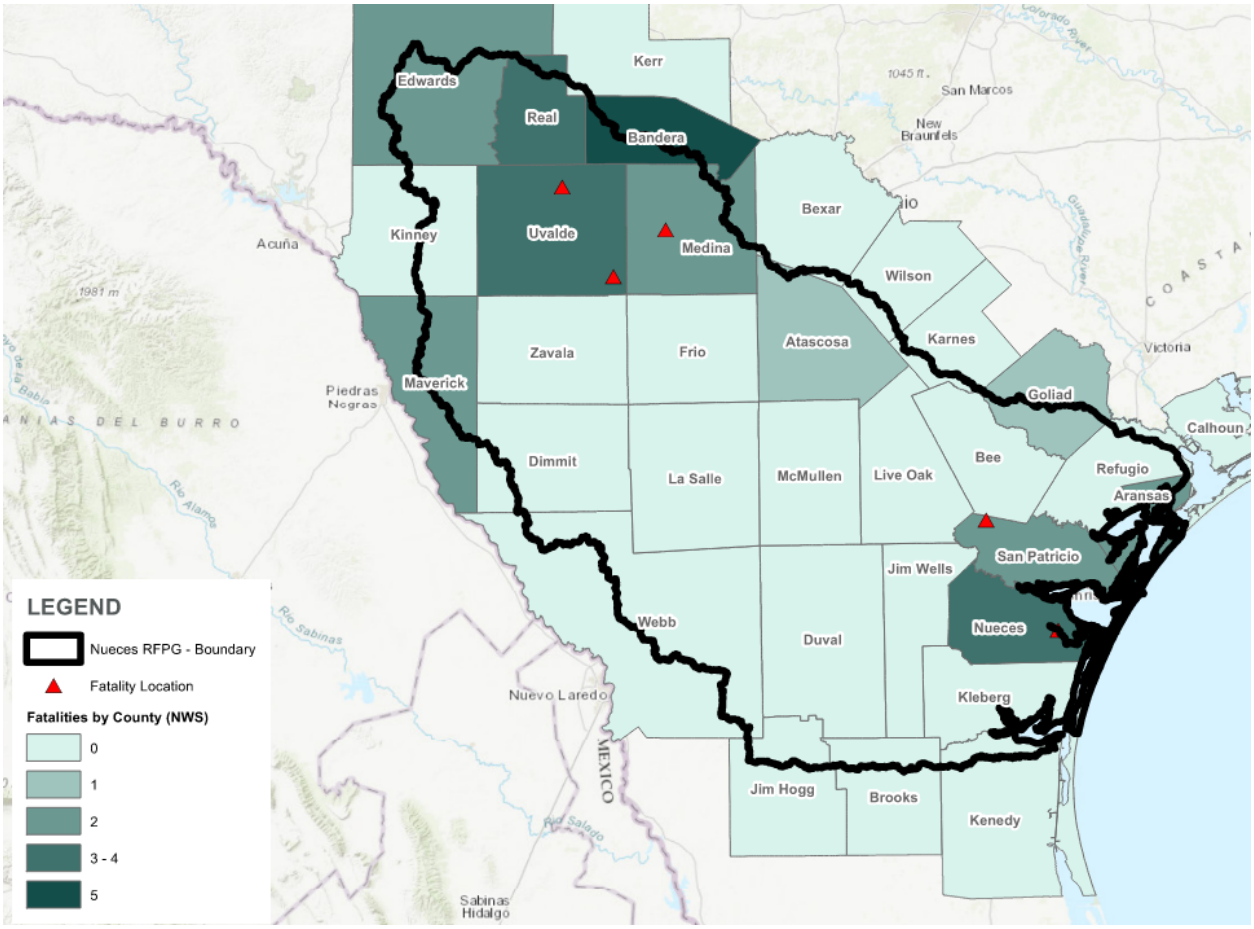

Figure 2. National Weather Service Fatalities from Flooding, since 1996

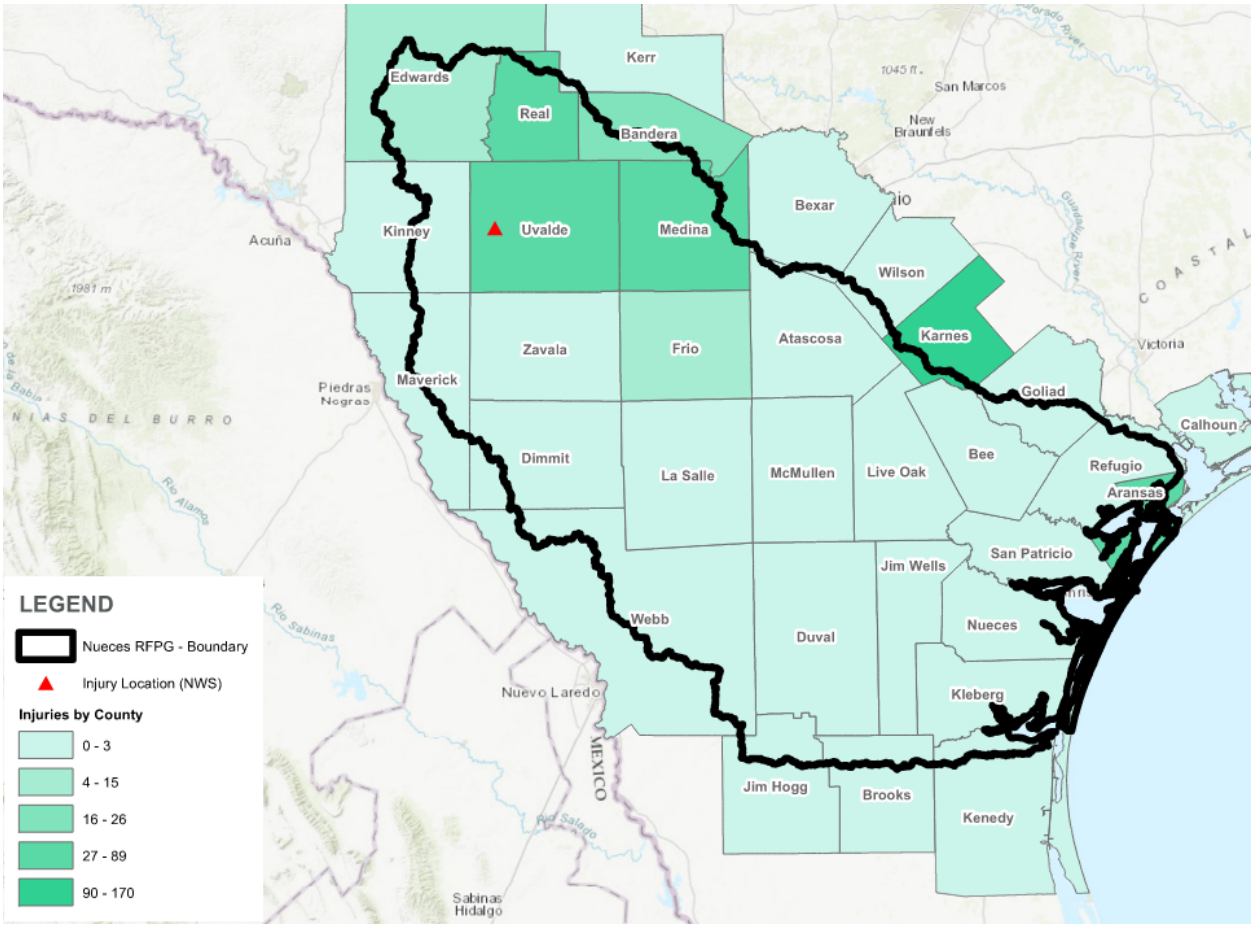

Figure 3. National Weather Service Injuries from Flooding, since 1996

Table 3. Losses associated with Flooding in Region 13 counties since 1996 as reported by the National Weather Service

