FLOOD RESILIENCE THROUGH LAND CONSERVATION IN HAYS COUNTY

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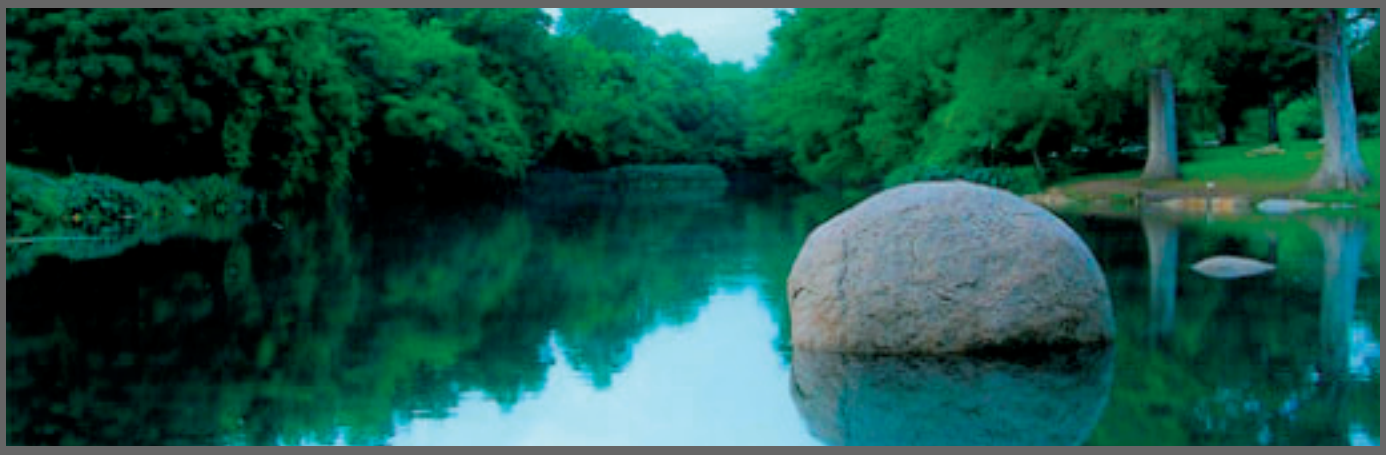

BACKGROUND

According to the 2022 Census, Hays County has grown by 53% over the course of 10 years and continues to expand. While the splendor of our natural landscape is a major draw, for young professionals, retirees, and family with children, it also creates vulnerability to unsustainable development that affects our aquifer and livelihood.

The prevalence of flash flood events is so frequent in Hays County that it is considered "Flash Flood Alley." With so much new development on the horizon it is important for the cities within this area to take major steps towards flood resilience. The Great Springs Project can help protect open space and recharge zones.

EFFECTS OF URBAN DEVELOPMENT

- Land clearing deteriorates root systems which hold the soil together to slow the rate of flooding and reduce erosion.
- Impervious surfaces such as roads, driveways, parking lots, and buildings prevent drainage into the ground causing harm to water quality and increase the frequency of flooding.
- Increased and concentrated residential development creates miles of sewer pipes that can leak and overflow, resulting in sewage spills and contamination of natural resources like the Edwards Aquifer.
- Features of the built environment like bridges and fences become barriers that impede both overland and channel flow.
- A study found that each square meter of impervious surface added to the landscape in 37 coastal counties in Texas caused an average of $3602 of added property damage from floods per year from 1997 to 2001.

DEVELOPMENT EXACERBATES FLOODING EXAMPLES IN SAN MARCOS, TEXAS

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The Balcones Escarpment experiences a substantial amount of water flow and is equipped to manage discharges of up to 40,000 cubic feet per second on a regular basis. The area encompasses the Blanco River, which spans across 355 square miles. However, during the Memorial Day flood in 2015, the volume of water exceeded 60,000 cubic feet per second (equivalent to an Olympic swimming pool), resulting in significant harm to the community. Such high discharge levels have only occurred ten times since 1998, causing major damage.

