

**Response of Oxbow Lake Biota to Hydrologic Exchanges
with the Brazos River Channel**

Final Project Report
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By
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Abstract

Fishes and aquatic habitat variables were sampled between June 2003 and September 2004 to obtain information on the ecological dynamics associated with river channel–oxbow lake connectivity in relation to instream flows. The ecological study complemented a concurrent research effort undertaken by the Texas Water Development Board to document geomorphological and hydrological features that determine degrees of oxbow to channel connectivity. The ecological study also examined fish population structure and dynamics at two river channel sites in the lower Brazos River upstream and downstream of the site selected for the Allen’s Creek reservoir. Standardized fish samples were collected using seines and gillnets, with data analyzed separately as catch per unit effort. Statistical ordination techniques revealed a strong gradient of fish assemblage structure that contrasted oxbow samples from river channel samples. A secondary gradient was associated with seasonal variation in oxbow lakes. In contrast to the river channel, oxbow lakes contained high densities of white crappie (*Pomoxis annularis*), sunfishes (*Lepomis* spp.), and shads (*Dorosoma* spp.). A number of minnow species (e.g., *Hybognathus nuchalis*, *Macrhybopsis hyostoma*) appear to be fluvial specialists that always or almost always were collected from the river channel. Several of these fluvial specialists were more abundant one to two months after periods of peak flow. For species common in oxbow lakes, density tended to decline following periods of peak flow, which indicates a net export of individuals from oxbows to the river channel during floods that connect these habitats. Consistent with this view were patterns of higher densities of these species in the river channel following periods of peak flow. Fluvial specialists appeared in oxbow lakes in low to moderate numbers during periods of peak flow, but these sub-populations generally did not persist more than a month or two. Densities of phytoplankton, zooplankton, and fish were much higher in oxbow lakes than in the river channel, and more so following prolonged periods of isolation. Oxbow lakes that were formed more recently and that are located closer to the river channel had lower “control points” in the natural levee, and as a result flooded at lower discharge levels. It is concluded that oxbow lakes of variable ages and geomorphological structures provide essential habitats that function to increase overall fish species diversity in the lower Brazos River.

Introduction

The importance of natural flow regimes for the maintenance of ecological processes in lotic systems is well recognized (Sparks 1995; Poff and Allan 1995; Poff et al 1997; Bunn and Arthington 2002; Bowen et al. 2003), and conceptual models of biological productivity in large rivers, such as The Flood Pulse Concept (Junk et al. 1989) and The Low Flow Recruitment Hypothesis (Humphries et al. 1999), suggest that flood dynamics significantly influence interannual variation in fish recruitment. Periodic inundation provides opportunities for aquatic organisms to move into off-channel floodplain habitats, such as oxbow lakes, sloughs, and marshes that appear to be more favorable for growth and reproduction of some species (Swales et al. 1999; Winemiller et al. 2000; Sommer et al. 2001; Sommer et al. 2004) and that may be major sources of fish production in these systems (Welcomme 1979).

In North America, most floodplain rivers have been impacted by the construction of dams and levees that modify natural flow regimes crucial for fish reproduction (Junk et al. 1989; Humphries et al. 2002) and disconnect productive off-channel habitats from the active river channel (Bayley 1991). Modification of natural flow regimes has been implicated in the establishment of exotic species (Moyle and Light 1996) and changes in fish distribution, abundance, and assemblage structure (Feyrer & Healy 2003; Sommer et al 2004). Restoration strategies for these systems include reestablishment of relatively natural flow regimes (Trexler 1995; Richter 1997) and increased connectivity with off-channel aquatic habitats (Amoros and Bornette 2002; Tockner and Stanford 2002). The primary method used by resource agencies to meet these goals is estimation of instream flows necessary to maintain ecosystem integrity (Instream flow council 2002).

Various methods of instream flow assessment focus on minimum flow, flow variability or habitat availability and may produce conflicting assessments depending on the method used (Jowett 1997). While the measurement of physical and hydrologic variables have improved with new technologies (Gard and Ballard 2003), there remains a lack of ecological data relevant to instream flow allocation in most river systems (Naiman 1995; Sparks 1995). Species inhabiting river-floodplain systems possess a wide range of life history strategies that allow them to take advantage of the spatial heterogeneity and flow variability of these systems (Winemiller 1996), and fish assemblage structure is strongly influenced by the physicochemical characteristics of habitats that result from successional processes and fluvial dynamics. Schemes that focus on indicator species may create optimal conditions for one species while degrading conditions for species that depend on alternate conditions (Sparks 1995).

This report provides findings from a research project that examined responses of fish assemblages and individual species to hydrologic variability in channel and floodplain habitats of the lower Brazos River. The project was funded by the Texas Water Development Board in consultation with the Texas Commission for Environmental Quality and the Texas Parks and Wildlife Department. The project was designed to supplement existing environmental information (Winemiller et al. 2000; Gelwick & Li 2002),

particularly with regard to ecological responses to instream flow variation, and was motivated by pending water development plans in the lower Brazos River Basin. Our goals were to identify fish taxa that may benefit from, or otherwise respond to, floodplain connectivity, to explore how fish biodiversity (species assemblages) in oxbow lakes with variable connection frequencies are influenced by periodic flood events, and to document fish assemblages in the main channel, with emphasis on flow-sensitive species.

Methods

Oxbow lakes and Brazos River at highway 21(reference site)

The main stem of the Brazos River originates in Stonewall County, Texas at the confluence of the Salt Fork and Double Mountain Fork. The river flows southeast for 1485 kilometers before entering the Gulf of Mexico 2 kilometers south of Freeport, Texas. The present study was conducted on the middle and lower Brazos River between Bryan, Texas and Lake Jackson, Texas. In this region the Brazos is a meandering lowland river with forest and agricultural lands dominating the catchment. The Brazos is partially regulated by dams in and above the city of Waco, Texas however discharge is primarily influenced by local runoff and current flow dynamics are relatively similar to those prior to river regulation (Figure 1). Oxbow lakes are common on the floodplain of the middle Brazos with over forty identified in aerial surveys by Winemiller et al. (2000).

In this study, six oxbow lakes and three sites in the Brazos River channel were surveyed between June 2003 and September 2004. Two oxbows (Big Bend Oxbow, Moehlman Slough) and the Brazos River at the State Highway 21 Bridge were surveyed monthly. Hog Island Oxbow was surveyed quarterly. Perry Lake, Cut Off Lake, Korthauer Bottom, and the Brazos River at the Interstate Highway 10 and Highway 521 bridges were surveyed once during summer 2003 (Figure 2). For a complete description of oxbow locations and physical characteristics see hydrology section.

High flows in the Brazos River prevented gillnetting at the Highway 21 site during February and April 2004, and no sample was collected from this location in June 2004 due to flooding. Gillnets were not deployed at Cut Off Lake due to high densities of submerged and emergent vegetation. An equipment malfunction prevented zooplankton collections at Big Bend Oxbow, Moehlman Slough and the Brazos River at I-10 and Highway 21 during June 2003.

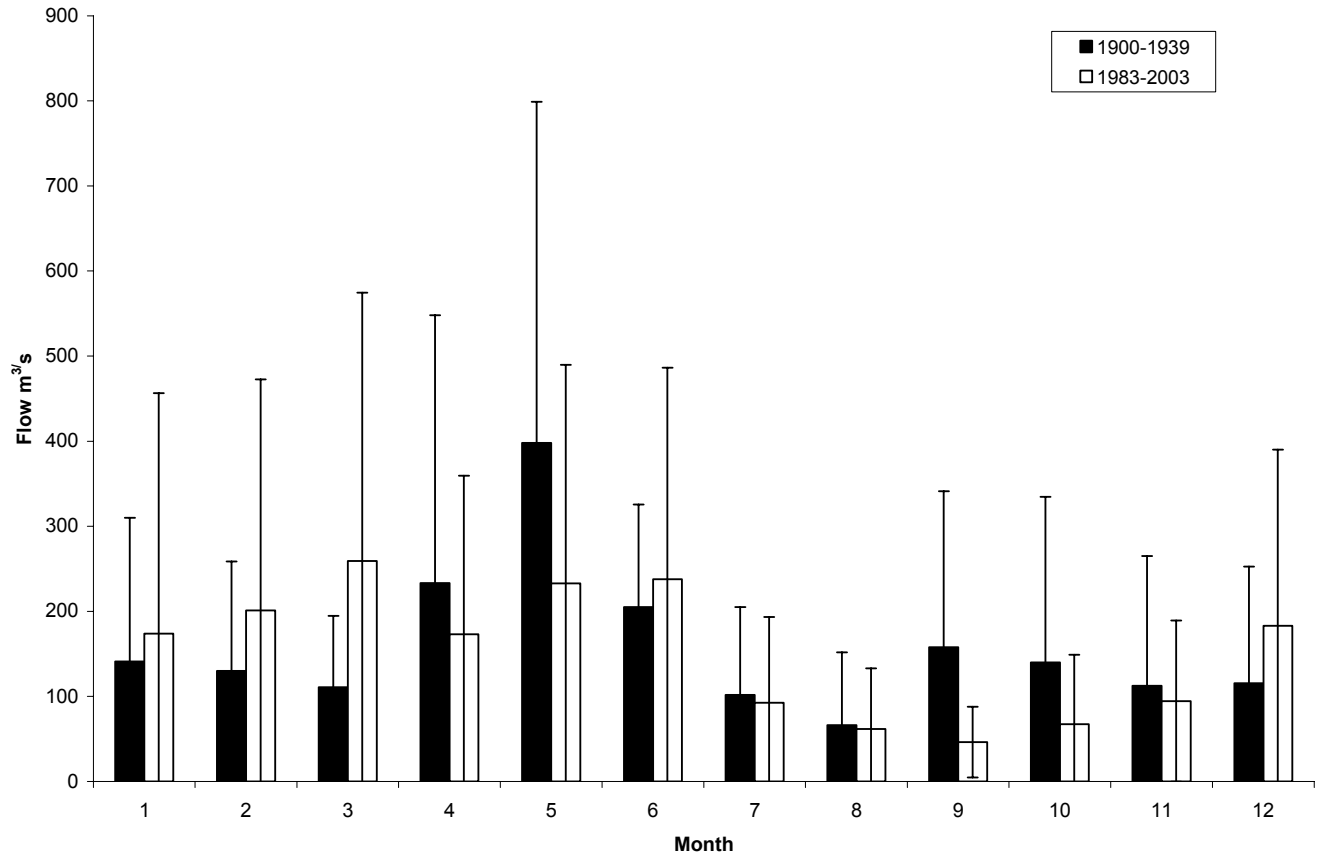


Figure 1. Mean monthly stream flow in the Brazos River at the State Highway 21 over-crossing for all years prior to river regulation, and for the last 20 years of record.

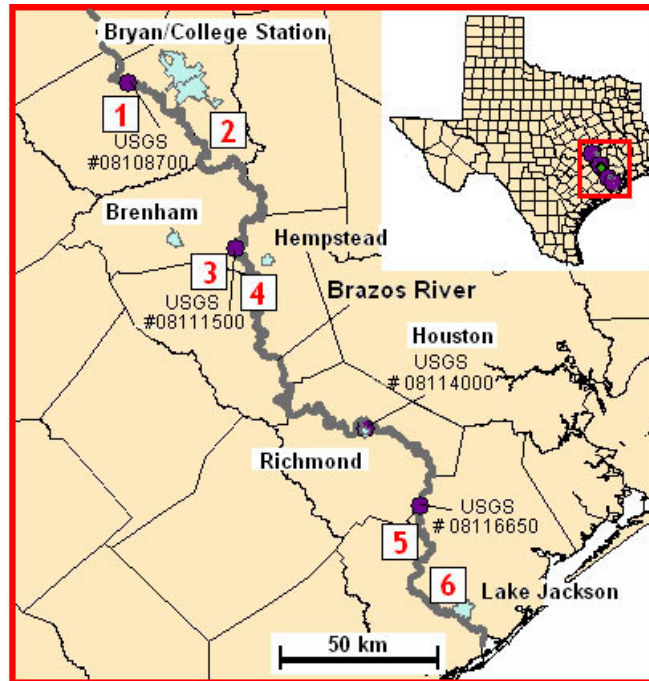


Figure 2. Map depicting the location of oxbow lakes in the study region, 1 = Moehlman Slough, 2 = Big Bend Oxbow, 3 = Korthauer Bottom, 4 = Perry Lake, 5 = Hog Island Oxbow and 6 = Cut Off Lake. Map created by Tim Osting TWDB.

A suite of physico-chemical parameters were measured during each survey. Temperature ($^{\circ}\text{C}$), dissolved oxygen concentration (mg/L), and conductivity (μs) were measured using a YSI model 85, and pH was measured with an electronic handheld meter. Maximum water depth was determined by conducting a series of measurements with a weighted tape measure along the length of the oxbow. Transparency was measured using a limnological Secchi disk 20 cm in diameter. Flow data for the Brazos River was obtained from USGS gauge 08108700 at the Texas State Highway 21 Bridge. Estimates of Brazos River flow needed to connect oxbow habitats with the active channel were provided by the Texas Water Development Board. Zooplankton was sampled using a 10-liter Schindler trap, fixed in a 5% formalin solution, and identified to the lowest feasible taxonomic level. Densities were determined from two 1ml sub-samples using a Sedgwick-Rafter counting cell. For estimation of water-column chlorophyll *a* concentration, 100 ml of flowing water was filtered through a membrane filter (0.45 μm pore size) and stored on ice. Samples were frozen upon returning to the laboratory. Chlorophyll *a* was extracted 90% alkaline acetone solution and quantified fluorometrically according to methods described by Wetzel and Likens (1991).

Small fish were sampled using a 10-m by 2-m bag seine with 0.64-cm mesh in the wings and 0.32-cm mesh in the bag. Seines were conducted perpendicular to shore at unique locations within the habitat until no new species were collected. The distance

traveled by each seine haul was estimated for catch-per-unit effort calculations [species number or biomass per meter seined(50 red shiner/ 60 m seine haul = 0.83 red shiner/m)]. Two multifilament experimental gillnets were deployed at each location to sample large-bodied fishes. Each gillnet consisted of three 16.5 m by 2 m panels with 2.54-, 5.1-, and 7.6 cm bar mesh. Gillnets were deployed between 1600 h and 0800 h the next day at sites that were surveyed monthly. At all other sites, gillnets were set between 1300 h and 1700 h. The time of each gillnet set was recorded for catch-per-unit effort calculations (species number or biomass per hour). All fishes collected were euthanized by emersion in MS-222. Small fishes were fixed in 10% formalin and transferred to 70% ethanol for storage. Large fishes were transported to the lab on ice and stored frozen for later analysis. Each individual was counted and weighed to the nearest 0.1 gram.



Figure 3. Seines and gillnets were the primary methods used to collect fishes from oxbow and channel habitats.

Data Analysis

For each survey, diversity calculations were performed on seine and gillnet numerical CPUE values using the reciprocal of Simpson's Index

$$N_2 = 1/\sum p_i^2$$

where p_i is the proportion of species numerical CPUE in each sample. Species richness was estimated as the number of species collected in each seine or gillnet sample.

Principle components analysis (PCA) was used to explore variation in physicochemical characteristics among sites and seasons. Canonical correspondence analysis (CCA) was performed on the seine numerical CPUE-by-site matrix to explore species-environment relationships. CCA is a direct gradient technique that ordines species and sample scores along gradients of environmental variation. Correspondence analysis (CA) was used to examine variation in species numerical CPUE among all sites. CA is an indirect gradient technique that ordines species and sample scores based on turnover of

species relative abundance without the influence of environmental variables. Detrended correspondence analysis was performed on the gill net numerical CPUE-by-site matrix due to an arch effect in the CA ordination.

For all multivariate analyses, species were excluded if they were collected on three or less occasions. Samples collected during June 2003 were excluded from CCA and PCA due to the lack of zooplankton data. Perry Lake, Cut Off Lake, and the Brazos River at the Highway 521 bridge were excluded from CCA and CA analyses. Landowner interviews indicated that the two oxbow lakes dried out in the late 1990's and had not connected with the active channel prior to sampling. The fish assemblage at the Highway 521 site was dominated by estuarine associated species as a result of low flows in the Brazos River that allowed a salt wedge to penetrate to the highway 521 site (salinity = 4.0 ppt).

To examine the response of fish species to hydrologic variability in each habitat, cross correlation analysis was performed (Box et al. 1994). This technique examines the correlation between two variables ($R_{x,y(k)}$) where x is lagged by k observations. Species CPUE values from seine collections were standardized by log transformation ($\log_{10} \text{CPUE} + 1$) to a monthly mean of 0 and unit standard deviation. Monthly mean flow and monthly peak discharge were similarly transformed for the length of the study period. Cross correlations were performed with time lags of 0, 1, and 2 months and statistical significance was assessed at $\alpha = 0.10$.

Brazos River- lower channel sites

Two sites were sampled on the lower Brazos River each month from November 2003 through August 2004 (excluding June 2004 because of high flow conditions). The upper site was located upstream from Hwy 290 crossing (Washington County) west of Hempstead, Texas. The lower site was located upstream from FM 1462 crossing (Brazoria County) west of Rosharon, Texas. Sites were selected to include a sampling location upstream and a sampling location downstream from the pending Allen's Creek Reservoir.

Fishes were collected with three, 30 to 40-m seine hauls and two, overnight gillnet sets. At each site, two wadeable, point sand-bar habitats and one protected eddy habitat were sampled with a 2 x 30 m bag seine (wing mesh size= 7 mm; bag mesh size= 3 mm). Point sand bars were sampled near shore (shallow seine haul) and in higher current velocity (deep seine haul). Protected eddy habitats were typically downstream of the point sandbars in deep water with sluggish current velocity. Fishes captured in each seine haul were anesthetized with MS-222 and fixed with 10% formalin. Percent substrate type (i.e., sand, silt, gravel) was estimated for each seine haul. Current velocity (m/s) and depth (m) were measured at four points across one transect. In the laboratory, fish were identified to species; total lengths (TL) of 30, randomly-selected individuals of each species were measured to construct length-frequency histograms. Two gill nets (identical to those used to survey oxbows) were set overnight in areas of sluggish flow and deep water. Captured fish were measured (TL) and released.

At each site, three macroinvertebrate samples were taken from sand and silt substrates with a Hess Sampler (area = 0.086 m²) and a 3-minute sediment stir. Smaller invertebrates were collected with a plankton tow net (12-cm diameter) pulled for 10 m. Contents acquired from the Hess Sampler and tow nets were preserved in 70% ethanol. Macroinvertebrates and zooplankton were sorted and identified to the lowest practical taxon. For chlorophyll *a*, 100 ml of flowing water was filtered through a membrane filter (0.45 µm pore size) and stored on ice. Samples were frozen upon returning to the laboratory. Chlorophyll *a* was extracted 90% alkaline acetone solution and quantified according to methods described by Wetzel and Likens (1991).

Mean daily discharge and peak discharge were obtained from USGS Station Gauging stations #08111500 (Hwy 290 crossing) and #08116650 (FM1642 crossing). From September 1, 2003 through August 31, 2004, mean daily discharge between the two gauging stations were strongly correlated ($r = 0.88$) so only discharge data from Gauging Station #08116650 (FM1642 crossing) was used for correlation analyses between discharge and fish density in this study. Likewise, mean daily discharge and peak discharge from Gauging Station #08116650 (FM1642 crossing) were strongly correlated ($r = 0.98$) so peak discharge was selected for correlation analyses. Seasonal trends in mean daily discharge during our collections were similar to long-term trends; discharge is elevated from January through June (Figure 4). However, high flows extended into July during our study.

Densities (numerical catch-per-effort; C/E), relative abundances (% numerical), taxa richness (S), diversity (N_2), evenness, similarities and turnover of fish capture with seines were calculated for each site and month. Density was calculated as the number of fish captured per length of seine haul. The reciprocal of Simpson's Index used to calculate diversity, and Gibson's E ($E = e^H/S$) was used to calculate evenness. Renkonen similarity indices (RSI) were used to calculate similarities between sites and turnover within each site. Density and taxa richness were correlated (Pearson correlation coefficient) with monthly peak discharge directly and with a one-month lag time (e.g., November peak discharge x December fish density) and two-month lag time (e.g., November peak discharge x fish density in January). Species associations with habitat parameters were assessed with canonical correspondence analysis (CCA). Rare species ($N < 18$) were excluded from the analyses. Habitat parameters were mean current velocity (per seine haul), mean depth, and percent substrate type (e.g., silt, sand, and gravel).

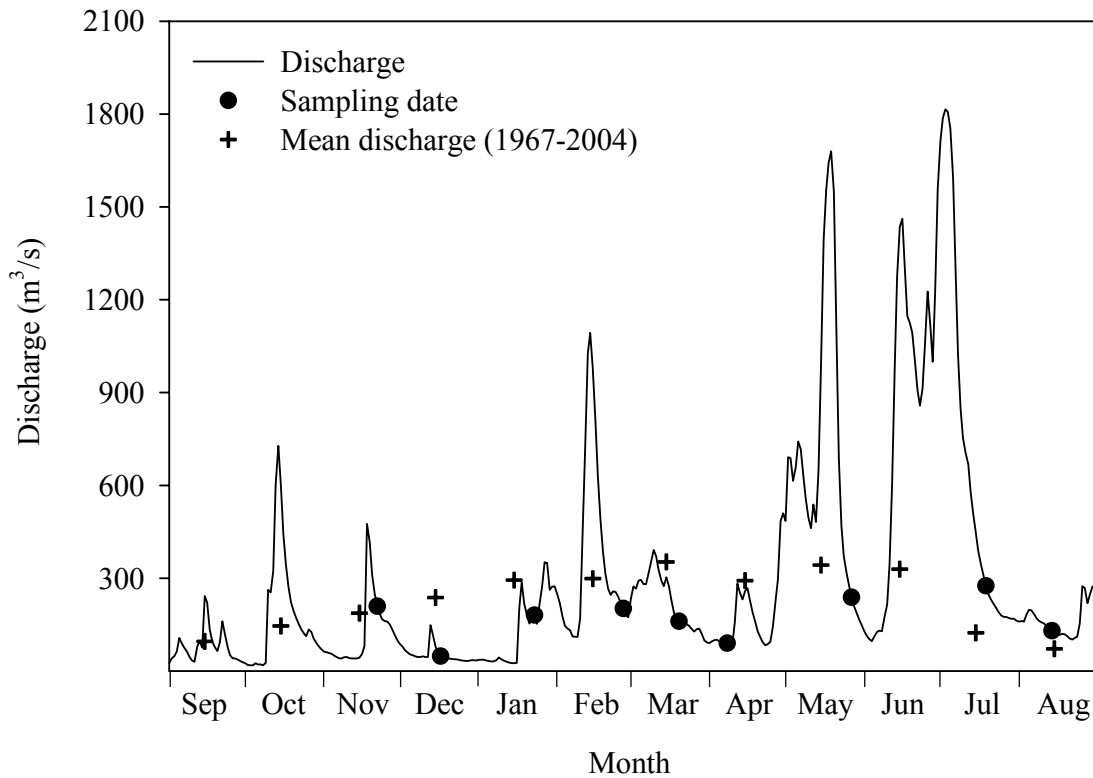


Figure 4. Hydrograph representing daily stream discharge for the lower Brazos River (Hwy 1462 crossing) from September 1, 2003 through August 31, 2004. The symbol (+) represents mean monthly discharge from 1967 through 2004. The symbol (•) represents sampling dates.

Results

Oxbow lakes and Brazos River at highway 21

Habitat

Principle components analysis yielded two axes that modeled 81% of the variation in physicochemical characteristics among sites and sample periods. Axis 1 explained 70% of the variation and differentiated the river channel that had greater depth and conductivity from oxbow lakes that had greater zooplankton densities and chlorophyll concentrations. Axis 2 explained 11% of the variation and described a weak seasonal gradient at all sites where positive scores corresponding to summer and fall samples were correlated with greater conductivity and chlorophyll concentrations (Figure 5). Perry Lake and Cut Off

Lake had scores similar to those of Big Bend whereas Korthauer Bottom was more similar to Moehlman Slough and Hog Island (Figure 5). The Brazos River at 521 had a score on axis 1 similar to the highway 21 site but was high on axis 2 due to greater conductivity.

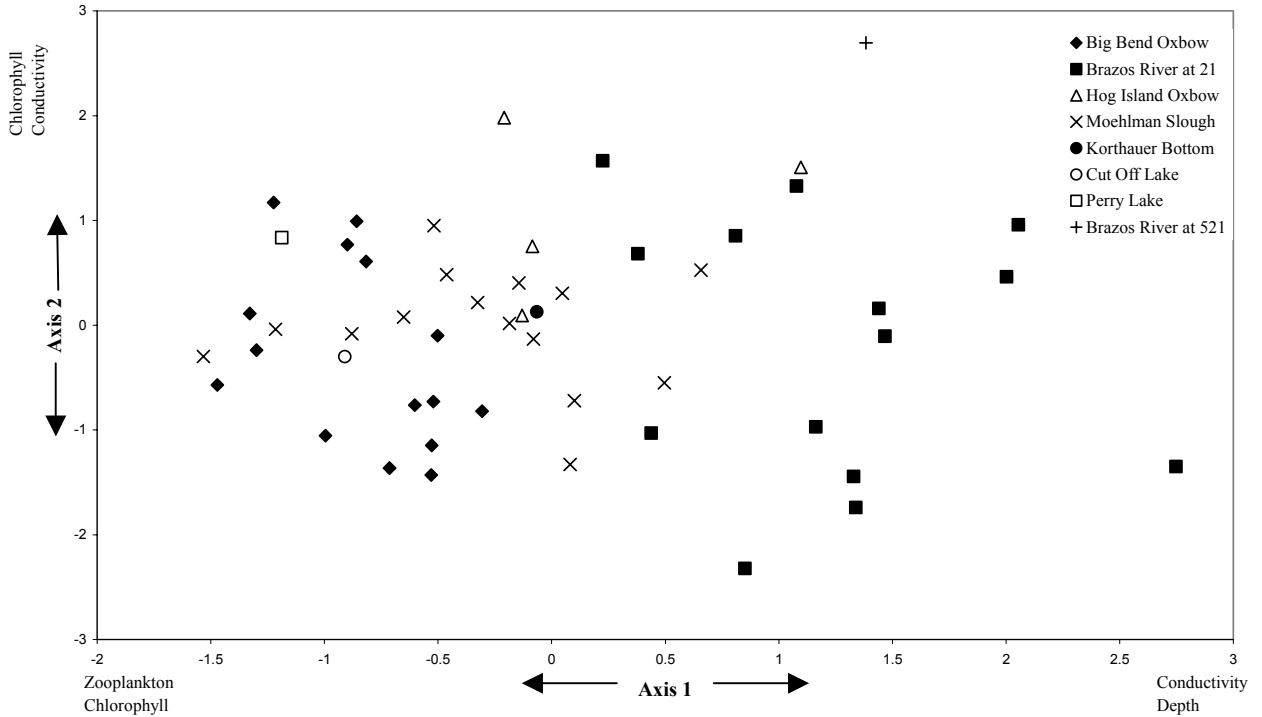


Figure 5. Plot of sample scores from Principle Components Analysis of oxbow and channel habitat characteristics.

Among sites surveyed monthly, oxbow lakes were more similar to each other than the river channel. The Brazos River possessed greater mean values for depth, conductivity, Secchi depth and dissolved oxygen concentration (Table 1). Oxbows had greater mean values for temperature, chlorophyll *a* concentration and densities of all zooplankton taxa (Table 1). Among oxbows, Big Bend was shallower, more turbid, and possessed greater densities of zooplankton. Moehlman Slough had greater chlorophyll *a* concentrations, dissolved oxygen and temperature (Table 1). Hog Island Oxbow and Korthauer Bottom possessed characteristics similar to Big Bend and Moehlman Slough whereas Perry Lake and Cut Off Lake possessed some characteristics more similar to each other than other oxbows. Perry Lake and Cut Off Lake were both relatively clear and contained higher densities of submerged and emergent vegetation (Figure 6).



Figure 6. *Clear water and an abundance of submerged and emergent vegetation characterized Perry Lake (left) and Cut Off Lake, whereas high turbidity and sparse aquatic vegetation generally characterized more recently connected oxbows such as Hog Island (right).*

Table 1. Ranges and mean values of physicochemical parameters, chlorophyll concentrations and zooplankton densities measured during the study period. Abbreviations: BB = Big Bend Oxbow, MO = Moehlman Slough, BR 21 = Brazos River at Highway 21, HIO = Hog Island Oxbow, COL = Cut Off Lake, PL = Perry Lake, KB = Korthauer Bottom, and BR 521 = Brazos River at Highway 521.

| Parameter | BB | MO | BR 21 | HIO |
|--------------------------|---------------------------|---------------------------|-----------------------|-------------------------|
| Temperature °C | 24.5 (13.2 - 32.6) | 25.5 (10.7 - 34.5) | 23 (11.9 - 33) | 25.1 (18 - 33) |
| Secchi depth (cm) | 18.6 (9 - 40.7) | 27.8 (9.5 - 42) | 30.5 (5.7 - 103) | 25 (11.8 - 43.1) |
| Conductivity ms | 341.1 (162 - 440) | 319.4 (189 - 407) | 783 (150 - 1472) | 577 (357 - 972) |
| Dissolved oxygen mg/L | 7.12 (3.16 - 11.28) | 7.68 (3.60 - 11.20) | 9.2 (6.48 - 11.39) | 8.47 (6.71 - 9.90) |
| pH | 8.5 (7.6 - 9.6) | 8.5 (7.6 - 9.4) | 8.6 (8.1 - 9.0) | 8.5 (8.1 - 9.1) |
| Maximum depth (cm) | 139 (42 - 142) | 165 (125 - 258) | 310 (176 - 1041) | 476 (365 - 607) |
| Chlorophyll mg/L | 15.1 (2.8 - 44.3) | 16.3 (5.4 - 39.7) | 10.1 (1.9 - 26.1) | 34.2 (14.5 - 76.7) |
| Rotifera/ L | 531 (37.5 - 2100) | 438.7 (26.25 - 2853.8) | 31 (0- 130) | 172.5 (22.5 - 251.3) |
| Nauplii/ L | 169.3 (33.8 - 476.3) | 63.9 (0 - 423.8) | 1.8 (0 - 10.0) | 18.75 (0 - 37.5) |
| Copepoda/ L | 132.3 (0 - 678.8) | 9 (0 - 67.5) | 0.6 (0 - 3.75) | 0 - |
| Cladocera/ L | 70.5 (7.5 - 191.3) | 9.8 (0 - 63.8) | 1.3 (0 - 7.5) | 2.8 (0 - 11.25) |
| Total zooplankton/ L | 903.1 (258.8 - 2208.8) | 521.4 (40 - 2861.25) | 35.1 (0 - 132.5) | 194 (22.5 - 251.25) |

Table 1 cont.

| Parameter | COL | PL | KB | BR 10 | BR 521 |
|--------------------------|------------|-------------|------------|------------|------------|
| Temperature °C | 34.3 - | 27.4 - | 35.3 - | 30.4 - | 32.7 - |
| Secchi depth (cm) | 41.5 - | 66.5 - | 21 - | 33 - | 58 - |
| Conductivity ms | 172 - | 223 - | 389 - | 919 - | 8400 - |
| Dissolved oxygen mg/L | 10.02 - | 9.45 - | 7.5 - | 11.74 - | 7.41 - |
| pH | 9.6 - | 9.3 - | 8.6 - | 8.9 - | 8.5 - |
| Maximum depth (cm) | 51 - | 120 - | 175 - | 254 - | 680 - |
| Chlorophyll mg/L | 14.4 - | 29.8 - | 14 - | 66.2 - | 15.2 - |
| Rotifera/ L | 585 - | 596.3 - | 161.3 - | - - | 18.75 - |
| Nauplii/ L | 37.5 - | 521.25 - | 15 - | - - | 7.5 - |
| Copepoda/ L | 22.5 - | 195 - | 3.8 - | - - | 0 - |
| Cladocera/ L | 0 - | 0 - | 0 - | - - | 0 - |
| Total zooplankton/ L | 645 - | 1312.5 - | 180 - | - - | 26.3 - |

Hydrology and habitat connectivity

Daily stream flow data indicated that Big Bend Oxbow connected with the river channel six times over the study period for a total of 19 days of connectivity (Figure 7). Moehlman Slough connected on three occasions for a total of 6 days (Figure 7 & 8). Hog Island Oxbow (Figure 9) was connected for a greater number of days than it was isolated. Prior to surveys in August 2003, Korthauer Bottom was last connected in April 2003 and Cut Off Lake was last connected in November 1998. Measurements of flood dynamics in Perry Lake were not available, however landowner interviews indicated that flood dynamics were similar to those in Cut Off Lake. Isotopic analysis performed by TWDB indicated that surface connections with the river channel were the primary source of oxbow water and although some oxbows had small tributaries, it is unlikely that they have significant impacts on oxbow water level (Chowdhury 2004). A more detailed analysis of Brazos River oxbow lake connectivity in response to hydrologic variation appears in a report by Osting et al. (2004).

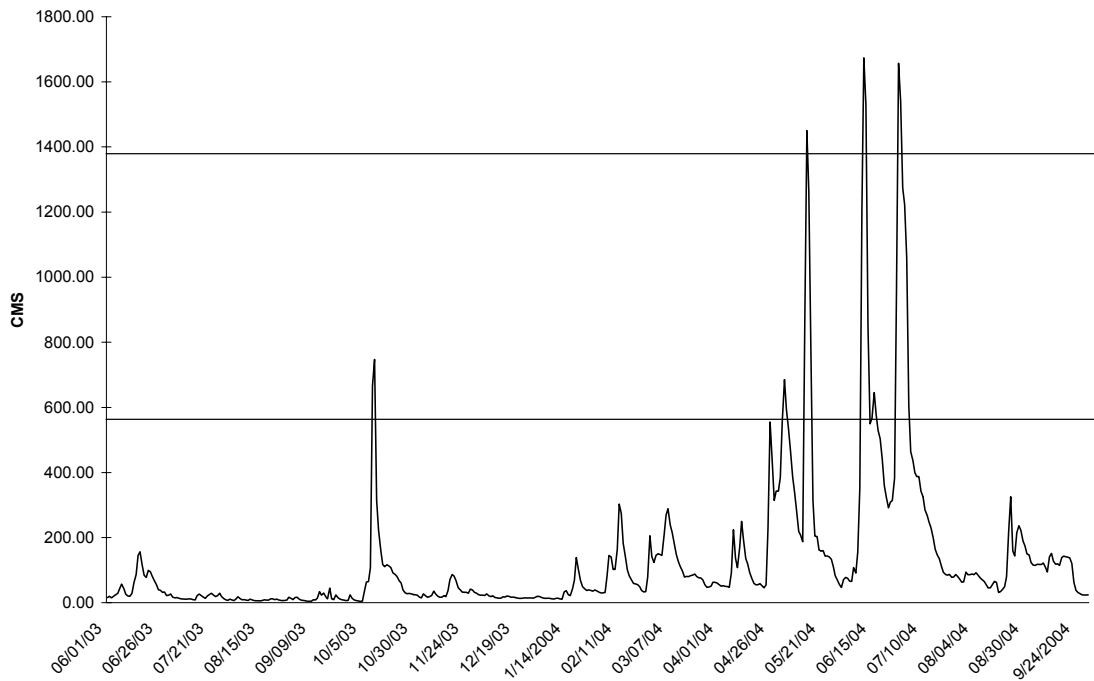


Figure 7. Daily stream flow hydrograph for the Brazos River at the Texas State Highway 21 Bridge (USGS gauge 08108700). Solid lines indicate flows required to connect Big Bend Oxbow (bottom), and Moehlman Slough (top).



Figure 8. *Moehlman Slough during a flood event in May 2004 (left) and during isolation in July 2004 (right).*



Figure 9. *Confluence of the Brazos River and Hog Island oxbow. The River can be seen in the background through the notch in the natural levee.*

Fish diversity and abundance

Across all sites and surveys, 90,682 individuals were collected representing 21 families and 66 species (Appendices 1 and 2). Among sites surveyed monthly, the Brazos River at Highway 21 had the greatest species richness (39) followed by Big Bend (31) and Moehlman Slough (27). Four surveys of Hog Island Oxbow yielded 38 species, and 13 species were collected from the remaining habitats that were not collected during monthly or quarterly surveys (Appendices 1 and 2). Individual surveys generally yielded between 10 and 20 species in seine collections and 4-10 species in gillnet collections (Appendices 1 and 2). Mean richness from seine samples was greatest in Hog Island and lowest in the Brazos River whereas mean gillnet richness was highest in Moehlman Slough and lowest in the Brazos River. Plots of species accumulation in Big Bend, Moehlman Slough and the Brazos River suggested that species richness increased in oxbow lakes in response to flooding whereas surveys of the Brazos River consistently collected new species (Figure 10). Richness values for the single survey sites were similar to oxbow and channel habitats surveyed more frequently with the exception of Perry Lake where few species were collected (Table 2).

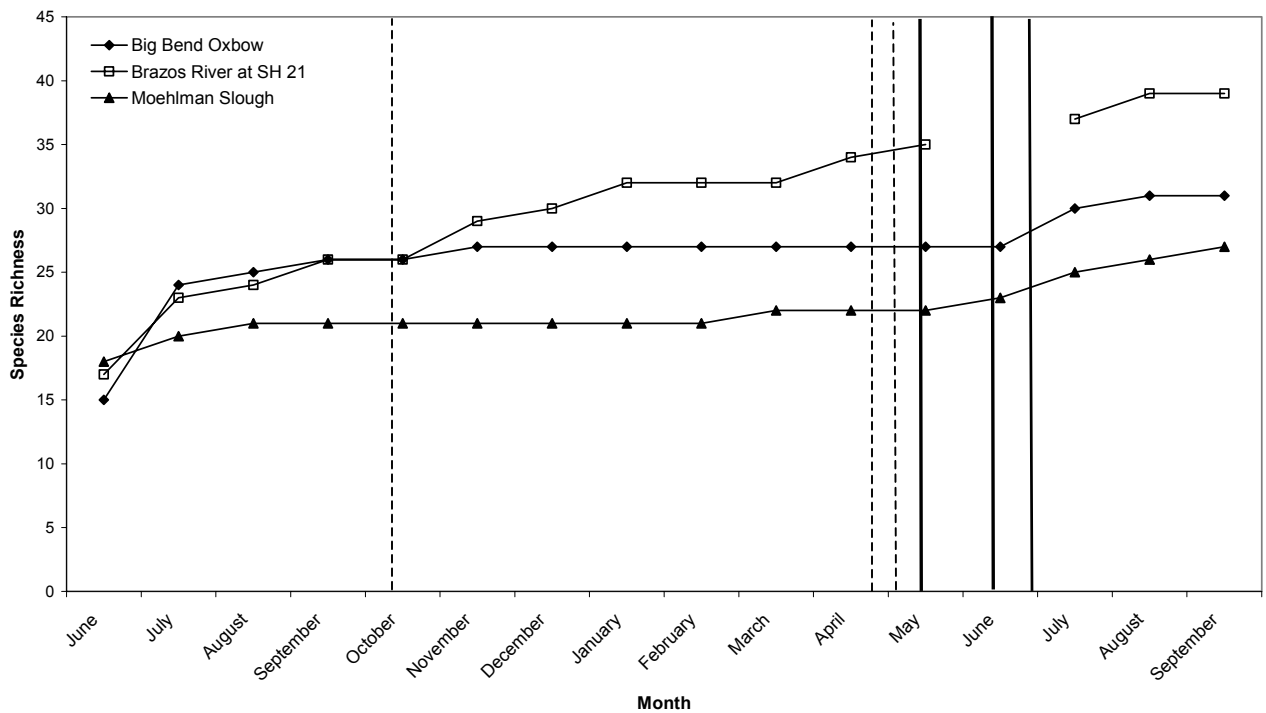


Figure 10. Plot of species accumulation in Big Bend Oxbow, Moehlman Slough and the Brazos River at SH 21 from June 2003 to September 2004. Dashed lines indicate floods that connected Big Bend, and solid lines indicate floods that connected Big Bend and Moehlman Slough. Richness increased in both oxbow lakes following floods in late spring and early summer 2004.

Assemblage diversity in seine and gillnet collections was generally higher in oxbows than the river channel. Hog Island had the highest mean diversity in seine collections followed

by Big Bend, Moehlman Slough and the Brazos River. Diversity of gillnet samples was highest in Big Bend and Moehlman Slough and lowest in the river channel. Diversity values for Korthauer Bottom, Cut Off Lake, Perry Lake, and the two lower Brazos River sites fell within the range of values calculated for more frequently sampled habitats (Table 2).

Numerical and biomass CPUE values from seine collections indicated that the Brazos River tended to have many small fish whereas oxbows have fewer, larger fishes. Mean numerical CPUE in the river channel was more than double the mean value from oxbow lakes, however biomass CPUE was lower than all oxbows (Table 2). Numerical CPUE in gillnet samples was highest in Moehlman Slough and biomass CPUE was greatest in Hog Island. The river channel ranked last in both numerical and biomass CPUE from gillnet samples (Table 3). The remaining sites had values within the range calculated for sites surveyed monthly or quarterly, with the exceptions of Perry Lake that had a seine numerical CPUE lower than any other oxbow collection, and the Brazos River at Highway 521 that had a gillnet biomass CPUE value less than any other river channel collection.

Table 2. Ranges (in parentheses) and mean estimates of species richness, diversity and CPUE from oxbow and Brazos River channel seine surveys.

| Location | Species Richness | Diversity | Numerical CPUE | Biomass CPUE (g) |
|----------------------|-------------------|----------------------|-------------------------|-------------------------|
| Big Bend Oxbow | 15.1 (9 - 22) | 3.8 (1.29 - 5.99) | 24.5 (4.02 - 80.65) | 43.7 (5.11 - 109.41) |
| Brazos River at 21 | 11.7 (6 - 17) | 1.8 (1.25 - 2.42) | 89.2 (9.35 - 233.30) | 27.8 (7.39 - 101.64) |
| Moehlman Slough | 13.3 (8 - 17) | 3.4 (1.33 - 5.60) | 29.6 (6.07 - 80.30) | 31.7 (6.38 - 68.48) |
| Hog Island Oxbow | 21.3 (13 - 26) | 4.0 (2.83 - 5.37) | 35.1 (20.14 - 44.83) | 33.5 (12.94 - 65.08) |
| Brazos River at I-10 | 13.0 - | 1.5 - | 25.3 - | 13.3 - |
| Cut Off Lake | 7.0 - | 1.2 - | 10.5 - | 19.4 - |
| Perry Lake | 3.0 - | 2.0 - | 2.0 - | 66.7 - |
| Brazos River at 521 | 14.0 - | 5.3 - | 5.7 - | 16.6 - |
| Korthauer Bottom | 13.0 - | 2.5 - | 18.2 - | 59.2 - |

Table 3. Ranges (in parentheses) and mean estimates of species richness, diversity and CPUE from oxbow and Brazos River channel gillnet surveys.

| Location | Species Richness | Diversity | CPUE Numerical | CPUE Biomass (g) |
|----------------------|------------------|------------------------|-----------------------|----------------------|
| Big Bend | 8.69 (4 - 15) | 6.57 (3.13 - 11.48) | 1.96 (0.73 - 4.20) | 1572 (688 - 5925) |
| Brazos River at 21 | 3.69 (1 - 7) | 3.13 (1.00 - 5.72) | 0.49 (0.13 - 0.86) | 763 (172 - 1474) |
| Moehlman Slough | 8.81 (6 - 11) | 6.27 (3.45 - 9.21) | 2.37 (0.97 - 3.81) | 950 (310 - 2157) |
| Hog Island Oxbow | 6 (2 - 10) | 5.16 (1.80 - 8.22) | 1.84 (0.41 - 3.48) | 2228 (124 - 5124) |
| Brazos River at I-10 | 3 - | 2.96 - | 0.5 - | 833 - |
| Perry Lake | 4 - | 3.13 - | 1.41 - | 777 - |
| Brazos River at 521 | 5 - | 3.6 - | 0.57 - | 157 - |
| Korthauer Bottom | 10 - | 7.58 - | 2.33 - | 2134 - |

Ordination of fish assemblages

Correspondence analysis of the seine numerical CPUE-by-site matrix yielded two axes that explained 41% of the variation in species CPUE. Axis 1 (eigenvalue 0.65) modeled 24.9% of the variation and described a gradient between all Brazos River sites that contained more speckled chub (*Macrhybopsis hyostoma*), ghost shiner (*Notropis buchanaui*), and bullhead minnow (*Pimephales vigilax*) compared with oxbow sites that contained more centrarchids, clupeids, and ictalurid catfishes. Axis 2 (eigenvalue 0.43) modeled 16.5% of the variation and differentiated Big Bend Oxbow that contained more white crappie (*Pomoxis annularis*), blue catfish (*Ictalurus furcatus*), and inland silverside (*Menidia beryllina*), from Moehlman Slough that contained more threadfin shad (*Dorosoma petenense*), green sunfish (*Lepomis cyanellus*), and bluegill sunfish (*Lepomis macrochirus*). A group of sample scores in the middle of the ordination contained two river channel samples and two Big Bend samples collected following flood events in the Brazos River.

Three of four Hog Island samples grouped here, and this oxbow was more frequently connected to the active channel than any other oxbow. The March 2004 sample in Big Bend also grouped here as a result of relatively high abundance of red shiner following a reproductive event in early spring (Figure 11).

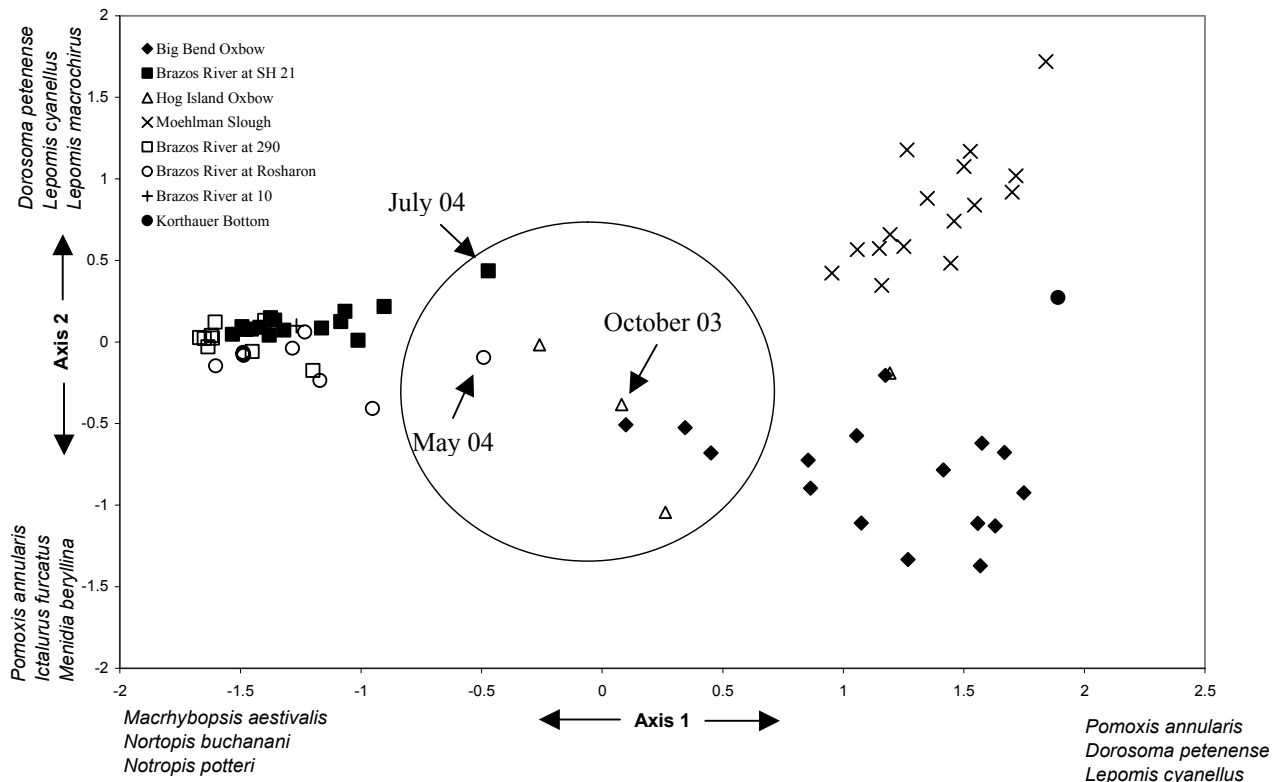


Figure 11. Plot of sample scores from correspondence analysis of seine CPUE values. Samples within the circle were collected following flood events in the Brazos

Canonical Correspondence Analysis yielded species-environment relationships that supported results from the CA ordination (Figure 12). Axis 1 (eigenvalue 0.45) explained 65.1% of the variation in species-environment relationships. Lotic adapted cyprinids characteristic of the river channel had high scores on axis 1 correlated with greater depth, pH, and conductivity. Centrarchids, clupeids and ictalurids generally had low scores on axis one correlated with higher temperature, chlorophyll, and zooplankton density; characteristics that were typical of oxbow lakes. Axis 2 (eigenvalue 0.087) explained 12.4% of the variation and generally described differences between species that were more abundant in Big Bend (*Ameiurus melas*, *Pomoxis annularis*) where zooplankton density and conductivity were higher, and species that were more abundant in Moehlman Slough (*Lepomis cyanellus*, *Dorosoma petenense*).

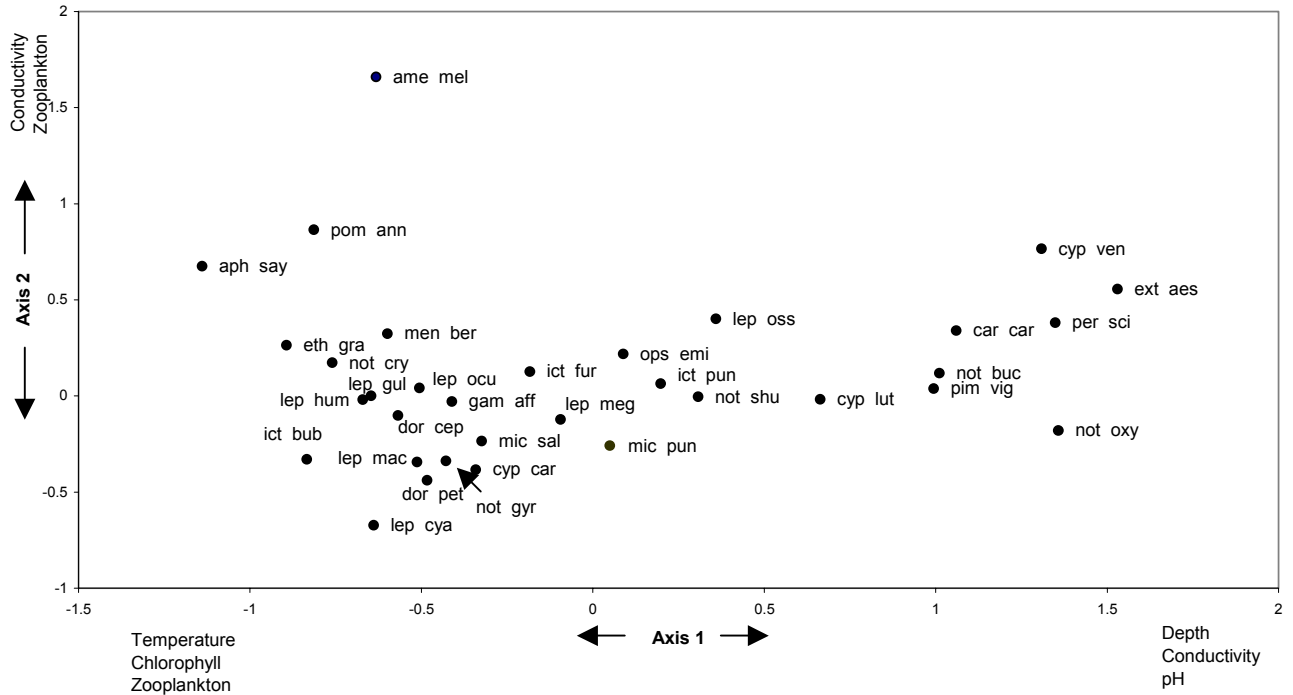


Figure 12. Plot of species scores from canonical correspondence analysis. Species codes are the first three letters of the genus and species.

Detrended correspondence analysis of the gillnet CPUE-by-site matrix produced two axes that modeled 48.8% of the variation in CPUE (Figure 13). Axis 1 (eigenvalue 0.57) explained 32% of the variation and described a gradient from the river channel and most frequently connected oxbows to the most isolated oxbow (Moehlman Slough). River channel samples contained more longnose gar (*Lepisosteus osseus*), blue catfish, and freshwater drum (*Aplodinotus grunniens*) whereas Moehlman Slough contained more white crappie, black bullhead (*Ameiurus melas*), and smallmouth buffalo (*Ictiobus bubalus*). Fish assemblages in Hog Island, Big Bend and Korthauer Bottom contained species common in the river channel and Moehlman Slough. One Big Bend sample score grouped with Hog Island and this sample was collected in June 2004 when Big Bend was connected with the river channel.

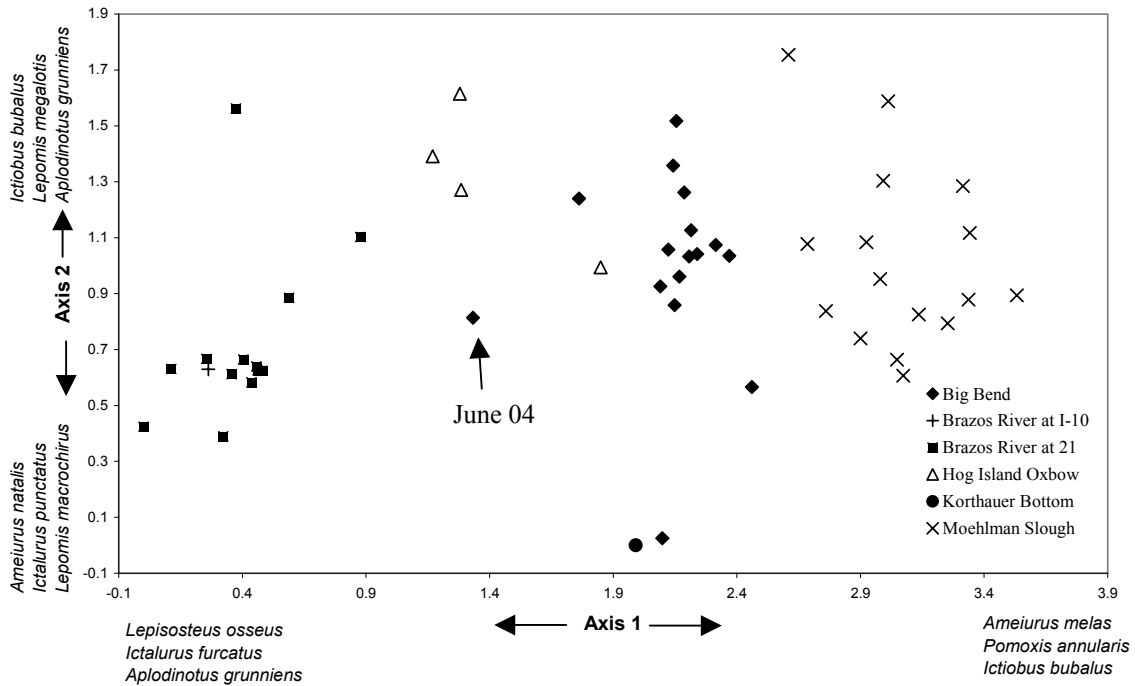


Figure 13. Plot of site scores from detrended correspondence analysis.

Cut Off Lake and Perry Lake both dried out in the late 1990's and had not connected with the river channel prior to surveys in summer 2003. The fish assemblage in Cut Off Lake was dominated by western mosquitofish and contained several species that were not collected in any other habitat (Appendix 1). This oxbow receives flow from a highly managed lake via a small creek and this is the likely source of fishes captured in Cut Off Lake. Perry Lake was dominated by largemouth bass (*Micropterus salmoides*) and bluegill sunfish; species that have been stocked into a nearby pond that flows into the oxbow during periods of heavy precipitation. Flow in the Brazos River was low in August 2003 and salinity was relatively high at the Highway 521 site (4.0 ppt). As a result, the species assemblage was dominated by estuarine associated species that were not collected in any other channel or oxbow habitat (Appendices 1 and 2).

Species responses to habitat hydrology

Cross correlation analysis of deviations in Brazos River species CPUE and hydrologic variables yielded positive correlations with species common in oxbow lakes but relatively rare in the river channel. White crappie, gizzard shad (Figure 14), threadfin shad and silverband shiner (*Notropis shumardi*) had positive correlations with hydrologic variables and no time lag. With a one-month time lag, positive correlations strengthened for white crappie and threadfin shad, and the correlation with gizzard shad and silverband shiner was no longer significant. Silverband shiners are much more abundant in the river than oxbows, and floods may provide opportunities for these minnow to return to the channel.

Threadfin shad and blackspot shiner (*Cyprinella venusta*) were the only species positively correlated with a two-month time lag.

Significantly negative correlations were found between hydrologic deviations and CPUE of dusky darter (*Percina sciera*), and sharpnose shiner (*Notropis oxyrhynchus*) with no time lag. With a one-month lag, negative correlations strengthened for the dusky darter and bullhead minnow (*Pimephales vigilax*). The sharpnose shiner was not significantly correlated at any other time lag. The red shiner (*Cyprinella lutrensis*) and ghost shiner had negative correlations with a two-month time lag, and the negative correlation of the bullhead minnow strengthened with a lag of two months (Appendix 3).



Figure 14. Shad had strong positive correlations with hydrology in the Brazos River channel. Longnose gar are common in the river but may move into oxbows during floods to feed on shad.

In Big Bend Oxbow, cross correlation with no time lag produced positive correlations between hydrologic variables, spotted gar (*Lepisosteus oculatus*) and pugnose minnow (*Opsopoeodus emiliae*). Negative correlations were found for the black bullhead, orangespot sunfish (*Lepomis humilis*), and longear sunfish (*Lepomis megalotis*). Species richness was positively correlated, and the bullhead minnow was negatively correlated with mean monthly flow but not peak discharge. A one-month time lag yielded positive correlations with species richness and abundance of threadfin shad, blue catfish, channel catfish (*Ictalurus punctatus*), spotted gar, and pugnose minnow. Seine biomass CPUE and the bullhead minnow were negatively correlated with hydrologic deviations lagged by one month. Gillnet biomass was negatively correlated with both hydrologic variables, and seine biomass CPUE was negatively correlated with monthly flow with a two-month lag. Species richness, threadfin shad, slough darter (*Etheostoma gracile*) and channel catfish were positively correlated with a 2-month lag, and blue catfish were positively correlated with monthly flow only (Appendix 4).

In Moehlman Slough, the bullhead minnow was the only species positively correlated with no time lag. With a one-month lag, species richness, bullhead minnow and orangespot sunfish were positively correlated with hydrologic variables. These variables and longear sunfish were also positively correlated with a two-month lag. Gizzard shad and green sunfish were negatively correlated with hydrologic variables at all time intervals. Bluegill sunfish, slough darter and western mosquito fish (*Gambusia affinis*) were negatively correlated with no lag and had no significant correlations at any other time interval. The golden shiner (*Notemigonus crysoleucas*) was negatively correlated with no lag and this relationship strengthened with a one-month lag. Gillnet biomass CPUE, gizzard shad CPUE and green sunfish CPUE were negatively correlated with a two-month lag (Appendix 5).

Brazos River- lower channel sites

Assemblage structure

A total of 111,962 fishes representing 39 species and 14 families were collected with seines from Hwy 290 and FM 1642 crossings (Table 4); 100,415 fishes and 32 species were collected from Hwy 290 crossing, and 11,547 fishes and 31 species were collected from FM 1642 crossing. *Cyprinella lutrensis* was the most abundant fish (61% in relative abundance) at Hwy 290 crossing, followed by *Notropis buchmanani* (18%), *Pimephales vigilax* (15%), and *Notropis shumardi* (5%). *Mugil cephalus* was the most abundant fish (32%) at FM 1642 crossing, followed by *Cyprinella lutrensis* (32%), *Gambusia affinis* (11%), and *Notropis shumardi* (6.4%). Fishes of regional importance included two Brazos River endemics (*Notropis oxyrhynchus*, N = 2; and *Notropis potteri*, N = 29) and two species (*Notropis shumardi*, N = 5,201; *Macrhybopsis storeriana*, N = 48) with disjunct populations in the Brazos River.

At Hwy 290 crossing, mean (\pm SE) taxa richness was 13.9 (1.62), diversity was 2.56 (0.78), and evenness was 0.24 (0.015) among months. Mean turnover (RSI) was 0.71 (0.043). At FM 1462 crossing, mean taxa richness was 12.6 (1.17), species diversity was 2.89 (1.31), and evenness was 0.312 (0.045). Mean turnover (RSI) was 0.41 (0.062). Collectively, fewer individuals and taxa were collected at FM 1462 crossing however the fish assemblage was more diverse, even, and variable in taxonomic composition and density through time compared to the assemblage at Hwy 290 crossing.

Between sites, mean similarity (RSI; \pm SE) was 0.52 (0.064). Twenty-three species were common to both sites, nine species were unique to Hwy 290 crossing, and eight species were unique to FM 1462 crossing. Likewise, abundances differed between sites. Four species (*Cyprinella lutrensis*, *Notropis buchmanani*, *Pimephales vigilax*, and *Notropis shumardi*) comprised 99% of the fish assemblage at Hwy 290 crossing, whereas these four species comprised only 45% of the fish assemblage at FM 1462 crossing. Instead, abundance of euryhaline *Mugil cephalus* and *Gambusia affinis* (collectively 44% of the fish assemblage) were greater at FM 1462 crossing.

Table 4. Number and relative abundances (%) of fishes collected from two sites on the lower Brazos River from November 2003 through August 2004.

| Species: | Hwy 290 | | FM 1462 | |
|--------------------------------|---------|---------|---------|--------|
| | N | % | N | % |
| <i>Lepisosteus oculatus</i> | | | 1 | <0.1 |
| <i>Lepisosteus osseus</i> | 4 | <0.1 | 4 | <0.1 |
| <i>Dorosoma cepedianum</i> | 6 | <0.1 | 4 | <0.1 |
| <i>Dorosoma petenense</i> | 28 | <0.1 | 15 | 0.1 |
| <i>Cyprinella lutrensis</i> | 61,390 | 61.1 | 3,724 | 32.3 |
| <i>Cyprinella venusta</i> | 6 | <0.1 | | |
| <i>Hybognathus nuchalis</i> | 92 | <0.1 | 1 | <0.1 |
| <i>Macrhybopsis hyostoma</i> | 601 | 0.6 | 814 | 7.0 |
| <i>Macrhybopsis storeriana</i> | | | 48 | 0.4 |
| <i>Notemigonus crysoleucas</i> | 1 | <0.1 | | |
| <i>Notropis buchanaui</i> | 17,829 | 17.8 | 76 | 0.7 |
| <i>Notropis oxyrhynchus</i> | 2 | <0.1 | | |
| <i>Notropis potteri</i> | 21 | <0.1 | 8 | <0.1 |
| <i>Notropis shumardi</i> | 5,201 | 5.2 | 744 | 6.4 |
| <i>Opsopoeodus emiliae</i> | | | 2 | <0.1 |
| <i>Pimephales vigilax</i> | 14,682 | 14.6 | 675 | 5.8 |
| <i>Carpionodes carpio</i> | 35 | <0.1 | 8 | <0.1 |
| <i>Ictiobus bubalus</i> | 7 | <0.1 | | |
| <i>Ictalurus furcatus</i> | 229 | 0.2 | 106 | 0.9 |
| <i>Ictalurus punctatus</i> | 75 | <0.1 | 124 | 1.1 |
| <i>Mugil cephalus</i> | 5 | <0.1 | 3,889 | 33.7 |
| <i>Labidesthes sicculus</i> | 9 | <0.1 | 2 | <0.1 |
| <i>Menidia beryllina</i> | 1 | <0.1 | 3 | <0.1 |
| <i>Strongylura marina</i> | | | 1 | <0.1 |
| <i>Fundulus notatus</i> | | | 1 | <0.1 |
| <i>Gambusia affinis</i> | 97 | 0.1 | 1,245 | 10.8 |
| <i>Poecilia formosa</i> | | | 19 | 0.2 |
| <i>Poecilia latipinna</i> | | | 2 | <0.1 |
| <i>Morone chrysops</i> | 3 | <0.1 | 1 | <0.1 |
| <i>Lepomis gulosus</i> | 2 | <0.1 | 2 | <0.1 |
| <i>Lepomis humilis</i> | 9 | <0.1 | | |
| <i>Lepomis macrochirus</i> | 16 | <0.1 | 5 | <0.1 |
| <i>Lepomis megalotis</i> | 20 | <0.1 | 1 | <0.1 |
| <i>Micropterus punctulatus</i> | 1 | <0.1 | | |
| <i>Micropterus salmoides</i> | 17 | <0.1 | 1 | <0.1 |
| <i>Pomoxis annularis</i> | 22 | <0.1 | 2 | <0.1 |
| <i>Pomoxis nigromaculatus</i> | 2 | <0.1 | | |
| <i>Etheostoma chlorosomum</i> | 1 | <0.1 | | |
| <i>Percina sciera</i> | 1 | <0.1 | | |
| <i>Aplodinotus grunniens</i> | | | 19 | 0.2 |
| Total N | | 100,415 | | 11,547 |

Species associations and habitat

Point sand bar habitats primarily consisted of sand substrate with some gravel (Table 5). Protected eddy habitats primarily consisted of silt habitat with small amounts of woody debris and leaves. Collectively, mean depth was 0.65 m and mean current velocity 0.34 cm/s of habitats sampled.

Table 5. Descriptions of habitats sampled from two sites on the lower Brazos River from November 2003 through August 2004.

| | HWY 290 | | | | | | | | | | FM 1462 | | | | | | | | | |
|-----------------------------|---------|------|------|------|------|------|------|-----|------|------|---------|------|------|------|------|------|------|-----|------|---|
| | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | |
| Substrate type (%) | | | | | | | | | | | | | | | | | | | | |
| Silt | 17 | 38 | 24 | 11 | 33 | - | 28 | - | 33 | - | 24 | 18 | 32 | 24 | 32 | 16 | 36 | - | 33 | |
| Sand | 83 | 62 | 76 | 77 | 65 | 60 | 65 | - | 67 | 100 | 76 | 82 | 68 | 76 | 68 | 84 | 64 | - | 67 | |
| Gravel | - | - | - | 11 | 2 | 40 | 7 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mean depth (m) | 0.68 | 0.51 | 0.64 | 0.74 | 0.78 | 0.54 | 0.58 | - | 1.21 | 0.63 | 0.47 | 0.72 | 0.62 | 0.70 | 0.67 | 0.44 | 0.55 | - | 0.66 | |
| Mean current velocity (m/s) | 0.56 | 0.20 | 0.40 | 0.59 | 0.33 | 0.54 | 0.10 | - | 0.42 | 0.49 | 0.31 | 0.07 | 0.26 | 0.31 | 0.39 | 0.30 | 0.28 | - | 0.36 | |
| Length (m) | 120 | 76 | 127 | 89 | 87 | 90 | 89 | - | 90 | 58 | 132 | 209 | 178 | 124 | 93 | 94 | 106 | - | 90 | |

Twenty percent ($P < 0.05$) of the fish assemblage variation from CCA (total inertia = 0.986) was attributed to habitat (e.g., substrate, depth, and current velocity; sum of all canonical eigenvalues = 0.169). Habitat variables with positive loadings on the first environmental axis in descending order were current velocity (0.81), depth (0.57), sand (0.44), and gravel (0.18). Silt substrate had a negative loading (0.43). Consequently, the first environmental axis described a gradient from swift and deep water with sand and gravel substrate to sluggish and shallow water with silt substrate. Fishes positively associated with axis 1 (in descending order) were *Aplodinotus grunniens* (2.1), *Macrhybopsis storeriana* (1.7), *Ictalurus furcatus* (0.95), *Ictalurus punctatus* (0.6), *Mugil cephalus* (0.36), *Macrhybopsis hyostoma* (0.33), *Carpiodes carpio* (0.11), *Notropis shumardi* (0.05), and *Notropis potteri* (0.01). Fish negatively associated with axis 1 (in descending order) were *Micropterus salmoides* (-1.1), *Poecilia latipinna* (-0.91), *Lepomis megalotis* (-0.89), *Pomoxis annularis* (-0.82), *Gambusia affinis* (-0.51), *Hybognathus nuchalis* (-0.36), *Lepomis macrochirus* (-0.29), *Notropis buechanani* (-0.26), *Pimephales vigilax* (-0.16), *Cyprinella lutrensis* (-0.12), and *Dorosoma petenense* (-0.06).

Habitat variables with positive loadings on the second environmental axis in descending order were gravel (0.54), sand (0.46), and current velocity (0.37). Habitat variables with negative loadings were depth (-0.71) and silt (-0.56). Second environmental axis described a gradient from shallow water habitats with gravel substrate to deep-water habitats with silt substrate. Fishes with the highest positive association with axis 2 were *Mugil cephalus* (0.74) and *Notropis potteri* (0.43). Fishes with the highest negative

association with axis 2 were *Aplodinotus grunniens* (-3.8), *Macrhybopsis storeriana* (-2.4), *Lepomis macrochirus* (-0.34), and *Lepomis megalotis* (-0.28).

Temporal patterns in fish assemblages

Species diversity and richness generally increased from winter to summer (Figure 14). Species diversity was lowest (1.36) in December 2003 attributed in part to >80% of the assemblage consisting of *C. lutrensis*. Species diversity consistently was high in May (4.13), July (2.61), and August (2.29) attributed in part to the decrease in abundance and density of several dominant species (*Cyprinella lutrensis* and *Notropis buchmanani*) and the occurrence of several species undetected in previous seining samples (*Ictiobus bubalus*, *Micropterus salmoides*, *Lepisosteus osseus*, *Morone chrysops*, *Etheostoma chlorosomum*, and *Aplodinotus grunniens*). Consequently, species diversity ($r = 0.58$; $P < 0.01$) and richness ($r = 0.65$; $P = 0.01$) were positively correlated with peak discharge, and likely the result of reproduction (e.g., *Ictiobus bubalus*, *Micropterus salmoides*, *Aplodinotus grunniens* were juveniles) and downstream displacement of typical tributary species (e.g., *Etheostoma chlorosomum*) because of high flows throughout the Brazos River drainage.

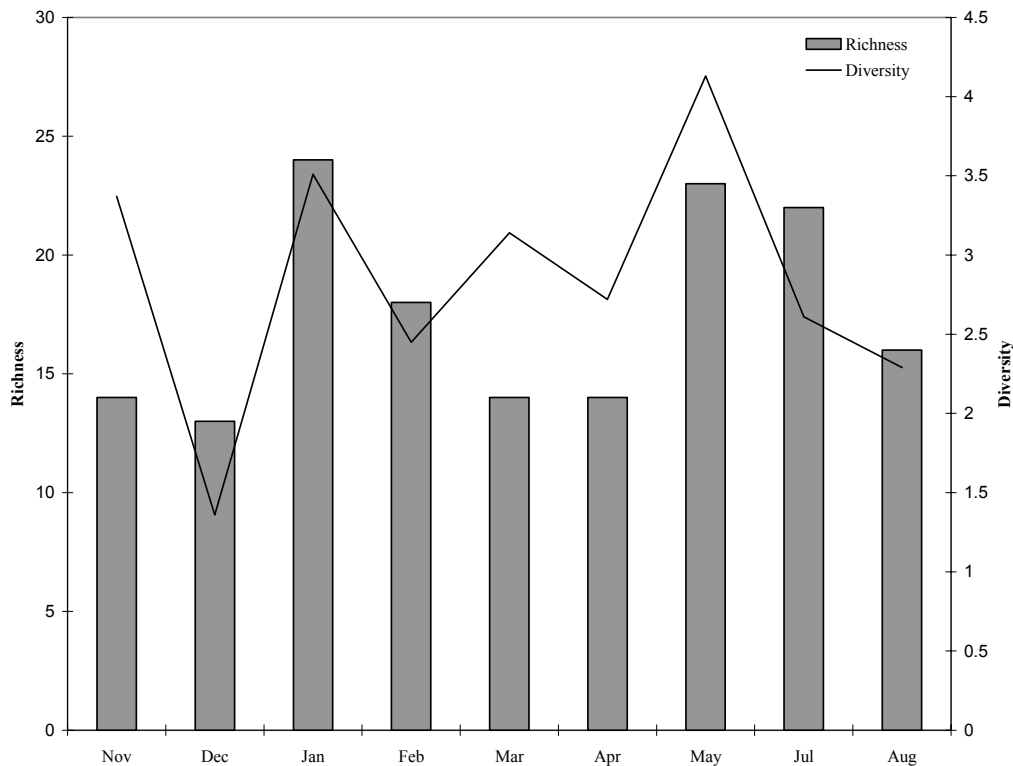


Figure 14. Species richness and species diversity (Base e) for fishes collected at two sites of the lower Brazos River from November 2003 through August 2004.

Among the most abundant fishes (Table 6), two general patterns were observed in fish densities through time. First, densities of *Cyprinella lutrensis*, *Notropis buchmanani*,

Pimphales vigilax, and *Notropis shumardi* generally decreased from winter to summer (Figure 15). Consequently, densities of these species were negatively correlated to peak discharge on a one or two month lag (Table 7). Second, densities of *Mugil cephalus*, *Macrhybopsis hystoma*, *Gambusia affinis*, *Ictalurus furcatus*, *Ictalurus punctatus*, and *Hybognathus nuchalis* generally increased from winter to summer (Figure 16; *M. cephalus* and *G. affinis* not shown) and were positively correlated to peak discharge (Table 7). Although densities of the most dominant fishes were correlated to peak discharge, biological factors such as life history characteristics, reproductive modes, and competition are not excluded from effecting changes in fish density changes through time.

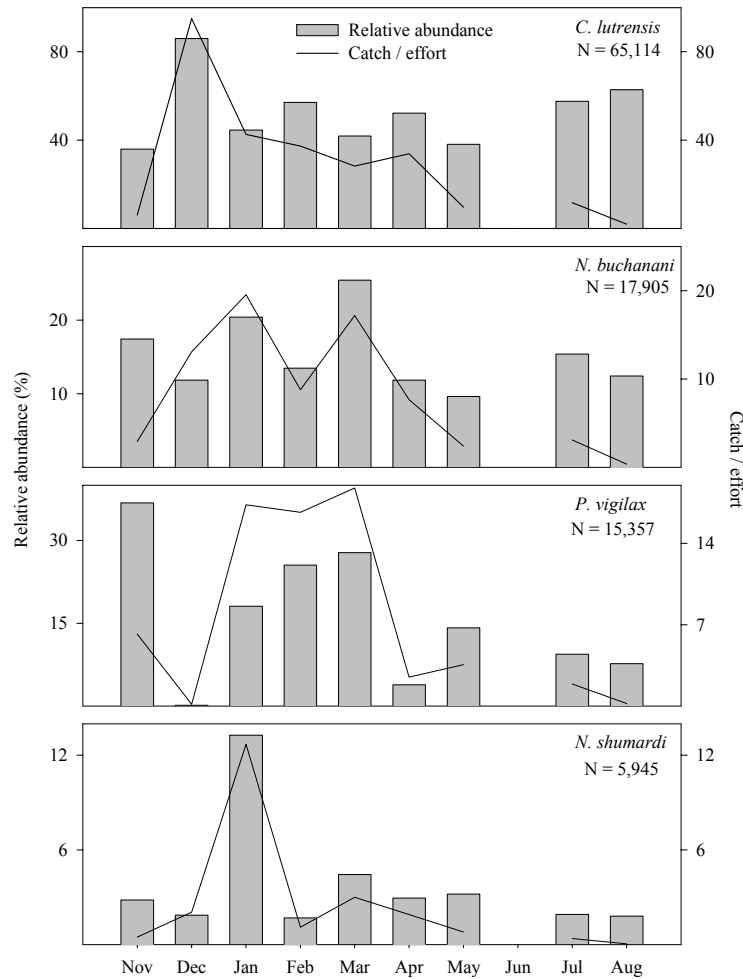


Figure 15. Relative abundance (%) and density (catch/effort) for *Cyprinella lutrensis*, *Notropis buchmanani*, *Pimephales vigilax*, and *Notropis shumardi* collected from the lower Brazos River from November 2003 through August 2004.

Table 6. Number of individuals and relative abundance (%) for the most abundant fish species collected from two sites on the lower Brazos River from November 2003 through August 2004.

| Species: | N | % |
|-------------------------------|--------|------|
| <i>Cyprinella lutrensis</i> | 65,114 | 58.2 |
| <i>Notropis buchanani</i> | 17,905 | 16.0 |
| <i>Pimephales vigilax</i> | 15,357 | 13.7 |
| <i>Notropis shumardi</i> | 5,945 | 5.3 |
| <i>Mugil cephalus</i> | 3,894 | 3.5 |
| <i>Macrohybopsis hyostoma</i> | 1,415 | 1.3 |
| <i>Gambusia affinis</i> | 1,342 | 1.2 |
| <i>Ictalurus furcatus</i> | 335 | 0.3 |
| <i>Ictalurus punctatus</i> | 199 | 0.2 |
| <i>Hybognathus nuchalis</i> | 93 | 0.1 |

Table 7. Direct and lag correlations between peak discharge and taxa richness, diversity, and species densities for fishes collected from two sites on the lower Brazos River from November 2003 through August 2004.

| Comparison | No lag | | 1-month lag | | 2-month lag | |
|--------------------------------------|--------|-------|-------------|-------|-------------|-------|
| | r | P | r | P | r | P |
| Peak discharge x Richness | 0.65 | <0.01 | -0.02 | 0.94 | -0.02 | 0.94 |
| Peak discharge x Diversity | 0.58 | 0.01 | 0.39 | 0.11 | 0.04 | 0.87 |
| Peak discharge x <i>C. lutrensis</i> | -0.42 | 0.08 | -0.66 | <0.01 | -0.20 | 0.42 |
| Peak discharge x <i>N. buchanani</i> | -0.44 | 0.07 | -0.61 | <0.01 | -0.51 | 0.03 |
| Peak discharge x <i>P. vigilax</i> | -0.15 | 0.55 | -0.39 | 0.11 | -0.71 | <0.01 |
| Peak discharge x <i>N. shumardi</i> | -0.30 | 0.22 | -0.52 | 0.03 | -0.39 | 0.11 |
| Peak discharge x <i>N. hyostoma</i> | 0.47 | 0.05 | -0.20 | 0.44 | -0.32 | 0.19 |
| Peak discharge x <i>I. furcatus</i> | 0.88 | <0.01 | 0.37 | 0.13 | 0.36 | 0.15 |
| Peak discharge x <i>I. punctatus</i> | 0.58 | 0.01 | 0.25 | 0.32 | 0.16 | 0.53 |
| Peak discharge x <i>H. nuchalis</i> | 0.91 | <0.01 | 0.25 | 0.31 | 0.23 | 0.36 |

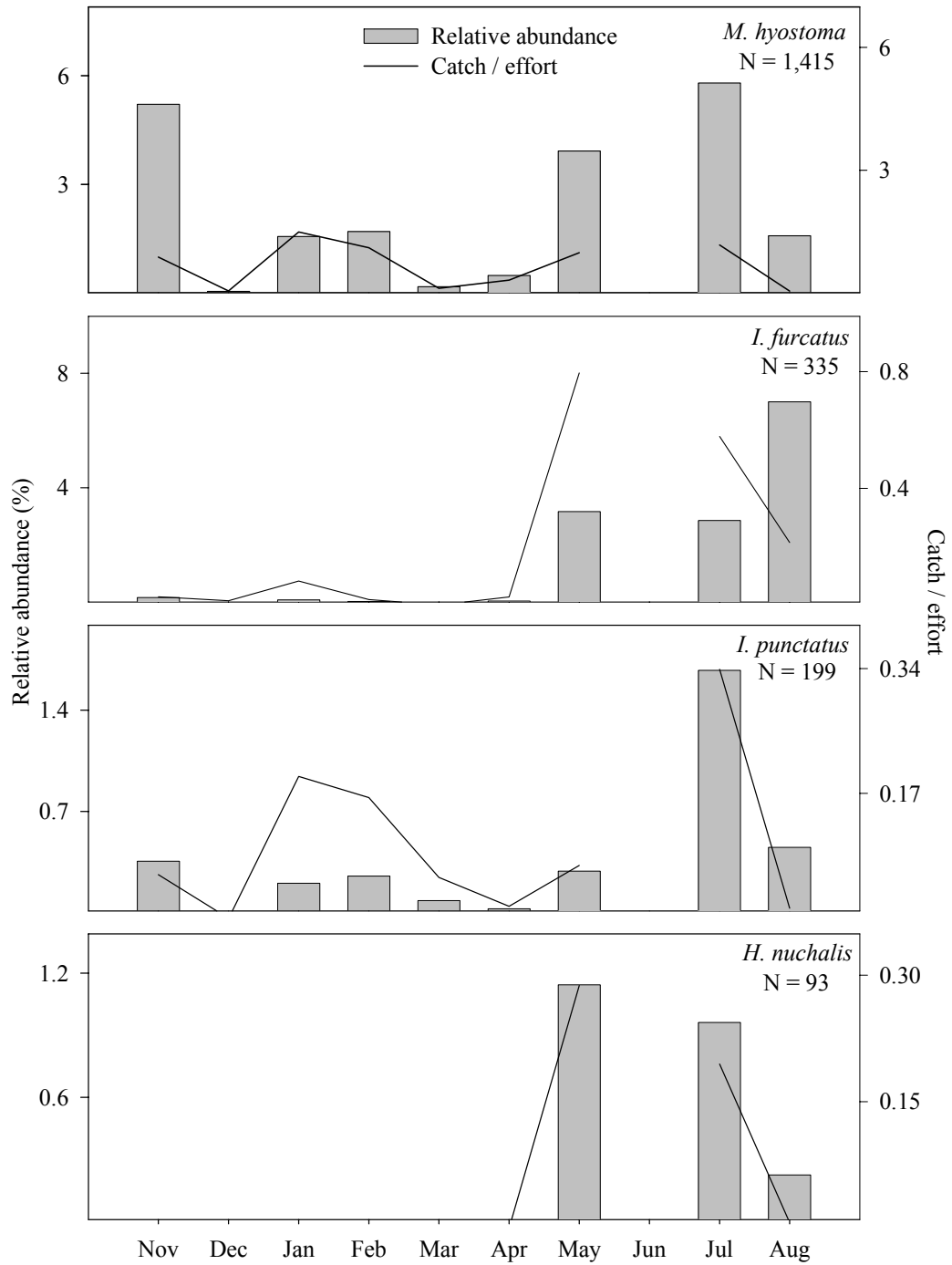


Figure 16. Relative abundance (%) and density (CPUE) for *Macrhybopsis hyostoma*, *Ictalurus furcatus*, *I. punctatus*, and *Hybognathus nuchalis* collected from the lower Brazos River from November 2003 through August 2004.

Species negatively associated with peak discharge

The *C. lutrensis* population consisted of at least four age groups (age 0, 1, 2, and 3) in the lower Brazos River (Figure 17a). Age-0 fish (Year class 2004) were first collected in August 2004 and were <25 mm in length. Except for age-0 fish, representatives of each age group were collected throughout the year. Thus, lower densities during the summer apparently occurred in each age group. Density decreases may be attributed to downstream displacement during high flow events, or may simply be a consequence of intense intraspecific competition during the winter and early spring.

The *N. buchanani* population consisted of at least three age groups (age 0, 1, and 2; Figure 16b). Age-0 fish (Year class 2004) possibly were collected as early as July 2004. Age-1 fish (Year class 2003) were collected throughout the year. Age-2 fish were not collected past May 2004. Few age-2 fish survive through their third summer (Pflieger 1975). Density decreases may be attributed to mortality of older fish or to the movement of age-1 fish into areas of low flow (e.g., tributaries; Pflieger 1975) to seek refuge during summer high flows in the Brazos River main stem.

The *P. vigilax* population consisted of at least three age groups (age 0, 1, and 2; Figure 18a). Age-0 fish were first collected in July 2004 and was the most common age group found in August 2004. Age-1 fish (Year class 2003) were collected through the year. Age-2 fish were collected through July 2004. A sharp decline in density occurred in April. This may be attributed to natural variation in the population because *P. vigilax* density in April was similar to that in December. However, the sharp density decline in April also corresponds with reproduction. The male prepares a redd under rocks, woody debris, or other hard substrate in early spring and will guard the nest after the female attaches her adhesive eggs (Parker 1964). Consequently, breeding pairs may move to areas with greater density of suitable substrate (e.g., tributaries) for redd preparation, thus reducing the Brazos River population. High flows may have aided in suppressing *P. vigilax* densities during the summer because of their preference for areas with slow water currents (Etnier and Starnes 1993).

The *N. shumardi* population consisted of at least four age groups (age 0, 1, 2, and 3; Figure 18b). Ages 1 (Year class 2003), 2, and 3 were generally common from November 2003 through May 2004. Corresponding with lower densities, the population during the summer consisted primarily of one age group. However, the age of this group is difficult to determine; these fishes may represent age 0 or age 1 fish. Little is known about the life history of *N. shumardi*. This fish typically is found only in large rivers and breed in swift current over sand or gravel substrates (Robison and Buchanan 1988). However, large specimens were collected from tributaries of the Brazos River during the summer (Leavy 2004). It is feasible that reproductive fish move into tributaries for spawning especially during periods of high flow events in the Brazos River main stem.

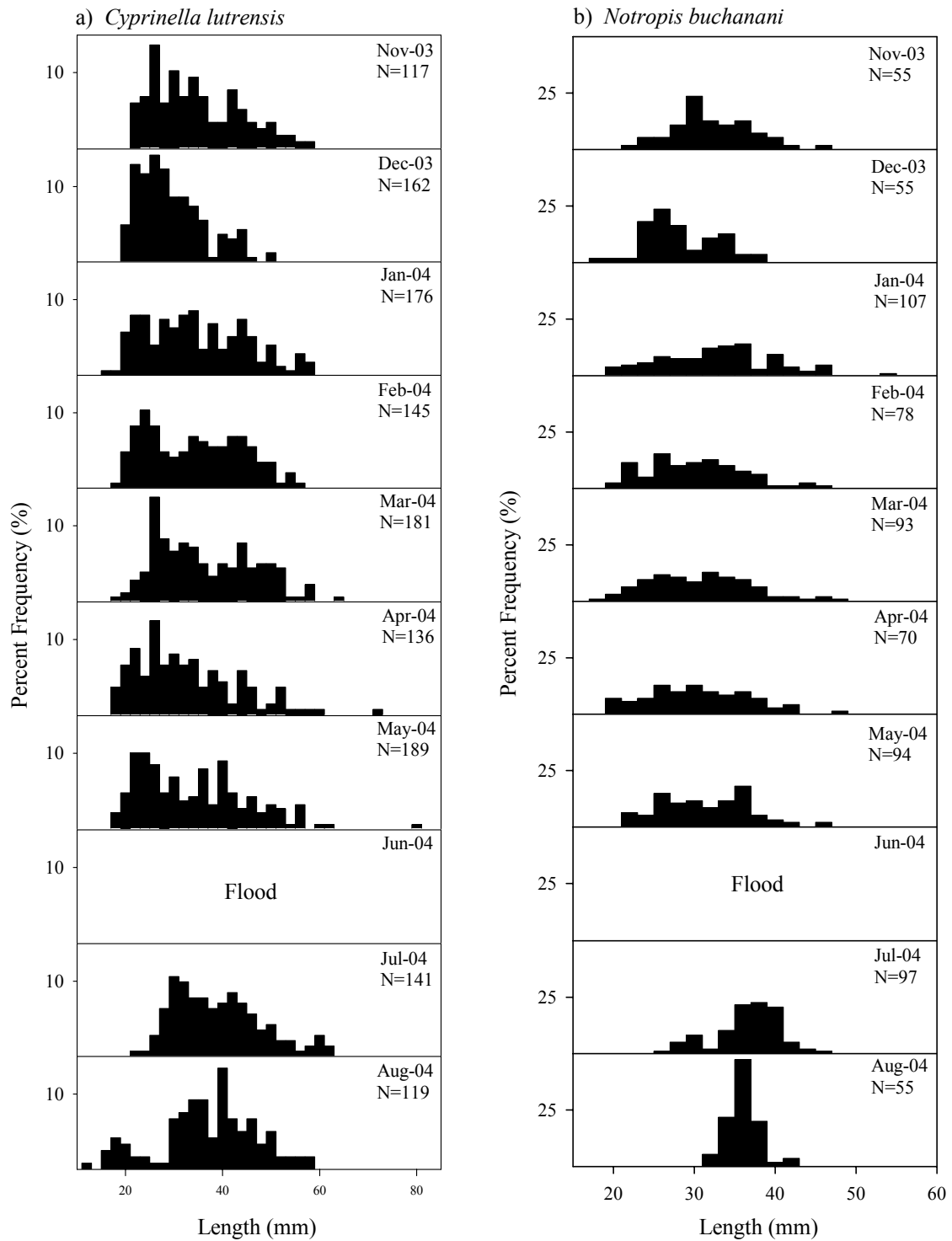


Figure 17. Monthly length frequency histograms for (a) *Cyprinella venusta* and (b) *Notropis buchanani* collected from the lower Brazos River from November 2003 through August 2004.

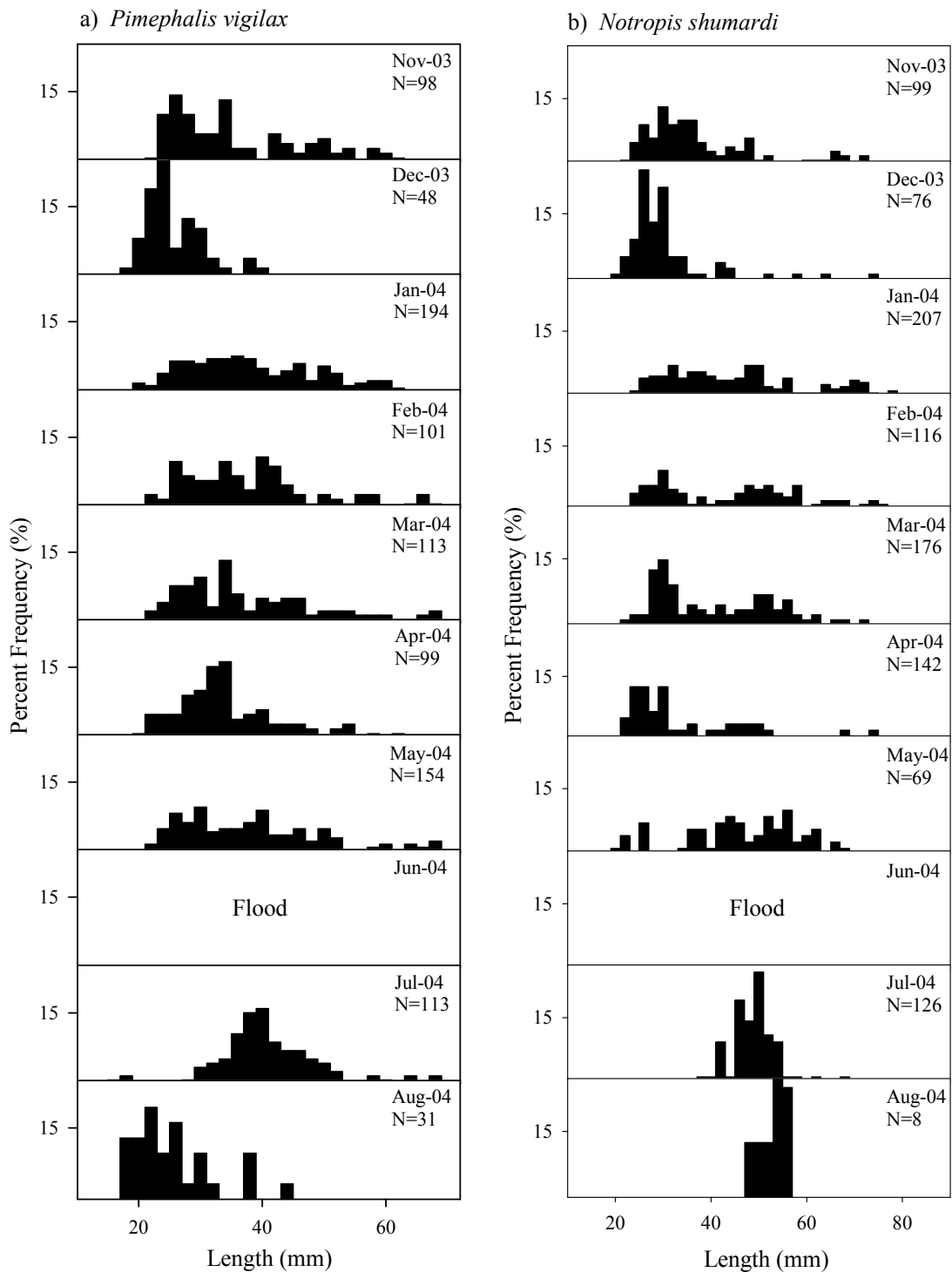


Figure 18. Monthly length frequency histograms for (a) *Pimephales vigilax* and (b) *Notropis shumardi* collected from the lower Brazos River from November 2003 through August 2004.