Flood Year	Damages (in Dollars)	Injuries	Fatalities
1996	56,367,000	0	1
1997	21,807,000	170	8
1998	94,424,000	495	5
1999	492,000	4	0
2000	961,000	1	0
2001	3,540,000	21	1
2002	4,680,000	29	1
2003	5,642,000	0	1
2004	2,585,000	7	1
2005	-	0	0
2006	2,170,000	0	0
2007	4,910,000	0	0
2008	7,207,000	2	1
2009	-	0	0
2010	10,775,000	0	3
2011	-	0	0
2012	6,770,000	0	0
2013	810,000	0	0
2014	1,550,000	0	0
2015	5,365,000	0	4
2016	2,335,000	0	0
2017[1]	4,278,561,000	65	2
2018	1,350,000	3	1
2019	155,000	0	0
2020	1,005,000	0	0
Totals	4,513,461,000	797	29

[1] Hurricane Harvey is responsible for most of these damages

Table 4. Losses associated with Flooding from 1996 to 2020 as reported by the National Weather Service

Counties	Damages	Injuries	Fatalities
Aransas	$ 1,952,322,000	65	2
Atascosa[2]	$ 2,067,000	0	1
Bandera[2]	$ 7,783,000	26	5
Bee	$ 1,049,000	0	0
Bexar[2]	$ -	0	0
Brooks[2]	$ 1,625,000	0	0
Dimmit[2]	$ 20,234,000	0	0
Duval	$ 50,000	0	0
Edwards[2]	$ 721,000	15	2
Frio	$ 2,342,000	15	0
Goliad[2]	$ 1,025,000	0	1
Jim Hogg[2]	$ -	0	0
Jim Wells	$ 4,816,000	0	0
Karnes[2]	$ 7,084,000	170	0
Kenedy[2]	$ -	0	0
Kerr[2]	$ -	0	0
Kinney[2]	$ 1,390,000	0	0
Kleberg	$ 1,170,000	0	0
La Salle	$ -	0	0
Live Oak	$ 425,000	0	0
Maverick[2]	$ 7,266,000	3	2
McMullen	$ 200,000	0	0
Medina[2]	$ 17,148,000	59	2
Nueces	$ 1,315,015,000	3	4
Real[2]	$ 2,666,000	69	4
Refugio[2]	$ 520,020,000	0	0
San Patricio	$ 518,722,000	0	2
Uvalde	$ 18,009,000	89	4
Webb[2]	$ -	0	0
Wilson[2]	$ 89,786,000	257	0
Zavala	$ 20,526,000	26	0
Total	$ 4,513,461,000	797	29

[2] Total county damages shown. These counties are only partially located in Region 13, with the remaining amount in an adjoining flood planning basin.

Federal Emergency Management Agency Flood Damage Data

Federal Emergency Management Agency (FEMA) funding for flood damages was obtained from 2002 to June 2021 as shown in Figure B-4. Table B-5 includes flood related damages by county. Unlike the gross damage data in Table B-3 and Table B-4, data in Table B-5 is summarized from various federal programs. First, raw data of all program funds in the Region 13 counties was downloaded from the FEMA website. Then, programs that are non-related to flood damages are filtered out. Finally, FEMA funding of four federal programs is summarized by county: Public Assistance Funded Project Summaries, Individuals and Households Program – Valid Registrations, Individual Assistance Housing Registrants – Large Disasters, and Housing Assistance Program.

