Monday, April 20, 2026
City Council Meeting

City Council Chambers
3815-B Sachse Road
6:30 PM

City Council meetings are available live and on-demand (https://sachsetx.swagit.com/live).

The City of Sachse reserves the right to reconvene, recess, or realign the meeting, called Executive Session, or order of business at any time prior to adjournment.

As authorized by Section 551.071(2) of the Texas Government Code, these meetings may be convened into closed Executive Session at any time during the meeting for the purpose of seeking confidential legal advice from the City Attorney on any agenda item listed herein.

A. Meeting Opening

1. Call to Order: The City Council of the City of Sachse will hold a regular meeting on Monday, April 20, 2026, at 6:30 PM to consider the following items of business:

2. Invocation and Pledges of Allegiance.

B. Recognition

1. Recognize the Community Emergency Response Team (CERT) and Radio Amatuer Civil Emergency Service (RACES) volunteer organizations for their dedication to the City of Sachse.

2. Present a proclamation recognizing National Public Safety Telecommunicators Week.

3. Present a proclamation recognizing the week of April 19-25, 2026, as National Library Week in the City of Sachse.

4. Present a proclamation recognizing April 25, 2026, as Arbor Day in the City of Sachse.

5. Present a proclamation recognizing April 25, 2026, as Keep America Beautiful - Great American Cleanup Day in the City of Sachse.

C. Public Comment

The public is invited to address Council regarding any topic not already on the agenda for action or public hearing. **Comments regarding the Consent Agenda or any discussion-only items on the agenda shall be addressed during this Public Comment section.** The time limit is three minutes per speaker. A Public Comment Card shall be presented to the City Secretary prior to the meeting. According to the Texas Open Meetings Act, Council is prohibited from discussing any item not posted on the agenda but will take comments under advisement.

D. Council/Staff Reports and Updates

1. Report on Public Comment from the April 6, 2026, City Council meeting.

2. Mayor and City Council announcements regarding special events, current activities, and local achievements.

E. Consent Agenda

Consent Agenda items are routine or administrative in nature, have been discussed previously at a Council meeting, and/or do not warrant discussion. Council will act upon these items with one motion. There will be no separate discussion of these items unless a Councilmember requests the item be removed from the consent agenda. **If you have comments related to items on the Consent Agenda, please address them in the Public Comment section of the meeting.**

1. Approve the April 6, 2026, meeting minutes.

2. Authorize the City Manager to award and execute the construction contract for West Creek Lane Reconstruction, BP-21-B02, to Axis Contracting Inc. in the amount of One Million, Three Hundred Forty-Seven Thousand, Eighty-Five and 15/100 Dollars ($1,347,085.15).

3. Authorize the City Manager to award and execute the construction contract for Woodbridge Parkway project, R-24-03, to Garret Shields Infrastructure, LLC in the amount of One Million, Six Hundred Thirty-Five Thousand, Two Hundred Eighty-Three and No/100 Dollars ($1,635,283.00).

F. Action Items

Action items are for Council discussion and consideration for action. **The Mayor will invite comments before the Council votes.** A Public Comment Card shall be given to the City Secretary prior to the start of the meeting.

1. Conduct a public hearing and consider approving an ordinance amending the Comprehensive Zoning Ordinance and Map, as heretofore amended; to grant a change of zoning from Residential-1 District (R-1) to Agricultural District (AG) on a ±4.0 acre tract of land situated in the James C. Tucker Survey, Abstract No. 1464, City of Sachse, Dallas County, Texas, said tract being all of a called 4.0 acre tract of land conveyed to Garland Independent School District (ISD) in a general warranty deed recorded in document No. 201800060483 of the official public record of Dallas County, Texas (O.P.R.D.C.T.), being more particularly described in "Exhibit A" and shown in "Exhibit B"; providing a conflicts resolution clause; providing a severability clause; providing a savings clause; providing a penalty of fine not to exceed the sum of Two Thousand Dollars ($2,000.00) for each offense; and providing an effective date.

2. Conduct a public hearing and consider approving an ordinance amending Chapter 8 “Subdivisions,” by amending Section 8-14 titled “Completion and maintenance of public improvements”; by amending Subsections 8-14a(3) and 8-14d(1); by amending Section 8-15 titled “General requirements and design standards” by amending Sections 8-15B(3)(b) and 8-15F(3); by amending Section 8-18 titled “Street design construction costs” by amending Subsection 18-8b; amending Section 8-20 titled “Impact fees” by amending Subsections 8-20B and 8-20C(1); and by amending Exhibit 11A titled “Zoning Ordinance” by amending Article 3 titled “Districts” by amending Section 11 titled “SP-special use permits” by amending 11.2 titled “Use regulations”; by amending Article 4 titled “General provisions applying to all or several districts” by amending Section 11 titled “Landscaping and screening” by amending 11.4 titled “Required landscaping” by amending 11.4d titled “Single-family residential development requirements” by amending 11.4d4 titled “Masonry wall required”; and by amending 11.6 titled “Screening standards” by amending 11.6d titled “Masonry wall standards” by amending 11.6d1 titled “Design and materials”; and by amending 11.6d6(c) titled “Additional requirements”; providing a conflicts clause; providing a repealing clause; providing a severability clause; providing a savings clause; providing a penalty of fine not to exceed Two Thousand Dollars ($2,000.00); and providing an effective date.

3. Consider approving an ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 3 “Building Regulations” by amending Article I “In General” by amending Section 3-13 “Standards for Construction of Public Facilities”; by deleting Section 3-17 “Drainage and Stormwater Control” in its entirety; by renumbering Sections 3-18 through 3-56; by amending Section 3-24 “Flatwork Requirements”; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed Five Hundred Dollars ($500.00); and providing for an effective date.

4. Discuss and consider approving an ordinance adopting revisions to the City of Sachse Engineering Design Manual; providing a repealing clause; providing a severability clause; and providing for an effective date.

5. Consider approving an ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 9 "Traffic Regulations" by amending Section 9-6 "Parking" by amending 9-6A "Truck Parking" by amending 9-6A(1) "Unlawful"; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed Five Hundred Dollars ($500.00); and providing for an effective date.

G. Discussion Items

These items are for Council and staff to discuss as needed. **Comments on Discussion Items shall be addressed in the Public Comment Section of this meeting.**

1. Receive the quarterly 2021 Bond update.

2. Discuss the implementation of the Sachse Safe Paws program.

3. Receive the Sachse Public Library's 2025 year end review presentation.

4. Discuss and review applications for the 2026 City of Sachse Scholarship.

H. Adjournment

I, the undersigned authority, do hereby certify that this notice of a public meeting was posted in accordance with the regulations of the Texas Open Meetings Act and was posted on the bulletin board, an accessible location at Sachse City Hall, on April 14, 2026, by 7 PM.

_____ _____

Leah K Granger, TRMC, City Secretary Date removed

Accommodation requests for persons with disabilities should be made at least 48 hours prior to the meeting by contacting Logan Thatcher, ADA Coordinator, via phone at 972-495-1212, via email at lthatcher@cityofsachse.com, or by appointment at 3815 Sachse Road, Building B, Sachse, Texas 75048.

B. Recognition

Subject:	**1. Recognize the Community Emergency Response Team (CERT) and Radio Amatuer Civil Emergency Service (RACES) volunteer organizations for their dedication to the City of Sachse.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Recognition
Fiscal Impact	None
Recommended Action	Recognize the Community Emergency Response Team (CERT) and Radio Amatuer Civil Emergency Service (RACES) volunteer organizations for their dedication to the City of Sachse.
Goals	Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse. Meet the public safety needs of a growing citizen; student; and business population.

BACKGROUND

The CERT and RACES volunteer organizations consistently assist the City in a variety of ways and do so without seeking recognition. They are dedicated to serving the community, and their service is often critical to the success of our mission, programs, scene management, and more. They respond to structure fires, City events, disasters, and much more. These organizations are always ready to assist when needed.

POLICY CONSIDERATIONS

There are no policy considerations.

RECOMMENDATION

Recognize the Community Emergency Response Team (CERT) and Radio Amatuer Civil Emergency Service (RACES) volunteer organizations for their dedication to the City of Sachse.

File Attachments
None

B. Recognition

Subject:	**2. Present a proclamation recognizing National Public Safety Telecommunicators Week.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Recognition
Fiscal Impact	None
Recommended Action	Present a proclamation recognizing National Public Safety Telecommunicators Week.
Goals	Provide excellent government services to Sachse citizens. Meet the public safety needs of a growing citizen; student; and business population.

BACKGROUND

Emergencies can occur at any time and a prompt response is critical to the protection of life and preservation of property. Public Safety Telecommunicators serve as the vital link between residents and first responders when emergencies occur. National Public Safety Telecommunicators Week is April 12–18.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Present a proclamation recognizing National Public Safety Telecommunicators Week.

File Attachments
1. Proclamation_Public Safety Telecommunicators Week_2026

Proclamation

City of Sachse, Texas

Whereas, emergencies can occur at any time that require police, fire, or EMS services, and the prompt response of police officers, firefighters, and paramedics is critical to the protection of life and the preservation of property; and

Whereas, the safety of our first responders is dependent upon the quality and accuracy of information obtained from citizens who telephone Sachse Dispatch, and Public Safety Telecommunicators are the first and most critical contact the public has with emergency services; and

Whereas, serving as the single, vital link for our officers, firefighters, and paramedics by monitoring their activities by radio, providing them information, and ensuring their safety, Public Safety Telecommunicators of the City of Sachse have contributed substantially to the apprehension of criminals, suppression of fires, and treatment of patients; and

Whereas, each dispatcher has exhibited compassion, understanding, and professionalism during the performance of his or her job in the past year.

Now, Therefore, I, Jeff Bickerstaff, Mayor of the City of Sachse, do hereby proclaim the week of April 12 – 18 as **National Public Safety Telecommunicators Week** in Sachse in honor of the men and women whose diligence and professionalism keep our city and the public safe.

In Witness Whereof, I have hereunto set my hand and caused the Seal of the City of Sachse, Texas, to be affixed on this 20th day of April 2026.

Gold Seal

Jeff Bickerstaff, Mayor

B. Recognition

Subject:	**3. Present a proclamation recognizing the week of April 19-25, 2026, as National Library Week in the City of Sachse.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Recognition
Fiscal Impact	None
Recommended Action	Present a proclamation recognizing the week of April 19-25, 2026, as National Library Week.
Goals	Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse.

BACKGROUND

National Library Week, April 19–25, 2026, is a time to celebrate the many ways libraries bring people together, spark imagination, and support lifelong learning. First celebrated in 1958, National Library Week is a national observance sponsored by the American Library Association and libraries of all types across the country each April.

Randall Cross, Manager of Library Services, will accept the proclamation.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Present a proclamation recognizing the week of April 19-25, 2026, as National Library Week.

File Attachments
1. Proclamation_National Library Week_2026

Proclamation

City of Sachse, Texas

Whereas, libraries offer the opportunity for residents to connect with others, learn new skills, and pursue their passions, no matter where they are on life's journey; and

Whereas, libraries adapt to the ever-changing needs of their communities, developing and expanding collections, programs, and services that are as diverse as the populations they serve; and

Whereas, libraries are accessible and inclusive places that promote a sense of local connection, advancing understanding, civic engagement, and shared community goals; and

Whereas, libraries are an essential public good and are fundamental institutions in democratic societies, working to improve society, protect the right to education and literacy, and promote the free exchange of information and ideas for all; and

Whereas, libraries, librarians, and library workers are joining library supporters and advocates across the nation to celebrate National Library Week with the theme "Find Your Joy."

Now, Therefore, I, Jeff Bickerstaff, Mayor of the City of Sachse, do hereby proclaim April 19-25, 2026, as **National Library Week** in Sachse and encourage all residents to connect with their library by visiting online or in-person to access resources and services.

In Witness Whereof, I have hereunto set my hand and caused the Seal of the City of Sachse, Texas, to be affixed on this 20th day of April 2026.

Gold Seal

Jeff Bickerstaff, Mayor

B. Recognition

Subject:	**4. Present a proclamation recognizing April 25, 2026, as Arbor Day in the City of Sachse.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Recognition
Fiscal Impact	None
Recommended Action	Present a proclamation recognizing April 25, 2026, as Arbor Day in the City of Sachse.
Goals	Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse.

BACKGROUND

This year marks the 17th celebration of Arbor Day in the City of Sachse and the 18th year the City has received the designation as a “Tree City USA”. Sachse is proud to be an active community that recognizes the importance of having healthy trees and understands the long-term benefits of tree conservation.

In recognition of the event, the City will host an Arbor Day celebration on April 25, 2026, at the Michael J. Felix Community Center. Volunteer groups will be at various parks and open spaces in Sachse cleaning, planting flowers, and planting trees.

Leisure Services Coordinator Jordan Beaulieu and Recreation Manager Cynthia Wiseman will accept the proclamation.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Present a proclamation recognizing April 25, 2026, as Arbor Day in the City of Sachse.

File Attachments
1. Proclamation_Arbor Day_2026

Proclamation

City of Sachse, Texas

Whereas, in 1872, J. Sterling Morton proposed to the Nebraska Board of Agriculture that a special day be set aside for the planting of trees, which became known as Arbor Day and is now observed throughout the nation and the world; and

Whereas, trees can reduce erosion of our precious topsoil by wind and water, decrease heating and cooling costs, clean the air, produce life-giving oxygen, and provide a habitat for wildlife; and

Whereas, trees are a renewable resource giving us wood for our homes, fuel for our fires, and paper for learning, communication, and entertainment; and

Whereas, trees beautify our community, increase property values, and enhance the economic vitality of business areas, and wherever planted, trees become a source of joy and spirituality.

Now, Therefore, I, Jeff Bickerstaff, Mayor of the City of Sachse, do hereby proclaim April 25, 2026, as **Arbor Day** in the City of Sachse and encourage all to celebrate by supporting efforts to protect our trees and woodlands.

In Witness Whereof, I have hereunto set my hand and caused the Seal of the City of Sachse, Texas, to be affixed on this 20th day of April 2026.

Gold Seal

Jeff Bickerstaff, Mayor

B. Recognition

Subject:	**5. Present a proclamation recognizing April 25, 2026, as Keep America Beautiful - Great American Cleanup Day in the City of Sachse.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Recognition
Fiscal Impact	None
Recommended Action	Present a proclamation recognizing April 25, 2026, as Keep America Beautiful - Great American Cleanup Day in the City of Sachse.
Goals	Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse.

BACKGROUND

The Keep America Beautiful - Great American Cleanup is the nation's largest annual community improvement program that the City of Sachse has participated in for the past 15 years. This is an outstanding community program where people of all ages may participate. In 2025, 3,120 pounds of trash were collected throughout the city as a part of the event. More than 225 individuals participated in the cleanup and collectively put in over 498 volunteer hours on beautification, cleanup projects, and planted 40 flowers. This year's event will be hosted on Saturday, April 25, 2026.

Leisure Services Coordinator Jordan Beaulieu and Recreation Manager Cynthia Wiseman will accept the proclamation.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Present a proclamation recognizing April 25, 2026, as Keep America Beautiful - Great American Cleanup Day in the City of Sachse.

File Attachments
1. Proclamation_Great American Cleanup_2026

Proclamation

City of Sachse, Texas

Whereas, Keep America Beautiful, Inc., a national not-for-profit organization dedicated to helping individuals improve their community environment, has established the Great American Cleanup as its signature national effort for involving American citizens in environmental stewardship; and

Whereas, the City of Sachse is proud of its natural resources and neighborhoods and seeks to protect and improve the community through the action of the individuals, schools, governments, and businesses working together; and

Whereas, the President of the United States of America has recognized the important commitment to improve American communities through litter prevention, beautification, and solid waste management initiatives and has assumed the title of Honorary Chair of the Keep America Beautiful - Great American Cleanup.

Now, Therefore, I, Jeff Bickerstaff, Mayor of the City of Sachse, do hereby proclaim April 25, 2026, as **Keep America Beautiful – Great American Cleanup Day** in Sachse and call upon the public to join in activities that promote responsible, environmental stewardship and help us renew our commitment to building a better world for future generations.

In Witness Whereof, I have hereunto set my hand and caused the Seal of the City of Sachse, Texas, to be affixed on this 20th day of April 2026.

Gold Seal

Jeff Bickerstaff, Mayor

E. Consent Agenda

Subject: **1. Approve the April 6, 2026, meeting minutes.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Action (Consent), Minutes
Fiscal Impact	None
Recommended Action	Approve the minutes as presented.
Goals	

BACKGROUND

Minutes from the April 6, 2026, Council regular meeting.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Approve the minutes as presented.

File Attachments
1. CityCouncil_Regular_Minutes_04.06.2026-unsigned

CITY COUNCIL OF THE CITY OF SACHSE
APRIL 6, 2026, MEETING MINUTES

The City Council of the City of Sachse held a regular meeting on Monday, April 6, 2026, at 6:30 PM at Sachse City Hall, 3815-B Sachse Road. Those present were: Mayor Jeff Bickerstaff, Mayor Pro Tem Brett Franks, Councilmember Michelle Howarth, Councilmember Frank Millsap, Councilmember Chance Lindsey, Councilmember Lindsay Buhler, Councilmember Matt Prestenberg.

A. Meeting Opening

1. Call to Order: The City Council of the City of Sachse will hold a regular meeting on Monday, April 6, 2026, at 6:30 PM to consider the following items of business:

Mayor Bickerstaff called the meeting to order at 6:30 PM.

2. Invocation and Pledges of Allegiance.

Councilmember Howarth offered the invocation and Councilmember Buhler led the pledges.

B. Recognition

1. Present a proclamation to recognize Animal Care and Control Appreciation Week.

Mayor Bickerstaff presented a proclamation to the Animal Services staff to recognize Animal Care and Control Appreciation Week.

2. Present a proclamation recognizing the months of March, April, and May 2026 as North Texas Community Cleanup Challenge months in the City of Sachse.

Mayor Bickerstaff read a proclamation to recognize the Texas Community Cleanup Challenge in March, April, and May 2026.

C. Public Comment

The public is invited to address Council regarding any topic not already on the agenda for action or public hearing. **Comments regarding the Consent Agenda or any discussion-only items on the agenda shall be addressed during this Public Comment section.** The time limit is three minutes per speaker. A Public Comment Card shall be presented to the City Secretary prior to the meeting. According to the Texas Open Meetings Act, Council is prohibited from discussing any item not posted on the agenda but will take comments under advisement.

Mayor Bickerstaff acknowledged a comment received from Sachse resident, Carmen Bradley, and Councilmembers received a copy of the comment.

D. Council/Staff Reports and Updates

1. Report on Public Comment from the March 2, 2026, City Council meeting.

Mayor Bickerstaff addressed comments from the March 2, 2026, City Council meeting.

"I'll start with Jayne Reed, Ms. Reed had some questions and her response to her questions

regarding the railroad easement and mowing questions along State Highway 78. Staff met with the railroad last fall to discuss expectations and coordination related to the maintenance of the railroad easement and to ensure a more proactive approach for the upcoming growing season. Regarding the pour-in-place surface used at the Heritage Park playground, it is designed and tested to withstand temperatures in the range of approximately 140–160 degrees, which is consistent with industry standards for this type of recreational surfacing. The dark blue color was intentionally chosen to match the pour-in-place surfacing on the upper level of the playground as well as the existing playground equipment, helping maintain a consistent design throughout the play area.

The next comments were from Mr. Tim Brooks and Ms. Tracy Brooks regarding the City to evaluate street naming standards. I have asked staff to review these standards as part of a larger review of the City's subdivision ordinance. It is anticipated that the initial review will first be presented to the Planning and Zoning Commission and then subsequently to the City Council.

Lastly, the comments from Mr. Holbolke. The Bailey Road Project. At the time, Mr. Holbolke stated, "You spent over $900,000 to design it. You had 16 months to do it, and your contract management and procedures were so good that you had to let it twice, and then you had to overpay $500,000." Mr. Holbolke continues a pattern of misrepresenting the facts. Mr. Holbolke's claim that the City "overpaid" ignores what actually happened in the procurement process. The first round of bids was rejected because the submissions were incomplete and raised significant concerns. That is not poor management, that is responsible management. The City then moved to a best qualified procurement approach, so staff could evaluate not just price, but also experience, staffing, schedule, and past performance to help ensure the best result for our residents. Rejecting questionable bids and rebidding a project under a better evaluation method is not a failure. It is exactly what good contract management looks like, something Mr. Holbolke should know as a registered professional civil engineer.

Mr. Holbolke then stated, "Well, in 2025, we had normal precipitation, wasn't a big rain year, big amount of rain early, some rain at the lake and a big dry period during peak construction season." That statement is also not supported by the facts. Based on data from several personal weather stations in Sachse, one of which is a NWS co-op station, including one on Bailey Road, Sachse received nearly 11 inches more rain than normal in 2025, with nearly 5 inches above normal during the critical April through October construction window. So, to describe 2025 in Sachse as a "normal" or "dry" year during peak construction season is pure fantasy.

Then Mr. Holbolke stated, "Jeff, I never said the project was gonna be done by Memorial Day or Labor Day or whatever came out of your lying mouth. I said, if it's gonna ice for a week and you can have no rain, it very well could be that far. But I didn't say it was, and you knew I didn't. But you're a coward, and you like to talk last, and you hide behind things." Despite Mr. Holbolke's insults and denials, the record speaks for itself. During the January 20, 2026, meeting, Mr. Holbolke stated: "Bailey Road. It rained last week. So does that mean it's going to be ready around Labor Day now?" The video and transcript of Mr. Holbolke's comments are on the City's website for everybody to see. When Mr. Holbolke's own statements are read back into the record, Mr. Holbolke pivots to insults, hostility, and personal attacks.

Let me be clear: Sachse welcomes disagreement, questions, and scrutiny. What I am not going to do is allow Mr. Holbolke to distort the facts, attack staff, and then hide behind semantics when the facts prove inconvenient. If Mr. Holbolke continues to misrepresent the

record, then I will correct that record publicly and clearly every single time."

2. Mayor and City Council announcements regarding special events, current activities, and local achievements.

Councilmember Buhler thanked everyone who supported the Easter Egg Hunts on March 28 and helped make it a success. She announced the next Pop-Up Park event on April 18 and the Arbor Day Jubilee and Great American Cleanup on April 25. Volunteers will gather at the Michael J. Felix Community Center at 9 AM for the opportunity to give back to the community. Free gift-trees will be distributed on a first-come, first-served basis. Register your family or group on the City's website. Councilmember Prestenberg introduced Atlas, the featured pet. This sweet, two-year-old Husky-mix male is ready for a family. Please contact the Sachse Animal Shelter at 972-675-9662. Councilmember Millsap announced events at the Library including a community-wide food drive through April 13, Button Making Try a Hobby on April 8, and the Make & Mingle: Sequin Eggs on April 15.

Ms. Nash welcomed new employees Nick Rivas as Animal Services Shelter Attendant and Miguel Quintero as Senior Neighborhood Services Specialist. She recognized Neighborhood Services Manager Christina Raemhild for her creative problem-solving and initiative related to the X-Treme Green event. Ms. Raemhild reflected the City's core value, Innovative.

Mayor Bickerstaff suggested residents mark their calendars for the X-Treme Green event on May 16 from 8 AM to 1 PM. The event will move to Heritage Park at 4408 Hudson Drive this year. Read more about this event on the City's website. He encouraged residents to sign up for emergency Nixle alerts by texting "75048" to 888777. The City is also giving away 10 weather radios this week. Check out the City's social media channels and the Sachse Scene newsletter for details on how to enter. He also noted that the splash pads at J.K. Sachse Park and Heritage Park are now open from 9 AM to 9 PM through October 31.

E. Consent Agenda

Consent Agenda items are routine or administrative in nature, have been discussed previously at a Council meeting, and/or do not warrant discussion. Council will act upon these items with one motion. There will be no separate discussion of these items unless a Councilmember requests the item be removed from the consent agenda. **If you have comments related to items on the Consent Agenda, please address them in the Public Comment section of the meeting.**

1. Approve the February 21, 2026, special meeting minutes.

2. Approve the March 2, 2026, meeting minutes.

3. Accept the monthly revenue and expenditure report for the period ending January 31, 2026.

4. Accept the monthly revenue and expenditure report for the period ending February 28, 2026.

5. Approve a resolution amending the Master Fee Schedule adopted by Resolution R-2026-02 by amending donation bin fees; and providing an effective date.

Councilmember Howarth made a motion to approve the Consent Agenda as presented. Councilmember Prestenberg seconded the motion, and it carried 6 - 0. None voted against.

F. Discussion Items

These items are for Council and staff to discuss as needed. **Comments on Discussion Items shall be addressed in the Public Comment Section of this meeting.**

1. Discuss and provide direction for the proposed infrastructure and software updates to the Garland, Mesquite, Rowlett, Sachse (GMRS) radio system.

Councilmember Franks arrived at 6:56 PM.

Police Chief Sylvester provided an overview of the Garland, Mesquite, Rowlett, Sachse (GMRS) radio system. The dispatch consoles and other critical hardware are approaching the end of support in 2028. Motorola presented an option to receive equipment in FY 26/27 and defer payment until FY 27/28. Chief Sylvester recommends the deferred payment option rather than the alternative of delaying purchase of new consoles. The delayed purchase increases the risk of failure of the current consoles as well as increased costs. Ms. Nash included that the presentation and discussion are intended to give Council an opportunity to provide direction for the budget preparation. Council provided feedback and asked clarifying questions. The general direction was to proceed with the deferred payment option.

G. Executive Session

1. The City Council shall convene into Executive Session pursuant to the Texas Government Code, Section §551.074 Personnel Matters: Regarding the annual review of the Municipal Judge.

2. The City Council shall convene into Executive Session pursuant to Texas Government Code Section §551.087 Economic Development Deliberations: Deliberate the offer of a financial or other incentive relating to the development of Project Yellow Jacket.

Mayor Bickerstaff adjourned the Council to Executive Session at 7:19 PM.
The Council returned to Regular Session at 7:56 PM.

H. Action Resulting from Executive Session

Action items are for Council discussion and consideration for action. **The Mayor will invite comments before the Council votes.** A Public Comment Card shall be given to the City Secretary prior to the start of the meeting.

1. Take any action as a result of Executive Session regarding the annual review of the Municipal Judge.

No action was taken.

2. Take any action as a result of Executive Session regarding Project Yellow Jacket.

Sachse resident, Fred Burlbaw, addressed Council regarding the details of the project.

Councilmember Buhler made a motion to authorize the Executive Director of the Sachse Economic Development Corporation to negotiate and execute an incentive agreement for Project Yellow Jacket and any amendments and instruments related thereto. Councilmember Prestenberg seconded the motion, and it carried 7 - 0. None voted against.

I. Adjournment

Mayor Bickerstaff adjourned the meeting at 7:59 PM.

_____
Jeff Bickerstaff, Mayor

ATTEST:

_____
Leah K Granger, TRMC, City Secretary

Subject:	**2. Authorize the City Manager to award and execute the construction contract for West Creek Lane Reconstruction, BP-21-B02, to Axis Contracting Inc. in the amount of One Million, Three Hundred Forty-Seven Thousand, Eighty-Five and 15/100 Dollars ($1,347,085.15).**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Action (Consent)
Fiscal Impact	Yes
Dollar Amount	$1,347,085.15
Budgeted	Yes
Budget Source	2021 Bond Funds
Recommended Action	Authorize the City Manager to execute and award the construction contract for West Creek Lane Reconstruction, BP-21-B02, to Axis Contracting Inc. in the amount of One Million, Three Hundred Forty-Seven Thousand, Eighty-Five and 15/100 Dollars ($1,347,085.15).
Goals	Strategically invest in the City's existing and future infrastructure.

BACKGROUND

West Creek Lane Reconstruction is the third roadway project of the 2021 Bond package. It includes the reconstruction of approximately 1,500 linear feet of West Creek Lane. The road will be constructed as a 29-foot wide concrete section with a 5-foot wide sidewalk. Drainage will be enclosed within a storm drain system. No right-of-way acquisition is required for this project. Franchise utility coordination has begun.

A pre-bid meeting was held on March 17, 2026, and bids were opened on March 31, 2026. The project was advertised in the Sachse News and online via www.CivCast.com, and a total of 12 bids were received. City staff and the design team reviewed and ranked each applicant on the following criteria:

- Proposed Contract Amount (50%)
- Similar Project Experience (10%)
- Quality of Bidders Goods and Services (10%)
- Qualifications of Project Personnel (10%)
- Project Delivery Schedule (10%)
- Reputation/Familiarity of Bidder (10%)

Based on review of the contract documents and evaluations of each bidder, the contractor that provides the best value to the City is Axis Contracting Inc. The total construction contract amount is under the original 2021 construction budget of $2,680,000.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Authorize the City Manager to execute and award the construction contract for West Creek Lane Reconstruction, BP-21-B02, to Axis Contracting Inc. in the amount of One Million, Three Hundred Forty-Seven Thousand, Eighty-

Five and 15/100 Dollars ($1,347,085.15).

File Attachments
1. Presentation_West Creek Lane Construction Award_FINAL

West Creek Lane Construction Contract Award (BP-21-B02)

City Council

April 20, 2026

Overview

- Project Location
- Project Description
- Bid Process
- Bid Evaluations
- Staff Recommendation

The City of SACHSE

Project Location

Project Description

- This is the third roadway design project started under the 2021 Bond package
- Reconstruction of approximately 1,500 linear feet of existing asphalt street with 29-foot-wide concrete section with 5-foot sidewalks
- Drainage will be enclosed within a storm drainage system with additional improvements on side streets
- There are no sewer lines within the project limits
- There is no right-of-way acquisition required for this project
- Franchise utility relocations are being coordinated

The City of SACHSE

Bid Process

- The project was advertised in the Sachse News and online via CivCast. A total of 13 bids were received
- Bids were opened on March 31, 2026
- One bid was withdrawn by the bidder. Several bids were considered non-responsive due to incomplete submittals or nonconformance with contract provisions. Those bidders were rejected

Bid Process

- Bids were evaluated based on the criteria listed in the contract
- City staff and the design team reviewed and ranked each applicant on the following criteria:
  - Proposed contract amount (50%)
  - Similar project experience (10%)
  - Quality of bidder's goods and services (10%)
  - Qualifications of project personnel (10%)
  - Project delivery schedule (10%)
  - Reputation/familiarity of bidder (10%)
- Based on review of the contract documents and evaluations of each bidder, the contractor that provides the best value to the City of Sachse is Axis Contracting Inc.

The City of SACHSE

Staff Recommendation

- Staff recommends Axis Contracting Inc. to be awarded the construction contract for the West Creek Lane reconstruction project, BP-21-B02, in the amount of One Million, Three Hundred Forty-Seven Thousand, Eighty-Five and 15/100 Dollars ($1,347,085.15)
- This contract will be funded from 2021 Bond funds
- The total construction contract amount is under the original 2021 construction budget of $2,680,000.00

The City of SACHSE

Questions?

Subject: **3. Authorize the City Manager to award and execute the construction contract for Woodbridge Parkway project, R-24-03, to Garret Shields Infrastructure, LLC in the amount of One Million, Six Hundred Thirty-Five Thousand, Two Hundred Eighty-Three and No/100 Dollars ($1,635,283.00).**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Action (Consent)
Fiscal Impact	Yes
Dollar Amount	$1,635,283.00
Budgeted	Yes
Budget Source	General Fund, Street Maintenance Sales Tax
Recommended Action	Authorize the City Manager to award and execute the construction contract for Woodbridge Parkway project, R-24-03, to Garret Shields Infrastructure, LLC in the amount of One Million, Six Hundred Thirty-Five Thousand, Two Hundred Eighty-Three and No/100 Dollars ($1,635,283.00).
Goals	Strategically invest in the City's existing and future infrastructure.

BACKGROUND

Woodbridge Parkway was originally constructed in 1998 with Woodbridge Phase 1. The roadway has deteriorated, and several panels need replacement. The project will replace approximately 3,470 linear feet of concrete beginning at SH 78 to Creek Crossing Lane. No right-of-way acquisition is required for this project. Franchise utility coordination has begun.

A pre-bid meeting was held March 19, 2026, and bids were opened on April 2, 2026. The project was advertised in the Sachse News and online via www.CivCast.com. A total of 16 bids were received.

Based on review of the contract documents, the lowest responsive bidder is Garret Shields Infrastructure, LLC. The total construction contract amount is under the original construction budget of $2,700,000.00.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Authorize the City Manager to award and execute the construction contract for Woodbridge Parkway project, R-24-03, to Garret Shields Infrastructure, LLC in the amount of One Million, Six Hundred Thirty-Five Thousand, Two Hundred Eighty-Three and No/100 Dollars ($1,635,283.00).

File Attachments
1. Presentation_Woodbridge Parkway Construction Contract Award_FINAL

Woodbridge Parkway Construction Contract Award (R-24-03)

City Council

April 20, 2026

Overview

- Project Location
- Project Description
- Bid Process
- Staff Recommendation

Project Location

Project Description

- Originally constructed in 1998 with Woodbridge Phase 1
- Over time, the roadway has deteriorated and several panels need replacement
- Reconstruct approximately 3,470 linear feet of concrete from SH 78 to Creek Crossing Lane
- Maximize funding by replacing panels rather than entire road

Bid Process

- Project was advertised in March
- Bids were opened on April 2
- Bids were evaluated based on the “lowest responsive bidder”
- A total of 16 Bids were received
- Based on the review of the contract documents, the lowest responsive bidder is Garret Shields Infrastructure, LLC

Staff Recommendation

- Staff recommends authorizing the City Manager to execute and award the construction contract for Woodbridge Parkway project, R-24-03, to Garret Shields Infrastructure, LLC in the amount of One Million, Six Hundred Thirty-Five Thousand, Two Hundred Eighty-Three and No/100 dollars ($1,635,283.00)
- The total construction contract amount is under the original construction budget of $2,700,000.00

Questions?

F. Action Items

Subject: **1. Conduct a public hearing and consider approving an ordinance amending the Comprehensive Zoning Ordinance and Map, as heretofore amended; to grant a change of zoning from Residential-1 District (R-1) to Agricultural District (AG) on a ±4.0 acre tract of land situated in the James C. Tucker Survey, Abstract No. 1464, City of Sachse, Dallas County, Texas, said tract being all of a called 4.0 acre tract of land conveyed to Garland Independent School District (ISD) in a general warranty deed recorded in document No. 201800060483 of the official public record of Dallas County, Texas (O.P.R.D.C.T.), being more particularly described in "Exhibit A" and shown in "Exhibit B"; providing a conflicts resolution clause; providing a severability clause; providing a savings clause; providing a penalty of fine not to exceed the sum of Two Thousand Dollars ($2,000.00) for each offense; and providing an effective date.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Public Hearing, Discussion, Action
Fiscal Impact	None
Recommended Action	Conduct a public hearing and approve the proposed rezoning request from Garland ISD.
Goals	

BACKGROUND

- The subject property consists of one tract of land and is currently vacant.
- Zone change request from R-1 Single Family Residential District to AG - Agricultural District.
- Applicant: VLK Architects
- Owner: Garland Independent School District
- Size: Approximately 4.0 acres
- Site Attributes: Vacant

The subject property is identified as Estate Residential on the Future Land Use Plan, which calls for large single-family lots with large street setbacks, minimal pedestrian amenities and open spaces. The applicant has stated in their request they intend to construct a new Agricultural Sciences building on the lot for Garland Independent School District. Properties surrounding this parcel are identified for Estate Residential uses in the Comprehensive Plan. The proposed rezoning request and uses are consistent with the vision identified in the Comprehensive Plan and are in compliance with the Future Land Use Plan.

At its March 23 regular meeting, the Planning & Zoning Commission voted 5-1 to recommend approval of the proposed zoning change as presented to the City Council.

POLICY CONSIDERATIONS

State law requires that zoning decisions must be adopted in accordance with the City's adopted Comprehensive Plan.

RECOMMENDATION

Conduct a public hearing and approve the proposed rezoning request from Garland ISD.

File Attachments
1. Presentation_GISD Rezone_REZ-2026-0001_FINAL
2. Ordinance Change in Zoning 4.0 Acres Garland ISD Owner from R-1 to AG_FINAL

Garland Independent School District Rezoning Request (REZ-2026-0001)

City Council

April 20, 2026

Request

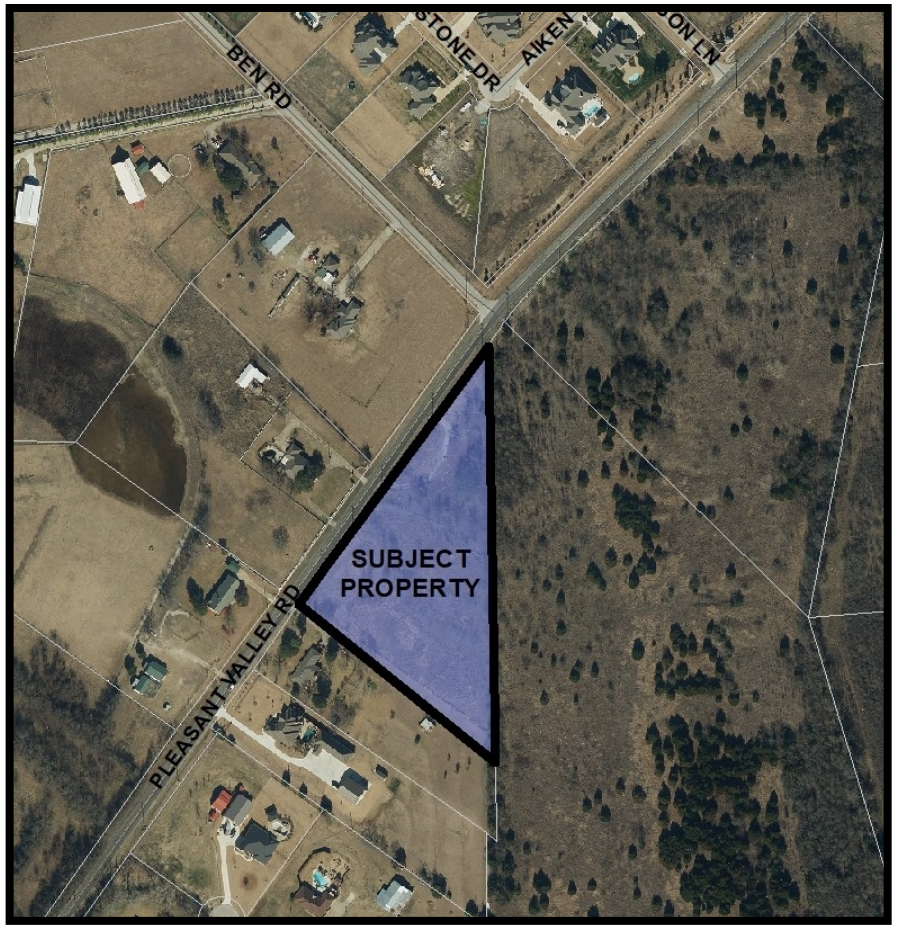
Conduct a public hearing and consider approval of a request by VLK Architects to rezone approximately four acres of land from R-1 Single Family Residential District to AG, Agricultural District, generally located southwest of the intersection of Ben Road and Pleasant Valley Road, within Sachse city limits.

Project Information

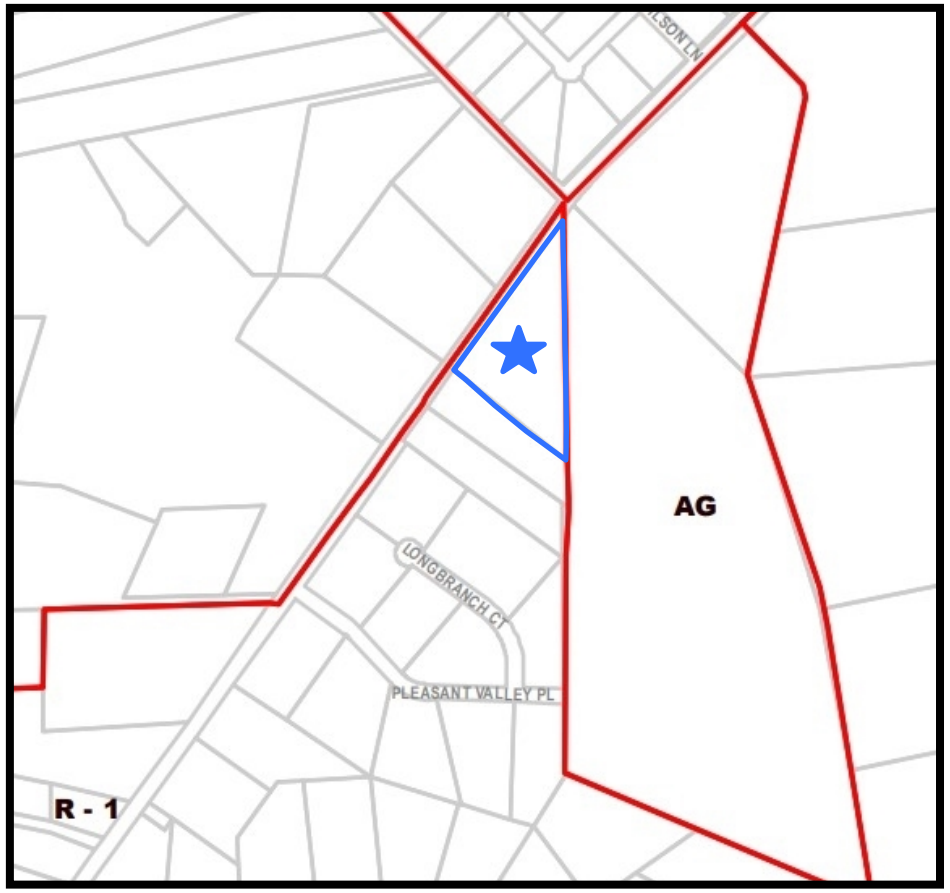
- Proposal to rezone property from R-1 Single Family Residential District to AG - Agricultural District
- Applicant: VLK Architects
- Owner: Garland Independent School District
- Size: Approximately four acres
- Site Attributes: Property is unplatted and currently vacant

Aerial Map

The property is located southwest of the Ben Road and Pleasant Valley Road intersection, within Sachse city limits.



Zoning Map



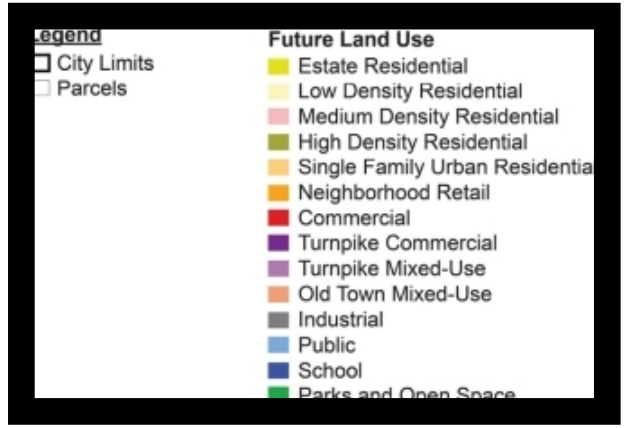
The property is zoned R-1. The blue star indicates the subject property.

AG Zoning District Standards

- Minimum Lot Area: five acres
- Minimum Building Size: 2,000 square feet (exclusive of garages)
- Maximum Height: two stories
- Minimum width at Building Line: 150’
- Minimum width at Street ROW: 150’

Future Land Use Plan (FLUP)

- The Future Land Use Plan (FLUP) designates the subject property for Estate Residential, which is described as “large single-family lots with large street setbacks, minimal pedestrian amenities and open spaces”.
- State law requires that zoning decisions “must be adopted in accordance with a Comprehensive Plan”.
- The FLUP supports the proposed rezoning request.



Recommendation

Staff recommends approval of the proposed rezoning request for the following reasons:

- The proposed rezoning request is consistent with the goals and objectives of the Comprehensive Plan and is in compliance with the Future Land Use Plan.
- The permitted uses within the proposed rezoning request would be consistent with surrounding residentially zoned and developed land.

At their March 23 regular meeting, the Planning & Zoning Commission voted 5-1, with 5 votes for approval and 1 abstention, to recommend approval of the proposed zoning change as presented.

Questions?

ORDINANCE NO. O-2026-_____

AN ORDINANCE OF THE CITY OF SACHSE, TEXAS, AMENDING THE COMPREHENSIVE ZONING ORDINANCE AND MAP, AS HERETOFORE AMENDED; TO GRANT A CHANGE OF ZONING FROM RESIDENTIAL-1 DISTRICT (R-1) TO AGRICULTURAL DISTRICT (AG) ON A ±4.0 ACRE TRACT OF LAND SITUATED IN THE JAMES C. TUCKER SURVEY, ABSTRACT NO. 1464, CITY OF SACHSE, DALLAS COUNTY, TEXAS, SAID TRACT BEING ALL OF A CALLED 4.0 ACRE TRACT OF LAND CONVEYED TO GARLAND INDEPENDENT SCHOOL DISTRICT IN A GENERAL WARRANTY DEED RECORDED IN DOCUMENT NO. 201800060483 OF THE OFFICIAL PUBLIC RECORDS OF DALLAS COUNTY, TEXAS (O.P.R.D.C.T.), BEING MORE PARTICULARLY DESCRIBED IN EXHIBIT "A" AND SHOWN IN EXHIBIT "B"; PROVIDING A CONFLICTS RESOLUTION CLAUSE; PROVIDING A SEVERABILITY CLAUSE; PROVIDING A SAVINGS CLAUSE; PROVIDING A PENALTY OF FINE NOT TO EXCEED THE SUM OF TWO THOUSAND DOLLARS ($2,000.00) FOR EACH OFFENSE; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the Planning and Zoning Commission of the City of Sachse and the governing body of the City of Sachse, in compliance with state laws applying to amending the Comprehensive Zoning Ordinance and Map, have given the requisite notice by publication and otherwise, and after holding due hearings and affording a full and fair hearing to all property owners generally, the governing body of the City of Sachse is of the opinion that said comprehensive Zoning Ordinance and Zoning Map should be amended as provided herein;

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SACHSE, TEXAS, THAT:

SECTION 1. The Comprehensive Zoning Ordinance and Zoning Map of the City of Sachse, Texas, as heretofore amended, be and the same are hereby further amended by changing the zoning from Residential District-1 (R-1) to Agricultural District (AG), on a ±4.0 acre tract of land situated in the James C. Tucker Survey, Abstract No. 1464, City of Sachse, Dallas County, Texas, said tract being all of a called 4.0 acre tract of land conveyed to Garland Independent School District in a General Warranty Deed recorded in Document No. 201800060483 of the Official Public Records of Dallas County, Texas (O.P.R.D.C.T.), more particularly described in Exhibit "A" and shown in Exhibit "B" attached hereto and incorporated herein by reference ("the Property") subject to the provisions of Section 2 of this Ordinance.

SECTION 2. All provisions of the ordinances of the City of Sachse in conflict with the provisions of this Ordinance be and the same are hereby repealed.

SECTION 3. In the event of an irreconcilable conflict between the provisions of another previously adopted ordinance of the City of Sachse and the provisions of this Ordinance as applicable to the use and development of the Property, the provisions of this Ordinance shall be controlling.

SECTION 4. Should any sentence, paragraph, subdivision, clause, phrase, or section of this ordinance be adjudged or held to be unconstitutional, illegal, or invalid, the same shall not affect the validity of this ordinance as a whole, or any part or provision hereof other than the part so decided to be invalid, illegal, or unconstitutional, and shall not affect the validity of the Comprehensive Zoning Ordinance as a whole.

SECTION 5. An offense committed before the effective date of this Ordinance is governed by the prior law and the provisions of the Code of Ordinances, as amended, in effect when the offense was committed and the former law is continued in effect for this purpose.

SECTION 6. Any person, firm, or corporation violating any of the provisions or terms of this Ordinance shall be subject to the same penalty as provided for in the Comprehensive Zoning Ordinance of the City of Sachse, as heretofore amended, and upon conviction shall be punished by a fine not to exceed the sum of two thousand dollars ($2,000.00) for each offense; and each and every day such violation shall continue shall be deemed to constitute a separate offense.

SECTION 7. This Ordinance shall take effect immediately from and after its passage and the publication of the caption, as the law and Charter in such cases provide.

PASSED AND APPROVED by the City Council of the City of Sachse, Texas on the 20th day of April 2026.

APPROVED:

_____
Jeff Bickerstaff
Mayor

DULY ENROLLED:

_____
Leah K Granger
City Secretary

APPROVED AS TO FORM:

_____
Joseph J. Gorfida, Jr., City Attorney
(03-05-2025: 4935-0212-2644, v. 1)

EXHIBIT "A"
Description of Property

EXHIBIT "A"

LEGAL DESCRIPTION

WHEREAS Garland Independent School District is the owner of a certain tract of land situated in the James C. Tucker Survey, Abstract No. 1464, City of Sachse, Dallas County, Texas, said tract being all of a called 4.0 acre tract of land conveyed to Garland Independent School District in a General Warranty Deed recorded in Document No. 201800060483 of the Official Public Records of Dallas County, Texas (O.P.R.D.C.T.), said tract being more particularly described in metes and bounds as follows;

BEGINNING at a 1/2" iron rod with yellow plastic cap stamped "4613" found for the south corner of the called 4.0 acre tract of land, said capped 1/2" iron rod being in the west line of a 56.418 acre tract of land conveyed to Garland Independent School District in (2) two Quit Claim Deeds recorded in Volume 97137, Page 5249 and Volume 97137, Page 5253 of the Deed Records of Dallas County, Texas, and said capped 1/2" iron rod also being the northeast corner of a called 1.378 acre tract of land currently owned by Jacquita Ann Sangster Yancey as shown in the Revocable Transfer on Death Deed recorded in Instrument No. 2024000115039. O.P.R.D.C.T.;

THENCE N 54°30'54" W with the southwest line of the called 4.0 acre tract of land for a distance of 500.86' to a 1/2" iron rod found for corner in the south Right Of Way line of Pleasant Valley Road, a 60' Right-of-Way as shown on the plat of Lot 6, Willow Lake Ranch No. 2, an addition to Dallas County, Texas as recorded in Volume 80180, Page 751 of the Plat Records of Dallas County, Texas;

THENCE N 35°16'42" E following the south Right Of Way line of Pleasant Valley Road for a distance of 695.70' to a 1/2" iron rod found for corner;

THENCE S 00°23'53" E a distance of 858.79' to the POINT OF BEGINNING, and containing 174,222 Square Feet or 4.000 acres of land.

David J. Surdukan R.P.L.S. No. 4613
DATE: FEBRUARY 26, 2026

STATE OF TEXAS
REGISTERED
DAVID J. SURDUKAN
4613
PROFESSIONAL
LAND SURVEYOR

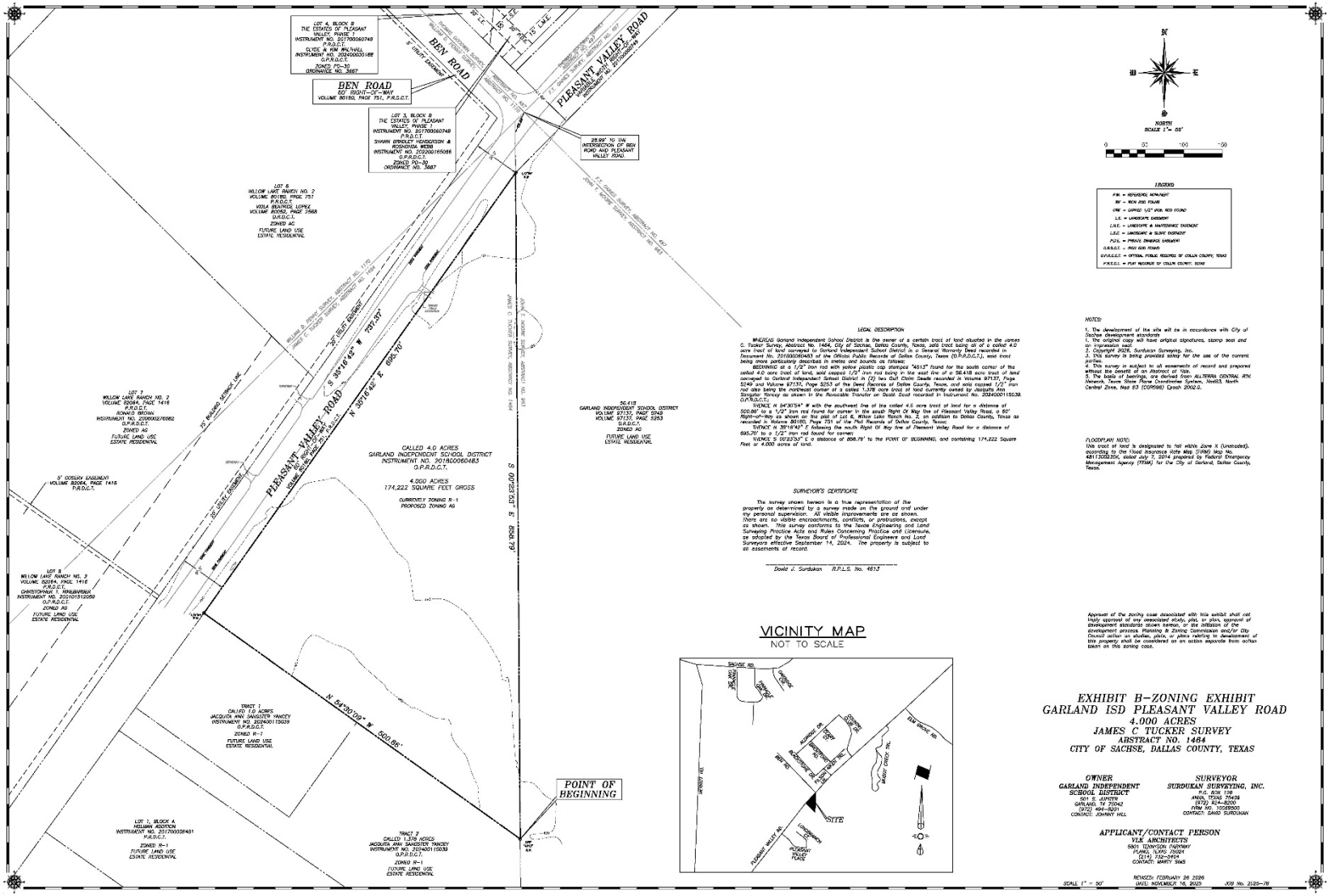
OWNER
GARLAND INDEPENDENT SCHOOL DISTRICT
501 S. JUPITER
GARLAND, TX 75042
(972) 494-8201
CONTACT: JOHNNY HILL

SURDUKAN SURVEYING INC

SURVEYOR
SURDUKAN SURVEYING, INC.
P.O. BOX 126
ANNA, TEXAS 75409
(972) 924-8200
FIRM NO. 10069500
CONTACT: DAVID SURDUKAN

LEGAL DESCRIPTION
4.000 ACRES
JAMES C TUCKER SURVEY
ABSTRACT NO. 1464
CITY OF SACHSE
DALLAS COUNTY, TEXAS

EXHIBIT "B"
Depiction of Property



4935-0212-2644, v. 1

Subject:	**2. Conduct a public hearing and consider approving an ordinance amending Chapter 8 "Subdivisions," by amending Section 8-14 titled "Completion and maintenance of public improvements"; by amending Subsections 8-14a(3) and 8-14d(1); by amending Section 8-15 titled "General requirements and design standards" by amending Sections 8-15B(3)(b) and 8-15F(3); by amending Section 8-18 titled "Street design construction costs" by amending Subsection 18-8b; amending Section 8-20 titled "Impact fees" by amending Subsections 8-20B and 8-20C(1); and by amending Exhibit 11A titled "Zoning Ordinance" by amending Article 3 titled "Districts" by amending Section 11 titled "SP-special use permits" by amending 11.2 titled "Use regulations"; by amending Article 4 titled "General provisions applying to all or several districts" by amending Section 11 titled "Landscaping and screening" by amending 11.4 titled "Required landscaping" by amending 11.4d titled "Single-family residential development requirements" by amending 11.4d4 titled "Masonry wall required"; and by amending 11.6 titled "Screening standards" by amending 11.6d titled "Masonry wall standards" by amending 11.6d1 titled "Design and materials"; and by amending 11.6d6(c) titled "Additional requirements"; providing a conflicts clause; providing a repealing clause; providing a severability clause; providing a savings clause; providing a penalty of fine not to exceed Two Thousand Dollars ($2,000.00); and providing an effective date.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Public Hearing, Discussion, Action
Fiscal Impact	None
Recommended Action	Conduct a public hearing and approve the proposed subdivision and zoning ordinance revisions.
Goals	Provide excellent government services to Sachse citizens.

BACKGROUND

The maintenance of existing ordinances is considered routine in order to provide a healthy and functioning regulatory framework that meets the needs of the community. Staff is proposing the following updates to the Subdivision and Zoning ordinance:

- Amendments to the Subdivision Ordinance to comply with state law;
- Amendments to references to City requirements for screening; and
- Amendment to use regulations.

At its March 23 regular meeting, the Planning & Zoning Commission voted 6-0 to recommend approval of the proposed subdivision and zoning ordinance revisions as presented.

This item is the first of three in a series of updates.

POLICY CONSIDERATIONS

The ongoing maintenance of regulations and the streamlining of processes and provisions are identified as tasks in the City's 2025 Comprehensive Plan Update.

RECOMMENDATION

Conduct a public hearing and approve the proposed subdivision and zoning ordinance revisions.

File Attachments
1. Presentation_Ch8 Zoning Amendments_FINAL
2. Ordinance Amending Zoning Chapter 8 Subdivisions and Zoning Exhibit 11A Sections 11.2 11.4 and 11.6_FINAL

Subdivision and Zoning Ordinance Amendments

City Council

April 20, 2026

Overview

- This item is the first part of three consecutive agenda items for ordinances that are being updated in connection with the Engineering Design Manual
  - Each item will be heard and acted upon separately.

- Specifically, the following ordinances are proposed to be updated:
  - Chapter 8 Subdivision Ordinance and Chapter 11 Zoning Ordinance
    - Cleaning up references to the Engineering Design Manual and other miscellaneous updates
  - Chapter 3 Building Regulations
    - Cleaning up references and removing redundancy of information that is within the Engineering Design Manual
  - Engineering Design Manual
    - Incorporating the standard construction details and general notes into the design manual and other miscellaneous updates

Request

- Conduct a public hearing and consider approval of an ordinance amending Chapter 8 Subdivisions, and Chapter 11 Zoning, Exhibit 11A Zoning Ordinance, Article 3, Section 11.2, and Article 4, Sections 11.4 and 11.6

Background

- The ongoing maintenance of regulations and the streamlining of processes and provisions are identified as tasks in the City's 2025 Comprehensive Plan Update

- Proposed changes include amendments to the City’s Subdivision and Zoning ordinance

Proposed Changes: Subdivisions

Amendment to comply with state law

- Current ordinance language is not fully aligned with updated state law requirements governing impact fee advisory committees
- The proposed amendment revises the ordinance to ensure compliance with current state statutes

Amend references to City requirements for screening

- Engineering and Public Works updated their standards for screening within the Engineering Design Manual and Standard Construction Details
- The proposed amendment updates the subdivision ordinance to reference the current adopted documents

Proposed Changes: Zoning Ordinance

Amend use regulations

- The current language allows consideration of a Special Use Permit (SUP) for uses not otherwise permitted in a zoning district
- The proposed change will limit Special Use Permit eligibility only to uses identified as “SUP” in the Use Charts of Exhibit A, Article 3, Section 13

Amend references to City requirements for screening

- Engineering and Public Works updated their standards for screening within the Engineering Design Manual and Standard Construction Details
- The proposed amendment updates the zoning ordinance to reference the current adopted documents

Recommendation

- At their March 23 regular meeting, the Planning & Zoning Commission voted 6-0 to recommend approval of the proposed subdivision and zoning ordinance amendments as presented

Questions?

ORDINANCE NO. O-2026-___

AN ORDINANCE OF THE CITY OF SACHSE, TEXAS, AMENDING THE CODE OF ORDINANCES BY AMENDING CHAPTER 8 "SUBDIVISIONS," BY AMENDING SECTION 8-14 TITLED "COMPLETION AND MAINTENANCE OF PUBLIC IMPROVEMENTS"; BY AMENDING SUBSECTIONS 8-14A(3) AND 8-14D(1); BY AMENDING SECTION 8-15 TITLED "GENERAL REQUIREMENTS AND DESIGN STANDARDS" BY AMENDING SUBSECTIONS 8-15B(3)(b) AND 8-15F(3); BY AMENDING SECTION 8-18 TITLED "STREET DESIGN AND CONSTRUCTION COSTS" BY AMENDING SUBSECTION 18-8B; AMENDING SECTION 8-20 TITLED "IMPACT FEES" BY AMENDING SUBSECTIONS 8-20B AND 8-20C(1); AND BY AMENDING EXHIBIT 11A TITLED "ZONING ORDINANCE" BY AMENDING ARTICLE 3 TITLED "DISTRICTS" BY AMENDING SECTION 11 TITLED "SP-SPECIAL USE PERMITS" BY AMENDING 11.2 TITLED "USE REGULATIONS"; BY AMENDING ARTICLE 4 TITLED "GENERAL PROVISIONS APPLYING TO ALL OR SEVERAL DISTRICTS" BY AMENDING SECTION 11 TITLED "LANDSCAPING AND SCREENING" BY AMENDING 11.4 TITLED "REQUIRED LANDSCAPING" BY AMENDING 11.4d TITLED "SINGLE-FAMILY RESIDENTIAL DEVELOPMENT REQUIREMENTS" BY AMENDING 11.4d4 TITLED "MASONRY WALL REQUIRED"; AND BY AMENDING 11.6 TITLED "SCREENING STANDARDS" BY AMENDING 11.6d TITLED "MASONRY WALL STANDARDS" BY AMENDING 11.6d1 TITLED "DESIGN AND MATERIALS"; AND BY AMENDING 11.6d6(c) TITLED "ADDITIONAL REQUIREMENTS"; PROVIDING A CONFLICTS CLAUSE; PROVIDING A REPEALING CLAUSE; PROVIDING A SEVERABILITY CLAUSE; PROVIDING A SAVINGS CLAUSE; PROVIDING A PENALTY OF FINE NOT TO EXCEED TWO THOUSAND DOLLARS ($2,000.00); AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the Planning and Zoning Commission and the governing body of the City of Sachse, Texas, in compliance with the laws of the State of Texas and the Ordinances of the City of Sachse, Texas, have given the requisite notices by publication and otherwise, and after holding due hearings and affording a full and fair hearing to all the property owners generally and to all persons interested and in the exercise of its legislative discretion, the City Council has concluded that the general regulations of the Comprehensive Zoning Ordinance, as previously amended, should be further amended as follows:

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SACHSE, TEXAS:

SECTION 1. That the City of Sachse Code of Ordinances is amended by amending Chapter 8 "Subdivisions," to read as follows:

"CHAPTER 8
SUBDIVISIONS

. . .

§ 8-14 Completion and maintenance of public improvements.

AMEND 8-14A(3):

A. Construction plan procedure.

. . .

(3) Failure to commence construction. If commencement of construction has not occurred within ~~one~~ two years after approval of the plans, resubmittal of plans may be required by the City engineer for meeting current standards and engineering requirements. For purposes of this section "Commencement of Construction" shall mean:

(a) Issuance of construction permit(s); and
(b) Grading of land.

. . .

AMEND 8-14D(1):

D. Inspection of public improvements.

(1) General procedure. Construction inspection shall be supervised by the city engineer or city construction inspectors. Construction shall be in accordance with the approved plans and the engineering design manual of the city. Any change in design required during construction should be made by the engineer whose seal and signature are shown on the plans. Another engineer may make revisions to the original engineering plans if so authorized by the owner of the plans and if those revisions are noted on the plans or documents, provided such revisions are permitted by the Texas Engineering Practice Act. All revisions shall be approved by the city engineer. If the city engineer's inspection finds that any of the required public improvements have not been constructed in accordance with the city's engineering design manual, the owner shall be responsible for completing and/or correcting the public

. . .

§ 8-15 General requirements and design standards.

. . .

AMEND 8-15B(3)(b)

B. Utilities.

. . .

3. Sewer improvements.

. . .

(b) The developer shall furnish and install the complete sewage system, including the mains, manholes, cleanouts, service laterals for all lots, lift stations and appurtenances. The sewage system shall be designed and constructed in accordance with the master plan when available and in accordance with the standard specifications and ~~standard construction details~~ engineering design manual of the City of Sachse.

. . .

AMEND 8-15F(3)

F. Blocks.

. . .

(3) Where blocks in the vicinity of a school, park or shopping center are platted 1,000 feet or longer the council may require a walkway near the middle of the block or at a street that terminates between the streets at the ends of the block. The walkway shall not be less than ~~four~~ five feet or more than eight feet in width, shall have a ~~four~~ five foot concrete walk through the block from sidewalk to sidewalk, or the rear property line.

. . .

§ 8-18 Street design and construction costs.

. . .

AMEND 8-18B

B. Street, design construction costs and escrow requirement.

(1) The owner shall be responsible for the design and construction of all streets within his development and one-half of the same if an unimproved perimeter street.

~~(2)~~(a) The owner shall be responsible for the construction of ~~the following width perimeter streets to his development~~ streets in accordance with the thoroughfare plan and engineering design manual.

~~**(a)** When developing land zoned residential or "F", the owner shall be responsible for the construction of one-half of a 37-foot collector street.~~

~~**(b)** When developing land zoned "C-1," "C-2," or "PD," the owner shall be responsible for construction of one-half of a 45-foot concrete street or one-half of the actual width of the proposed street, whichever is less.~~

~~**(c)** When developing land zoned "I-1," "I-2," the owner shall be responsible for the construction of one-half of the street actually proposed for construction, pursuant to the thoroughfare plan and engineering design manual of the City of Sachse.~~

(2) The owner shall construct all internal and perimeter streets at the time of development unless, from an engineering standpoint, it is not feasible to do so. Upon such determination, the owner shall be required to place an amount equal to his share of the construction costs plus six percent of such sum for future engineering costs in escrow with the city.

(3) The owner shall be responsible for all of the engineering and design costs of all internal streets and also of all perimeter streets which are constructed either entirely by the owner or through participation.

(4) The responsibilities of the owner relative to perimeter streets, shall not exceed a linear footage requirement equal to the square root of the area of the property expressed in feet. In the event the property is bound by more than one unimproved perimeter street, such formula shall apply to each such street. A total waiver of perimeter street responsibility is not within the contemplation of these rules and regulations.

(5) However, in any event, perimeter street escrow responsibility shall not exceed the factor of 0.0035 times the current street cost per linear foot (one-half of the applicable street width, based on zoning) times the square footage of the plat, plus six percent of such sum for future engineering costs.

. . .

§ 8-20 Impact fees.

. . .

AMEND 8-20B (Amend Definitions for "Advisory committee" and "Service unit")

. . .

B. Definitions. For purposes of this section, the following words and phrases shall have the meanings respectively ascribed to them by this subsection:

Advisory committee.
The ~~members of the planning and zoning commission, and the~~ representatives appointed by the city council as required by the state law.

. . .

Service unit.
The standardized measure of consumption, use, generation or discharge attributable to an individual unit of development, that had been calculated in accordance with generally accepted engineering and/or planning standards, as indicated in the land use equivalency tables located in the City of Sachse's "Water, Wastewater and Roadway 2024-2034 Impact Fee Update. ~~"2011-2021 Capital Improvements Plan and Impact Fee Analysis for Water, Sanitary Sewer and Thoroughfares", which is attached hereto as Exhibit "D" and incorporated by reference herein, as may be amended from time to time~~.

. . .

AMEND 8-20(C)

C. Advisory committee.

(1) The advisory committee shall consist of not less than five (5) members. ~~the planning and zoning commission. If~~ The committee must ~~does not~~ include at least 50 percent as ~~one~~ representatives of the real estate, development, or the building industry who is not an employee or official of a political Subdivision or governmental entity~~. the city council shall appoint at least one such representative as an ad hoc voting member of the advisory committee~~. If any impact fee is to be applied in the extraterritorial jurisdiction of the city, a representative from that area shall be appointed by the city council.

. . . "

SECTION 2. That the Comprehensive Zoning Ordinance and Map of the City of Sachse, Texas, is amended by amending Exhibit 11A titled "Zoning Ordinance" by amending Article 3 titled "Districts" by amending Section 11 titled "SP-Special Use Permits" by amending 11.2 titled "Use Regulations"; by amending Article 4 titled "General Provisions Applying to All or Several Districts" by amending Section 11 titled "Landscaping and Screening" by amending 11.4 titled "Single Family Residential Requirements" by amending 11.4d4 titled "Masonry Wall Required; and by amending 11.6 titled "Screening Standards" by amending 11.6d titled "Masonry Wall Standards" by amending 11.6d1 titled "Design and Materials"; and by amending 11.6d6(c) titled "Additional Requirements," to read in its entirety as follows:

"EXHIBIT 11A
ZONING ORDINANCE

. . .

ARTICLE 3 DISTRICTS

. . .

§ 11 SP-special use permits.

. . .

AMEND

11.2 Use regulations.

~~Any use which is not contrary to city, county, state or federal laws which is not listed as an allowed use in the zoning ordinance is a special use permit use in any district and subject to the provisions of this article.~~ The following uses are hereby authorized in the specified districts upon compliance with all of the requirements herein:

. . .

…"

ARTICLE 4 GENERAL PROVISIONS APPLYING TO ALL OR SEVERAL DISTRICTS

. . .

AMEND 11.4d4

§ 11 Landscaping and screening.

. . .

11.4 Required landscaping.

. . .

d. Single-family residential development requirements.

. . .

4. Masonry wall required. Unless otherwise approved by the city council, a masonry screening shall be provided along the rear and/or side property lines of residential districts when the area backs up to and/or sides a street which is designated on the city's thoroughfare plan as a thoroughfare. Screening walls shall be not less than six feet in height and designed in accordance with the City of Sachse Engineering Design Manual ~~and Standard Construction Details city requirements~~. A living screen may be proposed as an alternative landscape plan.

. . .

AMEND 11.6d1 and 11.d6(c)

11.6 Screening standards.

. . .

d. Masonry wall standards.

1. Design and materials. A masonry screening wall shall ~~consist of a reinforced wall of the same materials, color, and texture as used on the primary structure on the site,~~ having a minimum height of six feet and a maximum height of eight feet~~. A graphic detail and schedule of materials shall be shown on the plan. The masonry wall~~ and shall be designed and built in accordance with the City of Sachse Engineering Design Manual ~~and Standard Construction Details~~. The designs shall be signed by a structural engineer licensed to practice in the State of Texas.

. . .

6. Additional requirements.

. . .

(c) Masonry wall construction shall be in accordance with City of Sachse Engineering Design Manual ~~and Standard Construction Details~~.

. . ."

SECTION 3. That to the extent of any irreconcilable conflict with the provisions of this Ordinance and other Ordinances of the City of Sachse governing the use and development of the Property and which are not expressly amended by this Ordinance, the provisions of this Ordinance shall be controlling.

SECTION 4. That all provisions of the Ordinances of the City of Sachse, Texas, in conflict with the provisions of this Ordinance be and the same are hereby, repealed, and that all other provisions of the Ordinances of the City of Sachse not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 5. That should any sentence, paragraph, subdivision, clause, phrase, or section of this Ordinance be adjudged or held to be unconstitutional, illegal, or invalid, the same shall not affect the validity of this Ordinance as a whole or any part or provision thereof other than the part thereof decided to be unconstitutional, illegal, or invalid.

SECTION 6. That an offense committed before the effective date of this Ordinance is governed by prior law and the provisions of the Ordinances of the City of Sachse, as amended, in effect when the offense was committed and the former law is continued in effect for this purpose.

SECTION 7. That any person, firm, or corporation violating any provisions or terms of this Ordinance shall be subject to the same penalty as provided for in the Code of Ordinances, as amended, and upon conviction shall be punished by a fine not to exceed the sum of Two Thousand Dollars ($2,000.00) for each offense, and each and every day such violation shall continue shall be deemed to constitute a separate offense.

SECTION 8. That this Ordinance shall take effect immediately from and after its passage.

PASSED AND APPROVED by the City Council of the City of Sachse, Texas this the 20th day of April 2026.

APPROVED:

_____
Jeff Bickerstaff, Mayor

DULY ENROLLED:

_____
Leah K Granger, City Secretary

APPROVED AS TO FORM:

_____
Joseph J. Gorfida, Jr., City Attorney
(03-12-2026: 4915-0117-3911, v. 1)

Subject:	**3. Consider approving an ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 3 “Building Regulations” by amending Article I “In General” by amending Section 3-13 “Standards for Construction of Public Facilities”; by deleting Section 3-17 “Drainage and Stormwater Control” in its entirety; by renumbering Sections 3-18 through 3-56; by amending Section 3-24 “Flatwork Requirements”; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed Five Hundred Dollars ($500.00); and providing for an effective date.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion, Action
Fiscal Impact	None
Recommended Action	Approve an ordinance amending Chapter 3 Building Regulations.
Goals	Provide excellent government services to Sachse citizens.

BACKGROUND

The maintenance of existing ordinances is considered routine in order to provide a healthy and functioning regulatory framework that meets the needs of the community. The proposed amendment updates Chapter 3 "Building Regulations" of the City of Sachse to be in alignment with the current adopted documents. More specifically, the standards for construction of public infrastructure are now located within the Engineering Design Manual.

This item is the second update in the three-part series of items.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Approve an ordinance amending Chapter 3 Building Regulations.

File Attachments
1. Presentation_Ch3 Building Regulation Ordinance Amendment_FINAL
2. Ordinance Amending Chapter 3, Amending Sections 3-13, 3-17, 3-25_FINAL

Building Regulations Ordinance Amendments

City Council

April 20, 2026

Request

- Consider an ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 3 “Building Regulations” by amending Article I “In General” by amending Section 3-13 “Standards for Construction of Public Facilities”; by deleting Section 3-17 “Drainage and Stormwater Control” in its entirety; by renumbering Sections 3-18 through 3-56; by amending Section 3-24 “Flatwork Requirements”; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed five hundred dollars ($500.00); and providing for an effective date.

Background

- The ongoing maintenance of regulations and the streamlining of processes and provisions are identified as tasks in the City's 2025 Comprehensive Plan Update.

- Proposed changes include amendments to the City’s Building Regulations ordinance.

Proposed Changes

Amend references to City requirements for construction of public infrastructure

- The proposed amendment updates the building regulations ordinance to be in alignment with the current adopted documents.
- Standards for construction of public infrastructure are located within the Engineering Design Manual.

Recommendation

- Approve the ordinance amending Chapter 3 Building Regulations as presented.

Questions?

ORDINANCE NO. O-2026-___

AN ORDINANCE OF THE CITY OF SACHSE, TEXAS, AMENDING THE CODE OF ORDINANCES BY AMENDING CHAPTER 3 "BUILDING REGULATIONS" BY AMENDING ARTICLE I "IN GENERAL" BY AMENDING SECTION 3-13 "STANDARDS FOR CONSTRUCTION OF PUBLIC FACILITIES"; BY DELETING SECTION 3-17 "DRAINAGE AND STORMWATER CONTROL" IN ITS ENTIRETY; BY RENUMBERING SECTIONS 3-18 THROUGH 3-56; BY AMENDING SECTION 3-24 "FLATWORK REQUIREMENTS"; PROVIDING FOR A REPEALING CLAUSE; PROVIDING FOR A SEVERABILITY CLAUSE; PROVIDING A SAVINGS CLAUSE; PROVIDING FOR A PENALTY OF FINE NOT TO EXCEED TWO THOUSAND DOLLARS ($2,000.00); AND PROVIDING FOR AN EFFECTIVE DATE.

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SACHSE, TEXAS:

SECTION 1. That the City of Sachse Code of Ordinances is amended by amending Chapter 3 "Building Regulations" to read as follows:

"CHAPTER 3
BUILDING REGULATIONS

ARTICLE I IN GENERAL

. . .

AMEND AS FOLLOWS:

§ 3-13 Standards for construction of public facilities.

. . .

B. Design manual as adopted.

(1) There is hereby adopted that certain code known as the Engineering Design Manual which is on file in the office of the city secretary and made apart hereof for all purposes. From and after the adoption of this subsection all drainage facilities, water system facilities, sanitary sewer system facilities, and pavement of public streets, highways, alleys or other public places and appurtenances and structures thereto, constructed within the City of Sachse or within the jurisdiction of the City of Sachse, shall comply with the Engineering Design Manual as adopted.

(2) The Engineering Design Manual shall be considered a compliment to the "Standard Specifications for Public Works Construction" adopted in subsection A. If a conflict is determined between the "Standard Specifications for Public Works

Construction" and the Engineering Design Manual, the Engineering Design Manual will prevail .

DELETE (2) "STANDARDS FOR THE PERMITTED USES OF "ASPHALT PAVEMENTS FACILITIES" IN ITS ENTIRETY

~~(2) Standards for the permitted uses of asphalt pavements facilities.~~

RENUMBER (3) TO (2)

(2) Standards for the permitted uses of sidewalks, driveways, curb and gutter or drainage facilities.

. . .

(c) Sidewalks. Unless a different width is specially authorized by the city council, all sidewalks shall conform to the following:

(i) Along business establishments, schools, or commercial land use areas, a minimum width of five feet shall be installed with barrier free ramps conforming to the Engineering Design Manual.

(ii) Along residential areas, a minimum width of five feet shall be installed with barrier free ramps conforming to the Engineering Design Manual.

(iii) Delete (iii)

(d) Driveway. Private driveways shall have a minimum overall width of twelve feet and conform with the Engineering Design Manual. The driveway plan shall show the details of drainage, curb and gutter, materials, grades, etc., and the details of how the facility will be constructed. All construction costs of a new private driveway including any drainage pipe, shall be paid for by the property owner for the initial construction.

(e) Curb and gutter. Concrete curb and gutter which is constructed within a public right-of-way shall conform to the Engineering Design Manual. The property owner shall furnish plans and specifications to the city to identify the location, grades and types of any curb and gutter proposed for construction. The alignment and grade of any proposed improvements shall conform with the city's current plans for street and thoroughfare plans. All costs associated with the construction of curb and gutter improvements shall be paid by the property owner.

(f) Drainage. Drainage facilities improvements requested by property owner shall conform with the Engineering Design Manual. Any improvements related to private driveway shall be designed to a size which will accommodate the anticipated hydraulic flows passing through the structure. The proposed

construction shall conform to the future plans of the city on street and thoroughfare alignments. The proposed profile grades must allow for drainage flow to pass without creating hazards to the public safety and health. The cost of drainage improvements shall be paid by the property owner upon which the improvements benefit. If the city does elect to participate in the cost of reconstruction or improvements to an existing facility, specific approval must be given by the city.

. . .

C. Inspection requirements.

(8) A fee to defray the cost of inspection shall be collected by the city when the final plat for a private development or the final plat for any phase of a private development is accepted by the city council and the plat shall not be filed until the fee has been paid to the city.

. . .

DELETE SECTION 3.17 "DRAINAGE AND STORMWATER CONTROL" IN ITS ENTIRETY. RENUMBER REMAINING SECTIONS.

. . .

§ 3-24. Flatwork requirements.

. . .

(2) All new parking and drives shall be constructed with concrete to the city's Engineering Design Manual. Where residential drives exceed 150 feet in length, an all-weather, dust-free surface is permitted starting 20 feet beyond the property line so that the drive approach plus 20 feet is concrete.

. . ."

SECTION 2. That all provisions of the Ordinances of the City of Sachse, Texas, in conflict with the provisions of this Ordinance be and the same are hereby, repealed, and that all other provisions of the Ordinances of the City of Sachse not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 3. That should any sentence, paragraph, subdivision, clause, phrase or section of this Ordinance be adjudged or held to be unconstitutional, illegal, or invalid, the same shall not affect the validity of this Ordinance as a whole or any part or provision thereof other than the part thereof decided to be unconstitutional, illegal, or invalid.

SECTION 4. An offense committed before the effective date of this Ordinance is governed by prior law and the provisions of the Ordinances of the City of Sachse, as amended, in effect when the offense was committed and the former law is continued in effect for this purpose.

SECTION 5. That any person, firm, or corporation violating any provisions or terms of this Ordinance shall be subject to the same penalty as provided for in the Code of Ordinances, as amended, and upon conviction shall be punished by a fine not to exceed the sum of Two Thousand Dollars ($2,000.00) for each offense, and each and every day such violation shall continue shall be deemed to constitute a separate offense.

SECTION 6. This ordinance shall take effect immediately from and after its passage.

PASSED AND APPROVED by the City Council of the City of Sachse, Texas this the 20th day of April 2026.

APPROVED:

_____
Jeff Bickerstaff, Mayor

DULY ENROLLED:

_____
Leah K Granger, City Secretary

APPROVED AS TO FORM:

_____
Joseph J. Gorfida, Jr., City Attorney
(03-26-2026: FINAL 4934-9911-6699, v. 1)

Subject:	**4. Discuss and consider approving an ordinance adopting revisions to the City of Sachse Engineering Design Manual; providing a repealing clause; providing a severability clause; and providing for an effective date.**
Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion, Action
Fiscal Impact	None
Recommended Action	Approve the ordinance revising the City of Sachse Engineering Design Manual.
Goals	Provide excellent government services to Sachse citizens. Meet the public safety needs of a growing citizen; student; and business population.

BACKGROUND

The current Engineering Design Manual was adopted by Council on March 4, 2024. Since that time, the Public Works Department has received multiple questions and comments from engineers and developers regarding inconsistencies in the document. Staff has reviewed the manual and drafted revisions for Council's approval based on comments received and industry standards.

Revisions include:

- Streamlining the variance request process
- Adding missing information and references
- Removing outdated list references
- Codifying the Standard Construction Details into the Engineering Design Manual

This item is the final update in the three-part series of items.

POLICY CONSIDERATIONS

The City Council of the City of Sachse has the authority to adopt standards and requirements pertaining to the design and construction of public infrastructure.

RECOMMENDATION

Approve the ordinance revising the City of Sachse Engineering Design Manual.

File Attachments

1. Presentation_Design Manual Update_2026_FINAL
2. Ordinance for Adopting Design Manual Changes_FINAL
3. Engineering Design Manual_Record of Revisions_2026
4. Engineering Design Manual_04.20.2026

2026 Engineering Design Manual Update

City Council

April 20, 2026

Overview

- Background
- Proposed Changes
- Next Steps
- Discussion and Questions

Background

- Current manual adopted on March 4, 2024
- Staff reviewed the document based on inconsistencies pointed out by staff, engineers, and developers
- Standard Construction Details were not previously codified in the Ordinance and will now be included in the appendices of the Engineering Design Manual
- Updated Approved Materials List based on feedback from staff

Proposed Changes

Section	Update

1.6 – General Design	• Variance Request process updated to be streamlined and simplified
	  • Previous variance request process required the City Engineer to write a formal recommendation to the Director of Public Works for approval (this is currently one position)
	  • Updated format allows applicants to submit to staff for approval by Director of Public Works
	• Appeals will be reviewed by the City Manager rather than City Council

2.2 – Roadway Design	• Table 2-1 summarizes the general design criteria for the City's adopted Thoroughfare Plan classifications
	  • The table has been updated to show right-of-way widths not previously shown
	  • Roadway classifications have been updated to match the thoroughfare plan
	• Figure 2-1 was updated to reflect changes in Table 2-1

2.7 – Driveways	• Table 2-9 shows the Minimum Driveway Spacing Requirements • The revision adds a minimum of 12' and maximum width of 24' for residential driveways on local or collector streets

The City of SACHSE

Proposed Changes

Section	Update
7.8 – Screening Walls	• The City does not have a list of approved wall suppliers; therefore, the reference has been removed
Appendix B – Approved Materials List	• Removed approved Water Services pipe to be in line with industry standards • Updated list of fire hydrant manufacturers to those currently in City inventory • Added TNEMIC as Fire Hydrant Paint manufacturer to be in line with industry standards • City no longer approves traffic paint in ROW in favor of thermoplastic traffic markings; The list of traffic paint manufacturers was removed
Appendix C Appendix D	• City of Sachse Standard Construction Details were a standalone document not included in the original Ordinance. The addition of the General Notes to Appendix C and the addition of the Paving, Drainage, Water, and Sanitary Sewer Details to Appendix D will codify the Standard Construction Details into the Engineering Design Manual

Next Steps

- Adopt the Ordinance revising the Engineering Design Manual
- Publish the design manual on City Website
- A copy will be provided to City Secretary's Office
- Staff will continue to evaluate and update the manual based on updated technology, standards, and best management practices

Questions?

ORDINANCE NO. O-2026-___

AN ORDINANCE OF THE CITY OF SACHSE, TEXAS, ADOPTING REVISIONS TO THE CITY OF SACHSE ENGINEERING DESIGN MANUAL; PROVIDING A REPEALING CLAUSE; PROVIDING A SEVERABILITY CLAUSE; AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, the City of Sachse Subdivision Ordinance is the controlling document for the standards and requirements for the development of new subdivisions in the City of Sachse; and

WHEREAS, the City Council adopted Ordinance No. O-2024-04 on March 4, 2024, adopting a new City of Sachse Engineering Design Manual; and

WHEREAS, Ordinance No. O-2024-04 is now repealed in its entirety and the City Council will adopt a new Ordinance adopting revisions to the City of Sachse Engineering Design Manual which is attached hereto as "Exhibit A"; and

WHEREAS, the City Council, in the exercise of its discretion, has concluded that the revisions to the City of Sachse Engineering Design Manual attached as "Exhibit A" should be approved.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SACHSE, TEXAS:

SECTION 1. The revisions to the City of Sachse Engineering Design Manual for the design of public infrastructure which is attached as "Exhibit A" is hereby adopted, with a copy being kept on file in the office of the City Secretary. All new development projects within the City of Sachse must be designed in compliance with the revised Engineering Design Manual attached as "Exhibit A."

SECTION 2. All Ordinances of the City of Sachse, Texas, in conflict with the provisions of this Ordinance be, and the same are hereby, repealed; provided however, that all other provisions of said Ordinances not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 3. Should any word, sentence, paragraph, subdivision, clause, phrase, or section of this Ordinance be adjudged or held to be void or unconstitutional, the same shall not affect the validity of the remaining portions of said Ordinance which shall remain in full force and effect.

SECTION 4. This Ordinance shall take effect immediately from and after its passage as the law in such cases provides.

PASSED AND APPROVED by the City Council of the City of Sachse, Texas, this the 20th day of April 2026.

APPROVED:

_____
Jeff Bickerstaff
Mayor

DULY ENROLLED:

_____
Leah K Granger
City Secretary

APPROVED AS TO FORM:

_____
Joseph J. Gorfida, Jr.
City Attorney

“EXHIBIT A”
City of Sachse Engineering Design Manual

RECORD OF REVISIONS

The following list includes the effective date(s) of the City of Sachse's *Engineering Design Manual* and a summary of significant changes.

Effective Date	Description
03/04/2024	Adoption of the *Engineering Design Manual* by City Council.
04/20/2026	Following Revisions were made:

Section	Update
1.6	• Design Manual Variance Request process revised
2.2	• Table 2-1 updated
	• Figure 2-1 updated
2.7	• Table 2-9 revised
7.8	• 7.8.3.B revised
Appendix B	• Revised Appendix B
Appendix C	• Added Appendix C-General Notes
Appendix D	• Added Appendix D-Standard Details

Engineering Design Manual

The City of
SACHSE
Public Works

Adopted: March 2024

Revised: April 2026

RECORD OF REVISIONS

The following list includes the effective date(s) of the City of Sachse's *Engineering Design Manual* and a summary of significant changes.

Effective Date	Description
03/04/2024	Adoption of the *Engineering Design Manual* by City Council.
04/20/2026	Following Revisions were made:

Section	Update
1.6	• Design Manual Variance Request process revised
2.2	• Table 2-1 updated
	• Figure 2-1 updated
2.7	• Table 2-9 revised
7.8	• 7.8.3.B revised
Appendix B	• Revised Appendix B
Appendix C	• Added Appendix C-General Notes
Appendix D	• Added Appendix D-Standard Details

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SECTION 1 GENERAL DESIGN REQUIREMENTS

1.1. *Title* – These standards are hereby adopted and may be cited as the "Engineering Design Manual of the City of Sachse, Texas" ("Design Manual").

1.2. *Introduction* - The purpose of the Design Manual is to protect the public health, safety and welfare by establishing standard engineering practices, and minimum engineering construction and design requirements for the City and its extraterritorial jurisdiction ("ETJ"). The Design Manual consists of Sections 1 through 9, which provide generally applicable design requirements, as well as specific design requirements for the following facilities: roadway and traffic; drainage; water; wastewater; appurtenant structures; and landscape and irrigation. Appendices are attached to supplement the requirements in Sections 1 through 9 by providing greater specificity, checklists and approved material lists.

1.3. *Interpretation, Applicability, and the Respective Roles of the Engineer and the City*

1.3.1. *Intent/Conflict Resolution* – In the interpretation and application of the provisions of these regulations, it is the intention of the City that the principles, standards, and requirements provided for herein shall be minimum requirements for the design of both public and private development projects and City-maintained facilities located in or outside the City and its ETJ where regulatory authority for design and construction is granted by the Charter or ordinances of the City, state or federal law, or interlocal agreement. Where City, State, Federal, or other applicable regulations are more restrictive than this Design Manual, such other ordinances or regulations shall govern.

1.3.2. *References* – All references herein shall be to the current edition. If there are any discrepancies between the data in this manual and the referenced publication, the data from the current edition of the referenced publication shall be used.

1.3.3. *Definitions-Abbreviations* – Refer to *Section 9, Definitions-Abbreviations* for applicable definitions of terms and abbreviations.

1.3.4. *Figures* – Figures in this manual are not necessarily to scale; the Engineer shall not rely upon the scale of figures included in this manual.

1.3.5. *Responsibility of Engineer* – The Engineer shall be responsible for the application of the requirements of the Design Manual to the design of his/her project.

1.3.6. *Role of City Review* – City review of construction plans, reports and calculations will be conducted as a means to verify that the submitted design has been performed in compliance with the City's requirements, but shall not be considered a detailed technical review for adequacy, accuracy or completeness. The Engineer performing the design shall remain responsible for the technical adequacy, accuracy and completeness of the design and shall not be relieved of any responsibility for such as a result of the City's review.

1.3.7. *Other Requirements Applicable* – The City has adopted various ordinances, master plans, policies, and documents that may apply to a project in addition to the requirements of the Design Manual. While not intended to be exhaustive, a list of potentially applicable regulations is provided below. The Engineer is responsible for compliance with all applicable City requirements, whether or not included on this list.

1.3.7.A. *Checklists, Procedures and Forms* – Refer to **Appendix A** (City Checklists).

1.3.7.B. *Approved Materials Lists* – Refer to **Appendix B** (Approved Materials Lists).

1.3.7.C. *Sachse City Code, as amended*: https://z2.franklinlegal.net/franklin/Z2Browser2.html?showset=sachseset

1.3.7.D. *Catalytic Areas* – If the project falls within a catalytic area, compliance with those regulations is required.

1.3.7.E. *Master Plans*

- Comprehensive Plan (2017)
- Master Thoroughfare Plan (2017)
- Sanitary Sewer Master Plan (2012)
- Water Distribution System Master Plan (2011)
- Stormwater Management Plan (2019)

1.3.7.F. *Additional Standards*

- Construction Contract Documents (for public projects)
- Technical Specifications (for public projects)
- Irrigation Specifications and Details
- Landscape Specifications
- Backflow Residential Irrigation Installation Requirements, Backflow Prevention Assembly Installation Guide, Backflow Exterior Installation Specifications

1.4. *Enforcement* - The City shall enforce the requirements of this Design Manual to the full extent authorized by law, including but not limited to the City Charter and ordinances, state and federal law.

1.5. *Website Posting* –While the official copy of the approved Design Manual shall be kept on file in the Office of the City Secretary, the Design Manual and any updates will be posted on the City's website at https://www.cityofsachse.com/108/Engineering-Standards To access the latest design standards, the Engineer is directed to the City's website for the most current version of the Design Manual. A Design Manual Record of Revisions is provided in the posted Design Manual to identify significant revisions. A printed copy of the Design Manual may be requested through a Public Information Request made through the City Secretary's office.

1.6. *Design Manual Variance Requests*

1.6.1. A formal request for a variance to the requirements of the Design Manual may be submitted in writing to the Director of Public Works for consideration. A variance to the requirements of the Design Manual may not be granted unless the variance:

- Is not detrimental to the public welfare;
- Does not adversely impact the public facility in question;

- Is supported by a signed and sealed engineering analysis performed by a Professional Engineer licensed in the State of Texas;
- Is not based solely on financial interests;
- Preserves the aesthetics of the community;
- Does not adversely impact the life expectancy and maintenance costs of infrastructure;
- Does not create a potential danger to life and/or property;
- Does not create threats to public safety, increase public expense or create a nuisance;
- Does not conflict with state or federal laws or regulations;
- Does not conflict with any city ordinance or requirement other than the requirements of this Design Manual;
- Does not increase the susceptibility of the proposed or an existing facility, its contents or surrounding property to damage;
- Does not result in increased flood heights, create erosive velocities, increase the frequency or duration of flooding, or create other adverse impacts to other property;
- Preserves or expands natural floodplain, greenbelts and associated buffer areas of aesthetic and/or environmental value;
- Preserves adequate buffer distances to development and infrastructure from areas of potential flooding or erosion;
- Does not decrease the safety of access to property or facilities for ordinary and emergency vehicles;
- Is the only available and suitable location for the proposed facility that would not require a variance;
- Does not increase cost of providing governmental services, including maintenance and repair of public infrastructure for streets, bridges, storm sewer and channels, water, sanitary sewer, gas, electrical, telephone and other public facilities;
- Does not impede or interfere with the preservation of the historical character of structures or sites listed on the National Register of Historic Places or the State Inventory of Historic Places; and
- Is the minimum variance necessary to afford relief.

1.6.2. *Variance Process* – The following process shall be followed for variance requests.

1.6.2.A. *Submission* – Requests for variances to the *Design Manual* shall be submitted in writing to the Department of Public Works. In considering the variance request, public works staff shall review the technical, environmental, financial, social and aesthetic merits of the variance request. Public works staff shall forward the variance request to other relevant City staff for review and comment.

1.6.2.B. *Initial Decision* – The Director of Public Works shall summarize his/her findings in writing and make an initial decision for approval, approval with conditions or denial. As part of the decision, the Director of Public Works may attach conditions to the granting of the variance as deemed necessary to further the purposes of the Design Manual and the public welfare.

1.6.2.C. *Appeal to City Manager* – The decision of the Director of Public Works may be appealed to the City Manager. The City Manager shall have the authority to sustain, reverse, or modify the decision of the Director of Public Works. The decision of the City Manager shall be made within a reasonable time from the date of application for the variance, and shall be final.

1.6.2.D. *Maintenance of Record* – The Public Works shall maintain records of all variance requests, any appeals, and their outcome in accordance with Chapter 201 of the Texas Local Government Code.

1.6.3. *Time Limits* – Unless Chapter 245 of the Texas Local Government Code requires a different time limit, a variance granted pursuant to this section shall expire one year from the date of the granting of the variance if a permit is not approved and issued within that time and work begun. Should a building permit be issued and diligent work ceases for a period of more than 90 days, as determined by the Building Official, the variance shall expire and become null and void.

1.7. *Submittal Requirements for Construction Plans*

1.7.1. *Construction Plans* – All new construction, reconstruction, modifications, alterations and improvements shall be designed in accordance with the Design Manual. Construction plan requirements are listed in the Engineering Plan Submittal Requirements in **Appendix B** (City Checklists). All engineering plans shall be sealed by a licensed Professional Engineer in the State of Texas in accordance with the Texas Engineering Practice Act except as exempted by the Texas Engineering Practice Act and Policy Advisory Opinions issued by the Texas Board of Professional Engineers. It is the responsibility of the Engineer to ensure that all construction plans submitted for review adhere to the current version of the *Engineering Plan Submittal Checklist*. The City may specify additional submission requirements, as necessary, to facilitate the review.

1.7.2. *Construction Standards* – For public projects, the construction of all improvements shall be in accordance with the *Construction Contract Documents*. For private development projects, the construction of all improvements shall be in accordance with the Design Manual. The Design Manual shall be supplemented by the North Central Texas Council of Governments (NCTCOG) current edition of the *Public Works Construction Standards* as to any regulation not covered by the Design Manual; compliance with those supplementary regulations is required.

1.7.3. *City Permits* – Refer to the *Sachse City Code, as amended,* for requirements related to City permits, including, but not limited to, the following: Construction Permits, Building Permits, Grading Permits, Elevation Certificates, Right-of-Way Permits, Small Network Cell Permits, Driveway Permits and Certificates of Occupancy.

1.7.4. *Regulatory Agency Permits* – For any projects requiring permits from agencies other than the City, including, but not limited to TxDOT, NTTA, Railroad Commissions, FEMA, USACE, UPRR or TCEQ), the Engineer shall submit the required permit documents to the City for initial review. Authorization to submit permit requests to the agencies is contingent upon the City's approval of the initial review. The City may elect to lead coordination and/or submittal of permit requests to the agencies.

1.7.5. *ROW Use Permits for Franchised Utilities* – Application for all Franchise Utility Permits for ROW use must be made on the City's website. Refer to the City's website for applicable standards, including: general requirements, conditions, restrictions, and details.

1.7.6. *Field Changes* – Field changes to plans issued for construction in conjunction with a permit may be made only upon approval by the Director of Public Works or the Director of Public Works' designee. For ROW permits, field changes to issued permits may be made without approval by Director of Public Works if the installation of utility and appurtenances stays within area designated on Standard Details, maintains minimum clearances from all utilities required by the Design Manual and is not more than two feet from the alignment approved by the permit.

1.7.7. *Record Drawings* – Record drawings shall be submitted to the Director of Public Works at the completion of the project. ROW permits are exempt from this requirement.

1.8. *Easements and Right-of-Way ("ROW") Requirements*

1.8.1. *General*

1.8.1.A. *Dedications* – Easements and ROW required for construction of a proposed project dedicated to the City must be accepted prior to granting final acceptance of infrastructure. Permission must be obtained from offsite landowners prior to construction of offsite improvements on their property.

1.8.1.B. *Obstructions* – Refer to Appendix A for typical encroachments into easements and ROW.

1.8.1.C. *Minimum Vertical Clearance* – The minimum vertical clearance above any utility easement is 25 feet.

1.8.1.D. *Temporary Construction Easements* – Temporary construction easements may be required for off-site grading, access, utility lines or other facilities to be constructed outside the Developer's property.

1.8.1.E. *Maintenance* – The existence of an easement dedicated to the City does not change maintenance responsibility of the land. Perpetual maintenance responsibilities must be designated on the plat.

1.8.2. *Dedication of ROW and Easements*

1.8.2.A. *Form of Dedication* – ROW and easements shall be dedicated to the City by plat or by separate instrument. Refer to the City's *Subdivision Ordinance* and *Zoning Ordinance* for platting procedures. Also refer to the City's website for Procedures for Plat Review, Checklist for Plats, and the Final Platting Procedure.

1.8.2.B. *By Separate Instrument* – For easements and ROW by separate instrument, Owner shall submit to the Director of Public Works a mete and bounds description and an exhibit that ties the proposed dedication to an established property corner or survey markers, signed and sealed by a Texas Registered Professional Land Surveyor, showing the easement or ROW, location, and current ownership information of subject and surrounding properties tor.

1.8.2.C. *Process* – All easement and deed documents must be approved by the Director of Public Works prior to procuring any signatures. The Owner shall be responsible for procuring proper signatures and any required notarizations before delivering the fully executed original document to the Director of Public Works for filing in Deed records of the County where the property is located.

1.8.2.D. *Fees* – The Owner is responsible for any document preparation and all filing fees required for the recordation of executed documents with the County's Deeds Records office.

1.8.3. *Abandonment of ROW and Easements* – Action by the City Council is required to abandon a public easement with an existing utility or ROW. Refer to the ROW and Easement Abandonment Procedure in **Appendix B** (City Checklists) for additional information.

1.8.4. *Sight Visibility Triangle Easements* – Sight visibility triangle easements shall be provided where a public access driveway, an alley, or a stop-controlled street intersects an uncontrolled street and on any signalized intersection approach where right turn on red operation is permitted. Refer to **Section 2.4** (Sight Visibility) for additional requirements.

1.8.5. *Mutual (Joint) Access Easements* – Mutual or joint access easements may be required at shared driveways. Refer to **Section 2.7** (Driveways) for those requirements.

1.8.6. *Screening Wall Maintenance Easements* – Screening walls on private property shall be placed in the center of a minimum five-foot-wide screening wall easement.

1.8.7. *Sidewalk and Trail Easements* – Where possible, public pedestrian facilities (trails and sidewalks) should be placed within the street ROW. Where public pedestrian facilities are outside of street ROW, the width of the easement shall be the width of the pavement plus two feet on either side or ten feet, whichever is greater, to allow sufficient area for maintenance.

1.8.8. *Drainage Easements* – Drainage easements are required for the following drainage facilities.

1.8.8.A. *Storm Drains* – Storm drains shall be located in the center of a 15-foot-wide drainage easement; or 1.5 times the depth to the flowline plus the width of the structure, rounded up to the nearest five feet; whichever is greater. If the storm sewer is in ROW, and the easement size above is not contained within ROW, a drainage easement is required. If on private property, drainage easements shall be provided for all storm sewers that are 18 inches or greater in diameter.

1.8.8.B. *Roadside Ditches* – If the roadside ditch extends beyond the ROW, an additional drainage easement shall be dedicated extending at least five feet beyond the top of bank. Refer to **Figure 3-5** for additional information.

1.8.8.C. *Flumes* – An easement must contain the entire width of the flume plus five feet on each side. The easement must be a minimum of 15 feet wide or wider if required by the Director of Public Works.

1.8.8.D. *Positive Overflow Routes, Emergency Spillways, Swales, Berms, or Permanent BMPs* – Minimum width must encompass the structure or graded area.

1.8.8.E. *Detention/Retention Facilities and Levees* – An easement must encompass the entire facility plus 15 feet on all sides measured from the top of bank. An access route must be provided in accordance with **Section 3.7.8**. Unpaved portions of the access route shall be within the easement.

1.8.8.F. *Open Channels and Floodplains* – An easement's minimum width must encompass all areas having a ground elevation up to the one foot above the ultimate 100-year water surface elevation or the top of the high bank or channel edge, whichever is greater. The drainage easement shall also include at least a 15-foot-wide access route along both sides of the channel or a 20-foot-wide access route along one side of the channel.

Refer to **Section 3.7** (Open Channels) for additional access route requirements.

1.8.9. *Utility Easements* – Utility easements are required for all public utilities as follows.

1.8.9.A. *Minimum Width* – Utility easement minimum width requirements are summarized in **Table 1-1** through **Table 1-5**. The minimum width for exclusive utility easements is required when facilities are not located within the public ROW. The required easement dimensions shall be centered on the utility and the portion outside of the public ROW shall be dedicated to the City.

1.8.9.B. *Width for Certain Facilities* – The following equation shall be used for water mains, wastewater mains, and force mains with depths greater than 12 feet (measured from ground level to flowline of pipe).

Easement Width

$$W=2D+d+2$$

Where:

W = Easement width rounded up to nearest 5 feet (feet)
D = Depth of pipe, measured from the surface to flowline of pipe (feet)
d = Outside pipe diameter (feet)

1.8.9.C. *Maximum Width* – Easement shall not exceed 70 feet in width, unless required by the Director of Public Works for special circumstances.

1.8.9.D. *Widths to be Consistent* – If depths of lines/mains vary across the easement, the largest resulting easement width shall apply. Easement widths shall not vary within the same parcel/lot.