Species positively associated with peak discharge

Mugil cephalus were rare ($N < 9$) among monthly collections except in January ($N = 500$) and April ($N = 3,380$). Several mullet species and other marine-spawning fishes move substantial distances upstream in rivers to escape predation pressures in brackish water (Lucas and Baras 2001).

The *M. hyostoma* population consisted of at least three age groups (age 0, 1, and 2; Figure 19a). Age-0 fish (Year class 2004) were collected May through August 2004. Age-1 fish (Year class 2003) and age-2 fish were collected November 2003 through July 2004. Density of *M. hyostoma* was consistent through the year and rather weakly associated ($r = 0.47$; $P = 0.05$) with peak discharge. *Macrhybopsis hyostoma* is a broadcast spawner, releasing semi-buoyant eggs in areas of swift current such as the Brazos River main stem (Bottrell et al. 1964).

Gambusia affinis were rare ($N < 69$) among monthly collections except in May 2004 ($N = 1,182$) at Hwy 1462 crossing. The population consisted of age-0 and older fish.

Populations of *I. furcatus* (Figure 19b) and *I. punctatus* (Figure 20a) consisted of two age classes (age 0 and 1). Older catfishes are common in the lower Brazos River, but inhabit areas not effectively sampled with seines. Age-0 *I. furcatus* (Year class 2004) were collected in July and August 2004; age-0 *I. punctatus* were collected from May through August 2004. Positive correlations between peak discharge and catfish densities were attributed to reproduction, availability, and catchability (e.g., preference for shallow water habitats) of age-0 catfish.

The *H. nuchalis* population consisted of age 0 and one older fish (Figure 20b). Age-0 fish were collected from May through August 2004. Little is known about life history of *H. nuchalis*, but *Hybognathus* typically breed in backwater areas and smaller tributary streams with females scattering non-adhesive eggs in vegetation and over bare substrate (Raney 1939). Eggs and larvae are susceptible to downstream displacement during high flows. Hence, *H. nuchalis* were found only during the summer, and their density was positively correlated to peak discharge. Adult *H. nuchalis* likely inhabit smaller tributary streams and not the Brazos River main stem. However, main stem rivers may be important to the early development or another aspect of *H. nuchalis* life history (Etnier and Starnes 1993).

Gillnet data

Fifty-three individuals and five species were captured in gillnets. *Lepisosteus osseus* was the most common species captured ($N = 40$), followed by *Ictalurus furcatus* ($N = 6$), *Dorosoma cepedianum* ($N = 5$), *Carpionodes carpio* ($N = 1$) and *Ictiobus bubalus* ($N = 1$). Abundances of these species were not included in analyses because few fish were captured and representatives were recorded in seine data.

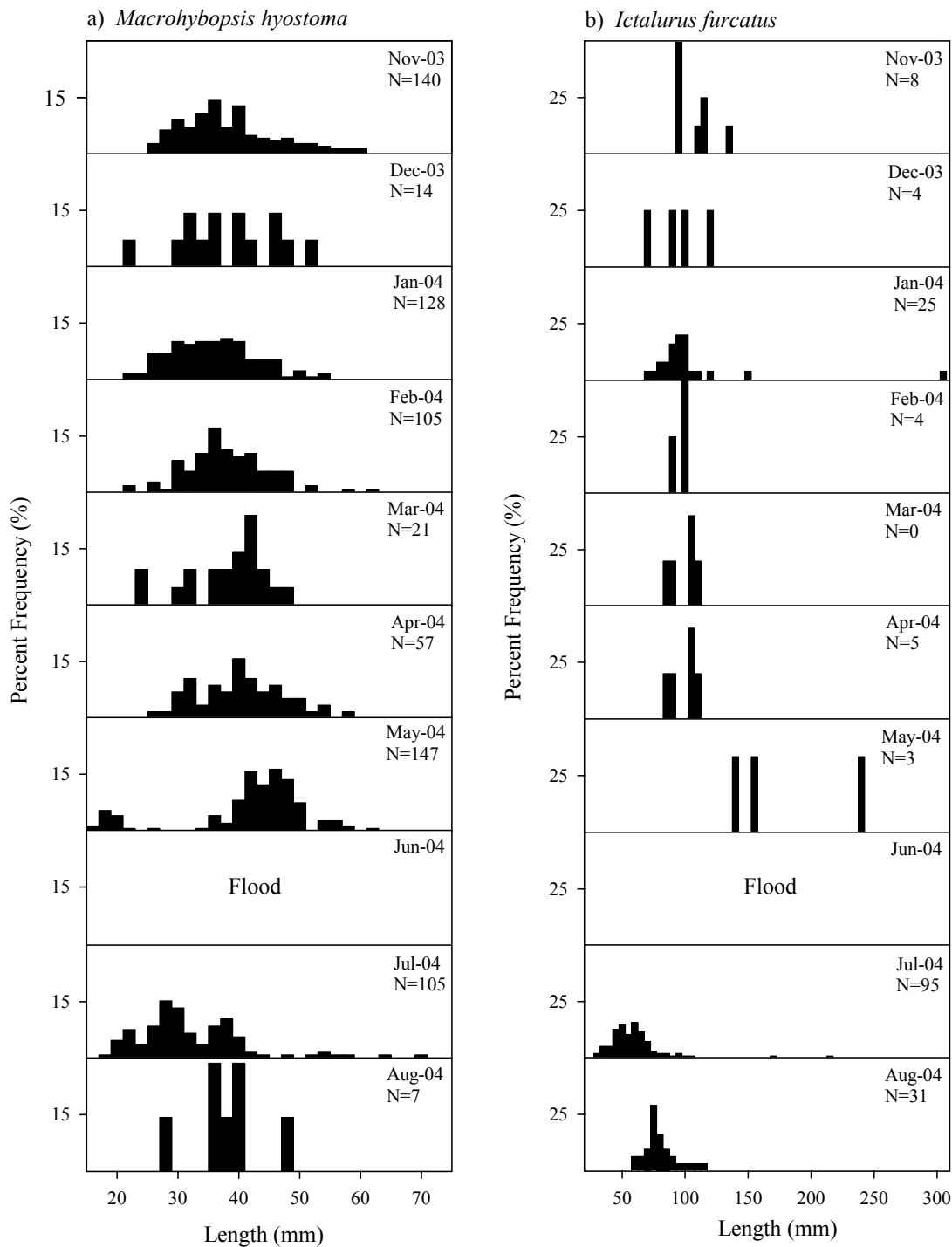


Figure 19. Monthly length frequency histograms for (a) *Macrhybopsis hyostoma* and (b) *Ictalurus furcatus* collected from the lower Brazos River from November 2003 through August 2004.

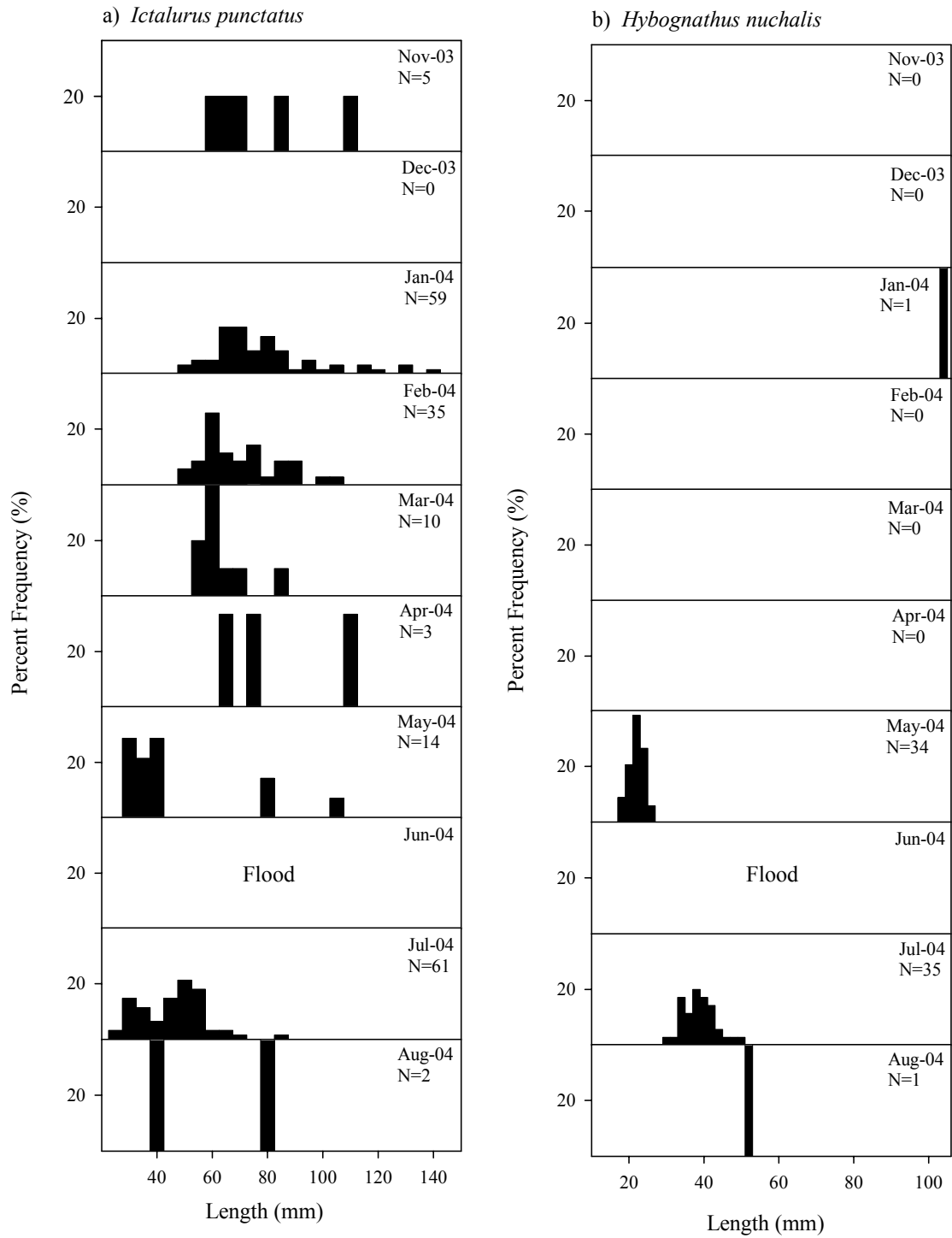


Figure 20. Monthly length frequency histograms for (a) *Ictalurus punctatus* and (b) *Hybognathus nuchalis* collected from the lower Brazos River from November 2003 through August 2004.

Macroinvertebrate and zooplankton

A total of 203 macroinvertebrates were collected from Hwy 290 and FM 1462 crossings. Chironomids (Diptera) were the most common (72% in relative abundance), followed by taxa in the family Ephemeroptera: Baetidae (11%), Heptageniidae (6%), and Tricorythidae (4%). Taxa that were <1% in relative abundance were Diptera (Ceratopogonidae, Simuliidae and Tipulidae), Trichoptera (Hydroptilidae), Odonata (Gomphidae), Nematoda (Mermithidae), Bivalva (*Corbicula*), and Decapoda (Cambaridae).

Mean density (number of organisms/L; \pm SD) of zooplankton was 4.5 (4.6). Rotifers were the most common (2.0 ± 1.8), followed by Cladocera (0.36 ± 0.74), Gastrotricha (0.22 ± 0.75), and Copepoda (0.19 ± 0.39).

Discussion

The timing and frequency of periodic flood events interacted with habitat features in determining the structure of oxbow and river channel fish assemblages as evidenced by multivariate ordinations and cross-correlation analyses. In seine CA ordinations, Brazos River and Big Bend oxbow sample scores moved toward each other following periods of connectivity that facilitated exchange of aquatic fauna. In Big Bend, the effect was strongest following a flood in October 2003, whereas the effect was strongest in the Brazos River following floods in late spring and summer. Piscivory may control the ability of small minnows typical of river channel assemblages from colonizing oxbow habitats (Zeug et al. in review), and piscivore abundance was lowest during fall and winter surveys of Big Bend. Most oxbow fishes reproduced prior to floods in May and June 2004, and lateral connectivity allowed juveniles to move from oxbow habitats to the river channel. Fish assemblages in Moehlman Slough appeared relatively stable over the study period, and no seine or gillnet samples grouped near the river channel, however cross correlation analyses suggested faunal exchange. Moehlman Slough was the most distant from the river, and this may have reduced large-scale colonization by small minnows that appear to have influenced Big Bend sample scores.

Species-specific responses to hydrologic variability appeared to be related to abundance patterns in oxbow and channel habitats at the time of connectivity. In oxbow lakes, (Big Bend, Moehlman Slough) species richness was positively correlated, and measures of biomass CPUE were negatively correlated with hydrologic variables suggesting a net movement of biomass from oxbows into the river channel but also colonization of oxbows by some individuals of channel-associated species. Cross-correlation analysis of Brazos River data yielded a pattern of increased abundance of crappie and shad and a decrease in the abundance of small colonizing cyprinids (bullhead minnow, ghost shiner, red shiner) in response to hydrologic connectivity. With the exception of mosquito fish, crappie and shad were the most abundant fishes in Big Bend and Moehlman Slough respectively. Gizzard shad were particularly abundant in Moehlman Slough and negative correlations with this species corresponded to positive correlations in the river channel. Similarly, the bullhead minnow was negatively correlated with hydrology in the river channel and

positively in Moehlman Slough. This suggests that oxbow and channel habitats can simultaneously act as source and sink habitats for different species. Conflicting correlations with the same species in different oxbows may indicate that physical factors other than flooding, or biological interactions specific to each oxbow influenced deviations in species CPUE. Spotted gar, blue catfish, channel catfish and pugnose minnow were positively correlated with hydrology in Big Bend but not Moehlman Slough. The effect of distance on colonization frequency has been well recognized and Moehlman Slough was 800 meters farther from the river channel than Big Bend. Longnose gar were abundant in Big Bend gillnet samples during the June 2004 flood, however these fish were rare during subsequent surveys. Gar may enter oxbows during floods to forage and return to the river as water levels fall. Gar species in the Brazos River system selectively feed on clupeids (Robertson et al. unpublished data) that apparently are more abundant in oxbow habitats, and which may provide a resource subsidy for piscivore populations in the river channel.

Winemiller (1996) and Winemiller et al. (2000) discussed how fish life history attributes influence species assemblage structure in Brazos oxbows, and made inferences about which life history strategies are most likely to benefit from periodic connectivity. Fishes were classified by life history strategy according to the model of life history evolution proposed by Winemiller and Rose (1992). Periodic strategists possess attributes (high fecundity, delayed maturation, iteroparity) that allow them to take advantage of large-scale spatiotemporal variation in resource availability and are characterized by strong year classes when conditions are favorable. Fishes with this strategy (e.g. gizzard shad, threadfin shad, crappie) were more abundant in oxbows, and these species had the strongest positive correlations with hydrology in the river channel. Equilibrium strategists, characterized by delayed maturation, low juvenile mortality and parental care (*Lepomis sp.*) were more abundant in Moehlman Slough where water levels are relatively stable and floods that may disrupt nesting activity are less frequent. Opportunistic species, characterized by small adult size, short generation times, extended breeding seasons, and high reproductive effort tended to be numerically dominant in the river channel and abundant in all habitats. Winemiller et al. (2000) and Zeug et al. (in review) found that these species were more abundant in oxbows that dry out with greater frequency, and during periods of drought when environmental conditions are harsh (low DO, high temperatures).

Multivariate ordinations generally described a gradient of connectivity among oxbow lakes. Oxbows that connect to the active channel more frequently had assemblages that were periodically dominated by species common in the river channel (red shiner, bullhead minnow, longnose gar, river carpsucker) but relatively rare in oxbow lakes during other periods. Hog Island oxbow consistently grouped near the river channel in ordinations based on both habitat characteristics and species CPUE. This oxbow is young (formed in 1996) and remained connected to the river channel at relatively low discharge when other oxbows were isolated, allowing for more frequent exchange of aquatic fauna. Big Bend oxbow connected more frequently than Moehlman Slough, and changes in assemblage structure were pulse like in response to flood events. Korthauer Bottom grouped with Big Bend and Moehlman Slough in seine and gillnet ordinations, however hydrologic analysis conducted by TWDB indicted that the flood dynamics of this oxbow were more similar to Big Bend (Osting et al. 2004). Surveys of this oxbow over longer time periods would likely

reveal assemblage responses similar to those observed in Big Bend. Cut Off Lake and Perry Lake are infrequently connected with the river channel, and colonization of these habitats is probably relatively independent of flood dynamics. Winemiller et al. (2000) found that assemblage structure in a highly isolated oxbow (PAC II) was unlike more frequently connected oxbows.

Patterns of species richness were similarly influenced by the frequency of habitat connectivity. Surveys in the Brazos River yielded 39 species and Hog Island, the most frequently connected oxbow, produced 38 species during only 4 surveys. Species richness in Big Bend and Moehlman Slough was 31 and 27, respectively. Petry et al. (2003) found a similar gradient of species richness in isolated and connected floodplain lagoons in Brazil. The position of Hog Island Oxbow in the Brazos River may have influenced estimates of species richness as several estuarine associated species were captured here that were not collected in more northern oxbows. Several species were captured only in oxbow lakes and other species appeared to be entirely restricted to the river channel (Appendices 1 and 2).

Variation in species relative abundance among oxbows during isolation was associated with a gradient of zooplankton density and conductivity. Crappie were more abundant in Big Bend whereas shad were more abundant in Moehlman Slough. Larvae and juveniles of these species are known to compete for zooplankton resources (Guest et al. 1990), and high abundances of one species may preclude high abundances of the other. Trophic interactions were implicated by Winemiller (1996) in structuring fish assemblages in these oxbows. Conductivity was greater in Hog Island where channel associated species (red shiner, bullhead minnow) were more common. Conductivity can be high in the Brazos during periods of high flow ($>1400 \mu\text{s}$), and Hog Island remained connected to the channel at all but the lowest levels of discharge.

In their survey of ten Brazos River oxbows, Winemiller et al. (2000) found that depth was a significant predictor of assemblage structure in Brazos River oxbows. Shallow oxbows that dry out with greater frequency tend to have more small, colonizing species and would be less likely to function as sources of fish production to the river channel (Zeug et al. in review). The present study was conducted during an unusually wet year which probably otherwise increased the similarity of physicochemical characteristics among oxbow lakes. Depth would be expected to be an important predictor during years when connectivity is low and oxbows exhibit more divergent physicochemical attributes. The influence of physicochemical characteristics on fish assemblage structure in floodplain habitats has been demonstrated in a variety of geographic regions including Brazil (Suarez et al. 2001), California (Feyrer et al. 2004), Canada (Halyk and Balon 1983), Texas (Winemiller et al. 2000), and Venezuela (Rodriguez and Lewis 1997).

Overall, Brazos oxbow fish assemblages were dominated by centrarchids, clupeids and ictalurids. In the Mississippi Basin, Flotemersch and Jackson (2003) found that floodplain habitats were profitable foraging areas for catfish, and Kwak (1988) and Raibley et al. (1997) determined these areas to be important for nest building centrarchids. Blue and channel catfish CPUE was positively correlated with hydrology in Big Bend, and these species may select floodplain habitats during periods of connectivity. Adult and juvenile

centrarchids were relatively rare in the river channel, and emigration from oxbow lakes may augment channel populations and provide dispersal corridors between oxbows. Adult gizzard shad were common in the river channel, however juveniles were primarily captured in oxbows following floods. Oxbows may function as rearing habitats for juvenile fishes that feed on zooplankton, a resource that is more abundant in oxbows (Winemiller et al. 2000). In contrast, the river channel may provide better habitat for larger size classes of species that primarily feed on detritus (Schaus et al. 2002).

The influence of habitat connectivity on fish assemblage structure in Brazos River oxbow lakes contrasts with findings from tropical floodplain systems where distance from the channel (Rodriguez and Lewis 1997; Tejerina-Garro et al. 1998) and type of isolation (Tejerina-Garro et al. 1998) were not significant predictors of assemblage structure. Conceptual models of river-floodplain ecology, such as the Flood Pulse Concept, (Junk et al. 1989) and the Flood Pulse Advantage (Bayley 1991), emphasize predictable flood pulses and optimal rates of water rise and fall that maximize biological productivity. The flood dynamics of the Brazos River are relatively unpredictable (Winemiller 1996) compared to tropical river systems where hydrology is driven by predictable precipitation patterns, or temperate systems influenced by spring snow melt. Less regular patterns of response by aquatic biota to this unpredictability is expected (Puckridge et al. 1998). King et al. (2003) found that fishes did not take advantage of flooding for reproduction in an Australian river with unpredictable dynamics, but that fish reproduced in floodplain and channel habitats during periods of isolation. Humphries et al. (1999) proposed the Low Flow Recruitment Hypothesis for rivers with unpredictable flow regimes. This conceptual model postulates that fish in these systems reproduce during periods of low flow when temperatures are warm and food resources are abundant. The ecology of fishes in the Brazos River system appears more closely related to the Low Flow Recruitment Hypothesis than other conceptual models. Brazos oxbows provide favorable habitat for certain species, such as white crappie, that tend to be uncommon in the river channel. Production of these species and others that exploit oxbows facultatively for reproduction (gizzard shad, smallmouth buffalo) is extremely high in oxbows as evidenced by seine and gillnet biomass CPUE values that were consistently greater than the river channel. Periodic flooding seems to be associated with a net movement of fish biomass from oxbows to the river channel.

Results from this study provide strong evidence of faunal exchanges between oxbow and channel habitats. Nonetheless, the analyses were correlative, and there were no direct observations of fish movements. In situ reproduction, competition and predation also may have influenced patterns of abundance correlation. Direct observation such as mark-recapture or radio telemetry would strengthen inferences based on abundance-hydrology correlations, however these techniques were beyond the scope of the current project and would not be feasible for small minnows. Responses of small fishes captured in seines were more reliably documented than those of large-bodied fishes sampled with gillnets. The greater depth and flow of the river channel may have influenced the ability of gillnets to effectively sample the entire assemblage of large-bodied fish. The short temporal scale of this study may have influenced the number of species that had significant correlations with hydrology. Many of the periodic-type fishes that are expected to benefit most from hydrologic connectivity are long lived, and optimal conditions for juvenile recruitment may

occur rarely. Surveys conducted over multiple years would likely find large pulses of recruitment by different species in years with different environmental conditions. Our study was of relatively short duration, and additional monthly surveys likely would have strengthened some of the fish abundance–hydrology correlations. Nonetheless, abundances of most of the fluvial-adapted species (e.g., *Hybognathus nuchalis*, *Macrhybopsis hystoma*) collected from the lower Brazos River sites were significantly correlated with peak discharge based on 10 months of data. Abundances of other species that were common in the channel (e.g., *Cyprinella lutrensis*, *Pimephales vigilax*) were negatively correlated with peak flows, which suggests they spawn and recruit more effectively under conditions of stable flow. Although these patterns probably are associated with reproductive requirements of both groups of common channel-dwelling species, other influences, such as competition and predation, cannot be ruled out.

Results clearly demonstrate that Brazos River oxbow lakes support diverse fish species, and play a particularly important role in supporting production of species that are relatively uncommon in the river channel, including sport fish (crappie) and forage species (shad) for channel predators (gar, ictalurid catfishes). Fish assemblage structure in both the river channel and oxbow lakes is influenced by habitat characteristics, and oxbows in various stages of geomorphic succession probably are required to maintain overall fish diversity and productivity on the Brazos River landscape. Modification of flow dynamics that yield oxbow formation and succession, or a reduction in floodplain connectivity would be expected to reduce fish productivity and biodiversity at multiple spatial scales. In addition, other beneficial ecosystem processes provided by floodplain habitats, such as moderation of flood height through water retention and nutrient recycling, would be lost if connectivity is reduced or eliminated by flood control structures (levees) or large-scale pumping. Findings from this study illustrate the importance of natural flow regimes for aquatic biota in the Brazos River system and have obvious implications for future water allocations that might have the potential to influence instream flows.

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Appendix 1. Total abundance of all fishes captured in seine surveys across all sites and sample periods.

| Species | BB | MO | BR 21 | HIO | COL | PL | KHB | BR 521 | BR 10 |
|--------------------------------|-----|-------|--------|-----|-----|----|-----|--------|-------|
| Lepisosteidae | | | | | | | | | |
| <i>Lepisosteus oculatus</i> | 12 | 11 | | 5 | | | | | |
| <i>Lepisosteus osseus</i> | 2 | 1 | 10 | | | | | | 2 |
| Clupeidae | | | | | | | | | |
| <i>Brevoortia patronus</i> | | | | 891 | | | | | |
| <i>Dorosoma cepedianum</i> | 734 | 3,583 | 161 | 219 | | | 22 | 1 | |
| <i>Dorosoma petenense</i> | 235 | 3,593 | 93 | 334 | | | 331 | | |
| Engraulidae | | | | | | | | | |
| <i>Anchoa mitchilli</i> | | | | 56 | | | | 1 | |
| Cyprinidae | | | | | | | | | |
| <i>Cyprinella lutrensis</i> | 718 | 1,269 | 30,715 | 536 | | | | | 818 |
| <i>Cyprinella venusta</i> | | 1 | 7 | | | | | | |
| <i>Cyprinus carpio</i> | 1 | 35 | 3 | | | | | | |
| <i>Macrhybopsis hyostoma</i> | | | 24 | | | | | | |
| <i>Hybognathus nuchalis</i> | | | 1 | | | | | | |
| <i>Lythrurus fumeus</i> | | | 1 | | | | | | |
| <i>Macrhybopsis storeriana</i> | | | | 6 | | | | | |
| <i>Notemigonus crysoleucas</i> | 31 | 123 | 1 | | | | | | |
| <i>Notropis buchanani</i> | 30 | 7 | 1,292 | 27 | | | | | 3 |
| <i>Notropis oxyrhynchus</i> | | | 6 | | | | | | |
| <i>Notropis potteri</i> | | | 2 | | | | | | 1 |
| <i>Notropis shumardi</i> | 32 | | 155 | 328 | | | | | 2 |
| <i>Opsopoeodus emiliae</i> | 59 | 28 | 1 | 301 | | | 30 | | |
| <i>Pimephales vigilax</i> | 281 | 129 | 16,468 | 414 | | | | | 159 |
| Catastomidae | | | | | | | | | |
| <i>Carpoides carpio</i> | 9 | | 305 | 6 | | | | | 1 |

| | | | | | | | | | |
|-----------------------------|-------|-------|-----|-----|-----|----|----|----|----|
| <i>Ictiobus bubalus</i> | 19 | 273 | | | | | | | |
| <i>Moxostoma congestum</i> | | | 1 | | | | | | |
| Ictaluridae | | | | | | | | | |
| <i>Ameiurus melas</i> | 42 | 29 | 4 | | | | | | |
| <i>Ameiurus natalis</i> | 3 | | | | | | | | |
| <i>Ictalurus furcatus</i> | 104 | 4 | 2 | 83 | | | | 8 | |
| <i>Ictalurus punctatus</i> | 33 | | 21 | 40 | | | | 47 | |
| <i>Noturus gyrinus</i> | 4 | | | 2 | | | | | |
| <i>Pylodictis olivaris</i> | | | | | | | | | 4 |
| Aphredoderidae | | | | | | | | | |
| <i>Aphredoderus sayanus</i> | 10 | | | 1 | | | | 1 | |
| Fundulidae | | | | | | | | | |
| <i>Fundulus chrysotus</i> | | | | | 15 | | | | |
| <i>Fundulus grandis</i> | | | | | 20 | | | | |
| <i>Fundulus notatus</i> | | | | | | | | 6 | |
| <i>Lucania parva</i> | | | | 1 | | | | | |
| Poeciliidae | | | | | | | | | |
| <i>Gambusia affinis</i> | 4,288 | 6,379 | 626 | 752 | 764 | 10 | 13 | 2 | 14 |
| <i>Poecilia latipinna</i> | | | | 19 | | | | 2 | |
| Mugilidae | | | | | | | | | |
| <i>Mugil cephalus</i> | | | | 6 | | | | 12 | 5 |
| Atherinidae | | | | | | | | | |
| <i>Labidesthes sicculus</i> | | | | | | | 55 | | |
| <i>Menidia beryllina</i> | 223 | | 8 | 26 | | | | 14 | |
| Moronidae | | | | | | | | | |
| <i>Morone chrysops</i> | | | 1 | | | | | | |
| Centrarchidae | | | | | | | | | |

| | | | | | | | | |
|--------------------------------|-------|-----|----|-----|----|----|----|---|
| <i>Elassoma zonatum</i> | | | | | 5 | | | |
| <i>Lepomis cyanellus</i> | 1 | 364 | 3 | 1 | | | | |
| <i>Lepomis gulosus</i> | 155 | 56 | 1 | 31 | 2 | | 1 | |
| <i>Lepomis humilis</i> | 1266 | 806 | | 38 | | | 11 | |
| <i>Lepomis macrochirus</i> | 130 | 729 | 21 | 85 | 17 | 70 | 10 | 1 |
| <i>Lepomis megalotis</i> | 31 | 111 | 47 | 12 | | | 1 | |
| <i>Lepomis symmetricus</i> | | | | | 10 | | | |
| <i>Micropterus punctulatus</i> | 1 | 2 | 7 | 1 | | | | 1 |
| <i>Micropterus salmoides</i> | 4 | 1 | 6 | | | 28 | 2 | |
| <i>Pomoxis annularis</i> | 5,115 | 18 | 4 | 280 | | | 63 | |

Percidae

| | | | | | | | | |
|-------------------------------|----|----|----|--|---|--|--|---|
| <i>Etheostoma chlorosomum</i> | | | | | 1 | | | |
| <i>Etheostoma gracile</i> | 32 | 42 | 3 | | | | | |
| <i>Percina sciera</i> | | | 22 | | | | | 2 |

Carangidae

| | | | | | | | | |
|---------------------|--|--|--|--|--|--|--|---|
| <i>Caranx latus</i> | | | | | | | | 6 |
|---------------------|--|--|--|--|--|--|--|---|

Gerreidae

| | | | | | | | | |
|----------------------------------|--|--|--|--|--|--|--|----|
| <i>Eucinostomus melanopterus</i> | | | | | | | | 10 |
|----------------------------------|--|--|--|--|--|--|--|----|

Sciaenidae

| | | | | | | | | |
|------------------------------|---|--|---|---|--|--|--|---|
| <i>Aplodinotus grunniens</i> | 1 | | 1 | 6 | | | | |
| <i>Leiostomus xanthurus</i> | | | | | | | | 4 |

Eleotridae

| | | | | | | | | |
|-----------------------------|--|--|--|---|--|--|--|---|
| <i>Dormitator maculatus</i> | | | | 4 | | | | 7 |
|-----------------------------|--|--|--|---|--|--|--|---|

Gobiidae

| | | | | | | | | |
|------------------------------|--|--|--|----|--|--|--|---|
| <i>Evorthodus lyricus</i> | | | | | | | | 6 |
| <i>Gobioides broussoneti</i> | | | | 15 | | | | |

Soleidae

| | | |
|----------------------------|---|---|
| <i>Achirus lineatus</i> | | 3 |
| <i>Trinectes maculatus</i> | 6 | |

Appendix 2. Total abundance of all fishes captured in gillnet collections across all sites and survey periods.

| Taxon | BB | MO | BR 21 | HIO | PL | KHB | BR 521 | BR 10 |
|-----------------------------|-----------|-----------|--------------|------------|-----------|------------|---------------|--------------|
| Lepisosteidae | | | | | | | | |
| <i>Atractosteus spatula</i> | 4 | 5 | 1 | | | | | |
| <i>Lepisosteus oculatus</i> | 87 | 218 | 4 | 9 | | 2 | | |
| <i>Lepisosteus osseus</i> | 15 | 12 | 182 | 18 | 1 | 2 | | 8 |
| Elopidae | | | | | | | | |
| <i>Elops saurus</i> | | | | | | | 5 | |
| Clupeidae | | | | | | | | |
| <i>Alosa chrysochloris</i> | | | 1 | | | | | |
| <i>Brevoortia patronus</i> | | | | | | | 4 | |
| <i>Dorosoma cepedianum</i> | 185 | 42 | 20 | 22 | 5 | 3 | | 1 |

Cyprinidae

Cyprinus carpio 39 109 1

Catastomidae

Carpoides carpio 51 12 5 1 1

Ictiobus bubalus 119 199 3 10 1

Ictaluridae

Ameiurus melas 18 329 2

Ameiurus natalis 11 2

Ictalurus furcatus 8 8 6 28

Ictalurus punctatus 50 25 3 2 2

Mugilidae

Mugil cephalus 1 1 1

Moronidae

Morone chrysops 2

Centrarchidae

Lepomis cyanellus 7 1

Lepomis gulosus 5 12

Lepomis macrochirus 4 19 4 2 6

Lepomis megalotis 2 1

Micropterus salmoides 4 3

Pomoxis annularis 52 239 1 13

Sparidae

Archosargus probatocephalus 1

Sciaenidae

Aplodinotus grunniens 8 4 8 1

Appendix 3. *Cross correlations between deviations in species CPUE, monthly mean flow and monthly peak discharge in the Brazos River from June 2003 to September 2004.*

| Brazos River No Lag | | |
|--|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma cepedianum</i> | 0.49 | 0.06 |
| Peak discharge x <i>Dorosoma petenense</i> | 0.47 | 0.08 |
| Peak discharge x <i>Notropis oxyrhynchus</i> | -0.49 | 0.06 |
| Peak discharge x <i>Notropis shumardi</i> | 0.43 | 0.10 |
| Peak discharge x <i>Percina sciera</i> | -0.44 | 0.10 |
| Peak discharge x <i>Pomoxis annularis</i> | 0.43 | 0.10 |
| Flow x <i>Dorosoma cepedianum</i> | 0.54 | 0.04 |
| Flow x <i>Dorosoma petenense</i> | 0.45 | 0.10 |
| Flow x <i>Notropis oxyrhynchus</i> | -0.49 | 0.07 |
| Flow x <i>Notropis shumardi</i> | 0.43 | 0.10 |
| Flow x <i>Percina sciera</i> | -0.49 | 0.06 |
| Flow x <i>Pomoxis annularis</i> | 0.44 | 0.10 |

| Brazos River One Month Lag | | |
|--|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma petenense</i> | 0.58 | 0.02 |
| Peak discharge x <i>Percina sciera</i> | -0.60 | 0.02 |
| Peak discharge x <i>Pimephales vigilax</i> | -0.58 | 0.02 |
| Peak discharge x <i>Pomoxis annularis</i> | 0.67 | 0.01 |
| Flow x <i>Dorosoma petenense</i> | 0.49 | 0.06 |
| Flow x <i>Percina sciera</i> | -0.64 | 0.01 |
| Flow x <i>Pimephales vigilax</i> | -0.47 | 0.08 |
| Flow x <i>Pomoxis annularis</i> | 0.73 | <0.01 |

| Brazos River Two Month Lag | | |
|--|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Cyprinella lutrensis</i> | -0.56 | 0.03 |
| Peak discharge x <i>Cyprinella venusta</i> | 0.52 | 0.05 |
| Peak discharge x <i>Dorosoma petenense</i> | 0.45 | 0.08 |
| Peak discharge x <i>Notropis buchanani</i> | -0.50 | 0.05 |
| Peak discharge x <i>Pimephales vigilax</i> | -0.58 | 0.02 |
| Flow x <i>Cyprinella lutrensis</i> | -0.63 | 0.01 |
| Flow x <i>Cyprinella venusta</i> | 0.56 | 0.03 |
| Flow x <i>Dorosoma petenense</i> | 0.48 | 0.07 |
| Flow x <i>Notropis buchanani</i> | -0.50 | 0.06 |
| Flow x <i>Pimephales vigilax</i> | -0.64 | 0.01 |

Appendix 4. Cross correlations between deviations in species CPUE, monthly mean flow and monthly peak discharge in Big Bend Oxbow from June 2003 to September 2004.

| Big Bend Oxbow No Lag | | |
|--|-------|------|
| Comparison | r | P |
| Peak discharge x <i>Ameiurus melas</i> | -0.43 | 0.10 |
| Peak discharge x <i>Lepisosteus oculatus</i> | 0.53 | 0.03 |
| Peak discharge x <i>Lepomis humilis</i> | -0.45 | 0.08 |
| Peak discharge x <i>Lepomis megalotis</i> | -0.51 | 0.04 |
| Peak discharge x <i>Opsopoeodus emiliae</i> | 0.43 | 0.10 |
| Flow x Richness | 0.41 | 0.10 |
| Flow x <i>Pimephales vigilax</i> | -0.42 | 0.10 |
| Flow x <i>Ameiurus melas</i> | -0.43 | 0.10 |
| Flow x <i>Lepisosteus oculatus</i> | 0.58 | 0.02 |
| Flow x <i>Lepomis humilis</i> | -0.48 | 0.06 |
| Flow x <i>Lepomis megalotis</i> | -0.48 | 0.06 |
| Flow x <i>Opsopoeodus emiliae</i> | 0.51 | 0.04 |

| Big Bend Oxbow One Month Lag | | |
|--|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma cepedianum</i> | 0.39 | 0.10 |
| Peak discharge x <i>Dorosoma petenense</i> | 0.59 | 0.02 |
| Peak discharge x Richness | 0.73 | <0.01 |
| Peak discharge x Seine biomass | -0.47 | 0.06 |
| Peak discharge x <i>Pimephales vigilax</i> | -0.59 | 0.02 |
| Peak discharge x <i>Ictalurus furcatus</i> | 0.42 | 0.10 |
| Peak discharge x <i>Ictalurus punctatus</i> | 0.48 | 0.06 |
| Peak discharge x <i>Lepisosteus oculatus</i> | 0.48 | 0.06 |
| Peak discharge x <i>Opsopoeodus emiliae</i> | 0.41 | 0.10 |
| Flow x <i>Dorosoma petenense</i> | 0.57 | 0.02 |
| Flow x Richness | 0.69 | <0.01 |
| Flow x Seine biomass | -0.44 | 0.08 |
| Flow x <i>Pimephales vigilax</i> | -0.57 | 0.02 |
| Flow x <i>Ictalurus furcatus</i> | 0.45 | 0.08 |
| Flow x <i>Ictalurus punctatus</i> | 0.46 | 0.07 |
| Flow x <i>Lepisosteus oculatus</i> | 0.41 | 0.10 |
| Flow x <i>Opsopoeodus emiliae</i> | 0.40 | 0.10 |

| Big Bend Oxbow Two Month Lag | | |
|---|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma petenense</i> | 0.70 | <0.01 |
| Peak discharge x Richness | 0.67 | <0.01 |
| Peak discharge x Gillnet biomass | -0.47 | 0.07 |
| Peak discharge x Seine biomass | -0.39 | 0.10 |
| Peak discharge x <i>Etheostoma gracile</i> | 0.45 | 0.08 |
| Peak discharge x <i>Ictalurus punctatus</i> | 0.49 | 0.05 |
| Flow x <i>Dorosoma petenense</i> | 0.77 | <0.01 |
| Flow x Richness | 0.74 | <0.01 |
| Flow x Gillnet biomass | -0.51 | 0.04 |
| Flow x <i>Etheostoma gracile</i> | 0.50 | 0.05 |
| Flow x <i>Ictalurus furcatus</i> | 0.43 | 0.09 |
| Flow x <i>Ictalurus punctatus</i> | 0.52 | 0.04 |

Appendix 5. Cross correlations between deviations in species CPUE, monthly mean flow and monthly peak discharge in Moehlman Slough from June 2003 to September 2004.

| Moehlman Slough No Lag | | |
|---|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma cepedianum</i> | -0.44 | 0.08 |
| Peak discharge x <i>Lepomis macrochirus</i> | -0.41 | 0.10 |
| Peak discharge x <i>Pimephales vigilax</i> | 0.50 | 0.05 |
| Peak discharge x <i>Etheostoma gracile</i> | -0.45 | 0.08 |
| Peak discharge x <i>Gambusia affinis</i> | -0.48 | 0.06 |
| Peak discharge x <i>Lepomis cyanellus</i> | -0.56 | 0.02 |
| Flow x <i>Dorosoma cepedianum</i> | -0.57 | 0.02 |
| Flow x <i>Lepomis macrochirus</i> | -0.39 | 0.10 |
| Flow x <i>Pimephales vigilax</i> | 0.54 | 0.03 |
| Flow x <i>Etheostoma gracile</i> | -0.42 | 0.10 |
| Flow x <i>Gambusia affinis</i> | -0.44 | 0.09 |
| Flow x <i>Lepomis cyanellus</i> | -0.62 | 0.01 |
| Flow x <i>Notemigonus crysoleucas</i> | -0.41 | 0.10 |

| Moehlman Slough One Month Lag | | |
|---|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma cepedianum</i> | -0.65 | 0.01 |
| Peak discharge x <i>Pimephales vigilax</i> | 0.66 | 0.01 |
| Peak discharge x Richness | 0.56 | 0.02 |
| Peak discharge x <i>Lepomis cyanellus</i> | -0.53 | 0.04 |
| Peak discharge x <i>Lepomis humilis</i> | 0.62 | 0.01 |
| Peak discharge x <i>Notemigonus crysoleucas</i> | -0.52 | 0.04 |
| Flow x <i>Dorosoma cepedianum</i> | -0.62 | 0.01 |
| Flow x <i>Pimephales vigilax</i> | 0.67 | <0.01 |
| Flow x Richness | 0.51 | 0.04 |
| Flow x <i>Lepomis cyanellus</i> | -0.52 | 0.04 |
| Flow x <i>Lepomis humilis</i> | 0.56 | 0.02 |
| Flow x <i>Notemigonus crysoleucas</i> | -0.54 | 0.03 |

| Moehlman Slough Two Month Lag | | |
|---|----------|----------|
| Comparison | r | P |
| Peak discharge x <i>Dorosoma cepedianum</i> | -0.52 | 0.04 |
| Peak discharge x <i>Pimephales vigilax</i> | 0.55 | 0.03 |
| Peak discharge x Richness | 0.55 | 0.03 |
| Peak discharge x Gillnet biomass | -0.40 | 0.10 |
| Peak discharge x <i>Lepomis cyanellus</i> | -0.51 | 0.04 |
| Peak discharge x <i>Lepomis humilis</i> | 0.47 | 0.07 |
| Peak discharge x <i>Lepomis megalotis</i> | 0.51 | 0.04 |
| Flow x <i>Dorosoma cepedianum</i> | -0.49 | 0.06 |
| Flow x <i>Pimephales vigilax</i> | 0.63 | 0.01 |
| Flow x Richness | 0.57 | 0.02 |
| Flow x Gillnet biomass | -0.39 | 0.10 |
| Flow x <i>Lepomis cyanellus</i> | -0.53 | 0.03 |
| Flow x <i>Lepomis humilis</i> | 0.47 | 0.07 |
| Flow x <i>Lepomis megalotis</i> | 0.57 | 0.02 |

Hydraulic interaction between groundwater, Brazos River and oxbow lakes: evidences from chemical and isotopic compositions, Brazos River Basin, Texas

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ABSTRACT

The Brazos River originates in northwest Texas and flows through outcrops of limestone, alluvium, clay, and sandstone to eventually discharge into the Gulf of Mexico. Numerous oxbow lakes occur along the river that are abandoned stream channels. Some of these oxbow lakes temporarily connect to the main channel during flood events.

The isotopic compositions of deuterium and oxygen of groundwater, river water and lake water show progressive enrichment in the isotope values along a linear evaporation trend line suggesting a common source and continued enrichment during evaporation. Most of the water in the Brazos River is sourced from baseflow from the alluvial aquifer and a small portion may be derived from spring flow in the upstream areas. Chemical and isotopic compositions of the Moelhman Slough and the Korthauer Bottom oxbow lakes suggest that the lake waters originated during high flow of the Brazos River. This observation is consistent with several recorded connections of these oxbow lakes to the Brazos River.

The Horseshoe Lake has experienced extensive evaporation which is supported by enriched deuterium and oxygen isotopic compositions and only one connection to the Brazos River over the past twelve years. Although the lake water chemistry has changed due to biological activity, sulfur, deuterium and oxygen isotope values of the river water near the lake mimic groundwater composition.

INTRODUCTION

The Brazos River originates in northwest Texas and flows through exposed bedrock of Late Cretaceous to Quaternary age to eventually discharge into the Gulf of Mexico (Figure 1). The bedrock formations crop out in bands parallel to the coast and dip towards the Gulf of Mexico. The Cretaceous exposed rock are composed mainly of limestone, marl and shale which do not form any important aquifer in the area. The Tertiary aged rocks mainly consist of shale and clay and sand which contain some of the major aquifers (Cronin and Wilson, 1967). Where the Brazos River crosses these aquifers, the alluvial aquifer is hydraulically connected to them (Ryder, 1996). Numerous oxbow lakes occur along the river that are essentially abandoned stream channels filled with stagnant water. These oxbow lakes were developed due to lateral stream erosion and subsequent changes in the course of the stream. Some of these oxbow lakes can also be connected temporarily to the main channel during flood events.

To better understand hydraulic interaction between the oxbow lakes and the groundwater aquifers, we sampled the waters for chemical and isotopic constituents from (1) three oxbow lakes (Moelhman Slough, Korthauer Bottom, and Horseshoe Lake) along the Brazos River, (2) surface waters from the main channel of the Brazos River near the oxbow lakes, and (3) groundwater from the alluvium aquifer in proximity of the lakes. We evaluated water-level information from the aquifers to establish groundwater flow direction to and from the river. We will show through chemical and isotopic analyses of the groundwater, and waters from the oxbow lakes and the Brazos River that the oxbow lakes (e.g., Moelhman Slough and Korthauer Bottom) largely comprised of the river water that it collected during connections to the main channel. Both Moelhman Slough and Korthauer Bottom have recorded several connections to the Brazos River throughout the historical record which is consistent with their chemical and isotopic compositions. The Horseshoe Lake record indicates only one connection over the last decade and has the most enriched isotopic values.

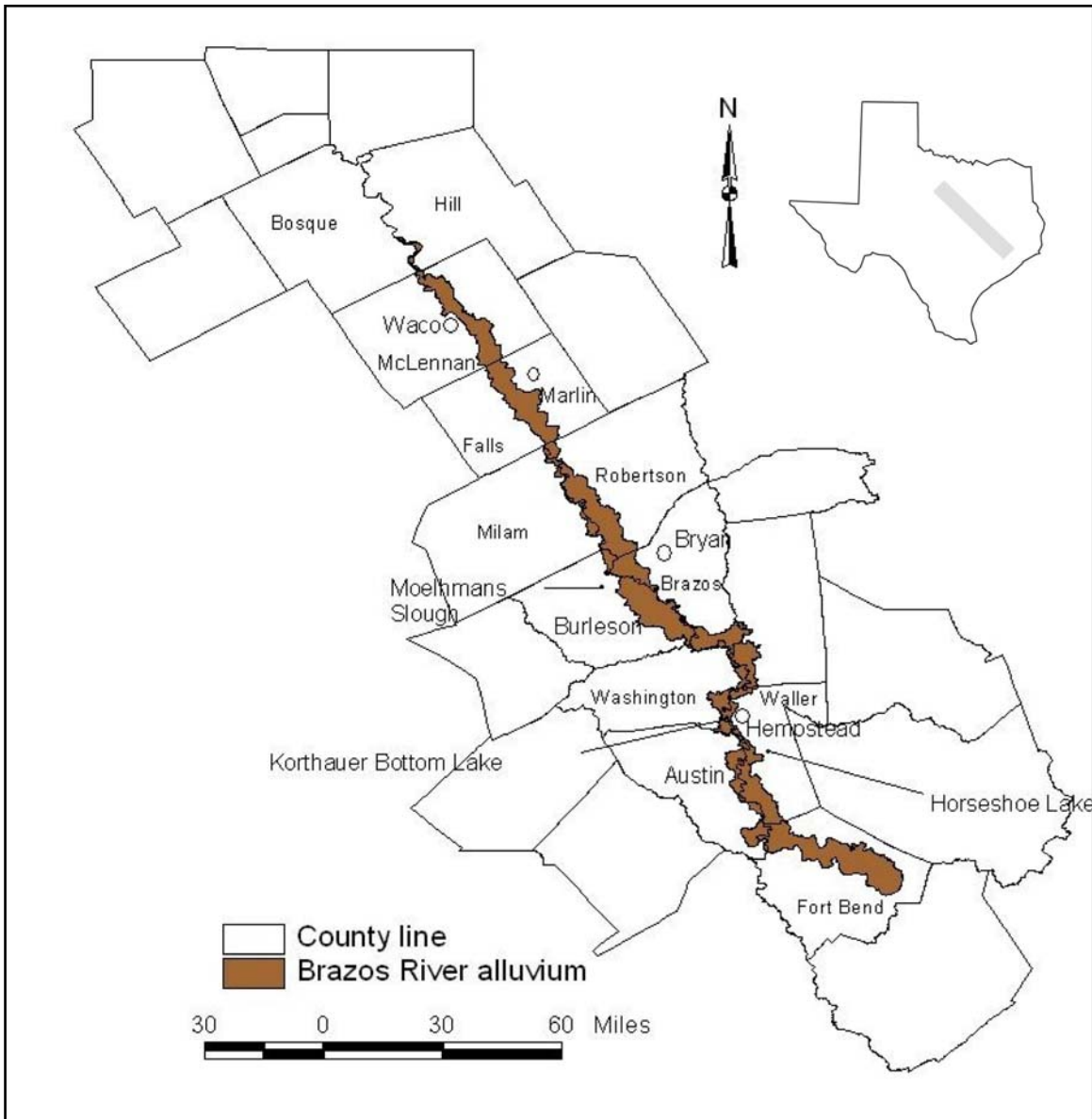


Figure 1. Location and extent of the Brazos River alluvium. General locations of the oxbow lakes are also shown. Open circles indicate major cities along the Brazos River.

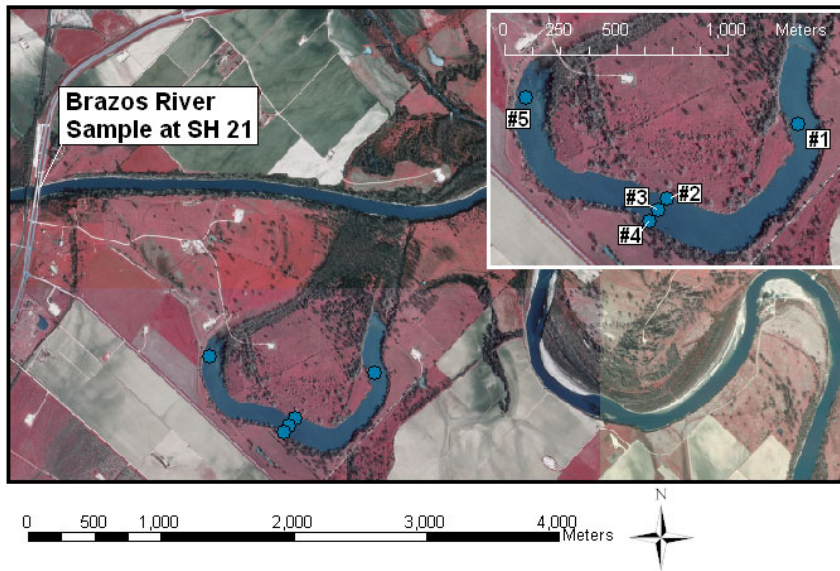
HISTORY OF THE OXBOW LAKES

Moelhman Slough is located about 1.4 miles downstream from the USGS gauge 08108700 near Bryan. It was formed in the 1920's when it was 8 feet deep and presently, it is 4 feet deep when not connected to the Brazos River (Figure 2). During flood events significant quantities of water may not reach the slough until the water in the Brazos River has begun flowing through the flow channel. A review of the historical hydrographs of the Brazos River from 1936 to 2001 suggests that during a wet year up to 9 connections or flooding may have occurred in the area.

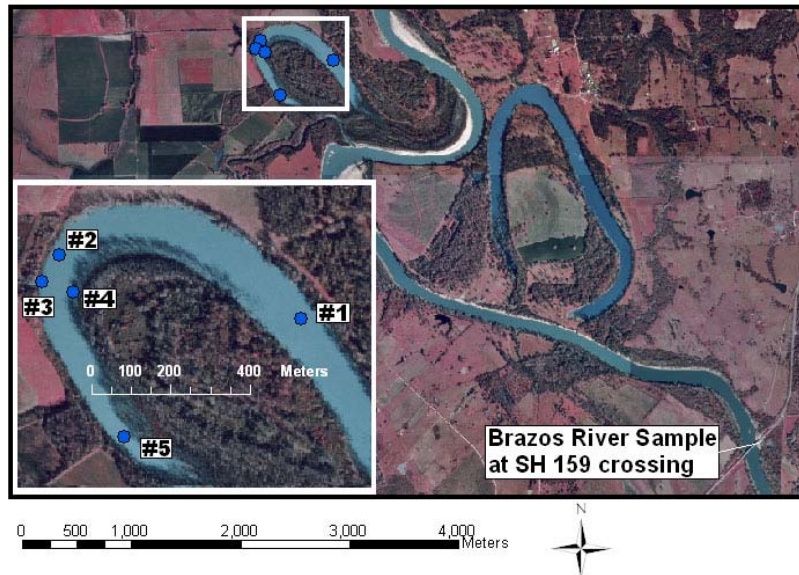
Korthauer Bottom is located about 10.5 miles downstream of USGS gauge 08111500 on the Brazos River near Hempstead, Texas. (Figure 2) The majority of the connections occur in the spring. Between 1994 to 2003, the average duration of connection was 8 days and the longest period without any connection lasted more than 1.5 years.

Horseshoe Lake is located at about 15.8 river miles downstream of USGS gauge 08111500 on the Brazos River near Hempstead (Figure 2) The lake is located on a plateau and rarely connects to the Brazos River.

(a)



(b)

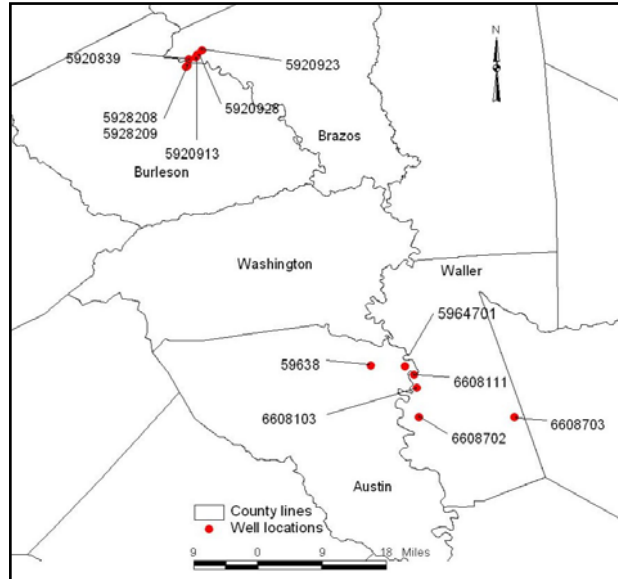


(c)



Figure 2. Map showing the geometry of the oxbow lakes, proximity to the Brazos River and sampling location sites (a) Moelhman's Slough, (b) Korthauer Bottom, and (c) Horseshoe Lake.

(a)



(b)

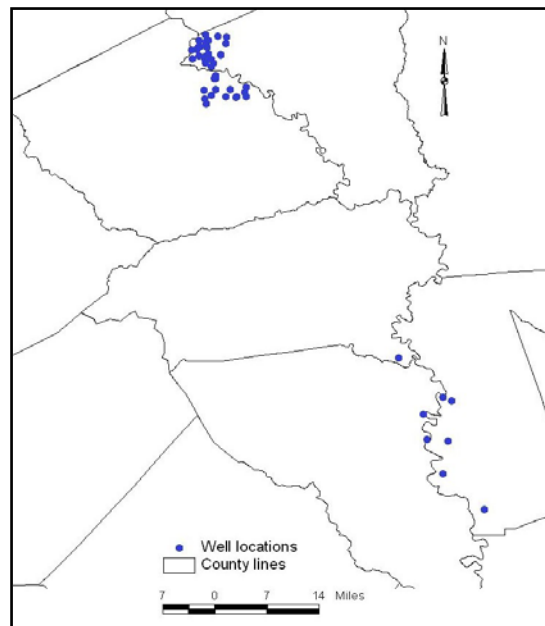


Figure 3. Well locations for the samples analyzed for (a) isotopes, and (b) general chemistry.

HYDROGEOLOGIC SETTING

The Brazos River alluvium hosts large quantities of water along the river between northern McLennan and central Fort Bend Counties, Texas (Figure 1). The flood-plain alluvium consists predominantly of gravel and fine to coarse sand, with lesser amounts of

clay and silt. Generally, fine-grained sediments occur at the top with coarser-grained sediments occurring at the base of the unit. Maximum thickness of the alluvium is about 100 feet with an average thickness of about 45 feet (Ryder, 1996). Groundwater from the alluvial aquifer is primarily used for irrigation.

The alluvial deposits are of Quaternary age and are underlain by rocks that range in age from Late Cretaceous to Quaternary. The underlying rocks dip toward the Gulf of Mexico and contain several major aquifers that crop out in bands parallel to the coast.

Recharge to the alluvial aquifer is mainly from precipitation that falls directly on the flood plain and alluvial terraces; estimates of recharge range from 2 to 5 inches per year (Cronin and Wilson, 1967).

WATER LEVELS

The groundwater levels in the alluvium generally lie above the water surface in the river and water from the aquifer discharges into the river as baseflow under normal hydrologic conditions. However, during high-water stages in the river, water from the river infiltrates the aquifer and the gradient is temporarily reversed locally over small areas adjacent to the stream. Locally, lowering of the artesian pressure of the Carrizo-Wilcox and Queen City-Sparta sand causes a downward flow of the groundwater from the alluvium (Cronin and Wilson, 1967). The water table in the alluvium ranges from less than 10 to nearly 50 feet below land surface. The water table slopes toward the river, and seepage from the Brazos River alluvium contributes to stream baseflow (Figure 4) (Cronin and Wilson, 1967). Cronin and Wilson (1967) estimated that baseflow was 46 cfs or about 0.38 cfs per mile between Waco and Bryan. Similarly, the baseflow was about 46 cfs or 0.55 cfs per mile between Marlin and Bryan.

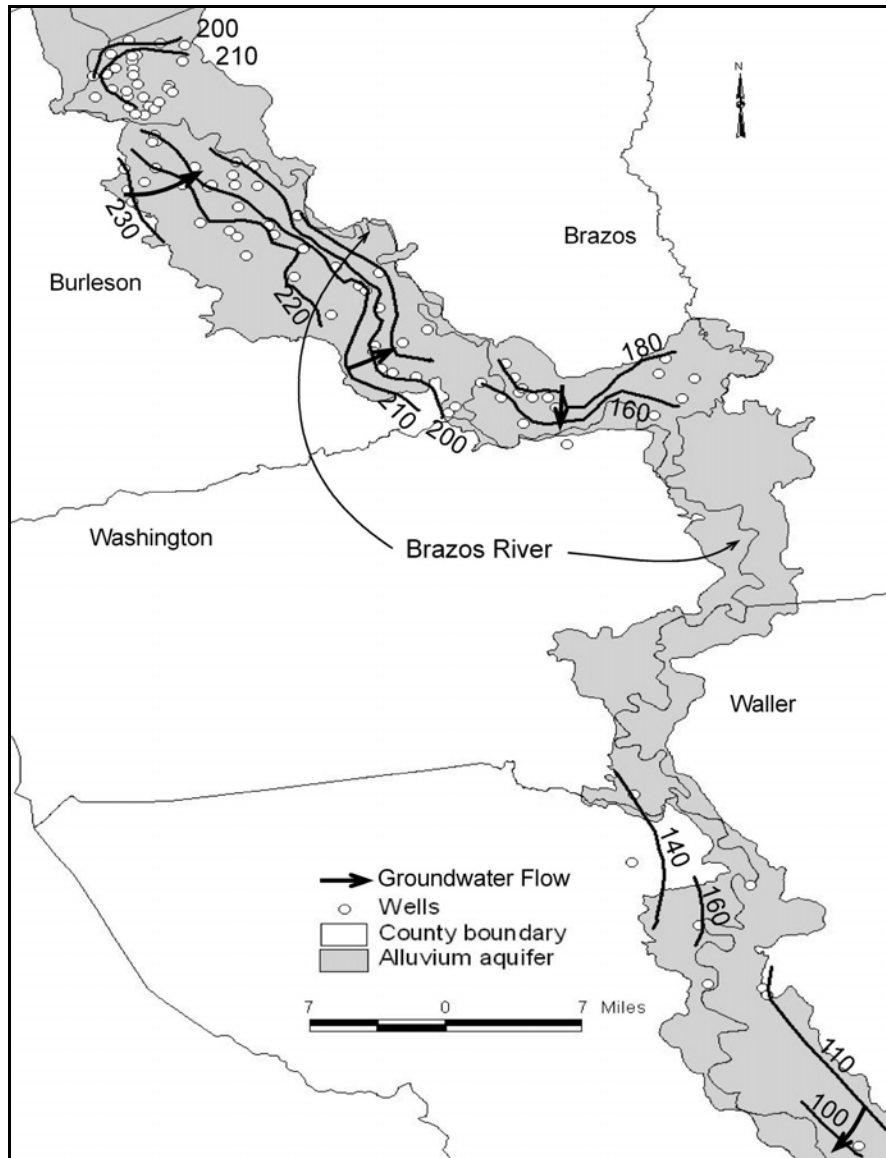


Figure 4. Water-level elevation map of the Brazos River alluvial aquifer. Water-level contours are in feet and includes water-level measurements from 1960 to 2000. Groundwater flow is mainly towards the river as indicated by arrows. Open circles indicate well control points.

METHODS

The three lakes that we sampled are: (1) Moelhman Slough, (2) Korthauer Bottom, and (3) Horseshoe Lake (Figure 2). Three water samples were collected from the central portion of each lake for general chemistry, $\delta^2\text{H}$, $\delta^{18}\text{O}$, and $\delta^{34}\text{S}$ isotopes. Of the three samples, two were collected near shore from the opposite banks of the lake, and the other was collected from the middle, deeper portion of the lake. One sample each from the northern and the southern ends of the lakes were also collected for general chemistry, $\delta^2\text{H}$

, $\delta^{18}\text{O}$, and $\delta^{34}\text{S}$ isotopes. Twelve groundwater samples were collected from areas near the lakes for general chemistry, $\delta^2\text{H}$, $\delta^{18}\text{O}$, and $\delta^{34}\text{S}$ isotopes. While it was much desired that the selected wells be located close to the oxbow lakes, we were unable to get many wells immediately adjacent to the oxbow lakes (Figure 3).

All groundwater and surface water samples were analyzed by Ion Chromatography-Mass Spectrometry (ICP-MS) for chemical parameters at the Lower Colorado River Authority's (LCRA) Environmental Laboratory. Analyses for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ were carried out at the Coastal Sciences laboratory in Austin. Isotopes for $\delta^{18}\text{O}$ was analyzed on a VG Micromass SIRA Series II mass spectrometer using the CO_2 equilibration method (Epstein and Mayeda, 1953). Sulfur 34 was analyzed by extracting SO_2 from the settled BaSO_4 using a mass spectrometer VG Model 10, Series II.

RESULTS

WATER CHEMISTRY

Groundwater compositions in the alluvium are mainly composed of Ca-Mg-Na- HCO_3 type with more Na-rich samples occurring in the Moellman's Slough area (Figure 5, Table 1). A Na vs. Cl plot of the samples indicates a deficiency in Na with respect to Cl ions in some of the groundwater assuming that both ions were derived from dissolution of halite (Figure 6). Na/Cl mole ratios of some of the waters are more than 1 suggesting sources of Na other than halite dissolution. If cation exchanges were mainly responsible for the Na-enrichment then excess Na (Na-Cl) and excess Ca and Mg ($\text{Ca}+\text{Mg}-1/2\text{HCO}_3-1/2\text{SO}_4$) should plot along a line at 2:1 ratio. However, we observe that they do not plot at 2:1 ratio suggesting that weathering reactions are probably more dominant than cation exchange reactions (Figure 6). A Ca+Mg vs. HCO_3 plot indicates that most of the Ca is probably derived from dissolution of carbonate minerals in the aquifer. A Ca vs. SO_4 plot indicates that Ca is considerably more depleted than SO_4 (Figure 6).

Surface water from the oxbow lakes are mainly Ca-Mg- HCO_3 type while the Brazos River samples are more Na-Ca- HCO_3 -Cl type (Figure 7, Table 2). Na-Cl enrichment in the river water probably indicates that in addition to baseflow from the alluvium, the river water receives additional Na-Cl input from upstream areas where the river flows through outcrops of the Permian evaporites. Several springs that arise in the Llano escarpment area in the upstream also provide saline water to the Brazos River.

Water compositions within the lakes are largely uniform suggesting an absence of stratification. Water compositions of the Horseshoe Lake are considerably different from the Moellman's Slough and the Korthauer Bottom, and that of the groundwater. No sulfate or chloride is present in this lake water. The nearby river sample has much higher concentrations of chloride and sulfate. Horseshoe Lake has dense growths of aquatic vegetation, Eurasian watermilfoil (*Myriophyllum spicatum*), and the water in the lake is very clear. Profuse growth of Eurasian watermilfoil in the lake probably results in uptake of some of the Ca, Cl, and SO_4 resulting in their reduced concentrations in the water.

In order to explore any relationship that might exist between different chemical parameters, we plotted Na vs. Cl, HCO₃ vs. Ca+Mg, and Ca vs. SO₄ of the lake and the river waters (Figure 8). We observed a progressive decrease in the concentrations of Ca+Mg and HCO₃ content of the lake waters from Moelhman Slough, Korthauer Bottom, and Horseshoe Lake (Table 2, Figure 8) which is probably attributed to local biological activity in the lake and varying composition of upstream inflow. Na and Cl in the lake and the river waters plot on the 1:1 line suggesting a strong influence of halite dissolution in these waters. Ca and SO₄ plot show a lower concentration in sulfate in all the lake waters unlike the river water or the groundwater.

Table 1. Chemical composition of the groundwater analyzed for isotopes.

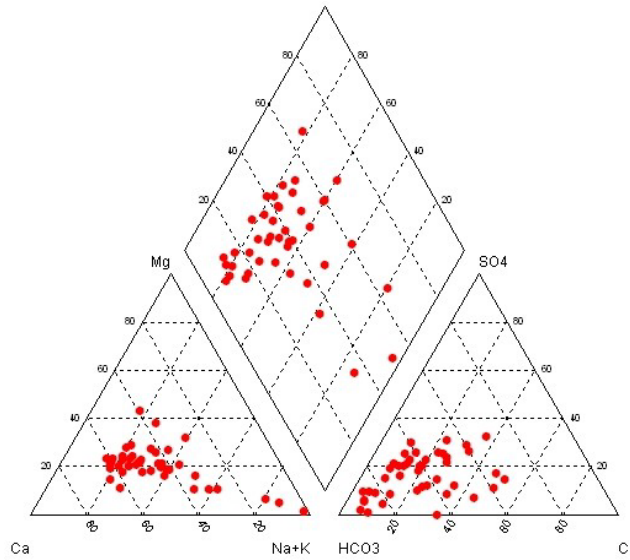
| Well Number | Chemical Composition (mg/l) | | | | | | | | | | | | | | |
|-------------|-----------------------------|------|------|------|------|------|-----------------|------------------|-----------------|------|------|-----------------|------|------|--|
| | Si | Ca | Mg | Na | K | Sr | CO ₃ | HCO ₃ | SO ₄ | Cl | F | NO ₃ | pH | TDS | |
| 5928208 | 13.9 | 38.7 | 9.73 | 240 | 5.99 | 1.09 | 0 | 197.69 | 374 | 104 | 0.12 | 0.14 | 7.87 | 885 | |
| 5943103 | 17 | 10.5 | 1.1 | 405 | 3.54 | 0.2 | 4.32 | 370.74 | 294 | 191 | 1.29 | 0.09 | 8.26 | 1110 | |
| 5963802 | 33.2 | 86.2 | 6.9 | 39.9 | 1.84 | 0.23 | 0 | 295.32 | 11.8 | 54.1 | 0.27 | 1.79 | 7.17 | 381 | |
| 6608111 | 23.6 | 46.3 | 13 | 48.8 | 3.12 | 1.03 | 0 | 236.74 | 6.81 | 61.4 | 0.45 | 0.09 | 7.57 | 321 | |
| 6608702 | 30.7 | 98.8 | 12.7 | 58.5 | 1.38 | 0.46 | 0 | 307.52 | 35.4 | 93.7 | 0.31 | 9.74 | 7.09 | 493 | |
| 6608804 | 28.3 | 53.7 | 9.04 | 49.2 | 2.24 | 0.66 | 0 | 226.98 | 16 | 57 | 0.34 | 0.09 | 7.52 | 328 | |
| 5920839 | 25.4 | 236 | 47.9 | 78.9 | 2.98 | 2 | 0 | 687.05 | 235 | 97.9 | 0.63 | 2.75 | 6.73 | 1067 | |
| 5920913 | 22.2 | 282 | 61.7 | 145 | 4.47 | 1.96 | 0 | 715.12 | 376 | 205 | 0.23 | 4.41 | 6.72 | 1455 | |
| 5920928 | 20.2 | 243 | 53.6 | 249 | 3.24 | 1.48 | 0 | 513.76 | 415 | 348 | 0.15 | 21.1 | 6.74 | 1607 | |
| 5920923 | 18.4 | 101 | 13.5 | 36.9 | 1.1 | 0.51 | 0 | 303.86 | 42 | 66.2 | 0.16 | 8.1 | 7.04 | 437 | |

Table 2. Chemical composition of the surface water from the oxbow lakes and the Brazos River.

| Site locations | Sample Number | Chemical Composition (in mg/l) | | | | | | |
|----------------------------------|---------------|--------------------------------|------|------|------|-----|------|-------------------------|
| | | Ca | Mg | K | Na | Cl | SO4 | ¹ Alkalinity |
| Horseshoe Lake | H-1 | 16.1 | 1.82 | 1.51 | 1.63 | 0 | 0 | 36 |
| Horseshoe Lake | H-2 | 16.5 | 1.86 | 4.25 | 1.49 | 0 | 0 | 32 |
| Horseshoe Lake | H-3 | 21.3 | 2.32 | 5.14 | 1.45 | 0 | 0 | 38 |
| Horseshoe Lake | H-4 | 10.9 | 0.92 | 2.9 | 1.67 | 0 | 0 | 8 |
| Horseshoe Lake | H-5 | 7.62 | 1.49 | 4.5 | 1.61 | 0 | 0 | 6 |
| Brazos River at Horseshoe Lake | BR-HL-6 | 69.6 | 12.5 | 4.71 | 40.6 | 61 | 36.8 | 174 |
| Moelhmans Slough | M2 | 43.3 | 6.83 | 8.44 | 13.6 | 15 | 6.23 | 140 |
| Moelhmans Slough | M6 | 46.4 | 6.99 | 8.33 | 13.6 | 15 | 5.99 | 148 |
| Moelhmans Slough | M10 | 46.1 | 6.89 | 8.26 | 13.5 | 15 | 5.86 | 149 |
| Moelhmans Slough | M14 | 46.5 | 6.96 | 8.31 | 13.6 | 15 | 5.86 | 149 |
| Moelhmans Slough | M18 | 44.8 | 7 | 8.42 | 13.1 | 16 | 6.3 | 141 |
| Brazos River at Moelhmans Slough | BR-M22 | 59.8 | 20.6 | 5.87 | 153 | 209 | 108 | 141 |
| Korthauer bottom | KB02 | 42.4 | 6.71 | 6.2 | 16.7 | 19 | 4.82 | 137 |
| Korthauer bottom | KB06 | 41 | 6.65 | 6.02 | 16.2 | 19 | 4.68 | 135 |
| Korthauer bottom | KB10 | 41.8 | 6.84 | 6.08 | 16.5 | 19 | 4.69 | 135 |
| Korthauer bottom | KB14 | 42.3 | 6.85 | 6.22 | 16.6 | 19 | 4.79 | 135 |
| Korthauer bottom | KB18 | 42.4 | 6.88 | 6.07 | 16.3 | 19 | 4.81 | 136 |
| Brazos River at Korthauer Bottom | BR-KB22 | 66.6 | 17.6 | 5.87 | 104 | 131 | 75.3 | 172 |

1 Alkalinity as bicarbonate (CaCO₃)

(a)



(b)

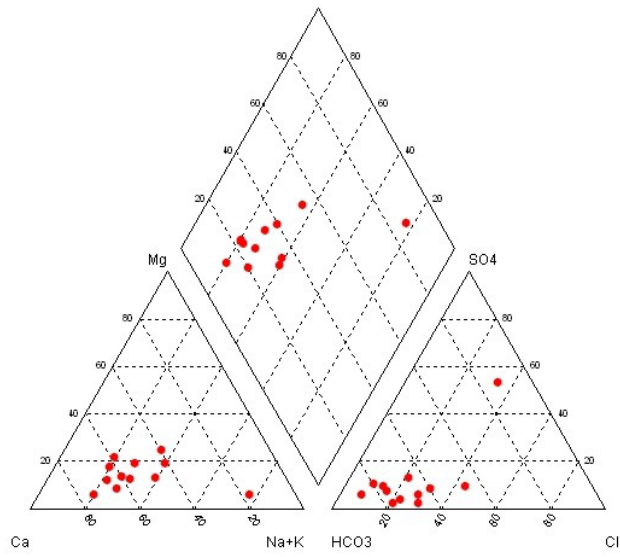
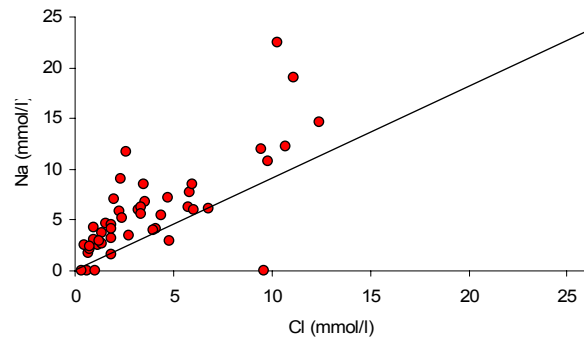
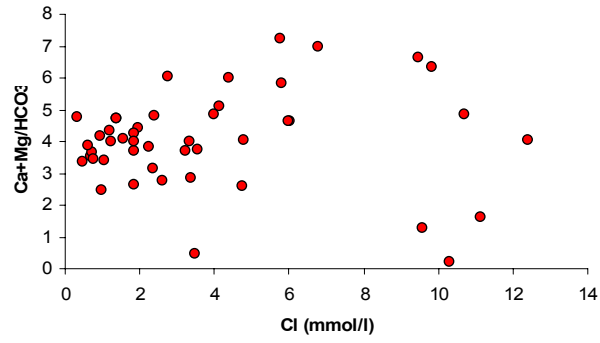


Figure 5: Piper plot of the groundwater from the Brazos River alluvium near (a) Moelhman Slough, (b) Korthauer Bottom.

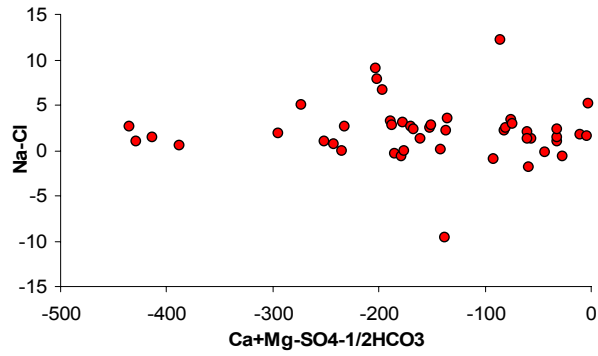
(a)



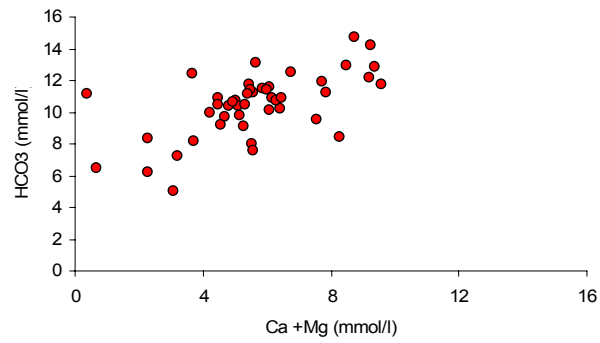
(b)



(c)



(d)



(e)

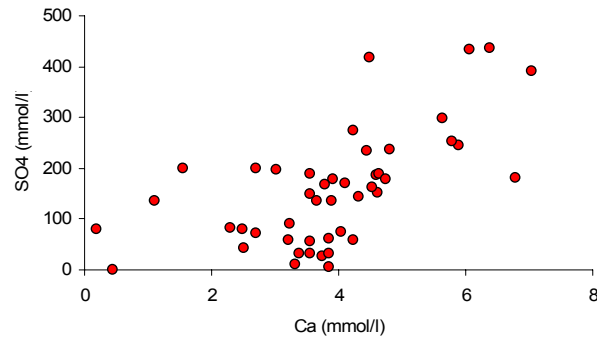


Figure 6. Plots of (a) Na vs. Cl, (b) Ca+Mg/HCO₃ vs. Cl, (c) Na-Cl vs. Ca+Mg-1/2HCO₃-SO₄ (d) Ca+Mg vs. HCO₃, and (e) Ca vs. SO₄ for typical groundwater samples from the Brazos River alluvial aquifer near Moelhman's Slough.

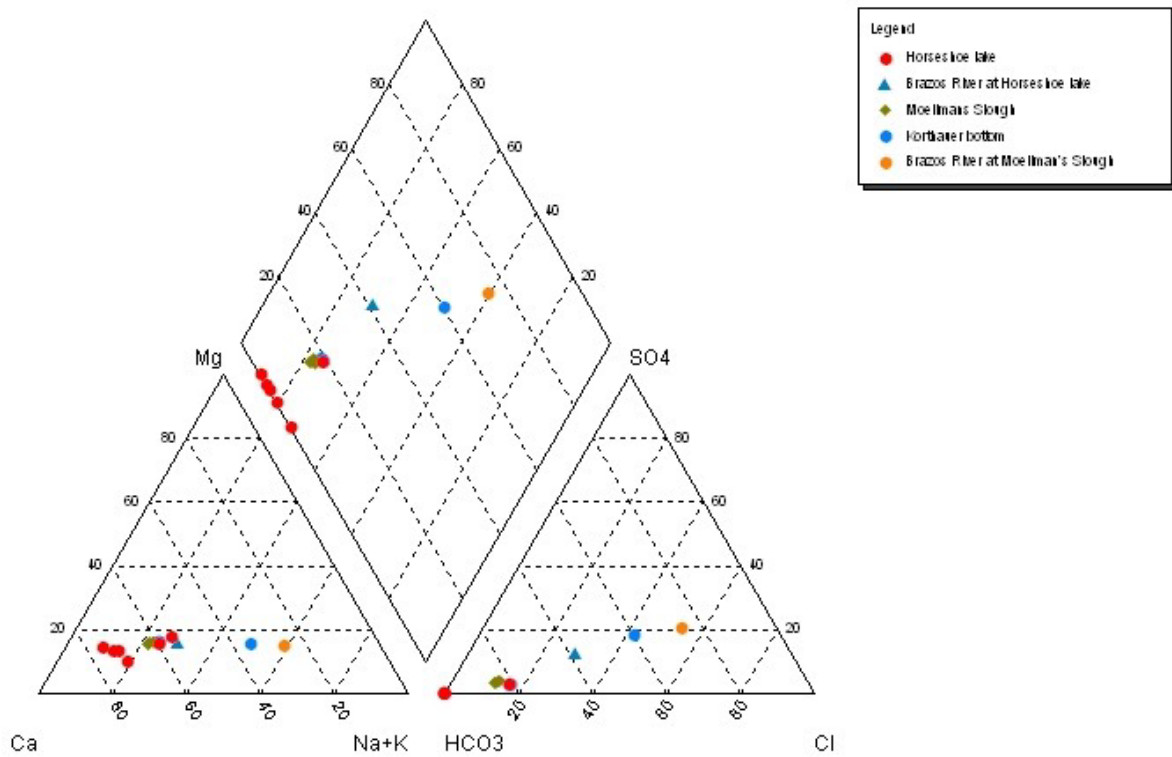
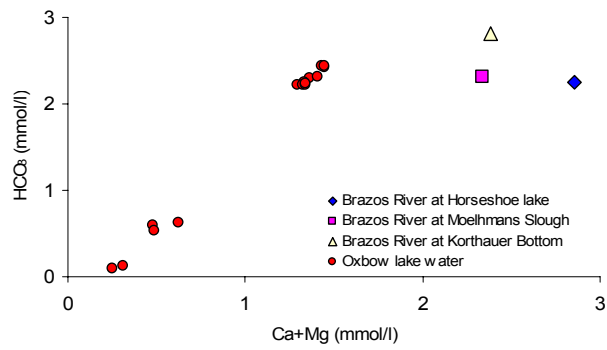
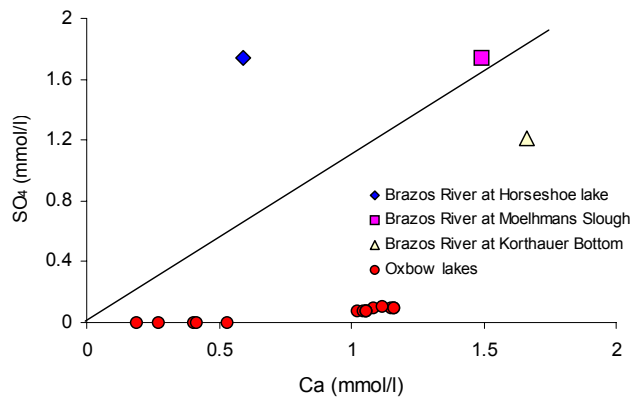
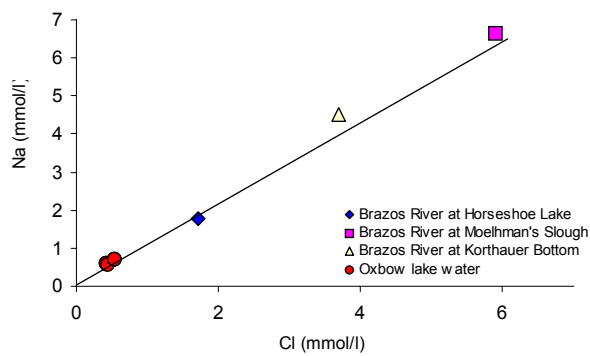


Figure 7. Piper plot of the surface water samples from the oxbow lakes and the Brazos River.

(a)



(b)



(c)

Figure 8: Plots of (a) HCO_3^- vs. Ca, (b) Na vs. Cl, and (c) SO_4 vs. Ca for waters from the oxbow lakes and the Brazos River. The line is 1:1 line representing equal concentration of elements plotted. No 1:1 line is shown for plot (a) as dissolution of carbonate minerals occur at 2HCO_3^- to 1 Ca ratio.

ISOTOPIC COMPOSITIONS

Isotopes of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ behave predictably during their hydrologic evolution from evaporation, rainout, re-evaporation, snow and ice accumulation, melting and runoff. As they partition into different fresh water reservoirs, relationship of the isotopes through the various phases of the hydrologic cycle are reflected in the global meteoric water line (GMWL) (Craig, 1961). The Global Meteoric Water Line is an average of the numerous local and regional meteoric water line as defined by the equation: $\delta^2\text{H} = 8\delta^{18}\text{O} + 10 \text{‰}$ SMOW (Craig, 1961). Thus, how isotope values in an area are positioned with respect to the GMWL reflects the nature of the isotopic evolution of the waters.

Changes in precipitation and temperature affect changes in the climate. Temperate climates have undergone rapid changes in temperature since late Pleistocene times (Clark and Fritz, 1997). A good correlation exists between isotopes in the rainfall and isotopes in the groundwater making it a useful tool for assessing climate change when investigating fossil or paleogroundwaters. A shift in the isotopic signatures, isotope values plotting along or below the GMWL, may indicate the existence of a pluvial (humid) climate during recharge of the paleogroundwater. Isotopic partition that results in depleted isotopic waters in cold regions and enriched waters in warm regions lead to its use as a tool in recharge and groundwater provenance studies (Craig, 1961; Clark and Fritz, 1997). Water also becomes progressively enriched with $\delta^2\text{H}$ and $\delta^{18}\text{O}$ during evaporation as would be expected in a closed basin (Gonfiantini, 1986). With continued evaporation, the isotope values are shifted towards more positive values depending on the mean residence time of the water in the basin and the degree of evaporation.

Results of the $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotope analyses indicate that each group of water samples have distinct isotopic compositions (Table 3). For example, the oxbow lake waters are more enriched in ^2H and ^{18}O with $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values ranging from -3 to $+9 \text{‰}$, $+1.6$ to $+4.7 \text{‰}$ SMOW, respectively. Brazos River waters have $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values ranging from -11 to -29‰ , -0.2 to -3‰ SMOW, respectively. Groundwater have the most depleted isotopes with $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values ranging from -29 to $+34 \text{‰}$, -4.5 to -5.2‰ , respectively (Table 3). A cross-plot of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ show that most of the isotope values fall below the Global Meteoric Water Line and along a linear evaporated trend line (Figure 9). The groundwater samples closely resemble the weighted mean $\delta^{18}\text{O}$ values of -4‰ SMOW present in the rainwater for central Texas (Barry and Chorley, 1987) which suggests that the rainwater rapidly infiltrated through the alluvium into the groundwater. The infiltrating rainwater was not mixed with another source water that could be derived from discharges from other aquifers beneath the alluvium. The Brazos River samples are more enriched in isotopic values than the groundwater samples indicating that they have undergone some evaporation along with some mixing with upstream waters. However, their general similarities in $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotopes and their position in the initial part of the evaporated line suggest that most of the river waters were derived from groundwater baseflow. This observation is consistent with the water-level map (Figure 4) that shows a strong hydraulic gradient towards the river suggesting that baseflow could contribute significant amount of water to the river.

Of the three oxbow lakes, the most enriched $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values were observed in the Horseshoe Lake. The lake water has enriched isotope values compared to the groundwater in the alluvium aquifer and the nearby Brazos River (Table 3). These enriched isotopic values may suggest that the waters in this lake have not been connected, even temporarily to the Brazos River for a long span of time, allowing continued evaporation of this ponded water. This interpretation is consistent with the observation that the lake has not been connected to the river for the last 10 or more years. Isotopic compositions of the Brazos River sample near Horseshoe Lake are very similar to the groundwater compositions (Figure 8) suggesting that this river sample has undergone the least evaporation compared to the other two river samples.

Table 3. Isotopic compositions of the waters from the oxbow lakes, Brazos River, and the groundwater from the study area.

| Site | Sample Number | Sampling location | $\delta^2\text{H} \text{‰}$ (SMOW) | $\delta^{18}\text{O} \text{‰}$ (SMOW) | $\delta^{34}\text{S} \text{‰}$ (SMOW) | SO_4 (mg/l) |
|----------------------|---------------|---|---------------------------------------|--|--|-------------------------|
| Moelhman's Slough | M17 | northern end of the lake | 2 | 2.4 | 1.65 | 6.3 |
| Moelhman's Slough | M1 | southern end of the lake | -2 | 2.1 | 1.7 | 6.23 |
| Moelhman's Slough | M5 | middle of the lake- east shore | -1 | 2.1 | 2.2 | 5.99 |
| Moelhman's Slough | M9 | middle of the lake - lake center, deeper pool | -2 | 1.8 | 2.5 | 5.86 |
| Moelhman's Slough | M13 | middle of the lake - west shore | -3 | 1.7 | 0.8 | 5.86 |
| Brazos River | | | | | | |
| at Moelhman's Slough | BR-MS-M21 | Near Highway SH21 crossing | -11 | -0.2 | 6.7 | 108 |
| Korthauer bottom | KB01 | northern end of the lake | -1 | 2 | 5 | 4.82 |
| Korthauer bottom | KB5 | middle of the lake - lake center, deeper pool | -3 | 1.7 | 3.6 | 4.68 |
| Korthauer bottom | KB9 | middle of the lake - west shore | -2 | 1.8 | 4 | 4.69 |
| Korthauer bottom | KB13 | middle of the lake - east shore | -3 | 1.6 | 3.8 | 4.79 |
| Korthauer bottom | KB17 | southern end of the lake | -2 | 2 | 4.1 | 4.81 |
| Brazos River | | | | | | |
| at Korthauer bottom | BR-KB-21 | | -17 | -1.9 | 6.5 | 75.3 |
| Horseshoe Lake | H-1-5 | southern end of the lake | 10 | 4.7 | 0 | 0 |
| Horseshoe Lake | H-2-5 | middle of the lake - west shore | 0 | 3.5 | 0 | 0 |
| Horseshoe Lake | H-3-5 | middle of the lake - lake center, deeper pool | 0.5 | 3.5 | 0 | 0 |
| Horseshoe Lake | H-4-5 | middle of the lake - east shore | 9 | 4.7 | 0 | 0 |
| Horseshoe Lake | H-5-5 | northern end of the lake | 4 | 4.2 | 0 | 0 |
| Brazos River | | | | | | |
| at Horseshoe Lake | BR-H6 | Near Highway SH 159 crossing | -29 | -3 | 2.2 | 36.8 |
| Groundwater | 59-20-913 | | -31 | -4.5 | -0.8 | 376 |
| Groundwater | 66-08-702 | | -30 | -4.6 | -3.9 | 35.4 |
| Groundwater | 66-08-703 | | -32 | -4.8 | 6.2 | 35 |
| Groundwater | 66-08-111 | | -31 | -4.8 | 8.8 | 6.81 |
| Groundwater | 59-63-8A | | -30 | -4.6 | 8.4 | |
| Groundwater | 59-20-928 | | -33 | -4.6 | 3.4 | 415 |
| Groundwater | 59-20-839 | | -32 | -4.7 | -3 | 235 |
| Groundwater | 59-20-923 | | -33 | -4.7 | 2.1 | 42 |
| Groundwater | 59-28-209 | | -34 | -5.2 | -2.3 | 14 |
| Groundwater | 59-28-208 | | -33 | -5.2 | -2 | 374 |
| Groundwater | 66-08-103 | | -31 | -4.8 | 9.8 | 35 |
| Groundwater | 59-64-701 | | -30 | -4.9 | 8.8 | |

All isotope values are reported in parts per thousand, SMOW refers to standard mean ocean water, CDT refers to Canyon Diablo Troilite

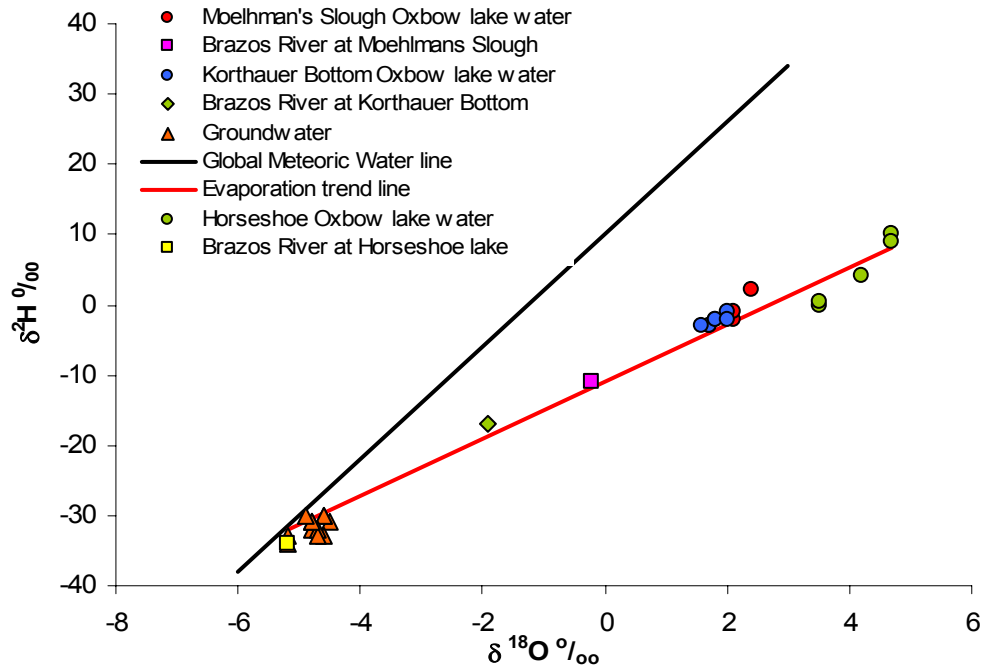


Figure 9. Plot of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of the oxbow lake water, river water and the groundwater from the study area. Note that all values plot along an evaporation trend line.