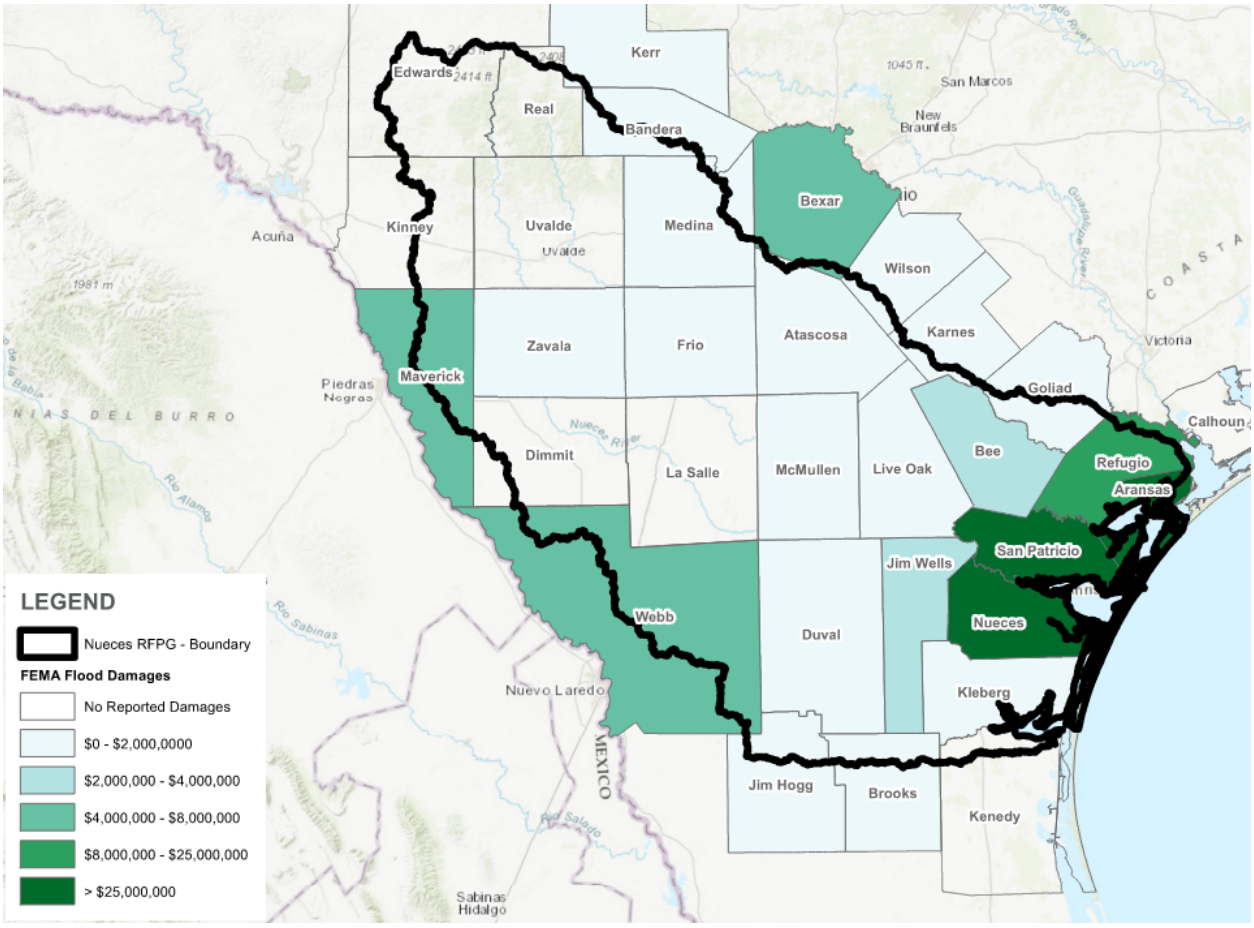

Figure 4. FEMA Flood Assistance to Owners and Renters for Flood Damages, since 2002

Table 5. FEMA Funding for Flood Related Damages by Program (2002 to June 2021)

