FLOOD INSURANCE STUDY

COMAL COUNTY, TEXAS
AND INCORPORATED AREAS
VOLUME 1 OF 3

Community Name	Community Number
Bulverde, City of	481681
Comal County, Unincorporated Areas	485463
Fair Oaks Ranch, City of	481644
Garden Ridge, City of	480148
New Braunfels, City of	485493
Schertz, City of	480269
Selma, City of	480046

Effective: September 2, 2009

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
48091CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

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EXHIBITS

FLOOD INSURANCE STUDY
COMAL COUNTY AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Comal County, including the Cities of Bulverde, Fair Oaks Ranch, Garden Ridge, New Braunfels, Schertz and Selma, and the unincorporated areas of Comal County (referred to collectively herein as Comal County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Fair Oaks Ranch is geographically located in Bexar, Comal and Kendall Counties. The flood-hazard information for the City of Fair Oaks Ranch that is available in the Comal County FIS does not cover those areas located in Bexar and Kendall Counties. See separately published Bexar and Kendall Counties FIS reports and Flood Insurance Rate Maps (FIRMs).

Please note that the City of New Braunfels is geographically located in Comal and Guadalupe Counties. The flood-hazard information for the City of New Braunfels that is available in the Comal County FIS does not cover those areas located in Guadalupe County. See separately published Guadalupe County FIS report and FIRMs.

Please note that the Cities of Schertz and Selma are geographically located in Bexar, Comal and Guadalupe Counties. The flood-hazard information for those Cities that is available in the Comal County FIS does not cover those areas located in Bexar or Guadalupe Counties. See separately published Bexar and Guadalupe Counties FIS reports and FIRMs.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Comal County:

The original hydrologic and hydraulic analyses for Comal County were performed for the Federal Emergency Management Agency (FEMA). The hydrologic and hydraulic analyses were updated by K. M. Ng & Associates, Inc., for FEMA. This work was completed in August 1983.

An update of the hydrologic and hydraulic analyses for portions of Cibolo Creek and Postoak Creek were prepared by C. A. Bolner and Associates, Inc. Cibolo Creek was revised from Ralph Fair Road to the county boundary to incorporate updated information and topographic data, and Postoak Creek was studied by detailed methods. This work was completed in July 1986.

An update of the hydraulic analyses for portions of the Guadalupe River (Upper Reach) was prepared by James Miertschin & Associates. In this update, the Guadalupe River (Upper Reach) from U.S. Route 281 to a point approximately 6,000 feet upstream was revised to incorporate a more up-to-date hydraulic analyses. This work was completed in May 1987.

Cibolo Creek, Cibolo-Kelley Creek Overflow, and Kelley Creek were studied by detailed methods as part of the Flood Insurance Studies for Bexar, Comal, and Guadalupe Counties, Texas. The hydrologic analyses for Cibolo Creek and Kelley Creek were performed by Dewberry & Davis. The hydraulic analyses for Cibolo Creek, Cibolo-Kelley Creek Overflow, and Kelley Creek were performed by the U.S. Army Corps of Engineers (USACE), Fort Worth District, for FEMA, under Interagency Agreement No. EMW-90-E-3263, Project Order No. 3. This work was completed in January 1993 (Reference 1).

The Comal County study was then revised on July 17, 1995, to update floodplain information for Cibolo Creek, to show more detailed hydrologic and hydraulic information along Kelley Creek and Cibolo-Kelley Creek Overflow that affects Comal County, Texas, and to reflect updated county limits.

The hydrologic and hydraulic analyses for Alligator Creek, Bracken Tributary, a segment of Dry Comal Creek (starting approximately 10.2 miles upstream of its confluence with the Comal River), Garden Ridge Tributary, the Guadalupe River Lower Reach from just upstream of the New Braunfels extra territorial jurisdictional limits to Canyon Lake Dam, Upper Dry Comal Creek and the West Fork were updated by Halff Associates, Inc., for FEMA under Contract No. EMT-2002-CO-0051. This study was completed in November 2005. The study also involved updates to approximate study streams throughout the County, and the creation of new hydrologic and hydraulic analyses for Alligator Tributary No. 6 and Bear Creek.

The hydrologic and hydraulic analyses for Cibolo Creek from the Comal/Guadalupe County line to the Kendall/Comal County line are based on preliminary models prepared by the USACE Fort Worth District, in support of an ongoing Planning Study for the San Antonio River Authority, the Guadalupe Blanco River Authority and the San Antonio Water System. The USACE study was not complete at the time of this FIS report preparation and both the hydrology and hydraulics modeling are subject to revisions. The USACE modeling represents the best available data for this reach of Cibolo Creek at that time. Floodways for this reach of Cibolo Creek were computed by Halff Associates, Inc., for FEMA under Contract No. EMT-2002-CO-0051. This floodway computation was completed in November 2005.

City of Bulverde:

The City of Bulverde is a newly incorporated community that merged the cities of Bulverde East (Community number 481681), Bulverde North (Community number 481683), and Bulverde South (Community number 481682). The City had no prior FIS reports or maps.

All FIS information was previously included on the Comal County FIRMs and FBFW maps, and the Comal County FIS report.

City of Fair Oaks Ranch:

The City of Fair Oaks Ranch did not have a separate previously printed FIS report. Effective data was included in the Bexar County FIS report and maps.

City of Garden Ridge:

The hydrologic and hydraulic analyses for the City of Garden Ridge FIS were performed by K. M. Ng & Associates, Inc., during the course of the Flood Insurance Study for Comal County, Texas. The Comal County study was completed in August 1983 (Reference 2).

City of New Braunfels:

The original hydrologic and hydraulic analyses for the City of New Braunfels FIS were performed by K. M. Ng & Associates, Inc., for FEMA. The work for that study was completed in August 1983.

The hydrologic and hydraulic analyses for the May 15, 1991, FIS report for New Braunfels, Comal and Guadalupe Counties, Texas, were performed by various contractors for FEMA. The hydrologic analyses for North and South Guadalupe Tributaries were performed by Freese and Nichols, Inc., Consulting Engineers; the hydraulic analyses for those streams were performed by Black & Veatch, Engineers-Architects, and Dewberry & Davis. The hydrologic and hydraulic analyses for Dry Comal Creek were performed by Dewberry & Davis. The work for the May 15, 1991, revision was completed in November 1989.

A revision to the hydrologic and hydraulic analyses was provided to FEMA by the City of New Braunfels, in accordance with the Cooperating Technical Partner Memorandum of Agreement dated May 31, 2001, between the City of New Braunfels, Comal County, and FEMA. The actual hydrologic and hydraulic analyses were performed by CH2M Hill for the City of New Braunfels. This work was completed on August 22, 2003 (Reference 3).

City of Schertz:

The initial City of Schertz FIS became effective on September 15, 1977. The City of Schertz hydrologic and hydraulic analyses were revised by Black & Veatch, Consulting Engineers for FEMA under Contract No. H-3814. The hydrologic and hydraulic analyses in this revision were prepared by Black & Veatch, Consulting Engineers during the preparation of the original study. The work for that revision was completed in February 1989. Dewberry & Davis also prepared updated hydraulic modeling for East Branch Dietz Creek, under the direction of FEMA. That work was completed in September 1991 (Reference 4).

City of Selma:

The hydrologic and hydraulic analyses for the City of Selma FIS dated January 1980 and the FIRM dated July 2, 1980, were prepared by the U.S. Geological Survey (USGS), Water Resources Division, Austin, Texas, for the Flood Insurance Administration (FIA), under Interagency Agreement No. IAA-H-17-75, Project Order No. 4. That work was completed in

July 1978 (Reference 5). The City of Selma is located in three counties, and each applicable area is to be shown in its respective county.

1.3 Coordination

The initial Consultation Coordination Officer (CCO) meeting was held on July 31, 2003, and attended by representatives of FEMA and Michael Baker Jr., Inc., Officials of the Cities of Bulverde, New Braunfels, Comal County, representatives of the Texas Water Development Board (TWDB), Carter and Burgess, Inc., CH2M Hill, The New Braunfels Herald-Zeitung, The Schultz Group, Inc., Watershed Concepts, and Halff Associates, Inc.

The results of the study were reviewed at the final CCO meeting held on October 13, 2004, and attended by representatives of Cities of Bulverde, New Braunfels, Comal County and Halff Associates, Inc.. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Comal County, Texas, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through July 2003.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and community officials.

The flooding sources studied by Detailed and Enhanced Approximate riverine methods along with the limits of study are shown in Table 1 “Scope of Study”.

Portions of the following sources and numerous unnamed streams were studied by (non-enhanced) approximate methods: Ahern Creek, Alligator Creek, Bear Creek (Bear Creek Watershed), Bear Creek (Lower Dry Comal Watershed), Blieders Creek Tributary 12, Caney Creek, Carpers Creek, Cherry Creek, Cypress Creek, Deep Creek, Devils Hollow, Dripping Springs Creek, Dry Bear Creek, Dutch Creek, Elm Creek, Four Mile Creek, a segment of the Guadalupe River just upstream of Canyon Lake, Hanz Creek, HID Trib 1 of Cibolo Creek, Honey Creek, Indian Creek, Indian Creek Tributary A, Isaac Creek, Jacobs Creek, Jentsch Creek, Kelley Creek, Lewis Creek, Little Bear Creek, Little Blanco River, Miller Creek, Mountain Hollow Creek, Museback Creek, Pleasant Valley Creek, Potter Creek, Puter Creek, Rebecca Creek, Rocky Creek, Schultz Creek, Sorrel Creek, Spring Branch, Swine Creek, Tom Creek, Turkey Creek, Water Hole Creek, West Fork Tributary, and York Creek.

The Canyon Lake Reservoir was also studied by detailed methods for its entire shoreline within the County. Part of Lewis Creek was originally studied by detailed methods in the Flood Insurance Study for Comal County, Texas, dated May 14, 1976; the detailed study was redelineated against updated topography and is once again incorporated into the FIS report.

Table 1 – Scope of Study
Stream Reaches Studied by Detailed Methods

Stream Name	Downstream Limit	Upstream Limit	Length (mi)
New/Revised Detailed Study Streams			
Alligator Creek	Comal County Limit	Approximately 220 feet upstream of Hoffman Lane	6.4
Alligator Creek Tributary No. 6	Confluence with Alligator Creek	Approximately 150 feet upstream of FM 306	2.3
Bear Creek (Dry Comal Watershed)	Confluence with Dry Comal Creek	Approximately 3.3 miles upstream	3.3
Blieders Creek (New Braunfels ETJ reach)	New Braunfels Corporate limits located approximately 2,160 feet upstream of River Road	New Braunfels Corporate Limits located approximately 700 feet downstream of State Highway 46	--
Blieders Creek (Upper Reach)	New Braunfels Corporate Limits located approximately 700 feet downstream of State Highway 46	New Braunfels Corporate Limits located approximately 2,800 feet upstream of Horseshoe Trail	--
Blieders Creek (New Braunfels ETJ reach upstream of Upper Reach)	New Braunfels Corporate Limits located approximately 2,800 feet upstream of Horseshoe Trail	Approximately 700 feet downstream of FM 1863	--
Bracken Tributary	Confluence with Cibolo Creek	2074 feet upstream of Garden North Drive	3.81
Cibolo Creek	Guadalupe County Boundary	Kendall County Boundary	46.16
Comal River/Dry Comal Creek	Confluence with the Guadalupe River	Approximately 600 feet upstream of Krueger Canyon Road	--
Comal Springs/Blieders Creek	Convergence with Old Channel Comal River and New Channel Comal River	New Braunfels Corporate Limits located approximately 2,160 feet upstream of River Road	--
Dry Comal Creek (New Braunfels ETJ reach)	New Braunfels Corporate Limits approximately 600 feet upstream of Krueger Canyon Road	Approximately 10.2 miles upstream of its confluence with the Comal River	--
Dry Comal Creek	Approximately 10.2 miles upstream of its confluence with the Comal River	Confluence of the West Fork and Upper Dry Comal streams	5.6
Garden Ridge Tributary	Confluence with Garden Ridge Tributary	152 feet upstream of Schoenthal Road	3.32
Guadalupe River Lower Reach, in New Braunfels	Approximately 9,900 feet downstream of U.S. Interstate 35	Approximately 300 feet upstream of Missouri Kansas Texas Railroad	--

Table 1 – Scope of Study
Stream Reaches Studied by Detailed Methods

Stream Name	Downstream Limit	Upstream Limit	Length (mi)
New/Revised Detailed Study Streams			
Guadalupe River Lower Reach, in New Braunfels ETJ	Approximately 300 feet upstream of Missouri Kansas Texas Railroad	Approximately 800 feet upstream of Elm Creek Road	--
Guadalupe River Lower Reach downstream of Canyon Lake Dam	Approximately 800 feet upstream of Elm Creek Road	Outlet from the Canyon Lake dam	14.5
New Channel Comal River	Convergence with Dry Comal Creek	Divergence from Old Channel Comal River and Comal Springs/Blieders Creek	--
North Guadalupe Tributary	Confluence with Guadalupe River	Approximately 120 feet upstream of FM 1044	--
Old Channel Comal River	Confluence	Divergence from Comal Springs and New Channel Comal Road	--
South Guadalupe Tributary	Confluence with North Guadalupe Tributary	Approximately 100 feet upstream of FM 1044	--
Upper Dry Comal Creek	Confluence with Dry Comal Creek	Schuetz Dam (SCS Dam 2)	1.1
West Fork	Confluence with Dry Comal Creek	Krause Dam (SCS Dam 1)	2.8
Redelineation Detailed Study Streams			
Lewis Creek	FM 1863	Approximately 4,800 feet upstream	0.91
Unrevised (Digital Conversion) Detailed Study Streams			
Cibolo-Kelley Creek Overflow	Confluence with Kelley Creek	Confluence with Cibolo Creek	--
Cibolo Tributary	Confluence with Cibolo Creek	Approximately 0.2 mile upstream of Ralph Fair Road	--
Cypress Creek	Confluence with the Guadalupe River (Upper Reach)	Approximately 4,800 feet upstream	1.14
Elm Creek	A point approximately 0.4 mile upstream of its confluence with the Guadalupe River	A point approximately 0.9 mile upstream of the Access Road Ford low water crossing	--

Table 1 – Scope of Study
Stream Reaches Studied by Detailed Methods

Stream Name	Downstream Limit	Upstream Limit	Length (mi)
Guadalupe River (Upper Reach)	Just upstream of Canyon Lake	County boundary	--
Digital Conversion Detailed Study Streams			
Indian Creek	Confluence with Cibolo Creek	Approximately 3.0 miles upstream	--
Indian Creek Tributary A	Confluence with Indian Creek	Approximately 0.6 mile upstream	--
Indian Creek Tributary B	Confluence with Indian Creek	Approximately 1.8 miles upstream	--
Kelley Creek	Confluence with Cibolo Creek	Approximately 8,510 feet upstream of confluence with Cibolo Creek	1.6
Postoak Creek	Confluence with Cibolo Creek	Kendall County boundary	--
Rebecca Creek	A point approximately 0.9 mile upstream of its confluence with the Guadalupe River	A point approximately 6.7 miles upstream of its confluence with the Guadalupe River	--
Sattler Tributary	Confluence with the Guadalupe River	Approximately 1.4 miles upstream	--
Unnamed Tributary No. 1 to Upper Dry Comal Creek	Confluence with Upper Dry Comal Creek	Approximately 860 feet upstream of State Highway 46	0.25
Unnamed Tributary No. 2 to Upper Dry Comal Creek	Confluence with Upper Dry Comal Creek	Approximately 640 feet upstream of State Highway 46	0.29
Unnamed Tributary to Cibolo Creek	Approximately 20 feet upstream of US 281	Approximately 2,250 feet upstream of US 281	0.42
Upper Dry Comal Creek	Approximately 8,000 feet downstream of State Highway 46	Approximately 2,250 feet downstream of State Highway 46	1.0
West Fork Tributary	Confluence with Dry Comal Creek	A point approximately 1.1 miles upstream	--
York Creek	Hays County boundary	A point approximately 0.9 mile upstream of the confluence of Bullhead Hollow	--
Stream Reaches Studied by Enhanced Approximate Methods Type II			
Dry Comal Tributary No. 13	Schuetz Dam	Approximately 4.7 miles upstream	4.7
Upper Dry Comal Creek	Confluence with Dry Comal Creek	Approximately 19 miles upstream of the dam	19.0

Table 1 – Scope of Study
Stream Reaches Studied by Detailed Methods

Stream Name	Downstream Limit	Upstream Limit	Length (mi)
West Fork	Krause Dam	Approximately 13.6 miles upstream of the dam	13.6

Table 2, "Stream Name Changes" lists those streams whose name has changed or differs from that published in the previous FIS for Comal County or any of the communities within.

Table 2 - Stream Name Changes

Community	Old Name	New Name
City of Garden Ridge	Apple Run	Garden Ridge Tributary

The countywide FIS incorporates the determination of Letters of Map Revision for the projects listed by community in Table 3, "Letters of Map Change".

Table 3 - Letters of Map Change

Project	Stream	Date
COMAL COUNTY UNINCORPORATED AREAS		
Lewis Ranch Road Subdivision (LOMR 98-06-448P)	Bear Creek Unnamed Tributaries	August 5, 1999
US Highway 281 H&H Analysis (LOMR 99-06-850P)	Cibolo Creek Unnamed Tributary	April 1, 1999
US Highway 281 H&H Analysis (LOMR 99-06-1314P)	Cibolo Creek Unnamed Tributary	June 23, 1999
Bulverde Commercial Subdivision Unit 2 (LOMR 03-06-418P)	Cibolo Creek Unnamed Tributary	April 7, 2003
Flood Study, Unnamed Tributary to the Bear Creek, Comal County, Texas (LOMR 00-06-1800P)	Bear Creek Unnamed Tributaries	June 5, 2001
Villareal Flood Study (LOMR 01-06-949P)	Cypress Creek	February 22, 2002
Lantana Ridge Subdivision (LOMR 03-06-1394P)	Swine Creek, Tributary No.1 to Swine Creek, Tributary No.2 to Swine Creek, Tributary No.3 to Swine Creek, Unnamed Tributary to Tributary No.1 to Swine Creek	August 4, 2004

Table 3 - Letters of Map Change

Project	Stream	Date
Upper Dry Comal Creek at Herbelin Road (LOMR 04-06-127P)	Upper Dry Comal Creek Unnamed Tributaries	June 4, 2004
Rockwall Ranch Subdivision (LOMR 04-06-A199P)	West Fork Tributary	January 14, 2005
The Woods of Bracken (LOMR 04-06-A135P)	Unnamed Tributary to Garden Ridge Tributary	April 28, 2005
River Crossing Subdivision (LOMR 06-06-BB92P)	Elm Creek 1, Hanz Creek	May 24, 2007
Rockwall Ranch Subdivision (LOMR 06-06-B357P)	Unnamed Tributary to West Fork	April 27, 2006
CITY OF BULVERDE		
US Highway 281 H&H Analysis (LOMR 99-06-850P)	Cibolo Creek Unnamed Tributary	April 1, 1999
US Highway 281 H&H Analysis (LOMR 99-06-1314P)	Cibolo Creek Unnamed Tributary	June 23, 1999
Bulverde Commercial Subdivision Unit 2 (LOMR 03-06-418P)	Cibolo Creek Unnamed Tributary	April 7, 2003
CITY OF SCHERTZ		
FM 3009 Channelization (LOMR 98-06-1251P)	Dry Comal Creek Unnamed Tributary	August 13, 1998

2.2 Community Description

Comal County is located in south-central Texas, approximately 7 miles northeast of the City of San Antonio. It is bordered by Bexar County and the City of Selma to the southwest, Kendall and Blanco Counties to the northwest, Hays County to the northeast, and Guadalupe County and the City of Schertz to the southeast. The City of New Braunfels lies mostly contained within the county boundary. According to the U.S. Bureau of the Census, the population of Comal County was 78,021 in 2000 (Reference 6). New Braunfels, the largest city within Comal County, had a population of 36,494 in 2000 (Reference 7).

Comal County was created and organized from parts of Bexar, Gonzales, and Travis Counties in 1846. The county is named for the Comal River, a spring-fed stream.

The Guadalupe River and Cibolo Creek originate outside the County, as do the Cibolo Tributary, Postoak Creek and Rebecca Creek. All runoff from the County drains into two major basins: the San Antonio River Basin and the Guadalupe River Basin.

The floodplains in the county are devoted mainly to agriculture, with the exception of the population centers. Most of the towns are characterized by residential development. New Braunfels, which is the county seat, has tourist centers and industries such as textile, furniture, and metal products.

The terrain varies from steep limestone outcroppings to broad, flat blackland soil cover. Most of the county is situated on the Texas Edwards Plateau, which is underlain by Edwards

Limestone strata with soil cover of the Tarrant, Brackett, Denton, and Crawford series. The southern portion of Comal County is located on the Blackland Prairies, underlain by Anacacho Limestone and Taylor Marl and clay with soil cover of the Austin, Heiden, Houston Black, Krum, Trinity, Stephe, Eddy, and Lewisville series. Between the Texas Edwards Plateau and the Blackland prairies is the Balcones Fault and Escarpment, which is usually accepted as the boundary between the lowlands and highlands of Texas. Above the Balcones Fault and Escarpment, the surface is characteristically eroded. All the streams in the county flow from the Texas Edward Plateau to the Black1and Prairies.