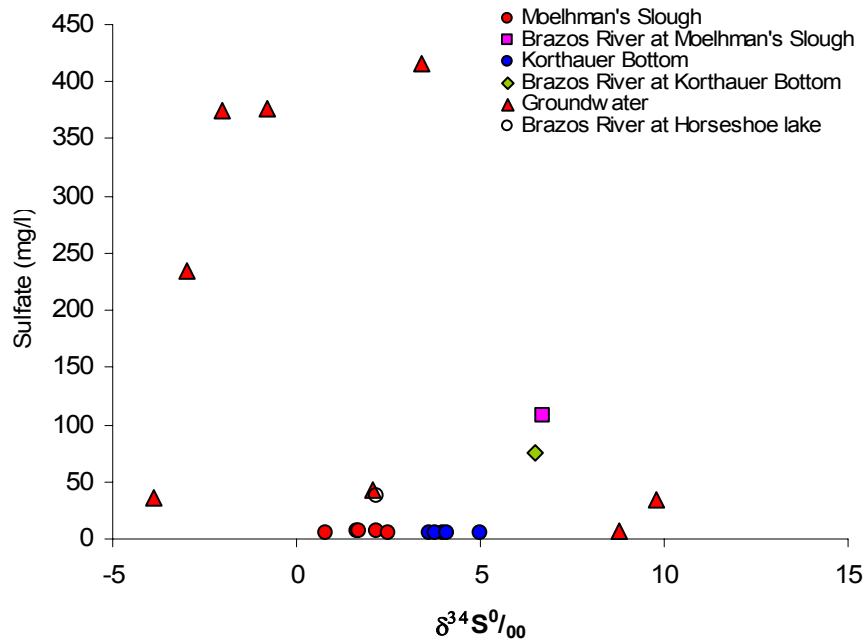


Figure 10. Relationship between ^{34}S isotope values and sulfate concentrations in the waters from the oxbow lakes, Brazos River, and the groundwater from the study area.

SULFUR ISOTOPES

Sulfur in the subsurface can occur in the form of sulfate and sulfide minerals, dissolved sulfate, dissolved sulfide, and hydrogen sulfide gas. Sulfur from these sources participate in the geochemical evolution of groundwater and contribute to groundwater salinity. $\delta^{34}\text{S}$ is generally fractionated between sulfur compounds due to biological cycling. Values exceeding $+20\text{‰}$ CDT are found in association with evaporites and limestones. Permian CaSO_4 can have $\delta^{34}\text{S}$ values in the range of 11 to 23 ‰ CDT. Negative $\delta^{34}\text{S}$ values are formed under diagenetic conditions where reduced sulfur compounds are formed. The dissolution of gypsum or anhydrite occurs without measurable isotopic fractionation and therefore, isotopic compositions of SO_4 can be used as a tracer of the sulfate origin (Clark and Fritz, 1997). The $\delta^{34}\text{S}_{\text{SO}_4}$ values of the modern seawater have a composition of 21 ‰ CDT.

We sampled waters from the oxbow lakes, Brazos River, and the groundwater for $\delta^{34}\text{S}$ isotopes (Table 3, Figure 10). We found that the $\delta^{34}\text{S}$ values in the oxbow lakes range from 0.8 to 5 ‰, in the Brazos River range from 2.2 to 6.7 ‰, and in the groundwater range from -0.8 to 9.8 ‰. $\delta^{34}\text{S}$ isotope values from the oxbow lakes are similar to the Brazos River which suggest a common source and the range of values suggest that the sulfates in the lake waters are derived from dissolution of evaporite. A larger spread in $\delta^{34}\text{S}$ values in the groundwater samples suggest that the sulfates in the groundwater were partly derived from bacterial reduction of sulfates to sulfides and dissolution of evaporites. The Brazos River sample near Horseshoe Lake has a similar $\delta^{34}\text{S}$ value in addition to similar $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values to that of the groundwater further suggesting that the river water near this lake probably receives considerable baseflow. At higher concentrations of dissolved sulfate, more depletion is observed in the $\delta^{34}\text{S}$ isotope values which suggests that the sulfates in the groundwater are derived mainly from the fine-grained interbedded clays which provide the necessary anaerobic conditions.

DISCUSSION

The water-level elevation map for the alluvial aquifer indicates that the Brazos River is largely fed by groundwater baseflow. In addition, some of the river water is sourced upstream from saline springs in the Permian Basin. Isotopic compositions of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ are progressively more depleted in the groundwater, river water, and the lake waters. This depletion in isotopic values and their occurrence along a linear evaporation trend line suggest that varying evaporation rates was probably the cause for the differences in isotope values. Groundwater composition in the alluvium aquifer are variable with a wide range of Na/Cl ratios, SO_4 , HCO_3 and Ca concentrations. Na/Cl ratios of the lake and the river waters are close to unity suggesting halite dissolution. A lower concentration of Na/Cl and Ca concentrations in the river and the lake waters are probably related to dilution during mixing with the river water from upstream and rainwater.

Similarities in Na/Cl, Ca, and HCO_3 compositions between the lake and the river waters suggest that the lake waters in Moelhan's Slough and the Korthauer Bottom originated

prior to the abandonment of the main channel. During high flows (~70,000 cfs) the river water may create a much deeper lake that when abandoned could remain wet for an extended period. An evaporation rate of 53 inches per year combined with a precipitation rate of 40 inches per year may sustain the lakes without requiring significant baseflow from the alluvial aquifer. Based on our survey, we noted that the river stage was high enough to overflow into Moelhman's Slough approximately 163 days prior to sampling and Moelhman's Slough may regularly overflow at least once every two years. Korthauer Bottom connects more frequently than Moehlman's, a few times every year. River stage was high enough to connect to the oxbow about 150 days prior to the sampling. Horseshoe Lake only connected to the river once in the past twelve years. Thus, it must receive a more significant component of baseflow. This lake has the most depleted values of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ supporting extended evaporation of the ponded water. Although the lake water has changed chemical composition due to biological activity, $\delta^{34}\text{S}$, $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of the river water near the lake mimic groundwater composition.

CONCLUSIONS

The $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotope values of the groundwater, river water and the lake water show progressive enrichment in the isotope values and the isotope values fall along a linear evaporation trend line which suggests a common source and enrichment during evaporation. This common source is the groundwater baseflow from the alluvium aquifer that largely feeds the Brazos River.

Chemical and isotopic compositions of the Moelhman Slough and the Korthauer Bottom suggest that the lake waters comprised of the river water that originated during connections to the Brazos River. This is supported by several connection records of the lakes to the Brazos River and a similar Na/Cl and SO_4 concentrations between the lakes and the river waters. On the contrary, the groundwater near the lakes have higher Na/Cl and SO_4 concentrations than the lake waters.

Horseshoe Lake has experienced extensive evaporation, which is supported by enriched $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotopic compositions and only one connection to the Brazos River over the last twelve years. Although the lake water composition has changed due to biological activity, $\delta^{34}\text{S}$, $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values of the river water near the lake mimic groundwater composition.

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Surface connectivity between six oxbow lakes and the Brazos River, Texas

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Surface Water Resources Division

Texas Water Development Board

Austin, Texas 78711

December 6, 2004

ABSTRACT

To complement the Texas Water Development Board (TWDB) contract study “Response of Oxbow Lake Biota to Hydrologic Exchanges with the Brazos River Channel” currently being conducted jointly by Texas A&M University (TAMU) and Texas State University (TSU) researchers (contract numbers and 2003-483-493 and 2003-483-003, respectively), staff at the TWDB conducted a field study to determine frequency and duration of surface connections between selected oxbow lakes and the Brazos River, and also to determine the source of water present in selected lakes.

The TWDB conducted field studies at six oxbow lakes where fish sampling was conducted by TAMU or TSU (Figure 1.1, 1.2). The lakes, numbered in order from upstream to downstream, were (1) Moelhman Slough, (2) Big Bend Oxbow, (3) Korthauer Bottom, (4) Horseshoe Lake, (5) Hog Island Lake and (6) Cutoff Lake. These specific lakes were chosen because they represent a range of both age and connectivity frequency, and their collective geographic extent encompassed much of the Brazos River length between College Station and the Gulf of Mexico.

To determine the frequency and duration of surface connectivity between the oxbow lakes and the river, site topographic and water surface elevation surveys were conducted at each lake. Recurrence intervals for connection of each lake were estimated for each lake, based upon historical measurements at USGS gauges on the Brazos River and the on-the-ground surveys. Big Bend Oxbow, Korthauer Bottom and Hog Island Oxbow lakes were all determined to connect with the Brazos River more than once per year; Moelhman Slough was estimated to connect at least once every 2 years and Cut-off Lake was estimated to connect at least once every 4.5 years. Horseshoe Lake connects infrequently, only during high-magnitude flood events.

Water chemistry and isotope samples were collected and the source of water existing in three lakes was determined. The origin of water entering Moelhman Slough and Korthauer Bottom oxbow lakes was determined to be via overland connection with the river, while the origin of water in Horseshoe Lake was determined to be via hyporheic upwelling (groundwater). The source water analysis is presented in a separate document (Chowdhury 2004).

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1.0 Introduction

To complement the Texas Water Development Board (TWDB) contract study “Response of Oxbow Lake Biota to Hydrologic Exchanges with the Brazos River Channel” currently being conducted jointly by Texas A&M University (TAMU) and Texas State University (TSU) researchers (contract numbers and 2003-483-493 and 2003-483-003, respectively), staff at the TWDB conducted a field study to determine frequency and duration of surface connections between selected oxbow lakes and the Brazos River, and also to determine the source of water present in selected lakes. The ultimate goal of the combined TWDB, TAMU and TSU studies is to assist state water planners to assess the impact of water development on the ecological environment in the Brazos River basin; this study will be incorporated into future instream flow studies for the Brazos River basin.

The TWDB conducted field studies at six oxbow lakes where fish sampling was conducted by TAMU or TSU (Figure 1.1, 1.2). The lakes, numbered in order from upstream to downstream, were (1) Moelhman Slough, (2) Big Bend Oxbow, (3) Korthauer Bottom, (4) Horseshoe Lake, (5) Hog Island Lake and (6) Cutoff Lake. These specific lakes were chosen because they represent a range of both age and connectivity frequency, and their collective geographic extent encompassed much of the Brazos River length between College Station and the Gulf of Mexico.

To determine the frequency and duration of surface connectivity between the oxbow lakes and the river, site topographic and water surface elevation surveys were conducted at each lake. The site surveys were tied to USGS gauging stations that provided historical records of stream flow. The four USGS Brazos River stream gauging stations used in this analysis, shown in Figure 1.1 with solid circles, were the Bryan, Hempstead, Richmond and Rosharon gauges.

To determine the source of water existing in the oxbow lakes, water chemistry and isotope samples were collected at three of the oxbow lakes: Moelhman Slough, Korthauer Bottom and Horseshoe Lake. The composition of water in these lakes was compared to the composition of water collected in the Brazos River and in the alluvial aquifer. Through the water sample composition comparisons, the origin of water entering Moelhman Slough and Korthauer Bottom oxbow lakes was determined to be via overland connection with the river, while the origin of water in Horseshoe Lake was determined to be via hyporheic upwelling (groundwater). The source water analysis is presented in a separate document (Chowdhury 2004).

Recurrence intervals for the USGS gauges on the Brazos River near Bryan, Hempstead, Richmond and Rosharon, as calculated with the Log-Pearson Type III (LP3) distribution method (Chow et al, 1988), are shown in Table 1.1. It shall be noted that these statistically-derived estimates may under-predict the magnitude of flood flows when compared to other estimates of high-magnitude floods. Richmond area estimates of 100-year floods range from 181,000 cfs (FEMA 1999; FEMA 2001) to 209,000 cfs (Dames and Moore 1975); however, the LP3 prediction for the 100-year flood is 138,034 cfs.

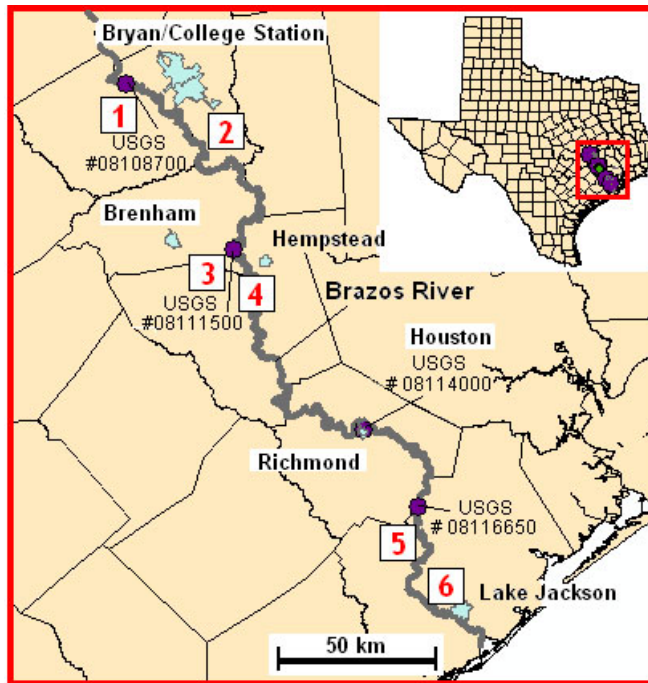


Figure 1.1 - Map of middle and lower Brazos River showing location of each oxbow lake, gauging stations, and water surface elevation measurements

Table 1.1 - Log-Pearson Type III Recurrence Intervals for USGS gauges on the Brazos River.

| LP3 Recurrence Interval | Discharge (cfs) | | | |
|-------------------------|------------------------------|------------------------|-----------------------|-----------------------|
| | USGS Gauge Location & Number | | | |
| | Bryan #08108700 ** | Hempstead #08111500 | Richmond #08114000 | Rosharon #08116650 |
| 2-year | 46327 | 55857 | 49922 | 51443 |
| 10-year | 107769 | 88372 | 96521 | 81028 |
| 50-year | 171868 | 93743 | 127473 | 95797 |
| 100-year | 201165 | 94041 | 138034 | 100053 |

** Data for the Bryan Gauge includes data from gauge #08108700 (1993-Present) and data from gauge #08109000 (1934-1993).

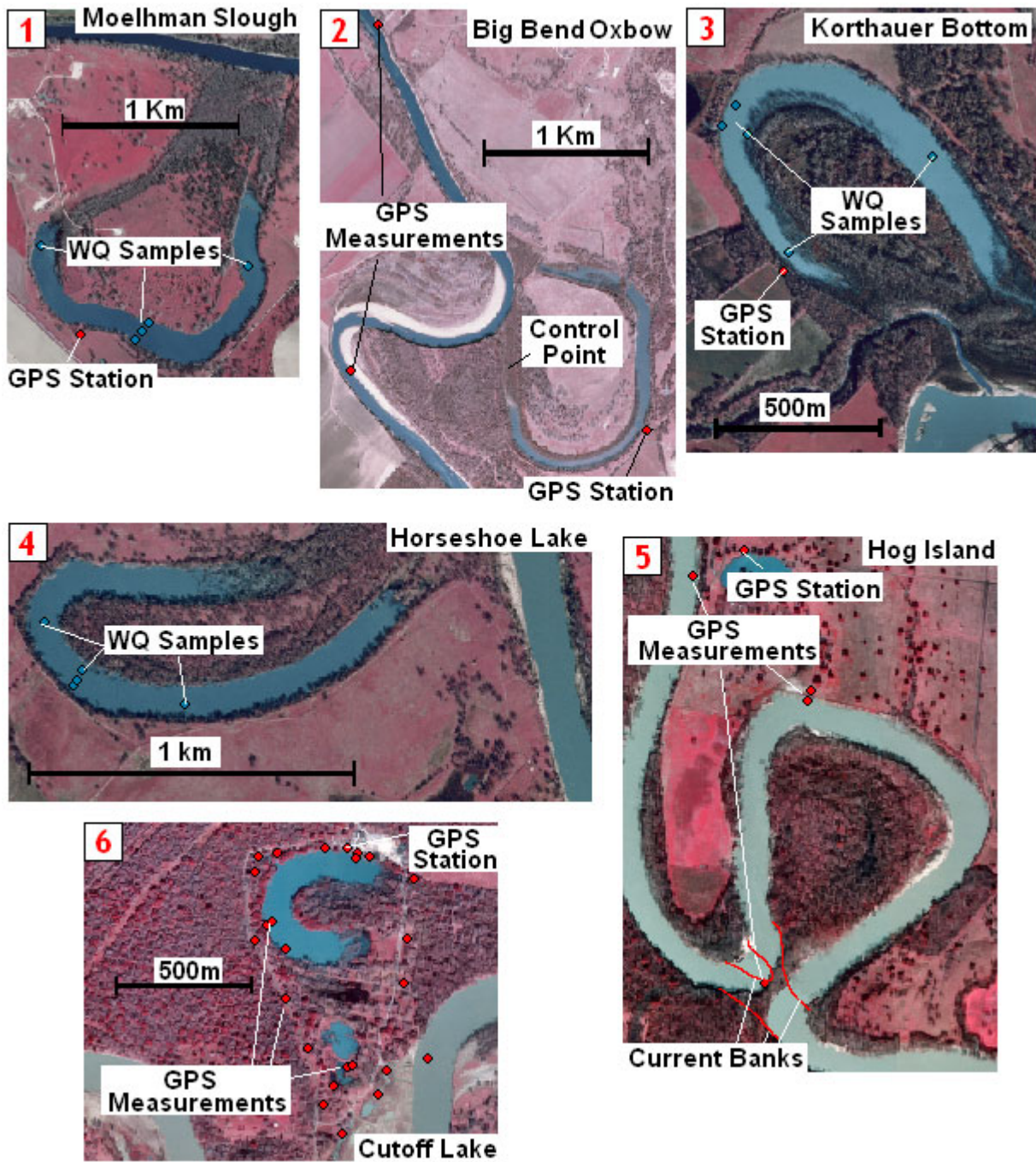


Figure 1.2 – DOQQ Maps of Oxbow Lakes Study Areas indicated on Figure 1.1.

2.0 Surface connectivity

To investigate the frequency and duration of surface exchange between the Brazos River and each oxbow lake, the lake's control point elevation was determined. For this report, the control point elevation refers to the water surface elevation required to initiate the exchange of water between the lake and the Brazos River (Figure 2.1). Control point elevations were determined by on-the-ground survey, as described in Section 2.2. On three lakes (Moelhman Slough, Big Bend Oxbow and Hog Island Oxbow) elevations were verified using water level data collected using pressure transducers installed on-site during this study. Detailed information with respect to each lake is provided in Chapter 3.

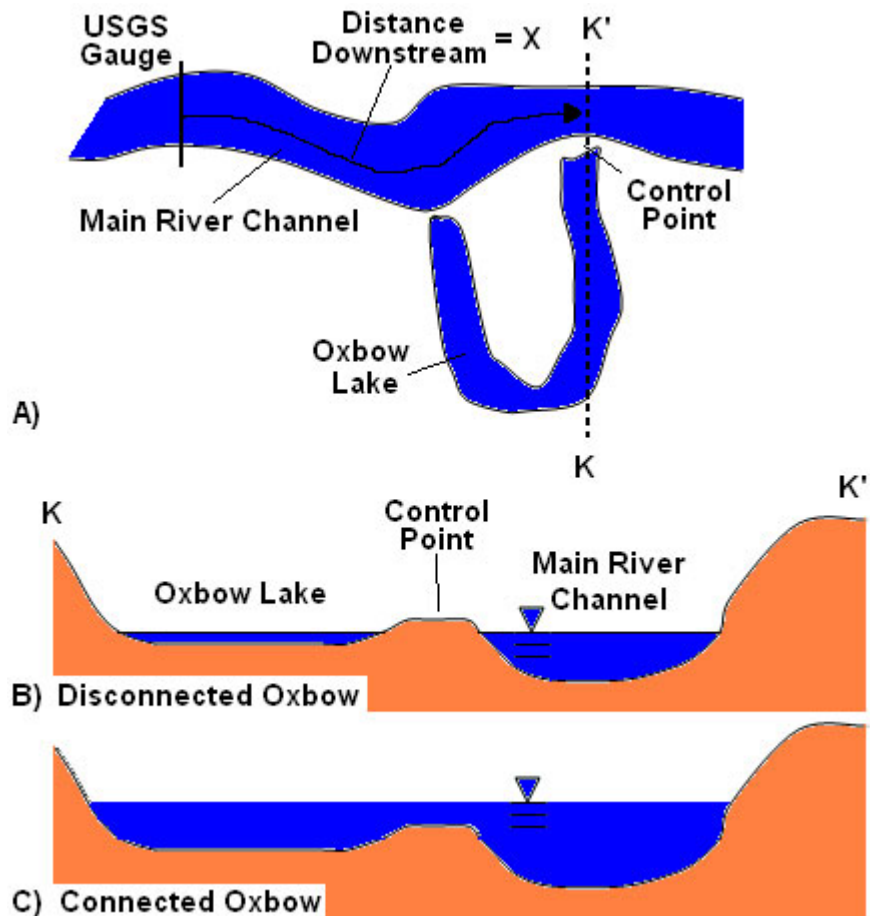


Figure 2.1 – Conceptual drawing of an oxbow lake connection to its nearby river. A) Map view showing the lake disconnected from the main channel of the river, B) Longitudinal profile (not to scale) along K-K', showing disconnection of the river and oxbow when the water surface elevation is below the control point elevation, C) Longitudinal profile (not to scale) along K-K', showing connection of the river and oxbow when the water surface elevation is above the control point elevation.

To establish a relationship between the control point elevation and the available historical stream records, the change in water surface elevation between the nearest USGS gauge and the water surface in the river near the control point location was determined. This slope relationship was used to estimate a flow rate at the gauge required to establish a river connection to the oxbow lake. Using the flow rate at the gauge as an indicator for connection at the oxbow, the frequency and duration of river-oxbow connections could be quantified for the entire period of record at the gauge. The method for quantifying the indicator flow rate is discussed in Section 2.1. When quantifying frequency and duration of connections a number of assumptions were made; discussion of these assumptions is discussed in Section 2.3.

2.1 Method for quantifying indicator flow rate

This section describes the approach used to relate control point elevation to the historical stream flow record. Hydraulic modeling of flood surfaces was not employed for this analysis; rather a simple assumption of constant slope was applied to relate the water surface elevation at a USGS gauging station and the water surface elevation at each oxbow lake.

The USGS gauge heights required to achieve a river stage equivalent to the control point elevation near each oxbow lake were determined using linear interpolation and measured river slopes (Figure 2.2). The WSE at the oxbow (O_{WSE}) was obtained by the formula:

$$O_{WSE} = G_{WSE} + S \times X \quad (1)$$

where G_{WSE} is gauge water surface elevation, S is the river water surface slope and X is the distance along the river between the gauge and the oxbow (Figure 2.2). A constant slope was assumed for all flow rates, and adjustments were not made to account for slope changes with changes in flow. The X distance downstream from USGS gauges was measured from aerial photos (DOQQs) using ArcGIS software.

Figure 2.2 depicts three different water surface elevations (A, B, and C) at the gauge upstream of the oxbow. Using the constant slope S and equation (1), the elevation A indicates that the oxbow is connected with the river, elevation B indicates that the river water surface elevation at the oxbow is equal to that of the control point, and elevation C indicates that the oxbow and river are disconnected. Elevation B is referred to as the critical gauge elevation because it represents the minimum elevation required for connection between the oxbow and the river.

Indicator flow rates required for river-to-oxbow connections were calculated based on the required gauge height (i.e. elevation B in Figure 2.2 minus the gauge datum) and the gauge rating curve data maintained by the USGS. Recurrence intervals for these indicator flow rates were estimated using the Log-Pearson Type III distribution method (Chow et al, 1988) based on the peak flow values for each year of record as recorded at the USGS gauge.

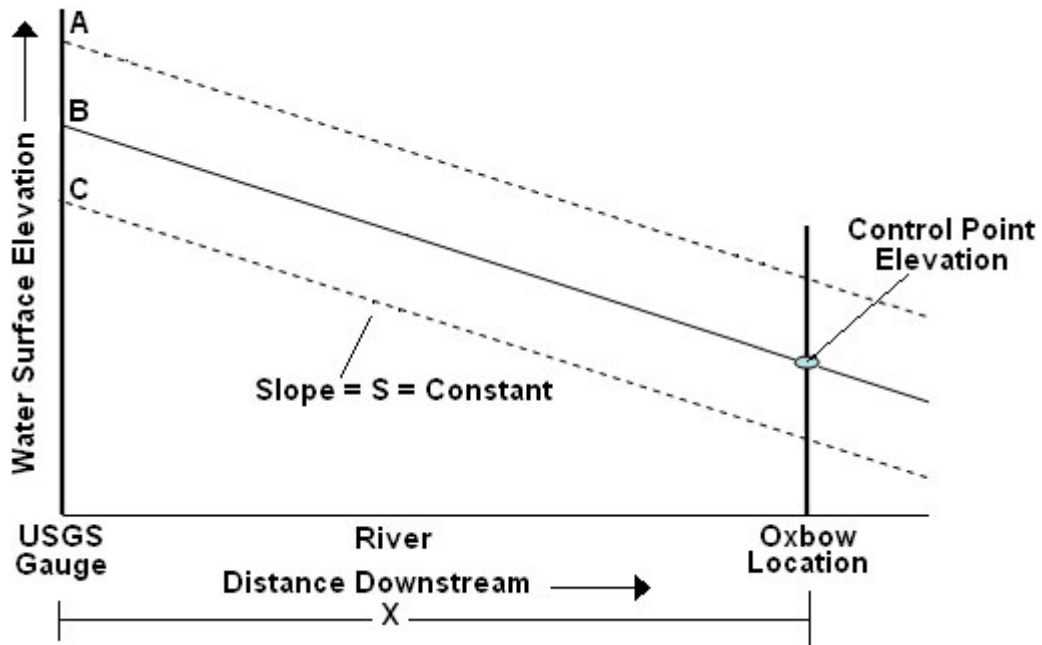


Figure 2.2 – Calculation of river water surface elevation (WSE) at the location of the oxbow control point based on known river slope (S), distance downstream (X), and water surface elevation at the USGS gauge.

2.2 Field data collection methods

All elevations included in this report were referenced to local National Geodetic Survey (NGS) elevation benchmarks using high-accuracy survey-grade GPS equipment in combination with traditional differential leveling. The GPS equipment used for the study was a two-receiver system that included a Trimble 5700 dual-frequency receiver as a fixed base station and a Trimble 5800 dual-frequency receiver as a mobile roving station. Vertical error of elevation measurements was approximately 5 cm RMS.

At each oxbow lake a semi-permanent elevation benchmark was established and its elevation was tied to the NAVD88 datum using published NGS marks in the region; the on-site benchmark is noted as “GPS station” in Figure 1.2. All on-site elevation measurements used the on-site benchmark as starting point and datum.

To ensure a common datum for all elevations in this study, published USGS gauge datums were not used; rather, the GPS equipment and NGS benchmarks were used to establish a new datum based upon the reported real-time gauge height from each gauge and the measured river water surface elevation at the time of survey.

To obtain time-series data of water surface elevations, water level loggers were installed in selected lakes. Each water level logger consisted of a pressure transducer submerged below

the water surface, a battery power source and a data logger. The datum for each pressure transducer was measured with respect to the on-site benchmark. Barometric pressure loggers were also installed near lakes in which non-vented water level loggers were installed. Time-series water surface elevation data were used to verify the post-dicted connections between the river and the oxbows based on site survey data and surveyed river slopes.

As described above and shown in Figure 2.1, the control point elevation refers to the water surface elevation required to initiate the exchange of water between a lake and the Brazos River. By way of a functional definition, the control point elevation is the lowest point between the river and the oxbow. Rather than perform a comprehensive, resource-intensive topographic survey of the terrain between the river and each lake, survey time and effort was minimized using visual inspection. Drainage between each lake and the river was evident in observed erosion channels; only one drainage channel per oxbow was observed and the control point was assumed to be at the highest elevation along the flow line of the drainage channel. That highest point was deemed the control point: the point over which river water would first enter the oxbow and the point over which a draining oxbow last discharge. Vertical error of surveyed control point elevations is not absolutely quantifiable, but assumed to be less than 0.3 meters (approximately 1 foot).

2.3 Rate of formation for oxbow lakes: assumption of steady-state

Erosional and depositional processes dictate the rates of formation and infill of oxbow lakes. The processes and rates are not static, and their quantification requires analysis of a long history of river plan form data. The compilation of time-series data in the form of aerial photos, land surveys or maps requires abundant resources and is only available for, at most, 200 years. Compilation of such data was not undertaken as part of this project.

In the absence of suitable data to describe the rates of oxbow formation and infill, an assumption can be made that, at any given time within recent history, a similar number and similar geographic distribution of oxbow lakes exist in the basin. Such a “steady-state” assumption is required to compare present-day measurements to historical measurements, and is useful for estimating the availability of similar habitat in the past or for the future.

The implication to this study of the steady-state of formation assumption relates primarily to the control point elevation. In the natural oxbow lake system, each surface connection between the river and the oxbow results in the deposition and scour of sedimentary material. As a result of most flood events, sediment from the river both fills the oxbow lake’s basin (decreasing the depth and volume available for habitat) and increases the control point elevation. While some scour could be expected during infrequently-occurring, extremely high-magnitude events, the net result of all flood events is sediment accumulation over time sufficient to fill in the oxbow lake to a level equal to the surrounding flood plane.

Conceptually, the rate of change over time in both lake depth and control point elevation is proportional to the frequency of connection. Since most connections increase the control point

elevation, each connection also decreases the rate of infill. The result is that an older oxbow is a more stable system that connects infrequently and whose rate of change is relatively low; conversely, a younger oxbow connects frequently and the rate of change is relatively high. In other words, an older oxbow that connects with the river roughly once per year is likely to connect once per year for many years or decades into the future. A younger oxbow that connected eight times per year last year, is more likely to connect only two times per year a decade into the future, and perhaps only one time per year another decade after that.

Since the change in connection frequency of each lake over time was not modeled, the steady-state assumption was made that the control point elevation of each lake remains constant. Therefore, in the frequency and duration analysis performed for each lake, it was assumed that conditions observed during this study also existed throughout the historical period of stream flow record.

3.0 Results of surface connectivity study for each oxbow

This section presents background information, photo-documentation and results of the on-site control point surveys conducted at each oxbow lake. The results of the surveys were used to calculate the frequency and duration of connections between each oxbow lake and the Brazos River, based on stream flow data reported at the nearest USGS gauging station.

All of the frequency and duration statistics presented in the following sections were based upon the assumption of a steady-state rate of oxbow formation. This concept was discussed in section 2.3.

Table 3.1 provides a summary of the results from the hydrologic analysis of oxbow connections. Greater detail is provided in the following sections describing each oxbow. The frequency of flooding events has been relatively constant over the last 20 years, and that the older oxbows (Horseshoe Lake, Cutoff Lake, and Moelhman Slough) connect less often than the oxbows that have formed most recently (Hog Island Oxbow, Korthauer Bottom, and Big Bend).

Table 3.1 – Connection Frequency Results for the Brazos River oxbow lakes

| Oxbow | Connections | | | Flood Description | |
|------------------|-------------|-----------|------|-------------------|--------------|
| | 1984-1993 | 1994-2004 | 2004 | Flow | LP3 interval |
| Moelhman Slough | 14 | 12 | 3 | 45,000 cfs | 1.9-year |
| Big Bend | 32 | 41 | 6 | 20,000 cfs | 1.1-year |
| Korthauer Bottom | 32 | 50 | 6 | 20,500 cfs | < 1.0-year |
| Horseshoe Lake | 1 | 0 | 0 | 99,000 cfs | > 10-year |
| Hog Island | 61 | 68 | 5 | 3,625 cfs | < 1.0-year |
| Cut Off Lake | 2 | 3 | 0 | 76,200 cfs | 4.4-year |

Each oxbow was connected to the Brazos River for more days in the Spring (functional definition, March 1 to May 31) than in any other season (Figure 3.1). The smallest difference in connection occurrence amongst the seasons was seen for the Hog Island Oxbow, which connected in the Spring and Summer months 60% and 40%, respectively. This was expected because of relatively small flood flows required for connection at this site. Connections at Horseshoe Lake, and Cut-off Lake, which require relatively large flow volumes, occurred less frequently in the Summer (June 1 to August 31) or Fall (September 1 to November 30). Temporal trends in connections are discussed further in the following sections.

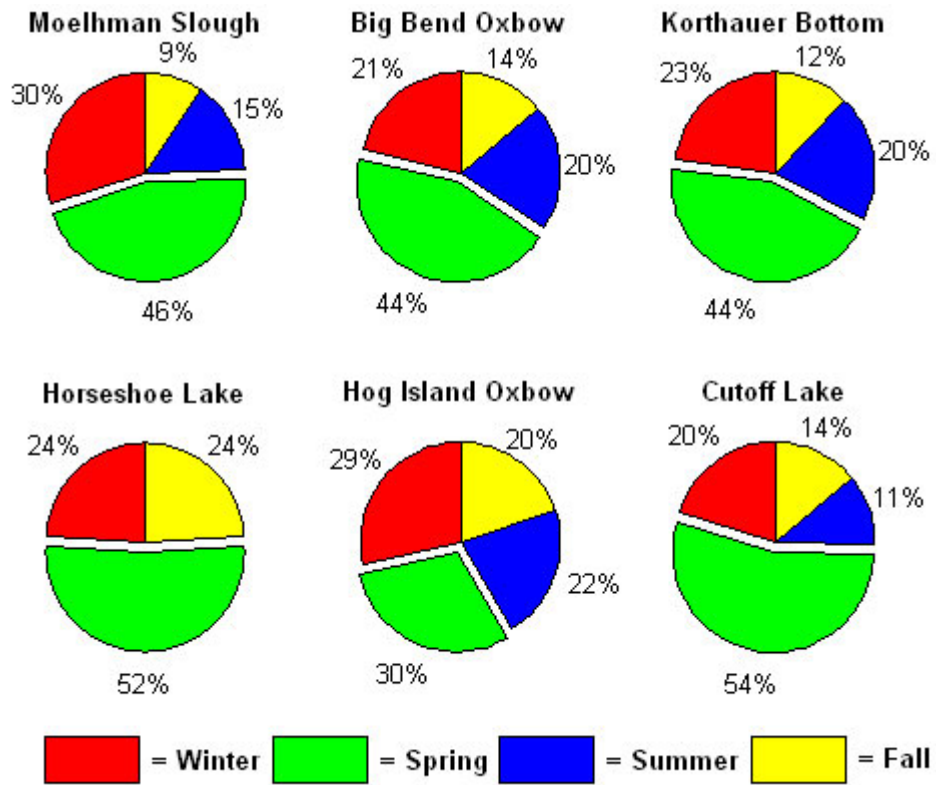


Figure 3.1 – Percent of days connected, by season for each oxbow.

3.1 Moelhman Slough

Moelhman Slough is located approximately 1.4 river miles downstream of USGS gauge 08108700 at SH21 on the Brazos River, near Bryan, TX (Figure 3.2). According to anecdotes from the land owner, the oxbow formed in the 1920's, was on average 8 ft deep in the 1950's and is currently 4 ft deep when not connected to the Brazos River. The landowner's estimate of average depth for the current condition is consistent with TAMU's measurements. Chemical and isotope signatures from sample water collected from the lake most closely resembled evaporated water that originated from the Brazos River at high flow (Chowdhury 2004).

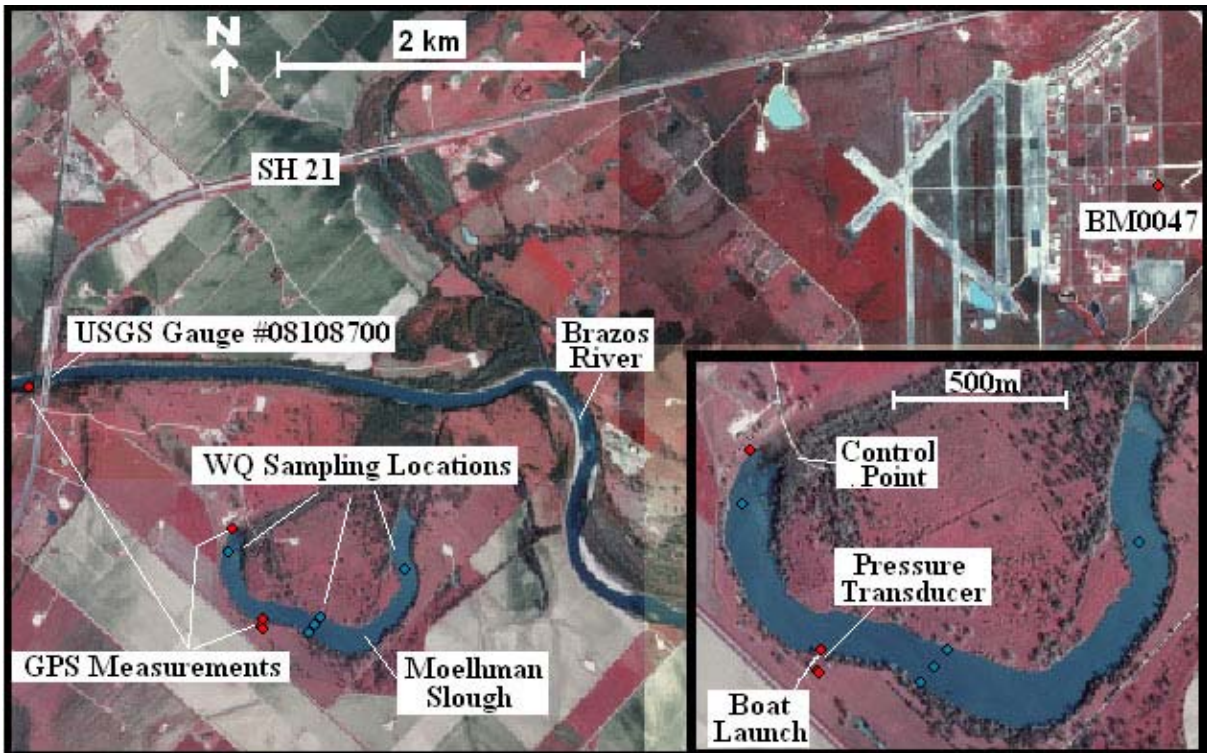


Figure 3.2 – DOQQ depicting Moelhman Slough and pertinent ground features.

The control point elevation at Moelhman's Slough, measured on 5/6/04 from the NAVD88 datum, was determined to be 219.4 ft (66.9 meters). Connections with the Brazos River occur along the west arm of the slough (Figure 3.2), where the control point is the elevation of the bottom of an 8' wide rectangular channel (Figure 3.3) cut into the dirt road embankment lying perpendicular to the slough (Figure 3.4). The road embankment is 2 feet to 5 feet higher than the ground surface between the banks of the old channel (based on differential leveling measurements). Two cylindrical culverts allow limited exchange of water beneath the roadway during flooding/rain events (Figure 3.5), but only connect low-lying areas of the field on the north of the embankment to the lake on the south side. To connect with the oxbow

lake, the Brazos River requires sufficient stage to exceed the flow line of the embankment opening at 219.4 ft (66.9m). The river stage sufficient to overtop the lowest point of the road embankment is 220 ft, while the entire embankment is submerged at 222.2 ft.

During flood events, significant quantities of water do not reach the slough until the water in the Brazos River has at least begun flowing through the rectangular channel in the embankment, although the amount of water flowing into the slough will be greatest when the river has overtopped the road embankment. After the flood peak has passed and river stage falls, water initially discharges out of Moelhman Slough over the road embankment. The flow out of the lake to the Brazos River slows when the water level in the slough dips below the road embankment and only flows through the rectangular channel. The water level in the slough diminishes until it is below the level of the flow channel.



Figure 3.3 – Rectangular flow channel serves as control point for Moelhman Slough connections with the Brazos River.



Figure 3.4 – Dirt Road Embankment crossing the old river channel between Moelhman Slough and the Brazos River. The flow channel shown in Figure 3.3 is off to the right of the view shown here.



Figure 3.5 – One of two cylindrical culverts running through the road embankment. These culverts will transmit water from the Brazos River to Moelhman Slough at river stages lower than the reported control elevation, but the volume of water transmitted is too small to consider the river and slough as “connected”.

3.1.1 Moelhman Slough: determining the indicator flow rate

To determine the frequency and duration of historical connections, streamflow records for the Brazos River near Moelhman Slough were derived from the following datasets:

- USGS Gauge #08108700 Brazos Rv at SH 21 nr Bryan, TX:
 - Discharge & Gauge Height Data – 15 min increments, 11/1/03- 10/15/04. Real-time data downloaded in 31 day units each 1st & 15th of the month without alteration
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08108700&agency_cd=USGS
- USGS Gauge #08108700 Brazos Rv at SH 21 nr Bryan, TX:
 - Provisional Discharge & Gauge Height Data – 15 min increments, 7/14/93-10/31/03.
Provided by Michael Greenslate of the US Geological Survey, Austin Unit
- USGS Gauge #08109000 Brazos Rv near Bryan, TX
 - Historical Daily Average Discharge Data (10/28/1934-7/14/1993)
Downloaded without alteration on 10/14/04
http://nwis.waterdata.usgs.gov/tx/nwis/discharge/?site_no=08109000
- USGS Gauge #08108700 Brazos Rv at SH 21 nr Bryan, TX:
 - Rating Curve Data
Provided by Michael Greenslate of the US Geological Survey, Austin Unit

USGS Gauge #08109000 was taken offline on 9/30/1993 and is no longer an active USGS gauge. The rating curve data for USGS Gauge #08108700 was accurate up to 5/24/04 and was used in this analysis to estimate gauge heights for the discharge data from USGS Gauge #08109000. These height estimates are only approximate given the following sources of error: (1) rating data is for USGS Gauge #08108700 whereas the discharge data is for USGS Gauge #08109000; (2) USGS Gauge #08108700 was not located in the same place as USGS Gauge #08109000; (3) river rating data changes with time as the river meanders and deposits/entrains bank sediment.

Discharge data for USGS Gauge #08109000 was only available as daily averages and may not represent the variation in flows (daily peaks or low flows) within individual days. For this analysis, the daily average discharges and their approximated gauge heights were assumed to have occurred at 12:00pm on each day. Discharges and gauge heights at other times of the day were approximated with linear interpolation between reported daily average flows taken at noon of each day. For the purposes of this analysis, the approximated discharge and height data from the USGS Gauge #08109000 are sufficient to suggest the behavior of the Brazos River near Moelhman Slough, although calculations of connection times and frequencies before 7/14/1993 must be considered approximate.

River water surface elevations were determined by adding the gauge height values to the datum values published by the USGS. The published NGVD29 gauge datum values are 192.33 ft and 188.65 ft, for gauges #08109000 and #08108700, respectively. Conversion of these datums to the NAD88 datum was performed using the VERTCON software from the

US National Geodetic Survey (<http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html>). The datums in the NAV88 system are 192.43 ft for gauge #08109000 and 188.76 ft for gauge #08108700. The gauge #08108700 datum was verified as accurate to within ± 0.3 ft on 5/6/04 and 9/7/04 using survey-grade GPS equipment and the NGS Benchmark BM0047

The river slope between the gauge #08108700 at SH 21 and the Big Bend oxbow lake 28.8 river miles downstream was measured using survey-grade GPS equipment as 0.6225 ft/mile 15,800 cfs on 5/6/04. This slope is similar to the 0.70 ft/mile slope reported for the Brazos River by the USGS (Dunn and Raines, 2001) and the 0.71 ft/mile mean slope calculated based upon the gauge height data from gauge #08108700 and gauge #08111500 Brazos Rv nr Hempstead, TX located 93.1 river miles downstream.

For this analysis, the GPS-measured constant slope of 0.6225 ft/mile was used, making a difference of 0.84ft between the water surface elevation at the gauge #08108700 and at the point where the connection between the Brazos River and Moelhman Slough begins. Connections between the Brazos River and Moelhman Slough occur when the water surface elevation at gauge #08108700 exceed the control point elevation at Moelhman Slough plus the difference in water surface elevation between the slough and gauge (point B on Figure 2.2). This occurs when the water surface elevation exceeds 220.24 ft (67.14 m). This elevation corresponds to a gauge height of 31.49 ft and a discharge of 45,000 cfs. Table 3.2 summarizes the elevation relationships for Moelhman Slough.

Table 3.2 – Requirements for Connection between the Brazos River and Moelhman Slough

| | |
|---|-----------------|
| Control Point Elevation | 219.40ft |
| River Slope | 0.6225 ft/mile |
| Distance From Gauge | 7200 ft |
| Elevation Difference from Gauge | -0.84 ft |
| Gauge Water Surface Elevation Required for Connection | 220.24 ft |
| Gauge Height Required for Connection | 31.49 ft |
| Gauge Discharge Required for Connection | 45,000 cfs |
| LP3 recurrence interval for Connection | 1.93-year flood |

3.1.2 Moelhman Slough: verifying surface connectivity

To verify the accuracy of the connection requirements in Table 3.2, pressure transducers were installed to measure the fluctuations in water levels within Moelhman Slough from 11/13/03 until 9/7/04. Water surface elevations within the slough were calculated by adding the measured depth of the transducer to the known transducer elevation, determined on date of installation using survey-grade GPS equipment. The time history of water surface elevations measured with the pressure transducers is shown in Figure 3.6.

During the time of the pressure transducer installation, the Brazos River connected with the slough on three occasions. These connections were recorded by the pressure transducers, which showed that the rise in water surface elevation within the slough occurred at the same time as at the upstream gauge. The first connection, in May of 2004, caused the water level in the slough to peak at 229.67 ft whereas the Brazos River peak water level reached 229.60 ft. The small difference in peak heights (0.07 ft) was within the range of error in the pressure transducer measurements, and indicated that the 0.6225 ft/mile constant slope used in calculating the change in river elevation downstream of the gauge was accurate. The second and third flood events produced differences in peak elevations in the river and slough of 0.3 ft. This difference was outside of the range of error in the pressure transducer measurements, but was sufficiently small to provide confidence in the value of the river slope used in the analysis. The larger difference in peak water surface elevations may be attributable to river and/or slough geometry changes due to sediment deposition or scour by the previous floods, to minor movement of the instrument, or, most likely, to a difference in flood plain width between the gauge location and the oxbow (constriction at gauge location causes higher peak at gauge). The spike in the slough water surface elevation on in February 19, 2004 was due to instrument interference during a biological sampling of the slough. This interference was temporary and did not affect the measurements made after the event.

The rate of decrease in water surface elevation within Moelhman Slough upon flood water recession was similar to that of the decrease in Brazos River surface elevation, until the slough water surface elevation reached 220.5 ft. Below this elevation, the rate of decrease in slough WSE was less, as water was no longer overtopping the road embankment and could only flow through the rectangular channel. The 19.5 inch decrease of the oxbow water level between 7/3/04 (the end of the last flood) to 9/7/04 (the date of the transducer removal) was not attributable only to evaporation. Based on historical records (from TWDB records available at <http://hyper20.twdb.state.tx.us/Evaporation/evap.html> on 11/4/04), the median evaporation rate in July and August for the Bryan area is 7 inches per month, or 14 inches for the two month period. Combined with the 7.6 inches of rainfall recorded at the NOAA station at the College Station, TX airport (See Section 4.3), the expected loss due to evaporation is 6.4 inches. The water surface elevation in Moelhman Slough decreased 19.5 inches in July and August, which is 3 times the expected loss due to evaporation alone. Groundwater recharge may also account for some of the decrease in lake WSE, where it is possible that lake water flows into the surrounding aquifer until the WSE approaches the elevation of the local water table. Based on the pressure transducer data from 11/03 to 5/04 (Figure 3.6), lake water levels maintain an equilibrium elevation of 216 ft, which is approximately equal to water table elevation reported for the area using pre-1962 well measurements (see Figure 4 in Chowdhury 2004). The elevation of the local water table was not measured during this project, and the assertion that lake water recharges the aquifer was not verified.

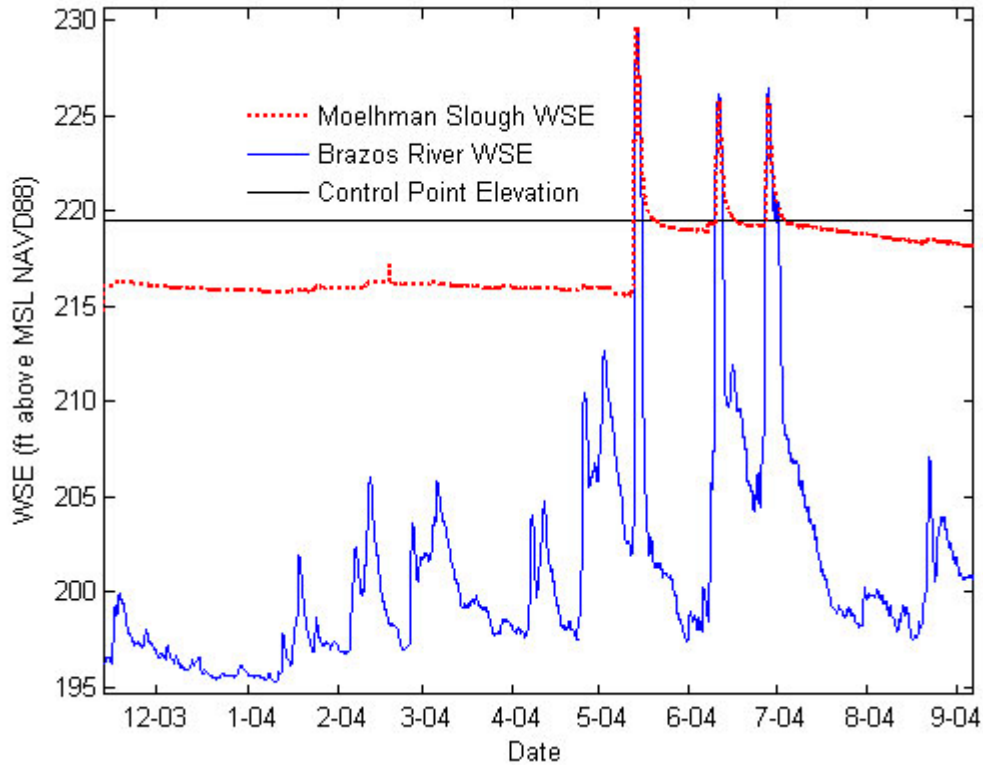


Figure 3.6 – Time history of Brazos River and Moelhman Slough water surface elevations (WSEs) as measured by USGS Gauge #08108700 and temporary pressure transducers installed near the slough boat ramp from 11/13/03 until 9/7/04.

3.1.3 Moelhman Slough: historical connections

Full reports of the dates of connection and disconnection between the Brazos River and Moelhman Slough are provided in Appendix A. Figures 3.7 and 3.8 show the timing and duration of connection and disconnection periods for the last 20 years, using the steady-state assumption (see Section 2.3) that the control point elevation does not change. The results shown in Figure 3.8 are only approximate due to the limitations of the stream flow data before 1993 and due to the steady-state assumption discussed in Section 2.3. The majority of connections occur during the winter months (December thru February), and connections have occurred in the last 20 years in every month other than August. Of the 20 years shown, nine years did not contain a single connection. The longest periods without connections spanned 3 to 4.5 years, whereas the shorter periods between connections spanned 1 to 5 days. The average duration of connections within the past 20 years was 3.8 days. Figure 3.9 displays a histogram of the number of connections per year for each of the years of record. Figure 3.1 shows the percentage of connected days by season.

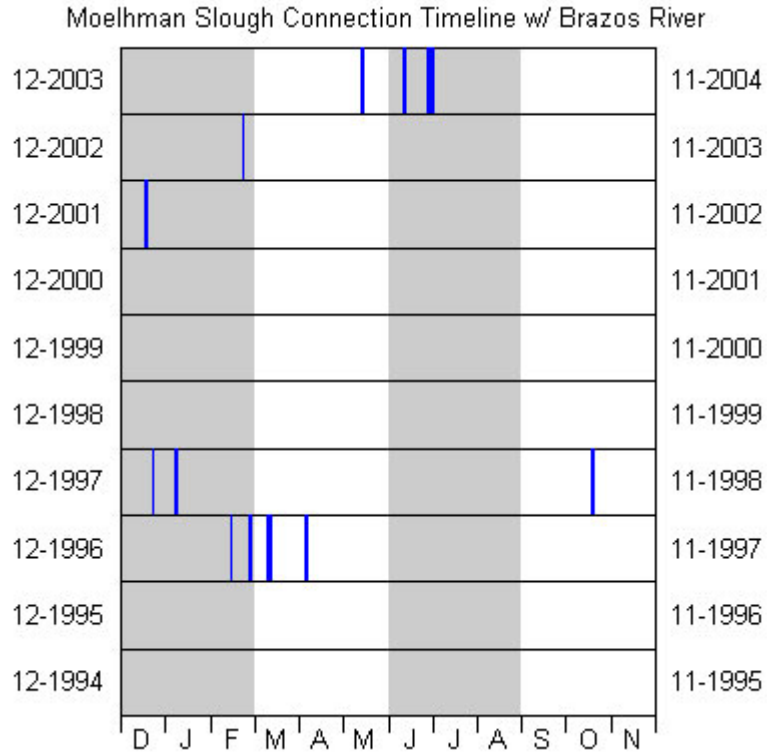


Figure 3.7 – Calendar of connections between the Brazos River and Moelhman Slough from December 1994 to the present. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

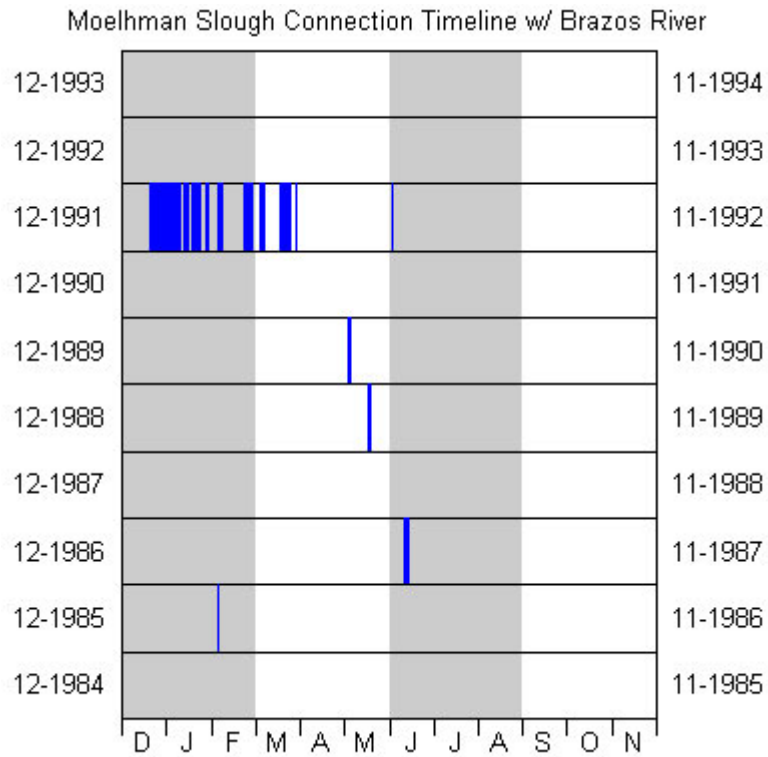


Figure 3.8 – Calendar of connections between the Brazos River and Moelhman Slough from December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

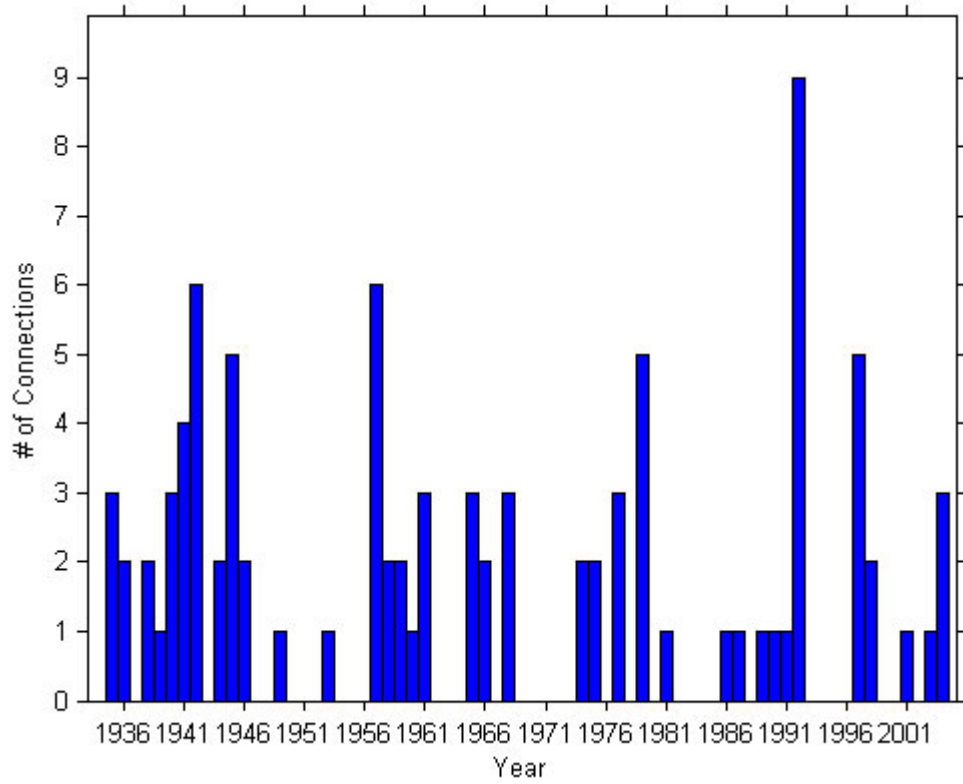


Figure 3.9 – Histogram showing the number of connections per year between the Brazos River and Moelhman Slough based on stream flow data from 1934-Present. Data before 1993 is approximate.

3.2 Big Bend Oxbow Lake

Big Bend Oxbow Lake is located approximately 28.8 river-miles downstream of USGS gauge #08108700 at SH21 on the Brazos River, near Bryan, TX (Figure 3.10). According to the land owner, it was formed in the 1974 and reconnects “frequently.” The oxbow has a drainage area of approximately 2,300 acres, and receives creek inflow from Minter Branch on its northern side.

The control point elevation at Big Bend Oxbow Lake, measured from the NAVD88 datum, was determined to be 192.3 ft (58.6 meters) on July 22, 2003. Connections with the Brazos River first occur along the south arm of the lake (Figures 3.10), where the control point is a rise in the 5-ft wide natural channel running from the Brazos River to the oxbow lake (Figures 3.11a and 3.11b).

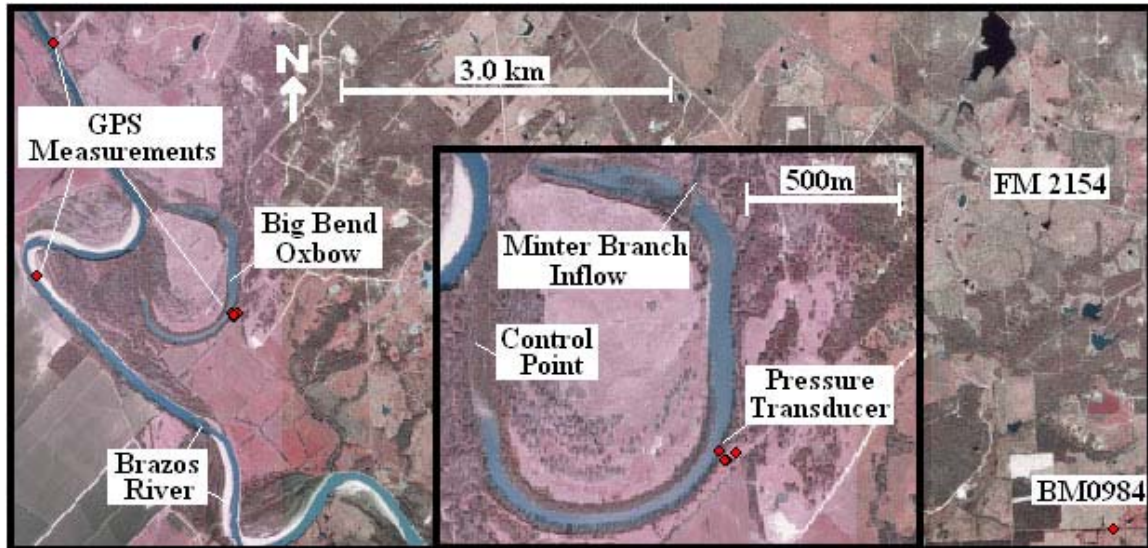


Figure 3.10 – DOQQ depicting Big Bend Oxbow Lake and pertinent ground features.



Figure 3.11a – Looking north along south arm of Big Bend Oxbow Lake (behind photographer to the south) towards Brazos River (past the trees in the background to the north).



Figure 3.11b – Channel from south arm of Big Bend Oxbow Lake (behind photographer to the south) to Brazos River (past the trees in the background to the north). Control point is located in the foreground in the small bare spot.

3.2.1 Big Bend Oxbow: determining the indicator flow rate

To determine frequency and duration of connection, streamflow records for the Brazos River near Big Bend Oxbow were derived from the same datasets and using the same methods as that previously described for Moelhman Slough (see section 3.1.1).

For this analysis, the GPS-measured slope of 0.6225 ft/mile was used, making a difference of 17.98 ft between the water surface elevation at the gauge #08108700 and at the point in the Brazos River where the connection with Big Bend Oxbow Lake begins. Connections between the Brazos River and Big Bend Oxbow Lake occur when the water surface elevation at gauge #08108700 exceed the control point elevation at Big Bend Oxbow Lake plus the difference in water surface elevation between the lake and gauge (point B in Figure 2.2). This occurs when the water surface elevation exceeds 210.28 ft (64.11 m). This elevation corresponds to a gauge height of 21.53 ft and a discharge of 20,000 cfs. Table 3.3 summarizes the elevation relationships for Big Bend Oxbow Lake.

Table 3.3 – Requirements for Connection between the Brazos River and Big Bend Oxbow

| | |
|---|-----------------|
| Control Point Elevation | 192.29 ft |
| River Slope | 0.6225 ft/mile |
| Distance From Gauge | 28.87 miles |
| Elevation Difference from Gauge | -17.98 ft |
| Gauge Water Surface Elevation Required for Connection | 210.27 ft |
| Gauge Height Required for Connection | 21.52 ft |
| Gauge Discharge Required for Connection | 20,000 cfs |
| LP3 recurrence interval for Connection | 1.13-year flood |

3.2.2 Big Bend Oxbow: verifying surface connectivity

To verify the accuracy of the connection requirements in Table 3.3, pressure transducers were used to measure the fluctuations in water levels within Big Bend Oxbow from 10/28/03 until 3/17/04 and from 5/6/04 until 9/7/04. Water surface elevations within the lake were calculated by adding the measured depth of the transducer to the known transducer elevation, determined upon installation using survey-grade GPS equipment. The time history of water surface elevations measured with the pressure transducers is shown in Figure 3.12.

During the time of the pressure transducer installation, the Brazos River connected with the oxbow lake on three occasions due to river flooding and once due to a rainfall event within the Big Bend Oxbow Lake watershed (Figure 3.12). The connection event attributed to rainfall (manifested as discharge out of the oxbow and into the river) occurred in mid-January 2004, coincident with a 2-in rainfall event recorded by NOAA at the airport in College Station, TX (precipitation data downloaded on 10/15/04 from http://www.weatherunderground.com/US/TX/College_Station.html). The water level in the oxbow rose 1 foot due to the rainfall event, causing water to drain over the control point and

into the Brazos River. Subsequent rainfall events caused the oxbow water level to rise on January 24, February 9, and March 1, 2004, each before sufficient time had passed for the oxbow's water level to drop below the control elevation.

Unlike Moelhman Slough and the other oxbows included in this study, rainfall events may trigger connections between Big Bend Oxbow and the Brazos River due to the lake's large watershed. The frequency of connections due solely to rainfall and runoff into the lake is a function of the frequency and intensity of precipitation in the lake's watershed, as well as ground cover and land use. These factors were not considered in this project. As shown in Figure 3.12, rainfall events that would cause runoff flow into Big Bend Oxbow Lake also tend to raise the Brazos River water surface elevation, and as observed in May to July of 2004 the Brazos River may overtop the control elevation as a result. However, the January, February, and March 2004 rain events did not cause sufficient increases in Brazos River WSEs to cause river water to enter the oxbow. Monitoring and recording local rainfall events may be sufficient for predicting the frequency of connection between the Brazos River and Big Bend Oxbow.

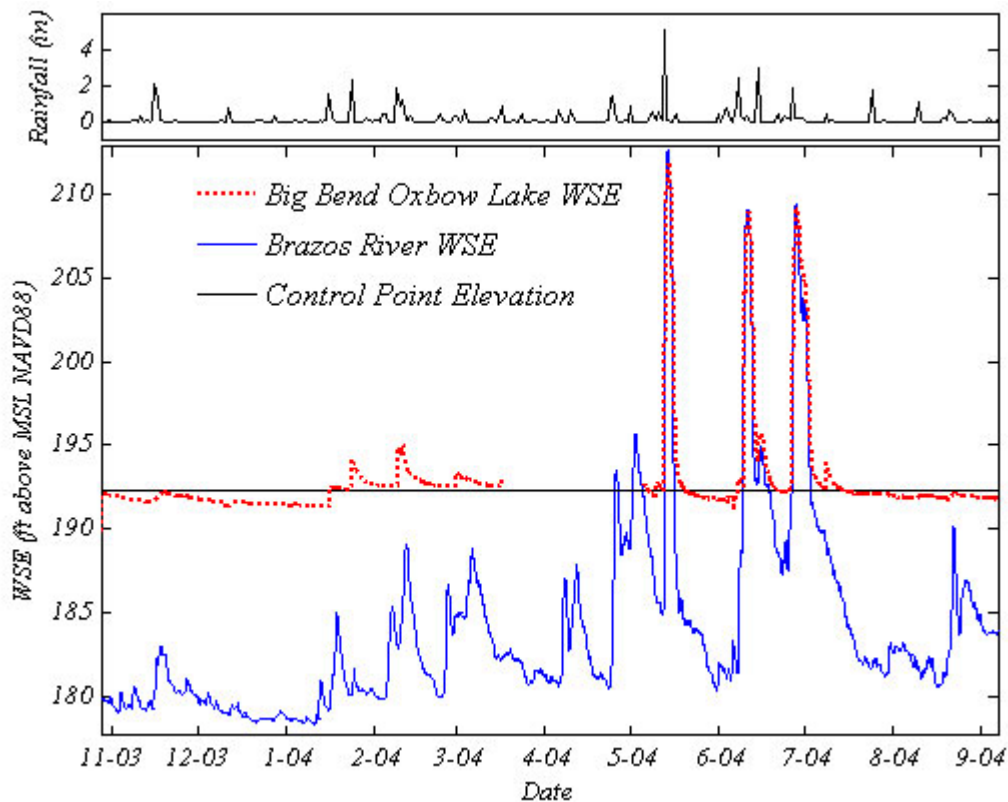


Figure 3.12 – Time history of Brazos River and Big Bend Oxbow Lake water surface elevations (WSEs) derived from measurements from USGS Gauge #08108700 and temporary pressure transducers installed near the lake boat ramp from 10/28/03 to 3/17/04 and 5/6/04 to 9/7/04. Rainfall data were measured at NOAA station KCLL at the airport in College Station, TX.

3.2.3 Big Bend Oxbow: historical connections

Full reports of the dates of connection and disconnection between the Brazos River and Big Bend Oxbow Lake are provided in Appendix B. These reports only consider connection resulting increased river stage; the reports do not consider connection resulting from increased lake water level attributable to local rainfall. Figures 3.13 and 3.14 show the timing and duration of predicted connection and disconnection periods for the last 20 years. The results shown in Figure 3.14 are only approximate due to the limitations of the stream flow data before 1993 and due to the steady-state assumption described in Section 2.3. The majority of the connections occur during the spring months (March thru May), and least often between August and early October (also see Figure 3.1). Of the 20 years shown, three years did not contain a single connection. The longest periods without connections spanned 1.5 to 2.0 years, whereas the shorter periods between connections spanned 2 to 35 days. The average duration of connections within the past 20 years was 5.9 days. Figure 3.15 displays a histogram of the number of connections per year for each of the years of record.

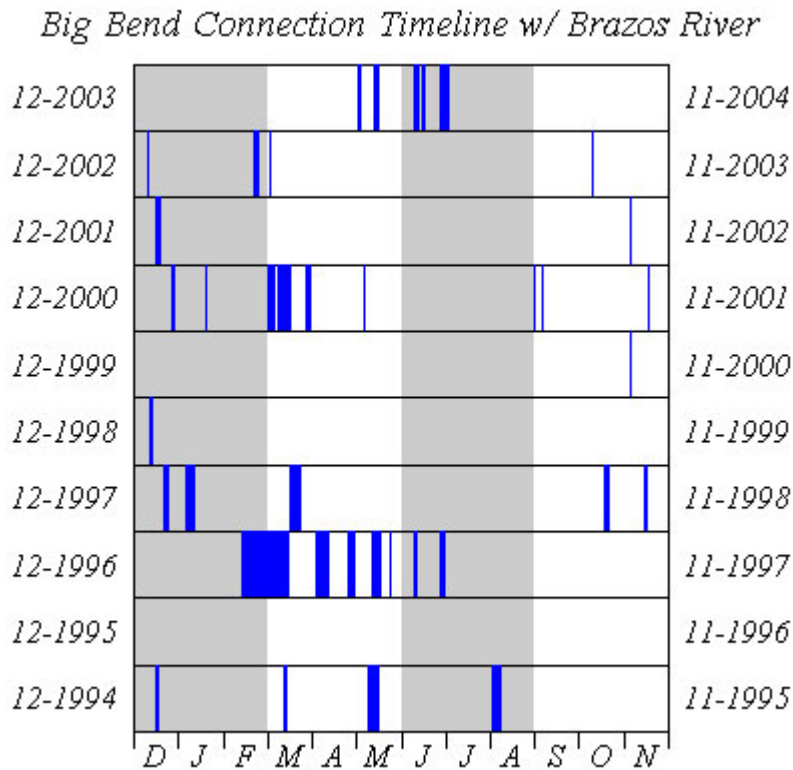


Figure 3.13 – Calendar of connections between the Brazos River and Big Bend Oxbow Lake from December 1994 to the present. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

Big Bend Connection Timeline w/ Brazos River

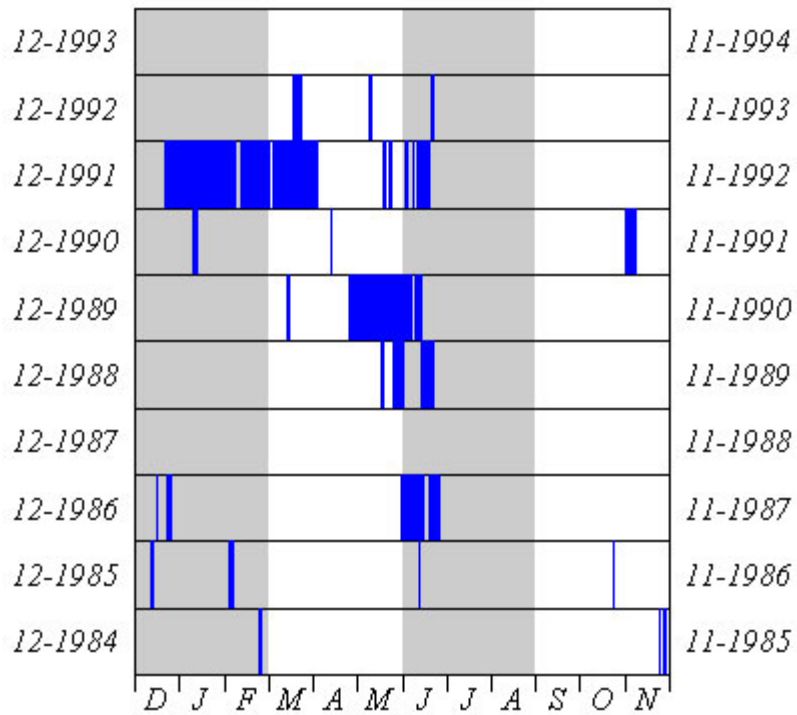


Figure 3.14 – Calendar of connections between the Brazos River and Big Bend Oxbow Lake from December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

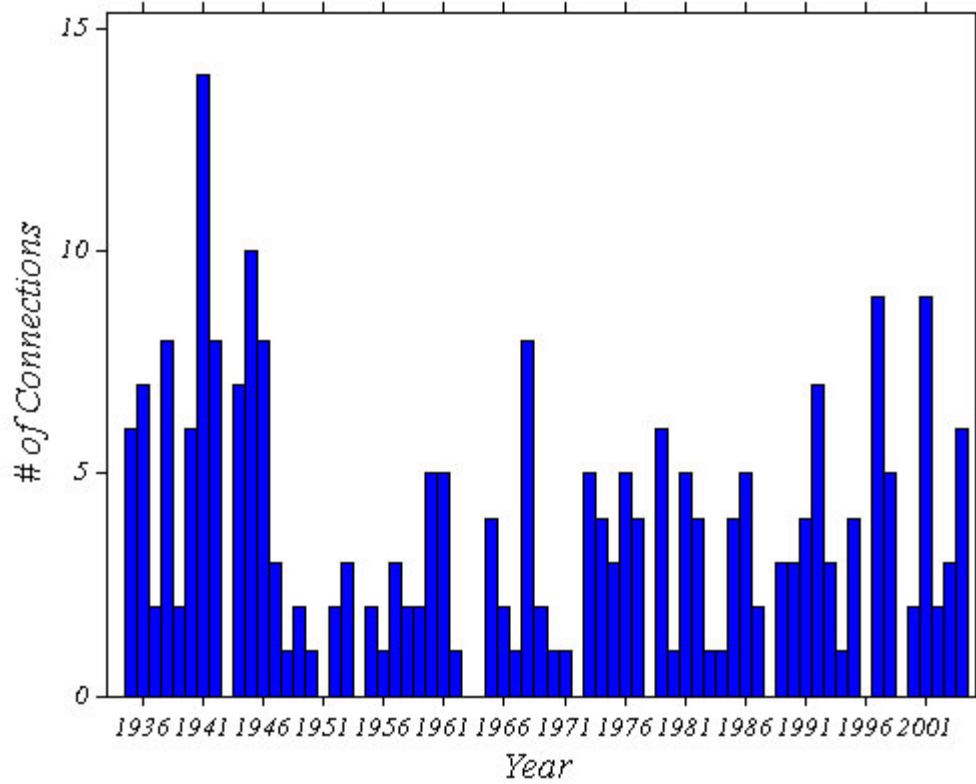


Figure 3.15 – Histogram showing the number of connections per year between the Brazos River and Big Bend Oxbow Lake based on stream flow data from 1934-Present. Data before 1993 is approximate.

3.3 Korthauer Bottom

Korthauer Bottom is located approximately 10.5 river-miles downstream of USGS gauge #08111500 on the Brazos River near Hempstead, TX (Figure 3.16) at the US 290 bridge. The oxbow lake is located just north of the Caney Creek watershed, which currently drains into the Brazos River south of the lake. Chemical and isotope signatures from sample water collected from the lake most closely resembled evaporated water that originated from the Brazos River at high flow (Chowdhury 2004).

The control point elevation at Korthauer Bottom, measured from the NAVD88 datum, was determined to be 126.6 ft (38.6 meters) on 9/16/03. Connections with the Brazos River first occur along the east arm of the lake (Figure 3.16), where the control point is the elevation of a swale between Caney Creek and the east arm of the oxbow. A bog exists between the control point and the east arm (Figure 3.17).

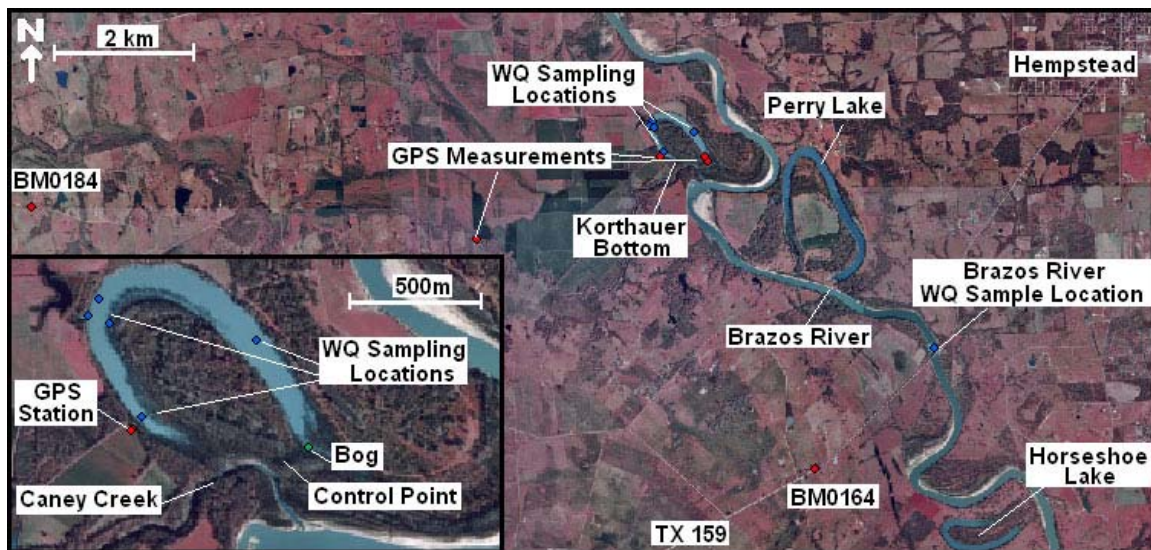


Figure 3.16 – DOQQ depicting Korthauer Bottom and pertinent ground features.



Figure 3.17 – Bog between Caney Creek and the south end of the east arm of Korthauer Bottom. The control point is the swale between the bog and the creek.

3.3.1 Korthauer Bottom: determining the indicator flow rate

To determine frequency and duration of connectivity, streamflow records for the Brazos River near Korthauer Bottom were derived from the following datasets:

- USGS Gauge #08111500 Brazos Rv at nr Hempstead, TX:
 - Real time Discharge & Gauge Height Data – 60 min increments, 10/21/03-10/15/04. Downloaded in 31 day units each 1st & 15th of the month without alteration
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=081111500&agency_cd=USGS
- USGS Gauge #08111500 Brazos Rv at nr Hempstead, TX:
 - Provisional Discharge & Gauge Height Data – 60 min increments, 10/1/95-10/21/03.
 Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit
- USGS Gauge #08111500 Brazos Rv at nr Hempstead, TX
 - Historical Daily Average Discharge Data, 10/1/38-10/1/95
 Downloaded without alteration on 10/18/04
http://nwis.waterdata.usgs.gov/tx/nwis/discharge/?site_no=08111500
- USGS Gauge #08111500 Brazos Rv at nr Hempstead, TX:
 - Rating Curve Data
 Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit

The rating curve data provided by the USGS for the USGS Gauge #08111500 was accurate up to 5/14/04 and was used to estimate gauge heights for the daily averaged discharge data.

These height estimates are only approximate given that river rating data changes with time as the river meanders and deposits/entrains bank sediment and that only daily-averaged discharge data was available. The daily averaged values may not represent the variation in flows (daily peaks or low flows) within individual days. For this analysis, the daily average discharges and their approximated gauge heights were assumed to have occurred at 12:00pm on each day. Discharges and gauge heights at other times of the day were approximated with linear interpolation. For the purposes of this analysis, the approximated discharge and height data from the USGS Gauge #08111500 are sufficient to suggest the behavior of the Brazos River near Korthauer Bottom, although calculations of connection times and frequencies before 10/1/95 must be considered approximate.

River water surface elevations were determined by adding the gauge height values to the datum value for the USGS gauge #08111500. As published by the USGS, the NGVD29 gauge datum value is 107.90 ft. Conversion of this datum to the NAD88 datum was performed using the VERTCON software from the US National Geodetic Survey (<http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html>). The datum in the NAVD88 system is 107.96 ft. Survey grade GPS equipment was used to verify the published gauge datum, based on published elevation data for NGS Benchmark BM0081. Based on the GPS calculations, the Brazos River water surface elevation near gauge #08111500 at 6:45PM on 9/7/04 was 128.04ft when the gauge height was recorded at 15.50 ft, suggesting the gauge datum to be 112.54 ft. The value represents a difference of 4.58 ft from the published USGS gauge datum. Time constraints prevented further GPS measurements to verify either the published USGS datum or the datum measured with the GPS. For the analysis presented in this report, the GPS calculated datum of 112.54 ft NAVD88 was used.

The river slope near Korthauer Bottom was approximated from comparisons of water surface elevations at the gauge #08111500 and at gauge #08114000 Brazos Rv at Richmond, TX 102.8 river miles downstream. The water surface elevations at gauge #08114000 were determined by adding the published gauge heights to the USGS published gauge datum (27.94 ft). River slopes were calculated based on gauge records from 1/1/01 until 10/15/04, and the mean slope was 1.11 ft/mile. This slope agrees well with the slope measured between Caney Creek and gauge #08111500 at 4:00PM on 9/16/03. At that time, the elevation in Caney Creek (as determined by differential leveling and survey grade GPS measurements) was 114.15 ft, the gauge height was 13.05 ft, and the gauge water surface elevation was 125.59 ft. With Caney Creek 10.5 miles downstream of the gauge, the measured elevation difference suggests a slope of 1.09 ft/mile on 9/16/03. An additional measurement of the river slope was obtained while surveying Horseshoe Lake (See Section 4.4) with survey-grade GPS equipment on 9/8/04. At 3:50PM the water surface elevation of the Brazos River at the TX 159 bridge (Figure 2.15) was 114.89 ft when the elevation at gauge #08111500 13.5 miles upstream was 128.05 ft, yielding a slope of 0.97 ft/mile at 4,740 cfs on 9/8/04. Given the similarity between the calculated slopes, the error in any single slope measurement may be assumed small. For this analysis, a river slope of 1.09 ft/mile was used, corresponding to the measured slope between gauge #08111500 and Caney Creek on 9/16/03.

Connections between the Brazos River and Korthauer Bottom occur when the water surface elevation at gauge #08108700 exceeds the control point elevation at the lake plus the difference in water surface elevation between the lake and gauge (point B on Figure 2.2). This occurs when the gauge water surface elevation exceeds 138.04 ft (42.0 m). This elevation corresponds to a gauge height of 25.50 ft and a discharge of 20,500 cfs. Table 3.4 summarizes the elevation relationships for Korthauer Bottom.

No water level instrumentation was installed on-site to verify connection predictions.

Table 3.4 – Requirements for Connection between the Brazos River and Korthauer Bottom

| | |
|---|----------------|
| Control Point Elevation | 126.60 ft |
| River Slope | 1.09 ft/mile |
| Distance From Gauge | 10.5 miles |
| Elevation Difference from Gauge | -11.44 ft |
| Gauge Water Surface Elevation Required for Connection | 138.04 ft |
| Gauge Height Required for Connection | 25.50 ft |
| Gauge Discharge Required for Connection | 20,500 cfs |
| LP3 recurrence interval for Connection | < 1-year flood |

3.3.2 Korthauer Bottom: historical connections

Full reports of the dates of connection and disconnection between the Brazos River and Korthauer Bottom are provided in Appendix C. Figures 3.18 and 3.19 show the timing and duration of predicted connection and disconnection periods for the last 20 years assuming that the control point elevation has not changed (see section 2.3). The results shown in Figure 3.19 are only approximate due to the limitations of the stream flow data before 1995. The majority of the connections occur during the spring months (March thru May), and least often between July and early October (see also Figure 3.1). Of the 20 years shown, two years did not contain a single connection. The longest periods without connections spanned 1.0 to 1.5 years, whereas the shorter periods between connections spanned 2 to 8 days. The average duration of connections within the past 20 years was 8.0 days. Figure 3.20 displays a histogram of the number of connections per year for each of the years of record.

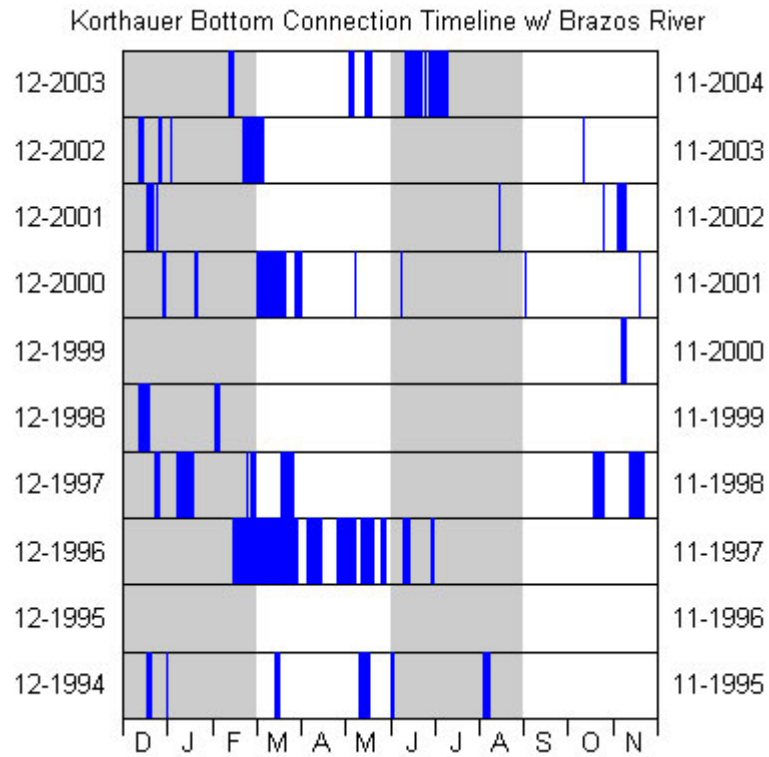


Figure 3.18 – Calendar of connections between the Brazos River and Korthauer Bottom from December 1994 to the present. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

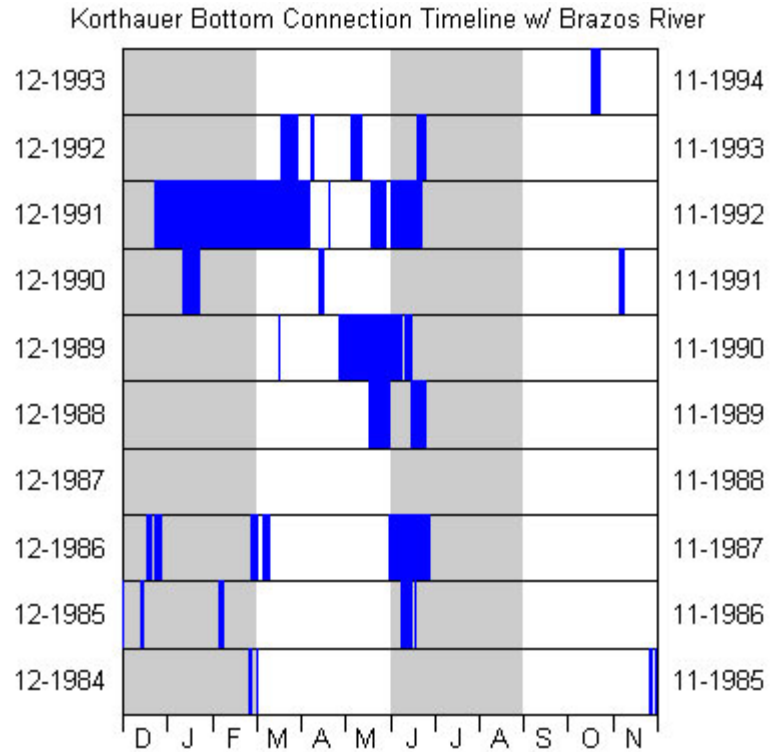


Figure 3.19 – Calendar of connections between the Brazos River and Korthauer Bottom from December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

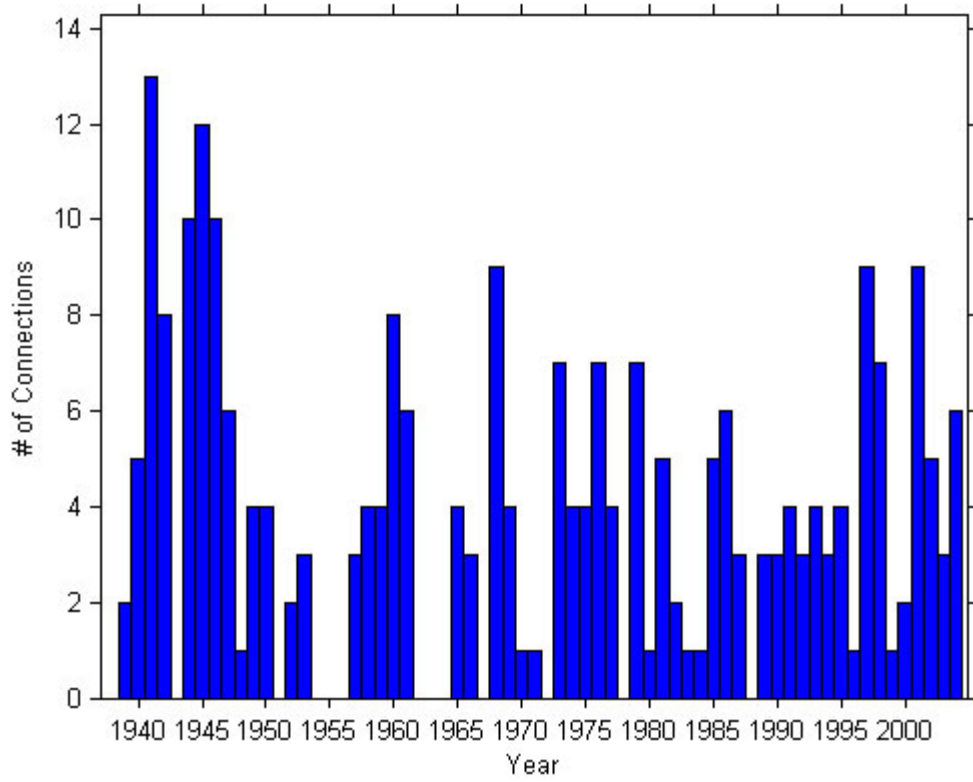


Figure 3.20 – Histogram showing the number of connections per year between the Brazos River and Korthauer Bottom based on stream flow data from 1938-Present. Data before 1995 is approximate.

3.4 Horseshoe Lake

Horseshoe Lake is located approximately 15.8 river-miles downstream of USGS gauge #08111500 on the Brazos River near Hempstead, TX (Figure 3.21). The lake is located on a plateau bordered by a sharp bend in the Brazos River, and is 2.25 miles downstream from SH159 bridging crossing the Brazos River. According to the landowner, the lake and river reconnect “very infrequently” and there is little surface runoff contributing to the lake volume. Chemical and isotope signatures from sample water collected from the lake most closely resembled evaporated water that originated from the alluvial aquifer (Chowdhury 2004).

