Technical Study Summaries: Middle and Lower Brazos River
Geomorphic Data

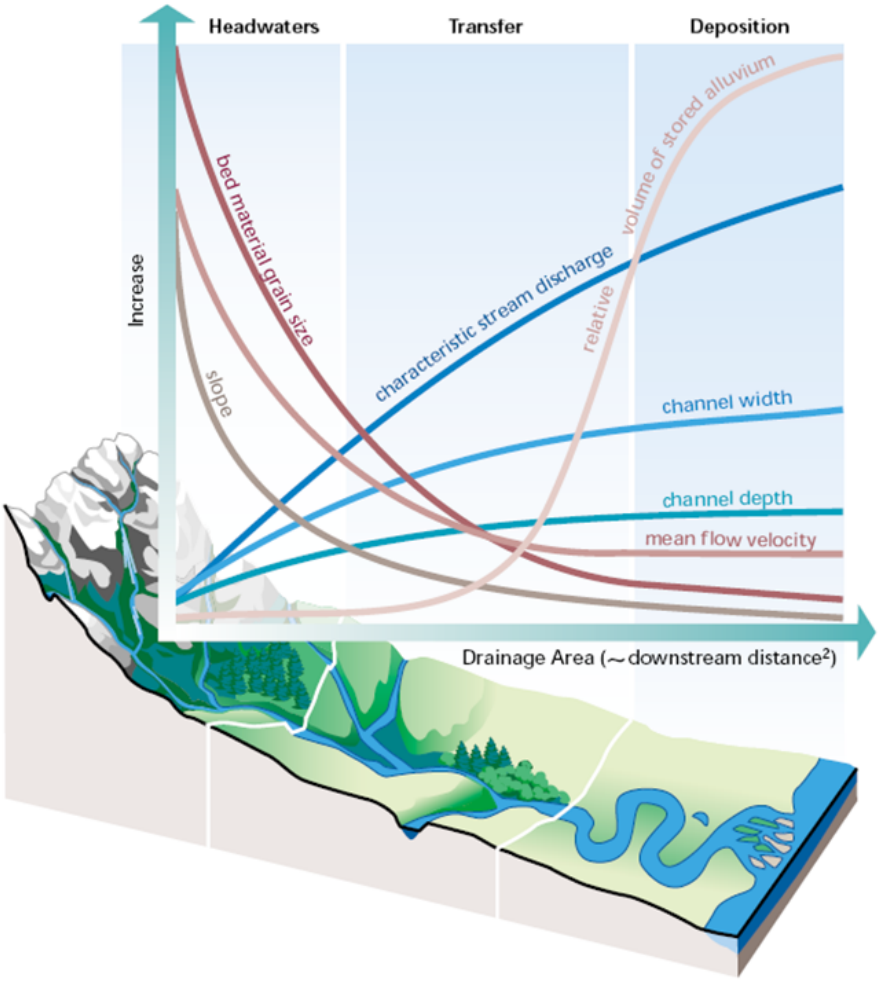
Active physical processes and characteristics are an important influence on the Middle and Lower Brazos River system. Studies of these processes and characteristics (termed fluvial geomorphology) contribute to our understanding of the system and the flows required to maintain a sound ecological environment.

Stream corridor restoration: principles, processes, and practices (1998)
By Federal Interagency Stream Restoration Working Group (FISRWG)

Interest in restoring stream ecosystems has driven recent advances in understanding the physical processes at work in healthy rivers and streams. It is now recognized that the relative importance of different physical processes varies along the length of a river. One particular instream flow recommendation is typically not sufficient to ensure the health of the entire length of a stream. Somewhat different flows may be required to ensure the health of different portions of the river.

As shown in the figure below, river basins can be divided into three general zones (headwaters, transfer, and deposition) based on dominant physical processes. Physical characteristics (such as channel slope, width and depth; bed material; and average discharge and velocity) vary from the upper watershed area to the mouth of a river. For most rivers, variable conditions such as climate and underlying geology interact to create a more complex situation than the idealized pattern of Figure 1.

Full report: http://www.nrcs.usda.gov/technical/stream_restoration



Headwaters Zone: Main source of water and sediment for a river system. Water and sediment are generally moving from the watershed to the channel.

Transfer Zone: Principle region of sediment transport in a river system. Channel and valley become larger, more developed.

Deposition Zone: Region of sediment dispersal and deposition. River has a well developed valley over which the channel is free to meander. At its mouth, the river may divide into multiple channels as it flows across a delta of built up sediment into the receiving water body (ocean or larger river).

Figure 1. General zones of a river based on dominant physical processes (adapted from FISRWG, 1998).