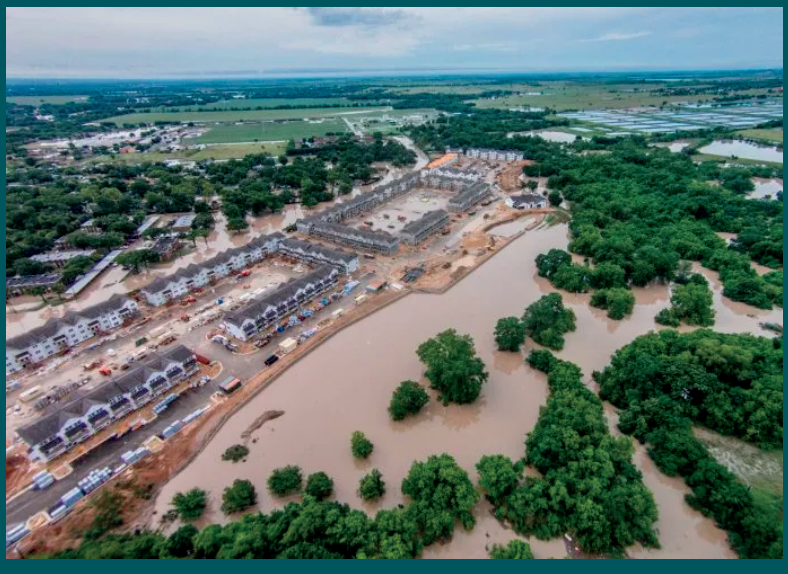
- The region's terrain facilitates high runoff and rapid concentration of runoff into streams.
- The majority of soils in the area fall under the "hydrologic soil groups C and D," indicating high runoff and low infiltration, typically less than 0.2 inches per hour.
- The uplift of the Balcones Escarpment has created a highly dissected region to the west, with a high drainage density, causing most slopes to direct runoff efficiently into channels.
- Flash floods can occur among drainages of all sizes during significant precipitation events.
- The fifty-year and 100-year events for the Blanco River at Wimberley are 92,700 ft3 /sec and 119,000 ft3/sec, respectively.

- Urbanization has significantly increased discharge in the Blanco River watershed.
- Despite this, San Marcos city decision makers permitted the construction of at least two large apartment complexes with over 100 units each on the 100-year floodplain.
- These structures were built at an elevated level above the designated flood level.
- One of the developments is adjacent to Purgatory Creek, which has caused several road closures since flooding in October 1998.
- The other development, located immediately east of Interstate Highway 35 along the channel of the San Marcos River, approximately half a mile upstream of the confluence with the Blanco River, has been implicated in raising flood levels in adjacent neighborhoods during the May 2015 flood.

State Highway 80 during Memorial Day Flooding. May 2015.

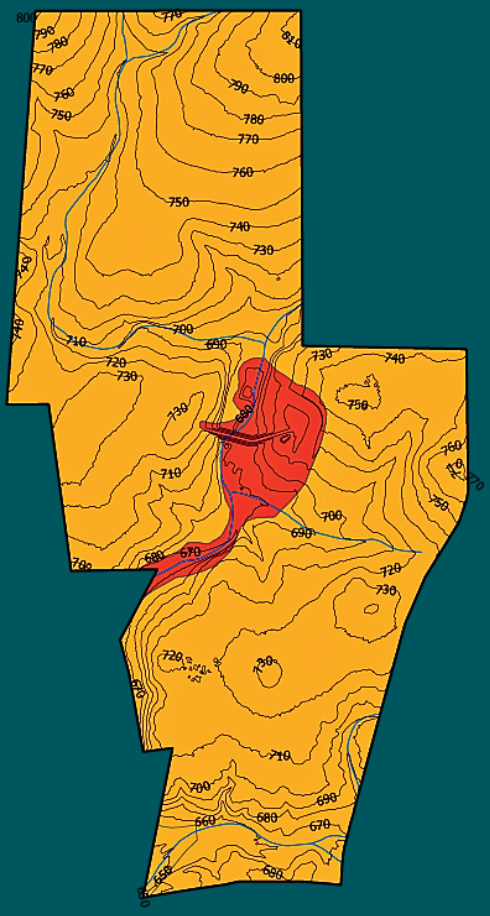
Central Texas Flood Damage in US Dollars

Memorial Day Flood 2015	Hays	$1.5 Billion
Haloween Flood 2013	Hays/Travis	$100 Million
Memorial Day Flood 1987	Travis /Hays/Caldwell	$160 Million



"The Woods" property flooded while under construction. May 2015.