The mean annual precipitation for the county is 27.54 inches with an extreme of 7.28 inches within a 24-hour period recorded in September 1973. The wettest month is September with an average rainfall of 3.71 inches; the driest month is December with an average rainfall of 1.46 inches. The average annual temperature is 69 degrees Fahrenheit (F). The hottest months are July and August with an average temperature of 96° F; the coldest month is January with an average temperature of 51° F (Reference 1).

2.3 Principal Flood Problems

The history of flooding on the streams within Comal County indicates that flooding usually occurs during the spring tornado season and from occasional fall hurricanes (References 8, 9, 10, 11 and 12). Heavy rains in the general geographic region produce higher flooding; however, intense local thunderstorms can also produce severe flooding.

Heavy flood damage was sustained in May 1972, particularly along the Guadalupe River below Canyon Lake (Reference 13). Other major flood damage occurred in August 1978 along the Guadalupe River at Spring Branch, which is upstream of Canyon Lake approximately 4 miles outside of Comal County, and above Canyon Lake (References 14 and 15).

Heavy flooding occurred in October 1998 in the watersheds feeding the Guadalupe River (below Canyon Dam), the Comal River and Dry Comal Creek that caused inundation of areas outside the flood boundaries of the previous effective FIS. According to the National Weather Service (NWS), two hurricanes in the Eastern Pacific, Hurricane Madeline and Hurricane Lester, coupled with an atmospheric trough of low pressure over the western United States, led to heavy thunderstorms in various counties including Kendall, Comal, Hays and Travis Counties. Many of the recording rain gages operated by the NWS overflowed during the storm and incremental rainfall totals are not available for much of the area with the greatest rainfall. The largest rainfall occurred in the Guadalupe River Basin; most of the Basin received 8 or more inches of rainfall. A streamflow of 142,000 cfs was recorded at Station No. 08168500, which drains the Guadalupe River above the Comal River at New Braunfels, while 222,000 cfs were recorded at Station No. 08169500, which drains the Guadalupe River at New Braunfels. The volume of runoff for the gage at Guadalupe River at Cuero was computed for the period October 17-31, 1998, at about 1,840,000 acre-feet. The total outflow from Canyon Lake was only about 2,600 acre-feet, thus, almost all runoff at the Cuero Station originated from the basin downstream of the reservoir. The maximum water elevation at Canyon Lake was about 923 feet, which is about 20 feet lower than the spillway crest at the reservoir (References 16 and 17).

In July 2002, 5 to 35 inches of rain caused massive flooding throughout central and southcentral Texas and affected thousands of homes. For the first time since it was filled in

1968, Canyon Lake Dam in Comal County poured over its emergency spillway (Reference 18). The 2002 flood is further illustrated in the City of New Braunfels section below.

City of Garden Ridge:

The history of flooding on the streams within the City of Garden Ridge indicates that flooding usually occurs during the spring tornado season and from occasional fall hurricanes. Heavy rains in the general geographic region produce higher flooding; however, intense local thunderstorms can also produce severe flooding (Reference 2).

City of New Braunfels:

New Braunfels has a long history of extreme rainfall events and flooding. Major floods were recorded in July 1869, October 1870, June 1872, December 1913, July 1927, July 1932, June 1935, September 1952, May 1958, May 1972, October 1998, and July 2002. Those flood events that are of particular note include the floods of 1972, 1998, and 2002. These are important because they occurred after the construction of Canyon Dam in 1963. Excerpts describing these disastrous floods are provided below (Reference 3).

Flood of May 1972 (References 19 and 20).
According to informal "bucket surveys" in the area, rainfall estimates were as high as 16 inches over a 4-hour period. In addition, observational reports received from residents in the area stated that they observed 12 inches of rain between 8:40 p.m. and 9:40 p.m. on May 11, 1972. This flood caused extensive damage throughout the city and resulted in the loss of 15 lives. Heavy damage was sustained in areas along Blieders Creek near Landa Park (Landa Estates), areas along the Comal River (Guada Coma Estates), and areas along the Guadalupe River at Common Street and Rio Drive. The Comal River gage at San Antonio Street at the Tube Chute Park crested at 11:45 p.m. May 11 at 36.55 feet, driven by the 60,800 cubic feet per second (cfs) flood peak from the Blieders Creek Watershed. The same gage crested again at 5:30 a.m. on May 12 at 35.45 feet, this time dominated by the 55,800 cfs flood peak from the flood from Dry Comal Creek Watershed. The Guadalupe River above the Comal River confluence (at Common Street) crested at 31.65 feet, 92,600 cfs, between 12:30 to 1:00 a.m. on May 12. The New Braunfels gage (at the "Factory Mall") crested at 38.0 feet.

Flood of October 1998.
According to the USGS, by 6:00 a.m. on October 17, 1998, the area from western Comal County to eastern Medina County had received 4 to 6 inches of rain. By 8:00 a.m., 6 to 10 inches had fallen; and by late morning, the area had received about 15 inches of rainfall. The largest documented rainfall was in southern Hays County just south of San Marcos, where at least 30 inches was recorded. A second center, with about 22 inches of rain, was documented at a site in western Comal County. A flood-retention dam constructed on Blieders Creek apparently spared residents in the floodplain above Landa Park the severe flooding experienced in the May 1972 flood. Dry Comal Creek flooded hundreds of homes in western New Braunfels above the Comal River confluence just below Landa Park. The Comal River flooded many homes and businesses below Landa Park, including the Tube Chute Park. Flooding was disastrous along the Guadalupe River below Canyon Dam, starting where Bear Creek confluences with the Guadalupe River (Reference 21). Nineteen homes washed downstream in New Braunfels. One group, just above Common Street, had slab elevations as low as 12.5-feet gage height. The flood crest at the Common Street gage was 35.08 feet. The Common Street bridge deck is 17-feet gage height; 18 feet lower than the crest of the flood.

The remnants of the homes stacked against a grove of trees two blocks below Common Street in a stack three stories high

Flood of July 2002.
As much as 35 inches of rainfall fell during the event. The flood caused at least nine deaths and damage to about 48,000 homes. Nearly 250 flood rescue calls were reported, more than 130 roads were closed, and thousands of homes and businesses lost electrical power and telephone service. Thirty-four counties were identified by FEMA as Federal Declared Disaster areas. The storms produced large volumes of runoff and as many as four flood peaks at each
of many streamflow-gaging stations in the Brazos, Colorado, and Guadalupe River Basins. The largest peak stream flow from the July 2002 storms represents the highest known peak gage height and discharge for 12 of the gaging stations. The July 2002 storm caused overtopping of Canyon Dam for the first time since its construction in 1963, contributing to a peak flow of 69,300 cfs along the Guadalupe River through New Braunfels (Reference 3).

There are three USGS Gage Stations in the study area: one on the Comal River and two on the Guadalupe River. USGS Gage 08169000 (Comal River at New Braunfels) is located on the Comal River at San Antonio Street. The May 11, 1972, peak flow of 60,800 cfs was recorded at this location with two of a total of five Natural Resources Conservation Service (NRCS) flood-retarding dams in place. In 1998, after all five NRCS dams were in service, the Comal River recorded a peak flow of 73,500 cfs at the San Antonio Street gage (Reference 3).

USGS Gage 08169500 (Guadalupe River at New Braunfels) is located on the Guadalupe River downstream of U.S. Interstate 35. USGS Gage 08168500 (Guadalupe River above Comal River) is located on the Guadalupe River at Common Street. The peak flow rates recorded for the Guadalupe River at this gage site since 1963 (construction of Canyon Dam) include the following (Reference 3).

- October 17, 1998 – 142,000 cfs
- May 12, 1972 – 92,600 cfs
- July 6, 2002 – 69,300 cfs
- May 5, 1993 – 13,100 cfs
- July 27, 1979 – 13,000 cfs

City of Schertz:

Accounts of flooding for Cibolo Creek in the City of Schertz have been well documented since installation of a gaging station at Selma by the USGS in 1947. Prior to this, recollection by long-time residents and high-water marks had been matched to establish previous events. The highest flood on record occurred July 16, 1973. The third highest flood occurred May 12, 1972. Both the 1972 and 1973 floods caused extensive property damage in Schertz. The second highest flood occurred in 1889, but little damage was noted due to lack of area development (Reference 4).

City of Selma:

In the City of Selma, three bridges on Cibolo Creek at the Interstate Highway 35 crossing in Guadalupe County cause only a small amount of backwater as the base flood is mostly contained within the channel banks. The main Interstate Highway 35 bridge has a stream

opening adequate to carry all of the selected discharges except the 0.2-percent-annual-chance -flood, which will overtop the main highway (Reference 5).

2.4 Flood Protection Measures

Canyon Lake, which is operated by the USACE, serves as a water conservation and major flood protection device on the Guadalupe River, with a total detention capacity of 736,700 acre-feet (References 22 and 23). Canyon Lake restrained most of the floodwaters from the August 1978 flood, restricting flood damage in Comal County. Major flooding did occur at Comfort and Spring Branch, which are upstream of the lake. There are four dams and reservoirs within the Comal River Watershed upstream of the county that serve as flood protection devices. These structures control runoff from 44.4 square miles, with a combined detention capacity of 9,875 acre-feet (Reference 24).

Four dams on Rebecca Creek form recreational lakes at housing subdivisions upstream of Comal County. There are several water-retarding structures within the Cibolo Creek Watershed upstream of Comal County. These structures control runoff from 34 square miles, with a combined detention capacity of 8,850 acre-feet (Reference 25). Two dams are located within the York Creek Watershed upstream of the county. These dams control runoff from 15.73 square miles with a combined detention capacity of 3,764 acre-feet. At the present time, no other flood control projects are known to be underway or proposed for the county.

Non-structural measures of flood protection can be utilized to aid in the prevention of future flood damage. These are in the form of land-use regulations adopted from the Code of Federal Regulations which control building within areas that have a high risk of flooding (Reference 1).

City of Garden Ridge:

At the present time, no flood control projects are underway or proposed for the City of Garden Ridge. Non-structural measures of flood protection can be utilized to aid in the prevention of future flood damage. These are in the form of land-use regulations adopted from the Code of Federal Regulations which control building within areas that have a high risk of flooding (Reference 2).

City of New Braunfels:

Canyon Dam is located upstream of New Braunfels, in the Guadalupe River Watershed. Completed in 1964, the Canyon Lake reservoir has a contributing drainage area of about 1,430 square miles, has a surface area of about 8,320 acres at normal pool elevation, and can impound 346,000 acre-feet of floodwaters before engaging the emergency spillway. The principal spillway has a capacity of about 5,000 cfs (Reference 26). However, the operating policy of the dam is to close the gates of this principal spillway and impound all the observed inflow when the flood peak downstream of the dam exceeds 12,000 cfs, based on the observed flow at the Gonzales, Texas gaging station. From 1964, when water was first impounded in Canyon Lake, until July 2002, no water was released from Canyon Lake during flood conditions. In July 2002, water overtopped the emergency spillway for the first time, with a peak rate of about 66,800 cfs as recorded on July 6, 2002 (References 26 and 27).

The NRCS, formerly the Soil Conservation Service, operates four flood control structures within the Dry Comal Creek Watershed, and one flood control structure in the Blieders Creek Watershed. These dams are upstream of New Braunfels and provide peak flow attenuation during intense storms, as follows (Reference 28):

- Dam No. 1 on Dry Comal Creek - flood storage of 3,737 acre-feet;
- Dam No. 2 on Dry Comal Creek - flood storage of 7,878 acre-feet;
- Dam No. 3 on Blieders Creek - flood storage of 3,422 acre-feet;
- Dam No. 4 on Dry Comal Creek - flood storage of 3,604 acre-feet; and
- Dam No. 5 on Dry Comal Creek - flood storage of 350 acre-feet.

On the North Guadalupe Tributary, immediately downstream of Walnut Drive, there is a small basin named Structure 40. The structure consists of a 370-feet long earthen berm adjacent to a 30-feet wide by 5.2-feet tall concrete weir outlet. The basin attenuates the North Tributary flow a negligible amount.

There are two low head dams on the studied reach of the Guadalupe River: upstream of Faust Street (No. 8) and upstream of Common Street (No. 7). These low-head dams do not provide flood protection.

Dunlap Dam is located at the downstream end of the Guadalupe River study area in Guadalupe County. This dam is used to impound water for hydropower and provides little flood attenuation for downstream communities. Channelization projects along the North and South Tributaries were completed in 1989. Other flood control projects such as channel improvements (brush clearing and dredging), regional and local detention ponds, and re-routing of stormwater runoff are being currently evaluated by the city as part of a citywide drainage master plan (Reference 3).

City of Schertz:

There are no flood control measures in the City of Schertz within Comal County at this time, although channel improvements are under construction further downstream in Guadalupe County. Drainage channel maintenance and City zoning ordinances are the primary attempts to provide flood protection. Appropriate updating is required to ensure that these measures remain current (Reference 4).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein

reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the county.

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 4, Summary of Discharges. The streams that were modeled or revised during the 2005 New Braunfels FIS update or the 2005 countywide study are marked "New/Revised Detailed Study Streams", streams that were redelineated as part of the countywide study are marked "Redelineation, Detailed Study Streams" and those converted from the effective FIS by digital conversion are marked "Unrevised Digitally Converted Detailed Study Streams".

3.1.1 New/Revised Detailed Study Streams

New Braunfels

The hydrologic analysis approach used for all the streams that were revised in the 2005 New Braunfels FIS Update followed procedures outlined in New Braunfels Drainage and Erosion Control Design Manual (Reference 29). The streams studied by detailed methods include Comal Springs, Blieders Creek, Blieders Creek (Upper Reach), the Comal River, Dry Comal Creek, the Guadalupe River (Lower Reach) in New Braunfels, the New Channel Comal River, the North Guadalupe Tributary, the Old Channel Comal River, and the South Guadalupe Tributary.

TABLE 4 – SUMMARY OF DISCHARGES
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
New/Revised Detailed Study Streams					
ALLIGATOR CREEK					
2110 feet downstream of FM 1101	13.30	9,600	18,000	21,700	32,500
2605 feet upstream of FM 1101	12.26	9,500	17,300	20,900	31,500
145 feet upstream of I-35 Northbound Lanes	10.09	9,500	16,500	20,000	30,300
890 feet upstream of I-35 Northbound Lanes	10.09	10,000	16,600	20,100	30,200
545 feet downstream of FM 1102	7.74	9,200	15,400	18,600	27,400
245 feet upstream of Hoffman Lane	7.27	9,300	16,200	19,700	28,200

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
New/Revised Detailed Study Streams					
ALLIGATOR TRIBUTARY NO. 6					
Approximately 3000 feet above the confluence with Alligator Creek	1.90	2,050	3,500	4,300	6,200
165 feet upstream of FM 306	0.56	900	1,550	1,850	2,650
BEAR CREEK					
SCS DAM 4	13.59	150	2,250	2,400	12,500
Split flow analysis	--[1]	150	443	1,046	5,803
Split flow analysis	--[1]	150	250	250	250
BRACKEN TRIBUTARY					
Upstream of Confluence with Garden Ridge Tributary (Sect. 2195)	3.2	2,227	4,092	5,032	7,767
Approx. 1200 feet upstream of Jethro Lane (Sect. 11042)	2.2	1,671	2,927	3,606	5,170
Approx. 480 feet downstream of Garden North Dr (Sect. 16331)	0.8	1,253	2,073	2,467	3,337
CIBOLO CREEK					
731 feet upstream of Guadalupe County boundary	271.6	34,404	81,696	99,469	140,722
102 feet downstream of confluence of Bracken Tributary	271.2	34,560	81,806	99,570	140,827
1116 feet E-SE of intersection of Wagon Road and Evans Road	265.5	34,504	81,492	99,183	140,401
Below Stream CC-23	263.1	34,589	81,452	99,125	140,342
2926 feet W of intersection of Tommy Trail Drive and Garden North Drive	260.3	34,589	81,322	98,953	140,151
Below Stream CC-22	257.0	34,723	81,278	98,853	140,071
1265 feet NE from northern most corner of Cibolo View	253.5	34,723	81,099	98,619	139,816
CIBOLO CREEK (cont'd)					
207 feet upstream of Cibolo Vista	249.7	34,904	81,047	98,495	139,665
XS 537372	242.2	34,883	80,558	97,782	138,847
Approximately 7350 feet upstream of FM 1863	238.4	35,103	80,533	97,623	138,638
2786 feet upstream of FM 1863	234.5	35,300	80,482	97,465	138,462
2799 feet S of end of Vogel Valley	230.8	35,284	80,217	97,079	138,061
830 feet SW of end of Twin Creeks Drive	228.8	35,477	80,250	97,050	138,002
1434 feet S-SW of intersection of Onion Creek Drive and FM 1863	206.4	35,143	78,186	93,753	134,663

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
New/Revised Detailed Study Streams					
1538 feet NE of end of Kingsnake Drive	203.0	35,288	78,359	93,736	134,739
737 feet downstream of downstream face of Highway 281 North	197.1	35,468	78,023	93,085	134,370
2071 feet upstream of Bulverde Road	192.1	35,652	77,391	92,046	133,858
2390 feet upstream of confluence of Museback Creek	179.2	35,151	74,878	89,412	131,007
241 feet SW of intersection of Leroy Scheel Road and Bulverde Road	175.2	35,518	74,087	88,612	130,242
1630 feet downstream of Specht Road	165.5	34,867	72,293	86,347	127,673
735 feet upstream of Specht Road	165.1	35,015	72,352	86,409	127,696
176 feet downstream of Ludwig Trail	162.6	34,974	72,046	85,940	127,141
813 feet upstream of Ludwig Trail	162.5	35,028	72,041	85,952	127,126
99 feet upstream of Blanco Road	154.3	34,718	70,899	84,362	125,215
Approximately 6450 feet upstream of Blanco Road	153.3	35,046	71,029	84,504	125,697
4250 feet upstream of confluence of Pleasant Valley Creek	151.1	35,027	70,813	84,100	125,213
2024 feet SE of end of Georg Oaks Drive	150.1	35,243	71,083	84,314	125,545
1206 feet E of end of Schaefer Road	127.9	32,595	65,405	77,354	116,975
Below Stream CC-18	124.9	33,217	66,201	78,092	117,435
1808 feet SW of end of Georg Street	121.8	33,217	65,836	77,541	116,809
XS 691005	120.6	33,570	66,062	77,563	116,971
XS 695851	117.0	33,416	65,252	76,600	115,896
1994 feet downstream of Ralph Fair Road	115.2	33,973	65,336	76,540	116,383
443 feet upstream of Ralph Fair Road	111.8	33,398	63,900	74,909	114,430
769 feet W-NW of intersection of Mellow Wind and Sweetwind	111.1	33,700	64,229	75,217	114,828
831 feet downstream of Battle Intense	102.6	31,046	59,372	69,820	108,422
1004 feet upstream of Comal County boundary	100.8	31,320	59,811	70,638	108,677
COMAL RIVER/DRY COMAL CREEK IN NEW BRAUNFELS					
At confluence with Guadalupe River	128.5	21,648	36,846	43,670	67,238
DRY COMAL CREEK (ETJ AREA)	--[2]	--[2]	--[2]	--[2]	--[2]
DRY COMAL CREEK					
Bunker Street	80.35	12,299	22,428	26,823	41,857
High Creek Road (Friesenhahn Lane)	79.80	12,194	22,212	26,542	41,307
Coyote Run	70.53	3,450	6,900	8,900	33,200

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
New/Revised Detailed Study Streams					
250 feet downstream of confluence with Bear Creek	68.81	3,400	6,300	8,100	32,800
125 feet downstream of confluence with West Fork Dry Comal Creek	53.83	2,850	5,200	6,500	27,100
COMAL SPRINGS/BLIEDERS CREEK IN NEW BRAUNFELS					
At confluence with Old Channel Comal River (Segment CRJ010)	16.8	4,114	7,132	8,126	14,644
BLIEDERS CREEK (ETJ AREA)	--[2]	--[2]	--[2]	--[2]	--[2]
BLIEDERS CREEK (UPPER REACH)					
At Klingeman Street, outflow to Comal Springs (Segment BC Outflow)	15.8	3,531	6,306	7,445	14,129
At Loop 337 (Segment BCJ220)	14.9	3,271	5,995	6,963	13,936
At NRCS Dam No. 3 (Outflow)	11.5	1,33	1,189	2,873	12,293
At NRCS Dam No. 3 (Inflow)	11.5	11,314	18,488	24,159	30,655
At State Highway 46 (Segment CJ041)	1.8	3,348	4,999	5,505	7,670
BLIEDERS CREEK (ETJ ABOVE UPPER REACH)	--[2]	--[2]	--[2]	--[2]	--[2]
GARDEN RIDGE TRIBUTARY					
Upstream of Confluence with Bracken Tributary (Sect. 326)	2.2	1,834	2,843	3,860	6,286
Upstream of FM 2252 (Sect. 6751)	1.5	1,834	2,843	3,369	4,843
Approx. 740 feet downstream of Forest Waters Circle (Sect. 13535)	0.5	1,569	2,397	2,805	3,820
GUADALUPE RIVER (LOWER REACH, NEW BRAUNFELS) [6]					
At Dunlap Dam	233	59,438	103,388	122,977	184,036
At US Interstate 35, below Comal River (Segment GRJ500)	221	58,588	102,133	120,962	188,253
At Common Street, above confluence with Comal River (Segment GRJ450)	88	39,233	71,559	85,458	132,918
At Gruence Road (Segment GRJ450)	85	39,086	71,372	85,458	132,975