The DOQQ aerial photo in Figure 3.21 was taken in 1995 and the lake surface area on the date of survey (September 8, 2004) is shown outlined in red. The Brazos River has also meandered since the date of the DOQQ, and the current right bank (facing downstream) is located at the left GPS measurement in the inset map on Figure 3.21. The extent of bank erosion along this bend is evident in Figure 3.22, a photograph taken from the plateau surface above which the GPS measurement of the Brazos River water surface elevation was collected.

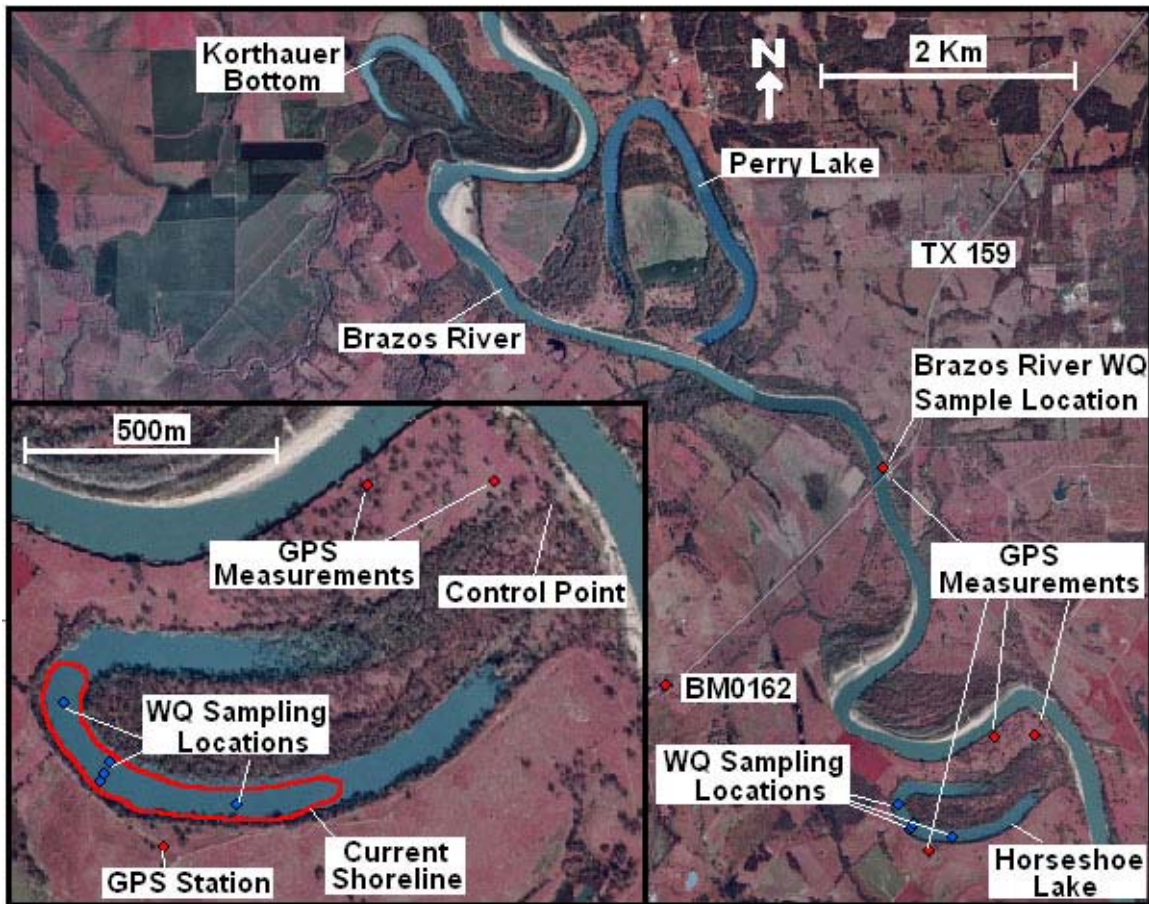


Figure 3.21 – DOQQ depicting Horseshoe Lake and pertinent ground features.

The control point elevation at Horseshoe Lake, measured from the NAVD88 datum, was determined to be 147.1 ft (44.9 meters) on 9/8/04. Connections with the Brazos River first occur along the north arm of the lake (Figure 3.21), where the control point is the high point in a small wooded channel running from the end of the oxbow arm (Figure 3.23). The control point elevation was measured by differential leveling from a temporary benchmark setup to the north (Figure 3.21 – the right most GPS measurement). Survey grade GPS equipment was used to determine the elevation of the temporary benchmark.



Figure 3.22 –Erosion along the banks of the Brazos River near Horseshoe Lake. Looking upstream from right bank above location of GPS measurement of Brazos River water surface elevation.



Figure 3.23 – Dirt road crossing the old river channel between the Brazos River and Horseshoe Lake. The control point is the road surface, from which the channel slopes westward toward the lake and eastward toward the river.

3.4.1 Horseshoe Lake: determining the indicator flow rate

To determine the frequency and duration of connection, streamflow records for the Brazos River near Horseshoe Lake were derived from the same datasets as those described for Korthauer Bottom.

The river slope near Horseshoe Lake was approximated from comparisons of water surface elevations at the gauge #08111500 and at gauge #08114000 Brazos Rv at Richmond, TX 102.8 river miles downstream. The water surface elevations at gauge #08114000 were determined by adding the published gauge heights to the USGS published gauge datum (27.94 ft). River slopes were calculated based on gauge records from 1/1/01 until 10/15/04, and the mean slope was 1.11 ft/mile. This slope is well above the 0.90 ft/mile slope measured with survey grade GPS on 9/8/04 at 3:50 pm at 4,740cfs when the water surface elevation near Horseshoe Lake was measured 113.8 ft (34.7 m), the USGS gauge #08111500 recorded 15.51 ft, and the water surface elevation at the gauge was 128.05 ft. Water surface elevation measurements of the Brazos River at TX 159 (2.25 miles upstream from Horseshoe Lake) suggest a river slope of 0.97 ft/mile from the #08111500 gauge to TX 159 and 0.49 ft/mile from TX159 to Horseshoe Lake. These discrepancies in slope values demonstrate the variable nature of the river slope within reaches of the Brazos River between Hempstead and Richmond, suggesting that the simple slope-based analysis presented here may not be suitable for predicting the connections between the Brazos River and Horseshoe Lake. For this analysis, the 0.90 ft/mile river slope measured on 9/8/04 using GPS was used in calculating river water surface elevations.

Connections between the Brazos River and Horseshoe Lake occur when the water surface elevation at gauge #08108700 exceeds the control point elevation at the lake plus the difference in water surface elevation between the lake and gauge. This occurs when the gauge water surface elevation exceeds 161.4 ft (49.4 m). This elevation corresponds to a gauge height of 48.85 ft and a discharge of 99,000 cfs. Table 3.5 summarizes the elevation relationships for Horseshoe Lake.

No water level instrumentation was installed on-site to verify connection predictions.

Table 3.5 – Requirements for Connection between the Brazos River and Horseshoe Lake

| | |
|---|----------------|
| Control Point Elevation | 147.1 ft |
| River Slope | 0.90 ft/mile |
| Distance From Gauge | 15.7 miles |
| Elevation Difference from Gauge | -14.3 ft |
| Gauge Water Surface Elevation Required for Connection | 161.4 ft |
| Gauge Height Required for Connection | 48.85 ft |
| Gauge Discharge Required for Connection | 99,000 cfs |
| LP3 recurrence interval for Connection | >10-year flood |

3.4.2 Horseshoe Lake: historical connections

Full reports of the dates of connection and disconnection between the Brazos River and Horseshoe Lake are provided in Appendix D. Figures 3.24 and 3.25 show the timing and duration of predicted connection and disconnection periods for the last 20 years, assuming that the control point did not change (see section 2.3). The results shown in Figure 3.25 are only approximate due to the limitations of the stream flow data before 1995. As shown, the only connection between the Brazos River and Horseshoe Lake occurred as a result of the 1991 flood, which had a peak discharge of 138,000 cfs. Over the entire period of record, only 6 connections occurred, with most connections occurring before 1970 (Figure 3.26).



Figure 3.24 – Calendar of connections between the Brazos River and Horseshoe Lake from December 1994 to the present. Blue regions denote periods of connection (none are shown). Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

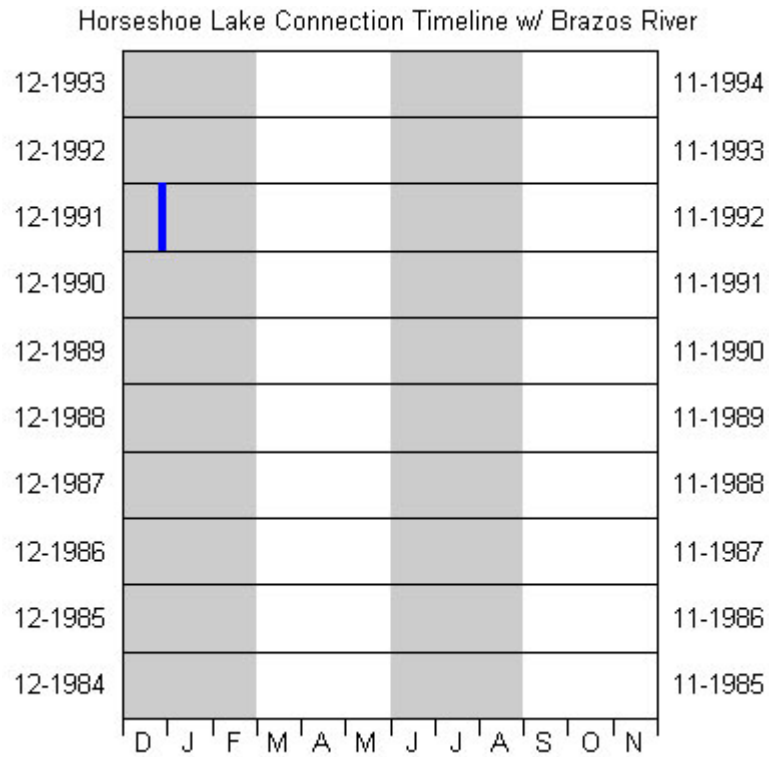


Figure 3.25 – Calendar of connections between the Brazos River and Horseshoe Lake from December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

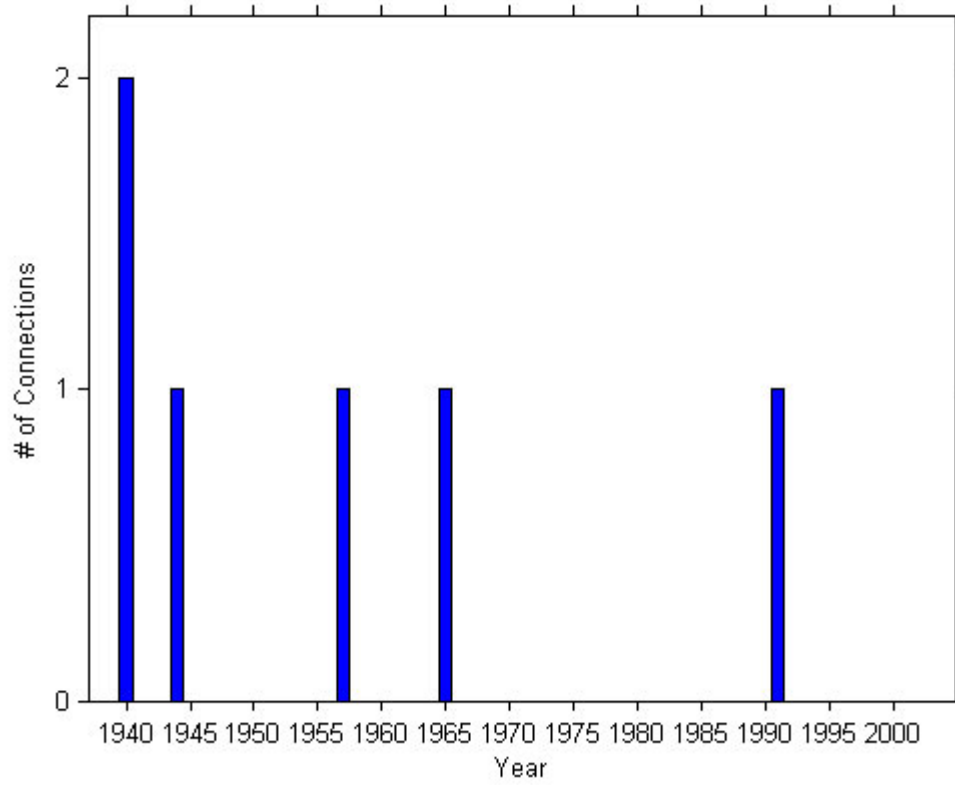


Figure 3.26 – Histogram showing the number of connections per year between the Brazos River and Horseshoe Lake based on stream flow data from 1938-Present. Data before 1995 is approximate.

3.5 Hog Island Oxbow Lake

Hog Island Oxbow Lake is located approximately 8.8 river-miles downstream of USGS gauge #08116650 on the Brazos River near Rosharon, TX (Figure 3.27). The lake formed within the last ten years and is no longer connected to the Brazos River. This lake was identified for further study by TWDB, TPWD, TCEQ and Freese and Nichols staff during aerial reconnaissance conducted for a lower Brazos River instream flow assessment (Osting et al 2004).

The south arm of the oxbow lake has been cut off from the river, and natural sand levees now abut a narrow channel connecting the north arm to the river at sufficient river flows (banks approximated by the red lines on Figure 3.27). Figures 3.28 to 3.32 illustrate the changes in the oxbow mouth from the time of the DOQQ photo (1996) to the present. From 2002 onward, sediment has accumulated at the connection between the oxbow and the river; the river banks have become steeper, especially where the south arm of the oxbow abuts the current river channel.

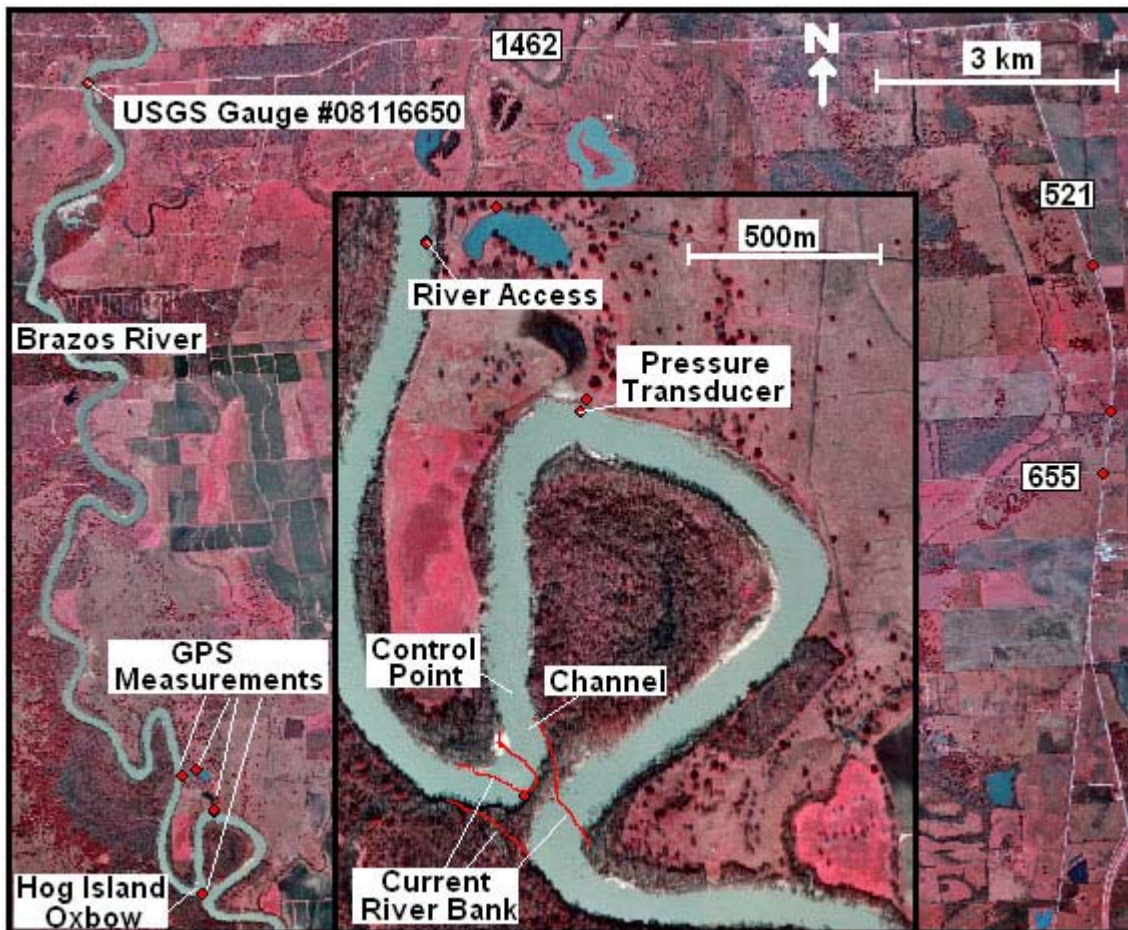


Figure 3.27 – DOQQ depicting Hog Island Oxbow Lake and pertinent ground features. DOQQ photographed January 23, 1996.



Figure 3.28 – Formation of Hog Island Oxbow – January 23, 2002. Gently sloping sand banks separate the south arm (right) from the Brazos River (bottom). Sand bar is beginning to form on the north arm and the connection channel is prevalent. Brazos River Flow ~4,800 cfs.



Figure 3.29 – Formation of Hog Island Oxbow – October, 2003. Looking upstream on the Brazos River from the downstream bank of the north arm of the oxbow. Flow is 2,277 cfs.



Figure 3.30 – Formation of Hog Island Oxbow – December, 2003. Looking downstream on the Brazos River from the upstream bank of the north arm of the oxbow. Brazos River Flow is 1,570 cfs.



Figure 3.31 – Formation of Hog Island Oxbow – June, 2004. Looking downstream on the Brazos River from the upstream bank of the north arm of the oxbow. Brazos River Flow is 3,470 cfs.



Figure 3.32 – Formation of Hog Island Oxbow – September, 2004. Looking downstream on the Brazos River from the upstream bank of the north arm of the oxbow. Brazos River Flow is 3,380 cfs.

The rapid changes in bank form between 2002 and 2004 suggest that sediment deposition is occurring within the oxbow and around its connection point with the Brazos river. This deposition caused changes to the control point elevation which affect the frequency with which river water may exchange with the oxbow water. The control point elevation at Hog Island Oxbow Lake was measured on two occasions using differential leveling and survey-grade GPS equipment. On December 18, 2003 the control point elevation was measured at 2.9 ft NAVD889. A 4” deep channel was discharging water from the oxbow to the river at the time of measurement (Figure 3.33). On September 27, 2004, the control elevation was measured at 4.0 ft, and the depth of the discharge into the Brazos River was 1.5 ft (Figure 3.34).

The 1.1 ft increase in control point elevation between December 2003 and September 2004 is indicative of the changes in the Hog Island Oxbow system resulting from sediment deposition. Significant Brazos River flooding between December 2003 and June of 2004 deposited over 1 foot of sediment (Figure 3.35) on the river banks near the river access point (Figure 3.27).



Figure 3.33 – Channel leading from the control point of the Hog Island Oxbow Lake to the Brazos River. The control point is located off the picture, around the bend in the channel.
(12/17/03)



Figure 3.34 – Channel leading from the control point of the Hog Island Oxbow Lake to the Brazos River. The control point is located off the picture, around the bend in the channel.
(9/27/04)



Figure 3.35 – *Sediment Deposition on the banks of the Brazos River from December 2003 until June 2004. Over 12” of sediment was deposited on installed equipment.*

Given the dynamic nature of the Hog Island Oxbow system, the use of a single control point elevation in determining periods of oxbow connection and disconnection, even for the short duration of this study, is not possible. However, the periods of disconnection are likely to be short given that the oxbow is connected at flows as low as 1,570 cfs (Figure 3.30), a flow value below the mean daily flows for each day of the year as reported by the USGS (http://nwis.waterdata.usgs.gov/tx/nwis/dvstat/?site_no=08116650&agency_cd=USGS). Therefore a wetted path between the oxbow and the river is likely to be available for the majority of the time; however, the change in control point elevation observed over the course of this study is an important indicator of the change in connectivity that can be expected over time. The rate of change in control point elevation was not predictable since the rate of sediment deposition is dependant upon the frequency of flood events and abundance of deposited sediment. For this analysis, the control point elevation was 2.9ft, as measured in December 2003.

3.5.1 Hog Island Oxbow: determining the indicator flow rate

To determine frequency and duration of connection, streamflow records for the Brazos River near Hog Island Oxbow Lake were derived from the following datasets:

- USGS Gauge #08116650 Brazos Rv nr Rosharon, TX:
 - Discharge & Gauge Height Data – 15 min increments, 12/31/01- 10/15/04.
Downloaded in 31 day units each 1st & 15th of the month without alteration
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08116650&agency_cd=USGS
- USGS Gauge #08116650 Brazos Rv nr Rosharon, TX:
 - Provisional Discharge & Gauge Height Data – 60 min increments, 10/1/95-12/31/01.
Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit
- USGS Gauge #08116650 Brazos Rv nr Rosharon, TX:
 - Daily Average Discharge Data, 4/1/67-10/1/95
Downloaded without alteration on 10/18/04
http://nwis.waterdata.usgs.gov/tx/nwis/discharge/?site_no=08116650
Data unavailable from 10/1/80 to 4/25/84
- USGS Gauge #08116650 Brazos Rv nr Rosharon, TX:
 - Rating Curve Data
Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit

The rating curve data for USGS Gauge #08116650 was accurate up to 9/1/04 and was used to estimate gauge heights for the daily averaged discharge data. These height estimates are only approximate given that river rating data changes with time as the river meanders and deposits/entrains bank sediment and that only daily-averaged discharge data was available. The daily averaged values may not represent the variation in flows (daily peaks or low flows) within individual days. For this analysis, the daily average discharges and their approximated gauge heights were assumed to have occurred at 12:00pm on each day. Discharges and gauge heights at other times of the day were approximated with linear interpolation. For the purposes of this analysis, the approximated discharge and height data from the USGS Gauge #08116650 are sufficient to suggest the behavior of the Brazos River near Hog Island Oxbow Lake, although calculations of connection times and frequencies before 10/1/95 must be considered approximate. It is also understood that “connections” determined before 1995 suggest only that sufficient flows existed to exchange water with the oxbow had the oxbow actually existed.

River water surface elevations were determined by adding the gauge height values to the datum value for the USGS gauge #08116650. As published by the USGS, the NGVD29 gauge datum value is 0.0 ft. Conversion of this datum to the NAD88 datum was performed using the VERTCON software from the US National Geodetic Survey (<http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html>). The datum in the NAV88 system is also 0.0 ft. Survey grade GPS equipment was used to verify the published gauge datum, based on published elevation data for NGS Benchmark BM0081. Based on the GPS calculations, the Brazos River water surface elevation near gauge #08116650 at 10:30AM on 9/28/04 was 8.70

ft when the gauge height was recorded at 7.53 ft, suggesting the gauge datum to be 1.27 ft. The value represents a difference of 1.27 ft from the published USGS gauge datum. Time constraints prevented further GPS measurements to verify either the published USGS datum or the datum measured with the GPS. For the analysis presented in this report, the GPS calculated datum of 1.27 ft was used.

The river slope near Hog Island Oxbow Lake was approximated from comparisons of water surface elevations at the gauge #08116650 and elevations measured with GPS equipment at the River Access point and at the oxbow mouth (Figure 3.27). Measurements on 12/18/03 and 6/3/04 suggest a slope of 0.50 and 0.51 ft/mile, respectively, between the gauge and the river access point. Measurements on 9/27/04 produced 0.43 ft/mile between the gauge and the access point, and 0.49 ft/mile between the gauge and the oxbow mouth. The consistency in these measurements suggested that a slope of 0.5 ft/mile would be an acceptable representation of the variable river slope within this stretch of the Brazos River. For this analysis, the 0.50 ft/mile river slope was used in calculating river water surface elevations.

Connections between the Brazos River and Hog Island Oxbow occur when the water surface elevation at gauge #08116650 exceeds the control point elevation at the lake plus the difference in water surface elevation between the lake and gauge (point B on Figure 2.2). This occurred when the gauge water surface elevation exceeds 7.4 ft (2.2 m). This elevation corresponds to a gauge height of 6.1 ft and a discharge of 1,570 cfs, consistent with the observation on 12/18/03 that the river is a near equilibrium with the oxbow at this flow (Figure 3.30). Table 3.6 summarizes the elevation relationships for Hog Island Oxbow Lake.

Table 3.6 – Requirements for Connection between the Brazos River and Hog Island Oxbow

| | |
|---|----------------|
| Control Point Elevation | 2.9-4.0 ft |
| River Slope | 0.50 ft/mile |
| Distance From Gauge | 8.8 miles |
| Elevation Difference from Gauge | -4.4 ft |
| Gauge Water Surface Elevation Required for Connection | 7.4 ft |
| Gauge Height Required for Connection | 6.1 ft |
| Gauge Discharge Required for Connection | 1,570 cfs |
| LP3 recurrence interval for Connection | < 1-year flood |

3.5.2 Hog Island Oxbow: verifying surface connectivity

To verify the accuracy of the connection measurements in Table 3.6, pressure transducers were installed to measure the fluctuations in water levels within Hog Island Oxbow Lake from 6/3/04 until 9/27/04. Water surface elevations within the lake were calculated by adding the measured depth of the transducer to the known transducer elevation, determined upon installation using survey-grade GPS equipment. The time history of water surface elevations measured with the pressure transducers is shown in Figure 3.36.

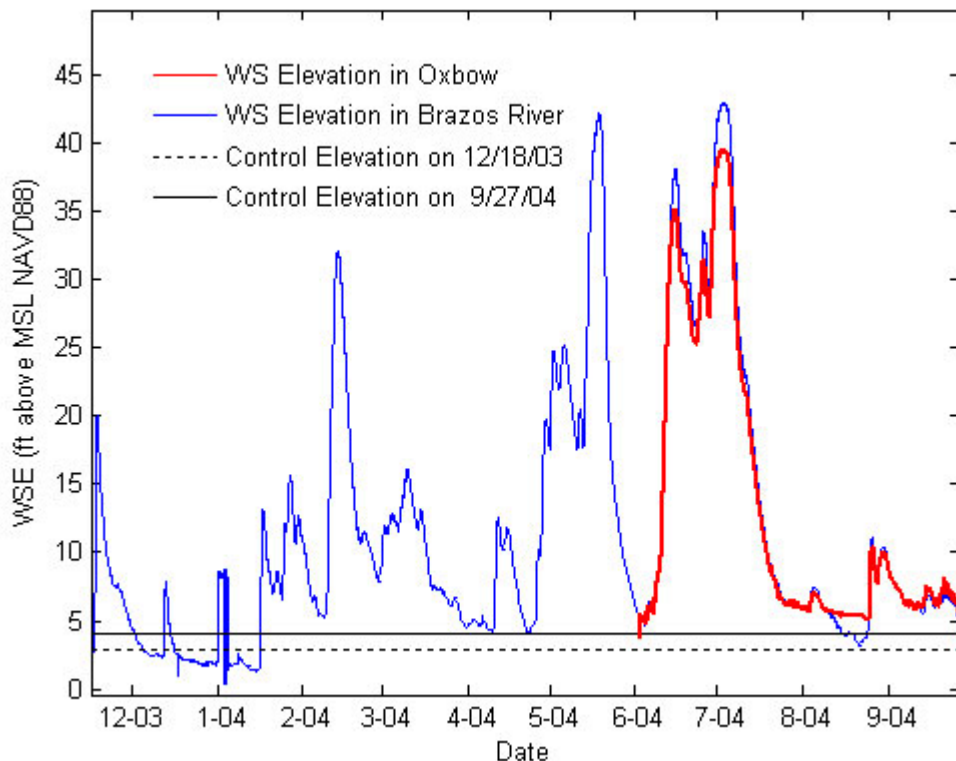


Figure 3.36 – Time history of Brazos River and Hog Island Oxbow Lake water surface elevations (WSEs) derived from measurements from USGS Gauge #08116650 and temporary pressure transducers installed near the lake boat ramp from 6/4/04 to 9/27/04.

The two substantial flooding events during the summer of 2004 caused Brazos River water to enter Hog Island Oxbow Lake, and the consequent rise in lake levels was confirmed with the pressure transducer data. The first connection rise, in June of 2004, caused the water level in the lake to peak at 35.2 ft whereas the Brazos River peak water level, based upon gauge records, reached 38.0 ft. The difference in peak heights (2.8 ft) could be due to either the 0.5 ft/mile slope being too low during flooding events (high flow may result in steeper slopes) or constriction at the gauge location resulting in higher water surface elevations at the gauge. The excellent agreement between WSEs at lower elevations suggested that the 0.5 ft/mile slope was appropriate under those conditions.

Evidence of flooding from an earlier May 2004 event was visible near the pressure transducer location on 6/3/04 (Figure 3.37) where the May flood event deposited sediment upon tree leaves. The approximate height of the high water mark from the May flood was measured (using differential leveling) to be approximately 38 ft, which is 4 feet below the peak rise in river elevation (estimated to be 42 ft) for that time period. This is the same difference between

river and oxbow peak WSEs as that which occurred in the July 2004 flood of the same magnitude.

As shown in Figure 3.36, although the elevation of the Brazos River dipped below the control elevation for Hog Island Oxbow Lake near the middle of August 2004, the elevation of the oxbow water surface did not decrease the same extent nor as rapidly. The observed slow rate of decrease (0.45 ft in 10 days) is too slow to suggest that the water is flowing from the oxbow over the control point and into the river. It is possible that the control elevation was higher during this time (near 6' NAVD88), or that debris reduced the flow into the river. The excellent agreement between the river and oxbow WSE data after mid August suggests that the pressure transducer was working properly and that the assumed 0.5 ft/mile river slope was still applicable.



Figure 3.37 – High water mark from the May 2004 flood is visible on trees on the bank of Hog Island Oxbow Lake. (6/3/2004)

3.5.3 Hog Island Oxbow: historical connections

Full reports of the dates of connection and disconnection between the Brazos River and Hog Island Oxbow are provided in Appendix E. Figures 3.38 and 3.39 show the timing and duration of predicted connection and disconnection periods for the last 20 years, assuming steady-state (see Section 2.3). The results before 1995 are indicative of the likelihood of connections having occurred had the oxbow existed at that time. As shown, Hog Island Oxbow readily exchanges water with the Brazos River, and most of the disconnections occur within the summer and fall months (see also Figure 3.1). Figure 3.40 shows a histogram of the number of separate connections occurring per year over the period of the stream flow records. Streamflow data was unavailable from 1981 until 1983.

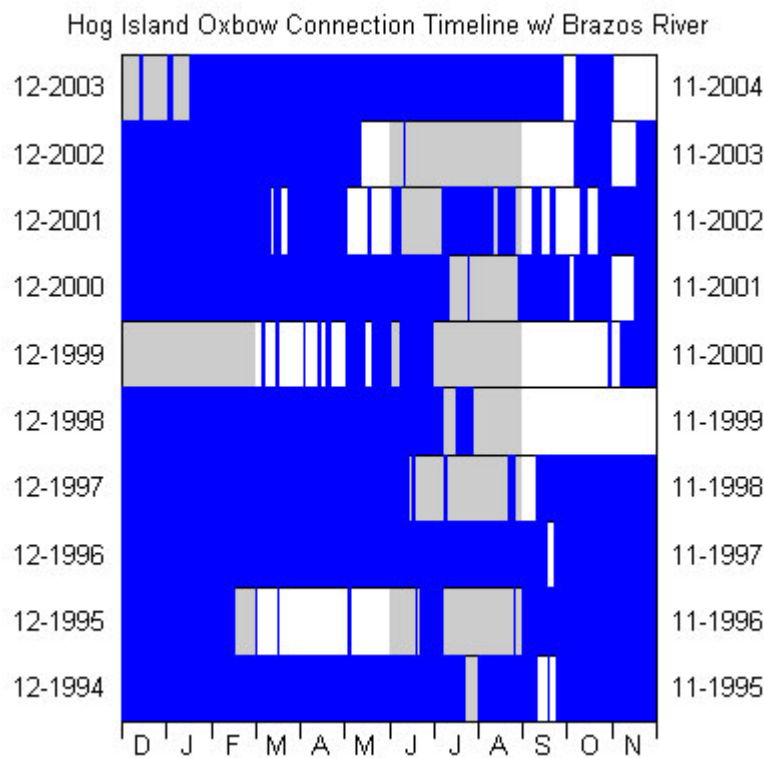


Figure 3.38 –Calendar of connections between the Brazos River and Hog Island Oxbow Lake from December 1994 to the present. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

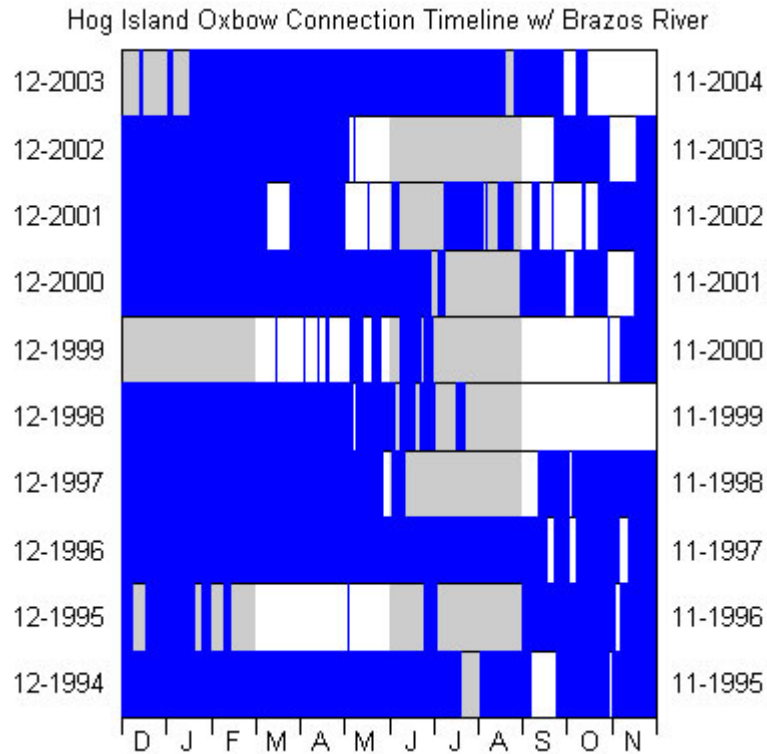


Figure 3.39 –Calendar of connections between the Brazos River and Hog Island Oxbow Lake from December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

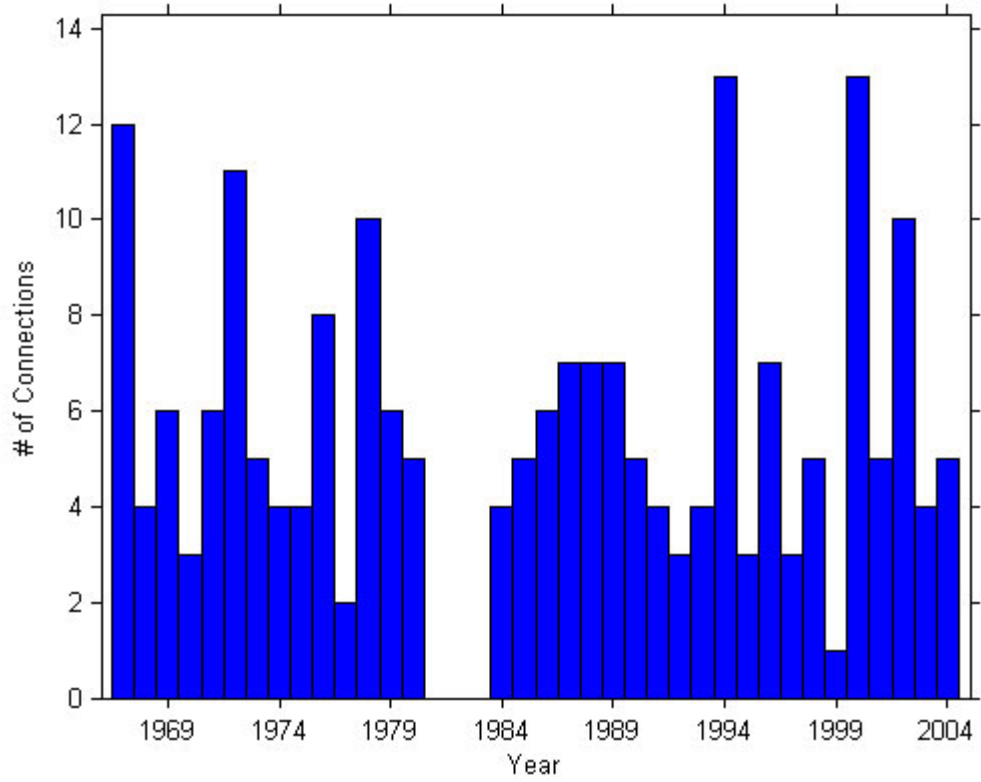


Figure 3.40 –Histogram showing the number of connections per year between the Brazos River and Hog Island Oxbow Lake based on stream flow data from 1967-Present. Data before 1995 is approximate. Data was unavailable from October 1980 to April 1984.

3.6 Cut-off Lake

Cut-off Lake is located near Lake Jackson, TX, approximately 38 river miles downstream of the Rosharon USGS gauging station, 29 river miles downstream of Hog Island oxbow and 20 river miles upstream from the Gulf of Mexico (Figures 3.41 and 3.42). The date of formation of this lake is unknown, but it is considered to be of similar age or older than Moelhman Slough. The oxbow was observed to receive surface drainage from a small creek located to the northwest (Figure 3.43); the drainage area of the creek included an irrigated gulf course and provides sufficient flow that the oxbow does not dry out. Surface connections between the Brazos River and the oxbow lake were described by the landowner as infrequent; the last connection was said to have occurred “during the last big flood 5 years ago,” which was likely the flood in October of 1998.

3.6.1 Cut-off Lake: determining the indicator flow rate

To determine the frequency and duration of connections, an on-the-ground survey was conducted and the most recent Flood Insurance Study (FIS) was consulted (FEMA 1999). Elevation measurements were collected in a ring around the oxbow using survey-grade GPS equipment in combination with an automatic level; the lowest measured elevation, referenced to NGS benchmarks on the NAVD88 datum, was 16.19’ and this was considered the control point elevation. The average ground surface elevation in the road circling the lake was 17.3’ NAVD88.

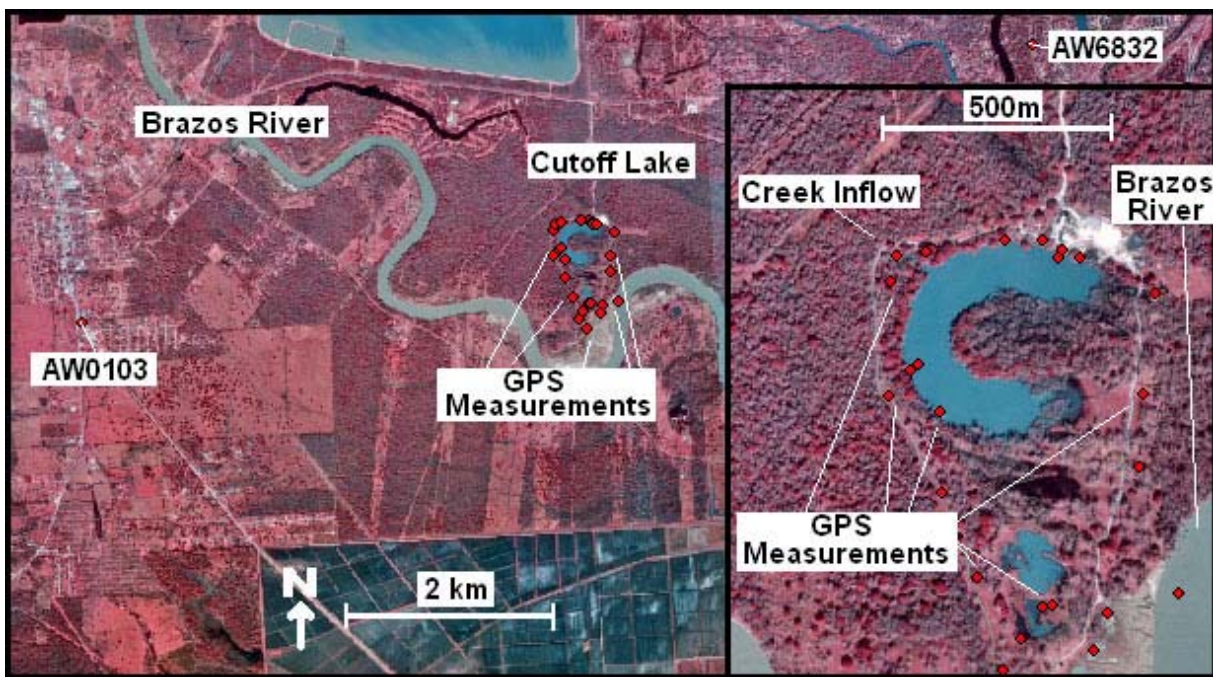


Figure 3.41 - DOQQ area and vicinity map for Cut-off Lake oxbow.

To tie the control point elevation to river stage, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) and a Brazoria County Flood Insurance Study (FIS) were consulted. FEMA FIRM Community Panel 48039C0595H effective June 5, 1989, included Cut-off Lake. The FIRM showed the lake to be in Zone AE with a Base Flood Elevation of 21' above the NGVD29 datum, and located between River Mile 18 and 19 (from mile zero at the coast).

Elevation benchmarks shown on the same FIRM panel allowed minor adjustment of the reported flood elevation to approximately 20' NAVD88. Considering the zone classification of AE, the water surface was estimated at or greater than approximately 3.0' of the ground surface, thus placing ground surface below 17' NAVD88 in the vicinity of the lake; this was consistent with elevation measurements taken on-site as part of this survey which averaged 17.3' NAVD88.

The flood surface elevation near the oxbow lake from profile 13P of the FIS (FEMA 1999) was determined. The flood elevation at River Mile 19 was shown as 19.75' NGVD29 for the 10-year flood, which was adjusted to 18.75' NAVD88 based upon the on-the-ground survey. The flow rate associated with the 10-year flood at this location was 76,200 cfs as recorded by the Richmond gauge (FEMA 1999). Streamflow records for the Brazos River near Cut-Off Lake were derived from the following datasets:

- USGS Gauge #08114000 Brazos Rv at Richmond, TX:
 - Discharge & Gauge Height Data – 15 min increments, 10/14/01- 11/1/04.
Real time data downloaded in 31 day units each 1st & 15th of the month without alteration
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08114000&agency_cd=USGS
- USGS Gauge #08114000 Brazos Rv at Richmond, TX:
 - Provisional Discharge & Gauge Height Data – 60 min increments, 10/1/95-10/14/01.
Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit
- USGS Gauge #08114000 Brazos Rv at Richmond, TX:
 - Daily Average Discharge Data, 1/1/1903-10/1/95
Downloaded without alteration on 10/18/04
http://nwis.waterdata.usgs.gov/tx/nwis/discharge/?site_no=08114000
- USGS Gauge #08114000 Brazos Rv at Richmond, TX:
 - Rating Curve Data
Provided by Debra A Sneck-Fahrer of the US Geological Survey, Houston Unit

The rating curve data for USGS Gauge #08114000 was accurate up to 4/15/04 and was used to estimate gauge heights for the daily averaged discharge data. These height estimates are only approximate given that river rating data changes with time as the river meanders and deposits/entrains bank sediment and that only daily-averaged discharge data was available. The daily averaged values may not represent the variation in flows (daily peaks or low flows) within individual days. For this analysis, the daily average discharges and their approximated gauge heights were assumed to have occurred at 12:00pm on each day. Discharges and gauge

heights at other times of the day were approximated with linear interpolation. For the purposes of this analysis, the approximated discharge and height data from the USGS Gauge #08114000 are sufficient to suggest the behavior of the Brazos River near Cut-Off Lake, although calculations of connection times and frequencies before 10/1/95 must be considered approximate.

No water level instrumentation was installed on-site to verify connection predictions.



Figure 3.42 – Photograph of Cutoff Lake (October 30, 2003).



Figure 3.43 – Photograph looking upstream of small creek draining into northwest side of Cutoff Lake; clear pooled water exhibited very low flow and tannic coloration.

3.6.2 Cut-off Lake: historical connections

The frequency and duration of occurrence of that flow rate is shown in Figures 3.44 and 3.45. Seasonal occurrence of connection is also shown in Figure 3.1. Thirty-one instances of potential connections were observed in the historical record that extends back to 1903. Mean duration of connection was 4.3 days, and connections predicted once every 3.4 years. Full reports of the dates of connection between the river and Cutoff Lake are provided in Appendix F.

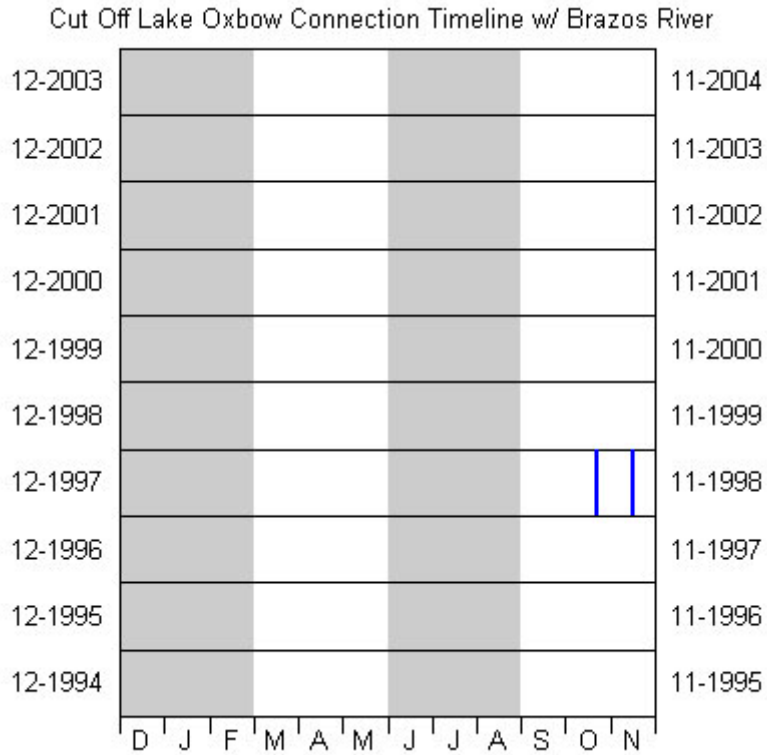


Figure 3.44 – Calendar of connections between Brazos River and Cutoff Lake for December 1994 to November 2004. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

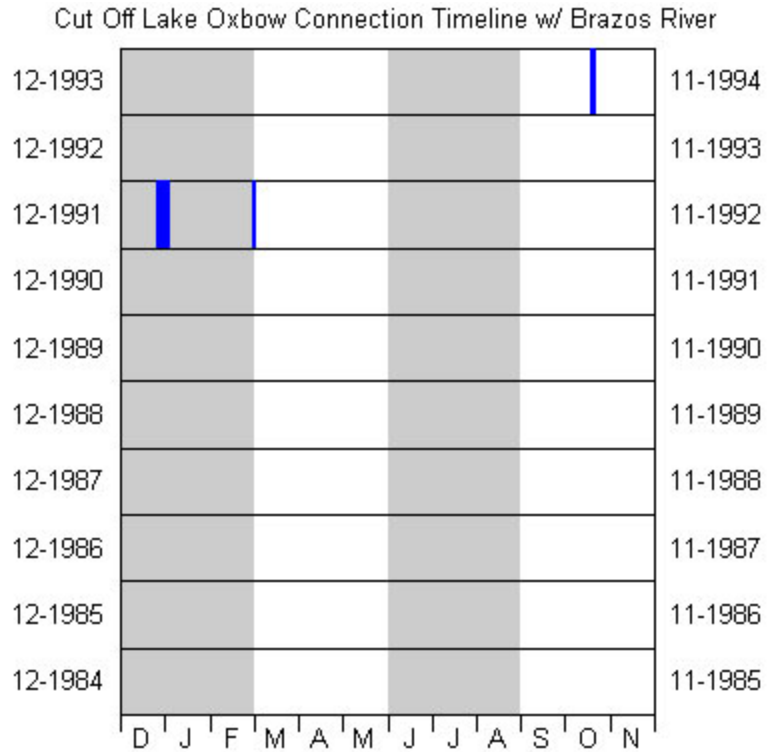


Figure 3.45 – Calendar of connections between Brazos River and Cutoff Lake for December 1984 to November 1994. Blue regions denote periods of connection. Dates are given at the ends of each row, with a row corresponding to 1 year. The winter and summer seasons are shown in grey.

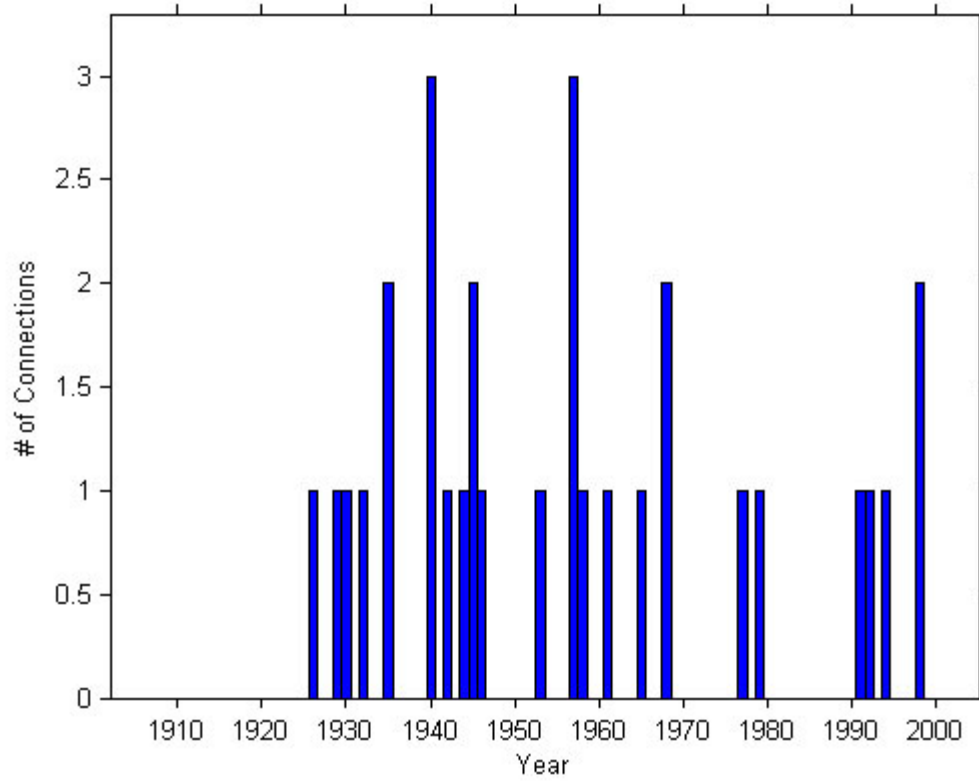


Figure 3.46 – Histogram showing the number of connections per year between the Brazos River and Cutoff Lake based upon stream flow data from 1903 to present.

4.0 Acknowledgements

The authors of this report would like to thank our cooperators and fellow researchers who gave some direction to this work. In particular we would like to thank the TWDB colleagues Dr. Barney Austin and Dr. Ali Chowdhury. Barney, our fearless leader, got this project off the ground and supported our efforts. Ali conducted the source water chemistry and isotope analysis.

Landowners

We would like to express our many thanks to the landowners who granted us access to their oxbow lakes over the last two years. We appreciate the opportunity to survey your important Texas resources.

Glenn Brandt
Tommy Lyons
W.C. Scasta
Ted and Dorothy Serna
John T. Smith
William Taylor
Ronald B. Woodley

Texas State University

Dr. Tim Bonner (co-PI),

Texas A&M University

Dr. Kirk Winemiller (co-PI), Dr. Frances Gelwick (co-PI), Steve Zeug, Clint Robertson

Texas Parks and Wildlife Department

Kevin Mayes, Dr. Randy Moss, Joe Trungale

Texas Commission on Environmental Quality

Doyle Mosier

Texas Department of Criminal Justice, Ramsey Unit

Joe Clinkowsky

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FEMA. 2001. Flood Insurance Study for Fort Bend County, Texas, and incorporated areas, November 7, 2001, 48157C. Federal Emergency Management Agency (FEMA), available from <http://msc.fema.gov/>.

Osting, Tim, Ray Mathews and Barney Austin. 2004. Analysis of instream flows for the lower Brazos River – Hydrology, Hydraulics and Fish Habitat Utilization, Final Report. Surface Water Resources Division, Texas Water Development Board. Contract 2001-REC-015 submitted to US Army Corps of Engineers in fulfillment of W45XMA11296580. June 2004. Available from <http://hyper20.twdb.state.tx.us/data/Inflow/Brazos04/LowBrazos2004.htm>

Moelhman Slough Oxbow Connections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/4/2004, 14:21

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 188.76ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 219.45 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81151 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76171 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 7217.8478 ft (1.36 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 484550.5249 ft (91.77 miles)
 Estimated Critical Gauge Height/WSE: 31.5413/220.3013 ft
 Height Buffer for "significant" connection: 0 ft
 Required Gauge Height/WSE for "significant" connection: 31.5413/220.3013 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-9/15/2004
 Number of Records: 335057
 Years of Record: 69.8828
 Number of Critical WSE Exceedences: 102
 Number of "significant" WSE Exceedences: 94
 Average Connections per year: 1.3451
 Flood Level Required for Connection: 1.9201 year flood (44683.9288 cfs)

Statistics

 Mean Duration of Connection (Days) : 3.614
 Standard Deviation of Connection Duration (Days) : 4.0702
 Minimum Duration of Connection (Days) : 0.41055
 Maximum Duration of Connection (Days) : 27.4884
 1st Percentile Duration of Connection (Days) : 0.38592
 10th Percentile Duration of Connection (Days) : 1.0519
 25th Percentile Duration of Connection (Days) : 1.7478
 50th Percentile Duration of Connection (Days) : 2.7093
 75th Percentile Duration of Connection (Days) : 3.8536
 95th Percentile Duration of Connection (Days) : 7.8357
 99th Percentile Duration of Connection (Days) : 27.2628
 Mean Time Between Connections (Days) : 265.9832
 Standard Deviation of Connection Duration (Days) : 442.7828
 Minimum Time Between Connections (Days) : 1.1332
 Maximum Time Between Connections (Days) : 2356.0437
 1st Percentile Time Between Connections (Days) : 1.0652
 10th Percentile Time Between Connections (Days) : 3.1127
 25th Percentile Time Between Connections (Days) : 10.3278
 50th Percentile Time Between Connections (Days) : 61.5281
 75th Percentile Time Between Connections (Days) : 339.6941
 95th Percentile Time Between Connections (Days) : 1349.0708
 99th Percentile Time Between Connections (Days) : 1755.4908

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, May 2004
 Statistics are derived based on "significant" connections

Moelhman Slough Oxbow Connections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/4/2004, 14:21

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 188.76ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 219.45 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81151 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76171 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 7217.8478 ft (1.36 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 484550.5249 ft (91.77 miles)
 Estimated Critical Gauge Height/WSE: 31.5413/220.3013 ft
 Height Buffer for "significant" connection: 0 ft
 Required Gauge Height/WSE for "significant" connection: 31.5413/220.3013 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-9/15/2004
 Number of Records: 335057
 Years of Record: 69.8828
 Number of Critical WSE Exceedences: 102
 Number of "significant" WSE Exceedences: 94
 Average Connections per year: 1.3451
 Flood Level Required for Connection: 1.9201 year flood (44683.9288 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|------------|------|-------|
| 94 | 06/27/2004 15:26 | 07/02/2004 06:54 | 4.64 days | 19 | |
| 93 | 06/10/2004 09:32 | 06/13/2004 02:34 | 2.70 days | 48 | |
| 92 | 05/13/2004 13:33 | 05/16/2004 04:39 | 2.62 days | 51 | |
| 91 | 02/22/2003 06:38 | 02/24/2003 04:51 | 1.92 days | 66 | |
| 90 | 12/17/2001 03:05 | 12/19/2001 11:44 | 2.36 days | 56 | |
| 89 | 10/18/1998 18:41 | 10/21/1998 20:03 | 3.05 days | 35 | |
| 88 | 01/07/1998 01:10 | 01/09/1998 19:38 | 2.76 days | 45 | |
| 87 | 12/22/1997 06:37 | 12/23/1997 20:41 | 1.58 days | 75 | |
| 86 | 04/05/1997 11:24 | 04/08/1997 10:50 | 2.97 days | 38 | |
| 85 | 03/11/1997 11:24 | 03/15/1997 11:27 | 4.00 days | 22 | |
| 84 | 02/26/1997 14:12 | 03/01/1997 09:19 | 2.79 days | 44 | |
| 83 | 02/14/1997 01:28 | 02/15/1997 09:06 | 1.31 days | 80 | |
| 82 | 06/02/1992 17:40 | 06/03/1992 19:14 | 1.06 days | 84 | |
| 81 | 03/29/1992 08:00 | 03/30/1992 23:26 | 1.64 days | 73 | |
| 80 | 03/18/1992 01:56 | 03/25/1992 15:45 | 7.57 days | 6 | |
| 79 | 03/04/1992 16:32 | 03/08/1992 06:42 | 3.59 days | 26 | |
| 78 | 02/22/1992 01:00 | 02/28/1992 18:06 | 6.71 days | 7 | |
| 77 | 02/05/1992 03:24 | 02/08/1992 01:48 | 2.93 days | 40 | |
| 76 | 01/27/1992 18:09 | 01/30/1992 09:23 | 2.63 days | 50 | |
| 75 | 01/18/1992 11:19 | 01/24/1992 18:46 | 6.31 days | 11 | |
| 74 | 12/20/1991 13:32 | 01/17/1992 01:15 | 27.48 days | 1 | |
| 73 | 05/04/1990 07:43 | 05/06/1990 21:45 | 2.58 days | 52 | |
| 72 | 05/18/1989 14:10 | 05/20/1989 12:00 | 1.90 days | 67 | |
| 71 | 06/12/1987 14:20 | 06/15/1987 22:43 | 3.34 days | 29 | |
| 70 | 02/04/1986 22:33 | 02/06/1986 12:21 | 1.57 days | 77 | |
| 69 | 06/17/1981 00:44 | 06/19/1981 17:02 | 2.67 days | 49 | |
| 68 | 07/27/1979 14:40 | 07/29/1979 12:53 | 1.92 days | 65 | |
| 67 | 06/03/1979 10:16 | 06/04/1979 14:09 | 1.16 days | 81 | |
| 66 | 05/29/1979 12:52 | 06/02/1979 07:04 | 3.75 days | 25 | |

| | | | | | | |
|----|------------|-------|------------|-------|------------|----|
| 65 | 05/22/1979 | 19:12 | 05/24/1979 | 16:52 | 1.90 days | 68 |
| 64 | 05/11/1979 | 13:21 | 05/13/1979 | 17:04 | 2.15 days | 61 |
| 63 | 04/21/1977 | 04:18 | 04/23/1977 | 01:56 | 1.90 days | 69 |
| 62 | 04/16/1977 | 13:47 | 04/20/1977 | 00:53 | 3.46 days | 28 |
| 61 | 02/11/1977 | 12:39 | 02/14/1977 | 12:15 | 2.98 days | 37 |
| 60 | 05/24/1975 | 17:33 | 05/27/1975 | 23:24 | 3.24 days | 30 |
| 59 | 02/03/1975 | 13:48 | 02/05/1975 | 20:55 | 2.29 days | 57 |
| 58 | 11/24/1974 | 16:59 | 11/26/1974 | 07:41 | 1.61 days | 74 |
| 57 | 11/01/1974 | 18:08 | 11/03/1974 | 08:05 | 1.58 days | 76 |
| 56 | 05/18/1968 | 23:12 | 05/20/1968 | 17:05 | 1.74 days | 72 |
| 55 | 05/10/1968 | 18:38 | 05/13/1968 | 15:57 | 2.88 days | 41 |
| 54 | 01/23/1968 | 11:49 | 01/24/1968 | 20:09 | 1.34 days | 79 |
| 53 | 05/02/1966 | 15:40 | 05/03/1966 | 17:37 | 1.08 days | 83 |
| 52 | 04/26/1966 | 11:04 | 04/29/1966 | 07:59 | 2.87 days | 42 |
| 51 | 05/28/1965 | 15:20 | 05/30/1965 | 21:28 | 2.25 days | 59 |
| 50 | 05/17/1965 | 10:29 | 05/24/1965 | 00:27 | 6.58 days | 9 |
| 49 | 01/22/1965 | 13:26 | 01/24/1965 | 16:35 | 2.13 days | 62 |
| 48 | 06/19/1961 | 17:57 | 06/20/1961 | 16:29 | 0.93 days | 89 |
| 47 | 02/06/1961 | 21:11 | 02/09/1961 | 08:36 | 2.47 days | 54 |
| 46 | 01/07/1961 | 13:17 | 01/15/1961 | 23:54 | 8.44 days | 5 |
| 45 | 12/09/1960 | 00:55 | 12/12/1960 | 23:41 | 3.94 days | 24 |
| 44 | 10/15/1959 | 02:30 | 10/15/1959 | 21:46 | 0.80 days | 90 |
| 43 | 10/06/1959 | 03:05 | 10/08/1959 | 23:24 | 2.84 days | 43 |
| 42 | 05/04/1958 | 07:33 | 05/06/1958 | 19:19 | 2.49 days | 53 |
| 41 | 02/24/1958 | 09:09 | 02/26/1958 | 15:33 | 2.26 days | 58 |
| 40 | 10/14/1957 | 19:59 | 10/18/1957 | 23:34 | 4.14 days | 21 |
| 39 | 06/18/1957 | 14:17 | 06/29/1957 | 16:38 | 11.09 days | 3 |
| 38 | 05/19/1957 | 19:21 | 06/16/1957 | 01:18 | 27.24 days | 2 |
| 37 | 05/11/1957 | 14:08 | 05/18/1957 | 02:02 | 6.49 days | 10 |
| 36 | 05/05/1957 | 07:33 | 05/05/1957 | 23:42 | 0.67 days | 91 |
| 35 | 04/23/1957 | 20:50 | 05/04/1957 | 02:05 | 10.21 days | 4 |
| 34 | 05/13/1953 | 23:04 | 05/19/1953 | 00:03 | 5.04 days | 18 |
| 33 | 05/20/1949 | 06:09 | 05/20/1949 | 16:01 | 0.41 days | 94 |
| 32 | 01/18/1947 | 12:01 | 01/19/1947 | 12:04 | 1.00 days | 88 |
| 31 | 05/16/1946 | 07:05 | 05/18/1946 | 01:05 | 1.75 days | 71 |
| 30 | 03/15/1946 | 04:03 | 03/15/1946 | 18:24 | 0.59 days | 92 |
| 29 | 04/21/1945 | 14:18 | 04/26/1945 | 23:40 | 5.39 days | 15 |
| 28 | 04/01/1945 | 11:23 | 04/04/1945 | 13:59 | 3.10 days | 32 |
| 27 | 03/03/1945 | 15:56 | 03/05/1945 | 17:21 | 2.05 days | 63 |
| 26 | 02/23/1945 | 07:30 | 02/23/1945 | 19:48 | 0.51 days | 93 |
| 25 | 01/20/1945 | 04:42 | 01/21/1945 | 07:12 | 1.10 days | 82 |
| 24 | 05/28/1944 | 08:45 | 05/31/1944 | 10:25 | 3.06 days | 34 |
| 23 | 05/02/1944 | 09:09 | 05/07/1944 | 10:21 | 5.04 days | 17 |
| 22 | 10/20/1942 | 00:14 | 10/21/1942 | 20:45 | 1.85 days | 70 |
| 21 | 09/08/1942 | 21:34 | 09/11/1942 | 21:50 | 3.01 days | 36 |
| 20 | 05/19/1942 | 13:28 | 05/23/1942 | 01:08 | 3.48 days | 27 |
| 19 | 04/24/1942 | 17:44 | 04/30/1942 | 17:54 | 6.00 days | 14 |
| 18 | 04/21/1942 | 14:54 | 04/22/1942 | 15:31 | 1.02 days | 87 |
| 17 | 04/08/1942 | 17:46 | 04/11/1942 | 16:44 | 2.95 days | 39 |
| 16 | 06/15/1941 | 20:35 | 06/19/1941 | 02:20 | 3.23 days | 31 |
| 15 | 05/06/1941 | 03:34 | 05/11/1941 | 06:37 | 5.12 days | 16 |
| 14 | 02/03/1941 | 00:06 | 02/05/1941 | 17:36 | 2.72 days | 47 |
| 13 | 01/14/1941 | 14:03 | 01/16/1941 | 12:33 | 1.93 days | 64 |
| 12 | 12/16/1940 | 00:37 | 12/19/1940 | 03:04 | 3.10 days | 33 |
| 11 | 12/12/1940 | 12:24 | 12/13/1940 | 13:39 | 1.05 days | 85 |
| 10 | 11/23/1940 | 14:56 | 11/29/1940 | 22:15 | 6.30 days | 12 |

| | | | | | | |
|---|------------|-------|------------|-------|-----------|----|
| 9 | 07/02/1940 | 11:10 | 07/04/1940 | 00:07 | 1.53 days | 78 |
| 8 | 05/18/1939 | 20:43 | 05/19/1939 | 21:58 | 1.05 days | 86 |
| 7 | 02/18/1938 | 22:42 | 02/21/1938 | 04:21 | 2.23 days | 60 |
| 6 | 01/23/1938 | 18:14 | 01/27/1938 | 17:28 | 3.96 days | 23 |
| 5 | 09/27/1936 | 21:34 | 10/04/1936 | 00:55 | 6.13 days | 13 |
| 4 | 05/27/1936 | 01:58 | 05/31/1936 | 10:01 | 4.33 days | 20 |
| 3 | 12/06/1935 | 14:39 | 12/09/1935 | 08:45 | 2.75 days | 46 |
| 2 | 05/18/1935 | 09:02 | 05/24/1935 | 23:08 | 6.58 days | 8 |
| 1 | 05/06/1935 | 02:53 | 05/08/1935 | 11:36 | 2.36 days | 55 |

Moelhman Slough Oxbow Connections to the Brazos River – Ranked by Connection Duration
 Jordan Furnans, TWDB 11/4/2004, 14:21

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 188.76ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 219.45 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81151 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76171 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 7217.8478 ft (1.36 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 484550.5249 ft (91.77 miles)
 Estimated Critical Gauge Height/WSE: 31.5413/220.3013 ft
 Height Buffer for "significant" connection: 0 ft
 Required Gauge Height/WSE for "significant" connection: 31.5413/220.3013 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-9/15/2004
 Number of Records: 335057
 Years of Record: 69.8828
 Number of Critical WSE Exceedences: 102
 Number of "significant" WSE Exceedences: 94
 Average Connections per year: 1.3451
 Flood Level Required for Connection: 1.9201 year flood (44683.9288 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|------------|------|-------|
| 74 | 12/20/1991 13:32 | 01/17/1992 01:15 | 27.48 days | 1 | |
| 38 | 05/19/1957 19:21 | 06/16/1957 01:18 | 27.24 days | 2 | |
| 39 | 06/18/1957 14:17 | 06/29/1957 16:38 | 11.09 days | 3 | |
| 35 | 04/23/1957 20:50 | 05/04/1957 02:05 | 10.21 days | 4 | |
| 46 | 01/07/1961 13:17 | 01/15/1961 23:54 | 8.44 days | 5 | |
| 80 | 03/18/1992 01:56 | 03/25/1992 15:45 | 7.57 days | 6 | |
| 78 | 02/22/1992 01:00 | 02/28/1992 18:06 | 6.71 days | 7 | |
| 2 | 05/18/1935 09:02 | 05/24/1935 23:08 | 6.58 days | 8 | |
| 50 | 05/17/1965 10:29 | 05/24/1965 00:27 | 6.58 days | 9 | |
| 37 | 05/11/1957 14:08 | 05/18/1957 02:02 | 6.49 days | 10 | |
| 75 | 01/18/1992 11:19 | 01/24/1992 18:46 | 6.31 days | 11 | |
| 10 | 11/23/1940 14:56 | 11/29/1940 22:15 | 6.30 days | 12 | |
| 5 | 09/27/1936 21:34 | 10/04/1936 00:55 | 6.13 days | 13 | |
| 19 | 04/24/1942 17:44 | 04/30/1942 17:54 | 6.00 days | 14 | |
| 29 | 04/21/1945 14:18 | 04/26/1945 23:40 | 5.39 days | 15 | |
| 15 | 05/06/1941 03:34 | 05/11/1941 06:37 | 5.12 days | 16 | |
| 23 | 05/02/1944 09:09 | 05/07/1944 10:21 | 5.04 days | 17 | |
| 34 | 05/13/1953 23:04 | 05/19/1953 00:03 | 5.04 days | 18 | |
| 94 | 06/27/2004 15:26 | 07/02/2004 06:54 | 4.64 days | 19 | |
| 4 | 05/27/1936 01:58 | 05/31/1936 10:01 | 4.33 days | 20 | |
| 40 | 10/14/1957 19:59 | 10/18/1957 23:34 | 4.14 days | 21 | |
| 85 | 03/11/1997 11:24 | 03/15/1997 11:27 | 4.00 days | 22 | |
| 6 | 01/23/1938 18:14 | 01/27/1938 17:28 | 3.96 days | 23 | |
| 45 | 12/09/1960 00:55 | 12/12/1960 23:41 | 3.94 days | 24 | |
| 66 | 05/29/1979 12:52 | 06/02/1979 07:04 | 3.75 days | 25 | |
| 79 | 03/04/1992 16:32 | 03/08/1992 06:42 | 3.59 days | 26 | |
| 20 | 05/19/1942 13:28 | 05/23/1942 01:08 | 3.48 days | 27 | |
| 62 | 04/16/1977 13:47 | 04/20/1977 00:53 | 3.46 days | 28 | |
| 71 | 06/12/1987 14:20 | 06/15/1987 22:43 | 3.34 days | 29 | |

| | | | | | | |
|----|------------|-------|------------|-------|-----------|----|
| 60 | 05/24/1975 | 17:33 | 05/27/1975 | 23:24 | 3.24 days | 30 |
| 16 | 06/15/1941 | 20:35 | 06/19/1941 | 02:20 | 3.23 days | 31 |
| 28 | 04/01/1945 | 11:23 | 04/04/1945 | 13:59 | 3.10 days | 32 |
| 12 | 12/16/1940 | 00:37 | 12/19/1940 | 03:04 | 3.10 days | 33 |
| 24 | 05/28/1944 | 08:45 | 05/31/1944 | 10:25 | 3.06 days | 34 |
| 89 | 10/18/1998 | 18:41 | 10/21/1998 | 20:03 | 3.05 days | 35 |
| 21 | 09/08/1942 | 21:34 | 09/11/1942 | 21:50 | 3.01 days | 36 |
| 61 | 02/11/1977 | 12:39 | 02/14/1977 | 12:15 | 2.98 days | 37 |
| 86 | 04/05/1997 | 11:24 | 04/08/1997 | 10:50 | 2.97 days | 38 |
| 17 | 04/08/1942 | 17:46 | 04/11/1942 | 16:44 | 2.95 days | 39 |
| 77 | 02/05/1992 | 03:24 | 02/08/1992 | 01:48 | 2.93 days | 40 |
| 55 | 05/10/1968 | 18:38 | 05/13/1968 | 15:57 | 2.88 days | 41 |
| 52 | 04/26/1966 | 11:04 | 04/29/1966 | 07:59 | 2.87 days | 42 |
| 43 | 10/06/1959 | 03:05 | 10/08/1959 | 23:24 | 2.84 days | 43 |
| 84 | 02/26/1997 | 14:12 | 03/01/1997 | 09:19 | 2.79 days | 44 |
| 88 | 01/07/1998 | 01:10 | 01/09/1998 | 19:38 | 2.76 days | 45 |
| 3 | 12/06/1935 | 14:39 | 12/09/1935 | 08:45 | 2.75 days | 46 |
| 14 | 02/03/1941 | 00:06 | 02/05/1941 | 17:36 | 2.72 days | 47 |
| 93 | 06/10/2004 | 09:32 | 06/13/2004 | 02:34 | 2.70 days | 48 |
| 69 | 06/17/1981 | 00:44 | 06/19/1981 | 17:02 | 2.67 days | 49 |
| 76 | 01/27/1992 | 18:09 | 01/30/1992 | 09:23 | 2.63 days | 50 |
| 92 | 05/13/2004 | 13:33 | 05/16/2004 | 04:39 | 2.62 days | 51 |
| 73 | 05/04/1990 | 07:43 | 05/06/1990 | 21:45 | 2.58 days | 52 |
| 42 | 05/04/1958 | 07:33 | 05/06/1958 | 19:19 | 2.49 days | 53 |
| 47 | 02/06/1961 | 21:11 | 02/09/1961 | 08:36 | 2.47 days | 54 |
| 1 | 05/06/1935 | 02:53 | 05/08/1935 | 11:36 | 2.36 days | 55 |
| 90 | 12/17/2001 | 03:05 | 12/19/2001 | 11:44 | 2.36 days | 56 |
| 59 | 02/03/1975 | 13:48 | 02/05/1975 | 20:55 | 2.29 days | 57 |
| 41 | 02/24/1958 | 09:09 | 02/26/1958 | 15:33 | 2.26 days | 58 |
| 51 | 05/28/1965 | 15:20 | 05/30/1965 | 21:28 | 2.25 days | 59 |
| 7 | 02/18/1938 | 22:42 | 02/21/1938 | 04:21 | 2.23 days | 60 |
| 64 | 05/11/1979 | 13:21 | 05/13/1979 | 17:04 | 2.15 days | 61 |
| 49 | 01/22/1965 | 13:26 | 01/24/1965 | 16:35 | 2.13 days | 62 |
| 27 | 03/03/1945 | 15:56 | 03/05/1945 | 17:21 | 2.05 days | 63 |
| 13 | 01/14/1941 | 14:03 | 01/16/1941 | 12:33 | 1.93 days | 64 |
| 68 | 07/27/1979 | 14:40 | 07/29/1979 | 12:53 | 1.92 days | 65 |
| 91 | 02/22/2003 | 06:38 | 02/24/2003 | 04:51 | 1.92 days | 66 |
| 72 | 05/18/1989 | 14:10 | 05/20/1989 | 12:00 | 1.90 days | 67 |
| 65 | 05/22/1979 | 19:12 | 05/24/1979 | 16:52 | 1.90 days | 68 |
| 63 | 04/21/1977 | 04:18 | 04/23/1977 | 01:56 | 1.90 days | 69 |
| 22 | 10/20/1942 | 00:14 | 10/21/1942 | 20:45 | 1.85 days | 70 |
| 31 | 05/16/1946 | 07:05 | 05/18/1946 | 01:05 | 1.75 days | 71 |
| 56 | 05/18/1968 | 23:12 | 05/20/1968 | 17:05 | 1.74 days | 72 |
| 81 | 03/29/1992 | 08:00 | 03/30/1992 | 23:26 | 1.64 days | 73 |
| 58 | 11/24/1974 | 16:59 | 11/26/1974 | 07:41 | 1.61 days | 74 |
| 87 | 12/22/1997 | 06:37 | 12/23/1997 | 20:41 | 1.58 days | 75 |
| 57 | 11/01/1974 | 18:08 | 11/03/1974 | 08:05 | 1.58 days | 76 |
| 70 | 02/04/1986 | 22:33 | 02/06/1986 | 12:21 | 1.57 days | 77 |
| 9 | 07/02/1940 | 11:10 | 07/04/1940 | 00:07 | 1.53 days | 78 |
| 54 | 01/23/1968 | 11:49 | 01/24/1968 | 20:09 | 1.34 days | 79 |
| 83 | 02/14/1997 | 01:28 | 02/15/1997 | 09:06 | 1.31 days | 80 |
| 67 | 06/03/1979 | 10:16 | 06/04/1979 | 14:09 | 1.16 days | 81 |
| 25 | 01/20/1945 | 04:42 | 01/21/1945 | 07:12 | 1.10 days | 82 |
| 53 | 05/02/1966 | 15:40 | 05/03/1966 | 17:37 | 1.08 days | 83 |
| 82 | 06/02/1992 | 17:40 | 06/03/1992 | 19:14 | 1.06 days | 84 |
| 11 | 12/12/1940 | 12:24 | 12/13/1940 | 13:39 | 1.05 days | 85 |

| | | | | | | |
|----|------------|-------|------------|-------|-----------|----|
| 8 | 05/18/1939 | 20:43 | 05/19/1939 | 21:58 | 1.05 days | 86 |
| 18 | 04/21/1942 | 14:54 | 04/22/1942 | 15:31 | 1.02 days | 87 |
| 32 | 01/18/1947 | 12:01 | 01/19/1947 | 12:04 | 1.00 days | 88 |
| 48 | 06/19/1961 | 17:57 | 06/20/1961 | 16:29 | 0.93 days | 89 |
| 44 | 10/15/1959 | 02:30 | 10/15/1959 | 21:46 | 0.80 days | 90 |
| 36 | 05/05/1957 | 07:33 | 05/05/1957 | 23:42 | 0.67 days | 91 |
| 30 | 03/15/1946 | 04:03 | 03/15/1946 | 18:24 | 0.59 days | 92 |
| 26 | 02/23/1945 | 07:30 | 02/23/1945 | 19:48 | 0.51 days | 93 |
| 33 | 05/20/1949 | 06:09 | 05/20/1949 | 16:01 | 0.41 days | 94 |

Moelhman Slough Oxbow Disconnections to the Brazos River - Chronology of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 14:21

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 188.76ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 219.45 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81151 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76171 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 7217.8478 ft (1.36 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 484550.5249 ft (91.77 miles)
 Estimated Critical Gauge Height/WSE: 31.5413/220.3013 ft
 Height Buffer for "significant" connection: 0 ft
 Required Gauge Height/WSE for "significant" connection: 31.5413/220.3013 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-9/15/2004
 Number of Records: 335057
 Years of Record: 69.8828
 Number of Critical WSE Exceedences: 102
 Number of "significant" WSE Exceedences: 94
 Average Connections per year: 1.3451
 Flood Level Required for Connection: 1.9201 year flood (44683.9288 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|-------------|------|----------------------------------|
| 94 | 07/02/2004 06:54 | 09/15/2004 05:00 | 74.92 days | 44 | Disconnected Period Not Complete |
| 93 | 06/13/2004 02:34 | 06/27/2004 15:26 | 15.28 days | 66 | |
| 92 | 05/16/2004 04:39 | 06/10/2004 09:32 | 25.38 days | 57 | |
| 91 | 02/24/2003 04:51 | 05/13/2004 13:33 | 444.57 days | 20 | |
| 90 | 12/19/2001 11:44 | 02/22/2003 06:38 | 430.34 days | 21 | |
| 89 | 10/21/1998 20:03 | 12/17/2001 03:05 | 430.34 days | 7 | |
| 88 | 01/09/1998 19:38 | 10/18/1998 18:41 | 282.69 days | 28 | |
| 87 | 12/23/1997 20:41 | 01/07/1998 01:10 | 14.85 days | 67 | |
| 86 | 04/08/1997 10:50 | 12/22/1997 06:37 | 258.33 days | 29 | |
| 85 | 03/15/1997 11:27 | 04/05/1997 11:24 | 21.64 days | 60 | |
| 84 | 03/01/1997 09:19 | 03/11/1997 11:24 | 10.73 days | 71 | |
| 83 | 02/15/1997 09:06 | 02/26/1997 14:12 | 12.06 days | 70 | |
| 82 | 06/03/1992 19:14 | 02/14/1997 01:28 | 12.06 days | 2 | |
| 81 | 03/30/1992 23:26 | 06/02/1992 17:40 | 63.75 days | 47 | |
| 80 | 03/25/1992 15:45 | 03/29/1992 08:00 | 3.67 days | 84 | |
| 79 | 03/08/1992 06:42 | 03/18/1992 01:56 | 9.80 days | 74 | |
| 78 | 02/28/1992 18:06 | 03/04/1992 16:32 | 4.93 days | 81 | |
| 77 | 02/08/1992 01:48 | 02/22/1992 01:00 | 13.96 days | 68 | |
| 76 | 01/30/1992 09:23 | 02/05/1992 03:24 | 5.75 days | 78 | |
| 75 | 01/24/1992 18:46 | 01/27/1992 18:09 | 2.97 days | 86 | |
| 74 | 01/17/1992 01:15 | 01/18/1992 11:19 | 1.41 days | 91 | |
| 73 | 05/06/1990 21:45 | 12/20/1991 13:32 | 592.65 days | 14 | |
| 72 | 05/20/1989 12:00 | 05/04/1990 07:43 | 348.82 days | 24 | |
| 71 | 06/15/1987 22:43 | 05/18/1989 14:10 | 702.64 days | 10 | |
| 70 | 02/06/1986 12:21 | 06/12/1987 14:20 | 491.08 days | 17 | |
| 69 | 06/19/1981 17:02 | 02/04/1986 22:33 | 491.08 days | 3 | |
| 68 | 07/29/1979 12:53 | 06/17/1981 00:44 | 688.49 days | 11 | |
| 67 | 06/04/1979 14:09 | 07/27/1979 14:40 | 53.02 days | 50 | |
| 66 | 06/02/1979 07:04 | 06/03/1979 10:16 | 1.13 days | 94 | |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|----|
| 65 | 05/24/1979 | 16:52 | 05/29/1979 | 12:52 | 4.83 days | 82 |
| 64 | 05/13/1979 | 17:04 | 05/22/1979 | 19:12 | 9.08 days | 75 |
| 63 | 04/23/1977 | 01:56 | 05/11/1979 | 13:21 | 748.47 days | 9 |
| 62 | 04/20/1977 | 00:53 | 04/21/1977 | 04:18 | 1.14 days | 93 |
| 61 | 02/14/1977 | 12:15 | 04/16/1977 | 13:47 | 61.06 days | 49 |
| 60 | 05/27/1975 | 23:24 | 02/11/1977 | 12:39 | 625.55 days | 13 |
| 59 | 02/05/1975 | 20:55 | 05/24/1975 | 17:33 | 107.85 days | 40 |
| 58 | 11/26/1974 | 07:41 | 02/03/1975 | 13:48 | 69.25 days | 45 |
| 57 | 11/03/1974 | 08:05 | 11/24/1974 | 16:59 | 21.37 days | 61 |
| 56 | 05/20/1968 | 17:05 | 11/01/1974 | 18:08 | 21.37 days | 1 |
| 55 | 05/13/1968 | 15:57 | 05/18/1968 | 23:12 | 5.30 days | 80 |
| 54 | 01/24/1968 | 20:09 | 05/10/1968 | 18:38 | 106.93 days | 42 |
| 53 | 05/03/1966 | 17:37 | 01/23/1968 | 11:49 | 629.75 days | 12 |
| 52 | 04/29/1966 | 07:59 | 05/02/1966 | 15:40 | 3.32 days | 85 |
| 51 | 05/30/1965 | 21:28 | 04/26/1966 | 11:04 | 330.56 days | 25 |
| 50 | 05/24/1965 | 00:27 | 05/28/1965 | 15:20 | 4.61 days | 83 |
| 49 | 01/24/1965 | 16:35 | 05/17/1965 | 10:29 | 112.74 days | 38 |
| 48 | 06/20/1961 | 16:29 | 01/22/1965 | 13:26 | 112.74 days | 6 |
| 47 | 02/09/1961 | 08:36 | 06/19/1961 | 17:57 | 130.38 days | 35 |
| 46 | 01/15/1961 | 23:54 | 02/06/1961 | 21:11 | 21.88 days | 59 |
| 45 | 12/12/1960 | 23:41 | 01/07/1961 | 13:17 | 25.56 days | 56 |
| 44 | 10/15/1959 | 21:46 | 12/09/1960 | 00:55 | 420.13 days | 22 |
| 43 | 10/08/1959 | 23:24 | 10/15/1959 | 02:30 | 6.12 days | 77 |
| 42 | 05/06/1958 | 19:19 | 10/06/1959 | 03:05 | 517.32 days | 16 |
| 41 | 02/26/1958 | 15:33 | 05/04/1958 | 07:33 | 66.66 days | 46 |
| 40 | 10/18/1957 | 23:34 | 02/24/1958 | 09:09 | 128.39 days | 36 |
| 39 | 06/29/1957 | 16:38 | 10/14/1957 | 19:59 | 107.13 days | 41 |
| 38 | 06/16/1957 | 01:18 | 06/18/1957 | 14:17 | 2.54 days | 87 |
| 37 | 05/18/1957 | 02:02 | 05/19/1957 | 19:21 | 1.72 days | 90 |
| 36 | 05/05/1957 | 23:42 | 05/11/1957 | 14:08 | 5.60 days | 79 |
| 35 | 05/04/1957 | 02:05 | 05/05/1957 | 07:33 | 1.22 days | 92 |
| 34 | 05/19/1953 | 00:03 | 04/23/1957 | 20:50 | 1.22 days | 5 |
| 33 | 05/20/1949 | 16:01 | 05/13/1953 | 23:04 | 1.22 days | 4 |
| 32 | 01/19/1947 | 12:04 | 05/20/1949 | 06:09 | 851.75 days | 8 |
| 31 | 05/18/1946 | 01:05 | 01/18/1947 | 12:01 | 245.45 days | 30 |
| 30 | 03/15/1946 | 18:24 | 05/16/1946 | 07:05 | 61.52 days | 48 |
| 29 | 04/26/1945 | 23:40 | 03/15/1946 | 04:03 | 322.18 days | 26 |
| 28 | 04/04/1945 | 13:59 | 04/21/1945 | 14:18 | 17.01 days | 65 |
| 27 | 03/05/1945 | 17:21 | 04/01/1945 | 11:23 | 26.75 days | 54 |
| 26 | 02/23/1945 | 19:48 | 03/03/1945 | 15:56 | 7.83 days | 76 |
| 25 | 01/21/1945 | 07:12 | 02/23/1945 | 07:30 | 33.01 days | 53 |
| 24 | 05/31/1944 | 10:25 | 01/20/1945 | 04:42 | 233.76 days | 31 |
| 23 | 05/07/1944 | 10:21 | 05/28/1944 | 08:45 | 20.93 days | 62 |
| 22 | 10/21/1942 | 20:45 | 05/02/1944 | 09:09 | 558.51 days | 15 |
| 21 | 09/11/1942 | 21:50 | 10/20/1942 | 00:14 | 38.09 days | 51 |
| 20 | 05/23/1942 | 01:08 | 09/08/1942 | 21:34 | 108.85 days | 39 |
| 19 | 04/30/1942 | 17:54 | 05/19/1942 | 13:28 | 18.81 days | 63 |
| 18 | 04/22/1942 | 15:31 | 04/24/1942 | 17:44 | 2.09 days | 89 |
| 17 | 04/11/1942 | 16:44 | 04/21/1942 | 14:54 | 9.92 days | 72 |
| 16 | 06/19/1941 | 02:20 | 04/08/1942 | 17:46 | 293.64 days | 27 |
| 15 | 05/11/1941 | 06:37 | 06/15/1941 | 20:35 | 35.58 days | 52 |
| 14 | 02/05/1941 | 17:36 | 05/06/1941 | 03:34 | 89.41 days | 43 |
| 13 | 01/16/1941 | 12:33 | 02/03/1941 | 00:06 | 17.48 days | 64 |
| 12 | 12/19/1940 | 03:04 | 01/14/1941 | 14:03 | 26.45 days | 55 |
| 11 | 12/13/1940 | 13:39 | 12/16/1940 | 00:37 | 2.45 days | 88 |
| 10 | 11/29/1940 | 22:15 | 12/12/1940 | 12:24 | 12.58 days | 69 |

| | | | | | | |
|---|------------|-------|------------|-------|-------------|----|
| 9 | 07/04/1940 | 00:07 | 11/23/1940 | 14:56 | 142.61 days | 34 |
| 8 | 05/19/1939 | 21:58 | 07/02/1940 | 11:10 | 409.55 days | 23 |
| 7 | 02/21/1938 | 04:21 | 05/18/1939 | 20:43 | 451.68 days | 19 |
| 6 | 01/27/1938 | 17:28 | 02/18/1938 | 22:42 | 22.21 days | 58 |
| 5 | 10/04/1936 | 00:55 | 01/23/1938 | 18:14 | 476.72 days | 18 |
| 4 | 05/31/1936 | 10:01 | 09/27/1936 | 21:34 | 119.48 days | 37 |
| 3 | 12/09/1935 | 08:45 | 05/27/1936 | 01:58 | 169.71 days | 33 |
| 2 | 05/24/1935 | 23:08 | 12/06/1935 | 14:39 | 195.64 days | 32 |
| 1 | 05/08/1935 | 11:36 | 05/18/1935 | 09:02 | 9.89 days | 73 |

Moelhmans Slough Oxbow Disconnections to the Brazos River – Ranked by Duration of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 14:21