PRESA GRANDE RANCH
450 MILLION GALLON DAM ANALYSIS



Floodplains of Presa Grande Ranch

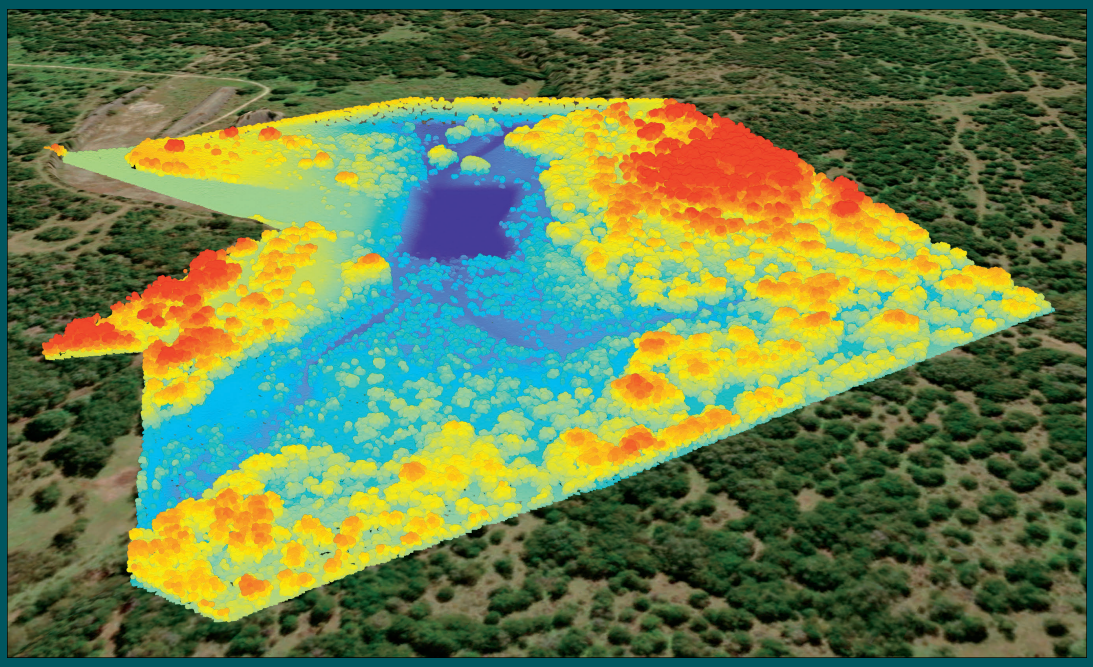
One of the easements of the Great Springs Project's trail runs through the 836 acre Presa Grande Ranch of San Marcos, TX. The ranch contains a major dam designed to alleviate the impact of floods upon the surrounding community. This feature also plays a major role in water capture for the Edwards Aquifer, with natural karst features on property transporting water to the San Marcos springs within 24 hours!

To the left is an elevation map of the entire Presa Grande Ranch Property. The area highlighted in red is the property's 100 year floodplain where two streams culminate into the dam's effective area. Beyond the 100 year floodplain is the property's 200 year floodplain in orange.

An analysis of available United States Geographical Survey (USGS) determined that the Presa Grande Dam can retain up to 450,000,000 gallons of water during a flood surge. Without the flood resilience contribution of the dam, floods in San Marcos would become more severe.

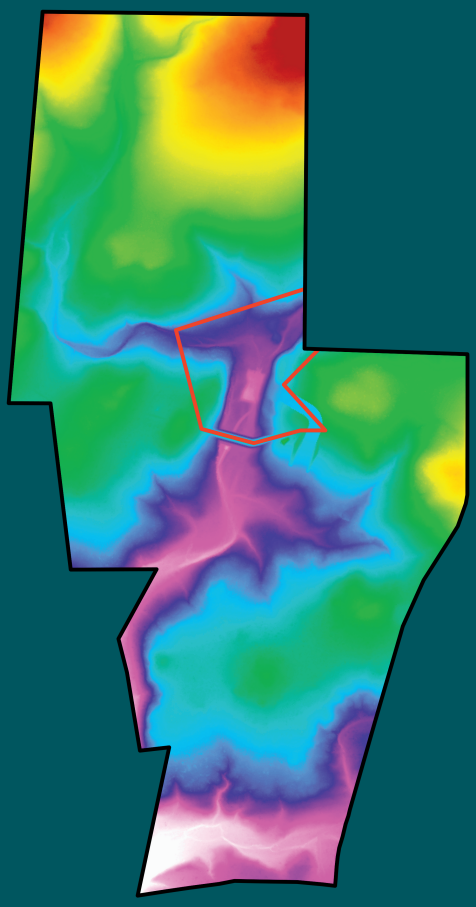
According to to estimations, the water held by the Presa Grande Dam during floods is enough to cover downtown San Marcos with 57 feet of water. Dams like these are critical to minimizing loss of property and life, especially with the increasing severity of climate change.