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
New/Revised Detailed Study Streams					
GUADALUPE RIVER (LOWER REACH, ETJ AREA) [6]	--[2]	--[2]	--[2]	--[2]	--[2]
GUADALUPE RIVER (LOWER REACH, FROM ETJ LIMITS TO CANYON LAKE DAM) [6]					
3880 feet upstream of River Road	60.91	35,900	61,000	72,400	129,700[3]
325 feet downstream of confluence of Deep Creek	58.99	37,600	63,400	75,100	129,700[3]
585 feet downstream of confluence of Turkey Creek	55.68	37,100	62,000	73,500	129,700[3]
425 feet downstream of confluence of Bear Creek	53.22	36,700	60,900	72,700	129,700[3]
555 feet upstream of Ponderosa Crossing	34.82	25,100	41,700	50,800	129,800[3]
5500 feet upstream of Ponderosa Crossing	29.96	21,700	37,200	44,900	129,800[3]
335 feet downstream of confluence of Sattler Tributary [4]	24.67	18,200	31,100	38,200	129,800[3]
220 feet downstream of confluence of Cordovs Hollow	22.56	17,500	29,800	36,200	129,900[3]
1600 feet upstream of FM 306	16.43	13,800	23,800	29,100	129,900[3]
7960 feet upstream of FM 306	2.37	--[5]	--[5]	14,000[3]	130,000[3]
7800 feet upstream of unnamed dam	2.37	5,500	5,900	7,200	10,100
NEW CHANNEL COMAL RIVER	--[2]	--[2]	--[2]	--[2]	--[2]
NORTH GUADALUPE TRIBUTARY					
At confluence with Guadalupe River (Mouth Segment NGJ080)	4.7	4,708	6,714	7,436	9,738
At FM 725 (Segment GRJ500)	1.4	2,058	2,890	3,073	3,656
At Walnut Avenue (Segment NGJ030)	0.8	1,882	2,707	2,936	4,267
OLD CHANNEL COMAL RIVER					
Just upstream of East Common Street	17.9	3,799	5,563	6,629	8,803
SOUTH GUADALUPE TRIBUTARY					
At FM 725 (Segment SGJ060)	3.0	3,005	4,256	4,755	6,177
At Walnut Avenue (Segment SGJ040)	2.0	2,705	4,028	4,496	6,283
UPPER DRY COMAL CREEK					
SCS DAM 2	30.15	200	1,200	3,600	14,800
Outflow of SCS DAM 2 minus weir flow	--[2]	200	330	330	330

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Unrevised Digitally Converted Detailed Study Streams					
Approximately 35,500 feet upstream of FM 1863	7.8	--[2]	--[2]	9,928	--[2]
WEST FORK DRY COMAL CREEK					
470 feet upstream of Tonne Drive	22.65	2,450	4,350	5,600	18,700
SCS DAM 1	18.38	900	2,300	5,600	18,600
Outflow of SCS DAM 1 minus weir flow	--[2]	900	1,500	1,500	1,500
Redelineation Detailed Study Streams					
LEWIS CREEK	--[2]	--[2]	--[2]	--[2]	--[2]
Unrevised Digitally Converted Detailed Study Streams					
CIBOLO-KELLEY CREEK OVERFLOW					
At time of Cibolo Creek peak	--[2]	--[2]	1,690	4,100	17,110
CIBOLO TRIBUTARY					
Upstream of confluence with Cibolo Creek	3.10	4,262	5,894	6,773	8,669
CYPRESS CREEK	--[2]	--[2]	--[2]	--[2]	--[2]
ELM CREEK					
Upstream of confluence with the Guadalupe River	15.3	3,010	4,565	5,471	7,620
At cross section O	4.6	2,854	4,322	5,180	7,217
At cross section Z	3.1	2,311	3,463	4,130	5,763
At cross section AJ	1.4	1,538	2,304	2,706	3,600
ELM CREEK 1					
Just Upstream of Confluence with Hanz Creek	6.07	--[2]	--[2]	11,870	--[2]
GUADALUPE RIVER (UPPER REACH)					
At cross section CP	1332.1	46,730	113,450	156,600	305,360
At cross section CZ	1328.8	46,940	114,450	158,260	309,670
Upstream of FM 331	1315.0	47,230	115,860	160,570	315,730
At confluence of Ahern Creek	1296.0	47,630	117,820	163,800	324,270

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Unrevised Digitally Converted Detailed Study Streams					
Upstream of Ammann Road	1270.2	48,820	123,730	173,620	350,530
Upstream of confluence of Curry Creek	1199.0	49,020	124,720	175,260	354,960
HANZ CREEK					
Approximately 2,550 feet Upstream of the confluence with Elm Creek 1	3.62	--[2]	--[2]	5,646	--[2]
INDIAN CREEK					
Upstream of confluence with Cibolo Creek	13.5	8,988	17,097	21,875	30,227
At the confluence of Indian Creek Tributary A	9.6	7,754	13,396	16,695	22,470
Upstream of confluence of Indian Creek Tributary B	9.1	7,603	12,936	16,063	21,578
INDIAN CREEK TRIBUTARY A					
Upstream of confluence with Indian Creek	2.0	3,135	4,165	4,682	5,868
INDIAN CREEK TRIBUTARY B					
Upstream of confluence with Indian Creek	0.8	1,606	2,066	2,276	2,741
KELLEY CREEK					
At confluence with Cibolo Creek (Cibolo Creek Diversion added)	10.85	7,200	13,800	15,910	22,740
POSTOAK CREEK					
At confluence with Cibolo Creek	8.20	2,600	5,300	7,300	10,237
REBECCA CREEK					
At cross section B	14.1	7,524	11,382	13,534	18,768
At cross section C	12.8	7,221	10,926	12,986	17,991
At cross section I	11.9	7,114	10,744	12,735	17,660
Upstream of confluence of Putter Creek	9.7	6,539	9,854	11,641	16,053
REBECCA CREEK (Cont'd)					
At FM 306	3.9	3,296	4,976	5,868	7,950
At cross section AG	1.9	1,577	2,390	2,821	3,853
SATTLER TRIBUTARY					
Upstream of confluence with the Guadalupe River	1.0	814	1,224	1,452	1,909

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Unrevised Digitally Converted Detailed Study Streams					
At cross section F	0.6	730	1,087	1,273	1,688
SWINE CREEK					
Approximately 2,600 feet downstream of Lantana Valley Drive	1.53	--[2]	--[2]	3,130	--[2]
Approximately 500 feet downstream of Lantana Valley Drive	1.29	--[2]	--[2]	2,827	--[2]
TRIBUTARY NO. 1 TO SWINE CREEK					
At confluence with Swine Creek	2.60	--[2]	--[2]	4,403	--[2]
TRIBUTARY NO. 2 TO SWINE CREEK					
At the confluence with Swine Creek	0.13	--[2]	--[2]	342	--[2]
TRIBUTARY NO. 3 TO SWINE CREEK					
At the confluence with Swine Creek	0.71	--[2]	--[2]	1,608	--[2]
UNNAMED TRIBUTARY TO CIBOLO CREEK					
Just upstream of US Highway 281	0.6	--[2]	--[2]	1,260	--[2]
UNNAMED TRIBUTARY NO. 1 TO UPPER DRY COMAL CREEK					
At the confluence with Upper Dry Comal Creek	0.6	--[2]	--[2]	1,020	--[2]
UNNAMED TRIBUTARY NO. 2 TO UPPER DRY COMAL CREEK					
At the confluence with Upper Dry Comal Creek	0.5	--[2]	--[2]	1,135	--[2]
UNNAMED TRIBUTARY TO TRIBUTARY NO. 1TO SWINE CREEK					
At confluence with Tributary No. 1 to Swine Creek	0.24	--[2]	--[2]	673	--[2]
WEST FORK TRIBUTARY					
Upstream of confluence with Dry Comal Creek	31.1	1,315	1,964	2,305	3,060

TABLE 4 – SUMMARY OF DISCHARGES (Cont'd)
Detailed Study Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Unrevised Digitally Converted Detailed Study Streams					
YORK CREEK					
At the downstream county boundary	32.9	10,407	15,801	18,664	25,563
At cross section I	31.4	5,173	7,917	9,348	12,981
Downstream of the Missouri-Kansas-Texas Railroad	19.7	3,443	5,142	6,119	8,094
Upstream of confluence of Bullhead Hollow	16.2	2,499	3,679	4,297	5,122

[1] Data not computed
[2] Data not available
[3] Spill from Canyon Lake Emergency Spillway included based on Design Flood Pattern
[4] Approximate location of USGS Gage 08167800 Guadalupe River at Sattler, TX
[5] Minimum Flow at upstream end based on Maximum Controlled Release Rate from Canyon Dam
[6] (does not include drainage areas upstream of (Canyon Lake Dam)

The analytical approach in the City Manual generally follows NRCS procedures, which is an umbrella term to cover a wide range of related procedures. Details of the NRCS procedures can be found in the publication Technical Release Number 55 (TR-55) (Reference 30) and in Section 4 of the National Engineering Handbook **(**Reference 31).

The hydrologic analysis was performed by CH2M Hill for the City of New Braunfels. This work was completed on August 22, 2003 (Reference 3). The CH2M Hill study also involved streams outside of the New Braunfels City Limits, roughly located in the New Braunfels ETJ area. The streams include Blieders Creek, Blieders Creek upstream of the Upper Reach, Dry Comal Creek and the Guadalupe River.

Lower Guadalupe River, Dry Comal and Alligator Creek Watersheds

The Lower Guadalupe River upstream of the New Braunfels ETJ area, the Dry Comal, and the Alligator Creek Watersheds were studied with detailed hydrologic methods for this phase of the Comal County Flood Insurance Restudy. The Guadalupe River was studied from just upstream of New Braunfels to Canyon Lake. Dry Comal Creek and Tributaries included detailed and limited detailed study reaches. The Alligator Creek Watershed was studied from the Comal/Guadalupe county line up to and including Tributary 6.

The Guadalupe and Dry Comal Basin analyses in this study are based on hydrology developed for the 2005 New Braunfels FIS mapping update prepared by CH2M Hill (Reference 16). The Alligator Creek hydrology was developed by Halff Associates, Inc. based on similar methodology.

The primary source of terrain data used for this hydrologic study was developed by Light Detection and Ranging (LiDAR) data methods by Spectrum Mapping, LLC in May of 2004

(Reference 32). In addition, topography surveyed in 2002 by the City of New Braunfels was used for Alligator Creek (Reference 33). The USGS 30-meter National Elevation Dataset Digital Elevation Model (DEM) was used where the detailed topography was not available (Reference 34).

Sub-basin delineation was performed in ArcMap GIS, utilizing the topography information described above. This Guadalupe Watershed consists of approximately 72.3 square miles of land below Canyon Lake and was divided into 36 sub-watersheds varying from approximately 0.1 to 14.5 square miles in size. The delineations were taken from the New Braunfels FIS Update hydrology model. The Dry Comal Watershed consists of approximately 77.5 square miles upstream of the railroad and was divided into 33 sub-watersheds varying from approximately 0.1 to 5.1 square miles in size. The delineations were based on the New Braunfels FIS Update hydrology model but the larger sub-basins were further subdivided to provide more accuracy. The Alligator Watershed consists of approximately 14.3 square miles upstream of the Comal/Guadalupe County line and was divided into 12 sub-watersheds varying from approximately 0.4 to 4.2 square miles in size.

Rainfall totals for the frequency floods were obtained from the City of New Braunfels FIS Update, developed and calibrated in the Milestone II Report, prepared by CH2M Hill and dated May, 2003 (Reference 16). This hydrologic simulation used the HMS 24-hour storm distribution, which was considered appropriate for New Braunfels and the surrounding Guadalupe and Comal County areas in the New Braunfels Update study.

It is customary in hydrologic studies to reduce the point total rainfall for areas as a function of drainage basin size. In the streams studied in detail for the Comal County flood mapping update, areal reduction factors were applied based on HMS default values.

Soil information was obtained from the U.S. Department of Agriculture, NRCS State Soil Geographic database (STATSGO) for Texas, published in 1994. Hydrologic soil types C and D are the dominant soils found in the watershed (Reference 35).

Runoff losses were computed using the NRCS Curve Number Method. Composite curve numbers were determined by overlaying GIS shape files of the land use polygons and STATSGO soil type polygons. These shape files were then intersected to create polygons consisting of specific land use and hydrologic soil group. These polygons were then weighted within their respective sub-basins to obtain a composite curve number.

The NRCS Lag method was selected to compute the unit hydrographs. The sub-basin time of concentration was computed using the TR-55 Method (Reference 30), dividing the flow into 3 types:

- Sheet flow- used TR-55 formula with a maximum length of 150 feet.
- Shallow Concentrated Flow- distance based on length from last identified stream channel (USGS designation) minus the length used for sheet flow; velocities based on TR-55 equations for unpaved areas.
- Channel Flow- distance based on length along actual stream channel; velocities based on velocity vs. channel slope relationship developed from computations for local streams in previous FIS and other studies.

Lag time for each subwatershed was computed as 60 percent of the time of concentration for the sub-basin.

The Modified Puls method was selected to route the hydrographs for all reaches studied in detail. Discharge-storage relationships were computed using the HEC-RAS models developed for hydraulics (Reference 36). The RAS models were generated using GeoRAS Version 8.1 and the Triangulated Irregular Network (TIN) developed specifically for this study from the available topography. Routing for stream reaches not studied in detail utilized the 8 point Muskingum Cunge method.

The 1 and 0.2 percent annual chance of exceedance (ACE) floods will discharge over the Canyon Dam Emergency Spillway into the Guadalupe River via a channel cut by the July 2002 flood event. The 1 and 0.2 percent ACE discharges are 14,000 cfs and 130,000 cfs respectively based on information supplied by the USACE, Fort Worth District Reservoir Operations Branch. In Comal County, the resulting routed hydrographs were used to define discharges downstream of the dam until a point where local runoff generated by the portion of the Guadalupe River watershed below Canyon Dam became greater. The 1 percent ACE spillway flows controlled for a distance of 2.6 miles and the 0.2 percent ACE spillway flows controlled for 13.9 miles or about 26,800 feet above the city limits of New Braunfels.

Bracken Tributary, Garden Ridge Tributary

Both Cibolo Creek Tributaries, the Bracken Tributary, and the Garden Ridge Tributary (the upper reach of the Garden Ridge Tributary is identified as Apple Run in the Garden Ridge FIS report, Reference 2), are part of the Bracken Tributary Watershed. The watershed was studied from the Bracken Tributary headwaters to its confluence with Cibolo Creek.

The hydrologic rainfall\runoff model from the Hydrologic Engineering Center, HEC-HMS Version 2.2.2 (May, 2003) was used to estimate peak discharges for the watershed (Reference 37).

The primary source of terrain data used for this hydrologic study was developed from the 2-foot interval topography that was created from TIN files obtained from the U.S. Army Corps of Engineers, which is being used for the current Cibolo Creek Restudy. To supplement the aerial mapping, a U.S. Geological Survey (USGS) 30-meter National Elevation Dataset DEM was used where the aerial topography was not available (Reference 34).

Sub-basin delineation was performed in ArcMap GIS, utilizing the topography information described above. The combined watershed is approximately 5.58 square miles and was divided for this study into 13 sub-watersheds varying in size from .0289 to 0.867 square miles.

Rainfall totals for the frequency floods were obtained from the previous City of New Braunfels' FIS update, developed and calibrated in the Milestone II Report, prepared by CH2M Hill and dated May, 2003 (Reference 16). This hydrologic simulation uses the NRCS Type III 24-hour storm distribution, which is considered appropriate for New Braunfels and the surrounding Comal County area. A 24-hour duration hypothetical storm was used for the various frequency event simulations in HEC-HMS (Reference 37).

For this hydrologic analysis, it was assumed that aerial reduction of point rainfall was not necessary for watersheds under 10 square miles. Therefore, aerial reduction factors were not used for the Bracken Tributary Watershed, which is 5.58 square miles in size.

Soil information, runoff losses, lag times and hydrograph routing were computed in a manner generally similar to the one used for the Lower Guadalupe River, Dry Comal and Alligator Creek Watersheds.

Soil information and runoff losses were determined using STATSGO and the NRCS Curve Number Method. Hydrologic soil types B and D are the dominant soils in the Bracken Tributary Watershed. Land use was determined from the aerial Digital Orthophotos that were flown in 2003 by Tobin International (Reference 38). The land use data file was developed by digitizing land uses using the Digital Orthophotos in GIS.

The NRCS Lag method was once again selected to compute the unit hydrographs. Sheet Flow computations used the TR-55 formula with a maximum of 125 feet in length and 20 minutes in time.

Cibolo Creek

The hydrologic analyses for Cibolo Creek are based on preliminary models prepared by the USACE Fort Worth District, in support of an ongoing Planning Study for the San Antonio River Authority, the Guadalupe Blanco River Authority and the San Antonio Water System. The USACE study was not complete at the time of this FIS report preparation and the hydrology modeling is subject to revision. The USACE modeling represents the best available data for this reach of Cibolo Creek at that time.

It should be noted that discharges on Cibolo Creek increase with decreasing drainage area. This phenomenon is caused by a loss of water starting just below Boerne in Kendall County and continuing downstream to Interstate Highway 10. This area has outcrops of massive cavernous limestone of the Cretaceous Period. The water is, in effect, stored in caverns underground and never reaches downstream points as flood flows (Reference 5).

3.1.2 Unrevised (Digitally Converted) Detailed Study Streams

Guadalupe River (Upper Reach)

Peak discharges for the Guadalupe River Upper Reach (above Canyon Lake) were not updated for this FIS revision; they were originally determined using the Log-Pearson Type III Method (Reference 39). Peak discharges for the Guadalupe River Lower Reach (below Canyon Lake) were revised using the USACE computer program HEC-HMS, as detailed in Section 3.1.1 above. These methods enabled taking into account the retention effects of Canyon Lake.

Cibolo Tributaries

Peak discharges for Cibolo Tributary, Indian Creek, Indian Creek Tributary A, and Indian Creek Tributary B were determined using USGS Water Resources Investigations 77-110 (Reference 40). Peak discharges for Postoak Creek were determined using discharge-frequency curves taken from the Texas State Department of Highways and Public Transportation's Hydraulic Manual (Reference 41).

The Kelley Creek hydrology was revised as part of the 1995 Comal FIS first revision (Reference 1). Peak discharges for the selected recurrence intervals for Kelley Creek were

determined using the HEC-l computer model (Reference 42). The findings were presented in the report entitled "Hydrologic Analysis of the Cibolo Creek Watershed," Federal Emergency Management Agency, March 1992. Peak discharges for the selected recurrence intervals for Cibolo-Kelley Creek Overflow were determined using the split flow option of the HEC-2 computer model (Reference 43).

On June 23, 1999, a Letter of Map Revision (LOMR) was issued by FEMA along an unnamed tributary to Cibolo Creek (Case Number 99-06-1314P). The LOMR reflected a detailed study along that reach and included an FIS flood profile plot, however no information on the hydrology was available in the text of the LOMR.

All Other Un-revised Streams

On February 22, 2002, a LOMR was issued by FEMA along Cypress Creek to reflect an existing hydrologic and hydraulic analysis for the Villarreal Flood Study (Case Number 01-06-949P). The LOMR indicated that a hydrologic and hydraulic analysis had been performed. The LOMR does not specify any hydrology methodology.

On June 4, 2004, a LOMR was issued by FEMA along three streams, Upper Dry Comal Creek, Upper Dry Comal Creek Unnamed Tributary No. 1, and Upper Dry Comal Creek Unnamed Tributary No. 2 (Case Number 04-06-127P). The LOMR indicated that the basis of the LOMR request included a hydrologic analysis which included computation of 1-percent -annual-chance discharges. The LOMR does not specify any hydrology methodology.

Peak discharges for all the other Comal County streams that are listed as Unrevised (Digitally Converted) Detailed Study Streams in "Table 1 – Scope of Study" were determined using the SCS TR-20 computer program (Reference 44). The results were compatible with the regional method derived from conducting a Log-Pearson Type III streamflow frequency analysis of gaging records in the surrounding area, and with a USGS statistical method used to determine discharges in several regions of Texas (Reference 45).

Pool elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods of Canyon Lake Reservoir were determined by the USACE, which is responsible for regulating the reservoir and dam (Reference 46). A summary of peak elevation-frequency relationships for Canyon Lake Reservoir is shown on Table 5, "Summary of Reservoir Stillwater Elevations."