Table 1-1. Easement Widths for Water Main and Service Lines

Water Mains and Service Lines	Minimum Easement Width
Water Mains (12-inch and smaller and less than 8 feet deep)	15 feet
Water Mains (16-inch and larger or 8 feet to 12 feet deep)	20 feet
Water Mains Adjacent to Street ROW	10 feet
Water Mains Adjacent to TxDOT ROW	20 feet
Water Service Lines	15 feet

Table 1-2. Easement Widths for Wastewater Main and Service Lines

Wastewater Mains and Service Lines	Minimum Easement Width
Wastewater Mains (12-inch and smaller and less than 8 feet deep)	15 feet
Wastewater Mains (15-inch and larger or 8 feet to 12 feet deep)	20 feet
Wastewater Mains Adjacent to Street ROW	10 feet
Wastewater Mains Adjacent to TxDOT ROW	20 feet
Wastewater Service Lines	15 feet

Table 1-3. Easement Widths for Force Mains

Force Mains	Minimum Easement Width
Force Mains (18-inch and smaller)	15 feet
Force Mains (24-inch and larger)	20 feet
Force Mains Adjacent to Street ROW	10 feet
Force Mains Adjacent to TxDOT ROW	20 feet

Table 1-4. Easement Widths for Combined Mains

Combined Mains	Minimum Easement Width
Combined Mains	Per approval of Director of Public Works

Table 1-5. Easement Widths for Facilities/Appurtenances[1]

Facility/Appurtenance	Minimum Easement Width
Fire Hydrants and Automatic Flushing Valves	5 feet x 5 feet
Air Valve Assembly	10 feet x 10 feet
Blow-Off Valve Assembly	10 feet x 10 feet
Water Meters (smaller than 3-inch)	5 feet x 5 feet
Water Meters (3-inch)	10 feet x 10 feet
Water Meters (larger than 3-inch)	15 feet x 15 feet
1. For appurtenances not listed here, the width of the easement shall be determined by Director of Public Works as required to insure adequate area is available for facility maintenance.	

1.9. *Subsurface Utility Engineering (SUE) Requirements*

1.9.1. *Prior to Initiation* – All existing utilities shall be located and marked prior to initiation of survey for design.

1.9.2. *SUE Provider Requirements* – SUE shall be managed by engineer, geologist, or land surveyor licensed in the State of Texas and work shall be conducted by well-trained, experienced, and capable individuals using state-of-the-art designating equipment, vacuum excavation, or comparable nondestructive locating equipment as well as surveying, data recording equipment, and software systems, as necessary.

1.9.3. *Quality Level Attributes* – Utility Quality Level (QL) attributes are described in the current edition of *Standard Guidelines for Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE 38-02* by American Society of Civil Engineers (ASCE). Accordingly, QL C and QL D shall be conducted for all projects. QL A and QL B shall be conducted in areas with congested utilities, areas where utility information is sparse, where a specific utility of high importance is being crossed (i.e., gas line), or as required by the Director of Public Works. The requirements for the four SUE QLs are as follows:

1.9.3.A. *Quality Level D* – Information derived from existing records or oral recollections.

1.9.3.B. *Quality Level C* – Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D.

1.9.3.C. *Quality Level B* – Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. This work shall be performed to obtain horizontal location of subsurface utilities.

1.9.3.D. *Quality Level A* – Precise horizontal and vertical location of utilities obtained by the actual exposure and subsequent measurement of subsurface utilities, usually at a specific point. This work shall be performed to obtain precise horizontal and vertical locations of subsurface utilities.

1.9.4. *Additional field work* – Additional SUE field work shall be required as conditions change from initial SUE field exploration.

1.10. *Grading, Excavation, Earthwork, and Erosion Control*

1.10.1. No person shall fill, grade, excavate, or otherwise disturb the surface of real property within the City without first having secured a Grading and Floodplain Development Permit. No owner of real property shall knowingly permit another person to fill, grade, excavate or otherwise disturb the surface of real property within the City without first having secured a permit from the Director of Public Works.

1.10.2. Requirements of Section 3.11 Erosion and Sediment Controls shall be met for any fill, grade, excavation or other activities that disturb the surface of real property.

1.11. *Survey Requirements*

1.11.1. *General*-The requirements provided herein shall be minimum standards for projects involving a survey. All surveys shall be tied to the City of Sachse Control Monuments. City monuments can be accessed here: https://www.cityofsachse.com/DocumentCenter/View/1173

1.11.2. *Markers* – Markers consisting of minimum 3/8-inch diameter steel rods at least 24 inches long with caps identifying responsible surveying firm or RPLS number, shall be placed at all:

1.11.2.A. Lot and block corners (wherever a lot line bearing changes);

1.11.2.B. Intersection points of alley and block lines;

1.11.2.C. Curve and tangent points along block, lot, and ROW lines within the subdivision; and

1.11.2.D. ROW dedications.

1.11.3. *Monuments* – Monuments shall be installed and three-dimensional coordinates noted on the plat. Coordinates shall be established using the scale factor.

1.11.4. *Private Project Monuments* – At least two Markers shall be placed at property corners. For developments greater than 10 acres, at least two Monuments at opposing ends of the property and tied into City's system shall be set.

1.11.5. *Public Project Monuments* – Found existing ROW monuments, survey markers or property corners, and proposed monuments shall be shown on the construction plans and located by station and offset, right or left from the control line, baseline or centerline, or by northing and easting.

1.11.6. *Final Acceptance* – If construction damages, destroys, or alters existing survey markers, monuments, or property corners, they must be reset by a licensed surveyor prior to final acceptance.

1.12. *Fees*

1.12.1. *Code Provides Fees* – Fees shall be in accordance with the *Sachse City Code, as amended*. Refer to the City's website for current fee schedules. https://www.cityofsachse.com/DocumentCenter/View/5653

1.12.2. *Other Agency Fees* – Additional fees may be assessed by other regulatory agencies.

1.13. *Revisions to the Design Manual*

1.13.1. *Content of Design Manual and Appendices* – Sections 1 through 9 of the Design Manual provide general procedures and design requirements applicable to all applications, as well as general design requirements for certain public facilities. The appendices to the Design Manual provide greater detail on the requirements provided in Sections 1 through 9, as well as practical tools to help facilitate an application.

1.13.2. *Procedure for Manual Sections Amendments*– Sections 1 through 9 may be amended by City Council approval.

1.13.3. *Procedure for Appendices Updates* – The appendices may be revised in accordance with the following procedures:

1.13.3.A. *Committee review* – All revisions to the Appendices will be considered and approved by a Committee consisting of the following

- Engineering Construction Inspector
- Director of Public Works
- Assistant Director of Public Works
- City Manager

1.13.3.B. *Posting* – Upon approval by the Committee, the proposed revisions will be incorporated into the Design Manual and posted on the Engineering Division Website and take immediate effect.

1.13.4. *Requests for modification* – A formal request to modify current design criteria or add new design criteria may be submitted in writing to the Director of Public Works for consideration by the Committee.

SECTION 2 ROADWAY AND TRAFFIC DESIGN REQUIREMENTS

Section Highlights

- The geometry (horizontal and vertical) for streets and alleys shall be per **Table 2-1** and per AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets*. Refer to the City's Thoroughfare Plan for classification designation.
- The pavement section for streets and alleys shall meet the minimum thicknesses shown on the Standard Details. For arterial roadways, a complete geotechnical report with pavement design shall be completed per **Section 2.11** (Pavement and Subgrade).
- Maximum slopes for natural ground is 4H:1V.
- Minimum sidewalk width is 5 feet if offset from curb and 6 feet if adjacent to curb. Refer to the City's Trail Plan for enhanced pedestrian elements required in corridors.
- All traffic signal designs and traffic control devices shall at a minimum meet the guidelines in Texas Department of Transportation's (TxDOT) current editions of *Texas Manual on Uniform Traffic Control Devices (TMUTCD)*; *Traffic Signals Manual; Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges; Traffic Standard Sheets*; and the requirements herein.

2.1. *General* – This section includes minimum design requirements associated with the City's streets, alleys, pedestrian facilities, off-street parking lots/areas, fire lanes and dumpsters, including geometry, traffic signals, street lighting, new development signage, pavement and subgrade. Traffic Impact Analysis (TIA) requirements and procedures are also included in this section.

2.2. *Roadway Design*

2.2.1. Functional Classification

2.2.1.A. *General* – The arrangement, character, extent, width, and location of all streets shall conform to the City's current adopted Thoroughfare Plan Map, and shall be considered in relation to existing and planned streets, topographical conditions, public safety, and the proposed uses of the land to be served by such streets. When such street is not on the City's *Thoroughfare Plan*, the arrangement of streets shall either:

- Provide for the continuation or appropriate extension of existing streets in surrounding areas; or,
- Conform to a plan for the neighborhood approved or adopted by the City to meet a particular situation where topographical or other conditions make continuance or conformity to existing streets impracticable.

2.2.1.B. *Roadway Classifications* –**Table 2-1** summarizes the general design criteria for the City's adopted thoroughfare plan classifications as well as residential alleys. Typical sections are depicted in **Figure 2-1**. The terms 'Minor Arterial' and 'Secondary Arterial' are interchangeable.

2.2.1.C. *Exceptions* – Exceptions to the design criteria presented in **Table 2-1** may be considered on a case-by-case basis and shall require Director of

Public Works approval. Refer to **Section 1.6** (Variance Requests). Exceptions may include the following:

2.2.1.C.i. *Overlay Districts* – Refer to **Section 1.3** (Interpretation and Applicability) for standards that apply to Overlay Districts. In all cases the design criteria within the *Engineering Design Manual* shall be satisfied. If the engineering design criteria is not met, a variance is required.

2.2.1.C.ii. *Rural Applications* – Rural roadways with roadside ditch drainage may be considered on a case-by-case basis. The right-of-way (ROW) width required for rural roadways varies based on the width of the ditch. Refer to **Section 3.7** (Open Channels) for applicable design criteria. In all cases, the following criteria shall be satisfied:

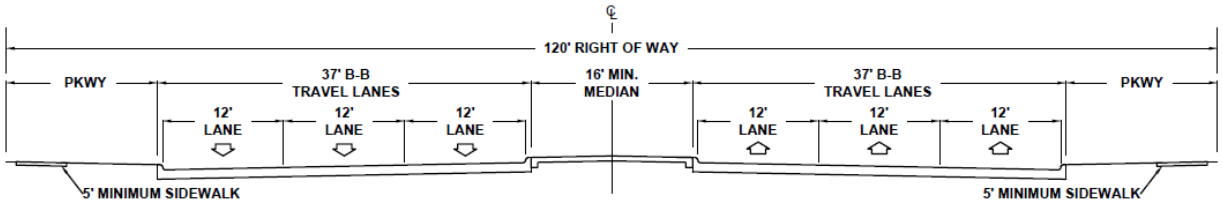
- ROW width shall be a minimum of 65 feet;
- Paving width shall be a minimum of 26 feet. If bike lanes are designated on the Trails Master Plan, additional paving width shall be required; and,
- An additional 5 feet of parkway shall be provided between the top of the ditch backslope and ROW line on both sides of the roadway. If sidewalks/trails exist or are planned, an additional 5 feet of parkway beyond the sidewalk/trail shall be required. Refer to **Figure 3-5** for applicable dimensions and drainage requirements.

2.2.1.C.iii. *Urban Streets* – Transportation facilities which serve established communities, serve an urban mixed-use development, or require multiple modes of travel may follow a context sensitive, multi-modal approach to identifying the typical street section(s). These typical street sections may not comply with those in **Table 2-1**.

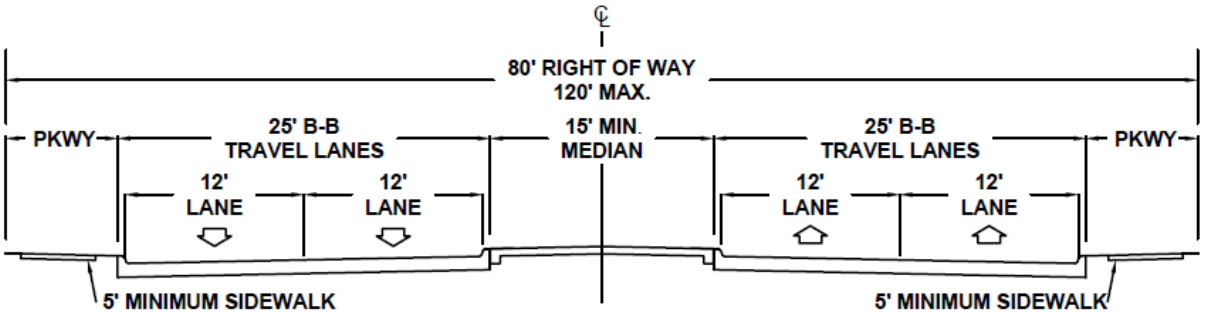
Table 2-1. General Roadway Design Criteria

Criteria[1]	Classification[1]										
	Principal Arterial	Minor Arterial			Collector			Local	Alley		
	A	B	PGBT-A[2]	PGBT-B[2]	C-1	C-2	PGBT GEN[2]	L-1	A-1	PGBT RES	PGBT COM
ROW Width[3]	120’	80’-120’	84’	54’	60’	60’	52’	50’	20’		32’
Number of Lanes	6	4	4	2	2	3	2	2	1	2	
Paving Width (B-B)	2x37’	2x25’	70’	41'	37’	37’	38’	31’	12’	16’	32’
Thru Lane Width[4]	12’		11’	12’	18’	12’	11’	15’	12’	8’	16’
Median Width (B-B)	16' Min.	15' Min.	N/A								
Continuous Left Turn Lane	N/A					12'	N/A				
Sidewalk Width	5' Min.	5' Min.	7’		5' Min.		7’	5’ Min.	N/A		
Design Speed	45 mph	40 mph			35 mph			30 mph	N/A		
Minimum Horizontal Inside Radius	1,050’	800'			540’			210’	210’		
Minimum Tangent Between Curves	100’	100’			0’			0’	0’		
Maximum Grade	5.00%	5.00%			5.00%			5.00%	5.00%		
Minimum Grade	0.60%	0.60%			1.00%			1.00%	1.00%		
Vertical Crest Curve (K)	61	44			29			12	12		
Vertical Sag Curve (K)	79	64			49			26	26		
Design Vehicle[5]	WB-67 Truck/Trailer				Fire Truck[6]						
On-Street Parking[7]	Prohibited		Included		Allowed	Prohibited	Included	Allowed	Prohibited		

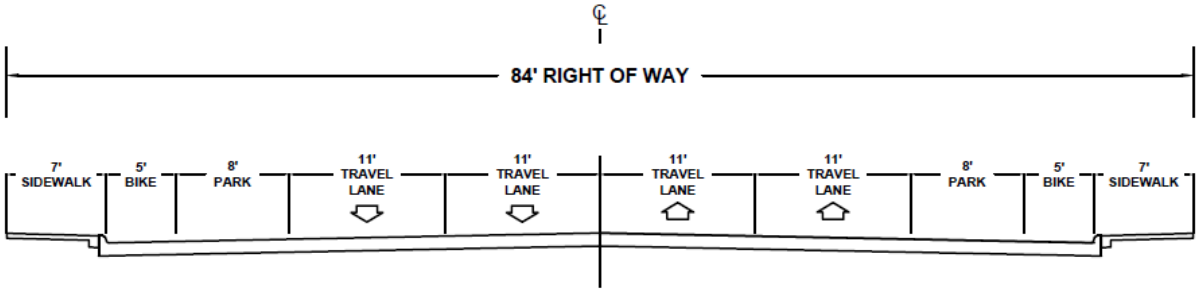
1. Design parameters shall be based on AASHTO’s current edition of *A Policy on Geometric Design of Highways and Streets*.
2. Street Classification defined within the PGBT zoning district. Different paving width B-B based on parking angle.
3. Reference **Table 2-3** for increased ROW width requirements at intersections.
4. Minimum lane width may increase if heavy truck traffic is expected.
5. Design vehicle as it relates to functional classification of the roadway.
6. Fire Truck design vehicle shall be in accordance with direction from the Fire Marshal.
7. On-street parking shall comply with these regulations unless otherwise provided by City Ordinance.



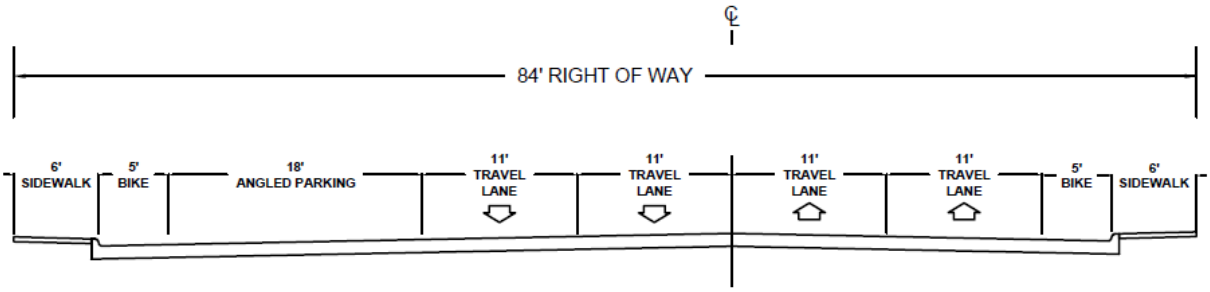
A PRINCIPAL ARTERIAL (MIDBLOCK)



B MINOR ARTERIAL (MIDBLOCK)



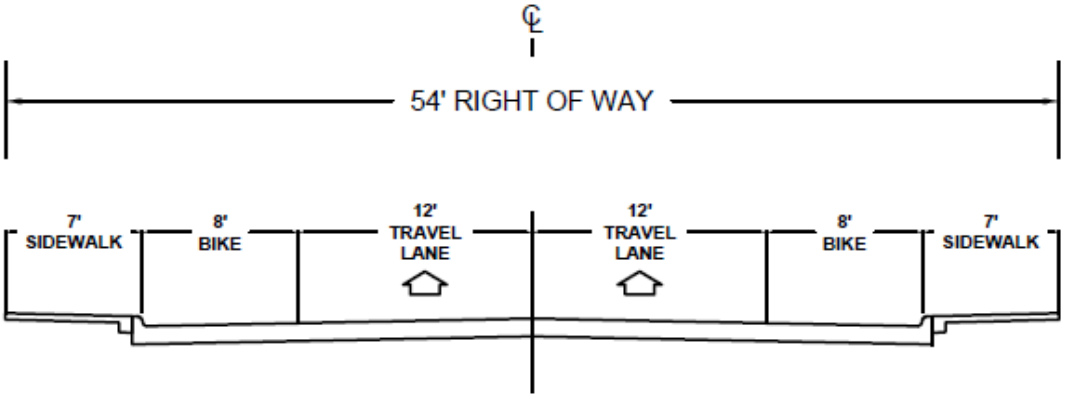
PGBT-A MINOR ARTERIAL (PARALLEL PARKING)



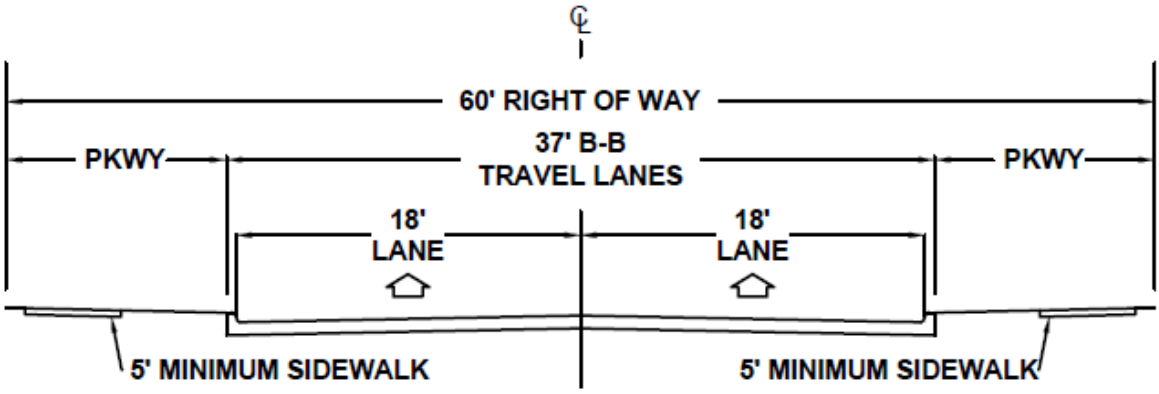
PGBT-A MINOR ARTERIAL (ANGLED PARKING)

Figure 2-1. Roadway Typical Sections

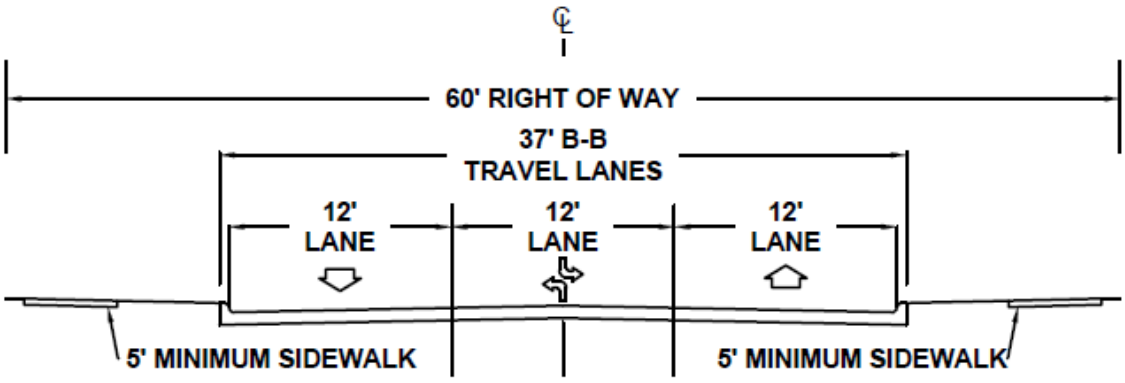
Note: Reference **Table 2-3** for increased ROW width requirements at intersections. Reference PGBT Zoning district in City code for determination of parking alignment.



PGBT-B MINOR ARTERIAL (MIDBLOCK)



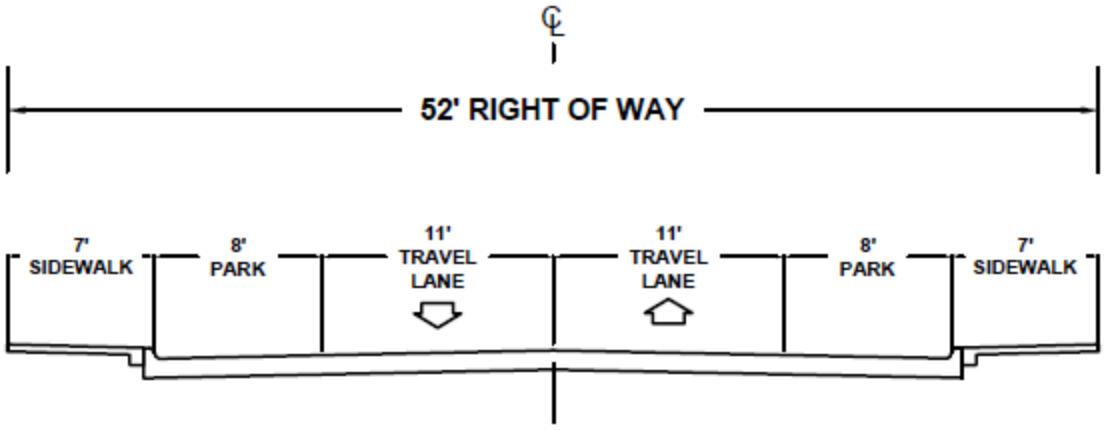
C-1 COLLECTOR (MIDBLOCK)



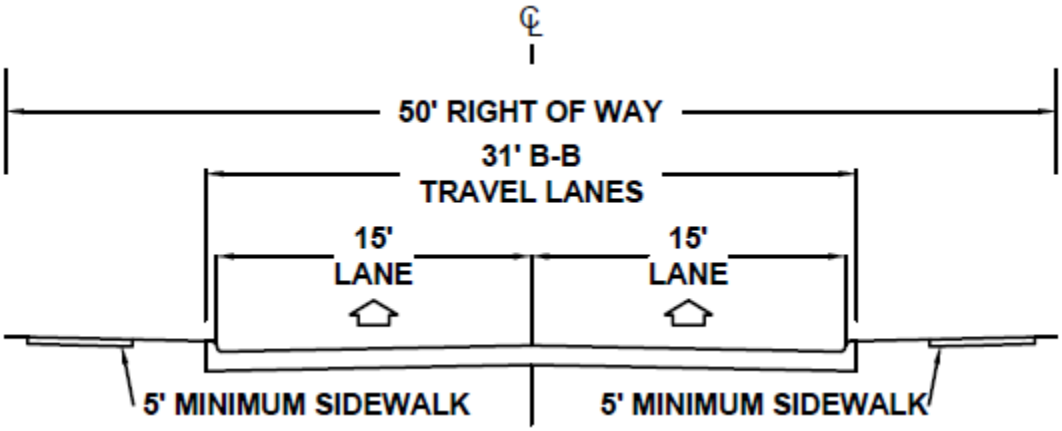
C-2 COLLECTOR (MIDBLOCK)

Figure 2-1. Roadway Typical Sections

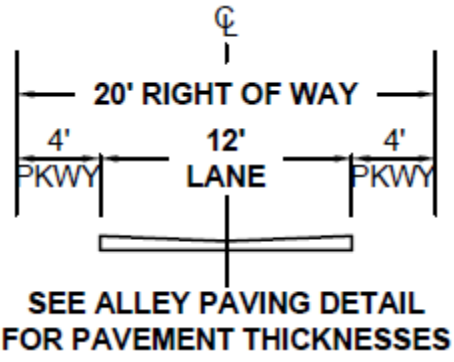
Note: Reference **Table 2-3** for increased ROW width requirements at intersections.



PGBT GENERAL COLLECTOR (MIDBLOCK)



LOCAL ROADWAY (MIDBLOCK)



TYPICAL RESIDENTIAL ALLEY (MIDBLOCK)

Figure 2-1. Roadway Typical Sections

Note: Reference **Table 2-3** for increased ROW width requirements at intersections.

2.2.2. Horizontal Alignment

2.2.2.A. Roadways shall be typically placed in the center of ROW. The Director of Public Works may require a shift in the horizontal alignment due to the inclusion of pedestrian elements or connection to existing streets.

2.2.2.B. The minimum radii shown in **Table 2-1** are based on a typical 2% adverse crown (-2%). Minimum radii are applicable to the inside radius, not the roadway centerline. Smaller radii are discouraged, but may be used with the appropriate super-elevation to maintain the design speed, with approval by the Director of Public Works.

2.2.3. Vertical Alignment

2.2.3.A. A vertical curve is required when two longitudinal street grades intersect at a point of vertical intersection (PVI) and the algebraic difference is more than 2.0% for residential alleys and local streets (L2 and L1). Vertical curves are required when the algebraic difference is more than 0.5% for all other roadway classifications. To determine the acceptable length of crest and sag curves follow the guidelines in AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets*. The K values for vertical crest curves and vertical sag curves provided in **Table 2-1** are target values, not minimums, for streets with curbs. This approach avoids poor drainage associated with long, flat curves.

2.2.3.B. In all cases, vertical curve alignment shall provide adequate stopping sight distance in accordance with AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets*.

2.2.4. Cross-Sectional Elements

2.2.4.A. *Pavement Cross-Slopes* – All streets shall have a maximum cross-slope of 2%. The cross-slope can vary where there is a transition into or out of a maximum 2% straight grade across the entire street width or street intersections. When super-elevation is approved by the Director of Public Works, the maximum allowable slope is 5%. Super-elevation must be designed in accordance with AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets*.

2.2.4.B. *Vertical Clearance* – No point within pavement surface area shall have a vertical clearance less than 16.5-feet from any bridge, structure, and utility. The vertical clearance for trees shall be 16.5 feet from all vehicular pavement plus a minimum of 5 feet behind back of curb.

2.2.4.C. *Clear Zone* – A clear zone shall be provided for all streets in accordance with AASHTO's current edition of *Roadside Design Guide*. In general, a minimum clear zone of 4 feet shall be provided from the face of curb on tangent sections and a minimum clear zone of 6 feet shall be provided from the face of curb on curved sections. Where clear zone requirements cannot be met, a guardrail or other type of barrier shall be required in accordance with AASHTO's current edition of *Roadside Design Guide*.

2.2.4.D. *Horizontal Clearance* – Horizontal clearance for 1.5 feet behind the face of curb shall be provided for all streets in accordance with AASHTO's current edition of *Roadside Design Guide*.

2.2.4.E. *Structures* – Private fences, walls, screening devices, and other structures shall not be erected within the ROW or visibility triangle. Power poles and street lights are excluded from this restriction provided they maintain visibility.

2.2.5. Partial or Half-Streets

2.2.5.A. The allowance of and ROW dedication for partial or half-streets is governed by the Sachse City Code.

2.2.5.B. If a partial street is allowed by the Sachse City Code, the Developer shall be responsible for at least two travel lanes of clear pavement width including bicycle facilities, if applicable. The travel lanes to be constructed shall be the two lanes closest to the property being developed (i.e. the outside lanes of the ultimate street configuration). In cases where the ultimate typical section travel width is less than 30 feet (face of curb to face of curb), the Developer shall be responsible for the full width of clear pavement. Additional ROW and easements shall be dedicated as necessary to install signage and to perform grading activities.

2.2.6. Dead-End Streets/Culs-de-Sac

2.2.6.A. New streets longer than 150 feet in length shall not dead-end without some means of traffic circulation. Properly designed culs-de-sac are acceptable.

2.2.6.B. Medians or islands in culs-de-sac are prohibited.

2.2.6.C. A cul-de-sac shall not be longer than 600 feet measured from the main street curb to the cul-de-sac curb furthest away. The closed end shall have a turn-around provided with an outside roadway diameter of at least 96 feet and a ROW line diameter of at least 120 feet. Culs-de-sac shall conform to the dimensions shown in **Figure 2-15**. Minimum dimensions may vary based on direction from the Fire Marshal.

2.2.7. Residential Streets

2.2.7.A. *Residential Frontage* – Residential lots shall conform to the City's Subdivision and Zoning Ordinances as well as City Council's plat approval requirements.

2.2.7.B. *Knuckles* – Knuckles should follow the culs-de-sac radius criteria.

2.3. *Intersections*

2.3.1. *General* – Intersections shall be designed to facilitate the safety, convenience, and efficiency of the motor vehicles, bicycles, and pedestrians traveling through it.

2.3.2. *Grading Plan* – A separate grading plan shall be provided for any intersection involving an arterial or collector. The grading plan shall include profiles and/or spot elevations for each curb return, curb ramp, and crosswalk.

2.3.3. *Alignment* – Thru lanes shall line up across intersections with no offset.

2.3.4. *Angles* – Arterials shall intersect at 90-degree angles. For collector and local roadway intersections, up to 10-degree skew is allowable.

2.3.5. *Curb Returns* – The curb return radius at an intersection shall be in accordance with **Table 2-2**. Gutter slope along the curb return shall be a minimum of 0.5%.

Table 2-2. Curb Return Radius

Largest Classification	Intersecting With	Curb Return Radius (feet)
Arterial	Arterial	40
Arterial or Collector	Collector	30
Arterial, Collector, or Local	Local	25

2.3.6. *Cross-Slopes* – Street cross-slopes shall be transitioned to allow for a sloped plane across intersections. Cross-slope shall not exceed 2% at crosswalks in accordance with **Section 2.9** (Pedestrian Facilities).

2.3.7. *Crosswalks* – Crosswalks shall be provided in all four directions. The City's preference is for crosswalks to pass through intersections prior to the start of the median nose. However, median refuge islands are acceptable. Refer to **Section 2.12** (Traffic Control) for additional requirements.

2.3.8. *Inlets* – Drainage inlets shall be installed to capture stormwater prior to entering intersections in accordance with **Section 3.4** (Inlet Location and Capacity).

2.3.9. *Pavement and Subgrade* – Refer to **Section 2.11** (Pavement and Subgrade) for pavement and subgrade requirements at intersections.

2.3.10. *Sight Visibility* – Adequate sight distances are required at intersections. Refer to **Section 2.4** (Sight Visibility).

2.3.11. *ROW Flares at Intersections* – ROW flares at intersections shall be required to accommodate left and right turn lanes for divided and undivided arterials. In addition, ROW flares at Principal Arterial/Principal Arterial intersections shall accommodate dual left turn lanes. ROW flares at all other intersections shall accommodate a single left turn lane per **Table 2-3**. ROW tapers shall occur with respect to left and right turn lane tapers and median widening (if applicable) as shown in **Figure 2-2**.

Table 2-3. ROW Flares at Intersections

Largest Classification at Intersection	Additional ROW Required Per Lane[1] (feet)
Principal Arterial	+12
Minor Arterial, Collector	+11
1. Refer to **Table 2-1** for ROW width.	

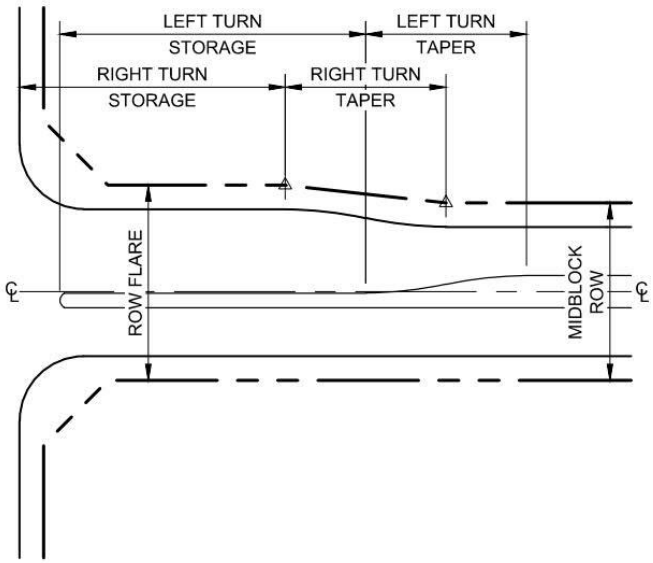


Figure 2-2. ROW Flare at Intersection

2.4. *Sight Visibility*

2.4.1. *General* – Sight visibility is required at all intersections via sight visibility triangles and corner clips as described in this section. At a minimum, all intersection visibility requirements shall meet the guidelines in AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets*.

2.4.2. Sight Visibility Triangles

2.4.2.A. Easements for sight visibility triangles shall be provided where a public access driveway, an alley, or a stop-controlled street intersects an uncontrolled street and on any signalized intersection approach where right turn on red operation is permitted.

2.4.2.B. Sight visibility triangles shall be free of obstructions between 2 feet and 9 feet above the top of pavement. Obstructions include hedges, trees, shrubs, bushes, plants, foliage, signs, poles, fences, screens, buffers, billboards, structures, walls, motorized or non-motorized vehicles, or any other man-made or natural item that conflicts with the visibility of pedestrians, bicycles, or motor vehicles approaching an intersection, public access driveway, or traffic control device. Power poles and street lights are excluded from this restriction provided they maintain visibility.

2.4.2.C. Sight visibility triangles at intersections shall be provided in accordance with **Figure 2-3** and **Table 2-4**. These calculations assume the driver is 15 feet behind the curb line of the intersecting street; at-grade intersection with approaches of 3.0% or less; driver eye height is 3.5 feet above pavement; and, both drivers can see each other. AASHTO's current edition of *A Policy on Geometric Design of Highways and Streets* shall be used to determine the sight visibility triangles.

Table 2-4. Sight Visibility Triangle Dimensions

Classification	Design Speed (mph)	Minimum Sight Distance (feet)	
		SD_L[1]	SD_n[1]
Local	30	245	255
Collector	35	315	325
Minor Arterial	40	480	545
Principal Arterial	45	580	650

1. SD_L and SD_n are the required sight distances to the left and to the right as measured from the driver's eye on the uncontrolled intersection approach looking toward oncoming cross-traffic.
2. W_L and W_n are the distances along the curb line of the side of the visibility triangle parallel to the path of traffic on the uncontrolled intersection approach.
3. D_L and D_n are the distances along the curb line of the side of the visibility triangle parallel to the path of the driver on the uncontrolled intersection approach.
4. The dimensions for W_L, W_n, D_L, and D_n must be calculated for each intersection.

2.4.2.D. In cases where the street contains a horizontal curvature, the intersection sight distance must be measured along the horizontal curve as shown in **Figure 2-4**.

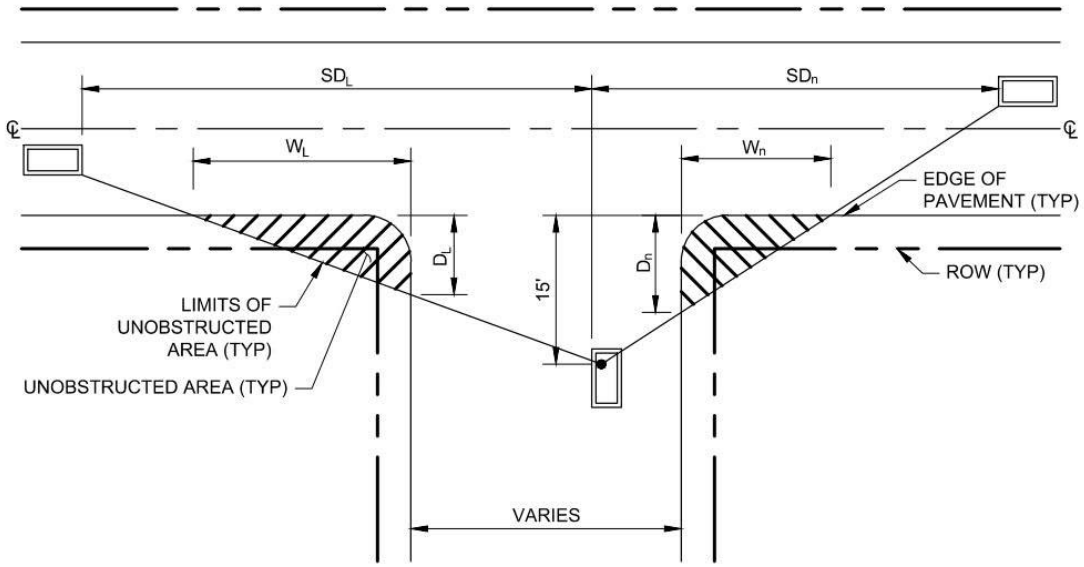


Figure 2-3. Sight Visibility Triangle Measurement

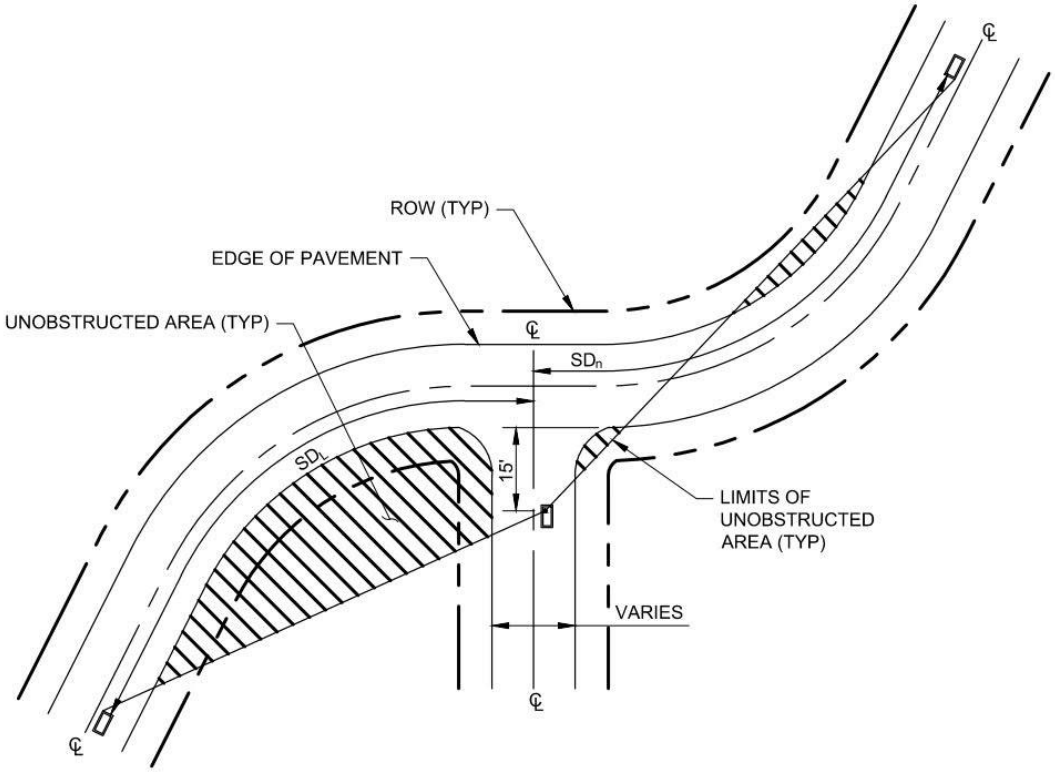


Figure 2-4. Sight Visibility Triangle Along Curve

2.4.3. Corner Clips

2.4.3.A. Corner clips are ROW dedications that shall be provided on all corners of an intersection between two streets or an intersection between an alley and a street. This corner clip aids in street intersection visibility as well as provides sufficient room for sidewalks, barrier free ramps, utility appurtenances, and other street facilities. If the corner clip is within the sight visibility triangle, all sight distance requirements must be maintained. As shown in **Figure 2-5**, the ROW dedication for the corner clip does not necessarily include the sight visibility easement.

2.4.3.B. All intersections shall have a corner clip as shown in **Figure 2-5** and **Table 2-5**.

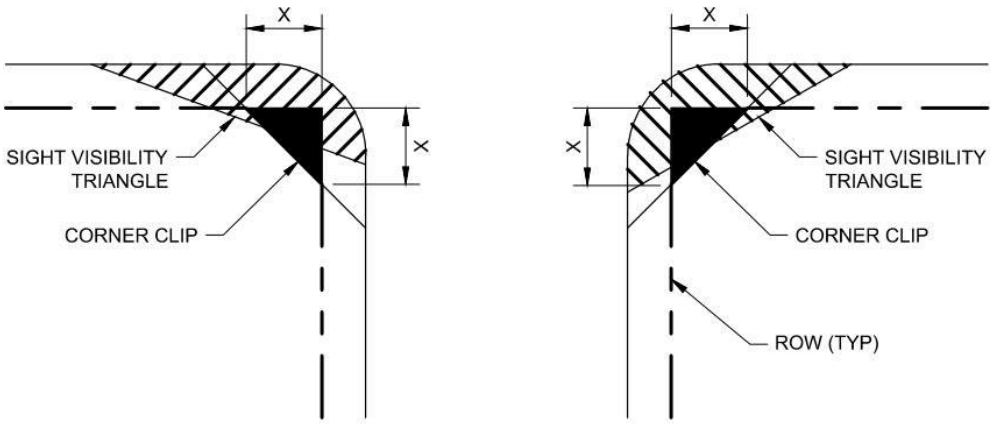


Figure 2-5. Corner Clips at an Intersection

Table 2-5. Corner Clip Distance

Intersection Type[1]	Distance X (feet)[2]
Signalized	25
Not Signalized	25
1. The Director of Public Works may determine corner clip requirements based on existing, proposed, or ultimate (future) conditions. 2. The corner clip shall have the same dimension on all corners of the intersection, based on the largest classification roadway at the intersection.	

2.5. *Access Management*

2.5.1. *General* – This section includes general access management requirements. Refer to **Section 2.16** (Traffic Impact Analysis) for Traffic Impact Analysis (TIA) requirements.

2.5.2. *High Volume Drive-Through Requirements* – The amount of stacking required on-site for a proposed development shall be based on what is required in the Sachse Zoning Ordinance or based on a TIA, whichever is greater.

2.5.3. *Minimum Access Points* – A minimum of two planned points of public ingress and egress are required to facilitate emergency vehicle access and to distribute traffic through the development as determined by the Fire Marshal and the Director of Public Works.

2.5.4. School Access and Location Criteria

2.5.4.A. *General* – The location of a daycare or school facility has an impact on adjacent land uses and mobility, and as potential sites are evaluated for future facilities, multiple factors should be considered. Early designation of school sites helps to ensure adequate access and traffic circulation as well as minimizing development costs. The following criteria are intended to assist City staff and Developers in the provision of proper site locations for these facilities during the development process. When applicable, Developers are encouraged to discuss with the school district where a proposed project is to be located, prior to submittal, to determine district's potential need of a facility, as well as best placement within the development.

2.5.4.B. *Traffic Management Plan* – A TMP is required for all public and private schools. This study shall include the estimated maximum peak hour trip generation of the facility, the planned circulation of inbound and outbound traffic during drop-off and pick-up operations, and the estimated length of the queue of cars waiting to pick up students. The TMP must alleviate all conflicts with through-traffic and traffic movements on public right-of-way abutting and in the vicinity of the application, and must include a design for picking-up and dropping-off students without queuing vehicles into public right-of-way.

2.6. *Median Openings and Turn Lanes*

2.6.1. General

2.6.1.A. Median openings shall be provided at driveways in accordance with this section. Refer to **Section 2.7** (Driveways) for additional design criteria.

2.6.1.B. Turn lanes shall be provided at all intersections in accordance with this section. Refer to **Section 2.3** (Intersections) for additional considerations at intersections.

2.6.1.C. Dimensions given are minimum design requirements. The Director of Public Works may alter parameters to fit the needs of specific situations, including, but not limited to, requiring longer storage lengths or regarding cross-access to properties.

2.6.2. Medians and Median Openings

2.6.2.A. Access points to subdivisions and developments shall be spaced per these requirements. At the intersection of a new subdivision or development street with an existing divided arterial, the Developer of the subdivision shall construct a median opening in the divided arterial to allow direct access to the property from the arterial per these spacing and dimensional requirements. The Developer shall be required to construct a left turn lane in the arterial to ensure adequate traffic control and safety at that intersection.

2.6.2.B. *Median Access Classifications* – The following median classifications may apply:

- *Full Median Opening* – An opening in the median of a roadway permitting midblock median opening traffic movements into and out of a properly aligned driveway;
- *Left Turn Entry Only (Hooded Left)* – An opening in the median of a roadway that permits left turns into a properly aligned driveway but prevents all other cross-median traffic movements;
- *Left Turn Exit Only* – An opening in the median of a roadway that permits left turns from a properly aligned driveway but prevents all other cross-median traffic movements; and,
- *U-Turn Only* – A median opening without driveways that permits U-turns.

2.6.2.C. *Cross-Median Access* – Cross-median access to or from an existing or proposed driveway may be allowed if:

- The median is of sufficient length to be subdivided into multiple medians, each of which meets or exceeds the minimum median length described in this section;
- The median is of sufficient width to permit the construction of an exclusive left turn lane; and,

- Such access does not adversely impact the provision for cross-median access to a lot, parcel, or tract of land on the opposite side of the street. If an existing driveway, street, or access point is already constructed on the opposite side of the roadway, the new driveway should align with the existing driveway, street, or access point.

2.6.2.D. *Median Opening Length* – Median openings shall be a minimum of 20 feet wider than the width of the driveway/street/access point throat width which they are serving. Regardless of driveway width, the minimum length of a full median opening shall be 60 feet and shall accommodate all the turning maneuvers of the design vehicle for which the driveway is designed. Refer to **Table 2-1** for design vehicles. The minimum length of a full median opening shall be of sufficient length so that concurrent turning maneuvers from exclusive left turn lanes serving the driveways on each side of the roadway do not conflict with each other. The maximum length of a full median opening shall be limited so that the median opening serves only a single driveway on each side of the roadway. Turning movements of design vehicle shall be shown plan submittal.

2.6.3. Left Turn Lanes and Median Islands

2.6.3.A. *Requirement* – Single left turn lanes shall be provided for all intersections and driveways that connect at a median opening. Dual left turn lanes shall be required for all arterial/arterial intersections when peak hour turning volumes exceed 300 vehicles.

2.6.3.B. *Storage Length* – Left turn storage lengths shall be sized to store the number of vehicles expected to queue in the lane during an average peak period. At a minimum, left turn storage length shall meet the minimum dimensions shown in **Table 2-6** and **Table 2-7**. Additional length may be required based on traffic volumes or TIA storage requirements discussed in **Section 2.16** (Traffic Impact Analysis).

2.6.3.C. *Width* – Single left turn lanes on arterials shall be 12 feet in width. Dual left turn lanes on arterials shall be 11 feet in width. All other left turn lanes shall be 11 feet in width.

2.6.3.D. *Taper Lengths* – Single left turn lane taper lengths shall be per **Table 2-6** and **Table 2-7**. Left turn lane tapers shall be designed using either:

- Symmetrical reverse curves of at least 250 feet minimum radius; or,
- Asymmetrical reverse curves where the leading reverse curve is twice the radius of the following reverse curve and the leading reverse curve has a minimum radius of at least 300 feet.

2.6.3.E. *Minimum Length of Median Islands and Associated Left Turn Lanes at Midblock Openings* – Median island, storage, and taper lengths shall be as shown in **Figure 2-6** and **Table 2-6**.

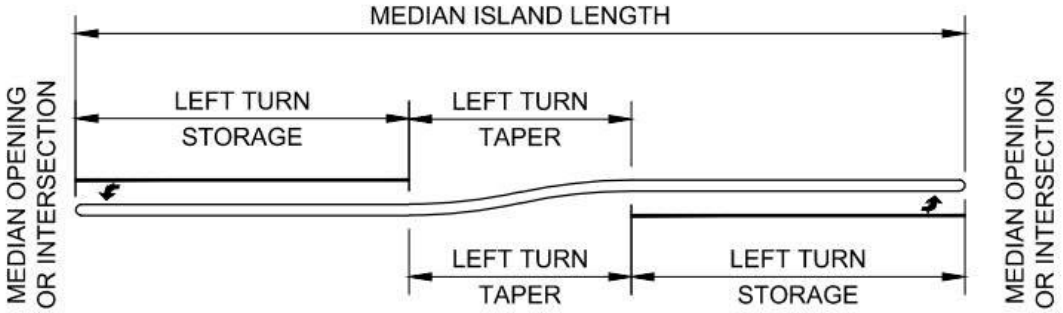


Figure 2-6. Minimum Spacing Between Median Opening or Intersection for Divided Arterials

Table 2-6. Minimum Spacing Between Median Opening or Intersection for Divided Arterials

Classification	Upstream Midblock Opening Classification	Downstream Midblock Opening Classification	Minimum Median Island Length (feet)	Left Turn Lane Lengths		
				Upstream Storage (feet)	Taper (feet)	Downstream Storage (feet)
Arterial Single Left	Arterial	All (Local)	500	150	200	150 (100)
Arterial Dual Left	Arterial	All (Local)	600	250	200	150 (100)
Principal or Minor Arterial	Non-Residential Collector, Local, or Driveway	Non-Residential Collector, Local, or Driveway	400	150	100	150
	Non-Residential Collector, Local, or Driveway	Residential Local	350	150	100	100
	Residential Local	Residential Local	300	100	100	100

2.6.3.F. *Minimum Length of Left Turn Lanes for Undivided Arterials* – Turn lane storage and taper lengths shall be as shown in **Table 2-7**.

Table 2-7. Minimum Left Turn Lane Lengths for Undivided Arterials

Classification	Intersecting Classification	Left Turn Lane Lengths	
		Storage (feet)	Taper (feet)
Minor Arterial	Arterial	200	100
	Non-Residential Collector, Local, or Driveway	150	100
	Residential Local	100	100
Collector	Arterial	150	100
	Non-Residential Collector, Local, or Driveway	100	100
	Residential Local	100	100

2.6.4. Right Turn Lanes

2.6.4.A. *Requirement* – Right turn lanes shall be provided at all intersections with arterials, and at all non-residential driveways where peak turning movement exceeds 100 vehicles per hour.

2.6.4.B. Placement

2.6.4.B.i. *Upstream Right Turn Lanes* – A minimum tangent section of 30 feet shall be provided between the preceding driveway or cross-street curb return and the taper of a right turn lane as shown in **Figure 2-7**.

2.6.4.B.ii. *Downstream Right Turn Lanes* – Refer to **Section 2.7** (Driveways) for corner clearance required at driveways.

2.6.4.B.iii. *Continuous Right Turn Lanes* – Where several successive driveways require exclusive right turn lanes, and the driveway spacing is not adequate to avoid encroachment of the right turn lane on another driveway, a continuous right turn lane shall be used.

2.6.4.C. *Storage Measurement* – Right turn storage length shall be measured from the end of the right turn taper to the point of curvature of the curb return radius into the driveway or intersection as shown in **Figure 2-7**.

2.6.4.D. *Storage Length* – Right turn storage lengths shall be sized to store the number of vehicles expected to queue in the lane during an average peak period. At a minimum, right turn storage length shall meet the minimum dimensions shown in **Table 2-8**. Additional length may be required based on traffic volumes or TIA storage requirements discussed in **Section 2.16** (Traffic Impact Analysis).

2.6.4.E. *Width* – Right turn lanes on arterials shall be 12 feet in width. All other right turn lanes shall be 11 feet in width.

2.6.4.F. *Taper Length* – Right turn lane taper lengths shall be 100 feet in length as shown in **Table 2-8**. Right turn lane tapers shall be designed using either:

- Symmetrical reverse curves of at least 250 feet minimum radius;
- Asymmetrical reverse curves where the leading reverse curve is twice the radius of the following reverse curve and the leading reverse curve has a minimum radius of at least 300 feet; or,
- A drop transition at the nearest driveway 100 feet or more upstream from the start of the required right turn lane length.

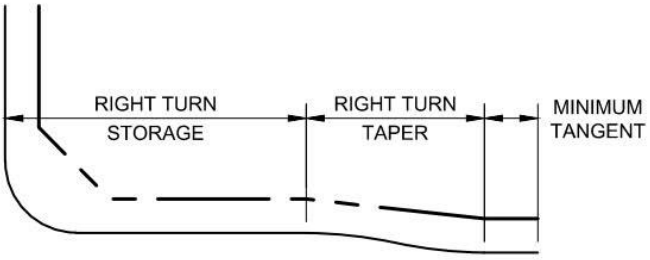


Figure 2-7. Minimum Right Turn Lane Lengths

Table 2-8. Minimum Right Turn Lane Lengths

Classification	Intersecting With	Right Turn Lane Lengths	
		Storage (feet)	Taper (feet)
Principal Arterial, Minor Arterial, or Collector	Arterial, Non-Residential Collector, Local, or Driveway	150	100
	Residential Local	100	100

2.7. *Driveways*

2.7.1. General

2.7.1.A. All driveways shall be provided to accommodate all vehicular and pedestrian movements as specified in this section. Driveways shall meet the minimum dimensions and spacing shown in **Table 2-9**.

2.7.1.B. *Driveway Types* – Driveways are permitted to intersect with the City's roadway classifications as follows:

- *Single-Family Residential* – Access prohibited to arterials; and,
- *Multi-Family, Industrial, Commercial* – Access permitted only to arterials and collectors.

2.7.1.C. *Approval* – Typical residential driveways are reviewed and approved by the Building Inspection Department. Requests for circular residential driveways are reviewed and approved by the Director of Public Works. Proposed commercial or industrial driveways are reviewed during the plan review process by applicable City staff. Widening of approach shall be required if driveway apron is widened.

2.7.1.D. *Minimum Standards* – All driveways shall be concrete and shall be designed in accordance with the Standard Details.

2.7.1.E. *Mutual Access* – Encroachment of driveways shall not occur on an adjacent property without a mutual access easement being executed between both property owners. Adjacent property owners may make a written request to the Building Official for a shared driveway connection. A shared driveway connection is created when the driveways of adjacent properties both abut the shared property line.

2.7.1.F. *Measurement* – Spacing between driveways shall be measured along property lines from the closest edge of pavement (throat) from one driveway to the closest edge of pavement (throat) of the next driveway.

2.7.1.G. *Driveways on Frontage Roads* – Driveway spacing on all frontage roads shall be governed by TxDOT and shall meet minimum standards in accordance with TxDOT's current edition of the Roadway Design Manual and the Access Management Manual.

Table 2-9. Minimum Driveway Spacing Requirements

Driveway Type	Located On	Flare/Radius			Driveway Width		Spacing from Another Driveway (C)	Spacing from Intersection (Intersection With → Minimum Distance)	Number of Driveways
		Type	Min.	Max.	Min.	Max.	Min.	Min.	Max.
Single-Family Residential	Alley	Fillet	5’	5’	12’	24’	10’	Street (any classification) → 25’ Alley → 20’	Rear entry garage or carport is limited to one alley connections per lot, tract or parcel Front or side entry garage or carport may have two street connection and one alley approaches per lot, tract or parcel
	Local or Collector	Radius or Fillet	5’	5’	12’	24’			
Utility Service	All	Radius or Fillet	15’		12’	15’	½ Commercial Driveway Requirements	Follow Commercial Driveway Requirements	
Multi-Family Residential/ Commercial/ Industrial	Principal Arterial	Radius	20’		30’	40’	150’	Principal Arterial → 150’ Minor Arterial → 125’ Collector → 100’ Local/Alley → 50’	Major/Minor Arterial → 150’ Collector/Local → 100’ A maximum of three driveways shall be permitted for each 1,000 feet of roadway frontage, regardless of the minimum spacing requirements.
	Minor Arterial	Radius	20’		30’	40’	150’	Major/Minor Arterial → 100’ Collector/Local/Alley → 50’	
	Collector	Radius	15’		24’	36’	100’	All → 50’	
	Local	Not Permitted							
	Alley	Not Permitted							

Notes:
1. Driveway spacing may be reduced by up to ½ for an entry only partial access driveway followed consecutively by a downstream exist only partial access driveway.
2. Exiting trips is actual or projected peak hour exiting trips.
3. Except as provided by the approval of circular driveway access.
4. Entry only and exit only partial access driveways shall be considered to be ½ of a right turn in/right turn out partial access driveway or full access driveway.

2.7.2. Geometry

2.7.2.A. *Flare/Radius* – The flare or radius cannot extend past the adjoining property line without written permission of adjacent property owner. The termination point of a driveway radius or fillet shall be a minimum of 10 feet from a storm sewer inlet and 5 feet from a fire hydrant.

2.7.2.B. *Minimum Number of Driveway Lanes per Driveway* – For full access driveways on an arterial, a minimum of one entering lane and two exiting lanes are required.

2.7.2.C. Driveway/Public Street Intersection Angle

2.7.2.C.i. The deflection angle of all full access or right turn in/right turn out partial access driveway connections to public streets may vary from 80 degrees to 100 degrees. The driveway shall be tangent and without curve from the right-of-way line to a point 25 feet within the lot, parcel or tract of land the driveway is accessing.

2.7.2.C.ii. The deflection angle of all entry only or exit only partial access driveway connections to public streets may vary from 45 degrees to 90 degrees. The driveway shall be tangent until it has fully entered private property.

2.7.2.D. *Location of Driveways* – A driveway serving a multifamily or non-residential land use shall not be located at established pedestrian crossings of public streets.

2.7.2.D.i. A driveway serving a multifamily or non-residential land use shall not be constructed in existing angle parking areas except when the curb is restored to its normal location along the roadway in front of the premises.

2.7.2.D.ii. A driveway serving a multifamily or non-residential land use shall not be designed or constructed for use for the standing or parking of vehicles or for use as angle parking.

2.7.2.E. *Street Intersection Corner Clearance* – When the adjacent street frontage is within the minimum corner clearance distance:

2.7.2.E.i. If the lot, tract or parcel is in the process of being subdivided and replatted from a larger tract of land with sufficient frontage to meet the minimum corner clearance distance, a joint access easement by plat shall be required of the subdivider so that the minimum corner clearance requirement is met.

2.7.2.E.ii. If the lot, tract or parcel cannot obtain a joint access easement to meet the minimum corner clearance requirements, a single driveway connection may be made at the point along the public street frontage that provides the maximum clearance distance.

Table 2-10. One-Way Driveway Dimensions

Driveway Type	Driveway Width		Curb Return Flare or Radius (feet)[1]	Median Width	
	Ingress (feet)	Egress (feet)		Minimum (feet)	Maximum (feet)
Commercial and Industrial One-Way	20	24	30	4	10
1. This is the City standard. Design vehicle may require different dimensions.					

2.7.3. *Grades* – Refer to the Standard Details for minimum and maximum grades.

2.7.4. Circular Residential Driveways

2.7.4.A. Circular driveways for single-family detached residential land uses may be approved for the following conditions:

- A corner lot at the intersection of two local residential streets or at the intersection of a local residential street and a collector street may have one circular driveway with a connection on each street subject to the corner and property line clearance requirements; or,
- A lot with only single street frontage on a local residential or collector street may have one circular driveway with a maximum of two connections in the front yard subject to the corner and property line clearance requirements.

2.7.4.B. The deflection angle of a circular driveway connection to the public street may vary from 45 degrees to 90 degrees.

2.7.4.C. The curb return radius of the obtuse entry or exit angle of each circular driveway connection shall be a minimum of 20 feet.

2.7.4.D. Circular driveways shall not be approved for duplex residential land uses.

2.7.5. Commercial, Industrial, and Multi-Family Driveways

2.7.5.A. A maximum of three driveways shall be permitted for each 1,000 feet of roadway frontage, regardless of the minimum spacing requirements.

2.7.5.B. *Opposite Driveway Offset* – Non-residential and multi-family driveways on opposite sides of an undivided street shall align with each other or be spaced a minimum of 75 feet apart to ensure that conflicting movements do not overlap as shown in **Figure 2-8**. This spacing shall also apply to a driveway that is on the opposite side of an undivided street from as intersecting street.

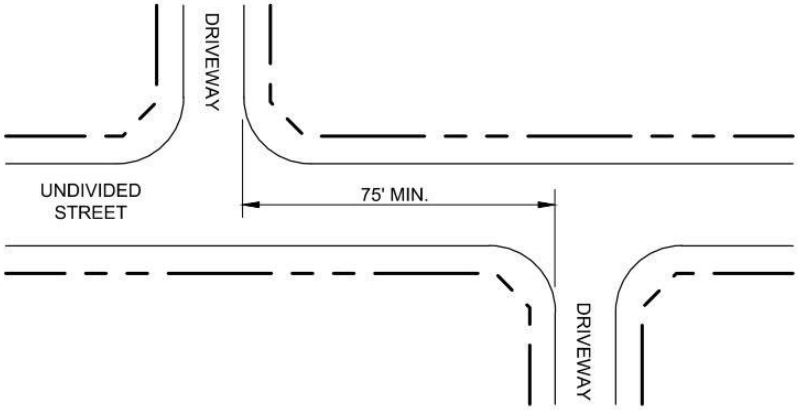


Figure 2-8. Driveway Spacing on Opposite Sides of an Undivided Street

2.8. *Alleys*

2.8.1. *Geometry* – Residential alleys shall be designed in accordance with the minimum design criteria provided in **Table 2-1**. ROW shall be a minimum 4 feet from the edge of pavement.

2.8.2. *Alignment* – Alleys shall be provided parallel to the property frontage on the street. Sudden changes in alignment are not allowed.

2.8.3. *Offsets* – Where the deflection of alley alignment exceeds 30 degrees, a cutback of a minimum 15 feet shall be established on the inside property line and the paving of the alley shall be cut back in the same manner as shown in **Figure 2-9** and **Figure 2-10**.

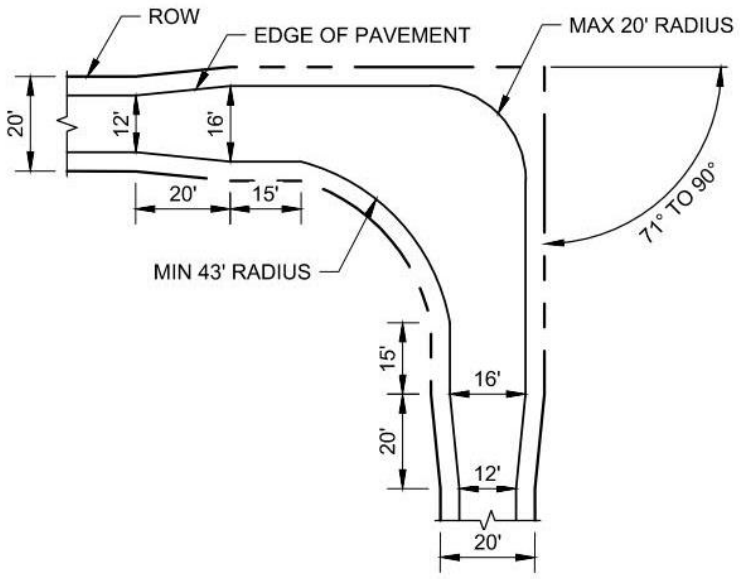


Figure 2-9. Alley Offsets – 71 to 90 Degrees

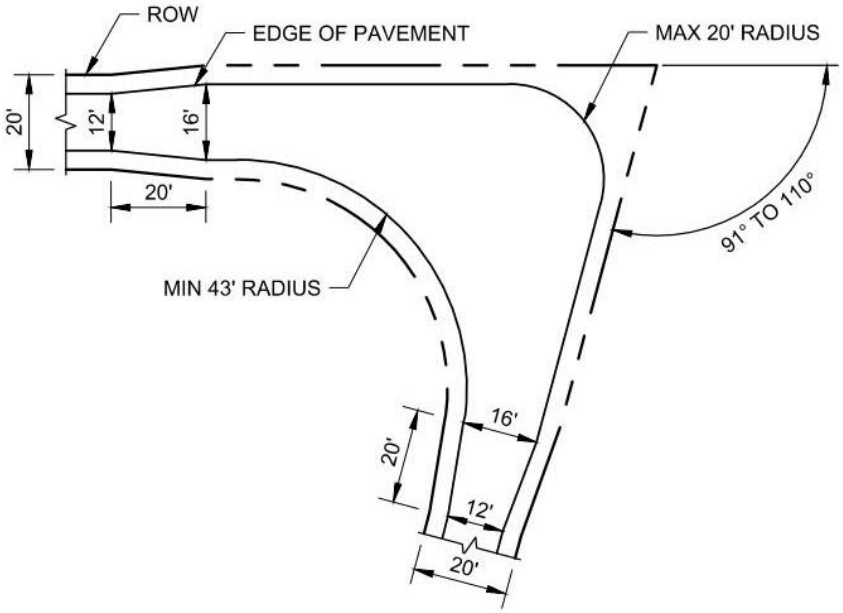


Figure 2-10. Alley Offsets – 91 to 110 Degrees

2.8.4. *Dead-End Alleys* – Dead-end alleys are not allowed.

2.8.5. *Alley Length* – The maximum length of alleys between outlets should not exceed 600 feet.

2.8.6. *Obstructions* – All alley ROW shall be kept free and clear of obstructions. Power poles and street lights are excluded from this restriction provided they maintain visibility and are within the zone shown on the Standard Details.

2.8.7. Alley to Street Intersections

2.8.7.A. Alleys shall only intersect with local or collector streets.

2.8.7.B. Alley intersection cannot be within 100 feet of an arterial intersection.

2.8.7.C. Alleys which run parallel to a Principal Arterial shall turn away from the Principal Arterial not less than one subdivision lot width or a minimum of 50 feet (whichever is greater) from the cross-street intersection. Where this occurs, a 5-foot common area shall be provided adjacent to the ROW.

2.8.7.D. Alleys shall be flared at intersections with streets in accordance with **Figure 2-11**.

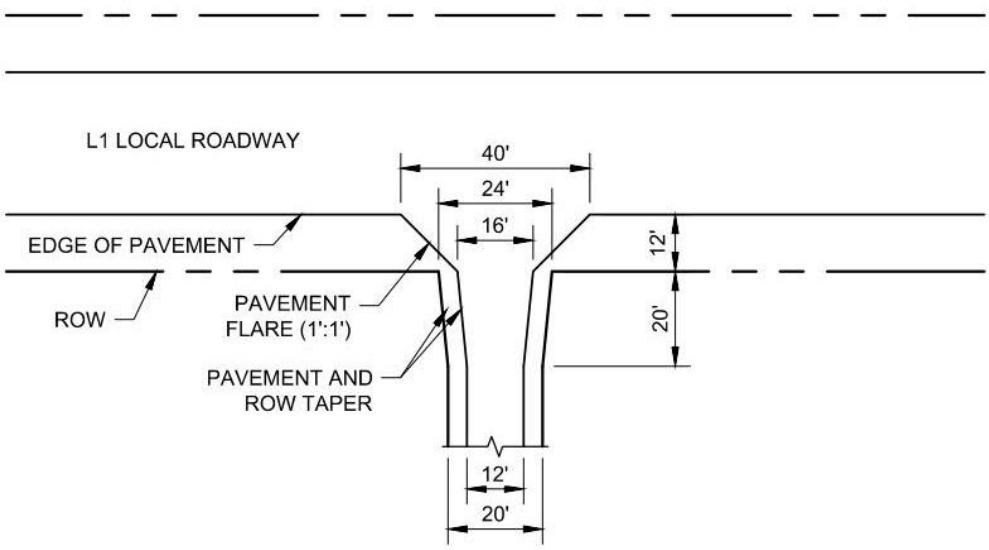


Figure 2-11. Alley to Street Intersection

2.8.8. Alley to Alley Intersections

2.8.8.A. Alley intersections should be avoided.

2.8.8.B. Four-way alley intersections are not permitted.

2.8.8.C. Alley to alley intersections shall be designed in accordance with **Figure 2-12**, **Figure 2-13**, and **Figure 2-14**.

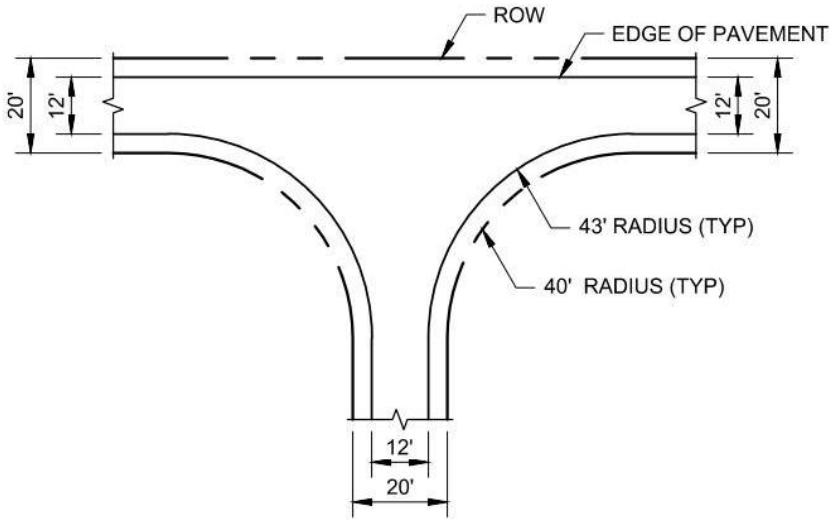


Figure 2-12. Alley to Alley Intersection – 90 Degrees

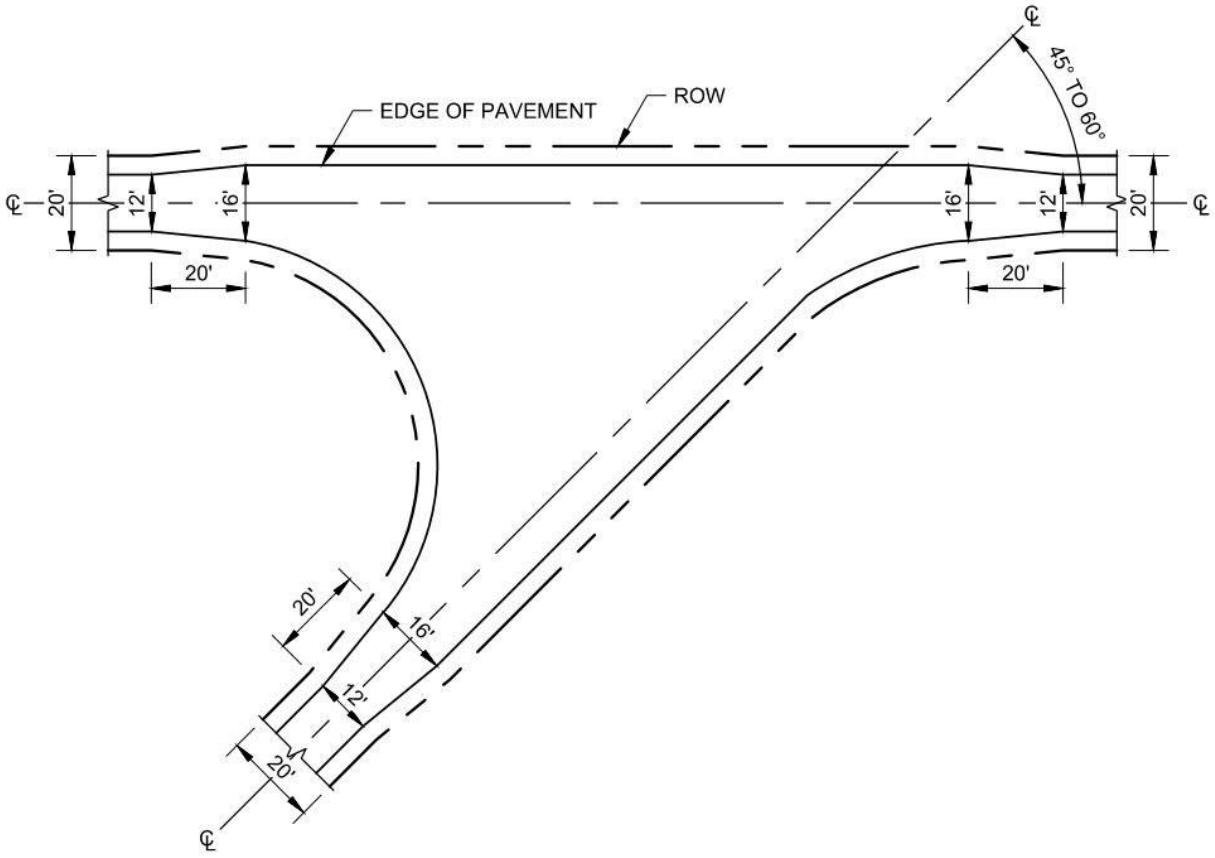


Figure 2-13. Alley to Alley Intersection – 45 to 60 Degrees

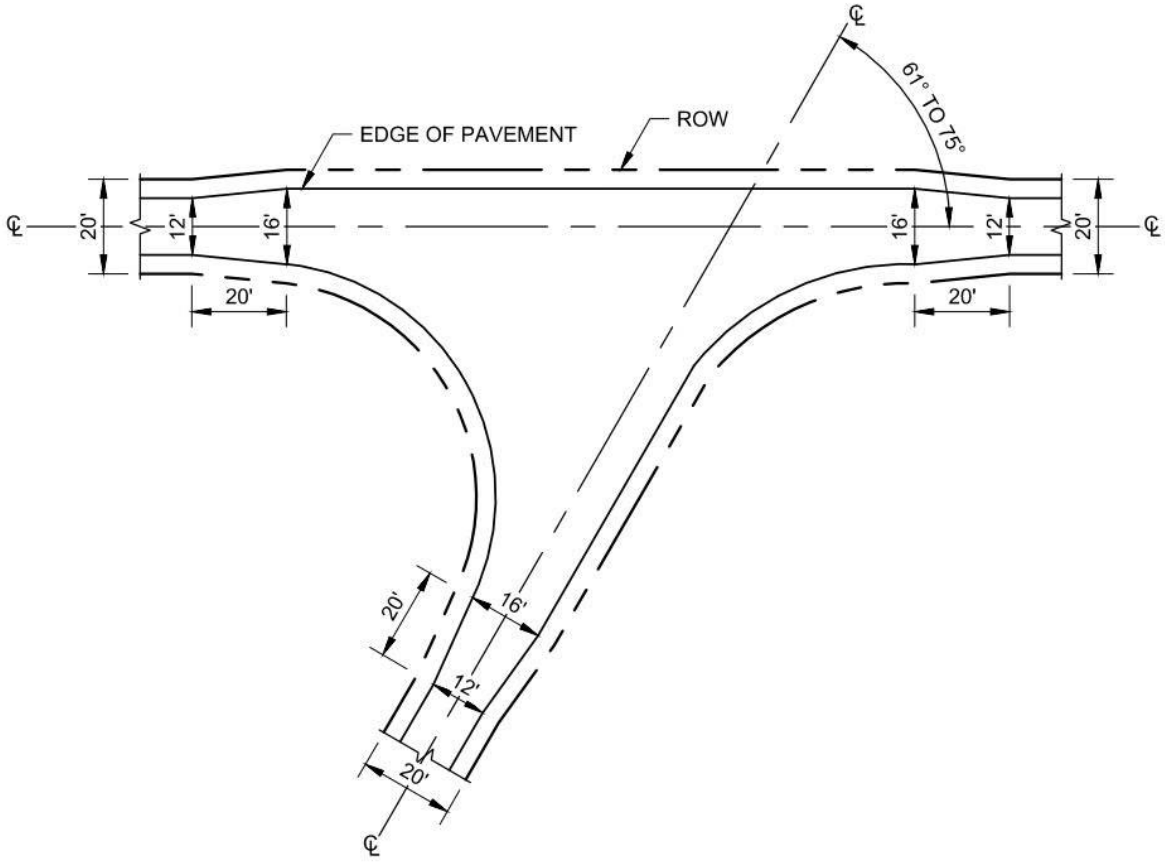


Figure 2-14. Alley to Alley Intersection – 61 to 75 Degrees

2.9. *Pedestrian Facilities*

2.9.1. *General* – Pedestrian facilities shall be designed to promote pedestrian safety and efficiency, minimize conflicts with motorized and non-motorized vehicle traffic, minimize tripping hazards and protruding objects, and accommodate accessibility needs of pedestrians. All pedestrian facilities must conform to current Federal, State, and Local ADA requirements and to the criteria in this section. Additionally, pedestrian facilities shall be designed and constructed in accordance with the City's Trail Plan and Thoroughfare Plan. For the purpose of this section, pedestrian facilities include sidewalks, trails, hike and bike routes, and barrier free ramps.

2.9.2. *Pedestrian Facilities Design Guidelines* – Pedestrian facilities shall comply with the following standards:

- United States Access Board's current edition of *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*;
- United States Access Board's current edition of *Proposed Accessibility Guidelines for Pedestrian Facilities in Public Right-of-Way (PROWAG)*;
- Texas Department of Licensing and Regulation's (TDLR) current edition of *Texas Accessibility Standards (TAS)*; and,
- TxDOT's current edition of *TMUTCD*.

2.9.3. *Cross-Sectional Elements* – The following denotes maximum grades for pedestrian facilities.

2.9.3.A. *All Pedestrian Paths* – All pedestrian paths shall have a typical 1.5% cross-slope and maximum 2% cross-slope. The least possible running slope should be used to maximize accessibility. The running slope of pedestrian facilities and crosswalks within the ROW may follow the grade of the parallel roadway.

2.9.3.B. *Barrier Free Ramps* – Accessible ramps for sidewalk crossings at all street intersection corners, at all crosswalks, and across any stop control on-residential or multi-family driveways shall be in accordance with **Section 2.9.2**.

2.9.4. Sidewalks and Trails

2.9.4.A. *Definition of a Sidewalk* – A sidewalk is defined as the paved area designated for pedestrians use which is generally located between the curb of the roadway and the adjacent property line.

2.9.4.B. Requirement

2.9.4.B.i. Sidewalks shall be provided around the perimeter of all blocks, 1-foot offset inside the ROW or easement.

2.9.4.B.ii. Sidewalks are to be constructed with the paving of streets or building construction unless deferred by the Director of Public Works.

2.9.4.B.iii. Sidewalks constructed as part of a new development or re-development are considered public facilities and shall be

constructed according to the requirements outlined in this section.

2.9.4.B.iv. When a lot is developed, pedestrian facilities along frontage of property shall be required at time of lot development. Sidewalks, ramps, and landing areas shall be installed along all roadways and common areas prior to final acceptance.

2.9.4.C. Geometry

2.9.4.C.i. *Width* – Pedestrian facilities width shall follow Trails Plan. If not shown on Trails plan pedestrian facility shall have a minimum width of 5 feet when not adjacent to the back of curb. Sidewalks adjacent to curb shall be a minimum of 6 feet in width.

2.9.4.C.ii. *Meandering Sidewalks* – Meandering sidewalks shall have a minimum 200-foot radius.

2.9.4.D. *Material* – Sidewalks shall be concrete in accordance with the Standard Details.

2.9.4.E. *Sidewalks at Bridges* – All street bridges shall have a sidewalk constructed on each side of the bridge. The sidewalk shall be a minimum of 6 feet wide with a parapet wall providing a minimum of 2 feet behind the curb of the roadway. A standard pedestrian bridge rail protecting the sidewalk shall be provided on the outside edge of the bridge. Refer to **Section 7.5** (Bridges) for additional railing requirements on bridges.

2.9.4.F. *Sidewalks Under Bridges* – When new bridges are built as a part of the construction or reconstruction of a divided arterial, and a pedestrian crossing for a hike and bike trail is needed, a sidewalk shall be built as a part of the embankment design underneath the bridge structure for the width of the trail required by the Trails Master Plan plus 2-feet. The bridge structure should provide a minimum clearance of 10 feet above the sidewalk for pedestrian access.

2.9.4.G. *Sidewalks at Culverts and Retaining Walls* – All culvert crossings shall have a sidewalk constructed across and on each side of the culvert. The sidewalk shall have a standard pedestrian handrail in accordance with **Section 2.9.2**. Combination rails or parapet walls may be required.

2.9.5. *Trail Enhancement Elements* – Street Enhancements, Signed Shared Roadways (Bike Routes), Trail-Roadway Crossings, and Signing and Striping at Roadway Crossings shall be designed in accordance with the City's Trails Plan. The placement and location of enhanced sidewalks and trails shall be determined by the Director of Public Works. Additional ROW and easements may be needed to accommodate these improvements.

2.10. *Site Paving*

2.10.1. *General* – This section includes site paving requirements for fire lanes, off-street-parking, and dumpsters.

2.10.2. Fire Lanes

2.10.2.A. Fire Department access routes shall be provided by the Developer as required by Ordinance and shall be approved by the Fire Marshal. Culs-de-sac shall conform to the dimensions shown in **Figure 2-15**. Hammer heads shall conform to the dimensions shown in **Figure 2-16**. Minimum dimensions may vary based on direction from the Fire Marshal.

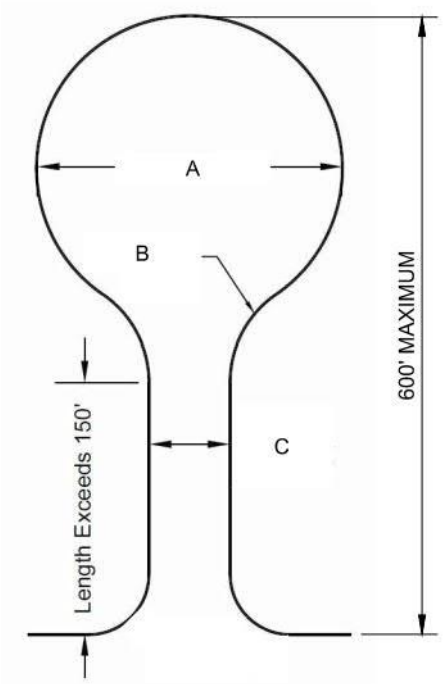


Figure 2-15. Typical Cul-de-Sac

Table 2-11. Typical Cul-de-Sac Dimensions

Dimensions	Street	Site
A	100’ minimum	100’ minimum
B	30’ typical	Refer to **Table 2-1**.
C	31’ minimum	26’ minimum
1. Minimum dimensions may vary based on direction from the Fire Marshal.		

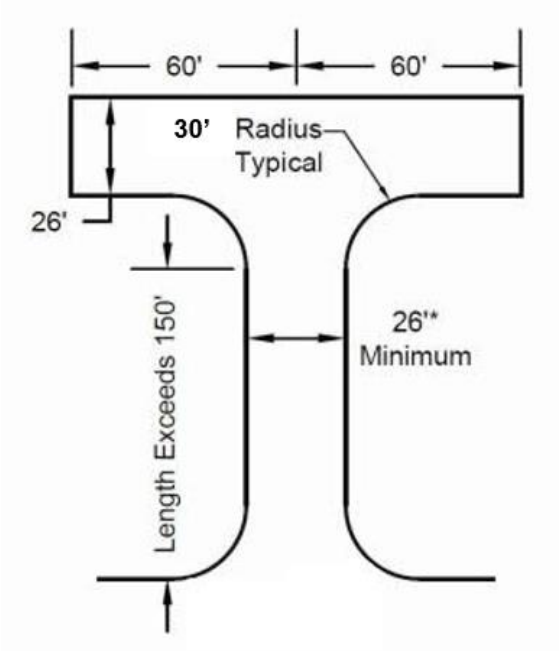


Figure 2-16. Typical 120-foot Hammer Head

2.10.2.B. There shall be adequate provision for safe and efficient ingress and egress to all off-street fire vehicle parking spaces. Except for single-family and duplex residential land uses, no fire vehicle parking space may require the use of public ROW or a private street for entering or leaving the parking space.

2.10.2.C. When a parking aisle is also serving as a fire lane, the aisle must meet the minimum width, radius, and construction standards for a fire lane, if these are greater than the requirements for a parking aisle.

2.10.2.D. Continuous marked fire lane access is required throughout the project in accordance with the Standard Details.

2.10.3. Parking Lots

2.10.3.A. *Parking Placement* –Parking lots shall be provided in accordance with the Sachse City Code, as amended.

2.10.3.B. *Paving Requirements* – Required parking shall be steel reinforced 5-inch thick minimum concrete. A variance may be pursued for asphalt, permeable pavement, or other materials subject to Director of Public Works approval. The variance must prove requested section of alternative material will support equivalent axial load or projected site loads (whichever is greater) designed in accordance with **Section 2.11** (Pavement and Subgrade).

2.10.4. Dumpsters

2.10.4.A. *General* – The City has a contract with a private solid waste collection company to provide commercial solid waste service for all

non-residential trash collection in the City of Sachse. All non-residential and apartment properties shall provide solid waste container and/or compactor pads as directed by the City and these shall be designed, located, screened, and constructed based on the following requirements.

2.10.4.B. Dumpster Location and Orientation

2.10.4.B.i. The solid waste container pad and/or the solid waste container shall not be located within the required front or exterior side building line.

2.10.4.B.ii. The solid waste container and enclosure shall be located and oriented to prevent direct viewing inside the enclosure from streets and residential districts. This solid waste container pad enclosure opening shall be oriented so that the container is not visible at an angle of greater than 45 degrees from adjacent sides as shown in **Figure 2-17**.

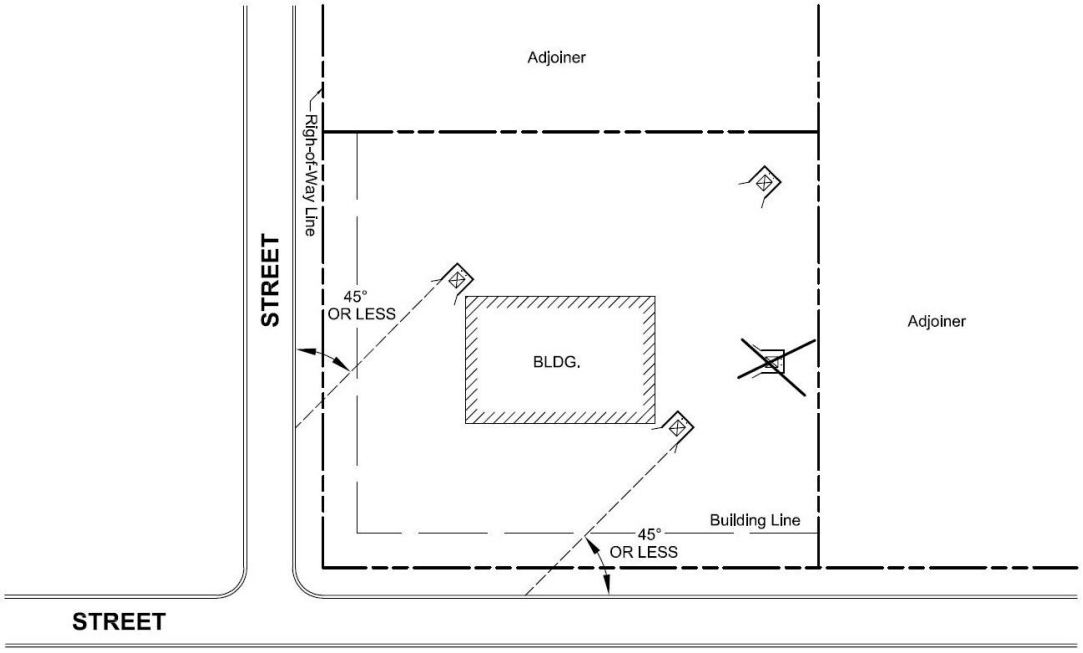


Figure 2-17. Solid Waste Container Enclosure Visibility Orientation

2.10.4.B.iii. A solid waste collection truck drive path must be identified on the site plan. This path must have a minimum width of 14 feet, and a minimum outside turning radius of 52 feet. A minimum space of 50 feet of uninterrupted and unimpeded space shall be provided in front of the solid waste container enclosure (measured from the solid waste container pad enclosure opening) as shown in **Figure 2-18**.

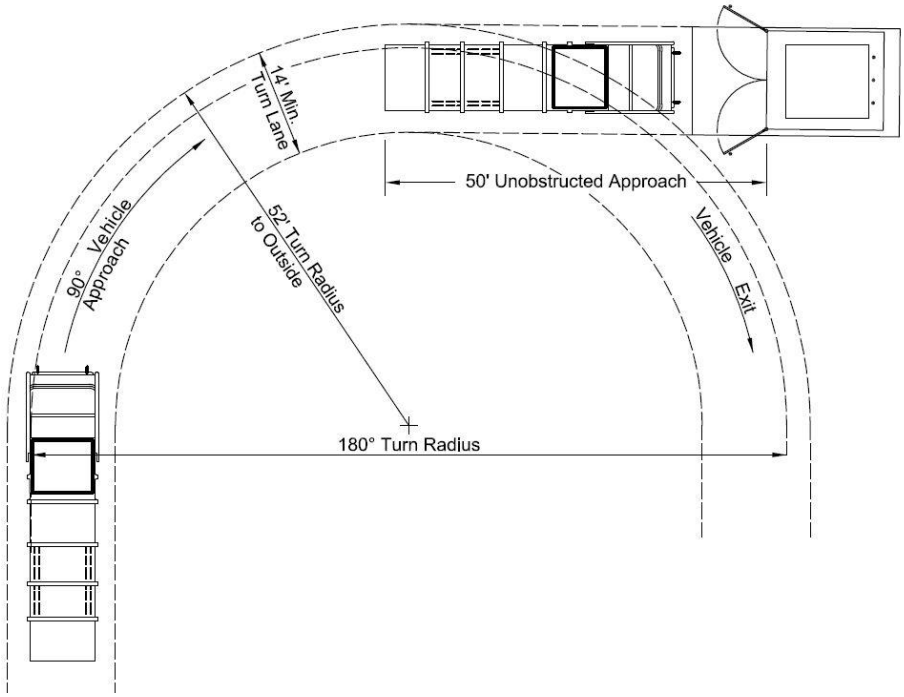


Figure 2-18. Solid Waste Container Front-Loader Vehicle Access

2.10.4.B.iv. The area immediately in front of the solid waste container enclosure (as measured from the opening of the solid waste container enclosure) shall have a 50-foot long by 14 feet wide by 24 feet high area that is clear of obstructions, including overhead obstructions, such as electrical power cables and overhead canopies, as shown in **Figure 2-19**.

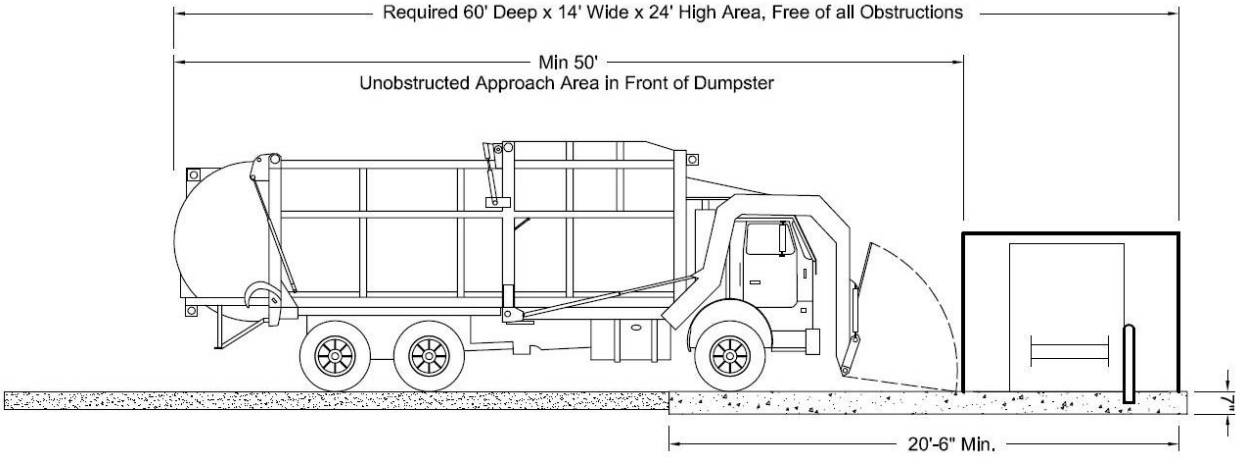


Figure 2-19. Solid Waste Container Front-Loader Vehicle Access

2.10.4.B.v. The solid waste collection truck drive path must require no more than 50 feet of backing by the truck to service the solid

waste container and exit the site to a public street or alley. The solid waste collection truck drive path cannot require the truck to back-out onto a public street.

2.10.4.B.vi. The container pad should not be located where delivery vehicles load and unload and shall not be obstructed by parked vehicles.

2.10.4.B.vii. Placement of solid waste containers shall be with respect to adjacent fire lanes, access easements, utility easements, parking stalls, drive aisles, and property lines as follows:

- Solid waste gates/doors cannot open into or obstruct the fire lane, access easements, or utility easements; and,
- Solid waste containers located in a parking lots are prohibited in a designated parking or loading space.

2.10.4.C. Screening

2.10.4.C.i. All solid waste container pads must be screened on three sides by a minimum 7-foot reinforced concrete or solid reinforced masonry wall that is faced on the exterior with a material that is compatible in material and color with main structure on the site and in conformance with Appendix C, “Zoning” of the Sachse City Code and Community Appearance Manual. Buildings onsite and other screening walls may also serve as dumpster screening.

2.10.4.C.ii. All solid waste container pads must be equipped with gates if the screened enclosure opening can be seen from a public street. If gates are installed, both gates must have stops to hold gates open during servicing. Gates shall be constructed in accordance with the material and aesthetic requirements of the Design Manual or approved by Director of Public Works.

2.11. *Pavement and Subgrade*

2.11.1. General

2.11.1.A. The following specifies minimum standards required for pavement and subgrade design for arterials. These minimum standards are not intended to replace the professional judgment of the Geotechnical Engineer for any specific project. The standards may need to be expanded or modified on a case-by-case basis as determined necessary and appropriate by the Geotechnical Engineer, and as approved by the Director of Public Works in writing. Refer to the Standard Details for minimum pavement and subgrade requirements for local roadways, collectors, alleys, and fire lanes.

2.11.1.B. *Pavement Design Life* – Pavement design life shall be 50 years.

2.11.1.C. *Minimum Thickness* – In no case shall the pavement and subgrade thicknesses be less than the minimums provided in this section.

2.11.1.D. *Geotechnical Report Requirement* – All arterials shall have a geotechnical investigation and pavement and subgrade design performed meeting the following requirements:

- Results of the geotechnical investigations, engineering analyses, and recommendations shall be presented in a Geotechnical Report for Roadways (Report). The Report and any subsequent re-evaluations and/or supplemental reports shall be prepared, signed, and sealed by a licensed Professional Engineer in the State of Texas trained and qualified to provide geotechnical engineering analyses and pavement and subgrade design recommendations;
- The Report shall address all items listed in the Geotechnical Report for Roadways Checklist (Checklist) in **Appendix B** (City Checklists). The Checklist shall be filled out completely and submitted with the Report;
- The Geotechnical Report for Roadways Checklist (Checklist) in **Appendix B** (City Checklists) shall also be filled out completely and submitted with the Report; and,
- The information and recommendations contained in the Report and any subsequent re-evaluation and/or supplement reports shall be accepted by the Director of Public Works in writing prior to release of construction.

2.11.2. Geotechnical Investigation

2.11.2.A. *Field Investigation* – Field investigation shall include the following:

- Borings shall be drilled along proposed roadway, or within proposed roadway widening, at 500-foot spacing (or less), to a depth of at least 20 feet below finished subgrade or until competent rock is encountered, whichever is shallower. Where existing roadways exist, borings shall be taken just outside the limits of the existing roadway. Refer to **Section 7.4** (Geotechnical Performance Specifications) for

boring requirements for structures. Additional borings may be requested by the Director of Public Works;

- Geotechnical investigation must address heavily treed areas, where such trees are to be removed. Additional borings may be required in these areas;
- Borings shall be sampled at 3-foot intervals or less to a depth of 10 feet below finished subgrade, and at 5-foot intervals or less thereafter; and,
- Bulk samples of each soil type encountered in the upper 5 feet shall be taken for laboratory investigation.

2.11.2.B. *Laboratory Investigation* – Laboratory investigation shall include the following:

2.11.2.B.i. *Moisture Content Tests* – Moisture Content Tests (ASTM D 2216) shall be performed. When the samples are wetter than normally expected due to seasonal variability, the samples shall be air dried such that the samples represent the drier portion of the year.

2.11.2.B.ii. *Swell Test Results* – Swell test results should be averaged to determine the mean maximum swell percentage and the standard deviation. For samples taken during the months of June through September, use the mean swell percentage to determine the design swell percentage. For samples taken during the months of October through May, use the mean plus one standard deviation to determine the design swell percentage.

2.11.2.B.iii. *Soil Classifications* – Soil types in each boring shall be classified including the following:

- Atterberg limits (ASTM D 4318);
- Percent Passing the No. 200 sieve (ASTM D 1140); and,
- Moisture/Density.

2.11.2.C. *Re-Evaluation Applicability* – A geotechnical re-evaluation will be required in the following situations:

- If more than two months transpire between the end of moisture conditioning and beginning of liming operations;
- When conditions have changed significantly between moisture conditioning and liming operations;
- When Contractor and/or Owner have not properly maintained moisture content; and/or,
- As deemed necessary by the Director of Public Works.

2.11.2.D. *Re-Evaluation Requirements* – If required, a re-evaluation shall include additional field and laboratory testing to either confirm moisture conditioning is still acceptable or determine how to rectify the

substandard condition prior to liming operations. Borings for the re-evaluation will be required on center of roadway at 1,000-foot spacing (or less) to a depth of at least 20 feet below finished grade or until competent rock is encountered, whichever is shallower.

2.11.3. Subsurface Design

2.11.3.A. Laboratory investigation elements shall include determining swell characteristics and movement potential using the Swell Test and the calculated Potential Vertical Rise (PVR) – TxDOT Tex-124-E methods for a 20-foot depth of moisture penetration. The results of both tests shall be included in the Report. The Geotechnical Engineer shall use the more conservative value in determining swell potential and depths of moisture treatment.

- *Swell Test* – Test for swell potential using swell test (ASTM D 4546) at 200 psf stress at least two samples per boring to approximate overburden pressure at the specific test depth to determine the average swell potential of the subgrade.
- *PVR-TxDOT Tex-124-E* – Test for swell potential using swell test (ASTM D 4546) necessary to calculate PVR for a 20-foot moisture penetration. The PVR shall be calculated based upon 20-foot moisture penetration and shall provide moisture treatment depth to limit PVR to 4.5 inches.

2.11.3.B. Average swell shall be determined to 10 feet or top of rock, whichever is less. **Table 2-12** shall be used to determine the minimum depth of moisture treatment based on average swell potential. The Geotechnical Engineer shall provide a recommendation for the subsurface to achieve swell less than 2%.

Table 2-12. Minimum Subbase Treatment Standards

Average Swell	Moisture Conditioning Depth
Average Swell < 2%	0”
2% ≤ Average Swell < 6%	60"
6% ≤ Average Swell < 8%	72"
8% ≤ Average Swell < 10%	84"
Average Swell ≥ 10%	96"

2.11.3.C. If moisture conditioning is required, a moisture barrier shall be placed 3 feet behind back of curb.

2.11.3.D. The Geotechnical Engineer shall address transitions between zones of varying depths of moisture treatment. Zones shall remain at the most conservative depth 150 feet from the location of the boring resulting in the greatest depth, prior to transitioning to a zone with less moisture conditioning depth. In no case shall the transitions be greater than 1H:1V.

2.11.3.E. If trees are existing or proposed within the limits of the moisture treated subgrade and moisture barriers, the Geotechnical Engineer shall address this condition in the Report and propose an alternate moisture/root barrier that is acceptable to the Director of Public Works.

2.11.4. Subgrade Design

2.11.4.A. **Table 2-13** includes the minimum lime stabilization thickness and lime application rates. Additional thickness may be required to achieve the modulus of subgrade reaction in **Table 2-14**.

2.11.4.B. *Lime Stabilization Series* – Laboratory Investigation elements shall include:

2.11.4.B.i. Lime stabilization series for each soil type expected to be in the upper 12 inches of the subgrade. The Eades-Grimm method of pH testing shall be used to obtain a beginning point. Additional testing shall be performed for each soil type to determine lime content. Minimum design criteria are:

- pH = 12.4 (or maximum pH) after mellowing (ASTM D 2976);
- Swell potential <1.0% under 200 psf stress test (ASTM D 4546); and,
- The minimum lime content shall be the percentage, by weight, of hydrated lime as determined by lime stabilization series plus 1.0%, and in no case be less than the City's minimum requirements as listed in **Table 2-13.**

2.11.4.B.ii. Test for sulfates in the upper 3 feet of the subgrade in each boring using EPA 9038 or EPA 375.4 with 10:1 dilution ratio. Provide testing to determine the levels of sulfate present in all soil types in the upper 3 feet.

2.11.4.C. Formations having over 6,000 ppm (0.6%) sulfates shall be lime stabilized using a double application method.

2.11.4.D. Alternative subgrade options may be proposed by the Geotechnical Engineer, and may be approved by the Director of Public Works.

2.11.4.E. If proposed as an alternate subgrade, flexible base shall have a minimum depth of 8 inches and shall extend a minimum of 1 foot behind the back of curb. Refer to the Standard Details for additional information.

2.11.5. Pavement Design

2.11.5.A. The minimum pavement thicknesses included in **Table 2-13** are based on the Pavement Design Input Values contained in **Table 2-14**. It is the Geotechnical Engineer's responsibility to ensure those input values are applicable. In no case shall the pavement sections be less than the City's minimum.

Table 2-13. Minimum Pavement and Subgrade Standards

Criteria	Classification			
	A	B	PGBT-A	PGBT-B
Concrete Thickness	11”	11”	11”	10”
Lime Thickness	8”	8”	8”	8”
Minimum Lime Application Rate	8%	8%	8%	8%

2.11.5.B. Additional pavement reinforcing shall be evaluated and determined for all concrete pavement sections thicker than 9 inches.

2.11.5.C. Pavement design shall be based on AASHTO’s current edition of *Guide for Design of Pavement Structures* utilizing Pavement Analysis Software (WinPAS). A printout from the software program shall be required.

2.11.5.D. Concrete thickness results from WinPAS shall be rounded up to the nearest inch.

2.11.5.E. Pavement at intersections shall be based on the highest classification at the intersection plus an additional 2 inches of concrete. This increased pavement thickness section shall extend from all approaches through the intersection as shown in **Figure 2-20**.

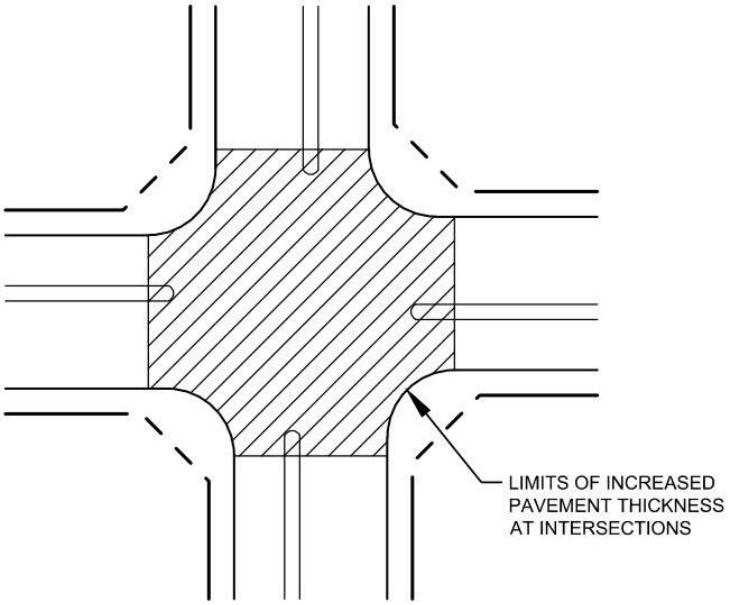


Figure 2-20. Pavement at Intersections

Table 2-14. Minimum Pavement Design Input Values

Criteria	Classification	
	Principal Arterial	**Minor Arterial**
Design Period (years)	50	50
Initial Serviceability	4.50	4.50
Terminal Serviceability	2.50	2.25
Concrete Modulus of Rupture @ 28 days (psi)	620	620
Concrete Modulus of Elasticity @ 28 days (psi)	4,000,000	4,000,000
Modulus of Subgrade Reaction[1] (pci)	300	300
Reliability (%)	90	90
Standard Deviation	0.35	0.35
Load Transfer Coefficient	3.00	3.00
Drainage Coefficient	1.00	1.00
Design Volume (vehicles per day)	36,000	20,000
Traffic Growth Rate (%)	0%	0%
Percent Trucks (%)[2]	4%	4%
Lane Distribution Factor	0.70	1.00

1. To be determined based on the California Bearing Ratio (CBR) value. CBR values range with soil and stabilization type. Geotechnical Engineer must document the CBR and Modulus of Subgrade Reaction in the Report.
2. If anticipated percentage of trucks for proposed development exceeds the minimum criteria shown in **Table 2-14**, the actual percentage shall be used.