Below is another representation of the property. The Light Detection and Ranging (LIDAR) data displayed represents the effective area of the dam and is colorized to indicate elevations 203 to 223 meters above sea level.



Colorized LIDAR Imagery of the Presa Grande Dam

PRESA GRANDE RANCH
DAM ANALYSIS METHODOLOGY



Presa Grande Dam Basin Outlined in Red

USGS LIDAR and Digital Elevation Models (DEM) were processed via ESRI's ArcGIS Pro to produce the renders and calculations featured within this document.

LIDAR and DEM files covering the property was downloaded from the USGS Lidar Explorer Map portal and opened in ArcGIS Pro. The elevation of the dam's peak was extracted (221 meters above sea level) and used to designate the dam's basin on property.

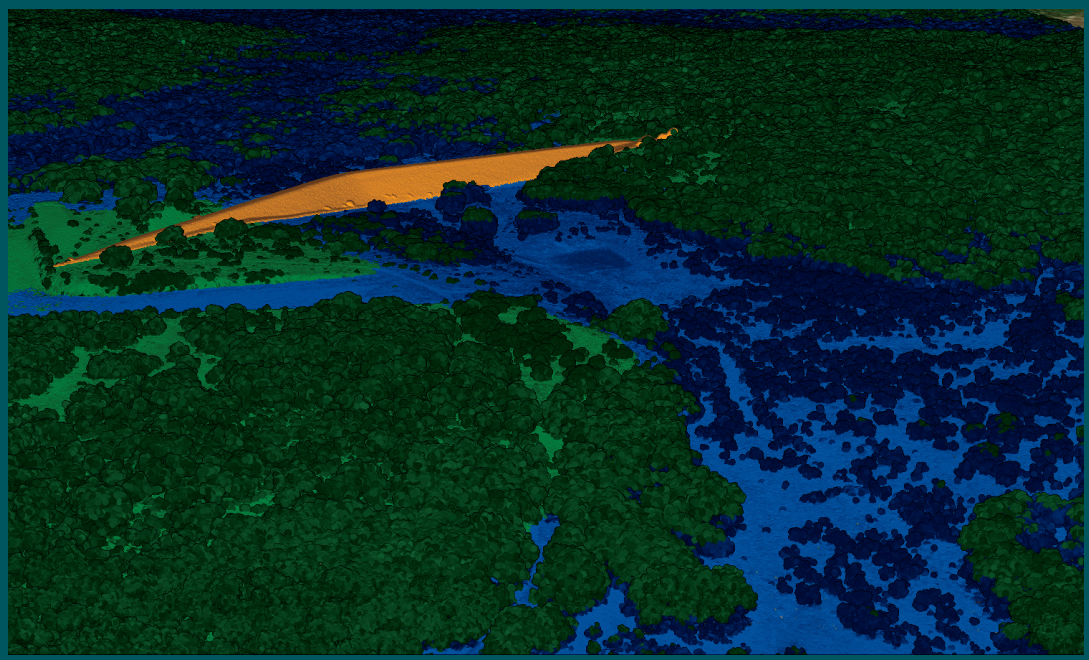
The elevation of each DEM cell (3.4 X 3.4 meters) within the basin was integerized to produce a table containing the number of cells at each elevation at meter increments. A new column was generated by the calculation of [221 - the row's elevation] to assign the distance between the ground and the dam's peak to each cell value.

The corresponding table is included on the next page.

This new column is multiplied by the number of cells to determine that 149,683 11.56 cubic meter units of space exist below 221 meters above sea level within the basin. These figures may thereafter be converted to cubic meters and then to gallons according to the following rates.

149,683 X 11.56 X 264.2 = 457,804,671 gallons of water

Furthermore, according to The City of San Marcos's Mainstreet District file: the downtown area is 83.62971 acres. This figure was used to determine how high the retained water would sit if covering the downtown area.



Secondary Colorized LIDAR Imagery of the Presa Grande Dam Flood Basin

APPENDIX A: BASIN DEM STATISTICS

Elevation Value	Terrestrial Cell Count	Meters Below Dam Peak	11.56 Cubic Meter Units
203	59	18	1062
204	232	17	3944
205	212	16	3392
206	209	15	3135
207	691	14	9674
208	1641	13	21333
209	1454	12	17448
210	1406	11	15466
211	1998	10	19980
212	1623	9	14607
213	1240	8	9920
214	1116	7	7812
215	908	6	5448
216	1329	5	6645
217	1149	4	4596
218	990	3	2970
219	774	2	1548
220	703	1	703
		Sum	149,683

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