TABLE 5 - SUMMARY OF RESERVOIR STILLWATER ELEVATIONS

	ELEVATION IN FEET (NAVD 88)			
FLOODING SOURCE AND LOCATION	**10% Annual Chance**	**2% Annual Chance**	**1% Annual Chance**	**0.2% Annual Chance**
CANYON LAKE				
Entire Shoreline within the County	924.0	940.0	946.0	949.7

3.1.3 Redelineated Detailed Study Streams

Lewis Creek was redelineated using the existing FIS profile. This method does not involve generating any hydrology or hydraulic data. The hydrologic analysis used for the detailed study area of Lewis Creek is not available.

3.1.4 Enhanced Approximate Study Streams

Streams studied by Enhanced Approximate Methods Type II, also referred to as Limited Detail Studies (LDS), were analyzed using the same methods as the New/Revised Detailed Study Streams described in Section 3.1.1. In the case of the West Fork of Dry Comal Creek and Upper Dry Comal Creek, the starting water surface elevations were based on rating curves established for the large detention structures on each stream. For each stream, the detention structure's rating curve was entered into the steady flow file as the downstream boundary condition, and the peak discharge for the structure, as calculated in the hydrology model, was input as a flow change at the downstream section.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

The channel and overbank "n" values for the streams studied by detailed methods are shown in Table 6, Summary of Roughness Coefficients.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For the streams studied by non-enhanced approximate methods and listed in Section 2.1, only the 1-percent-annual-chance flood elevations were determined. The flows used in the approximate studies were computed by taking the higher results of either the USGS Regional Regression Equation (Reference 45) or a cubic-feet-per-second-per-square-mile (CSM) relationship generated for selected streams in Comal County. Geo-RAS was used to generate cross-sections that were imported into RAS. The centerline for each stream was based on the best available topo and the n-values were determined using aerial photos. The boundary conditions for each Zone A model used the slope/area method.

TABLE 6 – SUMMARY OF ROUGHNESS COEFFICIENTS

Stream Reaches Studied by Detailed Methods

Stream Name	Channel "n" Value	Overbank "n" Value
New/Revised Detailed Study Streams		
Alligator Creek	0.040 – 0.050	0.040 – 0.100
Alligator Tributary No. 6	0.035 – 0.070	0.040 – 0.100
Bear Creek	0.040 – 0.140	0.035 – 0.140
Bracken Tributary	0.035 – 0.050	0.055 – 0.100
Cibolo Creek	0.040 – 0.065	0.060 – 0.090
Comal River/Dry Comal Creek in New Braunfels	0.045	0.065 – 0.150
Dry Comal Creek (ETJ area)	--[1]	--[1]
Dry Comal Creek	0.025 – 0.140	0.025 – 0.140
Comal Springs/Blieders Creek in New Braunfels	0.050 – 0.080	0.060 – 0.090
Blieders Creek (ETJ area)	--[1]	--[1]
Blieders Creek (Upper Reach)	0.040 – 0.090	0.060 – 0.090
Blieders Creek (ETJ above Upper Reach)	--[1]	--[1]
Garden Ridge Tributary	0.020 – 0.070	0.045 – 0.100
Guadalupe River in New Braunfels	0.035 – 0.040	0.060 – 0.110
Guadalupe River in ETJ area	--[1]	--[1]
Guadalupe River from ETJ limits to Canyon Lake Dam	--[1]	--[1]
New Channel Comal River	--[1]	--[1]
North Guadalupe Tributary	0.030 – 0.070	0.060 – 0.110
Old Channel Comal River	0.050 – 0.080	0.060 – 0.090
South Guadalupe Tributary	0.030 – 0.070	0.060 – 0.075
Upper Dry Comal Creek	0.045 – 0.140	0.045 – 0.140
West Fork Dry Comal Creek	0.045 – 0.140	0.040 – 0.140
Redelineation Detailed Study Streams		
Lewis Creek	--[1]	--[1]
Unrevised Digitally Converted Detailed Study Streams		
Cibolo-Kelley Creek Overflow	0.055 - 0.075	0.075 - 0.105
Cibolo Tributary	0.040 – 0.050	0.060 – 0.110

TABLE 6 – SUMMARY OF ROUGHNESS COEFFICIENTS (Cont'd)
Stream Reaches Studied by Detailed Methods

Stream Name	Channel "n" Value	Overbank "n" Value
New/Revised Detailed Study Streams		
Cypress Creek	--[1]	--[1]
Elm Creek	0.045 – 0.066	0.060 – 0.110
Guadalupe River (Upper Reach)	0.042 – 0.063	0.068 – 0.126
Indian Creek	0.048 – 0.060	0.066 – 0.130
Indian Creek Tributary A	0.060	0.130
Indian Creek Tributary B	0.058	0.090
Kelley Creek	0.045 – 0.075	0.070 – 0.095
Postoak Creek	0.042 – 0.066	0.054 – 0.132
Rebecca Creek	0.045 – 0.066	0.060 – 0.110
Sattler Tributary	0.040 – 0.060	0.060 – 0.110
Unnamed Tributary to Cibolo Creek	--[1]	--[1]
Unnamed Tributary No. 1 to Upper Dry Comal Creek	--[1]	--[1]
Unnamed Tributary No. 2 to Upper Dry Comal Creek	--[1]	--[1]
Upper Dry Comal Creek (LOMR)	--[1]	--[1]
West Fork Tributary	0.052 – 0.085	0.080 – 0.098
York Creek	0.050 – 0.060	0.075 – 0.110

[1] Data not available

3.2.1 New/Revised Detailed Study Streams

New Braunfels

The streams that were revised in the 2005 New Braunfels FIS Update include Comal Springs, Blieders Creek, Blieders Creek (Upper Reach), the Comal River, Dry Comal Creek in New Braunfels, the Guadalupe River (Lower Reach) in New Braunfels, the New Channel Comal River, the North Guadalupe Tributary, the Old Channel Comal River, and the South Guadalupe Tributary.

The backwater analyses stream and valley cross sections were derived from 2-foot contour topographic maps (Reference 33) using GIS techniques. In the case of the studied streams that are dry during normal conditions (all streams included in this FIS report, except the Comal River and Guadalupe River), the channel centerline was used to determine channel inverts. For the Guadalupe and Comal Rivers, the Guadalupe-Blanco River Authority (GBRA) developed underwater cross sections at representative locations coinciding with stream and valley cross sections derived from the topographic maps. Underwater geometry along the Guadalupe and Comal Rivers was developed using data from both the May 15,

1991 FIS report, and interpolating between the underwater surveys completed for this revision. Additionally, channel geometry at surveyed road crossings was applied to adjacent stream and valley sections for all studied streams.

For all streams revised in this FIS report, the Texas Department of Transportation (TXDOT) as-built drawings were used to obtain data on existing river crossing structures. Field surveys were performed to verify the hydraulic data for each of the low water crossings, bridges, culverts and other hydraulic restrictions that were not available through TXDOT. In the case of the flood-retarding dams and reservoirs included in this FIS report, rating tables and associated drawings were used as the source for hydrology modeling data. The USACE HEC-RAS (Reference 47) computer program was used for the hydraulic analysis of all streams revised in this FIS report. In many instances, peak discharges from the different flooding sources analyzed in this FIS report occurred at distinct times. Downstream boundary conditions and water surface elevations (WSELs) were determined as follows:

- Along the Guadalupe River, starting WSELs were interpolated from Dunlap Dam stage versus discharge tables (provided by GBRA) based on the Dunlap Dam spillway flow rate corresponding to each storm event.

- The Blieders Creek model extends from its headwaters downstream through Comal Springs at Landa Lake and ends at a diversion where the channel splits between the New Channel and Old Channel Comal River. A known WSEL was assigned to each storm based on the influence the upstream end of the New Channel Comal River has on the downstream end of Blieders Creek at the Landa Park diversion. The upstream end of Old Channel Comal River is an earthen weir; the weir does not influence the downstream WSEL on Blieders Creek.

- Along the Old Channel Comal River and New Channel Comal River, normal depth slopes were used in both models for hydraulic computations, and a backwater due to the Comal River below the confluence with Dry Comal Creek were manually entered for each storm, for floodplain mapping purposes.

- A normal depth was used in the Comal River model (including Dry Comal Creek) as the downstream boundary condition. The Guadalupe River peak stage was plotted as a backwater up the Comal River until it crossed the peak WSEL on the Comal River on the floodplain maps.

- The initial downstream boundary conditions for North Guadalupe Tributary were set as a constant slope for normal depth computations. The peak WSEL for each storm at the confluence with the Guadalupe River was shown as a backwater effect to the point the WSEL for the North Tributary exceeded the backwater elevation.

- Because the North and South Guadalupe Tributaries peak flows almost coincide with one another, a known WSEL for each storm on the North Guadalupe Tributary at the confluence with the South Guadalupe Tributary was entered into the South Guadalupe Tributary model as a downstream boundary condition. The Guadalupe backwater slightly influenced the most downstream end of the South Guadalupe Tributary floodplain.

There are three locations along the North and South Guadalupe Tributaries where the 1-percent-annual-chance floodwaters spill out of the defined channel in an indeterminate

manner. These locations are on the North Guadalupe Tributary between FM 725 and McQueeney Road, and on the South Guadalupe Tributary upstream of McQueeney Road and downstream of FM 725. The 1-percent-annual-chance WSEL exceeds the top of berm elevation of the channels by 0.21 to 0.75 feet at these isolated locations. Because the 1-percent-annual-chance flows get out of the channel by such a small amount, it was assumed that the floodplain beyond the channel in these areas will not be inundated sufficiently to warrant designation as floodplain. These areas were identified as areas of potential shallow flooding.

Channel roughness coefficients (Manning's "n" values) used in the hydraulic computations were chosen based on standard references, engineering judgment, aerial photographs, and field observations of the streams and floodplain areas. The primary reference for assigning values was Chow (Reference 48), and New Braunfels staff collaborated with CH2M Hill to determine how to apply Chow's values to New Braunfels (Reference 3).

Countywide Study.

As listed in Table 1 – Scope of Study, the following streams were revised or created for the purpose of the countywide FIS study: Alligator Creek, Alligator Creek Tributary No. 6, Bear Creek (Dry Comal Watershed), Bracken Tributary, Dry Comal Creek (starting approximately 10.2 miles upstream of its confluence with the Comal River), Garden Ridge Tributary, the Guadalupe River Lower Reach from the New Braunfels ETJ limits to Canyon Lake Dam, Upper Dry Comal Creek and the West Fork of Dry Comal Creek.

The revised reach of the Guadalupe River begins at its headwaters at the outlet of Canyon Lake dam and ends fourteen and a half stream miles downstream, at the Guadalupe Unnamed Tributary 11 confluence. The downstream limit corresponds to the study limits of the CH2M Hill (City of New Braunfels 2005 FIS Update) model, about 10,000 feet upstream of the actual New Braunfels ETJ limits. For comparison purposes, the study reach is referred to as the Guadalupe River (Lower Reach) from the New Braunfels ETJ limits to Canyon Lake Dam.

The USACE's River Analysis System (HEC-RAS), Version 3.1.2 (Reference 36), was used to compute the water surface profiles and floodways of the study streams.

One of the sources of terrain data was LiDAR data prepared by Spectrum Mapping LLC and acquired on February 17, 2004 (Reference 32). The data is referenced to the North American Vertical Datum of 1988 (NAVD88). Quality control of the resulting bare earth LiDAR data was performed by Spectrum Mapping and independently verified by Watershed Concepts. The LiDAR data was used to generate topographic information in the upstream reach of Alligator Tributary 6, the Guadalupe River revised reach, Bear Creek (Dry Comal Watershed), the revised reach of Dry Comal Creek, Upper Dry Comal Creek, and the West Fork of Dry Comal Creek.

The terrain data used for the hydraulic studies of Bracken and Garden Ridge Tributaries was developed from 2-foot interval topography that was created from the TIN files obtained from the USACE, which was used for the USACE Cibolo Creek study. The USACE's TIN, outside the Cibolo Creek's 0.2-percent-annual-chance floodplain, was developed from 5-foot contour interval topographic mapping, created using traditional photogrammetric compilation from aerial photography. The topography was flown in 2002 and is based on the North American Datum of 1983 and NAVD88.

Additional sources of topographic data for the study area included 2-foot contour data provided by the City of New Braunfels and standard USGS quadrangle contours. The 2-foot contour data was derived from orthophotography that was flown in 2001 as part of a FIS restudy prepared for the City by CH2M Hill (Reference 33). The CH2M Hill topographic information was used in the downstream reach of Alligator Tributary No. 6 and along the entire Alligator Creek study reach as well as Bear Creek (Dry Comal Watershed), the revised reach of Dry Comal Creek, Upper Dry Comal Creek and the West Fork of Dry Comal Creek. USGS quadrangle hypsography was obtained from the Texas Natural Resources Information System (TNRIS) website (Reference 34).

The primary terrain data was supplemented with field surveyed intermediate cross-section and structure data, based on field surveys conducted from November 2003 to May 2004. The cross sections were supplemented by underwater surveyed elevation shots as appropriate. In addition, interpolated cross sections were inserted in the model in order to better represent transitions in ground geometry.

The USACE HEC GeoRAS software package (Version 8.1) was used to extract channel and overbank cross-section data from the study TIN's and to map floodplains according to the results of the hydraulic studies.

Manning's "n" values (or roughness coefficients) were assigned by visual inspection and analysis of aerial and field photographs.

The water surface elevation profiles for the various frequency storms, the 10-, 2-, 1-, and 0.2-percent-annual-chance of exceedance floods for the studied streams, were computed using the USACE HEC-RAS program Version 3.1.2.

Starting boundary conditions for most of the streams were computed using the normal depth (slope-area) method, except in the case of the Guadalupe River where the starting boundary condition was taken from the CH2MHill New Braunfels FIS restudy HEC-RAS model.

Cibolo Creek

The hydraulic analyses for Cibolo Creek are based on preliminary models prepared by the USACE Fort Worth District, in support of an ongoing Planning Study for the San Antonio River Authority, the Guadalupe Blanco River Authority and the San Antonio Water System. The USACE study was not complete at the time of this FIS report preparation and the hydraulics modeling is subject to revision. The USACE modeling represents the best available data for this reach of Cibolo Creek at that time.

3.2.2 Unrevised (Digitally Converted) Detailed Study Streams

The hydraulic analyses for Kelley Creek and the Cibolo-Kelley Creek Overflow were updated for the 1995 Comal FIS first revision (Reference 1) using the HEC-2 computer program (Reference 43). Cross sections for the backwater analyses were obtained from field surveys, highway plans, and aerial photographs. Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the stream and floodplain areas. BFE's were added along Cibolo-Kelley Creek Overflow and along Kelley Creek from its confluence with Cibolo Creek to 8,510 feet upstream, resulting in revised floodplain boundaries.

Overbank cross-section data for the backwater analyses of all other unrevised (digitally converted) detailed study streams were obtained using topographic maps compiled from aerial photographs (Reference 49). Channel geometry was determined from field surveys. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 43). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Rebecca Creek and the Guadalupe River (Upper Reach) were determined using 10-, 2-, 1-, and 0.2-percent-annual-chance pool tables of Canyon Lake Reservoir (Reference 46). Starting water-surface elevations for South Guadalupe Tributary were determined assuming coincident peak flows with North Guadalupe Tributary. Starting water-surface elevations for all other streams studied by detailed methods were determined by the slope/area method. The hydraulic analyses used for the water-surface elevation determination of Lewis Creek were taken from the original Flood Insurance Study for Comal County (Reference 50).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas.

On June 23, 1999, a LOMR was issued by FEMA along an unnamed tributary to Cibolo Creek (Case Number 99-06-1314P). The LOMR reflects a detailed study along that reach and includes an FIS flood profile plot, however no information on the hydraulics methodology is available in the text of the LOMR. A profile is included in the countywide FIS and the FIRM (Exhibit 2) reflects the LOMR mapping.

On February 22, 2002, a LOMR was issued by FEMA along Cypress Creek to reflect an existing hydrologic and hydraulic analysis for the Villarreal Flood Study (Case Number 01-06-949P). The LOMR indicates that a hydrologic and hydraulic analysis has been performed. The LOMR does not specify any hydraulics methodology. A profile is included in the countywide FIS and the FIRM (Exhibit 2) reflects the LOMR mapping.

On June 4, 2004, a LOMR was issued by FEMA along 3 streams, Upper Dry Comal Creek, Upper Dry Comal Creek Unnamed Tributary No. 1, and Upper Dry Comal Creek Unnamed Tributary No. 2 (Case Number 04-06-127P). The LOMR indicates that the basis of the LOMR request includes a hydraulics analysis which included computation of 1-percent-annual-chance discharges. The LOMR does not specify any hydraulics methodology. A profile is included in the countywide FIS and the FIRM (Exhibit 2) reflects the LOMR mapping.

Water-surface elevations were initially computed through the use of computer programs. Table 7, “Hydraulic Methods” includes a listing of the specific version of the programs used, as well as the starting water surface method used in the profile computations.

3.2.3 Redelineated Detailed Study Streams

The detailed study reach of Lewis Creek was mapped using the prior effective FIS flood profile. A table was produced that recorded station and water surface elevation at inflection

points along the 1- and 0.2-percent-annual-chance profile lines, at limits of study, and any other location that assisted in creating the floodplains.

An attempt was made to also incorporate road crossing locations based on the prior effective FEMA profile, however, it appears that road crossings are shown incorrectly on the Lewis Creek profile, they were therefore ignored (the effective FIS profile does not show any structures at the road crossings).

Typical hydraulic mapping cross sections were placed to correspond to the stations from this table with consideration given to BFE locations. The cross sections were attributed with the water surface elevation matching the station from the created table.

3.2.4 Enhanced Approximate Study Streams

Streams listed on Table 1, Scope of Study, as having been studied by enhanced approximate methods type II (also referred to as Limited Detailed Studies) were analyzed using the same general methods as the New/Revised Detailed Study Streams described in Section 3.2.1, except that culvert and bridge survey data was generated by combining a top of road survey point with field sketches and structure measurements.

The streams were modeled using HEC-RAS 3.1.2. The Dry Comal Creek Tributary No. 13 downstream starting conditions were computed using the slope area method. In the case of the West Fork of Dry Comal Creek and Upper Dry Comal Creek, the rating curve for the SCS dams was taken from the hydrology model and used to determine the starting water surface elevations.

For streams studied using enhanced approximate methods, only the 1-percent-annual-chance flood was computed. No flood profiles are provided. The Manning's "n" values were based on aerial photography.

TABLE 7 – HYDRAULIC METHODS
Stream Reaches Studied by Detailed Methods

Stream Name	Starting Water-Surface Elevations	Hydraulic Program
New/Revised Detailed Study Streams		
Alligator Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Alligator Tributary No. 6	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Bear Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Bracken Tributary	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Cibolo Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Comal River/Dry Comal Creek in New Braunfels	Slope area method	HEC-RAS v 3.0.1 (Reference 47)
Dry Comal Creek (ETJ area)	Part of Comal River model	HEC-RAS v 3.0.1 (Reference 47)
Dry Comal Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)

TABLE 7 – HYDRAULIC METHODS (Cont'd)

Stream Reaches Studied by Detailed Methods

Stream Name	Starting Water-Surface Elevations	Hydraulic Program
New/Revised Detailed Study Streams		
Comal Springs/Blieders Creek in New Braunfels	Known WSEL from New Channel Comal River	HEC-RAS v 3.0.1 (Reference 47)
Blieders Creek (ETJ area)	Part of Blieders Creek model	HEC-RAS v 3.0.1 (Reference 47)
Blieders Creek (Upper Reach)	Part of Blieders Creek model	HEC-RAS v 3.0.1 (Reference 47)
Blieders Creek (ETJ above Upper Reach)	Part of Blieders Creek model	HEC-RAS v 3.0.1 (Reference 47)
Garden Ridge Tributary	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Guadalupe River in New Braunfels	Dunlap Dam stage versus discharges tables	HEC-RAS v 3.0.1 (Reference 47)
Guadalupe River in ETJ area	Part of Guadalupe River model	HEC-RAS v 3.0.1 (Reference 47)
Guadalupe River from ETJ limits to Canyon Lake Dam	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
New Channel Comal River	Slope area method	HEC-RAS v 3.0.1 (Reference 47)
North Guadalupe Tributary	Slope area method	HEC-RAS v 3.0.1 (Reference 47)
Old Channel Comal River	Slope area method	HEC-RAS v 3.0.1 (Reference 47)
South Guadalupe Tributary	Known WSEL from North Guadalupe Tributary	HEC-RAS v 3.0.1 (Reference 47)
Upper Dry Comal Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
West Fork Dry Comal Creek	Slope area method	HEC-RAS v 3.1.2 (Reference 36)
Redelineation Detailed Study Streams		
Lewis Creek	Older Comal County FIS (Reference 50)	Older Comal County FIS (Reference 50)
Cibolo-Kelley Creek Overflow	--[1]	HEC-2 split flow (Reference 43)
Cibolo Tributary	Slope area method	HEC-2 (Reference 43)
Cypress Creek	--[1]	--[1]
Elm Creek	Slope area method	HEC-2 (Reference 43)
Guadalupe River (Upper Reach)	Canyon Lake Reservoir elevation (Reference 1)	HEC-2 (Reference 43)
Indian Creek	Slope area method	HEC-2 (Reference 43)
Indian Creek Tributary A	Slope area method	HEC-2 (Reference 43)
Indian Creek Tributary B	Slope area method	HEC-2 (Reference 43)
Kelley Creek	--[1]	HEC-2 (Reference 43)

TABLE 7 – HYDRAULIC METHODS (Cont'd)
Stream Reaches Studied by Detailed Methods

Stream Name	Starting Water-Surface Elevations	Hydraulic Program
Unrevised Digitally Converted Detailed Study Streams		
Postoak Creek	Slope area method	HEC-2 (Reference 43)
Rebecca Creek	Canyon Lake Reservoir elevation (Reference 1)	HEC-2 (Reference 43)
Sattler Tributary	Slope area method	HEC-2 (Reference 43)
Unnamed Tributary to Cibolo Creek	--[1]	--[1]
Unnamed Tributary No. 1 to Upper Dry Comal Creek	--[1]	--[1]
Unnamed Tributary No. 2 to Upper Dry Comal Creek	--[1]	--[1]
Upper Dry Comal Creek (LOMR Area)	--[1]	--[1]
West Fork Tributary	Slope area method	HEC-2 (Reference 43)
York Creek	Slope area method	HEC-2 (Reference 43)

[1] Data not available

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum. The datum conversion factor from NGVD29 to NAVD88 in Comal County is +0.3 feet.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD 88 datum. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps. Table 8, "Topographic Mapping", lists the topographic maps used to delineate the floodplain boundaries for each community's previously printed FIS as well as the revised floodplain mapping for this countywide FIS.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and AO), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM.