2.12. *Traffic Control*

2.12.1. *General* – All permanent and temporary traffic control shall be in accordance with TxDOT's current edition of *TMUTCD* and this section. General requirements for traffic control devices in the City are described in the following sections. Refer to the Approved Materials List and the Standard Details.

2.12.2. *Pavement Markings* – The following pavement markings are required per street classification in accordance with the Standard Details.

2.12.2.A. Arterials

- Centerline stripe for undivided sections;
- Lane lines;
- Turn lane lines;
- Traffic arrows;
- Stop bars;
- Crosswalk markings;
- Delineators for roadside obstructions;
- Raised pavement markers; and,
- Edge lines for non-curbed streets and bridges.

2.12.2.B. Collectors

- Centerline stripe;
- Lane lines, turn lane lines, and traffic arrows, if requested by Director of Public Works, at intersections; and,
- Lane lines and edge lines for non-curbed streets.

2.12.3. Temporary Traffic Control

2.12.3.A. *General* – When the normal function of the roadway is suspended through closure of any portion of the ROW, temporary construction work zone traffic control devices shall be installed to guide the motoring public through the area. Consideration for roadway user safety, worker safety, and the efficiency of roadway user flow is an integral element of every traffic control zone.

2.12.3.B. All Temporary Traffic Control Plans shall be prepared and submitted in accordance with the standards identified in *Part VI: Temporary Traffic Control* of TxDOT's current edition of *TMUTCD*.

2.13. *Street Lighting*

2.13.1. General

2.13.1.A. This section includes street lighting and conduit system requirements for illumination on all roadway classifications. Continuous lighting is required on arterials. On collectors and residential local roadways, streetlights are installed at intersections, culs-de-sac, and curves as specified in this section.

2.13.1.B. The Developer shall pay for the procurement and installation of the poles and fixtures, with prior approval from Oncor and the Director of Public Works. Developer shall coordinate street light installation and any civil work with Oncor. Oncor shall inspect and approve all streetlight pole foundations, conduit, and grounding prior to concrete being poured. Oncor shall install and energize poles.

2.13.1.C. Street lighting shall be installed, inspected by City staff, and approved by Oncor prior to final acceptance of the construction of a roadway.

2.13.1.D. The City uses only Oncor-supported streetlights unless otherwise specifically approved in writing by the Director of Public Works. If Oncor-supported streetlights are not used, then they will have to be metered.

2.13.1.E. *Spacing Measurement* – Streetlight spacing shall be measured along the ROW from center of pole to center of pole.

2.13.2. *Lighting Plan* – A lighting plan shall be required for all new street lighting or street lighting modifications. The lighting plan shall be reviewed and approved by the Director of Public Works prior to receiving a construction permit. The lighting plan shall be prepared, signed, and sealed by a licensed Professional Engineer in the State of Texas trained and qualified to provide lighting planning, engineering, and preparation of similar analyses. At a minimum, the submittal shall include the following:

- Plans indicating the location of the lighting, and the type of illuminating devices, fixtures, lamps, supports, reflectors, and other devices;
- Description of the illuminating devices, fixtures, lamps, supports, reflectors, and other devices and the description may include, but is not limited to, catalog cuts by manufacturers and drawings (including sections where required) and height of the luminaires; and,
- Existing and proposed utilities shall be shown on plans identifying any possible location conflicts with proposed lighting.

2.13.3. *Continuous Arterial Lighting* – Continuous arterial lighting shall be provided based on the following standards:

- *Luminaires* – Luminaires shall be cobra head style with 250-Watt (W) LED equivalent lamps;

- *Poles* – Poles shall be 30-foot-tall round galvanized steel pole;
- *Spacing* – Streetlights shall be spaced normally at 140-foot intervals but no further apart than 180 feet;
- *Intersections* – At intersections with median openings, the pole shall be located 20 feet from the median nose; and,
- *Orientation* – Orientation shall alternate for the single luminaire (left to right) in the parkway along the arterial if there is no median present. For divided arterials, dual-arm light poles shall be placed in the median. A single luminaire shall be placed over left turn lanes. A single luminaire shall be oriented toward the side-street at an intersection with no median opening.

2.13.4. *Collector and Local Roadway Lighting* – Street lighting shall be provided on collectors and residential local roadways based on the following standards:

- *Luminaires* – Luminaires shall be cobra head style with 150 W LED equivalent lamps. Streetlights shall have a single luminaire;
- *Poles* – Poles shall be 25-foot-tall round galvanized steel pole;
- *Spacing* – Streetlights shall be spaced no further apart than 500 feet along tangent sections streets and shall be placed along horizontal curves where the road centerline changes by 30-degress or more;
- *Intersections* – Streetlights shall be placed at all intersections; and,
- *Culs-de-Sac* – Shall be placed at the end of all culs-de-sac except if the cul-de-sac is less than 250 feet from the streetlight at an intersection;

2.13.5. *Decorative Poles and Luminaires* – Decorative poles may be approved by the Director of Public Works. Decorative poles shall be in accordance with the Oncor-Approved TXU Electric Delivery's (TXU-ED) current edition of *Decorative Street Lighting Manual*. The following decorative luminaires are allowed:

- Acorn.

2.13.6. *Exceptions* – The following are exempt from these requirements:

2.13.6.A. Temporary lighting approved in writing by the Director of Public Works and at the expense of the requesting party.

2.13.6.B. Lighting luminaires in existence on the effective date of these requirements shall be exempt from these standards and shall be considered legally non-conforming. Such fixtures may be repaired, maintained, and/or replaced. If an identical replacement of non-conforming luminaires is not available, the new luminaires shall comply with these requirements.

2.13.6.C. *ROWs Overlay District* – If the development is within the ROWs Overlay District, a separate set of standards shall supersede this section. The Director of Public Works will provide specifications and details for lighting in this district.

2.13.7. *Ground Boxes* – Ground boxes shall be per Oncor requirements.

2.13.8. *Foundations* – Street lighting foundations shall be designed in accordance with Oncor requirements. Designer shall ensure that the bolt pattern of the foundation will accommodate the light poles selected. Oncor have standard foundation details and pre-cast options.

2.13.9. Conduit Systems

2.13.9.A. Street Lighting Conduit shall be installed in accordance with Oncor requirements.

2.13.9.B. *Electrical Service Pedestals* – Electrical service pedestals shall be coordinated with Oncor to determine if Oncor will provide the pedestals or require purchase from an authorized supplier.

2.14. *Traffic Signals*

2.14.1. General

2.14.1.A. All traffic signals shall be designed in accordance with this section.

2.14.1.B. *Warrant Criteria* – Traffic control signals should not be installed unless one or more of the signal warrants are met in accordance with TMUTCD. The satisfaction of a warrant or warrants is not in itself justification for a signal. Traffic signals should only be used where an Engineering Study indicates the installation of a traffic signal will improve the overall safety and/or operation of the intersection. If these requirements are not met, a traffic signal should neither be put into operation nor continued in operation (if already installed).

2.14.1.C. *Traffic Signal Plans* – All traffic signal plans shall be reviewed and approved by the Director of Public Works.

2.14.1.D. *Minimum Standards* – All traffic signal designs shall at a minimum meet the guidelines in TxDOT's current editions of *TMUTCD*; *Traffic Signals Manual; Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges;* and *Traffic Standard Sheets*.

2.14.1.D.i. Traffic signal poles shall be galvanized steel round-type following the 100 mph standard in accordance with TxDOT's current details.

2.14.1.E. *Equipment and Materials* – Refer to the Approved Materials List and technical specifications for approved materials and for city supplied items.

2.14.1.F. *Traffic Signal Spacing* – Signal spacing is an important factor in being able to provide progressive flow for a platoon of traffic. Traffic signal spacing shall be determined by the Director of Public Works and may preclude some locations from ever being signalized.

2.14.1.G. *Equipment Placement* – Make sure all equipment is within ROW or easement area.

2.14.1.H. *Electrical Service Pedestals* – Electrical service pedestals shall be 120V/240V and meet the local service provider's specifications.

2.14.1.I. *Number of Heads* – There shall be a signal head for each thru lane and right turn heads for any overlaps.

2.14.1.J. *Head Mounting* – The nearside heads shall be mounted on the right side of the roadway. If roadway curvature necessitates mounting the nearside head on the left side of the roadway, the nearside head should be mounted vertically on a signal pole.

2.14.2. Standards for Conduits and Wiring

2.14.2.A. *Conduits Sizes* – Conduit sizes shall be as follows:

- Schedule 40 PVC conduits shall be provided. The intersection conduit ring shall consist of a 4-inch conduit for signal and detector cables.
- Provide a 3-inch conduit between conduit ring and standard/pedestal poles.
- The home run shall have minimum two 4-inch conduits.

2.14.2.B. *Wire in Conduits* – Wire in conduits shall be as follows:

- 2-conductor, 12 American Wire Gage (AWG) Type C cable shall be used for each push button. All push buttons shall be wired separately.
- 10-conductor, 14 AWG cable shall be used to service pedestal poles.
- 20-conductor, 14 AWG cable shall be used to service standard poles. This can accommodate flashing yellow arrow, right turn overlaps, and nearside displays for one direction.
- 25-conductor, 14 AWG cable shall be used in lieu of 20-conductor if nearside displays are needed for two different directions on one pole.
- No. 6 Bare wire shall be used for grounding in all conduits except the run between the power service and disconnect.
- No. 4 or No. 6 XHHW shall be used between power service and disconnect. Three wires (hot, neutral, and ground) shall be used.

2.14.2.C. *Wire in Traffic Signal Poles* – Wire in traffic signal poles shall be as follows:

- 5-conductor, 14 AWG cable in pole shall be used for each ped head. For example, standard with two ped heads will have two 5-conductor cables. Provide 10 feet for each ped signal cable inside of pole.
- 5-conductor, 14 AWG cable shall be used for each three-section head. Provide 25 feet vertical plus the mast arm distance to the center of each head.

- 7-conductor, 14 AWG cable shall be used for each four- or five-section head. Provide 25 feet vertical plus the mast arm distance to the center of each head.
- 2-single conductor No. 12 XHHW shall be used for illumination and illuminated signs.

2.14.2.D. *Standard Wiring Charts* –Conductor wiring scheme shall be in accordance with **Table 2-15**.

Table 2-15. Color Code for Conductor Wiring Scheme

Conductor Number	Conductor Color	Signal Indication
1	Red	Red Ball – Through
2	Orange	Yellow Ball – Through
3	Green	Green Ball – Through
4	Blue	Yellow Arrow – Left Turn
5	Black	Green Arrow – Left Turn
6	White	A-C Common
7	Red/White	Don't Walk Phase 2 or 6
8	Green/White	Walk Phase 2 or 6
9	Blue/White	Ped Phase 2 or 6
10	Red/Black	Don't Walk Phase 4 or 8
11	Green/Black	Walk Phase 4 or 8
12	Blue/Black	Ped Phase 4 or 8
13	White/Black	PB Common
14	Black/Red	Yellow Arrow – Right Turn
15	Orange/Red	Green Arrow – Right Turn
16	Blue/Red	Spare
17	White/Red	Spare
18	Orange/Black	Spare
19	Black/White	Spare
20	Red/Green	Spare

2.14.3. Illuminated Street Name Signs (ILSN)

2.14.3.A. ILSNs shall be used for every signalized intersection. An ILSN shall be installed on each dedicated street leg.

2.14.3.B. Standard ILSN size is 10-foot by 18-inches and shall be installed on either a 30-foot signal pole or a 24-foot signal pole. Refer to the Standard Details and specification for addition information. City will provide ILSN and cost will be borne by developer though a development agreement.

2.14.4. *Signal Design Tables* – Signal design tables summarizing the following information shall be included on the plans.

2.14.4.A. *Percent Full* – The sizing of the conduits and assignment of the field wiring should keep the percent full estimate below 40%. However, it is not necessary to include the percent full estimate on the plans. Use the following Schedule 40 conduit sizes: 2-inch, 3-inch, 4-inch, 5-inch, or 6-inch.

2.14.4.B. *Wire and Conduit Quantities* – Estimated wire and conduit quantities shall be shown in the plans in a conduit and wiring table. Conduit lengths shown in the conduit and wiring table should be plan view distances rounded up to the nearest 5 feet. Wire lengths should be increased by 6 feet spare for conduit stub up into the controller box or foundation (3 feet each end of run). Wire lengths should be increased by 2 feet spare wire in each pull-box (2 feet per pull-box that the wire runs through).

2.14.4.C. *Conduit Run Labels* – Conduit run label or number in the signal design table must correspond to the letter label on the plan drawings. If more than one conduit exists in the same run, each conduit should be shown in a separate row in the table and designated with a text label “A1”, “A2”, “A3”, and so on.

2.14.4.D. *Total Run Length* – Total run length shall be specified in feet from the center of each pole or pull-box rounded up to the nearest 5 feet. Specify bore length measuring 1 foot in back of the curb or edge of roadway.

2.14.4.E. *Run Status* – Specify run status as “Installed” (I), “Existing” (E) or “Spare” (S).

2.15. *New Development Signage*

2.15.1. General

2.15.1.A. This section includes requirements for street name, regulatory, and warning signs.

2.15.1.B. *Warrant Criteria* – If required by the Director of Public Works, signs should be used only where justified by engineering judgment and demonstrated in an Engineering Study that indicates the location of necessary signs.

2.15.1.C. *Requirement* – The Developers of all new residential and commercial developments shall furnish and install all street name, regulatory, and warning signs at the locations designated by the Director of Public Works. The Developer shall confirm the required number and location of all street signs with the Director of Public Works. The Developer shall show the type and location of the required street signs on the plans. No building permit will be issued for the subdivision until all street signs are installed in accordance with the approved plans.

2.15.1.D. *Signing Plans* – All signing plans shall be designed in accordance with TxDOT's current edition of *TMUTCD* and shall be reviewed and approved by the Director of Public Works.

2.15.1.E. *Sign Face Layouts* – Sign face layouts shall meet the following requirements.

- Sign face layouts for all regulatory, warning, and guide signs, except street name signs, shall conform to TxDOT's current edition of *Standard Highway Sign Designs for Texas* and *TMUTCD*;
- Sizes of regulatory and warning signs shall conform to the dimensions listed as "Standard" in *Appendix A, Signing Listing*, in TxDOT's current edition of *TMUTCD*, unless otherwise directed by the Director of Public Works;
- Sign face layouts shall show the color and dimensions of all sign face legend components including background color, legend color, borders, symbols, letter size, and style; and,
- Sign face layouts, including the sizes of guide signs, shall be reviewed and approved by the Director of Public Works.

2.15.2. Street Name Signs

2.15.2.A. Two 9-inch tall street name sign assemblies shall be installed at all intersections that include one street that is listed as an arterial or collector on the City's *Thoroughfare Plan* and at other intersections designated by Director of Public Works. The location of the signs shall be determined by the Director of Public Works.

2.15.2.B. One 6-inch-tall street name sign shall be installed at all intersections where all entering streets are classified as local streets,

unless otherwise directed by the Director of Public Works. The location of the sign shall be determined by the Director of Public Works.

2.15.2.C. Refer to the Standard Details for requirements related to font, lateral spacing between letters and numbers, and sign fabrication.

2.15.2.D. Street name signs may be affixed to streetlight poles with the approval of the utility company and the City. When street name signs are affixed to streetlight poles, all street name signs at the intersection shall be affixed to the streetlight pole. Pole-mounted and post-mounted street name signs shall not be used on the same intersection comer.

2.15.3. *Illuminated Street Name Signs* – Refer to **Section 2.14** (Traffic Signals) for illuminated street name sign requirements.

2.15.4. *Ornamental Signage* – Standards for ornamental signage are determined on a case-by-case basis. Ornamental signage that will be attached to private utility poles shall require prior approval from the private utility pole owner. Refer to **Section 2.13** (Street Lighting).

2.16. *Traffic Impact Analysis (TIA)*

2.16.1. General

2.16.1.A. This section includes the general requirements for the preparation of a TIA.

2.16.1.B. *Applicability* – A TIA report may be required as part of the approval process for zoning changes, development plan, agreement approvals, building permit applications, subdivision platting, or changes of occupancy. If the TIA indicates traffic volumes that will significantly impact the capacity and/or safety of the transportation network, it shall be necessary to obtain ROW for off-site, abutting, and internal thoroughfares to support new development at the time of platting or development of the land.

2.16.1.C. *Preparation* – The TIA report shall be prepared, signed, and sealed by a licensed Professional Engineer in the State of Texas trained and qualified to provide transportation planning, engineering, and preparation of similar analyses.

2.16.1.D. *Purpose* – The purpose of the TIA is to:

- Identify the existing and future level of service (LOS) and ensure it is not degraded by the new development worse than LOS D along street segments and at intersections without recommended mitigation;
- Ensure that both development impacts on-site and off-site are mitigated through contributions and/or improvements of thoroughfare ROW;
- Ensure that new development does not contribute more than their proportionate share of costs or construction of thoroughfare ROW and

only contribute that which is necessary and attributable to the development; and,

- Assure that dedication of thoroughfare ROW and the City's construction requirements are proportional to the traffic demands created by a new development.

2.16.2. Determining Traffic Impact Analysis Requirements

2.16.2.A. *When Traffic Impact Analyses Are Required* – At the discretion of the Director of Public Works, a TIA shall be required for any development proposal expected to generate traffic volumes that will significantly impact the capacity and/or safety of the transportation network. A TIA may also be required for a proposed development located near a sensitive area, a high accident location, or an area already suffering from congestion. Additionally, a queuing analysis shall be required for sites such as schools or drive-through restaurants to demonstrate that the anticipated peak queuing will be accommodated on-site and not queued back onto City streets.

2.16.2.B. *Preliminary Trip General Assessment* – To determine if a TIA may be required, a preliminary trip general assessment of the proposed development shall be conducted based on Institute of Transportation Engineers' (ITE) current edition of *Trip Generation Manual*. If the preliminary assessment indicates the proposed development is forecast to generate the following trip thresholds, the Developer shall consult with the Director of Public Works to confirm if a TIA is required:

- 1,000 trips per average weekday (ADT);
- 100 directional trips during the peak hour of either the traffic generator or the adjacent roadway; or,
- Redevelopment, rezoning, additions, or changes of occupancy that are expected to increase trip generation by 20% or greater over existing conditions.

2.16.2.C. *Preliminary Meeting* – Prior to beginning a TIA, the Engineer shall contact the Director of Public Works to schedule a preliminary meeting. The purpose of this meeting is to discuss the project concepts and to establish the analysis requirements and identify issues pertinent to the TIA. The following items shall be determined during the preliminary meeting:

- The level of detail needed for the analysis;
- Identification of the study area, land uses, key intersections, and driveways;
- The study horizon;
- Trip generation rates to be used;

- If pass-by or modal split analysis is appropriate;
- The need for internal circulation and queuing analysis;
- Reductions to trips due to internal circulation, if appropriate;
- List of committed developments near the proposed site to be considered;
- Assumptions for area-wide growth (appropriate background traffic calculation methods);
- Consideration of phased development and transportation improvements;
- Identification of existing high accident areas;
- If consideration of pedestrian or bicycle impacts are needed;
- Acceptable trip distribution methods to be used;
- Approval of traffic analysis software to be used (any capacity analysis may be performed with traffic analysis software that applies TRB's current edition of the *Highway Capacity Manual*);
- Analysis period and typical peak hours for the proposed land use;
- If traffic counts should be collected on typical weekdays (Tuesdays, Wednesdays, or Thursdays), or weekends;
- If any traffic counts should be taken in addition to those listed herein; and,
- If any additional requirements are anticipated by the City.

2.16.2.D. *Level of Analysis* – Three levels of analyses have been identified based on the number of trips that a development is projected to generate in a 24-hour period (ADT) and during peak hours (AM and PM). **Table 2-16** includes typical requirements. The Director of Public Works may refine the requirements based on site-specific conditions.

Table 2-16. Levels of Traffic Impact Analyses

Level of Analysis	Criteria	Study Horizon	Study Area
I	Projected site-generated peak-hour trips of 100-200 per hour **AND** No significant modification of traffic signals or roadway geometry proposed	Year of completion, assuming full build-out and occupancy	All driveway access points, adjacent roadways, and adjacent major intersections. All signalized intersections on each street serving the site within 1/4 mile.
II	Projected site-generated peak-hour trips of 201-500 per hour **OR** Installation or modification of traffic signals or roadway geometry proposed, regardless of project size	Year of completion, assuming full build-out and occupancy **AND** Five years after completion	All driveway access points, adjacent roadways, and adjacent major intersections. All signalized and major unsignalized intersections on each street serving the site within 1/4 mile.
III	Projected site-generated peak-hour trips 501+ per hour **OR** Installation or modification of two or more traffic signals, addition of travel lanes, or modification of interchange proposed, regardless of project size	Year of completion, assuming full build-out and occupancy **AND** Five years after completion	All driveway access points, adjacent roadways, and adjacent major intersections. All signalized and major unsignalized intersections on each street serving the site within 1 mile.

2.16.3. Submittal and Review Procedures

2.16.3.A. A copy of the TIA report, including all necessary backup data, are required for review.

2.16.3.B. The Director of Public Works shall review the TIA in conjunction with the other elements of the development application. If the TIA is not of the proper scope or is executed improperly, the Developer shall be notified of the deficiencies and be required to submit corrections on the same schedule that applies to the other elements of the development application. Failure to submit corrections in a timely fashion may lead to a postponement of the application.

2.16.3.C. Director of Public Works approval is valid for 24 months, provided significant changes in the development proposal or surrounding conditions have not occurred. At the discretion of the Director of Public Works, the TIA shall be revised if the proposed land use is changed by type or size, if existing conditions have changed enough to invalidate the TIA results, or if the initial TIA assumptions are no longer valid.

2.16.3.D. In accordance with **Section 2.16.5**, if the site plan changes after initial TIA approval, the TMP shall be revised accordingly and resubmitted for Director of Public Works approval.

2.16.4. Mitigation and Mitigation Funding

2.16.4.A. The TIA may take into account City, State, and/or County approved traffic improvements with dedicated funding. The Director of Public Works will determine which approved traffic improvements may be considered. Prior to the issuance of a Certificate of Occupancy, the Developer shall complete any required traffic improvements which have not been funded or otherwise completed by government agencies.

2.16.4.B. When it can be demonstrated that a development will only partially contribute to the need for additional off-site improvements, the City may require a pro-rata contribution according to impacts of traffic added by the development.

2.16.4.C. Traffic levels exceeding Level of Service D, where the development is contributing five percent or more of the total trips should be mitigated if possible. Mitigation measures are limited to the following:

2.16.4.C.i. Requirements in addition to those provided in this Design Manual relating to driveway and median opening location design and distance between drives;

2.16.4.C.ii. Onsite improvements including access controls and site circulation adjustments; and,

2.16.4.C.iii. Offsite improvements including the construction of additional lanes where the surrounding thoroughfares are not fully developed or intersection improvements where the surrounding area is approaching full development.

2.16.5. *Traffic Impact Analysis Report Requirements* – At a minimum, the TIA shall incorporate all current and available transportation and land development information and include the following sections.

2.16.5.A. *Introduction* – Include a description of the site location and study area, including a location map identifying key intersections and other approved projects in the vicinity.

2.16.5.A.i. *Development Description* – Include type of land use and the following information where applicable:

- If residential, number and type of dwelling units;
- If commercial or industrial, square footage and type of development;
- Detailed site plan; and,
- Development phasing and timing.

2.16.5.A.ii. *Analysis Period* – Selection of analysis period shall be based on the proposed land use and the typical peak hours.

2.16.5.B. *Site Conditions* – Include a description of site conditions for the study area, including the following:

- Existing and proposed land use and zoning;
- Site access;
- Posted speed limits on all existing, adjoining, or impacted roadways;
- Distances from existing streets, driveways, and/or median cuts to the proposed development;
- Alignment of existing streets, driveways, and/or median cuts to the proposed development;
- Intersection layout, lane usage, lane widths, and roadway configuration;
- Traffic control devices;
- Traffic signal timing and phasing. Offset times should be shown if any coordination with adjacent signals is being used;
- ROW widths for all existing roadways that may be impacted by the development;
- Daily (ADT) and peak-hour (AM and PM) traffic counts (collected at the specified days of week based on the preliminary meeting), peak-hour intersection turning movement counts at key intersections taken at 15-minute increments, and any additional required traffic counts. Traffic counts used in a TIA shall be less than one year old. The existing counts shall be presented in diagrammatic form for each intersection counted;

- Pedestrian facilities and volumes;
- LOS of existing roadways and intersections as defined by TRB's current edition of *Highway Capacity Manual*; and,
- Photographs documenting existing transportation conditions.

2.16.5.C. *Projected Traffic* – The calculation of the projected traffic shall be shown in sufficient detail so that all calculations can be verified. Descriptions and figures of the following items shall be included in the report.

2.16.5.C.i. *Site Traffic* – Site traffic (daily and peak periods) shall include trip generation, trip distribution methods, and assignments. Include a list of trip rates and sources of rates used for the study. ITE's current edition of *Trip Generation Manual* shall be used. Calculate trip ends assuming 100% occupancy and development.

2.16.5.C.ii. *Background Traffic* – Background traffic (daily and peak periods) shall account for all approved developments in the study area as well as area growth beyond study area.

2.16.5.C.iii. *Reassignment Rates* – Reassignment rates for pass-by, diverted trips, and internal capture shall follow ITE's current edition of *Trip Generation Manual* based on different land use classifications. Reduction for any other land use types must be thoroughly documented and approved by the Director of Public Works.

2.16.5.C.iv. *Total Traffic* – Total traffic shall be shown combining site and background traffic for each intersection and driveway.

2.16.5.C.v. *Future Traffic* – If required, future traffic shall be calculated using background traffic volumes adjusted for the TIA horizon year.

2.16.5.D. *Traffic Analysis* – The following information shall be included in the report describing the detailed analyses performed.

2.16.5.D.i. Projected volume to capacity (V/C) ratios, vehicular delays, and LOS (background traffic and total traffic) for the study horizon shall include the following:

- Identification of any traffic analysis software used;
- Signalized intersection analysis;
- An LOS analysis using projected traffic volumes must be conducted using the Transportation Research Board's (TRB) current edition of *Highway Capacity Manual*;
- If signalization is warranted by the traffic signal warrants set forth in TxDOT's current edition of *TMUTCD*, conduct a

complete warrant analysis and analyze the intersections as signalized intersections;

- Impacts to LOS on arterials shall be determined; and,
- Turning vehicle storage space needed or the adequacy of storage space for turning vehicles at intersections in the study area shall be analyzed. This analysis shall consider signal phasing and overall signal cycle length as well as vehicle volumes. Analysis of queuing on-site may also be required.

2.16.5.D.ii. A table for each of the following shall be provided. All peak-hour data shall be shown.

- Existing LOS, delay, and V/C ratios;
- Background LOS, delay, and V/C ratios without development;
- Future LOS, delay, and V/C ratios with development; and,
- Net changes in LOS, delay, and V/C ratios between future and background scenarios, both with and without mitigation.

2.16.5.D.iii. Intersections, turn lanes, median openings, and driveways shall comply with **Section 2.3** (Intersections), **Section 2.6** (Median Openings and Turn Lanes), and **Section 2.7** (Driveways), respectively.

2.16.5.D.iv. Determine impacts to nearby neighborhoods.

2.16.5.D.v. Accident analysis covering the past five years may be required at intersections that currently have more than four property and/or injury accidents per year. The Director of Public Works shall provide recent reportable accident history for evaluation.

2.16.5.D.vi. The analysis should take additional facilities into account, such as sidewalks, crosswalks, school bus stops, and railroad crossings.

2.16.5.E. *Traffic Management Plan* – A TMP shall be required for any school and must be based on the current site plan. If the site plan changes after the TIA is approved, the TMP shall be revised to demonstrate the final site plan and resubmitted to the Director of Public Works for approval.

2.16.5.F. *Conclusions and Recommendations* – The final section of the report shall summarize the overall impact of the development and include the following:

2.16.5.F.i. Site Access, Driveway, and Circulation Plan

2.16.5.F.ii. Adjacent intersection and driveway improvements addressing, at a minimum, the following:

- Traffic control devices – modify existing or need for new;
- Additional lanes needed (left, right, or thru);
- Median openings;
- Intersection channelization;
- Acceleration and/or deceleration lanes;
- Length of storage bays;
- A detailed drawing of any intersection improvements; and,
- Implementation schedule.

2.16.5.F.iii. Off-site capital improvements and Transportation System Management (TSM) improvements to be programmed by the City may include the following:

- Modifications to existing traffic control devices;
- Additional traffic control devices, additional lane at major intersections, and additional roadways; and,
- Other improvements, if applicable.

2.16.5.G. *Appendix* – The following appendices shall be included in the report:

- Raw traffic count data;
- Printouts of analysis results;
- Photographs of site; and,
- Additional tables or figures not included in the report.

SECTION 3 DRAINAGE DESIGN REQUIREMENTS

Section Highlights

- For the purpose of this section, open channel velocities are considered erosive if greater than or equal to 6 feet per second. Average and subsection velocities must be analyzed to determine adequate placement and types of armoring within all new or improved open channels.
- Stormwater runoff shall be carried in a closed conduit when the volume of runoff is less than or equal to 800 cubic feet per second. Open channels may be used instead of enclosed storm drain systems only when the volume of runoff exceeds 800 cubic feet per second.
- All storm drain systems shall be reinforced concrete.
- Runoff computations shall be based on fully developed watershed conditions.
- Design storm frequencies are in **Table 3-1**. Storm drain systems shall be designed for 100-year storm event.
- The ultimate floodplain shall be based on the specified design storm frequency based on fully developed watershed conditions. In some cases, the FEMA floodplain may differ from the ultimate floodplain. Refer to **Section 3.6** (Floodplain Alterations) for additional information. `

3.1. *General*

3.1.1. *Minimum Design/Erosion and Sediment Control* – This section includes minimum design requirements associated with the City's storm drainage facilities, including streets, alleys, ditches, inlets, storm drain systems, creeks, floodplains, bridges, culverts, detention facilities, and retention facilities. This section also includes minimum erosion and sediment control required during construction and post-construction.

3.1.2. *Other Requirements Apply* – All drainage designs shall at a minimum meet the requirements of FEMA, United States Army Corps of Engineers (USACE), Texas Commission on Environmental Quality (TCEQ), and other agencies, as applicable.

3.1.3. *Engineer's Responsibility* – It is the responsibility of the Engineer to provide all necessary calculations and designs described herein. The Engineer shall provide the data, calculations, and designs necessary to demonstrate that the design does not adversely impact surrounding, upstream, or downstream properties and meets Local, State, and Federal regulations and requirements.

3.1.4. *Drainage Plan Requirement* – No individual, partnership, firm, or corporation shall deepen, widen, fill, re-route, or change the course or location of any existing ditch, channel, stream, or drainage way, without first submitting Engineering Plans for approval by the Director of Public Works. Such plans shall be prepared, signed, and sealed by a licensed Professional Engineer in the State of Texas experienced in civil engineering.

3.1.5. *Drainage Plan Submittals* – Refer to **Section 1.7** (Submittal Requirements for Construction Plans) and to the Engineering Plan Submittal Checklist included in **Appendix B** (City Checklists) for drainage plan submittal requirements.

3.1.6. *Floodplain Preservation* – Preservation and avoidance of floodplains is far preferable to reclaiming and developing floodplain areas. Refer to **Section 3.6** (Floodplain Alterations) for floodplain alteration processes and requirements.

3.1.7. *Drainage Structure Aesthetics* – Drainage design in the urban environment must consider appearance as an integral part of the design. When utilized, the design of drop structures, armoring, and other hydraulic structures should blend with the natural surroundings as much as possible to maintain the aesthetics of the natural channel.

3.1.8. *Drainage Easements* – Refer to **Section 1.8** (Easements and Right-of-Way Requirements) for considerations and processes related to drainage easements.

3.1.9. *Maintenance of Drainage Facilities* – Maintenance responsibilities shall be in accordance with the Drainage and Flood Hazard Area Regulations in Chapter 11 of the Sachse City Code, as amended. Drainage facilities that have been dedicated to and accepted by the City are maintained by the Property Owner. Private drainage facilities are typically maintained by the property Owner on which the facility is located. The existence of a drainage easement does not change ownership or maintenance responsibility. Maintenance plans for detention ponds and Best Management Practices (BMPs) are required and shall be in accordance with this section and the Drainage and Flood Hazard Area Regulations in Chapter 11 of the Sachse City Code, as amended.

3.1.10. *Permits* – The City has several permits related to storm drainage. Refer to the Chapter 11, “Planning and Development” of the Sachse City Code, as amended, for requirements related to Grading and Floodplain Development Permits and Elevation Certificates. The criteria in this section shall be met before a Development Permit can be issued for a proposed project.

3.1.11. *Section 404 Permitting* – If mitigation is required under Section 404 of the Clean Water Act, the areas shall be identified on the Engineering Plans. If applicable, permit documentation shall be provided to the City upon request.

3.1.12. *Flood Study* – Owners may be required to provide, at their expense, a drainage study for the total area to be ultimately developed. This study shall be submitted to the Director of Public Works as a part of the submitted data for consideration of preliminary plat or site plan approval for the portion of the property proposed for immediate development. Refer to **Section 3.6** (Floodplain Alterations) for Flood Study requirements for floodplain alterations.

3.1.13. *Warning and Disclaimer of Liability* - The degree of flood protection required by this Manual is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by manmade or natural causes. This Manual does not imply that land outside the area of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This Manual shall not create liability on the part of the City, any officer or employee thereof or FEMA for any flood damages that result from reliance on this Manual or any administrative decision lawfully made hereunder.

3.1.14. *General Lot Grading and Drainage Requirements* – Lot grading and drainage shall at a minimum meet the following requirements:

3.1.14.A. Existing drainage patterns shall be maintained. Grading and drainage shall not negatively impact surrounding properties.

3.1.14.B. Lot-to-lot drainage, defined as runoff from one individually owned private lot to another, is not allowed. Once runoff is conveyed to public right-of-way (ROW) or drainage easement, it may not be directed back onto property outside of a drainage easement.

3.1.14.C. Lots shall be graded to drain surface water away from foundation walls. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2% away from the building.

3.1.14.D. All earthen drainage swales draining areas less than one cumulative acre shall have a 2% minimum slope. Side yards and backyards shall have a 1% minimum slope. All paved drainage swales shall have a 1% minimum slope.

3.1.14.E. Drainage from residential areas, such as roof tops, should be allowed to flow overland before joining the storm sewer system.

3.1.14.F. Seepage into basements or sub-surface structures that is pumped to ground level, seepage from springs and runoff from roof drains on non-residential buildings that would flow onto or across driveways, sidewalks, or other areas commonly crossed by pedestrians, can create hazards or nuisances to pedestrians. Thus, if hazards or nuisances would be created, the basement and rooftop drains shall be tied directly to the nearest storm sewer, provided that pumped lines from basements have back flow preventers and the water is uncontaminated.

3.2. *Design Discharge*

3.2.1. General

3.2.1.A. *Contents* – This section includes design storm frequencies, freeboard requirements, rainfall intensities, and methodologies for calculating runoff.

3.2.1.B. *Runoff Method* – The selection of which method to use for calculating runoff depends upon the size of drainage area contributing runoff at a most downstream point of a project as described in this section.

- The Rational Method may be used for watersheds with drainage areas of 200 acres or less. Refer to **Section 3.2.3**.
- The Time of Concentration and Travel Time Method, commonly referred to as the Soil Conservation Service (SCS) or the National Resource Conservation Service (NRCS) Method, may be used for watersheds of any size. Refer to **Section 3.2.4**.
- The Snyder's Unit Hydrograph Method or SCS Dimensionless Unit Hydrograph Method may be used for watersheds of any size, in accordance with the current edition of the NCTCOG Integrated Stormwater Management (iSWM™) *Hydrology Technical Manual*. Other detailed Unit Hydrograph Methods may be used based upon standard engineering principles subject to approval of the Director of Public Works. The USACE's HEC-RAS modeling program shall be used for watersheds with drainage areas of 200 acres or more. Refer to **Section 3.2.5**.

3.2.1.C. *Ultimate Watershed Conditions* – Runoff computations shall be based upon fully developed watershed conditions in accordance with the ultimate land use projections in the City's Comprehensive Plan. The Engineer shall size drainage facilities by disregarding the detention effects of upstream property and calculating the runoff as if the off-site property was developed without any detention. If an approved regional detention/retention facility is in operation, the Engineer may size downstream drainage facilities based on consideration of the detention effects of the regional facility.

3.2.1.D. *Rainfall Loss Rates* – Losses due to interception, infiltration, and depression storage need to be deducted from the total design rainfall to obtain the effective design rainfall. The method used to account for rainfall losses will depend on the method used to compute the design discharge as follows:

3.2.1.D.i. *Rational Method* – Select an appropriate runoff coefficient.

3.2.1.D.ii. *Snyder's Unit Hydrograph Method* – Use the Initial and Constant Loss Method in accordance with USACE's current edition *HEC-HMS (Hydrologic Modeling System) User's Manual*.

3.2.1.D.iii. *SCS Dimensionless Unit Hydrograph Method* – Use the SCS Curve Number Loss Method in accordance with

USACE's current edition *HEC-HMS (Hydrologic Modeling System) User's Manual*.

3.2.1.E. *Detention Considerations* – Detention may be required by the Director of Public Works if the proposed runoff rates exceed pre-development rates, existing downstream facilities are undersized, or downstream cities have detention requirements. Refer to **Section 3.9** (Detention and Retention Facilities) and **Section 3.10** (Downstream Assessments) for additional requirements.

3.2.1.F. *Dams and Reservoirs* – The design rainfall for sizing auxiliary spillways on dams or impoundments shall be based on a percentage of the Probable Maximum Flood (PMF), as specified by the TCEQ under Title 30, Chapter 299 of the Texas Administrative Code (TAC) and further explained in TCEQ's current edition *Hydrologic and Hydraulic Guidelines for Dams in Texas*. Refer to **Section 3.9** (Detention and Retention Facilities) for additional design criteria.

3.2.2. *Design Storm Frequency* – The calculations of runoff quantities that must be accommodated in drainage facilities require the selection of the design storm frequency. The design storm frequencies and freeboard requirements for various drainage structures are shown below in **Table 3-1**.

Table 3-1. Design Storm Frequencies and Freeboard Requirements

Storm Drainage Facility	Frequency	Freeboard	Freeboard Reference Point
Enclosed Storm Drain Systems and Inlets	100-year with positive overflow	1.5 feet	Gutter elevation for roadways. Throat elevation for other locations.
Roadside Ditches	100-year	1 foot	Top of Bank
City Street Rights-of-Way[2]	100-year	None	Top of Curb
Culverts	100-year	1 foot	Top of Curb
Bridges	100-year	2 feet	Low Chord of Bridge
Pedestrian Bridges[1]	25-year	1 foot	Low Chord of Bridge
Earthen Channels, Concrete-Lined Channels, and Improved Channels	100-year	2 feet	Top of Bank
Levees	Refer to FEMA for requirements.	Per FEMA	Per FEMA
Detention and Retention Basins	100-year. Staged outlet required per **Section 3.9** (Detention and Retention Facilities).	1 foot	Lowest Point of Containment
Dams	See **Section 3.9** (Detention and Retention Facilities). Refer to TCEQ for requirements.	Per TCEQ	Per TCEQ
Standard Parking Lots for Passenger Vehicles	100-year	None	Permissible depth of ponding shall not exceed Top of Curb with maximum ponding depth at low points of 1 foot.
Truck Parking Lots	100-year	None	Permissible depth of ponding shall not exceed Top of Curb with maximum ponding depth at low points of 1.5 feet.

1. Pedestrian bridges must be sized to contain the 25-year storm event. Pedestrian bridges must meet floodplain alteration requirements for the 100-year storm event. Refer to **Section 3.6** (Floodplain Alterations).
2. Maximum water spread limits shall be met and may move the freeboard reference point.

3.2.3. *Rational Method* – The Rational Method can be used to estimate stormwater runoff peak flows for the design of gutter flows, drainage inlets, storm drain pipe, culverts, and ditches. It is most applicable to small, highly impervious areas. The peak discharge rate shall be computed by the following methodology:

Rational Method

$$Q = C_f * C * I * A$$

Where:

Q = Peak discharge rate (cubic feet per second)
C_f = Frequency factor from **Table 3-2** (dimensionless)
C = Runoff coefficient from **Table 3-5** for given area (dimensionless)
I = Average rainfall intensity during the time of concentration for a given storm event from **Table 3-3** and **Table 3-4** (inches per hour)
A = Drainage area contributing runoff to the design location (acres)

3.2.3.A. *Runoff Coefficient Frequency Factor (C_f)* – The runoff computations should include the frequency factor as identified in **Table 3-2**. This coefficient is intended to reflect the additional runoff that results from saturated ground conditions in larger storm events. The product of the runoff coefficient and the frequency factor shall not exceed 1.0 ($C_fC \leq 1.0$).

Table 3-2. Frequency Factors for Rational Formula

Recurrence Interval or Return Period (years)	Frequency Factor, C_f
10-year or less	1.0
25-year	1.1
50-year	1.2
100-year or greater	1.25

3.2.3.B. *Runoff Coefficient (C)* – Runoff coefficients shall be based on the ultimate land use (refer to the City's Land Use Map within the Comprehensive Plan) and the respective runoff coefficient provided in **Table 3-5**. If an area is not included on the City's Land Use Map, prior approval by the Director of Public Works of ultimate land uses and runoff coefficients shall be required. A minimum runoff coefficient of 0.60 shall be used for areas not covered by the Land Use Map. If an area has conflicting ultimate land uses between the Land Use Map and current zoning, the higher runoff coefficient between the two ultimate land uses shall be used. For a site with two or more land uses, a weighted runoff coefficient may be used if it is more representative of site conditions using the following equation:

Weighted Runoff Coefficient

$$C_W = \frac{C_1A_1 + C_2A_2 + \ldots + C_nA_n}{A_1 + A_2 + \ldots + A_n}$$

Where:

C_W = Weighted runoff coefficient (dimensionless)
C = Runoff coefficient from **Table 3-5** for given area (dimensionless)
A = Drainage area contributing runoff to the design location (acres)
n = Number of drainage areas

3.2.3.C. *Average Rainfall Intensity (I)* – Rainfall intensity for the design return period shall calculated be based on current NCTCOG iSWM™ *Hydrology Technical Manual* methodology. The following rainfall intensity equation and intensity coefficients shall be used.

Rainfall Intensity

$$I = \frac{b}{(T_c + d)^e}$$

Where:

I = Average rainfall intensity (inches per hour)
T_C = Time of concentration (minutes)
b, d, e = Intensity coefficients from **Table 3-3** and **Table 3-4** based on the specified rainfall return period and County (dimensionless)

Table 3-3. Intensity Coefficients for Dallas County[1]

Coefficients	2-year	5-year	25-year	100-year
b	55.179	70.024	87.970	100.079
d	10	12	13	13
e	0.81545	0.80449	0.78187	0.75870
1. Intensity coefficients provided in **Table 3-3** are based on iSWM™ *Hydrology Technical Manual* dated April 2010 and revised September 2014. The current edition shall be used.				

Table 3-4. Intensity Coefficients for Collin County[1]

Coefficients	2-year	5-year	25-year	100-year
b	50.523	64.259	76.069	86.709
d	9	11	11	11
e	0.79822	0.78901	0.75875	0.73702
1. Intensity coefficients provided in **Table 3-4** are based on iSWM™ *Hydrology Technical Manual* dated April 2010 and revised September 2014. The current edition shall be used.				

3.2.4. *Time of Concentration and Travel Time Method (SCS Method or NRCS Method)* – The section follows the procedures outlined in the NRCS's current edition of *TR-55 (Urban Hydrology for Small Watersheds)* to determine the time of concentration. This method separates the flow through the drainage area into sheet flow, shallow concentrated flow, and open channel flow. The time of

concentration is the sum of travel times for the flow regimes. The total time of concentration is determined as follows:

Time of Concentration

$$T_c = T_{t1} + T_{t2} + \ldots + T_{tn}$$

Where:

T_C = Time of concentration (hours)
T_t = Travel time (hours)
n = Number of flow segments

3.2.4.A. *Maximum Time of Concentration* – For inlets and laterals, the time of concentration shall be based on the City's specified inlet times in **Table 3-5.** The Engineer shall compare the specified inlet time in **Table 3-5** to the actual calculated time of concentration by computing the sheet flow, shallow concentrated flow, and open channel flow along the gutter, as applicable, to the first inlet. If the calculated inlet time differs from the specified inlet time in **Table 3-5**, the Engineer shall provide information to justify the inlet time calculations. In no case shall a longer inlet time be used than the specified inlet times provided in **Table 3-5**.

Table 3-5. Runoff Coefficients and Specified Inlet Times

Ultimate Land Use	Runoff Coefficient, C	Specified Inlet Time (minutes)
Agricultural and Unimproved Areas	0.30	15
Parks, Cemeteries, and Improved Open Areas	0.35	15
Single Family Residential (≥39,000 ft^2 lots)	0.45	15
Single Family Residential (>12,000 ft^2 lots)	0.60	15
Single Family Residential (≤12,000 ft^2 lots)	0.65	15
Churches and Schools	0.75	10
Multi-Family	0.85	10
Commercial, Industrial, and Business	0.90	10
Asphalt, Concrete, and Roofs	0.95	10

3.2.4.B. *Sheet Flow* – The maximum allowable length for sheet flow is 200 feet for undeveloped drainage areas and 100 feet for developed areas. The travel time, T_t, for sheet flow is determined using the following equation:

Sheet Flow

$$T_t = \frac{0.0007(nL)^{0.8}}{P_2^{0.5} S^{0.4}}$$

Where:

T_t = Travel time (hours)
n = Manning's roughness coefficient from **Table 3-6** (dimensionless)
L = Flow length (feet)
P_2 = 2-year, 24-hour rainfall (inches)
S = Slope of the flow path (feet per foot)

Table 3-6. Manning's Roughness Coefficients for Sheet Flow[1]

Surface Description	n
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass	
Short grass prairie	0.15
Dense grasses	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods	
Light underbrush	0.40
Dense underbrush	0.80
1. The roughness coefficients (n values) provided in **Table 3-6** for sheet flow are not the same for open channel flow. Roughness coefficients for sheet flow assume a vegetation height of 0.1 feet obstructs flow.	

3.2.4.C. *Shallow Concentrated Flow* – Shallow concentrated flow begins where sheet flow ends. A projected slope should be established along the flowline for the shallow concentrated flow length. The travel time, T_t, for shallow concentrated flow is determined by the following equation:

Shallow Concentrated Flow

$$T_t = \frac{L}{3600V}$$

Where:

T_t = Travel time (hours)
L = Flow length (feet)
V = Average velocity (feet per second)
$V_{unpaved}$ = $16.1345\ S^{0.5}$
V_{paved} = $20.3282\ S^{0.5}$
S = Slope of the flow path (feet per foot)

3.2.4.D. *Open Channel Flow* – Open channel flow is where the runoff is located within a defined channel or gutter. The travel time, T_t, for open channel flow is determined using the following equations:

Open Channel Flow

$$T_t = \frac{L}{3600V}$$

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

Where:

T_t = Travel time (hours)
L = Flow length (feet)
V = Average velocity (feet per second)
R = Hydraulic radius (R = A/P) (feet)
A = Cross sectional flow area (square feet)
P = Wetted perimeter (feet)
S = Slope of the hydraulic gradient (feet per foot)
n = Manning's roughness coefficient from **Table 3-20** (dimensionless)

3.2.5. Unit Hydrograph Method

3.2.5.A. The Unit Hydrograph Method shall be based upon fully developed watershed conditions in accordance with **Section 3.2.1**. Refer to **Section 3.6** (Floodplain Alterations) and **Section 3.7** (Open Channels) for additional modeling and submittal requirements.

3.2.5.B. Circumstances that may require the use of a Unit Hydrograph Method include:

- Sizing of open channels;
- Reclamation of floodplains;
- Creation of detention/retention ponds or lakes; or,
- Building other types of drainage-related structures or facilities.

3.2.6. *Modified Rational Method* – Refer to **Section 3.9** (Detention and Retention Facilities) for Modified Rational Method guidelines.

3.2.7. *Modified Puls Routing Method* – The Modified Puls Routing Method may be requested to be used in the design if the method is more characteristic of the hydrologic and hydraulic conditions of the watershed. Refer to **Section 3.6** (Floodplain Alterations) for additional information.

3.3. *Street and Alley Capacity*

3.3.1. *General* – This section includes equations to determine gutter, street, alley, and positive overflow route capacities.

3.3.2. *Gutter Capacity* – Gutter flow and depth calculations are necessary to establish the spread of water on the shoulder, parking lane, or pavement section.

3.3.2.A. The following form of the Manning's Equation should be used to evaluate gutter flow hydraulics:

Gutter Flow Equation

$$Q = \frac{0.56}{n} S_x^{5/3} S^{1/2} T^{8/3}$$

Where:

Q	=	Gutter flow rate (cubic feet per second)
n	=	Manning's roughness coefficient from **Table 3-20** (dimensionless)
S_x	=	Pavement cross slope (feet per feet)
S	=	Longitudinal slope of the gutter (feet per feet)
T	=	Spread of flow or width of flow (feet)

3.3.2.B. Depth of flow in the gutter can be calculated using the following equation which is modified from of the equation above. If the flow in the gutter is still excessive, the storm drain shall be extended to a point where the gutter flow can be effectively intercepted by curb inlets.

Depth of Flow in Gutter

$$d = z\left(\frac{QnS_x}{S^{1/2}}\right)^{3/8}$$

Where:

d	=	Depth of flow at the curb (feet)
z	=	1.24 (dimensionless)

3.3.3. *Street Capacity* – All straight crown street capacities shall be hydraulically designed using Manning's Equation:

Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3}S^{1/2}$$

Where:

Q	=	Gutter flow rate (cubic feet per second)
n	=	Manning's roughness coefficient from **Table 3-20** (dimensionless)
A	=	Cross section flow area (square feet)
R	=	Hydraulic radius of the conduit (R = A/P) (feet)
P	=	Wetted perimeter (feet)
S	=	Slope of the hydraulic gradient (feet per foot)

3.3.4. *Alley Capacity* – All alley capacities shall be hydraulically designed using the Manning's Equation shown above.

3.3.4.A. In residential areas where the standard alley section capacity is exceeded, storm drain systems with inlets shall be provided.

3.3.4.B. Inlets shall be located in alleys upstream from an intersection and where necessary to prevent water from entering intersections in amounts exceeding allowed street capacity.

3.3.4.C. Alley capacities shall be checked at all alley radii and "T" intersections to determine if curbing is needed or if grades should be adjusted.

3.3.4.D. Curbing shall be required for at least 10 feet on either side of an inlet in an alley and on the other side of the alley so that the top of the inlet is even with the adjacent top of curb.

3.3.5. *Positive Overflow Routes* – The drainage system shall include a positive overflow route at all sag (low) points. The term "positive overflow" means that when the inlets do not function properly or when the design capacity of the conduit is exceeded, the excess flow can be conveyed overland along a paved course. Normally, this would mean along a street or alley, or shall require the dedications of drainage easements on private property.

3.3.6. *Flumes* – The use of flumes is not recommended for widespread use. Flumes shall not be permitted when the purpose of a permanent flume is to carry runoff down the sides of earthen channels. A flume may be used for positive overflow routes or to direct runoff along property lines until the runoff can be intercepted by streets or conduits. Flumes crossing sidewalks shall be covered or bridged to minimize danger to pedestrians.

3.3.7. *Roadside Ditches* – Refer to **Section 3.7** (Open Channels) for roadside ditch design requirements.

3.4. *Inlet Location and Capacity*

3.4.1. *General* – This section includes spread criteria as well as minimum inlet and capacity design requirements. Refer to the current edition of FHWA's *Hydraulic Engineering Circular No. 22 (HEC-22)*, NCTCOG iSWM™'s *Hydraulics Technical Manual*, and TxDOT's *Hydraulic Design Manual* for additional design considerations. For the purpose of this manual, inlet types are limited to those covered by the Standard Details.

3.4.2. *Preferred Inlet Types* – A site-specific selection of inlet type and geometry will be necessary and contingent upon Director of Public Works approval. In general, the following list includes the inlet types that may be considered, listed in order of City preference:

- Recessed Curb Inlet;
- Standard Curb Inlet;
- Combination Inlet;
- Grate Inlet;
- Drop Inlet; or,
- Slot Inlet.

3.4.3. *Placement of Inlets* – Storm drain inlets shall be designed and constructed along paved streets and alleys to meet the spread criteria in **Section 3.4.4**. When an alley intersects a street, inlets shall be placed in the alley whenever flow in the alley would cause the capacity of the intersecting street to be exceeded.

3.4.4. *Spread Criteria* – All street flow calculations shall be based on fully developed conditions in accordance with **Section 3.2** (Design Discharge). All streets shall be capable of conveying the specified design flood in accordance with the spread limitations shown in **Figure 3-1**. Refer to **Section 2** (Roadway and Traffic Design Requirements) for typical sections. Lowering of the standard height of street crown shall not be allowed for the purposes of obtaining additional hydraulic capacity. Where additional hydraulic capacity is required, the proposed street gradient must be increased, or curb inlets and storm drains installed to remove a portion of the runoff. For non-curbed streets, the 100-year frequency storm event shall be safely contained within ROW.

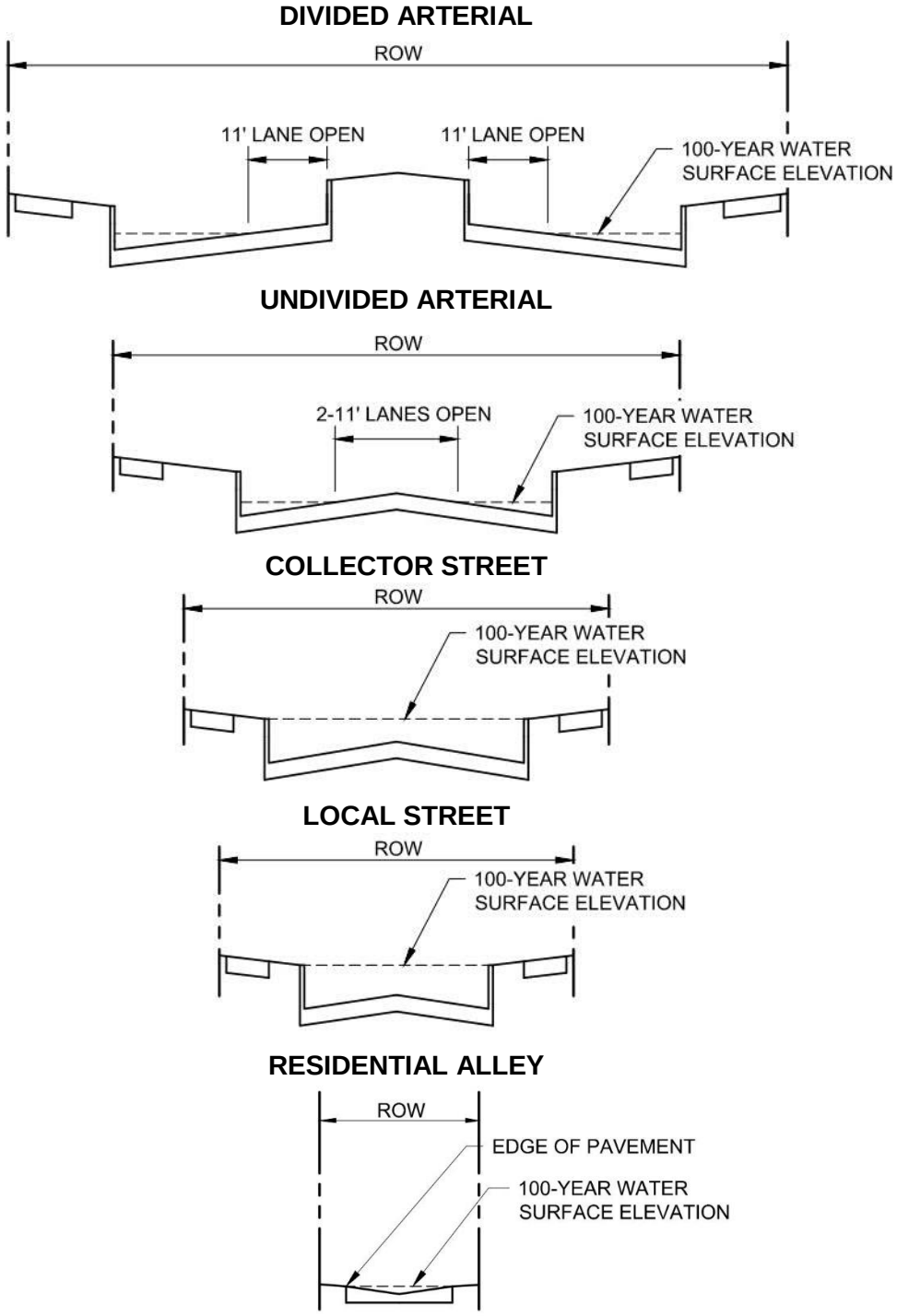


Figure 3-1. Maximum Water Spread Limits[1]

[1]Based on Typical Sections (Refer to **Section 2**). Not drawn to scale.

3.4.5. *Bypass Flow* – No depth of flow across street intersections is acceptable for the design flood. Inlets shall be placed to ensure no bypass flow for the design flood for any street classification.

3.4.6. *Design Parameters* – Several hydraulic parameters should be considered for storm drain inlet design. These design parameters include, but are not limited to, the following:

- Inlet sizes shall be in multiples of 5 feet. No more than 20 feet of inlets shall be placed along one gutter at any given location without Director of Public Works approval.
- In super-elevated sections of divided arterials, inlets placed against the center medians shall have no gutter depression. Interior gutter flow (flow along the median) shall be intercepted at the point of super-elevation transition, to prevent pavement cross flow.
- The maximum approved vertical inlet opening is 6 inches. Openings larger than 6 inches require approval of the Director of Public Works and, if approved, must contain a bar or other form of restraint to prevent entry by large debris.
- The design and location of all inlets must take into consideration pedestrian and bicycle traffic.
- At bridges with curbed approaches, gutter flow shall be intercepted prior to flowing onto the bridge deck.
- Inlets must be located where the allowable street flow capacities are exceeded, upstream of intersections, at low points (sags), and upstream of transitions between normal and super-elevated street sections.
- In parking lots, inlets must be located on the short dimension of parking stalls or outside of parking stalls to limit depth of ponding at driver and passenger doors.

3.4.7. *Limitations* – The following are design constraints on the use of the recommended storm drain inlet types. Consideration must be given to the below requirements:

- *Conflicts with Driveways/Curb Returns* – Inlets shall be sized along residential frontage to prevent conflicts with proposed driveways and curb returns. The Director of Public Works may limit the maximum inlet opening size where the possibility for a conflict may exist.
- *Interference with Sidewalks/Utilities* – Inlets shall not decrease the width of the adjacent sidewalk or interfere with utilities.
- *Combination Inlets* – Combination inlets shall not be used in City-maintained streets unless approved by the Director of Public Works. Combination inlets may be used only where conflicts exist behind the curb which prohibit the use of other inlet types. Combination inlets used in a sag shall have a minimum of a 5-foot sweeper curb inlet on both sides. Combination inlets on grade will have a minimum of a 5-foot sweeper curb inlet on the upstream side.
- *Grate Inlets* – Grate inlets shall not be used in City maintained streets or alleys unless approved by the Director of Public Works. Grate inlets may be used only where restrictions prohibit the use of other types of inlets. If used, the inlet opening should be designed to be twice as large as the theoretical required area to compensate for clogging, and must be approved by the Director of

Public Works. Grates shall be designed for safety of pedestrians, wheelchairs, and bicycles.

- *Drop Inlets* – Drop inlets shall only be located to collect water on non-paved areas where it is not practical to use a headwall, such as swales.
- *Slot Inlets* – The use of slot inlets is not allowed except where approved by the Director of Public Works. If slot inlets are used, the inlet capacity shall be the lesser of the calculated capacity from this manual or the manufacturer's design guidelines.

3.4.8. *Inlet Capacities* – Refer to **Table 3-8** for inlet capacity equations. These equations came from, or are modified forms of, equations found in the current edition of the FHWA *Hydraulic Engineering Circular No. 22 (HEC-22)*, the NCTCOG iSWM™ *Hydraulics Technical Manual*, and the TxDOT *Hydraulic Design Manual*. Refer to the current edition of these manuals for any figures, charts, and nomographs that may be used in conjunction with the equations in this section to determine the capacity for various inlet configurations. It is the responsibility of the Engineer to submit inlet capacity calculations for all storm drain systems to the City for review and approval. The following conditions shall be utilized with **Table 3-8**.

3.4.8.A. *Inlets on Grade* – An inlet located on the street with a continuous slope past the inlet with water entering from one direction.

3.4.8.B. *Inlets in Sag Locations* – An inlet located at a low point with water entering from both directions. These sump areas should have an overflow route. The capacity of an inlet in a sag location depends on the water depth at the inlet opening and the height of the inlet opening. The inlet operates as a weir to a depth equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage and the capacity should be based on the lesser of the computed weir and orifice capacities.

3.4.8.C. *Clogging Factors* – The calculated capacity of inlets shall be reduced based on the clogging factors in **Table 3-7**.

Table 3-7. Inlet Clogging Factors

Inlet Type	Clogging Factor
Recessed Curb Inlet	10%
Standard Curb Inlet	10%
Combination Inlet	10% for curb inlet, 50% for grate inlet
Grate Inlet	50%
Drop Inlet	10% without grate, 50% with grate
Slot Inlet	50%

Table 3-8. General Inlet Design

Inlet Types	Capacity Equation	
	Weir Conditions	**Orifice Conditions**
Recessed Curb Inlet and Standard Curb Inlet On Grade In Sag	*FHWA HEC-22 Equation 4-22* $L_T = 0.60Q^{0.42}S_L^{0.3}[1/(nS_e)]^{0.6}$ *FHWA HEC-22 Equation 4-24* $S_e = S_x + (a/W)E_0$ *FHWA HEC-22 Equation 4-16* $E_o = 1 - (1 - W/T)^{2.67}$ *FHWA HEC-22 Equation 4-21* $Q_i = EQ$ *FHWA HEC-22 Equation 4-23* $E = 1 - [1 - (L/L_T)]^{1.8}$ Where: Q_i = Capacity of inlet (cfs) E = Inlet efficiency Q = Total flow in the roadway (cfs) E_o = Ratio of frontal flow to total gutter flow (dimensionless) W = Width of depressed gutter or grate (ft) T = Total spread of water (ft) L_T = Curb opening length required to intercept 100% of the gutter flow (ft) S_L = Roadway longitudinal slope (ft/ft) n = Manning's roughness coefficient from **Table 3-20** (dimensionless) S_x = Roadway cross slope (ft/ft) L = Length of curb opening (ft) S_e = Equivalent cross slope (ft/ft) a = Gutter depression depth (ft)	

<table>
<tr><td></td><td colspan="2">Capacity Equation</td></tr>
<tr><td></td><td>Weir Conditions</td><td>Orifice Conditions</td></tr>
<tr><td></td><td>TxDOT Hydraulic Design Manual Equation 10-14
$Q = C_w(L + 1.8W)y^{3/2}$
Where:
Q = Capacity of inlet (cfs)
C_w = Weir coefficient, 2.3 (dimensionless)
L = Length of curb opening (ft)
W = Lateral width of depression (ft)
y = Head at inlet opening (ft)</td><td>TxDOT Hydraulic Design Manual Equation 10-16
$Q = C_o hL(2gd_o)^{1/2}$
Where:
Q = Capacity of inlet (cfs)
C_o = Orifice coefficient, 0.67 (dimensionless)
h = Height of inlet opening (ft)
L = Length of orifice opening (ft)
g = Acceleration due to gravity, 32.2 ft/s^2
d_o = Effective head at the center of the orifice opening (ft)</td></tr>
<tr><td>Grate Inlet

On Grade</td><td colspan="2">iSWM™ Hydraulics Technical Manual Equation 1.11
$Q_i = EQ = Q[R_fE_o + R_s(1-E_o)]$
Where:
Q_i = Capacity of inlet (cfs)
E = Inlet efficiency
Q = Total flow in the roadway (cfs)
E_o = Ratio of frontal flow to total gutter flow
R_f = Ratio of frontal flow intercepted to total frontal flow
R_s = Ratio of side flow intercepted to total side flow</td></tr>
<tr><td>In Sag</td><td>iSWM™ Hydraulics Technical Manual Equation 1.12
$Q_i = C_wP(d)^{3/2}$
Where:
Q_i = Capacity of inlet (cfs)
C_w = Weir coefficient, 3.0 (dimensionless)</td><td>iSWM™ Hydraulics Technical Manual Equation 1.13
$Q_i = C_oA(2gd)^{1/2}$
Where:
Q_i = Capacity of inlet (cfs)
C_o = Orifice coefficient, 0.67 (dimensionless)</td></tr>
</table>

	P = Perimeter of inlet disregarding the side against the curb (ft) d = Average depth of flow across the grate (ft)	A = Clear opening area in the grate (ft^2) d = Average depth of flow across the grate (ft) g = Acceleration due to gravity, 32.2 ft/s^2
Drop Inlet	*iSWM™ Hydraulics Technical Manual Equation 1.12* $Q_i = P3.0(y)^{3/2}$ Where: Q_i = Capacity of inlet (cfs) P = Perimeter of opening (ft) y = Head/depth of inlet (ft)	
Slot Inlet	*FHWA HEC-22 Equation 4-32* $Q_i = C_wL(d)^{3/2}$ Where: Q_i = Capacity of inlet (cfs) C_w = Weir coefficient, 2.48 (dimensionless) L = Length of slot (ft) d = Depth at curb (ft)	*FHWA HEC-22 Equation 4-33* $Q_i = 0.8LW(2gd)^{1/2}$ Where: Q_i = Capacity of inlet (cfs) L = Length of slot (ft) W = Width of slot (ft) d = Depth of water at slot for d > 0.4 ft g = Acceleration due to gravity, 32.2 ft/s^2

3.5. *Storm Drain Systems*

3.5.1. *General* – This section includes storm drain system design requirements. Refer to **Section 3.2** (Design Discharge) for design storm frequencies. Stormwater runoff shall be carried in a closed conduit when the volume of runoff is less than or equal to 800 cubic feet per second, or where it is necessary for the protection of adjacent facilities that the stormwater be carried in an enclosed facility. The required storm drain capacity to meet future needs shall be provided.

3.5.2. *Storm Drain Placement* – Storm drain lines shall be placed underneath roadway pavement in accordance with the Standard Details.

3.5.3. *Storm Drain Materials* – All storm drains in City ROW or easements shall be reinforced concrete. Refer to **Appendix E** (Approved Materials Lists) for approved storm drain system materials.

3.5.4. *Hydraulic Capacity* – A storm drain's size, shape, slope, and friction resistance controls its hydraulic capacity. Storm drain pipes shall be sized to flow full. For circular pipes flowing full, the following form of the Manning's Equation shall be used:

Storm Drain Capacity

$$Q = \frac{0.46}{n} D^{8/3} S_o^{1/2}$$

$$V = \frac{0.59}{n} D^{2/3} S_o^{1/2}$$

Where:

Q	=	Flow rate in the conduit (cubic feet per second)
V	=	Velocity of the flow in the conduit (feet per second)
n	=	Manning's roughness coefficient from **Table 3-10** (dimensionless)
D	=	Storm drain diameter (square feet)
S_o	=	Slope of the energy grade line (feet per foot)

3.5.5. *Minimum Slope and Velocity* – The minimum velocity in storm drain conduits shall be 2.5 feet per second. The minimum slopes for various pipe sizes that will maintain this minimum velocity are given in **Table 3-9**.

Table 3-9. Minimum Slopes for Concrete Pipes[1,2]

Pipe Diameter (inches)	Slope (feet/feet)
18	0.180
24	0.120
30	0.090
36	0.070
42	0.056
48	0.048
54	0.041
60	0.036
66	0.032
72	0.028

1. Minimum slopes given to produce a velocity of 2.5 feet per second or greater.
2. Assumes a Manning's roughness coefficient of 0.013.

3.5.6. *Manning's Roughness Coefficients for Conduits* – **Table 3-10** includes the Manning's roughness coefficients that shall be used for various types of conduits.

Table 3-10. Roughness Coefficients for Closed Conduits

Materials	Manning's Roughness Coefficient (n value)
Polyvinyl Chloride (PVC)[1]	0.009
High-Density Polyethylene (HDPE)[1]	0.012
Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe (CMP)[1]	0.024

1. Provided for reference for existing closed conduits only.

3.5.7. *Design Parameters* – The following are guidelines that shall be considered and met in storm drainage design:

3.5.7.A. Standard pipe sizes and fittings shall be used. The minimum allowable lateral storm drain pipe diameter shall be 18 inches.

3.5.7.B. Pipe sizes shall not be decreased in the downstream direction, unless otherwise approved by the Director of Public Works.

3.5.7.C. At points of change in storm drain size, pipe soffits shall be set at the same elevation.

3.5.7.D. Laterals shall be connected to trunk lines using manholes or manufactured wye connections. Special situations may require laterals to be connected to trunk lines by a cut-in. However, such cut-ins must be approved by the Director of Public Works and shown as a detail in the Engineering Plans.

3.5.7.E. Vertical curves in the storm pipe will not be permitted, and horizontal curves must meet manufacturer's requirements for offsetting of the joints.

3.5.7.F. The maximum access riser spacing is 500 feet. Additionally, manholes and junction boxes must also be located at the following scenarios:

- Concentration points having three or more laterals;
- Trunk line size changes for lines with a size difference greater than 18 inches;
- Vertical alignment changes where the algebraic slope difference is greater than or equal to 3%; and,
- Future collection points as determined by the Director of Public Works.

3.5.7.G. Manholes and junction boxes must be designed by a Professional Engineer competent in structural engineering licensed in the State of Texas. If the Standard Details are used for manholes, the maximum depth must not be exceeded. Angles of laterals must be checked to verify an adequately sized junction box or manhole. Manufacturer's design guidelines and joint deflection must also be checked.

3.5.7.H. Storm drain proposed for underground detention shall be submitted for review and approval by the Director of Public Works.

3.5.7.I. The flow regime shall be determined for all pipes in partial flow. If supercritical flow is anticipated, the location of any potential hydraulic jumps shall be determined and noted on the plans. In areas where hydraulic jumps are anticipated, additional erosion control measures may be required as directed by the Director of Public Works.

3.5.7.J. The maximum permissible flow velocity in culverts, inlet laterals, and storm drain pipes is 12 feet per second. The maximum flow velocity at the outlet of an enclosed pipe system shall be consistent with the maximum allowable velocity for the receiving channel. Refer to **Section 3.7** (Open Channels).

3.5.8. *Calculation of the Hydraulic Grade Line* – The hydraulic grade lines (HGL) for 100-year frequency storm events shall be computed and plotted for all storm drain systems. The determination of friction losses and minor losses are required for these calculations. The energy grade line (EGL) shall be computed and plotted for all storm drains in which the design velocity is expected to exceed 12 feet per second. It is the responsibility of the Engineer to submit calculations in tabular form on the Engineering Plans of the HGL and EGL for all storm drain systems to the City for review and approval. Many of the equations used in this section are directly from or modified forms of equations from FHWA's current edition *Hydraulic Engineering Circular No. 22 (HEC-22)*. Refer to that document for a more detailed discussion of these concepts. All HGL calculations should be provided in table format for Director of Public Works review. The column headers should be based on **Table 3-11**.

Table 3-11. Storm Drain Calculations

Column Header		Variable	Units
From		N/A	N/A
To		N/A	N/A
Pipe Length		L	ft
Drainage Area No.		N/A	N/A
Drainage Area Incremental		A	acres
Drainage Area Total		A	acres
Runoff Coefficient		C	dimensionless
Incremental CA		CA	acres
Total CA		CA	acres
Time of Concentration	Inlet Time	T_{t1}	min
	Travel Time	T_{t2}	min
	Total Time	T_c	min
100-year Intensity		I	in/hr
100-year Runoff		Q	cfs
Inlet Carryover to Inlet		Q	cfs
Inlet Carryover from Inlet		q	cfs
Sum of Discharge		Q_{pipe}	cfs
Pipe Size Diameter		D	in
Box Size	Width	W	ft
	Height	H	ft
Manning's Roughness Coefficient		n	dimensionless
Friction Slope		S_f	ft/ft
Hydraulic Grade Line	Upstream	HGL	ft
	Downstream	HGL	ft
Head Loss Calculations		V_1 (in)	ft/s
		V_2 (out)	ft/s
		$V_1^2/2g$	ft
		$V_2^2/2g$	ft
		K_j	dimensionless
		$K_jV_1^2/2g$	ft
		H_k	ft
Design Hydraulic Grade Line		HGL	ft
Invert Elevation	From	FL	ft
	To	FL	ft
Ground Elevation		EG	ft
Comments		N/A	N/A

3.5.9. *Starting Tailwater Conditions* – The Engineer must determine the tailwater conditions at the downstream end of the proposed storm drain system when calculating the hydraulic performance of the system.

3.5.9.A. When a proposed conduit is to connect to an existing storm drain, the hydraulic gradient of the proposed storm drain should start at the

elevation of the hydraulic gradient of the existing storm drain for the 100-year storm event. This criterion will be used for existing systems whether or not they are designed in accordance with this manual.

3.5.9.B. When proposed storm drains are to discharge into an open channel, the tailwater elevation shall be the greater of the water surface elevation of the receiving stream or the minimum outlet water surface elevation. The water surface elevation of the receiving stream shall be the 100-year water surface elevation of the receiving stream for the 100-year conduit design unless otherwise shown through analysis for coincidental peaks. **Table 3-12** outlines acceptable frequencies for coincidental occurrences.

Table 3-12. Frequencies for Coincidental Occurrences[1]

Area Ratio	100-year	
	Main Stream	Tributary
10,000:1	2	100
	100	2
1,000:1	10	100
	100	10
100:1	25	100
	100	25
10:1	50	100
	100	50
1:1	100	100
	100	100

1. Frequencies provided in **Table 3-12** are based on the iSWM™ *Hydraulics Technical Manual* dated April 2010 and revised September 2014. The current edition shall be used. If other frequencies are needed, refer to the current edition iSWM™ *Hydraulics Technical Manual.*

3.5.9.C. The minimum outlet water surface elevation, y_m, shall be calculated by the following equation:

Outlet Water Surface Elevation

$$y_m = \frac{D_o + y_c}{2} + FL$$

Where:

y_m = Minimum water surface elevation of the outlet pipe (feet msl)
D_o = Diameter of the outlet pipe (feet)
y_c = Critical flow depth in the outlet pipe (feet)
FL = Flowline elevation of the outlet pipe (feet msl)

3.5.9.D. Critical flow occurs when the Froude Number is equal to 1.0. The flow depth at critical flow is referred to as critical depth. The critical depth, y_c, shall be calculated by the following equation and solved for depth:

Critical Depth

$$Fr = 1.0 = \frac{V_c}{\sqrt{gD_c}}$$

Where:

Fr	=	Froude Number
V_c	=	Velocity for critical flow (feet per second) $V_C = Q/A$.
D_c	=	Hydraulic depth at critical flow (feet)
g	=	Acceleration due to gravity, 32.2 (feet per second squared)

3.5.9.E. For rectangular channels the hydraulic depth is equal to the flow depth. For other channel geometries, hydraulic depth shall be calculated by the following equation:

Hydraulic Depth

$$D_h = \frac{A}{T}$$

Where:

D_h	=	Hydraulic depth (feet)
A	=	Flow area (square feet)
T	=	Top width of the flow (feet)

3.5.10. *Energy Losses* – When establishing the hydraulic gradient of a storm drain, minor energy (head) losses at points of turbulence shall be calculated. Prior to computing the HGL, all energy losses in pipe runs and junctions must be estimated. The following sections present relationships for estimating typical energy losses in storm drainage systems.

3.5.10.A. *Friction Losses* – The major loss in a storm drainage system is the friction loss. The head loss due to friction in a pipe shall be calculated using the following equation. The friction slope is also the slope of the hydraulic gradient for a particular pipe run. The friction loss is simply the hydraulic gradient multiplied by the length of the run.

Friction Loss

$$H_f = S_f L$$

Where:

H_f	=	Friction loss (feet)
S_f	=	Friction slope (feet per feet)
L	=	Length of pipe (feet)

3.5.10.B. *Exit Losses* – The exit loss from a storm drain outlet is a function of the change in velocity at the outlet of the pipe. For a sudden

expansion such as an endwall, the exit loss shall be calculated using the following equation. When V_d equals zero, such as in a reservoir, the exit loss is equal to one. For outfalls in a channel with water moving in the same direction as the outlet water, the exit loss may be reduced to virtually zero.

Exit Loss

$$H_o = 1.0[(V_o^2/2g) - (V_d^2/2g)]$$

Where:

H_o = Exit loss (feet)
V_o = Average outlet velocity (feet per second)
V_d = Channel velocity downstream of outlet (feet per second)
g = Acceleration due to gravity, 32.2 (feet per second squared)

3.5.10.C. *Manhole and Bend Losses* – The head losses associated with manholes for pipe direction changes and bends in pipes of equal diameter shall be calculated using:

Manhole and Bend Loss

$$H_b = 0.0033\theta\left(\frac{V_o^2}{2g}\right)$$

Where:

H_b = Bend loss (feet)
θ = Angle of bend (degrees)
V_o = Velocity of the flow in the outlet pipe (feet per second)
g = Acceleration due to gravity, 32.2 (feet per second squared)

3.5.10.D. *Transition Losses (Sudden Expansion or Contraction)* – The head losses due to enlargements and contractions are calculated using the following equations.

3.5.10.D.i. *Non-Pressure Flow* – For gradual contractions, $K_c = 0.5\ K_e$. Typical values of K_e for gradual enlargements are shown in **Table 3-13**. Typical values of K_c for sudden contractions are shown in **Table 3-14**.

Transition Loss Non-Pressure Flow

$$H_c = K_c[(V_2^2/2g) - (V_1^2/2g)]$$

$$H_e = K_e[(V_1^2/2g) - (V_2^2/2g)]$$

Where:

H_c = Loss incurred at the contraction (feet)
H_e = Loss incurred at the expansion (feet)
K_c = Contraction coefficient from **Table 3-14** (dimensionless)
K_e = Expansion coefficient from **Table 3-13** (dimensionless)
V_1 = Velocity of the flow upstream of transition (feet per second)
V_2 = Velocity of the flow downstream of transition (feet per second)
g = Acceleration due to gravity, 32.2 (feet per second squared)

Table 3-13. Typical Values for K_e for Gradual Enlargement of Pipes in Non-Pressure Flow

D_2/D_1[1]	Angle of Cone						
	10°	20°	45°	60°	90°	120°	180°
1.5	0.17	0.40	1.06	1.21	1.14	1.07	1.00
3.0	0.17	0.40	0.86	1.02	1.06	1.04	1.00
1. D_2/D_1 = Ratio of diameter of larger pipe to smaller pipe.							

Table 3-14. Typical Values of K_c for Sudden Pipe Contractions

D_2/D_1[1]	K_c
0.2	0.5
0.4	0.4
0.6	0.3
0.8	0.1
1.0	0.0
1. D_2/D_1 = Ratio of diameter of smaller pipe to larger pipe.	

3.5.10.D.ii. *Pressure Flow* – The head losses due to enlargements and contractions in pressure flow are calculated using the following equations:

Transition Loss Pressure Flow

$$H_c = K_c[(V_2^2/2g)]$$

$$H_e = K_e[(V_1^2/2g)]$$

Where:

H_c = Loss incurred at the contraction (feet)
H_e = Loss incurred at the expansion (feet)
K_c = Contraction coefficient from **Table 3-16** (dimensionless)
K_e = Expansion coefficient from **Table 3-15** and **Table 3-17** (dimensionless)
V_1 = Velocity of the flow upstream of transition (feet per second)
V_2 = Velocity of the flow downstream of transition (feet per second)
g = Acceleration due to gravity, 32.2 (feet per second squared)

Table 3-15. Typical Values for K_e for Gradual Pipe Enlargement in Pressure Flow

D_2/D_1[1]	Angle of Cone[2]										
	2°	6°	10°	15°	20°	25°	30°	35°	40°	50°	60°
1.1	0.01	0.01	0.03	0.05	0.10	0.13	0.16	0.18	0.19	0.21	0.23
1.2	0.02	0.02	0.04	0.09	0.16	0.21	0.25	0.29	0.31	0.35	0.37
1.4	0.02	0.03	0.06	0.12	0.23	0.30	0.36	0.41	0.44	0.50	0.53
1.6	0.03	0.04	0.07	0.14	0.26	0.35	0.42	0.47	0.51	0.57	0.61
1.5	0.03	0.04	0.07	0.15	0.28	0.37	0.44	0.50	0.54	0.61	0.65
2.0	0.03	0.04	0.07	0.16	0.29	0.38	0.46	0.52	0.56	0.63	0.68
2.5	0.03	0.04	0.08	0.16	0.30	0.39	0.48	0.54	0.58	0.65	0.70
3.0	0.03	0.04	0.08	0.16	0.31	0.40	0.48	0.55	0.59	0.66	0.71
∞	0.03	0.05	0.08	0.16	0.31	0.40	0.49	0.56	0.60	0.67	0.72

1. D_2/D_1 = Ratio of diameter of larger pipe to smaller pipe.
2. Angle of cone is the angle in degrees between the sides of the tapering section.

Table 3-16. Typical Values for K_c Sudden Pipe Contractions in Pressure Flow

D_2/D_1	Velocity (feet per second)							
	2.0	4.0	6.0	8.0	10.0	20.0	30.0	40.0
1.1	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06
1.4	0.17	0.17	0.17	0.17	0.18	0.18	0.19	0.20
1.8	0.34	0.34	0.34	0.33	0.33	0.32	0.29	0.27
2.2	0.40	0.40	0.39	0.39	0.38	0.35	0.33	0.30
3.0	0.44	0.44	0.43	0.42	0.42	0.39	0.36	0.33
5.0	0.48	0.48	0.48	0.47	0.46	0.43	0.40	0.36
10.0	0.49	0.48	0.48	0.47	0.47	0.44	0.41	0.38

Table 3-17. Typical Values for K_e Sudden Pipe Enlargement in Pressure Flow

D_2/D_1	Velocity (feet per second)							
	2.0	4.0	6.0	8.0	10.0	20.0	30.0	40.0
1.2	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.08
1.4	0.26	0.25	0.24	0.24	0.23	0.22	0.21	0.20
1.6	0.40	0.38	0.37	0.36	0.35	0.33	0.32	0.32
2.0	0.60	0.56	0.55	0.53	0.52	0.50	0.48	0.47
3.0	0.83	0.78	0.76	0.74	0.73	0.69	0.67	0.65
5.0	0.96	0.91	0.88	0.86	0.84	0.80	0.77	0.75
10.0	1.00	0.96	0.93	0.91	0.89	0.84	0.82	0.80

3.5.10.E. *Junction Losses* – The head losses associated with wye connections or manholes with branch laterals entering the main line shall be calculated using:

Junction Loss

$$H_j = \{[(Q_oV_o) - (Q_iV_i) - (Q_lV_l\cos\theta_j)] / [0.5g (A_o + A_i)]\} + h_i - h_o$$

Where:

H_j = Junction loss (feet)
Q_o, Q_i, Q_l = Outlet, inlet, and lateral flows (cubic feet per second)
V_o, V_i, V_l = Outlet, inlet, and lateral velocities (feet per second)
h_o, h_i = Outlet and inlet velocity heads (feet)
A_o, A_i = Outlet and inlet cross-sectional areas (square feet)
g = Acceleration due to gravity, 32.2 (feet per second squared)
θ_j = Angle between the inflow and outflow pipes (degrees)

3.5.10.F. *Inlet and Manhole Losses* – The head losses which occur at all inlets located at the upstream end of pipe systems shall be calculated using the following equation. Applicable coefficients, K_{ah}, shall be in accordance with **Table 3-18**. This method can be used to estimate the initial pipe crown drop across a manhole or inlet structure to offset energy losses at the structure. The crown drop is then used to establish the appropriate pipe invert elevations. However, this method is used only in the preliminary design process and should not be used in the EGL calculations. It should be noted, however, that this equation only applies to pipes in pressure flow. Partial flow, especially in very steep pipes, can produce very high flow velocities where this equation would not be applicable. This may be true even for very small flow rates. For partial flow, a lower value of K_{ah} may be used with approval from the Director of Public Works.

Inlet Loss

$$H_{ah} = K_{ah} (V_o^2/2g)$$

Where:

H_{ah} = Loss incurred at the inlet (feet)
K_{ah} = Loss coefficient from **Table 3-18** (dimensionless)
V_o = Velocity of the flow in the outlet pipe (feet per second)
g = Acceleration due to gravity, 32.2 (feet per second squared)

Table 3-18. Head Loss Coefficients

Structure Configuration	K_{ah}
Inlet - straight run	0.50
Inlet - angled through	
90°	1.50
60°	1.25
45°	1.10
22.5°	0.70
Manhole - Straight run	0.15
Manhole - Angled through	
90°	1.00
60°	0.85
45°	0.75
22.5°	0.45

3.5.11. *Outfalls to Open Channels* – Outfalls to open channels shall be designed in accordance with **Figure 3-2**. Refer to **Section 3.6** (Floodplain Alterations) and **Section 3.7** (Open Channels) for applicable outfall design criteria. The following criteria also apply:

3.5.11.A. *Flowlines* – The flowlines of storm drain conduits that discharge into open channels shall be no greater than 1 foot above the channel flowline.

3.5.11.B. *Headwalls and Erosion Protection* – Headwalls and adequate erosion protection shall be designed and constructed at the outfall of all storm drain systems.

3.5.11.C. *Outfall Velocities* – The maximum discharge velocities in the pipe shall not exceed the permitted velocity of the receiving open channel at the outfall to prevent erosive conditions, as shown in **Table 3-20**. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipator (e.g. stilling basins, impact basins, drop structures, or riprap protection). Energy dissipators shall be approved by the Director of Public Works.

3.5.11.D. *Angles of Intersection* – Discharge pipes shall intersect creeks at an angle not to exceed 60 degrees where the channel bottom is 20 feet or less (measured from toe to toe). Discharge pipes may intersect creeks at a 90-degree angle where the channel bottom is greater than

20 feet (measured from toe to toe), with prior approval of the Director of Public Works. Discharge pipe shall point in the downstream direction.

3.5.11.E. *Flumes* – Flumes to bring the discharge down to the flowline of earthen creeks shall not be permitted. Refer to **Section 3.3** (Street and Alley Capacity) for additional flume design considerations.

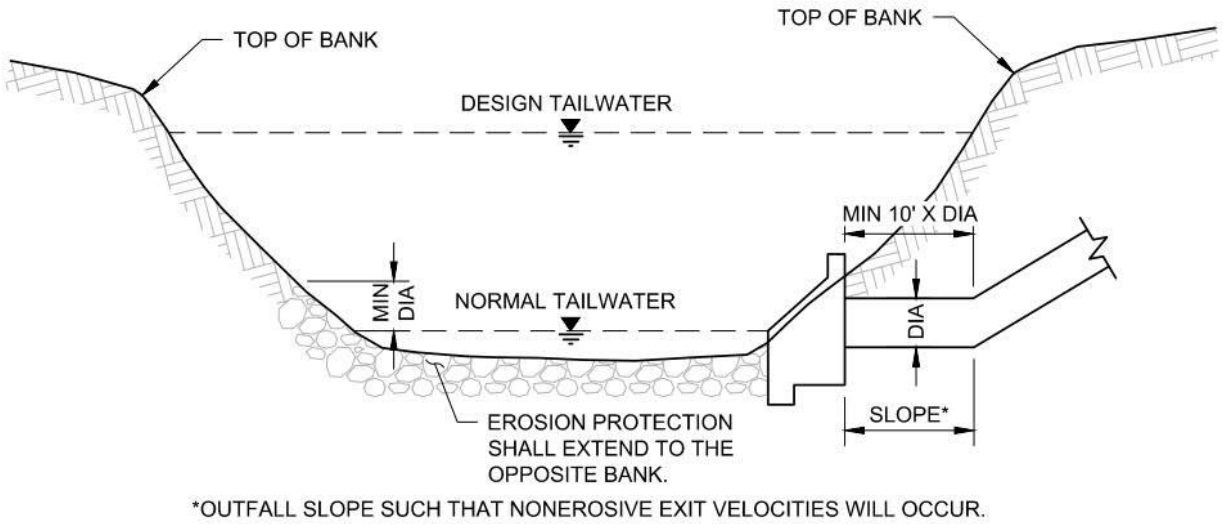


Figure 3-2. Outfalls to Open Channels

3.6. *Floodplain Alterations*

3.6.1. *General* – This section applies to all areas of land within the ultimate floodplain. All floodplain alterations, floodplain improvements, and construction permitted in the ultimate floodplain must comply with the Drainage and Flood Hazard Area Regulations in Chapter 11 of the Sachse City Code, as amended, and this section.

3.6.2. *Terminology* – The terms “floodplain” and “floodplain areas” include ultimate floodplain and FEMA floodplain limits. The term “ultimate floodplain” means the entire geographic area subject to flooding resulting from the ultimate 100-year design flood (based on fully developed watershed conditions). This differs from the regulatory FEMA floodplain and floodway. The term “FEMA floodplain” means the entire geographic area delineated by FEMA as Special Flood Hazard Areas (SFHA) within FEMA’s current effective Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM). Refer to **Section 3.2** (Design Discharge) and **Section 9** (Definitions and Abbreviations) for additional information.

3.6.3. *Permitted Uses of Floodplain Areas*

3.6.3.A. To minimize possible losses of life and property, the following uses are permitted in a floodplain area provided they are also permitted in the underlying zoning district:

- Farm or ranch;
- Local utilities, electrical substation, water reservoir or pumping station, and water treatment plant;
- Public park or playground, private recreation club or area, private community center and golf course;
- Outside commercial amusement approved by a specific use permit;
- Helistop approved by a specific use permit; and,
- Radio, television or microwave tower, and amateur communications tower approved by a special use permit.

3.6.3.B. Structures customarily associated with the above uses may be constructed within a floodplain area only if the proposed structure meets the same engineering requirements applicable to filling in a floodplain.

3.6.3.C. Open private recreation clubs or areas and private community centers, without exterior walls which would incur structural damage during flood conditions, are permitted in floodplain areas. Private facilities listed above, with enclosed walls that would incur damage, are not permitted in floodplain areas.

3.6.3.D. Uses and structures other than those mentioned above shall not be permitted in floodplain areas.

3.6.4. *Building and Structure Regulations*

3.6.4.A. *Residential Construction*

3.6.4.A.i. New construction in reclaimed floodplain areas and "substantial improvements" of any existing residential

structure in floodplain areas shall have the lowest floor, including basements or fully enclosed areas of any new or "substantial improvement" construction, elevated to at least 2 feet above the design flood elevation.

3.6.4.A.ii. Fill elevations shall be 1 foot above the elevation of the design flood. Incremental improvements, either at one time or over a period of time, the cumulative cost of which equals or exceeds fifty percent of the market value at the time of the first improvement, shall be considered as a "substantial improvement."

3.6.4.A.iii. New residential structures or "substantial improvements" on stilts or behind ring levees serving individual lots shall not be permitted.

3.6.4.A.iv. Improvements to an existing structure that increase the outside dimensions, but do not result in a "substantial improvement," must meet the requirements of **Section 3.6.5**.

3.6.4.B. *Non-Residential Construction*

3.6.4.B.i. New construction in reclaimed floodplain areas and "substantial improvement" of any existing commercial, industrial, or other non-residential structure in floodplain areas shall either have the lowest floor, including basements, of any new or "substantial improvement" construction, elevated to at least 2 feet above the design flood elevation, or, together with attendant utility and sanitary facilities, shall:

- Be flood-proofed so that below 2 feet above the design flood elevation the structure is watertight with walls substantially impermeable to the passage of water;
- Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and,
- Be certified by a registered Professional Engineer or architect that the standards of this subsection are satisfied.

3.6.4.B.ii. Incremental improvements, either at one time or over a period of time, the cumulative cost of which equals or exceeds fifty percent of the market value at the time of the first improvement, shall be considered as a "substantial improvement." Improvements to an existing commercial, industrial or other non-residential structure that increase the outside dimensions, but do not result in a "substantial improvement," must meet the requirements of **Section 3.6.5**.

3.6.4.C. *Manufactured Homes*

3.6.4.C.i. All manufactured homes shall be anchored to resist flotation, collapse or lateral movement by providing over-the-top and frame ties to ground anchors. Special requirements shall be that:

- Over-the-top ties be provided at each of the four corners of the manufactured home, with two additional ties per side at intermediate locations, with manufactured homes less than 50 feet long requiring one additional tie per side;
- Frame ties be provided at each corner of the home with five additional ties per side at intermediate points, with manufactured homes less than 50 feet long requiring four additional ties per side;
- All components of the anchoring system be capable of carrying a force of 4,800 pounds; and,
- Any additions to the manufactured home be similarly anchored.

3.6.4.C.ii. For all new manufactured homes, new manufactured home parks and manufactured home subdivisions; for expansions to existing manufactured home parks and manufactured home subdivisions; for existing manufactured home parks and manufactured home subdivisions where the repair, reconstruction or improvement of the streets, utilities and pads is planned; and for manufactured homes not placed in a manufactured home park or manufactured home subdivision; for new manufactured homes moved into an old site in an existing manufactured home park; and for substantial improvements to a manufactured home, require that:

- Stands or lots are elevated on compacted fill so that the lowest floor of the manufactured home will be at least 2 feet above the design flood elevation;
- Adequate surface drainage and access for a hauler are provided; and,
- No new manufactured homes shall be placed in a floodplain, except on a pad site created by compacted fill in an existing manufactured home park, in which the new fill pad site is elevated to the design flood elevation.

3.6.4.C.iii. Manufactured homes may be supported to the required 2 feet above the design flood elevation by stands or foundation features as accepted by FEMA.

3.6.4.D. *Recreation Vehicles* – Recreational vehicles located on a site within a designated floodplain area shall:

3.6.4.D.i. Be on the site for fewer than 180 consecutive days and be fully licensed and ready for highway use; or,

3.6.4.D.ii. Meet the elevation and anchoring requirements for "manufactured homes" outlined in this section. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices and has no permanently attached additions.

3.6.4.E. *Streets, Parking Lots, and Bridges* – Refer to **Table 3-1** for design storm frequencies and freeboard requirements for various drainage structures. Additionally, the following criteria apply:

3.6.4.E.i. The top of curb of all new streets to be built in reclaimed floodplain areas shall be at least 2 feet above the design flood elevation;

3.6.4.E.ii. The low beam of all new bridges to be constructed across floodplains shall be a minimum of 2 feet above the design flood elevation;

3.6.4.E.iii. All new private bridges to individual homes shall have their low beams at 2 feet above the design flood elevation;

3.6.4.E.iv. Parking lots associated with residential, commercial, and industrial uses in reclaimed floodplain areas shall be at least at the design flood elevation; and,

3.6.4.E.v. Parking lots for public parks or playgrounds, private recreation club or area, private community center and golf courses may be located below the design flood elevation.

3.6.4.F. *Utilities* – All new and replacement water supply systems, sanitary sewer facilities, and other public utilities shall be designed to minimize or eliminate flood damage and infiltration of flood waters into the system.

3.6.4.G. *Fences* – Fences (private and public screening) shall be constructed such that blockage of surface water flow does not occur. Fences shall not be allowed in floodplain area or within dedicated easements. This includes the requirement that erosive conditions shall not be created around, under, or near a fence structure.

3.6.4.H. *Additional Construction Standards for Structures* – All improvements and construction permitted in a floodplain area must comply with the following requirements:

3.6.4.H.i. Structures must be securely anchored to the foundation to prevent flotation and collapse during inundation and designed to prevent damage to nonstructural elements during inundation;

3.6.4.H.ii. Thermal insulation used below the first-floor elevation must be of a type that does not absorb water;

3.6.4.H.iii. Adhesives must have a bonding strength that is unaffected by inundation;

3.6.4.H.iv. Doors and all wood trim must be sealed with a waterproof paint or similar product;

3.6.4.H.v. Mechanical, electrical, and utility equipment shall be located above the design flood elevation. Water heaters, furnaces, electrical distribution panels, and other critical mechanical or electrical installations must not be placed in basements. Electrical circuits for basements shall be separate from circuits serving floors above the basement and circuits for basements shall be installed lowered from above;

3.6.4.H.vi. Basements are permitted for non-residential structures only if they are designed to preclude inundation by the design flood elevation, either by:

- The elimination of exterior openings below the design flood elevation; or,
- The use of water-tight closures, such as bulkheads and flood shields. However, no basements are permitted in soils whose permeability meets or exceeds the minimum local standards of permeability established for the installation of individual sewage disposal systems.

3.6.4.H.vii. Plywood used at or below the lowest floor elevation must be of an "exterior" or "marine" grade and of a water-resistant or waterproof variety;

3.6.4.H.viii. Wood flooring used at or below the lowest floor elevation must be installed to accommodate a lateral expansion of the flooring, perpendicular to the flooring grain, without incurring structural damage to the building;

3.6.4.H.ix. Basement ceilings for non-residential structures must be of sufficient wet strength and be so installed as to survive inundation;

3.6.4.H.x. Paints or other finishes used at or below the lowest floor elevation must be capable of surviving inundation;

3.6.4.H.xi. All air ducts, large pipes, and storage tanks located at or below the lowest floor elevation must be firmly anchored to prevent flotation; and,

3.6.4.H.xii. Tanks must be vented at a location above the design flood elevation.

3.6.5. *Floodplain Alterations Policy* – At a minimum, floodplain alterations shall comply with all FEMA requirements and the City's current edition of the Drainage and Flood Hazard Area Regulations in Chapter 11 of the Sachse City Code, as amended . Refer to **Figure 3-3** to determine whether a Flood Study, Conditional Letter of Map Revision (CLOMR), and/or Letter of Map Revision (LOMR) are required. **No new construction is allowed in the ultimate floodplain.** However, portions of the ultimate floodplain may be reclaimed provided that the following criteria are met.

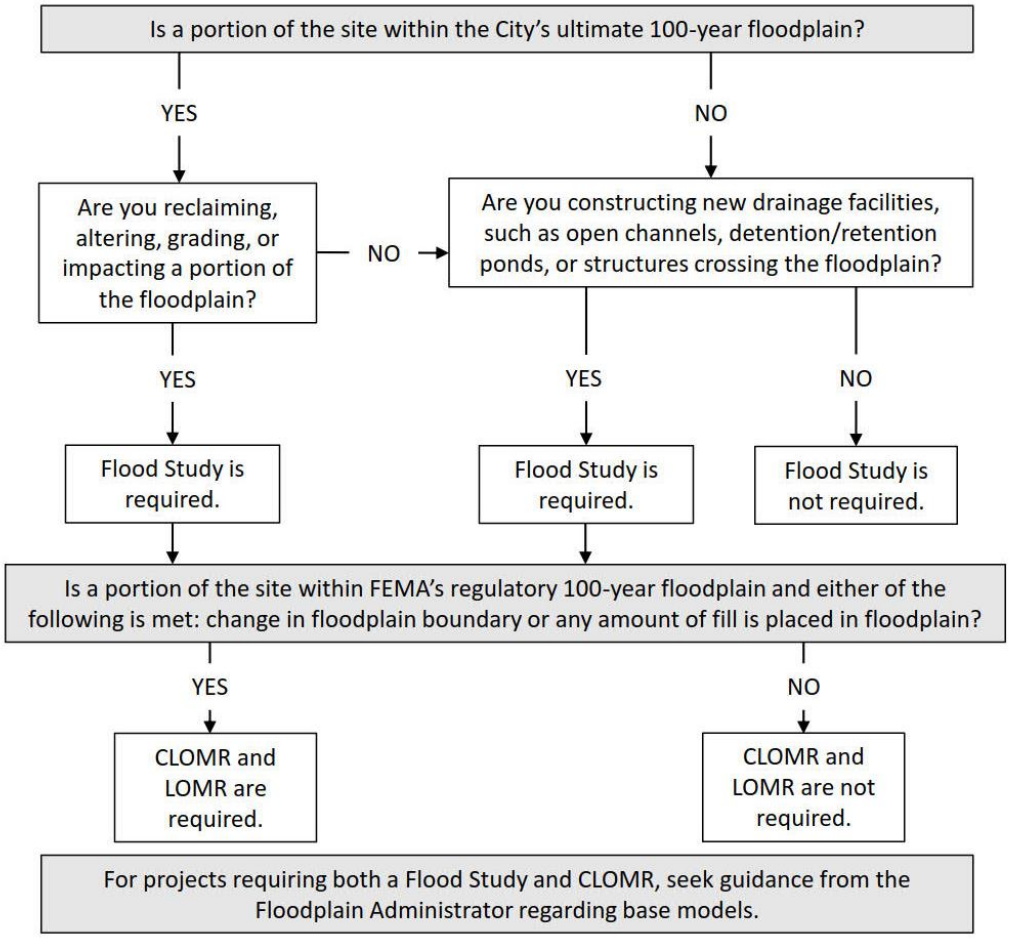


Figure 3-3. Floodplain Alterations Flow Chart

3.6.5.A. *Flood Study* – A Flood Study meeting the requirements of this section has been approved by the Director of Public Works;

3.6.5.B. *Grading and Floodplain Development Permit* – A Grading and Floodplain Development Permit has been granted;

3.6.5.C. *FEMA Compliance* – Alterations shall be in compliance with FEMA guidelines;

3.6.5.D. *Freeboard* – Freeboard requirements are satisfied for the design flood in accordance with **Section 3.2** (Design Discharge);

3.6.5.E. *Water Surface Elevations* – The ultimate 100-year water surface elevations on- or off-site shall not increase by more than 0.01 feet;

3.6.5.F. *Velocities* – Existing erosive average and maximum subsection velocities may not be increased above the maximum permissible velocity for the channel per **Table 3-20** and mitigation may be required at the discretion of the Director of Public Works. Alterations of the floodplain shall not create erosive velocities on- or off-site for average or maximum subsection velocities as follows:

- *Average Velocities* – Acceptable ultimate 100-year average velocities shall be achieved in accordance with **Table 3-20**; and,
- *Maximum Subsection Velocities* – Acceptable ultimate 5-year and ultimate 100-year maximum subsection velocities shall be achieved in accordance with **Table 3-20**.

3.6.5.G. *Channel Armoring* – Acceptable channel armoring has been provided at all locations that subsection velocities exceed 6 feet per second in accordance with **Section 3.7** (Open Channels);

3.6.5.H. *Valley Storage* – Floodplain alterations shall result in no loss of valley storage. HEC-RAS output tables must show no decrease in cumulative valley storage at every cross section. If the water surface elevation is decreased, hydrologic computation using the Modified Puls Routing Method may be used to evaluate impacts on flood discharges to prove no decrease in valley storage. Alternatively, a cut/fill balance that accounts for inundation reduction may be presented to show that no decrease in valley storage has been achieved within the ultimate floodplain limits;

3.6.5.I. *Equal Conveyance* – The floodplain shall be altered only to the extent permitted by equal conveyance on both sides of the natural channel, as defined by the USACE. Fill slopes, vertical walls, terracing, and other slope treatments may only be considered if no unbalancing of stream flow occurs; and,

3.6.5.J. *Design Requirements* – All open channel design requirements in **Section 3.7** (Open Channels) are met.