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 188.76ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 219.45 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81151 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76171 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 7217.8478 ft (1.36 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 484550.5249 ft (91.77 miles)
 Estimated Critical Gauge Height/WSE: 31.5413/220.3013 ft
 Height Buffer for "significant" connection: 0 ft
 Required Gauge Height/WSE for "significant" connection: 31.5413/220.3013 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-9/15/2004
 Number of Records: 335057
 Years of Record: 69.8828
 Number of Critical WSE Exceedences: 102
 Number of "significant" WSE Exceedences: 94
 Average Connections per year: 1.3451
 Flood Level Required for Connection: 1.9201 year flood (44683.9288 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|--------------|------|------------------------------------|
| 56 | 05/20/1968 17:05 | 11/01/1974 18:08 | 2356.04 days | 1 | Data not available for this period |
| 82 | 06/03/1992 19:14 | 02/14/1997 01:28 | 1717.15 days | 2 | |
| 69 | 06/19/1981 17:02 | 02/04/1986 22:33 | 1691.22 days | 3 | |
| 33 | 05/20/1949 16:01 | 05/13/1953 23:04 | 1454.29 days | 4 | |
| 34 | 05/19/1953 00:03 | 04/23/1957 20:50 | 1435.86 days | 5 | |
| 48 | 06/20/1961 16:29 | 01/22/1965 13:26 | 1311.87 days | 6 | |
| 89 | 10/21/1998 20:03 | 12/17/2001 03:05 | 1152.67 days | 7 | |
| 32 | 01/19/1947 12:04 | 05/20/1949 06:09 | 851.75 days | 8 | |
| 63 | 04/23/1977 01:56 | 05/11/1979 13:21 | 748.47 days | 9 | |
| 71 | 06/15/1987 22:43 | 05/18/1989 14:10 | 702.64 days | 10 | |
| 68 | 07/29/1979 12:53 | 06/17/1981 00:44 | 688.49 days | 11 | |
| 53 | 05/03/1966 17:37 | 01/23/1968 11:49 | 629.75 days | 12 | |
| 60 | 05/27/1975 23:24 | 02/11/1977 12:39 | 625.55 days | 13 | |
| 73 | 05/06/1990 21:45 | 12/20/1991 13:32 | 592.65 days | 14 | |
| 22 | 10/21/1942 20:45 | 05/02/1944 09:09 | 558.51 days | 15 | |
| 42 | 05/06/1958 19:19 | 10/06/1959 03:05 | 517.32 days | 16 | |
| 70 | 02/06/1986 12:21 | 06/12/1987 14:20 | 491.08 days | 17 | |
| 5 | 10/04/1936 00:55 | 01/23/1938 18:14 | 476.72 days | 18 | |
| 7 | 02/21/1938 04:21 | 05/18/1939 20:43 | 451.68 days | 19 | |
| 91 | 02/24/2003 04:51 | 05/13/2004 13:33 | 444.57 days | 20 | |
| 90 | 12/19/2001 11:44 | 02/22/2003 06:38 | 430.34 days | 21 | |
| 44 | 10/15/1959 21:46 | 12/09/1960 00:55 | 420.13 days | 22 | |
| 8 | 05/19/1939 21:58 | 07/02/1940 11:10 | 409.55 days | 23 | |
| 72 | 05/20/1989 12:00 | 05/04/1990 07:43 | 348.82 days | 24 | |
| 51 | 05/30/1965 21:28 | 04/26/1966 11:04 | 330.56 days | 25 | |
| 29 | 04/26/1945 23:40 | 03/15/1946 04:03 | 322.18 days | 26 | |
| 16 | 06/19/1941 02:20 | 04/08/1942 17:46 | 293.64 days | 27 | |
| 88 | 01/09/1998 19:38 | 10/18/1998 18:41 | 282.69 days | 28 | |
| 86 | 04/08/1997 10:50 | 12/22/1997 06:37 | 258.33 days | 29 | |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|----|
| 31 | 05/18/1946 | 01:05 | 01/18/1947 | 12:01 | 245.45 days | 30 |
| 24 | 05/31/1944 | 10:25 | 01/20/1945 | 04:42 | 233.76 days | 31 |
| 2 | 05/24/1935 | 23:08 | 12/06/1935 | 14:39 | 195.64 days | 32 |
| 3 | 12/09/1935 | 08:45 | 05/27/1936 | 01:58 | 169.71 days | 33 |
| 9 | 07/04/1940 | 00:07 | 11/23/1940 | 14:56 | 142.61 days | 34 |
| 47 | 02/09/1961 | 08:36 | 06/19/1961 | 17:57 | 130.38 days | 35 |
| 40 | 10/18/1957 | 23:34 | 02/24/1958 | 09:09 | 128.39 days | 36 |
| 4 | 05/31/1936 | 10:01 | 09/27/1936 | 21:34 | 119.48 days | 37 |
| 49 | 01/24/1965 | 16:35 | 05/17/1965 | 10:29 | 112.74 days | 38 |
| 20 | 05/23/1942 | 01:08 | 09/08/1942 | 21:34 | 108.85 days | 39 |
| 59 | 02/05/1975 | 20:55 | 05/24/1975 | 17:33 | 107.85 days | 40 |
| 39 | 06/29/1957 | 16:38 | 10/14/1957 | 19:59 | 107.13 days | 41 |
| 54 | 01/24/1968 | 20:09 | 05/10/1968 | 18:38 | 106.93 days | 42 |
| 14 | 02/05/1941 | 17:36 | 05/06/1941 | 03:34 | 89.41 days | 43 |
| 94 | 07/02/2004 | 06:54 | 09/15/2004 | 05:00 | 74.92 days | 44 |
| 58 | 11/26/1974 | 07:41 | 02/03/1975 | 13:48 | 69.25 days | 45 |
| 41 | 02/26/1958 | 15:33 | 05/04/1958 | 07:33 | 66.66 days | 46 |
| 81 | 03/30/1992 | 23:26 | 06/02/1992 | 17:40 | 63.75 days | 47 |
| 30 | 03/15/1946 | 18:24 | 05/16/1946 | 07:05 | 61.52 days | 48 |
| 61 | 02/14/1977 | 12:15 | 04/16/1977 | 13:47 | 61.06 days | 49 |
| 67 | 06/04/1979 | 14:09 | 07/27/1979 | 14:40 | 53.02 days | 50 |
| 21 | 09/11/1942 | 21:50 | 10/20/1942 | 00:14 | 38.09 days | 51 |
| 15 | 05/11/1941 | 06:37 | 06/15/1941 | 20:35 | 35.58 days | 52 |
| 25 | 01/21/1945 | 07:12 | 02/23/1945 | 07:30 | 33.01 days | 53 |
| 27 | 03/05/1945 | 17:21 | 04/01/1945 | 11:23 | 26.75 days | 54 |
| 12 | 12/19/1940 | 03:04 | 01/14/1941 | 14:03 | 26.45 days | 55 |
| 45 | 12/12/1960 | 23:41 | 01/07/1961 | 13:17 | 25.56 days | 56 |
| 92 | 05/16/2004 | 04:39 | 06/10/2004 | 09:32 | 25.38 days | 57 |
| 6 | 01/27/1938 | 17:28 | 02/18/1938 | 22:42 | 22.21 days | 58 |
| 46 | 01/15/1961 | 23:54 | 02/06/1961 | 21:11 | 21.88 days | 59 |
| 85 | 03/15/1997 | 11:27 | 04/05/1997 | 11:24 | 21.64 days | 60 |
| 57 | 11/03/1974 | 08:05 | 11/24/1974 | 16:59 | 21.37 days | 61 |
| 23 | 05/07/1944 | 10:21 | 05/28/1944 | 08:45 | 20.93 days | 62 |
| 19 | 04/30/1942 | 17:54 | 05/19/1942 | 13:28 | 18.81 days | 63 |
| 13 | 01/16/1941 | 12:33 | 02/03/1941 | 00:06 | 17.48 days | 64 |
| 28 | 04/04/1945 | 13:59 | 04/21/1945 | 14:18 | 17.01 days | 65 |
| 93 | 06/13/2004 | 02:34 | 06/27/2004 | 15:26 | 15.28 days | 66 |
| 87 | 12/23/1997 | 20:41 | 01/07/1998 | 01:10 | 14.85 days | 67 |
| 77 | 02/08/1992 | 01:48 | 02/22/1992 | 01:00 | 13.96 days | 68 |
| 10 | 11/29/1940 | 22:15 | 12/12/1940 | 12:24 | 12.58 days | 69 |
| 83 | 02/15/1997 | 09:06 | 02/26/1997 | 14:12 | 12.06 days | 70 |
| 84 | 03/01/1997 | 09:19 | 03/11/1997 | 11:24 | 10.73 days | 71 |
| 17 | 04/11/1942 | 16:44 | 04/21/1942 | 14:54 | 9.92 days | 72 |
| 1 | 05/08/1935 | 11:36 | 05/18/1935 | 09:02 | 9.89 days | 73 |
| 79 | 03/08/1992 | 06:42 | 03/18/1992 | 01:56 | 9.80 days | 74 |
| 64 | 05/13/1979 | 17:04 | 05/22/1979 | 19:12 | 9.08 days | 75 |
| 26 | 02/23/1945 | 19:48 | 03/03/1945 | 15:56 | 7.83 days | 76 |
| 43 | 10/08/1959 | 23:24 | 10/15/1959 | 02:30 | 6.12 days | 77 |
| 76 | 01/30/1992 | 09:23 | 02/05/1992 | 03:24 | 5.75 days | 78 |
| 36 | 05/05/1957 | 23:42 | 05/11/1957 | 14:08 | 5.60 days | 79 |
| 55 | 05/13/1968 | 15:57 | 05/18/1968 | 23:12 | 5.30 days | 80 |
| 78 | 02/28/1992 | 18:06 | 03/04/1992 | 16:32 | 4.93 days | 81 |
| 65 | 05/24/1979 | 16:52 | 05/29/1979 | 12:52 | 4.83 days | 82 |
| 50 | 05/24/1965 | 00:27 | 05/28/1965 | 15:20 | 4.61 days | 83 |
| 80 | 03/25/1992 | 15:45 | 03/29/1992 | 08:00 | 3.67 days | 84 |
| 52 | 04/29/1966 | 07:59 | 05/02/1966 | 15:40 | 3.32 days | 85 |

Disconnected Period Not Complete

| | | | | | | |
|----|------------|-------|------------|-------|-----------|----|
| 75 | 01/24/1992 | 18:46 | 01/27/1992 | 18:09 | 2.97 days | 86 |
| 38 | 06/16/1957 | 01:18 | 06/18/1957 | 14:17 | 2.54 days | 87 |
| 11 | 12/13/1940 | 13:39 | 12/16/1940 | 00:37 | 2.45 days | 88 |
| 18 | 04/22/1942 | 15:31 | 04/24/1942 | 17:44 | 2.09 days | 89 |
| 37 | 05/18/1957 | 02:02 | 05/19/1957 | 19:21 | 1.72 days | 90 |
| 74 | 01/17/1992 | 01:15 | 01/18/1992 | 11:19 | 1.41 days | 91 |
| 35 | 05/04/1957 | 02:05 | 05/05/1957 | 07:33 | 1.22 days | 92 |
| 62 | 04/20/1977 | 00:53 | 04/21/1977 | 04:18 | 1.14 days | 93 |
| 66 | 06/02/1979 | 07:04 | 06/03/1979 | 10:16 | 1.13 days | 94 |

Big Bend Oxbow Connections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/4/2004, 10:48

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 189.09ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 192.29 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81505 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76526 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 152454.0682 ft (28.87 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 339314.3045 ft (64.26 miles)
 Estimated Critical Gauge Height/WSE: 21.1812/210.2712 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 22.1812/211.2712 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-11/1/2004
 Number of Records: 339564
 Years of Record: 70.0113
 Number of Critical WSE Exceedences: 295
 Number of "significant" WSE Exceedences: 250
 Average Connections per year: 3.5709
 Flood Level Required for Connection: 1.1302 year flood (19362.4133 cfs)

Statistics

 Mean Duration of Connection (Days) : 5.3251
 Standard Deviation of Connection Duration (Days) : 7.4796
 Minimum Duration of Connection (Days) : 0.26895
 Maximum Duration of Connection (Days) : 76.9246
 1st Percentile Duration of Connection (Days) : 0.35225
 10th Percentile Duration of Connection (Days) : 1.1979
 25th Percentile Duration of Connection (Days) : 1.8919
 50th Percentile Duration of Connection (Days) : 3.18
 75th Percentile Duration of Connection (Days) : 6.0378
 95th Percentile Duration of Connection (Days) : 13.7626
 99th Percentile Duration of Connection (Days) : 39.0798
 Mean Time Between Connections (Days) : 96.3146
 Standard Deviation of Connection Duration (Days) : 153.7623
 Minimum Time Between Connections (Days) : 0.45139
 Maximum Time Between Connections (Days) : 859.1675
 1st Percentile Time Between Connections (Days) : 0.54838
 10th Percentile Time Between Connections (Days) : 2.589
 25th Percentile Time Between Connections (Days) : 7.6745
 50th Percentile Time Between Connections (Days) : 29.2905
 75th Percentile Time Between Connections (Days) : 109.1045
 95th Percentile Time Between Connections (Days) : 396.4379
 99th Percentile Time Between Connections (Days) : 690.86

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, May 2004
 Statistics are derived based on "significant" connections

Big Bend Oxbow Connections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/4/2004, 10:48

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 189.09ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 192.29 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81505 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76526 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 152454.0682 ft (28.87 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 339314.3045 ft (64.26 miles)
 Estimated Critical Gauge Height/WSE: 21.1812/210.2712 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 22.1812/211.2712 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-11/1/2004
 Number of Records: 339564
 Years of Record: 70.0113
 Number of Critical WSE Exceedences: 295
 Number of "significant" WSE Exceedences: 250
 Average Connections per year: 3.5709
 Flood Level Required for Connection: 1.1302 year flood (19362.4133 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-----------|------|-------|
| 250 | 06/27/2004 04:52 | 07/03/2004 15:07 | 6.42 days | 60 | |
| 249 | 06/15/2004 10:29 | 06/17/2004 16:59 | 2.27 days | 172 | |
| 248 | 06/10/2004 00:37 | 06/14/2004 06:49 | 4.25 days | 92 | |
| 247 | 05/13/2004 12:14 | 05/16/2004 17:37 | 3.22 days | 124 | |
| 246 | 05/02/2004 12:09 | 05/05/2004 04:34 | 2.68 days | 146 | |
| 245 | 04/26/2004 03:37 | 04/26/2004 22:44 | 0.79 days | 242 | |
| 244 | 10/10/2003 06:54 | 10/11/2003 22:05 | 1.63 days | 202 | |
| 243 | 03/04/2003 13:29 | 03/05/2003 23:35 | 1.42 days | 213 | |
| 242 | 02/21/2003 08:19 | 02/25/2003 01:17 | 3.70 days | 108 | |
| 241 | 12/10/2002 12:00 | 12/12/2002 01:33 | 1.56 days | 206 | |
| 240 | 11/04/2002 23:18 | 11/06/2002 19:59 | 1.86 days | 190 | |
| 239 | 12/16/2001 12:23 | 12/20/2001 05:25 | 3.70 days | 107 | |
| 238 | 11/17/2001 00:34 | 11/19/2001 01:31 | 2.03 days | 184 | |
| 237 | 09/06/2001 12:41 | 09/06/2001 23:51 | 0.46 days | 246 | |
| 236 | 08/31/2001 12:16 | 09/02/2001 05:20 | 1.71 days | 198 | |
| 235 | 05/07/2001 18:25 | 05/09/2001 05:27 | 1.45 days | 212 | |
| 234 | 03/28/2001 10:42 | 04/01/2001 09:49 | 3.96 days | 98 | |
| 233 | 03/09/2001 10:28 | 03/18/2001 20:19 | 9.40 days | 32 | |
| 232 | 03/02/2001 16:23 | 03/07/2001 17:26 | 5.04 days | 73 | |
| 231 | 01/19/2001 03:48 | 01/20/2001 15:32 | 1.48 days | 211 | |
| 230 | 12/27/2000 04:26 | 12/29/2000 13:31 | 2.37 days | 165 | |
| 229 | 11/04/2000 14:57 | 11/06/2000 07:19 | 1.68 days | 199 | |
| 228 | 12/11/1998 13:34 | 12/14/1998 03:09 | 2.56 days | 151 | |
| 227 | 11/14/1998 03:33 | 11/17/1998 07:40 | 3.17 days | 127 | |
| 226 | 10/18/1998 09:41 | 10/22/1998 20:34 | 4.45 days | 85 | |
| 225 | 03/18/1998 03:07 | 03/26/1998 13:03 | 8.41 days | 41 | |
| 224 | 01/05/1998 17:13 | 01/11/1998 22:23 | 6.21 days | 61 | |
| 223 | 12/21/1997 17:29 | 12/25/1997 18:35 | 4.04 days | 96 | |
| 222 | 06/28/1997 11:29 | 07/02/1997 07:14 | 3.82 days | 102 | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 221 | 06/10/1997 | 04:24 | 06/12/1997 | 23:27 | 2.79 days | 145 |
| 220 | 05/25/1997 | 04:44 | 05/26/1997 | 11:20 | 1.27 days | 219 |
| 219 | 05/12/1997 | 06:50 | 05/20/1997 | 17:49 | 8.45 days | 39 |
| 218 | 04/26/1997 | 20:29 | 05/03/1997 | 15:59 | 6.81 days | 56 |
| 217 | 04/14/1997 | 09:11 | 04/14/1997 | 15:38 | 0.26 days | 250 |
| 216 | 04/04/1997 | 20:39 | 04/13/1997 | 16:17 | 8.81 days | 36 |
| 215 | 03/26/1997 | 06:44 | 03/27/1997 | 22:03 | 1.63 days | 201 |
| 214 | 03/25/1997 | 11:35 | 03/25/1997 | 23:44 | 0.50 days | 245 |
| 213 | 03/23/1997 | 06:29 | 03/24/1997 | 22:06 | 1.65 days | 200 |
| 212 | 02/13/1997 | 07:36 | 03/19/1997 | 08:54 | 34.05 days | 4 |
| 211 | 08/03/1995 | 07:39 | 08/10/1995 | 00:56 | 6.72 days | 57 |
| 210 | 06/15/1995 | 01:28 | 06/16/1995 | 18:33 | 1.71 days | 197 |
| 209 | 05/18/1995 | 04:08 | 05/18/1995 | 11:28 | 0.30 days | 249 |
| 208 | 05/09/1995 | 08:10 | 05/17/1995 | 18:33 | 8.43 days | 40 |
| 207 | 03/14/1995 | 00:17 | 03/16/1995 | 08:21 | 2.33 days | 169 |
| 206 | 12/16/1994 | 05:33 | 12/18/1994 | 14:57 | 2.39 days | 163 |
| 205 | 05/15/1994 | 02:32 | 05/15/1994 | 12:06 | 0.39 days | 248 |
| 204 | 06/21/1993 | 22:23 | 06/23/1993 | 17:40 | 1.80 days | 191 |
| 203 | 05/09/1993 | 19:40 | 05/12/1993 | 23:59 | 3.18 days | 126 |
| 202 | 03/19/1993 | 17:43 | 03/25/1993 | 11:41 | 5.74 days | 67 |
| 201 | 06/07/1992 | 21:22 | 06/21/1992 | 05:51 | 13.35 days | 14 |
| 200 | 06/02/1992 | 04:28 | 06/05/1992 | 10:51 | 3.26 days | 123 |
| 199 | 05/23/1992 | 10:45 | 05/25/1992 | 22:52 | 2.50 days | 152 |
| 198 | 05/18/1992 | 11:31 | 05/20/1992 | 22:48 | 2.47 days | 156 |
| 197 | 03/04/1992 | 11:11 | 04/05/1992 | 12:11 | 32.04 days | 5 |
| 196 | 02/11/1992 | 16:44 | 03/03/1992 | 05:33 | 20.53 days | 8 |
| 195 | 12/21/1991 | 06:09 | 02/09/1992 | 07:12 | 50.04 days | 2 |
| 194 | 11/01/1991 | 20:10 | 11/09/1991 | 13:03 | 7.70 days | 47 |
| 193 | 04/14/1991 | 16:53 | 04/15/1991 | 23:11 | 1.26 days | 221 |
| 192 | 01/09/1991 | 20:26 | 01/13/1991 | 04:15 | 3.32 days | 121 |
| 191 | 06/10/1990 | 19:05 | 06/16/1990 | 09:32 | 5.60 days | 69 |
| 190 | 04/26/1990 | 01:25 | 06/09/1990 | 03:57 | 44.10 days | 3 |
| 189 | 03/14/1990 | 15:18 | 03/17/1990 | 17:11 | 3.07 days | 132 |
| 188 | 06/15/1989 | 05:17 | 06/24/1989 | 18:49 | 9.56 days | 31 |
| 187 | 05/26/1989 | 03:16 | 06/04/1989 | 04:16 | 9.04 days | 34 |
| 186 | 05/17/1989 | 17:39 | 05/21/1989 | 16:00 | 3.93 days | 100 |
| 185 | 06/20/1987 | 17:37 | 06/28/1987 | 07:20 | 7.57 days | 50 |
| 184 | 06/04/1987 | 06:07 | 06/17/1987 | 10:24 | 13.17 days | 17 |
| 183 | 06/01/1987 | 02:53 | 06/02/1987 | 21:15 | 1.76 days | 193 |
| 182 | 12/22/1986 | 21:24 | 12/26/1986 | 19:58 | 3.94 days | 99 |
| 181 | 12/15/1986 | 14:27 | 12/17/1986 | 07:52 | 1.72 days | 196 |
| 180 | 10/24/1986 | 21:03 | 10/25/1986 | 14:58 | 0.74 days | 243 |
| 179 | 06/13/1986 | 10:30 | 06/14/1986 | 19:54 | 1.39 days | 216 |
| 178 | 02/03/1986 | 15:52 | 02/07/1986 | 11:38 | 3.82 days | 101 |
| 177 | 12/11/1985 | 21:43 | 12/14/1985 | 12:02 | 2.59 days | 149 |
| 176 | 11/27/1985 | 19:06 | 11/30/1985 | 02:10 | 2.29 days | 170 |
| 175 | 11/24/1985 | 12:38 | 11/25/1985 | 18:28 | 1.24 days | 224 |
| 174 | 02/23/1985 | 17:13 | 02/26/1985 | 03:42 | 2.43 days | 158 |
| 173 | 10/22/1984 | 01:17 | 10/22/1984 | 16:32 | 0.63 days | 244 |
| 172 | 05/22/1983 | 02:48 | 05/23/1983 | 20:15 | 1.72 days | 195 |
| 171 | 06/26/1982 | 02:01 | 07/09/1982 | 07:34 | 13.23 days | 16 |
| 170 | 05/25/1982 | 14:12 | 06/05/1982 | 00:42 | 10.43 days | 27 |
| 169 | 05/22/1982 | 03:03 | 05/23/1982 | 09:01 | 1.24 days | 223 |
| 168 | 05/17/1982 | 15:23 | 05/18/1982 | 16:15 | 1.03 days | 233 |
| 167 | 05/13/1982 | 20:39 | 05/17/1982 | 04:33 | 3.32 days | 119 |
| 166 | 11/04/1981 | 15:36 | 11/06/1981 | 21:29 | 2.24 days | 176 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 165 | 10/18/1981 | 09:42 | 11/01/1981 | 13:50 | 14.17 days | 13 |
| 164 | 10/14/1981 | 22:14 | 10/16/1981 | 10:30 | 1.51 days | 207 |
| 163 | 06/13/1981 | 19:05 | 06/24/1981 | 08:29 | 10.55 days | 26 |
| 162 | 06/04/1981 | 18:03 | 06/08/1981 | 06:18 | 3.51 days | 115 |
| 161 | 05/15/1980 | 09:36 | 05/19/1980 | 02:14 | 3.69 days | 109 |
| 160 | 07/26/1979 | 15:00 | 07/30/1979 | 08:30 | 3.72 days | 104 |
| 159 | 05/30/1979 | 08:09 | 06/09/1979 | 01:13 | 9.71 days | 30 |
| 158 | 05/21/1979 | 19:02 | 05/26/1979 | 03:12 | 4.33 days | 88 |
| 157 | 05/06/1979 | 12:02 | 05/15/1979 | 21:15 | 9.38 days | 33 |
| 156 | 04/02/1979 | 07:54 | 04/05/1979 | 05:41 | 2.90 days | 140 |
| 155 | 03/21/1979 | 02:58 | 03/24/1979 | 19:01 | 3.66 days | 111 |
| 154 | 04/17/1977 | 08:18 | 05/03/1977 | 04:17 | 15.83 days | 9 |
| 153 | 03/30/1977 | 20:31 | 04/04/1977 | 20:19 | 4.99 days | 75 |
| 152 | 02/12/1977 | 04:30 | 02/15/1977 | 10:57 | 3.26 days | 122 |
| 151 | 12/12/1976 | 07:56 | 12/14/1976 | 21:45 | 2.57 days | 150 |
| 150 | 07/06/1976 | 08:21 | 07/08/1976 | 17:03 | 2.36 days | 168 |
| 149 | 05/06/1976 | 16:14 | 05/09/1976 | 11:37 | 2.80 days | 144 |
| 148 | 04/29/1976 | 21:18 | 05/02/1976 | 12:58 | 2.65 days | 147 |
| 147 | 04/18/1976 | 18:41 | 04/22/1976 | 21:53 | 4.13 days | 94 |
| 146 | 05/29/1975 | 13:28 | 06/01/1975 | 23:37 | 3.42 days | 116 |
| 145 | 05/25/1975 | 08:13 | 05/28/1975 | 23:53 | 3.65 days | 112 |
| 144 | 02/02/1975 | 16:53 | 02/08/1975 | 16:56 | 6.00 days | 64 |
| 143 | 11/23/1974 | 12:39 | 11/27/1974 | 18:21 | 4.23 days | 93 |
| 142 | 10/31/1974 | 16:19 | 11/15/1974 | 20:38 | 15.18 days | 11 |
| 141 | 09/17/1974 | 14:53 | 09/20/1974 | 15:59 | 3.04 days | 134 |
| 140 | 09/12/1974 | 12:44 | 09/15/1974 | 12:21 | 2.98 days | 138 |
| 139 | 10/12/1973 | 20:59 | 10/19/1973 | 19:52 | 6.95 days | 55 |
| 138 | 06/04/1973 | 14:17 | 06/10/1973 | 02:30 | 5.50 days | 70 |
| 137 | 04/25/1973 | 23:43 | 05/03/1973 | 06:51 | 7.29 days | 52 |
| 136 | 03/24/1973 | 15:31 | 03/26/1973 | 14:29 | 1.95 days | 186 |
| 135 | 01/26/1973 | 21:15 | 01/27/1973 | 18:26 | 0.88 days | 240 |
| 134 | 12/10/1971 | 21:47 | 12/12/1971 | 16:03 | 1.76 days | 194 |
| 133 | 03/03/1970 | 12:06 | 03/12/1970 | 08:50 | 8.86 days | 35 |
| 132 | 05/09/1969 | 05:07 | 05/19/1969 | 14:00 | 10.36 days | 28 |
| 131 | 04/12/1969 | 21:58 | 04/15/1969 | 22:39 | 3.02 days | 135 |
| 130 | 07/09/1968 | 14:47 | 07/11/1968 | 18:43 | 2.16 days | 181 |
| 129 | 06/23/1968 | 16:38 | 06/27/1968 | 06:24 | 3.57 days | 113 |
| 128 | 05/16/1968 | 09:29 | 05/27/1968 | 00:46 | 10.63 days | 24 |
| 127 | 05/09/1968 | 22:33 | 05/15/1968 | 09:38 | 5.46 days | 71 |
| 126 | 04/13/1968 | 22:02 | 04/14/1968 | 22:58 | 1.03 days | 232 |
| 125 | 03/22/1968 | 15:30 | 03/27/1968 | 04:41 | 4.54 days | 84 |
| 124 | 03/11/1968 | 15:14 | 03/14/1968 | 23:08 | 3.32 days | 120 |
| 123 | 01/19/1968 | 12:26 | 01/31/1968 | 14:58 | 12.10 days | 20 |
| 122 | 11/10/1967 | 16:23 | 11/12/1967 | 22:29 | 2.25 days | 173 |
| 121 | 09/16/1966 | 21:14 | 09/24/1966 | 16:54 | 7.81 days | 45 |
| 120 | 04/25/1966 | 04:15 | 05/15/1966 | 21:44 | 20.72 days | 6 |
| 119 | 05/12/1965 | 02:34 | 06/01/1965 | 15:39 | 20.54 days | 7 |
| 118 | 02/16/1965 | 19:27 | 02/19/1965 | 22:33 | 3.12 days | 130 |
| 117 | 02/10/1965 | 20:49 | 02/13/1965 | 00:20 | 2.14 days | 182 |
| 116 | 01/23/1965 | 05:39 | 01/25/1965 | 11:37 | 2.24 days | 175 |
| 115 | 09/13/1962 | 08:29 | 09/17/1962 | 01:38 | 3.71 days | 106 |
| 114 | 09/13/1961 | 21:43 | 09/15/1961 | 12:31 | 1.61 days | 203 |
| 113 | 06/19/1961 | 07:06 | 06/22/1961 | 02:29 | 2.80 days | 143 |
| 112 | 02/17/1961 | 03:14 | 02/20/1961 | 03:03 | 2.99 days | 136 |
| 111 | 02/05/1961 | 17:39 | 02/10/1961 | 18:19 | 5.02 days | 74 |
| 110 | 01/08/1961 | 07:02 | 01/18/1961 | 21:15 | 10.59 days | 25 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 109 | 12/07/1960 | 16:58 | 12/14/1960 | 06:58 | 6.58 days | 59 |
| 108 | 11/21/1960 | 19:56 | 11/23/1960 | 17:08 | 1.88 days | 189 |
| 107 | 10/28/1960 | 13:02 | 11/01/1960 | 20:48 | 4.32 days | 89 |
| 106 | 10/19/1960 | 23:59 | 10/21/1960 | 11:43 | 1.48 days | 210 |
| 105 | 01/06/1960 | 14:11 | 01/09/1960 | 00:45 | 2.43 days | 157 |
| 104 | 12/17/1959 | 01:47 | 12/19/1959 | 03:35 | 2.07 days | 183 |
| 103 | 10/04/1959 | 17:06 | 10/20/1959 | 08:34 | 15.64 days | 10 |
| 102 | 05/03/1958 | 08:52 | 05/16/1958 | 01:46 | 12.70 days | 18 |
| 101 | 02/22/1958 | 21:50 | 02/27/1958 | 18:49 | 4.87 days | 78 |
| 100 | 10/21/1957 | 17:59 | 10/25/1957 | 03:54 | 3.41 days | 117 |
| 99 | 10/15/1957 | 08:02 | 10/20/1957 | 03:36 | 4.81 days | 79 |
| 98 | 04/20/1957 | 16:17 | 07/06/1957 | 14:29 | 76.92 days | 1 |
| 97 | 05/02/1956 | 13:48 | 05/05/1956 | 04:39 | 2.61 days | 148 |
| 96 | 05/21/1955 | 00:10 | 05/22/1955 | 06:23 | 1.25 days | 222 |
| 95 | 04/10/1955 | 17:08 | 04/11/1955 | 17:05 | 0.99 days | 236 |
| 94 | 12/02/1953 | 20:33 | 12/05/1953 | 06:55 | 2.43 days | 159 |
| 93 | 10/26/1953 | 19:05 | 10/28/1953 | 23:12 | 2.17 days | 179 |
| 92 | 05/12/1953 | 14:58 | 05/20/1953 | 10:50 | 7.82 days | 44 |
| 91 | 05/24/1952 | 13:15 | 05/27/1952 | 00:43 | 2.47 days | 154 |
| 90 | 04/23/1952 | 18:15 | 04/25/1952 | 03:12 | 1.37 days | 217 |
| 89 | 02/13/1950 | 02:31 | 02/15/1950 | 07:49 | 2.22 days | 178 |
| 88 | 05/19/1949 | 02:24 | 05/21/1949 | 12:26 | 2.41 days | 161 |
| 87 | 04/25/1949 | 12:30 | 05/01/1949 | 12:02 | 5.98 days | 65 |
| 86 | 05/12/1948 | 19:13 | 05/14/1948 | 00:13 | 1.20 days | 225 |
| 85 | 05/21/1947 | 01:44 | 05/24/1947 | 14:50 | 3.54 days | 114 |
| 84 | 03/19/1947 | 23:56 | 03/21/1947 | 21:32 | 1.90 days | 188 |
| 83 | 01/17/1947 | 21:52 | 01/22/1947 | 06:14 | 4.34 days | 87 |
| 82 | 12/13/1946 | 00:40 | 12/15/1946 | 12:32 | 2.49 days | 153 |
| 81 | 11/17/1946 | 15:11 | 11/18/1946 | 15:17 | 1.00 days | 235 |
| 80 | 11/04/1946 | 19:27 | 11/07/1946 | 23:48 | 3.18 days | 125 |
| 79 | 06/02/1946 | 10:52 | 06/04/1946 | 01:19 | 1.60 days | 205 |
| 78 | 05/14/1946 | 07:20 | 05/21/1946 | 08:41 | 7.05 days | 54 |
| 77 | 04/23/1946 | 12:12 | 04/25/1946 | 23:37 | 2.47 days | 155 |
| 76 | 03/26/1946 | 14:39 | 03/27/1946 | 12:56 | 0.92 days | 238 |
| 75 | 03/14/1946 | 02:32 | 03/17/1946 | 22:05 | 3.81 days | 103 |
| 74 | 02/18/1946 | 12:59 | 02/21/1946 | 15:49 | 3.11 days | 131 |
| 73 | 01/16/1946 | 14:58 | 01/17/1946 | 12:47 | 0.90 days | 239 |
| 72 | 12/02/1945 | 19:01 | 12/05/1945 | 14:43 | 2.82 days | 141 |
| 71 | 07/11/1945 | 17:06 | 07/14/1945 | 02:21 | 2.38 days | 164 |
| 70 | 06/13/1945 | 21:36 | 06/15/1945 | 00:14 | 1.11 days | 230 |
| 69 | 04/22/1945 | 02:21 | 04/29/1945 | 13:43 | 7.47 days | 51 |
| 68 | 03/31/1945 | 05:12 | 04/06/1945 | 21:49 | 6.69 days | 58 |
| 67 | 03/04/1945 | 08:31 | 03/08/1945 | 23:31 | 4.62 days | 83 |
| 66 | 02/28/1945 | 14:54 | 03/01/1945 | 18:23 | 1.14 days | 229 |
| 65 | 02/22/1945 | 07:54 | 02/25/1945 | 11:46 | 3.16 days | 129 |
| 64 | 02/13/1945 | 19:41 | 02/15/1945 | 07:35 | 1.49 days | 209 |
| 63 | 01/18/1945 | 23:26 | 01/23/1945 | 01:33 | 4.08 days | 95 |
| 62 | 12/06/1944 | 20:22 | 12/07/1944 | 15:41 | 0.80 days | 241 |
| 61 | 06/07/1944 | 00:58 | 06/10/1944 | 00:44 | 2.99 days | 137 |
| 60 | 05/25/1944 | 21:52 | 06/03/1944 | 04:39 | 8.28 days | 42 |
| 59 | 05/01/1944 | 01:15 | 05/12/1944 | 21:58 | 11.86 days | 21 |
| 58 | 03/22/1944 | 17:54 | 03/24/1944 | 23:54 | 2.25 days | 174 |
| 57 | 02/26/1944 | 23:20 | 03/02/1944 | 17:19 | 4.74 days | 81 |
| 56 | 02/09/1944 | 18:57 | 02/11/1944 | 04:52 | 1.41 days | 214 |
| 55 | 10/19/1942 | 03:11 | 10/24/1942 | 02:58 | 4.99 days | 76 |
| 54 | 09/09/1942 | 09:55 | 09/14/1942 | 01:01 | 4.62 days | 82 |

| | | | | | | |
|----|------------|-------|------------|-------|------------|-----|
| 53 | 06/07/1942 | 17:05 | 06/19/1942 | 07:08 | 11.58 days | 23 |
| 52 | 05/18/1942 | 12:21 | 05/26/1942 | 13:06 | 8.03 days | 43 |
| 51 | 05/12/1942 | 01:27 | 05/14/1942 | 10:16 | 2.36 days | 167 |
| 50 | 05/07/1942 | 12:32 | 05/08/1942 | 16:15 | 1.15 days | 228 |
| 49 | 04/20/1942 | 20:46 | 05/04/1942 | 04:52 | 13.33 days | 15 |
| 48 | 04/07/1942 | 12:55 | 04/13/1942 | 05:53 | 5.70 days | 68 |
| 47 | 10/27/1941 | 16:36 | 10/29/1941 | 22:08 | 2.23 days | 177 |
| 46 | 10/19/1941 | 15:47 | 10/20/1941 | 20:32 | 1.19 days | 226 |
| 45 | 10/07/1941 | 08:41 | 10/09/1941 | 15:29 | 2.28 days | 171 |
| 44 | 07/11/1941 | 15:24 | 07/17/1941 | 10:51 | 5.80 days | 66 |
| 43 | 06/10/1941 | 18:38 | 06/23/1941 | 08:50 | 12.59 days | 19 |
| 42 | 06/03/1941 | 20:46 | 06/05/1941 | 03:35 | 1.28 days | 218 |
| 41 | 05/20/1941 | 05:38 | 06/01/1941 | 01:26 | 11.82 days | 22 |
| 40 | 05/03/1941 | 15:00 | 05/18/1941 | 19:06 | 15.17 days | 12 |
| 39 | 04/28/1941 | 16:08 | 05/01/1941 | 15:01 | 2.95 days | 139 |
| 38 | 04/25/1941 | 06:19 | 04/26/1941 | 16:04 | 1.40 days | 215 |
| 37 | 03/20/1941 | 00:04 | 03/21/1941 | 12:03 | 1.49 days | 208 |
| 36 | 03/07/1941 | 00:35 | 03/10/1941 | 17:44 | 3.71 days | 105 |
| 35 | 02/25/1941 | 11:25 | 02/27/1941 | 21:31 | 2.42 days | 160 |
| 34 | 02/01/1941 | 16:13 | 02/07/1941 | 17:58 | 6.07 days | 63 |
| 33 | 01/13/1941 | 16:32 | 01/18/1941 | 00:09 | 4.31 days | 90 |
| 32 | 12/27/1940 | 16:23 | 12/29/1940 | 14:29 | 1.92 days | 187 |
| 31 | 12/11/1940 | 19:11 | 12/20/1940 | 14:13 | 8.79 days | 37 |
| 30 | 11/24/1940 | 04:10 | 12/01/1940 | 19:28 | 7.63 days | 48 |
| 29 | 08/20/1940 | 18:17 | 08/22/1940 | 08:50 | 1.60 days | 204 |
| 28 | 06/28/1940 | 18:29 | 07/06/1940 | 08:19 | 7.57 days | 49 |
| 27 | 06/18/1940 | 13:45 | 06/20/1940 | 22:41 | 2.37 days | 166 |
| 26 | 06/21/1939 | 01:06 | 06/22/1939 | 00:24 | 0.97 days | 237 |
| 25 | 05/17/1939 | 20:42 | 05/22/1939 | 15:04 | 4.76 days | 80 |
| 24 | 07/26/1938 | 14:05 | 07/31/1938 | 00:42 | 4.44 days | 86 |
| 23 | 06/17/1938 | 20:57 | 06/20/1938 | 00:56 | 2.16 days | 180 |
| 22 | 04/27/1938 | 15:50 | 05/01/1938 | 15:34 | 3.98 days | 97 |
| 21 | 04/15/1938 | 17:11 | 04/18/1938 | 21:05 | 3.16 days | 128 |
| 20 | 04/07/1938 | 14:54 | 04/08/1938 | 19:21 | 1.18 days | 227 |
| 19 | 03/30/1938 | 01:19 | 04/01/1938 | 20:54 | 2.81 days | 142 |
| 18 | 02/17/1938 | 17:01 | 02/24/1938 | 20:16 | 7.13 days | 53 |
| 17 | 01/24/1938 | 05:48 | 01/29/1938 | 13:32 | 5.32 days | 72 |
| 16 | 12/29/1937 | 12:12 | 12/30/1937 | 12:50 | 1.02 days | 234 |
| 15 | 12/23/1937 | 22:33 | 12/25/1937 | 01:01 | 1.10 days | 231 |
| 14 | 01/13/1937 | 00:19 | 01/15/1937 | 09:48 | 2.39 days | 162 |
| 13 | 12/07/1936 | 02:29 | 12/10/1936 | 12:24 | 3.41 days | 118 |
| 12 | 10/26/1936 | 22:44 | 10/28/1936 | 21:43 | 1.95 days | 185 |
| 11 | 09/27/1936 | 03:56 | 10/05/1936 | 17:34 | 8.56 days | 38 |
| 10 | 09/18/1936 | 15:33 | 09/21/1936 | 16:59 | 3.06 days | 133 |
| 9 | 07/05/1936 | 03:35 | 07/06/1936 | 09:58 | 1.26 days | 220 |
| 8 | 07/02/1936 | 05:35 | 07/04/1936 | 00:28 | 1.78 days | 192 |
| 7 | 05/26/1936 | 04:46 | 06/02/1936 | 22:37 | 7.74 days | 46 |
| 6 | 12/07/1935 | 01:48 | 12/11/1935 | 09:12 | 4.30 days | 91 |
| 5 | 09/13/1935 | 08:26 | 09/13/1935 | 19:15 | 0.45 days | 247 |
| 4 | 09/08/1935 | 16:36 | 09/12/1935 | 09:09 | 3.68 days | 110 |
| 3 | 06/16/1935 | 02:54 | 06/22/1935 | 07:25 | 6.18 days | 62 |
| 2 | 05/17/1935 | 08:21 | 05/27/1935 | 07:24 | 9.96 days | 29 |
| 1 | 05/04/1935 | 20:52 | 05/09/1935 | 20:17 | 4.97 days | 77 |

Big Bend Oxbow Connections to the Brazos River – Ranked by Duration of Connections
 Jordan Furnans, TWDB 11/4/2004, 10:48

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 189.09ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 192.29 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81505 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76526 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 152454.0682 ft (28.87 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 339314.3045 ft (64.26 miles)
 Estimated Critical Gauge Height/WSE: 21.1812/210.2712 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 22.1812/211.2712 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-11/1/2004
 Number of Records: 339564
 Years of Record: 70.0113
 Number of Critical WSE Exceedences: 295
 Number of "significant" WSE Exceedences: 250
 Average Connections per year: 3.5709
 Flood Level Required for Connection: 1.1302 year flood (19362.4133 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|------------|------|-------|
| 98 | 04/20/1957 16:17 | 07/06/1957 14:29 | 76.92 days | 1 | |
| 195 | 12/21/1991 06:09 | 02/09/1992 07:12 | 50.04 days | 2 | |
| 190 | 04/26/1990 01:25 | 06/09/1990 03:57 | 44.10 days | 3 | |
| 212 | 02/13/1997 07:36 | 03/19/1997 08:54 | 34.05 days | 4 | |
| 197 | 03/04/1992 11:11 | 04/05/1992 12:11 | 32.04 days | 5 | |
| 120 | 04/25/1966 04:15 | 05/15/1966 21:44 | 20.72 days | 6 | |
| 119 | 05/12/1965 02:34 | 06/01/1965 15:39 | 20.54 days | 7 | |
| 196 | 02/11/1992 16:44 | 03/03/1992 05:33 | 20.53 days | 8 | |
| 154 | 04/17/1977 08:18 | 05/03/1977 04:17 | 15.83 days | 9 | |
| 103 | 10/04/1959 17:06 | 10/20/1959 08:34 | 15.64 days | 10 | |
| 142 | 10/31/1974 16:19 | 11/15/1974 20:38 | 15.18 days | 11 | |
| 40 | 05/03/1941 15:00 | 05/18/1941 19:06 | 15.17 days | 12 | |
| 165 | 10/18/1981 09:42 | 11/01/1981 13:50 | 14.17 days | 13 | |
| 201 | 06/07/1992 21:22 | 06/21/1992 05:51 | 13.35 days | 14 | |
| 49 | 04/20/1942 20:46 | 05/04/1942 04:52 | 13.33 days | 15 | |
| 171 | 06/26/1982 02:01 | 07/09/1982 07:34 | 13.23 days | 16 | |
| 184 | 06/04/1987 06:07 | 06/17/1987 10:24 | 13.17 days | 17 | |
| 102 | 05/03/1958 08:52 | 05/16/1958 01:46 | 12.70 days | 18 | |
| 43 | 06/10/1941 18:38 | 06/23/1941 08:50 | 12.59 days | 19 | |
| 123 | 01/19/1968 12:26 | 01/31/1968 14:58 | 12.10 days | 20 | |
| 59 | 05/01/1944 01:15 | 05/12/1944 21:58 | 11.86 days | 21 | |
| 41 | 05/20/1941 05:38 | 06/01/1941 01:26 | 11.82 days | 22 | |
| 53 | 06/07/1942 17:05 | 06/19/1942 07:08 | 11.58 days | 23 | |
| 128 | 05/16/1968 09:29 | 05/27/1968 00:46 | 10.63 days | 24 | |
| 110 | 01/08/1961 07:02 | 01/18/1961 21:15 | 10.59 days | 25 | |
| 163 | 06/13/1981 19:05 | 06/24/1981 08:29 | 10.55 days | 26 | |
| 170 | 05/25/1982 14:12 | 06/05/1982 00:42 | 10.43 days | 27 | |
| 132 | 05/09/1969 05:07 | 05/19/1969 14:00 | 10.36 days | 28 | |
| 2 | 05/17/1935 08:21 | 05/27/1935 07:24 | 9.96 days | 29 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|----|
| 159 | 05/30/1979 | 08:09 | 06/09/1979 | 01:13 | 9.71 days | 30 |
| 188 | 06/15/1989 | 05:17 | 06/24/1989 | 18:49 | 9.56 days | 31 |
| 233 | 03/09/2001 | 10:28 | 03/18/2001 | 20:19 | 9.40 days | 32 |
| 157 | 05/06/1979 | 12:02 | 05/15/1979 | 21:15 | 9.38 days | 33 |
| 187 | 05/26/1989 | 03:16 | 06/04/1989 | 04:16 | 9.04 days | 34 |
| 133 | 03/03/1970 | 12:06 | 03/12/1970 | 08:50 | 8.86 days | 35 |
| 216 | 04/04/1997 | 20:39 | 04/13/1997 | 16:17 | 8.81 days | 36 |
| 31 | 12/11/1940 | 19:11 | 12/20/1940 | 14:13 | 8.79 days | 37 |
| 11 | 09/27/1936 | 03:56 | 10/05/1936 | 17:34 | 8.56 days | 38 |
| 219 | 05/12/1997 | 06:50 | 05/20/1997 | 17:49 | 8.45 days | 39 |
| 208 | 05/09/1995 | 08:10 | 05/17/1995 | 18:33 | 8.43 days | 40 |
| 225 | 03/18/1998 | 03:07 | 03/26/1998 | 13:03 | 8.41 days | 41 |
| 60 | 05/25/1944 | 21:52 | 06/03/1944 | 04:39 | 8.28 days | 42 |
| 52 | 05/18/1942 | 12:21 | 05/26/1942 | 13:06 | 8.03 days | 43 |
| 92 | 05/12/1953 | 14:58 | 05/20/1953 | 10:50 | 7.82 days | 44 |
| 121 | 09/16/1966 | 21:14 | 09/24/1966 | 16:54 | 7.81 days | 45 |
| 7 | 05/26/1936 | 04:46 | 06/02/1936 | 22:37 | 7.74 days | 46 |
| 194 | 11/01/1991 | 20:10 | 11/09/1991 | 13:03 | 7.70 days | 47 |
| 30 | 11/24/1940 | 04:10 | 12/01/1940 | 19:28 | 7.63 days | 48 |
| 28 | 06/28/1940 | 18:29 | 07/06/1940 | 08:19 | 7.57 days | 49 |
| 185 | 06/20/1987 | 17:37 | 06/28/1987 | 07:20 | 7.57 days | 50 |
| 69 | 04/22/1945 | 02:21 | 04/29/1945 | 13:43 | 7.47 days | 51 |
| 137 | 04/25/1973 | 23:43 | 05/03/1973 | 06:51 | 7.29 days | 52 |
| 18 | 02/17/1938 | 17:01 | 02/24/1938 | 20:16 | 7.13 days | 53 |
| 78 | 05/14/1946 | 07:20 | 05/21/1946 | 08:41 | 7.05 days | 54 |
| 139 | 10/12/1973 | 20:59 | 10/19/1973 | 19:52 | 6.95 days | 55 |
| 218 | 04/26/1997 | 20:29 | 05/03/1997 | 15:59 | 6.81 days | 56 |
| 211 | 08/03/1995 | 07:39 | 08/10/1995 | 00:56 | 6.72 days | 57 |
| 68 | 03/31/1945 | 05:12 | 04/06/1945 | 21:49 | 6.69 days | 58 |
| 109 | 12/07/1960 | 16:58 | 12/14/1960 | 06:58 | 6.58 days | 59 |
| 250 | 06/27/2004 | 04:52 | 07/03/2004 | 15:07 | 6.42 days | 60 |
| 224 | 01/05/1998 | 17:13 | 01/11/1998 | 22:23 | 6.21 days | 61 |
| 3 | 06/16/1935 | 02:54 | 06/22/1935 | 07:25 | 6.18 days | 62 |
| 34 | 02/01/1941 | 16:13 | 02/07/1941 | 17:58 | 6.07 days | 63 |
| 144 | 02/02/1975 | 16:53 | 02/08/1975 | 16:56 | 6.00 days | 64 |
| 87 | 04/25/1949 | 12:30 | 05/01/1949 | 12:02 | 5.98 days | 65 |
| 44 | 07/11/1941 | 15:24 | 07/17/1941 | 10:51 | 5.80 days | 66 |
| 202 | 03/19/1993 | 17:43 | 03/25/1993 | 11:41 | 5.74 days | 67 |
| 48 | 04/07/1942 | 12:55 | 04/13/1942 | 05:53 | 5.70 days | 68 |
| 191 | 06/10/1990 | 19:05 | 06/16/1990 | 09:32 | 5.60 days | 69 |
| 138 | 06/04/1973 | 14:17 | 06/10/1973 | 02:30 | 5.50 days | 70 |
| 127 | 05/09/1968 | 22:33 | 05/15/1968 | 09:38 | 5.46 days | 71 |
| 17 | 01/24/1938 | 05:48 | 01/29/1938 | 13:32 | 5.32 days | 72 |
| 232 | 03/02/2001 | 16:23 | 03/07/2001 | 17:26 | 5.04 days | 73 |
| 111 | 02/05/1961 | 17:39 | 02/10/1961 | 18:19 | 5.02 days | 74 |
| 153 | 03/30/1977 | 20:31 | 04/04/1977 | 20:19 | 4.99 days | 75 |
| 55 | 10/19/1942 | 03:11 | 10/24/1942 | 02:58 | 4.99 days | 76 |
| 1 | 05/04/1935 | 20:52 | 05/09/1935 | 20:17 | 4.97 days | 77 |
| 101 | 02/22/1958 | 21:50 | 02/27/1958 | 18:49 | 4.87 days | 78 |
| 99 | 10/15/1957 | 08:02 | 10/20/1957 | 03:36 | 4.81 days | 79 |
| 25 | 05/17/1939 | 20:42 | 05/22/1939 | 15:04 | 4.76 days | 80 |
| 57 | 02/26/1944 | 23:20 | 03/02/1944 | 17:19 | 4.74 days | 81 |
| 54 | 09/09/1942 | 09:55 | 09/14/1942 | 01:01 | 4.62 days | 82 |
| 67 | 03/04/1945 | 08:31 | 03/08/1945 | 23:31 | 4.62 days | 83 |
| 125 | 03/22/1968 | 15:30 | 03/27/1968 | 04:41 | 4.54 days | 84 |
| 226 | 10/18/1998 | 09:41 | 10/22/1998 | 20:34 | 4.45 days | 85 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 24 | 07/26/1938 | 14:05 | 07/31/1938 | 00:42 | 4.44 days | 86 |
| 83 | 01/17/1947 | 21:52 | 01/22/1947 | 06:14 | 4.34 days | 87 |
| 158 | 05/21/1979 | 19:02 | 05/26/1979 | 03:12 | 4.33 days | 88 |
| 107 | 10/28/1960 | 13:02 | 11/01/1960 | 20:48 | 4.32 days | 89 |
| 33 | 01/13/1941 | 16:32 | 01/18/1941 | 00:09 | 4.31 days | 90 |
| 6 | 12/07/1935 | 01:48 | 12/11/1935 | 09:12 | 4.30 days | 91 |
| 248 | 06/10/2004 | 00:37 | 06/14/2004 | 06:49 | 4.25 days | 92 |
| 143 | 11/23/1974 | 12:39 | 11/27/1974 | 18:21 | 4.23 days | 93 |
| 147 | 04/18/1976 | 18:41 | 04/22/1976 | 21:53 | 4.13 days | 94 |
| 63 | 01/18/1945 | 23:26 | 01/23/1945 | 01:33 | 4.08 days | 95 |
| 223 | 12/21/1997 | 17:29 | 12/25/1997 | 18:35 | 4.04 days | 96 |
| 22 | 04/27/1938 | 15:50 | 05/01/1938 | 15:34 | 3.98 days | 97 |
| 234 | 03/28/2001 | 10:42 | 04/01/2001 | 09:49 | 3.96 days | 98 |
| 182 | 12/22/1986 | 21:24 | 12/26/1986 | 19:58 | 3.94 days | 99 |
| 186 | 05/17/1989 | 17:39 | 05/21/1989 | 16:00 | 3.93 days | 100 |
| 178 | 02/03/1986 | 15:52 | 02/07/1986 | 11:38 | 3.82 days | 101 |
| 222 | 06/28/1997 | 11:29 | 07/02/1997 | 07:14 | 3.82 days | 102 |
| 75 | 03/14/1946 | 02:32 | 03/17/1946 | 22:05 | 3.81 days | 103 |
| 160 | 07/26/1979 | 15:00 | 07/30/1979 | 08:30 | 3.72 days | 104 |
| 36 | 03/07/1941 | 00:35 | 03/10/1941 | 17:44 | 3.71 days | 105 |
| 115 | 09/13/1962 | 08:29 | 09/17/1962 | 01:38 | 3.71 days | 106 |
| 239 | 12/16/2001 | 12:23 | 12/20/2001 | 05:25 | 3.70 days | 107 |
| 242 | 02/21/2003 | 08:19 | 02/25/2003 | 01:17 | 3.70 days | 108 |
| 161 | 05/15/1980 | 09:36 | 05/19/1980 | 02:14 | 3.69 days | 109 |
| 4 | 09/08/1935 | 16:36 | 09/12/1935 | 09:09 | 3.68 days | 110 |
| 155 | 03/21/1979 | 02:58 | 03/24/1979 | 19:01 | 3.66 days | 111 |
| 145 | 05/25/1975 | 08:13 | 05/28/1975 | 23:53 | 3.65 days | 112 |
| 129 | 06/23/1968 | 16:38 | 06/27/1968 | 06:24 | 3.57 days | 113 |
| 85 | 05/21/1947 | 01:44 | 05/24/1947 | 14:50 | 3.54 days | 114 |
| 162 | 06/04/1981 | 18:03 | 06/08/1981 | 06:18 | 3.51 days | 115 |
| 146 | 05/29/1975 | 13:28 | 06/01/1975 | 23:37 | 3.42 days | 116 |
| 100 | 10/21/1957 | 17:59 | 10/25/1957 | 03:54 | 3.41 days | 117 |
| 13 | 12/07/1936 | 02:29 | 12/10/1936 | 12:24 | 3.41 days | 118 |
| 167 | 05/13/1982 | 20:39 | 05/17/1982 | 04:33 | 3.32 days | 119 |
| 124 | 03/11/1968 | 15:14 | 03/14/1968 | 23:08 | 3.32 days | 120 |
| 192 | 01/09/1991 | 20:26 | 01/13/1991 | 04:15 | 3.32 days | 121 |
| 152 | 02/12/1977 | 04:30 | 02/15/1977 | 10:57 | 3.26 days | 122 |
| 200 | 06/02/1992 | 04:28 | 06/05/1992 | 10:51 | 3.26 days | 123 |
| 247 | 05/13/2004 | 12:14 | 05/16/2004 | 17:37 | 3.22 days | 124 |
| 80 | 11/04/1946 | 19:27 | 11/07/1946 | 23:48 | 3.18 days | 125 |
| 203 | 05/09/1993 | 19:40 | 05/12/1993 | 23:59 | 3.18 days | 126 |
| 227 | 11/14/1998 | 03:33 | 11/17/1998 | 07:40 | 3.17 days | 127 |
| 21 | 04/15/1938 | 17:11 | 04/18/1938 | 21:05 | 3.16 days | 128 |
| 65 | 02/22/1945 | 07:54 | 02/25/1945 | 11:46 | 3.16 days | 129 |
| 118 | 02/16/1965 | 19:27 | 02/19/1965 | 22:33 | 3.12 days | 130 |
| 74 | 02/18/1946 | 12:59 | 02/21/1946 | 15:49 | 3.11 days | 131 |
| 189 | 03/14/1990 | 15:18 | 03/17/1990 | 17:11 | 3.07 days | 132 |
| 10 | 09/18/1936 | 15:33 | 09/21/1936 | 16:59 | 3.06 days | 133 |
| 141 | 09/17/1974 | 14:53 | 09/20/1974 | 15:59 | 3.04 days | 134 |
| 131 | 04/12/1969 | 21:58 | 04/15/1969 | 22:39 | 3.02 days | 135 |
| 112 | 02/17/1961 | 03:14 | 02/20/1961 | 03:03 | 2.99 days | 136 |
| 61 | 06/07/1944 | 00:58 | 06/10/1944 | 00:44 | 2.99 days | 137 |
| 140 | 09/12/1974 | 12:44 | 09/15/1974 | 12:21 | 2.98 days | 138 |
| 39 | 04/28/1941 | 16:08 | 05/01/1941 | 15:01 | 2.95 days | 139 |
| 156 | 04/02/1979 | 07:54 | 04/05/1979 | 05:41 | 2.90 days | 140 |
| 72 | 12/02/1945 | 19:01 | 12/05/1945 | 14:43 | 2.82 days | 141 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 19 | 03/30/1938 | 01:19 | 04/01/1938 | 20:54 | 2.81 days | 142 |
| 113 | 06/19/1961 | 07:06 | 06/22/1961 | 02:29 | 2.80 days | 143 |
| 149 | 05/06/1976 | 16:14 | 05/09/1976 | 11:37 | 2.80 days | 144 |
| 221 | 06/10/1997 | 04:24 | 06/12/1997 | 23:27 | 2.79 days | 145 |
| 246 | 05/02/2004 | 12:09 | 05/05/2004 | 04:34 | 2.68 days | 146 |
| 148 | 04/29/1976 | 21:18 | 05/02/1976 | 12:58 | 2.65 days | 147 |
| 97 | 05/02/1956 | 13:48 | 05/05/1956 | 04:39 | 2.61 days | 148 |
| 177 | 12/11/1985 | 21:43 | 12/14/1985 | 12:02 | 2.59 days | 149 |
| 151 | 12/12/1976 | 07:56 | 12/14/1976 | 21:45 | 2.57 days | 150 |
| 228 | 12/11/1998 | 13:34 | 12/14/1998 | 03:09 | 2.56 days | 151 |
| 199 | 05/23/1992 | 10:45 | 05/25/1992 | 22:52 | 2.50 days | 152 |
| 82 | 12/13/1946 | 00:40 | 12/15/1946 | 12:32 | 2.49 days | 153 |
| 91 | 05/24/1952 | 13:15 | 05/27/1952 | 00:43 | 2.47 days | 154 |
| 77 | 04/23/1946 | 12:12 | 04/25/1946 | 23:37 | 2.47 days | 155 |
| 198 | 05/18/1992 | 11:31 | 05/20/1992 | 22:48 | 2.47 days | 156 |
| 105 | 01/06/1960 | 14:11 | 01/09/1960 | 00:45 | 2.43 days | 157 |
| 174 | 02/23/1985 | 17:13 | 02/26/1985 | 03:42 | 2.43 days | 158 |
| 94 | 12/02/1953 | 20:33 | 12/05/1953 | 06:55 | 2.43 days | 159 |
| 35 | 02/25/1941 | 11:25 | 02/27/1941 | 21:31 | 2.42 days | 160 |
| 88 | 05/19/1949 | 02:24 | 05/21/1949 | 12:26 | 2.41 days | 161 |
| 14 | 01/13/1937 | 00:19 | 01/15/1937 | 09:48 | 2.39 days | 162 |
| 206 | 12/16/1994 | 05:33 | 12/18/1994 | 14:57 | 2.39 days | 163 |
| 71 | 07/11/1945 | 17:06 | 07/14/1945 | 02:21 | 2.38 days | 164 |
| 230 | 12/27/2000 | 04:26 | 12/29/2000 | 13:31 | 2.37 days | 165 |
| 27 | 06/18/1940 | 13:45 | 06/20/1940 | 22:41 | 2.37 days | 166 |
| 51 | 05/12/1942 | 01:27 | 05/14/1942 | 10:16 | 2.36 days | 167 |
| 150 | 07/06/1976 | 08:21 | 07/08/1976 | 17:03 | 2.36 days | 168 |
| 207 | 03/14/1995 | 00:17 | 03/16/1995 | 08:21 | 2.33 days | 169 |
| 176 | 11/27/1985 | 19:06 | 11/30/1985 | 02:10 | 2.29 days | 170 |
| 45 | 10/07/1941 | 08:41 | 10/09/1941 | 15:29 | 2.28 days | 171 |
| 249 | 06/15/2004 | 10:29 | 06/17/2004 | 16:59 | 2.27 days | 172 |
| 122 | 11/10/1967 | 16:23 | 11/12/1967 | 22:29 | 2.25 days | 173 |
| 58 | 03/22/1944 | 17:54 | 03/24/1944 | 23:54 | 2.25 days | 174 |
| 116 | 01/23/1965 | 05:39 | 01/25/1965 | 11:37 | 2.24 days | 175 |
| 166 | 11/04/1981 | 15:36 | 11/06/1981 | 21:29 | 2.24 days | 176 |
| 47 | 10/27/1941 | 16:36 | 10/29/1941 | 22:08 | 2.23 days | 177 |
| 89 | 02/13/1950 | 02:31 | 02/15/1950 | 07:49 | 2.22 days | 178 |
| 93 | 10/26/1953 | 19:05 | 10/28/1953 | 23:12 | 2.17 days | 179 |
| 23 | 06/17/1938 | 20:57 | 06/20/1938 | 00:56 | 2.16 days | 180 |
| 130 | 07/09/1968 | 14:47 | 07/11/1968 | 18:43 | 2.16 days | 181 |
| 117 | 02/10/1965 | 20:49 | 02/13/1965 | 00:20 | 2.14 days | 182 |
| 104 | 12/17/1959 | 01:47 | 12/19/1959 | 03:35 | 2.07 days | 183 |
| 238 | 11/17/2001 | 00:34 | 11/19/2001 | 01:31 | 2.03 days | 184 |
| 12 | 10/26/1936 | 22:44 | 10/28/1936 | 21:43 | 1.95 days | 185 |
| 136 | 03/24/1973 | 15:31 | 03/26/1973 | 14:29 | 1.95 days | 186 |
| 32 | 12/27/1940 | 16:23 | 12/29/1940 | 14:29 | 1.92 days | 187 |
| 84 | 03/19/1947 | 23:56 | 03/21/1947 | 21:32 | 1.90 days | 188 |
| 108 | 11/21/1960 | 19:56 | 11/23/1960 | 17:08 | 1.88 days | 189 |
| 240 | 11/04/2002 | 23:18 | 11/06/2002 | 19:59 | 1.86 days | 190 |
| 204 | 06/21/1993 | 22:23 | 06/23/1993 | 17:40 | 1.80 days | 191 |
| 8 | 07/02/1936 | 05:35 | 07/04/1936 | 00:28 | 1.78 days | 192 |
| 183 | 06/01/1987 | 02:53 | 06/02/1987 | 21:15 | 1.76 days | 193 |
| 134 | 12/10/1971 | 21:47 | 12/12/1971 | 16:03 | 1.76 days | 194 |
| 172 | 05/22/1983 | 02:48 | 05/23/1983 | 20:15 | 1.72 days | 195 |
| 181 | 12/15/1986 | 14:27 | 12/17/1986 | 07:52 | 1.72 days | 196 |
| 210 | 06/15/1995 | 01:28 | 06/16/1995 | 18:33 | 1.71 days | 197 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 236 | 08/31/2001 | 12:16 | 09/02/2001 | 05:20 | 1.71 days | 198 |
| 229 | 11/04/2000 | 14:57 | 11/06/2000 | 07:19 | 1.68 days | 199 |
| 213 | 03/23/1997 | 06:29 | 03/24/1997 | 22:06 | 1.65 days | 200 |
| 215 | 03/26/1997 | 06:44 | 03/27/1997 | 22:03 | 1.63 days | 201 |
| 244 | 10/10/2003 | 06:54 | 10/11/2003 | 22:05 | 1.63 days | 202 |
| 114 | 09/13/1961 | 21:43 | 09/15/1961 | 12:31 | 1.61 days | 203 |
| 29 | 08/20/1940 | 18:17 | 08/22/1940 | 08:50 | 1.60 days | 204 |
| 79 | 06/02/1946 | 10:52 | 06/04/1946 | 01:19 | 1.60 days | 205 |
| 241 | 12/10/2002 | 12:00 | 12/12/2002 | 01:33 | 1.56 days | 206 |
| 164 | 10/14/1981 | 22:14 | 10/16/1981 | 10:30 | 1.51 days | 207 |
| 37 | 03/20/1941 | 00:04 | 03/21/1941 | 12:03 | 1.49 days | 208 |
| 64 | 02/13/1945 | 19:41 | 02/15/1945 | 07:35 | 1.49 days | 209 |
| 106 | 10/19/1960 | 23:59 | 10/21/1960 | 11:43 | 1.48 days | 210 |
| 231 | 01/19/2001 | 03:48 | 01/20/2001 | 15:32 | 1.48 days | 211 |
| 235 | 05/07/2001 | 18:25 | 05/09/2001 | 05:27 | 1.45 days | 212 |
| 243 | 03/04/2003 | 13:29 | 03/05/2003 | 23:35 | 1.42 days | 213 |
| 56 | 02/09/1944 | 18:57 | 02/11/1944 | 04:52 | 1.41 days | 214 |
| 38 | 04/25/1941 | 06:19 | 04/26/1941 | 16:04 | 1.40 days | 215 |
| 179 | 06/13/1986 | 10:30 | 06/14/1986 | 19:54 | 1.39 days | 216 |
| 90 | 04/23/1952 | 18:15 | 04/25/1952 | 03:12 | 1.37 days | 217 |
| 42 | 06/03/1941 | 20:46 | 06/05/1941 | 03:35 | 1.28 days | 218 |
| 220 | 05/25/1997 | 04:44 | 05/26/1997 | 11:20 | 1.27 days | 219 |
| 9 | 07/05/1936 | 03:35 | 07/06/1936 | 09:58 | 1.26 days | 220 |
| 193 | 04/14/1991 | 16:53 | 04/15/1991 | 23:11 | 1.26 days | 221 |
| 96 | 05/21/1955 | 00:10 | 05/22/1955 | 06:23 | 1.25 days | 222 |
| 169 | 05/22/1982 | 03:03 | 05/23/1982 | 09:01 | 1.24 days | 223 |
| 175 | 11/24/1985 | 12:38 | 11/25/1985 | 18:28 | 1.24 days | 224 |
| 86 | 05/12/1948 | 19:13 | 05/14/1948 | 00:13 | 1.20 days | 225 |
| 46 | 10/19/1941 | 15:47 | 10/20/1941 | 20:32 | 1.19 days | 226 |
| 20 | 04/07/1938 | 14:54 | 04/08/1938 | 19:21 | 1.18 days | 227 |
| 50 | 05/07/1942 | 12:32 | 05/08/1942 | 16:15 | 1.15 days | 228 |
| 66 | 02/28/1945 | 14:54 | 03/01/1945 | 18:23 | 1.14 days | 229 |
| 70 | 06/13/1945 | 21:36 | 06/15/1945 | 00:14 | 1.11 days | 230 |
| 15 | 12/23/1937 | 22:33 | 12/25/1937 | 01:01 | 1.10 days | 231 |
| 126 | 04/13/1968 | 22:02 | 04/14/1968 | 22:58 | 1.03 days | 232 |
| 168 | 05/17/1982 | 15:23 | 05/18/1982 | 16:15 | 1.03 days | 233 |
| 16 | 12/29/1937 | 12:12 | 12/30/1937 | 12:50 | 1.02 days | 234 |
| 81 | 11/17/1946 | 15:11 | 11/18/1946 | 15:17 | 1.00 days | 235 |
| 95 | 04/10/1955 | 17:08 | 04/11/1955 | 17:05 | 0.99 days | 236 |
| 26 | 06/21/1939 | 01:06 | 06/22/1939 | 00:24 | 0.97 days | 237 |
| 76 | 03/26/1946 | 14:39 | 03/27/1946 | 12:56 | 0.92 days | 238 |
| 73 | 01/16/1946 | 14:58 | 01/17/1946 | 12:47 | 0.90 days | 239 |
| 135 | 01/26/1973 | 21:15 | 01/27/1973 | 18:26 | 0.88 days | 240 |
| 62 | 12/06/1944 | 20:22 | 12/07/1944 | 15:41 | 0.80 days | 241 |
| 245 | 04/26/2004 | 03:37 | 04/26/2004 | 22:44 | 0.79 days | 242 |
| 180 | 10/24/1986 | 21:03 | 10/25/1986 | 14:58 | 0.74 days | 243 |
| 173 | 10/22/1984 | 01:17 | 10/22/1984 | 16:32 | 0.63 days | 244 |
| 214 | 03/25/1997 | 11:35 | 03/25/1997 | 23:44 | 0.50 days | 245 |
| 237 | 09/06/2001 | 12:41 | 09/06/2001 | 23:51 | 0.46 days | 246 |
| 5 | 09/13/1935 | 08:26 | 09/13/1935 | 19:15 | 0.45 days | 247 |
| 205 | 05/15/1994 | 02:32 | 05/15/1994 | 12:06 | 0.39 days | 248 |
| 209 | 05/18/1995 | 04:08 | 05/18/1995 | 11:28 | 0.30 days | 249 |
| 217 | 04/14/1997 | 09:11 | 04/14/1997 | 15:38 | 0.26 days | 250 |

Big Bend Oxbow Connections to the Brazos River - Chronology of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 10:48

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 189.09ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 192.29 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81505 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76526 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 152454.0682 ft (28.87 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 339314.3045 ft (64.26 miles)
 Estimated Critical Gauge Height/WSE: 21.1812/210.2712 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 22.1812/211.2712 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-11/1/2004
 Number of Records: 339564
 Years of Record: 70.0113
 Number of Critical WSE Exceedences: 295
 Number of "significant" WSE Exceedences: 250
 Average Connections per year: 3.5709
 Flood Level Required for Connection: 1.1302 year flood (19362.4133 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|----------------------------------|
| 250 | 07/03/2004 15:07 | 11/01/2004 03:14 | 120.50 days | 60 | Disconnected Period Not Complete |
| 249 | 06/17/2004 16:59 | 06/27/2004 04:52 | 9.98 days | 177 | |
| 248 | 06/14/2004 06:49 | 06/15/2004 10:29 | 2.11 days | 231 | |
| 247 | 05/16/2004 17:37 | 06/10/2004 00:37 | 24.75 days | 134 | |
| 246 | 05/05/2004 04:34 | 05/13/2004 12:14 | 9.00 days | 180 | |
| 245 | 04/26/2004 22:44 | 05/02/2004 12:09 | 6.20 days | 201 | |
| 244 | 10/11/2003 22:05 | 04/26/2004 03:37 | 197.70 days | 43 | |
| 243 | 03/05/2003 23:35 | 10/10/2003 06:54 | 218.90 days | 38 | |
| 242 | 02/25/2003 01:17 | 03/04/2003 13:29 | 8.47 days | 186 | |
| 241 | 12/12/2002 01:33 | 02/21/2003 08:19 | 71.56 days | 76 | |
| 240 | 11/06/2002 19:59 | 12/10/2002 12:00 | 33.72 days | 116 | |
| 239 | 12/20/2001 05:25 | 11/04/2002 23:18 | 319.96 days | 27 | |
| 238 | 11/19/2001 01:31 | 12/16/2001 12:23 | 28.00 days | 128 | |
| 237 | 09/06/2001 23:51 | 11/17/2001 00:34 | 71.32 days | 77 | |
| 236 | 09/02/2001 05:20 | 09/06/2001 12:41 | 5.06 days | 209 | |
| 235 | 05/09/2001 05:27 | 08/31/2001 12:16 | 114.35 days | 62 | |
| 234 | 04/01/2001 09:49 | 05/07/2001 18:25 | 37.07 days | 110 | |
| 233 | 03/18/2001 20:19 | 03/28/2001 10:42 | 10.43 days | 174 | |
| 232 | 03/07/2001 17:26 | 03/09/2001 10:28 | 2.61 days | 225 | |
| 231 | 01/20/2001 15:32 | 03/02/2001 16:23 | 41.58 days | 103 | |
| 230 | 12/29/2000 13:31 | 01/19/2001 03:48 | 20.85 days | 144 | |
| 229 | 11/06/2000 07:19 | 12/27/2000 04:26 | 51.64 days | 89 | |
| 228 | 12/14/1998 03:09 | 11/04/2000 14:57 | 692.29 days | 3 | |
| 227 | 11/17/1998 07:40 | 12/11/1998 13:34 | 24.56 days | 136 | |
| 226 | 10/22/1998 20:34 | 11/14/1998 03:33 | 22.50 days | 139 | |
| 225 | 03/26/1998 13:03 | 10/18/1998 09:41 | 206.61 days | 41 | |
| 224 | 01/11/1998 22:23 | 03/18/1998 03:07 | 65.72 days | 80 | |
| 223 | 12/25/1997 18:35 | 01/05/1998 17:13 | 11.86 days | 171 | |
| 222 | 07/02/1997 07:14 | 12/21/1997 17:29 | 173.35 days | 46 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 221 | 06/12/1997 | 23:27 | 06/28/1997 | 11:29 | 16.48 days | 157 |
| 220 | 05/26/1997 | 11:20 | 06/10/1997 | 04:24 | 15.35 days | 160 |
| 219 | 05/20/1997 | 17:49 | 05/25/1997 | 04:44 | 5.43 days | 208 |
| 218 | 05/03/1997 | 15:59 | 05/12/1997 | 06:50 | 8.99 days | 181 |
| 217 | 04/14/1997 | 15:38 | 04/26/1997 | 20:29 | 13.17 days | 165 |
| 216 | 04/13/1997 | 16:17 | 04/14/1997 | 09:11 | 1.43 days | 240 |
| 215 | 03/27/1997 | 22:03 | 04/04/1997 | 20:39 | 8.55 days | 184 |
| 214 | 03/25/1997 | 23:44 | 03/26/1997 | 06:44 | 1.22 days | 243 |
| 213 | 03/24/1997 | 22:06 | 03/25/1997 | 11:35 | 0.93 days | 247 |
| 212 | 03/19/1997 | 08:54 | 03/23/1997 | 06:29 | 4.84 days | 210 |
| 211 | 08/10/1995 | 00:56 | 02/13/1997 | 07:36 | 553.69 days | 7 |
| 210 | 06/16/1995 | 18:33 | 08/03/1995 | 07:39 | 48.17 days | 92 |
| 209 | 05/18/1995 | 11:28 | 06/15/1995 | 01:28 | 28.04 days | 127 |
| 208 | 05/17/1995 | 18:33 | 05/18/1995 | 04:08 | 0.53 days | 249 |
| 207 | 03/16/1995 | 08:21 | 05/09/1995 | 08:10 | 54.16 days | 88 |
| 206 | 12/18/1994 | 14:57 | 03/14/1995 | 00:17 | 85.66 days | 68 |
| 205 | 05/15/1994 | 12:06 | 12/16/1994 | 05:33 | 215.26 days | 39 |
| 204 | 06/23/1993 | 17:40 | 05/15/1994 | 02:32 | 325.88 days | 25 |
| 203 | 05/12/1993 | 23:59 | 06/21/1993 | 22:23 | 39.93 days | 106 |
| 202 | 03/25/1993 | 11:41 | 05/09/1993 | 19:40 | 45.33 days | 96 |
| 201 | 06/21/1992 | 05:51 | 03/19/1993 | 17:43 | 271.49 days | 34 |
| 200 | 06/05/1992 | 10:51 | 06/07/1992 | 21:22 | 2.43 days | 228 |
| 199 | 05/25/1992 | 22:52 | 06/02/1992 | 04:28 | 7.23 days | 192 |
| 198 | 05/20/1992 | 22:48 | 05/23/1992 | 10:45 | 2.49 days | 227 |
| 197 | 04/05/1992 | 12:11 | 05/18/1992 | 11:31 | 42.97 days | 99 |
| 196 | 03/03/1992 | 05:33 | 03/04/1992 | 11:11 | 1.23 days | 242 |
| 195 | 02/09/1992 | 07:12 | 02/11/1992 | 16:44 | 2.39 days | 229 |
| 194 | 11/09/1991 | 13:03 | 12/21/1991 | 06:09 | 41.71 days | 102 |
| 193 | 04/15/1991 | 23:11 | 11/01/1991 | 20:10 | 199.87 days | 42 |
| 192 | 01/13/1991 | 04:15 | 04/14/1991 | 16:53 | 91.52 days | 67 |
| 191 | 06/16/1990 | 09:32 | 01/09/1991 | 20:26 | 207.45 days | 40 |
| 190 | 06/09/1990 | 03:57 | 06/10/1990 | 19:05 | 1.63 days | 237 |
| 189 | 03/17/1990 | 17:11 | 04/26/1990 | 01:25 | 39.34 days | 107 |
| 188 | 06/24/1989 | 18:49 | 03/14/1990 | 15:18 | 262.85 days | 37 |
| 187 | 06/04/1989 | 04:16 | 06/15/1989 | 05:17 | 11.04 days | 173 |
| 186 | 05/21/1989 | 16:00 | 05/26/1989 | 03:16 | 4.46 days | 211 |
| 185 | 06/28/1987 | 07:20 | 05/17/1989 | 17:39 | 689.42 days | 4 |
| 184 | 06/17/1987 | 10:24 | 06/20/1987 | 17:37 | 3.30 days | 221 |
| 183 | 06/02/1987 | 21:15 | 06/04/1987 | 06:07 | 1.37 days | 241 |
| 182 | 12/26/1986 | 19:58 | 06/01/1987 | 02:53 | 156.28 days | 51 |
| 181 | 12/17/1986 | 07:52 | 12/22/1986 | 21:24 | 5.56 days | 205 |
| 180 | 10/25/1986 | 14:58 | 12/15/1986 | 14:27 | 50.97 days | 91 |
| 179 | 06/14/1986 | 19:54 | 10/24/1986 | 21:03 | 132.04 days | 54 |
| 178 | 02/07/1986 | 11:38 | 06/13/1986 | 10:30 | 125.95 days | 55 |
| 177 | 12/14/1985 | 12:02 | 02/03/1986 | 15:52 | 51.15 days | 90 |
| 176 | 11/30/1985 | 02:10 | 12/11/1985 | 21:43 | 11.81 days | 172 |
| 175 | 11/25/1985 | 18:28 | 11/27/1985 | 19:06 | 2.02 days | 233 |
| 174 | 02/26/1985 | 03:42 | 11/24/1985 | 12:38 | 271.37 days | 35 |
| 173 | 10/22/1984 | 16:32 | 02/23/1985 | 17:13 | 124.02 days | 57 |
| 172 | 05/23/1983 | 20:15 | 10/22/1984 | 01:17 | 517.20 days | 8 |
| 171 | 07/09/1982 | 07:34 | 05/22/1983 | 02:48 | 316.80 days | 28 |
| 170 | 06/05/1982 | 00:42 | 06/26/1982 | 02:01 | 21.05 days | 143 |
| 169 | 05/23/1982 | 09:01 | 05/25/1982 | 14:12 | 2.21 days | 230 |
| 168 | 05/18/1982 | 16:15 | 05/22/1982 | 03:03 | 3.44 days | 218 |
| 167 | 05/17/1982 | 04:33 | 05/17/1982 | 15:23 | 0.45 days | 250 |
| 166 | 11/06/1981 | 21:29 | 05/13/1982 | 20:39 | 187.96 days | 44 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 165 | 11/01/1981 | 13:50 | 11/04/1981 | 15:36 | 3.07 days | 223 |
| 164 | 10/16/1981 | 10:30 | 10/18/1981 | 09:42 | 1.96 days | 236 |
| 163 | 06/24/1981 | 08:29 | 10/14/1981 | 22:14 | 112.57 days | 63 |
| 162 | 06/08/1981 | 06:18 | 06/13/1981 | 19:05 | 5.53 days | 206 |
| 161 | 05/19/1980 | 02:14 | 06/04/1981 | 18:03 | 381.65 days | 14 |
| 160 | 07/30/1979 | 08:30 | 05/15/1980 | 09:36 | 290.04 days | 30 |
| 159 | 06/09/1979 | 01:13 | 07/26/1979 | 15:00 | 47.57 days | 93 |
| 158 | 05/26/1979 | 03:12 | 05/30/1979 | 08:09 | 4.20 days | 213 |
| 157 | 05/15/1979 | 21:15 | 05/21/1979 | 19:02 | 5.90 days | 202 |
| 156 | 04/05/1979 | 05:41 | 05/06/1979 | 12:02 | 31.26 days | 122 |
| 155 | 03/24/1979 | 19:01 | 04/02/1979 | 07:54 | 8.53 days | 185 |
| 154 | 05/03/1977 | 04:17 | 03/21/1979 | 02:58 | 686.94 days | 5 |
| 153 | 04/04/1977 | 20:19 | 04/17/1977 | 08:18 | 12.49 days | 167 |
| 152 | 02/15/1977 | 10:57 | 03/30/1977 | 20:31 | 43.39 days | 98 |
| 151 | 12/14/1976 | 21:45 | 02/12/1977 | 04:30 | 59.28 days | 83 |
| 150 | 07/08/1976 | 17:03 | 12/12/1976 | 07:56 | 156.62 days | 50 |
| 149 | 05/09/1976 | 11:37 | 07/06/1976 | 08:21 | 57.86 days | 84 |
| 148 | 05/02/1976 | 12:58 | 05/06/1976 | 16:14 | 4.13 days | 214 |
| 147 | 04/22/1976 | 21:53 | 04/29/1976 | 21:18 | 6.97 days | 197 |
| 146 | 06/01/1975 | 23:37 | 04/18/1976 | 18:41 | 321.79 days | 26 |
| 145 | 05/28/1975 | 23:53 | 05/29/1975 | 13:28 | 0.56 days | 248 |
| 144 | 02/08/1975 | 16:56 | 05/25/1975 | 08:13 | 105.63 days | 64 |
| 143 | 11/27/1974 | 18:21 | 02/02/1975 | 16:53 | 66.93 days | 79 |
| 142 | 11/15/1974 | 20:38 | 11/23/1974 | 12:39 | 7.66 days | 189 |
| 141 | 09/20/1974 | 15:59 | 10/31/1974 | 16:19 | 41.01 days | 104 |
| 140 | 09/15/1974 | 12:21 | 09/17/1974 | 14:53 | 2.10 days | 232 |
| 139 | 10/19/1973 | 19:52 | 09/12/1974 | 12:44 | 327.70 days | 23 |
| 138 | 06/10/1973 | 02:30 | 10/12/1973 | 20:59 | 124.77 days | 56 |
| 137 | 05/03/1973 | 06:51 | 06/04/1973 | 14:17 | 32.30 days | 120 |
| 136 | 03/26/1973 | 14:29 | 04/25/1973 | 23:43 | 30.38 days | 123 |
| 135 | 01/27/1973 | 18:26 | 03/24/1973 | 15:31 | 55.87 days | 87 |
| 134 | 12/12/1971 | 16:03 | 01/26/1973 | 21:15 | 411.21 days | 13 |
| 133 | 03/12/1970 | 08:50 | 12/10/1971 | 21:47 | 638.53 days | 6 |
| 132 | 05/19/1969 | 14:00 | 03/03/1970 | 12:06 | 287.92 days | 31 |
| 131 | 04/15/1969 | 22:39 | 05/09/1969 | 05:07 | 23.26 days | 138 |
| 130 | 07/11/1968 | 18:43 | 04/12/1969 | 21:58 | 275.13 days | 33 |
| 129 | 06/27/1968 | 06:24 | 07/09/1968 | 14:47 | 12.34 days | 168 |
| 128 | 05/27/1968 | 00:46 | 06/23/1968 | 16:38 | 27.66 days | 129 |
| 127 | 05/15/1968 | 09:38 | 05/16/1968 | 09:29 | 0.99 days | 245 |
| 126 | 04/14/1968 | 22:58 | 05/09/1968 | 22:33 | 24.98 days | 133 |
| 125 | 03/27/1968 | 04:41 | 04/13/1968 | 22:02 | 17.72 days | 155 |
| 124 | 03/14/1968 | 23:08 | 03/22/1968 | 15:30 | 7.68 days | 188 |
| 123 | 01/31/1968 | 14:58 | 03/11/1968 | 15:14 | 40.01 days | 105 |
| 122 | 11/12/1967 | 22:29 | 01/19/1968 | 12:26 | 67.58 days | 78 |
| 121 | 09/24/1966 | 16:54 | 11/10/1967 | 16:23 | 411.97 days | 12 |
| 120 | 05/15/1966 | 21:44 | 09/16/1966 | 21:14 | 123.97 days | 58 |
| 119 | 06/01/1965 | 15:39 | 04/25/1966 | 04:15 | 327.52 days | 24 |
| 118 | 02/19/1965 | 22:33 | 05/12/1965 | 02:34 | 81.16 days | 73 |
| 117 | 02/13/1965 | 00:20 | 02/16/1965 | 19:27 | 3.79 days | 217 |
| 116 | 01/25/1965 | 11:37 | 02/10/1965 | 20:49 | 16.38 days | 158 |
| 115 | 09/17/1962 | 01:38 | 01/23/1965 | 05:39 | 859.16 days | 1 |
| 114 | 09/15/1961 | 12:31 | 09/13/1962 | 08:29 | 362.83 days | 15 |
| 113 | 06/22/1961 | 02:29 | 09/13/1961 | 21:43 | 83.80 days | 70 |
| 112 | 02/20/1961 | 03:03 | 06/19/1961 | 07:06 | 119.16 days | 61 |
| 111 | 02/10/1961 | 18:19 | 02/17/1961 | 03:14 | 6.37 days | 200 |
| 110 | 01/18/1961 | 21:15 | 02/05/1961 | 17:39 | 17.85 days | 153 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 109 | 12/14/1960 | 06:58 | 01/08/1961 | 07:02 | 25.00 days | 132 |
| 108 | 11/23/1960 | 17:08 | 12/07/1960 | 16:58 | 13.99 days | 164 |
| 107 | 11/01/1960 | 20:48 | 11/21/1960 | 19:56 | 19.96 days | 147 |
| 106 | 10/21/1960 | 11:43 | 10/28/1960 | 13:02 | 7.05 days | 195 |
| 105 | 01/09/1960 | 00:45 | 10/19/1960 | 23:59 | 284.96 days | 32 |
| 104 | 12/19/1959 | 03:35 | 01/06/1960 | 14:11 | 18.44 days | 150 |
| 103 | 10/20/1959 | 08:34 | 12/17/1959 | 01:47 | 57.71 days | 85 |
| 102 | 05/16/1958 | 01:46 | 10/04/1959 | 17:06 | 506.63 days | 9 |
| 101 | 02/27/1958 | 18:49 | 05/03/1958 | 08:52 | 64.58 days | 81 |
| 100 | 10/25/1957 | 03:54 | 02/22/1958 | 21:50 | 120.74 days | 59 |
| 99 | 10/20/1957 | 03:36 | 10/21/1957 | 17:59 | 1.59 days | 238 |
| 98 | 07/06/1957 | 14:29 | 10/15/1957 | 08:02 | 100.73 days | 65 |
| 97 | 05/05/1956 | 04:39 | 04/20/1957 | 16:17 | 350.48 days | 19 |
| 96 | 05/22/1955 | 06:23 | 05/02/1956 | 13:48 | 346.30 days | 21 |
| 95 | 04/11/1955 | 17:05 | 05/21/1955 | 00:10 | 39.29 days | 108 |
| 94 | 12/05/1953 | 06:55 | 04/10/1955 | 17:08 | 491.42 days | 10 |
| 93 | 10/28/1953 | 23:12 | 12/02/1953 | 20:33 | 34.88 days | 114 |
| 92 | 05/20/1953 | 10:50 | 10/26/1953 | 19:05 | 159.34 days | 49 |
| 91 | 05/27/1952 | 00:43 | 05/12/1953 | 14:58 | 350.59 days | 18 |
| 90 | 04/25/1952 | 03:12 | 05/24/1952 | 13:15 | 29.41 days | 124 |
| 89 | 02/15/1950 | 07:49 | 04/23/1952 | 18:15 | 798.43 days | 2 |
| 88 | 05/21/1949 | 12:26 | 02/13/1950 | 02:31 | 267.58 days | 36 |
| 87 | 05/01/1949 | 12:02 | 05/19/1949 | 02:24 | 17.59 days | 156 |
| 86 | 05/14/1948 | 00:13 | 04/25/1949 | 12:30 | 346.51 days | 20 |
| 85 | 05/24/1947 | 14:50 | 05/12/1948 | 19:13 | 354.18 days | 17 |
| 84 | 03/21/1947 | 21:32 | 05/21/1947 | 01:44 | 60.17 days | 82 |
| 83 | 01/22/1947 | 06:14 | 03/19/1947 | 23:56 | 56.73 days | 86 |
| 82 | 12/15/1946 | 12:32 | 01/17/1947 | 21:52 | 33.38 days | 118 |
| 81 | 11/18/1946 | 15:17 | 12/13/1946 | 00:40 | 24.39 days | 137 |
| 80 | 11/07/1946 | 23:48 | 11/17/1946 | 15:11 | 9.64 days | 178 |
| 79 | 06/04/1946 | 01:19 | 11/04/1946 | 19:27 | 153.75 days | 52 |
| 78 | 05/21/1946 | 08:41 | 06/02/1946 | 10:52 | 12.09 days | 170 |
| 77 | 04/25/1946 | 23:37 | 05/14/1946 | 07:20 | 18.32 days | 151 |
| 76 | 03/27/1946 | 12:56 | 04/23/1946 | 12:12 | 26.97 days | 130 |
| 75 | 03/17/1946 | 22:05 | 03/26/1946 | 14:39 | 8.69 days | 183 |
| 74 | 02/21/1946 | 15:49 | 03/14/1946 | 02:32 | 20.44 days | 145 |
| 73 | 01/17/1946 | 12:47 | 02/18/1946 | 12:59 | 32.00 days | 121 |
| 72 | 12/05/1945 | 14:43 | 01/16/1946 | 14:58 | 42.01 days | 101 |
| 71 | 07/14/1945 | 02:21 | 12/02/1945 | 19:01 | 141.69 days | 53 |
| 70 | 06/15/1945 | 00:14 | 07/11/1945 | 17:06 | 26.70 days | 131 |
| 69 | 04/29/1945 | 13:43 | 06/13/1945 | 21:36 | 45.32 days | 97 |
| 68 | 04/06/1945 | 21:49 | 04/22/1945 | 02:21 | 15.18 days | 161 |
| 67 | 03/08/1945 | 23:31 | 03/31/1945 | 05:12 | 22.23 days | 140 |
| 66 | 03/01/1945 | 18:23 | 03/04/1945 | 08:31 | 2.58 days | 226 |
| 65 | 02/25/1945 | 11:46 | 02/28/1945 | 14:54 | 3.13 days | 222 |
| 64 | 02/15/1945 | 07:35 | 02/22/1945 | 07:54 | 7.01 days | 196 |
| 63 | 01/23/1945 | 01:33 | 02/13/1945 | 19:41 | 21.75 days | 141 |
| 62 | 12/07/1944 | 15:41 | 01/18/1945 | 23:26 | 42.32 days | 100 |
| 61 | 06/10/1944 | 00:44 | 12/06/1944 | 20:22 | 179.81 days | 45 |
| 60 | 06/03/1944 | 04:39 | 06/07/1944 | 00:58 | 3.84 days | 216 |
| 59 | 05/12/1944 | 21:58 | 05/25/1944 | 21:52 | 12.99 days | 166 |
| 58 | 03/24/1944 | 23:54 | 05/01/1944 | 01:15 | 37.05 days | 111 |
| 57 | 03/02/1944 | 17:19 | 03/22/1944 | 17:54 | 20.02 days | 146 |
| 56 | 02/11/1944 | 04:52 | 02/26/1944 | 23:20 | 15.76 days | 159 |
| 55 | 10/24/1942 | 02:58 | 02/09/1944 | 18:57 | 473.66 days | 11 |
| 54 | 09/14/1942 | 01:01 | 10/19/1942 | 03:11 | 35.08 days | 113 |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|-----|
| 53 | 06/19/1942 | 07:08 | 09/09/1942 | 09:55 | 82.11 days | 71 |
| 52 | 05/26/1942 | 13:06 | 06/07/1942 | 17:05 | 12.16 days | 169 |
| 51 | 05/14/1942 | 10:16 | 05/18/1942 | 12:21 | 4.08 days | 215 |
| 50 | 05/08/1942 | 16:15 | 05/12/1942 | 01:27 | 3.38 days | 219 |
| 49 | 05/04/1942 | 04:52 | 05/07/1942 | 12:32 | 3.31 days | 220 |
| 48 | 04/13/1942 | 05:53 | 04/20/1942 | 20:46 | 7.61 days | 190 |
| 47 | 10/29/1941 | 22:08 | 04/07/1942 | 12:55 | 159.61 days | 48 |
| 46 | 10/20/1941 | 20:32 | 10/27/1941 | 16:36 | 6.83 days | 199 |
| 45 | 10/09/1941 | 15:29 | 10/19/1941 | 15:47 | 10.01 days | 175 |
| 44 | 07/17/1941 | 10:51 | 10/07/1941 | 08:41 | 81.90 days | 72 |
| 43 | 06/23/1941 | 08:50 | 07/11/1941 | 15:24 | 18.27 days | 152 |
| 42 | 06/05/1941 | 03:35 | 06/10/1941 | 18:38 | 5.62 days | 204 |
| 41 | 06/01/1941 | 01:26 | 06/03/1941 | 20:46 | 2.80 days | 224 |
| 40 | 05/18/1941 | 19:06 | 05/20/1941 | 05:38 | 1.43 days | 239 |
| 39 | 05/01/1941 | 15:01 | 05/03/1941 | 15:00 | 1.99 days | 235 |
| 38 | 04/26/1941 | 16:04 | 04/28/1941 | 16:08 | 2.00 days | 234 |
| 37 | 03/21/1941 | 12:03 | 04/25/1941 | 06:19 | 34.76 days | 115 |
| 36 | 03/10/1941 | 17:44 | 03/20/1941 | 00:04 | 9.26 days | 179 |
| 35 | 02/27/1941 | 21:31 | 03/07/1941 | 00:35 | 7.12 days | 193 |
| 34 | 02/07/1941 | 17:58 | 02/25/1941 | 11:25 | 17.72 days | 154 |
| 33 | 01/18/1941 | 00:09 | 02/01/1941 | 16:13 | 14.66 days | 163 |
| 32 | 12/29/1940 | 14:29 | 01/13/1941 | 16:32 | 15.08 days | 162 |
| 31 | 12/20/1940 | 14:13 | 12/27/1940 | 16:23 | 7.09 days | 194 |
| 30 | 12/01/1940 | 19:28 | 12/11/1940 | 19:11 | 9.98 days | 176 |
| 29 | 08/22/1940 | 08:50 | 11/24/1940 | 04:10 | 93.80 days | 66 |
| 28 | 07/06/1940 | 08:19 | 08/20/1940 | 18:17 | 45.41 days | 95 |
| 27 | 06/20/1940 | 22:41 | 06/28/1940 | 18:29 | 7.82 days | 187 |
| 26 | 06/22/1939 | 00:24 | 06/18/1940 | 13:45 | 362.55 days | 16 |
| 25 | 05/22/1939 | 15:04 | 06/21/1939 | 01:06 | 29.41 days | 125 |
| 24 | 07/31/1938 | 00:42 | 05/17/1939 | 20:42 | 290.83 days | 29 |
| 23 | 06/20/1938 | 00:56 | 07/26/1938 | 14:05 | 36.54 days | 112 |
| 22 | 05/01/1938 | 15:34 | 06/17/1938 | 20:57 | 47.22 days | 94 |
| 21 | 04/18/1938 | 21:05 | 04/27/1938 | 15:50 | 8.78 days | 182 |
| 20 | 04/08/1938 | 19:21 | 04/15/1938 | 17:11 | 6.90 days | 198 |
| 19 | 04/01/1938 | 20:54 | 04/07/1938 | 14:54 | 5.74 days | 203 |
| 18 | 02/24/1938 | 20:16 | 03/30/1938 | 01:19 | 33.21 days | 119 |
| 17 | 01/29/1938 | 13:32 | 02/17/1938 | 17:01 | 19.14 days | 149 |
| 16 | 12/30/1937 | 12:50 | 01/24/1938 | 05:48 | 24.70 days | 135 |
| 15 | 12/25/1937 | 01:01 | 12/29/1937 | 12:12 | 4.46 days | 212 |
| 14 | 01/15/1937 | 09:48 | 12/23/1937 | 22:33 | 342.53 days | 22 |
| 13 | 12/10/1936 | 12:24 | 01/13/1937 | 00:19 | 33.49 days | 117 |
| 12 | 10/28/1936 | 21:43 | 12/07/1936 | 02:29 | 39.19 days | 109 |
| 11 | 10/05/1936 | 17:34 | 10/26/1936 | 22:44 | 21.21 days | 142 |
| 10 | 09/21/1936 | 16:59 | 09/27/1936 | 03:56 | 5.45 days | 207 |
| 9 | 07/06/1936 | 09:58 | 09/18/1936 | 15:33 | 74.23 days | 75 |
| 8 | 07/04/1936 | 00:28 | 07/05/1936 | 03:35 | 1.13 days | 244 |
| 7 | 06/02/1936 | 22:37 | 07/02/1936 | 05:35 | 29.29 days | 126 |
| 6 | 12/11/1935 | 09:12 | 05/26/1936 | 04:46 | 166.81 days | 47 |
| 5 | 09/13/1935 | 19:15 | 12/07/1935 | 01:48 | 84.27 days | 69 |
| 4 | 09/12/1935 | 09:09 | 09/13/1935 | 08:26 | 0.97 days | 246 |
| 3 | 06/22/1935 | 07:25 | 09/08/1935 | 16:36 | 78.38 days | 74 |
| 2 | 05/27/1935 | 07:24 | 06/16/1935 | 02:54 | 19.81 days | 148 |
| 1 | 05/09/1935 | 20:17 | 05/17/1935 | 08:21 | 7.50 days | 191 |