TABLE 8 – TOPOGRAPHIC MAPPING			
Community and Topographic Mapping Source	**Scale**	**Contour Interval**	**Reference**
Comal County Unincorporated Areas			
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	10 feet	Reference 34
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	20 feet	Reference 34
New Braunfels FIS topo	1:6,000	2 feet	Reference 33
Spectrum LiDAR	n/a	2 feet	Reference 32
City of Bulverde			
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	20 feet	Reference 34
City of Fair Oaks Ranch			
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---
City of Garden Ridge			
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	20 feet	Reference 33
Spectrum LiDAR	n/a	2 feet	Reference 32
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---
City of New Braunfels			
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	20 feet	Reference 33
New Braunfels FIS topo	1:6,000	2 feet	Reference 33
Spectrum LiDAR	n/a	2 feet	Reference 32
City of Schertz			
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	10 feet	Reference 34
USGS 7.5-Minute Quads – 30 Meter DEMs	1:24,000	20 feet	Reference 34
New Braunfels FIS topo	1:6,000	2 feet	Reference 33
City of Selma			
USACE Cibolo Creek topo (TIN)	n/a	2 feet / 5 feet	---

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 9, Floodway Data). In cases where the floodway and 1-percent-annual -chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the WSEL of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

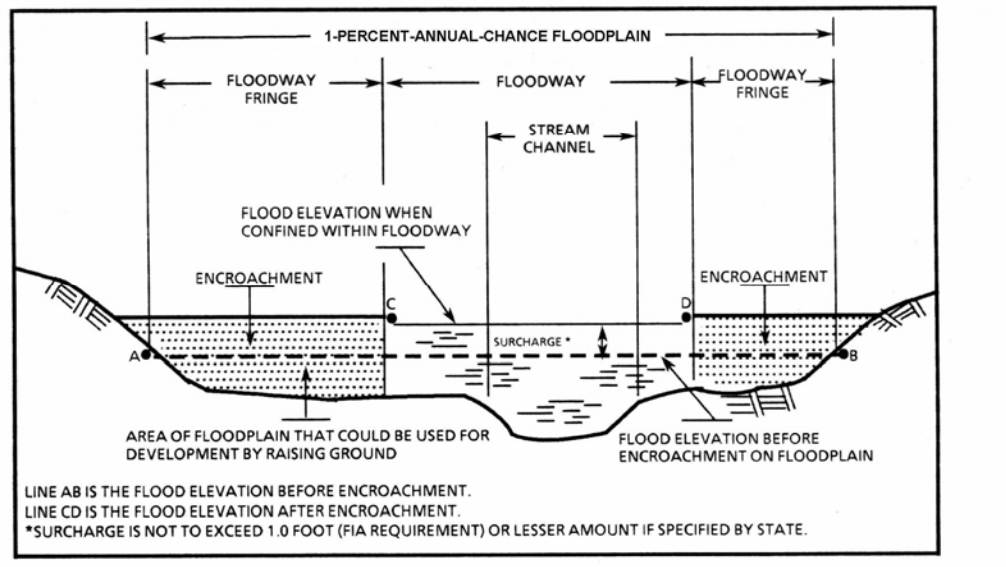

Figure 1. Floodway Schematic

No floodways were computed for Lewis Creek or Postoak Creek. None were shown in the original Flood Insurance Study of Comal County (Unincorporated Areas). No Postoak Creek floodway is shown for the City of Fair Oaks Ranch in the Bexar County FIS.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Alligator Creek								
A	30,085	695	5,341	4.2	642.7	642.7	643.7	1.0
B	31,367	871	5,576	4.1	644.4	644.4	645.2	0.8
C	33,330	890	5,142	4.4	647.7	647.7	648.2	0.5
D	34,553	857	4,145	5.2	649.2	649.2	649.7	0.5
E	36,098	605	3,688	5.9	651.9	651.9	652.7	0.8
F	37,611	706	4,412	4.9	655.3	655.3	655.8	0.5
G	39,544	581	3,128	6.7	657.7	657.7	658.3	0.6
H	40,999	626	2,737	7.6	661.4	661.4	662.0	0.6
I	42,478	830	6,067	3.4	664.2	664.2	665.1	0.9
J	44,584	990	7,910	2.6	670.4	670.4	671.4	1.0
K	46,185	841	5,153	3.9	672.8	672.8	673.6	0.8
L	48,114	605	3,481	5.8	675.6	675.6	676.3	0.7
M	49,968	458	3,468	5.8	680.8	680.8	681.4	0.6
N	50,300	614	4,637	4.3	682.0	682.0	682.3	0.3
O	51,663	627	4,268	4.7	684.7	684.7	685.2	0.5
P	53,589	464	2,927	6.9	688.6	688.6	688.7	0.1
Q	55,585	400	3,101	6.5	695.8	695.8	696.8	1.0
R	57,395	633	3,721	5.4	699.8	699.8	700.6	0.8
S	58,886	213	2,430	8.4	706.5	706.5	706.5	0.0
T	59,780	1,009	13,654	1.4	711.3	711.3	711.3	0.0
U	61,004	403	4,172	4.7	711.5	711.5	711.7	0.2
V	62,243	392	3,300	6.0	712.5	712.5	713.4	0.9
W	63,585	598	4,627	4.3	716.9	716.9	717.7	0.8

[1] Feet Above Confluence With Geronimo Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

ALLIGATOR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Alligator Creek Tributary No. 6								
A	412 [1]	412	773	5.6	716.5	714.5 [3]	714.5	0.0
B	1,773 [1]	268	1,006	4.3	723.3	723.3	723.4	0.1
C	3,002 [1]	348	1,145	3.8	731.5	731.5	731.5	0.0
D	5,127 [1]	323	695	2.7	746.9	746.9	746.9	0.0
E	6,150 [1]	211	585	3.2	754.8	754.8	754.9	0.1
F	7,483 [1]	108	391	4.7	765.1	765.1	765.2	0.1
G	8,921 [1]	224	477	3.9	776.1	776.1	776.1	0.0
H	9,810 [1]	120	382	4.8	782.3	782.3	783.1	0.8
I	10,950 [1]	97	336	5.5	789.1	789.1	789.5	0.4
J	11,912 [1]	136	323	5.7	795.5	795.5	795.9	0.4
Bear Creek								
A	162 [2]	155	532	4.5	733.0	729.9 [3]	730.3	0.4
B	931 [2]	99	195	5.4	737.7	737.7	737.7	0.0
C	1,413 [2]	179	500	0.5	739.4	739.4	739.4	0.0
D	2,459 [2]	221	1,873	9.7	800.9	800.9	800.9	0.0
E	3,428 [2]	417	2,981	6.1	800.9	800.9	800.9	0.0
F	4,813 [2]	386	2,754	6.6	800.9	800.9	800.9	0.0
G	5,721 [2]	300	2,038	8.9	800.9	800.9	800.9	0.0
H	6,786 [2]	396	3,285	5.5	801.0	801.0	801.0	0.0
I	7,556 [2]	378	3,491	5.2	801.1	801.1	801.1	0.0
J	8,562 [2]	720	4,574	4.0	801.5	801.5	801.5	0.0
K	9,757 [2]	458	3,875	4.7	802.3	802.3	802.3	0.0
L	10,232 [2]	476	3,771	4.8	803.4	803.4	803.4	0.0
M	11,481 [2]	239	2,833	6.4	808.7	808.7	809.5	0.8

[1] Feet Above Confluence With Alligator Creek

[2] Feet Above Confluence With Dry Comal Creek

[3] Elevation Computed Without Consideration Of Backwater Effects

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

ALLIGATOR CREEK TRIBUTARY NO. 6 / BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Bear Creek (Continued)								
N	12,853 [1]	245	3,081	4.5	815.0	815.0	815.8	0.8
O	13,271 [1]	255	3,130	4.5	816.1	816.1	817.1	1.0
P	14,388 [1]	240	2,836	4.9	820.6	820.6	821.0	0.4
Q	15,050 [1]	250	2,791	5.0	823.5	823.5	823.8	0.3
R	16,089 [1]	260	3,477	4.0	827.1	827.1	827.5	0.4
S	17,513 [1]	274	2,807	5.0	831.7	831.7	832.7	1.0
Bracken Tributary								
A	3,407 [2]	60	394	12.8	772.4	772.4	772.5	0.1
B	4,245 [2]	135	1,025	4.9	784.4	784.4	785.0	0.6
C	5,706 [2]	52	355	14.2	787.0	787.0	787.0	0.0
D	5,749 [2]	106	1,257	4.0	793.3	793.3	794.1	0.8
E	6,148 [2]	350	3,338	1.5	793.6	793.6	794.6	1.0
F	7,740 [2]	325	1,900	2.7	795.8	795.8	796.1	0.3
G	8,249 [2]	500	1,055	5.1	796.8	796.8	797.1	0.3
H	9,188 [2]	500	2,157	2.2	804.1	804.1	804.2	0.1
I	9,899 [2]	725	1,193	3.0	805.0	805.0	805.2	0.2
J	10,438 [2]	700	758	4.8	807.6	807.6	807.8	0.2
K	10,833 [2]	625	1,509	2.4	810.9	810.9	811.3	0.4
L	10,899 [2]	600	2,701	1.3	813.6	813.6	813.9	0.3
M	12,152 [2]	523	1,118	2.8	817.8	817.8	817.9	0.1
N	12,527 [2]	485	1,679	1.9	819.6	819.6	819.8	0.2
O	12,998 [2]	545	1,089	2.9	823.9	823.9	824.0	0.1
P	13,515 [2]	859	883	3.5	825.4	825.4	825.4	0.0
Q	14,268 [2]	825	1,165	2.7	830.6	830.6	830.9	0.3

[1] Feet Above Confluence With Dry Comal Creek

[2] Feet Above Confluence With Cibolo Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CREEK / BRACKEN TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Bracken Tributary (Continued)								
R	14,688 [1]	775	2,207	1.4	831.8	831.8	832.1	0.3
S	16,007 [1]	350	1,075	2.9	842.5	842.5	842.6	0.1
T	16,978 [1]	220	654	3.8	851.7	851.7	851.9	0.2
U	18,069 [1]	215	345	3.1	864.6	864.6	864.7	0.1
V	18,151 [1]	395	791	0.8	866.6	866.6	866.8	0.2
W	18,620 [1]	57	166	3.7	872.1	872.1	872.7	0.6
X	19,185 [1]	117	186	3.3	882.5	882.5	882.7	0.2
Y	19,614 [1]	107	204	3.0	890.3	890.3	890.6	0.3
Z	20,156 [1]	98	113	5.5	899.1	899.1	899.1	0.0
Cibolo Creek								
A	471,305 [2]	1,658 / 994 [3]	28,201	3.5	763.3	763.3	764.0	0.8
B	473,443 [2]	498 / 60 [3]	12,811	7.8	765.1	765.1	765.6	0.5
C	474,430 [2]	467 / 206 [3]	10,585	9.4	767.0	767.0	767.9	0.9
D	475,626 [2]	827 / 766 [3]	19,646	5.1	769.8	769.8	770.5	0.8
E	478,699 [2]	407 / 338 [3]	9,427	10.5	775.1	775.1	775.6	0.5
F	479,197 [2]	252 / 72 [3]	7,476	13.3	777.4	777.4	778.2	0.8
G	482,794 [2]	496 / 59 [3]	10,850	9.1	786.9	786.9	787.2	0.4
H	484,952 [2]	493 / 350 [3]	12,139	8.2	793.4	793.4	793.9	0.5
I	487,922 [2]	578 / 91 [3]	11,300	8.8	802.0	802.0	802.2	0.3
J	488,340 [2]	592 / 163 [3]	11,685	8.5	802.9	802.9	803.5	0.6
K	489,866 [2]	1,158 / 53 [3]	18,620	5.3	806.1	806.1	806.8	0.7
L	493,297 [2]	338 / 60 [3]	8,680	11.4	817.1	817.1	817.7	0.5
M	494,854 [2]	317 / 134 [3]	8,860	11.2	821.2	821.2	821.8	0.6
N	495,754 [2]	371 / 115 [3]	10,526	9.4	824.3	824.3	824.9	0.6

[1] Feet Above Confluence With Cibolo Creek

[2] Feet Above Confluence With San Antonio River

[3] Width / Width Within County

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

BRACKEN TRIBUTARY / CIBOLO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Cibolo Creek (Continued)								
O	496,784	328 / 267	9,440	10.5	827.0	827.0	827.5	0.5
P	497,111	280 / 229	8,504	11.6	827.6	827.6	828.1	0.5
Q	498,215	406 / 315	10,430	9.5	832.1	832.1	832.7	0.6
R	499,406	792 / 254	13,718	7.2	835.6	835.6	836.2	0.7
S	500,812	285 / 33	8,071	12.3	837.6	837.6	838.2	0.7
T	501,472	309 / 36	8,774	11.3	840.0	840.0	840.6	0.6
U	502,471	471 / 112	12,240	8.1	844.4	844.4	845.2	0.8
V	502,926	700 / 470	14,236	6.9	846.0	846.0	846.3	0.3
W	504,041	342 / 171	9,561	10.3	848.6	848.6	849.1	0.5
X	504,847	332 / 224	9,426	10.5	850.6	850.6	851.0	0.5
Y	505,559	360 / 190	10,252	9.6	852.3	852.3	852.9	0.6
Z	507,279	364 / 316	10,633	9.3	857.4	857.4	858.0	0.6
AA	507,708	341 / 302	9,921	9.9	858.2	858.2	858.7	0.6
AB	508,411	473 / 124	13,461	7.3	860.3	860.3	861.0	0.7
AC	509,824	424 / 114	9,156	10.8	862.3	862.3	863.1	0.8
AD	510,222	378 / 99	10,119	9.8	865.0	865.0	865.6	0.6
AE	515,303	263 / 211	7,527	13.1	877.8	877.8	878.0	0.3
AF	515,986	375 / 304	11,624	8.5	883.4	883.4	883.9	0.5
AG	522,123	1,150 / 923	24,595	4.0	895.6	895.6	896.1	0.6
AH	523,829	1,076 / 355	17,312	5.7	897.3	897.3	897.8	0.5
AI	525,305	425 / 62	9,568	10.2	898.9	898.9	899.5	0.6
AJ	526,125	573 / 24	14,238	6.9	901.4	901.4	902.1	0.7
AK	526,955	701 / 480	12,393	7.9	901.8	901.8	902.4	0.7
AL	528,242	594 / 373	14,050	7.0	904.1	904.1	904.7	0.5
AM	530,148	637 / 550	11,466	8.5	906.8	906.8	907.2	0.5

[1] Feet Above Confluence With San Antonio River

[2] Width / Width Within County

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

CIBOLO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Cibolo Creek (Continued)								
AN	531,741	516 / 356	10,845	9.0	910.6	910.6	911.2	0.7
AO	532,968	839 / 791	14,079	7.0	913.1	913.1	913.7	0.6
AP	533,509	1,021 / 977	13,751	7.1	914.1	914.1	914.8	0.6
AQ	534,776	1,115 / 932	13,110	7.5	916.2	916.2	916.7	0.5
AR	536,961	692 / 462	10,058	9.7	919.4	919.4	919.9	0.5
AS	538,533	1,032 / 937	13,059	7.5	923.0	923.0	923.6	0.6
AT	539,472	1,018 / 934	10,581	9.2	923.6	923.6	924.4	0.8
AU	540,257	724 / 581	12,159	8.0	926.3	926.3	926.6	0.3
AV	542,225	318 / 19	8,402	11.6	929.3	929.3	929.7	0.4
AW	543,822	383 / 245	9,718	10.1	933.2	933.2	933.5	0.3
AX	545,606	430 / 258	12,017	8.1	937.4	937.4	938.0	0.6
AY	546,894	309 / 57	8,003	12.2	938.5	938.5	939.3	0.8
AZ	547,479	377 / 69	10,600	9.2	941.2	941.2	941.9	0.7
BA	548,214	406 / 180	9,627	10.1	941.7	941.7	942.4	0.7
BB	549,081	442 / 303	10,055	9.7	943.2	943.2	943.8	0.5
BC	549,991	657 / 607	16,765	5.8	946.2	946.2	946.8	0.6
BD	551,845	283 / 38	7,517	13.0	947.8	947.8	948.2	0.5
BE	552,343	338 / 113	9,900	9.8	950.4	950.4	950.9	0.6
BF	553,488	559 / 452	13,811	7.1	952.6	952.6	953.2	0.6
BG	554,915	412 / 164	10,429	9.4	954.6	954.6	955.1	0.5
BH	556,683	951 / 676	18,496	5.3	957.9	957.9	958.5	0.6
BI	557,345	1,267 / 807	22,997	4.2	958.7	958.7	959.3	0.6
BJ	558,915	460 / 94	11,025	8.8	960.4	960.4	961.0	0.6
BK	559,410	858 / 23	16,710	5.8	962.3	962.3	963.0	0.7
BL	561,290	760 / 242	16,105	6.1	964.3	964.3	965.0	0.6

[1] Feet Above Confluence With San Antonio River

[2] Width / Width Within County

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

CIBOLO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Cibolo Creek (Continued)								
BM	563,150	548 / 257	12,185	8.0	967.4	967.4	968.0	0.6
BN	564,360	752 / 633	12,349	7.9	969.7	969.7	970.0	0.2
BO	567,722	1,211 / 1,185	18,938	5.1	977.7	977.7	978.3	0.6
BP	568,409	1,570 / 1,498	14,382	6.8	978.2	978.2	978.8	0.5
BQ	569,930	2,468 / 1,570	24,857	3.9	983.7	983.7	984.5	0.8
BR	571,681	2,557 / 190	22,180	4.4	985.0	985.0	985.8	0.8
BS	574,342	2,871 / 118	18,772	5.2	989.1	989.1	989.8	0.7
BT	577,429	1,875 / 118	10,722	8.7	995.9	995.9	996.3	0.4
BU	577,776	1,736 / 237	16,075	5.8	998.9	998.9	999.7	0.8
BV	579,307	700 / 160	12,239	7.7	1,002.0	1,002.0	1,002.4	0.3
BW	580,436	572 / 365	13,433	7.0	1,004.5	1,004.5	1,005.1	0.6
BX	581,611	473 / 291	8,980	10.4	1,006.0	1,006.0	1,006.6	0.6
BY	583,006	2,325 / 2,226	24,422	3.8	1,011.1	1,011.1	1,011.4	0.3
BZ	586,149	2,255 / 327	24,073	3.9	1,015.2	1,015.2	1,015.5	0.4
CA	589,459	2,796 / 563	16,574	5.7	1,018.1	1,018.1	1,018.5	0.3
CB	590,350	2,962 / 712	28,005	3.4	1,020.5	1,020.5	1,021.2	0.7
CC	591,898	876 / 303	12,017	7.8	1,021.4	1,021.4	1,022.0	0.6
CD	593,257	1,467 / 311	16,025	5.9	1,023.4	1,023.4	1,024.3	0.9
CE	594,562	1,760 / 152	19,146	4.9	1,025.7	1,025.7	1,026.2	0.6
CF	595,962	1,846 / 210	13,854	6.7	1,028.2	1,028.2	1,028.7	0.5
CG	597,272	1,642 / 252	16,883	5.5	1,033.2	1,033.2	1,033.7	0.5
CH	599,295	2,176 / 840	21,609	4.3	1,036.4	1,036.4	1,036.8	0.4
CI	603,698	1,494 / 476	14,884	6.3	1,043.7	1,043.7	1,044.2	0.5
CJ	604,622	1,291 / 130	20,122	4.6	1,046.0	1,046.0	1,046.5	0.5
CK	607,784	2,527 / 2,374	24,197	3.9	1,050.2	1,050.2	1,050.4	0.2