3.6.5.K. *Adverse Impacts*

3.6.5.K.i. Any alteration of floodplain areas shall not cause any additional expense in any current or projected public improvements.

3.6.5.K.ii. Alterations of the floodplain shall not adversely impact adjacent, adjoining, upstream, or downstream properties. Adverse impacts shall not be allowed unless:

- Full disclosure of the effects of the increase is made to the City;
- Full disclosure of the effects of the increase is made to all property Owners, governmental agencies and quasi-governmental agencies affected by such increase;
- The applicant provides evidence to the City, in a form acceptable to the City, that the applicant has acquired legal right (capable of being assigned to the City) to encroach upon the affected property which right shall take into consideration the effect of such encroachment on the remaining property of the affected Owners;
- Applicant's delivery to the City of policies of insurance in amounts and containing terms agreeable to the City and

which name the City as a named insured or as an additional insured, insuring City against claims by third parties arising as a result of claims which may be made by adjacent, adjoining, upstream or downstream property Owners for damages occasioned, or claimed to be occasioned, as a result of flooding due to development of the property or construction of any improvements upon the property; and,

- Applicant's delivery to the City of a legally enforceable and binding indemnity agreement containing terms agreeable to the City, indemnifying the City from and against all loss or liability (including attorney's fees) which may be occasioned by the City as a result of claims by third parties arising as a result of claims which may be made by adjacent, adjoining, upstream or downstream property Owners for damages occasioned, or claimed to be occasioned, as a result of flooding due to development of the property or construction of any improvements upon the property.

3.6.5.L. *Full Disclosure and Expense* – It shall be the duty and obligation of the applicant to show and establish that there will not be an increase of surface elevation, volume, or velocity, or alternatively the extent of the amount of such increase together with the full disclosure of all property affected by such increase. The matters herein required shall be evidenced by submission of drainage plans in form and content satisfactory to the City under seal of a professional registered engineer in the state. The cost of preparation of such drainage plans shall be paid exclusively by the applicant. The matters required by this section shall be reviewed by an outside consultant of the City's choosing. The cost incurred by the City as a result of outside consultant review shall be paid by the applicant.

3.6.6. *Flood Study Requirements* – Any Engineering Plans for floodplain alterations shall be based on engineering hydrologic and hydraulic analyses presented in a Flood Study.

3.6.6.A. *Process* – The review process and timeline varies for each project. All initial CLOMR submittals shall go through the City before submitting to FEMA.

- If a Flood Study is required, a preliminary Flood Study shall be submitted to the City to be reviewed by City staff or an engineering consultant. Review comments will be returned to the Engineer. Once comments have been addressed, a final Flood Study shall be submitted to the City for acceptance prior to receipt of a Grading and Floodplain Development Permit.
- If a Flood Study and CLOMR are required, a preliminary CLOMR application and Flood Study shall be submitted to the City to be reviewed by City staff or an engineering consultant. Review comments will be returned to the Engineer. Once the comments have

been addressed, a revised CLOMR application and Flood Study shall be submitted to the City for acceptance. The City's Floodplain Administrator must sign the MT-2 Form 1 prior to submitting to FEMA. Once the CLOMR application is submitted to FEMA, review comments will be returned to the Engineer. Comments should be addressed and returned to FEMA and the City. All projects within the FEMA floodplain shall receive acceptance from FEMA prior to issuance of a Grading and Floodplain Development Permit.

3.6.6.B. *Report* – The Flood Study shall be prepared, signed, and sealed by a Professional Engineer in the State of Texas trained and qualified to provide similar analyses. At a minimum, the Flood Study shall include the following:

- Project description;
- Vicinity map;
- *Data Collection* – Describe type of data collected (previous studies, record drawings, topographic data, survey, field observations, etc.);
- *Methodology* – Description of the hydrologic and/or hydraulic analyses used, including method used to determine historic rainfall and stream data, soils reports, selection of variables (such as Manning's roughness coefficients), base models, and discharges and water surface elevations for the ultimate design floods and FEMA base floods;
- *Scour Analysis* – Results of a scour analysis in accordance with USACE's current edition *HEC-RAS (River Analysis System) User's Manual* for structures within the floodplain, including bridges, culverts, aerial crossings, drop structures, and retaining walls;
- *Comparison Tables* – Comparison tables between existing and proposed conditions for water surface elevations, freeboard, discharge, valley storage, average velocities, and maximum subsection velocities in accordance with this section;
- *Results* – Documentation that the principles of equal conveyance and channel stability have been achieved;
- *Hydrologic Exhibits* – Drainage area maps, land use and soil data exhibits, and time of concentration calculations, if applicable;
- *Hydraulic Workmaps* – Exhibits showing the ultimate floodplain limits for the design flood for existing and proposed conditions. If applicable, FEMA floodplain and FEMA floodway limits shall also be shown;
- *Detention* – If applicable;
- *Appendix* – Additional tables or figures not included in the report;
- *Printouts* – Printouts from HEC-RAS and HEC-HMS, as applicable. At a minimum, HEC-RAS printouts should include: summary results table for existing and proposed conditions; stream profile for existing and proposed conditions; and, cross section plots for existing and

proposed conditions. Cross section plots shall at a minimum include the following variables: ultimate 100-year water surface elevation, subsection velocity distribution, Manning's roughness coefficients, and legend. Cross section plots shall at a minimum include the following labels: project title, plan title, run date, x and y axis titles, and cross section description;

- *Input and Output Data* – Copies of hydrologic and hydraulic modeling program input and output data for existing and proposed conditions for the ultimate design floods and FEMA base floods; and,
- *Digital Files* – Digital files of hydrologic and hydraulic models.

3.6.6.C. *Base Models* – The Engineer shall use the City's current effective base models for development along ultimate floodplain areas. If a model is not available, the Engineer shall be required to develop floodplain hydrologic and hydraulic models in accordance with these standards. Modeling must be performed for the ultimate design floods. In some cases, FEMA flow rates and ultimate flow rates are the same. If a CLOMR or LOMR is required, FEMA flows shall also be used. For projects requiring both a Flood Study and CLOMR, seek guidance from the Floodplain Administrator regarding base models.

3.6.6.D. *Modeling Programs* – In general, the information needed for the Flood Study shall be obtained by running a flood routing model, such as USACE's HEC-HMS or HEC-1, or NRCS's WinTR-20, and a backwater model, such as USACE's HEC-RAS or HEC-2. Unless an existing base model is in place, HEC-HMS and HEC-RAS shall be used.

3.6.7. *CLOMR and LOMR Requirements* – CLOMR and LOMR applications shall meet current FEMA requirements. For any FEMA floodplain alterations, a CLOMR must be approved before a Grading and Floodplain Development Permit will be granted. A LOMR shall be submitted within 6 months after the completion of any FEMA floodplain alterations.

3.6.8. *Verification of Floodplain Alterations*

3.6.8.A. Prior to final acceptance by the City of utilities and street construction for projects involving floodplain alterations or adjacent to defined floodplains, creeks, channels and drainageways, a certified statement shall be prepared by a registered public surveyor showing that all lot elevations, as developed within the subject project, meet or exceed the required minimum finished floor elevations shown on the final plat of the subdivision. This certification shall be filed with the Director of Public Works.

3.6.8.B. In addition, at any time in the future when a building permit is desired for existing platted property which is subject to flooding or carries a specified or recorded minimum finished floor elevation, a registered public surveyor shall survey the property prior to obtaining a building permit. The certified survey data showing the property to be at or above the specified elevation shall be furnished to the Director of Public Works

for approval. Certificate of compliance with the provisions of this article pertaining to specified finished floor elevations shall be required.

3.6.8.C. The Owner/Developer shall furnish, at his/her expense, to the Director of Public Works sufficient engineering information to confirm that the minimum floor elevations proposed are as required by this section. Construction permits will not be issued until:

- A CLOMR or amendment has been issued by FEMA; and,
- Lots and/or sites are certified by a registered public surveyor and are elevated from the floodplain according to the FEMA-approved revisions to the floodplain and the requirements of this article.

3.7. *Open Channels*

3.7.1. *General* – This section includes open channel design requirements and considerations, including geometry, maximum permissible velocities, and armoring. Refer to **Section 3.6** (Floodplain Alterations) for all applicable floodplain development criteria.

3.7.2. *When Open Channels Are Permissible* – Open channels may be used instead of enclosed storm drain systems when the volume of runoff exceeds 800 cubic feet per second.

3.7.3. *Easements Required for Open Channels* – Refer to **Section 1.8** (Easements and Right-of-Way Requirements) for considerations and processes related to drainage easements and maintenance.

3.7.4. *Steady State Modeling Requirements*

3.7.4.A. *Modeling Programs* – Refer to **Section 3.6** (Floodplain Alterations) for modeling program requirements.

3.7.4.B. *Design Frequency and Freeboard* – Refer to **Table 3-1** for design frequency and freeboard requirements.

3.7.4.C. *Model Extents* – At a minimum, the model should begin at the nearest downstream control, such as a bridge, culvert, dam, or confluence, and extend beyond the floodplain alterations until the proposed condition design storm profiles match existing condition design storm profiles.

3.7.4.D. *Boundary Conditions* – The starting water surface elevation shall be normal depth for all standard step backwater calculations. Some exceptions may apply allowing the downstream boundary condition at a known water surface elevation based on a FEMA FIS profile, backwater elevation, or City effective model output. Refer to **Table 3-12** for frequencies for coincidental occurrences.

3.7.4.E. *Flow Conditions* – Open channels shall be designed for subcritical flow conditions. Supercritical flow shall not be allowed in channels except at drop structures and other energy dissipators.

3.7.4.F. *Manning's Roughness Coefficients* – Manning's roughness coefficients shall comply with **Table 3-20**.

3.7.4.G. *Subsection Velocities* – HEC-RAS flow distribution locations (global subsections) are required with a minimum of 15 subsections for the channel (between bank stations) and a minimum of 10 subsections for each overbank as shown in **Figure 3-4**.

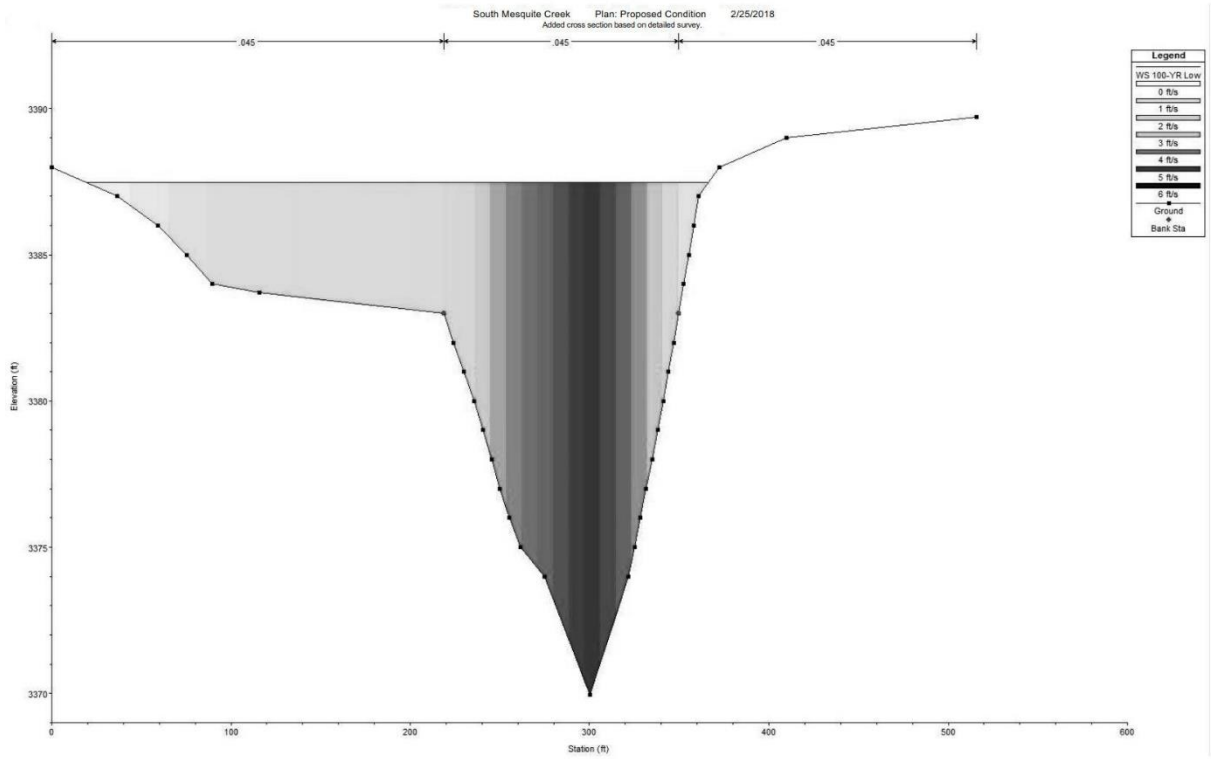


Figure 3-4. Minimum HEC-RAS Flow Distribution Locations for Subsection Velocities

3.7.5. *Geometry*

3.7.5.A. *Typical Cross Section* – Improved or new channels (lined or unlined) shall have a typical trapezoidal cross section. The channel section should have adequate flow area to convey the design flood and meet the freeboard requirements in **Section 3.2** (Design Discharge). Concrete-lined open channels shall be designed in accordance with the Standard Details.

3.7.5.B. *Concrete Pilot Channels* – Concrete pilot channel are required for all new open channels (excluding roadside ditches) and detention/retention facilities. The concrete pilot channel and erosion control placed continuously on both sides of the pilot channel shall be designed in accordance with the Standard Details. Concrete pilot channels are not required for improved channels. Refer to **Section 9** (Definitions and Abbreviations) for a definition of improved channels.

3.7.5.C. *Minimum Slope* – The minimum slope for new open channels is 1%, unless a pilot channel is constructed.

3.7.5.D. *Minimum Bottom Width* – Any permanent open channel, except roadside ditches, shall have a minimum bottom width of 8 feet.

3.7.5.E. *Maximum Side Slopes* – Maximum side slopes for open channels shall be based on slope stability. Refer to **Table 3-19** for maximum side

slopes. These criteria apply to all open channels (including roadside ditches) and detention/retention facilities.

Table 3-19. Maximum Side Slopes for Open Channels

Ground Cover	Slope (feet per foot)
Vegetation	4H:1V
Weathered Rock	4H:1V
Rock Riprap	3H:1V
Concrete-Lined	2H:1V
Unweathered Rock	2H:1V

3.7.5.F. *Ineffective Flow Areas* – Areas of ineffective flow around bridges, topographic constrictions, and other constrictions are excluded from the ultimate floodplain conveyance. At a typical crossing location, the contraction ratio shall be 1:1 (upstream) and the expansion ratio shall be 2:1 (downstream) in accordance with USACE's current edition *HEC-RAS (River Analysis System) User's Manual.*

3.7.5.G. *Excavation* – Excavation of the natural channel is not allowed as compensation for loss of conveyance. However, side swales may be permitted to provide additional conveyance, if they are graded to drain within the ultimate floodplain limits and the lowest elevation of the excavated area remains above one-third of the depth of the main channel (measured from top of bank to flowline). Cross sections of the proposed channel shall be plotted and carefully examined at 50 feet intervals and other critical points to ensure that a positive drainage can be obtained within the easement provided and that no ponding of water will occur beyond the channel.

3.7.6. *Armoring Requirements and Erosion Prevention* – For the purpose of this section, open channel velocities are considered erosive if greater than or equal to 6 feet per second. Average and subsection velocities must be analyzed to determine adequate placement and types of armoring within all new or improved open channels. Refer to **Table 3-20** for permissible channel velocities. All channel sections must consider and account for channel stabilization as follows:

3.7.6.A. The Developer is responsible for required stabilization. In cases where the entire channel section is not contained within the limits of the property boundary, refer to the Drainage and Flood Hazard Area Regulations Regulations in Chapter 11 of the Sachse City Code, as amended .

3.7.6.B. Channels may be left in their natural state provided that the channel velocities are not considered erosive, if approved by the Director of Public Works. Otherwise, all channels shall be partially armored or fully lined. Acceptable channel armoring materials include concrete, precast manufactured block (modular block walls), retaining walls, articulated concrete block (ACB), rock riprap, or stone masonry. Gabion baskets and gabion mattresses require Director of Public Works approval.

3.7.6.C. Unlined, unvegetated excavated channels are not allowed. All non-rock side slopes shall not be bare and shall have an approved ground cover in accordance with this section to prevent erosion. Unlined channels with bends shall be designed to minimize erosion at the bends. All vegetation selections must be in accordance with **Section 8** (Landscape and Irrigation Design Requirements).

Table 3-20. Roughness Coefficients and Allowable Velocities for Channels

Channel Description	Manning's Roughness Coefficient (n value)	Maximum Permissible Velocity[1] (feet per second)
NATURAL CHANNELS		
Floodplain – Vegetated		
Short grass	0.030	6.0
Tall grass	0.035	6.0
Mature field crops	0.040	6.0
Heavy weeds scattered brush	0.050	6.0
Wooded	0.120	6.0
Floodplain – Non-Vegetated		
Sand/Silt	0.030	3.0
Clay	0.030	5.0
Coarse Gravel	0.030	6.0
Shale	0.030	10.0
Rock	0.025	15.0
IMPROVED CHANNELS		
Concrete	0.013	15.0
Precast Manufactured Block	0.013	[2]
Articulated Concrete Block (ACB)	0.015	[2]
Rock Riprap[3]	0.040	[4]
Stone Masonry	0.032	10.0
Gabion	0.030	12.0

1. The values apply to average, uniform stands of each type of cover. Velocities exceeding 6.0 feet per second are permissible only where good cover and proper maintenance can be obtained.
2. Maximum permissible velocities for manufactured block and articulated concrete block based on manufacturer's specifications.
3. Rock riprap shall only be used with Director of Public Works approval. Rock riprap will not be accepted for armoring entire channels. Rock riprap may be accepted as a transition material or spot treatment.
4. Maximum permissible velocities for rock riprap based on gradation and depth.

3.7.7. Energy Dissipators

3.7.7.A. *Use and Design* – Energy dissipators shall be used to control erosion due to high velocities at storm drain outfalls or within open channel systems. Energy dissipators shall be designed in accordance with the

FHWA's current edition *Hydraulic Engineering Circular No. 14 (HEC-14)* and the Bureau of Reclamation's current edition *Engineering Monograph No. 25*. The design of energy dissipators shall be based on a geotechnical investigation and structural design.

3.7.7.B. *Supporting Calculations/Documentation* – All energy dissipation designs shall include supporting calculations showing the design is adequate. The City may require the Engineer to provide a hydraulic model as supporting documentation.

3.7.7.C. *Future Maintenance* – All energy dissipators should be designed to facilitate future maintenance.

3.7.7.D. *Aesthetic Consideration* – The design of outlet structures in or near parks or residential areas shall give special consideration to aesthetics and shall be approved by the Director of Public Works.

3.7.7.E. *Rock Riprap* – Non-grouted rock riprap may be used. Loose rock riprap with a nominal size of 12 inches or less (minimum 18 inches thick) will not be accepted. Rock riprap gradation depends on site characteristics, velocities, and flow depth. Rock riprap shall be sized, designed, and specified in accordance with FHWA's current edition of *Hydraulic Engineering Circular No. 23 (HEC-23)* and USACE's current edition of *1110-2-1601 (Hydraulic Design of Flood Control Channels)*. At a minimum, the Engineer shall specify the applicable nominal riprap size, gradation, and thickness; maximum side slope; bedding stone size, gradation, and thickness; and, filter fabric requirements. Rock riprap shall only be used with Director of Public Works approval.

3.7.7.F. *Drop Structures* – Drop structures may be used to establish a more desirable channel invert elevation, slope, and velocities. The drop structure height should be sufficient to stabilize the hydraulic jump. The drop length and the hydraulic jump length of the drop structure should be calculated to determine the length of the downstream apron required to prevent erosion. Refer to **Section 7.10** (Drop Structures) for applicable structural design requirements.

3.7.7.G. *Grade Control Structures* – Grade control structures shall have a minimum effective depth of 3 feet below existing or proposed grades with an adequate number of structures to prevent less than 1 foot of degradation.

3.7.8. *Access Routes*

3.7.8.A. Unobstructed access routes shall be provided to all natural and improved open channels to allow vehicular access for maintenance. All unpaved portions of the maintenance access routes shall be located entirely within drainage easements associated with the channel. The unobstructed access shall extend from the ROW and occur at a frequency of no less than 1,500 linear feet along the channel unless there exists an access route that is contained within a drainage easement on the opposite side of the channel. This may be adjusted by no more than 100 feet to lessen impacts to quality trees or to avoid restrictive slopes. Access routes shall also be provided to all energy

dissipators. Additional access routes may be required as directed by the Director of Public Works.

3.7.8.B. Access routes along open channels and to/from the ROW shall be a minimum of 15 feet wide with a maximum 4H:1V running slope and a maximum 6H:1V cross slope.

3.7.8.C. Access routes shall be kept clear of structures and equipment, except for fences.

3.7.8.D. Access routes shall be provided with a gate and signage. Shop Drawings for the gate and appurtenances shall be submitted to the Director of Public Works for review and approved prior to fabrication.

3.7.9. *Roadside Ditches*

3.7.9.A. *General* – Local rural streets with roadside ditches (in lieu of curb and gutter) are permissible only if a variance is pursued in accordance with **Section 2.2** (Roadway Design) and **Section 1.6** (Variance Requests).

3.7.9.B. *Design Frequency and Freeboard* – Refer to **Table 3-1** for design frequency and freeboard requirements.

3.7.9.C. *Geometry* – A grass lined roadside ditch shall have minimum bottom width, maximum side slopes, maximum depth (measured from crown of pavement), and minimum drainage easement width in accordance with **Figure 3-5**.

3.7.9.D. *Erosion Control* – All roadside ditches shall be protected with sod, back sloping, and/or other bank protection designed and constructed to control erosion.

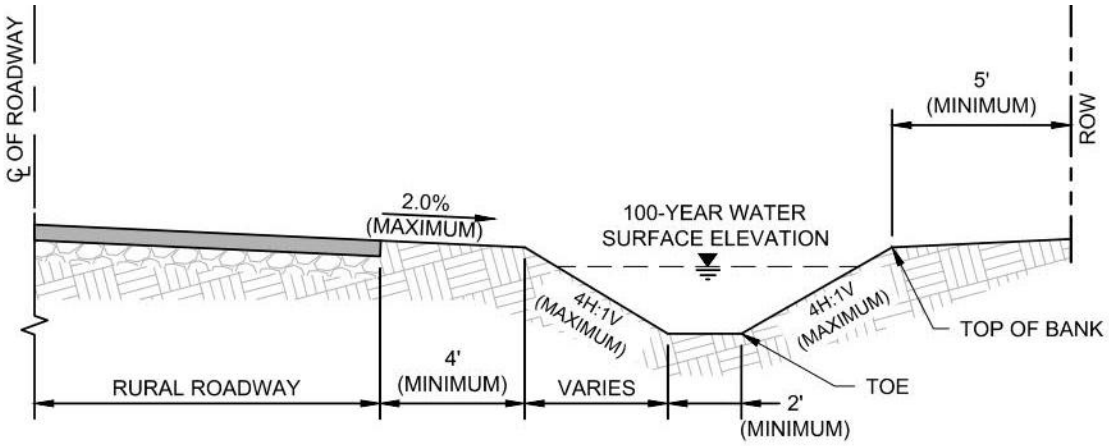


Figure 3-5. Rural Roadside Ditch

3.7.9.E. *Modeling Programs* – Hydraulic analysis of roadside ditches will require a HEC-RAS analysis for discharges greater than or equal to 10 cfs or where conditions other than normal depth are anticipated. Hydraulic analysis of roadside ditches for discharges less than 10 cfs may use FlowMaster, or approved equal program, upon approval of the Director of Public Works.

3.7.9.F. *Manning's Roughness Coefficients and Maximum Permissible Velocities* – Manning's roughness coefficients and maximum permissible velocities shall be in accordance with **Table 3-20**.

3.7.9.G. *Minimum Slope* – The minimum slope for roadside ditches is 1.0%.

3.7.9.H. *Roadside Drainage Cross Culverts* – Refer to **Section 3.8** (Bridge and Culvert Hydraulics) for cross culvert requirements.

3.8. *Bridge and Culvert Hydraulics*

3.8.1. *General*

3.8.1.A. *Contents* – This section includes the hydraulic design requirements for bridges and culverts. Refer to **Section 7** (Structural Design Requirements) for structural design requirements for bridges, culverts, abutments, headwalls, and wingwalls. Refer to **Section 3.6** (Floodplain Alterations) and **Section 3.7** (Open Channels) for floodplain alterations and open channel design requirements.

3.8.1.B. *Sizing* – Sizing of bridges and culverts shall take existing and proposed developments upstream of the structure into account. Bridges and culverts shall be designed based on the frequency and freeboard requirements found in **Table 3-1**. Bridges and culverts shall contain the design discharge within ROW or drainage easement limits.

3.8.1.C. *Modeling Requirements* – Bridges and culverts shall be modeled with USACE's backwater hydraulic modeling program HEC-RAS in accordance with **Section 3.6** (Floodplain Alterations). Refer to **Section 3.7** (Open Channels) for additional modeling requirements.

3.8.1.D. *Preferred Crossing Types* – A site-specific selection of crossing type and geometry will be necessary and contingent upon Director of Public Works approval. Consideration shall be given to reducing the environmental impacts of proposed crossings. Impacts should be minimized by reducing the footprint of the proposed improvements within the jurisdictional waters of the U.S. and within the ultimate floodplain. Piers within the ultimate floodplain should be limited to the maximum extent possible. Efficient sizes of culverts shall be used. Where feasible, longer span culverts are preferred to shorter span culverts to prevent creek blockages. Additionally, consideration shall be given to thickness of culvert walls to prevent debris blockages in creeks. In general, the following list includes the crossing types that may be considered, listed in order of City preference:

- Bridge spanning the ultimate floodplain;
- Arch culvert spanning the ultimate floodplain;
- Bridge with piers (minimum number of bents);
- Single box culvert;
- Arch culverts in series (minimum number of barrels); or,
- Box culverts in series (minimum number of barrels).

3.8.1.E. *Blockages* – Bridges and culverts shall be designed so that if they become partially or completely blocked, they will not divert flow from the natural or designed flow path or cause damage to the structure or surrounding properties.

3.8.2. *Bridge Hydraulics*

3.8.2.A. *Placement* – Bridges should be centered on the main channel portion of the ultimate floodplain. The middle bent should be centered over the normal water surface elevation.

3.8.2.B. *Alignment and Skew* – Bridge alignment shall be perpendicular to the direction of flow. The skew of the bridge piers and abutments shall be oriented as close to the existing direction of flow as possible. If applicable, a skew angle for the deck/roadway and piers shall be entered into HEC-RAS to account for the actual hydraulic length effecting the stream.

3.8.2.C. *Design Parameters* – Several hydraulic parameters should be considered in bridge design. These design parameters include, but are not limited to, the following:

- Channel transitions into and out of the bridge opening;
- Overall length and height of bridge;
- Cross-sectional opening of bridge;
- Number of crossings (dual or multiple bridges);
- Other obstructions to flow (piers and abutments);
- Erosion protection at piers and abutments; and,
- Possible damages to the structure or other property due to flows in excess of the design discharge.

3.8.2.D. *Channelization* – Channelization upstream or downstream of the proposed bridge will normally only be permitted when necessary to realign the flow to a more efficient angle of approach.

3.8.2.E. *Pedestrian Bridges* – Pedestrian bridges are not required to contain the ultimate 100-year peak discharge. Refer to **Table 3-1** for the design frequency and freeboard requirements. The design floodplain and ultimate 100-year floodplain shall be mapped to verify flows exceeding the bridge's hydraulic capacity will not be diverted out of the floodplain or cause damage to adjacent properties. Open channel modeling must

be performed, and all floodplain development criteria shall be satisfied per **Section 3.6** (Floodplain Alterations) and **Section 3.7** (Open Channels).

3.8.3. *Culvert Hydraulics*

3.8.3.A. *Culvert Design* – The hydraulic design of culverts shall be in accordance with TxDOT's current edition *Hydraulic Design Manual*, Chapter 8 (Culverts).

3.8.3.B. *Calculations* – The calculation of hydraulic grade lines shall consider both inlet and outlet control for the culvert. Culvert calculations shall be provided to the City for review. Submittals shall include, but are not limited to, inlet control, outlet control, and velocity calculations. Exhibits shall at a minimum include the following elevations: headwater, tailwater, flowline, lowest adjacent grade, and lowest adjacent structure.

3.8.3.C. *Alignment* – Culverts should always be aligned to follow the natural stream channel. The Engineer shall provide sufficient information to analyze the upstream and downstream impacts of the culvert and illustrate the interaction of the channel and culvert alignment.

3.8.3.D. *Entrance Losses* – Entrance loss coefficients for pipe culverts and reinforced box culverts shall be used in accordance with the USACE's current edition *HEC-RAS (River Analysis System) Hydraulic Reference Manual*.

3.8.3.E. *Emergency Overflow Path* – An emergency overflow path shall be provided for all culverts. The emergency overflow path shall be identified and provided on the Engineering Plans. The emergency overflow path shall be limited to ROW or drainage easements.

3.8.3.F. *Cross Culverts*

3.8.3.F.i. Cross culverts shall be placed at all driveway and roadway crossings and other locations where appropriate.

3.8.3.F.ii. Cross culverts shall be reinforced concrete pipe and have a minimum diameter of 18 inches.

3.8.3.F.iii. Cross culverts shall have headwalls approved by the Director of Public Works. Safety pipe runners are required for cross culverts 30 inches or greater in diameter.

3.8.3.F.iv. Erosion protection shall be provided at the upstream and downstream ends of all cross culverts.

3.8.4. *Bridge and Culvert Protection*

3.8.4.A. To prevent damage from scour and erosion, bridge and culvert protection is needed. Scour protection shall be provided in accordance with FHWA's current edition *Hydraulic Engineering Center No. 18* (*HEC-18) Evaluation of Scour at Bridges*.

3.8.4.B. The protection should extend upstream and downstream to a point where nonerosive channel velocities are established in accordance with **Table 3-20**. The protection should be placed sufficiently high on the

adjacent banks to provide protection from erosion under design flood conditions. The protection should be based on a scour analysis and consideration of the channel stability.

3.8.4.C. The critical depth shall be used to determine exit velocity and associated erosion control measures for a culvert with low tailwater. Refer to **Section 3.11** (Erosion and Sediment Controls) for permanent erosion control requirements. Refer to **Section 3.7** (Open Channels) for rock riprap sizing methods.

3.9. *Detention and Retention Facilities*

3.9.1. *General* – This section includes design requirements for detention and retention facilities, dams and impoundments, and levees. The term “basins” implies detention or retention basins, ponds, lagoons, reservoirs, or lakes, as applicable. As described in **Section 3.2** (Design Discharge), proposed runoff rates for all land uses are limited to the pre-development rates. This requirement applies to the development of all sites including churches, schools, and other institutional uses.

3.9.2. *When Detention Is Required* – Detention/retention facilities may be required by the Director of Public Works on a case-by-case basis in accordance with the following.

3.9.2.A. Detention will likely be required if the proposed runoff rates exceed pre-development rates, existing downstream facilities are undersized, or downstream cities have detention requirements.

3.9.2.B. Detention/retention facilities are likely not required by the City when runoff from the site can be directly carried to a channel that has adequate capacity. If the flows leaving the site cannot be conveyed to a channel without adversely impacting downstream property, then detention/retention will be required.

3.9.2.C. A Downstream Assessment may be required if the Director of Public Works has reason to believe that on-site detention may increase the ultimate 100-year peak flow due to coincidental peaks. If the assessment demonstrates coincidental peaks, on-site detention facilities will not be an acceptable option. Downstream improvements may be required if downstream capacity and easements are inadequate to convey the increased site flow. See **Section 3.10** (Downstream Assessments).

3.9.2.D. The need for detention/retention facilities may be reduced or eliminated by the implementation of permanent controls in accordance with **Section 3.11** (Erosion and Sediment Controls). If the use of permanent controls reduces the proposed runoff to the equivalent of the pre-developed condition, and there are no limitations related to downstream receiving systems, then detention/retention would not be required.

3.9.2.E. In cases of property redevelopment, detention/retention is required only if it is necessary to reduce the runoff rate from the redeveloped site to the runoff rate of the site prior to redevelopment.

3.9.2.F. **Figure 3-6** provides guidance on when detention and/or downstream assessment is required.

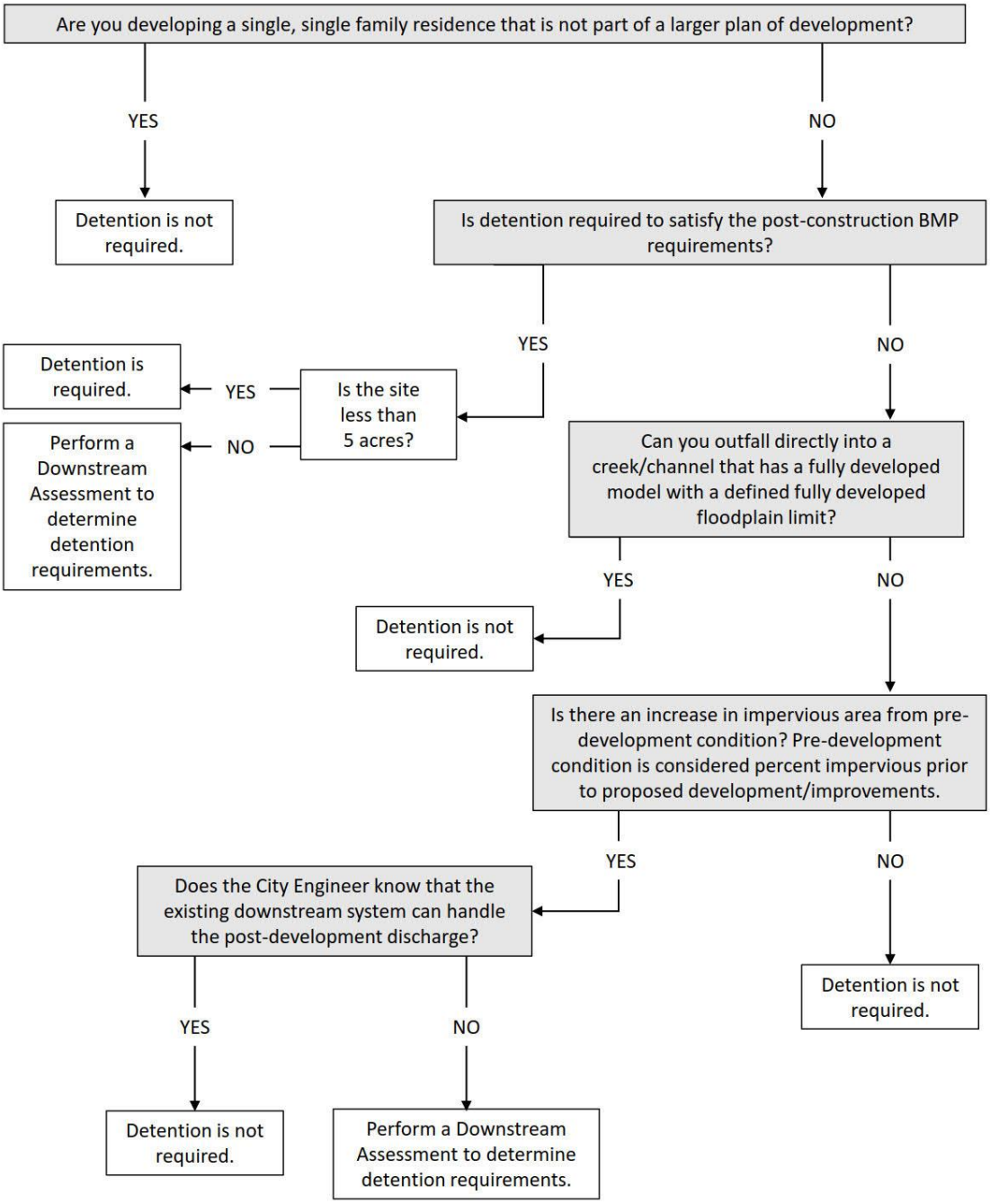


Figure 3-6. Detention and Downstream Assessment Flow Chart

3.9.3. *Easements Required for Detention/Retention Facilities* – Drainage easements shall be provided for all detention/retention facilities. Refer to **Section 1.8** (Easements and Right-of-Way Requirements) for considerations and processes related to drainage easements and maintenance.

3.9.4. *Storage Calculations* – The minimum amount of storage volume of the detention basin shall be the volume required to reduce the runoff rate to pre-developed conditions. Refer to **Section 3.2** (Design Discharge) for runoff calculations and design storm and freeboard requirements. In general, one of the following two methods may be used for detention storage calculations.

3.9.4.A. *Modified Rational Method* – For drainage areas of 200 acres or less, the Modified Rational Method may be used for the estimation or design of storage volumes for detention or retention basins, based on the following conditions:

- The current edition NCTCOG iSWM™ *Hydrology Technical Manual* methodology shall be used.
- Modified Rational Method is not acceptable for basins in series.
- Design must account for all on-site and off-site flows to the discharge point. If flow bypasses the detention basin, the allowable release must be adjusted accordingly. A range of storm durations is required to determine the critical duration for the detention basin.

3.9.4.B. *Unit Hydrograph Method* – For drainage areas of any size, a Unit Hydrograph Method may be used for design of storage volumes for detention or retention basins. The detailed Unit Hydrograph Method shall be based upon standard engineering principles subject to approval of the Director of Public Works. Refer to **Section 3.2** (Design Discharge) for additional Unit Hydrograph Method requirements.

3.9.5. *Minimum Design Requirements* – At a minimum, the following design requirements shall be met for detention/retention basins:

3.9.5.A. *Applicable Regulations* – The design shall meet the minimum requirements of Federal, State, and County regulations and guidelines;

3.9.5.B. *Permits* – All applicable permits must be obtained for basins with permanent water storage;

3.9.5.C. *Stage-Storage Requirements* – Detention/retention facilities shall be designed for the ultimate 5-year and ultimate 100-year design floods;

3.9.5.D. *Timing* – Detention/retention facilities shall be designed to empty in less than 24 hours, unless it is also serving as an erosion control facility; and,

3.9.5.E. *Outfalls* – If the structure outfalls into a natural or unlined channel, the discharge shall be nonerosive or the channel shall be armored in accordance with **Section 3.7** (Open Channels).

3.9.6. *Basin and Spillway Geometry* – The following shall be used for the design of detention/retention basins and spillways.

3.9.6.A. *Design Frequency and Freeboard* – Refer to **Table 3-1** for design frequency and freeboard requirements.

3.9.6.B. *Embankments* – Embankments used to temporarily or permanently impound surface water must be constructed according to specifications as required based on geotechnical investigations of the site and all

regulatory requirements. The steepest side slope permitted for a vegetated embankment is 4H:1V.

3.9.6.C. *Emergency Spillway* – Detention facilities shall be designed with a non-erodible emergency spillway or overflow path in case the primary outfall ceases to function as designed. At a minimum, the emergency spillway shall be designed to safely pass the ultimate 100-year storm event.

3.9.6.D. *Access* – Access shall be provided to the banks and bottom of a detention facility for maintenance. See **Section 1.8** (Easements and Right-of-Way Requirements).

3.9.6.E. *Concrete Pilot Channel* – A concrete pilot channel shall be provided for all detention/retention facilities to convey low flows from points of concentrated inflow to the basin outlet structure. The concrete pilot channel and erosion control placed continuously on both sides of the pilot channel shall be designed in accordance with the Standard Details.

3.9.6.F. *Positive Drainage* – Detention basins shall provide positive drainage throughout the basin with a minimum slope of 1% leading to the required pilot channel.

3.9.6.G. *Trash Racks* – To minimize both the possibility of clogging and the amount of debris conveyed to downstream, trash racks shall be required on detention system outlet structures. The design of trash racks shall be according to the guidelines set forth in the current edition NCTCOG iSWM™ *Hydraulics Technical Manual*.

3.9.6.H. *Safety Considerations* – It is the responsibility of the Engineer to consider pedestrian and vehicular safety in the design of detention facilities. Perimeter railing or fencing may be required.

3.9.7. *Dams and Impoundments* – If an Owner or Developer desires to modify an existing basin, or desires to impound stormwater by filling or constructing an above-ground dam, the criteria below shall be met.

3.9.7.A. *Maintenance and Liability* – The Owner shall retain private ownership of the impoundment and assume full responsibility for the protection of the general public from any health or safety hazards related to the impoundment. The Owner shall assume full responsibility for the maintenance of the impoundment. The Owner shall keep the Director of Public Works advised of the current responsible agent for this maintenance.

3.9.7.B. *Applicable Regulations* – All Federal, State, and County regulations pertaining to impoundment of surface water shall have been complied with, including the design, construction, and safety of the impounding structure. Any existing impounding structure, which is included in the project area, shall be improved to comply with the applicable Federal, State, County, and City safety requirements.

3.9.7.C. *Permits* – Copies of any Federal, State, and County permits issued for the proposed impoundments shall be submitted to the Director of Public Works upon request.

3.9.7.D. *Design Criteria* – Refer to **Section 3.2** (Design Discharge) for design criteria.

3.9.7.E. *Spillway and Emergency Overflow Areas* – The spillway and any emergency overflow areas shall be located so that flood waters will not inundate any buildings, roadways, or other structures.

3.9.7.F. *Flood Study and Downstream Assessment Requirements* – Before removing or altering any existing impounding structure, the Owner shall furnish a study of the effects of the alteration upon flooding conditions both upstream and downstream. The study shall be submitted to the Director of Public Works for approval prior to making the proposed alteration. Compensatory storage shall be provided in some manner such that equal or comparable flood retention capacity is maintained. Refer to **Section 3.6** (Floodplain Alterations) and **Section 3.10** (Downstream Assessments) for applicable study requirements.

3.9.7.G. *Engineering Plans* – The drainage design information shall be included on the final Engineering Plans. Refer to **Section 1.7** (Submittal Requirements for Construction Plans) for additional requirements.

3.9.7.H. *Acceptance* – Any improvements to existing impoundments, or construction of new impoundments shall be made at the expense of the Developer, prior to acceptance of the adjacent street, utility, and drainage improvements in accordance with the City's Subdivision Regulations in Appendix B of the Sachse City Code, as amended .

3.9.8. *Levees* – If Developers or Owners wish to build levees to protect an area from flooding, applicable FEMA and State of Texas guidelines and the following criteria apply:

3.9.8.A. Refer to **Table 3-1** for design frequency and freeboard requirements.

3.9.8.B. Levees shall be designed according to the USACE design criteria whether or not they are federally authorized levees.

3.9.8.C. Levee systems shall be designed with interior drainage systems to prevent flooding from local runoff contained within the system for the ultimate 100-year design flood.

3.9.8.D. Levee systems shall have written standard operation procedures (SOPs) that address gate closure conditions and emergency warning plans. A copy of these procedures shall be furnished to the Director of Public Works.

3.9.8.E. Automated gate closure systems shall have power from two independent sources and shall be capable of being operated manually.

3.9.8.F. Ring levees protecting individual structures shall not be permitted.

3.9.8.G. All new levee systems shall have permanent positive closures to the required design elevation. Temporary closures involving sandbagging or other procedures requiring manual operations shall not be permitted.

3.9.8.H. Provisions shall be made for ensuring the permanent maintenance of levees by a flood control district or similar governmental organization, or existing Owner and all future Owners.

3.9.8.I. The Engineering Plans shall at a minimum include: water surface profiles for the design flood and SPF; top of levee profile; definition of interior drainage facilities, including pump station and ponding areas; location of gravity outlets, gatewells, and closure structures; and elevation-duration data on the receiving system.

3.10. *Downstream Assessments*

3.10.1. *General* – This section includes procedural and submittal requirements for Downstream Assessments. In general, downstream impacts of any development must be carefully evaluated. The stormwater discharge from the development shall not cause adverse impacts to adjacent or downstream properties or facilities. In order to determine the impacts to the downstream properties or facilities, a Downstream Assessment may be required. Refer to **Figure 3-6** to determine if a Downstream Assessment is required. For sites less than 5 acres with proposed detention and draining a watershed less than or equal to 25 acres, a Downstream Assessment is not required. The detention volume must adequately address the increase in discharge due to the proposed development.

3.10.2. *Requirements* – Downstream Assessments shall demonstrate the development will produce no adverse impacts. No adverse impacts may include, but are not limited to, the following:

3.10.2.A. *Discharges* – No increases in downstream discharges caused by the proposed development that, in combination with existing discharges, exceeds the existing capacity of the downstream storm drainage system.

3.10.2.B. *Water Surface Elevations* – No increases in water surface elevations for the ultimate 5-year and ultimate 100-year design floods.

3.10.2.C. *Velocities* – No increases in existing erosive subsection velocities.

3.10.2.D. *Outfall* –No adverse flooding or erosive conditions downstream are created by the location and design of the outfall.

3.10.3. *Methods* – The following steps should be performed for a Downstream Assessment.

3.10.3.A. Determine the outfall location of the site and the pre- and post-development site conditions.

3.10.3.B. Use a topographic map to determine a preliminary Zone of Influence. The Downstream Assessment shall extend to a point downstream where the proposed development no longer has a significant impact upon the receiving stream or storm drainage system. The Engineer shall determine how far downstream the analysis for the Downstream Assessment shall extend. The following methods shall be used to determine the Zone of Influence:

- For sites less than or equal to 20 acres, the Downstream Assessment may use the iSWM™ 10% Rule to determine the Zone of Influence. The 10% Rule states the Zone of Influence can be considered to be the point where the proposed subject area controlled by the drainage facility comprises 10% of the contributing watershed. As an example,

if a structural control drains 10 acres, the Zone of Influence ends at a point where the total drainage area is at least 100 acres.

- For sites greater than 20 acres, the Zone of Influence will be defined by a detailed hydrologic and hydraulic modeling analysis.

3.10.3.C. Using a hydrologic model (HEC-HMS), determine the pre-development peak flows at each junction beginning at the development outfall and ending at the next junction beyond the 10% point.

3.10.3.D. Using a hydraulic model (HEC-RAS), determine the pre-development velocities at each junction beginning at the development outfall and ending at the next junction beyond the 10% point.

3.10.3.E. Change all parameters that have changed between pre- and post-development conditions and re-run the models.

3.10.3.F. Compare the pre- and post-development ultimate 5-year and ultimate 100-year peak discharges and maximum subsection velocities at the downstream end of the model. If the post-developed flows are higher than the pre-developed flows for the same frequency event, or the post-developed velocities are higher than the allowable velocity of the downstream receiving system, extend the model downstream. Repeat these steps until the post-development flows are equal to or less than the pre-developed flows, the post-developed maximum subsection velocities are equal to or below the maximum permissible subsection velocities, and the post-developed water surface elevations are equal to or below the pre-developed water surface elevations.

3.10.3.G. If shown that no peak flow increases occur downstream and post-developed maximum subsection velocities are allowable, the increase in discharge may be approved by the Director of Public Works.

3.10.3.H. If peak discharges are increased due to development, or if downstream velocities are erosive, further documentation may be required to prove existing downstream conveyance is adequate to convey the post-developed discharges. If peak discharges are increased due to development and the downstream velocities are erosive, an on-site detention facility will likely be required by the Director of Public Works, such that the post-development flows do not increase the peak flows, and the post-development velocities are nonerosive at the outlet and the determined junction locations.

3.10.4. *Submittal Requirements* – The Downstream Assessment shall be prepared, signed, and sealed by a Professional Engineer in the State of Texas trained and qualified to provide similar analyses. At a minimum, the Downstream Assessment shall include:

- *Methodology* – A letter report summarizing the methodology;
- *Hydrologic and Hydraulic Exhibits* – Exhibits showing the watershed, model limits, floodplain delineations, and cross sections;

- *Comparison Tables* – Comparison tables for pre-development and post-development conditions for discharges, water surface elevations, average velocities, and maximum subsection velocities;
- *Results* – Discussion of any downstream impacts; and,
- *Digital Files* – Hydrologic and hydraulic models.

3.11. *Erosion and Sediment Controls*

3.11.1. *General* – This section includes Best Management Practice (BMP) requirements for construction and post-construction activities.

3.11.2. *Grading and Floodplain Development Permit* – No person shall fill, grade, excavate, or otherwise disturb the surface of real property within the City without first having secured a Grading and Floodplain Development Permit. No Owner of real property shall knowingly permit another person to fill, grade, excavate or otherwise disturb the surface of real property within the City without first having secured a permit from the Director of Public Works. The following shall be submitted with permit application:

- Submission by the applicant of a Stormwater Pollution Prevention Plan (SWP3) for all work disturbing 1 acre of land or more. This SWP3 must be prepared by a licensed Professional Engineer in accordance with applicable Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ) regulations and approved by the Director of Public Works prior to issuing the grading permit.
- Submission by the applicant of a copy of Notice of Intent (NOI) and/or a Construction Site Notice (CSN) as required by the TCEQ regulations for all work disturbing 1 acre of land or more.
- The Director of Public Works may exclude that portion of tracts in excess of 10 acres that he determines to be so situated as to not contribute to erosion due to location and topography.
- The applicant provides a notarized statement from the property Owner giving permission for the applicant to fill, grade, excavate, or otherwise disturb the property and acknowledgment by property Owner of the responsibilities of the property Owner as described in the Sachse City Code, as amended,.

3.11.3. *Construction Permitting* – Construction permitting shall be in accordance with the TCEQ's Construction General Permit (TXR150000). Temporary erosion control BMPs shall be provided to control and reduce the discharge of sediment, silt, soil, and other materials to the Municipal Separate Storm Sewer System (MS4) and to waters of the United States during construction activities. Proof of compliance with applicable Local, State, and Federal environmental regulations shall be provided to the City upon request.

3.11.4. *Temporary Erosion Control BMPs* – The following temporary erosion control BMPs shall be designed to retain soil in place and to minimize the amount of sediment in runoff. Refer to the NCTCOG iSWM™ *Technical Manuals* and *Fact Sheets* for applicable design criteria.

3.11.4.A. *Temporary Stabilization* – Portions of a site that have been disturbed but where no work will occur for more than 21 days shall be

temporarily stabilized as soon as possible, and no later than 14 days from cessation of work, except when precluded by seasonal arid conditions or prolonged drought. Temporary stabilization shall consist of providing a protective cover, without large bare areas, that is designed to reduce erosion on disturbed areas. Temporary stabilization may be achieved using the following BMPs: temporary seeding, soil retention blankets, fibrous mulches, hydro-mulches, and other techniques that cover 100% of the disturbed areas until final stabilization can be achieved or until further construction activities take place.

3.11.4.B. *Slope Protection* – Slope protection shall be provided for disturbed or cut/fill slopes that are steeper than 4H:1V, 50 feet in length or longer, or on highly erodible soils. The location and type of BMPs shall be shown on the plans.

3.11.4.C. *Channel Protection* – Show the location and type of BMPs used to prevent the erosion of channels, drainage ways, streambanks, and outfalls until permanent structures and final stabilization measures are installed.

3.11.4.D. *Sediment Controls* – Sediment control BMPs shall be designed to capture sediment on the site when preventing erosion is not feasible due to ongoing construction activity. Sediment control BMPs and their locations shall be designed to change with the different phases of construction as site conditions and drainage patterns change. Sediment controls for the initial phase of construction shall be installed before any site disturbing activities begin. Sediment barriers may be linear controls, check dams, berms, sediment basins, sediment traps, active treatment systems, and other structural BMPs designed to capture sediment suspended in stormwater.

3.11.4.E. *Perimeter Controls* – A linear BMP shall be provided at all down slope boundaries of the construction activity and side slope boundaries where stormwater runoff may leave the site. Linear sediment barriers may be used to satisfy the requirement for perimeter controls.

3.11.4.F. *Storm Drain Inlet Protection* – Storm drain inlet protection shall not be used as a primary sediment control BMP unless all other primary controls are infeasible due to site configuration or the type of construction activity. Inlet protection is intended to be a last line of defense in the event of a temporary failure of other sediment controls.

3.11.4.G. *Construction Access Controls* – BMPs shall be provided to prevent off-site vehicle tracking of soil and pollutants.

3.11.4.H. *Dewatering Controls* – Water pumped from foundations, vaults, trenches and other low areas shall be discharged through a BMP or treated to remove suspended soil and other pollutants before the water leaves the site. The plans shall include notes that prohibit discharging the water directly into flumes, storm drains, creeks or other drainage ways. Where State or Local discharge permit requirements exist for the pollutant(s) suspected of being in the water, the plan shall include the discharge permit conditions.

3.11.4.I. *Final Stabilization* – Final stabilization practices shall be specified for disturbed areas that are not covered by buildings, pavement or other permanent structures upon completion of construction. Final stabilization measures shall be coordinated with the construction plans.

3.11.5. *Post-Construction Requirements* – Post-construction stabilization shall be provided in accordance with the EPA's NPDES and TCEQ's TPDES regulations for all new development and redevelopment.

3.11.5.A. *Construction and Maintenance Requirements* – The Owner shall construct all permanent controls in accordance with this section and is responsible for maintenance of the controls. When the control falls within a drainage easement, the plat or separate instrument dedicating the easement shall include a statement of the Owner's responsibility for maintenance. Refer to **Section 1.8** (Easements and Right-of-Way Requirements). Refer to NCTCOG iSWM™ *Construction Controls Technical Manual* for permanent control options.

3.11.5.B. *Operations and Maintenance Form* – Submittal of an Operations and Maintenance Form in **Appendix B** (City Checklists) is required to demonstrate the long-term maintenance of the permanent controls. The Operations and Maintenance Form must be accepted by the City before the final Engineering Plans are approved for construction. The Owner shall agree to the operations and maintenance procedures and frequency of maintenance for each permanent control specified on the form.

SECTION 4 GENERAL UTILITIES DESIGN REQUIREMENTS

Section Highlights

- All utilities designs shall at a minimum comply with the City's current adopted Water Master Plan and Sanitary Sewer Master Plan.
- Refer to **Section 5** (Water Design Requirements) and **Section 6** (Sanitary Sewer Design Requirements) for additional utilities design requirements.

4.1. *General*

4.1.1. *Compliance with Master Plans* – All water and sanitary sewer construction plans shall comply with the City's current adopted Water Master Plan and Sanitary Sewer Master Plan and be submitted to the Director of Public Works for review.

4.1.2. *General Design Criteria* – It is the responsibility of the Engineer to ensure that all water and sanitary sewer construction plans are in conformance with the current edition of the following:

- *Texas Commission on Environmental Quality (TCEQ) Rules and Regulations;*
- *30 Texas Administrative Code (TAC) Chapter 290 – Public Drinking Water Subchapter D: Rules and Regulations for Public Water Systems;*
- *30 TAC Chapter 217 – Design Criteria for Domestic Sanitary Sewer Systems Subchapter C: Conventional Collection Systems;*
- *North Central Texas Council of Governments (NCTCOG) – Public Works Construction Standard Specifications and Standard Drawings;* and,
- *American Water Works Association (AWWA) Standards*.

4.2. *Policy*

4.2.1. *Water and Sanitary Sewer Main Extensions* – Water and sanitary sewer mains shall be sized and extended through the limits of a development to provide a connection for ultimate development of adjacent properties. Refer to the *Sachse City Code* for policies and appeal process concerning the extension of water and sanitary sewer mains, water and sanitary sewer connection fees, and pro-rata fees.

4.2.2. Easements

4.2.2.A. *Minimum Easement Widths* – Refer to **Section 1.8** (Easements and Right-of-Way Requirements) for easement widths.

4.2.2.B. *Easements Required for Relocation/Replacement* – The developer shall dedicate such easements or ROW within the development as may be required to permit construction of the relocation/replacement. Responsibility for the acquisition of easements outside of the development shall be the responsibility of the developer to obtain.

4.3. *Typical Utility Layouts Within Right-of-Way*

4.3.1. *General* – Water and sanitary sewer mains shall be placed on opposite sides of the street paving.

4.3.2. *Water Main Locations* – Water mains are generally placed to be centered under the back of curb, unless otherwise approved by the Director of Public Works.

4.3.3. *Sanitary Sewer Main Locations* – Sanitary Sewer mains are generally placed in the parkway, 6 feet from the back of curb, unless otherwise approved by the Director of Public Works.

4.3.4. *Typical Locations* – Refer to the Standard Details for typical water and sanitary sewer main, service line, and appurtenance locations.

4.4. *Separation of Water Mains from Sanitary Sewer Mains*

4.4.1. *Minimum Horizontal Spacing* – The minimum horizontal space between a new sanitary sewer main and a water main shall be 9 feet, measured from the outside diameter of the water and sanitary sewer mains or facilities. The sanitary sewer main that is parallel to a water main shall be installed in a separate trench.

4.4.2. *TCEQ Requirements* – When the 9-foot separation distance cannot be achieved, water mains and sanitary sewer mains shall be separated per TCEQ Rules and Regulations. Refer to the following:

- *30 TAC Chapter 290 – Public Drinking Water Subchapter D: Rules and Regulations for Public Water Systems;* and,
- *30 TAC Chapter 217 – Design Criteria for Domestic Sanitary Sewer Systems Subchapter C: Conventional Collection Systems*.

4.5. *Clearance Requirements*

4.5.1. General

4.5.1.A. If water and/or sanitary sewer mains are less than 2 feet below finished grade, a concrete cap over the utility shall be installed.

4.5.2. Storm Drains

4.5.2.A. When water or sanitary sewer mains are parallel to storm drains, the minimum horizontal clearance shall be 5 feet as measured from the outside diameters of each main, or as allowed by the Director of Public Works, whichever is greater.

4.5.2.B. Water mains shall be designed over storm drains and be a minimum of 1 foot below the compacted subgrade.

4.5.2.C. Water service lines shall cross over storm drain mains and laterals.

4.5.2.D. If the water main crosses under a storm drain, the water main shall have a steel casing pipe with a minimum vertical clearance of 2 feet from the bottom of the storm drain to the outside diameter of the main. The casing pipe shall be extended a minimum of 10 feet from the outside edge of a box storm drain or the outside diameter edge of the storm

drain. If the minimum clearance of 2 feet crossing over the storm drain cannot be achieved, an alternative alignment may be required.

4.5.2.E. Additional Storm Drain Crossing Requirements for Sanitary Sewer Mains

4.5.2.E.i. When sanitary sewer mains cross storm drains, the sanitary sewer main should cross the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.

- Concrete Stabilized Sand (CSS) or Controlled Low Strength Material (CLSM) backfill is required for any storm drain crossings; and,
- If the minimum clearance of 2 feet crossing the storm drain cannot be achieved, casing, bridging structures, or other special engineered structural design may be required.

4.5.2.E.ii. In no case shall sanitary sewer mains be permitted to cross through storm drains or storm drain junction structures.

4.5.3. *Franchise Utilities* – Franchise utilities, excluding Gas/Energy Transmission lines discussed in **Section 4.5.4**, shall provide a minimum clearance of 2 feet horizontally and vertically from all City Utility lines.

4.5.4. *Gas/Energy Transmission Pipelines* – Water or sanitary sewer mains proposed to parallel or cross existing gas pipelines shall adhere to the owner of the gas pipeline's clearance and other requirements. When feasible, water and sanitary sewer mains shall maintain a minimum horizontal clearance of 5 feet and vertical clearance of 3 feet, as measured from the outside diameters of each main. Coordination with the pipeline owner is required to confirm clearance requirements. The more stringent clearance requirements will be enforced.

4.5.5. *Drilled Shafts* – Sanitary Sewer mains, or water mains within steel casing pipe, adjacent to drilled shafts, shall be designed with a minimum horizontal clearance of 5 feet as measured from the outside diameter of the main to the outside edge of the drilled shaft, or two times the outside diameter of the drilled shaft, whichever is greater. Water mains that are not cased shall be designed with a minimum horizontal clearance of 10 feet.

4.5.6. Drainage Headwalls and Inlets

4.5.6.A. Water or sanitary sewer mains shall not cross under headwalls.

4.5.6.B. Water or sanitary sewer mains adjacent or perpendicular to headwalls shall be designed with a minimum clearance of 10 feet to headwall as measured from the outside diameter of the main to the outside edge of the headwall.

4.5.7. Mechanically Stabilized Earth (MSE) or Other Retaining Walls

4.5.7.A. Water or sanitary sewer mains adjacent to MSE or other retaining walls shall be designed to be placed outside of the zone of influence of the wall, as determined by an Engineer.

4.5.7.B. Water or sanitary sewer mains crossing MSE or other retaining walls shall be designed with steel casing through the entirety of the zone of influence of the wall, as determined by an Engineer.

4.5.8. *Other Bridge Features* – A minimum clearance of 5 feet horizontally and vertically shall be maintained from all other bridge features.

4.5.9. *Coordination with Other Entities* – In situations where water or sanitary sewer mains are required to be placed adjacent, within, or crossing easements or ROW of highway or railroad entities, the Engineer is responsible for coordinating with such entity to confirm that future expansions from the entity will not impact the proposed water main. Documentation of such correspondence shall be provided for review.

4.6. *Pipe Materials* – The specification of pipe material is the responsibility of the Engineer based on the analysis of specific site, soil conditions, loading conditions, and pressure requirements. The guidelines in **Appendix B** (Approved Materials Lists) are based on pipe size only and do not relieve the Engineer of the responsibility of providing pipe material specifications applicable to the specific project and restrictions due to special construction methods.

4.7. *Pipe Embedment*

4.7.1. *General* – Refer to the Standard Details for typical water and sanitary sewer main pipe embedment requirements.

4.7.2. *Trench Dams* – Trench dams may be required by the Director of Public Works depending on the potential for ground water, pipe slope, and length of sloped line segments. When required, trench dams shall be installed at a minimum of every 300 linear feet for the entire length of the utility placement to prevent migration of ground water within the water or sanitary sewer main trench.

4.8. *Crossings*

4.8.1. *Casing Requirements* – Casing pipe shall be used for City utilities at all crossings of TxDOT or railroad ROW and other situations as indicated in this section and shall meet the permitting and insurance requirements of the respective governing authority.

4.8.2. *Pipeline Crossings* – Refer to **Section 1** (General Design Requirements) for requirements regarding coordination with regulatory agencies.

4.8.3. TxDOT Crossing

4.8.3.A. The design of mains within TxDOT ROW must be in compliance with the requirements of TxDOT. Refer to the current edition of the *TxDOT ROW Utilities Manual* and the *43 TAC Chapter 21 Subchapter C* for Utility Accommodation.

4.8.4. Railroad Crossings

4.8.4.A. The design of mains within railroad ROW must comply with the requirements of the appropriate railroad authority and the *43 TAC Chapter 21 Subchapter O* for Utility Accommodation for Rail Facilities. The Engineer shall determine which railroad company ROW is being crossed and obtain their utility accommodation policies prior to beginning the design.

4.8.4.B. Water valves, meters, manholes, cleanouts and other appurtenances shall be placed outside the limits of the railroad ROW.

4.8.4.C. Water main crossings shall include a valve on each side of the railroad crossing and sanitary sewer main crossings shall include a manhole on each side of the railroad crossing.

4.8.5. Creek Crossings

4.8.5.A. Pursuant to *30 TAC Chapter 290,* where water mains are laid under any flowing stream or semi-permanent body of water, such as a marsh or pond, the water main shall be installed in a separate watertight casing pipe or installed with valves on each side of the crossing to allow the isolation and testing of that portion of the water main to determine if there are any leaks.

4.8.5.B. A watertight casing pipe with a manhole on each side of the crossing should be used for sanitary sewer mains.

4.8.5.C. A primary consideration in the design of creek crossings is the prevention of soil erosion at the areas of trench backfill. At a minimum, cement stabilized backfill shall be used from bank to bank. The cement stabilized backfill shall be covered with riprap if the velocity of the flowing water is anticipated to be greater than the maximum permissible velocity in **Table 3-20**. Refer to **Section 3** (Drainage Design Requirements) for flood study and rock riprap sizing requirements. In areas where there is a planned channel improvement, the stabilized backfill shall be used up to the line of planned improvement. The area above this planned line of improvement shall be compacted fill. In addition, the main must be designed with a minimum clearance from the top of the pipe to the bottom of the channel of 5 feet. If minimum clearance cannot be met, the main shall follow the requirements of **Section 4.8.6**.

4.8.6. Elevated (Aerial) Crossings

4.8.6.A. Elevated crossings create special design problems in which no set of circumstances is duplicated from one design to another. Elevated crossings for water and sanitary sewer mains should be avoided and may only be considered upon approval by the Director of Public Works.

4.8.6.B. Two methods of elevated crossings acceptable for consideration by the Engineer are either:

- Attaching the water or sanitary sewer main to a roadway bridge; or,
- Designing a specific pier foundation/utility bridge for the support of the water or sanitary sewer main crossing.

4.8.6.C. The following basic criteria must be addressed by the Engineer for all crossings attached to a bridge:

- Increased loading effects on the bridge created by a full main and its supports; and,

- Proposed elevation of the main shall meet low chord bridge requirements and be 2 feet above the 100-year water surface elevation to prevent damage to the main.

4.8.6.D. Elevated crossings should be designed in accordance with American Association of State Highway and Transportation Officials' (AASHTO) current editions of *Load and Resistance Factor Design (LRFD) Bridge Design Specifications* and *Standard Specifications for Highway Bridges*. In addition, the Ductile Iron Pipe Association (DIPRA) publication *Design of Ductile Iron Pipe on Supports* provides guidance on the design of elevated crossing pipe structures. Stream subsection velocities and impact loading must be considered.

4.8.6.E. Elevated crossing and pier foundation design and construction plans should be coordinated with appropriate erosion control plans for bank protection where the main enters and exits the creek.

4.8.6.F. *Flood Study* – Refer to **Section 3.6** (Floodplain Alterations) for applicable Flood Study requirements for any elevated crossings located on a creek or stream.

4.8.6.G. Additional Requirements for Pier Foundations

4.8.6.G.i. Proposed water or sanitary sewer mains crossing a channel or creek with less than 5 feet of cover between the top of pipe and flow line of the channel or creek, or water or sanitary sewer mains crossing over an inverted siphon, shall be supported by a pier system as shown in the Standard Details. The Director of Public Works reserves the right to require design and construction of a long span elevated crossing that minimizes the number of piers needed to support the main. The supported pier system shall span the entire floodplain to account for stream meander.

4.8.6.G.ii. When applicable, a specific pier foundation for the support of the water or sanitary sewer main crossing shall be located downstream of any existing roadway bridge in the vicinity.

4.8.6.G.iii. *Site Specific Design* – In all cases, the Engineer shall be responsible for obtaining sufficient subsurface investigations and performing all necessary structural and hydraulic calculations for the elevated crossing and associated piping, piers, and attachments. Final pier shape, bearing depth, reinforcing configuration, etc. shall be determined by the Engineer.

4.8.6.G.iv. *Geotechnical Report* – Geotechnical performance specifications shall be required of all elevated crossings to determine soil strata and design bearing loads for piers. Refer to **Section 7.4** (Geotechnical Performance Specifications) for geotechnical requirements.

4.8.7. Trenchless Construction

4.8.7.A. Trenchless construction methods may be used for water and sanitary sewer main placement. Only straight pipe alignments for both horizontal and vertical alignment are allowed. Utility bores shall, where practicable, be located at approximately right angles to ROW, streets, and alleys. All bores shall have a vertical profile on the construction plans.

4.8.7.B. Auger Boring

4.8.7.B.i. Engineers should consider the location, size, and depth of boring and receiving pits when choosing the beginning and ending stations for boring. The location of the bore/jacking pit and receiving pit shall be shown and dimensioned on the plan and profile views of the utility construction plans. Size of the bore pit and receiving pit shall be adequate to accommodate the boring/jacking equipment and the pipe joint lengths being used. Wet bore crossings are not allowed.

4.8.7.B.ii. A bore pit typically exceeds 20 feet in length to accommodate one joint of pipe. Bore pit width varies depending on the depth and size of pipe, with the narrowest width approximately 5 to 7 feet. A profile is required for all bores greater than 20 feet in length for mains larger than 4 inches.

4.8.7.B.iii. Auger boring shall be designed in accordance with the Standard Details. The anticipated size and location for all bore pits should be included in the design for the main and shown on the drawings. Launching pits shall be located at the lower elevation end of the tunnel.

4.8.7.B.iv. Water mains shall include valves at each side of a cased bore or tunnel within effective distances at each side of the crossing to allow isolation of the water main within the bore.

4.8.7.B.v. Casing pipe length shall be determined by the respective governing authority.

4.8.7.B.vi. Plan and profile view of the bore shall include all existing utility lines, trees, signs, guide lines/wires, light poles, and other obstacles.

4.8.7.C. *Trenchless Rehabilitation Methods* – When renewing, rehabilitating, and/or renovating existing water and/or sanitary sewer mains, acceptable trenchless rehabilitation methods may include pipe bursting, slip lining, or cured-in-place pipe. These methods shall be designed by the Engineer and require submittal of design and technical specifications for additional review by the Director of Public Works.

4.8.7.D. *Other Trenchless Construction* – When traditional auger boring is not feasible for construction of the improvements, other trenchless methods of construction shall be designed by the Engineer. Submittal of these

design and technical specifications is required for additional review by the Director of Public Works.

4.9. *Abandonment of Water and Sanitary Sewer Mains and Appurtenances*

4.9.1. *General Water Mains* – Any existing water main being replaced shall be cut and plugged, or removed, as directed by the Director of Public Works. Valve stacks for abandoned mains shall be removed and/or filled with concrete as shown in the Standard Details.

4.9.2. *General Sanitary Sewer Mains* – Any existing sanitary sewer main being replaced or abandoned is to be cut and plugged, or removed, at the Director of Public Works's direction. Sanitary Sewer service lines shall be abandoned by cutting and plugging. The service line tap shall be removed from the sanitary sewer main. If crossing an abandoned service line, service line shall be abandoned by cutting and plugging with grout.

4.9.3. *Abandonment of Mains in Critical Areas* – All water and sanitary sewer mains within street ROW and less than 10 feet in depth, under major intersections, or in areas that could impact major infrastructure, shall be abandoned by draining the existing main and cutting and filling the existing main with grout.

4.9.4. *Abandonment of Shallow Manholes* – All manholes less than 4 feet deep shall be abandoned by removal. Other manholes or junction structures shall be abandoned by removing the top 4 feet of the manhole. Refer to the Standard Details for abandonment of manholes.

SECTION 5 WATER DESIGN REQUIREMENTS

Section Highlights

- Refer to **Section 4** (General Utilities Design Requirements) for compliance requirements, typical utility layouts, horizontal and vertical clearances, crossings, trenchless construction, and abandonments.
- The minimum water main size for a residential area or a commercial area is 8-inch inside diameter (I.D.). Larger main sizes may be required in compliance with the *Water Master Plan*, per **Section 5.3** (Sizing Water Mains).
- Refer to the Standard Details for typical water main, service line, and appurtenance locations.
- Minimum cover, measured from the top of surface (existing and future) to the top of pipe, for 12-inch and smaller mains shall be 42 inches and 60 inches for 16-inch and larger mains, per **Section 5.4** (Horizontal Alignment and Vertical Alignment).
- All fittings shall be mechanically restrained using restrained fittings shown on the City's Approved Water Materials List in **Appendix B** (Approved Materials Lists), per **Section 5.8** (Fittings).
- Gate valves are allowed for main sizes 4-inch through 36-inch. Valves larger than 24-inch (I.D.) may be butterfly valves, per **Section 5.9** (Gate Valves and Butterfly Valves).
- Required backflow preventers must be reduced pressure zone device (RPZ). RPZ must be stainless steel for fire sprinkler lines. Brass RPZ may be used for all other uses.

5.1. *General*

5.1.1. *Fire Flow* – Fire flow for water systems shall be designed to comply with the City's current edition of the *International Fire Code* (IFC) with adopted City amendments.

5.1.2. *Water System Design* – All components of the water system (pipe, valves, fittings, restraints, blocking, services, and appurtenances) shall be designed for 200 psi working pressure and an American Association of State Highway and Transportation Officials (AASHTO) HL-93 live load except where loading conditions could exceed HL-93 live load limits, in which case, the Director of Public Works shall specify the appropriate design load.

5.1.3. *Water Plan Requirement* – Construction plans are required for all water mains. A profile is required for all water mains 12 inches or larger, or for 4 inches or larger water mains/services when any of the following circumstances exist:

- Crossing and/or within corridors where there are several existing utilities present and the space available for the water main is limited;
- Crossing an arterial roadway;
- Creek crossings;
- By other than open cut crossings;
- Gas line crossings;

- Transmission main crossings; and/or,
- Other circumstances requiring special design considerations.

5.2. *Pressure Planes*

5.2.1. *Sachse Pressure Planes* – The City currently operates one pressure plane. The location of the existing and proposed pressure planes are shown in the City's *Water Master Plan*.

5.2.2. *Service Area Elevation* – The service area elevation designation is related to the high-water level of elevated storage tanks.

5.2.3. *Crossing Pressure Plane Boundaries* – Prior to the design of a water system, the Engineer shall investigate and determine if the proposed water main crosses the boundary between pressure planes. The Engineer shall coordinate with the City prior to the design of a water main that crosses a pressure plane boundary. For those pressure planes separated by a street, a main shall be provided for each pressure plane on their respective side of the street. Proposed mains that approach pressure zone boundaries shall be designed to loop within their designated pressure planes as shown in the City's *Water Master Plan*.

5.3. *Sizing Water Mains*

5.3.1. *Standard Sizes* – New water mains shall consist of the following diameters (in inches): 8, 12, 16, 24, 30, 36, and multiples of 6-inch thereon.

5.3.2. Minimum Water Main Size

5.3.2.A. *Residential and Commercial Water Mains* – The minimum water main size for a residential or commercial area is 8-inch inside diameter (I.D.), or such larger size as may be necessary to properly serve the proposed and existing development. Smaller residential developments may be allowed in certain cases to contain less than 8-inch (I.D.) water mains to help prevent water quality issues.

5.3.2.A.i. For cul-de-sacs serving 16 or fewer homes and less than 250 feet in length, the minimum size allowed is 4-inch water mains (with minimum 6-inch valves); and,

5.3.2.A.ii. For cul-de-sacs serving 16 or fewer homes and a length between 250 to 600 feet, the minimum size allowed is 6-inch water mains with a flushing station.

5.3.2.B. *Industrial Water Mains* – The minimum water main size for an industrial zoned area is 12-inch (I.D.), or such larger size as may be necessary to properly serve the proposed and existing development. The maximum velocity allowed shall be 10 feet per second (fps). In no case can water mains be allowed smaller than recommended by the Fire Department.

5.3.2.C. *Larger Main Sizes* – Larger main sizes may be required in compliance with the *Water Master Plan*. Larger main sizes may be required if needed to produce the required fire flow. The Design Engineer shall be required to demonstrate compliance with Fire Flow Requirements for Buildings in accordance with the City's current edition of the

International Fire Code, Fire Apparatus Access Roads, with adopted City amendments.

5.3.2.D. Minimum Water Main Size for Collector Roads – For areas not included in the City's *Water Master Plan* and which also include the construction of a collector road, the minimum water main size is 12-inch (I.D.), or such larger size as may be necessary to properly serve the proposed development.

5.3.3. *Water Demand and Supply* – Residential development submittals shall include the total number of units and the total acres of the proposed development. Non-residential development submittals shall include estimated water use records showing the minimum hourly demand, maximum hourly demand, maximum daily demand, total building square footage, and the total acres for the proposed development. The projected maximum daily demand and maximum hourly demand shall be calculated and shown in million gallons per day (MGD) in accordance with the current edition of the *Water Master Plan*. Per the City's *Water Master Plan*, the average day water use is 152 gallons per capita per day (gpcd).

5.3.4. *Water Main Sizing* – Water mains shall be sized to meet "Maximum Hour," or "Maximum Day" plus Fire Flow, whichever is greater. Full consideration shall be given to fire flow requirements as superimposed upon the maximum day conditions, elevation, and the type of development proposed, in arriving at the final water main capacity. Water mains shall be sized to have maximum velocities of 8 fps for maximum daily demands and maximum velocities of 10 fps for combined maximum daily demand and fire flow demands.

5.4. *Horizontal Alignment and Vertical Alignment*

5.4.1. *Radius of Curvature/Joint Deflection* – Minimum radius of curve and maximum deflection angle of pipe joints shall be restricted to 50% of manufacturer's recommendation, after which the use of horizontal or vertical bends shall be required. No bending of pipe is allowed.

5.4.2. *Bends* – All bends shall be 45 degrees or less where practicable. Two 45-degree bends in a series shall be separated by a distance of five pipe diameters instead of a 90-degree bend.

5.4.3. Depth of Cover

5.4.3.A. 12-inch and smaller mains shall be designed for a minimum cover of 42 inches measured from the top of surface (existing and future) to the top of pipe.

5.4.3.B. 16-inch and larger water mains shall be designed for a minimum cover of 60 inches measured from the top of surface (existing and future) to the top of pipe, unless otherwise approved by the Director of Public Works. To accommodate water main appurtenances requiring vaults, depths exceeding 60 inches may be necessary.

5.5. *Connections to Existing Water Mains*

5.5.1. *Tapping Sleeves and Valves* – Connections to existing water mains (6-inch through 12-inch in size), shall be designed with a tapping sleeve and valve. Both the tapping sleeve and valve shall be rated for a minimum 200 psi service pressure.

5.5.1.A. Size on size taps are not allowed.

5.5.1.B. Tapping valves shall be a flange by MJ resilient seat gate valve unless otherwise specified.

5.5.2. *Cut-in Tees* – When connecting to an existing main, it may be desirable to install an additional valve on the existing main to improve system operations and prevent further service disruptions. In this situation, the Engineer shall design the connection with a tee and valve being cut into the existing main. Connections are to be made in locations where existing valves can be closed to isolate the connection point while keeping as much of the surrounding system in service as possible. Flanged fittings shall be specified in accordance with the Standard Details. If this method is determined not to be feasible by the Director of Public Works, a tapping sleeve and valve may be used. Cut-in connections may require an additional valve on the existing main to reduce the number of service disruptions.

5.5.3. *Provision for Future Replacement* – Connections are to be designed to facilitate future replacements and improvements. Additional piping, valves, and fittings shall be used where necessary to accommodate future replacements.

5.6. *Dead-End Water Mains*

5.6.1. *General* – Dead-end mains shall be avoided and may only be considered when a looped or interconnected water main system is not available. The design of all water distribution systems shall include the opportunity for future looping or interconnect of any approved or proposed dead-end main.

5.6.2. *Residential Dead-End Mains* – Residential cul-de-sac, dead-end mains may be allowed to be reduced to 4-inch diameter, upon approval of the Director of Public Works.

5.6.2.A. The fire hydrant lead shall be installed prior to the reduction of the main size.

5.6.2.B. The maximum length of a dead-end main in a cul-de-sac without a fire hydrant is 250 feet.

5.6.3. *Flushing Requirements* – Where dead-end mains are approved, the design shall allow for periodic flushing of stagnant water through a flushing device in accordance with **Table 5-1**.

Table 5-1. Flushing Requirements

Dead-End Length (feet)	Flushing Requirement
Less than 100	Flush Point
100 – 300	Flush Point or Fire Hydrant
More than 300	Fire Hydrant or Automatic Flushing Device with De-chlorination Tabs with Connection to Existing Storm Drain

5.6.4. *Dead-End Main Extension* – Dead-end water mains shall extend a minimum of 5 feet beyond the edge of the pavement. If adjacent to a fitting, dead-end mains shall extend a minimum of 20 feet, or one pipe joint beyond fitting.

5.6.5. *Looped System Requirements* – Water mains serving more than two fire hydrants must be a looped system. Looped water mains through the site shall be connected to two different existing water mains to provide system redundancy.

5.7. *Fire Hydrants*

5.7.1. *General* – All fire hydrants supplied shall comply with *AWWA C-502*, with a minimum working pressure of 200 psi.

5.7.2. Spacing and Location

5.7.2.A. Fire hydrants shall be located within public street rights-of-way and water main easements and be spaced in accordance with the City's current edition of the *International Fire Code, Fire Hydrant Locations and Distribution*, with adopted City amendments. Refer to the Standard Details for typical fire hydrant locations.

5.7.2.A.i. *One and Two-Family Residences* – For all one and two-family residences, fire hydrants must be installed within (or

along) a 500-foot radius along a direct horizontal line from residence.

5.7.2.A.ii. *Other Land Uses* – For all other land uses, fire hydrants must be installed within (or along) a 300-foot radius along a direct horizontal line from building.

5.7.2.A.iii. *Cul-de-Sacs* – Streets longer than 300 feet, which end in a cul-de-sac, must have a fire hydrant in the cul-de-sac. When the cul-de-sac is less than 300 feet from the center of the connecting street intersection, a fire hydrant is required at the connecting street intersection.

5.7.2.B. On-site water mains and hydrants shall be installed capable of supplying fire flow required by the current adopted edition of *the International Fire Code, Fire-flow Requirements for Buildings* as interpreted by the City's Fire Marshal.

5.7.2.C. All fire sprinkler fire department connections (FDC) generally must be located within 100 feet of a fire hydrant and within 50 feet from a fire lane. Consult with the City's Fire Marshal and the *International Fire Code* concerning maximum distance from an FDC to a fire hydrant as measured along a route approved by the City's Fire Marshal.

5.7.2.D. Fire hydrants shall be located to minimize interference with driveways and shall be located with sufficient clearance from drive and street radii to prevent the fire hydrant from being struck if a vehicle jumps the curb and/or takes a wide turn. Hydrants shall not be placed in intersection radii or other locations with a high probability of being damaged by traffic. A 3-foot clear space shall be maintained around the circumference of fire hydrants except as otherwise required or approved.

5.7.2.E. Mid-block fire hydrants shall be located on property lines (extended) to minimize interference with drives and on-street parking.

5.7.2.F. Hydrants shall be placed 2 feet to 10 feet from the back of curb and shall not interfere with sidewalks, driveways, or other paved areas. Hydrants shall be placed so the bury mark is at ground or paving level. Mounding of the ground or paving shall not be allowed to achieve this requirement. No more than one extension of 18 inches maximum shall be allowed for grade adjustment. Hydrants shall have a barrel length of 4 feet to 6 feet unless approved by the Director of Public Works. All hydrants shall be surrounded by a concrete pad per the Standard Details.

5.7.2.G. Bollards shall only be used to protect fire hydrants in low speed areas where speed limit is 10 miles per hour or lower, such as around loading docks and in parking lots. Bollards are not a substitute for proper traffic flow layout and should only be used after options for relocation of the fire hydrant have proved infeasible. Bollards shall not be used in City ROW. Bollards that are installed shall meet the requirements of the Standard Details.

5.8. *Fittings*

5.8.1. *Joint Restraint* – All fittings shall be mechanically restrained using restrained fittings shown on the City's Approved Water Materials List in **Appendix B** (Approved Materials Lists) and meeting requirements of *ASTM F1674* (PVC) or *Underwriters Laboratories* (U.L.) *Standard 194* (Ductile Iron). Restraint gland and body wedge components shall be ductile iron material. Restrained lengths required beyond the fitting, valve, and other appurtenances shall be shown on the profile for water mains 12 inches and larger. For main diameters less than 12 inches, all joints within 15 feet of fitting shall be restrained.

5.8.2. *Concrete Blocking* – All fittings, valves, hydrants, and other appurtenances shall be blocked with 2,000 psi concrete, four-sack minimum cement content. All blocking shall be poured to avoid nuts and bolts to allow easy access for maintenance. Excessive blocking shall not be allowed and shall be removed at the contractor's expense. Sizing and construction of blocking shall be as shown in NCTCOG's current edition of the *Public Works Construction Standards*.

5.9. *Gate Valves and Butterfly Valves*

5.9.1. *General* – Gate valves are allowed for main sizes 4-inch through 36-inch. Manufacturers and models shall be in accordance with the City's Approved Water Materials List in **Appendix B** (Approved Materials Lists).

5.9.2. *Large Gate Valve Requirements* – 30-inch and larger gate valves require spur gearing and shall be placed within a vault.

5.9.3. Location

5.9.3.A. Valves shall be anchored to adjacent fittings at tee and cross fittings and on fire hydrant leads. Valves shall not be used at the dead end of mains as a plug. New mains shall start with a valve and end with a plug to avoid leakage when pressure testing.

5.9.3.B. A gate valve must be placed after the last service installed on the water main.

5.9.4. *Valve Orientation* – Valves shall be installed in the vertical direction. Horizontal orientations may be allowed if clearance requirements cannot be met with a vertical orientation. Horizontal valve orientation requires a special design to be submitted for review. Valves must be placed perpendicular to the existing/proposed ground elevation.

5.9.5. *Valve Ends* – In general, all in-line valves supplied shall have mechanical joint ends, unless otherwise specified.

5.9.6. Butterfly Valve Vaults and Manholes

5.9.6.A. Valves larger than 24-inch (I.D.) may be butterfly valves.

5.9.6.B. All butterfly valves 24-inch and larger with a gear box must be enclosed in manholes or vaults. The size of the manhole or vault lid shall be adequate to access and remove or service the valve, gear box, and sleeve from the enclosure. The valve must be installed with a sleeve to allow removal of the valve and must be mechanically thrust anchored with stainless all-thread or other approved system.

5.10. *Air Valve Assemblies*

5.10.1. *General* – In accordance with American Water Works Association (AWWA) standards and manuals of practice, combination air release/vacuum valves shall be installed in locations such to exhaust trapped air from the water distribution system. These locations include, but are not limited to, high points, the downstream side of mainline valves, increased downslopes or decreased upslopes, long ascents or descents, and the beginning and end of horizontal runs. Refer to *AWWA M51* for all suggested locations and sizing of combination air release/vacuum valves.

5.10.2. *Installation Requirements* – Combination air release/vacuum valves shall be installed in accordance with the Standard Details. Manufacturers and models shall be in accordance with the City's Approved Water Materials List in **Appendix B** (Approved Materials Lists).

5.11. *Blow-off Valve Assemblies*

5.11.1. *General* – Blow-off valves and vaults are required in the system to drain the mains and shall be placed at low points along transmission mains (16-inch and larger). Size of blow-up valve shall be determined by design engineer.

5.11.2. *2-inch Blow-off Valves* – For 2-inch blow-off valves, use fittings for a standard 2-inch service configuration.

5.12. *Water Services*

5.12.1. General

5.12.1.A. All water service lines and fittings shall be in accordance with the City's Approved Water Materials List in **Appendix B** (Approved Materials Lists).

5.12.1.B. Service line connections to water mains larger than 16-inch are not allowed unless approved by the Director of Public Works.

5.12.1.C. *Service Lines for Wide Paved Streets* – Spliced copper service lines are not permitted. To avoid pavement cut and repair issues, arterials shall require a double main system. Refer to **Section 2** (Roadway and Traffic Design Requirements) for classifications of arterials.

5.12.2. Meter and Service Location

5.12.2.A. Meters and services must be located within ROW or easements in accordance with City approved construction plans and details.

5.12.2.B. In residential developments, residential water meters and services are generally placed at the center of the lot in the grassed parkway. Water meters shall not be located in proposed driveways, sidewalks, parking lots, or other paved areas.

5.12.2.C. For narrow lots or front entry lots, the designer must review the location of the meters to make sure they are placed in an unpaved area. Meters in conflict with this requirement will be relocated by the developer/builder at their expense.

5.12.2.D. In non-single-family residential developments, water meters shall be located in unpaved islands.

5.12.3. *Meter Size* – Bullheaded, "split" ganged, or manifold meters are not allowed in lieu of a larger meter. The Director of Public Works may require meter sizing calculations in accordance with *the International Plumbing Code* or *AWWA Manual of Water Supply Practices M22 –Sizing Water Service Lines and Meters*.

5.12.4. *Maximum Number of Meters per Lot* – The maximum number of domestic meters per lot shall not exceed four without approval of Director of Public Works.

5.12.5. *Service Connections from Existing Lines* – Domestic water service taps shall be off a looped main. Domestic water service taps shall not be shared, split, or bullheaded with an irrigation tap and shall not tap to a fire hydrant lead or fire line. Irrigation meters may tap a fire hydrant lead, but hydrant lead must be sized to accommodate fire flow and irrigation. Utility contractor shall make the tap and install the service.

5.12.6. Use of existing water taps shall be governed by the following: Type K copper has been specified for water services in the City since the 1970's. However, materials and use of service saddles, corporation and angle stops have varied over the

years. In addition, Type K copper is susceptible to corrosion and leaks under certain conditions.

5.12.6.A. Any existing water services over 50-years old must be replaced.

5.12.6.B. For existing services less than 50-years old the Utility Division should verify:

- Condition of Existing Meter Box;
- Condition of Existing Meter Set including Angle Stop;
- Condition of Service, if there are any leaks apparent or suspected;
- Verify service is connected and active by opening the angle stop for a short time to verify flow;
- Verify if a meter is present, if so size and condition;
- Verify if the address has a current utility account; and,
- Any defects identified shall be noted and replacement of any defective or deteriorated water service parts noted on the Engineering Plans as a condition of development.

5.13. *Backflow Prevention*

5.13.1. *General* – As a condition of water service, all customers shall install, maintain, and operate their piping and plumbing systems in accordance with the City's *Plumbing Code, Division 5.5 – Control of Backflow and Cross-Connections*. Residential irrigation and non-residential service connections shall have a backflow prevention device to protect the public water system from cross contamination in accordance the most restrictive requirements set forth by *the Sachse City Code*, *Standard Details* and the *International Fire Code*.

5.13.2. *Circumstances Requiring Use of Backflow* – An approved backflow preventer shall be installed before the first branch line leading off the service line wherever the following conditions exist:

- When the nature and extent of any activity at a premise, or the materials used in connection with any activity at a premise, or materials stored at a premise, could contaminate or pollute the potable water supply;
- When a premise has one or more cross connections;
- When an auxiliary water supply that is not, or may not be, of safe bacteriological or chemical quality;
- When industrial fluids or any other objectionable substances are handled in such a fashion as to create an actual or potential hazard to the public water system. This shall include the handling of processed waters and waters originating from the utility system that have been subject to deterioration in quality;
- When internal cross connections are present that are not correctable; and/or,
- When intricate plumbing arrangements are present that make it impractical to ascertain whether cross connections exist.

5.13.3. *Location* – An approved backflow preventer shall be installed on each service line to a customer's system at or near the property line or immediately inside the building being served.

5.13.4. *Type of Backflow Preventer* – Any backflow prevention assembly that is required shall be an approved backflow assembly of a model and size approved by the Director of Public Works that has been manufactured in full conformance with the *AWWA C510-89 – Standard for Double Check Valve Backflow Prevention Assembly*, *AWWA C511-89 – Standard for Reduced-Pressure Principle Backflow Prevention Assembly*, and has met the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCHR) specifications of the *Manual of Cross-Connection Control*. The type of backflow preventer required shall depend upon the degree of hazard that exists as follows:

5.13.4.A. In the case of any premises where there is an auxiliary water supply and it is not subject to any of the following rules, the public water system shall be protected by an approved air-gap separation or an approved reduced-pressure backflow prevention assembly.

5.13.4.B. In the case of any premises where there is water or a substance that would be objectionable, but not a health hazard, if introduced into the public water system, an approved double check valve assembly shall protect the public water system.

5.13.4.C. In the case of any premises where there is any material dangerous to health that is handled in such a fashion as to create an actual or potential hazard to the public water system, the public water system shall be protected by an approved air-gap separation or an approved reduced-pressure backflow prevention assembly. Examples of premises where these conditions may exist include sewage treatment plants, sewage pumping stations, chemical manufacturing plants, hospitals, mortuaries, and plating plants.

5.13.4.D. In the case of any premises where there are "uncontrolled" cross connections, either actual or potential, the public water system shall be protected by an approved air-gap separation or an approved reduced-pressure backflow prevention assembly at the service connection.

5.13.4.E. In the case of any premises where, because of security requirements or other prohibitions or restrictions, it is impossible or impractical to make a complete in-plant cross connection survey, the public water system shall be protected by either an approved air-gap separation or an approved reduced-pressure backflow prevention assembly on each service to the premises.

5.13.4.F. In the case of any premises where, in the opinion of the Manager of Utilities, an undue health hazard exists because of the presence of extremely toxic substances, the Manager of Utilities may require an air-gap at the service connection to protect the public water system. This

requirement will be at the discretion of the city official and is dependent on the degree of hazard.

5.13.4.G. Refer to the City's *Backflow Prevention Assembly Installation Guide* for the backflow preventer assembly requirements for different pieces of equipment.

5.13.5. *Installation Requirements* – Backflow prevention assemblies shall be installed in accordance with the *Plumbing Code, City Code,* and the City's *Backflow Prevention Assembly Installation Guide.* The assembly installer shall obtain the required plumbing permits prior to installation and shall have the assembly inspected annually by a certified cross connection inspector as required by the *Plumbing Code.* Refer to the City's *Building Inspection Department Backflow Tester Registration Report* for a list of backflow assembly testers, registered with the City.

5.13.5.A. Assemblies shall not be installed under counters or behind equipment.

5.13.5.B. All assemblies shall be readily accessible with adequate room for maintenance and testing.

5.13.5.C. Assemblies shall be installed at a maximum height of 4 feet and a minimum of 1 foot from the floor.

5.14. *Underground Fire Sprinkler Systems*

5.14.1. *Fire Sprinkler and Remote Fire Department Connections* – A branch gate valve (tapping sleeve valve or cut-in tee) shall be installed to represent the demarcation between City and private maintenance responsibilities as shown in the Standard Details. Maintenance of the fire line from the downstream side of the branch gate valve on the City main to the building is the responsibility of the property owner and shall not be in a public easement.

5.14.2. *Below Grade Construction* – All below grade, up to 1 foot about building floor slab penetration construction must be reviewed, permitted and inspected through the Engineering Division. The construction plans must show fire lines up to a flange 1 foot above the building floor in the fire room. All interior piping above the flange connection, including backflow prevention and check valves, shall be permitted and inspected by the Fire Department. Any required backflow prevention devices shall be located on the riser in the fire room and not in an exterior vault. Refer to the Standard Details for typical applications.

5.14.3. *Other Requirements* – Design of the overall fire protection system shall be permitted through the Fire Department and meet requirements of *National Fire Protection Association (NFPA) Standard 13*. Refer to the *City of Sachse City Code* and *Texas Insurance Code Chapter 6003 – Fire Protection Sprinkler System Service and Installation*.

SECTION 6 SANITARY SEWER DESIGN REQUIREMENTS

Section Highlights

- Refer to **Section 4** (General Utilities Design Requirements) for compliance requirements, typical utility layouts, horizontal and vertical clearances, crossings, trenchless construction, and abandonments.
- The minimum sanitary sewer main size is 8 inches inside diameter (I.D.), per **Section 6.2** (Sizing Sanitary Sewer Mains).
- Refer to the Standard Details for typical sanitary sewer main, service line, and appurtenance locations.
- All sanitary sewer mains shall have a minimum cover of 5 feet from the top of pipe to the top of ground or proposed pavement top of curb, per **Section 6.3** (Horizontal Alignment and Vertical Alignment).
- Manholes are required at any 6-inch, or larger, residential or non-residential service line connection, per **Section 6.4** (Connections to Existing Sanitary Sewer Mains).
- Manholes shall be placed at all points of change in alignment, grade, size, material, or inside diameter of the sanitary sewer main. In addition, manholes shall be placed at an intersection of two or more sanitary sewer mains, at the end of the main (after the last service), and any locations required to provide accessibility for maintenance, per **Section 6.5** (Manholes).
- Refer to Table 6-2 for typical manhole spacing requirements and Table 6-3 for minimum manhole size and wall thickness.

6.1. *General* – Sanitary Sewer systems shall be designed in accordance with the Standard Details.

6.2. *Sizing Sanitary Sewer Mains*

6.2.1. *Standard Sizes* – New sanitary sewer mains shall consist of the following diameters (in inches): 8, 10, 12, 15, 18, 21, 24, 27, 30 and multiples of 6-inch thereon.

6.2.2. *Minimum Sanitary Sewer Main Size* – The minimum sanitary sewer main size is 8 inches I.D.

6.2.3. *Minimum Main Size Exception* – 6-inch diameter mains may be allowed if serving 16 or fewer single-family homes, and must be approved by the Director of Public Works.

6.2.4. *Minimum and Maximum Velocity* – Sanitary Sewer mains must obtain a minimum cleansing velocity of 2 feet per second with maximum design flows. Sanitary Sewer main maximum velocity shall not exceed 10 feet per second.

6.2.5. *Minimum and Maximum Slopes* – In accordance with the Texas Commission on Environmental Quality (TCEQ) requirements, maximum design flow velocity shall be determined using the Manning's Equation.

Manning's Equation

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

Where:

V = Velocity (feet per second)
n = Manning's roughness coefficient (n = 0.013)
R = Hydraulic radius of the conduit (R = A/P) (feet)
A = Cross section flow area (square feet)
P = Wetted perimeter (feet)
S = Slope (feet per foot)

6.2.6. Minimum and maximum slopes allowed for sanitary sewer mains, per *30 Texas Administrative Code (TAC) Chapter 217*, are shown in **Table 6-1**. Increasing the main diameter to obtain a flatter slope shall not be allowed unless the maximum design flows will fill the main greater than half-full.

Table 6-1. Minimum and Maximum Velocity and Slopes

Size of Main (inches)	Minimum Slope (percent)	Maximum Slope (percent)
6	0.50	12.35
8	0.33	8.40
10	0.25	6.23
12	0.20	4.88
15	0.15	3.62
Greater than 15	Use Manning's Equation.	

6.2.7. Sanitary Sewer Supply and Demand

6.2.7.A. Sanitary Sewer systems shall be sized and designed according to the current edition of the City's *Sanitary Sewer Collection System Master Plan* and Director of Public Works requirements.

6.2.7.B. Per the City's *Sanitary Sewer Collection System Master Plan,* the average load per person per day is 100 gallons.

6.2.8. *Sanitary Sewer Main Sizing* – Required size shall be determined by the Design Engineer and approved by the Director of Public Works after consulting the current edition of the City's *Sanitary Sewer Collection System Master Plan* and considering future extensions to serve the entire drainage basin. The Director of Public Works may require capacity calculations of the Developer to verify main sizing and adequate capacity prior to approval of the construction plans or building permits.

6.3. *Horizontal Alignment and Vertical Alignment*

6.3.1. *Horizontal Curves* – Horizontal curves shall be allowed as long as the curve does not exceed 50% of the manufacturers' recommendation for the pipe joint deflection. Manholes shall be located at the point of curvature (PC) and point of tangency (PT) of horizontal curves and have a maximum spacing of 300 feet on a curve. Vertical curves are not allowed. Horizontal curves shall be discouraged unless required and given approval by Director of Public Works.

6.3.2. *Vertical Drops Across Manholes* – To maintain proper flow, manholes for sanitary sewer mains 24-inch and smaller, and horizontal deflections of 15 degrees or larger, shall be designed with a 0.10 foot drop from the elevation of the inlet main to the outlet main.

6.3.3. Depth of Cover

6.3.3.A. The design engineer is responsible for insuring that sufficient depth and grade is maintained to serve all necessary tracts and parcels upstream in the drainage area. The design engineer shall also avoid excessive depths of cover. This is accomplished by calculating a 2% grade for the service line from the centerline of the collection main to the tract or parcel being served.

6.3.3.B. All sanitary sewer mains shall have a minimum cover of 3.5 feet from the top of pipe to the top of ground or proposed pavement top of curb. Any exception to minimum depths must be approved by the Director of Public Works.

6.3.4. *Deep Mains* – Sanitary Sewer service line connections are not permitted to new sanitary sewer mains exceeding 15 feet of cover as measured from the top of pipe to the top of the proposed ground or pavement top of curb. A parallel sanitary sewer main is required for sanitary sewer service line connections exceeding 15 feet in depth.

6.4. *Connections to Existing Sanitary Sewer Mains*

6.4.1. *Connections at a Manhole* – In accordance with TCEQ requirements, when connecting a proposed main to an existing main at a manhole, the preferred connection should have the elevation of the outfall main level with the top inside elevation of the proposed main.

6.4.2. *Manholes at Service Line Connections* – Manholes are required at any 6-inch, or larger, residential or non-residential service line connection.

6.4.3. *Manholes with Pipe of Different Sizes* – In manholes with pipes of different sizes (diameters), the tops of pipes shall be placed at the same elevation (soffit to soffit). Prior to connecting to the existing main, the new manhole and upstream pipe segment must pass inspection by the Director of Public Works.

6.4.4. *Service Line Connections* – Service line connections to sanitary sewer mains larger than 15-inches are not allowed unless approved by the Director of Public Works.

6.5. *Manholes*

6.5.1. *Manhole Locations* – Manholes shall be placed at all points of change in alignment, grade, size, material, or inside diameter of the sanitary sewer main. In addition, manholes shall be placed at an intersection of two or more sanitary sewer mains, at the end of the main (after the last service), and any locations required to provide accessibility for maintenance. Manholes shall not be located within a residential driveway or access point. Manhole location should not be within the wheel path. Manhole rings and covers should be designed so they do not project in to curb lines, sidewalks, retaining walls, guardrails, or other facilities sharing the same rights-of-way or easement.

6.5.2. *Manhole Spacing* – On sanitary sewer mains, the maximum distance between sanitary sewer manholes shall follow the requirements in **Table 6-2**.

Table 6-2. Maximum Manhole Spacing

Largest Main Size at Manhole	Maximum Manhole Spacing (feet)
6-inch to 15-inch	500
18-inch and larger	800

6.5.3. *Manhole Size and Type* – The minimum manhole diameter and wall thickness shall follow the requirements in **Table 6-3**.

Table 6-3. Manhole Size and Wall Thickness

Condition	Minimum Manhole Diameter	Minimum Wall Thickness
Depth of Manhole less than 15 feet (top of ring to flowline of lowest main) with the largest main entering the manhole less than 15 inches diameter	4 feet	5 inches Pre-Cast
		6 inches Cast-in-Place
Depth of Manhole greater than 15 feet (top of ring to flowline of lowest main) with the largest main entering the manhole less than 15 inches diameter	5 feet	6 inches Pre-Cast
		8 inches Cast-in-Place
All drop manholes (internal drop required) or any manhole with largest main entering 15 inches to 21 inches in diameter	5 feet	6 inches Pre-Cast
		8 inches Cast-in-Place
Manholes with largest main entering 24 inches to 30 inches in diameter	6 feet	8 inches
Larger or deeper mains and other special conditions and situations not covered by above requirements	As required by the Director of Public Works	As required by the Director of Public Works

6.5.4. *Drop Manholes* – Drop Manholes shall be installed if there is an incoming main with a vertical drop of more than 2 feet measured from flowline to flowline. All drop manholes shall be internal and conform to the Standard Details. Drop manholes shall have a minimum diameter of 5 feet. Existing manholes that have drops installed may terminate at the drop pipe at the invert ledge.

6.5.5. *Manhole Elevation* – The top of a manhole located within the 100-year floodplain shall have a minimum elevation of 1 foot above the ultimate 100-year water surface elevation. The tops of all other manholes shall be set to the grade of adjacent land or paving. Manholes shall have a concrete apron constructed at grade around all manholes in floodplain.

6.5.6. *Manhole at End of a Main* – In accordance with *30 TAC Chapter 217*, all sanitary sewer mains that may be extended at a future date, and laterals, shall end (highest point) with a manhole. The manhole should be placed after the last service.

6.5.7. *Connection Spacing* – To preserve the structural integrity of the manhole, all connections to manholes should provide a minimum 1-foot outside separation between sanitary sewer mains/service lines entering a manhole. All residential

service line connections to sanitary sewer mains must maintain a minimum 5-foot separation from the outside edge of any manhole.

6.6. *Special Requirements for Sanitary Sewer Service Lines*

6.6.1. *General* – Design of sanitary sewer service lines should follow the same design procedures as those outlined for mains, except that the information required is reduced in complexity to conform to the reduced function of a service line.

6.6.2. *Connections to a Manhole* – All sanitary sewer service lines that are 6 inches or larger shall connect to a manhole on the sanitary sewer main. Service lines from single-family residences shall not connect to a manhole and shall connect to sanitary sewer main a minimum of 5 feet from the wall of the manhole.

6.6.3. *Private Sanitary Sewer Services* – Private sanitary sewer service lines shall be designed, permitted and inspected per the *International Plumbing Code*. Typically, private systems are permitted and inspected by the City Building Inspection Division. Delineate on the sanitary sewer plan and profile which segments will be City maintained and which segments will be maintained by the private property owner.

6.6.4. *Single-Family Residential Service Line Size* – 4-inch minimum diameter service lines are required for all single-family residential services. Each residence shall be served by an individual service.