Field data collection in support of geomorphic classification of the Lower Brazos and Navasota (2007)
By J.D. Phillips

A detailed geomorphic classification of the Middle and Lower Brazos River provides a useful tool to understand differences in physical processes and habitats along the river. In this study, the river from near Bryan, TX to it's mouth was segmented into 30 reaches based on channel and valley characteristics. A description of each reach was provided, including characteristic channel and floodplain features such as point bars, bedrock outcrops, oxbow lakes, sloughs, and distributary channels. When investigating the river, some of these reaches may be combined, depending on the processes or features of interest.

Full report: http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0604830639_BrazosY2rept.pdf

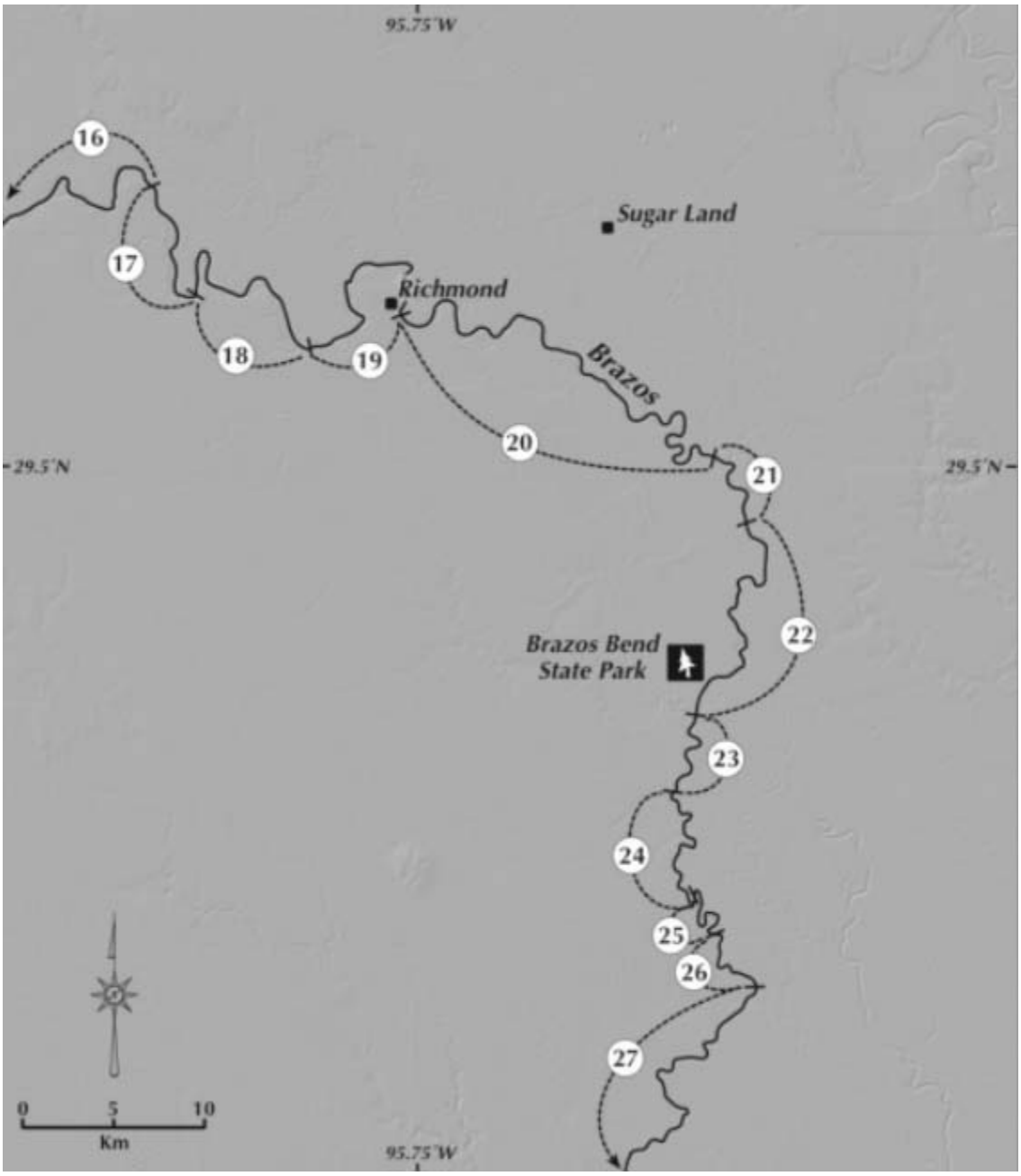


Figure 2. Geomorphic classification of a portion of the Lower Brazos River (from Phillips, 2007).

The Nature of Channel Planform Change: Brazos River, Texas (1997)
By B. M. Gillespie and J. R. Giardino in Texas Journal of Science 49:109-142

The channel migration rate of the Brazos River has decreased substantially since 1939, according to a study by Texas A&M University researchers. This study, based on aerial photographs taken from 1939 to 1988, examined 156 miles of river from near the intersection of Falls City, Milam, and Robertson counties to near Hempstead. The study also found that the river has decreased in width during this time. Beginning in 1939, decreases in both discharge and sediment load can be observed from data collected at USGS stream gages in the study area. These decreases are probably responsible for the changes in the river channel. According to the researchers, the channel was still adjusting to the changes in flow and discharge regime in 1988. This study is currently being updated using more current areal photography and data.