[1] Feet Above Confluence With San Antonio River

[2] Width / Width Within County

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Cibolo Creek (Continued)								
CL	610,377	968 / 839	9,122	10.2	1,052.9	1,052.9	1,053.8	0.8
CM	611,061	1,730 / 1,681	27,585	3.4	1,057.6	1,057.6	1,058.1	0.5
CN	613,049	661 / 248	9,529	9.8	1,058.3	1,058.3	1,058.7	0.4
CO	614,060	489 / 161	10,564	8.7	1,062.2	1,062.2	1,062.9	0.7
CP	615,425	1,411 / 1,263	14,017	6.6	1,066.6	1,066.6	1,067.4	0.8
CQ	618,147	564 / 205	10,291	8.9	1,073.1	1,073.1	1,073.6	0.5
CR	620,481	1,512 / 1,213	18,731	4.9	1,078.5	1,078.5	1,079.2	0.7
CS	622,314	2,193 / 1,889	16,766	5.5	1,081.4	1,081.4	1,082.1	0.7
CT	624,619	3,399 / 3,347	22,804	4.0	1,086.3	1,086.3	1,087.0	0.8
CU	630,594	1,376 / 286	14,648	6.1	1,097.4	1,097.4	1,098.0	0.6
CV	632,542	1,100 / 804	14,318	6.2	1,101.9	1,101.9	1,102.3	0.5
CW	634,571	1,325 / 253	11,341	7.8	1,104.7	1,104.7	1,105.0	0.3
CX	635,157	1,700 / 275	15,932	5.6	1,107.1	1,107.1	1,107.2	0.1
CY	637,102	895 / 602	12,967	6.7	1,109.4	1,109.4	1,109.8	0.4
CZ	641,224	705 / 546	13,289	6.5	1,117.6	1,117.6	1,118.0	0.4
DA	642,087	411 / 184	9,223	9.2	1,119.3	1,119.3	1,119.9	0.6
DB	644,853	349 / 192	6,546	12.9	1,126.7	1,126.7	1,126.9	0.3
DC	646,447	568 / 367	10,991	7.7	1,134.6	1,134.6	1,135.3	0.7
DD	648,606	347 / 139	7,492	11.3	1,139.0	1,139.0	1,139.6	0.6
DE	650,271	581 / 66	11,979	7.1	1,144.6	1,144.6	1,145.4	0.7
DF	655,187	326 / 270	7,549	11.1	1,153.9	1,153.9	1,154.5	0.7
DG	656,028	513 / 444	12,272	6.9	1,157.6	1,157.6	1,158.3	0.6
DH	658,049	642 / 35	12,842	6.6	1,162.2	1,162.2	1,162.7	0.5
DI	661,986	1,294 / 1,209	8,758	8.8	1,166.5	1,166.5	1,167.0	0.5
DJ	663,227	1,536 / 1,280	22,347	3.5	1,171.8	1,171.8	1,172.3	0.5

[1] Feet Above Confluence With San Antonio River

[2] Width / Width Within County

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

CIBOLO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Cibolo Creek (Continued)								
DK	664,425	440 / 188	10,034	7.7	1,172.0	1,172.0	1,172.9	0.9
DL	667,337	1,276 / 63	14,589	5.3	1,177.8	1,177.8	1,178.3	0.5
DM	670,448	270 / 241	6,842	11.4	1,182.1	1,182.1	1,182.5	0.4
DN	671,343	485 / 468	11,061	7.1	1,186.0	1,186.0	1,186.6	0.6
DO	672,299	420 / 387	10,773	7.3	1,188.3	1,188.3	1,189.0	0.7
DP	673,205	290 / 113	7,322	10.7	1,188.8	1,188.8	1,189.5	0.6
DQ	674,563	255 / 175	6,960	11.2	1,192.8	1,192.8	1,193.2	0.4
DR	675,492	674 / 663	17,112	4.6	1,196.5	1,196.5	1,197.1	0.6
DS	677,416	311 / 124	7,817	10.0	1,198.8	1,198.8	1,199.3	0.5
DT	678,025	478 / 202	11,367	6.9	1,201.4	1,201.4	1,202.0	0.5
DU	679,955	499 / 108	11,608	6.7	1,205.4	1,205.4	1,206.0	0.5
DV	683,147	1,099 / 237	9,173	8.5	1,209.6	1,209.6	1,209.9	0.3
DW	684,406	730 / 375	17,086	4.5	1,214.1	1,214.1	1,214.4	0.3
DX	687,622	455 / 364	10,268	7.6	1,220.0	1,220.0	1,220.4	0.5
DY	689,965	399 / 330	9,378	8.3	1,223.8	1,223.8	1,224.2	0.4
DZ	691,005	287 / 75	7,288	10.6	1,225.8	1,225.8	1,226.2	0.4
EA	693,908	744 / 592	11,678	6.6	1,232.0	1,232.0	1,232.4	0.4
EB	695,851	956 / 935	18,095	4.2	1,236.3	1,236.3	1,236.9	0.6
EC	697,900	530 / 431	10,327	7.4	1,239.2	1,239.2	1,239.7	0.5
ED	700,689	1,306 / 1,875	11,663	6.6	1,244.4	1,244.4	1,244.9	0.5
EE	703,580	865 / 687	8,518	9.0	1,249.4	1,249.4	1,249.8	0.4
EF	705,479	478 / 303	8,920	8.4	1,256.1	1,256.1	1,256.4	0.3
EG	706,048	615 / 184	11,196	6.7	1,258.2	1,258.2	1,258.6	0.3
EH	707,352	662 / 210	10,384	7.2	1,260.1	1,260.1	1,260.9	0.8
EI	708,789	1,418 / 1,267	17,887	4.2	1,263.7	1,263.7	1,264.1	0.4

[1] Feet Above Confluence With San Antonio River

[2] Width / Width Within County

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

CIBOLO CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [7]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Cibolo Creek (Continued)									
EJ		710,011 [2]	1,685 / 1,574 [5]	12,579	6.0	1,264.3	1,264.3	1,264.7	0.5
EK		711,822 [2]	2,038 / 1,796 [5]	11,024	6.3	1,268.6	1,268.6	1,269.1	0.4
EL		712,501 [2]	1,554 / 1,955 [5]	8,407	8.3	1,269.5	1,269.5	1,270.0	0.4
EM		713,367 [2]	2,085 / 1,850 [5]	15,166	4.7	1,273.1	1,273.1	1,273.7	0.6
Cibolo Tributary									
A		1,840 [3]	143	722	9.4	1,253.7	1,249.4 [6]	1,250.4	1.0
B		2,620 [3]	228	1,160	5.8	1,256.2	1,256.2	1,256.8	0.6
C		3,320 [3]	126	730	9.3	1,259.7	1,259.7	1,260.7	1.0
D		4,290 [3]	181	1,084	6.3	1,265.3	1,265.3	1,266.2	0.9
E		5,230 [3]	330	1,218	5.6	1,269.0	1,269.0	1,269.4	0.4
Comal River									
A	280	280 [4]	145	2,078	22.1	616.6	590.9 [6]	590.9	0.0
B	2,480	2,455 [4]	241	4,481	10.2	616.6	608.1 [6]	608.1	0.0
C	3,380	3,350 [4]	498	5,992	7.7	616.6	611.6 [6]	612.1	0.5
D	5,580	5,552 [4]	350	6,511	7.0	616.6	616.3 [6]	616.4	0.1
E	6,040	6,018 [4]	383	8,018	5.7	617.2	617.2	618.2	1.0
Dry Comal Creek A-E [1]									
F	6,960	6,980 [4]	280	6,131	7.1	618.0	618.0	618.8	0.8
G	8,680	8,655 [4]	147	3,941	11.1	621.5	621.5	622.3	0.8

[1] Cross Sections A-E Shown Under Comal River
[2] Feet Above Confluence With San Antonio River
[3] Feet Above Confluence With Cibolo Creek
[4] Feet Above Confluence With Guadalupe River, As Shown On FIS Profile
[5] Width / Width Within County
[6] Elevation Computed Without Consideration Of Backwater Effects
[7] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

CIBOLO CREEK / CIBOLO TRIBUTARY / COMAL RIVER / DRY COMAL CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [2]	MAPPED DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Dry Comal Creek (Continued)									
H	10,050	9,946	692	8,645	4.9	625.0	625.0	625.9	0.9
I	11,410	11,368	290	5,364	8.0	628.4	628.4	629.1	0.7
J	13,790	13,674	339	6,863	6.2	634.5	634.5	635.1	0.6
K	15,010	14,956	640	12,060	3.6	637.6	637.6	638.2	0.6
L	16,830	16,786	483	9,373	4.6	639.5	639.5	640.4	0.9
M	18,830	18,774	723	14,099	3.1	641.2	641.2	642.1	0.9
N	20,890	20,793	1,628	15,694	2.7	642.1	642.1	643.1	1.0
O	22,430	22,337	520	9,231	4.7	643.5	643.5	644.4	0.9
P	24,070	24,066	1,000	15,007	2.9	644.4	644.4	645.3	0.9
Q	26,290	26,297	1,190	11,174	3.9	645.7	645.7	646.7	1.0
R	28,440	28,414	1,550	12,065	3.5	647.7	647.7	648.7	1.0
S	30,450	30,404	1,100	8,493	5.0	651.3	651.3	651.9	0.6
T	32,230	32,177	1,913	12,432	3.4	654.7	654.7	655.6	0.9
U	33,980	33,913	950	9,531	4.0	658.5	658.5	659.4	0.9
V	36,220	36,149	784	9,458	4.0	661.0	661.0	661.8	0.8
W	38,220	38,164	1,400	11,609	3.3	663.7	663.7	664.6	0.9
X	39,570	39,498	1,399	13,461	2.8	664.7	664.7	665.7	1.0
Y	40,500	40,484	992	9,332	4.1	665.6	665.6	666.6	1.0
Z	42,620	42,580	1,042	10,578	2.9	667.9	667.9	668.9	1.0
AA	45,700	45,590	608	7,134	4.3	673.1	673.1	673.8	0.7
AB	48,640	48,700	962	10,552	2.7	677.4	677.4	678.2	0.8
AC	51,880	51,900	1,250	7,591	3.5	684.0	684.0	684.8	0.8
AD		53,880	887	7,405	3.6	687.2	687.2	687.7	0.5
AE		54,870	975	7,490	3.6	688.1	688.1	688.8	0.7
AF		55,754	794	4,238	6.3	688.6	688.6	689.6	1.0
AG		56,821	555	4,789	5.5	693.6	693.6	693.7	0.1

[1] Feet Above Confluence With Guadalupe River, As Shown On FIS Profile

[2] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

DRY COMAL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NAVD 88)			
Dry Comal Creek (Continued)								
AH	57,210	480	4,352	6.1	694.4	694.4	694.7	0.3
AI	58,088	460	5,385	4.9	697.0	697.0	697.8	0.8
AJ	59,258	330	3,815	2.3	699.8	699.8	700.6	0.8
AK	59,641	310	3,271	2.7	700.9	700.9	701.3	0.4
AL	59,915	310	2,899	3.1	700.9	700.9	701.5	0.6
AM	60,700	314	3,064	2.6	701.2	701.2	702.0	0.8
AN	61,623	333	3,473	2.3	701.5	701.5	702.5	1.0
AO	62,563	275	2,187	3.7	702.4	702.4	703.2	0.8
AP	63,781	174	1,506	5.4	704.8	704.8	705.2	0.4
AQ	64,798	234	1,308	6.2	709.7	709.7	710.3	0.6
AR	65,559	200	1,681	4.8	711.9	711.9	712.9	1.0
AS	66,004	163	1,417	5.7	713.5	713.5	714.4	0.9
AT	66,481	151	1,586	5.1	715.6	715.6	716.1	0.5
AU	67,702	155	1,248	6.5	720.8	720.8	721.0	0.2
AV	68,320	200	1,419	5.7	723.2	723.2	723.9	0.7
AW	69,217	180	1,662	4.9	725.2	725.2	726.1	0.9
AX	70,177	150	1,845	4.4	728.1	728.1	728.6	0.5
AY	71,246	164	1,429	5.7	732.6	732.6	733.4	0.8
AZ	71,634	128	1,572	4.1	733.9	733.9	734.7	0.8
BA	72,088	123	1,059	6.1	735.1	735.1	735.7	0.6
BB	73,325	105	931	7.0	742.6	742.6	742.7	0.1
BC	73,717	144	839	7.8	746.1	746.1	746.2	0.1
BD	75,512	141	1,865	3.5	750.1	750.1	750.5	0.4
BE	76,440	174	1,149	5.7	752.3	752.3	752.6	0.3
BF	77,774	171	1,342	4.8	758.8	758.8	759.1	0.3
BG	79,156	223	1,917	3.4	765.7	765.7	765.8	0.1

[1] Feet Above Confluence With Guadalupe River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

DRY COMAL CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [5]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Dry Comal Creek (Continued)									
BH		81,234 [2]	292	1,547	4.2	775.4	775.4	776.3	0.9
BI		82,586 [2]	259	2,171	3.0	779.3	779.3	780.2	0.9
BJ		83,539 [2]	192	1,418	4.6	780.3	780.3	781.0	0.7
Comal Springs									
A	8,580	8,232 [3]	319	932	8.7	624.5	623.5 [4]	623.5	0.0
B	9,340	8,956 [3]	535	3,170	2.4	626.0	626.0	626.0	0.0
C	9,910	9,545 [3]	289	1,485	5.0	626.6	626.6	626.6	0.0
D	10,310	9,998 [3]	292	1,759	4.2	627.8	627.8	627.8	0.0
E	11,090	10,739 [3]	265	2,372	3.1	629.0	629.0	629.0	0.0
F	11,800	11,455 [3]	188	1,318	5.7	630.1	630.1	630.2	0.1
G	12,560	12,237 [3]	261	1,747	4.3	632.4	632.4	632.5	0.1
Blieders Creek A-G [1]									
H	13,410	13,109 [3]	80	845	8.8	633.8	633.8	633.8	0.0
I	13,880	13,603 [3]	83	888	8.2	635.5	635.5	635.9	0.4
J	14,370	14,092 [3]	188	1,666	4.4	638.4	638.4	639.3	0.9
K	15,250	14,952 [3]	265	1,972	3.7	639.6	639.6	640.6	1.0
L	16,040	15,788 [3]	400	1,974	3.5	641.4	641.4	642.4	1.0
M	16,990	16,671 [3]	200	1,438	4.8	646.5	646.5	647.5	1.0
N	17,530	17,455 [3]	89	782	8.9	648.2	648.2	649.0	0.8
O	20,920	20,693 [3]	150	1,063	5.9	663.0	663.0	663.6	0.6
P	23,020	22,809 [3]	125	887	7.0	671.4	671.4	672.1	0.7

[1] Cross Sections A-F Shown Under Comal Springs

[2] Feet Above Confluence With Guadalupe River

[3] Feet Above Confluence With Comal River, Measured Along Old Channel Comal River, As Shown On FIS Profile

[4] Elevation Computed Without Consideration Of Backwater Effects

[5] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

DRY COMAL CREEK / COMAL SPRINGS / BLIEDERS CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [4]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Blieders Creek (Continued)									
Q	24,245	24,400 [1]	111	730	5.2	679.1	679.1	680.0	0.9
R	26,260	26,410 [1]	78	658	4.6	687.1	687.1	688.0	0.9
S	27,648	27,820 [1]	122	521	5.8	692.1	692.1	693.1	1.0
T	28,849	29,060 [1]	93	564	5.4	699.2	699.2	700.0	0.8
U	30,355	30,540 [1]	215	931	3.3	708.1	708.1	709.1	1.0
V	32,325	32,550 [1]	990	490	8.9	718.5	718.5	718.5	0.0
W	33,649	33,916 [1]	1,505	712	4.0	733.5	733.5	733.5	0.0
X	37,075	37,441 [1]	1,119	32,456	0.1	774.6	774.6	775.6	1.0
Y	40,725	41,164 [1]	430	3,241	1.9	774.8	774.8	775.7	0.9
Z	43,410	43,854 [1]	88	900	6.9	787.1	787.1	787.9	0.8
AA	46,075	46,982 [1]	99	828	6.7	810.0	810.0	810.7	0.7
AB	47,025	47,940 [1]	119	883	6.2	815.6	815.6	816.4	0.8
AC	47,660	48,566 [1]	150	1,192	4.0	823.0	823.0	823.7	0.7
AD	48,199	49,129 [1]	180	783	4.8	828.2	828.2	828.2	0.0
AE	49,180	50,117 [1]	160	790	4.7	836.3	836.3	836.3	0.0
AF	50,200	51,049 [1]	27	88	9.5	848.7	848.7	849.0	0.3
AG	51,348	52,199 [1]	61	218	3.9	868.6	868.6	869.5	0.9
AH	52,249	53,097 [1]	29	93	4.5	891.8	891.8	892.3	0.5
Elm Creek									
A		2,040 [2]	110	754	7.3	666.5	660.6 [3]	661.6	1.0
B		3,040 [2]	96	601	9.1	673.2	673.2	673.2	0.0
C		4,040 [2]	132	803	6.8	685.3	685.3	685.8	0.5
D		4,540 [2]	95	626	8.7	691.5	691.5	691.6	0.1
E		5,040 [2]	97	531	10.3	701.5	701.5	701.6	0.1

[1] Feet Above Confluence With Comal River, As Shown On FIS Profile

[2] Feet Above Confluence With Guadalupe River

[3] Elevation Computed Without Consideration of Backwater Effects

[4] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

BLIEDERS CREEK / ELM CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Elm Creek (Continued)								
F	6,040	132	1,340	4.1	718.6	718.6	718.6	0.0
G	7,040	138	776	7.1	724.7	724.7	724.8	0.1
H	8,040	112	637	8.6	738.7	738.7	738.8	0.1
I	9,040	104	924	5.9	750.1	750.1	750.3	0.2
J	10,040	128	682	8.0	760.1	760.1	760.4	0.3
K	11,040	165	796	6.9	775.3	775.3	775.3	0.0
L	12,040	121	1,053	5.2	783.8	783.8	784.0	0.2
M	13,040	91	612	8.9	792.5	792.5	792.8	0.3
N	13,770	290	2,174	2.5	799.6	799.6	800.1	0.5
O	15,030	205	810	6.4	809.4	809.4	809.5	0.1
P	16,030	146	1,129	4.6	818.8	818.8	818.8	0.0
Q	17,030	147	732	7.1	826.5	826.5	826.7	0.2
R	18,030	247	1,390	3.7	835.6	835.6	835.8	0.2
S	19,030	70	567	9.1	842.3	842.3	842.7	0.4
T	20,080	211	1,404	3.7	850.9	850.9	851.8	0.9
U	21,080	184	928	5.6	856.8	856.8	856.9	0.1
V	22,080	145	1,054	4.9	863.1	863.1	863.2	0.1
W	23,080	201	930	5.6	869.5	869.5	869.7	0.2
X	24,030	150	875	5.9	877.5	877.5	877.8	0.3
Y	25,030	141	895	5.8	884.7	884.7	885.1	0.4
Z	26,030	143	706	5.9	893.0	893.0	893.2	0.2
AA	27,030	202	980	4.2	900.6	900.6	900.6	0.0
AB	28,030	210	752	5.5	909.0	909.0	909.0	0.0
AC	29,030	129	832	5.0	917.6	917.6	917.7	0.1
AD	30,050	199	851	4.9	923.9	923.9	924.0	0.1
AE	31,050	134	582	7.1	935.6	935.6	935.7	0.1

[1] Feet Above Confluence With Guadalupe River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

ELM CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Elm Creek (Continued)								
AF	32,050 [1]	119	837	4.9	946.1	946.1	946.4	0.3
AG	32,510 [1]	125	504	8.2	952.3	952.3	952.4	0.1
AH	33,050 [1]	146	622	6.6	963.1	963.1	963.1	0.0
AI	34,050 [1]	207	1,289	3.2	971.5	971.5	971.9	0.4
AJ	35,050 [1]	299	1,187	2.3	973.7	973.7	973.9	0.2
Garden Ridge Tributary								
A	987 [2]	190	515	7.5	777.8	777.8	778.2	0.4
B	1,470 [2]	190	897	4.3	782.5	782.5	783.5	1.0
C	2,609 [2]	120	677	5.0	789.1	789.1	789.8	0.7
D	3,562 [2]	160	748	4.5	795.4	795.4	796.1	0.7
E	4,327 [2]	140	623	5.4	802.2	802.2	802.6	0.4
F	4,585 [2]	260	4,039	2.0	814.2	814.2	815.1	0.9
G	5,984 [2]	270	1,309	2.6	814.6	814.6	815.5	0.9
H	6,341 [2]	134	599	5.6	815.9	815.9	816.5	0.6
I	6,573 [2]	109	528	7.0	818.1	818.1	818.5	0.4
J	6,887 [2]	200	1,846	1.8	824.7	824.7	825.4	0.7
K	7,761 [2]	290	746	4.5	825.3	825.3	826.2	0.9
L	9,173 [2]	320	798	4.2	837.2	837.2	837.8	0.6
M	10,448 [2]	142	513	5.5	845.5	845.5	845.8	0.3
N	11,001 [2]	100	559	5.0	851.2	851.2	851.8	0.6
O	11,665 [2]	90	445	6.3	855.7	855.7	856.6	0.9
P	12,183 [2]	120	851	3.3	863.1	863.1	863.4	0.3
Q	12,763 [2]	139	437	3.7	863.4	863.4	864.4	1.0
R	12,893 [2]	110	638	2.6	866.9	866.9	867.4	0.5