6.6.5. *Service Line Location* – Service lines shall be located 10 feet downstream of the water service for the lot (water service generally to be located at the centerline of the lot), and plugged for suitable testing.

6.6.6. Service Line Depth of Cover

6.6.6.A. All sanitary sewer services are to have a minimum cover of 3 feet and a maximum cover of 5 feet as measured at the property line or easement line from the proposed grade to top of pipe.

6.6.6.B. In general, the minimum depth for a sanitary sewer main to serve given property with a 4-inch service line shall be 3 feet plus 2% times the length of the service line to the middle of the structure. Services that are longer than 100 feet from the main and larger buildings may require a deeper service line and may request an exemption by the Director of Public Works from the maximum cover requirements.

6.6.7. Use of existing sanitary sewer taps shall be governed by the following:

6.6.7.A. Existing taps made **prior to 1975** are likely CI or VCP and must be replaced.

6.6.7.B. Taps made in **1975 and later** request the Public Works Department to make a TV inspection to determine both material and condition. If TV inspection indicates material is anything other than PVC, replacement shall be required. If TV inspection indicates any defects in the service (pipe out of round, cracks, offset joints, roots, etc.) replacement shall be required.

6.7. *Cleanouts* – When required by the City, show cleanouts on the construction plans at the property line in accordance with the Standard Details.

6.8. *Inverted Siphons*

6.8.1. An inverted siphon can be designed to a portion of a sanitary sewer main which dips below the hydraulic grade line to avoid any obstructions including, but not limited to a drainage structure, utility, tunnel, or stream. Inverted siphons should be avoided and shall only be considered where all other design alternatives have been evaluated and avoidance or adjustment of the obstructing utility or structure is not feasible, as determined by the Director of Public Works.

6.8.2. *Siphon Design* – When allowed, a siphon must be designed in accordance with TCEQ requirements, and include the following:

- Two or more barrels;
- Minimum 8-inch diameter main;
- Two manholes with adequate clearance for cleaning with a flushing truck;
- Sufficient head to achieve a velocity of at least 3 feet per second at initial and design flows. The arrangement of inlet and outlet works must divert the normal flow to one barrel and designed such that any barrel can be taken out of service for cleaning;
- Provisions to allow cleaning across each bend with equipment available to the entity in charge of operation and maintenance of the facility; and,
- A design that minimizes nuisance odors.

6.9. *Odor Control Units* – The Director of Public Works may require the installation of odor control units at force mains, lift stations, and inverted siphons. Odor control units must be designed in accordance with requirements as determined by the Director of Public Works and be compatible with existing odor control units within the City.

6.10. *Pre-Treatment*

6.10.1. *General* – Pre-treatment shall meet all requirements and be designed in accordance with the *Sachse City Code, as amended*. The following sections are excerpts from the *Sachse City Code* related to design and regulatory requirements. It is the responsibility of the Engineer to refer to the *Sachse City Code* for current requirements.

6.10.2. *Compliance with Federal Authority* – Industrial users within the City shall comply with all National Categorical Pretreatment Regulations and with those National Categorical Pretreatment Standards applicable to each use type as specified in *40 CFR Subchapter N, Parts 405—471.*

6.10.3. Pre-Treatment Requirements

6.10.3.A. Industrial users shall provide necessary sanitary sewer treatment as required to comply with the National Categorical Pre-Treatment Standards, and any state or federal pretreatment regulation. Any facilities required to pretreat sanitary sewer to a level acceptable to the City shall be provided, operated and maintained at the user's expense. The City may require the development of a compliance schedule by

each industrial user for the installation of technology required to meet applicable pretreatment standards and requirements.

6.10.3.B. Before beginning construction of pre-treatment facilities, the user shall submit detailed plans and operating procedures for the facility to the Building Inspection Division for review and approval. The review and approval of such plans and procedures will in no way relieve the user from the responsibility of modifying the facility as necessary to produce an effluent acceptable to the City under the provisions of this division.

6.10.3.C. All industrial users shall promptly notify the Manager of Utilities in advance of any substantial change in the volume or character of pollutants in their discharge.

6.10.3.D. All records relating to compliance with the pretreatment standards shall be made available to officials of the City, State, or Environmental Protection Agency upon request.

6.10.3.E. The determination of the character and concentration of industrial sanitary sewer shall be made by the environmental officer at such times and on such schedules as he or she may establish.

6.10.4. Discharges Requiring Traps

6.10.4.A. Discharges requiring a trap include any non-residential establishment discharging the following:

- Grease or water containing grease;
- Oil;
- Sand;
- Flammable wastes; and/or,
- Other harmful substances.

6.10.4.B. Any person responsible for discharges requiring a trap shall at their own expense and as required by the environmental officer:

- Provide equipment and facilities of a type and capacity approved by the Director of Public Works;
- Locate the trap in a manner that provides ready and easy accessibility for cleaning and inspection; and,
- Maintain the trap in effective and operating condition.

6.11. *On-Site Sewage Facilities (OSSFs)*

6.11.1. *Connection to City Facilities* – Developments shall be required to have approved sanitary sewer facilities and shall be required to connect to the City's sanitary sewer facilities in accordance with *Sachse City Code,* unless alternative systems have been approved by the Director of Public Works.

6.11.2. *Alternative System Requirements* – Alternative systems, such as on-site sewage facilities, shall be designed and operated in strict compliance with all applicable permits, ordinances, regulatory guidance and regulations including the Environmental Protection Agency (EPA), TCEQ, Texas Department of State

Health Services, Dallas or Collin County, and the City. All OSSFs shall be designed strictly in accordance with *30 TAC Chapter 285* as approved by the appropriate permitting authority on a case-by-case basis.

6.11.2.A. On-site sewage facilities are permitted through TCEQ and/or the County if TCEQ has delegated authority.

6.11.2.B. On-site sewage facilities shall only be considered when all the following conditions are met:

- Single family residential development
- Lot greater than one-half acre or large enough to accommodate a duplicate system, whichever is greater.
- Property line does not extend to within one hundred (100) feet in horizontal distance to an organized disposal system or to within one hundred (100) feet of a proposed extension of an organized disposal system when the proposed extension is planned for construction within one (1) year
- No part of any private sewerage facility shall be installed or generated within a minimum horizontal distance of ten (10) feet from any property line or public road. Greater distances may be required based on results of percolation tests.

6.12. *Sanitary Sewer Lift Stations*

6.12.1. It is the intent of the City to provide sanitary sewer service by main extensions. In the rare occasion that a sanitary sewer main extension is not a feasible service alternative, the City may require design and construction of a lift station and force main to serve a development. Lift stations and force mains are discouraged due to their higher risk of causing a sanitary sewer overflow and increased maintenance costs. If service by a gravity sanitary sewer main and all other design alternatives have been evaluated and determined to be unfeasible by the Director of Public Works, lift stations and force mains shall be designed with the criteria described in the following sections.

6.12.2. *Design Considerations* – Lift stations and force mains must be designed in accordance with TCEQ requirements and requirements as determined by the Director of Public Works. The following shall be considered in the design of a lift station:

- Site selection;
- Wet well and valve vault design;
- Pumps, lift station piping, and valves;
- Force mains;
- Electrical requirements; and,
- Emergency provisions.

6.12.3. *Emergency Provisions* – In accordance with *30 TAC Chapter 217*, a lift station must include an audiovisual alarm system. The audiovisual alarm system must transmit alarm conditions through use of an auto-dialer system, Supervisory Control and Data Acquisition (SCADA) system, or telemetering system connected to a continuously monitored location. At a minimum, the alarm system must automatically activate to give warnings for power outages, pump failures, and high water levels. Audiovisual alarms are not required if the SCADA system alerts the operator about communication loss, in addition to the alarm conditions.

SECTION 7 STRUCTURAL DESIGN REQUIREMENTS

Section Highlights

- Retaining walls 4 feet in height or greater (measured from top of footing to top of wall along the front face) require structural design.
- Projects with retaining walls from 2 feet up to 4 feet in height or any wall supporting structures, such as parking areas, drive isles, screening walls, fences, handrails, or other surcharges shall include details in the construction plans.
- Retaining wall structural calculations shall be submitted with the plans if the retaining wall is 4 feet in height or greater. Calculations shall be submitted for any retaining wall (regardless of height) under unusual circumstances, such as live loading or other surcharges. Calculations shall be signed and sealed by a licensed professional in accordance with this section. Geotechnical investigations used in the calculations shall also be submitted.
- If a retaining wall has a drop off height greater than 30 inches within 3 feet horizontal of a walking surface, a guardrail or handrail detail shall be included in the construction plans. If a screening wall or handrail is either attached to or in the proximity of the retaining wall, the structural calculations shall reflect the appropriate loads and the construction details shall show the connection between the two.
- For commercial and multi-family applications, all walls will require an engineering design regardless of height.
- Screening walls must be precast and in accordance with **Section 7.8** (Screening Walls).

7.1. *General*

7.1.1. Responsibility

7.1.1.A. The Engineer shall bear the sole responsibility for meeting the engineering standard of care for all aspects of the design and providing a design that's required by the site-specific conditions and intended use of the facilities.

7.1.1.B. The structural design must be signed and sealed by a Professional Engineer competent in structural engineering licensed in the State of Texas. The Engineer is responsible for all engineering and recognizes that specific site circumstances or conditions may require improvements that exceed minimum standards contained in the *Engineering Design Manual*. The Engineer is responsible for evaluating and applying appropriate standards and specifications.

7.1.1.C. The Engineer shall rely on the geotechnical investigation recommendations as minimum design criteria. If in the Engineer's judgment, the structural design needs to be based upon more conservative geotechnical design criteria, the Engineer shall provide the more conservative design.

7.1.2. *Structures* – For this section of the *Engineering Design Manual*, structures shall include the following items, but not be limited to: bridges, foundations, retaining walls, screening walls, headwalls and wingwalls, culverts, slopes and

embankments, creek and channel structures, elevated (aerial) crossings, and other civil structures.

7.1.3. *Temporary Shoring* – Temporary shoring must be provided as applicable to protect adjacent infrastructure during construction. Infrastructure is defined as structures, pavement, utilities, hardscaping, or any other structure or facility. Design calculations and details sealed by a Professional Engineer licensed in the State of Texas shall be submitted to the City and filed for record purposes before constructing the shoring.

7.1.4. *Right-of-Way* – All elements of structures including foundations, walls, slabs, beams, etc. shall not extend inside the City's public ROW.

7.1.5. *Inspections* – Inspections of structures shall be performed in accordance with this section. Inspection for structures not performed directly by the City shall be performed by a third-party and include a letter signed and sealed by a qualified Professional Engineer licensed in the State of Texas stating that the structure was constructed in general compliance with the City-approved construction plans and specifications. Any structure outside the public ROW and any structure constructed with non-City funds whether inside or outside the public ROW, shall require third-party inspection.

7.1.5.A. Non-Bridge Construction Inspection

7.1.5.A.i. Inspections of non-bridge structures shall be performed during construction and reports provided to the City. The inspections and reports shall be performed at the following stages of construction (at a minimum):

- Subgrade/Foundation preparation – including but not limited to slabs, strips, and drilled shaft foundations prior to concrete placement;
- Formwork – including but not limited to formwork for footings, walls, slabs, and other elements requiring formwork prior to concrete placement;
- Reinforcing placement;
- Drainage system construction (if applicable);
- Concrete/Masonry/Mortar placement; and,
- Completion – post concrete placement.

7.1.5.A.ii. Third-party inspector shall verify and document that construction inspections were performed at the prescribed stages of construction. The inspection reports and final certificate of compliance shall be submitted to the City and include the following:

- Specific reference to the City-approved construction plans and specifications;
- Specific reference to the address and/or legal description for the construction location;

- Specific reference to the name and date of the project-specific geotechnical engineering report; and,
- A letter signed and sealed by a Licensed Professional Engineer in the State of Texas, that includes a statement that the structure was constructed in general compliance with the geotechnical design criteria identified in the construction plans and specifications and the City-approved construction plans and specifications.

7.1.5.B. Bridge Construction Inspection

7.1.5.B.i. Third-party inspector shall verify and document that bridge construction inspections were performed at the prescribed stages of construction.

7.1.5.B.ii. The inspection reports and final compliance documentation shall be submitted to the City.

7.1.6. *TxDOT Standard Sheets* – If TxDOT standard sheets pertaining to structures are utilized, the Engineer shall ensure the loading, geometry, and allowable soil pressures are applicable to the standard design selected. The Engineer shall ensure that interruptions to the structure (i.e., wall stem or footing reinforcement altered by openings, utilities, geometric changes, or curved sections of the wall) do not compromise the design and performance of the structure. Consideration shall be given to the site-specific geotechnical requirements and whether a TxDOT standard design is applicable. No TxDOT standard sheets shall be modified unless the Engineer designs, draws, signs, and seals the modified standard. If TxDOT standard sheets are not applicable, a custom structural design shall be provided. Engineer shall provide design calculations validating that TxDOT details used are applicable.

7.1.7. *Aesthetics* – Aesthetic treatments of structures within the ROW or City-owned facilities are required and shall complement the surrounding features. Aesthetic treatments shall not interfere with the functionality of the structure. Engineer shall consider any potential negative impacts resulting from the structure's drainage system design. Aesthetic treatments of handrails and guardrails shall comply with all Local, State, and Federal requirements. Aesthetic treatments shall also comply with the City's *Comprehensive Plan* and *Community Appearance Manual*.

7.1.8. *Corrosive Conditions* – Salts, chlorides, and sulfates can be detrimental to foundations and concrete at grade. Where these conditions exist, the Engineer shall take preventative measures. Use sulfate-resistant concrete for structures, as applicable or other approved methods.

7.1.9. Structural Plan Requirements

7.1.9.A. Construction plans and specifications shall be prepared and submitted to the Director of Public Works in accordance with **Section 1.7** (Submittal Requirements for Construction Plans).

7.1.9.B. Calculations pertinent to the design of all structures shall be submitted to the City along with the construction plans and will be filed for record purposes by the City. The Engineer remains responsible for the design of the structure(s).

7.2. *Code Requirements*

7.2.1. At a minimum, all structures shall be designed using the current standards as adopted by the City and shall meet all applicable Local, State, and Federal standards. For other standards not adopted by the City, the current version of that standard shall be utilized.

7.2.2. The design and construction of roadway bridges and bridge-class culverts shall be provided in accordance with the requirements of the AASHTO's current edition of the *Standard Specifications for Highway Bridges* and supplemented using TxDOT standards and guidelines as applicable.

7.2.3. Specifications for bridge construction shall be in accordance with TxDOT's current edition of *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*.

7.2.4. All bridge railing shall be in accordance with TxDOT's current edition of the *Bridge Railing Manual* and shall meet the specifications outlined in AASHTO's current edition of the *Manual for Assessing Safety Hardware (MASH)* and the *National Cooperative Highway Research Program (NCHRP) Report 350*. All railing shall be appropriately rated railing based on site and design conditions. Guardrail, end treatments, or other features associated with bridge construction shall be in accordance with AASHTO's current edition of the *Policy on Geometric Design of Highways and Streets*, AASHTO's current edition of *Roadside Design Guide*, and current TxDOT standards. All bridge railing shall meet applicable sight distance requirements.

7.2.5. For all bridges and bridge-class culverts adjacent to or in conjunction with roadways, sight visibility exhibits shall be submitted to the City for review and approval in accordance with **Section 2.4** (Sight Visibility).

7.2.6. More stringent requirements shall be utilized as required for unusual designs such as rehabilitations, reconstructions, or for unusual site conditions. The codes cannot replace sound engineering knowledge, experience, and judgment.

7.2.7. For any structure, the City or the Engineer may require the quality of materials and construction to be higher than the minimum requirements as stated in the codes based on structure usage or site conditions.

7.3. *Excavation Support*

7.3.1. Trench excavation protection shall be used for the installation of linear drainage or utility facilities that result in trenches deeper than 5 feet. Such trench protection includes vertical or sloped cuts, benches, shields, support systems, or other systems providing the necessary protection in accordance with Occupational Safety Heath Administration's (OSHA) current *Standards and Interpretations, 29 CFR 1926, Subpart P (Excavations)*. The Contractor must submit to the City, for informational purposes only, the design calculations and details sealed by a Professional Engineer licensed in the State of Texas before constructing the shoring. The design of the shoring must provide protection in accordance with OSHA's current Standards and Interpretations, 29 CFR 1926, Subpart P, Excavations.

7.3.2. Temporary shoring (including trench excavation discussed in **Section 7.3.1** above) shall be used for installations of walls, footings, and other structures that

require excavations deeper than 5 feet. Temporary shoring shall be designed and constructed to hold the surrounding earth, water, or both out of the work area. Options may include, but not be limited to, vertical or sloped cuts, benches, shields, support systems, or other systems to provide the necessary protection in accordance with the approved design. Unless a complete design for temporary shoring systems are included in the construction plans, the Contractor is responsible for the design of the temporary shoring system. The Contractor must submit to the City, for informational purposes only, the design calculations and details sealed by a Professional Engineer licensed in the State of Texas before constructing the shoring. The design of the shoring must provide protection in accordance with OSHA's current *Standards and Interpretations, 29 CFR 1926, Subpart P (Excavations).*

7.4. *Geotechnical Performance Specifications*

7.4.1. Field investigation, geotechnical testing, and geotechnical engineering shall be performed in accordance with the standard of care considering local experience and conditions. The geotechnical recommendations shall establish the minimum design criteria upon which the Engineer can rely.

7.4.2. A ROW Permit must be obtained prior to performing any boring within the City's ROW.

7.4.3. The complexity of geological conditions and the type, length, and width of the structure shall determine the number and locations of test holes required. The following should be considered by the Engineer in coordination with the Geotechnical Engineer:

- Depth of test hole;
- Location of proposed grade relative to existing grade;
- Location of groundwater;
- Channel relocations and/or channel widening;
- Scour;
- Foundation loads; and,
- Foundation types.

7.4.4. Test holes shall be located in an accessible area. Identify test hole locations on the construction plans.

7.4.5. Provide a complete soil and bedrock classification and log record for each test hole, including all pertinent information to complete the standard log. Location and surface elevation shall be shown on the boring logs.

7.4.6. Perform the appropriate field and laboratory tests necessary to determine the soil properties for geotechnical design criteria. The Geotechnical Engineer shall consider both the short-term and long-term conditions.

7.4.7. Ground water elevations shall be included as part of the data acquisition. Site conditions may require the installation of piezometers to establish a true groundwater surface elevation and a method of monitoring water surface fluctuations.

7.4.8. *Boring Requirements* – Minimum boring requirements are specified below. Based on the Geotechnical Engineer's experience and engineering judgment, if competent rock is encountered, the minimum boring depths specified below may be reduced with approval from the Director of Public Works.

7.4.8.A. *Slopes and Embankments including Bridge Approaches* – Obtain soil borings for cuts greater than 10 feet or embankments taller than 10 feet. The exploration shall include the following:

7.4.8.A.i. *The Soil Under Future Embankments* – Advance borings to a depth at least equal to the embankment height or 20 feet, whichever is greater, unless a greater depth is recommended by the Geotechnical Engineer.

7.4.8.A.ii. *Soil in Proposed Cuts* – Advance borings to a depth of at least 15 feet below the bottom of the proposed cut, unless a greater depth is recommended by the Geotechnical Engineer.

7.4.8.B. Bridges

7.4.8.B.i. In general, drill test holes shall penetrate a minimum of 15 feet into proposed bearing strata. Where depth of bearing strata becomes impractical, the Director of Public Works may determine minimum bore depth.

7.4.8.B.ii. Test holes shall be drilled near each abutment and bent location of the proposed structure plus a sufficient number of intermediate holes to determine depth and location of all significant soil and rock strata.

7.4.8.B.iii. A site inspection by the driller or logger shall be performed to evaluate site accessibility and special equipment needs.

7.4.8.B.iv. *Grade Separations* – If the borings indicate soft surface soils (fewer than 10 blows per foot), additional borings and testing shall be required for the design of the bridge approach embankments.

7.4.8.C. *Retaining Walls* – Obtain soil borings for walls taller than 4 feet. Soil borings shall also be obtained for any retaining wall (regardless of height) under unusual circumstances, such as live loading or other surcharges.

7.4.8.C.i. *Minimum Number/Spacing* – Obtain a minimum of two soil borings within limits of wall footprint. For walls longer than 200 feet, borings shall be obtained at a maximum spacing of 200 feet unless site conditions or the Engineer requires alternate spacing. A greater spacing may be allowed by the Director of Public Works only if recommended in writing by the Geotechnical Engineer.

7.4.8.C.ii. *Fill Walls* – For spread footing walls and Mechanically Stabilized Earth (MSE) walls, the depth of the boring shall be at least equal to the wall height depending on the wall type. The minimum boring depth is 10 feet below the bottom of the

proposed wall unless rock is encountered (see **Section 7.4.8**). Extend borings at least 5 feet into rock for fill walls unless additional depth is recommended by the Geotechnical Engineer.

7.4.8.C.iii. *Cut Walls* – For drilled shaft walls, tied-back walls, and soil and rock nail walls, the depth of the boring shall be based on the proposed ground line. Cantilever drilled shaft walls require the depth of boring to extend to the anticipated depth of the shaft below the cut, which is typically between one and two times the wall height unless additional depth is recommended by the Geotechnical Engineer. Borings for soil nails, tiebacks, and rock nailed walls shall be advanced through the material that is to be nailed. The minimum boring depth is 15 feet below the bottom of the proposed wall. Borings for proposed cut walls may need to penetrate bearing strata significant distances depending on the depth of the cut and wall height.

7.4.8.C.iv. *Additional Testing/Modeling* – Additional testing and modeling shall be provided for taller walls, walls on slopes, or walls on soft founding strata as necessary or as recommended by the Geotechnical Engineer to completely evaluate wall stability.

7.5. *Bridges*

7.5.1. The Engineer shall be responsible for selecting the appropriate bridge foundation. The Engineer shall consider the following factors in that selection:

7.5.1.A. *Design Load* – The magnitude of the design load and existing geotechnical conditions dictate the required size of the foundation.

7.5.1.B. *Geotechnical Engineering Recommendations* – The strength and depth of subsurface formations determine the type of foundation chosen. In general, drilled shafts are well suited to areas with competent soil and rock, and are the preferred foundation type subject to concurrence from the Geotechnical Engineer. Alternative foundation types require approval in writing from the Director of Public Works.

7.5.2. Disregard surface soil in the design of drilled shaft foundations. The discounted depth is the amount of surface soil that is not included in the design of the foundation due to potential erosion from scour, future excavation, seasonal moisture variation (shrinkage and swelling), lateral migration of waterways, disturbed material or fill, and recommendations of the geotechnical investigation.

7.5.3. Drilled shaft capacity relies upon penetrating a specific stratum a specified depth. The construction plans shall provide a note instructing the contractor and field personnel of the penetration requirement. The construction plans shall identify the specific type of material to be penetrated and the minimum penetration depth. The plan may allow for the drilled shaft to be shortened if the founding stratum is encountered at a shallower depth, and it requires the shaft to be lengthened if the founding stratum is not encountered at the expected elevation.

7.5.4. When the founding stratum is present at or near the surface, the Engineer shall consider the load-carrying capacity along with the stability of the superstructure on the foundation. For these conditions, a minimum drilled shaft length shall be specified on the construction plans and the drilled shaft will not be allowed to be shortened from plan length, but it may be lengthened if the founding stratum is not encountered at the expected elevation.

- For evaluating scour, TxDOT guidelines in *Evaluating Scour at Bridges (HEC-18)* shall be used.
- Bridge foundation scour analysis is required. However, abutments shall be protected against potential scour through use of flexible revetment, where possible or hard armoring.
- Design bridge foundations to withstand the scour depths for either the fully developed 100-year flood or smaller flood if it will cause scour depths deeper than the fully developed 100-year flood as described in **Section 3.6** (Floodplain Alterations).
- Check the bridge foundations against the scour depth associated with the 500-year flood as described in **Section 3.6** (Floodplain Alterations). This flood event is considered an extreme event and the factor of safety on the bridge foundations shall be greater than or equal to 1.

7.5.5. *Railing* – In addition to the requirements in **Section 7.2.4**, the following bridge railing criteria shall be met:

7.5.5.A. The face of railing shall be a minimum of 2 feet beyond edge of outside travel lane.

7.5.5.B. Separation rails shall be provided on all Major and Minor Arterial bridges. Separation rails shall not be required on Collectors or Local streets, or on culverts where the sidewalk is not located adjacent to the back of curb.

7.5.5.C. *Concrete Rail Finish* – Formline all vertical surfaces where aesthetic conditions apply with an Ashlar Stone or approved equal pattern. Stain and color(s) shall be approved by the Director of Public Works. Formliners shall meet the requirements as described in **Section 7.2.4**.

7.5.5.D. *Steel Rail Finish* – All rail surfaces shall be powder-coated. Color shall be approved by the Director of Public Works.

7.5.6. *Pedestrian Bridges* – Pedestrian bridges shall be designed in accordance with AASHTO's current edition of the *LRFD Guide Specifications for the Design of Pedestrian Bridges* and AASHTO's current edition of *Guide for the Development of Bicycle and Pedestrian Facilities,* and shall meet the following additional criteria:

7.5.6.A. *Design Requirements* – Refer to **Section 2.9** (Pedestrian Facilities) for applicable design requirements.

7.5.6.B. *Loading* – Design loads shall be in accordance with the applicable codes outlined in this section and shall include, but not be limited to, construction loads, surcharge loads, slopes, wind, stream loads, and

other structures. Loading shall conform to the specified use (i.e., bicycle, pedestrian, emergency vehicle traffic, and/or maintenance vehicle traffic).

7.5.6.C. *Construction Plans* – Cast-in-place bridge foundations shall be designed for a specified pre-cast bridge structure. The foundation plans and shop drawings for the pre-cast bridge structure shall be submitted for review and approval.

7.5.6.D. *Hydraulics* – Refer to **Section 3.6** (Floodplain Alterations) for design flood, freeboard, and flood study requirements associated with pedestrian bridge design.

7.5.6.E. *Maintenance* – Maintenance considerations of railing for pedestrian bridges that do not contain the fully developed 100-year flood with freeboard in accordance with **Section 3.2** (Design Discharge) shall be specified in the construction plans.

7.6. *Retaining Walls*

7.6.1. The Engineer is responsible for ensuring that the type of retaining wall selected for a given location is appropriate. The retaining wall selection process shall consider the following:

7.6.1.A. Height

7.6.1.A.i. Walls shall be measured from the top of wall footing to the top of the wall (not the top of the retained fill). An engineered design by a licensed Texas Professional Engineer is required for all walls 4 feet in height or greater (designed to ensure stability against overturning, sliding, bearing failure, excessive differential movement, and water uplift). For commercial and multi-family applications, all walls require an engineering design regardless of height.

7.6.1.A.ii. For a wall that has a variable height where part of the wall is under 4 feet and part of the wall is over 4 feet, an engineering design will be necessary for the entire wall.

7.6.1.A.iii. Factors of safety for design shall be as described in the current edition of the *International Building Code (IBC)* and *International Residential Code (IRC)* adopted by the City but at a minimum shall meet the following:

- Overturning: 2.0;
- Sliding: 1.5; and,
- Bearing: 2.0.

7.6.1.A.iv. If any wall has embedded posts, poles, or other structures anchored directly into the wall structure, wall design must also take into consideration the additional loadings due to these structures (axial, lateral, and wind). The structural design shall be provided in accordance with the geotechnical recommendations and minimum design criteria provided herein.

7.6.1.B. *Geometry* – Determine applicability of wall type – cut, cut/fill, or fill – based on geometry, site constraints, existing and proposed topography, and wall alignment and location. Identify available ROW and any necessary ROW or easements to accommodate the proposed improvements and the access necessary to accommodate access for maintenance. Identify location and type of existing and proposed utilities and drainage structures.

7.6.1.C. *Economics* – Evaluate the total installed cost of the wall and consider long-term maintenance requirements. Identify necessary excavation requirements (including shoring), required utility adjustments and costs, project schedule, construction phasing requirements, and these effects on the wall design and construction.

7.6.1.D. *Global Stability* – The Engineer is responsible for the global stability design of the wall. Evaluate all walls to ensure that the minimum applicable factors of safety are met, if not exceeded depending on the Engineer's judgment. Walls shall not be placed on slopes if avoidable.

7.6.1.E. *Passive Resistance to Sliding* – The Engineer shall follow the Geotechnical Engineer's guidance for use of passive resistance. If there is a slope in front of the wall, passive resistance shall be neglected.

7.6.1.F. *Constructability* – Determine whether walls are near water or subject to inundation or groundwater. Identify access limitations for equipment both during and after construction. Ensure adequate horizontal and vertical clearances are provided.

7.6.1.G. *Drainage* – Design the wall to prevent the build-up of hydrostatic pressure behind the wall. If conditions warrant, such as but not limited to, the inability to include a drainage system or situations of rapid drawdown, the City may require the wall design to withstand full hydrostatic pressure load. The wall design shall consider potential deleterious short- and long-term effects of water inundation including scour and rapid draw down.

7.6.1.H. *Loading* – Design loads shall be in accordance with the *Engineering Design Manual*, including construction loads and surcharge loads from slopes, structures, and vehicles.

7.6.2. Analyze and design walls following accepted geotechnical engineering industry standards for the area and in accordance with the *Engineering Design Manual*. In analysis, use earth pressures that follow the requirements of the project's geotechnical investigation specifically addressing the retaining wall design requirements for the project's specific location.

7.6.3. The Engineer must ensure that the retaining wall system is appropriate for its location and application. The Engineer shall design for all potential modes of wall system failure; including sliding, overturning, bearing pressure, global stability, and structural capacity of the wall itself. Placement of walls adjacent to roadways must comply with AASHTO's current edition *Roadside Design Guide* unless otherwise approved by the Director of Public Works.

7.6.4. Perched walls shall not be placed on slopes steeper than 8H:1V. When walls must be placed on slopes, or the retaining wall height or the combined wall and slope heights exceed 8 feet, the Geotechnical Engineer shall conduct a short-

term and long-term global stability analysis using applicable soil strength characteristics, geometry, and loading conditions (including load surcharge and hydrostatic). The Engineer is responsible for the design of the wall system, including its global stability.

7.6.5. Perched walls shall be analyzed as both independent structures and as a single unit for all design parameters.

7.6.6. If fences will be installed on top of walls, connection details must be included in the construction plans and taken into account during design as a part of the calculation package.

7.6.7. Retaining walls adjacent to bike trails must have at least a 2-foot setback/clear zone in accordance with the City's *Trails Master Plan*.

7.6.8. Tree placement within the zone of influence of a retaining wall shall be avoided. Any trees placed within zone of influence must be addressed in the structural design of the wall and submitted as a part of the calculation package.

7.6.9. Swimming pools, pergolas, and other structures placed within the zone of influence of a retaining wall shall be avoided. Any of these placed within the zone of influence must be addressed in the structural design of the wall and submitted as a part of the calculation package.

7.7. *Slope Stability*

7.7.1. All slopes exceeding 8 feet in height with a steepness of 4H:1V or greater, regardless of soil type, cut, or fill, shall be evaluated for global stability for both the short-term and the long-term conditions. Additionally, any known areas of existing fill, deleterious material, or soft soils which have a height over 4 feet or slope angle greater than 6H:1V shall be evaluated for global stability for both the short-term and the long-term conditions. Specific site conditions may require evaluation for additional types of slope failure, such as bearing capacity, settlement, shear, and undercutting. Calculations pertinent to the analysis shall be submitted with the construction plans when required by the City.

7.7.2. For global stability of a slope, minimum factors of safety must be met for long-term and short-term stability.

7.8. *Screening Walls*

7.8.1. General

7.8.1.A. All screening walls in the City and within its Extraterritorial Jurisdiction (ETJ), both privately and publicly maintained, shall be designed and constructed in accordance with this section.

7.8.1.B. The purpose of these standards is to provide design and construction standards for long-span precast concrete decorative screening walls that are extremely durable with extended service life, economical to maintain, and aesthetically pleasing.

7.8.1.C. These standards are minimum design, construction, and maintenance standards. All construction plans and specifications submitted for permit and construction shall be signed and sealed by a Professional Engineer licensed in the State of Texas. All construction plans and specifications submitted for permit shall be accompanied by supporting design

calculations, assumptions, code references, and sketches clearly notated for ease of review by the Director of Public Works. Submitted supporting design calculations, assumptions, and sketches shall be signed and sealed by a Professional Engineer in accordance with the Texas Engineering Practice Act and Rules.

7.8.1.D. All screening walls and associated structural elements such as columns, piers, and pier caps shall be designed and constructed in accordance with the current edition of *ASCE 7-10* and *ACI 318: Building Code Requirements for Reinforced Concrete*. In addition, the minimum design wind speed shall be 130 miles per hour (mph) with the equivalent velocity pressure of 31.23 pounds per square foot (PSF).

7.8.1.E. Screening walls shall be located, designed, constructed, and maintained in compliance with the requirements of *Sachse City Code, as amended,* and specific development ordinances and agreements applicable to the property where the wall is being constructed.

7.8.1.F. Screening walls shall be designed, constructed, and maintained in compliance with **Section 2.4** (Sight Visibility).

7.8.1.G. Whenever screening walls are located on public ROW, easement, or other publicly owned property, the perpetual maintenance shall be assured by a viable property owners association, subject to the approval of the Director of Public Works.

7.8.1.H. Screening walls and mow strips shall be designed to accommodate through drainage if required by the drainage plans approved by the Director of Public Works.

7.8.2. Placement of Screening Walls

7.8.2.A. The location, height, and appearance of screening walls shall be approved as part of the Site Plan process.

7.8.2.B. Screening walls constructed within public ROW shall be as close to the ROW line as possible without any encroachment of overhangs, foundations, piers, or mow strips onto private property.

7.8.2.C. Screening walls placed on private property shall be placed in a screening wall maintenance easement a minimum of 5-foot in width.

7.8.2.D. Screening walls adjacent to bike trails must have at least a 2-foot setback/clear zone in accordance with the City's *Comprehensive Plan*.

7.8.3. General Materials and Colors

7.8.3.A. Screening walls shall be precast reinforced concrete formlined with simulated brick, stone, or other texture approved by the City and shall achieve the final effect of realistic stone, brick, or other surface texture or design approved by the City.

7.8.3.B. Precast screening walls and associated elements and other product materials shall be of a design for which replacement units are readily available to the City and shall be manufactured within 500-miles of the City of Sachse.

7.8.3.C. All concrete for the precast screening wall panels, precast columns, and associated elements such as drilled piers, pier caps, mows strips, and column fill, shall have a minimum compressive design strength of 4,000 psi at 28 days, and shall contain a minimum of 6-sacks of cement per cubic yard of concrete.

7.8.3.D. Wall panels and columns shall include a texture/pattern approved by the City on each side. Pattern shall cover the entire face of panels exclusive of a maximum 1-foot wide border, if provided. Pattern shall cover the entire face of columns exclusive of a maximum 2-inch wide border, if provided. The City may require differing patterns on the two sides of the wall and different patterns for different segments of the wall.

7.8.3.E. Stone patterns shall incorporate an average relief of 1/2-inch minimum.

7.8.3.F. Brick patterns shall include a minimum 1/4-inch relief at the bricks and 3/8-inch at any included border.

7.8.3.G. All exposed concrete surfaces shall be painted/stained with an approved water-based acrylic concrete paint/sealer to provide protection from rain, pollution, and other elements and to achieve the desired natural stone, real brick, or other City-approved appearance.

7.8.3.H. Concrete surfaces shall be colored in the field after installation. All brick and stone patterns visible to the public shall be painted or stained to achieve a natural (earth tone) stone appearance and incorporate a base color and at least three accent colors. All brick patterns visible to the public shall be painted or stained to achieve a real brick appearance including separate colors for mortar and brick.

7.8.4. Screening Wall Piers

7.8.4.A. Reinforcing steel shall at a minimum meet the requirements of the current edition of *ACI 318: Building Code Requirements for Reinforced Concrete*. The construction plans showing the reinforcing placement shall be signed and sealed by a licensed Professional Engineer in the State of Texas. The following minimums shall be followed if greater than requirements of *ACI 318*:

7.8.4.A.i. Reinforcing steel shall be minimum of six #4 deformed bars conforming to ASTM A615 grade 60.

7.8.4.A.ii. Tie bars and spirals shall be minimum #3 bars.

7.8.4.A.iii. Reinforcing steel that extends into the columns shall meet the requirements of **Section 7.8.7** and be embedded in the pier a minimum of 3 feet.

7.8.4.B. Piers shall be designed based on the results from performing a geotechnical investigation. Design criteria obtained shall be the basis for pier diameter, depth of embedment, lateral capacity, uplift capacity, and end bearing capacity at a minimum. Piers shall be a minimum 18-inch diameter and penetrate a minimum of 3 feet into solid rock as

determined by the design engineer and confirmed by the City, or bear on stiff clay at a minimum depth of 12 feet.

7.8.4.C. All drilled shaft construction shall be in accordance with required geotechnical report and TxDOT Item 416 (Drilled Shaft Foundations).

7.8.4.D. Pier caps shall be a minimum 24 inches square and have a top elevation of no more than 2-inches below grade to no more than 8-inches above grade.

7.8.5. Screening Wall Concrete Mow Strip

7.8.5.A. The concrete mow strip between piers shall be at least as wide as the maximum outside dimension of the pier/pier cap and no less than 24 inches.

7.8.5.B. The concrete mow strip shall include a minimum of three longitudinal #4 steel reinforcing bars with 12-inch maximum spacing and #3 steel reinforcing bars at 24-inch maximum spacing transversely.

7.8.5.C. The concrete mow strip shall be a minimum thickness of 6-inches and be variable height to limit the gap between the wall panels and the mow strip finished grade to a maximum of 1.5-inches. The mow strip must be formed above ground and a minimum of 6-inches below the finished grade at all locations.

7.8.5.D. Approved expansion material 3/4-inch in thickness shall be placed on each side of the fence column pier caps where the concrete mow strip meets the pier caps.

7.8.5.E. The concrete mow strip shall include a City-approved method to accommodate through drainage. Screening walls and mow strips shall be designed to accommodate through drainage if dictated by the drainage plans approved by the Director of Public Works.

7.8.6. Wall Panels

7.8.6.A. Reinforcing steel shall be determined by a registered Engineer and shall meet the requirements of *ACI-318: Building Code Requirements for Reinforced Concrete* or minimums specified herein, whichever is greater.

7.8.6.B. Wall panels shall be, at a minimum, continually reinforced along the top, bottom, and side portions of the panels with deformed steel reinforcing bars conforming to ASTM A615 grade 60 with reinforcement provided being #4 bars or larger as required.

7.8.6.C. Wall panels shall be continually reinforced with a minimum of one mat of grade 60 welded wire conforming to ASTM A185 or A497 and attached to the top rebar with a minimum vertical and horizontal area of 0.08 inch-squared/foot or larger as required.

7.8.6.D. The construction plans showing the reinforcing placement shall be signed and sealed by a Professional Engineer licensed in the State of Texas.

7.8.6.E. Minimum panel thickness shall be 5 inches for rebar reinforced portions of the wall and 3 inches for wire mesh reinforced portions of the wall.

7.8.6.F. Panels shall be uniform in finish, color, and appearance and shall be readily interchangeable.

7.8.6.G. Curing of concrete panels shall be in accordance with the recommended practice of the Precast Concrete Institute of America.

7.8.6.H. Panels shall include lifting eyes for lifting with additional reinforcing at lift points adequate to support the weight of the panels during construction operations.

7.8.7. Columns

7.8.7.A. Columns shall be precast and a minimum 18 inches square.

7.8.7.B. Column minimum and maximum spacing shall be 12-feet and 15-feet, respectively, between columns measured from the center of the column, except for end panels or at angle points which can be shorter as approved by the City.

7.8.7.C. Reinforcing steel shall be minimum #4 deformed bars conforming to ASTM A615 grade 60. Tie bars and spirals shall be minimum #3 bars. The construction plans showing the reinforcing placement shall be signed and sealed by a Professional Engineer licensed in the State of Texas.

7.8.7.D. Columns shall be connected to piers with either a minimum of four vertical #8 deformed steel reinforcing bars or a W4x13 steel w-shape wide flange steel beam post within the hollow core of the pre-cast column. The hollow core of columns shall be filled with concrete flexible base and the gaps between the adjacent wall panels sealed with an approved sealant/caulk to a minimum of six (6) inches above the steel bar or I-beam column reinforcement. The connection shall be sized according to the design Engineer and embedded in the pier a minimum of 3 feet. Rebar shall extend into full height of the column with a right-angle bend at the bottom. W-beam posts shall be embedded a minimum of 3 feet into the pier and extend into the column to half the height of the column.

7.8.8. Column Caps

7.8.8.A. Column caps are required on all columns and shall include a lip that extends down over the column a minimum of 1 inch to prevent lateral movement or affixed to the column by a method approved by the City.

7.8.8.B. Column caps shall be compatible with the wall and uniform in size and appearance.

7.8.9. *Approved Suppliers* – Refer to the list of approved suppliers in **Appendix B** (Approved Materials Lists).

7.9. *Culverts, Headwalls, and Wingwalls*

7.9.1. Refer to **Section 3.8** (Bridge and Culvert Hydraulics) for applicable design requirements.

7.9.2. Refer to **Section 7.1.6** for use of TxDOT standard sheets.

7.9.3. All headwalls and wingwalls shall be reinforced concrete. Wingwalls shall be either straight (parallel), flared, or tapered. Approach and discharge aprons shall be provided for all culvert headwall designs.

7.10. *Drop Structures*

7.10.1. Refer to **Section 3.7.7** for hydraulic design requirements of drop structures.

7.10.2. The design of drop structures shall be based on the height of the drop, the flow depths upstream and downstream of the drop structure, and the flow rate. All drop structures shall be constructed of reinforced concrete, gabions, or other material approved by the Director of Public Works. To facilitate maintenance, drop structures should be accessible to equipment normally used for maintenance, as approved by the Director of Public Works.

7.10.3. An apron shall be provided immediately upstream and downstream of a drop structure to protect against scour caused by the increasing velocities and turbulence at each drop structure. Apron dimensions shall be site specific and based on velocities. At a minimum, the upstream apron shall extend at least 10 feet upstream from the point where flow becomes supercritical and shall include a cutoff wall into the ground sufficient to protect the structure from scour and hydraulic uplift. The downstream apron shall extend a minimum of 20 feet beyond the anticipated location of the jump and shall include a cutoff wall into the ground. The cutoff wall at each end shall extend below the calculated scour depth or sound bedrock (in accordance with **Section 3.6.5** and FHWA's current edition *Hydraulic Engineering Center No. 18* (*HEC-18))* but shall be a minimum of 3 feet below channel flowline.

7.11. *Elevated (Aerial) Crossings* – Refer to **Section 4.8.6** for applicable design requirements, including structural design and scour analysis.

SECTION 8 LANDSCAPE AND IRRIGATION DESIGN REQUIREMENTS

Section Highlights

- The purpose of this section is to provide additional requirements and standards to address landscaping and irrigation requirements within the medians and right-of-way of public roadways.
- Landscape and irrigation construction plans must be prepared and sealed by a licensed professional in accordance with **Section 8.1** (General).
- Approved trees and plantings are included in **Section 8.2** (Landscape Requirements Within Right-of-Way).
- Trees shall be planted a minimum 5 feet from adjacent paving, back of roadway curbs, and utilities. Trees planted within 5 feet to 10 feet of any paving, back of roadway curbs, or utilities shall include a rigid root barrier in accordance with this section.

8.1. *General*

8.1.1. This section includes the minimum requirements and standards to address landscaping and irrigation requirements within the medians and right-of-way (ROW) of public roadways. Refer to the following ordinances and documents for additional standards:

- *City of Sachse Streetscape and landscape standards – Chapter 11, Article 3, Section 14, 14.8.E*
- *City of Sachse Street trees and landscaping (within the pedestrian easement) – Chapter 11, Article 3, Section 14, 14.8.F*

8.1.2. Landscape construction plans shall be prepared and sealed by a Registered Landscape Architect (RLA), with a license to practice within the State of Texas.

8.1.3. Irrigation construction plans shall be prepared and sealed by a Licensed Irrigator (LI), with a license to practice within the State of Texas.

8.1.4. *Approved Plantings* – Refer to the list of approved plantings within medians and ROW, provided in **Section 8.2** (Landscape Requirements Within Right-of-Way).

8.1.5. *Approved Irrigation Standards* – Refer to the approved irrigation standards of the *City of Sachse Irrigation – Chapter 11, Article 4, Section 11, 11.5.h*

8.2. *Landscape Requirements Within Right-of-Way*

8.2.1. *General* – This section includes the general requirements for tree and shrub plantings located within the public ROW.

8.2.1.A. Sight Distance and Visibility

8.2.1.A.i. Compliance with these landscaping requirements is required unless such compliance would result in visibility obstructions and/or blind corners at intersections and median openings.

8.2.1.A.ii. When two or more streets or driveways intersect, a sight visibility triangle is created in accordance with **Section 2.4** (Sight Visibility). Landscaping within the sight visibility triangle shall be designed to provide unobstructed cross-visibility between 2 feet and 9 feet in height above the gutter elevation. Shade trees may be permitted in this area provided they are trimmed so that no limbs or foliage extend into the cross-visibility area, and the trees are not planted, aligned or grouped so that the trunks of the trees provide a visibility obstruction. Refer to **Section 2.4** (Sight Visibility) for additional visibility requirements regarding landscaping and obstructions at intersections and within medians.

8.2.1.A.iii. All trees shall be planted outside sight visibility triangles.

8.2.1.B. Clearance and Setbacks

8.2.1.B.i. Trees shall be planted along existing and proposed sidewalks and roadways in an effort to limit conflicts with pedestrian and vehicular traffic.

8.2.1.B.ii. Trees shall be planted a minimum 5-foot distance from adjacent paving, back of roadway curbs, and utilities. Shade trees planted within 5 feet to 10 feet of any paving, back of roadway curbs, and utilities shall include a 24-inch minimum depth rigid root barrier, as approved by the Director of Parks and Recreation.

8.2.1.B.iii. Tree canopies and limbs shall be maintained in an effort to limit conflicts with pedestrian and vehicular traffic. A minimum 10-foot vertical clearance shall be provided along all pedestrian pavement (sidewalks and trails), and a minimum 16.5-foot vertical clearance shall be provided along all vehicular pavement plus a minimum of 5 feet behind back of curb in accordance with **Figure 8-1**.

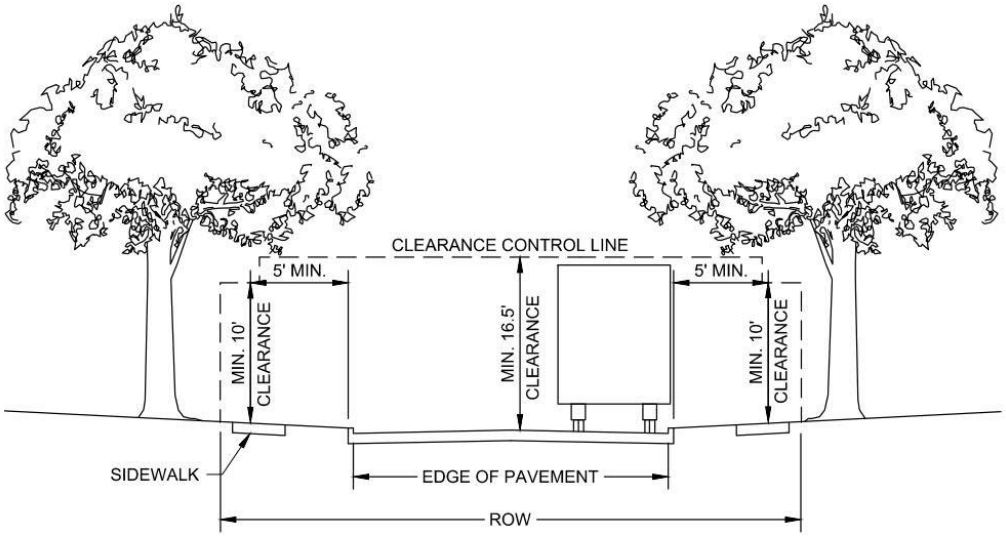


Figure 8-1. Tree Clearance

8.2.1.C. Planting Requirements

8.2.1.C.i. Trees and planting areas shall not be installed on slopes steeper than 4H:1V. All trees and planting areas shall have soils prepared prior to seeding, planting, or installation.

8.2.1.C.ii. Trees shall be planted within medians and parkways in an effort to provide the appearance of natural planting and grouping. Trees should not be planted with formal or on-center spacing, unless otherwise directed by the Director of Parks and Recreation. Trees shall be planted with varying spacing, with a minimum spacing of 50 feet. Refer to **Figure 8-2**.

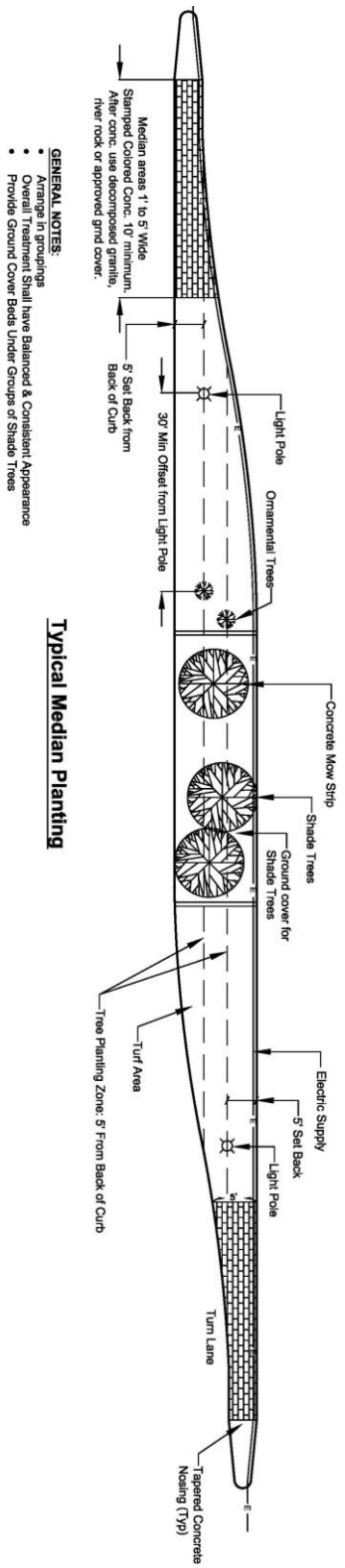


Figure 8-2. Typical Median Planting

8.2.1.C.iii. Shrubs shall be planted within medians and parkways in an effort to provide the appearance of natural planting and

grouping. Shrubs should be grouped in clusters and planted with triangular spacing. Refer to **Figure 8-2**.

8.2.1.C.iv. All median landscape areas designated as lawn planting areas shall receive solid sod. Sod shall be placed within the parkway along curbs and sidewalks for a minimum distance of 4 feet. All sod shall be placed after properly preparing the ground as designated on the construction plans and in accordance with the City's *Standard Landscaping Specifications*.

8.2.1.C.v. Areas not required to be sodded shall be treated (seeded, mulched, etc.) after properly preparing the ground as designated on the construction plans and in accordance with the City's *Standard Landscaping Specifications*.

8.2.1.C.vi. All landscape areas shall be planted with materials in living and thriving condition. Placement of artificial or non-living plant materials is prohibited.

8.2.1.C.vii. Plantings within medians shall meet the requirements of **Table 8-1**.

Table 8-1. Median Landscaping Requirements

Median Width (feet)	Landscaping Requirements
< 5	Stamped Colored Concrete for Minimum 10 feet; Hardscape Components Only
5 to 15	Ornamental Trees, Shrubs, Turf Grass, Groundcover, Hardscape Components and Native Grasses/Wildflowers (Maximum 18-inch Height)
> 15	Trees, Shrubs, Turfgrass, Groundcover, and Native Grasses/Wildflowers (Maximum 24-inch Height)

8.2.1.C.viii. Plantings within the ROW shall be limited to the approved lists provided in **Table 8-2**, **Table 8-3**, **Table 8-4**, and **Table 8-5**. A variety of tree species should be provided within the ROW. All City projects shall be designed with species variation, and shall not exceed 25% of any single species.

Table 8-2. Approved Shade Trees for Medians and Parkways

Common Name	Scientific Name
Texas Walnut	Juglans microcarpa
Pecan[1]	Carya illinoinensis
Caddo Maple	Acer saccharum var. caddo
Cedar Elm	Ulmus crassifolia
Chinquapin Oak	Quercus muhlenbergii
Live Oak[1]	Quercus virginiana
Texas Red Oak	Quercus texana
Western Soapberry	Sapindus drummondii
Shantung Maple[1]	Acer truncatum
Lacebark Elm	Ulmus parvifolia
Chinese Pistachio	Pistacia chinensis
Arizona Cypress	Cupressus arizonica
1. Not for use in medians.	

Table 8-3. Approved Ornamental Trees for Medians and Parkways

Common Name	Scientific Name
Crape Myrtle	Lagerstroemia indica
Holly	Ilex spp.
Eastern Red Cedar	Juniperus virginiana
Eve's Necklace	Sophora affinis
Little Gem Magnolia	Magnolia grandiflora 'Little Gem'
Mexican Plum	Prunus mexicanus
Red Bud	Cercis canadensis 'Texensis'
Texas Mountain Laurel	Sophora secundiflora
Vitex	Vitex agnus-castus
Wax Myrtle	Myrica cerifera

Table 8-4. Approved Shrubs for Medians and Parkways

Common Name	Scientific Name
Harbor Dwarf Nandina	Nandina domestica 'Harbor Dwarf'
Nandina	Nandina domestica
Dwarf Crepe Myrtle	Lagerstroemia indica
Adam's Needle Yucca	Yucca filamentosa
Texas Sage	Leucophyllum frutescens
Indian Hawthorn	Rhaphiolepis indica
Holly	Ilex spp.
Autumn Sage	Salvia greggii
Rusty Blackhaw Viburnum	Viburnum rufidulum
Sumac	Rhus spp.

Table 8-5. Approved Groundcover/Grass for Medians and Parkways

Common Name	Scientific Name
Purple Wintercreeper	Euonymus fortunei 'Coloratus'
Asian Jasmine	Trachelospermum asiaticum
Liriopes	Liriope muscari
Mondo Grass	Ophiopogon japonicas
Salvia	Salvia spp.
Lantana	Lantana spp.
Daylily	Hemerocallis spp.
Green and Gray Santolina	Santolina chamaecyparissus
Little Bunny Fountain Grass	Pennisetum alopecuroides 'Little Bunny'
Gulf Muhly	Muhlenbergia capillaris
Little Bluestem	Schizachyrium scoparium
Zebra Grass	Miscanthus sinensis 'Zebrinus'
Adagio Maiden Grass	Miscanthus sinensis 'Adagio'
Celebration Bermuda	Cynodon dactylon 'Celebration'
609 Buffalo Grass	Buchloe dactyloides '609'

8.3. *Irrigation Requirements Within Right-of-Way*

8.3.1. Irrigation system shall be designed and installed to minimize runoff onto paved surfaces. Overspray on streets and sidewalks is prohibited. All irrigation systems shall be installed in accordance with the current and published laws and regulations of the Texas Commission on Environmental Quality (TCEQ).

8.3.2. The Engineer shall contact Development Services for the most recent irrigation standards and specifications.

8.3.3. Irrigation shall be required as follows:

- All proposed landscape areas shall be irrigated, unless otherwise directed by Development Services;
- Artificial turf areas within the public ROW are not allowed. The specific limits shall be determined by Development Services; and,
- Medians shall be landscaped using the guidance of the standard requirements and have an irrigation system designed with different zones for plantings, tree bubblers, and turf to allow water conservation.

SECTION 9 DEFINITIONS AND ABBREVIATIONS

DEFINITIONS

The definitions within this section are intended to provide descriptions for terms used within the *Engineering Design Manual*. When words and terms are defined herein and in other City ordinances, they shall be read in harmony. If an irreconcilable conflict exists, the definition contained herein shall control in the construction and application of this *Engineering Design Manual*. Where no definition appears, the term should be interpreted according to their customary usage in the practice of municipal planning and engineering. The Director of Public Works has the final determination of interpretation.

Words used in the present tense include the future tense. Words in the singular tense include the plural tense. The word “shall” is mandatory and not directory. The word “may” is directory and not mandatory.

100-year – A flood event that statistically has a recurrence interval (return period) of 100 years and a one percent chance of being equaled or exceeded in any given year. The event shall be based upon fully developed watershed conditions unless otherwise specified.

Alley – A minor public right-of-way, not intended to provide the primary means of access to abutting lots, which is used primarily for vehicular service access to the back or sides of properties otherwise abutting on a public way.

Applicant – Any firm, entity, partnership, company, public utility company, or individual submitting a formal request or application.

Arterial – A roadway designed to carry large volumes of traffic of a local nature to the freeway or expressway systems. Interchange of traffic from freeway systems to the local streets occurs via the arterial street.

Average Daily Traffic (ADT) – A volume that represents the total two-way traffic on a roadway for a period of less than a year, divided by the total number of days it represents, and that includes both weekday and weekend traffic. ADT is typically adjusted for day of the week, seasonal variations, and/or vehicle classification.

Base Flood – The flood event having a one percent chance of being equaled or exceeded in any given year based on existing watershed conditions, FEMA guidelines, and SFHA as shown in the current effective FIS and FIRM. Differs from design flood. The resulting water surface elevation from the base flood shall correspond with the FEMA BFE.

Best Management Practice (BMP) – Schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spills or leaks, waste disposal, or drainage from raw material storage areas. A BMP may be temporary to protect during construction, or permanent to protect from long-term impacts of the development.

Casing Pipe – An exterior protective pipe that encases a carrier pipe for various types of crossings, including roadways, creeks, and railroads. Also known as encasement pipe.

Collector – A roadway designed to pass through neighborhoods collecting traffic from local streets and distributing the traffic to arterial streets. These streets also serve neighborhood facilities.

Connection – The point at which a facility is provided service by the City water or wastewater system.

Corner Clip – Right-of-way dedication at intersection corners to provide sufficient room for intersection visibility, pedestrian access, and other street facilities.

Crown – Depending on context, (a) the highest point on the inside of a closed conduit; or(b) the highest point of a roadway cross section. Also known as soffit.

Deceleration Lane – A speed-change lane, including tapered areas, which enables a vehicle exiting a roadway to leave the travel lanes and slow before making a turn.

Depression Storage – The collection and storage of rainfall in natural depressions or puddles after exceeding the infiltration capacity of the soil.

Design Flood – The flood event that is used as the basis for design to provide a stated degree of protection or other specified result. The design flood for the City of Sachse is the frequency flood specified in **Table 3-1** based on fully developed watershed conditions. Also known as design storm. Differs from base flood. The City of Sachse design flood elevation will not necessarily correspond with the FEMA BFE.

Design Speed – A selected speed used to determine the various geometric design features of the roadway.

Detention Basin – A dry basin or depression constructed to temporarily store stormwater runoff and discharge the water over time at a reduced rate than would have otherwise occurred.

Director of Public Works – The Director of Public Works, or his/her designee.

Distribution System – A system of pipes that conveys potable water from a water treatment plant to consumers. Distribution systems include pump stations, ground and elevated storage tanks, potable water mains, potable water service lines, and all associated valves, fittings, and meters, but excludes potable water customer service lines.

Drainage System – Storm drainage facilities including streets, alleys, ditches, inlets, storm drain systems, creeks, floodplains, bridges, culverts, detention facilities, retention facilities, overflow routes, and any other facility through which or over which stormwater flows.

Emergency Overflow Path – A path stormwater will take when a drainage facility becomes clogged or does not function as designed.

Engineer – The Professional Engineer (P.E.) licensed in the State of Texas through the Texas Board of Professional Engineers (TPBE) who is responsible for the signing and sealing of construction plans, studies, calculations, and/or any other engineering documents in accordance with TBPE's requirements for professional practice.

Flood Control – The elimination or reduction of stormwater damage by means of land use restrictions, detention storage, erosion control, drainage systems, channel improvements, dikes and levees, bypass channels, and/or other engineering works. Also known as stormwater management.

Floodplain Administrator – The Director of Public Works or his/her designee appointed to administer and implement the provisions of the Drainage and Flood Hazard Area Regulations Ordinance and other appropriate sections of 44 CFR (Emergency Management and Assistance – NFIP Regulations) pertaining to floodplain management.

Floodplain Reclamation – The act of removing property from floodplain.

Floodplain, FEMA – The entire geographic area subject to flooding based on the base flood. The FEMA floodplain shall refer to the area subject to flooding resulting from the 100-year base flood (based on existing watershed conditions).

Floodplain, Ultimate – The entire geographic area that must be reserved in order to discharge the design flood without cumulatively increasing the water surface elevation. The ultimate floodplain shall refer to the area subject to flooding resulting from the ultimate 100-year design flood (based on fully developed watershed conditions). Formerly referred to as natural floodway. The ultimate floodplain shall encompass all areas identified in FEMA floodplain. Areas of ineffective flow around bridges, topographic constrictions and other constrictions are excluded from the ultimate floodplain. The effective flow area and limits of the ultimate floodplain are determined using 4:1 flow expansions downstream of constrictions and 1:1 flow expansions upstream of constrictions.

Floodway, FEMA – The channel of a watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation by more than one foot. Also known as regulatory floodway.

Flowline – The floor, bottom, or lowest elevation of an open channel or closed conduit. Also known as invert.

Freeboard – The distance between the design flood elevation and the freeboard reference point specified in **Table 3-1**.

Frontage Road – A local roadway along an arterial highway governed by TxDOT allowing control of access and service to adjacent areas and property. Also known as a service road.

Improved Channel – A channel or area of concentrated drainage that has been cleared, excavated, realigned, lined, graded, stabilized, or created by equipment. Also known as improved creek and improved stream.

Intersection – Any at-grade connection with a roadway. Includes the connection of two roadways or a driveway and a roadway. The junction of an alley with a roadway shall not constitute an intersection.

Level of Service (LOS) – A measure of traffic flow and congestion. LOS is a qualitative measure describing operational conditions within a traffic stream, generally described in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Local Street – A roadway designed to provide the basic function of serving private property with access to other streets. Also known as residential street.

Maximum Daily Demand – The total amount of water used during the day of heaviest consumption in any given year and the minimum rate which the high service pumps shall be capable of pumping. Water shall be supplied to the pumps at this rate.

Maximum Hourly Demand – The rate at which water is drawn from the entire system during the hour of maximum consumption on the day of maximum demand. This rate is generally of a short duration and is most economically provided for by the use of elevated storage in addition to water supplied to the system by pumps. The distribution system, including storage and pumping capacity, shall be able to satisfy this demand. Also known as peak flow.

Median – The portion of a divided roadway separating the opposing traffic flows. A median may be traversable or non-traversable.

Median Opening – An opening in a non-traversable median that allows accessing or crossing the opposing traffic lanes.

Minimum Hourly Demand – The rate at which water is drawn from the distribution system during the hour of minimum demand on the day of maximum demand. This rate is used in the water distribution analysis to determine the adequacies of the system to replenish elevated storage.

Natural Channel – An unlined and unimproved existing drainage channel that has not been graded, modified, cleared, or created by equipment. Also known as natural creek and natural stream.

Non-traversable Median – A physical barrier in a roadway or driveway that separates vehicular traffic traveling in opposite directions, and prohibits movement of traffic across the median. Non-traversable medians include, but are not limited to, concrete barriers, raised concrete curbs and/or islands, and grass or swale medians.

Normal Water Surface Elevation – The typical observed water surface elevation in the absence of a flood event. Also referred to as ordinary high water mark or normal pool level.

Open Channel – A channel in which water flows with a free surface. Includes creeks, lakes, flood control sags, or natural water ways.

Owner – The person or entity financially responsible for developing a particular site or project. Also referred to as Developer.

Parkway – An area within the right-of-way but outside the edge of pavement which is typically reserved for public use other than vehicular traffic.

Post-development – The condition of the given site and drainage area after the anticipated development has taken place. Also known as proposed condition or post-project.

Pre-development – The existing condition of the given site and drainage area prior to development. Also known as existing condition or pre-project.

Right-of-Way (ROW) – A strip of land dedicated by plat for use of public roadways and/or related facilities. Other facilities include, but are not limited to, utilities, drainage systems, and other transportation uses. Unless otherwise specified, the term right-of-way shall refer to a public right-of-way.

ROW Width – The shortest horizontal distance between the lines which delineate the limits of right-of-way.

Schools – A public, private, or parochial institution for the education of students in any grade between pre-kindergarten through twelfth grade or any combination thereof. A public school includes an open enrollment charter school as defined under the Texas Education Code.

Includes elementary and secondary schools. Does not include trade, vocational, or commercial schools.

Sidewalk – A paved area behind the curb intended for the use of pedestrians and/or bicyclists.

Sight Distance – The distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway from a designated location and to a specified height above the roadway when the view is unobstructed by traffic.

Standard of Care – The care and skill ordinarily used by members of the subject profession practicing under similar circumstances at the same time and in the same locality. No provision or requirement of the *Engineering Design Manual* shall relieve the engineer of his/her responsibility to meet the standards of conduct and ethics established by the Texas Board of Professional Engineers (TPBE).

Storage Length – The portion of a turn lane required to store the number of vehicles expected to accumulate in the lane during an average peak period.

Time of Concentration – The estimated time required for runoff to flow from the most hydraulically remote point of the drainage area to the point at which the flow is to be determined. Hydraulically remote refers to the travel path with the longest flow travel time, not necessarily the longest linear distance.

Trunk Line – The main line of a storm drain system. Includes lines extending from manhole to manhole or from manhole to outlet structure.

Ultimate – The condition of the watershed after the entire watershed has undergone development. Refer to the current City's Land Use Map to determine future land uses. Also known as fully developed.

Utility Easement – An easement for the use of any City owned and/or maintained utility, including storm, water, sewer, fiber optic, etc. The utility and appurtenances may be located above and/or below ground.

Watershed – The area contributing stormwater runoff to a stream or drainage system. Also known as drainage area, drainage basin, and catchment area.

ABBREVIATIONS

% – Percent.

’ – Foot or feet.

” – Inch or inches.

A – Major Arterial.

AASHTO – American Association of State Highway and Transportation Officials.

ACB – Articulated concrete block.

ACI – American Concrete Institute.

ADA – Americans with Disabilities Act.

ADAAG – Americans with Disabilities Act Accessibility Guidelines.

ADT – Average Daily Traffic.

ASCE – American Society of Civil Engineers.

ASTM – American Society for Testing and Materials.

AWWA – American Water Works Association.

b-b – Back of curb to back of curb distance.

BFE – Base Flood Elevation.

BMP – Best Management Practice.

C – Collector or Capacity (depending on context).

CAD – Computer-aided Design.

CBR – California Bearing Ratio.

CFR – Code of Federal Regulations.

cfs – Cubic feet per second.

CLOMR – Conditional Letter of Map Revision.

CLSM – Controlled low strength material.

CSS – Concrete stabilized sand.

D – Divided.

DIPRA – Ductile Iron Pipe Association.

EGL – Energy grade line.

EPA – Environmental Protection Agency.

ET – Evapotranspiration.

ETJ – Extraterritorial Jurisdiction.

FDC – Fire Department Connection.

FEMA – Federal Emergency Management Agency.

f-f – Face of curb to face of curb distance.

FFE – Finished Floor Elevation.

FHWA – Federal Highway Administration.

FIRM – Federal Insurance Rate Map.

FIS – Flood Insurance Study.

fps – Feet per second.

gpcd – Gallons per capita per day.

GPS – Global Positioning System.

H – Horizontal or Height (depending on context).

HDPE – High Density Polyethylene.

HEC-HMS – Hydrologic Engineering Center Hydrologic Modeling System.

HEC-RAS – Hydrologic Engineering Center River Analysis System.

HGL – Hydraulic grade line.

I.D. – Inside Diameter.

IFC – International Fire Code.

ILSN – Illuminated Street Name Sign.

in – Inch.

iSWM – Integrated Stormwater Management.

ITE – Institute of Transportation Engineers.

L – Local or Length (depending on context).

lbs – Pound or pounds.

LED – Light-emitting diode.

LF – Linear Feet.

LI – Licensed Irrigator.

LOMR – Letter of Map Revision.

LOS – Level of Service.

LRFD – Load and Resistance Factor Design.

MASH – Manual for Assessing Safety Hardware.

Max – Maximum.

MGD – Million gallons per day.

Min – Minimum or Minutes (depending on context).

mph – Miles per hour.

MPR – Matched Precipitation Rate.

MS4 – Municipal Separate Storm Sewer System.

MSE – Mechanically Stabilized Earth.

msl – Mean seal level.

NCHRP – National Cooperative Highway Research Program.

NCTCOG – North Central Texas Council of Governments.

NFIP – National Flood Insurance Program.

NFPA – National Fire Protection Association.

NOI – Notice of Intent.

NOT – Notice of Termination.

NPDES – National Pollution Discharge Elimination System.

NRCS – National Resources Conservation Service (formerly SCS).

NTTA – North Texas Tollway Authority.

OSHA – Occupational Safety and Health Administration.

OSSF – On-site sewage facilities.

P.E. – Professional Engineer.

PBMP – Permanent Best Management Practice.

PC – Point of curvature.

pci – Pounds per cubic inch.

PD – Planned Development.

PI – Plasticity Index or Point of intersection (depending on context).

PMF – Probable Maximum Flood.

ppm – Parts per million.

PROWAG – Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.

psi – Pounds per square inch.

PT – Point of tangency.

PTZ – Pan-Tilt-Zoom.

PVC – Polyvinyl Chloride.

PVI – Point of Vertical Intersection.

PVR – Potential Vertical Rise.

QL – Quality Level.

RCP – Reinforced concrete pipe.

RLA – Registered Landscape Architect.

ROW – Right-of-Way.

S – Secondary (Minor) Arterial.

SCADA – Supervisory Control and Data Acquisition.

SCS – Soil Conservation Service.

SD – Sight Distance.

SFHA – Special Flood Hazard Area.

SOP – Standard operating procedure.

SPF – Standard Project Flood.

SUE – Subsurface Utility Engineering.

SWMP – Stormwater Management Program.

SWPPP – Stormwater Pollution Prevention Plan.

TAC – Texas Administrative Code.

TAS – Texas Accessibility Standards.

TBPE – Texas Board of Professional Engineers.

T_c – Time of Concentration.

TCEQ – Texas Commission on Environmental Quality.

TCP – Traffic Control Plan.

TDLR – Texas Department of Licensing and Regulation.

TIA – Traffic Impact Analysis.

TMP – Traffic Management Plan.

TMUTCD – Texas Manual on Uniform Traffic Control Devices.

TPDES – Texas Pollution Discharge Elimination System.

TRB – Transportation Research Board.

TSM – Transportation System Management.

TxDOT – Texas Department of Transportation.

U.L. – Underwriters Laboratories

U.S. – United States.

USACE – United States Army Corps of Engineers.

USCFCCHR – University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.

V – Vertical, Velocity, or Volume (depending on context).

VIVDS – Video Imagery Vehicle Detection System.

WinPAS – Windows Pavement Analysis Software.

APPENDIX A

CITY CHECKLISTS

CITY CHECKLISTS

1. Engineering Plan Submittal Requirements
2. Engineering Plan Submittal Checklist
3. Traffic Impact Analysis Checklist
4. Geotechnical Report for Roadways Checklist
5. Grading and Floodplain Development Permit Form
6. Individual Single-Family Lot Residential Development – Engineering Plans Checklist
7. ROW and Easement Abandonment Procedure
8. Temporary Concrete Batch Plant Permit Procedure
9. Final Acceptance Checklist
10. Project Closeout and Acceptance Checklist
11. Variance Request Form
12. Drainage Plan Requirements

The Engineer shall verify the current edition of the checklists with the Engineering Department.

Engineering Plan Submittal Checklist

Project Name: _____

Engineer Name: _____

Engineering Firm: _____

Report Date: _____ Date Received: _____

INSTRUCTIONS:

The most current Engineering Plan Submittal Checklist spreadsheet should be downloaded from the City's
website and filled out completely.

Submission of this completed checklist is part of the Engineering Plan submittal requirements. Any Missing or Incomplete response shall include a written explanation with adequate justification, as deemed necessary by the City.

Administrative items shall be submitted as a high quality digital color PDF document for ease of review and long term storage. Refer to City criteria for other submittal requirements.

All submittal shall be via email to: Engineering@cityofsachse.com

Refer to the *Engineering Design Manual* for design requirements.

MISCELLANEOUS NOTES:

Engineer Signature: _____ **Date**: _____

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					City prefers that many administrative items be submitted as a high quality color pdf document for ease of review and long term storage	
					All submittals shall be through the Citizen's Access Portal: https://energov.cityofSachse.com	
					Items on this Checklist are Standard Requirements. This is a generic list that covers many items needed for projects. Additional or less items may be required based on project.	
					ADMINISTRATIVE ITEMS	
					Engineering Plan Review Fees	
					Digital copy in pdf format of the full engineering plan submission (including details)	
					Annotated Review Comments, if applicable	
					One **Digital (pdf)** copy of any Study or Report Completed in Support of the Project	
					Impervious Area Summary Form Completed	
					Grading Permit Fee and Deposit	
					Executed Grading Permit Owner's Affidavit	
					Executed NOI, CSN (large or small depending on acreage disturbed) and SWPPP **(Digital only)** if 1 acre or over (NOI only required if 5-acres or more disturbed land)	
					Engineering Inspection Fee Calculation	
					Engineering Inspection Fee Paid	
					TXDOT Permit for Drive Approach Connections (letter) **(Digital Copy)**	
					TXDOT Utility Permit Obtained-Usually the City must obtain this permit)	
					Other Agency or Land Owner Approval Obtained (specify)	
					Corps of Engineers (COE) Wetland Permit Obtained, if applicable	
					Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision (CLOMR) Obtained	
					Pro-Rata Fee Paid and Agreement Executed (rare)	
					Interlocal Agreements Approved and Executed (explain)	
					Letter of Permission for Offsite Grading Work	
					Easements for Permenant Offsite Improvements	
					Other Agreements (explain)	
					STUDIES - IF APPROPRIATE OR REQUIRED	
					Geotechnical Report **(Color Digital copy only-pdf)**	
					Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision (CLOMR) Flood Study Submitted and City Review Fee Paid	
					Hydraulic Study Submitted	
					Water Study Submitted	
					Sanitary Sewer Capacity Study Submitted	
					Traffic Impact Analysis (TIA) Study **(Digital pdf Only)**	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					ALL SHEETS	
					Sheet Size 22"x34" Preferred, 24" x 36" maximum sheet size (All sheet sizes should match and **all sheets should be printed to scale**)	
					Title Block with Subdivision Name, Project Name and Sheet Description	
					Revision Block - Filled Out	
					North Arrow	
					Vertical and Horizontal Scale Listed and Accurate	
					Benchmarks Listed and Described	
					Legend of All Drawing Symbols and Line Types Used	
					Engineer's Seal, Signature and Date per Texas Engineering Practices Act	
					811 Logo	
					Responsibility Note Required on All Sheets: "ALL RESPONSIBILITY FOR ADEQUACY OF DESIGN REMAINS WITH THE DESIGN ENGINEER. THE CITY OF SACHSE, IN REVIEWING AND RELEASING PLANS FOR CONSTRUCTION, ASSUMES NO RESPONSIBILITY FOR ADEQUACY OR ACCURACY OF DESIGN."	
					Provide Key Map for Project Showing Sheet Locations	
					Clear Drafting with Proper Line Weights for Ease of Reading	
					No Overlapping Text	
					Drafting at Adequate Scale to Obtain Ease of Reading and Scanning	
					COVER SHEET	
					Plan Type (Civil Site Engineering, Mass Grading, Etc)	
					Project Name	
					Official Plat Name as Assigned by the Planning and Zoning Division (including Block & Lot)	
					Official Project Address Assigned by the City GIS Division	
					Year of Probable Start of Project Construction	
					Revision Table	
					Engineer Contact Information (Name, Address, Phone Number, email address)	
					Owner Contact Information (Name, Address, Phone Number, email address)	
					Sheet Index - List ALL sheets included in plan set including details	
					Location Map with North Arrow	
					Side Bar - Project Name	
					City Project Acceptance Requirements see: https://www.cityofSachse.com/DocumentCenter/Home/View/6792	
					PLAT	
					Latest Plat is Located in Plan Set	
					Plat is Immediately After Cover Sheet	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					APPROVED SITE PLAN	
					Approved Site Plan is Located Immediatly After Plat	
					Copy Official Site Plan Attached with Planning and Zoning Division Stamp and Signature Only Selected sheets of the approved site plan that involve site layout, drainage, utilities, etc. should be included. **Do not include** building elevations or landscaping/irrigation sheets from the approved site plan. **(Applicant should retain original copies of approved site plan)**	
					DIMENSIONAL CONTROL & PAVING PLAN	
					Lot Boundary with Dimensions and Bearings	
					GPS Grid Coordinates Shown for Two Property Corners & Properly Locates Tract in City GIS System **(must be in grid)**	
					Street Names Shown	
					Existing ROW	
					R.O.W. Dedication and ROW Corner Clips Shown with Dimensions	
					Verification of public rights-of-way width ("variable width" is not acceptable)	
					Visibility Easements Shown as Required by City Code	
					Building Setback Lines Shown	
					Minimum Finished Floor (FF) Elevation Shown for each Structure	
					Dimensions (thickness, width, length, radius) for all paved areas (parking areas, driveways, fire lanes, turn lanes, drive aisles, sidewalks, etc)	
					Driveways Location, Spacing and Width Meet City Code Requirements	
					Driveways- Width, Radius, Distance to Adjacent Drives, Alignment with other Drives Across Street Shown	
					Driveway Radius Minimum Distance away from Inlets and Fire Hydrants per *Engineering Design Manual*	
					Driveway Grades from Gutter per *Engineering Design Manual*	
					Fire Lane - Width, Radius & Distance from Building Shown and Detailed	
					Fire Lane Pavement Thickness, Concrete Strength, Reinforcing, Subgrade Detailed Per City Requirements	
					Sidewalk Location, width, offset from back-of-curb	
					Barrier Free Ramp (Per TxDOT Pedestrian Facilities Curb Ramps PED - 18 Details) Location and **Type of Ramp**	
					Location of Fire Sprinkler Fire Department Connection (FDC) Shown	
					Location of Electrical Transformers Shown	
					Dumpster Location, Access and Construction Requirements Met (Backing Distance and Maneuver - Accessible by SU-30 Turning Template)	
					All Existing and Proposed Utility and Drainage Easements Shown (15' minimum width)	
					Existing and Required Access Easements Shown	
					Show Required Paving Blockouts for Inlets with Dimensions	
					Screening Wall Location, Foundation, Height, Start/End of Wall	
					Retaining Wall Location, Foundation, Height, Start/End of Wall, Top of Wall and Bottom of Wall Elevations	
					Existing and Required Sidewalks and Trails Shown with Dimensions	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Limits of 100-Year Ultimate Flood Plain Shown	
					Note Identifying Reference for 100 Year Floodplain and WSE Information	
					Left Turn Lane Complies with City Requirements (Spacing, Length, Construction)	
					Existing and Proposed Infrastructure within Median Modifications Shown (Trees, Street Lights, Conduit, Irrigation, etc)	
					Streets and Alley Profiles (if Applicable)	
					Street and Alley Vertical and Horizontal Curve Information (if Applicable)	
					Street and Alley Pavement Thickness, Concrete Strength, Reinforcing, Subgrade Detailed Per City Requirements (if Applicable)	
					Sight Distance Triangles Shown on Street and Alley Intersections	
					Streets and Alley Centerline Stationing (if Applicable)	
					Details and Spot Grades on Street Intersections - Denote Valley Gutters, Crown Transitions, etc.	
					Details on Horizontal and Vertical Curves with Layout Information (if Applicable)	
					Paving Marking Should be Shown - If a City Street Must comply with City Pavement Marking Standard Details	
					Show Existing Fences and Trees on Site and in Close Proximity to Property Line	
					LEFT-TURN LANES AND MEDIAN MODIFICATIONS	
					Median Details with Dimensions, Existing and Proposed Trees, Existing and Proposed Median Lighting, Lighting Conduit and Conductors, Other Improvements	
					Show Left-Turn Lane Median Geometry and Reverse Curve Dimensions and Layout Information	
					Show Spot Grades on Median to Ensure Median Opening Cross-Fall is Not Excessive	
					Show Locations of Existing and Proposed Driveways in Relation to the Left-Turn Lane on Both Sides of the Street with Dimensions	
					Left Turn Lane Buttons and Monolithic Nose Shown per City Requirements	
					Plans for Required Modifications to City Irrigation Systems (usually in medians)	
					GRADING PLAN	
					Benchmarks	
					Exist Lot Lines & Corners (lot lines screened if being changed)	
					Proposed Lot Lines	
					Existing (screened) & Proposed ROW	
					Street Names Shown	
					Drainage Easements for Drainage Features and Structures Shown (15' minimum width)	
					Existing & Proposed Improvements (paving and building footprints)	
					Minimum Finished Floor (FF) Elevations for Structures meet Requirements of Drainage Ordinance	
					Minimum Finished Floor (FF) Elevation Shown for each Structure	
					Existing & Proposed Contours for Site and Minimum of 50' Beyond Property Lines (with appropriate contour interval)	
					Existing & Proposed Spot Elev. Showing Grade; High & Low Points; Swales, Inverts & Ridges	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Lot Area and Disturbed Land Area	
					Adjacent Property Improvements Within Minimum 25' of site	
					Existing & Proposed On-site and Off-site Drainage Features (Design Info Shown)	
					Maximum Slope 4H:1V (H=Horizontal, V=Vertical)	
					Ditches Adjacent to Site Cleared, Cleaned & Regraded	
					Positive Overflow Routes	
					Limits of 100-Year Ultimate Floodplain Shown	
					Ultimate (Fully Developed) 100-Year Floodplain Water Surface Elevations (WSE's) Shown a Minimum of Every 100'	
					Note Identifying Reference for 100 Year Floodplain and WSE Information	
					Cross sections to scale with hydraulic calculations	
					Location of Cross-Sections With Stationing Shown	
					Existing and Proposed Retaining Walls with Top & Bottom Spot Elevations	
					No Lot-to-Lot Drainage	
					Grading Plan Matches Drainage Area Map	
					Does Grading Plan Address Impacts to Adjacent Properties Requiring Easements or Letters of Permission	
					DRAINAGE AREA MAP	
					Storm Drainage Analysis and design shall comply with the Drainage Ordinance	
					Existing and Proposed Drainage Area Maps Shown	
					Existing and Proposed Drainage System and Structures Shown (pipe, inlets, etc)	
					Current Zoning or Anticipated Ultimate Development Shown and Correct For Off-Site Areas	
					Ensure Site Drainage is Collected on Site	
					Design for a Ultimate (Fully Developed) 100 Year Storm Event	
					Design showing Elevation Contours for the Entire Off-Site Drainage Basin and 50' beyond Property	
					Design with most recent 2-foot Contour Information - Not USGS Quads (Minimum 2')	
					Drainage Area Map shows Subbasins For Each Collection Point and Inlet	
					Each Drainage Area has ID, Q100, Acres and Direction of Flow to the Outfall Shown	
					Each Outfall labeled with an Identification, direction of flow and Total Flow	
					Drainage Direction Arrows for Both On-site and Off-site Drainage Basins	
					Indicate all Sags and Crests With Flow Arrows	
					Drainage Area Map Calculation Table With Outfall Summary Included	
					I - Values Meet City Requirements	
					C - Values Meet City Requirements	
					Time of Concentration Values Used Meet City Requirements	
					Time of Concentration Calculations Shown (for larger areas)	
					Q - Calculated Flow in cfs	
					Provide a Subtotal for each Drainage Line	
					Drainage Area Map & Calculations for all Offsite Drainage	
					Limits of 100-Year Ultimate Floodplain Shown	
					Ultimate (Fully Developed) 100-Year Floodplain Water Surface Elevations (WSE's) shown	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Note Identifying Reference for 100 Year Floodplain and WSE Information	
					Show Limits of Each Plan Sheet	
					STORM DRAINAGE PLANS (Inlets and Storm Drain Systems)	
					Benchmark Location and Elevation	
					Minimum Finished Floor (FF) Elevations for Structures meet Requirements of Drainage Ordinance	
					Minimum Finished Floor (FF) Elevation Shown for each Structure	
					Flood Study / FEMA FIRM Map Reference Information Listed by Note	
					Storm Sewer Alignment Logical, Sharp Bends Eliminated	
					Collecting On-Site Drainage with Storm Sewer/Inlets	
					Profile Given for all Storm Sewer Mains and Laterals	
					Minimum Slopes Maintained for All Storm Drain	
					Pipe Size, Material and Class Identified on Plan and Profile	
					Hydraulic Grade Line Shown on all Storm Sewer Profiles for Mains/Laterals	
					Other Hydraulic Info Shown on Storm Sewer Profiles for all Mains/Laterals (Q100, Qcap, Velocity, V2/2g)	
					Vertical and Horizontal Alignment, Stationing, Layout, Curve Information and Slope Shown for all Mains/Laterals on Plan and Profile	
					Hydraulic Grade Line Meets City Design Requirements	
					Starting Hydraulic Grade Line Calculations/Assumptions Listed	
					Starting Hydraulic Grade Line Meets City Design Requirements	
					Ultimate 100-Year Water Surface Elevation For Outfalls into Creeks, Ponds, and Lakes Shown	
					Acceptable Pipe Velocity per *Engineering Design Manual*	
					Elevation Information on Plan View (Flowlines, Top-of-Curb, etc) Matches Profile View	
					Show Crossings of Existing and Proposed Water and Sanitary Sewer on Storm Sewer Profile	
					Note minimum Cover for Pipes and Culverts	
					Drainage System Reviewed for Constructability - Depth and Clearance From Streets, Structures, Other Utilities	
					Street Gutter Capacity Calculations Shown	
					Inlet Capacity Calculations Provided In Tabular Form	
					Inlets Placed to Capture Runoff Before It Enters Street or Major Thoroughfare	
					Driveway Radius Minimum Distance away from Inlets and Fire Hydrants per *Engineering Design Manual*	
					No Inlets Under Minimum Requirements	
					If Street Drainage, Calculations Showing Curb & Street Capacity	
					If Street Drainage, Show Nearest Inlet & all Upstream Drainage	
					Inlet Construction Layout Information Shown (Top of Curb, Flowline, Throat Elevation, Type, Size, Etc)	
					No Grate Inlets at Sag Points	
					Storm Sewer Inlet Location, Size, Type, Material and Construction Detail Per City Requirements	
					Provide Curbing in Alleys at Inlet Locations	
					Storm Sewer Manhole Location, Size, Type, Material and Construction Detail Per City Requirements	
					Pipe Intersections at 60 degrees with Larger Main (if possible)	
					Acceptable Pipe Intersections Angles per *Engineering Design Manual*	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Outfall, Headwall, and Other Structure Location, Type, Velocity, and Erosion/Scouring Protection per *Engineering Design*	
					Headwall Handrail and/or Traffic Rail Details, if Required	
					Pipe Outfall into Creeks and Ditches Point Downstream	
					Pipe Outfall Flowline at Acceptable Elevation Compared to Creek Flowline per *Engineering Design Manual*	
					Pipe Outfall Erosion Protection at Creek or Ditch per *Engineering Design Manual*	
					Pipe Outfall Energy Dissipation (if required)	
					Show Aesthetic Treatments for Headwalls	
					Positive Overflow Route Identified Through Site	
					Sag Points Identified and Paved Positive Overflow Designed	
					Outfall/Headwall Locations Pointed Down Stream	
					Outfall/Headwall Flowline at Acceptable Elevation Compared to Creek Flowline per *Engineering Design Manual*	
					Outfalls Discharge into Existing Drainage Features or Provide Easements as Required	
					Outfall Velocity per *Engineering Design Manual*	
					Appropriate Details are Included for Structures, Junction Boxes, Headwalls and Inlets	
					Connection Details Provided for Non-Standard Connections	
					Limits of 100-Year Ultimate Floodplain Shown	
					Ultimate (Fully Developed) 100-Year Floodplain Water Surface Elevations (WSE's) Shown a Minimum of Every 100'	
					Note Identifying Reference for 100 Year Floodplain and WSE Information	
					Drainage Easements for Drainage Features and Structures Shown (15' Minimum Width)	
					STORM DRAINAGE PLANS (Ditches, Swales, Flumes and Open Channels)	
					Minimum Finished Floor (FF) Elevations for Structures meet Requirements of Drainage Ordinance	
					Minimum Finished Floor (FF) Elevation Shown for each Structure	
					Ditches, Swales and Open Channels have Plan and Profile View with Stationing, Layout Information, Hydraulic Information, Cross Sections	
					Paved Flumes at all Overland Flow Locations (between houses)	
					Direction of Flow Indicated for Ditches, Swales and Open Channels	
					Ditches, Swales and Open Channels have 100 year Ultimate Water Surface Shown on Profile	
					Ditches, Swales and Open Channels have 100 year Ultimate Water Surface Shown on Cross Sections	
					Ditches, Swales and Open Channels Armored with Approved Material in Areas Where Average & Localized Velocities are Above	
					Ditches, Swales and Open Channels can Carry 100-year Ultimate Storm with 1.0' of Freeboard and 2.0' of Sediment Storage	
					Ditches, Swales and Open Channels Hydraulic Information Shown On Plans	
					Ditches, Swales and Open Channels Hydraulic Information Shown On Plans Matches Hydraulic Report or Flood Study	
					Ditches, Swales and Open Channels Side Slopes Less Than 4H:1V for Grassed/Un-Armored Sections	
					Ditch, Swale and Open Channel Width, Depth, Running and Side Slopes and Capacity Per City Requirements	
					Drainage Easements for Drainage Features and Structures Shown (15' minimum width)	
					STORM DRAINAGE PLANS (Detention and Ponds)	
					Required Detention Shown	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Detention Calculation Shown and Correct	
					Detention/Retention Pond Location, Size, Depth, Capacity, and Material Per *Engineering Design Manual*	
					Grading Plan for Detention/Retention Pond	
					TCEQ Permits for Retention Ponds	
					TCEQ Requirements met for Dams/Ponds - Breach Analysis, Etc…	
					Soils Analysis for Retention Ponds and Dams	
					Retention Ponds Should Not have Submurged Inlet Structures	
					Provide Access and Structures that Contribute to Long Term Maintenance of Detention Pond	
					Drainage Easements for Drainage Features and Structures Shown (15' Minimum Width on Both Sides or 20' Minimum Width on One Side)	
					UTILITY (WATER AND SANITARY SEWER) PLANS	
					Private Utility Note: "ALL SANITARY SEWER AND WATER WORK DESIGNATED AS “PRIVATE” IN THIS SET OF PLANS SHALL BE INSTALLED IN ACCORDANCE WITH THE INTERNATIONAL PLUMBING CODE, PERMITTED AND INSPECTED BY THE CITY BUILDING INSPECTION DIVISION AND INSTALLED BY A LICENSED PLUMBER."	
					WATER	
					Water Main Sized In Compliance with Water System Master Plan	
					Water Mains Provided to Front Property Along all Street Frontages	
					Water Main Extension Required By Code Shown	
					Water Mains Looped to Provide Circulating and Redundant Feed	
					Water Main Size, Material and Class Called Out	
					Existing Water Mains and Valves Shown; Show Valves on both sides of Tap in Case Area Needs to be Isolated	
					Existing & Proposed Fire Hydrants Shown	
					Utility Easements for Water Mains Shown (15' minimum width)	
					Utility Easements for Fire Hydrant Shown (15' minimum width)	
					Proposed and Existing Fire Lanes Shown	
					Fire Hydrant Spacing Meets Requirements of Adopted International Fire Code (IFC)	
					Fire Sprinkler Line Shown into Riser Room	
					Fire Sprinkler Line Outside of Utility Easement	
					Fire Sprinkler Line Called Out as "Private" Past Easement or Right-of-Way	
					Fire Sprinkler Line Called Out as "Public" Within Easement or Right-of-Way	
					Fire Sprinkler Fire Department Connection (FDC) Location Shown and Detailed	
					Water Main Fittings, Valves, etc Identified	
					Water Mains Profiled when Required as per *Engineering Design Manual*	
					All Water Main Bores Profiled	
					All Crossings Identified on Appropriate Profile and Plan	
					Bore complies with Bore and Utility Crossing General Design Standards	
					Existing Water Meters Shown with Size	
					Proposed Water Meters Shown (Both Domestic and Irrigation) with Size(s)	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					Domestic Water Meters on Looped/Circulating Main	
					All Water Meters on Separate Service - No Water Meter "Bullheads" or Manifolds Allowed	
					Water Meters Located in Unpaved Area	
					Water Meter Sizes Identified	
					Water Service Line Called Out as "Private" Before Meter	
					Water Service Line Called Out as "Public" Past Meter	
					Appropriate Backflow Prevention (RPZ) Shown on Private Side of Irrigation Meters, DC is required on domestic on riser in building	
					Water System Reviewed for Constructability and Maintenance - Depth and Clearance From Streets, Structures, Other Utilities	
					Water Mains Identified as Either Public or Private with Lines of Demarcation	
					Utility Crossings Shown in All Profiles and Bore Profiles including Franchise Utilities and Street Light Utilities	
					SANITARY SEWER	
					Sanitary Sewer Mains Provided to Front Property or Otherwise Extended to Serve Upstream Property	
					Existing Sanitary Sewer Mains, Manholes, Cleanouts and Services Shown	
					Proposed Sanitary Sewer Mains, Manholes, Cleanouts and Services Shown	
					Sanitary Sewer Mains Profiled	
					Bore complies with Bore and Utility Crossing General Design Standards	
					Sanitary Sewer Main Size, Material and Class Identified on Plan and Profile	
					Sanitary Sewer Depth, Slope, Service Locations, Cleanouts and Manholes shown in all Profiles	
					Sanitary Sewer Rim, Flow Line In & Flow Line Out Elevations for All Manholes	
					Utility Crossings Shown in All Profiles and Bore Profiles including Franchise Utilities and Street Light Utilities	
					Sanitary Sewer System Reviewed for Constructability and Maintainability - Depth and Clearance From Streets, Structures, Other Utilities	
					All Existing and Proposed Public and Private Easements and Rights of Way Shown	
					Sanitary Sewer Line Called Out as "Private" Before Easement or Right-of-Way	
					Sanitary Sewer Line Called Out as "Public" Within Easement or Right-of-Way	
					Sanitary Sewer Mains Identified as Either Public or Private with Lines of Demarcation and Private Utility Note	
					Single-Family Residence Not Connected to Main at Manhole	
					Nonsingle-Family Residence Connected to Main at Manhole	
					Sanitary Sewer Main Ends at a Manhole	
					PAVEMENT MARKING, SIGNAGE AND LIGHTING	
					Plan Sheets and Details on Required Street Name Signs, Street Lighting and Pavement Marking and Traffic Signage for City	
					MISCELLANEOUS DETAILS AND REQUIREMENTS	
					Plans for Required Modifications to City Irrigation Systems (usually in medians)	

Engineering Plan Checklist - March 2024

Project Name: _____ **Engineer Completing Checklist:** _____ **Date of Plan Submission:** _____

Not Applicable	Included	Missing	Incomplete	Code Ref	Item Description	Notes
					EROSION CONTROL (For Sites Greater 1- Acre or Larger) / SWP3 (If Required by TCEQ Regulations)	
					Owners Name, Address & Phone No.	
					Developers Name Address & Phone No.	
					Engineers Name Address & Phone No.	
					Site Acreage Listed	
					Disturbed Acreage Listed (Acres)	
					Limits of Construction and Disturbed Areas Shown	
					Existing Ground Contours, Drainage Features and Structures	
					100-Yr Flood Plain with Elevations	
					Limits of Trees/Shrubs to Remain	
					Grades Match Grading Plan	
					Proposed Storm Drainage, Structures & Pavement	
					Borrow & Spoil Area Identified	
					BMP Locations, details, Calculations, and Maintenance Schedule	
					Sediment Basin, required if disturbed area greater than 10 acres	
					General Design Standards & Standard Details	
					City of Sachse's General Notes Sheet	
					All Applicable City Standard Details	
					TxDOT Pedestrian Facilities Curb Ramps PED - 18 Details	
					TxDOT Precast SET Type II Cross and Parallel Drainage Details	
					Specialized Manufacturer's Details	
					Other Pertinent Details - Explain	
					Other Pertinent Details - Explain	

Traffic Impact Analysis Checklist

Project Name: _____

Engineer Name: _____

Engineering Firm: _____

Report Date: _____ Date Received: _____

Note: This checklist is provided for convenience only and represents only a partial list of the requirements for TIAs. Refer to ***Section 2.16*** *(Traffic Impact Analysis) for all requirements. Any N/A response shall include a written explanation with adequate justification, as deemed necessary by the Engineering Department.*

COMPLETE	N/A	1. PRELIMINARY MEETING
☐	☐	Contact the Manager of Traffic Engineering prior to beginning the study
☐	☐	Analysis needed for weekday peak hours
☐	☐	Analysis needed for weekend peak hours
☐	☐	Analysis needed for mid-day weekday or school period
☐	☐	Method of distributing trips
☐	☐	Analysis software
☐	☐	Percentage of pass-by or internal capture

COMPLETE	N/A	2. INTRODUCTION
☐	☐	Description site location and study area
☐	☐	Development description
☐	☐	Selection of analysis period

COMPLETE	N/A	3. SITE CONDITIONS
☐	☐	Existing Conditions ○ Existing zoning (source cited) ○ Geometric parameters of existing roads from governing body ○ Existing traffic counts ○ Intersection and driveway counts (eight hours if a traffic signal warrant will be conducted) ○ 24-hour volume counts (Tuesday to Thursday, or possibly weekend)
☐	☐	Site Development ○ Vicinity map ○ Site plan ○ Driveway locations and street alignment

COMPLETE	N/A	4. PROJECTED TRAFFIC
☐	☐	Site Traffic ○ Clear and concise description for trip generation purpose (source cited) ○ Trip generation using the current edition of ITE's *Trip*

Generation Manual
- Trip distribution and assignment (each step of this procedure should be clearly shown in enough detail so that all calculations can be verified)
- Account for pass-by trip and internal capture reductions

☐ ☐ Background Traffic
- Clear and concise description for trip generation purpose (source cited)
- Vicinity map of background sources
- Trip generation using the current edition of ITE's *Trip Generation Manual*
- Trip distribution and assignment (each step of this procedure should be clearly shown in enough detail so that all calculations can be verified)

☐ ☐ Reassignment Rates
- Clear and concise description (source cited)
- Pass-by, diverted trips, and internal capture using the current edition of ITE's *Trip Generation Manual* based on different land use classifications
- Reduction for any other land use types should be documented and approved by the City

☐ ☐ Total Traffic
- Clear and concise description for trip generation purpose (source cited)
- Combine site and background traffic for each intersection and driveway

☐ ☐ Future Traffic
- Clear and concise description for trip generation purpose (source cited)
- If required, calculate using background traffic volumes adjusted for the TIA horizon year

COMPLETE	N/A	5. TRAFFIC ANALYSIS
☐	☐	Existing level of service (LOS) analysis using software approved by the City
☐	☐	Background LOS analysis using software approved by the City

- Capacity analysis for unsignalized intersection using current version of HCS software or other software approved by the City
- Signal warrants analysis using TMUTCD
- Capacity analysis for signalized intersection using software approved by the City (if existing or warranted)
- Turning vehicle storage space (queuing) analysis, as required by City Code

☐ ☐ Projected LOS analysis using software approved by the City

- Capacity analysis for unsignalized intersection using software approved by the City
- Signal warrants analysis using TMUTCD
- Capacity analysis for signalized intersection using software approved by the City (if existing or warranted)
- Turning vehicle storage space (queuing) analysis as required by City Code

☐	☐	Site circulation/parking analysis
☐	☐	Summarize net change in Measures of Effectiveness
☐	☐	Safety analysis
☐	☐	Discussion of additional facilities (sidewalks, crosswalks, school bus stops, railroad crossings, etc.)

COMPLETE	N/A	6. TRAFFIC MANAGEMENT PLAN
☐	☐	Traffic Management Plan (TMP) based on the site plan (include estimated maximum peak hour trip generation, the planned traffic circulation, and the estimated traffic queuing)

COMPLETE	N/A	7. CONCLUSIONS AND RECOMMENDATIONS
☐	☐	Site access, driveways, and circulation plan
☐	☐	Recommended site modifications (include drawings and cost estimate)
☐	☐	Recommended intersection and driveway improvements (include drawings, cost estimate, timing methods, etc.)
☐	☐	Recommended off-site improvements (include drawings and cost estimate)

COMPLETE	N/A	8. APPENDIX/DOCUMENTATION
☐	☐	Raw traffic count data
☐	☐	The current edition of ITE's trip generation data summary
☐	☐	Capacity analysis printouts and data file
☐	☐	TMUTCD's Traffic Signal Warrant Analysis worksheets
☐	☐	Photographs of the site
☐	☐	Additional tables or figures not included in the report

COMPLETE	N/A	9. SUBMITTAL AND REVIEW PROCEDURES
☐	☐	Two bound copies of the TIA report, including all documentation and signed and sealed by a licensed Professional Engineer in the State of Texas.
☐	☐	Traffic Engineer approval is valid for 24 months, provided significant changes in the development proposal or surrounding conditions have not occurred. If site plan changes after initial TIA approval, the TMP shall be revised accordingly and resubmitted for Traffic Engineer approval.

MISCELLANEOUS NOTES:

_____

_____

_____

_____

_____

_____

_____

Engineer Signature: _____ **Date**: _____

GEOTECHNICAL REPORT FOR ROADWAYS CHECKLIST

Project Name: _____

Geotechnical Engineer/Firm: _____

Report Date: _____ Date Received: _____

Note: Any N/A response shall include a written explanation with adequate justification, as deemed necessary by the Director of Public Works.

COMPLETE	N/A	1. SECTION 2.11.1 GENERAL
☐	☐	A. Include the *Summary of Geotechnical Recommendations Form*
☐	☐	B. Description of Project
☐	☐	C. Location of Project
☐	☐	D. Roadway type and classification
☐	☐	E. Grading plan and summary
☐	☐	F. Discussion of underground utilities within the Project limits

COMPLETE	N/A	2. SECTION 2.11.2 GEOTECHNICAL INVESTIGATION
☐	☐	A. Discussion of existing surface/subsurface conditions that may affect subgrade and pavement design or performance (i.e. vegetation, terrain, existing structures, existing pavement, etc.)
☐	☐	B. Discussion of geological conditions that may impact subgrade and pavement design or performance. Specify formation.
☐	☐	C. Surface/subsurface conditions with logs - Sampling techniques - Description of soil and rock encountered, including lab test details - Discussion of water and groundwater conditions - Discussion of seasonal variations in moisture content - Atterberg limits (ASTM D 4318) - Percent Passing the No. 200 sieve (ASTM D 1140)
☐	☐	D. All standards used in field and laboratory testing shall be identified. Any deviations to standard procedures shall be discussed.

COMPLETE	N/A	3. SECTION 2.11.3 SUBSURFACE DESIGN
☐	☐	A. Expansive Soils Evaluation - Percent swell calculation and test results - Effect of cut/fills (i.e. long-term soil uplift in cut areas; settlement overburden pressure effects in fill areas) - Identify soil movement estimates at each boring location - Explanation of anomalous variations within the soil profile and between borings (i.e., Atterberg limits, PI, sulfates, clay to rock, etc.)
☐	☐	B. Soil Moisture Conditioning - Discussion of swell test results summary - Recommended depth of moisture conditioning

- Address transition between zones of varying depth
- Discussion of possible variations during construction and mitigation thereof

- Discussion of techniques to maintain moisture in soil
- Discussion of methods to test soil moisture conditioning during construction (i.e. a second geotechnical investigation/re-evaluation may be required to specifically address soil moisture prior to lime operations)
- Address street trees

COMPLETE	N/A	4. SECTION 2.11.4 SUBGRADE DESIGN
☐	☐	A. Subgrade Stabilization - Typical subgrade type - Explanation of anomalous soil conditions anticipated and discussion of potential variations to consider - Construction techniques to implement - Effects of rock/rock fragments encountered during construction and recommendations to abate
☐	☐	B. Soluble Sulfates - Identify soluble sulfate test results; summarize results and discuss variations - Discussion of techniques during construction to mitigate sulfate- induced heaving - Sulfate retesting during construction

COMPLETE	N/A	5. SECTION 2.11.5 PAVEMENT DESIGN
☐	☐	A. Identify roadway type(s) and classifications(s)
☐	☐	B. Identify deviations from Pavement Design Input Values (Re: **Table 2-23**)
☐	☐	C. Identify recommended pavement section

COMPLETE	N/A	6. APPENDIX
☐	☐	A. Geological Map
☐	☐	B. Boring Locations
☐	☐	C. Boring Logs
☐	☐	D. Grading Plan (for non-linear projects)
☐	☐	E. Cut vs. fill by station number (for linear projects)
☐	☐	F. Printout from WinPAS pavement design software program
☐	☐	G. Proposed typical section with dimensions showing pavement thickness, subgrade type and thickness, moisture conditioning depth, and location of moisture barrier. If applicable, location of proposed trees and root barriers shall be shown.