Big Bend Oxbow Connections to the Brazos River – Ranked by Duration of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 10:48

USGS Gauge: USGS 08108700 Brazos Rv at SH21 nr Bryan, TX
 Gauge Datum: 188.65 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 189.09ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 192.29 ft
 Measured River Slope (Using TWDB GPS): 0.62275 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Bryan and Hempstead Gauges: 0.81505 ft/mile - with USGS Datum at Hempstead
 Mean Slope Between Bryan and Hempstead Gauges: 0.76526 ft/mile - with TWDB Datum at Hempstead
 Distance upstream to Bryan Gauge from Oxbow: 152454.0682 ft (28.87 miles)
 Distance downstream to Hempstead Gauge from Oxbow: 339314.3045 ft (64.26 miles)
 Estimated Critical Gauge Height/WSE: 21.1812/210.2712 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 22.1812/211.2712 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/28/1934-11/1/2004
 Number of Records: 339564
 Years of Record: 70.0113
 Number of Critical WSE Exceedences: 295
 Number of "significant" WSE Exceedences: 250
 Average Connections per year: 3.5709
 Flood Level Required for Connection: 1.1302 year flood (19362.4133 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|------------------------------------|
| 115 | 09/17/1962 01:38 | 01/23/1965 05:39 | 859.16 days | 1 | Data not available for this period |
| 89 | 02/15/1950 07:49 | 04/23/1952 18:15 | 798.43 days | 2 | |
| 228 | 12/14/1998 03:09 | 11/04/2000 14:57 | 692.29 days | 3 | |
| 185 | 06/28/1987 07:20 | 05/17/1989 17:39 | 689.42 days | 4 | |
| 154 | 05/03/1977 04:17 | 03/21/1979 02:58 | 686.94 days | 5 | |
| 133 | 03/12/1970 08:50 | 12/10/1971 21:47 | 638.53 days | 6 | |
| 211 | 08/10/1995 00:56 | 02/13/1997 07:36 | 553.69 days | 7 | |
| 172 | 05/23/1983 20:15 | 10/22/1984 01:17 | 517.20 days | 8 | |
| 102 | 05/16/1958 01:46 | 10/04/1959 17:06 | 506.63 days | 9 | |
| 94 | 12/05/1953 06:55 | 04/10/1955 17:08 | 491.42 days | 10 | |
| 55 | 10/24/1942 02:58 | 02/09/1944 18:57 | 473.66 days | 11 | |
| 121 | 09/24/1966 16:54 | 11/10/1967 16:23 | 411.97 days | 12 | |
| 134 | 12/12/1971 16:03 | 01/26/1973 21:15 | 411.21 days | 13 | |
| 161 | 05/19/1980 02:14 | 06/04/1981 18:03 | 381.65 days | 14 | |
| 114 | 09/15/1961 12:31 | 09/13/1962 08:29 | 362.83 days | 15 | |
| 26 | 06/22/1939 00:24 | 06/18/1940 13:45 | 362.55 days | 16 | |
| 85 | 05/24/1947 14:50 | 05/12/1948 19:13 | 354.18 days | 17 | |
| 91 | 05/27/1952 00:43 | 05/12/1953 14:58 | 350.59 days | 18 | |
| 97 | 05/05/1956 04:39 | 04/20/1957 16:17 | 350.48 days | 19 | |
| 86 | 05/14/1948 00:13 | 04/25/1949 12:30 | 346.51 days | 20 | |
| 96 | 05/22/1955 06:23 | 05/02/1956 13:48 | 346.30 days | 21 | |
| 14 | 01/15/1937 09:48 | 12/23/1937 22:33 | 342.53 days | 22 | |
| 139 | 10/19/1973 19:52 | 09/12/1974 12:44 | 327.70 days | 23 | |
| 119 | 06/01/1965 15:39 | 04/25/1966 04:15 | 327.52 days | 24 | |
| 204 | 06/23/1993 17:40 | 05/15/1994 02:32 | 325.88 days | 25 | |
| 146 | 06/01/1975 23:37 | 04/18/1976 18:41 | 321.79 days | 26 | |
| 239 | 12/20/2001 05:25 | 11/04/2002 23:18 | 319.96 days | 27 | |
| 171 | 07/09/1982 07:34 | 05/22/1983 02:48 | 316.80 days | 28 | |
| 24 | 07/31/1938 00:42 | 05/17/1939 20:42 | 290.83 days | 29 | |

| | | | | | | | |
|-----|------------|-------|------------|-------|-------------|----|----------------------------------|
| 160 | 07/30/1979 | 08:30 | 05/15/1980 | 09:36 | 290.04 days | 30 | |
| 132 | 05/19/1969 | 14:00 | 03/03/1970 | 12:06 | 287.92 days | 31 | |
| 105 | 01/09/1960 | 00:45 | 10/19/1960 | 23:59 | 284.96 days | 32 | |
| 130 | 07/11/1968 | 18:43 | 04/12/1969 | 21:58 | 275.13 days | 33 | |
| 201 | 06/21/1992 | 05:51 | 03/19/1993 | 17:43 | 271.49 days | 34 | |
| 174 | 02/26/1985 | 03:42 | 11/24/1985 | 12:38 | 271.37 days | 35 | |
| 88 | 05/21/1949 | 12:26 | 02/13/1950 | 02:31 | 267.58 days | 36 | |
| 188 | 06/24/1989 | 18:49 | 03/14/1990 | 15:18 | 262.85 days | 37 | |
| 243 | 03/05/2003 | 23:35 | 10/10/2003 | 06:54 | 218.90 days | 38 | |
| 205 | 05/15/1994 | 12:06 | 12/16/1994 | 05:33 | 215.26 days | 39 | |
| 191 | 06/16/1990 | 09:32 | 01/09/1991 | 20:26 | 207.45 days | 40 | |
| 225 | 03/26/1998 | 13:03 | 10/18/1998 | 09:41 | 206.61 days | 41 | |
| 193 | 04/15/1991 | 23:11 | 11/01/1991 | 20:10 | 199.87 days | 42 | |
| 244 | 10/11/2003 | 22:05 | 04/26/2004 | 03:37 | 197.70 days | 43 | |
| 166 | 11/06/1981 | 21:29 | 05/13/1982 | 20:39 | 187.96 days | 44 | |
| 61 | 06/10/1944 | 00:44 | 12/06/1944 | 20:22 | 179.81 days | 45 | |
| 222 | 07/02/1997 | 07:14 | 12/21/1997 | 17:29 | 173.35 days | 46 | |
| 6 | 12/11/1935 | 09:12 | 05/26/1936 | 04:46 | 166.81 days | 47 | |
| 47 | 10/29/1941 | 22:08 | 04/07/1942 | 12:55 | 159.61 days | 48 | |
| 92 | 05/20/1953 | 10:50 | 10/26/1953 | 19:05 | 159.34 days | 49 | |
| 150 | 07/08/1976 | 17:03 | 12/12/1976 | 07:56 | 156.62 days | 50 | |
| 182 | 12/26/1986 | 19:58 | 06/01/1987 | 02:53 | 156.28 days | 51 | |
| 79 | 06/04/1946 | 01:19 | 11/04/1946 | 19:27 | 153.75 days | 52 | |
| 71 | 07/14/1945 | 02:21 | 12/02/1945 | 19:01 | 141.69 days | 53 | |
| 179 | 06/14/1986 | 19:54 | 10/24/1986 | 21:03 | 132.04 days | 54 | |
| 178 | 02/07/1986 | 11:38 | 06/13/1986 | 10:30 | 125.95 days | 55 | |
| 138 | 06/10/1973 | 02:30 | 10/12/1973 | 20:59 | 124.77 days | 56 | |
| 173 | 10/22/1984 | 16:32 | 02/23/1985 | 17:13 | 124.02 days | 57 | |
| 120 | 05/15/1966 | 21:44 | 09/16/1966 | 21:14 | 123.97 days | 58 | |
| 100 | 10/25/1957 | 03:54 | 02/22/1958 | 21:50 | 120.74 days | 59 | |
| 250 | 07/03/2004 | 15:07 | 11/01/2004 | 03:14 | 120.50 days | 60 | disconnected Period Not Complete |
| 112 | 02/20/1961 | 03:03 | 06/19/1961 | 07:06 | 119.16 days | 61 | |
| 235 | 05/09/2001 | 05:27 | 08/31/2001 | 12:16 | 114.35 days | 62 | |
| 163 | 06/24/1981 | 08:29 | 10/14/1981 | 22:14 | 112.57 days | 63 | |
| 144 | 02/08/1975 | 16:56 | 05/25/1975 | 08:13 | 105.63 days | 64 | |
| 98 | 07/06/1957 | 14:29 | 10/15/1957 | 08:02 | 100.73 days | 65 | |
| 29 | 08/22/1940 | 08:50 | 11/24/1940 | 04:10 | 93.80 days | 66 | |
| 192 | 01/13/1991 | 04:15 | 04/14/1991 | 16:53 | 91.52 days | 67 | |
| 206 | 12/18/1994 | 14:57 | 03/14/1995 | 00:17 | 85.66 days | 68 | |
| 5 | 09/13/1935 | 19:15 | 12/07/1935 | 01:48 | 84.27 days | 69 | |
| 113 | 06/22/1961 | 02:29 | 09/13/1961 | 21:43 | 83.80 days | 70 | |
| 53 | 06/19/1942 | 07:08 | 09/09/1942 | 09:55 | 82.11 days | 71 | |
| 44 | 07/17/1941 | 10:51 | 10/07/1941 | 08:41 | 81.90 days | 72 | |
| 118 | 02/19/1965 | 22:33 | 05/12/1965 | 02:34 | 81.16 days | 73 | |
| 3 | 06/22/1935 | 07:25 | 09/08/1935 | 16:36 | 78.38 days | 74 | |
| 9 | 07/06/1936 | 09:58 | 09/18/1936 | 15:33 | 74.23 days | 75 | |
| 241 | 12/12/2002 | 01:33 | 02/21/2003 | 08:19 | 71.56 days | 76 | |
| 237 | 09/06/2001 | 23:51 | 11/17/2001 | 00:34 | 71.32 days | 77 | |
| 122 | 11/12/1967 | 22:29 | 01/19/1968 | 12:26 | 67.58 days | 78 | |
| 143 | 11/27/1974 | 18:21 | 02/02/1975 | 16:53 | 66.93 days | 79 | |
| 224 | 01/11/1998 | 22:23 | 03/18/1998 | 03:07 | 65.72 days | 80 | |
| 101 | 02/27/1958 | 18:49 | 05/03/1958 | 08:52 | 64.58 days | 81 | |
| 84 | 03/21/1947 | 21:32 | 05/21/1947 | 01:44 | 60.17 days | 82 | |
| 151 | 12/14/1976 | 21:45 | 02/12/1977 | 04:30 | 59.28 days | 83 | |
| 149 | 05/09/1976 | 11:37 | 07/06/1976 | 08:21 | 57.86 days | 84 | |
| 103 | 10/20/1959 | 08:34 | 12/17/1959 | 01:47 | 57.71 days | 85 | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 83 | 01/22/1947 | 06:14 | 03/19/1947 | 23:56 | 56.73 days | 86 |
| 135 | 01/27/1973 | 18:26 | 03/24/1973 | 15:31 | 55.87 days | 87 |
| 207 | 03/16/1995 | 08:21 | 05/09/1995 | 08:10 | 54.16 days | 88 |
| 229 | 11/06/2000 | 07:19 | 12/27/2000 | 04:26 | 51.64 days | 89 |
| 177 | 12/14/1985 | 12:02 | 02/03/1986 | 15:52 | 51.15 days | 90 |
| 180 | 10/25/1986 | 14:58 | 12/15/1986 | 14:27 | 50.97 days | 91 |
| 210 | 06/16/1995 | 18:33 | 08/03/1995 | 07:39 | 48.17 days | 92 |
| 159 | 06/09/1979 | 01:13 | 07/26/1979 | 15:00 | 47.57 days | 93 |
| 22 | 05/01/1938 | 15:34 | 06/17/1938 | 20:57 | 47.22 days | 94 |
| 28 | 07/06/1940 | 08:19 | 08/20/1940 | 18:17 | 45.41 days | 95 |
| 202 | 03/25/1993 | 11:41 | 05/09/1993 | 19:40 | 45.33 days | 96 |
| 69 | 04/29/1945 | 13:43 | 06/13/1945 | 21:36 | 45.32 days | 97 |
| 152 | 02/15/1977 | 10:57 | 03/30/1977 | 20:31 | 43.39 days | 98 |
| 197 | 04/05/1992 | 12:11 | 05/18/1992 | 11:31 | 42.97 days | 99 |
| 62 | 12/07/1944 | 15:41 | 01/18/1945 | 23:26 | 42.32 days | 100 |
| 72 | 12/05/1945 | 14:43 | 01/16/1946 | 14:58 | 42.01 days | 101 |
| 194 | 11/09/1991 | 13:03 | 12/21/1991 | 06:09 | 41.71 days | 102 |
| 231 | 01/20/2001 | 15:32 | 03/02/2001 | 16:23 | 41.58 days | 103 |
| 141 | 09/20/1974 | 15:59 | 10/31/1974 | 16:19 | 41.01 days | 104 |
| 123 | 01/31/1968 | 14:58 | 03/11/1968 | 15:14 | 40.01 days | 105 |
| 203 | 05/12/1993 | 23:59 | 06/21/1993 | 22:23 | 39.93 days | 106 |
| 189 | 03/17/1990 | 17:11 | 04/26/1990 | 01:25 | 39.34 days | 107 |
| 95 | 04/11/1955 | 17:05 | 05/21/1955 | 00:10 | 39.29 days | 108 |
| 12 | 10/28/1936 | 21:43 | 12/07/1936 | 02:29 | 39.19 days | 109 |
| 234 | 04/01/2001 | 09:49 | 05/07/2001 | 18:25 | 37.07 days | 110 |
| 58 | 03/24/1944 | 23:54 | 05/01/1944 | 01:15 | 37.05 days | 111 |
| 23 | 06/20/1938 | 00:56 | 07/26/1938 | 14:05 | 36.54 days | 112 |
| 54 | 09/14/1942 | 01:01 | 10/19/1942 | 03:11 | 35.08 days | 113 |
| 93 | 10/28/1953 | 23:12 | 12/02/1953 | 20:33 | 34.88 days | 114 |
| 37 | 03/21/1941 | 12:03 | 04/25/1941 | 06:19 | 34.76 days | 115 |
| 240 | 11/06/2002 | 19:59 | 12/10/2002 | 12:00 | 33.72 days | 116 |
| 13 | 12/10/1936 | 12:24 | 01/13/1937 | 00:19 | 33.49 days | 117 |
| 82 | 12/15/1946 | 12:32 | 01/17/1947 | 21:52 | 33.38 days | 118 |
| 18 | 02/24/1938 | 20:16 | 03/30/1938 | 01:19 | 33.21 days | 119 |
| 137 | 05/03/1973 | 06:51 | 06/04/1973 | 14:17 | 32.30 days | 120 |
| 73 | 01/17/1946 | 12:47 | 02/18/1946 | 12:59 | 32.00 days | 121 |
| 156 | 04/05/1979 | 05:41 | 05/06/1979 | 12:02 | 31.26 days | 122 |
| 136 | 03/26/1973 | 14:29 | 04/25/1973 | 23:43 | 30.38 days | 123 |
| 90 | 04/25/1952 | 03:12 | 05/24/1952 | 13:15 | 29.41 days | 124 |
| 25 | 05/22/1939 | 15:04 | 06/21/1939 | 01:06 | 29.41 days | 125 |
| 7 | 06/02/1936 | 22:37 | 07/02/1936 | 05:35 | 29.29 days | 126 |
| 209 | 05/18/1995 | 11:28 | 06/15/1995 | 01:28 | 28.04 days | 127 |
| 238 | 11/19/2001 | 01:31 | 12/16/2001 | 12:23 | 28.00 days | 128 |
| 128 | 05/27/1968 | 00:46 | 06/23/1968 | 16:38 | 27.66 days | 129 |
| 76 | 03/27/1946 | 12:56 | 04/23/1946 | 12:12 | 26.97 days | 130 |
| 70 | 06/15/1945 | 00:14 | 07/11/1945 | 17:06 | 26.70 days | 131 |
| 109 | 12/14/1960 | 06:58 | 01/08/1961 | 07:02 | 25.00 days | 132 |
| 126 | 04/14/1968 | 22:58 | 05/09/1968 | 22:33 | 24.98 days | 133 |
| 247 | 05/16/2004 | 17:37 | 06/10/2004 | 00:37 | 24.75 days | 134 |
| 16 | 12/30/1937 | 12:50 | 01/24/1938 | 05:48 | 24.70 days | 135 |
| 227 | 11/17/1998 | 07:40 | 12/11/1998 | 13:34 | 24.56 days | 136 |
| 81 | 11/18/1946 | 15:17 | 12/13/1946 | 00:40 | 24.39 days | 137 |
| 131 | 04/15/1969 | 22:39 | 05/09/1969 | 05:07 | 23.26 days | 138 |
| 226 | 10/22/1998 | 20:34 | 11/14/1998 | 03:33 | 22.50 days | 139 |
| 67 | 03/08/1945 | 23:31 | 03/31/1945 | 05:12 | 22.23 days | 140 |
| 63 | 01/23/1945 | 01:33 | 02/13/1945 | 19:41 | 21.75 days | 141 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 11 | 10/05/1936 | 17:34 | 10/26/1936 | 22:44 | 21.21 days | 142 |
| 170 | 06/05/1982 | 00:42 | 06/26/1982 | 02:01 | 21.05 days | 143 |
| 230 | 12/29/2000 | 13:31 | 01/19/2001 | 03:48 | 20.85 days | 144 |
| 74 | 02/21/1946 | 15:49 | 03/14/1946 | 02:32 | 20.44 days | 145 |
| 57 | 03/02/1944 | 17:19 | 03/22/1944 | 17:54 | 20.02 days | 146 |
| 107 | 11/01/1960 | 20:48 | 11/21/1960 | 19:56 | 19.96 days | 147 |
| 2 | 05/27/1935 | 07:24 | 06/16/1935 | 02:54 | 19.81 days | 148 |
| 17 | 01/29/1938 | 13:32 | 02/17/1938 | 17:01 | 19.14 days | 149 |
| 104 | 12/19/1959 | 03:35 | 01/06/1960 | 14:11 | 18.44 days | 150 |
| 77 | 04/25/1946 | 23:37 | 05/14/1946 | 07:20 | 18.32 days | 151 |
| 43 | 06/23/1941 | 08:50 | 07/11/1941 | 15:24 | 18.27 days | 152 |
| 110 | 01/18/1961 | 21:15 | 02/05/1961 | 17:39 | 17.85 days | 153 |
| 34 | 02/07/1941 | 17:58 | 02/25/1941 | 11:25 | 17.72 days | 154 |
| 125 | 03/27/1968 | 04:41 | 04/13/1968 | 22:02 | 17.72 days | 155 |
| 87 | 05/01/1949 | 12:02 | 05/19/1949 | 02:24 | 17.59 days | 156 |
| 221 | 06/12/1997 | 23:27 | 06/28/1997 | 11:29 | 16.48 days | 157 |
| 116 | 01/25/1965 | 11:37 | 02/10/1965 | 20:49 | 16.38 days | 158 |
| 56 | 02/11/1944 | 04:52 | 02/26/1944 | 23:20 | 15.76 days | 159 |
| 220 | 05/26/1997 | 11:20 | 06/10/1997 | 04:24 | 15.35 days | 160 |
| 68 | 04/06/1945 | 21:49 | 04/22/1945 | 02:21 | 15.18 days | 161 |
| 32 | 12/29/1940 | 14:29 | 01/13/1941 | 16:32 | 15.08 days | 162 |
| 33 | 01/18/1941 | 00:09 | 02/01/1941 | 16:13 | 14.66 days | 163 |
| 108 | 11/23/1960 | 17:08 | 12/07/1960 | 16:58 | 13.99 days | 164 |
| 217 | 04/14/1997 | 15:38 | 04/26/1997 | 20:29 | 13.17 days | 165 |
| 59 | 05/12/1944 | 21:58 | 05/25/1944 | 21:52 | 12.99 days | 166 |
| 153 | 04/04/1977 | 20:19 | 04/17/1977 | 08:18 | 12.49 days | 167 |
| 129 | 06/27/1968 | 06:24 | 07/09/1968 | 14:47 | 12.34 days | 168 |
| 52 | 05/26/1942 | 13:06 | 06/07/1942 | 17:05 | 12.16 days | 169 |
| 78 | 05/21/1946 | 08:41 | 06/02/1946 | 10:52 | 12.09 days | 170 |
| 223 | 12/25/1997 | 18:35 | 01/05/1998 | 17:13 | 11.86 days | 171 |
| 176 | 11/30/1985 | 02:10 | 12/11/1985 | 21:43 | 11.81 days | 172 |
| 187 | 06/04/1989 | 04:16 | 06/15/1989 | 05:17 | 11.04 days | 173 |
| 233 | 03/18/2001 | 20:19 | 03/28/2001 | 10:42 | 10.43 days | 174 |
| 45 | 10/09/1941 | 15:29 | 10/19/1941 | 15:47 | 10.01 days | 175 |
| 30 | 12/01/1940 | 19:28 | 12/11/1940 | 19:11 | 9.98 days | 176 |
| 249 | 06/17/2004 | 16:59 | 06/27/2004 | 04:52 | 9.98 days | 177 |
| 80 | 11/07/1946 | 23:48 | 11/17/1946 | 15:11 | 9.64 days | 178 |
| 36 | 03/10/1941 | 17:44 | 03/20/1941 | 00:04 | 9.26 days | 179 |
| 246 | 05/05/2004 | 04:34 | 05/13/2004 | 12:14 | 9.00 days | 180 |
| 218 | 05/03/1997 | 15:59 | 05/12/1997 | 06:50 | 8.99 days | 181 |
| 21 | 04/18/1938 | 21:05 | 04/27/1938 | 15:50 | 8.78 days | 182 |
| 75 | 03/17/1946 | 22:05 | 03/26/1946 | 14:39 | 8.69 days | 183 |
| 215 | 03/27/1997 | 22:03 | 04/04/1997 | 20:39 | 8.55 days | 184 |
| 155 | 03/24/1979 | 19:01 | 04/02/1979 | 07:54 | 8.53 days | 185 |
| 242 | 02/25/2003 | 01:17 | 03/04/2003 | 13:29 | 8.47 days | 186 |
| 27 | 06/20/1940 | 22:41 | 06/28/1940 | 18:29 | 7.82 days | 187 |
| 124 | 03/14/1968 | 23:08 | 03/22/1968 | 15:30 | 7.68 days | 188 |
| 142 | 11/15/1974 | 20:38 | 11/23/1974 | 12:39 | 7.66 days | 189 |
| 48 | 04/13/1942 | 05:53 | 04/20/1942 | 20:46 | 7.61 days | 190 |
| 1 | 05/09/1935 | 20:17 | 05/17/1935 | 08:21 | 7.50 days | 191 |
| 199 | 05/25/1992 | 22:52 | 06/02/1992 | 04:28 | 7.23 days | 192 |
| 35 | 02/27/1941 | 21:31 | 03/07/1941 | 00:35 | 7.12 days | 193 |
| 31 | 12/20/1940 | 14:13 | 12/27/1940 | 16:23 | 7.09 days | 194 |
| 106 | 10/21/1960 | 11:43 | 10/28/1960 | 13:02 | 7.05 days | 195 |
| 64 | 02/15/1945 | 07:35 | 02/22/1945 | 07:54 | 7.01 days | 196 |
| 147 | 04/22/1976 | 21:53 | 04/29/1976 | 21:18 | 6.97 days | 197 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 20 | 04/08/1938 | 19:21 | 04/15/1938 | 17:11 | 6.90 days | 198 |
| 46 | 10/20/1941 | 20:32 | 10/27/1941 | 16:36 | 6.83 days | 199 |
| 111 | 02/10/1961 | 18:19 | 02/17/1961 | 03:14 | 6.37 days | 200 |
| 245 | 04/26/2004 | 22:44 | 05/02/2004 | 12:09 | 6.20 days | 201 |
| 157 | 05/15/1979 | 21:15 | 05/21/1979 | 19:02 | 5.90 days | 202 |
| 19 | 04/01/1938 | 20:54 | 04/07/1938 | 14:54 | 5.74 days | 203 |
| 42 | 06/05/1941 | 03:35 | 06/10/1941 | 18:38 | 5.62 days | 204 |
| 181 | 12/17/1986 | 07:52 | 12/22/1986 | 21:24 | 5.56 days | 205 |
| 162 | 06/08/1981 | 06:18 | 06/13/1981 | 19:05 | 5.53 days | 206 |
| 10 | 09/21/1936 | 16:59 | 09/27/1936 | 03:56 | 5.45 days | 207 |
| 219 | 05/20/1997 | 17:49 | 05/25/1997 | 04:44 | 5.43 days | 208 |
| 236 | 09/02/2001 | 05:20 | 09/06/2001 | 12:41 | 5.06 days | 209 |
| 212 | 03/19/1997 | 08:54 | 03/23/1997 | 06:29 | 4.84 days | 210 |
| 186 | 05/21/1989 | 16:00 | 05/26/1989 | 03:16 | 4.46 days | 211 |
| 15 | 12/25/1937 | 01:01 | 12/29/1937 | 12:12 | 4.46 days | 212 |
| 158 | 05/26/1979 | 03:12 | 05/30/1979 | 08:09 | 4.20 days | 213 |
| 148 | 05/02/1976 | 12:58 | 05/06/1976 | 16:14 | 4.13 days | 214 |
| 51 | 05/14/1942 | 10:16 | 05/18/1942 | 12:21 | 4.08 days | 215 |
| 60 | 06/03/1944 | 04:39 | 06/07/1944 | 00:58 | 3.84 days | 216 |
| 117 | 02/13/1965 | 00:20 | 02/16/1965 | 19:27 | 3.79 days | 217 |
| 168 | 05/18/1982 | 16:15 | 05/22/1982 | 03:03 | 3.44 days | 218 |
| 50 | 05/08/1942 | 16:15 | 05/12/1942 | 01:27 | 3.38 days | 219 |
| 49 | 05/04/1942 | 04:52 | 05/07/1942 | 12:32 | 3.31 days | 220 |
| 184 | 06/17/1987 | 10:24 | 06/20/1987 | 17:37 | 3.30 days | 221 |
| 65 | 02/25/1945 | 11:46 | 02/28/1945 | 14:54 | 3.13 days | 222 |
| 165 | 11/01/1981 | 13:50 | 11/04/1981 | 15:36 | 3.07 days | 223 |
| 41 | 06/01/1941 | 01:26 | 06/03/1941 | 20:46 | 2.80 days | 224 |
| 232 | 03/07/2001 | 17:26 | 03/09/2001 | 10:28 | 2.61 days | 225 |
| 66 | 03/01/1945 | 18:23 | 03/04/1945 | 08:31 | 2.58 days | 226 |
| 198 | 05/20/1992 | 22:48 | 05/23/1992 | 10:45 | 2.49 days | 227 |
| 200 | 06/05/1992 | 10:51 | 06/07/1992 | 21:22 | 2.43 days | 228 |
| 195 | 02/09/1992 | 07:12 | 02/11/1992 | 16:44 | 2.39 days | 229 |
| 169 | 05/23/1982 | 09:01 | 05/25/1982 | 14:12 | 2.21 days | 230 |
| 248 | 06/14/2004 | 06:49 | 06/15/2004 | 10:29 | 2.11 days | 231 |
| 140 | 09/15/1974 | 12:21 | 09/17/1974 | 14:53 | 2.10 days | 232 |
| 175 | 11/25/1985 | 18:28 | 11/27/1985 | 19:06 | 2.02 days | 233 |
| 38 | 04/26/1941 | 16:04 | 04/28/1941 | 16:08 | 2.00 days | 234 |
| 39 | 05/01/1941 | 15:01 | 05/03/1941 | 15:00 | 1.99 days | 235 |
| 164 | 10/16/1981 | 10:30 | 10/18/1981 | 09:42 | 1.96 days | 236 |
| 190 | 06/09/1990 | 03:57 | 06/10/1990 | 19:05 | 1.63 days | 237 |
| 99 | 10/20/1957 | 03:36 | 10/21/1957 | 17:59 | 1.59 days | 238 |
| 40 | 05/18/1941 | 19:06 | 05/20/1941 | 05:38 | 1.43 days | 239 |
| 216 | 04/13/1997 | 16:17 | 04/14/1997 | 09:11 | 1.43 days | 240 |
| 183 | 06/02/1987 | 21:15 | 06/04/1987 | 06:07 | 1.37 days | 241 |
| 196 | 03/03/1992 | 05:33 | 03/04/1992 | 11:11 | 1.23 days | 242 |
| 214 | 03/25/1997 | 23:44 | 03/26/1997 | 06:44 | 1.22 days | 243 |
| 8 | 07/04/1936 | 00:28 | 07/05/1936 | 03:35 | 1.13 days | 244 |
| 127 | 05/15/1968 | 09:38 | 05/16/1968 | 09:29 | 0.99 days | 245 |
| 4 | 09/12/1935 | 09:09 | 09/13/1935 | 08:26 | 0.97 days | 246 |
| 213 | 03/24/1997 | 22:06 | 03/25/1997 | 11:35 | 0.93 days | 247 |
| 145 | 05/28/1975 | 23:53 | 05/29/1975 | 13:28 | 0.56 days | 248 |
| 208 | 05/17/1995 | 18:33 | 05/18/1995 | 04:08 | 0.53 days | 249 |
| 167 | 05/17/1982 | 04:33 | 05/17/1982 | 15:23 | 0.45 days | 250 |

Korthauer Bottom Oxbow Connections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/3/2004, 8:57

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 126.6 ft
 Measured River Slope (Using TWDB GPS): 1.09 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 55423.2283 ft (10.49 miles)
 Distance downstream to Richmond Gauge from Oxbow: 487335.958 ft (92.29 miles)
 Estimated Critical Gauge Height/WSE: 25.5015/138.0415 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 26.5015/139.0415 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-11/1/2004
 Number of Records: 100268
 Years of Record: 66.0852
 Number of Critical WSE Exceedences: 282
 Number of "significant" WSE Exceedences: 251
 Average Connections per year: 3.7981
 Flood Level Probability of Connection: 0.26329 year flood (20543.0753 cfs)

Statistics

 Mean Duration of Connection (Days) : 6.867
 Standard Deviation of Connection Duration (Days) : 10.061
 Minimum Duration of Connection (Days) : 0.30147
 Maximum Duration of Connection (Days) : 106.707
 1st Percentile Duration of Connection (Days) : 0.42372
 10th Percentile Duration of Connection (Days) : 1.1081
 25th Percentile Duration of Connection (Days) : 2.0854
 50th Percentile Duration of Connection (Days) : 4.1799
 75th Percentile Duration of Connection (Days) : 8.2898
 95th Percentile Duration of Connection (Days) : 20.184
 99th Percentile Duration of Connection (Days) : 44.5907
 Mean Time Between Connections (Days) : 88.4642
 Standard Deviation of Connection Duration (Days) : 165.4732
 Minimum Time Between Connections (Days) : 0.48678
 Maximum Time Between Connections (Days) : 1229.3711
 1st Percentile Time Between Connections (Days) : 0.80597
 10th Percentile Time Between Connections (Days) : 2.657
 25th Percentile Time Between Connections (Days) : 7.2307
 50th Percentile Time Between Connections (Days) : 26.4165
 75th Percentile Time Between Connections (Days) : 80.649
 95th Percentile Time Between Connections (Days) : 392.4016
 99th Percentile Time Between Connections (Days) : 687.3238

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, August 2004
 Statistics are derived based on "significant" connections

Korthauer Bottom Oxbow Connections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/3/2004, 8:57

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 126.6 ft
 Measured River Slope (Using TWDB GPS): 1.09 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 55423.2283 ft (10.49 miles)
 Distance downstream to Richmond Gauge from Oxbow: 487335.958 ft (92.29 miles)
 Estimated Critical Gauge Height/WSE: 25.5015/138.0415 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 26.5015/139.0415 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-11/1/2004
 Number of Records: 100268
 Years of Record: 66.0852
 Number of Critical WSE Exceedences: 282
 Number of "significant" WSE Exceedences: 251
 Average Connections per year: 3.7981
 Flood Level Probability of Connection: 0.26329 year flood (20543.0753 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|------------|------|-------|
| 251 | 06/27/2004 12:14 | 07/10/2004 17:28 | 13.21 days | 27 | |
| 250 | 06/24/2004 17:25 | 06/25/2004 13:13 | 0.82 days | 241 | |
| 249 | 06/10/2004 21:47 | 06/22/2004 20:43 | 11.95 days | 39 | |
| 248 | 05/14/2004 01:52 | 05/20/2004 00:20 | 5.93 days | 85 | |
| 247 | 05/03/2004 13:56 | 05/07/2004 06:48 | 3.70 days | 146 | |
| 246 | 02/11/2004 09:30 | 02/15/2004 07:58 | 3.93 days | 138 | |
| 245 | 10/11/2003 07:25 | 10/13/2003 15:02 | 2.31 days | 181 | |
| 244 | 02/21/2003 05:46 | 03/08/2003 16:03 | 15.42 days | 18 | |
| 243 | 01/02/2003 20:22 | 01/03/2003 16:46 | 0.84 days | 240 | |
| 242 | 12/25/2002 14:48 | 12/27/2002 17:26 | 2.11 days | 185 | |
| 241 | 12/11/2002 05:37 | 12/15/2002 19:09 | 4.56 days | 115 | |
| 240 | 11/04/2002 11:54 | 11/10/2002 12:48 | 6.03 days | 83 | |
| 239 | 10/25/2002 00:18 | 10/26/2002 02:22 | 1.08 days | 229 | |
| 238 | 08/15/2002 11:40 | 08/16/2002 13:02 | 1.05 days | 232 | |
| 237 | 12/24/2001 07:28 | 12/25/2001 14:22 | 1.28 days | 217 | |
| 236 | 12/17/2001 09:51 | 12/22/2001 04:37 | 4.78 days | 113 | |
| 235 | 11/18/2001 12:04 | 11/20/2001 01:19 | 1.55 days | 208 | |
| 234 | 09/01/2001 21:20 | 09/03/2001 08:08 | 1.45 days | 212 | |
| 233 | 06/09/2001 16:12 | 06/10/2001 00:40 | 0.35 days | 250 | |
| 232 | 05/09/2001 01:48 | 05/10/2001 08:30 | 1.27 days | 219 | |
| 231 | 03/28/2001 20:18 | 04/03/2001 06:25 | 5.42 days | 99 | |
| 230 | 03/03/2001 01:59 | 03/23/2001 15:36 | 20.56 days | 13 | |
| 229 | 01/19/2001 15:50 | 01/22/2001 10:13 | 2.76 days | 169 | |
| 228 | 12/28/2000 04:27 | 12/31/2000 00:26 | 2.83 days | 167 | |
| 227 | 11/05/2000 12:31 | 11/09/2000 13:44 | 4.05 days | 133 | |
| 226 | 02/02/1999 11:20 | 02/06/1999 14:25 | 4.12 days | 129 | |
| 225 | 12/12/1998 01:39 | 12/20/1998 08:24 | 8.28 days | 64 | |
| 224 | 11/12/1998 19:38 | 11/22/1998 12:58 | 9.72 days | 53 | |
| 223 | 10/18/1998 13:25 | 10/26/1998 20:58 | 8.31 days | 63 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 222 | 03/19/1998 | 03:10 | 03/28/1998 | 23:28 | 9.84 days | 52 |
| 221 | 02/26/1998 | 05:36 | 03/02/1998 | 04:13 | 3.94 days | 137 |
| 220 | 02/23/1998 | 19:48 | 02/25/1998 | 12:59 | 1.71 days | 205 |
| 219 | 01/06/1998 | 18:48 | 01/19/1998 | 00:58 | 12.25 days | 35 |
| 218 | 12/22/1997 | 20:29 | 12/27/1997 | 00:53 | 4.18 days | 126 |
| 217 | 06/29/1997 | 20:38 | 07/02/1997 | 19:55 | 2.97 days | 159 |
| 216 | 06/10/1997 | 22:03 | 06/15/1997 | 09:16 | 4.46 days | 118 |
| 215 | 05/26/1997 | 03:12 | 05/30/1997 | 13:22 | 4.42 days | 120 |
| 214 | 05/13/1997 | 05:13 | 05/21/1997 | 19:15 | 8.58 days | 60 |
| 213 | 04/26/1997 | 13:05 | 05/10/1997 | 04:42 | 13.65 days | 26 |
| 212 | 04/17/1997 | 12:43 | 04/18/1997 | 04:21 | 0.65 days | 246 |
| 211 | 04/05/1997 | 10:16 | 04/16/1997 | 18:14 | 11.33 days | 42 |
| 210 | 02/14/1997 | 02:16 | 03/31/1997 | 09:25 | 45.29 days | 3 |
| 209 | 09/21/1996 | 19:10 | 09/22/1996 | 02:24 | 0.30 days | 251 |
| 208 | 08/04/1995 | 13:22 | 08/09/1995 | 23:22 | 5.41 days | 100 |
| 207 | 06/01/1995 | 15:13 | 06/04/1995 | 12:04 | 2.86 days | 165 |
| 206 | 05/11/1995 | 07:13 | 05/19/1995 | 02:25 | 7.8 days | 68 |
| 205 | 03/15/1995 | 03:17 | 03/19/1995 | 16:43 | 4.55 days | 116 |
| 204 | 12/30/1994 | 19:34 | 12/31/1994 | 21:03 | 1.06 days | 230 |
| 203 | 12/17/1994 | 04:25 | 12/21/1994 | 23:34 | 4.79 days | 110 |
| 202 | 10/17/1994 | 00:32 | 10/23/1994 | 08:19 | 6.32 days | 81 |
| 201 | 06/19/1993 | 12:19 | 06/26/1993 | 23:08 | 7.45 days | 73 |
| 200 | 05/06/1993 | 08:56 | 05/14/1993 | 19:12 | 8.42 days | 62 |
| 199 | 04/08/1993 | 23:18 | 04/10/1993 | 20:05 | 1.86 days | 200 |
| 198 | 03/19/1993 | 14:30 | 03/31/1993 | 23:37 | 12.37 days | 32 |
| 197 | 06/01/1992 | 08:21 | 06/22/1992 | 15:28 | 21.29 days | 11 |
| 196 | 05/17/1992 | 23:25 | 05/30/1992 | 06:04 | 12.27 days | 34 |
| 195 | 04/19/1992 | 19:08 | 04/21/1992 | 02:01 | 1.28 days | 218 |
| 194 | 12/22/1991 | 09:28 | 04/07/1992 | 02:26 | 106.70 days | 1 |
| 193 | 11/04/1991 | 16:25 | 11/09/1991 | 17:50 | 5.05 days | 103 |
| 192 | 04/14/1991 | 13:19 | 04/17/1991 | 22:31 | 3.38 days | 153 |
| 191 | 01/11/1991 | 04:09 | 01/23/1991 | 09:09 | 12.20 days | 36 |
| 190 | 06/11/1990 | 17:42 | 06/17/1990 | 04:26 | 5.44 days | 98 |
| 189 | 04/27/1990 | 06:12 | 06/10/1990 | 04:04 | 43.91 days | 4 |
| 188 | 03/17/1990 | 10:37 | 03/18/1990 | 10:37 | 1 00 days | 236 |
| 187 | 06/16/1989 | 09:17 | 06/26/1989 | 11:26 | 10.08 days | 51 |
| 186 | 05/24/1989 | 08:14 | 06/02/1989 | 10:38 | 9.10 days | 56 |
| 185 | 05/18/1989 | 16:12 | 05/23/1989 | 09:49 | 4.73 days | 114 |
| 184 | 05/31/1987 | 17:06 | 06/29/1987 | 23:37 | 29.27 days | 5 |
| 183 | 03/06/1987 | 18:37 | 03/12/1987 | 05:43 | 5.46 days | 97 |
| 182 | 02/26/1987 | 12:03 | 03/03/1987 | 08:04 | 4.83 days | 109 |
| 181 | 12/23/1986 | 05:30 | 12/28/1986 | 21:55 | 5.68 days | 90 |
| 180 | 12/20/1986 | 09:21 | 12/21/1986 | 20:33 | 1.46 days | 211 |
| 179 | 12/17/1986 | 06:44 | 12/19/1986 | 10:44 | 2.16 days | 184 |
| 178 | 06/18/1986 | 14:38 | 06/19/1986 | 17:11 | 1.10 days | 227 |
| 177 | 06/09/1986 | 07:49 | 06/16/1986 | 18:40 | 7.45 days | 72 |
| 176 | 02/04/1986 | 13:41 | 02/08/1986 | 23:59 | 4.42 days | 119 |
| 175 | 12/13/1985 | 00:44 | 12/15/1985 | 21:52 | 2.88 days | 164 |
| 174 | 11/29/1985 | 11:49 | 12/02/1985 | 14:25 | 3.10 days | 156 |
| 173 | 11/25/1985 | 12:02 | 11/28/1985 | 08:33 | 2.85 days | 166 |
| 172 | 03/02/1985 | 13:45 | 03/03/1985 | 13:21 | 0.98 days | 238 |
| 171 | 02/25/1985 | 06:57 | 02/27/1985 | 15:17 | 2.34 days | 179 |
| 170 | 10/21/1984 | 15:37 | 11/01/1984 | 19:30 | 11.16 days | 44 |
| 169 | 05/20/1983 | 21:16 | 05/26/1983 | 12:06 | 5.61 days | 93 |
| 168 | 07/01/1982 | 18:22 | 07/03/1982 | 03:35 | 1.38 days | 215 |
| 167 | 05/15/1982 | 09:19 | 06/05/1982 | 19:47 | 21.43 days | 10 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 166 | 11/05/1981 | 23:52 | 11/07/1981 | 22:53 | 1.95 days | 193 |
| 165 | 10/17/1981 | 22:53 | 11/03/1981 | 09:06 | 16.42 days | 15 |
| 164 | 10/15/1981 | 16:39 | 10/17/1981 | 06:44 | 1.58 days | 207 |
| 163 | 06/12/1981 | 01:14 | 06/27/1981 | 06:11 | 15.20 days | 19 |
| 162 | 06/05/1981 | 17:40 | 06/09/1981 | 19:27 | 4.07 days | 130 |
| 161 | 05/14/1980 | 17:26 | 05/22/1980 | 21:40 | 8.17 days | 66 |
| 160 | 07/27/1979 | 15:46 | 07/31/1979 | 22:10 | 4.26 days | 123 |
| 159 | 05/29/1979 | 23:03 | 06/14/1979 | 03:30 | 15.18 days | 20 |
| 158 | 05/23/1979 | 06:55 | 05/27/1979 | 19:35 | 4.52 days | 117 |
| 157 | 05/12/1979 | 04:59 | 05/16/1979 | 06:44 | 4.07 days | 131 |
| 156 | 04/01/1979 | 13:22 | 04/07/1979 | 04:14 | 5.61 days | 92 |
| 155 | 03/22/1979 | 07:40 | 03/27/1979 | 04:01 | 4.84 days | 108 |
| 154 | 02/07/1979 | 14:09 | 02/09/1979 | 14:26 | 2.01 days | 192 |
| 153 | 04/16/1977 | 21:06 | 05/09/1977 | 17:22 | 22.84 days | 8 |
| 152 | 03/31/1977 | 13:51 | 04/05/1977 | 12:34 | 4.94 days | 105 |
| 151 | 02/19/1977 | 03:40 | 02/20/1977 | 13:21 | 1.40 days | 214 |
| 150 | 02/11/1977 | 20:16 | 02/17/1977 | 21:29 | 6.05 days | 82 |
| 149 | 12/11/1976 | 20:26 | 12/20/1976 | 12:11 | 8.65 days | 59 |
| 148 | 07/07/1976 | 03:54 | 07/08/1976 | 07:32 | 1.15 days | 223 |
| 147 | 06/01/1976 | 14:54 | 06/03/1976 | 06:22 | 1.64 days | 206 |
| 146 | 05/14/1976 | 17:16 | 05/16/1976 | 16:13 | 1.95 days | 194 |
| 145 | 05/08/1976 | 01:21 | 05/11/1976 | 11:11 | 3.41 days | 152 |
| 144 | 05/01/1976 | 07:49 | 05/03/1976 | 19:27 | 2.48 days | 175 |
| 143 | 04/19/1976 | 20:46 | 04/24/1976 | 01:39 | 4.20 days | 125 |
| 142 | 05/24/1975 | 18:14 | 06/08/1975 | 03:45 | 14.39 days | 23 |
| 141 | 05/10/1975 | 11:36 | 05/14/1975 | 13:00 | 4.05 days | 132 |
| 140 | 04/13/1975 | 19:37 | 04/15/1975 | 05:21 | 1.40 days | 213 |
| 139 | 02/03/1975 | 22:07 | 02/13/1975 | 02:34 | 9.18 days | 54 |
| 138 | 11/25/1974 | 02:56 | 11/29/1974 | 04:00 | 4.04 days | 134 |
| 137 | 11/01/1974 | 22:26 | 11/17/1974 | 12:05 | 15.56 days | 17 |
| 136 | 09/14/1974 | 02:36 | 09/22/1974 | 07:21 | 8.19 days | 65 |
| 135 | 01/24/1974 | 16:55 | 01/30/1974 | 09:01 | 5.67 days | 91 |
| 134 | 10/12/1973 | 15:46 | 10/23/1973 | 10:52 | 10.79 days | 46 |
| 133 | 06/05/1973 | 16:21 | 06/18/1973 | 16:30 | 13.00 days | 28 |
| 132 | 05/08/1973 | 17:18 | 05/10/1973 | 19:29 | 2.09 days | 187 |
| 131 | 04/25/1973 | 18:13 | 05/04/1973 | 11:34 | 8.72 days | 58 |
| 130 | 04/17/1973 | 22:01 | 04/22/1973 | 16:59 | 4.78 days | 111 |
| 129 | 03/23/1973 | 12:56 | 03/28/1973 | 18:00 | 5.21 days | 101 |
| 128 | 01/27/1973 | 15:25 | 01/28/1973 | 16:52 | 1.06 days | 231 |
| 127 | 12/11/1971 | 16:53 | 12/13/1971 | 10:38 | 1.73 days | 204 |
| 126 | 03/08/1970 | 11:00 | 03/14/1970 | 08:32 | 5.89 days | 87 |
| 125 | 05/09/1969 | 06:28 | 05/20/1969 | 13:29 | 11.29 days | 43 |
| 124 | 04/13/1969 | 05:21 | 04/22/1969 | 00:04 | 8.77 days | 57 |
| 123 | 03/15/1969 | 12:27 | 03/18/1969 | 22:41 | 3.42 days | 151 |
| 122 | 02/21/1969 | 15:06 | 02/22/1969 | 18:07 | 1.12 days | 226 |
| 121 | 07/08/1968 | 14:35 | 07/16/1968 | 08:32 | 7.74 days | 69 |
| 120 | 06/24/1968 | 10:24 | 07/01/1968 | 21:21 | 7.45 days | 71 |
| 119 | 06/04/1968 | 01:36 | 06/09/1968 | 06:13 | 5.19 days | 102 |
| 118 | 05/09/1968 | 18:25 | 05/31/1968 | 06:33 | 21.50 days | 9 |
| 117 | 04/12/1968 | 17:22 | 04/16/1968 | 21:36 | 4.17 days | 127 |
| 116 | 04/08/1968 | 19:05 | 04/10/1968 | 18:01 | 1.95 days | 195 |
| 115 | 03/22/1968 | 15:09 | 03/28/1968 | 03:42 | 5.52 days | 95 |
| 114 | 03/12/1968 | 21:08 | 03/15/1968 | 22:02 | 3.03 days | 157 |
| 113 | 01/20/1968 | 18:40 | 02/01/1968 | 14:15 | 11.81 days | 40 |
| 112 | 09/21/1966 | 22:47 | 09/24/1966 | 20:21 | 2.89 days | 162 |
| 111 | 09/19/1966 | 02:18 | 09/21/1966 | 11:06 | 2.36 days | 178 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 110 | 04/26/1966 | 11:38 | 05/17/1966 | 04:05 | 20.68 days | 12 |
| 109 | 06/06/1965 | 20:52 | 06/09/1965 | 18:01 | 2.88 days | 163 |
| 108 | 05/11/1965 | 12:01 | 06/03/1965 | 21:25 | 23.39 days | 7 |
| 107 | 02/12/1965 | 02:18 | 02/22/1965 | 05:19 | 10.12 days | 50 |
| 106 | 01/23/1965 | 02:38 | 01/26/1965 | 11:21 | 3.36 days | 154 |
| 105 | 09/11/1961 | 18:55 | 09/17/1961 | 11:21 | 5.68 days | 89 |
| 104 | 07/12/1961 | 17:31 | 07/13/1961 | 14:19 | 0.86 days | 239 |
| 103 | 06/27/1961 | 23:35 | 06/29/1961 | 06:34 | 1.29 days | 216 |
| 102 | 06/18/1961 | 23:47 | 06/25/1961 | 19:07 | 6.80 days | 76 |
| 101 | 02/05/1961 | 16:28 | 02/25/1961 | 13:21 | 19.87 days | 14 |
| 100 | 01/08/1961 | 01:47 | 01/23/1961 | 00:36 | 14.95 days | 22 |
| 99 | 12/08/1960 | 21:56 | 12/19/1960 | 13:15 | 10.63 days | 48 |
| 98 | 11/21/1960 | 19:46 | 11/26/1960 | 01:19 | 4.23 days | 124 |
| 97 | 10/28/1960 | 12:10 | 11/03/1960 | 12:05 | 5.99 days | 84 |
| 96 | 10/20/1960 | 15:18 | 10/21/1960 | 15:24 | 1.00 days | 234 |
| 95 | 06/25/1960 | 16:29 | 06/28/1960 | 16:28 | 2.99 days | 158 |
| 94 | 05/01/1960 | 01:54 | 05/02/1960 | 14:48 | 1.53 days | 210 |
| 93 | 02/06/1960 | 10:27 | 02/06/1960 | 22:15 | 0.49 days | 249 |
| 92 | 01/07/1960 | 13:46 | 01/08/1960 | 17:42 | 1.16 days | 222 |
| 91 | 12/16/1959 | 13:29 | 12/20/1959 | 06:52 | 3.72 days | 145 |
| 90 | 10/05/1959 | 16:35 | 10/21/1959 | 06:49 | 15.59 days | 16 |
| 89 | 04/18/1959 | 08:11 | 04/20/1959 | 04:18 | 1.83 days | 201 |
| 88 | 04/11/1959 | 18:22 | 04/15/1959 | 16:30 | 3.92 days | 139 |
| 87 | 07/11/1958 | 12:10 | 07/12/1958 | 12:09 | 0.99 days | 237 |
| 86 | 05/03/1958 | 10:19 | 05/17/1958 | 04:29 | 13.75 days | 25 |
| 85 | 04/29/1958 | 10:13 | 05/02/1958 | 05:53 | 2.81 days | 168 |
| 84 | 02/24/1958 | 04:59 | 03/01/1958 | 22:37 | 5.73 days | 88 |
| 83 | 11/26/1957 | 01:46 | 11/28/1957 | 09:49 | 2.33 days | 180 |
| 82 | 10/14/1957 | 18:15 | 10/28/1957 | 23:39 | 14.22 days | 24 |
| 81 | 04/18/1957 | 13:26 | 07/07/1957 | 15:24 | 80.08 days | 2 |
| 80 | 12/03/1953 | 17:11 | 12/06/1953 | 04:32 | 2.47 days | 176 |
| 79 | 10/27/1953 | 22:01 | 10/30/1953 | 00:25 | 2.1 days | 186 |
| 78 | 05/13/1953 | 22:48 | 05/24/1953 | 23:58 | 11.04 days | 45 |
| 77 | 05/25/1952 | 15:42 | 05/28/1952 | 08:00 | 2.67 days | 170 |
| 76 | 04/24/1952 | 16:11 | 04/25/1952 | 22:04 | 1.24 days | 220 |
| 75 | 06/06/1950 | 22:08 | 06/08/1950 | 15:56 | 1.74 days | 203 |
| 74 | 06/02/1950 | 16:35 | 06/04/1950 | 05:30 | 1.53 days | 209 |
| 73 | 04/18/1950 | 21:00 | 04/20/1950 | 23:05 | 2.08 days | 189 |
| 72 | 02/12/1950 | 21:46 | 02/17/1950 | 06:46 | 4.37 days | 122 |
| 71 | 05/20/1949 | 04:30 | 05/22/1949 | 06:37 | 2.08 days | 188 |
| 70 | 04/27/1949 | 08:17 | 05/02/1949 | 20:41 | 5.51 days | 96 |
| 69 | 04/22/1949 | 04:47 | 04/24/1949 | 02:05 | 1.88 days | 198 |
| 68 | 02/28/1949 | 08:56 | 03/01/1949 | 00:14 | 0.63 days | 247 |
| 67 | 05/13/1948 | 12:02 | 05/14/1948 | 12:02 | 1.00 days | 235 |
| 66 | 08/27/1947 | 00:10 | 08/29/1947 | 16:15 | 2.67 days | 171 |
| 65 | 05/29/1947 | 14:47 | 05/31/1947 | 13:03 | 1.92 days | 197 |
| 64 | 05/18/1947 | 12:04 | 05/25/1947 | 22:35 | 7.43 days | 74 |
| 63 | 03/19/1947 | 20:20 | 03/23/1947 | 14:40 | 3.76 days | 142 |
| 62 | 03/13/1947 | 14:53 | 03/16/1947 | 00:57 | 2.41 days | 177 |
| 61 | 01/17/1947 | 19:00 | 01/23/1947 | 08:46 | 5.57 days | 94 |
| 60 | 12/14/1946 | 07:10 | 12/16/1946 | 09:06 | 2.08 days | 190 |
| 59 | 11/16/1946 | 22:27 | 11/20/1946 | 15:55 | 3.72 days | 144 |
| 58 | 11/06/1946 | 02:54 | 11/08/1946 | 16:17 | 2.55 days | 173 |
| 57 | 06/02/1946 | 07:25 | 06/05/1946 | 19:34 | 3.50 days | 150 |
| 56 | 05/13/1946 | 14:30 | 05/25/1946 | 09:48 | 11.80 days | 41 |
| 55 | 04/26/1946 | 03:08 | 04/26/1946 | 21:20 | 0.75 days | 243 |

| | | | | | | |
|----|------------|-------|------------|-------|------------|-----|
| 54 | 03/26/1946 | 18:56 | 03/28/1946 | 17:23 | 1.93 days | 196 |
| 53 | 03/12/1946 | 22:39 | 03/19/1946 | 21:55 | 6.96 days | 75 |
| 52 | 02/20/1946 | 09:42 | 02/24/1946 | 00:07 | 3.60 days | 147 |
| 51 | 01/16/1946 | 00:44 | 01/19/1946 | 19:52 | 3.79 days | 141 |
| 50 | 12/04/1945 | 23:21 | 12/06/1945 | 02:55 | 1.14 days | 225 |
| 49 | 08/29/1945 | 20:59 | 08/30/1945 | 15:06 | 0.75 days | 244 |
| 48 | 07/12/1945 | 14:44 | 07/14/1945 | 20:43 | 2.24 days | 183 |
| 47 | 06/21/1945 | 07:17 | 06/21/1945 | 19:06 | 0.49 days | 248 |
| 46 | 06/15/1945 | 07:09 | 06/16/1945 | 00:26 | 0.72 days | 245 |
| 45 | 04/21/1945 | 14:51 | 05/02/1945 | 04:28 | 10.56 days | 49 |
| 44 | 03/30/1945 | 17:23 | 04/11/1945 | 20:59 | 12.15 days | 38 |
| 43 | 03/16/1945 | 16:53 | 03/19/1945 | 07:25 | 2.60 days | 172 |
| 42 | 03/04/1945 | 01:43 | 03/10/1945 | 00:05 | 5.93 days | 86 |
| 41 | 03/01/1945 | 16:24 | 03/02/1945 | 18:55 | 1.10 days | 228 |
| 40 | 02/21/1945 | 23:19 | 02/26/1945 | 09:21 | 4.41 days | 121 |
| 39 | 01/18/1945 | 21:37 | 01/25/1945 | 09:21 | 6.48 days | 79 |
| 38 | 12/30/1944 | 23:38 | 01/03/1945 | 19:19 | 3.82 days | 140 |
| 37 | 12/05/1944 | 18:37 | 12/09/1944 | 22:27 | 4.15 days | 128 |
| 36 | 11/26/1944 | 01:51 | 11/28/1944 | 14:58 | 2.54 days | 174 |
| 35 | 06/06/1944 | 20:49 | 06/11/1944 | 18:22 | 4.89 days | 106 |
| 34 | 05/25/1944 | 22:44 | 06/04/1944 | 01:55 | 9.13 days | 55 |
| 33 | 05/02/1944 | 06:15 | 05/15/1944 | 01:43 | 12.81 days | 31 |
| 32 | 03/23/1944 | 23:47 | 03/26/1944 | 07:17 | 2.31 days | 182 |
| 31 | 02/26/1944 | 16:57 | 03/04/1944 | 03:45 | 6.44 days | 80 |
| 30 | 02/10/1944 | 19:44 | 02/11/1944 | 23:19 | 1.14 days | 224 |
| 29 | 01/29/1944 | 19:32 | 02/02/1944 | 00:07 | 3.19 days | 155 |
| 28 | 10/20/1942 | 04:15 | 10/24/1942 | 23:02 | 4.78 days | 112 |
| 27 | 09/08/1942 | 16:21 | 09/15/1942 | 04:52 | 6.52 days | 78 |
| 26 | 06/08/1942 | 13:53 | 06/20/1942 | 22:53 | 12.37 days | 33 |
| 25 | 05/20/1942 | 02:34 | 05/30/1942 | 21:09 | 10.77 days | 47 |
| 24 | 05/13/1942 | 07:31 | 05/16/1942 | 05:58 | 2.93 days | 161 |
| 23 | 05/08/1942 | 16:34 | 05/10/1942 | 12:08 | 1.81 days | 202 |
| 22 | 04/22/1942 | 07:15 | 05/05/1942 | 03:34 | 12.84 days | 30 |
| 21 | 04/09/1942 | 10:39 | 04/18/1942 | 00:12 | 8.56 days | 61 |
| 20 | 10/30/1941 | 21:55 | 11/01/1941 | 18:44 | 1.86 days | 199 |
| 19 | 10/07/1941 | 23:52 | 10/10/1941 | 01:11 | 2.05 days | 191 |
| 18 | 07/12/1941 | 20:59 | 07/20/1941 | 08:08 | 7.46 days | 70 |
| 17 | 06/11/1941 | 02:55 | 06/26/1941 | 05:17 | 15.09 days | 21 |
| 16 | 06/04/1941 | 21:41 | 06/05/1941 | 22:53 | 1.05 days | 233 |
| 15 | 05/05/1941 | 07:40 | 06/02/1941 | 00:23 | 27.69 days | 6 |
| 14 | 04/29/1941 | 21:49 | 05/02/1941 | 20:27 | 2.94 days | 160 |
| 13 | 04/23/1941 | 15:20 | 04/27/1941 | 08:58 | 3.73 days | 143 |
| 12 | 03/20/1941 | 03:50 | 03/23/1941 | 16:24 | 3.52 days | 148 |
| 11 | 03/07/1941 | 07:51 | 03/12/1941 | 08:11 | 5.01 days | 104 |
| 10 | 02/25/1941 | 04:30 | 03/01/1941 | 03:31 | 3.95 days | 136 |
| 9 | 02/03/1941 | 03:51 | 02/09/1941 | 21:57 | 6.75 days | 77 |
| 8 | 01/15/1941 | 01:07 | 01/19/1941 | 00:08 | 3.95 days | 135 |
| 7 | 12/28/1940 | 07:45 | 12/31/1940 | 19:58 | 3.50 days | 149 |
| 6 | 12/12/1940 | 06:24 | 12/24/1940 | 10:14 | 12.16 days | 37 |
| 5 | 11/24/1940 | 06:20 | 12/07/1940 | 06:25 | 13.00 days | 29 |
| 4 | 08/21/1940 | 18:21 | 08/22/1940 | 23:46 | 1.22 days | 221 |
| 3 | 06/30/1940 | 05:07 | 07/08/1940 | 01:40 | 7.85 days | 67 |
| 2 | 06/21/1939 | 21:08 | 06/22/1939 | 16:51 | 0.82 days | 242 |
| 1 | 05/18/1939 | 22:26 | 05/23/1939 | 18:59 | 4.85 days | 107 |

Korthauer Bottom Oxbow Connections to the Brazos River – Ranked by Connection Duration
 Jordan Furnans, TWDB 11/3/2004, 8:57

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 126.6 ft
 Measured River Slope (Using TWDB GPS): 1.09 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 55423.2283 ft (10.49 miles)
 Distance downstream to Richmond Gauge from Oxbow: 487335.958 ft (92.29 miles)
 Estimated Critical Gauge Height/WSE: 25.5015/138.0415 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 26.5015/139.0415 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-11/1/2004
 Number of Records: 100268
 Years of Record: 66.0852
 Number of Critical WSE Exceedences: 282
 Number of "significant" WSE Exceedences: 251
 Average Connections per year: 3.7981
 Flood Level Probability of Connection: 0.26329 year flood (20543.0753 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|-------|
| 194 | 12/22/1991 09:28 | 04/07/1992 02:26 | 106.70 days | 1 | |
| 81 | 04/18/1957 13:26 | 07/07/1957 15:24 | 80.08 days | 2 | |
| 210 | 02/14/1997 02:16 | 03/31/1997 09:25 | 45.29 days | 3 | |
| 189 | 04/27/1990 06:12 | 06/10/1990 04:04 | 43.91 days | 4 | |
| 184 | 05/31/1987 17:06 | 06/29/1987 23:37 | 29.27 days | 5 | |
| 15 | 05/05/1941 07:40 | 06/02/1941 00:23 | 27.69 days | 6 | |
| 108 | 05/11/1965 12:01 | 06/03/1965 21:25 | 23.39 days | 7 | |
| 153 | 04/16/1977 21:06 | 05/09/1977 17:22 | 22.84 days | 8 | |
| 118 | 05/09/1968 18:25 | 05/31/1968 06:33 | 21.50 days | 9 | |
| 167 | 05/15/1982 09:19 | 06/05/1982 19:47 | 21.43 days | 10 | |
| 197 | 06/01/1992 08:21 | 06/22/1992 15:28 | 21.29 days | 11 | |
| 110 | 04/26/1966 11:38 | 05/17/1966 04:05 | 20.68 days | 12 | |
| 230 | 03/03/2001 01:59 | 03/23/2001 15:36 | 20.56 days | 13 | |
| 101 | 02/05/1961 16:28 | 02/25/1961 13:21 | 19.87 days | 14 | |
| 165 | 10/17/1981 22:53 | 11/03/1981 09:06 | 16.42 days | 15 | |
| 90 | 10/05/1959 16:35 | 10/21/1959 06:49 | 15.59 days | 16 | |
| 137 | 11/01/1974 22:26 | 11/17/1974 12:05 | 15.56 days | 17 | |
| 244 | 02/21/2003 05:46 | 03/08/2003 16:03 | 15.42 days | 18 | |
| 163 | 06/12/1981 01:14 | 06/27/1981 06:11 | 15.20 days | 19 | |
| 159 | 05/29/1979 23:03 | 06/14/1979 03:30 | 15.18 days | 20 | |
| 17 | 06/11/1941 02:55 | 06/26/1941 05:17 | 15.09 days | 21 | |
| 100 | 01/08/1961 01:47 | 01/23/1961 00:36 | 14.95 days | 22 | |
| 142 | 05/24/1975 18:14 | 06/08/1975 03:45 | 14.39 days | 23 | |
| 82 | 10/14/1957 18:15 | 10/28/1957 23:39 | 14.22 days | 24 | |
| 86 | 05/03/1958 10:19 | 05/17/1958 04:29 | 13.75 days | 25 | |
| 213 | 04/26/1997 13:05 | 05/10/1997 04:42 | 13.65 days | 26 | |
| 251 | 06/27/2004 12:14 | 07/10/2004 17:28 | 13.21 days | 27 | |
| 133 | 06/05/1973 16:21 | 06/18/1973 16:30 | 13.00 days | 28 | |
| 5 | 11/24/1940 06:20 | 12/07/1940 06:25 | 13.00 days | 29 | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|----|
| 22 | 04/22/1942 | 07:15 | 05/05/1942 | 03:34 | 12.84 days | 30 |
| 33 | 05/02/1944 | 06:15 | 05/15/1944 | 01:43 | 12.81 days | 31 |
| 198 | 03/19/1993 | 14:30 | 03/31/1993 | 23:37 | 12.37 days | 32 |
| 26 | 06/08/1942 | 13:53 | 06/20/1942 | 22:53 | 12.37 days | 33 |
| 196 | 05/17/1992 | 23:25 | 05/30/1992 | 06:04 | 12.27 days | 34 |
| 219 | 01/06/1998 | 18:48 | 01/19/1998 | 00:58 | 12.25 days | 35 |
| 191 | 01/11/1991 | 04:09 | 01/23/1991 | 09:09 | 12.20 days | 36 |
| 6 | 12/12/1940 | 06:24 | 12/24/1940 | 10:14 | 12.16 days | 37 |
| 44 | 03/30/1945 | 17:23 | 04/11/1945 | 20:59 | 12.15 days | 38 |
| 249 | 06/10/2004 | 21:47 | 06/22/2004 | 20:43 | 11.95 days | 39 |
| 113 | 01/20/1968 | 18:40 | 02/01/1968 | 14:15 | 11.81 days | 40 |
| 56 | 05/13/1946 | 14:30 | 05/25/1946 | 09:48 | 11.80 days | 41 |
| 211 | 04/05/1997 | 10:16 | 04/16/1997 | 18:14 | 11.33 days | 42 |
| 125 | 05/09/1969 | 06:28 | 05/20/1969 | 13:29 | 11.29 days | 43 |
| 170 | 10/21/1984 | 15:37 | 11/01/1984 | 19:30 | 11.16 days | 44 |
| 78 | 05/13/1953 | 22:48 | 05/24/1953 | 23:58 | 11.04 days | 45 |
| 134 | 10/12/1973 | 15:46 | 10/23/1973 | 10:52 | 10.79 days | 46 |
| 25 | 05/20/1942 | 02:34 | 05/30/1942 | 21:09 | 10.77 days | 47 |
| 99 | 12/08/1960 | 21:56 | 12/19/1960 | 13:15 | 10.63 days | 48 |
| 45 | 04/21/1945 | 14:51 | 05/02/1945 | 04:28 | 10.56 days | 49 |
| 107 | 02/12/1965 | 02:18 | 02/22/1965 | 05:19 | 10.12 days | 50 |
| 187 | 06/16/1989 | 09:17 | 06/26/1989 | 11:26 | 10.08 days | 51 |
| 222 | 03/19/1998 | 03:10 | 03/28/1998 | 23:28 | 9.84 days | 52 |
| 224 | 11/12/1998 | 19:38 | 11/22/1998 | 12:58 | 9.72 days | 53 |
| 139 | 02/03/1975 | 22:07 | 02/13/1975 | 02:34 | 9.18 days | 54 |
| 34 | 05/25/1944 | 22:44 | 06/04/1944 | 01:55 | 9.13 days | 55 |
| 186 | 05/24/1989 | 08:14 | 06/02/1989 | 10:38 | 9.10 days | 56 |
| 124 | 04/13/1969 | 05:21 | 04/22/1969 | 00:04 | 8.77 days | 57 |
| 131 | 04/25/1973 | 18:13 | 05/04/1973 | 11:34 | 8.72 days | 58 |
| 149 | 12/11/1976 | 20:26 | 12/20/1976 | 12:11 | 8.65 days | 59 |
| 214 | 05/13/1997 | 05:13 | 05/21/1997 | 19:15 | 8.58 days | 60 |
| 21 | 04/09/1942 | 10:39 | 04/18/1942 | 00:12 | 8.56 days | 61 |
| 200 | 05/06/1993 | 08:56 | 05/14/1993 | 19:12 | 8.42 days | 62 |
| 223 | 10/18/1998 | 13:25 | 10/26/1998 | 20:58 | 8.31 days | 63 |
| 225 | 12/12/1998 | 01:39 | 12/20/1998 | 08:24 | 8.28 days | 64 |
| 136 | 09/14/1974 | 02:36 | 09/22/1974 | 07:21 | 8.19 days | 65 |
| 161 | 05/14/1980 | 17:26 | 05/22/1980 | 21:40 | 8.17 days | 66 |
| 3 | 06/30/1940 | 05:07 | 07/08/1940 | 01:40 | 7.85 days | 67 |
| 206 | 05/11/1995 | 07:13 | 05/19/1995 | 02:25 | 7.8 days | 68 |
| 121 | 07/08/1968 | 14:35 | 07/16/1968 | 08:32 | 7.74 days | 69 |
| 18 | 07/12/1941 | 20:59 | 07/20/1941 | 08:08 | 7.46 days | 70 |
| 120 | 06/24/1968 | 10:24 | 07/01/1968 | 21:21 | 7.45 days | 71 |
| 177 | 06/09/1986 | 07:49 | 06/16/1986 | 18:40 | 7.45 days | 72 |
| 201 | 06/19/1993 | 12:19 | 06/26/1993 | 23:08 | 7.45 days | 73 |
| 64 | 05/18/1947 | 12:04 | 05/25/1947 | 22:35 | 7.43 days | 74 |
| 53 | 03/12/1946 | 22:39 | 03/19/1946 | 21:55 | 6.96 days | 75 |
| 102 | 06/18/1961 | 23:47 | 06/25/1961 | 19:07 | 6.80 days | 76 |
| 9 | 02/03/1941 | 03:51 | 02/09/1941 | 21:57 | 6.75 days | 77 |
| 27 | 09/08/1942 | 16:21 | 09/15/1942 | 04:52 | 6.52 days | 78 |
| 39 | 01/18/1945 | 21:37 | 01/25/1945 | 09:21 | 6.48 days | 79 |
| 31 | 02/26/1944 | 16:57 | 03/04/1944 | 03:45 | 6.44 days | 80 |
| 202 | 10/17/1994 | 00:32 | 10/23/1994 | 08:19 | 6.32 days | 81 |
| 150 | 02/11/1977 | 20:16 | 02/17/1977 | 21:29 | 6.05 days | 82 |
| 240 | 11/04/2002 | 11:54 | 11/10/2002 | 12:48 | 6.03 days | 83 |
| 97 | 10/28/1960 | 12:10 | 11/03/1960 | 12:05 | 5.99 days | 84 |
| 248 | 05/14/2004 | 01:52 | 05/20/2004 | 00:20 | 5.93 days | 85 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 42 | 03/04/1945 | 01:43 | 03/10/1945 | 00:05 | 5.93 days | 86 |
| 126 | 03/08/1970 | 11:00 | 03/14/1970 | 08:32 | 5.89 days | 87 |
| 84 | 02/24/1958 | 04:59 | 03/01/1958 | 22:37 | 5.73 days | 88 |
| 105 | 09/11/1961 | 18:55 | 09/17/1961 | 11:21 | 5.68 days | 89 |
| 181 | 12/23/1986 | 05:30 | 12/28/1986 | 21:55 | 5.68 days | 90 |
| 135 | 01/24/1974 | 16:55 | 01/30/1974 | 09:01 | 5.67 days | 91 |
| 156 | 04/01/1979 | 13:22 | 04/07/1979 | 04:14 | 5.61 days | 92 |
| 169 | 05/20/1983 | 21:16 | 05/26/1983 | 12:06 | 5.61 days | 93 |
| 61 | 01/17/1947 | 19:00 | 01/23/1947 | 08:46 | 5.57 days | 94 |
| 115 | 03/22/1968 | 15:09 | 03/28/1968 | 03:42 | 5.52 days | 95 |
| 70 | 04/27/1949 | 08:17 | 05/02/1949 | 20:41 | 5.51 days | 96 |
| 183 | 03/06/1987 | 18:37 | 03/12/1987 | 05:43 | 5.46 days | 97 |
| 190 | 06/11/1990 | 17:42 | 06/17/1990 | 04:26 | 5.44 days | 98 |
| 231 | 03/28/2001 | 20:18 | 04/03/2001 | 06:25 | 5.42 days | 99 |
| 208 | 08/04/1995 | 13:22 | 08/09/1995 | 23:22 | 5.41 days | 100 |
| 129 | 03/23/1973 | 12:56 | 03/28/1973 | 18:00 | 5.21 days | 101 |
| 119 | 06/04/1968 | 01:36 | 06/09/1968 | 06:13 | 5.19 days | 102 |
| 193 | 11/04/1991 | 16:25 | 11/09/1991 | 17:50 | 5.05 days | 103 |
| 11 | 03/07/1941 | 07:51 | 03/12/1941 | 08:11 | 5.01 days | 104 |
| 152 | 03/31/1977 | 13:51 | 04/05/1977 | 12:34 | 4.94 days | 105 |
| 35 | 06/06/1944 | 20:49 | 06/11/1944 | 18:22 | 4.89 days | 106 |
| 1 | 05/18/1939 | 22:26 | 05/23/1939 | 18:59 | 4.85 days | 107 |
| 155 | 03/22/1979 | 07:40 | 03/27/1979 | 04:01 | 4.84 days | 108 |
| 182 | 02/26/1987 | 12:03 | 03/03/1987 | 08:04 | 4.83 days | 109 |
| 203 | 12/17/1994 | 04:25 | 12/21/1994 | 23:34 | 4.79 days | 110 |
| 130 | 04/17/1973 | 22:01 | 04/22/1973 | 16:59 | 4.78 days | 111 |
| 28 | 10/20/1942 | 04:15 | 10/24/1942 | 23:02 | 4.78 days | 112 |
| 236 | 12/17/2001 | 09:51 | 12/22/2001 | 04:37 | 4.78 days | 113 |
| 185 | 05/18/1989 | 16:12 | 05/23/1989 | 09:49 | 4.73 days | 114 |
| 241 | 12/11/2002 | 05:37 | 12/15/2002 | 19:09 | 4.56 days | 115 |
| 205 | 03/15/1995 | 03:17 | 03/19/1995 | 16:43 | 4.55 days | 116 |
| 158 | 05/23/1979 | 06:55 | 05/27/1979 | 19:35 | 4.52 days | 117 |
| 216 | 06/10/1997 | 22:03 | 06/15/1997 | 09:16 | 4.46 days | 118 |
| 176 | 02/04/1986 | 13:41 | 02/08/1986 | 23:59 | 4.42 days | 119 |
| 215 | 05/26/1997 | 03:12 | 05/30/1997 | 13:22 | 4.42 days | 120 |
| 40 | 02/21/1945 | 23:19 | 02/26/1945 | 09:21 | 4.41 days | 121 |
| 72 | 02/12/1950 | 21:46 | 02/17/1950 | 06:46 | 4.37 days | 122 |
| 160 | 07/27/1979 | 15:46 | 07/31/1979 | 22:10 | 4.26 days | 123 |
| 98 | 11/21/1960 | 19:46 | 11/26/1960 | 01:19 | 4.23 days | 124 |
| 143 | 04/19/1976 | 20:46 | 04/24/1976 | 01:39 | 4.20 days | 125 |
| 218 | 12/22/1997 | 20:29 | 12/27/1997 | 00:53 | 4.18 days | 126 |
| 117 | 04/12/1968 | 17:22 | 04/16/1968 | 21:36 | 4.17 days | 127 |
| 37 | 12/05/1944 | 18:37 | 12/09/1944 | 22:27 | 4.15 days | 128 |
| 226 | 02/02/1999 | 11:20 | 02/06/1999 | 14:25 | 4.12 days | 129 |
| 162 | 06/05/1981 | 17:40 | 06/09/1981 | 19:27 | 4.07 days | 130 |
| 157 | 05/12/1979 | 04:59 | 05/16/1979 | 06:44 | 4.07 days | 131 |
| 141 | 05/10/1975 | 11:36 | 05/14/1975 | 13:00 | 4.05 days | 132 |
| 227 | 11/05/2000 | 12:31 | 11/09/2000 | 13:44 | 4.05 days | 133 |
| 138 | 11/25/1974 | 02:56 | 11/29/1974 | 04:00 | 4.04 days | 134 |
| 8 | 01/15/1941 | 01:07 | 01/19/1941 | 00:08 | 3.95 days | 135 |
| 10 | 02/25/1941 | 04:30 | 03/01/1941 | 03:31 | 3.95 days | 136 |
| 221 | 02/26/1998 | 05:36 | 03/02/1998 | 04:13 | 3.94 days | 137 |
| 246 | 02/11/2004 | 09:30 | 02/15/2004 | 07:58 | 3.93 days | 138 |
| 88 | 04/11/1959 | 18:22 | 04/15/1959 | 16:30 | 3.92 days | 139 |
| 38 | 12/30/1944 | 23:38 | 01/03/1945 | 19:19 | 3.82 days | 140 |
| 51 | 01/16/1946 | 00:44 | 01/19/1946 | 19:52 | 3.79 days | 141 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 63 | 03/19/1947 | 20:20 | 03/23/1947 | 14:40 | 3.76 days | 142 |
| 13 | 04/23/1941 | 15:20 | 04/27/1941 | 08:58 | 3.73 days | 143 |
| 59 | 11/16/1946 | 22:27 | 11/20/1946 | 15:55 | 3.72 days | 144 |
| 91 | 12/16/1959 | 13:29 | 12/20/1959 | 06:52 | 3.72 days | 145 |
| 247 | 05/03/2004 | 13:56 | 05/07/2004 | 06:48 | 3.70 days | 146 |
| 52 | 02/20/1946 | 09:42 | 02/24/1946 | 00:07 | 3.60 days | 147 |
| 12 | 03/20/1941 | 03:50 | 03/23/1941 | 16:24 | 3.52 days | 148 |
| 7 | 12/28/1940 | 07:45 | 12/31/1940 | 19:58 | 3.50 days | 149 |
| 57 | 06/02/1946 | 07:25 | 06/05/1946 | 19:34 | 3.50 days | 150 |
| 123 | 03/15/1969 | 12:27 | 03/18/1969 | 22:41 | 3.42 days | 151 |
| 145 | 05/08/1976 | 01:21 | 05/11/1976 | 11:11 | 3.41 days | 152 |
| 192 | 04/14/1991 | 13:19 | 04/17/1991 | 22:31 | 3.38 days | 153 |
| 106 | 01/23/1965 | 02:38 | 01/26/1965 | 11:21 | 3.36 days | 154 |
| 29 | 01/29/1944 | 19:32 | 02/02/1944 | 00:07 | 3.19 days | 155 |
| 174 | 11/29/1985 | 11:49 | 12/02/1985 | 14:25 | 3.10 days | 156 |
| 114 | 03/12/1968 | 21:08 | 03/15/1968 | 22:02 | 3.03 days | 157 |
| 95 | 06/25/1960 | 16:29 | 06/28/1960 | 16:28 | 2.99 days | 158 |
| 217 | 06/29/1997 | 20:38 | 07/02/1997 | 19:55 | 2.97 days | 159 |
| 14 | 04/29/1941 | 21:49 | 05/02/1941 | 20:27 | 2.94 days | 160 |
| 24 | 05/13/1942 | 07:31 | 05/16/1942 | 05:58 | 2.93 days | 161 |
| 112 | 09/21/1966 | 22:47 | 09/24/1966 | 20:21 | 2.89 days | 162 |
| 109 | 06/06/1965 | 20:52 | 06/09/1965 | 18:01 | 2.88 days | 163 |
| 175 | 12/13/1985 | 00:44 | 12/15/1985 | 21:52 | 2.88 days | 164 |
| 207 | 06/01/1995 | 15:13 | 06/04/1995 | 12:04 | 2.86 days | 165 |
| 173 | 11/25/1985 | 12:02 | 11/28/1985 | 08:33 | 2.85 days | 166 |
| 228 | 12/28/2000 | 04:27 | 12/31/2000 | 00:26 | 2.83 days | 167 |
| 85 | 04/29/1958 | 10:13 | 05/02/1958 | 05:53 | 2.81 days | 168 |
| 229 | 01/19/2001 | 15:50 | 01/22/2001 | 10:13 | 2.76 days | 169 |
| 77 | 05/25/1952 | 15:42 | 05/28/1952 | 08:00 | 2.67 days | 170 |
| 66 | 08/27/1947 | 00:10 | 08/29/1947 | 16:15 | 2.67 days | 171 |
| 43 | 03/16/1945 | 16:53 | 03/19/1945 | 07:25 | 2.60 days | 172 |
| 58 | 11/06/1946 | 02:54 | 11/08/1946 | 16:17 | 2.55 days | 173 |
| 36 | 11/26/1944 | 01:51 | 11/28/1944 | 14:58 | 2.54 days | 174 |
| 144 | 05/01/1976 | 07:49 | 05/03/1976 | 19:27 | 2.48 days | 175 |
| 80 | 12/03/1953 | 17:11 | 12/06/1953 | 04:32 | 2.47 days | 176 |
| 62 | 03/13/1947 | 14:53 | 03/16/1947 | 00:57 | 2.41 days | 177 |
| 111 | 09/19/1966 | 02:18 | 09/21/1966 | 11:06 | 2.36 days | 178 |
| 171 | 02/25/1985 | 06:57 | 02/27/1985 | 15:17 | 2.34 days | 179 |
| 83 | 11/26/1957 | 01:46 | 11/28/1957 | 09:49 | 2.33 days | 180 |
| 245 | 10/11/2003 | 07:25 | 10/13/2003 | 15:02 | 2.31 days | 181 |
| 32 | 03/23/1944 | 23:47 | 03/26/1944 | 07:17 | 2.31 days | 182 |
| 48 | 07/12/1945 | 14:44 | 07/14/1945 | 20:43 | 2.24 days | 183 |
| 179 | 12/17/1986 | 06:44 | 12/19/1986 | 10:44 | 2.16 days | 184 |
| 242 | 12/25/2002 | 14:48 | 12/27/2002 | 17:26 | 2.11 days | 185 |
| 79 | 10/27/1953 | 22:01 | 10/30/1953 | 00:25 | 2.1 days | 186 |
| 132 | 05/08/1973 | 17:18 | 05/10/1973 | 19:29 | 2.09 days | 187 |
| 71 | 05/20/1949 | 04:30 | 05/22/1949 | 06:37 | 2.08 days | 188 |
| 73 | 04/18/1950 | 21:00 | 04/20/1950 | 23:05 | 2.08 days | 189 |
| 60 | 12/14/1946 | 07:10 | 12/16/1946 | 09:06 | 2.08 days | 190 |
| 19 | 10/07/1941 | 23:52 | 10/10/1941 | 01:11 | 2.05 days | 191 |
| 154 | 02/07/1979 | 14:09 | 02/09/1979 | 14:26 | 2.01 days | 192 |
| 166 | 11/05/1981 | 23:52 | 11/07/1981 | 22:53 | 1.95 days | 193 |
| 146 | 05/14/1976 | 17:16 | 05/16/1976 | 16:13 | 1.95 days | 194 |
| 116 | 04/08/1968 | 19:05 | 04/10/1968 | 18:01 | 1.95 days | 195 |
| 54 | 03/26/1946 | 18:56 | 03/28/1946 | 17:23 | 1.93 days | 196 |
| 65 | 05/29/1947 | 14:47 | 05/31/1947 | 13:03 | 1.92 days | 197 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 69 | 04/22/1949 | 04:47 | 04/24/1949 | 02:05 | 1.88 days | 198 |
| 20 | 10/30/1941 | 21:55 | 11/01/1941 | 18:44 | 1.86 days | 199 |
| 199 | 04/08/1993 | 23:18 | 04/10/1993 | 20:05 | 1.86 days | 200 |
| 89 | 04/18/1959 | 08:11 | 04/20/1959 | 04:18 | 1.83 days | 201 |
| 23 | 05/08/1942 | 16:34 | 05/10/1942 | 12:08 | 1.81 days | 202 |
| 75 | 06/06/1950 | 22:08 | 06/08/1950 | 15:56 | 1.74 days | 203 |
| 127 | 12/11/1971 | 16:53 | 12/13/1971 | 10:38 | 1.73 days | 204 |
| 220 | 02/23/1998 | 19:48 | 02/25/1998 | 12:59 | 1.71 days | 205 |
| 147 | 06/01/1976 | 14:54 | 06/03/1976 | 06:22 | 1.64 days | 206 |
| 164 | 10/15/1981 | 16:39 | 10/17/1981 | 06:44 | 1.58 days | 207 |
| 235 | 11/18/2001 | 12:04 | 11/20/2001 | 01:19 | 1.55 days | 208 |
| 74 | 06/02/1950 | 16:35 | 06/04/1950 | 05:30 | 1.53 days | 209 |
| 94 | 05/01/1960 | 01:54 | 05/02/1960 | 14:48 | 1.53 days | 210 |
| 180 | 12/20/1986 | 09:21 | 12/21/1986 | 20:33 | 1.46 days | 211 |
| 234 | 09/01/2001 | 21:20 | 09/03/2001 | 08:08 | 1.45 days | 212 |
| 140 | 04/13/1975 | 19:37 | 04/15/1975 | 05:21 | 1.40 days | 213 |
| 151 | 02/19/1977 | 03:40 | 02/20/1977 | 13:21 | 1.40 days | 214 |
| 168 | 07/01/1982 | 18:22 | 07/03/1982 | 03:35 | 1.38 days | 215 |
| 103 | 06/27/1961 | 23:35 | 06/29/1961 | 06:34 | 1.29 days | 216 |
| 237 | 12/24/2001 | 07:28 | 12/25/2001 | 14:22 | 1.28 days | 217 |
| 195 | 04/19/1992 | 19:08 | 04/21/1992 | 02:01 | 1.28 days | 218 |
| 232 | 05/09/2001 | 01:48 | 05/10/2001 | 08:30 | 1.27 days | 219 |
| 76 | 04/24/1952 | 16:11 | 04/25/1952 | 22:04 | 1.24 days | 220 |
| 4 | 08/21/1940 | 18:21 | 08/22/1940 | 23:46 | 1.22 days | 221 |
| 92 | 01/07/1960 | 13:46 | 01/08/1960 | 17:42 | 1.16 days | 222 |
| 148 | 07/07/1976 | 03:54 | 07/08/1976 | 07:32 | 1.15 days | 223 |
| 30 | 02/10/1944 | 19:44 | 02/11/1944 | 23:19 | 1.14 days | 224 |
| 50 | 12/04/1945 | 23:21 | 12/06/1945 | 02:55 | 1.14 days | 225 |
| 122 | 02/21/1969 | 15:06 | 02/22/1969 | 18:07 | 1.12 days | 226 |
| 178 | 06/18/1986 | 14:38 | 06/19/1986 | 17:11 | 1.10 days | 227 |
| 41 | 03/01/1945 | 16:24 | 03/02/1945 | 18:55 | 1.10 days | 228 |
| 239 | 10/25/2002 | 00:18 | 10/26/2002 | 02:22 | 1.08 days | 229 |
| 204 | 12/30/1994 | 19:34 | 12/31/1994 | 21:03 | 1.06 days | 230 |
| 128 | 01/27/1973 | 15:25 | 01/28/1973 | 16:52 | 1.06 days | 231 |
| 238 | 08/15/2002 | 11:40 | 08/16/2002 | 13:02 | 1.05 days | 232 |
| 16 | 06/04/1941 | 21:41 | 06/05/1941 | 22:53 | 1.05 days | 233 |
| 96 | 10/20/1960 | 15:18 | 10/21/1960 | 15:24 | 1.00 days | 234 |
| 67 | 05/13/1948 | 12:02 | 05/14/1948 | 12:02 | 1.00 days | 235 |
| 188 | 03/17/1990 | 10:37 | 03/18/1990 | 10:37 | 1.00 days | 236 |
| 87 | 07/11/1958 | 12:10 | 07/12/1958 | 12:09 | 0.99 days | 237 |
| 172 | 03/02/1985 | 13:45 | 03/03/1985 | 13:21 | 0.98 days | 238 |
| 104 | 07/12/1961 | 17:31 | 07/13/1961 | 14:19 | 0.86 days | 239 |
| 243 | 01/02/2003 | 20:22 | 01/03/2003 | 16:46 | 0.84 days | 240 |
| 250 | 06/24/2004 | 17:25 | 06/25/2004 | 13:13 | 0.82 days | 241 |
| 2 | 06/21/1939 | 21:08 | 06/22/1939 | 16:51 | 0.82 days | 242 |
| 55 | 04/26/1946 | 03:08 | 04/26/1946 | 21:20 | 0.75 days | 243 |
| 49 | 08/29/1945 | 20:59 | 08/30/1945 | 15:06 | 0.75 days | 244 |
| 46 | 06/15/1945 | 07:09 | 06/16/1945 | 00:26 | 0.72 days | 245 |
| 212 | 04/17/1997 | 12:43 | 04/18/1997 | 04:21 | 0.65 days | 246 |
| 68 | 02/28/1949 | 08:56 | 03/01/1949 | 00:14 | 0.63 days | 247 |
| 47 | 06/21/1945 | 07:17 | 06/21/1945 | 19:06 | 0.49 days | 248 |
| 93 | 02/06/1960 | 10:27 | 02/06/1960 | 22:15 | 0.49 days | 249 |
| 233 | 06/09/2001 | 16:12 | 06/10/2001 | 00:40 | 0.35 days | 250 |
| 209 | 09/21/1996 | 19:10 | 09/22/1996 | 02:24 | 0.30 days | 251 |