[1] Feet Above Confluence With Guadalupe River

[2] Feet Above Confluence With Bracken Tributary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

ELM CREEK / GARDEN RIDGE TRIBUTARY

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [3]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Garden Ridge Tributary (Continued)									
S		13,215 [1]	175	696	2.3	871.4	871.4	871.8	0.4
T		13,743 [1]	249	494	3.3	884.7	884.7	884.7	0.0
U		13,883 [1]	478	1,063	1.5	884.9	884.9	884.9	0.0
V		14,131 [1]	590	1,262	4.0	884.8	884.8	884.8	0.0
W		14,604 [1]	110	338	3.8	896.4	896.4	896.7	0.3
X		15,167 [1]	23	55	3.3	898.9	898.9	899.2	0.3
Y		15,602 [1]	23	48	3.5	909.3	909.3	909.7	0.4
Z		16,785 [1]	22	31	6.0	933.7	933.7	933.7	0.0
AA		17,389 [1]	60	121	1.4	951.4	951.4	951.8	0.4
Guadalupe River (Lower Reach)									
A	27,700	28,211 [2]	332	9,459	15.4	598.3	598.3	599.2	0.9
B	28,700	29,102 [2]	377	10,994	13.2	600.0	600.0	600.9	0.9
C	29,700	30,066 [2]	540	15,650	10.0	602.0	602.0	602.9	0.9
D	30,660	30,971 [2]	396	11,910	13.1	602.0	602.0	602.9	0.9
E	31,980	32,292 [2]	371	10,332	15.7	602.8	602.8	603.6	0.8
F	33,340	33,808 [2]	329	10,963	13.8	604.8	604.8	605.6	0.8
G	34,880	35,215 [2]	309	9,564	16.4	605.8	605.8	606.5	0.7
H	35,660	36,077 [2]	615	15,388	12.8	608.3	608.3	609.1	0.8
I	37,260	37,586 [2]	851	23,372	5.2	610.7	610.7	611.5	0.8
J	39,060	39,384 [2]	587	14,727	8.2	612.0	612.0	612.9	0.9
K	40,560	40,845 [2]	570	17,238	11.1	615.1	615.1	616.0	0.9

[1] Feet Above Confluence With Bracken Tributary

[2] Feet Above Dunlap Dam, As Shown On The FIS Profile

[3] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GARDEN RIDGE TRIBUTARY / GUADALUPE RIVER (LOWER REACH)

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [2]	MAPPED DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Guadalupe River (Lower Reach) (Continued)									
L	42,690	42,999	1,204	25,412	12.9	616.3	616.3	617.1	0.8
M	44,210	44,489	775	20,292	7.0	617.4	617.4	618.1	0.7
N	46,270	46,514	399	10,269	13.1	617.6	617.6	618.1	0.5
O	47,810	48,012	723	16,798	9.0	619.4	619.4	620.2	0.8
P	49,290	49,544	605	14,538	8.7	620.8	620.8	621.8	1.0
Q	50,650	50,768	351	9,984	12.3	621.9	621.9	622.6	0.7
R	52,710	52,933	446	11,630	10.0	624.6	624.6	625.3	0.7
S	54,230	54,520	485	12,120	11.7	625.0	625.0	625.7	0.7
T	55,150	55,370	661	17,577	9.6	627.2	627.2	628.1	0.9
U	57,630	57,704	1,621	21,237	11.4	628.9	628.9	629.2	0.3
V	60,310	60,340	874	14,898	12.9	630.4	630.4	631.4	1.0
W	61,450	61,724	564	11,206	10.0	633.9	633.9	634.8	0.9
X		66,490	270	7,333	11.5	639.3	639.3	640.3	1.0
Y		70,490	249	6,257	13.4	644.0	644.0	644.6	0.6
Z		74,490	305	6,898	12.1	653.4	653.4	653.8	0.4
AA		80,010	367	8,595	9.0	670.2	670.2	670.7	0.5
AB		82,820	239	5,978	11.7	672.7	672.7	673.3	0.6
AC		85,550	290	7,119	9.8	676.6	676.6	677.4	0.8
AD		87,090	282	6,015	11.6	677.6	677.6	678.4	0.8
AE		90,130	304	5,954	11.7	681.3	681.3	682.0	0.7
AF		91,177	434	7,508	9.6	685.0	685.0	686.0	1.0
AG		92,191	233	6,145	11.8	687.3	687.3	687.9	0.6
AH		93,334	261	7,494	9.7	689.5	689.5	690.3	0.8

[1] Feet Above Dunlap Dam, As Shown On FIS Profile

[2] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (LOWER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Lower Reach) (Continued)								
AI	94,538	326	7,553	9.6	691.3	691.3	692.1	0.8
AJ	96,774	354	8,661	8.7	694.2	694.2	695.1	0.9
AK	97,634	390	8,580	8.8	695.1	695.1	696.0	0.9
AL	98,997	494	9,360	8.0	697.1	697.1	698.0	0.9
AM	99,892	279	5,543	13.6	697.1	697.1	698.1	1.0
AN	101,095	327	7,419	10.1	701.0	701.0	701.8	0.8
AO	102,580	281	6,740	11.1	703.1	703.1	703.8	0.7
AP	103,354	224	6,361	11.6	704.0	704.0	704.7	0.7
AQ	104,392	291	7,639	9.6	705.7	705.7	706.5	0.8
AR	105,414	257	6,975	10.5	706.7	706.7	707.4	0.7
AS	107,383	351	8,631	8.5	709.9	709.9	710.7	0.8
AT	108,123	329	7,384	10.0	711.0	711.0	711.6	0.6
AU	109,718	384	8,823	8.3	712.8	712.8	713.7	0.9
AV	111,506	286	6,802	10.8	714.1	714.1	714.9	0.8
AW	113,497	473	7,073	10.3	716.8	716.8	717.4	0.6
AX	115,105	419	10,119	7.2	720.2	720.2	721.1	0.9
AY	116,871	293	7,184	10.1	721.5	721.5	722.4	0.9
AZ	118,276	753	13,028	5.6	723.9	723.9	724.9	1.0
BA	120,467	191	5,191	9.8	725.0	725.0	725.9	0.9
BB	121,358	237	5,722	8.9	726.1	726.1	726.9	0.8
BC	122,243	252	6,211	8.2	726.9	726.9	727.8	0.9
BD	123,903	180	5,074	10.0	727.8	727.8	728.6	0.8
BE	124,923	203	4,804	10.6	728.9	728.9	729.6	0.7

[1] Feet Above Dunlap Dam

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (LOWER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Lower Reach) (Continued)								
BF	126,119	325	7,363	6.1	732.7	732.7	733.5	0.8
BG	126,916	219	5,395	8.3	732.8	732.8	733.6	0.8
BH	128,360	221	5,714	7.9	734.0	734.0	734.7	0.7
BI	129,382	262	7,214	6.2	735.0	735.0	735.7	0.7
BJ	130,448	295	6,585	6.8	735.3	735.3	736.0	0.7
BK	131,508	223	4,984	7.7	736.0	736.0	736.7	0.7
BL	132,574	271	5,807	6.6	737.2	737.2	737.8	0.6
BM	133,957	244	5,045	7.2	738.8	738.8	739.7	0.9
BN	135,126	235	5,153	7.0	739.9	739.9	740.8	0.9
BO	135,924	171	4,238	8.5	740.4	740.4	741.3	0.9
BP	137,547	191	4,451	8.1	741.9	741.9	742.8	0.9
BQ	139,212	188	4,316	8.4	743.0	743.0	743.8	0.8
BR	140,067	199	4,490	8.1	744.1	744.1	744.9	0.8
BS	140,669	230	4,700	7.7	745.3	745.3	746.2	0.9
BT	141,767	191	4,121	8.8	746.8	746.8	747.6	0.8
BU	143,179	363	6,218	4.7	749.5	749.5	750.4	0.9
BV	144,504	288	4,780	6.1	750.3	750.3	751.2	0.9
BW	146,370	260	4,139	7.0	751.9	751.9	752.7	0.8
BX	148,025	214	4,458	6.5	755.3	755.3	755.3	0.0
BY	149,575	189	3,758	7.7	756.2	756.2	756.2	0.0
BZ	150,506	138	2,786	5.0	757.2	757.2	757.4	0.2
CA	151,332	140	2,911	4.8	757.5	757.5	757.8	0.3
CB	153,509	155	2,690	5.2	758.2	758.2	758.8	0.6

[1] Feet Above Dunlap Dam

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (LOWER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Lower Reach) (Continued)								
CC	155,590 [1]	184	2,685	5.2	760.5	760.5	761.4	0.9
CD	156,847 [1]	260	3,369	2.1	761.5	761.5	762.3	0.8
CE	158,811 [1]	192	3,398	2.1	761.8	761.8	762.7	0.9
CF	159,506 [1]	192	3,721	1.9	761.9	761.9	762.7	0.8
CG	160,606 [1]	172	2,991	2.4	762.0	762.0	762.8	0.8
CH	162,407 [1]	141	2,017	3.6	762.3	762.3	763.1	0.8
CI	163,368 [1]	198	2,543	2.8	762.6	762.6	763.4	0.8
Guadalupe River (Upper Reach)								
CJ	19,130 [2]	1,614	27,488	5.7	965.4	965.4	966.1	0.7
CK	20,080 [2]	1,532	26,544	5.9	966.1	966.1	966.8	0.7
CL	21,130 [2]	1,627	30,985	5.1	967.0	967.0	967.7	0.7
CM	22,255 [2]	805	24,230	6.5	967.5	967.5	968.2	0.7
CN	23,130 [2]	492	16,015	9.8	967.4	967.4	968.1	0.7
CO	24,080 [2]	922	24,802	6.3	969.5	969.5	970.3	0.8
CP	24,240 [2]	922	24,545	6.4	969.5	969.5	970.3	0.8
CQ	25,130 [2]	1,262	28,267	5.5	970.1	970.1	970.9	0.8
CR	26,130 [2]	2,245	59,988	2.6	970.6	970.6	971.4	0.8
CS	27,500 [2]	1,053	19,761	7.9	970.6	970.6	971.4	0.8
CT	29,110 [2]	674	13,846	11.4	973.6	973.6	974.4	0.8
CU	30,110 [2]	665	14,626	10.8	975.5	975.5	976.0	0.5
CV	31,110 [2]	891	18,171	8.7	977.3	977.3	978.0	0.7

[1] Feet Above Dunlap Dam

[2] Feet Above Confluence With Canyon Lake

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (LOWER REACH) / GUADALUPE RIVER (UPPER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Upper Reach) (Continued)								
CW	32,110	750	17,011	9.3	978.1	978.1	978.8	0.7
CX	33,110	914	20,452	7.7	979.9	979.9	980.9	1.0
CY	34,310	1,082	21,380	7.4	981.1	981.1	981.8	0.7
CZ	35,110	2,053	20,183	7.8	981.8	981.8	982.6	0.8
DA	36,110	2,526	24,381	6.5	983.1	983.1	983.9	0.8
DB	37,110	2,721	24,373	6.5	984.0	984.0	984.8	0.8
DC	38,110	3,000	24,232	6.5	984.8	984.8	985.6	0.8
DD	39,110	3,003	31,142	5.1	985.6	985.6	986.4	0.8
DE	40,110	2,552	32,646	4.8	986.1	986.1	986.9	0.8
DF	41,110	1,429	30,719	5.2	986.5	986.5	987.3	0.8
DG	42,110	486	12,821	12.3	986.5	986.5	987.3	0.8
DH	43,140	529	15,159	10.4	988.6	988.6	989.4	0.8
DI	44,110	568	16,505	9.6	990.0	990.0	990.7	0.7
DJ	45,080	907	18,019	8.8	990.8	990.8	991.5	0.7
DK	46,110	1,256	18,016	8.8	992.1	992.1	992.7	0.6
DL	47,110	661	16,564	9.6	993.2	993.2	993.8	0.6
DM	47,910	696	13,681	11.7	994.0	994.0	994.6	0.6
DN	48,050	710	14,067	11.4	994.6	994.6	995.2	0.6
DO	48,960	600	13,810	11.6	995.8	995.8	996.2	0.4
DP	49,960	608	15,081	10.6	997.9	997.9	998.3	0.4
DQ	50,960	566	13,406	12.0	998.7	998.7	999.1	0.4
DR	51,960	722	16,612	9.7	1,001.8	1,001.8	1,002.2	0.4
DS	52,560	711	15,827	10. 1	1,002.5	1,002.5	1,002.9	0.4
DT	53,960	414	9,998	16.1	1,002.7	1,002.7	1,002.7	0.0
DU	54,960	438	13,224	12. 1	1,008.2	1,008.2	1,008.8	0.6

[1] Feet Above Confluence With Canyon Lake

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (UPPER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Upper Reach) (Continued)								
DV	55,960	593	19,927	8.2	1,010.7	1,010.7	1,011.4	0.7
DW	56,270	552	18,315	8.9	1,011.2	1,011.2	1,011.8	0.6
DX	56,960	672	17,195	9.5	1,012.3	1,012.3	1,012.8	0.5
DY	57,960	722	16,379	10.0	1,013.3	1,013.3	1,013.8	0.5
DZ	58,960	618	16,135	10.2	1,014.6	1,014.6	1,015.3	0.7
EA	59,960	507	16,242	10. 1	1,015.7	1,015.7	1,016.4	0.7
EB	60,960	702	16,876	9.7	1,017.1	1,017.1	1,017.9	0.8
EC	61,960	598	20,357	8.0	1,018.8	1,018.8	1,019.6	0.8
ED	62,960	508	17,147	9.6	1,019.4	1,019.4	1,020.2	0.8
EE	63,960	563	17,527	9.3	1,020.6	1,020.6	1,021.5	0.9
EF	64,960	496	17,550	9.3	1,022.0	1,022.0	1,022.9	0.9
EG	65,960	503	19,601	8.4	1,024.0	1,024.0	1,024.9	0.9
EH	67,960	508	19,680	8.3	1,027.0	1,027.0	1,027.7	0.7
EI	68,960	664	26,240	6.2	1,028.2	1,028.2	1,029.0	0.8
EJ	69,960	591	24,008	6.8	1,028.9	1,028.9	1,029.7	0.8
EK	70,960	447	16,483	9.9	1,029.1	1,029.1	1,029.9	0.8
EL	71,960	683	22,589	7.3	1,030.8	1,030.8	1,031.6	0.8
EM	72,960	611	22,863	7.2	1,031.5	1,031.5	1,032.3	0.8
EN	73,960	875	24,145	6.8	1,032.3	1,032.3	1,033.1	0.8
EO	74,960	957	25,442	6.4	1,033.2	1,033.2	1,034.0	0.8
EP	75,960	578	21,158	7.7	1,034.1	1,034.1	1,034.9	0.8
EQ	76,960	404	18,460	9.4	1,034.8	1,034.8	1,035.7	0.9
ER	77,960	515	19,648	8.8	1,036.0	1,036.0	1,037.0	1.0
ES	78,960	495	16,796	10.3	1,037.1	1,037.1	1,038.1	1.0
ET	79,960	540	21,723	8.0	1,038.8	1,038.8	1,039.8	1.0

[1] Feet Above Confluence With Canyon Lake

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (UPPER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Guadalupe River (Upper Reach) (Continued)								
EU	80,960	569	18,380	9.4	1,039.4	1,039.4	1,040.4	1.0
EV	81,960	612	23,193	7.5	1,041.5	1,041.5	1,042.5	1.0
EW	82,960	571	17,376	10.0	1,041.8	1,041.8	1,042.7	0.9
EX	83,960	427	17,237	10.1	1,044.0	1,044.0	1,044.9	0.9
EY	84,960	508	19,417	8.9	1,045.0	1,045.0	1,045.9	0.9
EZ	85,960	613	21,225	8.2	1,046.7	1,046.7	1,047.6	0.9
FA	87,260	542	20,745	8.4	1,048.1	1,048.1	1,049.1	1.0
FB	87,960	636	21,803	8.0	1,048.7	1,048.7	1,049.7	1.0
FC	88,960	562	22,302	7.9	1,049.5	1,049.5	1,050.5	1.0
FD	89,960	550	20,305	8.6	1,050.4	1,050.4	1,051.4	1.0
FE	90,960	390	16,009	10.9	1,051.3	1,051.3	1,052.3	1.0
FF	91,960	705	29,222	6.0	1,053.3	1,053.3	1,054.3	1.0
FG	92,960	957	28,131	6.2	1,053.6	1,053.6	1,054.6	1.0
FH	93,960	667	24,094	7.3	1,054.3	1,054.3	1,055.3	1.0
FI	94,960	790	29,754	5.9	1,055.0	1,055.0	1,056.0	1.0
FJ	95,960	1,654	20,835	8.4	1,056.1	1,056.1	1,057.1	1.0
FK	96,940	1,784	23,527	7.4	1,058.1	1,058.1	1,059.1	1.0
FL	97,960	1,624	23,251	7.5	1,059.7	1,059.7	1,060.7	1.0
FM	98,960	1,730	31,651	5.5	1,061.3	1,061.3	1,062.2	0.9
FN	99,960	910	26,843	6.5	1,061.9	1,061.9	1,062.8	0.9
FO	100,960	376	15,359	11.4	1,062.7	1,062.7	1,063.6	0.9
FP	101,960	696	19,370	9.0	1,064.7	1,064.7	1,065.6	0.9

[1] Feet Above Confluence With Canyon Lake

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

GUADALUPE RIVER (UPPER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NAVD 88)			
Indian Creek								
A	7,670 [1]	309	2,326	7.2	1,091.1	1,088.5 [3]	1,089.1	0.6
B	8,600 [1]	370	3,088	5.4	1,092.5	1,092.4 [3]	1,093.4	1.0
C	9,880 [1]	481	3,077	5.4	1,096.7	1,096.7	1,097.5	0.8
D	10,380 [1]	608	3,581	4.7	1,098.7	1,098.7	1,099.3	0.6
E	10,880 [1]	545	3,574	4.7	1,103.6	1,100.5	1,100.9	0.4
F	12,180 [1]	402	2,601	6.4	1,107.6	1,105.0	1,106.0	1.0
G	12,830 [1]	414	2,512	6.6	1,110.9	1,109.0	1,109.8	0.8
H	13,680 [1]	400	2,966	5.4	1,113.2	1,113.2	1,114.1	0.9
I	14,850 [1]	272	2,141	6.5	1,117.9	1,117.9	1,118.5	0.6
J	16,130 [1]	441	2,460	5.7	1,124.2	1,124.2	1,125.1	0.9
Indian Creek Tributary A								
A	2,020 [2]	572	1,292	3.6	1,089.9	1,089.9	1,089.9	0.0
B	3,200 [2]	246	816	5.7	1,096.8	1,096.8	1,096.9	0.1
Indian Creek Tributary B								
A	6,540 [2]	657	777	2.9	1,104.0	1,104.0	1,104.0	0.0
B	7,560 [2]	397	1,051	2.2	1,107.4	1,107.4	1,108.0	0.6
C	9,260 [2]	300	363	6.3	1,117.7	1,117.7	1,117.7	0.0
Kelley Creek								
A	2,280 [1]	318	3,545	4.5	1,120.3	1,114.9 [3]	1,115.8	0.9
B	3,160 [1]	299	2,757	5.8	1,123.6	1,117.4 [3]	1,118.3	0.9
C	4,110 [1]	202	3,295	4.8	1,126.5	1,119.9 [3]	1,120.9	1.0