Geotechnical Engineer Signature: _____ **Date**: _____

GRADING & FLOODPLAIN DEVELOPMENT PERMIT

CITY OF SACHSE

Permit No. _____

This permit allows the owner to fill, grade, excavate, or otherwise disturb the surface of property described below, in accordance with Sachse City Code, Section 11-50 to 11-57.

PROJECT NAME: _____

PLAT NAME: _____

PROPERTY LOCATION: _____

PROPERTY OWNER: _____

DEPOSIT REQUIRED:	**$ 0.00**	**(Disturbed land area-acreage)**
PERMIT FEE (NON-REFUNDABLE):	**$ 100.00**	
TOTAL:	**$ 0.00**	

Requirements and conditions of this permit:

☒ **Grading plans have been submitted and approved by the City.**

☒ **Submission of a notarized statement from the property owner giving permission to the Contractor to fill, grade, excavate, or otherwise disturb the property and acknowledgment by property owner of his responsibilities as described in section 11-57 of the Sachse City Code.**

☐ **For projects disturbing 1 acre or more of land, submission of a Storm Water Pollution Prevention Plan (SWPPP) in accordance with City, TCEQ and EPA regulations and requirements.**

☐ **For projects disturbing 5 acres or more of land submit a copy of the Notice of Intent (NOI) from all site "Operators".**

☐ **When applicable, submit copy of Parks & Recreation Department Approval of the tree preservation plan to the Engineer.**

☐ **When applicable (floodplain encroachment), provide a copy of a Conditional Letter of Map Revision (CLOMR) from FEMA.**

☐ **Special Conditions –**

The Developer, Contractor and Engineer is hereby notified that issuance of this permit does not indicate approval of the engineering plans and that grade revisions can and will be made if determined necessary after a complete review of the final plans.

At any time the City determines that the project is in non-compliance with this permit or any other applicable permits and/or letters of permission, this permit shall be revoked and a stop work order shall be issued to the Developer and / or Contractor.

If it is necessary for the City to remove soil, rock, mud or debris from its streets, alleys, utility facilities, rights of way or easements, or construct erosion devices on the permit site to prevent erosion in connection with this permit, the cost of such will be charged to the holder of this permit and subtracted from the balance of the deposit required herein. To be reimbursed for deposited funds NOT used to reimburse the City for construction or removal of soil, rock, mud and debris, a written request must be made to the City Engineer from the depositor named below within two (2) years of written project acceptance by the City Engineer, and the following conditions must be met. Failure to request funds within the prescribed time will result in forfeiture of such funds to the City's General Fund.

1. **All disturbed areas on and off site are vegetated with a vigorous stand of grass or other ground cover.**
2. **Temporary erosion control devices are no longer required and have been removed.**
3. **Permanent erosion control devices are in place on the site and working properly and no further hazard of erosion is present on the site.**
4. **Where applicable, a copy of the TCEQ Notice of Termination (NOT) for the project has been submitted to the City.**
5. **The City Engineer has given written acceptance of the project.**

The Depositor must notify the City of Sachse, Attn: Engineering Division in writing of all address changes.

Deposited By:

Name:

Address:

Phone:

Permit Issued By:

Name:

Title: Storm Water Specialist

Date:

cc: Construction File
Property Owner
Construction Contractor
Grading Permit File

Form Revised: 1-15-2019

CITY OF SACHSE

OWNER'S STATEMENT OF PERMISSION AND RESPONSIBILITY

I, _____, being the Owner and/or Officer of

_____,

the Company/Individual/Partnership ***(circle one)*** that owns the property described in the attached Grading Permit and being fully authorized to execute this statement for the purposes stated herein, do hereby give permission to

_____,

contractor, to fill, grade, excavate, or otherwise disturb the described property. Further, I acknowledge and understand all of the responsibilities and obligations of the Property Owner described in Sections 11-50 to 11-57 of the *Code of the City of Sachse, Texas,* and all of the provisions of such Sections including the right of the City of Sachse to go upon the property to perform any requirements unfulfilled by the Owner.

SIGNED this _____ day of _____, _____.

By: _____
Signature

_____
Printed Name

_____
Texas Drivers License No.

_____
Title

_____
Company Name

_____
Mailing Address

_____
Mailing Address

_____
Telephone & Fax Numbers

DEPOSIT REQUIRED:	
$ _____; 1st Acre $500 + $100 for each additional Acre (round up)	
$ 300.00	**PERMIT FEE (NON-REFUNDABLE)**
$ _____	**TOTAL AMOUNT DUE**

State of Texas §
§
County of _____ §

Before me, the undersigned authority, on this day personally appeared the person whose name is subscribed to the forgoing *Owner's Statement of Permission and Responsibility* and acknowledged to me that he/she has the authority to execute the same for the Company named therein.

GIVEN under my hand and official seal this _____ day of _____, _____.

_____
Notary in and for the State of Texas

City of Sachse – Engineering Department

ALLOWABLE FILL MATERIALS

(Per the City Code of Sachse)

FILL IN AREAS ZONED FOR COMMERCIAL USE (excluding ROW or Easements):

- Clean soil, clay, shale, gravel, or sands.
- Broken concrete pavement, if the maximum particle size is 4" in diameter and all reinforcing steel is removed.

Note: Consult with the Building Inspection Division for Compaction Requirements.

FILL IN AREAS ZONED FOR RESIDENTIAL DEVELOPMENT (excluding ROW or Easements):

- Clean soil, clay, shale, gravel, or sands.

All fill on residential lots and pads shall be compacted to a minimum **95% of standard proctor** (ASTM D-698) with optimum moisture content of 0% to +6%. Compaction shall be placed with a maximum of 12" loose lifts and shall be compacted with sheep's foot vibratory roller.

FILL IN AREAS THAT ARE OR MAY BECOME CITY RIGHT-OF-WAY OR EASEMENT:

- Clean soil, clay, shale's, gravel, or sands.
- **Under existing paving**, fill material shall be crushed concrete flexible base, TXDOT Item 247, Grade 1, Type D.

All fill within City right-of-way or easements shall be compacted to a minimum **95% of standard proctor** (ASTM D-698) with optimum moisture content of 0% to +6%. Compaction shall be placed with a maximum of 12" loose lifts and shall be compacted with sheep's foot vibratory roller.

MATERIALS UNSUITABLE FOR FILL:

The following materials are unsuitable for fill due to their high potential for settlement, decomposition, or other unsatisfactory engineering properties:

- Trash or debris of any kind.
- Any soil or debris that has a high organic content, such as pond silt, topsoil with roots, wood chips, brush or tree limbs, etc… Topsoil may be used in landscaping areas when there is an approved site plan that details the location of future paving and structures and landscape areas.
- Broken concrete pavement, if the particle size is greater than 4" in diameter or if there is any reinforcing steel.
- Reinforcing steel or other steel products.
- Asphaltic materials.

NOTE: Per the Texas Administrative Code, Title 30 Environmental Quality, Chapter 330 "Municipal Solid Waste" - the use of asphaltic materials and concrete containing reinforcing steel for fill is not permitted.

Individual Single-Family Lot Residential Development Engineering Plans Checklist

Revised: March 2024

This checklist is intended to assist the developer of individual or a small number (four or less) of single-family home lots with requirements for engineering plan submittal. Closely following this checklist will help minimize the number of comments returned and speed the overall process of engineering plan review. Please read the ***Engineering Plan Submittal Requirements*** **located in Appendix B of the Engineering Design Manual for a more thorough** explanation of requirements listed below.

It is strongly suggested that a meeting be held with the City Engineer or assigned City Project Engineer prior to purchasing a lot for building a home and prior to hiring an engineer.

Prior to submission please research and have the following questions answered:

1. Does the lot have existing water and sewer services that are relatively new (less than 20-year old) and could be used for the new home? – Contact Utilities Division to verify – Engineering plans are required if new water or sanitary sewer services are needed. Refer to Section 5.12 of the Engineering Design manual for guidance on when a new water tap is required and refer to Section 6.6 of the Engineering Design Manual for guidance on when a new sewer service needs to be installed.
2. Does the street in front of the lot have curb and gutter or no curb and gutter (only ditches)? Engineering plans are required if there is a ditch in front of the house and a culvert is needed.
3. Is there significant off-site storm water directed to the lot? Engineering plans are required if there is significant off-site storm water runoff draining through or directed toward the site.
4. Is the lot in or adjacent to a floodplain? Engineering plans will be required if the site is adjacent to or contains a significant drainage feature such as a ditch, creek, detention pond or floodplain.
5. Does the area have a history of flooding problems as recorded in the Engineering Division complaint database? Engineering plans are required if the area has a history of flooding problems.
6. Does the lot need platting?

<u>Each Engineering Plan Submission Shall Consist of:</u>

☐ **Digital copy in pdf format per eReview Standards:**

- **Engineering plans (including details)**
- **Supporting design calculations, reports, hydraulic studies, geotechnical reports, SWPPP, etc.**
- **Required Administrative Items (such as supporting permit documentation, etc. – Refer to the *Engineering Plan Submittal Checklist* in Appendix B of the Engineering Design Manual**

☐ **Correct engineering plan review fee**

All submittals of the above information will be through the Citizen Access Portal at:

https://energov.cityofSachse.com

Engineering Plan Set Will Generally Include the Following Sheets:
(Read *Engineering Plan Submission Requirements* and *Engineering Plan Checklist* for detailed requirements)

☐ Cover Sheet
☐ Plat
☐ Dimensional Control & Paving (usually on the same sheet)
☐ Grading Plan
☐ Drainage Area Map
☐ Drainage Plan
☐ Utility Plan Showing:
- Existing Site Features in the area of the proposed installation, including buildings, trees, paving and other utilities.
- Building Finished Floor elevation
- Existing water and sewer main location, size and material
- R.O.W. and easement lines

☐ Appropriate Standard Details

General Design Information on water and sewer service:

☐ All water services from the City main to the meter shall be within dedicated ROW or in a 15' min. utility easement.
☐ Profiles for all bores showing all crossings of existing utilities.
☐ Domestic taps must be off a looped main and not a dead end/fire hydrant lead.
☐ Single Family Residential sanitary sewer tap cannot be at a manhole.
☐ Show pavement to be removed and replaced if required.
☐ Taps on mains larger than 12-inch diameter should be avoided and may not be allowed in some cases.

Grading, Drainage Area Map & Drainage Plans are generally the most difficult portion of the engineering plans. These plans must include/address the following:

☐ Provide side yard swales and drainage around house with spot elevations and drainage direction arrows (lot-to-lot drainage is generally prohibited)
☐ Show the Minimum Finish floor elevation – see Drainage Ordinance for requirements
☐ Show the topography for site and at least 50 feet outside of site
☐ Show Benchmarks – Elevation and description of benchmark location
☐ New water and sanitary sewer services (old services must be disconnected/capped at main)
☐ Show adjacent drives, adjacent ditches, adjacent homes, adjacent culverts
☐ If a culvert is required – Hydraulic calculations, RCP pipe embedment details, precast SET headwalls & profile
☐ Drainage Area Map – show contributing off-site drainage to site and bar-ditch
☐ Hydraulic Study / Flood Study Information –If adjacent to a Drainage Feature or in a floodplain

Note: A site survey showing all visible ground features such as water valves, manholes, curbs, trees, pavement headwalls, storm water inlets, and other features is required. The survey may be limited to the location around the service tap and service lines. Additional survey may be required if the tap location needs to be moved. Utility locator maps and As-builts can be obtained through our Engineering GIS website. Standard Details and Plan submittal application can be found on the Engineering Department website under Engineering Resources.

An Engineering Inspection Fee payment is required based on the estimated cost of improvements.

City of Sachse ROW & Easement Abandonment Procedure

Revised: March 2024

The procedure to abandon ROW or an easement is as follows:

R.O.W. or easements will only be abandoned if they do not contain City facilities or facilities of a franchised utility company, and if the ROW or easement is not currently being utilized or is determined to no longer be needed for public use. At times portions of easements may be abandoned or abandonment may occur reserving a utility easement, but only if a partial abandonment or such reservation does not hinder the City's ability to maintain its facilities or a utility company's ability to maintain the facilities of the franchised utility company.

Since Right-of-Way (ROW) and easements are dedicated to the City for the public use, action by the City Council is required to abandon a public ROW or easement. City ROW and easements are also utilized by various privately owned utility companies through contractual franchise agreements with the City. Therefore, the franchised utility companies must agree with the abandonment of an easement or ROW.

If all of the requirements set forth in this procedure are met, abandonment will be considered by the City Council by adoption of an ordinance (or other appropriate legal instrument as outlined below) abandoning the affected ROW or easement. Once approved by the City Council, the ordinance and/or other appropriate legal instrument will be filed in the Deed Records of the County where the abandoned property is located.

If a street easement was acquired by plat, the method for abandonment of whatever interest the city acquired will be by council ordinance, which will be filed of record to provide a searchable item in the county land records.

If the easement was acquired as a specific dedication by separate instrument or by prescriptive easement and not by plat, a document that expressly abandons the easement and releases all of the city's interest (a vacating document) must be approved by the city council and these documents *must* be filed at the county records office.

If the city acquired fee simple title, the city must convey it by deed, following all the applicable procedures in the Local Government Code, Section 272.001 et seq.

A pre-application meeting with the City Engineer is highly recommended to look at the specifics and receive initial guidance through the process. The applicant requesting the abandonment must obtain the following information and forward this information to the Engineering Division **as a complete packet**:

☐ A letter of request from the applicant and all adjoining property owners requesting abandonment of the subject ROW or easement. Where the underlying title to the ROW is in more than one owner, all owners must agree to the abandonment. The City will not be responsible for determinations of ownership and division of property.

☐ Check made out to the "City of Sachse" in the amount of **$500.00** for the administrative processing fee for abandonment of public easements or ROW (per Ordinance No. 3970 – Sachse City Code Section 1-18).

☐ A copy of the original ROW and/or easement dedication instrument (usually this is a plat or a separate dedication instrument). Often the Engineering Division or City Secretary's office will have

copies of the dedication instrument on file and can make copies of the document for the applicant. However, in some cases the Engineering Division or City Secretary will not have copies. In these cases the applicant must do the required research and obtain certified copies of the documents.
This research often requires research of the County Records. The Applicant will likely require the assistance of a surveyor, title company, or other land records professional of the applicant's choice in finding the required documents.

☐ The applicant must have a survey and field notes prepared by a licensed surveyor for the ROW or easement to be abandoned. Often only a portion of the original dedication can be abandoned. The sketch and field notes should reflect only those portions to be abandoned.

☐ Actual field locations of all City utilities should be recorded by the applicant's surveyors. If the utilities are under or close to a structure these locations should be shown on the sketch of the area to be abandoned, along with the necessary easements. The City Utility Division will aid surveyors in the location of the utilities.

☐ Letters from all the franchised utility companies indicating they have no objections to the ROW or easement abandonment are required. If the easement contains facilities of the franchised utilities, these facilities should be shown on the sketch. Contact should be made with the respective franchised utility companies to locate their respective facilities.

☐ In some cases, ROW or easement abandonment will involve the purchase of property or interest therein from the City. In such cases the applicant must have an appraisal done by a **MAI certified appraiser** who is pre-approved by the City. This appraisal will be the basis for determining fair market value of the property to be paid to the City by the applicant. **Contact the City Engineer for specific guidance whether this step is required**.

When the relevant above information has been received by the Engineering Division, the applicant will be notified that the file is complete and ready for City Council action. At this time, the City Engineer will place the abandonment on the City Council agenda, prepare a M&C with recommendation, and inform the applicant of the date and time of the council meeting. Generally this type of item is placed on the consent agenda.

The City Engineer will request preparation of an abandonment ordinance from the City Attorney's office and forward to them the applicable sketch, field notes, and M&C for the abandonment.

The applicant should be present at the City Council meeting in the event the City Council pulls the item off of the consent agenda and wishes to discuss the matter in open session.

Upon City Council approval of the abandonment ordinance the applicant is required to pay to the City the value of the abandonment as determined by the MIA appraisal (if applicable). Once the settlement is received the City finalizes the abandonment ordinance and forwards a copy of the ordinance to the applicant.

Additional copies are given to the Engineering Division for filing in the applicable subdivision file (along with the information assembled by the applicant) and for recording on various City maps.

City Of Sachse - Temporary Concrete Batch Plant Permits

Revision Date: March, 2024

PURPOSE:
To provide a uniform and equitable procedure for the permitting of temporary concrete or asphalt batch plants.

HISTORY:
The zoning ordinance, Section 1-602(C) gives the City Council authority to approve temporary concrete or asphalt batch plant permits. This authority was delegated to City staff by the City Council June 3, 1974.

Administrative Directive No.2 assigned permitting responsibility for temporary concrete batch plants to the Engineering Division.

PROCEDURE:
In applying for a temporary batch plant permit, the following six items of information must be submitted by the applicant to the Engineering Division:

1. Letter of request from applicant for permit.
2. An area map of approximate location of proposed site put on Mapsco Grid. This area map should indicate proposed truck route of aggregate haulers and concrete trucks.
3. A plot plan of the batch plant site showing dimensions to existing construction, location of fire hydrant for proposed water source, etc.
4. Copy of Texas Commission on Environmental Quality (TCEQ) application. This should include copies of required public notices, if applicable.
5. Copy of TCEQ permit.
6. Notarized letter of permission from property owner allowing use of property for batch plant site. This requirement can be waived if the batch plant is within the boundaries of the project.

Engineering staff shall evaluate the permit for compliance with the zoning ordinance, Section 1-602(C) requirement – ***"Such batch plant shall be located at least five hundred (500) feet from any occupied residential lot, and shall not be used for construction at any other location than the project for which it is permitted."***

Once this information has been received and reviewed by the Engineering Division and all information is satisfactory, a letter of permit shall be sent to the applicant. A copy of the permit letter should be sent to the Public Works Construction Inspector assigned to the project.

Generally, permits shall be granted for specific projects within the City of Sachse; and only for the time duration of that specific project. Exceptions to these guidelines can be granted by the Director of Public Works.

City of Sachse - Engineering Acceptance of Civil Construction:

March 2024

In addition to proper completion of the construction shown on the engineering plans, there are several important administrative items that must be submitted and approved prior to City acceptance of the improvements and issuance of a Certificate of Occupancy for a project. These administrative items include:

- ☐ **Record Drawings.** If changes to the "released" set of Engineering Plans are needed during construction, they must be submitted to the City Engineering Division for review and release. Both hard copy and electronic copy of record drawings are required prior to final acceptance. Refer to the *Record Drawings Procedures Private Projects* in Appendix B of the Engineering Design Manual

- ☐ **Maintenance Bond** – a one-year maintenance bond for 10% of the cost of the public improvements (or a minimum of $500.00) must be submitted to your assigned Engineering Division Public Works Construction Inspector.

- ☐ **Acceptance Letter Request Form –** fill out this form and turn into your assigned Engineering Division Public Works Construction Inspector. Refer to the *Acceptance Letter Request Form* in Appendix B of the Engineering Design Manual

- ☐ All required **construction and material tests reports** have been successfully completed and witnessed by your inspector and related documentation of these tests submitted to your assigned Engineering Division Public Works Construction Inspector.

- ☐ All other project documentation complete, City invoices paid, etc.

VARIANCE REQUEST FORM:

Project Name: _____

Engineer Name: _____

Engineering Firm: _____

Request Date: _____ Date Received: _____

REQUIREMENT REQUESTING TO BE VARIED:

_____

_____

_____

_____

VARIANCE REQUESTING:

_____

_____

_____

_____

Note: All the following items should be included with this form for a variance request to be reviewed. Any N/A response shall include a written explanation with adequate justification, as deemed necessary by the Director of Public Works.

COMPLETE	N/A	1. GENERAL
☐	☐	A. Description of Project
☐	☐	B. Location of Project

COMPLETE	N/A	2. VARIANCE REQUEST SPECIFICS
☐	☐	A. Signed and sealed engineering analysis

The City Engineer will review variance request and will request additional information necessary to complete review.

Engineer Signature: _____ **Date:** _____

Drainage Plan Requirements

For residential lots without grading information a Drainage Plan is required. The plan must be signed and sealed by a civil engineer licensed in the State of Texas. The plan must provide the following information:

1. Proposed contours at 1 foot intervals
2. The Finished Pad Elevation (FP) and Finished Floor Elevation (FFE)
3. The elevation of the lot corners
4. Drainage arrows showing direction of flow
5. Culvert information including pipe size and material, flow lines at both ends and slope.
6. The location of any sub-surface drainage systems NOTE: drainage terminations must be clearly identified and must be at least 2 feet away from ROW or adjacent property lines.
7. Spot elevations at high points or inlets
8. All existing utilities and improvements including inlets, manholes, fire hydrants and ADA facilities
9. Proposed utility locations including water meter and sanitary sewer cleanout location
10. All retaining walls with top and bottom of wall elevations
11. All proposed flatwork, including driveways; include driveway width
12. All Easements

APPENDIX B

APPROVED MATERIALS LISTS

APPROVED MATERIALS LISTS

1. Approved Material List for Water
2. Approved Material List for Sanitary Sewer
3. Approved Material List for Drainage
4. Approved Material List for Paving
5. Approved Material List for Traffic

The Engineer shall verify the current edition of the approved materials lists with the Engineering Department.

Approved Materials List for Water

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Water Pipe						
Water Main	4" to 18" Dia		PVC, Class 305, DR 14	AWWA C900	Designed for minimum working pressure of 200psi and minimum field test pressure of 200 psi; HS-20 Live Load; HDPE and PVC shall be blue in color	Push on joints: ASTM D-3139; Gaskets: ASTM F477; Fusible PVC and Certa-Lok are acceptable PVC pipe materials
			HDPE, Class 333, DR7	ASTM F714, PE 4710		
	> 18" Dia		As approved by Director of Public Works			
		Rehau Municipex	PEX-A	AWWA C904, ASTM F876	Blue Color	Cross-linked polyehtylene; Stainless steel stiffeners shall be used; Install with 12 gauge detectable tracing wire with HDPE coating
Fire Hydrants						
Fire Hydrants		Mueller	Super Centurion 250-A423		Manufactured within 2 years of install date; 1~ 4" Steamer Nozzle; 2 ~ 2.5" Hose Nozzles; 1 1/4" Pentagon Operating Nut Turns Counter - Clockwise to Open; Install without chains	
		Waterous	Pacer WB67			
Fire Hydrant Paint	Aluminum	Flynt			Paint color shall match Engineering Design Manual specification	
		TNEMIC	Series 43-46 Chrome Aluminum			
	Blue	Flynt				
		TNEMIC	Series 2H Hi-Build Tneme-Gloss 11SF-True Blue/Safety			
	Yellow	Flynt				
		TNEMIC	Series 2H Hi-Build Tneme-Gloss 02SF-Lemon Yellow/Safety			
Bores						
Casing Spacers		Pipeline Seal and Insulator, Inc.	Model Ranger II			
		Power Seal	Model 4810			
Casing End Seals		Advanced Product & Systems, Inc.	Model AW (wrap around) End Seal			
		CCI Pipeline Systems	Model ESW Wrap Around Neoprene Rubber End Seal			

Approved Materials List for Water

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Fittings, Misc						
Tapping Sleeves		Mueller	H304		Require 3/4" NPT Brass Test Plug; Stainless Steel Tapping Sleeve with Stainless Steel Flange	
		Ford	FTSS, FTSS-MJ			
		Smith-Blair	665, 665MJ			
		Dresser	630			
		PowerSeal	Model 3490			
		Romac Industries	SST III			
Restraint (Retainer) Glands	Ductile Iron	Uni-Flange	Series 1400		Require 3/4" NPT Brass Test Plug; Stainless Steel Tapping Sleeve with Stainless Steel Flange	
		EBAA	Iron 1100 Series Megalug			
		Stargrip	Series 3000			
		Tyler Union	Field Lock, Tufgrip 1000			
		SIP Industries	EZ Grip			
	PVC	Uni-Flange	Series 1500			
		EBAA	Iron 2000PV Series Megalug			
		Stargrip	Series 4000			
		Tyler Union	Tufgrip 2000			
		SIP Industries	EZ Grip			
		Napco	Certa-Lok AWWA C900 Restrained Joint Integral Bell			
		Sigma	One Lok			
Ductile Iron Fittings		American Pipe			Require 3/4" NPT Brass Test Plug; Stainless Steel Tapping Sleeve with Stainless Steel Flange	
		Tyler Pipe Products				
		Clow Products				
		Star Pipe Products	Tees, bends, anchor nipples			
		Sigma/Nappco	Tees, bends, anchor nipples			
		Griffin Pipe Products				
		SIP Industries				
Restraint (Internal Joint Restraint)	C900 PVC Pipe	Eagle	LOC 900			
		Diamond	Lok-21			
Couplings		Romac Industries, Inc.	Macro HP			
Flushing Systems		Mueller Co.	Hydro-Guard HG-1 Automatic Flushing System			
Polyethylene Wrap				AWWA C105, Method A	All ductile iron pipe and fittings shall be wrapped	For wrapping pipe - blue color

Approved Materials List for Water

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Service Connections						
Corporation Valve (Stops)	3/4", 1", 1.5", 2"	Mueller	B-25008		AWWA C800 equipped with ball valve; For Ductile Iron pipe - use threaded corp stop with Teflon tape wrap;	
		Jones	J-1937-SG			
		Ford	FB-1000-3-Q, FB-1000-4-Q, FB-1000-6-Q, FB-1000-7-Q			
		A.Y. McDonald	4701BQ			
Angle Valve (Stops)	3/4", 1", 1.5", 2"	Mueller	B-24258 (3/4", 1"); B-24276 (1.5", 2")		AWWA C800 equipped with ball valve and lock wing	
		Jones	J-1963W-SG (3/4", 1"); J-1975W-SG (1.5", 2")			
		Ford	BA43-332-WQ (3/4"), BA43-444-WQ (1"), BFA43-666-WQ (1.5"), BFA43-777-WQ (2")			
		A.Y. McDonald	4602BQ			
Service Saddles	For PVC, DI, CI Pipe: 3/4", 1", 1.5", 2"	Mueller	BR-2B, BR-2S		AWWA C800 with AWWA taper threads outlet; CC Thread; Stainless Steel Bolt/Nut/Washer, with the exception of double strap	
		Jones	J-979, J-969			
		Ford	202B, 202BS	Smith-Blair		
		A.Y. McDonald	3825, 3845	317		
	For AC Pipe	Ford	FS2			Tapped, Minimum 12.5" Length
Access Hatch	For meter vaults	Forterra	Aluminum Hatch Pedestrian 36x36, Single Leaf, Trough Frame (Drawing No. SPT3636AL		Hinged 1/4" aluminum diamond plate cover with 1/4" extruded aluminum frame. Hatch to be furnished with 316 Stainless Steel Snap Lock & Brass Hinges	
		Bilco	PCM-4			
Meter Boxes	3/4" Service	DFW Plastics	DFW1814F1PS-1KA%F with DFW18AMR-1KA%F-LID		HDPE Base Enclosure - With Slot; Not Traffic Rated; Cast Iron Ring with HDPE Locking Lid that will accept AMR/AMI antenna through lid	Nominal 18-inch diameter
	1", 1.5", 2" Service	DFW Plastics	DFW2818F-1BA MCK with DFW20AMRI-1BA MCK-LID			Nominal 30" diameter

Approved Materials List for Water

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Valves						
Valves	>= 6"	Mueller	Resilient Seat		Valves >24" shall be horiztonal installation valves	
		Mueller	Resilient Wedge			
		American Darling	Resilient Wedge			
		US Pipe & Foundry	Metro-Seal Resilient Wedge			
		American Flow Control	Series 2500 Resilient Wedge			
		Kennedy	Resilient Wedge			
		Clow	Resilient Wedge			
		MH	Resilient Wedge Gate Valve			
		American	AVK Resilient Seated Gate Valve Series 25, 4"-12"			
	> 36"	Mueller	Butterfly		Butterfly only allowed with approval of City of Engineer	
		American Darling	Butterfly			
		Pratt	Butterfly			
Air Release Valves		Vent-O-Mat	025 RBX 2521 (1") / 050 RBX 2521 (2")			
Valve Stacks and Boxes		Bass & Hays	Model 2436S			

Approved Materials List for Sanitary Sewer

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Sewer Pipes						
Sewer Main	4" to 15" Dia		PVC, SDR-35, SDR-26 for depths greater than 10 ft.	ASTM D3034	Green color	Fusible PVC and Certa-Lok are acceptable PVC pipe materials
			HDPE, DR 13.5	ASTM F714, PE 4710		
	18" to 30" Dia		PVC, PS115	ASTM F679		Fusible PVC and Certa-Lok are acceptable PVC pipe materials
	18" to 54" Dia	Hobas Pipe, US Composite Pipe South and Ameron International	Fiberglass	ASTM D3262 / ASTM 4161		Must submit thickness design for wall thickness calculations
Aerial Crossing			Ductile iron pipe (CL 54) with Protecto 401 internal coating		Green color	
Service Laterals	4" Residential; 6" Commercial (min.)		PVC		Green color	
Manhole and Appurtenances						
Manhole Pipe connectors		A-Loc	Quick-Lok			
		Hamilton Kent	Tylox MIB Boot			
		Press-Seal	PSX: Direct Drive			
Manhole Lids and Rings	Connecting Lines < 15" Dia	EJ USA, Inc., Bass & Hays	V1600-4; 1810A4; VRM-30	ASTM A48 CL35B	30-inch Clear Opening; AASHTO HS-20 Load Rated; Words and Logo per	Equipped with MPIC Pick Slot, elastomer T-Gasket in lid
	Retrofit Work Only	EJ USA, Inc., Bass & Hays	400-24D			Equipped with MPIC Pick Slot, elastomer T-Gasket in lid
Manhole Coating		Raven Lining Systems	Raven 405			125 ml thick
Manhole Grade Rings		LadTech Inc.	HDPE Adjustment Rings			
		Cretex Seals	ARPRO Expanded Polypropylene	ASTM D3575		
		EJ USA, Inc.	Infra-Riser			
Precast Polymer Manhole		Amorock	Polymer concrete manhole	ASTM C478		
Geotextile Material Under Manhole		Tencate	Mirafi 140N			
		Propex Geosolutions	Geotex 401			
Manhole Chimney Seals, Ring & Cover sealing systems		Garlock	Riser-Wrap			
	Retrofit Work Only	Cretex	Interior Chimney Seal with stainless steel self locking bands			For use with EJ USA, Inc. 24-inch manhole lid only
Threaded Lid Anchor		Hilti USA	KWIK BOLT 3 WEDGE ACNCHOR SS 304 5/8"			All manhole ring anchors must be embedded a minimum of 4.5-inches into concrete cone. All stainless steel bolts threads and nuts must be coated with approved anti-seize compound: Permatex Nickel Anti-Seize or approved equal.
		Simpson Strong-Tie	Strong Bolt 5/8"			
Miscellaneous						
Double Cleanout Meter Box		Bass & Hays	BH3 Lid-2 Sewer			

Approved Materials List for Drainage

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Storm Drain						
Storm Sewer	<= 15"		PVC, SDR 26	ASTM D3034		
		ADS	N-12, HDPE, Double Wall, Smooth Interior	ASTM F2648		
	> 15"		Reinforced concrete pipe, Class III	ASTM C76		Spigot end coated with asphaltic primer for better adhesion of Butyl rubber sealant. Class IV or greater may be required depending on surface loads and depth of pipe.
Gaskets	> 20' from structure	Ram-Nek	Preformed Flexible Plastic Gaskets			Sufficient quantity must be used to achieve squeeze out
	<= 20' from structures		O-ring gasket	ASTM C443		
Manholes, Junction Structures	Ring & Cover	Bass & Hays	380-24P			
Inlets	Ring & Lid	Bass & Hays	BH184L	ASTM A48 CL35B	Cast iron inlet ring and cast iron locking inlet cover	

Approved Materials List for Paving

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Pedestrian Elements						
Detectable Warnings		ADA Solutions, Inc.	(Wet Set) Replaceable Tactile Warning Surface Unit (glass and carbon fiber reinforced composite)			Color: Brick Red or Clay Red
		ADA Solutions, Inc.	Cast-in-Place Composite Tactile Warning Tile Units (glass and carbon fiber reinforced composite)			Color: Brick Red or Clay Red
		Strong Go Industries, LLC	Tech-Way Dome-Tiles (precast polymer concrete tiles)			Color: Terracotta; 24" x 24" or 24" x 30" or 24" x 36" with stainless steel anchoring system
		Engineered Plastics, Inc.	Armor Tile Cast in Place Tile (vitrified polymer composite)			Color: Brick Red or Colonial Red
Miscellaneous						
Root Barrier		Deep Root	UB 24-2			

Approved Materials List for Traffic

Revised: April 2026

BASIC PRODUCT CATEGORY	SUB-CATEGORY	MANUFACTURER	MODEL, TYPE, OR STYLE APPROVED	GOVERNING SPECIFICATION	GENERAL REQUIREMENTS	NOTES
Pavement Markings	Prefabricated	Ennis-Flint	Premark			8", 12", 24" wide stripes
	Thermoplastic	TxDOT MPL - Thermoplastic Pavement Marking Materials				4", 6" wide stripes
Raised Pavement Markers		Apex Universal Inc.				
		Pac-Tec Inc. - Ray-O-Lite Division				
		Semex				
		3M Company				
		Rayolite				
Traffic Buttons		Apex Universal Inc.				
		Artuk				
		Batterson LLP				
		Applied Ceramics Inc.				
		Pac-Tec Inc. - Ray-O-Lite Division				
		TrafCo Industries Inc.				
		Trantex Inc.				
		Ennis-Flint				
Traffic Signs	Signs			TMUTCD		High Intensity Grade Prismatic(HIP); School zone signs - Flourescent Yellow Green (FYG); Diamond Grade required on case-by-case basis
	Illuminated Street Name Signs - Mounting Hardware	Astro-Brac				
	Sign Posts					
Traffic Signals	Conduit, Electrical Conductors, Ground Boxes, Electrical Services, Pedestal Pole Assemblies	TxDOT MPL - Illumination and Electrical Supplies				

APPENDIX C

GENERAL NOTES

The General Notes Sheet shall be inserted into every Engineering Plan set submitted.

GENERAL NOTES FOR CONSTRUCTION ACTIVITIES:

1. ALL WORK SHALL CONFORM TO THE CITY OF SACHSE'S GENERAL DESIGN STANDARDS. IN THE EVENT AN ITEM OF WORK IS NOT COVERED IN THE PLANS OR THE CITY OF SACHSE GENERAL DESIGN STANDARDS, THE MOST CURRENT NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS (NCTCOG) STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE MOST CURRENT VERSION OF TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES SHALL APPLY WITH CONCURRING NOTIFICATION TO THE DIRECTOR OF PUBLIC WORKS AND THE PROJECT ENGINEER. THE DIRECTOR OF PUBLIC WORKS SHALL HAVE FINAL DECISION ON ALL CONSTRUCTION MATERIALS, METHODS, AND PROCEDURES.

2. ALL CONTRACTORS AND DEVELOPERS, WITH THEIR EMPLOYEES AND AGENTS, SHALL COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL SAFETY LAWS AND REGULATIONS, INCLUDING BUT NOT LIMITED TO THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, AND ORDINANCES RULES, REGULATIONS AND ORDERS OF ANY PUBLIC AUTHORITY HAVING JURISDICTION FOR THE SAFETY OF PERSONS OR PROPERTY TO PROTECT THEM FROM DEATH, INJURY, DAMAGE OR LOSS

3. ALL COMMUNICATION BETWEEN THE CITY AND THE CONTRACTOR SHALL BE THROUGH THE CONSTRUCTION INSPECTOR AND DIRECTOR OF PUBLIC WORKS ONLY. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE APPROPRIATE DEPARTMENT FOR INSPECTIONS OF WORK NOT FALLING UNDER THE APPROVED FOR CONSTRUCTION PLANS.

4. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL HAVE IN THEIR POSSESSION ALL NECESSARY PERMITS, PLANS, LICENSES, ETC. CONTRACTOR SHALL HAVE AT LEAST ONE SET OF APPROVED FOR CONSTRUCTION ENGINEERING PLANS AND SPECIFICATIONS ON-SITE AT ALL TIMES.

5. IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY UTILITY COMPANIES TO ARRANGE FOR EXACT LOCATIONS AT LEAST 48 HOURS PRIOR TO BEGINNING CONSTRUCTION. THE COMPLETENESS AND ACCURACY OF THE UTILITY DATA SHOWN ON THE PLANS IS NOT GUARANTEED. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE DEPTH AND LOCATION OF EXISTING UNDERGROUND UTILITIES PRIOR TO EXCAVATING, TRENCHING, OR DRILLING AND SHALL BE REQUIRED TO TAKE ANY PRECAUTIONARY MEASURES TO PROTECT ALL LINES SHOWN AND / OR ANY OTHER UNDERGROUND UTILITIES NOT ON RECORD OR NOT SHOWN ON THE PLANS. THE CONTRACTOR WILL BE RESPONSIBLE FOR DAMAGES TO UTILITIES IF THE DAMAGE IS CAUSED BY NEGLIGENCE OR FAILURE TO HAVE LOCATES PERFORMED.

   i. TEXAS 811 811
   ii. PUBLIC WORKS - MAINLINE 972-495-7600
   iii. PUBLIC WORKS - SERVICE CENTER 469-429-9833

6. VERIFICATION OF THE CONDITION OF EXISTING CITY UTILITIES PRIOR TO CONNECTIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL REQUEST FOR LINE LOCATES AS DIRECTED IN ITEM #5.

7. ALL FITTINGS, SLEEVES, PIPES, VALVES, .ETC ON PUBLIC INFRASTRUCTURE SHALL NOT BE FOREIGN MADE.

8. CONTRACTOR SHALL LOCATE AND PROTECT ALL EXISTING LANDSCAPE IRRIGATION SYSTEMS. DAMAGE TO EXISTING IRRIGATION SYSTEMS SHALL BE RESTORED TO EQUAL OR BETTER CONDITION BY A LICENSED IRRIGATOR AT THE CONTRACTORS EXPENSE.

9. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES OR ADJACENT PROPERTIES DURING CONSTRUCTION. ANY REMOVAL OR DAMAGE TO EXISTING FACILITIES OR ADJACENT PROPERTIES SHALL BE REPLACED OR REPAIRED TO EQUAL OR BETTER CONDITION BY THE CONTRACTOR. THE CONTRACTOR SHALL COORDINATE ALL REPAIRS TO PRIVATE PROPERTY WITH THE PROPERTY OWNER. CONTRACTOR SHALL PAY AND/OR SETTLE WITH PRIVATE PROPERTY OWNER FOR ALL COSTS RELATED TO ANY DAMAGE. FOR MORE DETAIL, REFER TO **NCTCOG 107.24.**

10. TESTING AND INSPECTION OF MATERIALS SHALL BE PERFORMED BY A COMMERCIAL TESTING LABORATORY APPROVED BY THE CITY. CONTRACTOR SHALL FURNISH MATERIALS OR SPECIMENS FOR TESTING, AND SHALL FURNISH SUITABLE EVIDENCE THAT THE MATERIALS PROPOSED TO BE INCORPORATED INTO THE WORK ARE IN ACCORDANCE WITH THE SPECIFICATIONS. ALL TESTING AND RE-TESTING COSTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. FOR MORE DETAIL, REFER TO **NCTCOG 106.5** AND TABLE 1.

11. CONTRACTOR SHALL NOTIFY THE CITY AT LEAST 48 HOURS PRIOR TO BEGINNING ANY CONSTRUCTION.

12. ALL SHOP DRAWINGS, WORKING DRAWINGS OR OTHER DOCUMENTS WHICH REQUIRE REVIEW BY THE CITY SHALL BE SUBMITTED BY THE CONTRACTOR SUFFICIENTLY IN ADVANCE OF SCHEDULED CONSTRUCTION TO ALLOW NO LESS THAN 10 BUSINESS DAYS FOR REVIEW AND RESPONSE BY THE CITY.

13. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REQUIRED CONSTRUCTION SURVEYING AND STAKING AND SHALL NOTIFY THE CITY OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH ANY WORK. FOR MORE DETAIL, REFER TO **NCTCOG 105.4**.

14. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL SURVEY MARKERS INCLUDING IRON RODS, PROPERTY CORNERS, OR SURVEY MONUMENTS WITHIN THE LIMITS OF CONSTRUCTION AND OUTSIDE RIGHT-OF-WAY DURING CONSTRUCTION. ANY SURVEY MARKERS DISTURBED DURING CONSTRUCTION SHALL BE REPLACED BY THE CONTRACTOR AT NO COST TO THE CITY.

15. CONTRACTOR SHALL NOT STORE MATERIALS, EQUIPMENT OR OTHER CONSTRUCTION ITEMS ON ADJACENT PROPERTIES OR RIGHT-OF-WAY WITHOUT THE PRIOR WRITTEN CONSENT OF THE PROPERTY OWNER AND THE CITY. THE PROJECT SHALL NOT BE ACCEPTED UNTIL THE CONTRACTOR PROVIDES A LETTER FROM THE PROPERTY OWNER STATING THEY ARE SATISFIED WITH THE CONDITION OF THE PROPERTY. REFER TO NCTCOG SPECIFICATIONS SECTIONS 106.4 AND 107.22 FOR MORE INFORMATION.

16. UNUSABLE EXCAVATED MATERIAL, OR CONSTRUCTION DEBRIS SHALL BE REMOVED AND DISPOSED OF OFFSITE AT AN APPROVED DISPOSAL FACILITY BY THE CONTRACTOR.

17. ALL SIGNAGE SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD).

18. ALL GUARDRAILS SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF TXDOT BARRIER (FLEXIBLE) STANDARDS.

GENERAL NOTES FOR EROSION CONTROL/STORM WATER POLLUTION PREVENTION:

19. THE CONTRACTOR SHALL COMPLY WITH THE CITY OF SACHSE'S STORM WATER ORDINANCE, THE TDPES GENERAL CONSTRUCTION PERMIT TXR150000 AND ANY OTHER STATE AND/OR LOCAL REGULATIONS.

20. CONTRACTOR IS RESPONSIBLE FOR KEEPING STREETS AND DRIVEWAYS ADJACENT TO THE PROJECT FREE OF MUD AND DEBRIS AT ALL TIMES. CONTRACTOR SHALL CLEAN UP AND REMOVE ALL LOOSE MATERIAL RESULTING FROM CONSTRUCTION OPERATIONS. STOCKPILING OR STAGING OF MATERIALS WILL NOT BE ALLOWED IN RIGHT-OF-WAY WITHOUT PRIOR AUTHORIZATION. THE CONTRACTOR SHALL TAKE ALL AVAILABLE PRECAUTIONS TO CONTROL DUST. ANY DIRT, MUD, DEBRIS TRACKED OFFSITE SHALL BE CLEANED UP BY THE CONTRACTOR IMMEDIATELY.

21. ALL EROSION CONTROL DEVICES SHOWN ON THE PLANS RELEASED FOR CONSTRUCTION SHALL BE INSTALLED IN ACCORDANCE WITH THE SWP3 SEQUENCING PRIOR TO COMMENCING ANY EARTH DISTURBING ACTIVITIES. FAILURE TO INSTALL THE EROSION CONTROL DEVICES BEFORE STARTING THE EARTH DISTURBING ACTIVITIES MAY RESULT IN SANCTIONS INCLUDING, BUT NOT LIMITED TO, WITHHOLDING OF RELEASE OF CONSTRUCTION PERMITS, INSPECTIONS, PAYMENT OF CITY FUNDED PORTIONS OF THE PROJECT, SUSPENSION OF CONSTRUCTION ACTIVITIES, OR CITATIONS. EROSION CONTROL DEVICES SHALL BE INSTALLED AND MAINTAINED IN COMPLIANCE WITH THE PROJECT PLANS, CITY STORMWATER ORDINANCE AND/OR SWP3 AND CONSTRUCTION GENERAL PERMIT. THE CONTRACTOR SHALL INSPECT THE SITE DAILY AND KEEP THE SITE FREE OF TRASH AND CONSTRUCTION DEBRIS.

22. CONTRACTOR MUST EXECUTE AND KEEP A COPY OF THE CONSTRUCTION SITE NOTICE (CSN) FOR THOSE ACTIVITIES DISTURBING MORE THAN 1 ACRES AND A NOTICE OF INTENT (NOI) FOR THOSE ACTIVITIES DISTURBING 5 ACRES OR MORE.

GENERAL NOTES FOR TRAFFIC CONTROL:

23. CONTRACTOR SHALL PROVIDE THE DIRECTOR OF PUBLIC WORKS WITH A TRAFFIC CONTROL PLAN THAT IS SITE SPECIFIC AND SEALED BY A TEXAS P.E. AT LEAST 10 BUSINESS DAYS BEFORE ANY WORK ON A CITY STREET. TRAFFIC CONTROL MEASURES SHALL CONFORM TO THE LATEST REVISION OF THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD)

24. CONTACT DIRECTOR OF PUBLIC WORKS OR CITY CONSTRUCTION INSPECTOR AT LEAST 48 HOURS PRIOR TO WORK REQUIRING THE REMOVAL OR RELOCATION OF TRAFFIC SIGNS, TRAFFIC CONTROL EQUIPMENT OR OTHER TRAFFIC CONTROL APPURTENANCES. TRAFFIC SIGNS SHALL ONLY BE REMOVED UNDER THE DIRECTION OF THE CITY CONSTRUCTION INSPECTOR.

25. IN THE EVENT THE CONSTRUCTION WORK REQUIRES THE CLOSURE OF AN EXISTING STREET, ALLEY, OR FIRE LANE, THE CONTRACTOR SHALL REQUEST THE ROAD CLOSURE THROUGH THE CITY CONSTRUCTION INSPECTOR A MINIMUM OF 48 HOURS IN ADVANCE OF THE REQUESTED CLOSURE. CLOSURES WILL NOT BE ALLOWED PRIOR TO 9:00 A.M. OR AFTER 3:30 P.M., MONDAY THROUGH FRIDAY UNLESS OTHERWISE APPROVED BY THE CITY. IN THE EVENT A DRIVEWAY(S) NEEDS TO BE CLOSED, THE CONTRACTOR SHALL REQUEST THE DRIVEWAY CLOSURE THROUGH THE CITY CONSTRUCTION INSPECTOR, WHO WILL IN TURN NOTIFY DISPATCH AND OTHER PERTINENT CITY DEPARTMENTS. CLOSURES ARE PROHIBITED DURING SCHOOL ZONES TIMES IN AND AROUND SCHOOLS.

26. IF THE CONSTRUCTION ZONE AFFECTS THE MOVEMENTS OF PEDESTRIANS, ADEQUATE PEDESTRIAN ACCESS AND WALKWAYS SHALL BE PROVIDED IN ACCORDANCE WITH THE DISABILITIES ACT ACCESSIBILITY GUIDELINES, PROWAG, TAS AND THE TMUTCD. WHERE DEVELOPMENTS OCCUR WITHIN 0.5 MILES OF A SCHOOL SITE, TEMPORARY SIDEWALKS MUST BE CONSTRUCTED CONNECTING THE DEVELOPMENT TO THE SCHOOL SITE. THE ROUTE SHALL BE APPROVED BY THE DIRECTOR OF PUBLIC WORKS. TEMPORARY SIDEWALKS MAY BE CONSTRUCTED WITH MATERIALS OTHER THAN CONCRETE. THE MATERIAL SHALL BE APPROVED BY THE DIRECTOR OF PUBLIC WORKS AND BE AN ALL-WEATHER MATERIAL OF A COLOR AND TEXTURE DISTINCTLY DIFFERENT FROM THE PERMANENT SIDEWALK.

27. OVERNIGHT LANE CLOSURES SHALL BE APPROVED BY CITY PRIOR CLOSING THE LANE. ANY LANE OR SHOULDER CLOSURE ON AN ARTERIAL ROAD THAT EXTENDS INTO THE NIGHT SHALL REQUIRE THE MANDATORY USE OF ARROW BOARDS.

GENERAL NOTES FOR PAVING

28. ALL ROADWAY SIGNAGE TO COMPLY WITH CURRENT EDITION OF TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND TXDOT STANDARDS.

29. ABSOLUTELY NO EARTHWORK, LIME APPLICATION, OR OTHER PREPARATION OF THE SUBGRADE FOR PAVING OF STREETS, ALLEYS, SIDEWALKS, TRAILS, FIRE LANES OR OTHER TRANSPORTATION RELATED FLATWORK SHALL BE INITIATED WITHOUT AUTHORIZATION FROM THE CITY. THE CITY WILL AUTHORIZE THE SUBGRADE WORK IN PREPARATION FOR PAVING AFTER UTILITY TRENCH BACKFILL TESTING HAS BEEN COMPLETED AND VERIFIED TO MEET THE CITY REQUIREMENTS.

30. ALL SIDEWALKS SHALL COMPLY WITH THE AMERICANS WITH DISABILITIES ACT AND THE TEXAS ARCHITECTURAL BARRIERS ACT. THE CITY OF SACHSE HAS NOT REVIEWED THESE PLANS FOR COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT, TEXAS ARCHITECTURAL BARRIERS ACT, OR ANY OTHER ACCESSIBILITY LEGISLATION, AND DOES NOT WARRANTY OR APPROVE THESE PLANS FOR ANY ACCESSIBILITY STANDARDS. PRIOR TO PROJECT ACCEPTANCE, THE CONTRACTOR SHALL SUBMIT TO THE CITY DOCUMENTATION THAT THE PROJECT WAS INSPECTED BY A REGISTERED ACCESSIBILITY SPECIALIST, REGISTERED WITH THE TEXAS DEPARTMENT OF LICENSING AND REGULATION CERTIFYING THE PROJECT IS IN COMPLIANCE WITH THE REQUIREMENTS OF THE TEXAS ARCHITECTURAL BARRIERS ACT.

31. ALL CONCRETE PAVING (STREETS, ALLEYS, SIDEWALKS, DRIVEWAYS) WITHIN CITY ROW SHALL HAVE A 28 DAY MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI, CONTAINING A MINIMUM OF 6 SACKS OF CEMENT PER CUBIC YARD , WITH A SLUMP RANGE OF 1" TO 3" SLUMP FOR MACHINE POURS AND 3" TO 5" SLUMP FOR HAND POURS UNLESS OTHERWISE NOTED IN THE GENERAL DESIGN STANDARDS. ALL MATERIALS AND REQUIREMENTS FOR CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT NCTCOG ITEM "PORTLAND CEMENT CONCRETE PAVEMENT" WITH THE EXCEPTION THAT FLY ASH MAY BE SUBSTITUTED FOR UP TO 20% OF THE CEMENT CONTENT REQUIREMENT AT 1 TO 1.25 CEMENT TO FLY ASH SUBSTITUTION RATE.

32. ALL CONCRETE MUST BE MECHANICALLY VIBRATED. THE PLACING OF NEW STREET AND ALLEY PAVEMENT MECHANICALLY SCREENED AND TAMPED. CONCRETE SHALL BE HAND PLACED AT INTERSECTIONS AND MISCELLANEOUS AREAS.

33. TABLE 303.5.5.(A) CONCRETE PLACEMENT AND NCTCOG 303.5.5.2 ARE TO BE FOLLOWED. TEMPERATURE DURING CONCRETE PLACEMENT:
   a. THE TEMPERATURE OF CONCRETE AS PLACED SHALL NOT EXCEED 95°F.
   b. NO CONCRETE SHALL BE PLACED ON A FROZEN SUBGRADE
   c. IF THE AMBIENT AIR TEMPERATURE IS LESS THAN 40°F AND DROPPING CONCRETE SHALL NOT BE PLACED.
   d. IF CONCRETE IS PLACED AND THERE IS AN ANTICIPATED LOW TEMPERATURE OF LESS THAN 40°F WITHIN 5 DAYS AFTER PLACEMENT THE CONCRETE MUST BE COVERED AND KEPT AT A TEMPERATURE OF NO LESS THAN 50°F.
   e. IN ALL CASES, CONCRETE SHOULD NOT BE KEPT AT A TEMPERATURE OF LESS THAN 50°F FOR A PERIOD OF 5 DAYS' MINIMUM.

31. REINFORCING SHALL CONFORM TO ASTM A 615 AND BE A MINIMUM GRADE OF 60 PER ASTM A 370. REINFORCING STEEL BAR LAPS ARE TO BE 30 BAR DIAMETERS OR 15" PER ACI 318, WHICHEVER IS GREATER. A MINIMUM OF 50% OF REBAR INTERSECTIONS ARE TO BE SECURED WITH TIE WIRE AND SUPPORTED WITH CHAIRS. ALL REINFORCEMENT SHALL BE FREE FROM RUST, SCALE, OIL, PAINT AND OTHER SUBSTANCES WHICH PREVENT BONDING TO THE CONCRETE. UNLESS OTHERWISE SPECIFIED, STEEL SHALL BE PLACED AT 1/2 THE PAVEMENT DEPTH.

32. WHITE CURING COMPOUND IS TO BE APPLIED, PER MANUFACTURER'S RECOMMENDATIONS, TO ALL EXPOSED CONCRETE SURFACES (INCLUDING BACKS OF CURBS) IMMEDIATELY AFTER COMPLETION OF FINISHING OPERATIONS, PER ASTM C-309, TYPE 2, NCTCOG SECTION 303.2.13.1.1.

33. NO VEHICLE TRAFFIC SHALL BE PERMITTED ON NEWLY PAVED AREAS FOR SEVEN DAYS AFTER CONCRETE POUR OR UNTIL 3,000 PSI IS ACHIEVED.

34. ALL FILL AND LIME SUBGRADES SHALL BE PLACED IN MAXIMUM 8" COMPACTED LIFTS AND BE COMPACTED TO 95% STANDARD PROCTOR AT A MOISTURE RANGE OF 0% TO 6% OF OPTIMUM MOISTURE. MOISTURE LEVEL MUST BE MAINTAINED, BY WETTING OR APPLICATION OF ASPHALT EMULSION PRIME COAT (0.25 TO 0.50 GAL/SY) IF NECESSARY, UNTIL PLACING OF CONCRETE PAVING. REFER TO TABLE 1 FOR ADDITIONAL TESTING REQUIREMENTS.

GENERAL NOTES FOR TRENCHING AND CONFINED SPACE

35. ALL EXCAVATION AND TRENCH OPERATIONS SHALL BE SITE SPECIFIC AND CONDUCTED IN ACCORDANCE WITH 29 CODE OF FEDERAL REGULATIONS (CFR), PART 1926, SUBPART P AND ALL OTHER APPLICABLE STATE AND CITY REGULATIONS. PRIOR TO COMMENCING ANY EXCAVATION OR TRENCHING OPERATION, THE CONTRACTOR SHALL SUBMIT TO THE CITY ENGINEER A PLAN SEALED BY A TEXAS LICENSED PROFESSIONAL ENGINEER INDICATING THE INTENDED PROCEDURES TO BE USED BY THE CONTRACTOR TO COMPLY WITH OSHA REQUIREMENTS. SUCH PLAN SHALL FURTHER IDENTIFY THE "COMPETENT PERSON" AS REQUIRED BY PARAGRAPH 1926.651(K)(1) THAT WILL WORK WITH EACH CREW. AN AFFIDAVIT FROM THE CONTRACTOR INDICATING THE COMPETENT PERSON MUST BE SUBMITTED WITH THE TRENCH SAFETY PLAN TO THE CITY ENGINEER. A COPY OF THE TRENCH SAFETY PLAN MUST BE ON THE JOB AT ALL TIMES. THE CITY RESERVES THE RIGHT TO DENY PAYMENT FOR ANY CONSTRUCTION ACTIVITIES IN EXCAVATIONS OR TRENCHES THAT ARE NOT IN ACCORDANCE WITH THE SUBMITTED PLAN. THE CITY DOES NOT APPROVE OR DISAPPROVE TRENCH SAFETY PLANS, BUT WILL RETAIN A FILE COPY.

36. IMPLEMENTATION OF TRENCH SAFETY SHALL COMPLY WITH SUBMITTED TRENCH SAFETY DESIGN PLAN. SUBMIT DESIGNATED COMPETENT PERSON WHO WILL BE ON-SITE FULL TIME AND IS CAPABLE OF IDENTIFYING EXISTING AND PREDICTABLE HAZARDS IN SURROUNDING OR WORK CONDITIONS WHICH ARE UNSANITARY, HAZARDOUS, OR DANGEROUS TO EMPLOYEES AND WHO HAS THE AUTHORIZATION TO TAKE PROMPT CORRECTIVE MEASURES TO ELIMINATE THEM. INSTALL, OPERATE, MAINTAIN, ADJUST, AND REMOVE TRENCH SAFETY EQUIPMENT, AND PRECAUTIONS IN ACCORDANCE WITH TRENCH SAFETY DESIGN.

37. ALL ENTRY INTO CONFINED SPACES CONDUCTED IN ACCORDANCE WITH 29 CODE OF FEDERAL REGULATIONS (CFR), PART 1910.147 P AND ALL OTHER APPLICABLE STATE AND CITY REGULATIONS. PRIOR TO COMMENCING ANY CONFINED SPACE ENTRY, THE CONTRACTOR SHALL SUBMIT TO THE CITY ENGINEER A COPY OF THE CONFINED SPACE ENTRY PLAN WITH A COMPLETED PERMIT.

TABLE 1

REQUIRED TESTING					
MATERIAL	**DESIGNATION**	**TEST**	**FREQUENCY**	**REQUIREMENTS**	**NOTES**
SUBGRADE	ASTM D-6938	IN-PLACE DENSITY AND WATER CONTENT	EVERY 300 LINEAR FEET*	MOISTURE CONTENT: 0%-6% OF OPTIMUM, DENSITY: 95% OF STANDARD PROCTOR	EVERY 8" LIFT
		LIME STABILIZED SUBGRADE - DEPTH CHECK		DEPTH OF STABILIZATION AS SPECIFIED PER PLANS	
		LIME STABILIZED SUBGRADE - SIEVE ANALYSIS		1.75" SIEVE: 100% PASSING; No. 4 SIEVE: 60%	
	ASTM D-698	PROCTOR	EVERY NEW MATERIAL SOURCE		
CONCRETE PAVING	ASTM C-143	SLUMP OF PORTLAND CEMENT CONCRETE	FIRST TRUCK EACH DAY + 1 EVERY 60 CY	1"-3" MACHINE POURS; 3"-5" HAND POURS	
	ASTM C-231	CONCRETE AIR CONTENT BY PRESSURE METHOD (FOR FRESH CONCRETE)	FIRST TRUCK EACH DAY + 1 EVERY 60 CY		
	ASTM C-1064	TEMPATURE OF FRESHLY MIXED PORTLAND CEMENT CONCRETE	EVERY TRUCK	95 F MAX (HOT WEATHER) AND 50 F MIN (COLD WEATHER)	
	ASTM C-39	COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS	3 CYLINDERS TAKEN FROM FIRST TRUCK EVERY DAY + 3 EVERY 60 CY	3,000 PSI MINIMUM FOR TRAFFIC; 4,000 PSI MINIMUM AT 28-DAYS	1 BROKEN AT 7 DAYS AND THE OTHER TWO BROKEN AT 28 DAYS, IF NEEDING TO GET TRAFFIC ON PAVEMENT FASTER THEN ADDITIONAL CYLINDER BROKEN AT 3 DAYS
	ASTM C-42	OBTAINING AND TESTING DRILLED CORES OF CONCRETE	EVERY 300 LINEAR FEET*	4,000PSI COMPRESSIVE AT 28-DAYS	4" DIAMETER TAKEN 28 DAYS AFTER POUR
	ASTM C-174	MEASURING LENGTH OF DRILLED CONCRETE CORES		DEPTH OF PAVEMENT AS SPECIFIED PER PLANS	

*PER LANE, TRENCH, ALLEY OR SIDEWALK

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

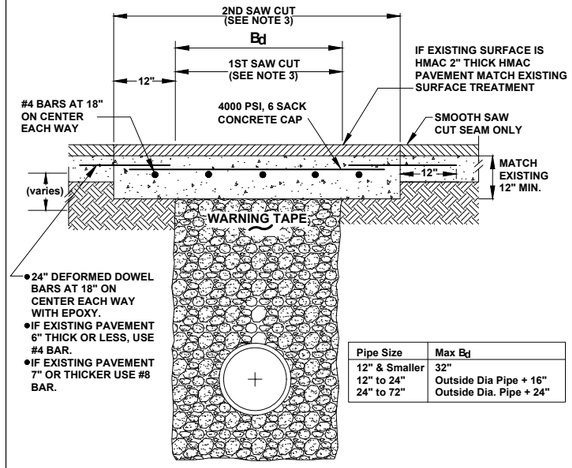
GENERAL NOTES 1
SHEET TITLE

DRAWN BY: CCC

SCALE: N.T.S.

DATE: 04/20/2026

G-1
SHEET NO.

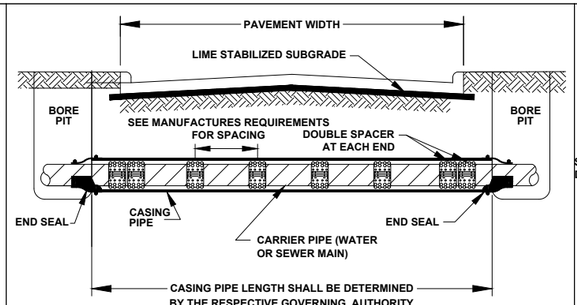


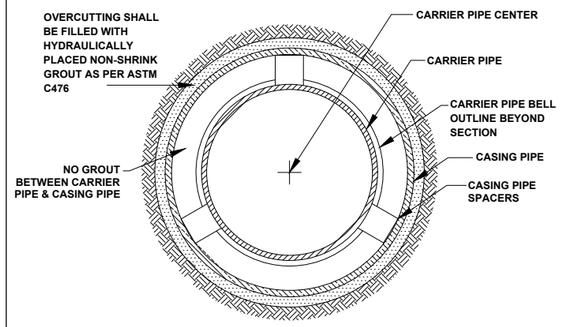
Pipe Size	Max B_d
12" & Smaller	32"
12" to 24"	Outside Dia Pipe + 16"
24" to 72"	Outside Dia. Pipe + 24"

NOTES:
1. PAVEMENT CUTS SHALL BE FULL DEPTH SAW CUTS
2. WITHIN 3' OF AN EXISTING JOINT, REMOVE JOINT. CITY CONSTRUCTION INSPECTOR CAN REQUIRE ADDITIONAL PAVEMENT REMOVAL AND REPLACEMENT TO AN ADJACENT JOINT.
3. MAKE 1ST SAWCUT WHEN BEGINNING PIPE INSTALLATION. MAKE 2ND CUT AFTER PIPE INSTALLATION, TEST AND BACKFILL TO BOTTOM OF PROPOSED PAVEMENT REPLACEMENT.
4. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.
5. BACKFILL MATERIAL, TRENCH WIDTH, EMBEDMENT DEPTH AND MATERIAL SHALL MATCH UTILITY INSTALLATION DETAIL FOR INSTALLATION UNDER PAVEMENT.

TYPICAL PAVEMENT REPAIR OVER TRENCH

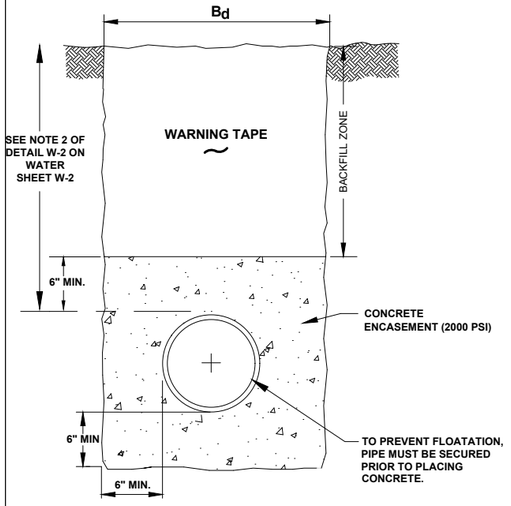
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-1





UTILITY BORE

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-2

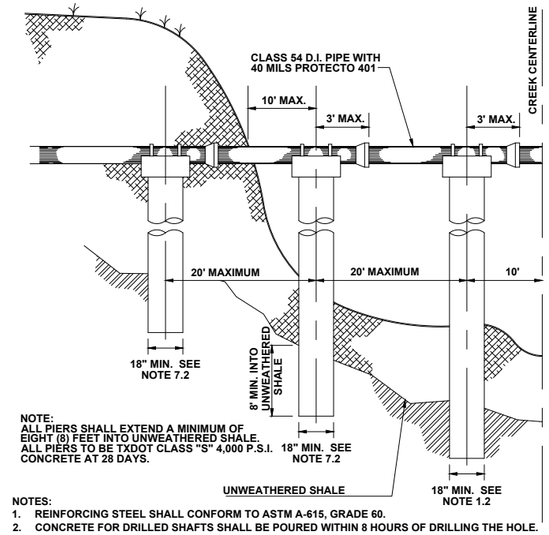


PIPE SIZE	MAX B_d
12" & Smaller	32"
12" to 24"	Outside Dia Pipe + 16"
24" to 72"	Outside Dia. Pipe + 24"

NOTES:
1. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.

CONCRETE ENCASEMENT

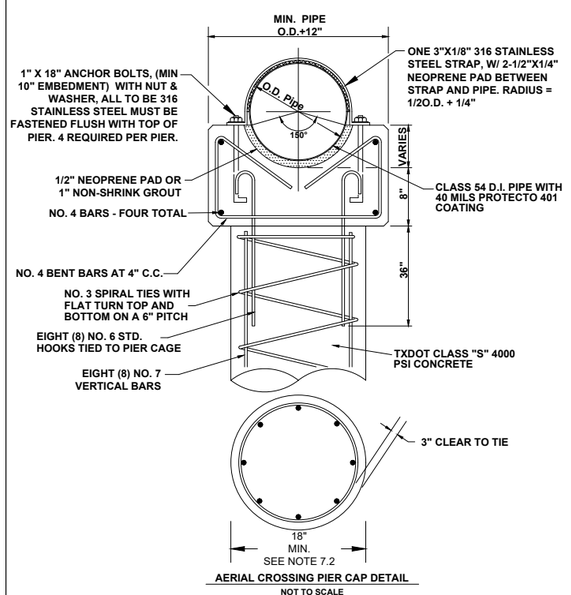
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-3



NOTES:
1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GRADE 60.
2. CONCRETE FOR DRILLED SHAFTS SHALL BE POURED WITHIN 8 HOURS OF DRILLING THE HOLE.
3. CASING MAY BE REQUIRED DURING INSTALLATION OF THE PIERS TO KEEP THE WALLS OF THE SHAFTS FROM CAVING IN AND TO LIMIT GROUNDWATER SEEPAGE INTO PIER SHAFTS.
4. DUCTILE IRON PIPE TO BE CLASS 54 WITH PROTECTO 401 INTERIOR COATING. POLYWRAP ALL D.I. PIPE BELOW GRADE.
5. TXDOT SPECIFICATIONS SHALL GOVERN CONSTRUCTION OF DRILL SHAFTS, COLUMNS AND PIER CAPS.
6. 2" COVER FOR ALL STEEL REINFORCING ABOVE GRADE.
7. 3" COVER FOR ALL STEEL REINFORCING BELOW GRADE.
8. 3/4" CHAMFER ON ALL EXPOSED CORNERS.
9. THIS DETAILS GIVES MINIMUM ACCEPTABLE CRITERIA. ALL AERIAL CROSSINGS SHALL BE DESIGNED IN ACCORDANCE WITH ENGINEERING DESIGN MANUAL, SECTION 4.8.6.

AERIAL CROSSING

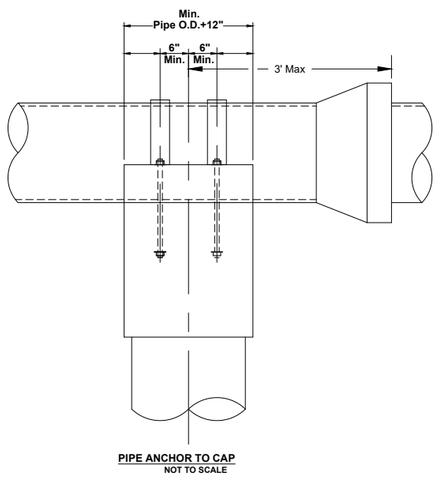
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-4



AERIAL CROSSING PIER CAP DETAIL
NOT TO SCALE

AERIAL CROSSING

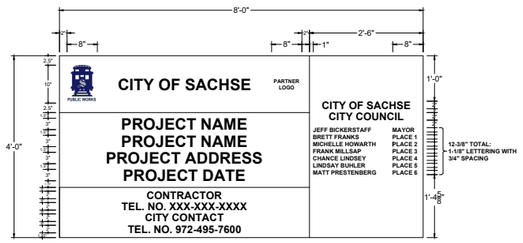
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-5



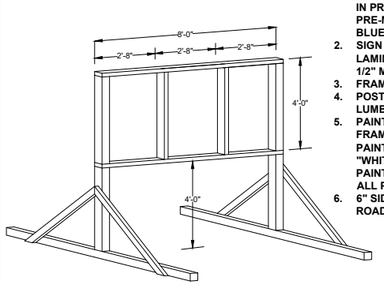
PIPE ANCHOR TO CAP
NOT TO SCALE

AERIAL CROSSING

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-6



PROJECT SIGN DETAIL



SIGN FRAME DETAIL

NOTES:
1. LETTERING - ARIAL SIZES AS SHOWN IN PROJECT SIGN DETAIL. USE PRE-MANUFACTURED VINYL, DARK BLUE.
2. SIGN PANEL SHALL BE 1/2" LAMINATED DUOLOX MASONITE OR 1/2" MARINE PLYWOOD.
3. FRAME SHALL BE 4" x 4" STOCK.
4. POST SHALL BE 4" x 6" TREATED LUMBER.
5. PAINT SHALL BE:
   FRAME TO BE PAINTED "WHITE".
   PAINT BACKGROUND OF SIGN "WHITE".
   PAINT MESSAGE OF SIGN "BLUE".
   ALL PAINT TO BE "EXTERIOR TYPE".
6. 6" SIDE SHALL BE PARALLEL TO ROADWAY.

PROJECT SIGN

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: G-7

The City of SACHSE Public Works

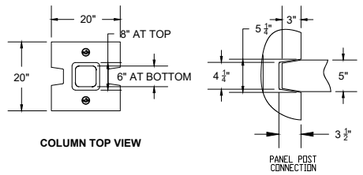
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

GENERAL NOTES 2
SHEET TITLE

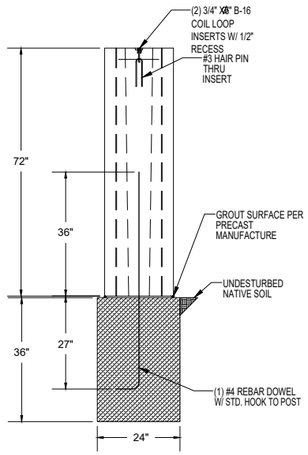
DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

G-2
SHEET NO.

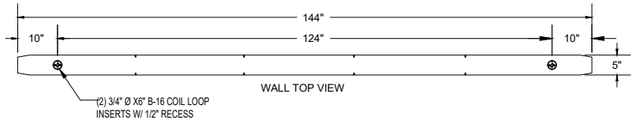


COLUMN TOP VIEW

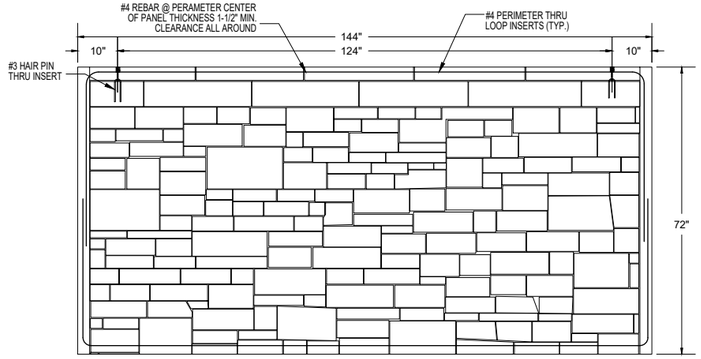
PANEL POST CONNECTION



COLUMN FRONT VIEW



WALL TOP VIEW



WALL FRONT VIEW

NOTES:

1. POST AND PANEL CONCRETE TO BE 5000 PSI.
2. FOOTING CONCRETE TO BE 3000 PSI.
3. MIN. SOIL LATERAL BEARING ALLOWABLE: 150 PSF/FT OF DEPTH BELOW GRADE.
4. MIN. ALLOWABLE SOIL BEARING PRESSURE: 2000 PSF
5. DIMENSIONS MAY BE REDUCED TO FIT PROJECT REQUIREMENTS.
6. GROUT BETWEEN POST AND FOOTING TO BE 2500 PSI.
7. DESIGN TO BE SIGNED AND SEALED BY LICENSED TEXAS P.E.
8. COLOR(S) TO BE APPROVED BY CITY.

The City of SACHSE Public Works

SCREENING WALL

GENERAL DESIGN STANDARDS STANDARD DETAILS	
SCALE: N.T.S	DETAIL: G-8
REVISION DATE: 04/20/2026	

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF ENGINEERING

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

GENERAL NOTES 1
SHEET TITLE

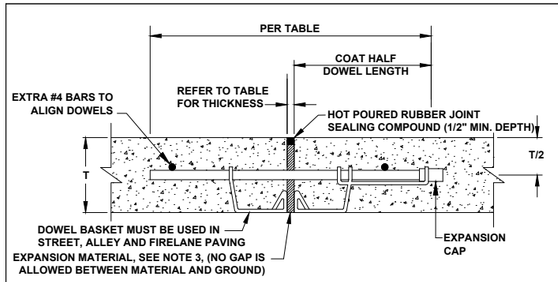
DRAWN BY: CCC
SCALE: N.T.S.
DATE: 04/20/2026

GN-3
SHEET NO.

APPENDIX D

STANDARD DETAILS

Engineer shall select applicable details and include in plan set.

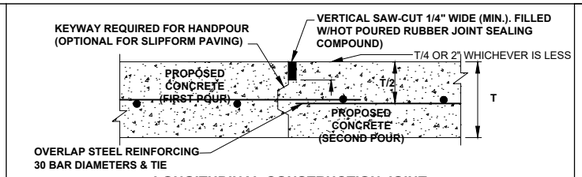


EXPANSION JOINT

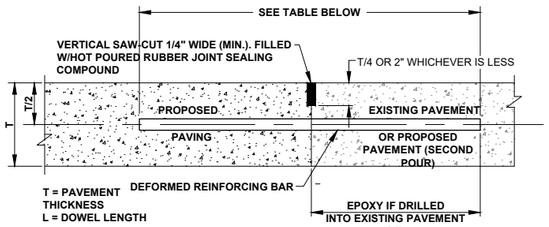
SMOOTH DOWEL BARS				
COMMERCIAL DRIVEWAY, STREET, ALLEY & FIRELANE PAVING THICKNESS (IN.)	DIAMETER (IN.)	LENGTH (IN.)	SPACING (IN.)	EXPANSION JOINT THICKNESS
6	#8 (1 in.)	30	18	3/4"
> 6 and ≤ 12	#12 (1-1/2 in.)	30	12	3/4"
> 12	DETERMINED BY DIRECTOR OF PUBLIC WORKS			
SIDEWALK, RESIDENTIAL DRIVEWAY AND TRAIL THICKNESS (IN.)	DIAMETER (IN.)	LENGTH (IN.)	SPACING (IN.)	EXPANSION JOINT THICKNESS
4-6	#4 (1/2 in.)	24	12	1/2"

NOTES:
1. EXPANSION CAP FOR DOWELS SHALL HAVE AN INSIDE DIAMETER OF 1/16" GREATER THAN THAT OF DOWEL AND BE DESIGNED TO PROVIDE FREE MOVEMENT OF THE DOWEL BAR.
2. EXPANSION CAP TO FIT DOWEL MIN. 2" EMBEDMENT AND MIN. 1-1/4" CLEARANCE FROM THE CLOSED END OF THE SLEEVE TO THE DOWEL.
3. EXPANSION JOINTS SHALL BE INSTALLED AT A MAXIMUM DISTANCE OF SIX HUNDRED (600) FEET, AND AT STREET INTERSECTIONS RADII, PC'S AND PT'S OR AS OTHERWISE DIRECTED. NO EXPANSION JOINT SHALL FALL IN A DRIVEWAY APPROACH OR INLET.
4. EXPANSION MATERIAL PER APPROVED MATERIAL LIST.
5. DOWEL BARS TO BE PLACED PARALLEL TO PAVEMENT AT SPACING AND LENGTHS PER TABLE, CENTERED ON EXPANSION MATERIAL. ONE SIDE OF DOWEL BAR SHALL BE COATED IN THIN FILM OF GREASE OR OTHER APPROVED DE-BONDING MATERIAL. WHERE DRILLING OF DOWEL BARS IS REQUIRED, IT SHALL BE DONE BY AN APPROVED MECHANICAL RIG.
6. EXPANSION JOINTS SHALL NOT BE PLACED AT PAVEMENT GRADE BREAKS.

The City of SACHSE Public Works | EXPANSION JOINTS | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-1



LONGITUDINAL CONSTRUCTION JOINT

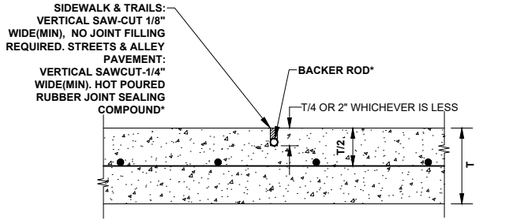


TRANSVERSE CONSTRUCTION JOINT

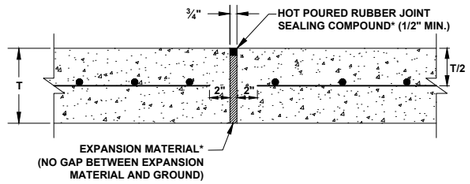
DEFORMED REINFORCING BARS			
COMMERCIAL DRIVEWAY, STREET, ALLEY & FIRELANE PAVING THICKNESS (IN.)	DIAMETER (IN.)	LENGTH (IN.) (L)	SPACING (IN.)
< 8	#8 (1 IN.)	**30**	**18**
≥ 8	#12 (1-1/2 IN.)	30	**12**
SIDEWALK, RESIDENTIAL DRIVEWAY AND TRAIL THICKNESS (IN.)	DIAMETER (IN.)	LENGTH (IN.)	SPACING (IN.)
4-6	#4 (.5 IN)	24	12

NOTES:
1. DOWEL BARS TO BE PLACED PARALLEL TO PAVEMENT AT SPACING AND LENGTHS PER TABLE. WHERE DRILLING OF DOWEL BARS IS REQUIRED, IT SHALL BE DONE BY AN APPROVED MECHANICAL RIG.

The City of SACHSE Public Works | CONSTRUCTION JOINTS | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-2



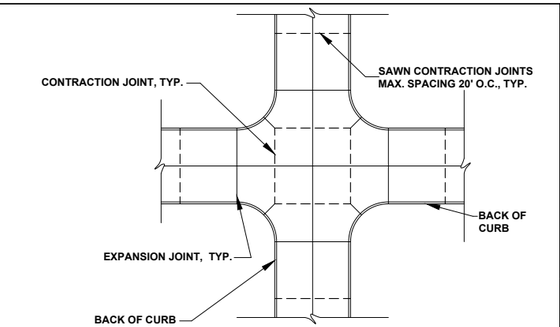
SAWED CONTRACTION JOINT



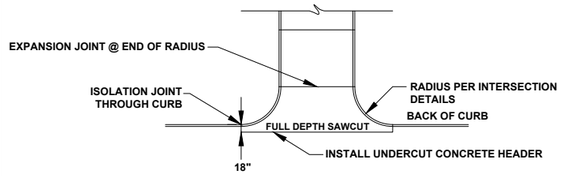
ISOLATION JOINT

* REFER TO APPROVED MATERIALS LIST FOR RECOMMENDED MATERIAL.

The City of SACHSE Public Works | SAWED CONTRACTION & ISOLATION JOINT | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-3



TYPICAL STREET JOINTING



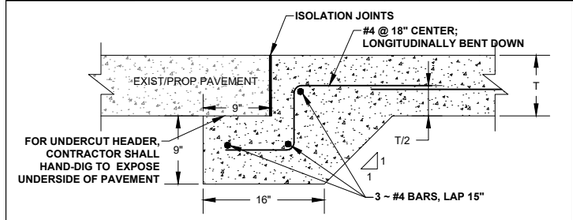
EXISTING CONCRETE STREET TO NEW CONCRETE STREET TEE INTERSECTION

NOTE:
1. ALL CONCRETE PLACEMENT SHALL END IN A CONSTRUCTION JOINT, AN EXPANSION JOINT OR A CONCRETE HEADER.
2. SAWED CONTRACTION JOINTS ARE REQUIRED AT CENTER LINE AND LANE LINE ON ANY STREET PAVEMENT WIDTH GREATER THAN 22.5 FEET (BACK TO BACK OF CURB).
3. EXPANSION JOINTS SHALL BE INSTALLED AT A MAXIMUM DISTANCE OF SIX HUNDRED (600) FEET AND STREET INTERSECTIONS, PC'S AND PT'S OR AS OTHERWISE DIRECTED. NO EXPANSION JOINT SHALL FALL IN A DRIVEWAY APPROACH OR INLET.

The City of SACHSE Public Works | STREET JOINTING | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-4

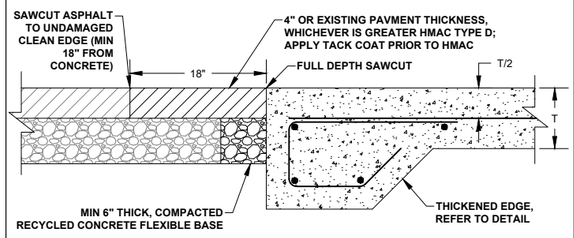
The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023



CONCRETE HEADER

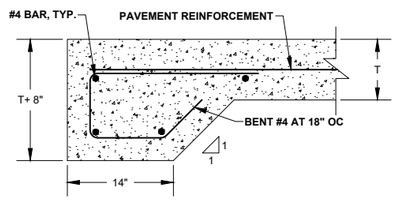
T = PAVEMENT THICKNESS, NOT LESS THAN STREET PAVEMENT DEPTH OR 8", WHICHEVER IS GREATER



CONCRETE TO ASPHALT HEADER

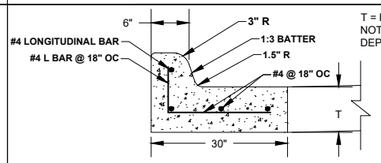
NOTE:
CONCRETE HEADERS SHALL BE CONTINUOUS ALONG EXISTING OR PHASED PAVEMENT WHEN ADJACENT TO THE NEW PAVEMENT. ADDITIONAL LOCATIONS CAN BE SHOWN ON THE PLANS OR AT THE DISCRETION OF THE DIRECTOR OF PUBLIC WORKS.

The City of SACHSE Public Works | TYPICAL HEADERS | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-5

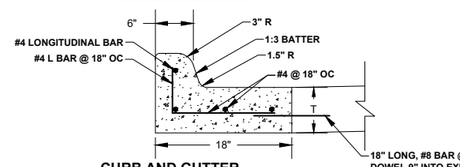


T = PAVEMENT THICKNESS, NOT LESS THAN STREET PAVEMENT DEPTH OR 8", WHICHEVER IS GREATER

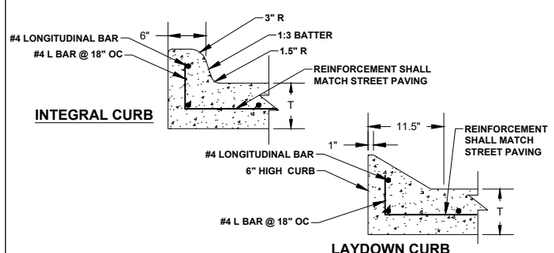
The City of SACHSE Public Works | THICKENED CONCRETE EDGE | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-6



CURB AND GUTTER (HMAC PAVEMENT)



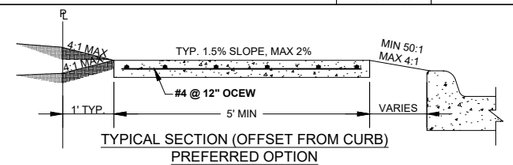
CURB AND GUTTER (CONCRETE PAVEMENT - FOR RECONSTRUCTION)



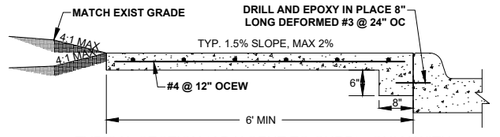
LAYDOWN CURB

NOTES:
1. INTEGRAL CURB SHALL BE USED ON ALL NEW STREETS.
2. ANY HONEYCOMB PRESENT ON BACKSIDE OF CURB SHALL BE FILLED IN.

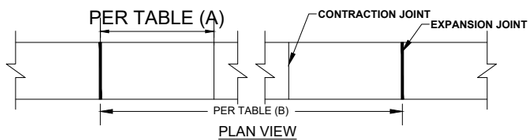
The City of SACHSE Public Works | TYPICAL CURB & GUTTER | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-7



TYPICAL SECTION (OFFSET FROM CURB)
PREFERRED OPTION



TYPICAL SECTION (ADJACENT TO CURB) - ONLY WITH PERMISSION OF CITY ENGINEER



PLAN VIEW

TYPE	WIDTH	THICKNESS	CONTRACTION JOINT (A)	EXPANSION JOINT (B)
SIDEWALK	MIN. 5' < 8	4"	10' SPACING TOOLED JOINT	120' MAX.
TRAIL - HIKE & BIKE	≥ 8'	6"	15' SPACING SAWCUT	600' MAX.

NOTES:
1. EXPANSION JOINTS SHALL BE PLACED AT MAXIMUM INTERVALS PER TABLE AND SHALL ALSO BE PLACED AT EACH LOT LINE
2. EXPANSION JOINT IS REQUIRED BETWEEN SIDEWALK AND ABUTTING CONCRETE PAVEMENT. NO EXPANSION JOINT IS REQUIRED BETWEEN SIDEWALK AND ADJACENT STREET CURB. FOR EXPANSION JOINTS ON DRIVEWAYS, REFER TO DETAILS P- 18 THROUGH P-21 ON SHEET P-2.
3. ALL SIDEWALKS SHALL DRAIN POSITIVE.

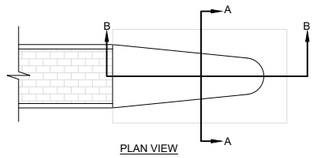
The City of SACHSE Public Works | PEDESTRIAN FACILITIES | GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: P-8

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

PAVING DETAILS 1
SHEET TITLE

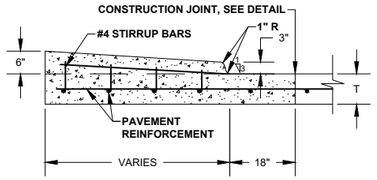
DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

P-1
SHEET NO.

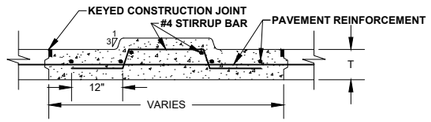


PLAN VIEW

T = PAVEMENT THICKNESS, NOT LESS THAN STREET PAVEMENT DEPTH OR 8", WHICHEVER IS GREATER



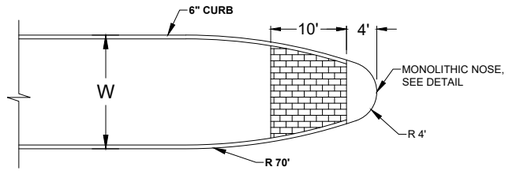
SECTION B-B



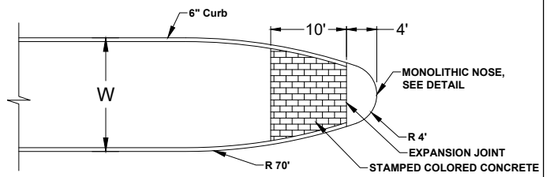
SECTION A-A

NOTE:
1. IF CONSTRUCTING MEDIAN NOSE ON EXISTING PAVEMENT, CONTRACTOR SHALL FULL DEPTH SAWCUT EXISTING PAVEMENT AND SHALL DOWEL INTO EXISTING PAVEMENT PER TRANSVERSE CONSTRUCTION JOINT DETAIL PAGE P-1 DETAIL P-2.

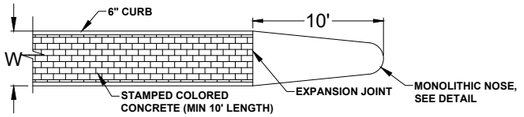
The City of SACHSE Public Works	MONOLITHIC NOSE	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-9



MEDIAN NOSE: W > 15'



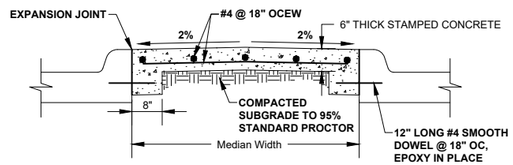
MEDIAN NOSE: 5' < W < 15'

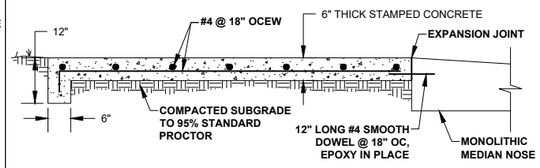


MEDIAN NOSE: W < 5'

NOTES:
1. MEDIANS LESS THAN 5' IN WIDTH, BACK-OF-CURB TO BACK-OF-CURB, SHALL BE STAMPED COLORED CONCRETE - ANTIQUE RED IN COLOR.
2. MEDIAN AREAS THAT ARE NOT STAMPED CONCRETE OR PART OF THE MONOLITHIC NOSE SHALL BE FILLED WITH SIX INCHES OF TOP SOIL OR SANDY LOAM. ALL ROCKS, LARGE ROOTS AND OTHER DEBRIS SHALL BE REMOVED AND THE AREA GRADED SMOOTH.

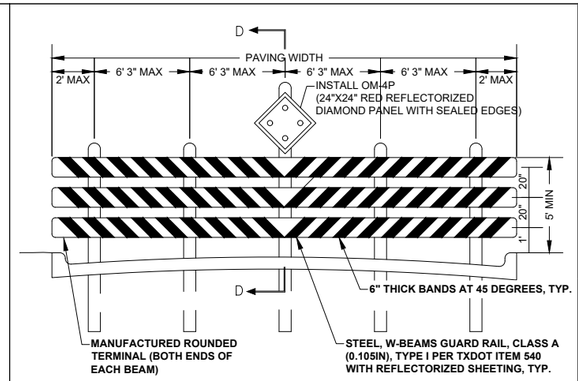
The City of SACHSE Public Works	MEDIAN	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-10





NOTES:
1. CONTRACTOR TO PROVIDE CONCRETE STAMPING MATS USED FOR CONSTRUCTION, TO CITY UPON COMPLETION OF CONSTRUCTION.
2. COLOR SHALL BE FULL DEPTH AND INTEGRAL WITH CONCRETE AND SHALL COMPLY WITH THE APPROVED MATERIALS LIST.
3. PATTERN SHALL BE A RUNNING BOND, AND AS PER APPROVED MATERIALS LIST.
4. STAMPED CONCRETE SHALL BE ANTIQUE RED IN COLOR.

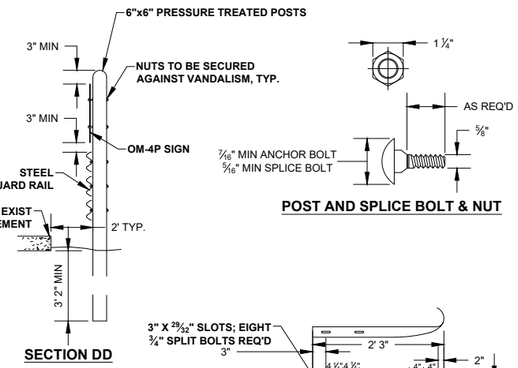
The City of SACHSE Public Works	STAMPED CONCRETE MEDIAN PAVEMENT	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-11



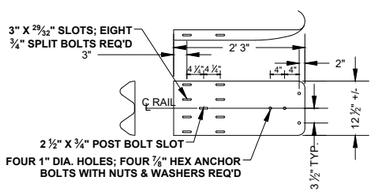
TYPICAL PERMANENT BARRICADE (MUTCD 3F-1)

NOTES:
1. THIS PERMANENT BARRICADE IS INTENDED FOR DEAD-END STREETS WHEN A HAZARDOUS CONDITION EXISTS PAST THE EXTENTS OF THE PAVEMENT, SUCH AS A NATURAL STREAM OR DEEP EXCAVATION. AT OTHER DEAD ENDS, ONLY PLACE THE SIGN OM-4P(24"X24") MUTCD 3C-4, WITH SEALED EDGES.
2. TYPICAL MOUNTING HEIGHT SHALL BE AS SHOWN AND THE OFFSET FROM THE POINT OF ROAD CLOSURE SHALL BE 10'. THE EXACT LOCATION AND HEIGHT OF METAL BEAM GUARD FENCE SHALL BE AS DIRECTED BY DIRECTOR OF PUBLIC WORKS.
3. BOLTS SHALL BE ⅝" DIAMETER, GALVANIZED AND OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND NO MORE THAN ¾" BEYOND IT.
4. POSTS TO BE BACKFILLED WITH A COHESIONLESS MATERIAL. DO NOT BACKFILL TIMBER POSTS WITH CONCRETE. POSTS SHALL BE 7" DIAMETER CREOSOTE TREATED WOOD.
5. METAL BEAMS, BOLTS, SPLICES AND ALL FITTINGS TO BE GALVANIZED.
6. RED REFLECTORIZED STRIPES SHALL BE HIGH INTENSITY SHEETING.
7. DIRECTIONAL SIGNS MAY BE REQUIRED ON BARRICADES AT DISCRETION OF THE DIRECTOR OF PUBLIC WORKS (S.D.H.P.T. CWI-6 OR CWI-7).
8. CONSULT THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR DIRECTION OF STRIPING.

The City of SACHSE Public Works	PERMANENT BARRICADE	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-12



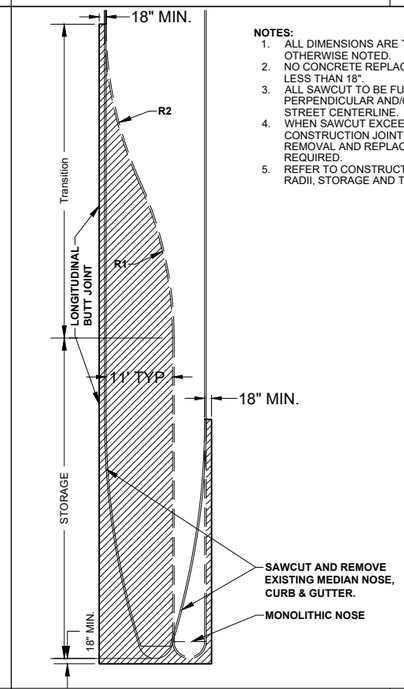
POST AND SPLICE BOLT & NUT



SECTION DD

ROUNDED TERMINAL DETAIL

The City of SACHSE Public Works	PERMANENT BARRICADE	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-13

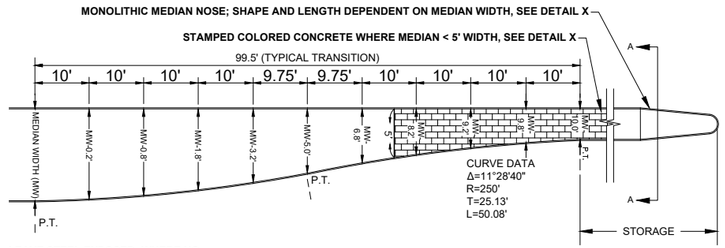


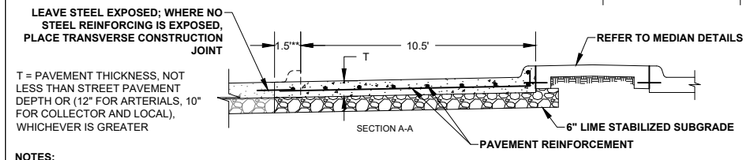
NOTES:
1. ALL DIMENSIONS ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.
2. NO CONCRETE REPLACEMENT WIDTH SHALL BE LESS THAN 18".
3. ALL SAWCUT TO BE FULL DEPTH AND EITHER PERPENDICULAR AND/OR PARALLEL WITH STREET CENTERLINE.
4. WHEN SAWCUT EXCEEDS HALF OF CONSTRUCTION JOINT PANEL WIDTH, FULL PANEL REMOVAL AND REPLACEMENT SHALL BE REQUIRED.
5. REFER TO CONSTRUCTION DRAWINGS FOR CURB RADII, STORAGE AND TRANSITION LENGTHS.

The City of SACHSE Public Works	LEFT TURN LANE CONCRETE REMOVAL AND REPLACEMENT	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-14

MONOLITHIC MEDIAN NOSE; SHAPE AND LENGTH DEPENDENT ON MEDIAN WIDTH, SEE DETAIL X

STAMPED COLORED CONCRETE WHERE MEDIAN < 5' WIDTH, SEE DETAIL X





T = PAVEMENT THICKNESS, NOT LESS THAN STREET PAVEMENT DEPTH OR (12" FOR ARTERIALS, 10" FOR COLLECTOR AND LOCAL), WHICHEVER IS GREATER

NOTES:
1. IN LIEU OF 6" LIME STABILIZED SUBGRADE, CONTRACTOR MAY INSTALL 6" RECYCLED CRUSHED CONCRETE. TXDOT ITEM NO. 247, GRADE 1, TYPE D OR INCREASE PAVING DEPTH BY 2".
2. SEE CITY PAVEMENT MARKING STANDARDS FOR MARKING LEFT TURN LANE.
3. FOR PROJECT SPECIFIC TRANSITION AND STORAGE LENGTHS, REFER TO CONSTRUCTION DRAWINGS.

** THIS CONFIGURATION APPLIES ONLY WHERE A NEW LEFT TURN LANE IS INTRODUCED ON A MEDIAN.

The City of SACHSE Public Works	LEFT TURN LANE DETAIL	GENERAL DESIGN STANDARDS PAVING DETAILS	SCALE: N.T.S; REVISION DATE: 04/20/2026; DETAIL: P-15

The City of SACHSE Public Works

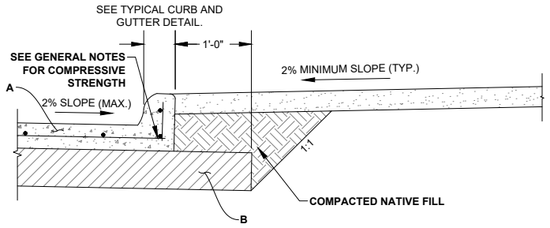
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

PAVING DETAILS 2
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

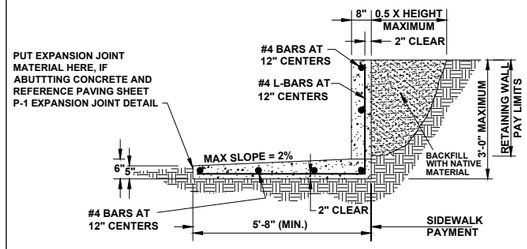
P-2
SHEET NO.



CLASSIFICATION	MINIMUM PAVEMENT THICKNESS (A)	MINIMUM SUBGRADE THICKNESS (B)	MINIMUM BAR: MAXIMUM SPACING REINFORCING STEEL
LOCAL	6"	6" LIME STABILIZED AT 8% (OR 6" CRUSHED CONCRETE)	#4 @ 18" C.C.
COLLECTOR	8"	8" LIME STABILIZED AT 8% (OR 8" CRUSHED CONCRETE)	#4 @ 18" C.C.
FIRE LANE	PER FIRE LANE DETAILS 22 AND 23 THIS SHEET		
ALLEYS	PER TYPICAL ALLEY DETAILS 24 THROUGH 27 SHEET P-4		
ARTERIALS	PER ENGINEERING DESIGN MANUAL SECTION 2.11		#4 @ 18" C.C.

NOTE:
CRUSHED CONCRETE SHALL MEET TXDOT SPECIFICATIONS, ITEM 247, TYPE D, GRADE 1 OR 2 WITH TRIAX TX 140 GEOGRID (OR APPROVED EQUAL).

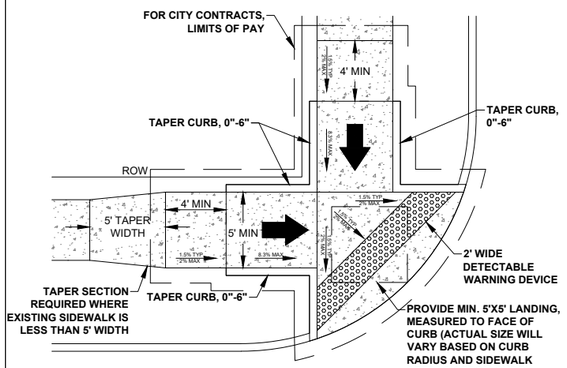
CONCRETE PAVEMENT DETAIL TYPICAL SECTION	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-16



SECTIONAL ELEVATION

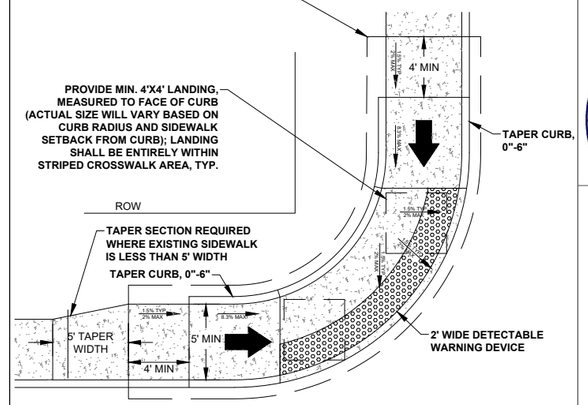
NOTES:
1. EXPOSED FACE OR WALL SHALL HAVE FORM LINER SIKA GREENSTREAK #439 SIERRA DRYSTACK OR SYMONS #F3170575 /#F3170503 STANDARD DRY STACK OR AS DIRECTED BY THE CITY ENGINEER. FORM LINER IS REQUIRED FOR WALLS 6-INCHES IN HEIGHT AND OVER.
2. MINIMUM COMPRESSIVE DESIGN STRENGTH OF THE CONCRETE SHALL BE 4,000PSI AT 28 DAYS, 6 SACK MINIMUM CEMENT CONTENT.
3. MINIMUM GRADE OF REINFORCING STEEL IS TO BE ASTM A615 GRADE 60.
4. ALL DISTANCES TO REINFORCING STEEL REFER TO CLEAR CONCRETE COVER OVER REINFORCING STEEL UNLESS NOTED OTHERWISE.
5. MINIMUM REINFORCING STEEL LAP IS TO BE THIRTY (30) BAR DIAMETERS.
6. MAXIMUM SPACING OF EXPANSION JOINTS SHALL BE 120-FEET. AN EXPANSION JOINT SHALL BE PLACED AT EACH PROPERTY LINE. EXPANSION JOINTS SHALL BE CONTINUOUS THROUGH WALL AND ASSOCIATED SIDEWALK.
7. ALL EXPOSED EDGES SHALL HAVE A 3/4 INCH CHAMFER.
8. SIDEWALK WIDTH SHOWN IS MINIMUM WIDTH. CONSULT PAVING PLANS FOR THE CLEAR SIDEWALK WIDTH.