Recent studies focus on characteristics of Brazos River alluvium aquifer (2007)
By US Geological Survey and Texas Water Development Board

The Brazos River alluvium aquifer, which extends along the river from Bosque County to Fort Bend County, has been the focus of several recent studies. These studies have determined the location and thickness of the aquifer, as well as hydraulic properties such as specific conductance, transmissivity, and hydraulic conductivity. For more information related to this topic, please see the Hydrology and Hydraulics Summary.

Negative impacts of overbank flows estimated for different sizes of floods (ongoing)
By National Weather Service

The negative impacts of overbanks flows are summarized at most streamflow gages maintained by the US Geological Service. These estimates are based on observations and damage reports from previous flooding incidents. The magnitude of floods is described by the surface elevation of the water, not the discharge value. However, because of the stage discharge relationship developed at each USGS gage, the value for surface elevation of the water or “stage” can be converted into an approximate discharge value. This allows comparison to the magnitude of overbank flows that may be part of an instream flow recommendation. An example from USGS gage #08114000, Brazos River at Richmond, is provided in the table below.

For flood impact data:
http://ahps.srh.noaa.gov/ahps2/hydrograph.php?wfo=hgx&gage=rmot2&view=1,1,1,1,1,1,1,1

Table 1. Flood impacts of various stages at USGS gage #08114000, Brazos River at Richmond, TX.

Stage [feet above gage datum]	Flood Impact
50.7	Major lowland flooding begins as homes in Richmond begin to flood and many homes in Simonton and Thompsons have water in them. Many homes in the Oyster Creek Farms subdivison have water in them due to significant flooding up Flat Bank Creek and there is major flow across the flood plain into Oyster Creek near Harris Reservoir and the Ramsey Unit Prison Farm.
49.8	Massive lowland flooding occurs with many homes in Simonton and Thompsons flooded. There is major flow across the flood plain into Oyster Creek near Harris Reservoir and the Ramsey Unit Prison Farm.
48	Flooding begins in vicinity of gage with homes threatened upstream in Simonton and downstream in Thompsons. Backwater flooding up Flat Bank Creek puts water in homes in Missouri City and water passes through the flood plain and enters Oyster Creek north of Harris Reservoir.
47.6	Water is in the Simonton area upstream from the gage. Significant backwater flooding up Flat Bank Creek threatens homes in Missouri City. Water enters Oyster Creek through culverts and through the flood plain north of Harris Reservoir.
46.1	Backwater up Flat Bank Creek downstream from gage threatens homes in Missouri City. Minor flow passes into Oyster Creek through culverts and water is very close to passing through flood plain just north of Harris Reservoir into Oyster Creek.

Indicators: Middle and Lower Brazos River
Geomorphology

Geomorphology Objectives

- Identify interrelationships among flows, bank stability, channel maintenance, and alluvial and associated aquifers

Geomorphic Indicators

Category	Indicator	Explanation
Bank Stability	Rate of lateral channel migration	Rate of lateral movement of channel across valley. Some migration of the channel is crucial to support diverse riparian habitats and a healthy ecosystem.
	Rate of channel avulsion	Rate of creation of channel cut-offs. Cut-offs, in the form of oxbow lakes, back water areas, and abandoned channels, provide distinct and important habitats.
	Rate of bank erosion	The rate at which flows erode the sides of channels. This will vary by bank material and condition of the banks (vegetated, saturated, etc.).
Channel maintenance	In-channel bars (area, configuration, sediment size)	Sediment bars are an important in-channel bed form. Flow across these features provides a diversity of hydraulic conditions. Bar formation, in combination with opposite-bank erosion, is the driving process behind channel migration. As bars age, they gradually create new areas of floodplain and riparian habitat.
	Meander pools (depth)	Meander pools are another important in-channel bed form. Deep pools provide diverse hydraulic conditions and cover for some species. They also provide refuge habitat for many species during low flow periods.
Alluvial and associated aquifers	Flow gain or loss in section of river	Difference in the amount of water entering and leaving a specific section of the river channel. Sources of gains include inflow from tributaries, alluvial and deeper aquifers, and discharges to the river. Sources of losses include evaporation, evapo-transpiration from riparian areas, diversions, and recharge of alluvial and deeper aquifers. Indicator may be influenced by shallow groundwater surface elevation and hydraulic head of deeper aquifers.
Flood impacts	Stage (at USGS gage locations)	The National Weather Service provides flood impact summaries for most USGS streamflow gage sites, based on water surface elevation or “stage.” These summaries provide an estimate of impacts of overbank flows.