Korthauer Bottom Oxbow Connections to the Brazos River – Chronology of Disconnections
 Jordan Furnans, TWDB 11/3/2004, 8:57

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 126.6 ft
 Measured River Slope (Using TWDB GPS): 1.09 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 55423.2283 ft (10.49 miles)
 Distance downstream to Richmond Gauge from Oxbow: 487335.958 ft (92.29 miles)
 Estimated Critical Gauge Height/WSE: 25.5015/138.0415 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 26.5015/139.0415 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-11/1/2004
 Number of Records: 100268
 Years of Record: 66.0852
 Number of Critical WSE Exceedences: 282
 Number of "significant" WSE Exceedences: 251
 Average Connections per year: 3.7981
 Flood Level Probability of Connection: 0.26329 year flood (20543.0753 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|----------------------------------|
| 251 | 07/10/2004 17:28 | 11/01/2004 03:00 | 113.39 days | 53 | Disconnected Period Not Complete |
| 250 | 06/25/2004 13:13 | 06/27/2004 12:14 | 2.19 days | 234 | |
| 249 | 06/22/2004 20:43 | 06/24/2004 17:25 | 2.26 days | 232 | |
| 248 | 05/20/2004 00:20 | 06/10/2004 21:47 | 22.64 days | 134 | |
| 247 | 05/07/2004 06:48 | 05/14/2004 01:52 | 7.33 days | 188 | |
| 246 | 02/15/2004 07:58 | 05/03/2004 13:56 | 79.14 days | 67 | |
| 245 | 10/13/2003 15:02 | 02/11/2004 09:30 | 121.26 days | 47 | |
| 244 | 03/08/2003 16:03 | 10/11/2003 07:25 | 217.04 days | 32 | |
| 243 | 01/03/2003 16:46 | 02/21/2003 05:46 | 48.77 days | 91 | |
| 242 | 12/27/2002 17:26 | 01/02/2003 20:22 | 6.47 days | 197 | |
| 241 | 12/15/2002 19:09 | 12/25/2002 14:48 | 10.58 days | 174 | |
| 240 | 11/10/2002 12:48 | 12/11/2002 05:37 | 31.30 days | 116 | |
| 239 | 10/26/2002 02:22 | 11/04/2002 11:54 | 10.26 days | 176 | |
| 238 | 08/16/2002 13:02 | 10/25/2002 00:18 | 69.76 days | 71 | |
| 237 | 12/25/2001 14:22 | 08/15/2002 11:40 | 233.02 days | 29 | |
| 236 | 12/22/2001 04:37 | 12/24/2001 07:28 | 2.57 days | 229 | |
| 235 | 11/20/2001 01:19 | 12/17/2001 09:51 | 28.17 days | 123 | |
| 234 | 09/03/2001 08:08 | 11/18/2001 12:04 | 76.24 days | 69 | |
| 233 | 06/10/2001 00:40 | 09/01/2001 21:20 | 84.18 days | 61 | |
| 232 | 05/10/2001 08:30 | 06/09/2001 16:12 | 30.51 days | 118 | |
| 231 | 04/03/2001 06:25 | 05/09/2001 01:48 | 36.57 days | 107 | |
| 230 | 03/23/2001 15:36 | 03/28/2001 20:18 | 5.49 days | 199 | |
| 229 | 01/22/2001 10:13 | 03/03/2001 01:59 | 40.61 days | 102 | |
| 228 | 12/31/2000 00:26 | 01/19/2001 15:50 | 20.44 days | 139 | |
| 227 | 11/09/2000 13:44 | 12/28/2000 04:27 | 49.05 days | 90 | |
| 226 | 02/06/1999 14:25 | 11/05/2000 12:31 | 638.42 days | 6 | |
| 225 | 12/20/1998 08:24 | 02/02/1999 11:20 | 44.45 days | 94 | |
| 224 | 11/22/1998 12:58 | 12/12/1998 01:39 | 20.15 days | 141 | |
| 223 | 10/26/1998 20:58 | 11/12/1998 19:38 | 17.55 days | 146 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 222 | 03/28/1998 | 23:28 | 10/18/1998 | 13:25 | 203.99 days | 34 |
| 221 | 03/02/1998 | 04:13 | 03/19/1998 | 03:10 | 17.12 days | 149 |
| 220 | 02/25/1998 | 12:59 | 02/26/1998 | 05:36 | 1.26 days | 244 |
| 219 | 01/19/1998 | 00:58 | 02/23/1998 | 19:48 | 36.55 days | 108 |
| 218 | 12/27/1997 | 00:53 | 01/06/1998 | 18:48 | 11.51 days | 169 |
| 217 | 07/02/1997 | 19:55 | 12/22/1997 | 20:29 | 173.48 days | 38 |
| 216 | 06/15/1997 | 09:16 | 06/29/1997 | 20:38 | 15.08 days | 159 |
| 215 | 05/30/1997 | 13:22 | 06/10/1997 | 22:03 | 11.42 days | 170 |
| 214 | 05/21/1997 | 19:15 | 05/26/1997 | 03:12 | 4.53 days | 205 |
| 213 | 05/10/1997 | 04:42 | 05/13/1997 | 05:13 | 3.23 days | 219 |
| 212 | 04/18/1997 | 04:21 | 04/26/1997 | 13:05 | 8.44 days | 182 |
| 211 | 04/16/1997 | 18:14 | 04/17/1997 | 12:43 | 1.46 days | 241 |
| 210 | 03/31/1997 | 09:25 | 04/05/1997 | 10:16 | 5.29 days | 201 |
| 209 | 09/22/1996 | 02:24 | 02/14/1997 | 02:16 | 145.25 days | 45 |
| 208 | 08/09/1995 | 23:22 | 09/21/1996 | 19:10 | 408.98 days | 13 |
| 207 | 06/04/1995 | 12:04 | 08/04/1995 | 13:22 | 61.05 days | 73 |
| 206 | 05/19/1995 | 02:25 | 06/01/1995 | 15:13 | 13.53 days | 164 |
| 205 | 03/19/1995 | 16:43 | 05/11/1995 | 07:13 | 52.60 days | 86 |
| 204 | 12/31/1994 | 21:03 | 03/15/1995 | 03:17 | 73.26 days | 70 |
| 203 | 12/21/1994 | 23:34 | 12/30/1994 | 19:34 | 8.83 days | 179 |
| 202 | 10/23/1994 | 08:19 | 12/17/1994 | 04:25 | 54.83 days | 82 |
| 201 | 06/26/1993 | 23:08 | 10/17/1994 | 00:32 | 477.05 days | 10 |
| 200 | 05/14/1993 | 19:12 | 06/19/1993 | 12:19 | 35.71 days | 109 |
| 199 | 04/10/1993 | 20:05 | 05/06/1993 | 08:56 | 25.53 days | 129 |
| 198 | 03/31/1993 | 23:37 | 04/08/1993 | 23:18 | 7.98 days | 184 |
| 197 | 06/22/1992 | 15:28 | 03/19/1993 | 14:30 | 269.95 days | 24 |
| 196 | 05/30/1992 | 06:04 | 06/01/1992 | 08:21 | 2.09 days | 237 |
| 195 | 04/21/1992 | 02:01 | 05/17/1992 | 23:25 | 26.89 days | 126 |
| 194 | 04/07/1992 | 02:26 | 04/19/1992 | 19:08 | 12.69 days | 167 |
| 193 | 11/09/1991 | 17:50 | 12/22/1991 | 09:28 | 42.65 days | 98 |
| 192 | 04/17/1991 | 22:31 | 11/04/1991 | 16:25 | 200.74 days | 35 |
| 191 | 01/23/1991 | 09:09 | 04/14/1991 | 13:19 | 81.17 days | 63 |
| 190 | 06/17/1990 | 04:26 | 01/11/1991 | 04:09 | 207.98 days | 33 |
| 189 | 06/10/1990 | 04:04 | 06/11/1990 | 17:42 | 1.56 days | 240 |
| 188 | 03/18/1990 | 10:37 | 04/27/1990 | 06:12 | 39.81 days | 104 |
| 187 | 06/26/1989 | 11:26 | 03/17/1990 | 10:37 | 263.96 days | 27 |
| 186 | 06/02/1989 | 10:38 | 06/16/1989 | 09:17 | 13.94 days | 162 |
| 185 | 05/23/1989 | 09:49 | 05/24/1989 | 08:14 | 0.93 days | 249 |
| 184 | 06/29/1987 | 23:37 | 05/18/1989 | 16:12 | 688.69 days | 3 |
| 183 | 03/12/1987 | 05:43 | 05/31/1987 | 17:06 | 80.47 days | 64 |
| 182 | 03/03/1987 | 08:04 | 03/06/1987 | 18:37 | 3.43 days | 215 |
| 181 | 12/28/1986 | 21:55 | 02/26/1987 | 12:03 | 59.58 days | 77 |
| 180 | 12/21/1986 | 20:33 | 12/23/1986 | 05:30 | 1.37 days | 242 |
| 179 | 12/19/1986 | 10:44 | 12/20/1986 | 09:21 | 0.94 days | 248 |
| 178 | 06/19/1986 | 17:11 | 12/17/1986 | 06:44 | 180.56 days | 37 |
| 177 | 06/16/1986 | 18:40 | 06/18/1986 | 14:38 | 1.83 days | 239 |
| 176 | 02/08/1986 | 23:59 | 06/09/1986 | 07:49 | 120.32 days | 48 |
| 175 | 12/15/1985 | 21:52 | 02/04/1986 | 13:41 | 50.65 days | 88 |
| 174 | 12/02/1985 | 14:25 | 12/13/1985 | 00:44 | 10.42 days | 175 |
| 173 | 11/28/1985 | 08:33 | 11/29/1985 | 11:49 | 1.13 days | 247 |
| 172 | 03/03/1985 | 13:21 | 11/25/1985 | 12:02 | 266.94 days | 25 |
| 171 | 02/27/1985 | 15:17 | 03/02/1985 | 13:45 | 2.93 days | 222 |
| 170 | 11/01/1984 | 19:30 | 02/25/1985 | 06:57 | 115.47 days | 50 |
| 169 | 05/26/1983 | 12:06 | 10/21/1984 | 15:37 | 514.14 days | 8 |
| 168 | 07/03/1982 | 03:35 | 05/20/1983 | 21:16 | 321.73 days | 17 |
| 167 | 06/05/1982 | 19:47 | 07/01/1982 | 18:22 | 25.94 days | 127 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 166 | 11/07/1981 | 22:53 | 05/15/1982 | 09:19 | 188.43 days | 36 |
| 165 | 11/03/1981 | 09:06 | 11/05/1981 | 23:52 | 2.61 days | 228 |
| 164 | 10/17/1981 | 06:44 | 10/17/1981 | 22:53 | 0.67 days | 250 |
| 163 | 06/27/1981 | 06:11 | 10/15/1981 | 16:39 | 110.43 days | 54 |
| 162 | 06/09/1981 | 19:27 | 06/12/1981 | 01:14 | 2.24 days | 233 |
| 161 | 05/22/1980 | 21:40 | 06/05/1981 | 17:40 | 378.83 days | 14 |
| 160 | 07/31/1979 | 22:10 | 05/14/1980 | 17:26 | 287.80 days | 22 |
| 159 | 06/14/1979 | 03:30 | 07/27/1979 | 15:46 | 43.51 days | 96 |
| 158 | 05/27/1979 | 19:35 | 05/29/1979 | 23:03 | 2.14 days | 236 |
| 157 | 05/16/1979 | 06:44 | 05/23/1979 | 06:55 | 7.00 days | 191 |
| 156 | 04/07/1979 | 04:14 | 05/12/1979 | 04:59 | 35.03 days | 110 |
| 155 | 03/27/1979 | 04:01 | 04/01/1979 | 13:22 | 5.38 days | 200 |
| 154 | 02/09/1979 | 14:26 | 03/22/1979 | 07:40 | 40.71 days | 100 |
| 153 | 05/09/1977 | 17:22 | 02/07/1979 | 14:09 | 638.86 days | 5 |
| 152 | 04/05/1977 | 12:34 | 04/16/1977 | 21:06 | 11.35 days | 172 |
| 151 | 02/20/1977 | 13:21 | 03/31/1977 | 13:51 | 39.02 days | 105 |
| 150 | 02/17/1977 | 21:29 | 02/19/1977 | 03:40 | 1.25 days | 245 |
| 149 | 12/20/1976 | 12:11 | 02/11/1977 | 20:16 | 53.33 days | 85 |
| 148 | 07/08/1976 | 07:32 | 12/11/1976 | 20:26 | 156.53 days | 42 |
| 147 | 06/03/1976 | 06:22 | 07/07/1976 | 03:54 | 33.89 days | 113 |
| 146 | 05/16/1976 | 16:13 | 06/01/1976 | 14:54 | 15.94 days | 154 |
| 145 | 05/11/1976 | 11:11 | 05/14/1976 | 17:16 | 3.25 days | 218 |
| 144 | 05/03/1976 | 19:27 | 05/08/1976 | 01:21 | 4.24 days | 207 |
| 143 | 04/24/1976 | 01:39 | 05/01/1976 | 07:49 | 7.25 days | 189 |
| 142 | 06/08/1975 | 03:45 | 04/19/1976 | 20:46 | 316.70 days | 19 |
| 141 | 05/14/1975 | 13:00 | 05/24/1975 | 18:14 | 10.21 days | 177 |
| 140 | 04/15/1975 | 05:21 | 05/10/1975 | 11:36 | 25.26 days | 131 |
| 139 | 02/13/1975 | 02:34 | 04/13/1975 | 19:37 | 59.71 days | 76 |
| 138 | 11/29/1974 | 04:00 | 02/03/1975 | 22:07 | 66.75 days | 72 |
| 137 | 11/17/1974 | 12:05 | 11/25/1974 | 02:56 | 7.61 days | 187 |
| 136 | 09/22/1974 | 07:21 | 11/01/1974 | 22:26 | 40.62 days | 101 |
| 135 | 01/30/1974 | 09:01 | 09/14/1974 | 02:36 | 226.73 days | 30 |
| 134 | 10/23/1973 | 10:52 | 01/24/1974 | 16:55 | 93.25 days | 58 |
| 133 | 06/18/1973 | 16:30 | 10/12/1973 | 15:46 | 115.96 days | 49 |
| 132 | 05/10/1973 | 19:29 | 06/05/1973 | 16:21 | 25.86 days | 128 |
| 131 | 05/04/1973 | 11:34 | 05/08/1973 | 17:18 | 4.23 days | 208 |
| 130 | 04/22/1973 | 16:59 | 04/25/1973 | 18:13 | 3.05 days | 220 |
| 129 | 03/28/1973 | 18:00 | 04/17/1973 | 22:01 | 20.16 days | 140 |
| 128 | 01/28/1973 | 16:52 | 03/23/1973 | 12:56 | 53.83 days | 84 |
| 127 | 12/13/1971 | 10:38 | 01/27/1973 | 15:25 | 411.19 days | 12 |
| 126 | 03/14/1970 | 08:32 | 12/11/1971 | 16:53 | 637.34 days | 7 |
| 125 | 05/20/1969 | 13:29 | 03/08/1970 | 11:00 | 291.89 days | 20 |
| 124 | 04/22/1969 | 00:04 | 05/09/1969 | 06:28 | 17.26 days | 148 |
| 123 | 03/18/1969 | 22:41 | 04/13/1969 | 05:21 | 25.27 days | 130 |
| 122 | 02/22/1969 | 18:07 | 03/15/1969 | 12:27 | 20.76 days | 138 |
| 121 | 07/16/1968 | 08:32 | 02/21/1969 | 15:06 | 220.27 days | 31 |
| 120 | 07/01/1968 | 21:21 | 07/08/1968 | 14:35 | 6.71 days | 194 |
| 119 | 06/09/1968 | 06:13 | 06/24/1968 | 10:24 | 15.17 days | 156 |
| 118 | 05/31/1968 | 06:33 | 06/04/1968 | 01:36 | 3.79 days | 212 |
| 117 | 04/16/1968 | 21:36 | 05/09/1968 | 18:25 | 22.86 days | 133 |
| 116 | 04/10/1968 | 18:01 | 04/12/1968 | 17:22 | 1.97 days | 238 |
| 115 | 03/28/1968 | 03:42 | 04/08/1968 | 19:05 | 11.64 days | 168 |
| 114 | 03/15/1968 | 22:02 | 03/22/1968 | 15:09 | 6.71 days | 195 |
| 113 | 02/01/1968 | 14:15 | 03/12/1968 | 21:08 | 40.28 days | 103 |
| 112 | 09/24/1966 | 20:21 | 01/20/1968 | 18:40 | 482.93 days | 9 |
| 111 | 09/21/1966 | 11:06 | 09/21/1966 | 22:47 | 0.48 days | 251 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 110 | 05/17/1966 | 04:05 | 09/19/1966 | 02:18 | 124.92 days | 46 |
| 109 | 06/09/1965 | 18:01 | 04/26/1966 | 11:38 | 320.73 days | 18 |
| 108 | 06/03/1965 | 21:25 | 06/06/1965 | 20:52 | 2.97 days | 221 |
| 107 | 02/22/1965 | 05:19 | 05/11/1965 | 12:01 | 78.27 days | 68 |
| 106 | 01/26/1965 | 11:21 | 02/12/1965 | 02:18 | 16.62 days | 153 |
| 105 | 09/17/1961 | 11:21 | 01/23/1965 | 02:38 | 16.62 days | 2 |
| 104 | 07/13/1961 | 14:19 | 09/11/1961 | 18:55 | 60.19 days | 75 |
| 103 | 06/29/1961 | 06:34 | 07/12/1961 | 17:31 | 13.45 days | 165 |
| 102 | 06/25/1961 | 19:07 | 06/27/1961 | 23:35 | 2.18 days | 235 |
| 101 | 02/25/1961 | 13:21 | 06/18/1961 | 23:47 | 113.43 days | 52 |
| 100 | 01/23/1961 | 00:36 | 02/05/1961 | 16:28 | 13.66 days | 163 |
| 99 | 12/19/1960 | 13:15 | 01/08/1961 | 01:47 | 19.52 days | 143 |
| 98 | 11/26/1960 | 01:19 | 12/08/1960 | 21:56 | 12.85 days | 166 |
| 97 | 11/03/1960 | 12:05 | 11/21/1960 | 19:46 | 18.32 days | 144 |
| 96 | 10/21/1960 | 15:24 | 10/28/1960 | 12:10 | 6.86 days | 193 |
| 95 | 06/28/1960 | 16:28 | 10/20/1960 | 15:18 | 113.95 days | 51 |
| 94 | 05/02/1960 | 14:48 | 06/25/1960 | 16:29 | 54.07 days | 83 |
| 93 | 02/06/1960 | 22:15 | 05/01/1960 | 01:54 | 84.15 days | 62 |
| 92 | 01/08/1960 | 17:42 | 02/06/1960 | 10:27 | 28.69 days | 121 |
| 91 | 12/20/1959 | 06:52 | 01/07/1960 | 13:46 | 18.28 days | 145 |
| 90 | 10/21/1959 | 06:49 | 12/16/1959 | 13:29 | 56.27 days | 79 |
| 89 | 04/20/1959 | 04:18 | 10/05/1959 | 16:35 | 168.51 days | 39 |
| 88 | 04/15/1959 | 16:30 | 04/18/1959 | 08:11 | 2.65 days | 227 |
| 87 | 07/12/1958 | 12:09 | 04/11/1959 | 18:22 | 273.25 days | 23 |
| 86 | 05/17/1958 | 04:29 | 07/11/1958 | 12:10 | 55.31 days | 81 |
| 85 | 05/02/1958 | 05:53 | 05/03/1958 | 10:19 | 1.18 days | 246 |
| 84 | 03/01/1958 | 22:37 | 04/29/1958 | 10:13 | 58.48 days | 78 |
| 83 | 11/28/1957 | 09:49 | 02/24/1958 | 04:59 | 87.79 days | 59 |
| 82 | 10/28/1957 | 23:39 | 11/26/1957 | 01:46 | 28.08 days | 124 |
| 81 | 07/07/1957 | 15:24 | 10/14/1957 | 18:15 | 99.11 days | 55 |
| 80 | 12/06/1953 | 04:32 | 04/18/1957 | 13:26 | 99.11 days | 1 |
| 79 | 10/30/1953 | 00:25 | 12/03/1953 | 17:11 | 34.69 days | 112 |
| 78 | 05/24/1953 | 23:58 | 10/27/1953 | 22:01 | 155.91 days | 43 |
| 77 | 05/28/1952 | 08:00 | 05/13/1953 | 22:48 | 350.61 days | 16 |
| 76 | 04/25/1952 | 22:04 | 05/25/1952 | 15:42 | 29.73 days | 119 |
| 75 | 06/08/1950 | 15:56 | 04/24/1952 | 16:11 | 686.01 days | 4 |
| 74 | 06/04/1950 | 05:30 | 06/06/1950 | 22:08 | 2.69 days | 226 |
| 73 | 04/20/1950 | 23:05 | 06/02/1950 | 16:35 | 42.72 days | 97 |
| 72 | 02/17/1950 | 06:46 | 04/18/1950 | 21:00 | 60.59 days | 74 |
| 71 | 05/22/1949 | 06:37 | 02/12/1950 | 21:46 | 266.63 days | 26 |
| 70 | 05/02/1949 | 20:41 | 05/20/1949 | 04:30 | 17.32 days | 147 |
| 69 | 04/24/1949 | 02:05 | 04/27/1949 | 08:17 | 3.25 days | 217 |
| 68 | 03/01/1949 | 00:14 | 04/22/1949 | 04:47 | 52.18 days | 87 |
| 67 | 05/14/1948 | 12:02 | 02/28/1949 | 08:56 | 289.87 days | 21 |
| 66 | 08/29/1947 | 16:15 | 05/13/1948 | 12:02 | 257.82 days | 28 |
| 65 | 05/31/1947 | 13:03 | 08/27/1947 | 00:10 | 87.46 days | 60 |
| 64 | 05/25/1947 | 22:35 | 05/29/1947 | 14:47 | 3.67 days | 213 |
| 63 | 03/23/1947 | 14:40 | 05/18/1947 | 12:04 | 55.89 days | 80 |
| 62 | 03/16/1947 | 00:57 | 03/19/1947 | 20:20 | 3.80 days | 211 |
| 61 | 01/23/1947 | 08:46 | 03/13/1947 | 14:53 | 49.25 days | 89 |
| 60 | 12/16/1946 | 09:06 | 01/17/1947 | 19:00 | 32.41 days | 114 |
| 59 | 11/20/1946 | 15:55 | 12/14/1946 | 07:10 | 23.63 days | 132 |
| 58 | 11/08/1946 | 16:17 | 11/16/1946 | 22:27 | 8.25 days | 183 |
| 57 | 06/05/1946 | 19:34 | 11/06/1946 | 02:54 | 153.30 days | 44 |
| 56 | 05/25/1946 | 09:48 | 06/02/1946 | 07:25 | 7.90 days | 185 |
| 55 | 04/26/1946 | 21:20 | 05/13/1946 | 14:30 | 16.71 days | 151 |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|-----|
| 54 | 03/28/1946 | 17:23 | 04/26/1946 | 03:08 | 28.40 days | 122 |
| 53 | 03/19/1946 | 21:55 | 03/26/1946 | 18:56 | 6.87 days | 192 |
| 52 | 02/24/1946 | 00:07 | 03/12/1946 | 22:39 | 16.93 days | 150 |
| 51 | 01/19/1946 | 19:52 | 02/20/1946 | 09:42 | 31.57 days | 115 |
| 50 | 12/06/1945 | 02:55 | 01/16/1946 | 00:44 | 40.90 days | 99 |
| 49 | 08/30/1945 | 15:06 | 12/04/1945 | 23:21 | 96.34 days | 56 |
| 48 | 07/14/1945 | 20:43 | 08/29/1945 | 20:59 | 46.01 days | 92 |
| 47 | 06/21/1945 | 19:06 | 07/12/1945 | 14:44 | 20.81 days | 137 |
| 46 | 06/16/1945 | 00:26 | 06/21/1945 | 07:17 | 5.28 days | 202 |
| 45 | 05/02/1945 | 04:28 | 06/15/1945 | 07:09 | 44.11 days | 95 |
| 44 | 04/11/1945 | 20:59 | 04/21/1945 | 14:51 | 9.74 days | 178 |
| 43 | 03/19/1945 | 07:25 | 03/30/1945 | 17:23 | 11.41 days | 171 |
| 42 | 03/10/1945 | 00:05 | 03/16/1945 | 16:53 | 6.70 days | 196 |
| 41 | 03/02/1945 | 18:55 | 03/04/1945 | 01:43 | 1.28 days | 243 |
| 40 | 02/26/1945 | 09:21 | 03/01/1945 | 16:24 | 3.29 days | 216 |
| 39 | 01/25/1945 | 09:21 | 02/21/1945 | 23:19 | 27.58 days | 125 |
| 38 | 01/03/1945 | 19:19 | 01/18/1945 | 21:37 | 15.09 days | 158 |
| 37 | 12/09/1944 | 22:27 | 12/30/1944 | 23:38 | 21.04 days | 135 |
| 36 | 11/28/1944 | 14:58 | 12/05/1944 | 18:37 | 7.15 days | 190 |
| 35 | 06/11/1944 | 18:22 | 11/26/1944 | 01:51 | 167.31 days | 40 |
| 34 | 06/04/1944 | 01:55 | 06/06/1944 | 20:49 | 2.78 days | 225 |
| 33 | 05/15/1944 | 01:43 | 05/25/1944 | 22:44 | 10.87 days | 173 |
| 32 | 03/26/1944 | 07:17 | 05/02/1944 | 06:15 | 36.95 days | 106 |
| 31 | 03/04/1944 | 03:45 | 03/23/1944 | 23:47 | 19.83 days | 142 |
| 30 | 02/11/1944 | 23:19 | 02/26/1944 | 16:57 | 14.73 days | 160 |
| 29 | 02/02/1944 | 00:07 | 02/10/1944 | 19:44 | 8.81 days | 180 |
| 28 | 10/24/1942 | 23:02 | 01/29/1944 | 19:32 | 461.85 days | 11 |
| 27 | 09/15/1942 | 04:52 | 10/20/1942 | 04:15 | 34.97 days | 111 |
| 26 | 06/20/1942 | 22:53 | 09/08/1942 | 16:21 | 79.72 days | 65 |
| 25 | 05/30/1942 | 21:09 | 06/08/1942 | 13:53 | 8.69 days | 181 |
| 24 | 05/16/1942 | 05:58 | 05/20/1942 | 02:34 | 3.85 days | 210 |
| 23 | 05/10/1942 | 12:08 | 05/13/1942 | 07:31 | 2.80 days | 224 |
| 22 | 05/05/1942 | 03:34 | 05/08/1942 | 16:34 | 3.54 days | 214 |
| 21 | 04/18/1942 | 00:12 | 04/22/1942 | 07:15 | 4.29 days | 206 |
| 20 | 11/01/1941 | 18:44 | 04/09/1942 | 10:39 | 158.66 days | 41 |
| 19 | 10/10/1941 | 01:11 | 10/30/1941 | 21:55 | 20.86 days | 136 |
| 18 | 07/20/1941 | 08:08 | 10/07/1941 | 23:52 | 79.65 days | 66 |
| 17 | 06/26/1941 | 05:17 | 07/12/1941 | 20:59 | 16.65 days | 152 |
| 16 | 06/05/1941 | 22:53 | 06/11/1941 | 02:55 | 5.16 days | 203 |
| 15 | 06/02/1941 | 00:23 | 06/04/1941 | 21:41 | 2.88 days | 223 |
| 14 | 05/02/1941 | 20:27 | 05/05/1941 | 07:40 | 2.46 days | 231 |
| 13 | 04/27/1941 | 08:58 | 04/29/1941 | 21:49 | 2.53 days | 230 |
| 12 | 03/23/1941 | 16:24 | 04/23/1941 | 15:20 | 30.95 days | 117 |
| 11 | 03/12/1941 | 08:11 | 03/20/1941 | 03:50 | 7.81 days | 186 |
| 10 | 03/01/1941 | 03:31 | 03/07/1941 | 07:51 | 6.18 days | 198 |
| 9 | 02/09/1941 | 21:57 | 02/25/1941 | 04:30 | 15.27 days | 155 |
| 8 | 01/19/1941 | 00:08 | 02/03/1941 | 03:51 | 15.15 days | 157 |
| 7 | 12/31/1940 | 19:58 | 01/15/1941 | 01:07 | 14.21 days | 161 |
| 6 | 12/24/1940 | 10:14 | 12/28/1940 | 07:45 | 3.89 days | 209 |
| 5 | 12/07/1940 | 06:25 | 12/12/1940 | 06:24 | 4.99 days | 204 |
| 4 | 08/22/1940 | 23:46 | 11/24/1940 | 06:20 | 93.27 days | 57 |
| 3 | 07/08/1940 | 01:40 | 08/21/1940 | 18:21 | 44.69 days | 93 |
| 2 | 06/22/1939 | 16:51 | 06/30/1940 | 05:07 | 373.51 days | 15 |
| 1 | 05/23/1939 | 18:59 | 06/21/1939 | 21:08 | 29.09 days | 120 |

Korthauer Bottom Oxbow Connections to the Brazos River – Ranked by Disconnection Duration
 Jordan Furnans, TWDB 11/3/2004, 8:57

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 126.6 ft
 Measured River Slope (Using TWDB GPS): 1.09 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 55423.2283 ft (10.49 miles)
 Distance downstream to Richmond Gauge from Oxbow: 487335.958 ft (92.29 miles)
 Estimated Critical Gauge Height/WSE: 25.5015/138.0415 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 26.5015/139.0415 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-11/1/2004
 Number of Records: 100268
 Years of Record: 66.0852
 Number of Critical WSE Exceedences: 282
 Number of "significant" WSE Exceedences: 251
 Average Connections per year: 3.7981
 Flood Level Probability of Connection: 0.26329 year flood (20543.0753 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|--------------|------|-------|
| 80 | 12/06/1953 04:32 | 04/18/1957 13:26 | 1229.37 days | 1 | |
| 105 | 09/17/1961 11:21 | 01/23/1965 02:38 | 1223.63 days | 2 | |
| 184 | 06/29/1987 23:37 | 05/18/1989 16:12 | 688.69 days | 3 | |
| 75 | 06/08/1950 15:56 | 04/24/1952 16:11 | 686.01 days | 4 | |
| 153 | 05/09/1977 17:22 | 02/07/1979 14:09 | 638.86 days | 5 | |
| 226 | 02/06/1999 14:25 | 11/05/2000 12:31 | 638.42 days | 6 | |
| 126 | 03/14/1970 08:32 | 12/11/1971 16:53 | 637.34 days | 7 | |
| 169 | 05/26/1983 12:06 | 10/21/1984 15:37 | 514.14 days | 8 | |
| 112 | 09/24/1966 20:21 | 01/20/1968 18:40 | 482.93 days | 9 | |
| 201 | 06/26/1993 23:08 | 10/17/1994 00:32 | 477.05 days | 10 | |
| 28 | 10/24/1942 23:02 | 01/29/1944 19:32 | 461.85 days | 11 | |
| 127 | 12/13/1971 10:38 | 01/27/1973 15:25 | 411.19 days | 12 | |
| 208 | 08/09/1995 23:22 | 09/21/1996 19:10 | 408.98 days | 13 | |
| 161 | 05/22/1980 21:40 | 06/05/1981 17:40 | 378.83 days | 14 | |
| 2 | 06/22/1939 16:51 | 06/30/1940 05:07 | 373.51 days | 15 | |
| 77 | 05/28/1952 08:00 | 05/13/1953 22:48 | 350.61 days | 16 | |
| 168 | 07/03/1982 03:35 | 05/20/1983 21:16 | 321.73 days | 17 | |
| 109 | 06/09/1965 18:01 | 04/26/1966 11:38 | 320.73 days | 18 | |
| 142 | 06/08/1975 03:45 | 04/19/1976 20:46 | 316.70 days | 19 | |
| 125 | 05/20/1969 13:29 | 03/08/1970 11:00 | 291.89 days | 20 | |
| 67 | 05/14/1948 12:02 | 02/28/1949 08:56 | 289.87 days | 21 | |
| 160 | 07/31/1979 22:10 | 05/14/1980 17:26 | 287.80 days | 22 | |
| 87 | 07/12/1958 12:09 | 04/11/1959 18:22 | 273.25 days | 23 | |
| 197 | 06/22/1992 15:28 | 03/19/1993 14:30 | 269.95 days | 24 | |
| 172 | 03/03/1985 13:21 | 11/25/1985 12:02 | 266.94 days | 25 | |
| 71 | 05/22/1949 06:37 | 02/12/1950 21:46 | 266.63 days | 26 | |
| 187 | 06/26/1989 11:26 | 03/17/1990 10:37 | 263.96 days | 27 | |
| 66 | 08/29/1947 16:15 | 05/13/1948 12:02 | 257.82 days | 28 | |
| 237 | 12/25/2001 14:22 | 08/15/2002 11:40 | 233.02 days | 29 | |

| | | | | | | | |
|-----|------------|-------|------------|-------|-------------|----|----------------------------------|
| 135 | 01/30/1974 | 09:01 | 09/14/1974 | 02:36 | 226.73 days | 30 | |
| 121 | 07/16/1968 | 08:32 | 02/21/1969 | 15:06 | 220.27 days | 31 | |
| 244 | 03/08/2003 | 16:03 | 10/11/2003 | 07:25 | 217.04 days | 32 | |
| 190 | 06/17/1990 | 04:26 | 01/11/1991 | 04:09 | 207.98 days | 33 | |
| 222 | 03/28/1998 | 23:28 | 10/18/1998 | 13:25 | 203.99 days | 34 | |
| 192 | 04/17/1991 | 22:31 | 11/04/1991 | 16:25 | 200.74 days | 35 | |
| 166 | 11/07/1981 | 22:53 | 05/15/1982 | 09:19 | 188.43 days | 36 | |
| 178 | 06/19/1986 | 17:11 | 12/17/1986 | 06:44 | 180.56 days | 37 | |
| 217 | 07/02/1997 | 19:55 | 12/22/1997 | 20:29 | 173.48 days | 38 | |
| 89 | 04/20/1959 | 04:18 | 10/05/1959 | 16:35 | 168.51 days | 39 | |
| 35 | 06/11/1944 | 18:22 | 11/26/1944 | 01:51 | 167.31 days | 40 | |
| 20 | 11/01/1941 | 18:44 | 04/09/1942 | 10:39 | 158.66 days | 41 | |
| 148 | 07/08/1976 | 07:32 | 12/11/1976 | 20:26 | 156.53 days | 42 | |
| 78 | 05/24/1953 | 23:58 | 10/27/1953 | 22:01 | 155.91 days | 43 | |
| 57 | 06/05/1946 | 19:34 | 11/06/1946 | 02:54 | 153.30 days | 44 | |
| 209 | 09/22/1996 | 02:24 | 02/14/1997 | 02:16 | 145.25 days | 45 | |
| 110 | 05/17/1966 | 04:05 | 09/19/1966 | 02:18 | 124.92 days | 46 | |
| 245 | 10/13/2003 | 15:02 | 02/11/2004 | 09:30 | 121.26 days | 47 | |
| 176 | 02/08/1986 | 23:59 | 06/09/1986 | 07:49 | 120.32 days | 48 | |
| 133 | 06/18/1973 | 16:30 | 10/12/1973 | 15:46 | 115.96 days | 49 | |
| 170 | 11/01/1984 | 19:30 | 02/25/1985 | 06:57 | 115.47 days | 50 | |
| 95 | 06/28/1960 | 16:28 | 10/20/1960 | 15:18 | 113.95 days | 51 | |
| 101 | 02/25/1961 | 13:21 | 06/18/1961 | 23:47 | 113.43 days | 52 | |
| 251 | 07/10/2004 | 17:28 | 11/01/2004 | 03:00 | 113.39 days | 53 | Disconnected Period Not Complete |
| 163 | 06/27/1981 | 06:11 | 10/15/1981 | 16:39 | 110.43 days | 54 | |
| 81 | 07/07/1957 | 15:24 | 10/14/1957 | 18:15 | 99.11 days | 55 | |
| 49 | 08/30/1945 | 15:06 | 12/04/1945 | 23:21 | 96.34 days | 56 | |
| 4 | 08/22/1940 | 23:46 | 11/24/1940 | 06:20 | 93.27 days | 57 | |
| 134 | 10/23/1973 | 10:52 | 01/24/1974 | 16:55 | 93.25 days | 58 | |
| 83 | 11/28/1957 | 09:49 | 02/24/1958 | 04:59 | 87.79 days | 59 | |
| 65 | 05/31/1947 | 13:03 | 08/27/1947 | 00:10 | 87.46 days | 60 | |
| 233 | 06/10/2001 | 00:40 | 09/01/2001 | 21:20 | 84.18 days | 61 | |
| 93 | 02/06/1960 | 22:15 | 05/01/1960 | 01:54 | 84.15 days | 62 | |
| 191 | 01/23/1991 | 09:09 | 04/14/1991 | 13:19 | 81.17 days | 63 | |
| 183 | 03/12/1987 | 05:43 | 05/31/1987 | 17:06 | 80.47 days | 64 | |
| 26 | 06/20/1942 | 22:53 | 09/08/1942 | 16:21 | 79.72 days | 65 | |
| 18 | 07/20/1941 | 08:08 | 10/07/1941 | 23:52 | 79.65 days | 66 | |
| 246 | 02/15/2004 | 07:58 | 05/03/2004 | 13:56 | 79.14 days | 67 | |
| 107 | 02/22/1965 | 05:19 | 05/11/1965 | 12:01 | 78.27 days | 68 | |
| 234 | 09/03/2001 | 08:08 | 11/18/2001 | 12:04 | 76.24 days | 69 | |
| 204 | 12/31/1994 | 21:03 | 03/15/1995 | 03:17 | 73.26 days | 70 | |
| 238 | 08/16/2002 | 13:02 | 10/25/2002 | 00:18 | 69.76 days | 71 | |
| 138 | 11/29/1974 | 04:00 | 02/03/1975 | 22:07 | 66.75 days | 72 | |
| 207 | 06/04/1995 | 12:04 | 08/04/1995 | 13:22 | 61.05 days | 73 | |
| 72 | 02/17/1950 | 06:46 | 04/18/1950 | 21:00 | 60.59 days | 74 | |
| 104 | 07/13/1961 | 14:19 | 09/11/1961 | 18:55 | 60.19 days | 75 | |
| 139 | 02/13/1975 | 02:34 | 04/13/1975 | 19:37 | 59.71 days | 76 | |
| 181 | 12/28/1986 | 21:55 | 02/26/1987 | 12:03 | 59.58 days | 77 | |
| 84 | 03/01/1958 | 22:37 | 04/29/1958 | 10:13 | 58.48 days | 78 | |
| 90 | 10/21/1959 | 06:49 | 12/16/1959 | 13:29 | 56.27 days | 79 | |
| 63 | 03/23/1947 | 14:40 | 05/18/1947 | 12:04 | 55.89 days | 80 | |
| 86 | 05/17/1958 | 04:29 | 07/11/1958 | 12:10 | 55.31 days | 81 | |
| 202 | 10/23/1994 | 08:19 | 12/17/1994 | 04:25 | 54.83 days | 82 | |
| 94 | 05/02/1960 | 14:48 | 06/25/1960 | 16:29 | 54.07 days | 83 | |
| 128 | 01/28/1973 | 16:52 | 03/23/1973 | 12:56 | 53.83 days | 84 | |
| 149 | 12/20/1976 | 12:11 | 02/11/1977 | 20:16 | 53.33 days | 85 | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 205 | 03/19/1995 | 16:43 | 05/11/1995 | 07:13 | 52.60 days | 86 |
| 68 | 03/01/1949 | 00:14 | 04/22/1949 | 04:47 | 52.18 days | 87 |
| 175 | 12/15/1985 | 21:52 | 02/04/1986 | 13:41 | 50.65 days | 88 |
| 61 | 01/23/1947 | 08:46 | 03/13/1947 | 14:53 | 49.25 days | 89 |
| 227 | 11/09/2000 | 13:44 | 12/28/2000 | 04:27 | 49.05 days | 90 |
| 243 | 01/03/2003 | 16:46 | 02/21/2003 | 05:46 | 48.77 days | 91 |
| 48 | 07/14/1945 | 20:43 | 08/29/1945 | 20:59 | 46.01 days | 92 |
| 3 | 07/08/1940 | 01:40 | 08/21/1940 | 18:21 | 44.69 days | 93 |
| 225 | 12/20/1998 | 08:24 | 02/02/1999 | 11:20 | 44.45 days | 94 |
| 45 | 05/02/1945 | 04:28 | 06/15/1945 | 07:09 | 44.11 days | 95 |
| 159 | 06/14/1979 | 03:30 | 07/27/1979 | 15:46 | 43.51 days | 96 |
| 73 | 04/20/1950 | 23:05 | 06/02/1950 | 16:35 | 42.72 days | 97 |
| 193 | 11/09/1991 | 17:50 | 12/22/1991 | 09:28 | 42.65 days | 98 |
| 50 | 12/06/1945 | 02:55 | 01/16/1946 | 00:44 | 40.90 days | 99 |
| 154 | 02/09/1979 | 14:26 | 03/22/1979 | 07:40 | 40.71 days | 100 |
| 136 | 09/22/1974 | 07:21 | 11/01/1974 | 22:26 | 40.62 days | 101 |
| 229 | 01/22/2001 | 10:13 | 03/03/2001 | 01:59 | 40.61 days | 102 |
| 113 | 02/01/1968 | 14:15 | 03/12/1968 | 21:08 | 40.28 days | 103 |
| 188 | 03/18/1990 | 10:37 | 04/27/1990 | 06:12 | 39.81 days | 104 |
| 151 | 02/20/1977 | 13:21 | 03/31/1977 | 13:51 | 39.02 days | 105 |
| 32 | 03/26/1944 | 07:17 | 05/02/1944 | 06:15 | 36.95 days | 106 |
| 231 | 04/03/2001 | 06:25 | 05/09/2001 | 01:48 | 36.57 days | 107 |
| 219 | 01/19/1998 | 00:58 | 02/23/1998 | 19:48 | 36.55 days | 108 |
| 200 | 05/14/1993 | 19:12 | 06/19/1993 | 12:19 | 35.71 days | 109 |
| 156 | 04/07/1979 | 04:14 | 05/12/1979 | 04:59 | 35.03 days | 110 |
| 27 | 09/15/1942 | 04:52 | 10/20/1942 | 04:15 | 34.97 days | 111 |
| 79 | 10/30/1953 | 00:25 | 12/03/1953 | 17:11 | 34.69 days | 112 |
| 147 | 06/03/1976 | 06:22 | 07/07/1976 | 03:54 | 33.89 days | 113 |
| 60 | 12/16/1946 | 09:06 | 01/17/1947 | 19:00 | 32.41 days | 114 |
| 51 | 01/19/1946 | 19:52 | 02/20/1946 | 09:42 | 31.57 days | 115 |
| 240 | 11/10/2002 | 12:48 | 12/11/2002 | 05:37 | 31.30 days | 116 |
| 12 | 03/23/1941 | 16:24 | 04/23/1941 | 15:20 | 30.95 days | 117 |
| 232 | 05/10/2001 | 08:30 | 06/09/2001 | 16:12 | 30.51 days | 118 |
| 76 | 04/25/1952 | 22:04 | 05/25/1952 | 15:42 | 29.73 days | 119 |
| 1 | 05/23/1939 | 18:59 | 06/21/1939 | 21:08 | 29.09 days | 120 |
| 92 | 01/08/1960 | 17:42 | 02/06/1960 | 10:27 | 28.69 days | 121 |
| 54 | 03/28/1946 | 17:23 | 04/26/1946 | 03:08 | 28.40 days | 122 |
| 235 | 11/20/2001 | 01:19 | 12/17/2001 | 09:51 | 28.17 days | 123 |
| 82 | 10/28/1957 | 23:39 | 11/26/1957 | 01:46 | 28.08 days | 124 |
| 39 | 01/25/1945 | 09:21 | 02/21/1945 | 23:19 | 27.58 days | 125 |
| 195 | 04/21/1992 | 02:01 | 05/17/1992 | 23:25 | 26.89 days | 126 |
| 167 | 06/05/1982 | 19:47 | 07/01/1982 | 18:22 | 25.94 days | 127 |
| 132 | 05/10/1973 | 19:29 | 06/05/1973 | 16:21 | 25.86 days | 128 |
| 199 | 04/10/1993 | 20:05 | 05/06/1993 | 08:56 | 25.53 days | 129 |
| 123 | 03/18/1969 | 22:41 | 04/13/1969 | 05:21 | 25.27 days | 130 |
| 140 | 04/15/1975 | 05:21 | 05/10/1975 | 11:36 | 25.26 days | 131 |
| 59 | 11/20/1946 | 15:55 | 12/14/1946 | 07:10 | 23.63 days | 132 |
| 117 | 04/16/1968 | 21:36 | 05/09/1968 | 18:25 | 22.86 days | 133 |
| 248 | 05/20/2004 | 00:20 | 06/10/2004 | 21:47 | 22.64 days | 134 |
| 37 | 12/09/1944 | 22:27 | 12/30/1944 | 23:38 | 21.04 days | 135 |
| 19 | 10/10/1941 | 01:11 | 10/30/1941 | 21:55 | 20.86 days | 136 |
| 47 | 06/21/1945 | 19:06 | 07/12/1945 | 14:44 | 20.81 days | 137 |
| 122 | 02/22/1969 | 18:07 | 03/15/1969 | 12:27 | 20.76 days | 138 |
| 228 | 12/31/2000 | 00:26 | 01/19/2001 | 15:50 | 20.44 days | 139 |
| 129 | 03/28/1973 | 18:00 | 04/17/1973 | 22:01 | 20.16 days | 140 |
| 224 | 11/22/1998 | 12:58 | 12/12/1998 | 01:39 | 20.15 days | 141 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 31 | 03/04/1944 | 03:45 | 03/23/1944 | 23:47 | 19.83 days | 142 |
| 99 | 12/19/1960 | 13:15 | 01/08/1961 | 01:47 | 19.52 days | 143 |
| 97 | 11/03/1960 | 12:05 | 11/21/1960 | 19:46 | 18.32 days | 144 |
| 91 | 12/20/1959 | 06:52 | 01/07/1960 | 13:46 | 18.28 days | 145 |
| 223 | 10/26/1998 | 20:58 | 11/12/1998 | 19:38 | 17.55 days | 146 |
| 70 | 05/02/1949 | 20:41 | 05/20/1949 | 04:30 | 17.32 days | 147 |
| 124 | 04/22/1969 | 00:04 | 05/09/1969 | 06:28 | 17.26 days | 148 |
| 221 | 03/02/1998 | 04:13 | 03/19/1998 | 03:10 | 17.12 days | 149 |
| 52 | 02/24/1946 | 00:07 | 03/12/1946 | 22:39 | 16.93 days | 150 |
| 55 | 04/26/1946 | 21:20 | 05/13/1946 | 14:30 | 16.71 days | 151 |
| 17 | 06/26/1941 | 05:17 | 07/12/1941 | 20:59 | 16.65 days | 152 |
| 106 | 01/26/1965 | 11:21 | 02/12/1965 | 02:18 | 16.62 days | 153 |
| 146 | 05/16/1976 | 16:13 | 06/01/1976 | 14:54 | 15.94 days | 154 |
| 9 | 02/09/1941 | 21:57 | 02/25/1941 | 04:30 | 15.27 days | 155 |
| 119 | 06/09/1968 | 06:13 | 06/24/1968 | 10:24 | 15.17 days | 156 |
| 8 | 01/19/1941 | 00:08 | 02/03/1941 | 03:51 | 15.15 days | 157 |
| 38 | 01/03/1945 | 19:19 | 01/18/1945 | 21:37 | 15.09 days | 158 |
| 216 | 06/15/1997 | 09:16 | 06/29/1997 | 20:38 | 15.08 days | 159 |
| 30 | 02/11/1944 | 23:19 | 02/26/1944 | 16:57 | 14.73 days | 160 |
| 7 | 12/31/1940 | 19:58 | 01/15/1941 | 01:07 | 14.21 days | 161 |
| 186 | 06/02/1989 | 10:38 | 06/16/1989 | 09:17 | 13.94 days | 162 |
| 100 | 01/23/1961 | 00:36 | 02/05/1961 | 16:28 | 13.66 days | 163 |
| 206 | 05/19/1995 | 02:25 | 06/01/1995 | 15:13 | 13.53 days | 164 |
| 103 | 06/29/1961 | 06:34 | 07/12/1961 | 17:31 | 13.45 days | 165 |
| 98 | 11/26/1960 | 01:19 | 12/08/1960 | 21:56 | 12.85 days | 166 |
| 194 | 04/07/1992 | 02:26 | 04/19/1992 | 19:08 | 12.69 days | 167 |
| 115 | 03/28/1968 | 03:42 | 04/08/1968 | 19:05 | 11.64 days | 168 |
| 218 | 12/27/1997 | 00:53 | 01/06/1998 | 18:48 | 11.51 days | 169 |
| 215 | 05/30/1997 | 13:22 | 06/10/1997 | 22:03 | 11.42 days | 170 |
| 43 | 03/19/1945 | 07:25 | 03/30/1945 | 17:23 | 11.41 days | 171 |
| 152 | 04/05/1977 | 12:34 | 04/16/1977 | 21:06 | 11.35 days | 172 |
| 33 | 05/15/1944 | 01:43 | 05/25/1944 | 22:44 | 10.87 days | 173 |
| 241 | 12/15/2002 | 19:09 | 12/25/2002 | 14:48 | 10.58 days | 174 |
| 174 | 12/02/1985 | 14:25 | 12/13/1985 | 00:44 | 10.42 days | 175 |
| 239 | 10/26/2002 | 02:22 | 11/04/2002 | 11:54 | 10.26 days | 176 |
| 141 | 05/14/1975 | 13:00 | 05/24/1975 | 18:14 | 10.21 days | 177 |
| 44 | 04/11/1945 | 20:59 | 04/21/1945 | 14:51 | 9.74 days | 178 |
| 203 | 12/21/1994 | 23:34 | 12/30/1994 | 19:34 | 8.83 days | 179 |
| 29 | 02/02/1944 | 00:07 | 02/10/1944 | 19:44 | 8.81 days | 180 |
| 25 | 05/30/1942 | 21:09 | 06/08/1942 | 13:53 | 8.69 days | 181 |
| 212 | 04/18/1997 | 04:21 | 04/26/1997 | 13:05 | 8.44 days | 182 |
| 58 | 11/08/1946 | 16:17 | 11/16/1946 | 22:27 | 8.25 days | 183 |
| 198 | 03/31/1993 | 23:37 | 04/08/1993 | 23:18 | 7.98 days | 184 |
| 56 | 05/25/1946 | 09:48 | 06/02/1946 | 07:25 | 7.90 days | 185 |
| 11 | 03/12/1941 | 08:11 | 03/20/1941 | 03:50 | 7.81 days | 186 |
| 137 | 11/17/1974 | 12:05 | 11/25/1974 | 02:56 | 7.61 days | 187 |
| 247 | 05/07/2004 | 06:48 | 05/14/2004 | 01:52 | 7.33 days | 188 |
| 143 | 04/24/1976 | 01:39 | 05/01/1976 | 07:49 | 7.25 days | 189 |
| 36 | 11/28/1944 | 14:58 | 12/05/1944 | 18:37 | 7.15 days | 190 |
| 157 | 05/16/1979 | 06:44 | 05/23/1979 | 06:55 | 7.00 days | 191 |
| 53 | 03/19/1946 | 21:55 | 03/26/1946 | 18:56 | 6.87 days | 192 |
| 96 | 10/21/1960 | 15:24 | 10/28/1960 | 12:10 | 6.86 days | 193 |
| 120 | 07/01/1968 | 21:21 | 07/08/1968 | 14:35 | 6.71 days | 194 |
| 114 | 03/15/1968 | 22:02 | 03/22/1968 | 15:09 | 6.71 days | 195 |
| 42 | 03/10/1945 | 00:05 | 03/16/1945 | 16:53 | 6.70 days | 196 |
| 242 | 12/27/2002 | 17:26 | 01/02/2003 | 20:22 | 6.47 days | 197 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 10 | 03/01/1941 | 03:31 | 03/07/1941 | 07:51 | 6.18 days | 198 |
| 230 | 03/23/2001 | 15:36 | 03/28/2001 | 20:18 | 5.49 days | 199 |
| 155 | 03/27/1979 | 04:01 | 04/01/1979 | 13:22 | 5.38 days | 200 |
| 210 | 03/31/1997 | 09:25 | 04/05/1997 | 10:16 | 5.29 days | 201 |
| 46 | 06/16/1945 | 00:26 | 06/21/1945 | 07:17 | 5.28 days | 202 |
| 16 | 06/05/1941 | 22:53 | 06/11/1941 | 02:55 | 5.16 days | 203 |
| 5 | 12/07/1940 | 06:25 | 12/12/1940 | 06:24 | 4.99 days | 204 |
| 214 | 05/21/1997 | 19:15 | 05/26/1997 | 03:12 | 4.53 days | 205 |
| 21 | 04/18/1942 | 00:12 | 04/22/1942 | 07:15 | 4.29 days | 206 |
| 144 | 05/03/1976 | 19:27 | 05/08/1976 | 01:21 | 4.24 days | 207 |
| 131 | 05/04/1973 | 11:34 | 05/08/1973 | 17:18 | 4.23 days | 208 |
| 6 | 12/24/1940 | 10:14 | 12/28/1940 | 07:45 | 3.89 days | 209 |
| 24 | 05/16/1942 | 05:58 | 05/20/1942 | 02:34 | 3.85 days | 210 |
| 62 | 03/16/1947 | 00:57 | 03/19/1947 | 20:20 | 3.80 days | 211 |
| 118 | 05/31/1968 | 06:33 | 06/04/1968 | 01:36 | 3.79 days | 212 |
| 64 | 05/25/1947 | 22:35 | 05/29/1947 | 14:47 | 3.67 days | 213 |
| 22 | 05/05/1942 | 03:34 | 05/08/1942 | 16:34 | 3.54 days | 214 |
| 182 | 03/03/1987 | 08:04 | 03/06/1987 | 18:37 | 3.43 days | 215 |
| 40 | 02/26/1945 | 09:21 | 03/01/1945 | 16:24 | 3.29 days | 216 |
| 69 | 04/24/1949 | 02:05 | 04/27/1949 | 08:17 | 3.25 days | 217 |
| 145 | 05/11/1976 | 11:11 | 05/14/1976 | 17:16 | 3.25 days | 218 |
| 213 | 05/10/1997 | 04:42 | 05/13/1997 | 05:13 | 3.23 days | 219 |
| 130 | 04/22/1973 | 16:59 | 04/25/1973 | 18:13 | 3.05 days | 220 |
| 108 | 06/03/1965 | 21:25 | 06/06/1965 | 20:52 | 2.97 days | 221 |
| 171 | 02/27/1985 | 15:17 | 03/02/1985 | 13:45 | 2.93 days | 222 |
| 15 | 06/02/1941 | 00:23 | 06/04/1941 | 21:41 | 2.88 days | 223 |
| 23 | 05/10/1942 | 12:08 | 05/13/1942 | 07:31 | 2.80 days | 224 |
| 34 | 06/04/1944 | 01:55 | 06/06/1944 | 20:49 | 2.78 days | 225 |
| 74 | 06/04/1950 | 05:30 | 06/06/1950 | 22:08 | 2.69 days | 226 |
| 88 | 04/15/1959 | 16:30 | 04/18/1959 | 08:11 | 2.65 days | 227 |
| 165 | 11/03/1981 | 09:06 | 11/05/1981 | 23:52 | 2.61 days | 228 |
| 236 | 12/22/2001 | 04:37 | 12/24/2001 | 07:28 | 2.57 days | 229 |
| 13 | 04/27/1941 | 08:58 | 04/29/1941 | 21:49 | 2.53 days | 230 |
| 14 | 05/02/1941 | 20:27 | 05/05/1941 | 07:40 | 2.46 days | 231 |
| 249 | 06/22/2004 | 20:43 | 06/24/2004 | 17:25 | 2.26 days | 232 |
| 162 | 06/09/1981 | 19:27 | 06/12/1981 | 01:14 | 2.24 days | 233 |
| 250 | 06/25/2004 | 13:13 | 06/27/2004 | 12:14 | 2.19 days | 234 |
| 102 | 06/25/1961 | 19:07 | 06/27/1961 | 23:35 | 2.18 days | 235 |
| 158 | 05/27/1979 | 19:35 | 05/29/1979 | 23:03 | 2.14 days | 236 |
| 196 | 05/30/1992 | 06:04 | 06/01/1992 | 08:21 | 2.09 days | 237 |
| 116 | 04/10/1968 | 18:01 | 04/12/1968 | 17:22 | 1.97 days | 238 |
| 177 | 06/16/1986 | 18:40 | 06/18/1986 | 14:38 | 1.83 days | 239 |
| 189 | 06/10/1990 | 04:04 | 06/11/1990 | 17:42 | 1.56 days | 240 |
| 211 | 04/16/1997 | 18:14 | 04/17/1997 | 12:43 | 1.46 days | 241 |
| 180 | 12/21/1986 | 20:33 | 12/23/1986 | 05:30 | 1.37 days | 242 |
| 41 | 03/02/1945 | 18:55 | 03/04/1945 | 01:43 | 1.28 days | 243 |
| 220 | 02/25/1998 | 12:59 | 02/26/1998 | 05:36 | 1.26 days | 244 |
| 150 | 02/17/1977 | 21:29 | 02/19/1977 | 03:40 | 1.25 days | 245 |
| 85 | 05/02/1958 | 05:53 | 05/03/1958 | 10:19 | 1.18 days | 246 |
| 173 | 11/28/1985 | 08:33 | 11/29/1985 | 11:49 | 1.13 days | 247 |
| 179 | 12/19/1986 | 10:44 | 12/20/1986 | 09:21 | 0.94 days | 248 |
| 185 | 05/23/1989 | 09:49 | 05/24/1989 | 08:14 | 0.93 days | 249 |
| 164 | 10/17/1981 | 06:44 | 10/17/1981 | 22:53 | 0.67 days | 250 |
| 111 | 09/21/1966 | 11:06 | 09/21/1966 | 22:47 | 0.48 days | 251 |

Horseshoe Lake Oxbow Connections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/4/2004, 13:13

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 147.13 ft
 Measured River Slope (Using TWDB GPS): 0.90356 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 83375.9843 ft (15.79 miles)
 Distance downstream to Richmond Gauge from Oxbow: 459383.2021 ft (87 miles)
 Estimated Critical Gauge Height/WSE: 48.858/161.398 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 49.858/162.398 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-10/1/2004
 Number of Records: 99525
 Years of Record: 66.0005
 Number of Critical WSE Exceedences: 7
 Number of "significant" WSE Exceedences: 6
 Average Connections per year: 0.090908
 Flood Level Required for Connection: 9294.8276 year flood (99089.9188 cfs)

Statistics

 Mean Duration of Connection (Days) : 3.2744
 Standard Deviation of Connection Duration (Days) : 1.6926
 Minimum Duration of Connection (Days) : 1.573
 Maximum Duration of Connection (Days) : 5.6989
 1st Percentile Duration of Connection (Days) : 0.094381
 10th Percentile Duration of Connection (Days) : 0.94381
 25th Percentile Duration of Connection (Days) : 1.5774
 50th Percentile Duration of Connection (Days) : 2.5407
 75th Percentile Duration of Connection (Days) : 4.1261
 95th Percentile Duration of Connection (Days) : 5.4042
 99th Percentile Duration of Connection (Days) : 5.64
 Mean Time Between Connections (Days) : 3883.8345
 Standard Deviation of Connection Duration (Days) : 3411.5188
 Minimum Time Between Connections (Days) : 1.824
 Maximum Time Between Connections (Days) : 9712.225
 1st Percentile Time Between Connections (Days) : 0.10944
 10th Percentile Time Between Connections (Days) : 1.0944
 25th Percentile Time Between Connections (Days) : 626.8168
 50th Percentile Time Between Connections (Days) : 2939.1673
 75th Percentile Time Between Connections (Days) : 4698.9905
 95th Percentile Time Between Connections (Days) : 8220.3482
 99th Percentile Time Between Connections (Days) : 9413.8497

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, August 2004
 Statistics are derived based on "significant" connections

Horseshoe Lake Oxbow Connections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/4/2004, 13:13

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 147.13 ft
 Measured River Slope (Using TWDB GPS): 0.90356 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 83375.9843 ft (15.79 miles)
 Distance downstream to Richmond Gauge from Oxbow: 459383.2021 ft (87 miles)
 Estimated Critical Gauge Height/WSE: 48.858/161.398 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 49.858/162.398 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-10/1/2004
 Number of Records: 99525
 Years of Record: 66.0005
 Number of Critical WSE Exceedences: 7
 Number of "significant" WSE Exceedences: 6
 Average Connections per year: 0.090908
 Flood Level Required for Connection: 9294.8276 year flood (99089.9188 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|---|------------------|------------------|-----------|------|-------|
| 6 | 12/25/1991 18:31 | 12/30/1991 11:42 | 4.71 days | 2 | |
| 5 | 05/21/1965 23:21 | 05/23/1965 13:07 | 1.57 days | 6 | |
| 4 | 04/29/1957 02:34 | 05/04/1957 19:21 | 5.69 days | 1 | |
| 3 | 05/06/1944 05:21 | 05/07/1944 19:19 | 1.58 days | 5 | |
| 2 | 11/27/1940 21:04 | 12/01/1940 09:55 | 3.53 days | 3 | |
| 1 | 11/23/1940 12:19 | 11/26/1940 01:17 | 2.54 days | 4 | |

Horseshoe Lake Oxbow Connections to the Brazos River – Ranked by Connection Duration
 Jordan Furnans, TWDB 11/4/2004, 13:13

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 147.13 ft
 Measured River Slope (Using TWDB GPS): 0.90356 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 83375.9843 ft (15.79 miles)
 Distance downstream to Richmond Gauge from Oxbow: 459383.2021 ft (87 miles)
 Estimated Critical Gauge Height/WSE: 48.858/161.398 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 49.858/162.398 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-10/1/2004
 Number of Records: 99525
 Years of Record: 66.0005
 Number of Critical WSE Exceedences: 7
 Number of "significant" WSE Exceedences: 6
 Average Connections per year: 0.090908
 Flood Level Required for Connection: 9294.8276 year flood (99089.9188 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|---|------------------|------------------|-----------|------|-------|
| 4 | 04/29/1957 02:34 | 05/04/1957 19:21 | 5.69 days | 1 | |
| 6 | 12/25/1991 18:31 | 12/30/1991 11:42 | 4.71 days | 2 | |
| 2 | 11/27/1940 21:04 | 12/01/1940 09:55 | 3.53 days | 3 | |
| 1 | 11/23/1940 12:19 | 11/26/1940 01:17 | 2.54 days | 4 | |
| 3 | 05/06/1944 05:21 | 05/07/1944 19:19 | 1.58 days | 5 | |
| 5 | 05/21/1965 23:21 | 05/23/1965 13:07 | 1.57 days | 6 | |

Horseshoe Lake Oxbow disconnections to the Brazos River – Chronology of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 13:13

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 147.13 ft
 Measured River Slope (Using TWDB GPS): 0.90356 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1146 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.07 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 83375.9843 ft (15.79 miles)
 Distance downstream to Richmond Gauge from Oxbow: 459383.2021 ft (87 miles)
 Estimated Critical Gauge Height/WSE: 48.858/161.398 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 49.858/162.398 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-10/1/2004
 Number of Records: 99525
 Years of Record: 66.0005
 Number of Critical WSE Exceedences: 7
 Number of "significant" WSE Exceedences: 6
 Average Connections per year: 0.090908
 Flood Level Required for Connection: 9294.8276 year flood (99089.9188 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|---|------------------|------------------|----------|------|--------------------------------------|
| 6 | 12/30/1991 11:42 | 10/01/2004 04:00 | 4658.67 | 3 | *** Disconnected Period Not Complete |
| 5 | 05/23/1965 13:07 | 12/25/1991 18:31 | 9712.22 | 1 | |
| 4 | 05/04/1957 19:21 | 05/21/1965 23:21 | 2939.16 | 4 | |
| 3 | 05/07/1944 19:19 | 04/29/1957 02:34 | 4739.30 | 2 | |
| 2 | 12/01/1940 09:55 | 05/06/1944 05:21 | 1251.80 | 5 | |
| 1 | 11/26/1940 01:17 | 11/27/1940 21:04 | 1.82 | 6 | |

Horseshoe Lake Oxbow disconnections to the Brazos River – Ranked Duration of Disconnections
 Jordan Furnans, TWDB 12/6/2004, 15:35

USGS Gauge: 08111500 Brazos Rv nr Hempstead, TX
 Gauge Datum: 107.90 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 112.54ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 147.13 ft
 Measured River Slope (Using TWDB GPS): 0.90356 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Mean Slope Between Hempstead and Richmond Gauges: 1.1138 ft/mile - TWDB Datum
 Mean Slope Between Hempstead and Richmond Gauges: 1.0693 ft/mile - USGS Datum
 Distance upstream to Hempstead Gauge from Oxbow: 83375.9843 ft (15.79 miles)
 Distance downstream to Richmond Gauge from Oxbow: 459383.2021 ft (87 miles)
 Estimated Critical Gauge Height/WSE: 48.858/161.398 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 49.858/162.398 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 10/1/1938-10/1/2004
 Number of Records: 99525
 Years of Record: 66.0005
 Number of Critical WSE Exceedences: 7
 Number of "significant" WSE Exceedences: 6
 Average Connections per year: 0.090908
 Flood Level Required for Connection: 9294.8276 year flood (99089.9188 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|---|------------------|------------------|----------|--------------|------------------------------------|
| 5 | 05/23/1965 13:07 | 12/25/1991 18:31 | 18:31 | 9712.22 days | 1 |
| 3 | 05/07/1944 19:19 | 04/29/1957 02:34 | 02:34 | 4739.30 days | 2 |
| 6 | 12/30/1991 11:42 | 10/01/2004 04:00 | 04:00 | 4658.67 days | 3 Disconnected Period Not Complete |
| 4 | 05/04/1957 19:21 | 05/21/1965 23:21 | 23:21 | 2939.16 days | 4 |
| 2 | 12/01/1940 09:55 | 05/06/1944 05:21 | 05:21 | 1251.80 days | 5 |
| 1 | 11/26/1940 01:17 | 11/27/1940 21:04 | 21:04 | 1.82 days | 6 |

Hog Island Oxbow Connections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/4/2004, 12:43

USGS Gauge: 08116650 Brazos Rv nr Rosharon, TX
 Gauge Datum: 0.0 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 1.275ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 2.9 ft
 Measured River Slope (Using TWDB GPS): 0.5 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Distance upstream to Rosharon Gauge from Oxbow: 46522.3097 ft (8.81 miles)
 Estimated Critical Gauge Height/WSE: 6.0305/7.3055 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 7.0305/8.3055 ft
 Required Discharge for "significant" connection: 3152.7609 cfs
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 4/1/1967-11/1/2004
 Number of Records: 150152
 Years of Record: 37.5869
 Number of Critical WSE Exceedences: 265
 Number of "significant" WSE Exceedences: 207
 Average Connections per year: 5.5072
 Flood Level Required for Connection: 1.0002 year flood (3152.7609 cfs)

Statistics

 Mean Duration of Connection (Days) : 38.2761
 Standard Deviation of Connection Duration (Days) : 76.4882
 Minimum Duration of Connection (Days) : 0.3412
 Maximum Duration of Connection (Days) : 383.4676
 1st Percentile Duration of Connection (Days) : 0.39842
 10th Percentile Duration of Connection (Days) : 1.0721
 25th Percentile Duration of Connection (Days) : 2.5297
 50th Percentile Duration of Connection (Days) : 7.185
 75th Percentile Duration of Connection (Days) : 24.7968
 95th Percentile Duration of Connection (Days) : 222.3236
 99th Percentile Duration of Connection (Days) : 334.6942
 Mean Time Between Connections (Days) : 27.7225
 Standard Deviation of Connection Duration (Days) : 102.6776
 Minimum Time Between Connections (Days) : 0.26016
 Maximum Time Between Connections (Days) : 1432.6057
 1st Percentile Time Between Connections (Days) : 0.82052
 10th Percentile Time Between Connections (Days) : 1.9795
 25th Percentile Time Between Connections (Days) : 4.1566
 50th Percentile Time Between Connections (Days) : 11.0105
 75th Percentile Time Between Connections (Days) : 22.9686
 95th Percentile Time Between Connections (Days) : 80.5893
 99th Percentile Time Between Connections (Days) : 165.7178

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, August 2004
 Statistics are derived based on "significant" connections

Hog Island Oxbow Connections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/4/2004, 12:43

USGS Gauge: 08116650 Brazos Rv nr Rosharon, TX
 Gauge Datum: 0.0 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 1.275ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 2.9 ft
 Measured River Slope (Using TWDB GPS): 0.5 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Distance upstream to Rosharon Gauge from Oxbow: 46522.3097 ft (8.81 miles)
 Estimated Critical Gauge Height/WSE: 6.0305/7.3055 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 7.0305/8.3055 ft
 Required Discharge for "significant" connection: 3152.7609 cfs
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 4/1/1967-11/1/2004
 Number of Records: 150152
 Years of Record: 37.5869
 Number of Critical WSE Exceedences: 265
 Number of "significant" WSE Exceedences: 207
 Average Connections per year: 5.5072
 Flood Level Required for Connection: 1.0002 year flood (3152.7609 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|-------------------------------|
| 207 | 10/06/2004 19:52 | 11/01/2004 03:00 | 25.29 days | 52 | Connected Period Not Complete |
| 206 | 09/30/2004 23:47 | 10/01/2004 07:59 | 0.34 days | 207 | |
| 205 | 08/22/2004 15:59 | 09/29/2004 00:44 | 37.36 days | 37 | |
| 204 | 01/17/2004 02:56 | 08/21/2004 22:29 | 217.81 days | 12 | |
| 203 | 01/01/2004 16:47 | 01/04/2004 23:12 | 3.26 days | 138 | |
| 202 | 12/12/2003 23:12 | 12/16/2003 04:29 | 3.21 days | 139 | |
| 201 | 11/17/2003 17:46 | 12/04/2003 01:52 | 16.33 days | 68 | |
| 200 | 10/06/2003 06:08 | 11/01/2003 05:44 | 25.98 days | 51 | |
| 199 | 06/12/2003 13:14 | 06/13/2003 14:29 | 1.05 days | 189 | |
| 198 | 10/22/2002 00:29 | 05/14/2003 05:37 | 204.21 days | 15 | |
| 197 | 10/10/2002 07:44 | 10/15/2002 02:14 | 4.77 days | 126 | |
| 196 | 09/20/2002 07:41 | 09/23/2002 22:14 | 3.60 days | 133 | |
| 195 | 09/07/2002 05:21 | 09/13/2002 15:59 | 6.44 days | 113 | |
| 194 | 08/14/2002 16:29 | 08/27/2002 18:44 | 13.09 days | 81 | |
| 193 | 07/08/2002 05:44 | 08/11/2002 20:14 | 34.60 days | 40 | |
| 192 | 06/03/2002 08:29 | 06/10/2002 09:04 | 7.02 days | 106 | |
| 191 | 05/17/2002 23:55 | 05/21/2002 07:02 | 3.29 days | 137 | |
| 190 | 03/24/2002 08:59 | 05/04/2002 19:03 | 41.41 days | 33 | |
| 189 | 03/15/2002 14:29 | 03/20/2002 11:31 | 4.87 days | 125 | |
| 188 | 11/16/2001 08:52 | 03/13/2002 09:14 | 117.01 days | 26 | |
| 187 | 10/05/2001 23:17 | 11/01/2001 12:56 | 26.56 days | 50 | |
| 186 | 08/29/2001 08:38 | 10/02/2001 20:23 | 34.48 days | 41 | |
| 185 | 07/25/2001 22:18 | 07/26/2001 11:58 | 0.56 days | 201 | |
| 184 | 07/04/2001 00:38 | 07/13/2001 07:58 | 9.30 days | 94 | |
| 183 | 11/06/2000 06:27 | 07/03/2001 16:14 | 239.40 days | 10 | |
| 182 | 10/27/2000 23:32 | 10/30/2000 15:18 | 2.65 days | 151 | |
| 181 | 06/08/2000 04:39 | 07/01/2000 18:50 | 23.59 days | 55 | |
| 180 | 05/20/2000 01:16 | 06/02/2000 17:32 | 13.67 days | 76 | |
| 179 | 05/05/2000 02:09 | 05/16/2000 02:56 | 11.03 days | 91 | |
| 178 | 05/02/2000 20:26 | 05/04/2000 10:09 | 1.57 days | 175 | |
| 177 | 04/17/2000 21:57 | 04/22/2000 16:19 | 4.76 days | 127 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 176 | 04/12/2000 | 14:04 | 04/15/2000 | 06:32 | 2.68 days | 150 |
| 175 | 04/02/2000 | 23:05 | 04/05/2000 | 09:59 | 2.45 days | 157 |
| 174 | 03/14/2000 | 22:49 | 03/17/2000 | 16:28 | 2.73 days | 148 |
| 173 | 03/10/2000 | 13:58 | 03/11/2000 | 17:56 | 1.16 days | 185 |
| 172 | 03/05/2000 | 12:49 | 03/08/2000 | 22:18 | 3.39 days | 135 |
| 171 | 01/13/2000 | 03:56 | 01/13/2000 | 22:56 | 0.79 days | 197 |
| 170 | 07/16/1999 | 23:44 | 07/29/1999 | 21:56 | 12.92 days | 84 |
| 169 | 09/10/1998 | 07:27 | 07/08/1999 | 22:58 | 301.64 days | 5 |
| 168 | 08/22/1998 | 14:56 | 08/27/1998 | 02:38 | 4.48 days | 128 |
| 167 | 07/13/1998 | 00:04 | 07/13/1998 | 09:51 | 0.40 days | 205 |
| 166 | 07/08/1998 | 23:09 | 07/11/1998 | 12:28 | 2.55 days | 156 |
| 165 | 06/16/1998 | 21:58 | 06/19/1998 | 11:26 | 2.56 days | 155 |
| 164 | 09/22/1997 | 11:41 | 06/15/1998 | 22:58 | 266.47 days | 8 |
| 163 | 09/19/1997 | 09:15 | 09/19/1997 | 18:48 | 0.39 days | 206 |
| 162 | 09/18/1997 | 08:40 | 09/18/1997 | 18:38 | 0.41 days | 204 |
| 161 | 08/30/1996 | 12:26 | 09/17/1997 | 23:39 | 383.46 days | 1 |
| 160 | 08/25/1996 | 15:49 | 08/26/1996 | 04:38 | 0.53 days | 202 |
| 159 | 06/21/1996 | 14:39 | 07/07/1996 | 22:28 | 16.32 days | 69 |
| 158 | 06/18/1996 | 17:44 | 06/20/1996 | 02:59 | 1.38 days | 178 |
| 157 | 05/02/1996 | 21:59 | 05/05/1996 | 17:58 | 2.83 days | 147 |
| 156 | 03/16/1996 | 17:28 | 03/18/1996 | 09:58 | 1.68 days | 173 |
| 155 | 03/01/1996 | 02:18 | 03/03/1996 | 15:56 | 2.56 days | 154 |
| 154 | 09/24/1995 | 07:14 | 02/17/1996 | 02:28 | 145.80 days | 23 |
| 153 | 09/18/1995 | 02:49 | 09/19/1995 | 03:11 | 1.01 days | 191 |
| 152 | 08/02/1995 | 02:51 | 09/11/1995 | 03:35 | 40.03 days | 34 |
| 151 | 10/13/1994 | 11:49 | 07/23/1995 | 18:55 | 283.29 days | 6 |
| 150 | 09/09/1994 | 23:55 | 09/17/1994 | 05:25 | 7.22 days | 104 |
| 149 | 09/05/1994 | 19:56 | 09/06/1994 | 15:44 | 0.82 days | 196 |
| 148 | 08/09/1994 | 18:14 | 08/10/1994 | 16:40 | 0.93 days | 194 |
| 147 | 05/14/1994 | 10:23 | 07/05/1994 | 22:38 | 52.51 days | 30 |
| 146 | 05/01/1994 | 01:48 | 05/09/1994 | 02:50 | 8.04 days | 99 |
| 145 | 04/18/1994 | 04:01 | 04/20/1994 | 08:18 | 2.17 days | 160 |
| 144 | 04/04/1994 | 10:56 | 04/06/1994 | 21:45 | 2.45 days | 158 |
| 143 | 03/30/1994 | 22:31 | 03/31/1994 | 13:43 | 0.63 days | 199 |
| 142 | 02/22/1994 | 10:08 | 03/28/1994 | 19:30 | 34.39 days | 42 |
| 141 | 02/11/1994 | 10:30 | 02/14/1994 | 00:26 | 2.58 days | 153 |
| 140 | 02/07/1994 | 19:34 | 02/08/1994 | 13:37 | 0.75 days | 198 |
| 139 | 01/28/1994 | 23:34 | 02/05/1994 | 08:03 | 7.35 days | 103 |
| 138 | 12/17/1993 | 17:42 | 01/14/1994 | 16:14 | 27.93 days | 49 |
| 137 | 11/16/1993 | 10:32 | 12/11/1993 | 01:39 | 24.63 days | 53 |
| 136 | 10/21/1993 | 07:50 | 11/02/1993 | 06:46 | 11.95 days | 87 |
| 135 | 10/13/1993 | 23:26 | 10/15/1993 | 00:54 | 1.06 days | 188 |
| 134 | 12/15/1992 | 04:04 | 07/27/1993 | 22:06 | 224.75 days | 11 |
| 133 | 11/20/1992 | 05:43 | 12/04/1992 | 22:37 | 14.70 days | 72 |
| 132 | 10/31/1992 | 23:11 | 11/03/1992 | 22:44 | 2.98 days | 144 |
| 131 | 11/01/1991 | 16:51 | 09/30/1992 | 23:39 | 334.28 days | 4 |
| 130 | 09/26/1991 | 03:46 | 10/10/1991 | 09:12 | 14.22 days | 73 |
| 129 | 08/18/1991 | 18:21 | 09/20/1991 | 02:09 | 32.32 days | 44 |
| 128 | 01/04/1991 | 08:02 | 07/16/1991 | 08:07 | 193.00 days | 16 |
| 127 | 11/14/1990 | 02:22 | 11/20/1990 | 03:58 | 6.06 days | 115 |
| 126 | 09/17/1990 | 03:51 | 09/17/1990 | 16:11 | 0.51 days | 203 |
| 125 | 02/20/1990 | 17:59 | 07/31/1990 | 11:08 | 160.71 days | 19 |
| 124 | 02/08/1990 | 05:24 | 02/12/1990 | 03:57 | 3.93 days | 131 |
| 123 | 01/25/1990 | 15:20 | 01/29/1990 | 09:21 | 3.75 days | 132 |
| 122 | 12/29/1989 | 22:38 | 01/01/1990 | 00:23 | 2.07 days | 164 |
| 121 | 05/08/1989 | 15:22 | 08/24/1989 | 11:03 | 107.82 days | 28 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 120 | 03/30/1989 | 11:13 | 04/19/1989 | 07:54 | 19.86 days | 62 |
| 119 | 03/25/1989 | 15:23 | 03/26/1989 | 15:23 | 1.00 days | 192 |
| 118 | 02/22/1989 | 22:22 | 03/04/1989 | 16:26 | 9.75 days | 93 |
| 117 | 01/29/1989 | 17:26 | 02/10/1989 | 08:27 | 11.62 days | 88 |
| 116 | 01/19/1989 | 23:59 | 01/25/1989 | 14:38 | 5.61 days | 120 |
| 115 | 06/07/1988 | 13:55 | 06/16/1988 | 11:31 | 8.89 days | 96 |
| 114 | 06/01/1988 | 23:00 | 06/03/1988 | 00:51 | 1.07 days | 187 |
| 113 | 04/30/1988 | 07:44 | 05/03/1988 | 15:04 | 3.30 days | 136 |
| 112 | 03/18/1988 | 09:50 | 04/10/1988 | 23:32 | 23.57 days | 56 |
| 111 | 03/02/1988 | 10:24 | 03/15/1988 | 17:17 | 13.28 days | 80 |
| 110 | 02/24/1988 | 07:59 | 03/01/1988 | 10:55 | 6.12 days | 114 |
| 109 | 02/20/1988 | 16:33 | 02/23/1988 | 07:41 | 2.63 days | 152 |
| 108 | 12/21/1987 | 03:31 | 01/25/1988 | 08:37 | 35.21 days | 39 |
| 107 | 11/23/1987 | 08:41 | 12/11/1987 | 10:51 | 18.09 days | 64 |
| 106 | 09/28/1987 | 22:01 | 10/04/1987 | 06:52 | 5.36 days | 121 |
| 105 | 09/26/1987 | 01:22 | 09/27/1987 | 23:43 | 1.93 days | 167 |
| 104 | 09/20/1987 | 02:54 | 09/22/1987 | 04:37 | 2.07 days | 165 |
| 103 | 09/15/1987 | 05:20 | 09/16/1987 | 18:18 | 1.54 days | 176 |
| 102 | 09/12/1987 | 17:12 | 09/13/1987 | 23:28 | 1.26 days | 180 |
| 101 | 10/07/1986 | 14:31 | 09/07/1987 | 07:55 | 334.72 days | 3 |
| 100 | 09/08/1986 | 05:39 | 10/07/1986 | 08:17 | 29.10 days | 48 |
| 99 | 08/24/1986 | 02:40 | 08/25/1986 | 22:06 | 1.80 days | 169 |
| 98 | 05/03/1986 | 11:04 | 08/19/1986 | 13:30 | 108.10 days | 27 |
| 97 | 04/16/1986 | 04:31 | 04/17/1986 | 17:04 | 1.52 days | 177 |
| 96 | 03/24/1986 | 01:49 | 03/27/1986 | 05:52 | 3.16 days | 140 |
| 95 | 10/19/1985 | 15:36 | 03/22/1986 | 04:21 | 153.53 days | 21 |
| 94 | 10/06/1985 | 02:59 | 10/08/1985 | 05:39 | 2.11 days | 162 |
| 93 | 06/16/1985 | 16:05 | 07/08/1985 | 16:27 | 22.01 days | 59 |
| 92 | 06/10/1985 | 23:10 | 06/15/1985 | 09:46 | 4.44 days | 129 |
| 91 | 05/05/1985 | 11:44 | 06/06/1985 | 15:24 | 32.15 days | 45 |
| 90 | 11/29/1984 | 22:20 | 05/04/1985 | 11:23 | 155.54 days | 20 |
| 89 | 10/15/1984 | 01:35 | 11/23/1984 | 10:46 | 39.38 days | 36 |
| 88 | 06/09/1984 | 17:37 | 06/13/1984 | 18:58 | 4.05 days | 130 |
| 87 | 05/19/1984 | 17:40 | 05/25/1984 | 19:10 | 6.06 days | 117 |
| 86 | 05/14/1980 | 10:04 | 06/17/1980 | 03:08 | 33.71 days | 43 |
| 85 | 05/01/1980 | 09:22 | 05/08/1980 | 03:17 | 6.74 days | 109 |
| 84 | 03/29/1980 | 02:14 | 04/28/1980 | 23:23 | 30.88 days | 47 |
| 83 | 03/08/1980 | 05:56 | 03/09/1980 | 03:57 | 0.91 days | 195 |
| 82 | 01/19/1980 | 15:47 | 03/01/1980 | 11:11 | 41.80 days | 32 |
| 81 | 12/13/1979 | 03:13 | 01/14/1980 | 05:12 | 32.08 days | 46 |
| 80 | 11/25/1979 | 05:48 | 12/01/1979 | 22:52 | 6.71 days | 111 |
| 79 | 11/01/1979 | 12:47 | 11/02/1979 | 12:40 | 0.99 days | 193 |
| 78 | 09/17/1979 | 12:14 | 10/07/1979 | 16:07 | 20.16 days | 61 |
| 77 | 03/19/1979 | 07:43 | 09/11/1979 | 16:59 | 176.38 days | 17 |
| 76 | 01/01/1979 | 00:03 | 03/15/1979 | 09:21 | 73.38 days | 29 |
| 75 | 11/23/1978 | 04:27 | 12/10/1978 | 22:48 | 17.76 days | 65 |
| 74 | 09/23/1978 | 12:40 | 09/25/1978 | 17:07 | 2.18 days | 159 |
| 73 | 09/14/1978 | 02:54 | 09/20/1978 | 20:41 | 6.74 days | 110 |
| 72 | 08/19/1978 | 11:06 | 08/25/1978 | 12:36 | 6.06 days | 116 |
| 71 | 06/08/1978 | 10:06 | 06/14/1978 | 09:32 | 5.97 days | 118 |
| 70 | 06/03/1978 | 19:12 | 06/05/1978 | 16:06 | 1.87 days | 168 |
| 69 | 03/11/1978 | 07:38 | 03/24/1978 | 22:20 | 13.61 days | 77 |
| 68 | 02/09/1978 | 10:09 | 03/01/1978 | 03:02 | 19.70 days | 63 |
| 67 | 01/17/1978 | 08:04 | 01/29/1978 | 09:54 | 12.07 days | 86 |
| 66 | 01/11/1978 | 17:44 | 01/13/1978 | 20:08 | 2.10 days | 163 |
| 65 | 12/16/1977 | 18:53 | 12/19/1977 | 12:22 | 2.72 days | 149 |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|-----|
| 64 | 09/02/1977 | 04:21 | 09/10/1977 | 01:03 | 7.86 days | 100 |
| 63 | 09/29/1976 | 18:13 | 07/04/1977 | 14:47 | 277.85 days | 7 |
| 62 | 09/23/1976 | 02:56 | 09/24/1976 | 09:18 | 1.26 days | 179 |
| 61 | 09/03/1976 | 18:31 | 09/13/1976 | 16:36 | 9.92 days | 92 |
| 60 | 04/09/1976 | 09:36 | 08/17/1976 | 18:54 | 130.38 days | 24 |
| 59 | 03/11/1976 | 06:29 | 03/22/1976 | 09:25 | 11.12 days | 90 |
| 58 | 02/29/1976 | 21:28 | 03/02/1976 | 01:32 | 1.16 days | 184 |
| 57 | 02/13/1976 | 16:46 | 02/14/1976 | 17:48 | 1.04 days | 190 |
| 56 | 02/02/1976 | 09:54 | 02/08/1976 | 20:58 | 6.46 days | 112 |
| 55 | 12/25/1975 | 09:44 | 01/07/1976 | 18:47 | 13.37 days | 79 |
| 54 | 12/01/1975 | 20:35 | 12/03/1975 | 14:41 | 1.75 days | 171 |
| 53 | 10/28/1975 | 07:38 | 11/10/1975 | 17:42 | 13.41 days | 78 |
| 52 | 09/19/1975 | 19:58 | 09/28/1975 | 19:58 | 8.99 days | 95 |
| 51 | 09/01/1974 | 10:33 | 09/13/1975 | 22:56 | 377.51 days | 2 |
| 50 | 05/06/1974 | 09:01 | 05/23/1974 | 17:36 | 17.35 days | 66 |
| 49 | 04/21/1974 | 11:23 | 04/23/1974 | 06:46 | 1.80 days | 170 |
| 48 | 03/16/1974 | 10:13 | 04/05/1974 | 19:21 | 20.38 days | 60 |
| 47 | 09/30/1973 | 21:25 | 03/14/1974 | 03:20 | 164.24 days | 18 |
| 46 | 09/05/1973 | 08:29 | 09/19/1973 | 12:31 | 14.16 days | 74 |
| 45 | 08/06/1973 | 11:30 | 08/19/1973 | 05:07 | 12.73 days | 85 |
| 44 | 01/06/1973 | 04:28 | 08/05/1973 | 11:08 | 211.27 days | 14 |
| 43 | 01/01/1973 | 20:41 | 01/04/1973 | 21:58 | 3.05 days | 142 |
| 42 | 12/17/1972 | 11:19 | 12/31/1972 | 04:10 | 13.70 days | 75 |
| 41 | 12/13/1972 | 06:41 | 12/16/1972 | 09:46 | 3.12 days | 141 |
| 40 | 12/06/1972 | 22:56 | 12/08/1972 | 03:18 | 1.18 days | 183 |
| 39 | 10/28/1972 | 09:11 | 12/03/1972 | 14:53 | 36.23 days | 38 |
| 38 | 08/04/1972 | 02:56 | 08/07/1972 | 16:59 | 3.58 days | 134 |
| 37 | 07/11/1972 | 20:07 | 07/13/1972 | 02:13 | 1.25 days | 181 |
| 36 | 06/17/1972 | 18:52 | 06/25/1972 | 08:36 | 7.57 days | 101 |
| 35 | 06/10/1972 | 21:51 | 06/13/1972 | 00:56 | 2.12 days | 161 |
| 34 | 05/05/1972 | 04:52 | 05/29/1972 | 14:03 | 24.38 days | 54 |
| 33 | 04/30/1972 | 00:53 | 05/02/1972 | 02:27 | 2.06 days | 166 |
| 32 | 03/22/1972 | 09:48 | 03/25/1972 | 09:10 | 2.97 days | 145 |
| 31 | 10/19/1971 | 00:47 | 02/22/1972 | 05:45 | 126.20 days | 25 |
| 30 | 09/10/1971 | 08:18 | 09/23/1971 | 07:47 | 12.97 days | 83 |
| 29 | 07/31/1971 | 14:21 | 08/16/1971 | 03:57 | 15.56 days | 71 |
| 28 | 05/14/1971 | 01:11 | 05/19/1971 | 09:00 | 5.32 days | 122 |
| 27 | 04/25/1971 | 07:47 | 04/25/1971 | 22:58 | 0.63 days | 200 |
| 26 | 01/15/1971 | 16:05 | 01/16/1971 | 21:33 | 1.22 days | 182 |
| 25 | 10/01/1970 | 10:14 | 11/09/1970 | 20:22 | 39.42 days | 35 |
| 24 | 09/12/1970 | 20:37 | 09/29/1970 | 09:28 | 16.53 days | 67 |
| 23 | 09/01/1970 | 19:44 | 09/08/1970 | 23:07 | 7.14 days | 105 |
| 22 | 12/06/1969 | 04:50 | 07/05/1970 | 15:45 | 211.45 days | 13 |
| 21 | 11/20/1969 | 13:02 | 11/29/1969 | 08:12 | 8.79 days | 98 |
| 20 | 11/03/1969 | 02:05 | 11/14/1969 | 16:12 | 11.58 days | 89 |
| 19 | 09/23/1969 | 15:39 | 10/02/1969 | 12:23 | 8.86 days | 97 |
| 18 | 02/15/1969 | 11:48 | 07/13/1969 | 04:42 | 147.70 days | 22 |
| 17 | 01/16/1969 | 08:39 | 02/01/1969 | 07:15 | 15.94 days | 70 |
| 16 | 11/29/1968 | 11:47 | 01/12/1969 | 08:05 | 43.84 days | 31 |
| 15 | 11/18/1968 | 11:00 | 11/25/1968 | 06:12 | 6.80 days | 108 |
| 14 | 10/04/1968 | 12:24 | 10/27/1968 | 03:57 | 22.64 days | 58 |
| 13 | 09/06/1968 | 05:32 | 09/29/1968 | 17:39 | 23.50 days | 57 |
| 12 | 12/18/1967 | 07:31 | 08/18/1968 | 06:31 | 243.95 days | 9 |
| 11 | 12/15/1967 | 14:34 | 12/17/1967 | 08:12 | 1.73 days | 172 |
| 10 | 11/13/1967 | 07:36 | 11/26/1967 | 08:28 | 13.03 days | 82 |
| 9 | 11/02/1967 | 13:39 | 11/08/1967 | 06:02 | 5.68 days | 119 |

| | | | | |
|---|------------------|------------------|-----------|-----|
| 8 | 10/23/1967 01:37 | 10/24/1967 15:59 | 1.59 days | 174 |
| 7 | 09/22/1967 01:07 | 09/25/1967 02:07 | 3.04 days | 143 |
| 6 | 08/25/1967 20:47 | 08/27/1967 00:45 | 1.16 days | 186 |
| 5 | 06/17/1967 04:37 | 06/22/1967 07:06 | 5.10 days | 123 |
| 4 | 06/02/1967 07:31 | 06/09/1967 04:18 | 6.86 days | 107 |
| 3 | 05/25/1967 02:05 | 05/28/1967 00:52 | 2.94 days | 146 |
| 2 | 05/06/1967 11:18 | 05/11/1967 11:28 | 5.00 days | 124 |
| 1 | 04/16/1967 02:45 | 04/23/1967 15:16 | 7.52 days | 102 |