CONCRETE SIDEWALK WITH RETAINING WALL	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-17



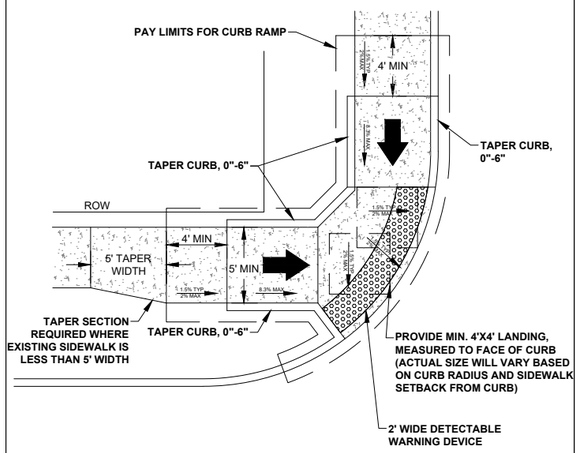
NOTES:
1. ALL PEDESTRIAN ELEMENTS, INCLUDING CURB RAMPS, SHALL COMPLY WITH THE PROPOSED ACCESSIBILITY GUIDELINES FOR PEDESTRIAN FACILITIES IN THE PUBLIC RIGHT-OF-WAY (PROWAG), PUBLISHED BY THE ARCHITECTURAL AND TRANSPORTATION COMPLIANCE BOARD ON JULY 26, 2011, 36 CFR PART 1190 OR ITS FINAL ADOPTED GUIDELINES.
2. ALL PEDESTRIAN PATHS SHALL HAVE TYPICAL 1.5%, MAXIMUM 2% CROSS SLOPE.
3. DETAIL ARE REPRESENTATION OF INFORMATION FROM PROWAG AND ARE INTENDED TO PROVIDE GUIDANCE. IT IS THE RESPONSIBILITY OF THE DESIGN PROFESSIONAL AND THE CONTRACTOR TO ENSURE THAT ALL RAMPS CONSTRUCTED MEET THE REQUIREMENTS OF PROWAG.

CURB RAMP TYPE A	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-18



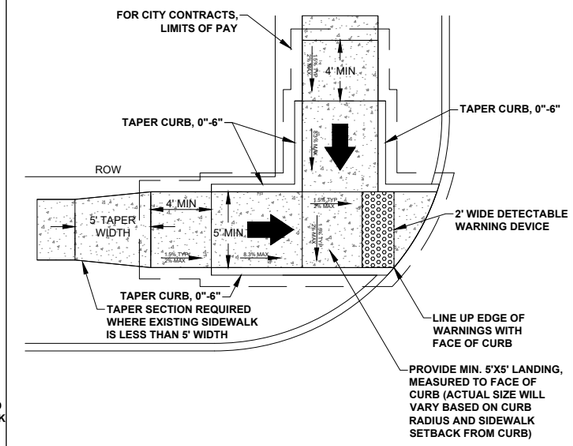
NOTES:
1. ALL PEDESTRIAN ELEMENTS, INCLUDING CURB RAMPS, SHALL COMPLY WITH THE PROPOSED ACCESSIBILITY GUIDELINES FOR PEDESTRIAN FACILITIES IN THE PUBLIC RIGHT-OF-WAY (PROWAG), PUBLISHED BY THE ARCHITECTURAL AND TRANSPORTATION COMPLIANCE BOARD ON JULY 26, 2011, 36 CFR PART 1190 OR ITS FINAL ADOPTED GUIDELINES.
2. ALL PEDESTRIAN PATHS SHALL HAVE TYPICAL 1.5%, MAXIMUM 2% CROSS SLOPE.
3. DETAIL ARE REPRESENTATION OF INFORMATION FROM PROWAG AND ARE INTENDED TO PROVIDE GUIDANCE. IT IS THE RESPONSIBILITY OF THE DESIGN PROFESSIONAL AND THE CONTRACTOR TO ENSURE THAT ALL RAMPS CONSTRUCTED MEET THE REQUIREMENTS OF PROWAG.

CURB RAMP TYPE B	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-19



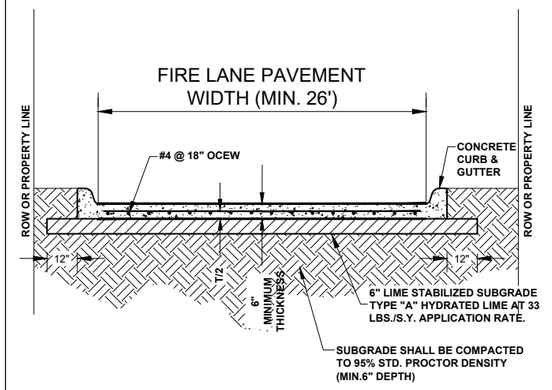
NOTES:
1. ALL PEDESTRIAN ELEMENTS, INCLUDING CURB RAMPS, SHALL COMPLY WITH THE PROPOSED ACCESSIBILITY GUIDELINES FOR PEDESTRIAN FACILITIES IN THE PUBLIC RIGHT-OF-WAY (PROWAG), PUBLISHED BY THE ARCHITECTURAL AND TRANSPORTATION COMPLIANCE BOARD ON JULY 26, 2011, 36 CFR PART 1190 OR ITS FINAL ADOPTED GUIDELINES.
2. ALL PEDESTRIAN PATHS SHALL HAVE TYPICAL 1.5%, MAXIMUM 2% CROSS SLOPE.
3. DETAIL ARE REPRESENTATION OF INFORMATION FROM PROWAG AND ARE INTENDED TO PROVIDE GUIDANCE. IT IS THE RESPONSIBILITY OF THE DESIGN PROFESSIONAL AND THE CONTRACTOR TO ENSURE THAT ALL RAMPS CONSTRUCTED MEET THE REQUIREMENTS OF PROWAG.

CURB RAMP TYPE C	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-20



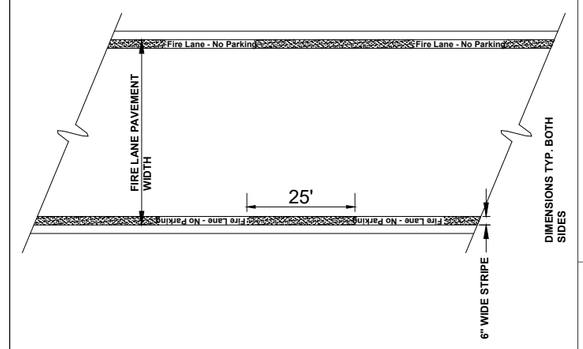
NOTES:
1. ALL PEDESTRIAN ELEMENTS, INCLUDING CURB RAMPS, SHALL COMPLY WITH THE PROPOSED ACCESSIBILITY GUIDELINES FOR PEDESTRIAN FACILITIES IN THE PUBLIC RIGHT-OF-WAY (PROWAG), PUBLISHED BY THE ARCHITECTURAL AND TRANSPORTATION COMPLIANCE BOARD ON JULY 26, 2011, 36 CFR PART 1190 OR ITS FINAL ADOPTED GUIDELINES.
2. ALL PEDESTRIAN PATHS SHALL HAVE TYPICAL 1.5%, MAXIMUM 2% CROSS SLOPE.
3. DETAIL ARE REPRESENTATION OF INFORMATION FROM PROWAG AND ARE INTENDED TO PROVIDE GUIDANCE. IT IS THE RESPONSIBILITY OF THE DESIGN PROFESSIONAL AND THE CONTRACTOR TO ENSURE THAT ALL RAMPS CONSTRUCTED MEET THE REQUIREMENTS OF PROWAG.

CURB RAMP TYPE D	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-21



NOTES:
1. REFER TO DETAIL FOR EXPANSION JOINT AND CONTRACTION JOINT, FOR SPACING, ETC. OF JOINTS WHERE A CURB IS USED, THE REQUIRED CLEARANCE SHALL BE MEASURED FROM THE CURB FACE TO ANY PERMANENT TRAFFIC OBSTACLE.
2. CONCRETE SHALL BE 4,000 PSI AT 28 DAYS, 6 SACK MIX MINIMUM. REFER TO PAVING GENERAL NOTES FOR ADDITIONAL REQUIREMENTS.
3. 6" LIME STABILIZED SUBGRADE MAY BE SUBSTITUTED BY EITHER ADDITIONAL 2" OF CONCRETE PAVING OR 6" OF RECYCLED CONCRETE FLEXIBLE BASE (PER TXDOT ITEM 247, GRADE 1, TYPE D).
4. ALL DIMENSIONS ARE FACE TO FACE OF CURB.
5. WHERE A FIRE LANE DEAD ENDS AND EXCEEDS 150' LENGTH, A HAMMERHEAD OR CUL-DE-SAC PER DETAIL P-15 MUST BE PROVIDED FOR THE FIRE TRUCK TO TURN AROUND.
6. FOR FIRE LANE PAVEMENT WIDTH, REFER TO 2015 INTERNATIONAL FIRE CODE APPENDIX D 103 AND CITY ORDINANCE X FOR AMENDMENTS.

FIRE LANE PAVING	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-22



NOTES:
1. LETTERING SHALL BE "FIRE LANE - NO PARKING" OR "NO PARKING-FIRE LANE" WITH 4" WHITE LETTERS.
2. WHERE CURB IS AVAILABLE, THE STRIPING SHALL BE ON THE VERTICAL FACE OF CURB.

FIRE LANE STRIPING	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	REVISION DATE: 04/20/2026	DETAIL: P-23

The City of SACHSE Public Works

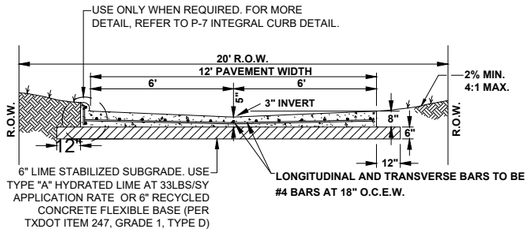
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

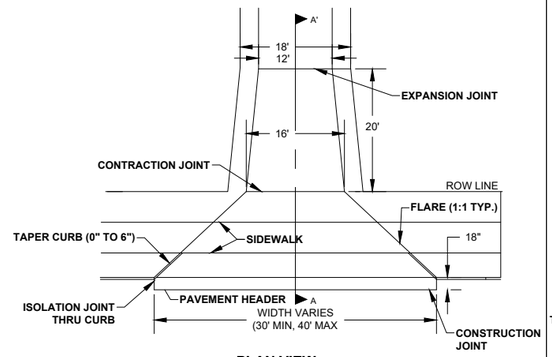
PAVING DETAILS 3
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

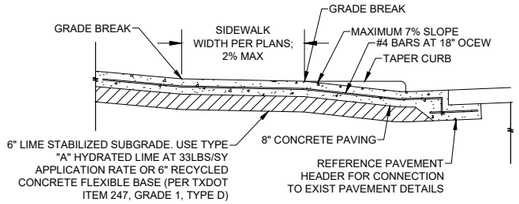
P-3
SHEET NO.



TYPICAL 12' ALLEY SECTION

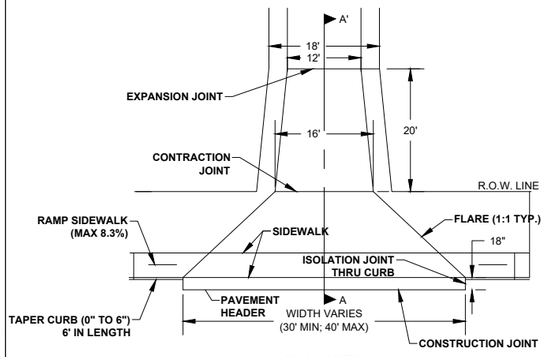


PLAN VIEW

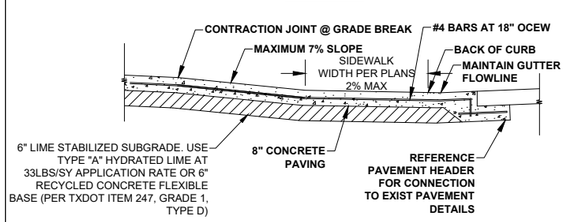


SECTION A-A'

NOTE:
FLARE SHOULD START AT RIGHT-OF-WAY, TYPICAL, BUT CAN BE ADJUSTED TO ACCOMMODATE MIN/MAX WIDTH REQUIREMENT.

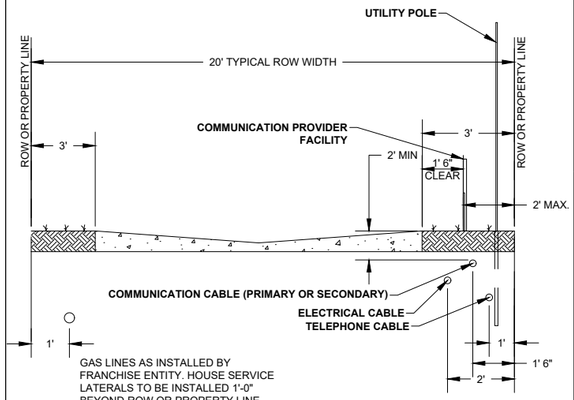


PLAN VIEW



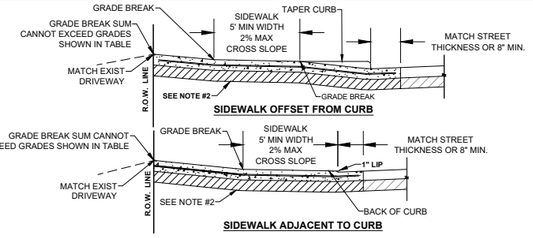
SECTION A-A'

NOTE:
FLARE SHOULD START AT RIGHT-OF-WAY, TYPICAL, BUT CAN BE ADJUSTED TO ACCOMMODATE MIN/MAX WIDTH REQUIREMENT.



NOTE:
ALL FRANCHISED UTILITIES ARE TO HAVE A MINIMUM BURIAL DEPTH OF 24" BELOW BOTTOM OF PAVING, AS REQUIRED BY STATE AND FEDERAL CODES AND STANDARDS.

The City of SACHSE Public Works	ALLEY PAVING	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-24
The City of SACHSE Public Works	ALLEY/STREET INTERSECTION OFFSET SIDEWALK	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-25
The City of SACHSE Public Works	ALLEY/STREET INTERSECTION ADJACENT SIDEWALK	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-26
The City of SACHSE Public Works	FRANCHISE UTILITY LOCATION	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-27



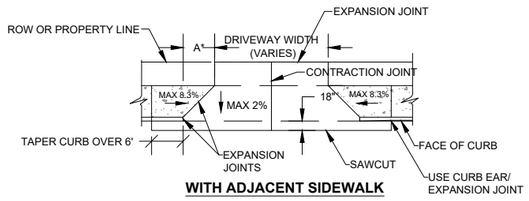
SIDEWALK OFFSET FROM CURB

SIDEWALK ADJACENT TO CURB

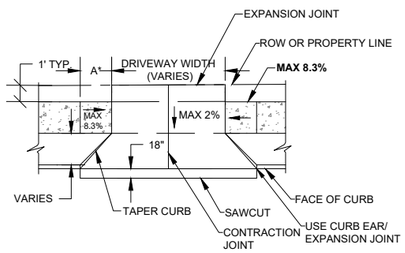
	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
CONCRETE THICKNESS (MINIMUM)	6"	8" MIN.	12"
REINFORCING (MINIMUM)	#4 @ 18" OCEW		
MAX SLOPE CONNECTING TO STREET	10%	7%	7%
MAX SLOPE CONNECTING TO ALLEY	14%	11%	11%
FLARE/RADIUS	5' MIN.	BY ORDINANCE	BY ORDINANCE

DRIVEWAY PARAMETERS

NOTES:
1. ON RESIDENTIAL DRIVEWAYS, IN LIEU OF 18" BLOCKOUT INTO STREET, CONTRACTOR MAY HORIZONTALLY SAWCUT CURB. ON COMMERCIAL DRIVEWAYS, USE FULL-DEPTH SAWCUT 18" FROM FACE OF CURB.
2. FOR DRIVEWAY WIDTH AND CURB RADII, REFER TO SECTION 2.7 OF DESIGN MANUAL. RESIDENTIAL DRIVEWAY SHALL BE A MINIMUM 10' WIDE AND MAXIMUM 24' WIDE. IF RESIDENTIAL PROPERTY HAS THREE ENCLOSED GARAGES, MAXIMUM DRIVEWAY WIDTH CAN BE 30'. DRIVEWAYS MUST STILL BE IN COMPLIANCE WITH ORDINANCE IN PERCENTAGE OF IMPROVED AREA ALLOWED.
3. THE FLARE OR RADIUS CANNOT EXTEND PAST THE EXTENSION OF THE ADJOINING PROPERTY LINE.
4. SIDEWALK RAMPS ADJACENT TO COMMERCIAL DRIVEWAYS MUST BE COMPLIANT AS PER TEXAS ACCESSIBILITY STANDARDS (TAS) & DRAFT PROPOSED RIGHT-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG). AS PER PROWAG R208.1, WHERE COMMERCIAL DRIVEWAYS ARE PROVIDED WITH YIELD OR STOP CONTROL, DETECTABLE WARNING SURFACES SHOULD BE PROVIDED AT THE JUNCTION BETWEEN THE SIDEWALK AND STREET.
5. EXPANSION JOINTS ARE REQUIRED AT THE RIGHT-OF-WAY/PROPERTY LINE, WHEN CONNECTING TO EXISTING CONCRETE DRIVEWAYS AND AT GRADE BREAKS ON DRIVEWAY APPROACHES.
6. SIDEWALK THROUGH A DRIVEWAY IS TO BE BUILT TO MAINTAIN CONSTANT CROSS-SLOPE ACROSS THE LENGTH OF THE DRIVEWAY.
7. WHERE DRIVEWAY CONNECTIONS ARE MADE TO PUBLIC STREETS WITH CURBS AND GUTTERS; SUCH CURB AND GUTTER SHALL BE REMOVED TO THE NEAREST CONSTRUCTION JOINT. DESIGN OF SUCH CONNECTIONS ARE TO BE SUBMITTED TO THE CITY PRIOR CONSTRUCTION.
8. RESIDENTIAL DRIVEWAYS FROM ROW LINE TO HOUSE/DWELLING SHALL BE MINIMUM 4" THICK, 4,000 PSI COMPRESSIVE STRENGTH AT 28-DAYS CONCRETE, REINFORCED WITH #3 BARS AT 24" OCEW OR 6X6-W2.9XW2.9 WIRE MESH PANELS.

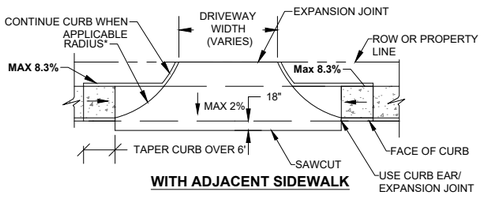


WITH ADJACENT SIDEWALK

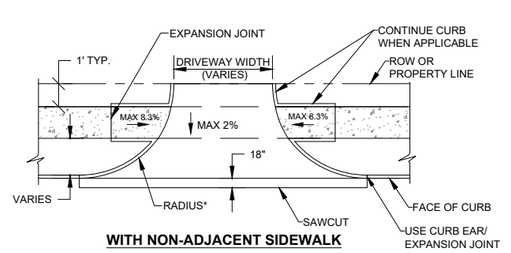


WITH NON-ADJACENT SIDEWALK

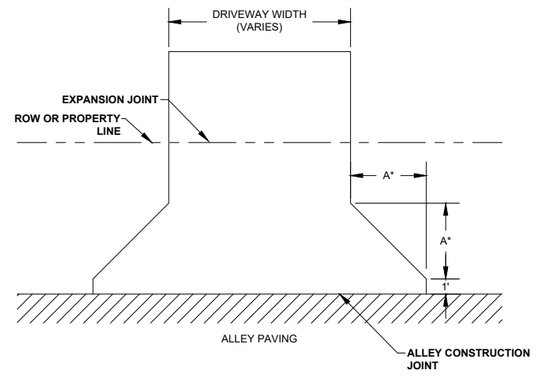
* REFER TO DETAIL 28, DRIVEWAY PARAMETERS TABLE, THIS PAGE.



WITH ADJACENT SIDEWALK



WITH NON-ADJACENT SIDEWALK



TYPICAL DRIVE OR STREET CONNECTION TO EXISTING ASPHALT STREET

The City of SACHSE Public Works	DRIVEWAY	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-28
The City of SACHSE Public Works	DRIVEWAY FLARED	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-29
The City of SACHSE Public Works	DRIVEWAY RADIAL	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-30
The City of SACHSE Public Works	DRIVEWAY RESIDENTIAL IN ALLEY	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S / REVISION DATE: 04/20/2026 / DETAIL: P-31

The City of SACHSE Public Works

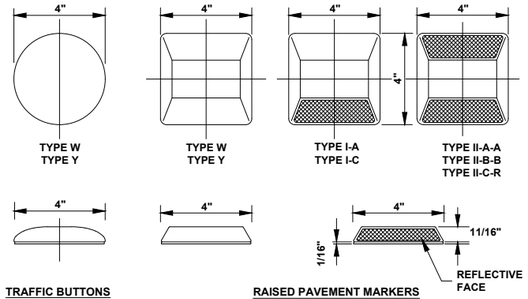
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

PAVING DETAILS 4
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

P-4
SHEET NO.



USE TYPE II-B-B ONLY AT FIRE HYDRANT LOCATIONS, AND TYPE II-C-R ONLY ON DIVIDED ROADWAYS.

REQUIREMENTS FOR INSTALLATION OF PAVEMENT MARKERS AND MARKINGS (ON ALL PUBLIC ROW):

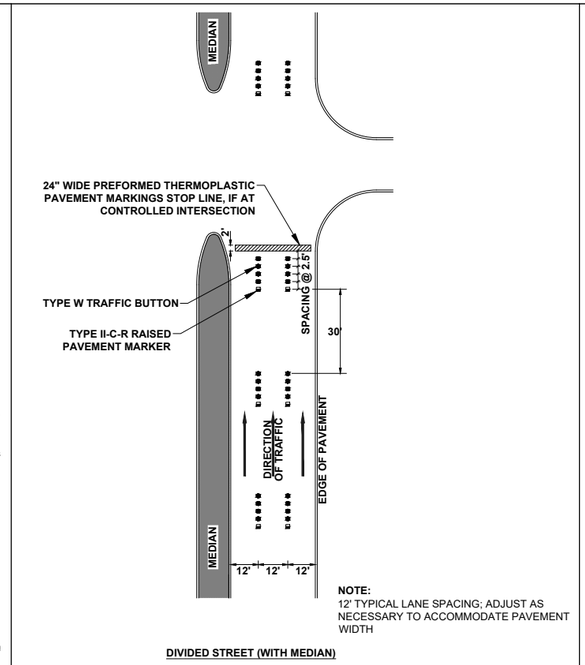
1. REFLECTOR CODE: A - AMBER REFLECTOR, C - WHITE REFLECTOR, R - RED REFLECTOR, B - BLUE REFLECTOR
2. PAVEMENT UPON WHICH TRAFFIC BUTTONS, PAVEMENT MARKERS, JIGGLE BAR TILES, THERMOPLASTIC AND PAINT ARE TO BE APPLIED SHALL HAVE ITS SURFACE PREPARED IN ACCORDANCE WITH TXDOT SPECIFICATIONS ITEM 677.1 TO 677.4 INCLUSIVE AND ITEM 678.1 TO 678.4 INCLUSIVE. MEASUREMENT AND PAYMENT FOR REMOVAL OF EXISTING PAVEMENT MARKINGS AND MARKERS AND SURFACE PREPARATION SHALL BE SUBSIDIARY TO THE PAVEMENT MARKINGS OR MARKER INSTALLATION PAY ITEMS.
3. TRAFFIC BUTTONS, PAVEMENT MARKERS AND JIGGLE BAR TILES SHALL BE INSTALLED IN ACCORDANCE WITH TXDOT SPECIFICATION 672, HOWEVER ALL TRAFFIC BUTTONS, PAVEMENT MARKERS AND JIGGLE BAR TILES SHALL BE INSTALLED USING EPOXY ADHESIVE; USE OF BITUMINOUS ADHESIVE IS PROHIBITED. TYPE I-C AND TYPE II-C-R RAISED PAVEMENT MARKERS MUST HAVE A WHITE COLORED BODY; A SILVER-WHITE BODY COLOR IS PROHIBITED.
4. TYPE II-B-B (BLUE REFLECTORS) PAVEMENT MARKERS SHALL ONLY BE USED TO IDENTIFY FIRE HYDRANT LOCATIONS.
5. RAISED PAVEMENT MARKERS AND TRAFFIC BUTTONS SHALL NOT BE INSTALLED OVER PAVEMENT JOINTS OF ANY KIND.
6. THERMOPLASTIC SHALL BE INSTALLED PER TXDOT SPECIFICATIONS ITEM 666 AND / OR ITEM 668, AND CITY SPECIFICATIONS, WHICHEVER IS MORE RESTRICTIVE.
7. DIMENSIONAL LAYOUT, SIZING AND SPACING FOR ALL TRAFFIC ARROWS, "ONLY" DESIGNATIONS, AND OTHER PAVEMENT MARKINGS SHALL CONFORM TO THE MOST RECENT FEDERAL HIGHWAY ADMINISTRATION (FHWA) STANDARD HIGHWAY SIGNS MANUAL AND THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD), PART 3.
8. THERMOPLASTIC STOP BARS SHALL STOP 12-INCHES FROM FACE OF CURB.
9. ALL PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL SHALL BE PER THE TRAFFIC APPROVED MATERIALS LIST OR AS APPROVED BY MANAGER OF TRAFFIC ENGINEERING.

GUARDRAIL DELINEATORS:
ALL CORRUGATED W-BEAM METAL GUARDRAIL INSTALLED IN THE CITY SHALL BE INSTALLED WITH TRIANGULAR GUARDRAIL REFLECTORS TABS (BOLT ON TYPE) OF THE APPROPRIATE COLOR INSTALLED IN THE CENTER OF THE CORRUGATED RAIL AT EACH POST BOLT, BUT NO LESS THAN EVERY 6-FEET.

PAVEMENT MARKING

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-32



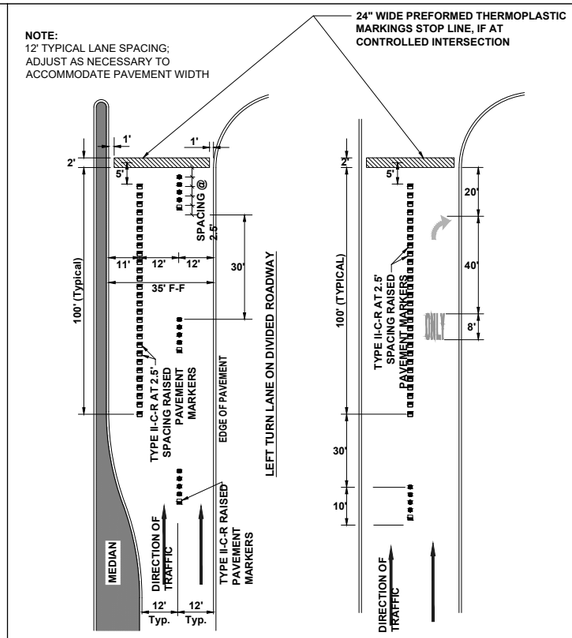
NOTE:
12' TYPICAL LANE SPACING; ADJUST AS NECESSARY TO ACCOMMODATE PAVEMENT WIDTH

DIVIDED STREET (WITH MEDIAN)

PAVEMENT MARKING

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-33

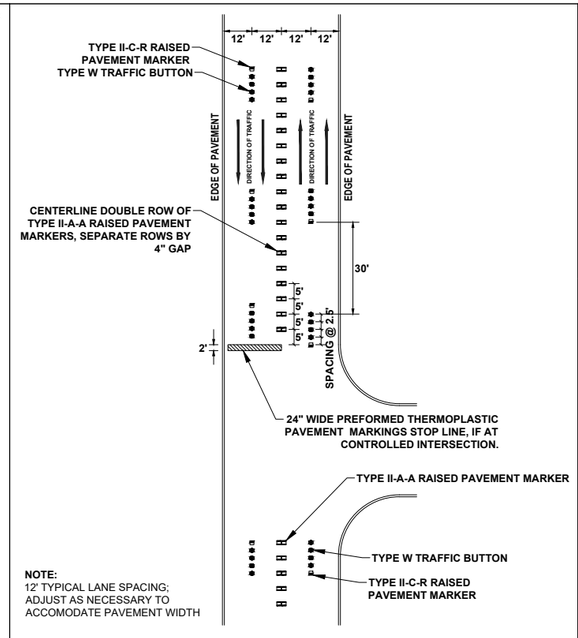


MANDATORY RIGHT TURN LANE ON DIVIDED ROADWAY

PAVEMENT MARKING

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-34



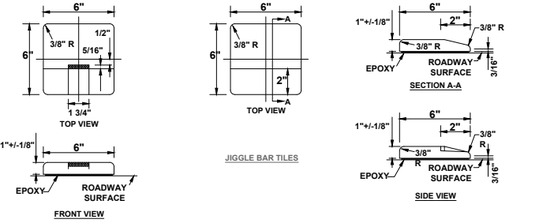
NOTE:
12' TYPICAL LANE SPACING; ADJUST AS NECESSARY TO ACCOMODATE PAVEMENT WIDTH

4-LANE UNDIVIDED ROADWAY

PAVEMENT MARKING

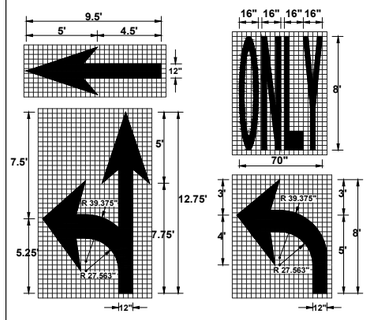
GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-35

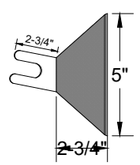


TRAFFIC ARROW TEMPLATES

USE AT SPEEDS OF 40 MPH AND LOWER. TEMPLATES ARE FROM FHWA STANDARD HIGHWAY SIGNS, 2004 EDITION. ONE SQUARE IS 4-INCHES



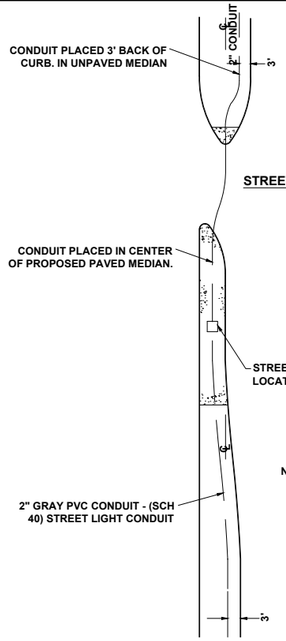
TRIANGULAR REFLECTOR TAB FOR DELINEATING GUARDRAIL



JIGGLE BARS & TRAFFIC ARROWS

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-36

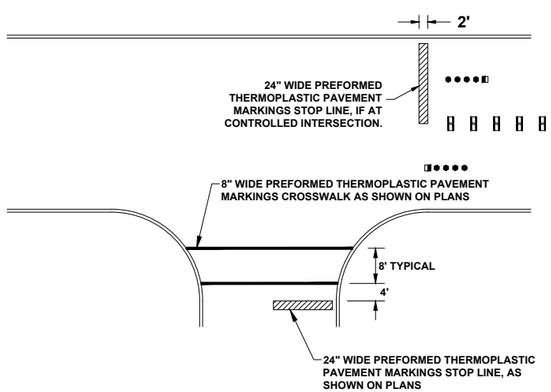


NOTES:
1. STREET LIGHT CONDUIT TO BE CONTINUOUS 2-INCH GRAY PCV (SCH. 40) WITH NYLON PULL LINE.
2. CONDUIT TO BE INSTALLED A MINIMUM OF 24-INCHES DEEP AND A MAXIMUM OF 36-INCHES DEEP. CAP ALL OPENINGS.
3. AFTER INSTALLATION AND PRIOR TO BACK-FILL OF TRENCH, REQUEST AN INSPECTION OF CONDUIT INSTALLATION FROM ELECTRIC DELIVERY (24 HOUR NOTICE).

STREET LIGHTING CONDUIT

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-37



NOTE:
INSTALL CROSSWALKS & STOP LINES ONLY AT DIRECTION OF MANAGER OF TRAFFIC ENGINEERING - GENERALLY AT CONTROLLED INTERSECTIONS, TRAFFIC SIGNALS, STOP SIGNS OR SCHOOL ZONES.

CROSSWALK PAVEMENT MARKING

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-38

STREET NAME SIGNS (LOCATED ALONG ARTERIAL STREET)

STREET NAME SIGNS (NOT LOCATED ON ARTERIAL STREET)

NOTES:
1. TYPICAL LAYOUT AND DETAIL FOR STREET SIGNS.
2. WHITE LOGO AND LETTERING. LOGO IS CAPITAL S FROM THE LAANDBRAU REGULAR FONT. LETTERING IS TO COMPLY WITH THE LATEST VERSION OF THE TMUTCD USING THE APPROVED CLEARVIEW FONT UTILIZING UPPER AND LOWER CASE LETTERS.
3. BACKGROUND COLOR IS BLUE (RGB = 0-30-96).
4. SIGN THICKNESS: 0.125"
5. EXTRUDED ALUMINUM FOR POST MOUNTED SIGNS

STREET NAME SIGN LAYOUT

GENERAL DESIGN STANDARDS
STANDARD DETAILS

SCALE: N.T.S
REVISION DATE: 04/20/2026
DETAIL: P-39

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

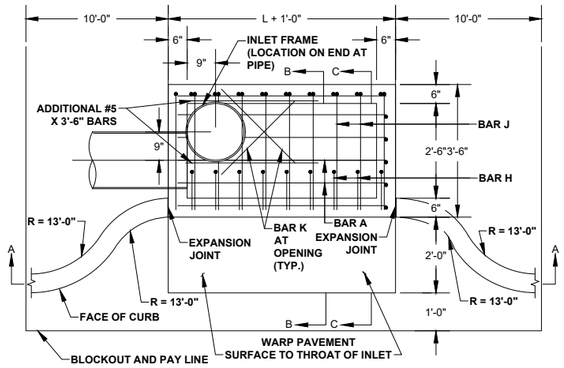
CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

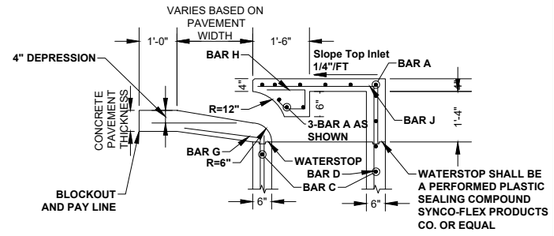
PAVING DETAILS 5
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

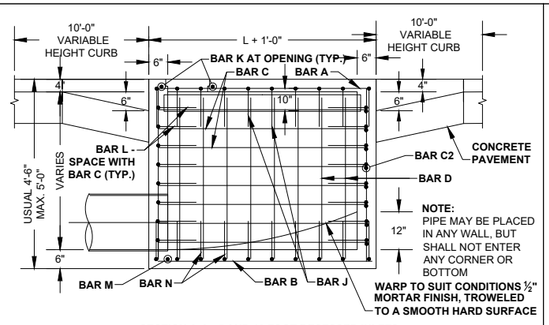
P-5
SHEET NO.



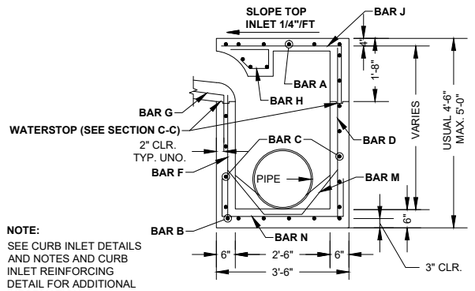
5 AND 10 FOOT RECESSED INLETS - PLAN VIEW



SECTION C-C - 5 AND 10 FOOT RECESSED INLETS

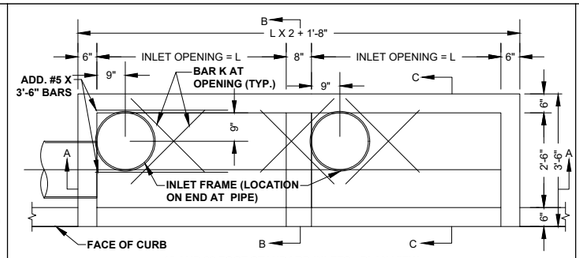


SECTION A-A - 5 AND 10 FOOT RECESSED INLETS



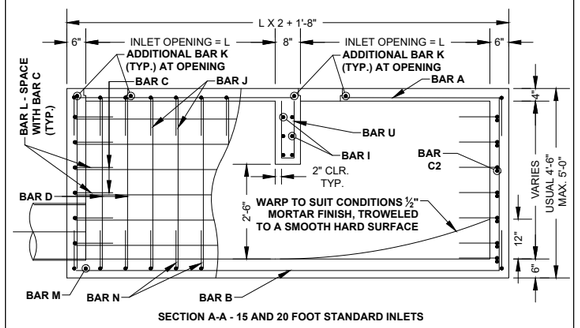
NOTE:
SEE CURB INLET DETAILS AND NOTES AND CURB INLET REINFORCING DETAIL FOR ADDITIONAL INFORMATION.

SECTION B-B - 5 AND 10 FOOT RECESSED INLETS

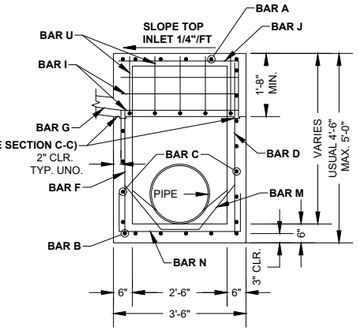


15 AND 20 FOOT STANDARD INLETS - PLAN VIEW

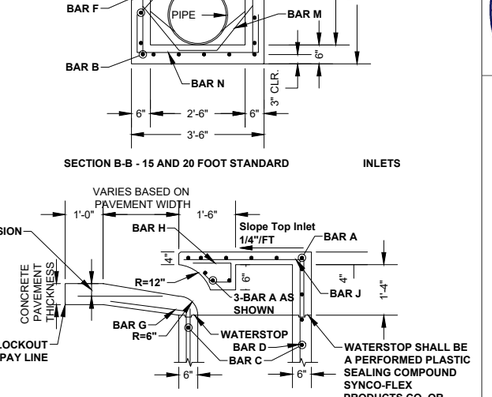
NOTES:
1. REINFORCEMENT SHOWN IS ADDITIONAL FOR PIPE OPENINGS, SEE SECTIONS FOR OTHER REINFORCING.
2. BARS J SHALL BE CUT AT OPENING TO MAINTAIN 2" MINIMUM CLEAR COVER. ADDITIONAL #5 BARS X 3'-6" SHALL BE PROVIDED AT EACH SIDE OF OPENING.



SECTION A-A - 15 AND 20 FOOT STANDARD INLETS

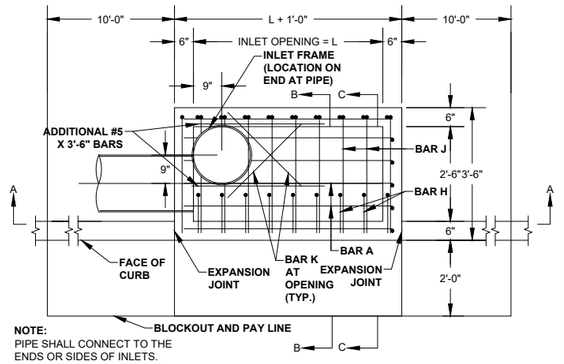


SECTION B-B - 15 AND 20 FOOT STANDARD INLETS



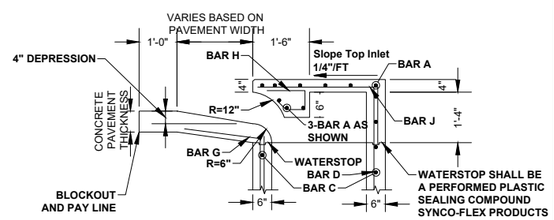
SECTION C-C - 15 AND 20 FOOT STANDARD INLETS

NOTE:
SEE CURB INLET DETAILS AND NOTES AND CURB INLET REINFORCING DETAIL FOR ADDITIONAL INFORMATION.

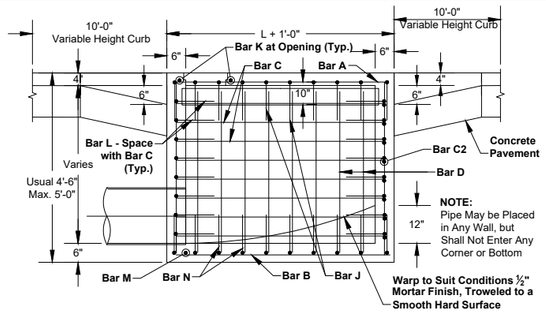


NOTE:
PIPE SHALL CONNECT TO THE ENDS OR SIDES OF INLETS. CONNECTION SHALL BE MADE AT CORNER OR BOTTOM.

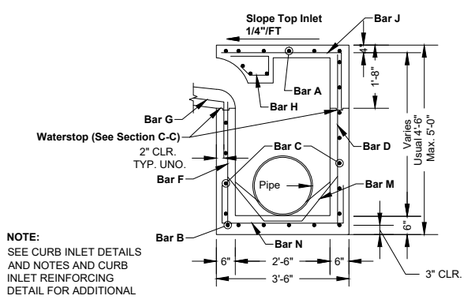
5' AND 10' STANDARD CURB INLET - PLAN VIEW



SECTION C-C - 5 AND 10 FOOT STANDARD INLETS



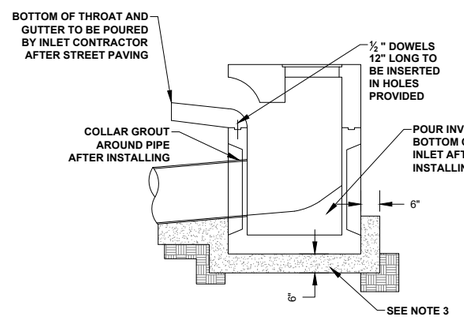
SECTION A-A - 5 AND 10 FOOT STANDARD INLETS



NOTE:
SEE CURB INLET DETAILS AND NOTES AND CURB INLET REINFORCING DETAIL FOR ADDITIONAL INFORMATION.

SECTION B-B - 5 AND 10 FOOT STANDARD INLETS

NOTE:
PRECAST INLETS MUST BE APPROVED BY DIRECTOR OF PUBLIC WORKS.



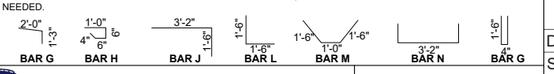
INSTALLATION DRAWING FOR PRECAST CURB INLETS

NOTES (APPLICABLE TO ALL CURB INLETS):
1. PRECAST INLETS MUST BE APPROVED BY DEPARTMENT OF PUBLIC WORKS.
2. THE EXCAVATION MUST PROVIDE A FIRM, LEVEL BED FOR THE BASE SECTION TO REST UPON.
3. A MINIMUM OF 6 INCHES OF 1" DIAMETER (MAXIMUM ROCK OR GRAVEL SHALL BE USED TO PREPARE THE BEDDING TO FINAL GRADE.
4. CONCRETE TO BE 4,000 PSI.
5. LOCKING DEVICE IS REQUIRED ON ALL STORM DRAIN LIDS.
6. "NO DUMPING" WARNING PLAQUE TO BE INSTALLED ON ALL STANDARD AND RECESSED INLETS.
7. DESIGN SHOWN FOR INLETS UP TO 5'-0" IN DEPTH. SPECIAL DESIGN WILL BE REQUIRED FOR INLETS GREATER THAN 5'-0" IN DEPTH.
8. THROAT OPENING SHALL BE 6 INCHES.
9. FOR ALL STANDARD CURB INLETS, SEE STANDARD 30" MANHOLE RING AND COVER DETAIL.
10. BARS SHALL BE ADJUSTED OR CUT AS NECESSARY TO MAINTAIN A MINIMUM 2" CLEAR AT ALL OPENINGS.

	INLET OPENING "L"	BAR	BAR SIZE	BAR LENGTH	BAR SPACING
DOUBLE INLETS	7'-6"	A	#4	16'-4"	8" O.C. MAX.
		B	#4	16'-4"	8" O.C. MAX.
		C	#4	16'-4"	8" O.C. MAX.
		C2	#4	3'-2"	8" O.C. MAX.
		D	#5	4'-6"	12" O.C. MAX.
		F	#5	3'-3"	12" O.C. MAX.
		G	#4	3'-6"	12" O.C. MAX.
		H	#4	2'-6"	12" O.C. MAX.
		I	#4	2'-0"	8" O.C. MAX.
		J	#5	4'-8"	12" O.C. MAX.
		K**	#4	3'-0"	
		L	#4	3'-0"	8" O.C. MAX.
		M**	#4	4'-0"	
		N	#5	6'-2"	8" O.C. MAX.
		U	#4	3'-4"	8" O.C. MAX.

	INLET OPENING "L"	BAR	BAR SIZE	BAR LENGTH	BAR SPACING
SINGLE INLETS	5'-0"	A	#4	5'-0"	8" O.C. MAX.
		B	#4	5'-0"	8" O.C. MAX.
		C	#4	5'-0"	8" O.C. MAX.
		C2	#4	3'-2"	8" O.C. MAX.
		D	#5	4'-6"	12" O.C. MAX.
		F	#5	3'-3"	12" O.C. MAX.
		G	#4	3'-6"	12" O.C. MAX.
		H	#4	2'-6"	12" O.C. MAX.
		J	#5	4'-8"	12" O.C. MAX.
		K**	#4	3'-0"	
		L	#4	3'-0"	8" O.C. MAX.
		M**	#4	4'-0"	
		N	#5	6'-2"	8" O.C. MAX.

* BAR LENGTHS SHOWN ARE FOR MAX. HEIGHT INLETS. VALUES SHALL BE ADJUSTED FOR USUAL HEIGHT INLETS.
** DIMENSIONS SHOWN FOR TOP SLAB OPENINGS AS SHOWN IN THE DETAILS. ADDITIONAL BARS SHALL BE PROVIDED AT ALL PIPE OPENINGS AS SHOWN IN THE DETAILS, NUMBER AND DIMENSIONS TO BE MODIFIED AS NEEDED.



The City of SACHSE Public Works

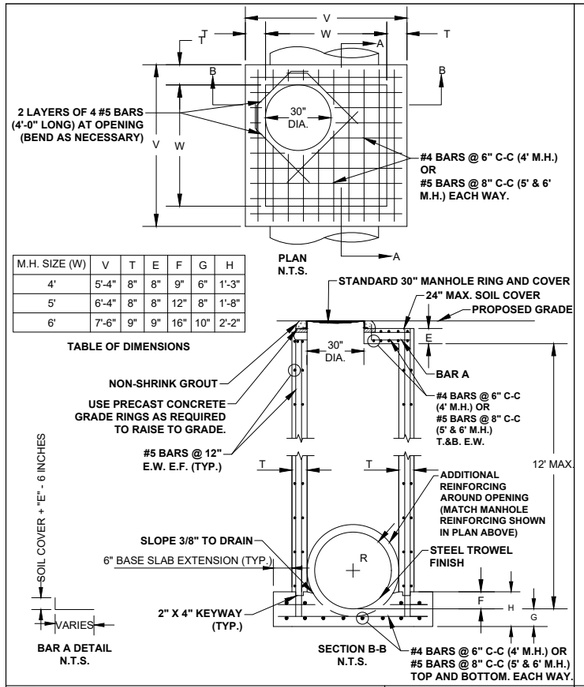
CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD, BUILDING B
SACHSE, TX 75048
(972) 495-7600

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

DRAINAGE DETAILS 1
SHEET TITLE

DRAWN BY: CCC
SCALE: N.T.S.
DATE: 04/20/2026

D-1
SHEET NO.



M.H. SIZE (W)	V	T	E	F	G	H
4'	5'-4"	8"	8"	9"	6"	1'-3"
5'	6'-4"	8"	8"	12"	8"	1'-8"
6'	7'-6"	9"	9"	16"	10"	2'-2"

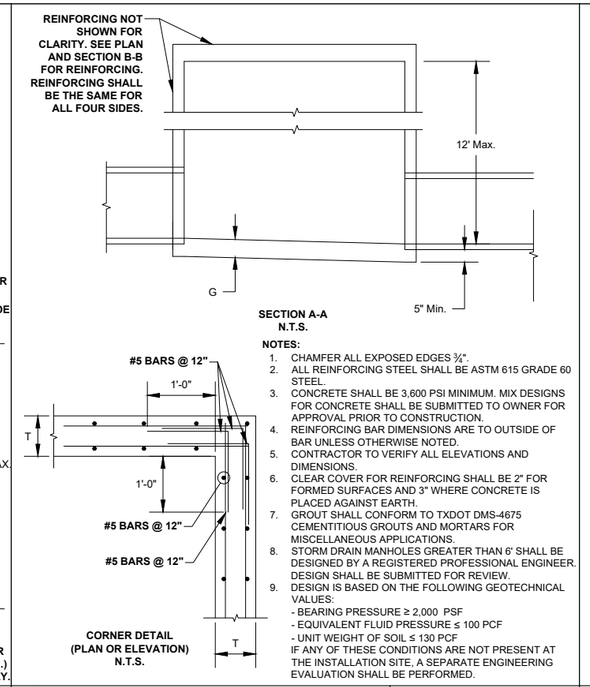
TABLE OF DIMENSIONS

STORM DRAIN MANHOLE 4', 5' OR 6' SQUARE (1 OF 2)

GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-9

REVISION DATE: 04/20/2026



NOTES:

1. CHAMFER ALL EXPOSED EDGES ¾".
2. ALL REINFORCING STEEL SHALL BE ASTM 615 GRADE 60 STEEL.
3. CONCRETE SHALL BE 3,600 PSI MINIMUM. MIX DESIGNS FOR CONCRETE SHALL BE SUBMITTED TO OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
4. REINFORCING BAR DIMENSIONS ARE TO OUTSIDE OF BAR UNLESS OTHERWISE NOTED.
5. CONTRACTOR TO VERIFY ALL ELEVATIONS AND DIMENSIONS.
6. CLEAR COVER FOR REINFORCING SHALL BE 2" FOR FORMED SURFACES AND 3" WHERE CONCRETE IS PLACED AGAINST EARTH.
7. GROUT SHALL CONFORM TO TXDOT DMS-4675 CEMENTITIOUS GROUTS AND MORTARS FOR MISCELLANEOUS APPLICATIONS.
8. STORM DRAIN MANHOLES GREATER THAN 6' SHALL BE DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER. DESIGN SHALL BE SUBMITTED FOR REVIEW.
9. DESIGN IS BASED ON THE FOLLOWING GEOTECHNICAL VALUES:
   - BEARING PRESSURE ≥ 2,000 PSF
   - EQUIVALENT FLUID PRESSURE ≤ 100 PCF
   - UNIT WEIGHT OF SOIL ≤ 130 PCF

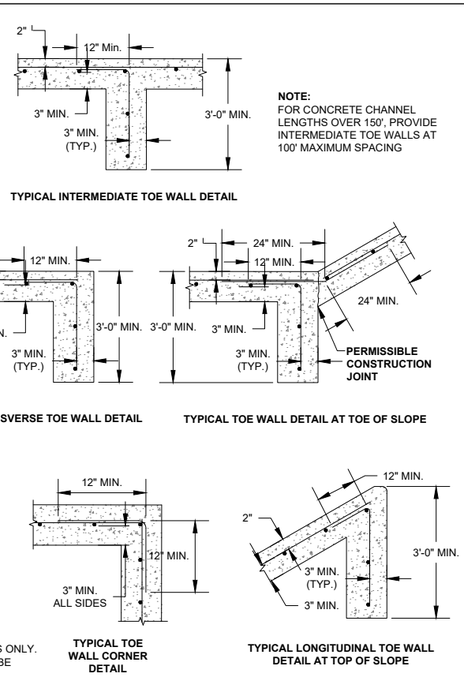
   IF ANY OF THESE CONDITIONS ARE NOT PRESENT AT THE INSTALLATION SITE, A SEPARATE ENGINEERING EVALUATION SHALL BE PERFORMED.

STORM DRAIN MANHOLE 4', 5' OR 6' SQUARE (2 OF 2)

GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-10

REVISION DATE: 04/20/2026



NOTE: FOR CONCRETE CHANNEL LENGTHS OVER 150', PROVIDE INTERMEDIATE TOE WALLS AT 100' MAXIMUM SPACING

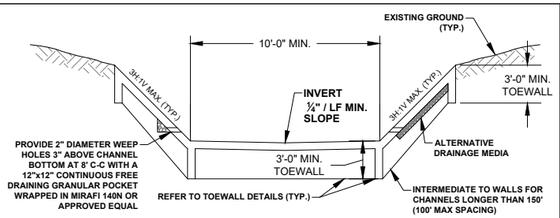
NOTE: MINIMUM REQUIREMENTS ONLY. DESIGN SHALL BE SUBMITTED.

CONCRETE CHANNEL DETAILS (1 OF 2)

GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-11

REVISION DATE: 04/20/2026

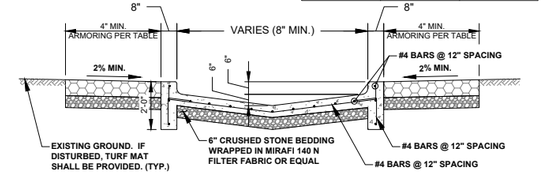


CONCRETE CHANNEL LINING TYPICAL SECTION

NOTES:

1. CHAMFER ALL EXPOSED EDGES OF CONCRETE ¾".
2. ALL CONCRETE SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
3. ALL CLEAR COVER FOR CONCRETE SHALL BE 3" AGAINST EARTH AND 2" ELSEWHERE UNLESS OTHERWISE SHOWN.
4. ALL REINFORCING STEEL SHALL BE ASTM 615 GR 60 STEEL.
5. ALL MATERIAL SHALL BE SUBMITTED TO OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
6. MIX DESIGNS FOR CONCRETE SHALL BE SUBMITTED TO OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
7. REINFORCING BAR DIMENSIONS ARE TO OUTSIDE OF BAR UNLESS OTHERWISE NOTED.
8. CONTRACTOR TO VERIFY ALL ELEVATIONS AND DIMENSIONS.
9. FOR SLOPES STEEPER THAN 3H:1V, SLOPE STABILITY ANALYSIS SHALL BE PERFORMED BY A LICENSED GEOTECHNICAL ENGINEER IN THE STATE OF TEXAS.
10. CONCRETE CHANNELS SHALL HAVE A MINIMUM THICKNESS OF 6" BUT SHALL BE DESIGNED FOR SITE SPECIFIC CONDITIONS. DESIGN SHALL BE PERFORMED BY A LICENSED ENGINEER IN THE STATE OF TEXAS.
11. ALTERNATIVE DRAINAGE MEDIA MAY BE SUBMITTED FOR REVIEW. ALTERNATIVE SHALL BE DESIGNED BY A LICENSED ENGINEER IN THE STATE OF TEXAS.

100 YEAR VELOCITY (FPS)	ARMORING MATERIAL	REQUIREMENTS
≤ 6	TURF MAT	PER MANUFACTURER
≤ 12	GABION	PER STANDARD DETAIL
PER MANUFACTURER	ARTICULATED CONCRETE BLOCK (ACB)	PER MANUFACTURER



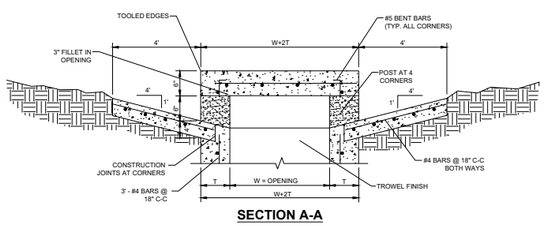
CONCRETE PILOT CHANNEL TYPICAL SECTION

CONCRETE CHANNEL DETAILS (2 OF 2)

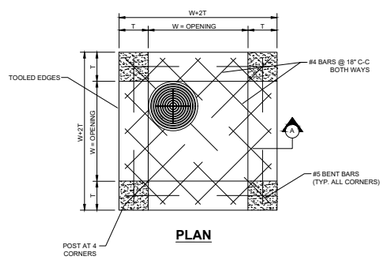
GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-12

REVISION DATE: 04/20/2026



SECTION A-A



PLAN

INLET SIZE TABLE

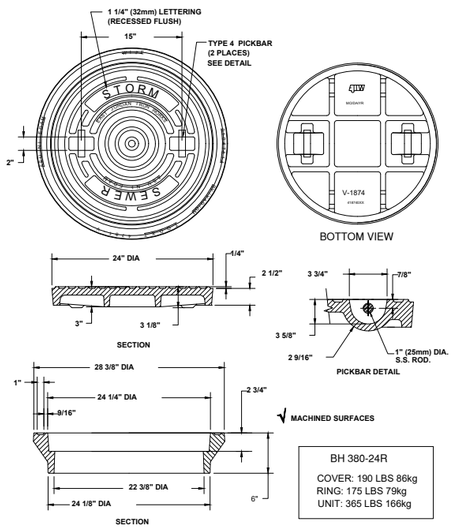
INLET SIZE	T	W
2' SQUARE	7"	2'-0"
4' SQUARE	7"	4'-0"
5' SQUARE	8"	5'-0"
6' SQUARE	9"	6'-0"

WYE INLET

GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-13

REVISION DATE: 04/20/2026



BH 380-24R
COVER: 190 LBS 86kg
RING: 175 LBS 79kg
UNIT: 365 LBS 166kg

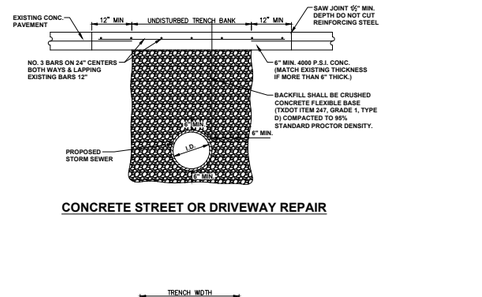
INLET FRAME AND COVER

INLET FRAME AND COVER

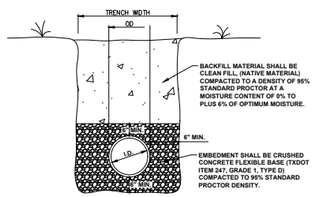
GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-14

REVISION DATE: 04/20/2026



CONCRETE STREET OR DRIVEWAY REPAIR



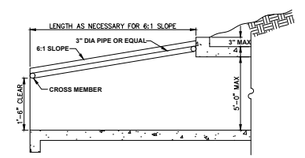
STORM SEWER PIPE BEDDING DETAIL

EMBEDMENT

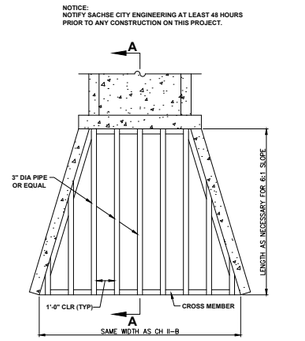
GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-15

REVISION DATE: 04/20/2026



SECTION A-A



SAFETY GRATES FOR PIPE AND BOX CULVERTS

SAFETY GRATES FOR PIPE AND BOX CULVERTS

GENERAL DESIGN STANDARDS STANDARD DETAILS

SCALE: N.T.S | DETAIL: D-16

REVISION DATE: 04/20/2026

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD, BUILDING B
SACHSE, TX 75048
(972) 495-7600

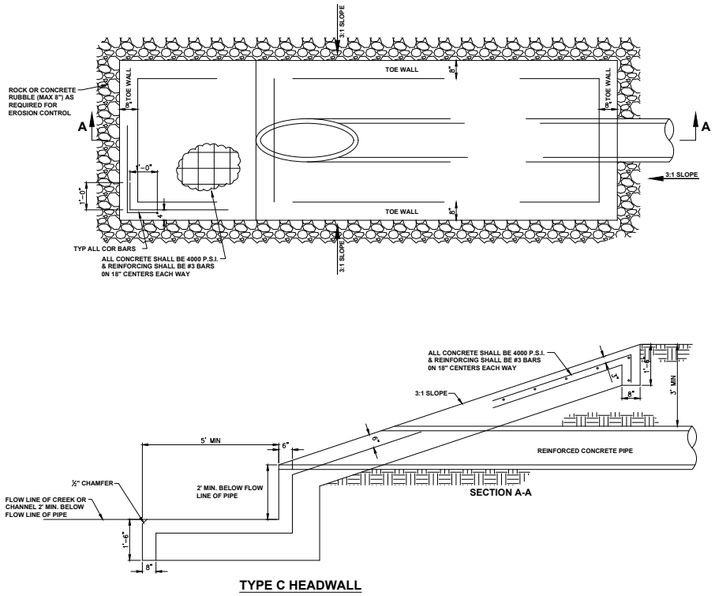
DRAINAGE DETAILS 2
SHEET TITLE

DRAWN BY: CCC

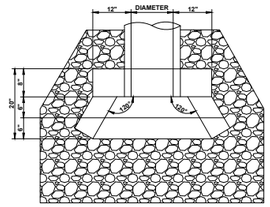
SCALE: AS SHOWN

DATE: 04/20/2026

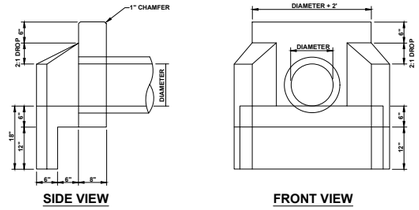
D-2
SHEET NO.



TYPE C HEADWALL



TYPE "B" HEADWALL



TYPE "B" HEADWALL

NOTES:
1. ALL CONCRETE TO BE 4000 PSI CONCRETE.
2. ALL STEEL REINFORCEMENT TO BE GRADE 60 STEEL.
3. REFER TO TXDOT STANDARD DETAIL SETP-FW-0 FOR REINFORCEMENT SIZE AND SPACING FOR TYPE "B" HEADWALLS.
4. STORM OUTLET POINTS NEED TO HAVE ADEQUATE EROSION PROTECTION. THE LEVEL OF PROTECTION REQUIRED WILL BE DETERMINED BY THE CITY ENGINEER BASED UPON THE ANTICIPATED VELOCITY AND QUANTITY OF STORM WATER RUNOFF AT THE OUTLET.

TYPE C HEADWALL	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	DETAIL: D-17
		REVISION DATE: 04/20/2026	

TYPE B HEADWALL	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	DETAIL: D-18
		REVISION DATE: 04/20/2026	

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(972) 495-7600

DRAINAGE DETAILS 3
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

D-3
SHEET NO.

GENERAL NOTES FOR WATER MAINS AND RELATED APPURTENANCES:

1. ALL WATER SYSTEM IMPROVEMENTS IN THE CITY OF SACHSE, BOTH PRIVATELY AND PUBLICLY MAINTAINED SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE CITY OF SACHSE ENGINEERING DESIGN STANDARDS.
2. ALL WATER SYSTEM DESIGN AND CONSTRUCTION SHALL CONFORM TO THE CURRENT TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) REGULATIONS. THESE REGULATIONS CAN BE FOUND IN THE TEXAS ADMINISTRATIVE CODE (TAC), TITLE 30, CHAPTER 290, SUBCHAPTER D - (RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS).
3. ALL WATER SYSTEM DESIGN, CONSTRUCTION AND MATERIALS SHALL CONFORM TO CURRENT AMERICAN WATER WORKS ASSOCIATION (AWWA) STANDARDS.
4. ALL MATERIALS THAT WILL COME INTO CONTACT WITH POTABLE WATER MUST BE APPROVED FOR USE UNDER NATIONAL SANITATION FOUNDATION (NSF) STANDARD 61 (DRINKING WATER SYSTEM COMPONENTS - HEALTH EFFECTS)
5. WATER SYSTEMS SHALL BE DESIGNED TO COMPLY WITH THE LATEST CITY ADOPTED VERSION OF THE INTERNATIONAL FIRE CODE WITH ADOPTED CITY AMENDMENTS.
6. WATER SYSTEMS SHALL BE DESIGNED TO COMPLY WITH THE CURRENT INSURANCE SERVICES OFFICE (ISO) FIRE SUPPRESSION RATING SCHEDULE (EDITION 02-03) - SECTION 600 - WATER SUPPLY.
7. ALL WATER MAINS THAT ARE PROPOSED TO BE ABANDONED WITHIN STREET ROW AND LESS THAN 10 FEET IN DEPTH, UNDER ANY MAJOR INTERSECTIONS, OR IN AREAS THAT COULD IMPACT MAJOR INFRASTRUCTURE, SHALL BE ABANDONED BY DRAINING THE EXISTING MAIN AND CUTTING AND FILLING THE EXISTING MAIN WITH GROUT.
8. WHERE THE INSTALLATION OF A BACK-FLOW DEVICE IS REQUIRED, AN APPROVED RPZ SHALL BE UTILIZED IN LIEU OF A DOUBLE-CHECK DEVICE.

GENERAL INSTALLATION:

9. ALL COMPONENTS OF THE WATER SYSTEM (PIPE, VALVES, FITTINGS, RESTRAINTS, BLOCKING, SERVICES, AND APPURTENANCES) SHALL BE DESIGNED FOR 200 PSI WORKING PRESSURE AND AN AASHTO HS-20 LIVE LOAD EXCEPT WHERE LOADING CONDITIONS COULD EXCEED HS-20 LIVE LOAD LIMITS IN WHICH CASE THE ENGINEER SHALL SPECIFY THE APPROPRIATE DESIGN LOAD.
10. MINIMUM COVER: WATER MAINS WITH A NOMINAL DIAMETER LESS THAN 14-INCHES SHALL HAVE A MINIMUM COVER OF 42" AND WATER MAINS WITH A NOMINAL DIAMETER 14" OR GREATER SHALL HAVE A MINIMUM COVER OF 60-INCHES.
11. UTILITY CLEARANCE: WATER MAINS AND SANITARY SEWER MAINS SHALL HAVE A MINIMUM CLEARANCE OF NINE (9) FEET. IF THIS CLEARANCE CANNOT BE MAINTAINED, TCEQ ALTERNATE REQUIREMENTS SHALL BE MET.
12. WATER MAINS ARE GENERALLY PLACED TO BE CENTERED UNDER THE BACK OF CURB, UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF PUBLIC WORKS.
13. STORM SEWER INLETS SHALL BE STAKED PRIOR TO WATER MAIN PLACEMENT SO THAT THE WATER MAIN CAN BE GRADUALLY DEFLECTED AROUND AND BELOW THE PROPOSED INLETS OR OTHER OBSTRUCTIONS OR CONFLICTS IN ALIGNMENT. THE CONTRACTOR SHALL STAKE THE LOCATION OF THE BACK OF CURBS TO ENSURE NO VALVES FALL WITHIN A CURB.
14. WARNING TAPE: WARNING TAPE SHALL BE INSTALLED 24 INCHES ABOVE THE TOP OF PIPE OR AS OTHERWISE DIRECTED BY THE DIRECTOR OF PUBLIC WORKS. THE TAPE SHALL BE A PLASTIC, HIGH STRETCH, 4-INCH WIDTH TAPE APPROVED BY THE DIRECTOR OF PUBLIC WORKS. THE TAPE SHALL BE BLUE IN COLOR AND HAVE THE WORDS "CAUTION - WATER MAIN BURIED BELOW" IMPRINTED ON THE TAPE.
15. GRADING OPERATIONS: THE CONTRACTOR SHALL COMPLETE ALL FILL AND CUT OPERATIONS IN ACCORDANCE WITH RELEASED ENGINEERING PLANS PRIOR TO INSTALLING ANY UTILITIES (I.E. WATER, SANITARY SEWER, DRAINAGE).
16. THE CONTRACTOR SHALL NOT OPERATE ANY VALVES IN THE EXISTING WATER SYSTEM NOR OPERATE ANY NEW VALVES THAT WOULD ALLOW CONNECTION TO THE CITY WATER SYSTEM. THE CONTRACTOR SHALL COORDINATE AND NOTIFY THE CITY CONSTRUCTION INSPECTOR 72-HOURS IN ADVANCE TO SCHEDULE A SHUT-DOWN OF THE EXISTING WATER SYSTEM BY CITY PERSONNEL. THE CITY MAY REQUIRE A NIGHT OR WEEKEND SHUT-DOWN IN ORDER TO MAINTAIN CUSTOMER SERVICE.
17. TEMPORARY FIRE HYDRANT METERS: THE CITY OF SACHSE REQUIRES PORTABLE FIRE HYDRANT METERS FOR TEMPORARY AND/OR CONSTRUCTION WATER USE AT CONSTRUCTION SITES. THEY ARE ROUTINELY USED TO ACCOUNT FOR WATER USAGE PRIOR TO INSTALLATION OF A PERMANENT WATER METER. THESE METERS HAVE A BACKFLOW PREVENTION DEVICE ATTACHED. THE CITY REQUIRES SUPPORT FOR THIS DEVICE TO PREVENT EXCESSIVE TORQUE WHEN ATTACHED TO A FIRE HYDRANT. THE CITY REQUIRES PAYMENT FOR EACH METER. AN INVOICE FOR WATER USE IS RENDERED EACH MONTH. ARRANGEMENTS FOR PORTABLE FIRE HYDRANT METERS ARE ADMINISTERED BY THE CITY OF SACHSE PUBLIC WORKS DEPARTMENT. PLEASE COORDINATE METER USAGE THROUGH THE PUBLIC WORKS DEPARTMENT.

MATERIALS:

18. BOLTS AND NUTS FOR ALL FITTINGS SHALL BE STAINLESS STEEL GRADE 304 OR 316 OR ASTM A325 TYPE 3 ENHANCED CORROSION RESISTANT STEEL. STAINLESS STEEL ALL-THREAD MAY BE USED IN SOME APPLICATIONS WITH THE APPROVAL OF THE DIRECTOR OF PUBLIC WORKS.
19. ALL FITTINGS SHALL BE MECHANICALLY RESTRAINED USING RESTRAINED FITTINGS AS SHOWN ON THE CITY OF SACHSE APPROVED WATER MATERIALS LIST AND MEETING REQUIREMENTS OF ASTM F1674 (PVC) OR U.L. STANDARD 194 (DUCTILE IRON). RESTRAINT GLAND AND BODY AND WEDGE COMPONENTS SHALL BE DUCTILE IRON MATERIAL. FOR PIPE DIAMETERS 12" OR GREATER, WATERLINE PLAN SHALL SHOW LENGTH OF JOINTS TO BE RESTRAINED ON EACH SIDE OF FITTINGS. FOR PIPE DIAMETERS LESS THAN 12", ALL JOINTS WITHIN 15-FEET OF FITTING SHALL BE RESTRAINED.
20. CONCRETE BLOCKING:
    - 20.1. ALL FITTINGS, VALVES, HYDRANTS, ETC. SHALL BE BLOCKED WITH 2,000 P.S.I. CONCRETE, 4-SACK MINIMUM CEMENT CONTENT. ALL BLOCKING SHALL BE POURED TO AVOID NUTS AND BOLTS TO ALLOW EASY ACCESS FOR MAINTENANCE. EXCESSIVE BLOCKING SHALL NOT BE ALLOWED AND SHALL BE REMOVED AT THE CONTRACTOR'S EXPENSE. SIZING AND CONSTRUCTION OF BLOCKING SHALL BE AS SHOWN IN STANDARD DRAWINGS 4010A TO 4040 OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS PUBLIC WORKS CONSTRUCTION STANDARDS, FIFTH EDITION (NOVEMBER 2017) OR CURRENT EDITION.
21. POLYETHYLENE TUBE WRAP:
    - 21.1. ALL CAST AND DUCTILE IRON PIPE, FITTINGS AND VALVES SHALL BE WRAPPED WITH POLYETHYLENE TUBE WRAP IN ACCORDANCE WITH AWWA C105. THE POLYETHYLENE WRAP MUST BE BLUE IN COLOR. THE WRAP SHALL BE INSTALLED IN ACCORDANCE WITH AWWA C105, METHOD A.

VALVES:

22. LOCATION:
    - 22.1. VALVES SHALL BE ANCHORED TO ADJACENT FITTINGS AT TEE AND CROSS FITTINGS AND ON FIRE HYDRANT LEADS. VALVES SHALL NOT BE USED AT THE DEAD END OF MAINS AS A PLUG. CONTRACTORS GENERALLY DO NOT WISH TO PRESSURE TEST AGAINST AN OLD VALVE THAT MAY LEAK, THEREFORE NEW MAINS SHALL START WITH A VALVE AND END WITH A PLUG.
23. LOCATION MARKING:
    - 23.1. VALVES LOCATED WITHIN A RIGHT-OF-WAY SHALL BE INDICATED ON THE FACE OF THE CURB, OR WHERE CURBS DO NOT EXIST, ON A CONSPICUOUS LOCATION ADJACENT TO THE VALVE LOCATION. MARKINGS ARE TO BE THE CUTTING OF A FOUR (4) INCH HIGH AND 1/8" DEEP LETTER "V" WITH THE POINT OF THE "V" POINTING TOWARDS THE VALVE LOCATION. THE "V" SHALL BE CUT INTO THE CURB OR PAVING USING AN APPROVED MOTOR DRIVEN CONCRETE SAW. THE COMPLETED CUT AND VALVE RISER LIDS SHALL RECEIVE A COATING OF BLUE PAINT IF A MAIN LINE VALVE OR RED IF A FIRE HYDRANT VALVE. CONTRACTOR SHALL COAT THE INTERIOR, AND EXTERIOR OF THE CUT TO A WIDTH OF ONE (1) INCH.
24. JOINT RESTRAINT:
    - 24.1. ALL VALVES SHALL BE MECHANICALLY RESTRAINED PER SECTION 3.2. BOLTS AND NUTS FOR ALL FITTINGS SHALL BE ASTM A325 TYPE 3 ENHANCED CORROSION RESISTANT STEEL, OR STAINLESS STEEL A151 304 OR 316.
25. THREE-PIECE ADJUSTABLE VALVE BOXES: ADJUSTABLE VALVE BOXES SHALL BE FURNISHED AND SET ON EACH VALVE IN ACCORDANCE WITH THE APPROPRIATE GENERAL DESIGN STANDARDS AND THE CITY OF SACHSE APPROVED MATERIALS LIST. AFTER THE FINAL CLEAN UP AND ALIGNMENT HAS BEEN COMPLETED, THE CONTRACTOR SHALL CAST IN PLACE A CONCRETE BLOCK, 2-FOOT X 2-FOOT X 4-INCH AROUND ALL VALVE BOX TOPS AT THE FINISH GRADE.

TAPPING SLEEVES AND VALVES:

26. WET CONNECTIONS TO EXISTING WATER MAINS (6-INCH THROUGH 12-INCH IN SIZE), SHALL BE MADE WITH A TAPPING SLEEVE AND VALVE. EXCEPTION: IN SOME CASES WHERE THE SIZE OF THE TAP APPROACHES THE SIZE OF THE MAIN, AS JUDGED BY THE DIRECTOR OF PUBLIC WORKS, THE USE OF A CUT-IN SLEEVE AND TEE WILL BE REQUIRED. BOTH THE TAPPING SLEEVE AND VALVE SHALL BE RATED FOR A MINIMUM 200 PSI SERVICE PRESSURE.
27. PRIOR TO TAPPING, ALL TAPPING SLEEVES AND VALVES SHALL BE AIR TESTED AT 120 PSI FOR THREE (3) MINUTES, WITH NO PRESSURE LOSS.
28. TAPPING IS TO BE ACCOMPLISHED WITH NO INTERRUPTION OF SERVICE. FACILITIES SHALL BE PROVIDED FOR PROPER DEWATERING AND FOR DISPOSAL OF WATER REMOVED FROM THE WATER MAINS AND EXCAVATIONS WITHOUT DAMAGE TO ADJACENT PROPERTY. SPECIAL CARE SHALL BE TAKEN TO PREVENT CONTAMINATION OF THE EXISTING POTABLE WATER LINE WHEN DEWATERING, CUTTING, AND MAKING CONNECTIONS WITH EXISTING PIPE. NO TRENCH WATER, MUD, OR OTHER CONTAMINATING SUBSTANCES SHALL BE PERMITTED TO ENTER THE EXISTING LINES. THE INTERIOR OF ALL TAPPING SLEEVES, TAPPING MACHINE CUTTER ASSEMBLIES, AND TAPPING GATE VALVES INSTALLED IN SUCH CONNECTIONS, AND THE SURFACE OF THE EXISTING PIPE AT THESE CONNECTIONS, SHALL BE THOROUGHLY CLEANED AND THEN SWABBED WITH A SOLUTION HAVING A CHLORINE CONTENT OF 200 MILLIGRAMS PER LITER.

FIRE HYDRANTS:

29. FIRE HYDRANTS SHALL BE LOCATED TO MINIMIZE INTERFERENCE WITH DRIVEWAYS AND SHALL BE LOCATED WITH SUFFICIENT CLEARANCE FROM DRIVE AND STREET RADII TO PREVENT THE FIRE HYDRANT FROM BEING STRUCK IF A VEHICLE JUMPS THE CURB AND/OR TAKES A WIDE TURN. HYDRANTS SHALL NOT BE PLACED IN INTERSECTION RADII OR OTHER LOCATIONS WITH A HIGH PROBABILITY OF BEING DAMAGED BY TRAFFIC. A 3-FOOT CLEAR SPACE SHALL BE MAINTAINED AROUND THE CIRCUMFERENCE OF FIRE HYDRANTS EXCEPT AS OTHERWISE REQUIRED OR APPROVED.
30. MID-BLOCK FIRE HYDRANTS SHALL BE LOCATED ON PROPERTY LINES (EXTENDED) TO MINIMIZE INTERFERENCE WITH DRIVES AND ON-STREET PARKING.
31. HYDRANTS SHALL BE PLACED 2-FEET TO 10-FEET FROM THE BACK OF CURB AND SHALL NOT INTERFERE WITH SIDEWALKS, DRIVEWAYS, ETC. HYDRANTS SHALL BE PLACED SO THE BURY MARK IS AT GROUND OR PAVING LEVEL. MOUNDING OF THE GROUND OR PAVING SHALL NOT BE ALLOWED TO ACHIEVE THIS REQUIREMENT. NO MORE THAN ONE EXTENSION OF 18 INCHES MAXIMUM WILL BE ALLOWED FOR GRADE ADJUSTMENT. HYDRANTS SHALL HAVE A BARREL LENGTH OF 4-FEET TO 6-FEET UNLESS APPROVED BY THE DIRECTOR OF PUBLIC WORKS. ALL HYDRANTS SHALL BE SURROUNDED BY A 2 TO 9 FEET LONG X 3-FEET WIDE X 4-INCH THICK CONCRETE PAD WITH 4,000 PSI, 6 SACK CONCRETE AND #4 REINFORCING BARS ON 18" CENTERS BOTH WAYS PLACED TO ANCHOR THE HYDRANT AND TO PROVIDE A SPLASH PAD BETWEEN THE HYDRANT AND THE CURB FOR FLUSHING OPERATIONS.
32. INSTALLATION:
    - 32.1. INSTALLATION SHALL BE OF A TYPE AS DETAILED IN THESE STANDARDS. ALL FIRE HYDRANT LEADS SHALL BE FROM AN MJ TO FLANGED TEE AND ALL VALVES AND FITTINGS FROM THE TEE TO HYDRANT SHALL BE FLANGED.
33. OUT OF SERVICE:
    - 33.1. IF A FIRE HYDRANT IS OUT OF SERVICE, FOR ANY REASON, THE CONTRACTOR SHALL BAG THE FIRE HYDRANT WITH A BLACK TRASH BAG SECURED WITH DUCT TAPE AND REPORT HYDRANT TO THE FIRE DEPARTMENT WITH THE REASON WHY IT IS OUT OF SERVICE. THIS INCLUDES, BUT IS NOT LIMITED TO, HYDRANTS THAT ARE OUT OF SERVICE FOR THE FOLLOWING REASONS:
        - 33.1.1. WATER MAIN VALVED-OFF AND BEING ABANDONED BUT CONNECTED HYDRANT IS NOT YET REMOVED.
        - 33.1.2. NEW HYDRANT RECENTLY INSTALLED BUT NOT YET READY FOR SERVICE
        - 33.1.3. HYDRANT TEMPORARILY OUT OF SERVICE DUE TO MAIN SHUT DOWN
34. FIRE HYDRANT MARKERS:
    - 34.1. THE CONTRACTOR SHALL PLACE A STEMSONITE MODEL 88-SSA BLUE FIRE HYDRANT MARKER IN THE STREET ADJACENT TO THE HYDRANT. THE MARKER SHALL BE LOCATED PERPENDICULAR TO THE CURB, AT THE CENTER OF THE DRIVING LANE CLOSEST TO THE FIRE HYDRANT. THE MARKER SHALL BE INSTALLED WITH A TWO PART EPOXY ADHESIVE PER MANUFACTURER'S INSTRUCTIONS.
35. FIRE HYDRANT PAINTING (COLOR CODING):
    - 35.1. ALL FIRE HYDRANTS ARE TO BE PAINTED WITH A BASE COAT CONSISTING OF TWO (2) COATS OF ALUMINUM PAINT AS SPECIFIED BELOW. REFER TO CITY OF SACHSE APPROVED WATER MATERIALS LIST FOR APPROVED PAINT. WHEN A COLOR CODE OTHER THAN ALUMINUM IS REQUIRED, THE TOP BONNET (FROM OPERATING NUT TO UNDERNEATH THE UPPERMOST FLANGE) SHALL BE PAINTED TWO COATS OF THE APPROPRIATE COLOR IN ACCORDANCE WITH THE FOLLOWING COLOR CODE. NOZZLE CAPS ARE NOT TO BE COLOR-CODED.
        - 35.1.1. BASE UNDERCOAT: TWO (2) COATS OF ALUMINUM PAINT ARE REQUIRED AS A BASE COAT ON ALL HYDRANTS.
        - 35.1.2. OVERCOATS: TWO (2) ADDITIONAL COATS OF PAINT ARE REQUIRED OVER THE BASE COAT. THE COLORS SHALL CONFORM AS FOLLOWS:

MAIN SIZE	COLOR
6 INCHES	ALUMINUM - TOP & BOTTOM
8 INCHES	BLUE TOP - ALUMINUM BOTTOM
10 INCHES OR LARGER	YELLOW TOP - ALUMINUM BOTTOM

SERVICES AND METERS:

36. METER AND SERVICE LOCATION:
    - 36.1. METERS AND SERVICES MUST BE LOCATED WITHIN R.O.W. OR EASEMENTS IN ACCORDANCE WITH CITY APPROVED PLANS AND DETAILS. IN RESIDENTIAL DEVELOPMENTS, RESIDENTIAL WATER METERS AND SERVICES ARE GENERALLY PLACED AT THE PROPERTY LINE. WATER METERS SHALL NOT BE LOCATED IN PROPOSED DRIVEWAYS, SIDEWALKS, PARKING LOTS OR OTHER PAVED AREAS. FOR NARROW LOTS OR FRONT ENTRY LOTS, THE DESIGNER MUST DESIGN THE LOCATION OF THE METERS TO MAKE SURE THEY ARE PLACED IN AN UNPAVED AREA. METERS IN CONFLICT WITH THIS REQUIREMENT WILL BE RELOCATED BY THE DEVELOPER/BUILDER AT THEIR EXPENSE. IN NON-RESIDENTIAL DEVELOPMENTS, WATER METERS SHALL BE LOCATED IN UNPAVED ISLANDS. METERS SHOULD BE SET SO THAT THE METER FACE IS 6-INCHES TO 10-INCHES BELOW FINISHED GRADE.
37. ALL PEX-A WATER SERVICE LINES SHALL BE IN ACCORDANCE WITH ASTM F876 AND AWWA C904 AND BE OF POLY SDR 9 (CTS) AND THE FOLLOWING PROCEDURES:
    - 37.1. FOR INSTALLATION UNDER A NON-RESIDENTIAL STREET, SERVICE LINE SHALL BE INSTALLED WITH DETECTABLE TRACING WIRE. DETECTABLE TRACING WIRE SHALL BE A MINIMUM 12 GAUGE WITH HDPE COATING.
    - 37.2. A STEEL INSERT STIFFENER SHALL BE USED AT ALL FITTINGS.
38. ALL WATER SERVICES SHALL BE CONTINUOUS FROM THE CORPORATION VALVE AT THE WATER MAIN TO THE ANGLE METER VALVE IN THE METER BOX (NO COUPLINGS). SERVICE LINE SHALL BE "GOOSE NECKED". CRIMPING OR EXCESSIVE BENDING OF THE SERVICE LINE SHALL NOT BE ALLOWED. SERVICE LINES SHALL BE CONTINUOUS AND SHALL HAVE NO FITTINGS UNDER ANY PAVING, UNLESS APPROVED BY THE DIRECTOR OF PUBLIC WORKS. WHEN INSTALLING A WATER MAIN THE CONTRACTOR SHALL FURNISH AND INSTALL NEW METER BOXES. SERVICE LINES SHALL BE POLY-WRAPPED FOR THE FIRST 5-FEET OF SERVICE FROM THE MAIN. WATER SERVICES SHALL HAVE A MINIMUM DEPTH UNDER PAVING OF 36-INCHES (MEASURED FROM SURFACE OF PAVING).
39. ALL SERVICE CONNECTIONS TO THE MAIN FOR SERVICES 2" OR SMALLER SHALL BE MADE WITH SERVICE SADDLES.
40. A WATER METER BOX WITH LOCKING LID SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AFTER PAVING AND FINE GRADING IS COMPLETE. WHEN INSTALLING A WATER MAIN, NEW METER BOXES SHALL BE FURNISHED, INSTALLED AND CONNECTED TO THE MAIN. METERS LARGER THAN 2-INCHES IN SIZE SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR IN CONCRETE VAULTS IN ACCORDANCE WITH CITY DETAILS.
41. EACH INDIVIDUAL SERVICE LOCATION SHALL BE MARKED ON THE FACE OF THE CURB WITH A 4-INCH HIGH AND 1/8 -INCH DEEP SCRIBE MARK "I" CUT IN THE CURB USING AN APPROVED MOTOR DRIVEN CONCRETE SAW. THE SCRIBE MARK "I" SHALL RECEIVE A COATING OF BLUE PAINT, WHICH SHALL COAT THE INTERIOR AND EXTERIOR OF THE CUT TO A WIDTH OF 1-INCH.

WATER SYSTEM INSTALLATION:

42. EXCAVATION:
    - 42.1. EXCAVATION IN GENERAL, SHALL BE MADE IN OPEN CUT FROM THE SURFACE OF THE GROUND AND SHALL BE NO GREATER IN WIDTH AND DEPTH THAN IS NECESSARY TO PERMIT THE PROPER CONSTRUCTION OF THE WORK. WHEN THE TRENCH DEPTH EXCEEDS FIVE (5) FEET, SEE STANDARD PROCEDURES SECTION 12.2 REGARDING "TRENCH SAFETY" REQUIREMENTS. THE AMOUNT OF TRENCH EXCAVATION TO GRADE SHALL NOT EXCEED 100 (ONE HUNDRED) FEET FROM THE END OF THE PIPE LAYING OPERATIONS AND NO EXCAVATION SHALL BE 300 (THREE HUNDRED) FEET IN ADVANCE OF THE COMPLETED PIPE OPERATIONS (INCLUDES BACKFILLING). AT THE END OF THE WORKDAY, ALL TRENCH EXCAVATION SHALL BE BACKFILLED. ANY LANDSCAPING AND IRRIGATION SYSTEM WITHIN THE CITY MEDIANS AND RIGHT-OF-WAYS THAT ARE DISTURBED, REMOVED, OR DAMAGED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL CONDITION OR BETTER BY A LICENSED IRRIGATOR.
43. MINIMUM BURY DEPTH:
    - 43.1. MINIMUM BURY DEPTH SHALL BE FORTY-TWO (42) INCHES FROM FINISHED GRADE TO THE TOP OF THE PIPE, UNLESS OTHERWISE DIRECTED BY THE DIRECTOR OF PUBLIC WORKS.
44. SANITATION:
    - 44.1. THE INSIDE OF ALL PIPE AND FITTINGS SHALL BE KEPT CLEAN DURING INSTALLATION. THE DIRECTOR OF PUBLIC WORKS MAY REQUIRE SWABBING OR PIGGING OF ALL NEW PIPE IF THE PIPE IS INSTALLED IN AN UNSANITARY MANOR. SEE TESTING PROCEDURES ON NEXT PAGE FOR MORE INFORMATION.
45. LIFTING STRAPS:
    - 45.1. ALL WATER PIPE, VALVES, FIRE HYDRANTS, AND FITTINGS SHALL BE INSTALLED BY THE USE OF LIFTING STRAPS. THE USE OF CHAINS IS PROHIBITED.
46. BACKFILL AND COMPACTION:
    - 46.1. FOR TRENCHES NOT UNDER PAVING, FINAL BACKFILL MATERIAL SHALL BE FROM THE TRENCH EXCAVATION PLACED IN A MAXIMUM OF 12 INCH LOOSE LIFTS AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE. UNDER EXISTING OR PROPOSED PAVING (PUBLIC/PRIVATE SIDEWALKS, STREETS, ALLEYS, DRIVEWAYS, ETC.), BACKFILL SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT, ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE UNLESS ALTERNATE MATERIAL IS APPROVED BY THE DIRECTOR OF PUBLIC WORKS. THE CONTRACTOR SHALL TAKE NEW PROCTORS AT EACH CHANGE IN SOIL TYPE. WATER JETTING WILL NOT BE ALLOWED FOR ANY TRENCH.

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

WATER DETAILS 1
SHEET TITLE

DRAWN BY: CCC
SCALE: N.T.S.
DATE: 04/20/2026

W-1
SHEET NO.

TESTING PROCEDURES:

46. NOTIFICATION OF TESTING:

46.1. THE CONTRACTOR SHALL HIRE AN INDEPENDENT TESTING LAB, SUBJECT TO THE APPROVAL OF THE DIRECTOR OF PUBLIC WORKS, FOR ALL MATERIAL AND ACCEPTANCE TESTING AT CONTRACTORS EXPENSE. THE CONTRACTOR SHALL NOTIFY THE ASSIGNED CITY CONSTRUCTION INSPECTOR OF ALL DENSITY TESTING 24 HOURS PRIOR TO THE SCHEDULED TEST. COPIES OF ALL TEST REPORTS SHALL BE SENT TO THE PUBLIC WORKS INSPECTOR FOR REVIEW AND ACCEPTANCE AND INCLUSION IN THE CITY PROJECT FILE. PROJECTS WILL NOT RECEIVE CITY ACCEPTANCE UNTIL ALL TEST RESULTS ARE COMPLETE AND SATISFACTORY.

47. COMPACTION OF TRENCHES AND EXCAVATIONS:

47.1. DENSITY TESTS SHALL BE PERFORMED AT A FREQUENCY OF ONE TEST PER LIFT, PER 300 LINEAR FEET OF TRENCH (INCLUDING SERVICES) AT LOCATIONS SPECIFIED BY THE CITY CONSTRUCTION INSPECTOR. ALL NUCLEAR GAUGE DENSITY TESTS SHALL BE PERFORMED PER ASTM D2922.

48. PRESSURE TESTING AND DISINFECTING WATER MAINS:

48.1. THE PURPOSE OF THIS SPECIFICATION IS TO DEFINE THE MINIMUM REQUIREMENTS FOR THE PRESSURE TESTING AND DISINFECTION OF WATER MAINS, INCLUDING THE PREPARATION OF WATER MAINS, HYDROSTATIC TESTS, FLUSHING, APPLICATION OF CHLORINE, AND SAMPLING FOR THE PRESENCE OF COLIFORM BACTERIA. WATER MAINS, SERVICES AND FIRE SPRINKLER SYSTEMS SHALL BE FLUSHED AND DISINFECTED PER THE FOLLOWING REQUIREMENTS AND IN ACCORDANCE WITH AWWA C651 “DISINFECTING WATER MAINS”.

49. CONNECTION TO EXISTING WATER SYSTEM:

49.1. WATER REQUIRED TO FILL THE NEW MAIN FOR HYDROSTATIC PRESSURE TESTING, DISINFECTION, AND FLUSHING SHALL BE SUPPLIED THROUGH A TEMPORARY CONNECTION BETWEEN THE DISTRIBUTION SYSTEM AND THE NEW MAIN. THE TEMPORARY CONNECTION SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE AND SHALL BE DISCONNECTED DURING THE HYDROSTATIC PRESSURE TEST. AS AN ALTERNATE, A CONNECTION TO THE EXISTING DISTRIBUTION SYSTEM IS PERMITTED PROVIDED A NEW VALVE IS PLACED AT THE CONNECTION POINT. DO NOT TEST AGAINST AN EXISTING VALVE IN THE EXISTING SYSTEM.

50. GENERAL PROCEDURES AND PRECAUTIONS TAKEN DURING CONSTRUCTION:

50.1. INSPECT MATERIALS PRIOR TO INSTALLATION TO ENSURE THEIR CLEANLINESS AND INTEGRITY.

50.2. KEEP INTERIOR OF PIPE DRY AND CLEAN DURING STORAGE AND INSTALLATION. PREVENT CONTAMINATES FROM ENTERING THE WATER MAIN DURING STORAGE AND CONSTRUCTION.

50.3. IF DIRT ENTERS THE PIPE DURING STORAGE OR INSTALLATION, IT SHALL BE REMOVED AND THE INTERIOR SURFACE SWABBED WITH A 1 TO 5 PERCENT HYPOCHLORITE DISINFECTING SOLUTION.

50.4. DURING CONSTRUCTION OPENINGS IN THE PIPE SHALL BE CLOSED WITH A WATERTIGHT PLUG WHEN PIPE LAYING IS STOPPED AT THE CLOSE OF EACH DAY'S WORK OR FOR OTHER REASONS SUCH AS REST BREAKS AND MEALS TO PREVENT CONTAMINANTS AND ANIMALS FROM ENTERING PIPE

50.5. REMOVE, BY FLUSHING OR OTHER MEANS, THOSE MATERIALS THAT MAY HAVE ENTERED THE WATER MAIN.

50.6. CHLORINATING ANY RESIDUAL CONTAMINATION THAT MAY REMAIN, AND FLUSHING THE CHLORINATED WATER FROM THE MAIN.

50.7. PROTECTING THE EXISTING DISTRIBUTION SYSTEM FROM BACKFLOW CAUSED BY HYDROSTATIC TEST AND DISINFECTION PROCEDURE.

50.8. DOCUMENTING THAT AN ADEQUATE LEVEL OF CHLORINE CONTACTED EACH PIPE TO PROVIDE DISINFECTION.

50.9. ONCE THE CONTRACTOR HAS BEEN NOTIFIED BY THE CITY PUBLIC WORKS CONSTRUCTION INSPECTOR OF A SUCCESSFULLY (NEGATIVE RESULT) LABORATORY BACTERIOLOGICAL TESTING RESULT, THE CONTRACTOR CAN MAKE CONNECTION OF THE APPROVED NEW WATER MAIN TO THE ACTIVE DISTRIBUTION SYSTEM.

51. HYDROSTATIC (PRESSURE) TEST:

51.1. ALL WATER MAINS, FITTINGS AND SERVICES SHALL BE TESTED WITH A HYDRAULIC TEST PRESSURE OF NOT LESS THAN 150 PSI OVER A PERIOD OF NOT LESS THAN 4 HOURS. THE ALLOWABLE LEAKAGE, IN GALLONS, OF ALL PIPE TESTED SHALL BE CALCULATED PER THE FOLLOWING EQUATION:

$$\text{ALLOWABLE LEAKAGE} = \frac{28.28L*D}{148{,}000}$$

WHERE L = LENGTH OF PIPE (FT)

D = DIAMETER OF PIPE (IN)

51.1.1. FOR A FOUR HOUR PRESSURE TEST AT A PRESSURE OF 150 PSI. IF THE TESTS INDICATE A LEAKAGE IN EXCESS OF THE ACCEPTABLE RATE, THE CONTRACTOR SHALL BE REQUIRED TO FIND AND REPAIR THE LEAK. EVEN IF THE TEST REQUIREMENTS ARE MET, ALL APPARENT LEAKS SHALL BE REPAIRED AND STOPPED.

51.1.2. THE HYDROSTATIC PUMP SHALL BE CONNECTED TO A SYSTEM WHERE THE AMOUNT OF LEAKAGE CAN BE DETERMINED BY MEASUREMENT OR GAUGE. THE 200-PSI PRESSURE SHALL BE MAINTAINED AT THE HIGHEST POINT OF THE MAIN BEING TESTED OVER THE ENTIRE 2-HOUR TEST PERIOD. THE LEAKAGE SHALL BE DETERMINED BY COMPARING THE QUANTITY OF WATER IN THE MEASURING SYSTEM AT THE BEGINNING OF THE TEST AND QUANTITY OF WATER AT THE END OF THE TEST. THE DIFFERENCE IN THESE QUANTITIES SHALL BE THE LEAKAGE. AN ALTERNATE METHOD IS TO ADD WATER TO THE MEASURING SYSTEM DURING THE TEST. AT THE END OF THE 2-HOUR TEST, THE QUANTITY OF WATER ADDED SHALL BE THE LEAKAGE.

52. FLUSHING AND PIGGING THE MAIN PRIOR TO DISINFECTION / CHLORINATION

52.1. FLUSHING METHOD:

52.1.1. BEFORE THE MAIN IS CHLORINATED, IT SHALL BE FILLED TO ELIMINATE AIR POCKETS AND FLUSHED TO REMOVE PARTICULATES. THE FLUSHING VELOCITY IN THE MAIN SHALL NOT BE LESS THAN 3.0 FT/SEC. BELOW IS THE REQUIRED FLOW AND OPENINGS NEEDED TO FLUSH PIPELINES WITH A PRESSURE OF 40 PSI.

52.1.2. FOR LARGER PROJECTS, SUCH AS RESIDENTIAL SUBDIVISIONS OR MULTI-FAMILY DEVELOPMENTS, A FLUSHING PLAN PROVIDED BY THE DESIGN ENGINEER MAY BE REQUIRED IN ORDER TO PROPERLY CLEAN AND DISINFECT THE WATER SYSTEM. THIS SHALL BE PROVIDED PRIOR TO PLAN APPROVAL TO THE DIRECTOR OF PUBLIC WORKS.

M	FLOW (GPM)	1" TAP	1.5" TAP	2" TAP	2.5" HYDRANT OUTLET
6"	260		1		1
8"	470		2		1
10"	730		3	2	1
12"	1060			3	2
16"	1880			5	2

52.2. PIGGING METHOD:

52.2.1. PIGGING IS ACCOMPLISHED BY PASSING AN APPROPRIATE SIZED PIG THROUGH THE PIPE. A PIG IS A BULLET-SHAPED, FLEXIBLE SPONGE AVAILABLE IN DIFFERENT SIZES, DENSITIES, AND DEGREES OF ROUGHNESS. ALL MAINS 12-INCH AND LARGER MUST BE PIGGED PRIOR TO FLUSHING AND DISINFECTION WITH CHLORINE.

52.2.2. THE PIG SHALL BE INSERTED IN THE NEW CONDUIT AT THE LOCATION WHERE THE NEW CONDUIT IS CONNECTED TO THE ACTIVE DISTRIBUTION SYSTEM.

52.2.3. WHERE EXPULSION OF THE PIG IS REQUIRED THROUGH A DEAD-ENDED CONDUIT, THE CONTRACTOR SHALL MAKE EVERY EFFORT TO PREVENT BACK FLOW OF THE PURGED WATER INTO THE CONDUIT AFTER PASSAGE OF THE PIG. BACKWATER RE-ENTRY INTO THE PIPE CAN BE PREVENTED BY THE TEMPORARY INSTALLATION OF MECHANICAL JOINT BENDS AND PIPE JOINTS TO PROVIDE A RISER OUT OF THE TRENCH.

52.2.4. AFTER PASSAGE OF THE PIG, FLUSHING OF ALL BACKWATER FROM THE PIPE, AND SATISFACTORY TEST RESULTS, THE CONTRACTOR SHALL SECURE THE TEST LOCATION OPENINGS AND THEN PROCEED WITH DISINFECTION.

52.3. DISINFECTION (CHLORINATION):

52.3.1. THE CONTINUOUS-FEED METHOD MUST BE USED UNLESS IT IS STATED OTHERWISE IN THE CONTRACT SPECIFICATIONS.

52.3.2. THE CONTRACTOR SHALL INSTALL AND REMOVE ALL PUMP-IN, BLOW-OFF AND SAMPLING POINTS.

52.3.3. WATER FROM THE EXISTING SYSTEM OR OTHER APPROVED SOURCE SHALL BE MADE TO FLOW AT A CONSTANT RATE IN THE NEW MAIN.

52.3.4. AT A POINT NO MORE THAN 10-FT DOWNSTREAM OF THE BEGINNING OF THE NEW CONDUIT, WATER ENTERING THE NEW CONDUIT SHALL RECEIVE A DOSE OF CHLORINE SUCH THAT THE WATER SHALL HAVE NOT LESS THAN 100-MG/L (PPM) FREE CHLORINE. CHLORINE APPLICATION SHALL NOT CEASE UNTIL THE ENTIRE CONDUIT IS FILLED WITH HEAVILY CHLORINATED WATER. 125 LBS OF CALCIUM HYPOCHLORITE (65% AVAILABLE CHLORINE) IS REQUIRED IN 100,000 GAL OF WATER TO PRODUCE 100 MG/L (PPM) CHLORINE CONCENTRATION.

52.3.5. THE CHLORINATED WATER SHALL BE RETAINED IN THE CONDUIT FOR AT LEAST 24 HOURS, DURING WHICH TIME ALL VALVES AND HYDRANTS IN THE SECTION TREATED SHALL BE OPERATED IN ORDER TO DISINFECT THE APPURTENANCES. EVERY EFFORT SHALL BE MADE TO PREVENT THE FLOW OF CHLORINATED WATER INTO CONDUITS IN ACTIVE SERVICE. AT THE END OF THE 24-HOUR PERIOD, THE TREATED WATER IN ALL PORTIONS OF THE CONDUIT SHALL HAVE A RESIDUAL OF AT LEAST 10-MG/L (PPM) FREE CHLORINE.

52.3.6. CHLORINE FOR DISINFECTION:

52.3.6.1. CALCIUM HYPOCHLORITE IN GRANULAR FORM CONFORMING TO ANSI/AWWA B300 MUST BE USED AND MUST CONTAIN APPROXIMATELY 65 PERCENT AVAILABLE CHLORINE BY WEIGHT. THE MATERIAL SHOULD BE STORED IN A COOL, DRY, AND DARK ENVIRONMENT TO MINIMIZE DETERIORATION.

52.3.6.2. THE HEAVILY CHLORINATED WATER SHALL THEN BE FLUSHED FROM THE CONDUIT AND DISPOSED IN A MANNER MEETING THE REQUIREMENTS SET OUT BELOW.

52.3.6.3. THE CHLORINE RESIDUAL SHALL BE TESTED PRIOR TO FLUSHING OPERATIONS.

52.4. DISPOSAL OF HYPER-CHLORINATED WATER:

52.4.1. IF THE CHLORINE RESIDUAL EXCEEDS 4-MG/L (PPM) THE WATER SHALL REMAIN IN THE NEW WATER CONDUIT UNTIL THE CHLORINE RESIDUAL IS LESS THAN 4-MG/L (PPM). AS AN ALTERNATE, THE CONTRACTOR MAY CHOOSE TO EVACUATE THE WATER INTO WATER TRUCKS, OR AN APPROVED STORAGE FACILITY (SUCH AS A DETENTION POND UNTIL THE CHLORINE RESIDUAL IS 4-MG/L (PPM) OR LESS), OR TREAT THE WATER WITH SODIUM BISULFITE OR ANOTHER DECHLORINATION CHEMICAL (SULFUR DIOXIDE, SODIUM SULFITE, SODIUM THIOSULFATE, OR ASCORBIC ACID) OR METHOD APPROPRIATE FOR POTABLE WATER AND APPROVED BY THE OWNER UNTIL THE CHLORINE RESIDUAL IS REDUCED TO 4-MG/L (PPM) OR LESS. THE HEAVILY CHLORINATED WATER SHALL NOT BE DISPOSED OF INTO THE STORM SEWER SYSTEM. AFTER THE SPECIFIED CHLORINE RESIDUAL IS OBTAINED, LESS THAN 4-MG/L (PPM), THE WATER MAY THEN BE DISCHARGED INTO THE STORM SEWER SYSTEM OR UTILIZED BY THE CONTRACTOR.

52.4.2. THE REQUIREMENT FOR DISCHARGE OF HEAVILY CHLORINATED WATER IS FOUND IN THE TPDES GENERAL PERMIT TO AUTHORIZE THE DISCHARGE OF STORM WATER AND CERTAIN NON-STORM WATER DISCHARGES FROM REGULATED CONSTRUCTION ACTIVITIES WITHIN THE STATE OF TEXAS.