[1] Feet Above Confluence With Cibolo Creek

[2] Feet Above Confluence With Indian Creek

[3] Elevation Computed Without Consideration Of Backwater Effects

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

INDIAN CREEK / INDIAN CREEK TRIBUTARIES A AND B / KELLEY CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [5]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Kelley Creek (Continued)									
D		5,020 [1]	122	1,930	8.2	1,131.2	1,122.1 [4]	1,122.8	0.7
E		6,020 [1]	244	2,431	6.5	1,134.7	1,130.0 [4]	1,130.8	0.8
F		6,870 [1]	415	3,426	4.6	1,135.0	1,133.3 [4]	1,134.1	0.8
G		7,920 [1]	463	3,221	4.9	1,137.3	1,137.3	1,138.2	0.9
H		8,510 [1]	623	4,447	3.6	1,140.1	1,140.1	1,141.1	1.0
New Channel Comal River									
A	5,330	9,756 [2]	41	135	10.3	624.5	615.8 [4]	615.8	0.0
B	6,730	11,174 [2]	73	280	5.0	624.5	618.5 [4]	618.5	0.0
C	7,235	11,687 [2]	47	436	3.2	624.5	622.5 [4]	623.0	0.5
D	7,710	12,190 [2]	187	1,545	0.9	624.5	623.4 [4]	623.8	0.4
North Guadalupe Tributary									
A	300	270 [3]	225	3,109	2.4	602.1	596.1 [4]	596.9	0.8
B	1,550	1,579 [3]	92	1,374	2.3	602.1	596.6 [4]	597.5	0.9
C	2,070	2,054 [3]	100	1,019	3.1	602.1	597.0 [4]	597.9	0.9
D	2,935	2,980 [3]	66	477	16.0	602.1	601.4 [4]	601.6	0.2
E	3,225	3,272 [3]	79	821	9.8	605.2	605.2	605.8	0.6
F	4,025	4,068 [3]	70	655	4.7	609.1	609.1	609.4	0.3
G	5,425	5,463 [3]	66	408	7.6	614.7	614.7	615.0	0.3
H	6,125	6,131 [3]	120	566	5.4	616.8	616.8	616.8	0.0
I	6,975	7,008 [3]	120	490	5.8	618.5	618.5	618.6	0.1

[1] Feet Above Confluence With Cibolo Creek

[2] Feet Above Confluence With Comal River, As Shown On FIS Profile

[3] Feet Above Confluence With Guadalupe River, As Shown On FIS Profile

[4] Elevation Computed Without Consideration Of Backwater Effects

[5] Stream Station Per The DFIRM And RAS Model Cross-Sections

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

KELLEY CREEK / NEW CHANNEL COMAL RIVER / NORTH GUADALUPE TRIBUTARY

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [4]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
North Guadalupe Tributary (Continued)									
J	8,025	8,045 [1]	120	456	6.9	621.4	621.4	621.6	0.2
K	8,925	8,957 [1]	100	480	5.8	626.9	626.9	627.0	0.1
L	10,075	10,104 [1]	71	352	7.9	629.9	629.9	630.5	0.6
M	10,825	10,852 [1]	140	490	6.7	633.0	633.0	633.6	0.6
N	11,135	11,153 [1]	257	601	4.6	635.3	635.3	635.4	0.1
O	11,885	11,882 [1]	120	533	3.2	642.9	642.9	643.1	0.2
P	12,950	12,873 [1]	48	197	9.0	647.8	647.8	647.8	0.0
Q	13,950	13,904 [1]	94	259	3.8	655.2	655.2	655.5	0.3
R	14,475	14,430 [1]	48	156	6.4	657.9	657.9	657.9	0.0
S	15,625	15,488 [1]	100	186	2.9	675.6	675.6	675.6	0.0
Old Channel Comal River									
A	10	10 [2]	110	934	7.3	617.7	605.2 [3]	606.1	0.9
B	1,000	890 [2]	84	854	8.0	617.7	607.9 [3]	608.8	0.9
C	1,400	1,175 [2]	92	1,160	5.9	617.7	612.3 [3]	612.4	0.1
D	2,200	1,987 [2]	98	1,344	5.1	617.7	613.0 [3]	613.3	0.3
E	2,900	2,679 [2]	126	1,802	3.8	617.7	613.5 [3]	614.0	0.5
F	4,460	4,202 [2]	128	1,431	4.8	617.7	614.12 [3]	614.7	0.6
G	5,850	5,556 [2]	121	1,232	5.5	617.7	615.8 [3]	616.7	0.9
H	6,170	5,894 [2]	125	1,115	6.1	617.7	616.5 [3]	617.1	0.6
I	7,180	6,932 [2]	160	1,458	4.7	618.7	618.7	619.7	1.0
J	7,900	7,692 [2]	130	1,199	5.7	620.5	620.5	621.2	0.7

[1] Feet Above Confluence With Guadalupe River, As Shown On FIS Profile

[2] Feet Above Confluence With Comal River, As Shown On FIS Profile

[3] Elevation Computed Without Consideration Of Backwater Effects

[4] Stream Station Per The DFIRM And RAS Model Cross-Sections.

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH GUADALUPE TRIBUTARY / OLD CHANNEL COMAL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Rebecca Creek								
A	4,600	348	7,538	1.8	946.3	946.3	947.3	1.0
B	6,600	208	3,278	4.1	947.0	947.0	948.0	1.0
C	7,460	248	3,752	3.5	950.2	950.2	950.7	0.5
D	8,240	197	1,811	7.2	952.2	952.2	952.5	0.3
E	9,000	236	2,356	5.5	955.3	955.3	955.8	0.5
F	10,320	186	1,605	8.1	962.0	962.0	962.5	0.5
G	11,320	280	1,852	7.0	967.2	967.2	967.5	0.3
H	12,300	438	2,608	4.9	976.3	976.3	976.3	0.0
I	13,370	292	1,870	6.8	980.0	980.0	980.0	0.0
J	14,160	297	1,560	8.2	986.4	986.4	986.4	0.0
K	14,920	236	1,615	7.8	991.8	991.8	991.8	0.0
L	15,670	255	1,351	9.4	997.6	997.6	997.6	0.0
M	17,470	202	1,559	8.0	1,012.4	1,012.4	1,012.4	0.0
N	18,510	336	1,930	6.0	1,018.0	1,018.0	1,018.0	0.0
O	19,660	108	805	14.5	1,029.3	1,029.3	1,029.3	0.0
P	20,610	230	2,752	4.2	1,042.4	1,042.4	1,042.4	0.0
Q	21,430	189	1,033	11.3	1,060.7	1,060.7	1,060.7	0.0
R	21,660	377	1,877	6.2	1,067.1	1,067.1	1,067.1	0.0
S	22,620	466	2,112	5.5	1,073.3	1,073.3	1,073.3	0.0
T	23,650	212	1,309	8.9	1,081.7	1,081.7	1,081.7	0.0
U	24,700	338	2,759	3.8	1,089.5	1,089.5	1,089.5	0.0
V	25,650	207	1,784	5.8	1,091.6	1,091.6	1,091.6	0.0
W	26,650	140	931	11.2	1,100.6	1,100.6	1,100.6	0.0
X	27,650	146	1,412	7.4	1,112.6	1,112.6	1,112.6	0.0
Y	28,100	149	810	12.8	1,119.2	1,119.2	1,119.2	0.0
Z	28,650	230	1,731	6.0	1,130.7	1,130.7	1,130.7	0.0
AA	29,650	158	1,133	9.2	1,137.2	1,137.2	1,137.5	0.3

[1] Feet Above Confluence With Guadalupe River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

REBECCA CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [4]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
Rebecca Creek (Continued)									
AB		30,750 [1]	301	2,296	2.6	1,144.0	1,144.0	1,145.0	1.0
AC		31,510 [1]	219	1,159	5.1	1,148.9	1,148.9	1,149.4	0.5
AD		32,010 [1]	215	1,027	5.7	1,153.3	1,153.3	1,153.7	0.4
AE		33,200 [1]	156	924	6.3	1,163.5	1,163.5	1,164.0	0.5
AF		34,000 [1]	136	755	7.8	1,172.4	1,172.4	1,172.9	0.5
AG		35,000 [1]	245	834	3.4	1,182.0	1,182.0	1,182.4	0.4
Sattler Tributary									
A		340 [1]	67	163	8.9	740.2	740.2	740.2	0.0
B		1,340 [1]	68	290	5.0	747.6	747.6	747.8	0.2
C		2,340 [1]	331	318	4.6	763.5	763.5	763.5	0.0
D		3,020 [1]	453	1,333	1. 1	779.0	779.0	779.0	0.0
E		3,340 [1]	263	571	2.5	781.3	781.3	781.3	0.0
F		4,340 [1]	68	188	6.8	795.8	795.8	795.8	0.0
G		5,340 [1]	60	267	4.8	815.8	815.8	815.8	0.0
H		6,340 [1]	54	176	7.2	833.9	833.9	833.9	0.0
I		7,340 [1]	127	142	3.9	865.6	865.6	865.6	0.0
South Guadalupe Tributary									
A	30	30 [2]	100	811	5.8	602.1	597.2 [3]	598.1	0.9
B	1,050	1,033 [2]	125	848	5.6	608.4	608.4	608.4	0.0
C	1,600	1,593 [2]	103	524	9.1	610.3	610.3	610.3	0.0
D	2,550	2,541 [2]	280	1,087	5.3	614.3	614.3	614.6	0.3
E	3,325	3,304 [2]	287	1,354	4.5	615.4	615.4	615.9	0.5

[1] Feet Above Confluence With Guadalupe River

[2] Feet Above Confluence With North Guadalupe Tributary, As Shown On FIS Profile

[3] Elevation Computed Without Consideration Of Backwater Effects

[4] Stream Station Per The DFIRM And RAS Model Cross-Sections.

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

REBECCA CREEK / SATTLER TRIBUTARY / SOUTH GUADALUPE TRIBUTARY

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	FIRM CROSS-SECTION [4]	MAPPED DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
							FEET (NAVD 88)		
South Guadalupe Tributary (Continued)									
F	4,250	4,224 [1]	400	1,612	3.6	616.2	616.2	617.0	0.8
G	5,155	5,194 [1]	300	1,167	4.3	618.0	618.0	619.0	1.0
H	5,773	5,788 [1]	177	891	5.2	620.0	620.0	620.1	0.1
I	6,750	6,788 [1]	85	345	13.3	623.0	623.0	623.0	0.0
J	6,890	6,844 [1]	360	692	6.7	626.6	626.6	626.6	0.0
K	7,250	7,234 [1]	73	357	12.6	628.8	628.8	628.8	0.0
L	8,100	7,991 [1]	96	653	6.9	633.7	633.7	633.7	0.0
M	9,080	8,973 [1]	113	534	8.4	635.1	635.1	635.6	0.5
N	9,670	9,527 [1]	103	605	7.4	638.1	638.1	638.1	0.0
O	10,300	10,157 [1]	229	940	5.0	639.6	639.6	639.9	0.3
P	10,675	10,547 [1]	286	699	9.1	641.5	641.5	641.9	0.4
Q	11,900	11,736 [1]	180	583	7.7	646.9	646.9	647.2	0.3
R	13,885	13,669 [1]	89	303	11.3	656.1	656.1	656.1	0.0
S	14,695	14,471 [1]	130	593	3.6	661.6	661.6	661.6	0.0
T	15,532	15,423 [1]	130	261	8.2	669.1	669.1	669.3	0.2
Upper Dry Comal Creek									
A		154 [2]	84	750	4.8	780.3	779.1 3	779.7	0.6
B		1,225 [2]	131	1,196	3.0	785.9	785.9	786.6	0.7
C		1,915 [2]	122	936	3.9	787.8	787.8	788.3	0.5
D		3,088 [2]	168	1,183	3.0	793.2	793.2	794.2	1.0
E		4,247 [2]	175	1,347	2.7	796.7	796.7	797.7	1.0
F		5,424 [2]	168	952	0.4	797.9	797.9	798.9	1.0
G		6,263 [2]	180	680	0.5	798.0	798.0	799.0	1.0

[1] Feet Above Confluence With North Guadalupe Tributary, As Shown On FIS Profile

[2] Feet Above Confluence With Dry Comal Creek

[3] Elevation Computed Without Consideration Of Backwater Effects

[4] Stream Station Per The DFIRM And RAS Model Cross-Sections.

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH GUADALUPE TRIBUTARY / UPPER DRY COMAL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
West Fork Dry Comal Creek								
A	317 [1]	97	829	6.8	781.7	781.7	782.0	0.3
B	1,074 [1]	132	827	6.8	789.7	789.7	790.0	0.3
C	1,673 [1]	211	1,578	3.6	793.2	793.2	793.7	0.5
D	2,749 [1]	187	1,331	4.2	796.1	796.1	796.3	0.2
E	2,946 [1]	201	1,506	3.7	798.6	798.6	798.7	0.1
F	4,029 [1]	145	1,277	4.4	802.2	802.2	802.3	0.1
G	4,507 [1]	197	1,056	5.3	804.2	804.2	804.2	0.0
H	4,726 [1]	170	1,916	2.9	809.7	809.7	809.8	0.1
I	5,361 [1]	174	1,474	3.8	810.9	810.9	811.0	0.1
J	5,707 [1]	203	1,511	3.7	812.6	812.6	812.7	0.1
K	6,613 [1]	299	1,519	3.7	818.2	818.2	818.3	0.1
L	7,807 [1]	202	1,442	3.9	823.8	823.8	823.8	0.0
M	8,497 [1]	159	1,314	4.3	827.6	827.6	827.7	0.1
N	8,874 [1]	188	1,941	2.9	831.7	831.7	831.8	0.1
O	9,825 [1]	227	1,698	3.3	834.6	834.6	834.7	0.1
P	10,720 [1]	288	1,946	2.9	840.0	840.0	840.5	0.5
Q	11,055 [1]	358	1,764	3.2	841.4	841.4	841.5	0.1
R	12,178 [1]	401	2,006	2.8	846.9	846.9	846.9	0.0
S	12,707 [1]	322	1,705	3.3	850.3	850.3	850.4	0.1
T	13,535 [1]	230	1,497	3.7	855.1	855.1	855.9	0.8
U	14,349 [1]	195	2,312	0.7	855.6	855.6	856.5	0.9
West Fork Tributary								
A	330 [2]	120	787	2.9	801.9	801.9	802.9	1.0
B	820 [2]	100	302	7.6	806.4	806.4	806.6	0.2

[1] Feet Above Confluence With Dry Comal Creek

[2] Feet Above Confluence With West Fork Dry Comal Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

WEST FORK DRY COMAL CREEK / WEST FORK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
West Fork Tributary (Continued)								
C	1,270 [1]	71	325	7.1	812.6	812.6	812.6	0.0
D	2,270 [1]	139	528	4.4	818.8	818.8	819.4	0.6
E	3,630 [1]	119	346	6.7	830.9	830.9	830.9	0.0
F	4,630 [1]	213	213	5.0	843.4	843.4	843.5	0.1
G	5,630 [1]	122	122	4.9	851.7	851.7	851.8	0.1
York Creek								
A	-440 [2]	912 [3]	5,028	3.7	569.4	569.4	570.3	0.9
B	860 [2]	1,082	5,869	3.2	571.5	571.5	572.2	0.7
C	2,360 [2]	1,864	5,117	3.6	576.0	576.0	576.6	0.6
D	3,360 [2]	1,159	5,402	3.5	580.5	580.5	581.5	1.0
E	4,360 [2]	1,641	4,951	3.8	583.9	583.9	584.5	0.6
F	5,360 [2]	1,513	4,653	4.0	589.2	589.2	589.7	0.5
G	6,560 [2]	1,020	4,407	4.2	594.2	594.2	594.7	0.5
H	7,620 [2]	316	3,226	5.8	597.0	597.0	597.6	0.6
I	7,900 [2]	287	2,934	6.4	598.0	598.0	598.6	0.6
J	9,150 [2]	146	1,357	6.9	600.8	600.8	601.3	0.5
K	10,250 [2]	211	2,214	4.2	603.2	603.2	603.5	0.3
L	11,250 [2]	190	1,900	4.9	604.1	604.1	604.4	0.3
M	12,650 [2]	203	1,366	6.8	607.8	607.8	608.0	0.2
N	13,310 [2]	92	899	10.4	614.9	614.9	614.9	0.0
O	13,750 [2]	120	1,366	6.8	618.1	618.1	618.1	0.0
P	14,350 [2]	93	947	9.9	620.3	620.3	620.4	0.1
Q	14,830 [2]	224	1,865	3.3	623.3	623.3	623.4	0.1
R	15,830 [2]	83	719	8.5	625.9	625.9	626.5	0.6

[1] Feet Above Confluence With West Fork Dry Comal Creek

[2] Feet Above County Boundary

[3] Width Extends Beyond County Boundary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

WEST FORK TRIBUTARY / YORK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
York Creek (Continued)								
S	16,630	127	1,205	3.6	629.8	629.8	630.8	1.0
T	17,830	135	788	5.5	634.6	634.6	635.0	0.4
U	18,880	115	618	7.0	643.5	643.5	643.5	0.0
V	20,120	243	1,268	3.4	651.8	651.8	652.3	0.5
W	20,830	223	867	5.0	655.8	655.8	656.0	0.2
X	21,830	120	577	7.4	667.0	667.0	667.2	0.2

[1] Feet Above County Boudary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

YORK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Swine Creek								
A	21,328 [1]	158	479	6.5	1,123.2	1,123.2	1,123.7	0.5
B	22,523 [1]	140	483	6.5	1,136.1	1,136.1	1,136.7	0.6
C	23,778 [1]	235	640	4.4	1,154.9	1,154.9	1,155.1	0.2
D	24,733 [1]	145	458	6.2	1,165.6	1,165.6	1,166.1	0.5
E	26,183 [1]	52	163	7.6	1,190.3	1,190.3	1,190.3	0.0
Tribuary No.1 to Swine Creek								
A	1,150 [2]	98	521	7.6	1,119.0	1,119.0	1,119.2	0.2
B	2,050 [2]	190	772	5.1	1,124.4	1,124.4	1,125.2	0.8
C	2,650 [2]	337	915	4.3	1,129.3	1,129.3	1,129.3	0.0
Unnamed Tributary to Tribuary No.1 to Swine Creek								
A	390 [3]	126	149	4.5	1,118.6	1,116.2 [5]	1,116.2	0.0
B	985 [3]	145	224	3.0	1,123.6	1,123.6	1,123.7	0.1
Tribuary No.1 to Swine Creek								
A	570 [4]	70	108	3.2	1,144.7	1,144.7	1,145.6	0.9
B	1,935 [4]	34	56	6.1	1,173.3	1,173.3	1,173.3	0.0
C	2,815 [4]	14	24	7.1	1,208.6	1,208.6	1,208.6	0.0

[1] Distance in feet above confluence with Guadalupe River

[2] Distance in feet above confluence with Swine Creek

[3] Distance in feet above confluence with Tributary No. 1 to Swine Creek

[4] Distance in feet above confluence with Swine Creek

[5] Elevation computed without consiering backwater effects from Tributary No.1 to Swine Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

FLOODWAY DATA

Swine Creek/Tribuary No.1 to Swine Creek/ Unnamed Tributary to Tribuary No.1 to Swine Creek/ Tribuary No.2 to Swine Creek

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
Comal County, Unincorporated Areas	November 9, 1973	None	November 9, 1973	July 1, 1974 May 14, 1976 September 29, 1986 February 4, 1988 June 15, 1988 July 17, 1995
Bulverde, City of	November 9, 1973	None	November 9, 1973	July 1, 1974 May 14, 1976 September 29, 1986 February 4, 1988 June 15, 1988 July 17, 1995
Fair Oaks Ranch, City of	Septermber 2, 2009	None	Septermber 2, 2009	None
Garden Ridge, City of	October 25, 1974	January 30, 1976	April 30, 1986	None
New Braunfels, City of	December 2, 1972	None	December 2, 1972	November 9, 1973 July 1, 1974 September 12, 1975 May 7, 1976 June 17, 1986 May 15, 1991 January 5, 2006
Schertz, City of	March 1, 1974 August 6, 1976	None	September 15, 1977	September 30, 1992 July 17, 1995
Selma, City of	September 2, 2009	None	September 2, 2009	None

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

The countywide FIRM presents flooding information for the entire geographic area of Comal County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFM's), where applicable.

Historical data relating to the maps prepared for each community are presented in Table 10, "Community Map History."

7.0 OTHER STUDIES

No previous studies have been prepared for the countywide Comal County Flood Insurance Study. However, a countywide FIS was being finalized for Guadalupe County at the time of the Comal County FIS preparation. Also, an update of the Bexar County FIS was being performed with a tentative release date of 2007 or 2008.

The hydrologic and hydraulic analyses for the reach of Cibolo Creek from upstream of Interstate Highway 10 to the Comal/Guadalupe County line are based on preliminary models prepared by the USACE Fort Worth District, in support of an ongoing Planning Study for the San Antonio River Authority, the Guadalupe Blanco River Authority and the San Antonio Water System. The USACE study is not complete at the time of this FIS report preparation and both the hydrology and hydraulics modeling are subject to revisions. The USACE modeling represents the best available data for this reach of Cibolo Creek at this time.

Drainage improvements were being designed in the year 2004 by the Comal County Road Department on Schoenthal Road along Bear Creek in the Dry Comal Creek Watershed that would construct 10-foot x 10-foot x 10-foot box culverts in the place of the existing low water crossing. Construction had not started at the time of the countywide FIS report preparation, and the new culverts are not included in the FIS.

A large dry detention facility has also been designed along Dry Comal Creek by CH2M Hill (Dry Comal Creek Dam – Site 11). The construction plans were at the review stage at the time of the FIS report preparation and the facility is not included in the FIS.

A Flood Control project along the South Tributary was under development at the time of the FIS report publication. The project includes channel modifications and storm water detention considering multi-use facilities (trails and recreation fields). Construction is anticipated to be complete by 2007.

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region VI, Federal Regional Center, Room 206, 800 North Loop 288, Denton, Texas 76201-3698.

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