Hog Island Oxbow Connections to the Brazos River – Ranked by Connection Duration
 Jordan Furnans, TWDB 11/4/2004, 12:43

USGS Gauge: 08116650 Brazos Rv nr Rosharon, TX
 Gauge Datum: 0.0 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 1.275ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 2.9 ft
 Measured River Slope (Using TWDB GPS): 0.5 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Distance upstream to Rosharon Gauge from Oxbow: 46522.3097 ft (8.81 miles)
 Estimated Critical Gauge Height/WSE: 6.0305/7.3055 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 7.0305/8.3055 ft
 Required Discharge for "significant" connection: 3152.7609 cfs
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 4/1/1967-11/1/2004
 Number of Records: 150152
 Years of Record: 37.5869
 Number of Critical WSE Exceedences: 265
 Number of "significant" WSE Exceedences: 207
 Average Connections per year: 5.5072
 Flood Level Required for Connection: 1.0002 year flood (3152.7609 cfs)

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|-------|
| 161 | 08/30/1996 12:26 | 09/17/1997 23:39 | 383.46 days | 1 | |
| 51 | 09/01/1974 10:33 | 09/13/1975 22:56 | 377.51 days | 2 | |
| 101 | 10/07/1986 14:31 | 09/07/1987 07:55 | 334.72 days | 3 | |
| 131 | 11/01/1991 16:51 | 09/30/1992 23:39 | 334.28 days | 4 | |
| 169 | 09/10/1998 07:27 | 07/08/1999 22:58 | 301.64 days | 5 | |
| 151 | 10/13/1994 11:49 | 07/23/1995 18:55 | 283.29 days | 6 | |
| 63 | 09/29/1976 18:13 | 07/04/1977 14:47 | 277.85 days | 7 | |
| 164 | 09/22/1997 11:41 | 06/15/1998 22:58 | 266.47 days | 8 | |
| 12 | 12/18/1967 07:31 | 08/18/1968 06:31 | 243.95 days | 9 | |
| 183 | 11/06/2000 06:27 | 07/03/2001 16:14 | 239.40 days | 10 | |
| 134 | 12/15/1992 04:04 | 07/27/1993 22:06 | 224.75 days | 11 | |
| 204 | 01/17/2004 02:56 | 08/21/2004 22:29 | 217.81 days | 12 | |
| 22 | 12/06/1969 04:50 | 07/05/1970 15:45 | 211.45 days | 13 | |
| 44 | 01/06/1973 04:28 | 08/05/1973 11:08 | 211.27 days | 14 | |
| 198 | 10/22/2002 00:29 | 05/14/2003 05:37 | 204.21 days | 15 | |
| 128 | 01/04/1991 08:02 | 07/16/1991 08:07 | 193.00 days | 16 | |
| 77 | 03/19/1979 07:43 | 09/11/1979 16:59 | 176.38 days | 17 | |
| 47 | 09/30/1973 21:25 | 03/14/1974 03:20 | 164.24 days | 18 | |
| 125 | 02/20/1990 17:59 | 07/31/1990 11:08 | 160.71 days | 19 | |
| 90 | 11/29/1984 22:20 | 05/04/1985 11:23 | 155.54 days | 20 | |
| 95 | 10/19/1985 15:36 | 03/22/1986 04:21 | 153.53 days | 21 | |
| 18 | 02/15/1969 11:48 | 07/13/1969 04:42 | 147.70 days | 22 | |
| 154 | 09/24/1995 07:14 | 02/17/1996 02:28 | 145.80 days | 23 | |
| 60 | 04/09/1976 09:36 | 08/17/1976 18:54 | 130.38 days | 24 | |
| 31 | 10/19/1971 00:47 | 02/22/1972 05:45 | 126.20 days | 25 | |
| 188 | 11/16/2001 08:52 | 03/13/2002 09:14 | 117.01 days | 26 | |
| 98 | 05/03/1986 11:04 | 08/19/1986 13:30 | 108.10 days | 27 | |
| 121 | 05/08/1989 15:22 | 08/24/1989 11:03 | 107.82 days | 28 | |
| 76 | 01/01/1979 00:03 | 03/15/1979 09:21 | 73.38 days | 29 | |
| 147 | 05/14/1994 10:23 | 07/05/1994 22:38 | 52.51 days | 30 | |
| 16 | 11/29/1968 11:47 | 01/12/1969 08:05 | 43.84 days | 31 | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|--------------------------------------|
| 82 | 01/19/1980 | 15:47 | 03/01/1980 | 11:11 | 41.80 days | 32 |
| 190 | 03/24/2002 | 08:59 | 05/04/2002 | 19:03 | 41.41 days | 33 |
| 152 | 08/02/1995 | 02:51 | 09/11/1995 | 03:35 | 40.03 days | 34 |
| 25 | 10/01/1970 | 10:14 | 11/09/1970 | 20:22 | 39.42 days | 35 |
| 89 | 10/15/1984 | 01:35 | 11/23/1984 | 10:46 | 39.38 days | 36 |
| 205 | 08/22/2004 | 15:59 | 09/29/2004 | 00:44 | 37.36 days | 37 |
| 39 | 10/28/1972 | 09:11 | 12/03/1972 | 14:53 | 36.23 days | 38 |
| 108 | 12/21/1987 | 03:31 | 01/25/1988 | 08:37 | 35.21 days | 39 |
| 193 | 07/08/2002 | 05:44 | 08/11/2002 | 20:14 | 34.60 days | 40 |
| 186 | 08/29/2001 | 08:38 | 10/02/2001 | 20:23 | 34.48 days | 41 |
| 142 | 02/22/1994 | 10:08 | 03/28/1994 | 19:30 | 34.39 days | 42 |
| 86 | 05/14/1980 | 10:04 | 06/17/1980 | 03:08 | 33.71 days | 43 |
| 129 | 08/18/1991 | 18:21 | 09/20/1991 | 02:09 | 32.32 days | 44 |
| 91 | 05/05/1985 | 11:44 | 06/06/1985 | 15:24 | 32.15 days | 45 |
| 81 | 12/13/1979 | 03:13 | 01/14/1980 | 05:12 | 32.08 days | 46 |
| 84 | 03/29/1980 | 02:14 | 04/28/1980 | 23:23 | 30.88 days | 47 |
| 100 | 09/08/1986 | 05:39 | 10/07/1986 | 08:17 | 29.10 days | 48 |
| 138 | 12/17/1993 | 17:42 | 01/14/1994 | 16:14 | 27.93 days | 49 |
| 187 | 10/05/2001 | 23:17 | 11/01/2001 | 12:56 | 26.56 days | 50 |
| 200 | 10/06/2003 | 06:08 | 11/01/2003 | 05:44 | 25.98 days | 51 |
| 207 | 10/06/2004 | 19:52 | 11/01/2004 | 03:00 | 25.29 days | 52 *** Connected Period Not Complete |
| 137 | 11/16/1993 | 10:32 | 12/11/1993 | 01:39 | 24.63 days | 53 |
| 34 | 05/05/1972 | 04:52 | 05/29/1972 | 14:03 | 24.38 days | 54 |
| 181 | 06/08/2000 | 04:39 | 07/01/2000 | 18:50 | 23.59 days | 55 |
| 112 | 03/18/1988 | 09:50 | 04/10/1988 | 23:32 | 23.57 days | 56 |
| 13 | 09/06/1968 | 05:32 | 09/29/1968 | 17:39 | 23.50 days | 57 |
| 14 | 10/04/1968 | 12:24 | 10/27/1968 | 03:57 | 22.64 days | 58 |
| 93 | 06/16/1985 | 16:05 | 07/08/1985 | 16:27 | 22.01 days | 59 |
| 48 | 03/16/1974 | 10:13 | 04/05/1974 | 19:21 | 20.38 days | 60 |
| 78 | 09/17/1979 | 12:14 | 10/07/1979 | 16:07 | 20.16 days | 61 |
| 120 | 03/30/1989 | 11:13 | 04/19/1989 | 07:54 | 19.86 days | 62 |
| 68 | 02/09/1978 | 10:09 | 03/01/1978 | 03:02 | 19.70 days | 63 |
| 107 | 11/23/1987 | 08:41 | 12/11/1987 | 10:51 | 18.09 days | 64 |
| 75 | 11/23/1978 | 04:27 | 12/10/1978 | 22:48 | 17.76 days | 65 |
| 50 | 05/06/1974 | 09:01 | 05/23/1974 | 17:36 | 17.35 days | 66 |
| 24 | 09/12/1970 | 20:37 | 09/29/1970 | 09:28 | 16.53 days | 67 |
| 201 | 11/17/2003 | 17:46 | 12/04/2003 | 01:52 | 16.33 days | 68 |
| 159 | 06/21/1996 | 14:39 | 07/07/1996 | 22:28 | 16.32 days | 69 |
| 17 | 01/16/1969 | 08:39 | 02/01/1969 | 07:15 | 15.94 days | 70 |
| 29 | 07/31/1971 | 14:21 | 08/16/1971 | 03:57 | 15.56 days | 71 |
| 133 | 11/20/1992 | 05:43 | 12/04/1992 | 22:37 | 14.70 days | 72 |
| 130 | 09/26/1991 | 03:46 | 10/10/1991 | 09:12 | 14.22 days | 73 |
| 46 | 09/05/1973 | 08:29 | 09/19/1973 | 12:31 | 14.16 days | 74 |
| 42 | 12/17/1972 | 11:19 | 12/31/1972 | 04:10 | 13.70 days | 75 |
| 180 | 05/20/2000 | 01:16 | 06/02/2000 | 17:32 | 13.67 days | 76 |
| 69 | 03/11/1978 | 07:38 | 03/24/1978 | 22:20 | 13.61 days | 77 |
| 53 | 10/28/1975 | 07:38 | 11/10/1975 | 17:42 | 13.41 days | 78 |
| 55 | 12/25/1975 | 09:44 | 01/07/1976 | 18:47 | 13.37 days | 79 |
| 111 | 03/02/1988 | 10:24 | 03/15/1988 | 17:17 | 13.28 days | 80 |
| 194 | 08/14/2002 | 16:29 | 08/27/2002 | 18:44 | 13.09 days | 81 |
| 10 | 11/13/1967 | 07:36 | 11/26/1967 | 08:28 | 13.03 days | 82 |
| 30 | 09/10/1971 | 08:18 | 09/23/1971 | 07:47 | 12.97 days | 83 |
| 170 | 07/16/1999 | 23:44 | 07/29/1999 | 21:56 | 12.92 days | 84 |
| 45 | 08/06/1973 | 11:30 | 08/19/1973 | 05:07 | 12.73 days | 85 |
| 67 | 01/17/1978 | 08:04 | 01/29/1978 | 09:54 | 12.07 days | 86 |
| 136 | 10/21/1993 | 07:50 | 11/02/1993 | 06:46 | 11.95 days | 87 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 117 | 01/29/1989 | 17:26 | 02/10/1989 | 08:27 | 11.62 days | 88 |
| 20 | 11/03/1969 | 02:05 | 11/14/1969 | 16:12 | 11.58 days | 89 |
| 59 | 03/11/1976 | 06:29 | 03/22/1976 | 09:25 | 11.12 days | 90 |
| 179 | 05/05/2000 | 02:09 | 05/16/2000 | 02:56 | 11.03 days | 91 |
| 61 | 09/03/1976 | 18:31 | 09/13/1976 | 16:36 | 9.92 days | 92 |
| 118 | 02/22/1989 | 22:22 | 03/04/1989 | 16:26 | 9.75 days | 93 |
| 184 | 07/04/2001 | 00:38 | 07/13/2001 | 07:58 | 9.30 days | 94 |
| 52 | 09/19/1975 | 19:58 | 09/28/1975 | 19:58 | 8.99 days | 95 |
| 115 | 06/07/1988 | 13:55 | 06/16/1988 | 11:31 | 8.89 days | 96 |
| 19 | 09/23/1969 | 15:39 | 10/02/1969 | 12:23 | 8.86 days | 97 |
| 21 | 11/20/1969 | 13:02 | 11/29/1969 | 08:12 | 8.79 days | 98 |
| 146 | 05/01/1994 | 01:48 | 05/09/1994 | 02:50 | 8.04 days | 99 |
| 64 | 09/02/1977 | 04:21 | 09/10/1977 | 01:03 | 7.86 days | 100 |
| 36 | 06/17/1972 | 18:52 | 06/25/1972 | 08:36 | 7.57 days | 101 |
| 1 | 04/16/1967 | 02:45 | 04/23/1967 | 15:16 | 7.52 days | 102 |
| 139 | 01/28/1994 | 23:34 | 02/05/1994 | 08:03 | 7.35 days | 103 |
| 150 | 09/09/1994 | 23:55 | 09/17/1994 | 05:25 | 7.22 days | 104 |
| 23 | 09/01/1970 | 19:44 | 09/08/1970 | 23:07 | 7.14 days | 105 |
| 192 | 06/03/2002 | 08:29 | 06/10/2002 | 09:04 | 7.02 days | 106 |
| 4 | 06/02/1967 | 07:31 | 06/09/1967 | 04:18 | 6.86 days | 107 |
| 15 | 11/18/1968 | 11:00 | 11/25/1968 | 06:12 | 6.80 days | 108 |
| 85 | 05/01/1980 | 09:22 | 05/08/1980 | 03:17 | 6.74 days | 109 |
| 73 | 09/14/1978 | 02:54 | 09/20/1978 | 20:41 | 6.74 days | 110 |
| 80 | 11/25/1979 | 05:48 | 12/01/1979 | 22:52 | 6.71 days | 111 |
| 56 | 02/02/1976 | 09:54 | 02/08/1976 | 20:58 | 6.46 days | 112 |
| 195 | 09/07/2002 | 05:21 | 09/13/2002 | 15:59 | 6.44 days | 113 |
| 110 | 02/24/1988 | 07:59 | 03/01/1988 | 10:55 | 6.12 days | 114 |
| 127 | 11/14/1990 | 02:22 | 11/20/1990 | 03:58 | 6.06 days | 115 |
| 72 | 08/19/1978 | 11:06 | 08/25/1978 | 12:36 | 6.06 days | 116 |
| 87 | 05/19/1984 | 17:40 | 05/25/1984 | 19:10 | 6.06 days | 117 |
| 71 | 06/08/1978 | 10:06 | 06/14/1978 | 09:32 | 5.97 days | 118 |
| 9 | 11/02/1967 | 13:39 | 11/08/1967 | 06:02 | 5.68 days | 119 |
| 116 | 01/19/1989 | 23:59 | 01/25/1989 | 14:38 | 5.61 days | 120 |
| 106 | 09/28/1987 | 22:01 | 10/04/1987 | 06:52 | 5.36 days | 121 |
| 28 | 05/14/1971 | 01:11 | 05/19/1971 | 09:00 | 5.32 days | 122 |
| 5 | 06/17/1967 | 04:37 | 06/22/1967 | 07:06 | 5.10 days | 123 |
| 2 | 05/06/1967 | 11:18 | 05/11/1967 | 11:28 | 5.00 days | 124 |
| 189 | 03/15/2002 | 14:29 | 03/20/2002 | 11:31 | 4.87 days | 125 |
| 197 | 10/10/2002 | 07:44 | 10/15/2002 | 02:14 | 4.77 days | 126 |
| 177 | 04/17/2000 | 21:57 | 04/22/2000 | 16:19 | 4.76 days | 127 |
| 168 | 08/22/1998 | 14:56 | 08/27/1998 | 02:38 | 4.48 days | 128 |
| 92 | 06/10/1985 | 23:10 | 06/15/1985 | 09:46 | 4.44 days | 129 |
| 88 | 06/09/1984 | 17:37 | 06/13/1984 | 18:58 | 4.05 days | 130 |
| 124 | 02/08/1990 | 05:24 | 02/12/1990 | 03:57 | 3.93 days | 131 |
| 123 | 01/25/1990 | 15:20 | 01/29/1990 | 09:21 | 3.75 days | 132 |
| 196 | 09/20/2002 | 07:41 | 09/23/2002 | 22:14 | 3.60 days | 133 |
| 38 | 08/04/1972 | 02:56 | 08/07/1972 | 16:59 | 3.58 days | 134 |
| 172 | 03/05/2000 | 12:49 | 03/08/2000 | 22:18 | 3.39 days | 135 |
| 113 | 04/30/1988 | 07:44 | 05/03/1988 | 15:04 | 3.30 days | 136 |
| 191 | 05/17/2002 | 23:55 | 05/21/2002 | 07:02 | 3.29 days | 137 |
| 203 | 01/01/2004 | 16:47 | 01/04/2004 | 23:12 | 3.26 days | 138 |
| 202 | 12/12/2003 | 23:12 | 12/16/2003 | 04:29 | 3.21 days | 139 |
| 96 | 03/24/1986 | 01:49 | 03/27/1986 | 05:52 | 3.16 days | 140 |
| 41 | 12/13/1972 | 06:41 | 12/16/1972 | 09:46 | 3.12 days | 141 |
| 43 | 01/01/1973 | 20:41 | 01/04/1973 | 21:58 | 3.05 days | 142 |
| 7 | 09/22/1967 | 01:07 | 09/25/1967 | 02:07 | 3.04 days | 143 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 132 | 10/31/1992 | 23:11 | 11/03/1992 | 22:44 | 2.98 days | 144 |
| 32 | 03/22/1972 | 09:48 | 03/25/1972 | 09:10 | 2.97 days | 145 |
| 3 | 05/25/1967 | 02:05 | 05/28/1967 | 00:52 | 2.94 days | 146 |
| 157 | 05/02/1996 | 21:59 | 05/05/1996 | 17:58 | 2.83 days | 147 |
| 174 | 03/14/2000 | 22:49 | 03/17/2000 | 16:28 | 2.73 days | 148 |
| 65 | 12/16/1977 | 18:53 | 12/19/1977 | 12:22 | 2.72 days | 149 |
| 176 | 04/12/2000 | 14:04 | 04/15/2000 | 06:32 | 2.68 days | 150 |
| 182 | 10/27/2000 | 23:32 | 10/30/2000 | 15:18 | 2.65 days | 151 |
| 109 | 02/20/1988 | 16:33 | 02/23/1988 | 07:41 | 2.63 days | 152 |
| 141 | 02/11/1994 | 10:30 | 02/14/1994 | 00:26 | 2.58 days | 153 |
| 155 | 03/01/1996 | 02:18 | 03/03/1996 | 15:56 | 2.56 days | 154 |
| 165 | 06/16/1998 | 21:58 | 06/19/1998 | 11:26 | 2.56 days | 155 |
| 166 | 07/08/1998 | 23:09 | 07/11/1998 | 12:28 | 2.55 days | 156 |
| 175 | 04/02/2000 | 23:05 | 04/05/2000 | 09:59 | 2.45 days | 157 |
| 144 | 04/04/1994 | 10:56 | 04/06/1994 | 21:45 | 2.45 days | 158 |
| 74 | 09/23/1978 | 12:40 | 09/25/1978 | 17:07 | 2.18 days | 159 |
| 145 | 04/18/1994 | 04:01 | 04/20/1994 | 08:18 | 2.17 days | 160 |
| 35 | 06/10/1972 | 21:51 | 06/13/1972 | 00:56 | 2.12 days | 161 |
| 94 | 10/06/1985 | 02:59 | 10/08/1985 | 05:39 | 2.11 days | 162 |
| 66 | 01/11/1978 | 17:44 | 01/13/1978 | 20:08 | 2.10 days | 163 |
| 122 | 12/29/1989 | 22:38 | 01/01/1990 | 00:23 | 2.07 days | 164 |
| 104 | 09/20/1987 | 02:54 | 09/22/1987 | 04:37 | 2.07 days | 165 |
| 33 | 04/30/1972 | 00:53 | 05/02/1972 | 02:27 | 2.06 days | 166 |
| 105 | 09/26/1987 | 01:22 | 09/27/1987 | 23:43 | 1.93 days | 167 |
| 70 | 06/03/1978 | 19:12 | 06/05/1978 | 16:06 | 1.87 days | 168 |
| 99 | 08/24/1986 | 02:40 | 08/25/1986 | 22:06 | 1.80 days | 169 |
| 49 | 04/21/1974 | 11:23 | 04/23/1974 | 06:46 | 1.80 days | 170 |
| 54 | 12/01/1975 | 20:35 | 12/03/1975 | 14:41 | 1.75 days | 171 |
| 11 | 12/15/1967 | 14:34 | 12/17/1967 | 08:12 | 1.73 days | 172 |
| 156 | 03/16/1996 | 17:28 | 03/18/1996 | 09:58 | 1.68 days | 173 |
| 8 | 10/23/1967 | 01:37 | 10/24/1967 | 15:59 | 1.59 days | 174 |
| 178 | 05/02/2000 | 20:26 | 05/04/2000 | 10:09 | 1.57 days | 175 |
| 103 | 09/15/1987 | 05:20 | 09/16/1987 | 18:18 | 1.54 days | 176 |
| 97 | 04/16/1986 | 04:31 | 04/17/1986 | 17:04 | 1.52 days | 177 |
| 158 | 06/18/1996 | 17:44 | 06/20/1996 | 02:59 | 1.38 days | 178 |
| 62 | 09/23/1976 | 02:56 | 09/24/1976 | 09:18 | 1.26 days | 179 |
| 102 | 09/12/1987 | 17:12 | 09/13/1987 | 23:28 | 1.26 days | 180 |
| 37 | 07/11/1972 | 20:07 | 07/13/1972 | 02:13 | 1.25 days | 181 |
| 26 | 01/15/1971 | 16:05 | 01/16/1971 | 21:33 | 1.22 days | 182 |
| 40 | 12/06/1972 | 22:56 | 12/08/1972 | 03:18 | 1.18 days | 183 |
| 58 | 02/29/1976 | 21:28 | 03/02/1976 | 01:32 | 1.16 days | 184 |
| 173 | 03/10/2000 | 13:58 | 03/11/2000 | 17:56 | 1.16 days | 185 |
| 6 | 08/25/1967 | 20:47 | 08/27/1967 | 00:45 | 1.16 days | 186 |
| 114 | 06/01/1988 | 23:00 | 06/03/1988 | 00:51 | 1.07 days | 187 |
| 135 | 10/13/1993 | 23:26 | 10/15/1993 | 00:54 | 1.06 days | 188 |
| 199 | 06/12/2003 | 13:14 | 06/13/2003 | 14:29 | 1.05 days | 189 |
| 57 | 02/13/1976 | 16:46 | 02/14/1976 | 17:48 | 1.04 days | 190 |
| 153 | 09/18/1995 | 02:49 | 09/19/1995 | 03:11 | 1.01 days | 191 |
| 119 | 03/25/1989 | 15:23 | 03/26/1989 | 15:23 | 1.00 days | 192 |
| 79 | 11/01/1979 | 12:47 | 11/02/1979 | 12:40 | 0.99 days | 193 |
| 148 | 08/09/1994 | 18:14 | 08/10/1994 | 16:40 | 0.93 days | 194 |
| 83 | 03/08/1980 | 05:56 | 03/09/1980 | 03:57 | 0.91 days | 195 |
| 149 | 09/05/1994 | 19:56 | 09/06/1994 | 15:44 | 0.82 days | 196 |
| 171 | 01/13/2000 | 03:56 | 01/13/2000 | 22:56 | 0.79 days | 197 |
| 140 | 02/07/1994 | 19:34 | 02/08/1994 | 13:37 | 0.75 days | 198 |
| 143 | 03/30/1994 | 22:31 | 03/31/1994 | 13:43 | 0.63 days | 199 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 27 | 04/25/1971 | 07:47 | 04/25/1971 | 22:58 | 0.63 days | 200 |
| 185 | 07/25/2001 | 22:18 | 07/26/2001 | 11:58 | 0.56 days | 201 |
| 160 | 08/25/1996 | 15:49 | 08/26/1996 | 04:38 | 0.53 days | 202 |
| 126 | 09/17/1990 | 03:51 | 09/17/1990 | 16:11 | 0.51 days | 203 |
| 162 | 09/18/1997 | 08:40 | 09/18/1997 | 18:38 | 0.41 days | 204 |
| 167 | 07/13/1998 | 00:04 | 07/13/1998 | 09:51 | 0.40 days | 205 |
| 163 | 09/19/1997 | 09:15 | 09/19/1997 | 18:48 | 0.39 days | 206 |
| 206 | 09/30/2004 | 23:47 | 10/01/2004 | 07:59 | 0.34 days | 207 |

Hog Island Oxbow Connections to the Brazos River – Chronology of Disconnections
 Jordan Furnans, TWDB 11/4/2004, 12:43

USGS Gauge: 08116650 Brazos Rv nr Rosharon, TX
 Gauge Datum: 0.0 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 1.275ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 2.9 ft
 Measured River Slope (Using TWDB GPS): 0.5 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Distance upstream to Rosharon Gauge from Oxbow: 46522.3097 ft (8.81 miles)
 Estimated Critical Gauge Height/WSE: 6.0305/7.3055 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 7.0305/8.3055 ft
 Required Discharge for "significant" connection: 3152.7609 cfs
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 4/1/1967-11/1/2004
 Number of Records: 150152
 Years of Record: 37.5869
 Number of Critical WSE Exceedences: 265
 Number of "significant" WSE Exceedences: 207
 Average Connections per year: 5.5072
 Flood Level Required for Connection: 1.0002 year flood (3152.7609 cfs)

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|-----|------------------|------------------|-------------|------|-------|
| 206 | 10/01/2004 07:59 | 10/06/2004 19:52 | 5.97 days | 134 | |
| 205 | 09/29/2004 00:44 | 09/30/2004 23:47 | 2.15 days | 183 | |
| 204 | 08/21/2004 22:29 | 08/22/2004 15:59 | 1.70 days | 189 | |
| 203 | 01/04/2004 23:12 | 01/17/2004 02:56 | 12.90 days | 95 | |
| 202 | 12/16/2003 04:29 | 01/01/2004 16:47 | 17.23 days | 72 | |
| 201 | 12/04/2003 01:52 | 12/12/2003 23:12 | 9.72 days | 111 | |
| 200 | 11/01/2003 05:44 | 11/17/2003 17:46 | 16.58 days | 75 | |
| 199 | 06/13/2003 14:29 | 10/06/2003 06:08 | 2.44 days | 180 | |
| 198 | 05/14/2003 05:37 | 06/12/2003 13:14 | 30.25 days | 37 | |
| 197 | 10/15/2002 02:14 | 10/22/2002 00:29 | 7.91 days | 121 | |
| 196 | 09/23/2002 22:14 | 10/10/2002 07:44 | 17.35 days | 71 | |
| 195 | 09/13/2002 15:59 | 09/20/2002 07:41 | 7.38 days | 122 | |
| 194 | 08/27/2002 18:44 | 09/07/2002 05:21 | 10.88 days | 105 | |
| 193 | 08/11/2002 20:14 | 08/14/2002 16:29 | 3.78 days | 164 | |
| 192 | 06/10/2002 09:04 | 07/08/2002 05:44 | 28.79 days | 41 | |
| 191 | 05/21/2002 07:02 | 06/03/2002 08:29 | 14.04 days | 88 | |
| 190 | 05/04/2002 19:03 | 05/17/2002 23:55 | 13.90 days | 89 | |
| 189 | 03/20/2002 11:31 | 03/24/2002 08:59 | 4.83 days | 146 | |
| 188 | 03/13/2002 09:14 | 03/15/2002 14:29 | 3.15 days | 172 | |
| 187 | 11/01/2001 12:56 | 11/16/2001 08:52 | 15.66 days | 81 | |
| 186 | 10/02/2001 20:23 | 10/05/2001 23:17 | 3.40 days | 167 | |
| 185 | 07/26/2001 11:58 | 08/29/2001 08:38 | 34.48 days | 33 | |
| 184 | 07/13/2001 07:58 | 07/25/2001 22:18 | 12.9 days | 96 | |
| 183 | 07/03/2001 16:14 | 07/04/2001 00:38 | 0.97 days | 201 | |
| 182 | 10/30/2000 15:18 | 11/06/2000 06:27 | 7.07 days | 124 | |
| 181 | 07/01/2000 18:50 | 10/27/2000 23:32 | 118.71 days | 6 | |
| 180 | 06/02/2000 17:32 | 06/08/2000 04:39 | 6.1 days | 132 | |
| 179 | 05/16/2000 02:56 | 05/20/2000 01:16 | 4.19 days | 155 | |
| 178 | 05/04/2000 10:09 | 05/05/2000 02:09 | 0.81 days | 205 | |
| 177 | 04/22/2000 16:19 | 05/02/2000 20:26 | 10.59 days | 107 | |
| 176 | 04/15/2000 06:32 | 04/17/2000 21:57 | 3.56 days | 165 | |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 175 | 04/05/2000 | 09:59 | 04/12/2000 | 14:04 | 7.23 days | 123 |
| 174 | 03/17/2000 | 16:28 | 04/02/2000 | 23:05 | 16.36 days | 77 |
| 173 | 03/11/2000 | 17:56 | 03/14/2000 | 22:49 | 3.99 days | 158 |
| 172 | 03/08/2000 | 22:18 | 03/10/2000 | 13:58 | 2.59 days | 178 |
| 171 | 01/13/2000 | 22:56 | 03/05/2000 | 12:49 | 52.36 days | 23 |
| 170 | 07/29/1999 | 21:56 | 01/13/2000 | 03:56 | 168.15 days | 3 |
| 169 | 07/08/1999 | 22:58 | 07/16/1999 | 23:44 | 8.73 days | 117 |
| 168 | 08/27/1998 | 02:38 | 09/10/1998 | 07:27 | 14.64 days | 84 |
| 167 | 07/13/1998 | 09:51 | 08/22/1998 | 14:56 | 41.12 days | 30 |
| 166 | 07/11/1998 | 12:28 | 07/13/1998 | 00:04 | 1.54 days | 191 |
| 165 | 06/19/1998 | 11:26 | 07/08/1998 | 23:09 | 19.63 days | 63 |
| 164 | 06/15/1998 | 22:58 | 06/16/1998 | 21:58 | 1.90 days | 187 |
| 163 | 09/19/1997 | 18:48 | 09/22/1997 | 11:41 | 3.36 days | 168 |
| 162 | 09/18/1997 | 18:38 | 09/19/1997 | 09:15 | 0.85 days | 204 |
| 161 | 09/17/1997 | 23:39 | 09/18/1997 | 08:40 | 1.01 days | 196 |
| 160 | 08/26/1996 | 04:38 | 08/30/1996 | 12:26 | 4.74 days | 149 |
| 159 | 07/07/1996 | 22:28 | 08/25/1996 | 15:49 | 49.51 days | 25 |
| 158 | 06/20/1996 | 02:59 | 06/21/1996 | 14:39 | 2.11 days | 185 |
| 157 | 05/05/1996 | 17:58 | 06/18/1996 | 17:44 | 44.69 days | 29 |
| 156 | 03/18/1996 | 09:58 | 05/02/1996 | 21:59 | 46.45 days | 27 |
| 155 | 03/03/1996 | 15:56 | 03/16/1996 | 17:28 | 13.51 days | 91 |
| 154 | 02/17/1996 | 02:28 | 03/01/1996 | 02:18 | 13.29 days | 93 |
| 153 | 09/19/1995 | 03:11 | 09/24/1995 | 07:14 | 5.16 days | 143 |
| 152 | 09/11/1995 | 03:35 | 09/18/1995 | 02:49 | 6.96 days | 125 |
| 151 | 07/23/1995 | 18:55 | 08/02/1995 | 02:51 | 9.33 days | 114 |
| 150 | 09/17/1994 | 05:25 | 10/13/1994 | 11:49 | 26.26 days | 44 |
| 149 | 09/06/1994 | 15:44 | 09/09/1994 | 23:55 | 3.34 days | 170 |
| 148 | 08/10/1994 | 16:40 | 09/05/1994 | 19:56 | 26.13 days | 45 |
| 147 | 07/05/1994 | 22:38 | 08/09/1994 | 18:14 | 34.81 days | 32 |
| 146 | 05/09/1994 | 02:50 | 05/14/1994 | 10:23 | 5.31 days | 141 |
| 145 | 04/20/1994 | 08:18 | 05/01/1994 | 01:48 | 10.72 days | 106 |
| 144 | 04/06/1994 | 21:45 | 04/18/1994 | 04:01 | 11.26 days | 102 |
| 143 | 03/31/1994 | 13:43 | 04/04/1994 | 10:56 | 3.88 days | 161 |
| 142 | 03/28/1994 | 19:30 | 03/30/1994 | 22:31 | 2.12 days | 184 |
| 141 | 02/14/1994 | 00:26 | 02/22/1994 | 10:08 | 8.40 days | 119 |
| 140 | 02/08/1994 | 13:37 | 02/11/1994 | 10:30 | 2.87 days | 174 |
| 139 | 02/05/1994 | 08:03 | 02/07/1994 | 19:34 | 2.48 days | 179 |
| 138 | 01/14/1994 | 16:14 | 01/28/1994 | 23:34 | 14.30 days | 85 |
| 137 | 12/11/1993 | 01:39 | 12/17/1993 | 17:42 | 6.66 days | 128 |
| 136 | 11/02/1993 | 06:46 | 11/16/1993 | 10:32 | 14.15 days | 87 |
| 135 | 10/15/1993 | 00:54 | 10/21/1993 | 07:50 | 6.28 days | 130 |
| 134 | 07/27/1993 | 22:06 | 10/13/1993 | 23:26 | 78.05 days | 12 |
| 133 | 12/04/1992 | 22:37 | 12/15/1992 | 04:04 | 10.22 days | 108 |
| 132 | 11/03/1992 | 22:44 | 11/20/1992 | 05:43 | 16.29 days | 78 |
| 131 | 09/30/1992 | 23:39 | 10/31/1992 | 23:11 | 30.98 days | 36 |
| 130 | 10/10/1991 | 09:12 | 11/01/1991 | 16:51 | 22.31 days | 54 |
| 129 | 09/20/1991 | 02:09 | 09/26/1991 | 03:46 | 6.06 days | 133 |
| 128 | 07/16/1991 | 08:07 | 08/18/1991 | 18:21 | 33.42 days | 34 |
| 127 | 11/20/1990 | 03:58 | 01/04/1991 | 08:02 | 45.16 days | 28 |
| 126 | 09/17/1990 | 16:11 | 11/14/1990 | 02:22 | 57.42 days | 22 |
| 125 | 07/31/1990 | 11:08 | 09/17/1990 | 03:51 | 47.69 days | 26 |
| 124 | 02/12/1990 | 03:57 | 02/20/1990 | 17:59 | 8.58 days | 118 |
| 123 | 01/29/1990 | 09:21 | 02/08/1990 | 05:24 | 9.83 days | 110 |
| 122 | 01/01/1990 | 00:23 | 01/25/1990 | 15:20 | 24.62 days | 51 |
| 121 | 08/24/1989 | 11:03 | 12/29/1989 | 22:38 | 127.48 days | 4 |
| 120 | 04/19/1989 | 07:54 | 05/08/1989 | 15:22 | 19.31 days | 66 |

| | | | | | | |
|-----|------------|-------|------------|-------|-------------|-----|
| 119 | 03/26/1989 | 15:23 | 03/30/1989 | 11:13 | 3.82 days | 163 |
| 118 | 03/04/1989 | 16:26 | 03/25/1989 | 15:23 | 20.95 days | 60 |
| 117 | 02/10/1989 | 08:27 | 02/22/1989 | 22:22 | 12.57 days | 98 |
| 116 | 01/25/1989 | 14:38 | 01/29/1989 | 17:26 | 4.11 days | 156 |
| 115 | 06/16/1988 | 11:31 | 01/19/1989 | 23:59 | 217.51 days | 2 |
| 114 | 06/03/1988 | 00:51 | 06/07/1988 | 13:55 | 4.54 days | 152 |
| 113 | 05/03/1988 | 15:04 | 06/01/1988 | 23:00 | 29.33 days | 39 |
| 112 | 04/10/1988 | 23:32 | 04/30/1988 | 07:44 | 19.34 days | 65 |
| 111 | 03/15/1988 | 17:17 | 03/18/1988 | 09:50 | 2.68 days | 176 |
| 110 | 03/01/1988 | 10:55 | 03/02/1988 | 10:24 | 0.97 days | 200 |
| 109 | 02/23/1988 | 07:41 | 02/24/1988 | 07:59 | 1.01 days | 199 |
| 108 | 01/25/1988 | 08:37 | 02/20/1988 | 16:33 | 26.33 days | 43 |
| 107 | 12/11/1987 | 10:51 | 12/21/1987 | 03:31 | 9.69 days | 112 |
| 106 | 10/04/1987 | 06:52 | 11/23/1987 | 08:41 | 50.07 days | 24 |
| 105 | 09/27/1987 | 23:43 | 09/28/1987 | 22:01 | 0.92 days | 203 |
| 104 | 09/22/1987 | 04:37 | 09/26/1987 | 01:22 | 3.86 days | 162 |
| 103 | 09/16/1987 | 18:18 | 09/20/1987 | 02:54 | 3.35 days | 169 |
| 102 | 09/13/1987 | 23:28 | 09/15/1987 | 05:20 | 1.24 days | 194 |
| 101 | 09/07/1987 | 07:55 | 09/12/1987 | 17:12 | 5.38 days | 139 |
| 100 | 10/07/1986 | 08:17 | 10/07/1986 | 14:31 | 0.26 days | 206 |
| 99 | 08/25/1986 | 22:06 | 09/08/1986 | 05:39 | 13.31 days | 92 |
| 98 | 08/19/1986 | 13:30 | 08/24/1986 | 02:40 | 4.54 days | 151 |
| 97 | 04/17/1986 | 17:04 | 05/03/1986 | 11:04 | 15.75 days | 79 |
| 96 | 03/27/1986 | 05:52 | 04/16/1986 | 04:31 | 19.94 days | 61 |
| 95 | 03/22/1986 | 04:21 | 03/24/1986 | 01:49 | 1.89 days | 188 |
| 94 | 10/08/1985 | 05:39 | 10/19/1985 | 15:36 | 11.41 days | 100 |
| 93 | 07/08/1985 | 16:27 | 10/06/1985 | 02:59 | 89.43 days | 10 |
| 92 | 06/15/1985 | 09:46 | 06/16/1985 | 16:05 | 1.26 days | 193 |
| 91 | 06/06/1985 | 15:24 | 06/10/1985 | 23:10 | 4.32 days | 153 |
| 90 | 05/04/1985 | 11:23 | 05/05/1985 | 11:44 | 1.01 days | 198 |
| 89 | 11/23/1984 | 10:46 | 11/29/1984 | 22:20 | 6.48 days | 129 |
| 88 | 06/13/1984 | 18:58 | 10/15/1984 | 01:35 | 123.27 days | 5 |
| 87 | 05/25/1984 | 19:10 | 06/09/1984 | 17:37 | 14.93 days | 83 |
| 86 | 06/17/1980 | 03:08 | 05/19/1984 | 17:40 | 14.93 days | 1 |
| 85 | 05/08/1980 | 03:17 | 05/14/1980 | 10:04 | 6.28 days | 131 |
| 84 | 04/28/1980 | 23:23 | 05/01/1980 | 09:22 | 2.41 days | 181 |
| 83 | 03/09/1980 | 03:57 | 03/29/1980 | 02:14 | 19.92 days | 62 |
| 82 | 03/01/1980 | 11:11 | 03/08/1980 | 05:56 | 6.78 days | 127 |
| 81 | 01/14/1980 | 05:12 | 01/19/1980 | 15:47 | 5.44 days | 138 |
| 80 | 12/01/1979 | 22:52 | 12/13/1979 | 03:13 | 11.18 days | 103 |
| 79 | 11/02/1979 | 12:40 | 11/25/1979 | 05:48 | 22.71 days | 53 |
| 78 | 10/07/1979 | 16:07 | 11/01/1979 | 12:47 | 24.86 days | 50 |
| 77 | 09/11/1979 | 16:59 | 09/17/1979 | 12:14 | 5.80 days | 137 |
| 76 | 03/15/1979 | 09:21 | 03/19/1979 | 07:43 | 3.93 days | 159 |
| 75 | 12/10/1978 | 22:48 | 01/01/1979 | 00:03 | 21.05 days | 59 |
| 74 | 09/25/1978 | 17:07 | 11/23/1978 | 04:27 | 58.47 days | 20 |
| 73 | 09/20/1978 | 20:41 | 09/23/1978 | 12:40 | 2.66 days | 177 |
| 72 | 08/25/1978 | 12:36 | 09/14/1978 | 02:54 | 19.59 days | 64 |
| 71 | 06/14/1978 | 09:32 | 08/19/1978 | 11:06 | 66.06 days | 17 |
| 70 | 06/05/1978 | 16:06 | 06/08/1978 | 10:06 | 2.75 days | 175 |
| 69 | 03/24/1978 | 22:20 | 06/03/1978 | 19:12 | 70.86 days | 15 |
| 68 | 03/01/1978 | 03:02 | 03/11/1978 | 07:38 | 10.19 days | 109 |
| 67 | 01/29/1978 | 09:54 | 02/09/1978 | 10:09 | 11.01 days | 104 |
| 66 | 01/13/1978 | 20:08 | 01/17/1978 | 08:04 | 3.49 days | 166 |
| 65 | 12/19/1977 | 12:22 | 01/11/1978 | 17:44 | 23.22 days | 52 |
| 64 | 09/10/1977 | 01:03 | 12/16/1977 | 18:53 | 97.74 days | 9 |

| | | | | | | |
|----|------------|-------|------------|-------|-------------|-----|
| 63 | 07/04/1977 | 14:47 | 09/02/1977 | 04:21 | 59.56 days | 19 |
| 62 | 09/24/1976 | 09:18 | 09/29/1976 | 18:13 | 5.37 days | 140 |
| 61 | 09/13/1976 | 16:36 | 09/23/1976 | 02:56 | 9.43 days | 113 |
| 60 | 08/17/1976 | 18:54 | 09/03/1976 | 18:31 | 16.98 days | 74 |
| 59 | 03/22/1976 | 09:25 | 04/09/1976 | 09:36 | 18.00 days | 70 |
| 58 | 03/02/1976 | 01:32 | 03/11/1976 | 06:29 | 9.20 days | 115 |
| 57 | 02/14/1976 | 17:48 | 02/29/1976 | 21:28 | 15.15 days | 82 |
| 56 | 02/08/1976 | 20:58 | 02/13/1976 | 16:46 | 4.82 days | 147 |
| 55 | 01/07/1976 | 18:47 | 02/02/1976 | 09:54 | 25.62 days | 48 |
| 54 | 12/03/1975 | 14:41 | 12/25/1975 | 09:44 | 21.79 days | 57 |
| 53 | 11/10/1975 | 17:42 | 12/01/1975 | 20:35 | 21.11 days | 58 |
| 52 | 09/28/1975 | 19:58 | 10/28/1975 | 07:38 | 29.48 days | 38 |
| 51 | 09/13/1975 | 22:56 | 09/19/1975 | 19:58 | 5.87 days | 135 |
| 50 | 05/23/1974 | 17:36 | 09/01/1974 | 10:33 | 100.70 days | 7 |
| 49 | 04/23/1974 | 06:46 | 05/06/1974 | 09:01 | 13.09 days | 94 |
| 48 | 04/05/1974 | 19:21 | 04/21/1974 | 11:23 | 15.66 days | 80 |
| 47 | 03/14/1974 | 03:20 | 03/16/1974 | 10:13 | 2.28 days | 182 |
| 46 | 09/19/1973 | 12:31 | 09/30/1973 | 21:25 | 11.37 days | 101 |
| 45 | 08/19/1973 | 05:07 | 09/05/1973 | 08:29 | 17.14 days | 73 |
| 44 | 08/05/1973 | 11:08 | 08/06/1973 | 11:30 | 1.01 days | 197 |
| 43 | 01/04/1973 | 21:58 | 01/06/1973 | 04:28 | 1.27 days | 192 |
| 42 | 12/31/1972 | 04:10 | 01/01/1973 | 20:41 | 1.68 days | 190 |
| 41 | 12/16/1972 | 09:46 | 12/17/1972 | 11:19 | 1.06 days | 195 |
| 40 | 12/08/1972 | 03:18 | 12/13/1972 | 06:41 | 5.14 days | 144 |
| 39 | 12/03/1972 | 14:53 | 12/06/1972 | 22:56 | 3.33 days | 171 |
| 38 | 08/07/1972 | 16:59 | 10/28/1972 | 09:11 | 81.67 days | 11 |
| 37 | 07/13/1972 | 02:13 | 08/04/1972 | 02:56 | 22.02 days | 56 |
| 36 | 06/25/1972 | 08:36 | 07/11/1972 | 20:07 | 16.48 days | 76 |
| 35 | 06/13/1972 | 00:56 | 06/17/1972 | 18:52 | 4.74 days | 150 |
| 34 | 05/29/1972 | 14:03 | 06/10/1972 | 21:51 | 12.32 days | 99 |
| 33 | 05/02/1972 | 02:27 | 05/05/1972 | 04:52 | 3.10 days | 173 |
| 32 | 03/25/1972 | 09:10 | 04/30/1972 | 00:53 | 35.65 days | 31 |
| 31 | 02/22/1972 | 05:45 | 03/22/1972 | 09:48 | 29.16 days | 40 |
| 30 | 09/23/1971 | 07:47 | 10/19/1971 | 00:47 | 25.70 days | 47 |
| 29 | 08/16/1971 | 03:57 | 09/10/1971 | 08:18 | 25.18 days | 49 |
| 28 | 05/19/1971 | 09:00 | 07/31/1971 | 14:21 | 73.22 days | 13 |
| 27 | 04/25/1971 | 22:58 | 05/14/1971 | 01:11 | 18.09 days | 69 |
| 26 | 01/16/1971 | 21:33 | 04/25/1971 | 07:47 | 98.42 days | 8 |
| 25 | 11/09/1970 | 20:22 | 01/15/1971 | 16:05 | 66.82 days | 16 |
| 24 | 09/29/1970 | 09:28 | 10/01/1970 | 10:14 | 2.03 days | 186 |
| 23 | 09/08/1970 | 23:07 | 09/12/1970 | 20:37 | 3.89 days | 160 |
| 22 | 07/05/1970 | 15:45 | 09/01/1970 | 19:44 | 58.16 days | 21 |
| 21 | 11/29/1969 | 08:12 | 12/06/1969 | 04:50 | 6.85 days | 126 |
| 20 | 11/14/1969 | 16:12 | 11/20/1969 | 13:02 | 5.86 days | 136 |
| 19 | 10/02/1969 | 12:23 | 11/03/1969 | 02:05 | 31.57 days | 35 |
| 18 | 07/13/1969 | 04:42 | 09/23/1969 | 15:39 | 72.45 days | 14 |
| 17 | 02/01/1969 | 07:15 | 02/15/1969 | 11:48 | 14.18 days | 86 |
| 16 | 01/12/1969 | 08:05 | 01/16/1969 | 08:39 | 4.02 days | 157 |
| 15 | 11/25/1968 | 06:12 | 11/29/1968 | 11:47 | 4.23 days | 154 |
| 14 | 10/27/1968 | 03:57 | 11/18/1968 | 11:00 | 22.29 days | 55 |
| 13 | 09/29/1968 | 17:39 | 10/04/1968 | 12:24 | 4.78 days | 148 |
| 12 | 08/18/1968 | 06:31 | 09/06/1968 | 05:32 | 18.95 days | 68 |
| 11 | 12/17/1967 | 08:12 | 12/18/1967 | 07:31 | 0.97 days | 202 |
| 10 | 11/26/1967 | 08:28 | 12/15/1967 | 14:34 | 19.25 days | 67 |
| 9 | 11/08/1967 | 06:02 | 11/13/1967 | 07:36 | 5.06 days | 145 |
| 8 | 10/24/1967 | 15:59 | 11/02/1967 | 13:39 | 8.90 days | 116 |

| | | | | |
|---|------------------|------------------|------------|-----|
| 7 | 09/25/1967 02:07 | 10/23/1967 01:37 | 27.97 days | 42 |
| 6 | 08/27/1967 00:45 | 09/22/1967 01:07 | 26.01 days | 46 |
| 5 | 06/22/1967 07:06 | 08/25/1967 20:47 | 64.57 days | 18 |
| 4 | 06/09/1967 04:18 | 06/17/1967 04:37 | 8.01 days | 120 |
| 3 | 05/28/1967 00:52 | 06/02/1967 07:31 | 5.27 days | 142 |
| 2 | 05/11/1967 11:28 | 05/25/1967 02:05 | 13.60 days | 90 |
| 1 | 04/23/1967 15:16 | 05/06/1967 11:18 | 12.83 days | 97 |

Hog Island Oxbow Connections to the Brazos River – Ranked by Disconnection Duration
 Jordan Furnans, TWDB 11/4/2004, 12:43

USGS Gauge: 08116650 Brazos Rv nr Rosharon, TX
 Gauge Datum: 0.0 ft above MSL (NGVD29) (USGS Published Value)
 Gauge Datum: 1.275ft above MSL (NAD88) (TWDB Measurement with GPS)
 Control Point Elevation: 2.9 ft
 Measured River Slope (Using TWDB GPS): 0.5 ft/mile
 Common Brazos River Slope (See Dunn and Raines): 0.7 ft/mile
 Distance upstream to Rosharon Gauge from Oxbow: 46522.3097 ft (8.81 miles)
 Estimated Critical Gauge Height/WSE: 6.0305/7.3055 ft
 Height Buffer for "significant" connection: 1 ft
 Required Gauge Height/WSE for "significant" connection: 7.0305/8.3055 ft
 Required Discharge for "significant" connection: 3152.7609 cfs
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 4/1/1967-11/1/2004
 Number of Records: 150152
 Years of Record: 37.5869
 Number of Critical WSE Exceedences: 265
 Number of "significant" WSE Exceedences: 207
 Average Connections per year: 5.5072
 Flood Level Required for Connection: 1.0002 year flood (3152.7609 cfs)

| ----- Disconnection Details ----- | | | | | | |
|-----------------------------------|------------------|------------------|--------------|------|-------|--|
| # | Start Date | End Date | Duration | Rank | Notes | |
| 86 | 06/17/1980 03:08 | 05/19/1984 17:40 | 1432.60 days | 1 | | |
| 115 | 06/16/1988 11:31 | 01/19/1989 23:59 | 217.51 days | 2 | | |
| 170 | 07/29/1999 21:56 | 01/13/2000 03:56 | 168.15 days | 3 | | |
| 121 | 08/24/1989 11:03 | 12/29/1989 22:38 | 127.48 days | 4 | | |
| 88 | 06/13/1984 18:58 | 10/15/1984 01:35 | 123.27 days | 5 | | |
| 181 | 07/01/2000 18:50 | 10/27/2000 23:32 | 118.71 days | 6 | | |
| 50 | 05/23/1974 17:36 | 09/01/1974 10:33 | 100.70 days | 7 | | |
| 26 | 01/16/1971 21:33 | 04/25/1971 07:47 | 98.42 days | 8 | | |
| 64 | 09/10/1977 01:03 | 12/16/1977 18:53 | 97.74 days | 9 | | |
| 93 | 07/08/1985 16:27 | 10/06/1985 02:59 | 89.43 days | 10 | | |
| 38 | 08/07/1972 16:59 | 10/28/1972 09:11 | 81.67 days | 11 | | |
| 134 | 07/27/1993 22:06 | 10/13/1993 23:26 | 78.05 days | 12 | | |
| 28 | 05/19/1971 09:00 | 07/31/1971 14:21 | 73.22 days | 13 | | |
| 18 | 07/13/1969 04:42 | 09/23/1969 15:39 | 72.45 days | 14 | | |
| 69 | 03/24/1978 22:20 | 06/03/1978 19:12 | 70.86 days | 15 | | |
| 25 | 11/09/1970 20:22 | 01/15/1971 16:05 | 66.82 days | 16 | | |
| 71 | 06/14/1978 09:32 | 08/19/1978 11:06 | 66.06 days | 17 | | |
| 5 | 06/22/1967 07:06 | 08/25/1967 20:47 | 64.57 days | 18 | | |
| 63 | 07/04/1977 14:47 | 09/02/1977 04:21 | 59.56 days | 19 | | |
| 74 | 09/25/1978 17:07 | 11/23/1978 04:27 | 58.47 days | 20 | | |
| 22 | 07/05/1970 15:45 | 09/01/1970 19:44 | 58.16 days | 21 | | |
| 126 | 09/17/1990 16:11 | 11/14/1990 02:22 | 57.42 days | 22 | | |
| 171 | 01/13/2000 22:56 | 03/05/2000 12:49 | 52.36 days | 23 | | |
| 106 | 10/04/1987 06:52 | 11/23/1987 08:41 | 50.07 days | 24 | | |
| 159 | 07/07/1996 22:28 | 08/25/1996 15:49 | 49.51 days | 25 | | |
| 125 | 07/31/1990 11:08 | 09/17/1990 03:51 | 47.69 days | 26 | | |
| 156 | 03/18/1996 09:58 | 05/02/1996 21:59 | 46.45 days | 27 | | |
| 127 | 11/20/1990 03:58 | 01/04/1991 08:02 | 45.16 days | 28 | | |
| 157 | 05/05/1996 17:58 | 06/18/1996 17:44 | 44.69 days | 29 | | |
| 167 | 07/13/1998 09:51 | 08/22/1998 14:56 | 41.12 days | 30 | | |
| 32 | 03/25/1972 09:10 | 04/30/1972 00:53 | 35.65 days | 31 | | |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|----|
| 147 | 07/05/1994 | 22:38 | 08/09/1994 | 18:14 | 34.81 days | 32 |
| 185 | 07/26/2001 | 11:58 | 08/29/2001 | 08:38 | 34.48 days | 33 |
| 128 | 07/16/1991 | 08:07 | 08/18/1991 | 18:21 | 33.42 days | 34 |
| 19 | 10/02/1969 | 12:23 | 11/03/1969 | 02:05 | 31.57 days | 35 |
| 131 | 09/30/1992 | 23:39 | 10/31/1992 | 23:11 | 30.98 days | 36 |
| 198 | 05/14/2003 | 05:37 | 06/12/2003 | 13:14 | 30.25 days | 37 |
| 52 | 09/28/1975 | 19:58 | 10/28/1975 | 07:38 | 29.48 days | 38 |
| 113 | 05/03/1988 | 15:04 | 06/01/1988 | 23:00 | 29.33 days | 39 |
| 31 | 02/22/1972 | 05:45 | 03/22/1972 | 09:48 | 29.16 days | 40 |
| 192 | 06/10/2002 | 09:04 | 07/08/2002 | 05:44 | 28.79 days | 41 |
| 7 | 09/25/1967 | 02:07 | 10/23/1967 | 01:37 | 27.97 days | 42 |
| 108 | 01/25/1988 | 08:37 | 02/20/1988 | 16:33 | 26.33 days | 43 |
| 150 | 09/17/1994 | 05:25 | 10/13/1994 | 11:49 | 26.26 days | 44 |
| 148 | 08/10/1994 | 16:40 | 09/05/1994 | 19:56 | 26.13 days | 45 |
| 6 | 08/27/1967 | 00:45 | 09/22/1967 | 01:07 | 26.01 days | 46 |
| 30 | 09/23/1971 | 07:47 | 10/19/1971 | 00:47 | 25.70 days | 47 |
| 55 | 01/07/1976 | 18:47 | 02/02/1976 | 09:54 | 25.62 days | 48 |
| 29 | 08/16/1971 | 03:57 | 09/10/1971 | 08:18 | 25.18 days | 49 |
| 78 | 10/07/1979 | 16:07 | 11/01/1979 | 12:47 | 24.86 days | 50 |
| 122 | 01/01/1990 | 00:23 | 01/25/1990 | 15:20 | 24.62 days | 51 |
| 65 | 12/19/1977 | 12:22 | 01/11/1978 | 17:44 | 23.22 days | 52 |
| 79 | 11/02/1979 | 12:40 | 11/25/1979 | 05:48 | 22.71 days | 53 |
| 130 | 10/10/1991 | 09:12 | 11/01/1991 | 16:51 | 22.31 days | 54 |
| 14 | 10/27/1968 | 03:57 | 11/18/1968 | 11:00 | 22.29 days | 55 |
| 37 | 07/13/1972 | 02:13 | 08/04/1972 | 02:56 | 22.02 days | 56 |
| 54 | 12/03/1975 | 14:41 | 12/25/1975 | 09:44 | 21.79 days | 57 |
| 53 | 11/10/1975 | 17:42 | 12/01/1975 | 20:35 | 21.11 days | 58 |
| 75 | 12/10/1978 | 22:48 | 01/01/1979 | 00:03 | 21.05 days | 59 |
| 118 | 03/04/1989 | 16:26 | 03/25/1989 | 15:23 | 20.95 days | 60 |
| 96 | 03/27/1986 | 05:52 | 04/16/1986 | 04:31 | 19.94 days | 61 |
| 83 | 03/09/1980 | 03:57 | 03/29/1980 | 02:14 | 19.92 days | 62 |
| 165 | 06/19/1998 | 11:26 | 07/08/1998 | 23:09 | 19.63 days | 63 |
| 72 | 08/25/1978 | 12:36 | 09/14/1978 | 02:54 | 19.59 days | 64 |
| 112 | 04/10/1988 | 23:32 | 04/30/1988 | 07:44 | 19.34 days | 65 |
| 120 | 04/19/1989 | 07:54 | 05/08/1989 | 15:22 | 19.31 days | 66 |
| 10 | 11/26/1967 | 08:28 | 12/15/1967 | 14:34 | 19.25 days | 67 |
| 12 | 08/18/1968 | 06:31 | 09/06/1968 | 05:32 | 18.95 days | 68 |
| 27 | 04/25/1971 | 22:58 | 05/14/1971 | 01:11 | 18.09 days | 69 |
| 59 | 03/22/1976 | 09:25 | 04/09/1976 | 09:36 | 18.00 days | 70 |
| 196 | 09/23/2002 | 22:14 | 10/10/2002 | 07:44 | 17.35 days | 71 |
| 202 | 12/16/2003 | 04:29 | 01/01/2004 | 16:47 | 17.23 days | 72 |
| 45 | 08/19/1973 | 05:07 | 09/05/1973 | 08:29 | 17.14 days | 73 |
| 60 | 08/17/1976 | 18:54 | 09/03/1976 | 18:31 | 16.98 days | 74 |
| 200 | 11/01/2003 | 05:44 | 11/17/2003 | 17:46 | 16.58 days | 75 |
| 36 | 06/25/1972 | 08:36 | 07/11/1972 | 20:07 | 16.48 days | 76 |
| 174 | 03/17/2000 | 16:28 | 04/02/2000 | 23:05 | 16.36 days | 77 |
| 132 | 11/03/1992 | 22:44 | 11/20/1992 | 05:43 | 16.29 days | 78 |
| 97 | 04/17/1986 | 17:04 | 05/03/1986 | 11:04 | 15.75 days | 79 |
| 48 | 04/05/1974 | 19:21 | 04/21/1974 | 11:23 | 15.66 days | 80 |
| 187 | 11/01/2001 | 12:56 | 11/16/2001 | 08:52 | 15.66 days | 81 |
| 57 | 02/14/1976 | 17:48 | 02/29/1976 | 21:28 | 15.15 days | 82 |
| 87 | 05/25/1984 | 19:10 | 06/09/1984 | 17:37 | 14.93 days | 83 |
| 168 | 08/27/1998 | 02:38 | 09/10/1998 | 07:27 | 14.64 days | 84 |
| 138 | 01/14/1994 | 16:14 | 01/28/1994 | 23:34 | 14.30 days | 85 |
| 17 | 02/01/1969 | 07:15 | 02/15/1969 | 11:48 | 14.18 days | 86 |
| 136 | 11/02/1993 | 06:46 | 11/16/1993 | 10:32 | 14.15 days | 87 |

| | | | | | | |
|-----|------------|-------|------------|-------|------------|-----|
| 191 | 05/21/2002 | 07:02 | 06/03/2002 | 08:29 | 14.04 days | 88 |
| 190 | 05/04/2002 | 19:03 | 05/17/2002 | 23:55 | 13.90 days | 89 |
| 2 | 05/11/1967 | 11:28 | 05/25/1967 | 02:05 | 13.60 days | 90 |
| 155 | 03/03/1996 | 15:56 | 03/16/1996 | 17:28 | 13.51 days | 91 |
| 99 | 08/25/1986 | 22:06 | 09/08/1986 | 05:39 | 13.31 days | 92 |
| 154 | 02/17/1996 | 02:28 | 03/01/1996 | 02:18 | 13.29 days | 93 |
| 49 | 04/23/1974 | 06:46 | 05/06/1974 | 09:01 | 13.09 days | 94 |
| 203 | 01/04/2004 | 23:12 | 01/17/2004 | 02:56 | 12.90 days | 95 |
| 184 | 07/13/2001 | 07:58 | 07/25/2001 | 22:18 | 12.90 days | 96 |
| 1 | 04/23/1967 | 15:16 | 05/06/1967 | 11:18 | 12.83 days | 97 |
| 117 | 02/10/1989 | 08:27 | 02/22/1989 | 22:22 | 12.57 days | 98 |
| 34 | 05/29/1972 | 14:03 | 06/10/1972 | 21:51 | 12.32 days | 99 |
| 94 | 10/08/1985 | 05:39 | 10/19/1985 | 15:36 | 11.41 days | 100 |
| 46 | 09/19/1973 | 12:31 | 09/30/1973 | 21:25 | 11.37 days | 101 |
| 144 | 04/06/1994 | 21:45 | 04/18/1994 | 04:01 | 11.26 days | 102 |
| 80 | 12/01/1979 | 22:52 | 12/13/1979 | 03:13 | 11.18 days | 103 |
| 67 | 01/29/1978 | 09:54 | 02/09/1978 | 10:09 | 11.01 days | 104 |
| 194 | 08/27/2002 | 18:44 | 09/07/2002 | 05:21 | 10.88 days | 105 |
| 145 | 04/20/1994 | 08:18 | 05/01/1994 | 01:48 | 10.72 days | 106 |
| 177 | 04/22/2000 | 16:19 | 05/02/2000 | 20:26 | 10.59 days | 107 |
| 133 | 12/04/1992 | 22:37 | 12/15/1992 | 04:04 | 10.22 days | 108 |
| 68 | 03/01/1978 | 03:02 | 03/11/1978 | 07:38 | 10.19 days | 109 |
| 123 | 01/29/1990 | 09:21 | 02/08/1990 | 05:24 | 9.83 days | 110 |
| 201 | 12/04/2003 | 01:52 | 12/12/2003 | 23:12 | 9.72 days | 111 |
| 107 | 12/11/1987 | 10:51 | 12/21/1987 | 03:31 | 9.69 days | 112 |
| 61 | 09/13/1976 | 16:36 | 09/23/1976 | 02:56 | 9.43 days | 113 |
| 151 | 07/23/1995 | 18:55 | 08/02/1995 | 02:51 | 9.33 days | 114 |
| 58 | 03/02/1976 | 01:32 | 03/11/1976 | 06:29 | 9.20 days | 115 |
| 8 | 10/24/1967 | 15:59 | 11/02/1967 | 13:39 | 8.90 days | 116 |
| 169 | 07/08/1999 | 22:58 | 07/16/1999 | 23:44 | 8.73 days | 117 |
| 124 | 02/12/1990 | 03:57 | 02/20/1990 | 17:59 | 8.58 days | 118 |
| 141 | 02/14/1994 | 00:26 | 02/22/1994 | 10:08 | 8.40 days | 119 |
| 4 | 06/09/1967 | 04:18 | 06/17/1967 | 04:37 | 8.01 days | 120 |
| 197 | 10/15/2002 | 02:14 | 10/22/2002 | 00:29 | 7.91 days | 121 |
| 195 | 09/13/2002 | 15:59 | 09/20/2002 | 07:41 | 7.38 days | 122 |
| 175 | 04/05/2000 | 09:59 | 04/12/2000 | 14:04 | 7.23 days | 123 |
| 182 | 10/30/2000 | 15:18 | 11/06/2000 | 06:27 | 7.07 days | 124 |
| 152 | 09/11/1995 | 03:35 | 09/18/1995 | 02:49 | 6.96 days | 125 |
| 21 | 11/29/1969 | 08:12 | 12/06/1969 | 04:50 | 6.85 days | 126 |
| 82 | 03/01/1980 | 11:11 | 03/08/1980 | 05:56 | 6.78 days | 127 |
| 137 | 12/11/1993 | 01:39 | 12/17/1993 | 17:42 | 6.66 days | 128 |
| 89 | 11/23/1984 | 10:46 | 11/29/1984 | 22:20 | 6.48 days | 129 |
| 135 | 10/15/1993 | 00:54 | 10/21/1993 | 07:50 | 6.28 days | 130 |
| 85 | 05/08/1980 | 03:17 | 05/14/1980 | 10:04 | 6.28 days | 131 |
| 180 | 06/02/2000 | 17:32 | 06/08/2000 | 04:39 | 6.10 days | 132 |
| 129 | 09/20/1991 | 02:09 | 09/26/1991 | 03:46 | 6.06 days | 133 |
| 206 | 10/01/2004 | 07:59 | 10/06/2004 | 19:52 | 5.97 days | 134 |
| 51 | 09/13/1975 | 22:56 | 09/19/1975 | 19:58 | 5.87 days | 135 |
| 20 | 11/14/1969 | 16:12 | 11/20/1969 | 13:02 | 5.86 days | 136 |
| 77 | 09/11/1979 | 16:59 | 09/17/1979 | 12:14 | 5.80 days | 137 |
| 81 | 01/14/1980 | 05:12 | 01/19/1980 | 15:47 | 5.44 days | 138 |
| 101 | 09/07/1987 | 07:55 | 09/12/1987 | 17:12 | 5.38 days | 139 |
| 62 | 09/24/1976 | 09:18 | 09/29/1976 | 18:13 | 5.37 days | 140 |
| 146 | 05/09/1994 | 02:50 | 05/14/1994 | 10:23 | 5.31 days | 141 |
| 3 | 05/28/1967 | 00:52 | 06/02/1967 | 07:31 | 5.27 days | 142 |
| 153 | 09/19/1995 | 03:11 | 09/24/1995 | 07:14 | 5.16 days | 143 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 40 | 12/08/1972 | 03:18 | 12/13/1972 | 06:41 | 5.14 days | 144 |
| 9 | 11/08/1967 | 06:02 | 11/13/1967 | 07:36 | 5.06 days | 145 |
| 189 | 03/20/2002 | 11:31 | 03/24/2002 | 08:59 | 4.83 days | 146 |
| 56 | 02/08/1976 | 20:58 | 02/13/1976 | 16:46 | 4.82 days | 147 |
| 13 | 09/29/1968 | 17:39 | 10/04/1968 | 12:24 | 4.78 days | 148 |
| 160 | 08/26/1996 | 04:38 | 08/30/1996 | 12:26 | 4.74 days | 149 |
| 35 | 06/13/1972 | 00:56 | 06/17/1972 | 18:52 | 4.74 days | 150 |
| 98 | 08/19/1986 | 13:30 | 08/24/1986 | 02:40 | 4.54 days | 151 |
| 114 | 06/03/1988 | 00:51 | 06/07/1988 | 13:55 | 4.54 days | 152 |
| 91 | 06/06/1985 | 15:24 | 06/10/1985 | 23:10 | 4.32 days | 153 |
| 15 | 11/25/1968 | 06:12 | 11/29/1968 | 11:47 | 4.23 days | 154 |
| 179 | 05/16/2000 | 02:56 | 05/20/2000 | 01:16 | 4.19 days | 155 |
| 116 | 01/25/1989 | 14:38 | 01/29/1989 | 17:26 | 4.11 days | 156 |
| 16 | 01/12/1969 | 08:05 | 01/16/1969 | 08:39 | 4.02 days | 157 |
| 173 | 03/11/2000 | 17:56 | 03/14/2000 | 22:49 | 3.99 days | 158 |
| 76 | 03/15/1979 | 09:21 | 03/19/1979 | 07:43 | 3.93 days | 159 |
| 23 | 09/08/1970 | 23:07 | 09/12/1970 | 20:37 | 3.89 days | 160 |
| 143 | 03/31/1994 | 13:43 | 04/04/1994 | 10:56 | 3.88 days | 161 |
| 104 | 09/22/1987 | 04:37 | 09/26/1987 | 01:22 | 3.86 days | 162 |
| 119 | 03/26/1989 | 15:23 | 03/30/1989 | 11:13 | 3.82 days | 163 |
| 193 | 08/11/2002 | 20:14 | 08/14/2002 | 16:29 | 3.78 days | 164 |
| 176 | 04/15/2000 | 06:32 | 04/17/2000 | 21:57 | 3.56 days | 165 |
| 66 | 01/13/1978 | 20:08 | 01/17/1978 | 08:04 | 3.49 days | 166 |
| 186 | 10/02/2001 | 20:23 | 10/05/2001 | 23:17 | 3.40 days | 167 |
| 163 | 09/19/1997 | 18:48 | 09/22/1997 | 11:41 | 3.36 days | 168 |
| 103 | 09/16/1987 | 18:18 | 09/20/1987 | 02:54 | 3.35 days | 169 |
| 149 | 09/06/1994 | 15:44 | 09/09/1994 | 23:55 | 3.34 days | 170 |
| 39 | 12/03/1972 | 14:53 | 12/06/1972 | 22:56 | 3.33 days | 171 |
| 188 | 03/13/2002 | 09:14 | 03/15/2002 | 14:29 | 3.15 days | 172 |
| 33 | 05/02/1972 | 02:27 | 05/05/1972 | 04:52 | 3.10 days | 173 |
| 140 | 02/08/1994 | 13:37 | 02/11/1994 | 10:30 | 2.87 days | 174 |
| 70 | 06/05/1978 | 16:06 | 06/08/1978 | 10:06 | 2.75 days | 175 |
| 111 | 03/15/1988 | 17:17 | 03/18/1988 | 09:50 | 2.68 days | 176 |
| 73 | 09/20/1978 | 20:41 | 09/23/1978 | 12:40 | 2.66 days | 177 |
| 172 | 03/08/2000 | 22:18 | 03/10/2000 | 13:58 | 2.59 days | 178 |
| 139 | 02/05/1994 | 08:03 | 02/07/1994 | 19:34 | 2.48 days | 179 |
| 199 | 06/13/2003 | 14:29 | 10/06/2003 | 06:08 | 2.44 days | 180 |
| 84 | 04/28/1980 | 23:23 | 05/01/1980 | 09:22 | 2.41 days | 181 |
| 47 | 03/14/1974 | 03:20 | 03/16/1974 | 10:13 | 2.28 days | 182 |
| 205 | 09/29/2004 | 00:44 | 09/30/2004 | 23:47 | 2.15 days | 183 |
| 142 | 03/28/1994 | 19:30 | 03/30/1994 | 22:31 | 2.12 days | 184 |
| 158 | 06/20/1996 | 02:59 | 06/21/1996 | 14:39 | 2.11 days | 185 |
| 24 | 09/29/1970 | 09:28 | 10/01/1970 | 10:14 | 2.03 days | 186 |
| 164 | 06/15/1998 | 22:58 | 06/16/1998 | 21:58 | 1.90 days | 187 |
| 95 | 03/22/1986 | 04:21 | 03/24/1986 | 01:49 | 1.89 days | 188 |
| 204 | 08/21/2004 | 22:29 | 08/22/2004 | 15:59 | 1.70 days | 189 |
| 42 | 12/31/1972 | 04:10 | 01/01/1973 | 20:41 | 1.68 days | 190 |
| 166 | 07/11/1998 | 12:28 | 07/13/1998 | 00:04 | 1.54 days | 191 |
| 43 | 01/04/1973 | 21:58 | 01/06/1973 | 04:28 | 1.27 days | 192 |
| 92 | 06/15/1985 | 09:46 | 06/16/1985 | 16:05 | 1.26 days | 193 |
| 102 | 09/13/1987 | 23:28 | 09/15/1987 | 05:20 | 1.24 days | 194 |
| 41 | 12/16/1972 | 09:46 | 12/17/1972 | 11:19 | 1.06 days | 195 |
| 161 | 09/17/1997 | 23:39 | 09/18/1997 | 08:40 | 1.01 days | 196 |
| 44 | 08/05/1973 | 11:08 | 08/06/1973 | 11:30 | 1.01 days | 197 |
| 90 | 05/04/1985 | 11:23 | 05/05/1985 | 11:44 | 1.01 days | 198 |
| 109 | 02/23/1988 | 07:41 | 02/24/1988 | 07:59 | 1.01 days | 199 |

| | | | | | | |
|-----|------------|-------|------------|-------|-----------|-----|
| 110 | 03/01/1988 | 10:55 | 03/02/1988 | 10:24 | 0.97 days | 200 |
| 183 | 07/03/2001 | 16:14 | 07/04/2001 | 00:38 | 0.97 days | 201 |
| 11 | 12/17/1967 | 08:12 | 12/18/1967 | 07:31 | 0.97 days | 202 |
| 105 | 09/27/1987 | 23:43 | 09/28/1987 | 22:01 | 0.92 days | 203 |
| 162 | 09/18/1997 | 18:38 | 09/19/1997 | 09:15 | 0.85 days | 204 |
| 178 | 05/04/2000 | 10:09 | 05/05/2000 | 02:09 | 0.81 days | 205 |
| 100 | 10/07/1986 | 08:17 | 10/07/1986 | 14:31 | 0.26 days | 206 |

Cut-Off Lake Oxbow Disconnections to the Brazos River - Summary
 Jordan Furnans, TWDB 11/1/2004, 11:27

USGS Gauge: 0811400 Brazos Rv at Richmond, TX
 Control Point Elevation: 45.66 ft
 Flow Criteria for control point selection: 76200 cfs at Richmond gauge
 Required Gauge Height for connection: 45.66 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 1/1/1903-11/1/2004
 Number of Records: 102658
 Years of Record: 101.8334
 Number of Critical WSE Exceedences: 31
 Number of "significant" WSE Exceedences: 30
 Average Connections per year: 0.2946
 Flood Level Required for Connection: 4.4728 year flood

Statistics

 Mean Duration of Connection (Days) : 4.3067
 Standard Deviation of Connection Duration (Days) : 3.1038
 Minimum Duration of Connection (Days) : 0.95691
 Maximum Duration of Connection (Days) : 10.9099
 1st Percentile Duration of Connection (Days) : 0.28707
 10th Percentile Duration of Connection (Days) : 1.5093
 25th Percentile Duration of Connection (Days) : 1.9713
 50th Percentile Duration of Connection (Days) : 2.7979
 75th Percentile Duration of Connection (Days) : 5.7216
 95th Percentile Duration of Connection (Days) : 10.1134
 99th Percentile Duration of Connection (Days) : 10.7245
 Mean Time Between Connections (Days) : 951.7331
 Standard Deviation of Connection Duration (Days) : 1077.8463
 Minimum Time Between Connections (Days) : 5.4472
 Maximum Time Between Connections (Days) : 4581.8153
 1st Percentile Time Between Connections (Days) : 1.6342
 10th Percentile Time Between Connections (Days) : 9.5566
 25th Percentile Time Between Connections (Days) : 91.9229
 50th Percentile Time Between Connections (Days) : 639.3012
 75th Percentile Time Between Connections (Days) : 1303.0382
 95th Percentile Time Between Connections (Days) : 2886.7461
 99th Percentile Time Between Connections (Days) : 4173.3578

Notes

 Historical Data = Daily Averaged Stream Flows
 Historical Gauge Heights Estimated with rating curve provided by USGS, August 2004
 Statistics are derived based on "significant" connections

Cut Off Lake Oxbow Disconnections to the Brazos River – Chronology of Connections
 Jordan Furnans, TWDB 11/1/2004, 11:27

USGS Gauge: 0811400 Brazos Rv at Richmond, TX
 Control Point Elevation: 45.66 ft
 Flow Criteria for control point selection: 76200 cfs at Richmond gauge
 Required Gauge Height for connection: 45.66 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 1/1/1903-11/1/2004
 Number of Records: 102658
 Years of Record: 101.8334
 Number of Critical WSE Exceedences: 31
 Number of "significant" WSE Exceedences: 30
 Average Connections per year: 0.2946
 Flood Level Required for Connection: 4.4728 year flood

----- Connection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|------------|------|-------|
| 30 | 11/15/1998 04:19 | 11/17/1998 11:03 | 2.28 days | 21 | |
| 29 | 10/20/1998 20:00 | 10/23/1998 20:02 | 3.00 days | 14 | |
| 28 | 10/18/1994 18:42 | 10/22/1994 20:04 | 4.05 days | 11 | |
| 27 | 02/29/1992 06:17 | 03/02/1992 12:00 | 2.23 days | 22 | |
| 26 | 12/25/1991 17:12 | 01/04/1992 15:38 | 9.93 days | 3 | |
| 25 | 06/08/1979 04:00 | 06/09/1979 21:38 | 1.73 days | 26 | |
| 24 | 04/21/1977 20:28 | 04/23/1977 18:17 | 1.90 days | 25 | |
| 23 | 06/25/1968 15:02 | 06/27/1968 13:30 | 1.93 days | 24 | |
| 22 | 05/13/1968 01:27 | 05/15/1968 14:53 | 2.56 days | 19 | |
| 21 | 05/20/1965 05:35 | 05/28/1965 05:31 | 7.99 days | 6 | |
| 20 | 01/15/1961 18:00 | 01/17/1961 06:13 | 1.50 days | 28 | |
| 19 | 02/26/1958 13:32 | 02/27/1958 12:30 | 0.95 days | 30 | |
| 18 | 10/18/1957 10:02 | 10/21/1957 07:53 | 2.91 days | 15 | |
| 17 | 05/15/1957 19:54 | 05/20/1957 07:50 | 4.49 days | 10 | |
| 16 | 04/29/1957 11:20 | 05/10/1957 09:10 | 10.90 days | 1 | |
| 15 | 05/17/1953 17:07 | 05/20/1953 11:34 | 2.76 days | 17 | |
| 14 | 05/19/1946 12:07 | 05/21/1946 12:16 | 2.00 days | 23 | |
| 13 | 04/24/1945 20:42 | 04/28/1945 15:19 | 3.77 days | 12 | |
| 12 | 04/01/1945 12:57 | 04/04/1945 04:44 | 2.65 days | 18 | |
| 11 | 05/03/1944 17:40 | 05/11/1944 15:21 | 7.90 days | 7 | |
| 10 | 04/28/1942 20:10 | 05/01/1942 03:46 | 2.31 days | 20 | |
| 9 | 12/13/1940 14:52 | 12/20/1940 08:26 | 6.73 days | 8 | |
| 8 | 11/24/1940 13:49 | 12/04/1940 20:49 | 10.29 days | 2 | |
| 7 | 07/04/1940 04:33 | 07/05/1940 21:08 | 1.69 days | 27 | |
| 6 | 05/19/1935 12:58 | 05/28/1935 23:28 | 9.43 days | 4 | |
| 5 | 05/06/1935 18:53 | 05/09/1935 23:36 | 3.19 days | 13 | |
| 4 | 02/22/1932 21:40 | 02/25/1932 16:49 | 2.79 days | 16 | |
| 3 | 05/23/1930 06:16 | 05/24/1930 14:26 | 1.34 days | 29 | |
| 2 | 05/31/1929 03:29 | 06/09/1929 06:49 | 9.13 days | 5 | |
| 1 | 04/25/1926 05:33 | 04/29/1926 22:37 | 4.71 days | 9 | |

Cut Off Lake Oxbow Disconnections to the Brazos River – Ranked by Connection Duration
 Jordan Furnans, TWDB 11/1/2004, 11:27

USGS Gauge: 0811400 Brazos Rv at Richmond, TX
 Control Point Elevation: 45.66 ft
 Flow Criteria for control point selection: 76200 cfs at Richmond gauge
 Required Gauge Height for connection: 45.66 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 1/1/1903-11/1/2004
 Number of Records: 102658
 Years of Record: 101.8334
 Number of Critical WSE Exceedences: 31
 Number of "significant" WSE Exceedences: 30
 Average Connections per year: 0.2946
 Flood Level Required for Connection: 4.4728 year flood

| ----- Connection Details ----- | | | | | | |
|--------------------------------|------------------|------------------|------------|------|-------|--|
| # | Start Date | End Date | Duration | Rank | Notes | |
| 16 | 04/29/1957 11:20 | 05/10/1957 09:10 | 10.90 days | 1 | | |
| 8 | 11/24/1940 13:49 | 12/04/1940 20:49 | 10.29 days | 2 | | |
| 26 | 12/25/1991 17:12 | 01/04/1992 15:38 | 9.93 days | 3 | | |
| 6 | 05/19/1935 12:58 | 05/28/1935 23:28 | 9.43 days | 4 | | |
| 2 | 05/31/1929 03:29 | 06/09/1929 06:49 | 9.13 days | 5 | | |
| 21 | 05/20/1965 05:35 | 05/28/1965 05:31 | 7.99 days | 6 | | |
| 11 | 05/03/1944 17:40 | 05/11/1944 15:21 | 7.90 days | 7 | | |
| 9 | 12/13/1940 14:52 | 12/20/1940 08:26 | 6.73 days | 8 | | |
| 1 | 04/25/1926 05:33 | 04/29/1926 22:37 | 4.71 days | 9 | | |
| 17 | 05/15/1957 19:54 | 05/20/1957 07:50 | 4.49 days | 10 | | |
| 28 | 10/18/1994 18:42 | 10/22/1994 20:04 | 4.05 days | 11 | | |
| 13 | 04/24/1945 20:42 | 04/28/1945 15:19 | 3.77 days | 12 | | |
| 5 | 05/06/1935 18:53 | 05/09/1935 23:36 | 3.19 days | 13 | | |
| 29 | 10/20/1998 20:00 | 10/23/1998 20:02 | 3.00 days | 14 | | |
| 18 | 10/18/1957 10:02 | 10/21/1957 07:53 | 2.91 days | 15 | | |
| 4 | 02/22/1932 21:40 | 02/25/1932 16:49 | 2.79 days | 16 | | |
| 15 | 05/17/1953 17:07 | 05/20/1953 11:34 | 2.76 days | 17 | | |
| 12 | 04/01/1945 12:57 | 04/04/1945 04:44 | 2.65 days | 18 | | |
| 22 | 05/13/1968 01:27 | 05/15/1968 14:53 | 2.56 days | 19 | | |
| 10 | 04/28/1942 20:10 | 05/01/1942 03:46 | 2.31 days | 20 | | |
| 30 | 11/15/1998 04:19 | 11/17/1998 11:03 | 2.28 days | 21 | | |
| 27 | 02/29/1992 06:17 | 03/02/1992 12:00 | 2.23 days | 22 | | |
| 14 | 05/19/1946 12:07 | 05/21/1946 12:16 | 2.00 days | 23 | | |
| 23 | 06/25/1968 15:02 | 06/27/1968 13:30 | 1.93 days | 24 | | |
| 24 | 04/21/1977 20:28 | 04/23/1977 18:17 | 1.90 days | 25 | | |
| 25 | 06/08/1979 04:00 | 06/09/1979 21:38 | 1.73 days | 26 | | |
| 7 | 07/04/1940 04:33 | 07/05/1940 21:08 | 1.69 days | 27 | | |
| 20 | 01/15/1961 18:00 | 01/17/1961 06:13 | 1.50 days | 28 | | |
| 3 | 05/23/1930 06:16 | 05/24/1930 14:26 | 1.34 days | 29 | | |
| 19 | 02/26/1958 13:32 | 02/27/1958 12:30 | 0.95 days | 30 | | |

Cut Off Lake Oxbow Disconnections to the Brazos River – Chronology of Disconnection
 Jordan Furnans, TWDB 11/1/2004, 11:27

USGS Gauge: 0811400 Brazos Rv at Richmond, TX
 Control Point Elevation: 45.66 ft
 Flow Criteria for control point selection: 76200 cfs at Richmond gauge
 Required Gauge Height for connection: 45.66 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 1/1/1903-11/1/2004
 Number of Records: 102658
 Years of Record: 101.8334
 Number of Critical WSE Exceedences: 31
 Number of "significant" WSE Exceedences: 30
 Average Connections per year: 0.2946
 Flood Level Required for Connection: 4.4728 year flood

----- Disconnection Details -----

| # | Start Date | End Date | Duration | Rank | Notes |
|----|------------------|------------------|--------------|------|----------------------------------|
| 30 | 11/17/1998 11:03 | 11/01/2004 03:30 | 2175.68 days | 4 | Disconnected Period Not Complete |
| 29 | 10/23/1998 20:02 | 11/15/1998 04:19 | 22.66 days | 26 | |
| 28 | 10/22/1994 20:04 | 10/20/1998 20:00 | 1459.95 days | 7 | |
| 27 | 03/02/1992 12:00 | 10/18/1994 18:42 | 960.27 days | 13 | |
| 26 | 01/04/1992 15:38 | 02/29/1992 06:17 | 55.61 days | 24 | |
| 25 | 06/09/1979 21:38 | 12/25/1991 17:12 | 4581.81 days | 1 | |
| 24 | 04/23/1977 18:17 | 06/08/1979 04:00 | 775.40 days | 14 | |
| 23 | 06/27/1968 13:30 | 04/21/1977 20:28 | 3220.29 days | 2 | |
| 22 | 05/15/1968 14:53 | 06/25/1968 15:02 | 41.00 days | 25 | |
| 21 | 05/28/1965 05:31 | 05/13/1968 01:27 | 1080.83 days | 11 | |
| 20 | 01/17/1961 06:13 | 05/20/1965 05:35 | 1583.97 days | 6 | |
| 19 | 02/27/1958 12:30 | 01/15/1961 18:00 | 1053.22 days | 12 | |
| 18 | 10/21/1957 07:53 | 02/26/1958 13:32 | 128.23 days | 23 | |
| 17 | 05/20/1957 07:50 | 10/18/1957 10:02 | 151.09 days | 21 | |
| 16 | 05/10/1957 09:10 | 05/15/1957 19:54 | 5.44 days | 30 | |
| 15 | 05/20/1953 11:34 | 04/29/1957 11:20 | 1439.99 days | 8 | |
| 14 | 05/21/1946 12:16 | 05/17/1953 17:07 | 2553.20 days | 3 | |
| 13 | 04/28/1945 15:19 | 05/19/1946 12:07 | 385.86 days | 18 | |
| 12 | 04/04/1945 04:44 | 04/24/1945 20:42 | 20.66 days | 27 | |
| 11 | 05/11/1944 15:21 | 04/01/1945 12:57 | 324.89 days | 20 | |
| 10 | 05/01/1942 03:46 | 05/03/1944 17:40 | 733.57 days | 15 | |
| 9 | 12/20/1940 08:26 | 04/28/1942 20:10 | 494.48 days | 17 | |
| 8 | 12/04/1940 20:49 | 12/13/1940 14:52 | 8.75 days | 29 | |
| 7 | 07/05/1940 21:08 | 11/24/1940 13:49 | 141.69 days | 22 | |
| 6 | 05/28/1935 23:28 | 07/04/1940 04:33 | 1863.21 days | 5 | |
| 5 | 05/09/1935 23:36 | 05/19/1935 12:58 | 9.55 days | 28 | |
| 4 | 02/25/1932 16:49 | 05/06/1935 18:53 | 1166.08 days | 9 | |
| 3 | 05/24/1930 14:26 | 02/22/1932 21:40 | 639.30 days | 16 | |
| 2 | 06/09/1929 06:49 | 05/23/1930 06:16 | 347.97 days | 19 | |
| 1 | 04/29/1926 22:37 | 05/31/1929 03:29 | 1127.20 days | 10 | |

Cut Off Lake Oxbow Disconnections to the Brazos River – Ranked by Disconnection Duration
 Jordan Furnans, TWDB 11/1/2004, 11:27

USGS Gauge: 0811400 Brazos Rv at Richmond, TX
 Control Point Elevation: 45.66 ft
 Flow Criteria for control point selection: 76200 cfs at Richmond gauge
 Required Gauge Height for connection: 45.66 ft
 Time Buffer for "significant" connection: 6 hrs
 Period of Record: 1/1/1903-11/1/2004
 Number of Records: 102658
 Years of Record: 101.8334
 Number of Critical WSE Exceedences: 31
 Number of "significant" WSE Exceedences: 30
 Average Connections per year: 0.2946
 Flood Level Required for Connection: 4.4728 year flood

| ----- Disconnection Details ----- | | | | | | |
|-----------------------------------|------------------|------------------|--------------|------|----------------------------------|--|
| # | Start Date | End Date | Duration | Rank | Notes | |
| 25 | 06/09/1979 21:38 | 12/25/1991 17:12 | 4581.81 days | 1 | | |
| 23 | 06/27/1968 13:30 | 04/21/1977 20:28 | 3220.29 days | 2 | | |
| 14 | 05/21/1946 12:16 | 05/17/1953 17:07 | 2553.20 days | 3 | | |
| 30 | 11/17/1998 11:03 | 11/01/2004 03:30 | 2175.68 days | 4 | Disconnected Period Not Complete | |
| 6 | 05/28/1935 23:28 | 07/04/1940 04:33 | 1863.21 days | 5 | | |
| 20 | 01/17/1961 06:13 | 05/20/1965 05:35 | 1583.97 days | 6 | | |
| 28 | 10/22/1994 20:04 | 10/20/1998 20:00 | 1459.95 days | 7 | | |
| 15 | 05/20/1953 11:34 | 04/29/1957 11:20 | 1439.99 days | 8 | | |
| 4 | 02/25/1932 16:49 | 05/06/1935 18:53 | 1166.08 days | 9 | | |
| 1 | 04/29/1926 22:37 | 05/31/1929 03:29 | 1127.20 days | 10 | | |
| 21 | 05/28/1965 05:31 | 05/13/1968 01:27 | 1080.83 days | 11 | | |
| 19 | 02/27/1958 12:30 | 01/15/1961 18:00 | 1053.22 days | 12 | | |
| 27 | 03/02/1992 12:00 | 10/18/1994 18:42 | 960.27 days | 13 | | |
| 24 | 04/23/1977 18:17 | 06/08/1979 04:00 | 775.40 days | 14 | | |
| 10 | 05/01/1942 03:46 | 05/03/1944 17:40 | 733.57 days | 15 | | |
| 3 | 05/24/1930 14:26 | 02/22/1932 21:40 | 639.30 days | 16 | | |
| 9 | 12/20/1940 08:26 | 04/28/1942 20:10 | 494.48 days | 17 | | |
| 13 | 04/28/1945 15:19 | 05/19/1946 12:07 | 385.86 days | 18 | | |
| 2 | 06/09/1929 06:49 | 05/23/1930 06:16 | 347.97 days | 19 | | |
| 11 | 05/11/1944 15:21 | 04/01/1945 12:57 | 324.89 days | 20 | | |
| 17 | 05/20/1957 07:50 | 10/18/1957 10:02 | 151.09 days | 21 | | |
| 7 | 07/05/1940 21:08 | 11/24/1940 13:49 | 141.69 days | 22 | | |
| 18 | 10/21/1957 07:53 | 02/26/1958 13:32 | 128.23 days | 23 | | |
| 26 | 01/04/1992 15:38 | 02/29/1992 06:17 | 55.61 days | 24 | | |
| 22 | 05/15/1968 14:53 | 06/25/1968 15:02 | 41.00 days | 25 | | |
| 29 | 10/23/1998 20:02 | 11/15/1998 04:19 | 22.66 days | 26 | | |
| 12 | 04/04/1945 04:44 | 04/24/1945 20:42 | 20.66 days | 27 | | |
| 5 | 05/09/1935 23:36 | 05/19/1935 12:58 | 9.55 days | 28 | | |
| 8 | 12/04/1940 20:49 | 12/13/1940 14:52 | 8.75 days | 29 | | |
| 16 | 05/10/1957 09:10 | 05/15/1957 19:54 | 5.44 days | 30 | | |