	Public Assistance Funded Project Summaries	Individuals and Households Program - Valid Registrations		Individual Assistance Housing Registrants - Large Disasters	Housing Assistance Program
Counties	Federal Share Obligated	Flood Damage Amount	Repair Amount	Real Property Damage Amount Observed by FEMA	Owners and Renters Combined Amount
Aransas[2]	75,674,264	616,914	734,181	8,457,466	50,377,516
Atascosa[2]	1,534,103	0	0	0	668,809
Bandera[2]	2,077,275	0	0	0	72,991
Bee	1,198,186	9,016	7,686	62,702	2,908,309
Bexar[2]	0	0	0	0	6,886,899
Brooks[2]	152,608	0	0	0	218,103
Dimmit[2]	758,646	0	0	0	0
Duval	0	0	0	0	595,316
Edwards[2]	0	0	0	0	0
Frio	497,840	4,767	7,737	0	435,145
Goliad[2]	618,371	453	1,175	40,534	1,550,171
Jim Hogg[2]	265,938	0	0	0	404,417
Jim Wells	1,754,451	150,464	59,198	895	3,090,062
Karnes[2]	751,420	482	3,677	6,823	1,108,783
Kenedy[2]	29,192	0	0	0	0
Kerr[2]	1,110,759	0	0	0	5,902
Kinney[2]	663,038	0	0	0	0
Kleberg	1,185,217	63,131	30,086	32,654	999,455

Table 5. FEMA Funding for Flood Related Damages by Program (2002 to June 2021)

	Public Assistance Funded Project Summaries	Individuals and Households Program - Valid Registrations		Individual Assistance Housing Registrants - Large Disasters	Housing Assistance Program
Counties	**Federal Share Obligated**	**Flood Damage Amount**	**Repair Amount**	**Real Property Damage Amount Observed by FEMA**	**Owners and Renters Combined Amount**
La Salle	783,237	0	0	0	0
Live Oak	333,648	1,530	3,911	0	633,648
Maverick[2]	568,802	0	0	0	5,485,074
McMullen	125,315	0	0	0	30,906
Medina[2]	2,658,555	0	0	0	1,448,375
Nueces	107,325,093	2,543,856	2,049,947	7,302,464	43,018,855
Real[2]	1,427,573	0	0	0	0
Refugio[2]	27,531,715	2,028	0	323,289	8,183,992
San Patricio	38,006,297	0	0	2,481,751	25,725,502
Uvalde	2,934,567	0	0	0	0
Webb[2]	3,761,150	0	0	0	4,085,755
Wilson[2]	2,059,932	0	0	0	267,428
Zavala	3,827,640	27,034	14,984	0	1,408,517
Totals	***279,614,832***	***3,419,675***	***2,912,582***	***18,708,578***	***159,609,930***

Historical Flood Data Summary

National Weather Service (NWS) and Federal Emergency Management Agency (FEMA) data both report flood damages and correlate well throughout the basin. These two agencies report different figures, but the underlying data agrees on important points for regional flood planning including which counties see the largest financial losses due to flooding, what type of storms are the most damaging, and which years were the costliest. In summary of these two data sources the coastal counties of Aransas, Nueces, San Patricio, and Refugio see the most expensive damages and receive the most federal relief in relation to flooding. Hurricanes and tropical storms cause the higher rates of loss experienced in these counties. However, NWS reported injuries and fatalities indicate that the flash flooding of the northwest basin and riverine flooding of the middle basin are also dangerous and costly. It is important to mention that neither of these data providers are able to completely capture the total amount of damages caused by flooding. The NWS, for example, reports no damages in Webb County since 1996 while FEMA reports some $4 million provided to homeowners and renters for flood damage repairs since 2002. The NWS also reports damages that FEMA does not when no federal funds are distributed for repair or future mitigation.

Flash floods prove to be even more dangerous making up 72% of all fatalities and 59% of all injuries reported by the NWS since 1996 with most of these incidents in the northwestern counties. While dangerous, flash floods are responsible for less than 3% of total damages with a total across all Region 13 counties of $105 million. These figures may include losses that occurred in adjacent flood planning regions if a county is located in more than one region.