52.4.3. THE CONTRACTOR SHALL PREPARE THE CONDUIT FOR DISINFECTION ACTIVITIES AND SECURE SAME AFTER CHLORINATION IS COMPLETE.

52.4.4. THIS SHALL CONSIST OF FURNISHING ALL EQUIPMENT, MATERIAL AND LABOR TO SATISFACTORILY PREPARE THE CONDUIT FOR DISINFECTION. THE CONTRACTOR SHALL ALSO BE REQUIRED TO PROVIDE ADEQUATE PROVISIONS FOR SAMPLING.

52.4.5. THE CONTRACTOR SHALL MAKE ALL NECESSARY TAPS INTO THE PIPE TO ACCOMPLISH CHLORINATION OF A NEW LINE.

52.4.6. AFTER SATISFACTORY COMPLETION OF THE DISINFECTION OPERATION, THE CONTRACTOR SHALL REMOVE SURPLUS PIPE AT THE CHLORINATION AND SAMPLING POINTS, PLUG THE REMAINING PIPE, BACKFILL, AND COMPLETE ALL APPURTENANT WORK NECESSARY TO SECURE THE CONDUIT.

52.5. BACTERIAL SAMPLING:

52.5.1. UNLESS OTHERWISE SPECIFIED, THE CONTRACTOR SHALL INJECT CHLORINE DISINFECTANT INTO THE CONDUIT AND MONITOR THE SOLUTION.

52.5.2. THE CITY CONSTRUCTION INSPECTOR SHALL COORDINATE WITH THE CITY'S WATER QUALITY TECHNICIAN TO COLLECT BACTERIOLOGICAL SAMPLES FROM A SUITABLE TAP (NOT THROUGH A FIRE HYDRANT) FOR ANALYSIS BY THE NORTH TEXAS MUNICIPAL WATER DISTRICT LABORATORY. THE SAMPLE(S) SHALL BE TRANSPORTED BY CITY STAFF TO THE LABORATORY AT 9:00 AM ON THE SAME DAY THEY ARE COLLECTED. THE CITY CONSTRUCTION INSPECTOR SHALL NOTIFY THE CONTRACTOR OF THE RESULTS.

52.5.3. MICROBIOLOGICAL SAMPLING SHALL BE DONE PRIOR TO CONNECTING THE NEW CONDUIT INTO THE EXISTING DISTRIBUTION SYSTEM IN ACCORDANCE WITH AWWA C651 DISINFECTING WATER MAINS. SAMPLES SHALL BE TESTED IN ACCORDANCE WITH STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER. SAMPLES FOR BACTERIOLOGICAL ANALYSIS SHALL BE COLLECTED IN STERILE BOTTLES TREATED WITH SODIUM THIOSULFATE. AT LEAST ONE SAMPLE SHALL BE COLLECTED FROM EVERY 1,000-LINEAR-FEET OF NEW WATER CONDUIT, PLUS ONE SET FROM THE END OF THE LINE AND AT LEAST ONE SET FROM EACH BRANCH. IF TRENCH WATER HAS ENTERED THE NEW CONDUIT DURING CONSTRUCTION OR, IF IN THE OPINION OF THE CITY INSPECTOR, EXCESSIVE QUANTITIES OF DIRT OR DEBRIS HAVE ENTERED THE NEW CONDUIT, SAMPLES SHALL BE TAKEN AT INTERVALS OF APPROXIMATELY 200-LINEAR-FEET. SAMPLES SHALL BE TAKEN OF WATER THAT HAS BEEN IN THE NEW CONDUIT FOR AT LEAST 16-HOURS.

52.5.4. UNSATISFACTORY TEST RESULTS SHALL REQUIRE A REPEAT OF THE DISINFECTION PROCESS AND RESAMPLING AS REQUIRED ABOVE UNTIL A SATISFACTORY SAMPLE IS OBTAINED.

52.5.5. IN THE EVENT THERE ARE TWO UNSATISFACTORY TEST RESULTS FROM THE SAME SAMPLING POINT, THE CONTRACTOR MUST “POLY-PIG” THE NEW WATER MAIN AND SAMPLES TAKEN AGAIN UNTIL A SATISFACTORY SAMPLE IS OBTAINED.

52.6. TAPPING SLEEVE AND VALVE AIR TEST:

52.6.1. PRIOR TO TAPPING, ALL TAPPING SLEEVES AND VALVES SHALL BE AIR TESTED AT 120 PSI FOR THREE (3) MINUTES, WITH NO PRESSURE LOSS.

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

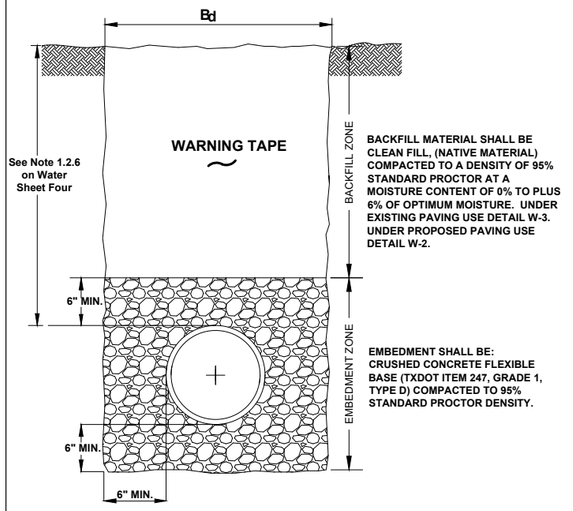
WATER DETAILS 2
SHEET TITLE

DRAWN BY: CCC

SCALE: N.T.S.

DATE: 04/20/2026

W-2
SHEET NO.



BACKFILL MATERIAL SHALL BE CLEAN FILL, (NATIVE MATERIAL) COMPACTED TO A DENSITY OF 95% STANDARD PROCTOR AT A MOISTURE CONTENT OF 0% TO PLUS 6% OF OPTIMUM MOISTURE. UNDER EXISTING PAVING USE DETAIL W-3. UNDER PROPOSED PAVING USE DETAIL W-2.

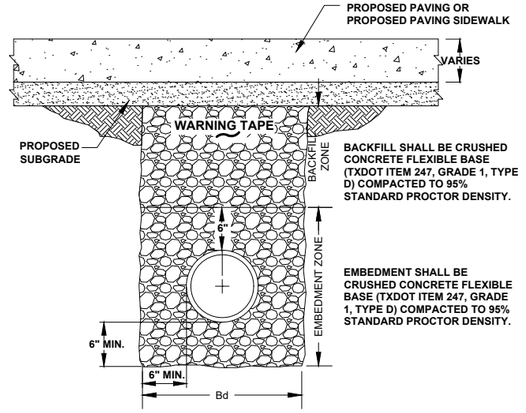
EMBEDMENT SHALL BE: CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

Pipe Size	Max B_d
12" & Smaller	32"
12" to 24"	Outside Dia Pipe + 16"
24" to 72"	Outside Dia. Pipe + 24"

NOTES:
1. TYPICAL COVER OVER WATER MAIN IS 42".
2. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.
3. DUCTILE IRON PIPE AND ALL FITTINGS SHALL HAVE CONTINUOUS POLYETHYLENE WRAP. (BLUE COLOR)

WATER MAIN EMBEDMENT (NOT UNDER PAVING)

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-1



BACKFILL SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

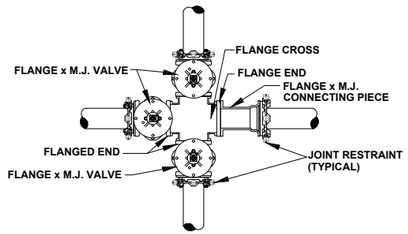
EMBEDMENT SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

Pipe Size	Max B_d
12" & Smaller	32"
12" to 24"	Outside Dia Pipe + 16"
24" to 72"	Outside Dia. Pipe + 24"

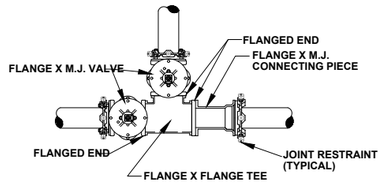
NOTES:
1. TYPICAL COVER OVER WATER MAIN IS 42".
2. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.

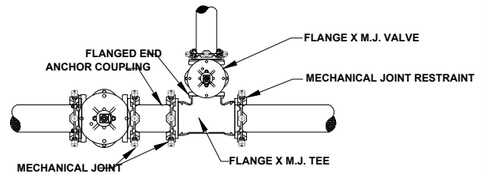
WATER MAIN EMBEDMENT (UNDER PAVING)

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-2



TYPICAL CROSS / VALVE FITTING SETUP

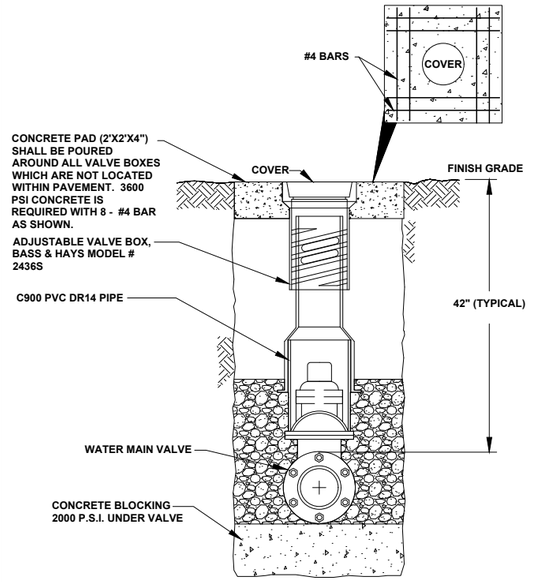




TYPICAL TEE / VALVE SETUP

WATER FLANGED FITTINGS

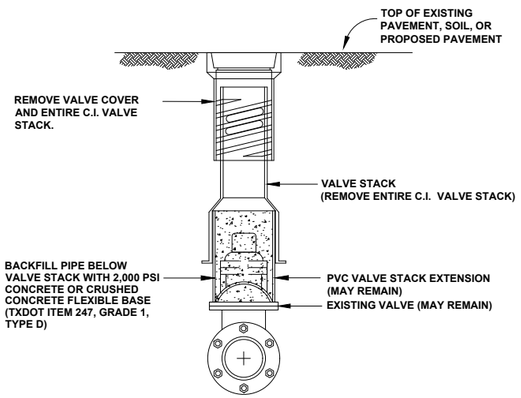
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-3



NOTES:
SEE DETAILS W-1 AND W-2 FOR VALVE EMBEDMENT & BACKFILL REQUIREMENTS.

WATER VALVE

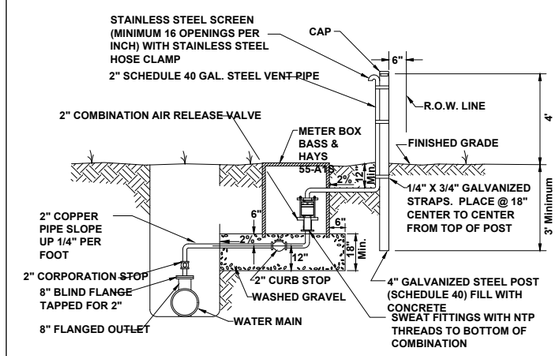
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-4



NOTES:
1. NOT IN PAVEMENT - MATCH EXISTING SOIL AND SOD. COMPACT TO 95% STANDARD PROCTOR DENSITY.
2. IN PAVEMENT - ALL PAVEMENT REPAIRS MUST CONFORM TO DETAIL W-3.

ABANDONMENT OF VALVE STACK

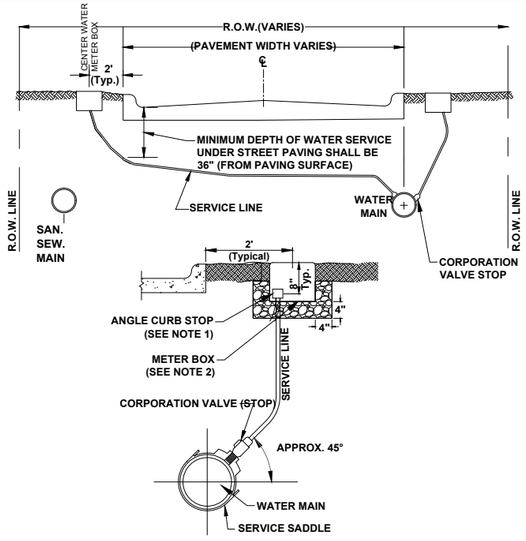
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-5



NOTES:
1. FOR 1" AIR RELEASE VALVE
2. FOR LARGER SIZES CONSULT WITH DIRECTOR OF PUBLIC WORKS
3. CORPORATION & CURB STOP PER TYPICAL SERVICE DETAIL

AIR RELEASE VALVE

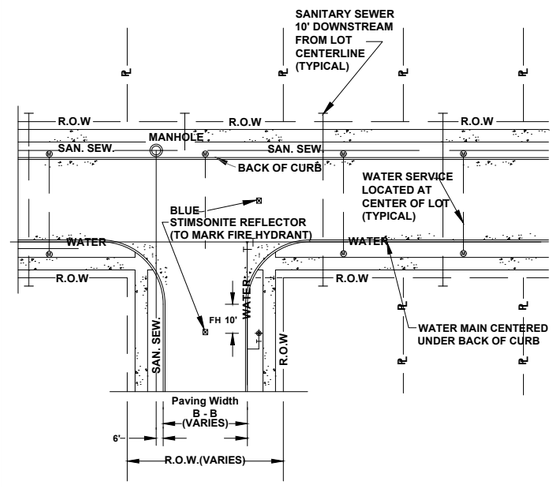
GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-6



NOTES:
1. ANGLE METER VALVE SHALL BE PLACED SO THAT THE TOP OF THE WATER METER IS 6"-10" BELOW TOP OF METER BOX.
2. NEW METER BOX SET IN ¾" TO 1" GRAVEL OR STONE DRAIN BASE. SET LID AT ¼" PER FOOT ABOVE THE TOP OF CURB.
3. DO NOT SET WATER METER BOX IN SIDEWALK, DRIVEWAY OR OTHER PAVED SURFACES.
4. WATER SERVICE TAPS SHALL BE SEPARATED BY A MINIMUM 3' SPACE ALONG THE MAIN.
5. SERVICE LINES SHALL BE 1", 1.5", 2", 3" OR 4". SIZE FOR SERVICE LINES GREATER THAN 4" SHALL BE APPROVED BY THE DIRECTOR OF PUBLIC WORKS. FOR SERVICES GREATER THAN 2", A 4" GATE VALVE SHALL BE INSTALLED PRIOR TO THE METER VAULT.

WATER SERVICE

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-7



NOTES:
1. WATER METERS SHALL NOT BE IN PAVING. (SIDEWALKS, DRIVES, PARKING)
2. FIRE HYDRANTS LOCATED AT STREET INTERSECTIONS SHALL BE PLACED A MINIMUM OF 10' FROM THE STREET RADIUS TANGENT POINT.
3. ALL WATER AND SEWER SERVICE LOCATIONS SHALL BE MARKED AT THE CURB AND PAINTED PER CITY STANDARDS.

TYPICAL UTILITY LOCATIONS

GENERAL DESIGN STANDARDS STANDARD DETAILS | SCALE: N.T.S | REVISION DATE: 04/20/2026 | DETAIL: W-8

The City of SACHSE Public Works

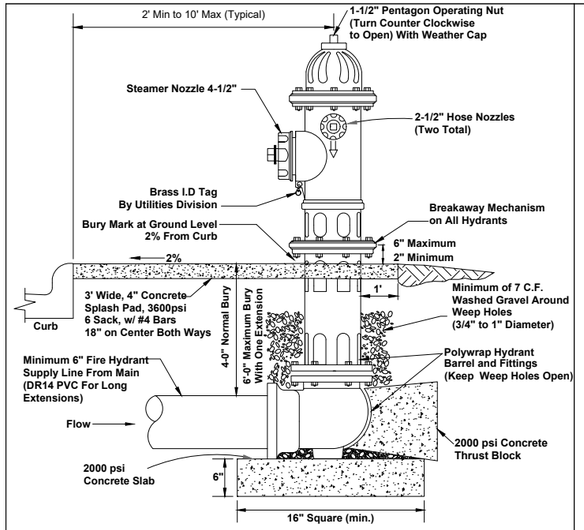
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

WATER DETAILS 3
SHEET TITLE

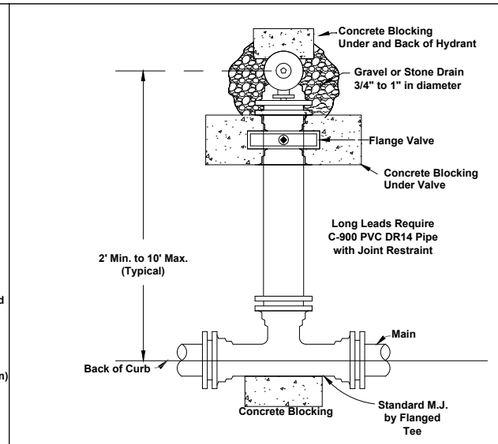
DRAWN BY: CCC
SCALE: N.T.S.
DATE: 04/20/2026

W-3
SHEET NO.



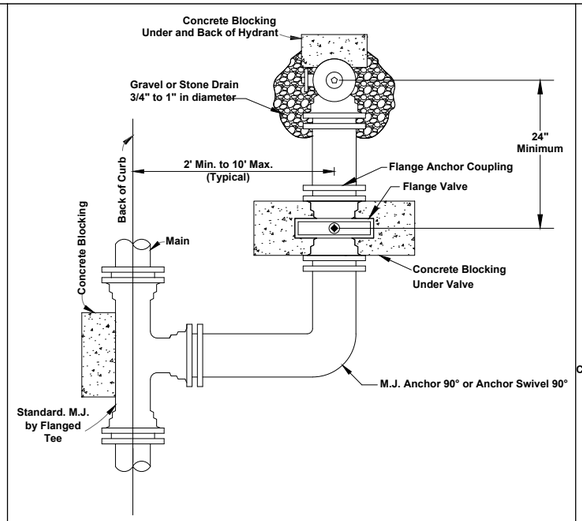
NOTES:
1. FIRE HYDRANTS SHALL NOT BE INSTALLED IN SIDEWALKS OR OVERHANG SIDEWALKS (ADA REQUIREMENT).
2. FIRE HYDRANTS SHALL NOT BE PLACED WITHIN CURB RADIUS.
3. FIRE HYDRANTS LOCATED BETWEEN STREET INTERSECTIONS SHALL BE PLACED AT A PROPERTY LINE (EXTENDED). 4. FIRE HYDRANT LEADS SHALL HAVE EMBEDMENT & BACKFILL THE SAME AS WATER MAIN EMBEDMENT.
5. ALL FITTINGS AND VALVES SHALL HAVE M.J. ANCHORING COUPLINGS, FLANGED JOINTS OR MECHANICAL RESTRAINED RETAINER GLANDS.
6. FIRE HYDRANTS SHALL HAVE NO MORE THAN ONE EXTENSION - 18" MAXIMUM.
7. ALL CONCRETE BLOCKING SHALL BE MINIMUM 2000 PSI.

The City of SACHSE Public Works	**FIRE HYDRANT**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-9**
		REVISION DATE: 04/20/2026	



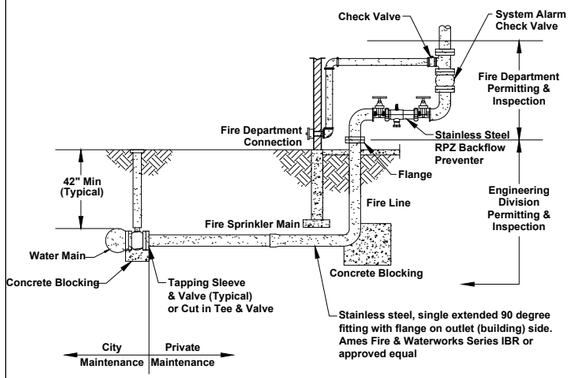
NOTES:
1. FIRE HYDRANTS SHALL NOT BE INSTALLED IN SIDEWALKS OR OVERHANG SIDEWALKS (ADA REQUIREMENT)
2. FIRE HYDRANTS SHALL NOT BE PLACED WITHIN CURB RADIUS
3. FIRE HYDRANTS LOCATED BETWEEN STREET INTERSECTIONS SHALL BE PLACED AT A PROPERTY LINE (EXTENDED)
4. FIRE HYDRANT LEADS SHALL HAVE EMBEDMENT AND BACKFILL THE SAME AS WATER MAIN EMBEDMENT
5. ALL FITTINGS AND VALVES SHALL HAVE M.J. ANCHORING COUPLINGS, FLANGED JOINTS OR MECHANICAL RESTRAINED RETAINER GLANDS
6. FIRE HYDRANTS SHALL HAVE NO MORE THAN ONE EXTENSION - 18" MAXIMUM
7. ALL CONCRETE BLOCKING SHALL BE MINIMUM 200 PSI
8. IF HYDRANT LEAD EXTENDS UNDER ARTERIAL ROADWAY, AN ADDITIONAL VALVE SHALL BE INSTALLED AT THE TEE.

The City of SACHSE Public Works	**FIRE HYDRANT (STRAIGHT)**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-10**
		REVISION DATE: 04/20/2026	



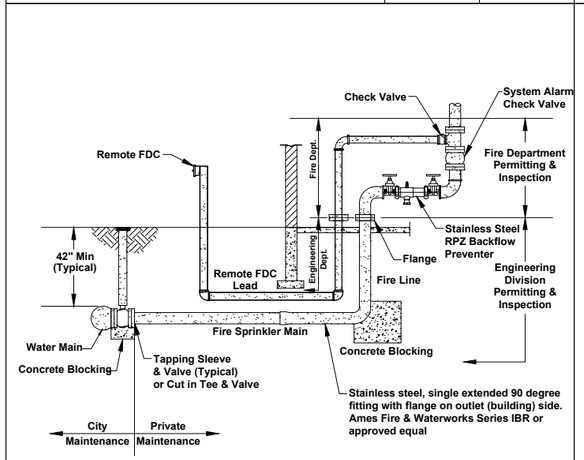
NOTES:
1. FIRE HYDRANTS SHALL NOT BE INSTALLED IN SIDEWALKS OR OVERHANG SIDEWALKS (ADA REQUIREMENT).
2. FIRE HYDRANTS SHALL NOT BE PLACED WITHIN CURB RADIUS.
3. FIRE HYDRANT LOCATED BETWEEN STREET INTERSECTIONS SHALL BE PLACED AT A PROPERTY LINE (EXTENDED).
4. FIRE HYDRANT LEADS SHALL HAVE EMBEDMENT & BACKFILL THE SAME AS WATER MAIN EMBEDMENT.
5. ALL FITTINGS AND VALVES SHALL HAVE M.J. ANCHORING COUPLINGS, FLANGED JOINTS OR MECHANICAL RESTRAINED RETAINER GLANDS
6. FIRE HYDRANTS SHALL HAVE NO MORE THAN ONE EXTENSION - 18" MAXIMUM.
7. ALL CONCRETE BLOCKING SHALL BE MINIMUM 2000 PSI.

The City of SACHSE Public Works	**FIRE HYDRANT (90 BEND)**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-11**
		REVISION DATE: 04/20/2026	



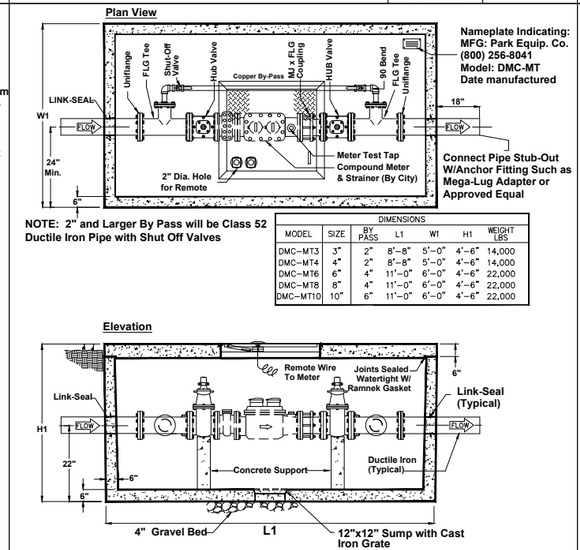
NOTES:
1. ALL FITTINGS MUST BE MECHANICALLY ANCHORED & BLOCKED.
2. ALL BELOW GRADE / GROUND CONSTRUCTION IS PERMITTED & INSPECTED BY THE CITY INSPECTOR (INCLUDING REMOTE FDC).
3. ALL ABOVE GRADE / GROUND CONSTRUCTION IS PERMITTED & INSPECTED BY FIRE DEPARTMENT.
4. ALL CONCRETE BLOCKING SHALL BE MINIMUM 2000 PSI.
5. UNDERGROUND TEST REPORTS ARE REQUIRED FOR FIRE SPRINKLER LEAD AND FDC BY A LICENSED INSTALLER.

The City of SACHSE Public Works	**FIRE SPRINKLER YARD PIPING**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-12**
		REVISION DATE: 04/20/2026	



NOTES:
1. ALL FITTINGS MUST BE MECHANICALLY ANCHORED & BLOCKED.
2. ALL BELOW GRADE / GROUND CONSTRUCTION IS PERMITTED & INSPECTED BY THE CONSTRUCTION INSPECTOR (INCLUDING REMOTE FDC).
3. ALL ABOVE GRADE / GROUND CONSTRUCTION IS PERMITTED & INSPECTED BY FIRE DEPARTMENT. (INCLUDING REMOTE FDC THAT REMAINS IN THE BUILDING AND ABOVE GROUND
4. ALL CONCRETE BLOCKING SHALL BE MINIMUM 2000 PSI.
5. UNDERGROUND TEST REPORTS ARE REQUIRED FOR FIRE SPRINKLER LEAD AND FDC BY A LICENSED INSTALLER.

The City of SACHSE Public Works	**REMOTE FDC AND FIRE LINE**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-13**
		REVISION DATE: 04/20/2026	

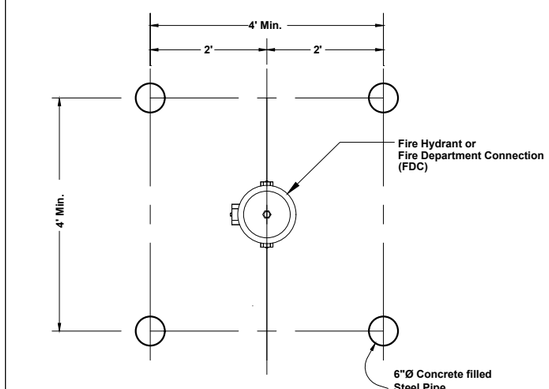


NOTE: 2" and Larger By Pass will be Class 52 Ductile Iron Pipe with Shut Off Valves

DIMENSIONS						
MODEL	SIZE	BY PASS	L1	W1	H1	WEIGHT LBS
DMC–MT3	3"	2"	8'–8"	5'–0"	4'–6"	14,000
DMC–MT4	4"	2"	8'–8"	5'–0"	4'–6"	14,000
DMC–MT6	6"	4"	11'–0"	6'–0"	4'–6"	22,000
DMC–MT8	8"	4"	11'–0"	6'–0"	4'–6"	22,000
DMC–MT10	10"	6"	11'–0"	6'–0"	4'–6"	22,000

NOTES:
1. VAULT CONCRETE: CLASS 1 CONCRETE WITH DESIGN STRENGTH OF 4500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR AND FIRST STAGE OF WALL WITH SECTIONAL RISER DEPTH.
2. VAULT REINFORCEMENT: GRADE 60 REINFORCED. STEEL REBAR CONFORMING TO ASTM A615 ON REQUIRED CENTERS OR EQUAL.
3. VAULT HATCHWAY: 36" x 36" ALUMINUM HATCHWAY (BILCO PCM-4). HINGED ALUMINUM DIAMOND PLATE COVER, WITH EXTRUDED ALUMINUM FRAME. HATCH TO BE FURNISHED WITH 316 STAINLESS STEEL SNAP LOCK & BRASS HINGES.

The City of SACHSE Public Works	**3" THRU 10" DOMESTIC WATER METER ASSEMBLY**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-14**
		REVISION DATE: 04/20/2026	



NOTES:
1. BOLLARDS ARE NOT A SUBSTITUTE FOR PROPER TRAFFIC FLOW LAYOUT AND SHOULD BE USED ONLY AFTER OPTIONS FOR RELOCATION OF HYDRANT HAVE PROVED INFEASIBLE.
2. BOLLARDS SHALL ONLY BE USED IN LOW SPEED AREAS WHERE SPEED LIMIT IS 10 MPH OR LOWER (SUCH AS AROUND LOADING DOCKS AND IN PARKING LOTS).
3. BOLLARDS SHALL NOT BE USED IN CITY STREET RIGHT-OF-WAY OR ALLEY RIGHT-OF-WAY.
4. 5' OF BOLLARD SHALL EXTEND ABOVE PAVING TO ALLOW VIEWING OF BOLLARD IN REAR VIEW MIRRORS. 5. 6" DIAMETER STEEL PIPE, SCHEDULE 40, 0.28" WALL THICKNESS, FILLED WITH CONCRETE.
6. 8' LENGTH (5' ABOVE PAVING, 3' BELOW PAVING), SET 18" DIAMETER PIER.
7. BOLLARD SHALL BE PAINTED YELLOW.

The City of SACHSE Public Works	**FIRE HYDRANT BOLLARD**	GENERAL DESIGN STANDARDS STANDARD DETAILS	
		SCALE: N.T.S	DETAIL: **W-15**
		REVISION DATE: 04/20/2026	

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS

3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

WATER DETAILS 4
SHEET TITLE

DRAWN BY: CCC
SCALE: N.T.S.
DATE: 04/20/2026

W-4
SHEET NO.

GENERAL NOTES FOR SANITARY SEWER AND RELATED APPURTENANCES:

1. ALL SANITARY SEWER SYSTEM IMPROVEMENTS IN THE CITY OF SACHSE, BOTH PRIVATELY AND PUBLICLY MAINTAINED SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE CITY OF SACHSE ENGINEERING DESIGN STANDARDS.
2. ALL SANITARY SEWER SYSTEM DESIGN AND CONSTRUCTION SHALL CONFORM TO THE MOST CURRENT TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) REGULATIONS. THESE REGULATIONS CAN BE FOUND IN THE TEXAS ADMINISTRATIVE CODE (TAC), TITLE 30, CHAPTER 217, SUBCHAPTER C (DESIGN CRITERIA FOR DOMESTIC WASTEWATER SYSTEMS).
3. ALL SANITARY SEWER MAINS THAT ARE PROPOSED TO BE ABANDONED WITHIN STREET ROW AND LESS THAN 10 FEET IN DEPTH, UNDER ANY MAJOR INTERSECTIONS, OR IN AREAS THAT COULD IMPACT MAJOR INFRASTRUCTURE, SHALL BE ABANDONED BY DRAINING THE EXISTING MAIN AND CUTTING AND FILLING THE EXISTING MAIN WITH GROUT.

SANITARY SEWER MAINS

4. SANITARY SEWER MAINS ARE GENERALLY PLACED IN THE PARKWAY, 6 FEET BACK OF CURB, UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF PUBLIC WORKS.
5. TRENCH BOXES SHALL BE REQUIRED FOR CONSTRUCTION OF MAINS WHERE ADEQUATE CLEARANCE FROM STREETS OR PRIMARY STRUCTURES CANNOT BE ACHIEVED. ADEQUATE CLEARANCE IS DEFINED AS A DISTANCE FROM THE PAVEMENT / STRUCTURE EQUAL TO THE DEPTH OF THE TRENCH.
6. THE SPACING AND SEPARATION OF WATER MAINS FROM SANITARY SEWER MAINS SHALL FOLLOW THE NINE (9) FOOT RULE AS SET FORTH IN THE TCEQ REGULATION (30 TAC 217.53). WATER AND SANITARY SEWER MAINS (INCLUDING MANHOLES) SHALL BE SEPARATED BY NINE FEET IN ALL DIRECTIONS AND INSTALLED IN SEPARATE TRENCHES.
7. WARNING TAPE SHALL BE INSTALLED 18 INCHES ABOVE THE TOP OF THE EMBEDMENT OR AS OTHERWISE DIRECTED BY THE PUBLIC WORKS CONSTRUCTION INSPECTOR. THE TAPE SHALL BE A PLASTIC, HIGH STRETCH, 4 INCH WIDTH TAPE APPROVED BY THE DIRECTOR OF PUBLIC WORKS THE TAPE SHALL BE GREEN IN COLOR AND HAVE THE WORDS "CAUTION SANITARY SEWER MAIN BURIED BELOW" IMPRINTED ON THE TAPE.
8. PRIVATE SANITARY SEWER MAINS AND LATERALS SHALL BE DESIGNED, PERMITTED AND INSPECTED PER THE INTERNATIONAL PLUMBING CODE; GENERALLY PRIVATE SYSTEMS ARE PERMITTED AND INSPECTED BY THE CITY BUILDING INSPECTION DIVISION.
9. SANITARY SEWER MAINS DEEPER THAN TEN (10) FEET OF DEPTH SHALL BE SDR 26 PIPE.

SERVICE LATERALS

10. SERVICE LATERALS SHALL BE LOCATED TEN (10) FEET DOWNSTREAM OF THE CENTERLINE FOR THE LOT (WATER SERVICE GENERALLY TO BE LOCATED AT THE CENTERLINE OF THE LOT), AND PLUGGED SUITABLE FOR TESTING.
11. ALL SANITARY SEWER SERVICES ARE TO HAVE A MINIMUM COVER OF THREE (3) FEET AND A MAXIMUM COVER OF FIVE (5) FEET AS MEASURED AT THE PROPERTY LINE OR EASEMENT LINE FROM THE PROPOSED GRADE TO TOP OF PIPE. IN GENERAL, THE MINIMUM DEPTH FOR SEWER TO SERVE GIVEN PROPERTY WITH A 4-INCH LATERAL SHALL BE 3-FEET PLUS 2% TIMES THE LENGTH OF THE LATERAL TO THE MIDDLE OF THE STRUCTURE. SERVICES THAT ARE LONGER THAN 100 FEET FROM THE MAIN AND LARGER BUILDINGS MAY REQUIRE A DEEPER SERVICE LINE AND MAY REQUEST AN EXEMPTION BY THE DIRECTOR OF PUBLIC WORKS FROM THE MAXIMUM COVER REQUIREMENTS. NO SERVICES SHALL BE CONNECTED TO MAINS OVER 15 FEET DEEP AS MEASURED FROM THE PROPOSED GROUND ELEVATION TO THE MAIN FLOWLINE.
12. CONTRACTOR SHALL INSTALL A PROPERTY LINE CLEANOUT PER THE CITY OF SACHSE GENERAL DESIGN DETAILS IF REQUIRED BY THE PUBLIC WORKS OR ENGINEERING DEPARTMENTS. CONTRACTOR SHALL NOT INSTALL DOUBLE SERVICE CLEANOUTS IN CONCRETE PAVING.
13. SERVICE FITTINGS SHALL BE A TEE OR WYE FITTING TO BE INSTALLED ON THE MAIN. SADDLE SERVICES ARE NOT ALLOWED FOR NEW CONSTRUCTION.
14. EACH INDIVIDUAL SERVICE LOCATION SHALL BE MARKED ON THE FACE OF THE CURB WITH A FOUR (4) INCH HIGH AND 1/8" DEEP DOUBLE SCRIBE MARK "II" CUT IN THE CURB USING AN APPROVED MOTOR DRIVEN CONCRETE SAW. THE DOUBLE SCRIBE MARK "II" SHALL RECEIVE A COATING OF GREEN PAINT, WHICH SHALL COAT THE INTERIOR AND EXTERIOR OF THE CUT TO A WIDTH OF ONE (1) INCH.

MANHOLES

15. MANHOLE WALL THICKNESS SHALL CONFORM TO THE FOLLOWING TABLE:

MANHOLE DIAMETER	MINIMUM WALL THICKNESS (PRE-CAST)	MINIMUM WALL THICKNESS (CAST-IN PLACE)
4 FEET	5"	6"
5 FEET	6"	8"
6 FEET	8"	8"
> 6 FEET AND/OR SPECIAL CONDITIONS AND SITUATIONS	AS REQUIRED BY DIRECTOR OF PUBLIC WORKS	

16. DROP MANHOLES SHALL BE INSTALLED IF THERE IS AN INCOMING LINE WITH A VERTICAL DROP OF MORE THAN TWO (2) FEET MEASURED FROM FLOWLINE TO FLOWLINE. ALL DROPS MANHOLES SHALL BE INTERNAL AND CONFORM TO CITY OF SACHSE STANDARD DETAILS. DROP MANHOLES SHALL HAVE A MINIMUM DIAMETER OF SIX (6) FEET. EXISTING MANHOLES THAT HAVE DROPS INSTALLED MAY TERMINATE THE DROP PIPE AT THE INVERT LEDGE.
17. THE TOP OF A MANHOLE LOCATED IN A FLOODPLAIN AREA SHALL HAVE A MINIMUM ELEVATION OF THE ULTIMATE 100 YEAR WATER SURFACE ELEVATION AND SHALL BE A MINIMUM OF 2-FEET AND A MAXIMUM OF 3-FEET ABOVE THE ADJACENT GRADE. THE TOPS OF ALL OTHER MANHOLES SHALL BE SET TO THE GRADE OF ADJACENT LAND OR PAVING.
18. THE EXCAVATION WITHIN 6-FEET OF A MANHOLE SHALL BE BACKFILLED WITH CRUSHED CONCRETE FLEXIBLE BASE (TXDOT, ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE PRE-CAST MANHOLES SHALL BE USED ON ALL NEW CONSTRUCTION UNLESS AN ALTERNATE IS APPROVED BY THE DIRECTOR OF PUBLIC WORKS.
19. MANHOLE MATERIALS
    - 19.1. PRE-CAST CONCRETE SHALL CONFORM TO CURRENT ASTM DESIGNATION C 478 (C 478M). LIFTING EYES ARE NOT ALLOWED IN PRE-CAST MANHOLES. "T" BASE MANHOLES MAY BE SUBSTITUTED WITH THE CITY ENGINEER'S APPROVAL FOR PRE-CAST MANHOLES FOR RCP MAINS LARGER THAN 36 INCHES IN DIAMETER. SHOP DRAWING SHALL BE SUBMITTED TO THE DIRECTOR OF PUBLIC WORKS FOR ALL PRE-CAST MANHOLES.
    - 19.2. CAST-IN-PLACE CONCRETE MANHOLES SHALL ONLY BE ALLOWED WITH SPECIAL PERMISSION OF THE DIRECTOR OF PUBLIC WORKS. GENERALLY THE DIRECTOR OF PUBLIC WORKS WILL ONLY GRANT PERMISSION FOR CAST-IN-PLACE MANHOLES FOR CONNECTIONS TO EXISTING MAINS CARRYING LIVE SEWER. WHEN CAST-IN-PLACE MANHOLES ARE APPROVED BY THE DIRECTOR OF PUBLIC WORKS, CONSTRUCTION MUST CONFORM TO CITY OF SACHSE ENGINEERING DESIGN STANDARDS. MANHOLES MUST HAVE A CONCENTRIC TOP CONE SECTION. ECCENTRIC CONE MANHOLES MAY BE USED IN SITUATIONS WHERE CONFLICTS WITH OTHER FACILITIES WARRANT IT.
    - 19.3. BRICK OR FIBERGLASS MANHOLES OR ANY OTHER TYPE OF MANHOLE MATERIAL OTHER THAN CONCRETE WILL NOT BE ALLOWED.
20. ALL RINGS SHALL BE BOLTED TO THE MANHOLE CONE SECTION WITH A LAYER OF MASTIC APPLIED BETWEEN THE RING AND CONE SECTION.
21. ALL MANHOLE RING AND COVERS ON MANHOLES WITH A CONNECTING SANITARY SEWER MAIN SIZE OF 15-INCHES OR LARGER SHALL BE COATED WITH A CITY APPROVED STRUCTURAL / HIGH SULFIDE RESISTANT COATING (SEE CITY OF SACHSE APPROVED MATERIALS LIST).
22. MANHOLE RINGS AND COVERS SHALL BE ADJUSTED BY THE USE OF APPROVED GRADE RINGS WITH BUTYL SEALANT BETWEEN GRADE RINGS, COVER RING AND MANHOLE. MAXIMUM ADJUSTMENT IS EIGHT (8) INCHES. GRADE RINGS MAY BE HDPE, PRECAST CONCRETE GRADE RINGS OR RUBBER AS SHOWN ON THE CITY OF SACHSE APPROVED MATERIALS LIST AND IN ACCORDANCE WITH NCTCOG PUBLIC WORKS CONSTRUCTION STANDARD 502.1.2. BRICKS, STEEL AND IRON ARE NOT ACCEPTABLE FOR ADJUSTMENT.
23. ALL MANHOLES SHALL HAVE FULL DEPTH INVERTS TO THE DEPTH OF THE LARGEST ENTERING MAIN.
24. MANHOLE RING SEALING TO MANHOLE CONE/FLAT TOP: ALL MANHOLES RINGS SHALL BE SEALED AND CONTAIN AN INTERNAL MANHOLE CHIMNEY SEAL OR APPROVED EXTERNAL SEAL OR WRAP AS SHOWN ON THE CITY OF SACHSE APPROVED MATERIALS LIST.
25. FALSE BOTTOMS:
    - 25.1. ALL MANHOLES SHALL HAVE A ¾ INCH THICK PLYWOOD FALSE BOTTOM INSTALLED PRIOR TO INITIATION OF GRADING AND/OR LIMING OPERATIONS.
26. MANHOLE COATINGS:
    - 26.1. ALL MANHOLES WITH A CONNECTING PIPE OF FIFTEEN (15) INCHES IN DIAMETER OR LARGER SHALL BE COATED. MANHOLES SHALL BE COATED WITH A CITY APPROVED STRUCTURAL/HIGH SULFIDE RESISTANT COATING (SEE CITY OF SACHSE APPROVED MATERIALS LIST). COATING APPLICATION PROCEDURES SHALL CONFORM TO THE RECOMMENDATIONS OF THE COATING MANUFACTURER, INCLUDING MATERIAL HANDLING, MIXING, AND ENVIRONMENTAL CONTROLS DURING APPLICATION, SAFETY, AND EQUIPMENT.
27. MANHOLE TESTING:
    - 27.1. MANHOLE TESTING SHALL BE IN ACCORDANCE WITH SECTION 5.3.
28. LOCATION MARKING:
    - 28.1. EACH MANHOLE SHALL BE MARKED ON THE FACE OF THE CURB WITH A FOUR (4) INCH HIGH AND 1/8" DEEP MARK "MH" CUT IN THE CURB USING AN APPROVED MOTOR DRIVEN CONCRETE SAW. THE DOUBLE MARK "MH" SHALL RECEIVE A COATING OF GREEN PAINT, WHICH SHALL COAT THE INTERIOR AND EXTERIOR OF THE CUT TO A WIDTH OF ONE (1) INCH.
29. MAIN LINE CLEANOUTS:
    - 29.1. MAIN LINE CLEANOUTS ARE TO BE LOCATED AND INSTALLED AS PER APPROVED DRAWINGS AND CITY OF SACHSE ENGINEERING DESIGN STANDARDS. EACH CLEANOUT SHALL BE MARKED ON THE FACE OF THE CURB WITH A FOUR (4) INCH HIGH AND 1/8" DEEP MARK "CO" CUT IN THE CURB USING AN APPROVED MOTOR DRIVEN CONCRETE SAW. THE DOUBLE MARK "CO" SHALL RECEIVE A COATING OF GREEN PAINT, WHICH SHALL COAT THE INTERIOR AND EXTERIOR OF THE CUT TO A WIDTH OF ONE (1) INCH.
30. MANHOLE STUB OUTS:
    - 30.1. STUB OUTS FROM MANHOLES SHALL BE A MINIMUM FIVE (5) FOOT LONG AND CAPPED.
31. MANHOLES LOCATED IN FLOODPLAIN OR IN MIDDLE OF FIELD SHALL HAVE A MINIMUM 5' TALL MARKER ATTACHED TO MANHOLE LID.

INSTALLATION AND CONSTRUCTION

32. INSTALLATION OF ALL SANITARY SEWER SHALL CONFORM TO NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS (NCTCOG) STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION ITEMS 505.1 AND 507 EXCEPT AS AMENDED IN THESE STANDARDS.
33. EXCAVATION IN GENERAL, SHALL BE MADE IN OPEN CUT FROM THE SURFACE OF THE GROUND AND SHALL BE NO GREATER IN WIDTH AND DEPTH THAN IS NECESSARY TO PERMIT THE PROPER CONSTRUCTION OF THE WORK. WHEN THE TRENCH DEPTH EXCEEDS FIVE (5) FEET, SEE SECTION 6.2 REGARDING "TRENCH SAFETY" REQUIREMENTS. THE AMOUNT OF TRENCH EXCAVATION TO GRADE SHALL NOT EXCEED ONE HUNDRED (100) FEET FROM THE END OF THE PIPE LAYING OPERATIONS AND NO EXCAVATION SHALL BE THREE HUNDRED (300) FEET IN ADVANCE OF THE COMPLETED PIPE OPERATIONS (INCLUDES BACKFILLING). AT THE END OF THE WORKDAY, ALL TRENCH EXCAVATION SHALL BE BACKFILLED. ANY LANDSCAPING AND IRRIGATION SYSTEM WITHIN THE CITY MEDIANS AND RIGHT-OF-WAYS THAT IS DISTURBED, REMOVED, OR DAMAGED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL CONDITION OR BETTER BY A LICENSED IRRIGATOR.
34. BACKFILL AND COMPACTION: FOR TRENCHES NOT UNDER PAVING, FINAL BACKFILL MATERIAL SHALL BE FROM THE TRENCH EXCAVATION PLACED IN A MAXIMUM OF 12 INCH LOOSE LIFTS AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE. UNDER EXISTING OR PROPOSED PAVING (PUBLIC/PRIVATE SIDEWALKS, STREETS, ALLEYS, DRIVEWAYS, ETC.), BACKFILL SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT, ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE UNLESS ALTERNATE MATERIAL IS APPROVED BY THE CITY ENGINEER. THE CONTRACTOR SHALL TAKE NEW PROCTORS AT EACH CHANGE IN SOIL TYPE. WATER JETTING WILL NOT BE ALLOWED FOR ANY TRENCH.

TESTING

35. NOTIFICATION OF TESTING:
    THE CONTRACTOR SHALL NOTIFY THE ASSIGNED CITY CONSTRUCTION INSPECTOR OF ALL TESTING 24 HOURS PRIOR TO THE SCHEDULED TEST. COPIES OF ALL TEST REPORTS SHALL BE SENT TO THE CITY CONSTRUCTION INSPECTOR FOR REVIEW AND ACCEPTANCE AND INCLUSION IN THE CITY PROJECT FILE. PROJECTS WILL NOT RECEIVE CITY ACCEPTANCE UNTIL ALL TEST RESULTS ARE COMPLETE AND SATISFACTORY.
36. COMPACTION OF TRENCHES AND EXCAVATIONS:
    THE CONTRACTOR SHALL TAKE NUCLEAR GAUGE DENSITY TESTS PER ASTM D2922 AT A FREQUENCY OF ONE TEST PER LIFT, PER 300 LINEAR FEET OF TRENCH (INCLUDING SERVICES) AT LOCATIONS SPECIFIED BY THE CITY PUBLIC WORKS INSPECTOR. IN ADDITION TO THE ABOVE TRENCH DENSITY TESTS, TWO NUCLEAR GAUGE DENSITY TESTS PER ASTM D2922 SHALL BE TAKEN OF THE MANHOLE BACKFILL WITHIN 4 FOOT OF THE MANHOLE. DENSITY TESTS MUST MEET A MINIMUM COMPACTION OF 95% OF STANDARD PROCTOR DENSITY (ASTM D698) AT A MOISTURE RANGE OF 0% TO PLUS 6% OF OPTIMUM MOISTURE.
37. MANHOLE TESTING:
    ALL MANHOLES SHALL BE VACUUM TESTED INCLUDING GRADE RINGS AND CASTING PER NCTCOG PUBLIC WORKS CONSTRUCTION STANDARD 502.1.5.2 AND MEET TCEQ REGULATIONS 30 TAC 217 AND ASTM C1244, "STANDARD TEST METHOD FOR CONCRETE SEWER MANHOLES BY THE NEGATIVE AIR PRESSURE (VACUUM) TEST PRIOR TO BACKFILL". THE TIME FOR THE VACUUM TO DROP FROM 10 INCHES OF MERCURY TO 9 INCHES SHALL NOT BE LESS THAN TWO (2) MINUTES.
38. DEFLECTION TESTING:
    MAINS LESS THAN THIRTY SIX (36) INCHES IN DIAMETER SHALL PASS DEFLECTION MANDREL TEST PER NCTCOG STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, ITEM 507.5.1.4 FLEXIBLE PIPE (DEFLECTION) TESTING AND TCEQ REGULATIONS CHAPTER 217.57(B) DEFLECTION TESTING. ALTERNATE METHODS FOR MEASURING DEFLECTION FOR PIPES LARGER THAN THIRTY SIX (36) INCHES IN DIAMETER SUBJECT TO CITY APPROVAL. TESTING OF MAINS THIRTY SIX (36) INCHES AND LARGER SHALL OCCUR AT LEAST 30 DAYS AFTER INSTALLATION AND BACKFILL. PIPE WITH DEFLECTION EXCEEDING THE PERCENTAGE ALLOWED DEFLECTION PER NCTCOG TABLE 507.5.1.4.2(A) AT THE TIME OF TESTING SHALL BE UNCOVERED AND REINSTALLED. IF DEFLECTION EXCEEDS 7% AT THE TIME OF TESTING, PIPE SHALL BE REMOVED AND REPLACED WITH NEW MATERIALS. ALL FAILED JOINTS, PIPES, SECTIONS OR STRUCTURES SHALL BE RETESTED UPON COMPLETION OF REMEDIAL ACTIONS. FAILED SECTIONS SHALL BE RETESTED AFTER THE REMEDIAL CONSTRUCTION HAS BEEN IN PLACE FOR 30 DAYS.
39. AIR TESTING:
    MAINS LESS THAN THIRTY SIX (36) INCHES IN DIAMETER AND LATERALS SHALL PASS A LOW PRESSURE AIR TEST PER NCTCOG STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, ITEM 507.5.1.3 LOW PRESSURE AIR TESTING AND TCEQ REGULATIONS 30 TAC CHAPTER 217.57(A)(1) LOW PRESSURE AIR TEST. PIPES 36-INCHES AND LARGER MAY BE TESTED PER NCTCOG ITEM 507.5.1.3.3 (INDIVIDUAL JOINT AIR TEST METHOD). TESTING OF MAINS THIRTY SIX (36) INCHES AND LARGER SHALL OCCUR AT LEAST 30 DAYS AFTER INSTALLATION AND BACKFILL. ALL FAILED JOINTS, PIPES, SECTIONS OR STRUCTURES SHALL BE RETESTED UPON COMPLETION OF REMEDIAL ACTIONS. FAILED SECTIONS SHALL BE RETESTED AFTER THE REMEDIAL CONSTRUCTION HAS BEEN IN PLACE FOR 30 DAYS.
40. TV CAMERA INSPECTION:
    AFTER THE DEFLECTION MANDREL AND AIR PRESSURE TEST, THE CONTRACTOR SHALL CONDUCT A COLOR TELEVISION CAMERA INSPECTION OF THE INTERIOR OF THE INSTALLED SANITARY SEWER SYSTEM. THE MAIN MUST BE LACED WITH ENOUGH WATER TO FILL ANY LOW POINTS. A COPY OF THE RECORDING IN DIGITAL FORMAT AND STORAGE DEVICE (FLASH DRIVE, ETC.) AS SPECIFIED BY THE CITY, WITH WRITTEN LOG OF THE INSPECTION, SHALL BE PROVIDED TO THE PUBLIC WORKS CONSTRUCTION INSPECTOR PRIOR TO FINAL ACCEPTANCE OF THE PROJECT.

The City of SACHSE Public Works

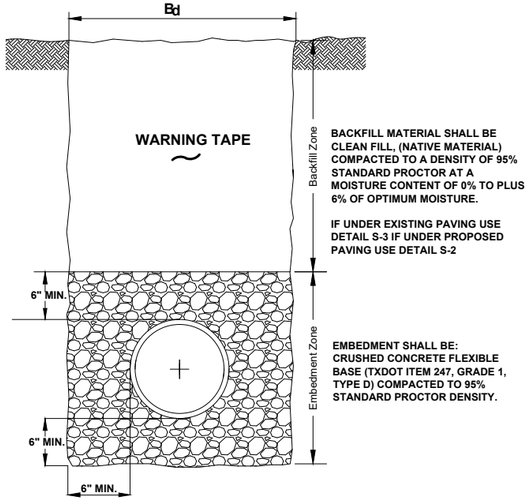
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

SANITARY SEWER DETAILS 1
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

SS-1
SHEET NO.



BACKFILL MATERIAL SHALL BE CLEAN FILL, (NATIVE MATERIAL) COMPACTED TO A DENSITY OF 95% STANDARD PROCTOR AT A MOISTURE CONTENT OF 0% TO PLUS 6% OF OPTIMUM MOISTURE.

IF UNDER EXISTING PAVING USE DETAIL S-3 IF UNDER PROPOSED PAVING USE DETAIL S-2

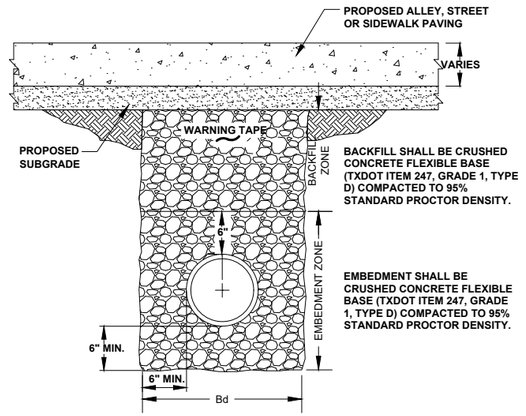
EMBEDMENT SHALL BE: CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

PIPE SIZE	Max B_d
12" & LESS	32"
12" to 24"	OUTSIDE DIA PIPE + 16"
24" to 72"	OUTSIDE DIA. PIPE + 24"

NOTES:
1. SEE SEWER SYSTEM IMPROVEMENTS NOTES FOR DESIGN & CONSTRUCTION REQUIREMENTS.
2. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.

SANITARY SEWER EMBEDMENT (NOT UNDER PAVING)

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-1



BACKFILL SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

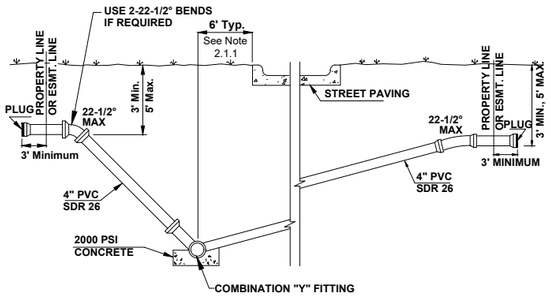
EMBEDMENT SHALL BE CRUSHED CONCRETE FLEXIBLE BASE (TXDOT ITEM 247, GRADE 1, TYPE D) COMPACTED TO 95% STANDARD PROCTOR DENSITY.

PIPE SIZE	Max B_d
12" & LESS	32"
12" to 24"	OUTSIDE DIA PIPE + 16"
24" to 72"	OUTSIDE DIA. PIPE + 24"

NOTES:
1. SEE SEWER SYSTEM IMPROVEMENTS NOTES FOR DESIGN & CONSTRUCTION REQUIREMENTS.
2. WARNING TAPE SHALL BE PLACED APPROXIMATELY 24" ABOVE TOP OF PIPE.
3. DEPTHS OVER 10' SHALL BE FLOWABLE FILL.

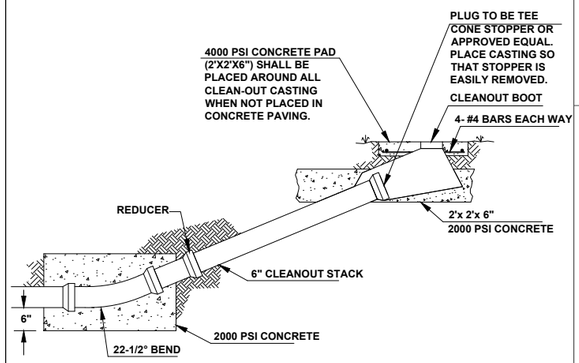
SANITARY SEWER EMBEDMENT (UNDER PAVING)

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-2



SANITARY SEWER LATERAL

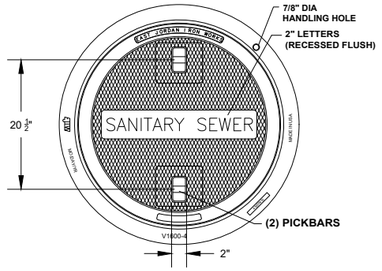
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-3



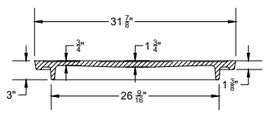
NOTES:
1. EMBEDMENT FOR LATERAL AND MAINLINE CLEANOUTS TO BE THE SAME AS THE MAINLINE.
2. MAINLINE CLEANOUTS SHALL ONLY BE USED AT THE DIRECTION OF THE DIRECTOR OF PUBLIC WORKS.

SANITARY SEWER MAINLINE CLEANOUT

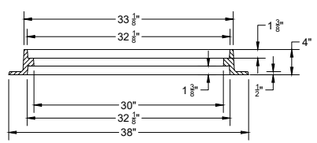
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-4



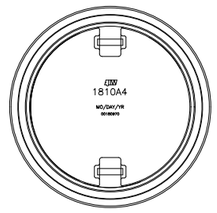
COVER



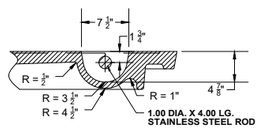
COVER SECTION



FRAME SECTION



BOTTOM OF COVER



PICKBAR DETAIL

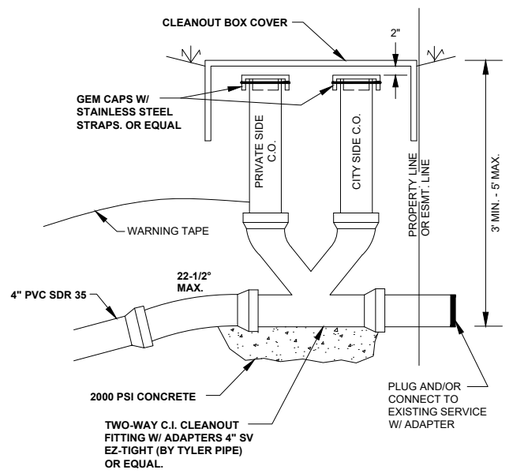
NOTES:
1. MANHOLE COVER AND FRAME SHALL BE STANDARD CAST IRON MANHOLE COVER.
2. COVERS SHALL BE ONE MAN OPERABLE USING STANDARD TOOLS AND SHALL BE CAPABLE OF WITHSTANDING A TEST LOAD OF 80,000 LBS.
3. FRAMES SHALL BE CIRCULAR, INCORPORATE A SEATING RING, AND SHALL HAVE A 30 INCH CLEAR OPENING. THE FRAME DEPTH SHALL NOT EXCEED 5", AND THE FLANGE SHALL INCORPORATE BEDDING SLOTS, BOLT HOLES, AND LIFTING EYES.
4. ALL COMPONENTS SHALL BE BLACK COATED.

SANITARY SEWER MANHOLE RING AND COVER

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-5

SANITARY SEWER MANHOLE RING AND COVER (CONTINUED)

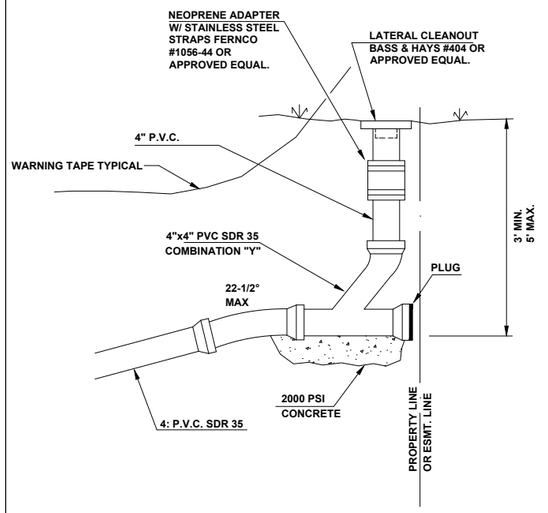
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-6



INSTALL ONLY AT THE DIRECTION OF THE DIRECTOR OF PUBLIC WORKS.

DOUBLE CLEANOUT

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-7



INSTALL ONLY AT THE DIRECTION OF THE DIRECTOR OF PUBLIC WORKS.

SINGLE CLEANOUT

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-8

The City of SACHSE Public Works

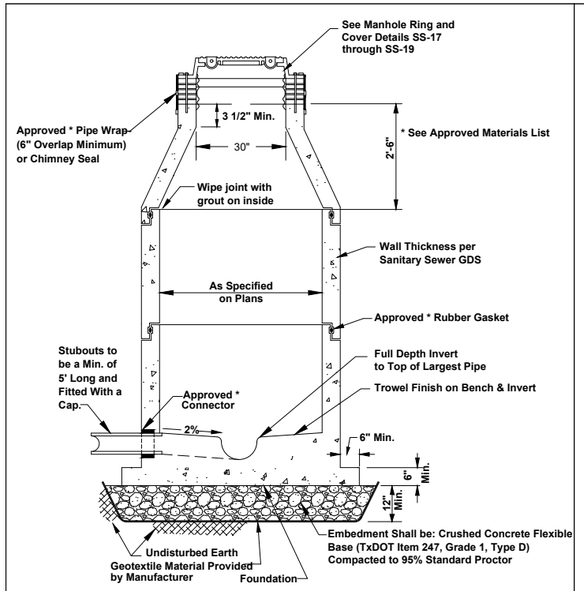
STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

SANITARY SEWER DETAILS 2
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

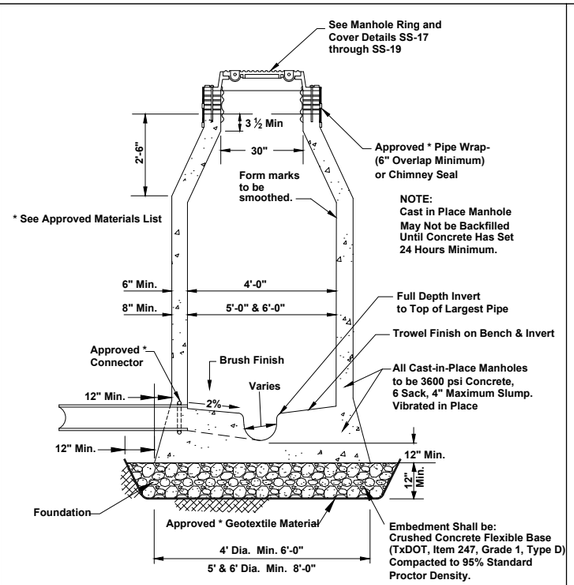
SS-2
SHEET NO.



NOTES:
1. PRECAST MANHOLES ARE STANDARD. CAST-IN-PLACE MANHOLES SHALL BE CONSTRUCTED ONLY WITH APPROVAL OF DIRECTOR OF PUBLIC WORKS.
2. PRECAST RISER SHALL CONFORM TO REQUIREMENTS OF ASTM C-478
3. LIFTING HOLES NOT PERMITTED.
4. NO STEPS ALLOWED.

PRECAST MANHOLE

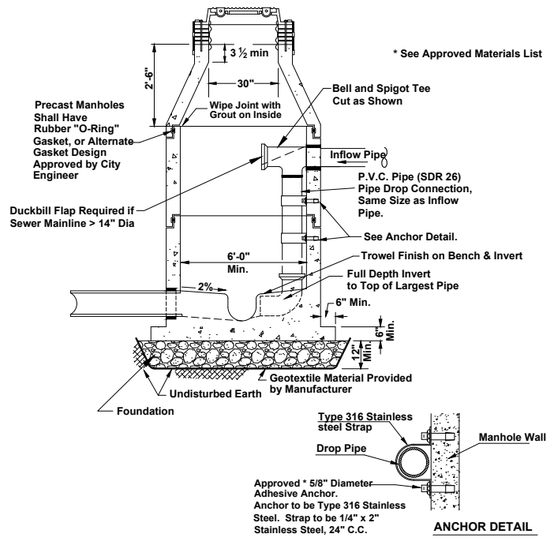
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-9



NOTES:
1. NO STEPS ALLOWED.

CAST-IN-PLACE MANHOLE

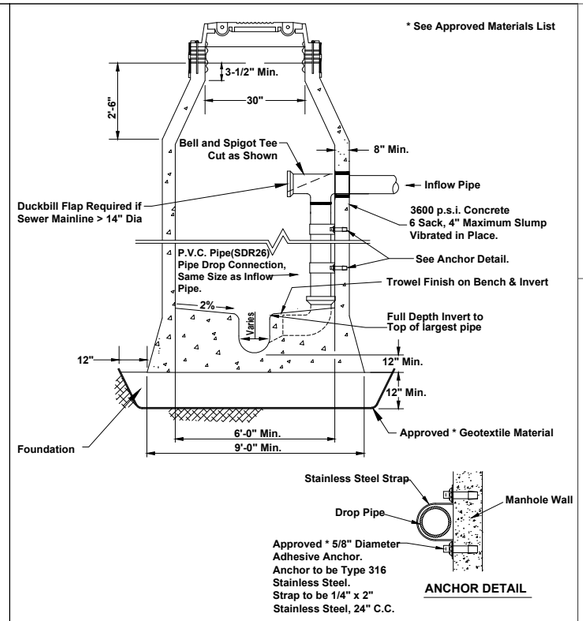
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-10



NOTES:
1. SEE PRECAST MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS .
2. NO STEPS ALLOWED.

PRECAST DROP MANHOLE

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-11



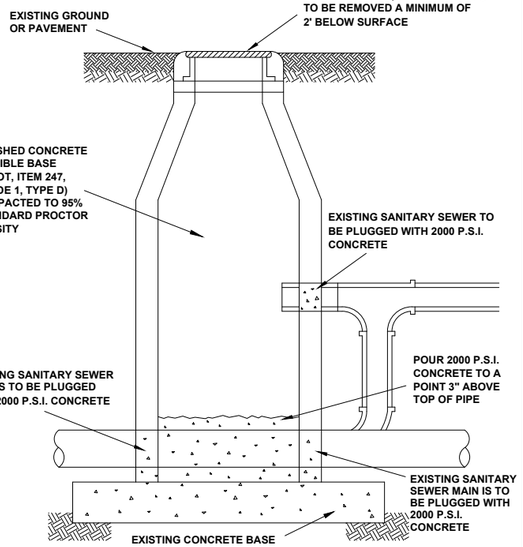
NOTES:
1. SEE CAST-IN-PLACE MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS .
2. NO STEPS ALLOWED.

CAST-IN-PLACE DROP MANHOLE

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-12

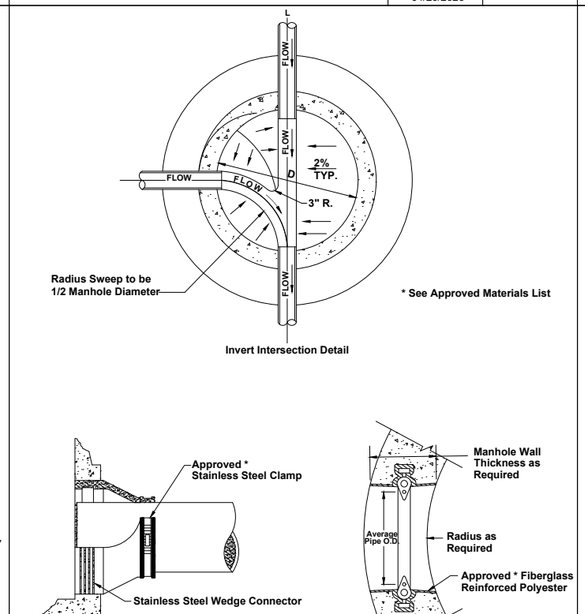
The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023



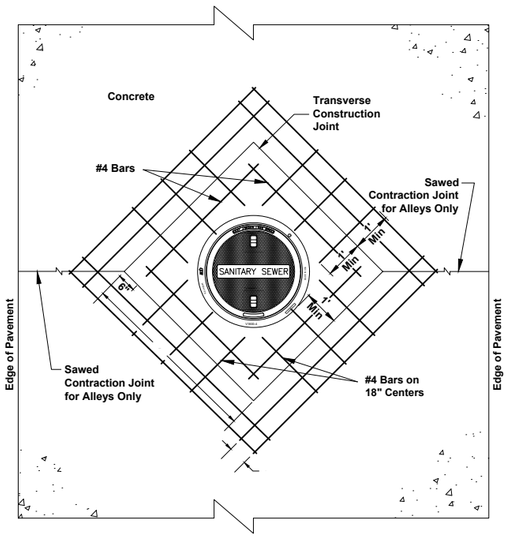
ABANDONED MANHOLE

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-13



MANHOLE INVERT AND CONNECTION

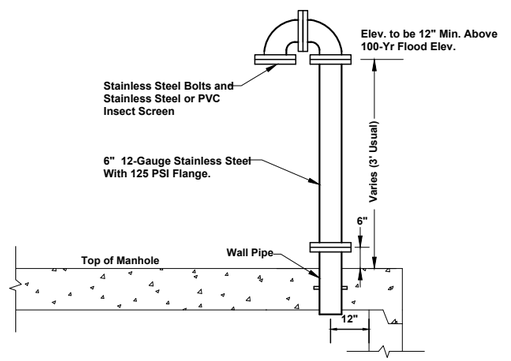
GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-14



NOTES:
1. FOR NEW PAVING ONLY.
2. DEPTH OF BLOCKOUT TO MATCH ROADWAY PAVEMENT DEPTH.
3. MANHOLE OD + 1' (6' FOR 5' DIAMETER MANHOLE, 7' FOR 6' DIAMETER DROP MANHOLE).

MANHOLE BLOCKOUT

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-15



NOTES:
1. USE ONLY WHEN SPECIFIED ON PLANS.
2. CHARCOAL CANISTER REQUIRED SEE APPROVED MATERIAL LIST.

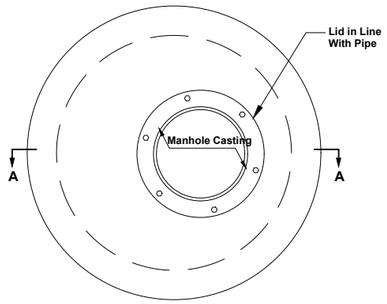
MANHOLE VENT

GENERAL DESIGN STANDARDS
STANDARD DETAILS
SCALE: N.T.S
REVISION DATE: 04/20/2026
SHEET: SS-16

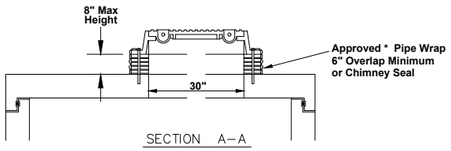
CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

SANITARY SEWER DETAILS 3
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026
SS-3
SHEET NO.

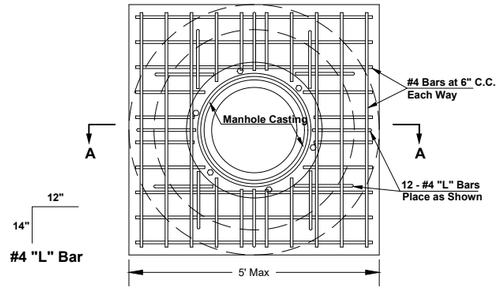


* See Approved Materials List

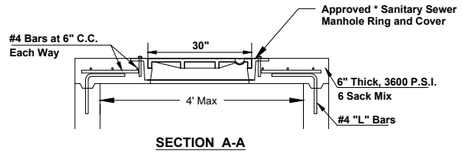


NOTES:
1. MANHOLE FLAT LIDS MUST BE LOAD RATED FOR HS-20 LOADINGS.
2. SEE CAST-IN-PLACE MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.
3. ALTERNATE: RING AND COVER MAY BE CAST IN TO THE LID PER DETAIL S-16.

PRECAST FLAT MANHOLE LID	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	SHEET: SS-17
		REVISION DATE: 04/20/2026	



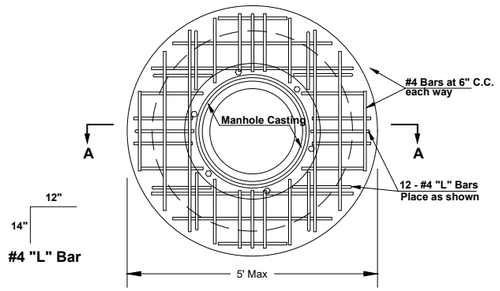
* See Approved Materials List



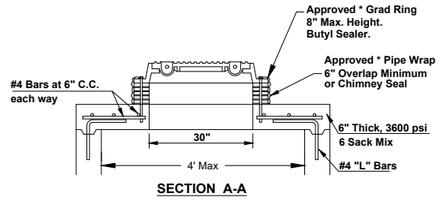
SECTION A-A

NOTES:
1. USE MUST BE APPROVED BY THE CITY ENGINEER. FOR IN STREET APPLICATION ONLY.
2. MANHOLE FLAT LIDS MUST BE LOAD RATED FOR HS-20 LOADINGS.
3. SEE CAST-IN-PLACE MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.

CAST-IN-PLACE FLUSH MANHOLE LID	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	SHEET: SS-18
		REVISION DATE: 04/20/2026	



* See Approved Materials List



* See Approved Materials List

SECTION A-A

NOTES:
1. USE MUST BE APPROVED BY THE DIRECTOR OF PUBLIC WORKS
2. FOR IN STREET APPLICATION ONLY
3. MANHOLE FLAT LIDS MUST BE LOAD RATED FOR HS-20 LOADINGS.
4. SEE CAST-IN-PLACE MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.

CAST-IN-PLACE MANHOLE LID	GENERAL DESIGN STANDARDS STANDARD DETAILS	SCALE: N.T.S	SHEET: SS-19
		REVISION DATE: 04/20/2026	

The City of SACHSE Public Works

STANDARD CONSTRUCTION DETAILS
PROJECT NO: GDS-2023

CITY OF SACHSE, TEXAS
DEPARTMENT OF PUBLIC WORKS
3815 SACHSE RD. BUILDING B
SACHSE, TX 75048
(469) 429-4787

SANITARY SEWER DETAILS 4
SHEET TITLE

DRAWN BY: CCC
SCALE: AS SHOWN
DATE: 04/20/2026

SS-4
SHEET NO.

Subject: **5. Consider approving an ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 9 "Traffic Regulations" by amending Section 9-6 "Parking" by amending 9-6A "Truck Parking" by amending 9-6A(1) "Unlawful"; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed Five Hundred Dollars ($500.00); and providing for an effective date.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion, Action
Fiscal Impact	None
Recommended Action	Approve an ordinance amending Chapter 9 Traffic Regulations.
Goals	Meet the public safety needs of a growing citizen; student; and business population.

BACKGROUND

Currently, the City has two areas with striped, on-street public parking: the PGBT zoning district and the Old Town zoning district. Under existing Ordinances, there are no specific restrictions on the type of vehicle or trailer that may use these marked spaces. While large semi-trucks, trailers, buses, and RVs are generally prohibited from parking on public streets within the city, the Ordinance does not explicitly address whether these restrictions apply to striped, on-street public parking areas.

Parking large vehicles in these designated spaces can reduce visibility for drivers and compromise pedestrian safety. The proposed Ordinance clarifies and updates the parking standards along public rights-of-way that include designated on-street parking to restrict the type of vehicles utilizing these spaces and ensure safety and accessibility. Specifically, it extends the existing prohibition to include all public streets with designated on-street parking, preventing large semi-trucks, trailers, buses, and RVs from parking in striped spaces as well as other public street areas.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Approve an ordinance amending Chapter 9 Traffic Regulations.

File Attachments
1. Presentation_Ch9 Traffic Amendment_FINAL
2. Ordinance_Amending Chapter 9 Traffic, Amending Section 9-6 Parking (Truck Parking)_FINAL

Traffic Regulations Ordinance Amendment

City Council

April 20, 2026

Request

- Consider an Ordinance of the City of Sachse, Texas, amending the Code of Ordinances by amending Chapter 9 "Traffic Regulations" by amending Section 9-6 "Parking" by amending 9-6A "Truck Parking" by amending 9-6A(1) "Unlawful“; providing for a repealing clause; providing for a severability clause; providing a savings clause; providing for a penalty of fine not to exceed Five Hundred Dollars ($500.00); and providing for an effective date

Background

- Under existing Ordinances, there are no restrictions on the type of vehicle or trailer that can park in striped, on-street parking spaces. As currently written, the parking of large semi-trucks, trailers, buses and RVs are not permitted on any public streets within the City. However, the existing Ordinance does not specify restrictions for striped public on-street parking spaces

- Proposed changes include amendments to restrict large semi-trucks, trailers, buses and RVs from parking along any public street, including striped on-street parking spaces

Recommendation

- Approve the Ordinance amending Chapter 9 Traffic Regulations as presented

Questions?

ORDINANCE NO. O-2026-___

AN ORDINANCE OF THE CITY OF SACHSE, TEXAS, AMENDING THE CODE OF ORDINANCES BY AMENDING CHAPTER 9 "TRAFFIC REGULATIONS" BY AMENDING SECTION 9-6 "PARKING" BY AMENDING 9-6A "TRUCK PARKING" BY AMENDING 9-6A(1) "UNLAWFUL"; PROVIDING FOR A REPEALING CLAUSE; PROVIDING FOR A SEVERABILITY CLAUSE; PROVIDING A SAVINGS CLAUSE; PROVIDING FOR A PENALTY OF FINE NOT TO EXCEED FIVE HUNDRED DOLLARS ($500.00); AND PROVIDING FOR AN EFFECTIVE DATE.

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SACHSE, TEXAS:

SECTION 1. The City of Sachse Code of Ordinances is amended by amending Chapter 9 "Traffic Regulations" by amending Section 9-6 "Parking", to read as follows:

"CHAPTER 3
TRAFFIC REGULATIONS

. . .

AMEND 9-6 AS FOLLOWS:

§ 9-6 Parking.

A. Truck Parking.

(1) Unlawful. It shall be unlawful for any person or any owner to leave, park, or stand any truck-tractor, road tractor, semi-trailer, pole trailer, bus, truck, or trailer (of any length or purpose), or towable or motorized recreational vehicle, upon any public street, public on-street parking, or highway within any area zoned as either single-family dwelling district, duplex district, multiple-family district, commercial district, industrial district, PGBT, or Old Town, according to the zoning ordinance of the city.

. . .

SECTION 2. All provisions of the Ordinances of the City of Sachse, Texas, in conflict with the provisions of this Ordinance be and the same are hereby, repealed, and that all other provisions of the Ordinances of the City of Sachse not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 3. Should any sentence, paragraph, subdivision, clause, phrase, or section of this Ordinance be adjudged or held to be unconstitutional, illegal, or invalid, the same shall not

affect the validity of this Ordinance as a whole or any part or provision thereof other than the part thereof decided to be unconstitutional, illegal, or invalid.

SECTION 4. An offense committed before the effective date of this Ordinance is governed by prior law and the provisions of the Ordinances of the City of Sachse, as amended, in effect when the offense was committed and the former law is continued in effect for this purpose.

SECTION 5. Any person, firm, or corporation violating any provisions or terms of this Ordinance shall be subject to the same penalty as provided for in the Code of Ordinances, as amended, and upon conviction shall be punished by a fine not to exceed the sum of Five Hundred Dollars ($500.00) for each offense, and each and every day such violation shall continue shall be deemed to constitute a separate offense.

SECTION 6. This Ordinance shall take effect immediately from and after its passage.

PASSED AND APPROVED by the City Council of the City of Sachse, Texas this the 20th day of April 2026.

APPROVED:

_____
Jeff Bickerstaff, Mayor

DULY ENROLLED:

_____
Leah K Granger, City Secretary

APPROVED AS TO FORM:

_____
Joseph J. Gorfida, Jr., City Attorney
(03-31-2026: FINAL 4896-4843-3053, v. 1)

G. Discussion Items

Subject: **1. Receive the quarterly 2021 Bond update.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion
Fiscal Impact	None
Recommended Action	Receive the quarterly 2021 Bond update.
Goals	Strategically invest in the City's existing and future infrastructure. Meet the public safety needs of a growing citizen; student; and business population. Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse.

BACKGROUND

The last 2021 Bond update was presented at the December 1, 2025, City Council meeting. Sachse residents approved four propositions on the November 2021 Bond Election ballot.

The projects include:

- Designing the expansion and upgrades to Sachse Road, from Miles Road to the city limits
- Upgrading and developing:
    - Bailey-Hooper Road, from SH 78 to Sachse Road
    - Williford Road, from SH 78 to Bailey Road
    - West Creek Lane, from Sachse Road to Timbercreek Court
- Reconstructing the City of Sachse neighborhood and residential streets within the city limits
- Design and construct a new City animal shelter to facilitate adoptions

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Receive the quarterly 2021 Bond update.

File Attachments
1. Presentation_Quarterly Bond Update_Apr_2026_FINAL

2021 Bond Projects Update

City Council

April 20, 2026

Overview

- Approved Bond Projects
- Bailey-Hooper Road
- Sachse Road Phase 2
- Sachse Road Phase 3
- Williford Road
- West Creek Lane
- Neighborhood Packages
- Future Bond Projects Timeline

Approved Bond Projects

Sachse residents voted to approve four propositions included on the November 2021 Bond Election ballot. The projects include:

- Designing the expansion and upgrades to Sachse Road, from Miles Road to the city limits
  - These updates include the construction of the road, along with associated sidewalks, drainage, signage, lighting, curbs, traffic safety improvements, landscaping, and more
- Upgrading and developing several City of Sachse streets and roads
  - This includes traffic safety, sidewalks and pedestrian rights-of-way (ROW), curbs and related drainage, utility relocations, and more. The roads or streets are:
    - Bailey-Hooper Road, from SH 78 to Sachse Road
    - Williford Road, from SH 78 to Bailey Road
    - West Creek Lane, from Sachse Road to Timbercreek Court

Approved Bond Projects

- Reconstructing City of Sachse neighborhood and residential streets within the city limits
  - This could include expanding the roads or streets, enhancing or creating sidewalks, intersections, providing lighting, traffic safety, drainage improvements, and more
- Design and construct a new City animal shelter to facilitate adoptions

Bailey-Hooper Road

- Project is approximately 90% completed
- Stormwater, Water, and Sanitary Sewer lines are completely installed
- Roadway paving is completed south of Williford Road to Sachse Road
- Roadway paving is completed from Vicuna Circle to SH 78
- Roadway paving from Williford Road to Creek Crossing was completed this month
- Contractor is completing remaining driveways, sidewalk, and trails. Sod will be laid once final grading is completed in these areas
- Anticipated completion is May 2026

Bailey-Hooper Road

Sachse Road Phase 2

- Limits: Miles Road to Merritt Road
- Consultant has finalized plans and contract documents
- City has made initial offers for ROW and easement acquisition
- Property appraisals are complete
- Staff has met with Dallas County to help coordinate franchise plans and relocations
- Construction anticipated in fall 2026

Sachse Road Phase 3

- Limits: Merritt Road to Country Club Drive
- Reconstruction of a two-lane asphalt road to a four-lane divided concrete street
- Utility and drainage systems will be upgraded/improved
- Proposed illumination, landscape, and pedestrian amenities will be included
- Staff awarded the design contract in December 2025
- Design began in January 2026
- Construction anticipated in spring 2028

Williford Road

- Limits: SH 78 to Bailey Road
- Consultant is working on 100% plans and documents
- Project includes major drainage improvements at Salmon Park
- City has made initial offers for ROW acquisition
- Construction anticipated in fall 2026

West Creek Lane

- Limits: Sachse Road to Timbercreek Court
- City received bids on March 31
- Staff will present recommended contractor on April 20
- Construction anticipated in summer 2026

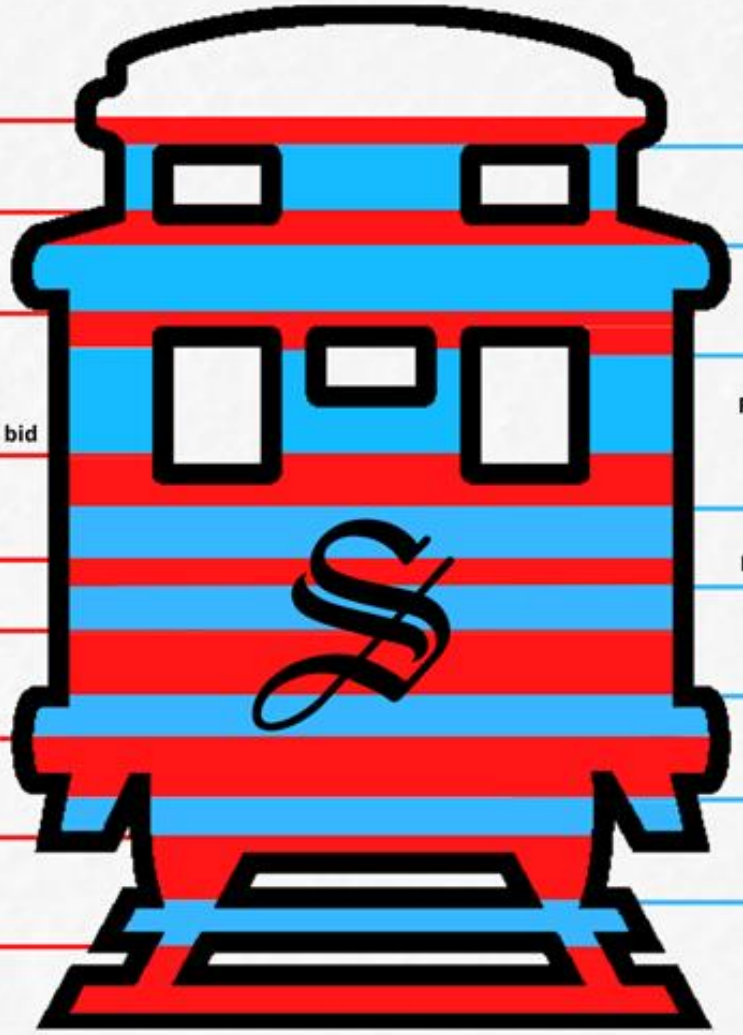
Neighborhood Packages

- Funding has been accelerated, and staff has prepared projects for construction in FY 2024-2025 and FY 2025-2026
- Projects awarded and under construction:
  - Industrial Drive/Park Lane – staff is currently working with property owners to finalize design
  - Ridgeview Drive and alley – start April 2026

SACHSE 2021 BOND

SAK[SEE] OUR PROGRESS

Bailey-Hooper Road



April 2026
Construction 90% completed

August 2025
Construction 25% completed

October 2024
Franchise relocation underway
Construction begins

May 2024
All project bids rejected. Revised contract language will allow the best-value bid to be selected rather than the lowest responsible bid

December 2023
Finalizing construction documents
On schedule to advertise Q1 of 2024

July 2023
60% plans submitted for staff review

January 17, 2023
City Council discussed conceptual layout of project

As of June 20, 2022
Topographic survey/
design survey 80% completed

January 18, 2022
Professional service agreement executed

December 2025
Construction 50% completed

April 2025
Construction 10% completed

August 2024
Construction contract awarded to McMahon Contracting LP

March 2024
Review of final plans and specifications have been completed
Advertising last week of March
Award construction contract in May

August 2023
Plan comments returned to consultant

April 6, 2023
Held open house for residents affected by the project

July 18, 2022
*Asphalt overlay project on Bailey Rd/Anthony Ln begins

As of June 20, 2022
Traffic counts completed

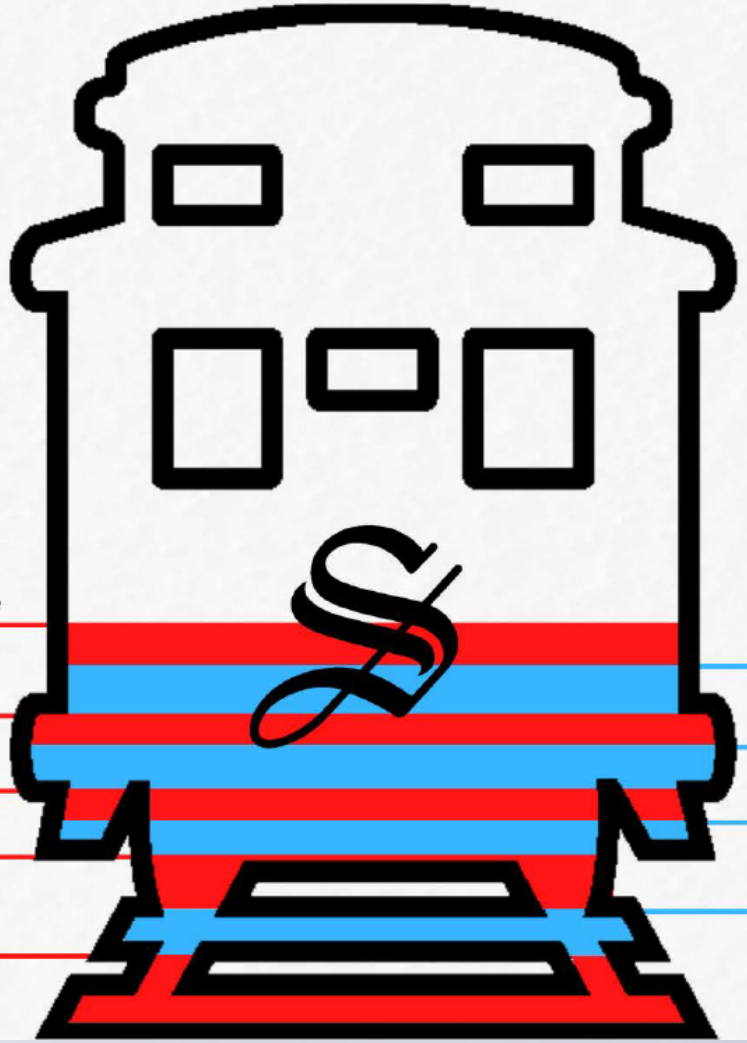
* Please note that this project was not funded by the bond

The City of SACHSE

SACHSE 2021 BOND

SAK[SEE] OUR PROGRESS

Sachse Road Phase 2



April 2026
Plans and contract documents finalized, property appraisals completed, and initial ROW and easement acquisition offers made

August 2025
90% design underway

November 2024
30% design underway

August 2024
Designs 30% completed

February 2024
Professional Services Agreement with Garver USA for design approved

December 2025
Consultant is working on final plans and contract documents

April 2025
Designs 60% completed

August 2024
Concept plans completed

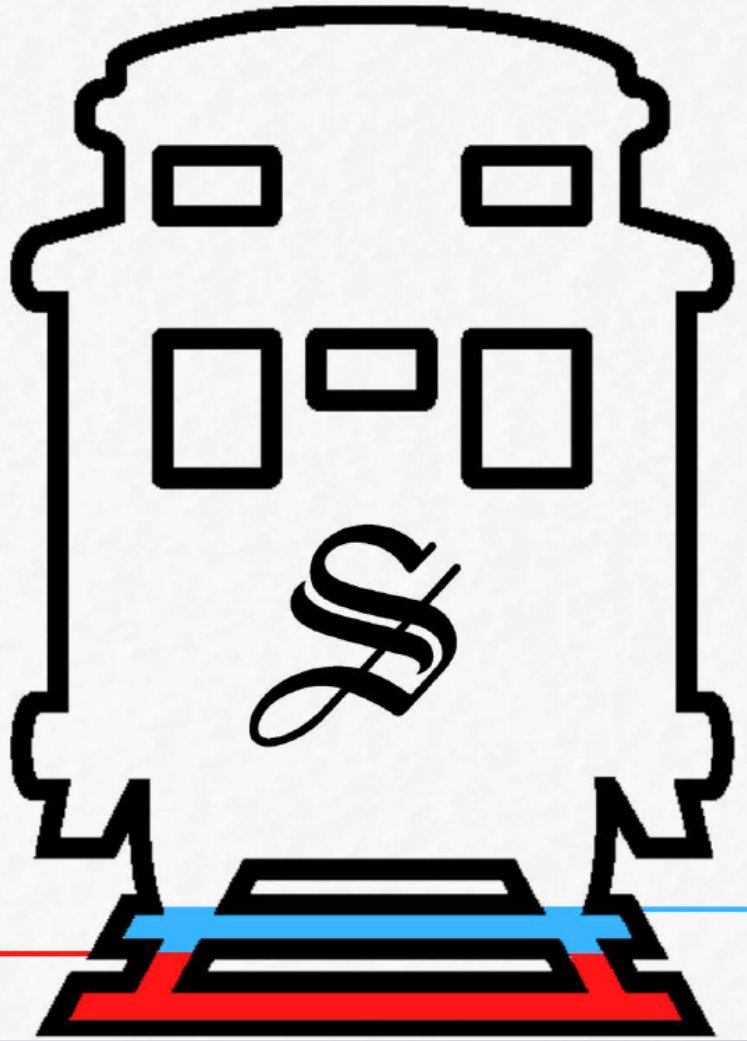
March 2024
Currently under design

The City of SACHSE

SACHSE 2021 BOND

SAK[SEE] OUR PROGRESS

Sachse Road Phase 3



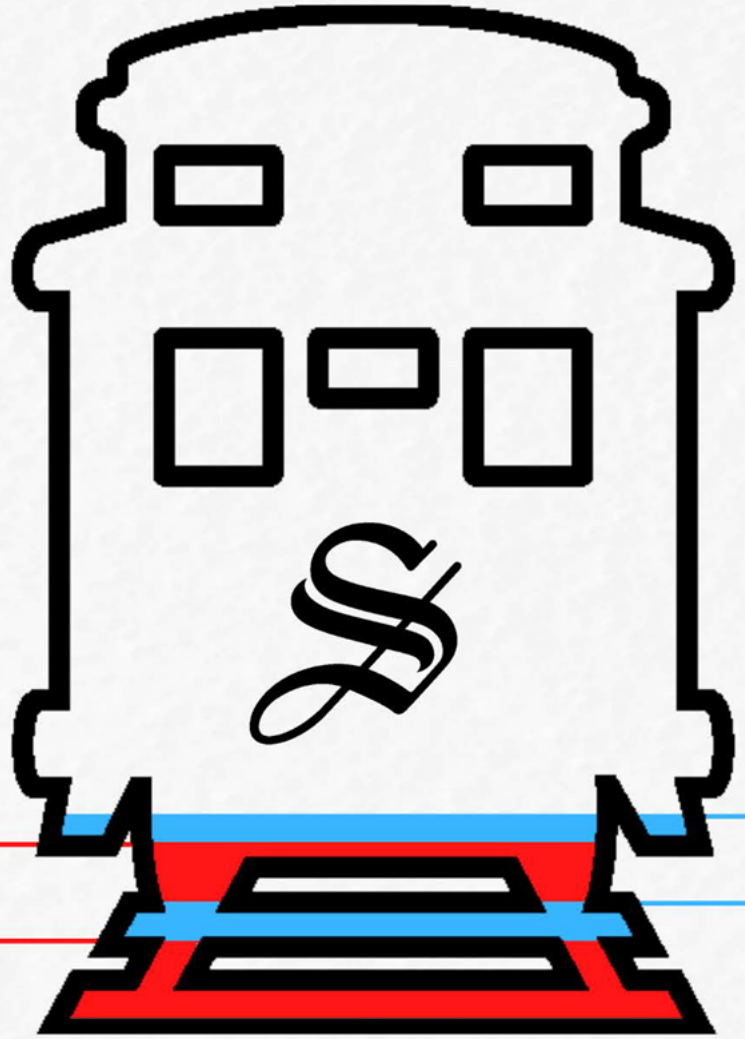
December 2025
Professional Services Agreement with Garver USA for design approved

April 2026
Currently under design

SACHSE 2021 BOND

SAK[SEE] OUR PROGRESS

Williford Road



December 2025
Designs 90% completed

April 2025
Working toward 30% construction plans

April 2026
Designs nearly completed, initial offers for ROW acquisition extended

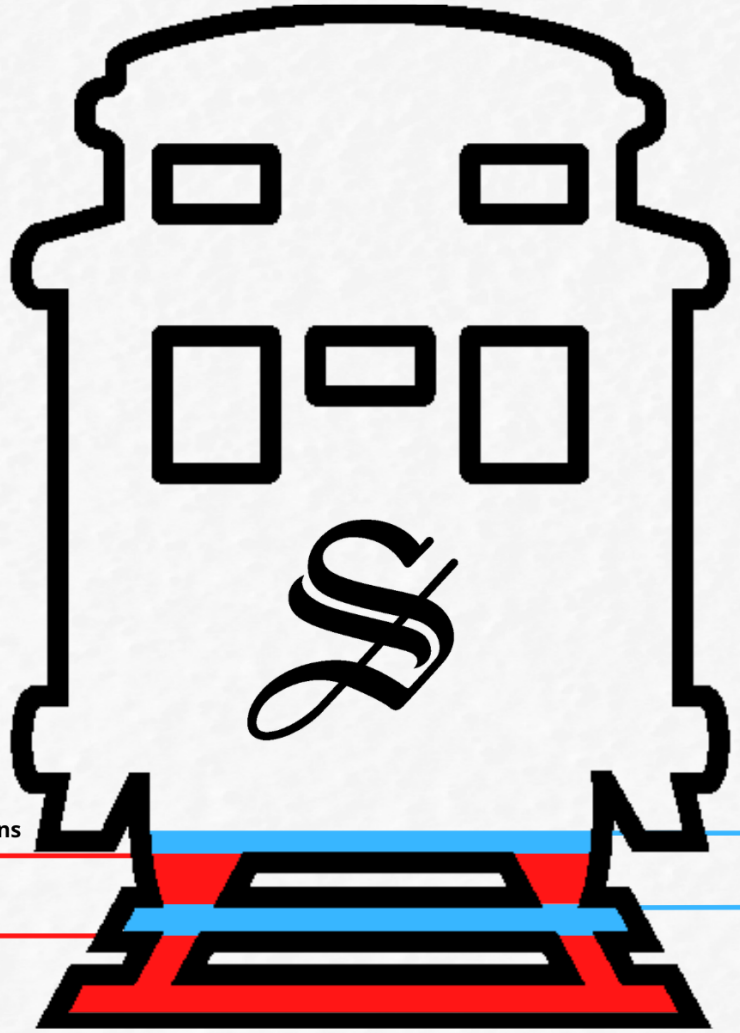
August 2025
Designs nearly 60% completed

The City of SACHSE

SACHSE 2021 BOND

SAK[SEE] OUR PROGRESS

West Creek Lane



December 2025
Design near completion. Beginning to coordinate franchise utilities relocation plans

April 2025
Working toward 30% construction plans

April 2026
Bids received, staff will present recommended contractor on April 20

August 2025
Designs nearly 90% completed

The City of SACHSE

Completed Bond Projects

- Sachse Animal Shelter
- Neighborhood Packages:
  - Creek Crossing
  - Rustic Ridge Street and alley
  - Alberta Circle
  - Cedar Creek Lane alley, Cedar Brook Court alley
  - Jewel Street alley
  - Maple Shade Avenue alley
  - Seventh Street

All information on the bond process can be found at www.cityofsachse.com/bond2021

G. Discussion Items

Subject: **2. Discuss the implementation of the Sachse Safe Paws program.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion, Reports
Fiscal Impact	None
Recommended Action	Discuss the implementation of the Sachse Safe Paws program.
Goals	Meet the public safety needs of a growing citizen; student; and business population.

BACKGROUND

The City of Sachse is launching the "Sachse Safe Paws Program" to improve the timely reunification of lost pets with their owners through microchip scanning. Currently, reunification efforts often rely on Animal Services or shelter intake, which can result in delays and increased shelter populations due to limited hours of operation and availability of staff. With the assistance of Sachse Fire-Rescue personnel, the Sachse Safe Paws Program will enable onsite microchip scanning when Animal Services facilities are closed, increasing the likelihood of immediate reunification between pets and their owners. To support and promote the program, the City will host a Sachse Safe Paws Microchip Event in partnership with the Friends of Rescue Animals (FRAs) organization on Saturday, May 2, from 10 AM to 1 PM at Fire Station #2, providing residents with an opportunity to have their pets microchipped at no cost.

The Sachse Safe Paws Program improves operational efficiency by increasing the likelihood of immediate pet reunification and reducing delays that occur when Animal Services facilities are closed. The program requires minimal resources, primarily limited to scanners and staff training, making it a cost-effective collaborative initiative. Clear procedures led by Sachse Fire-Rescue ensure public safety and consistent service delivery. Additionally, the program includes appropriate privacy safeguards by requiring owner's consent before sharing personal information.

This program is made possible through a collaborative effort between Sachse Fire-Rescue and Sachse Animal Services.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Discuss the implementation of the Sachse Safe Paws program.

File Attachments
1. Presentation_Sachse SafePaws_FINAL

Sachse Safe Paws Program

City Council Meeting

April 20, 2026

Overview

- Background
- Program Details
- Collaboration Opportunity
- Microchipping Event for Program Launch
- Next Steps

Background

- Owners of lost pets must often rely on Animal Services staff or Shelter intake for reunification as they are equipped with the required scanning devices to check microchips
- Delays in the process occur when pets are lost during non-operational Animal Shelter hours, in the evenings or on the weekends
- Since Sachse Fire-Rescue (SFR) operations are 24-7, the proposed program will help to provide more timely reunification of lost pets with their owners in Sachse
- Microchip scanners are relatively low-cost, and staff can provide the training on utilization for free

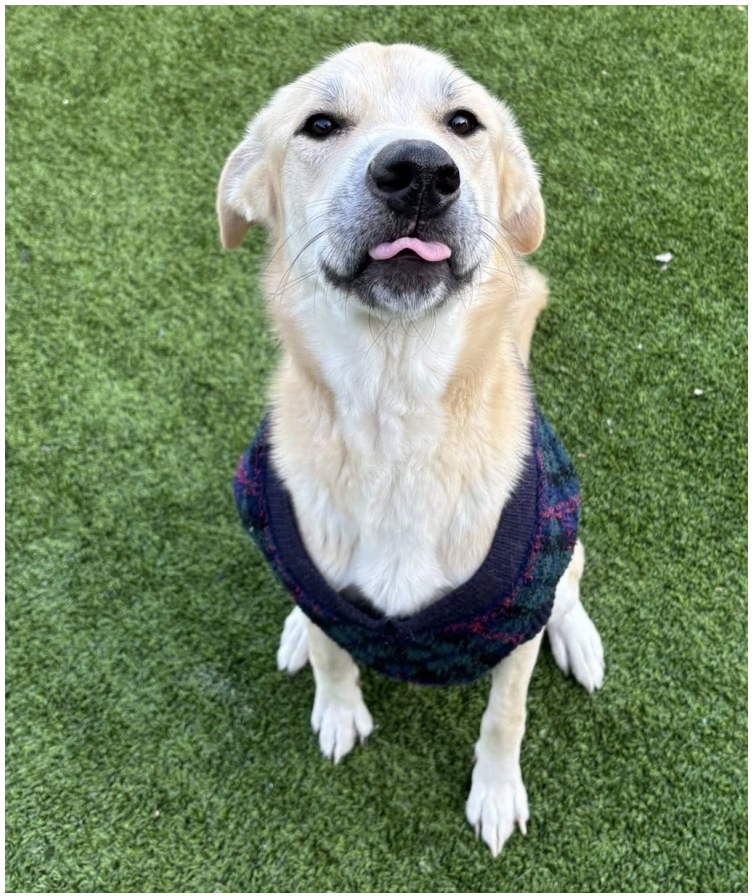
Program Details

- Fire Station 1 and 2 are now equipped with microchip scanners and staff have been trained on how to utilize the machines
- If a resident encounters a lost pet after-hours, they can bring them to either Fire Station 1 or Fire Station 2 to have the animal checked for a microchip
- If a microchip is in place, SFR staff will help the resident connect with the owner
- If no microchip is in place, the resident can bring the animal to the shelter during normal hours or SFR can arrange for the Animal Services on-call protocol to take the animal to the shelter

Program Details

- Important to note:
  - SFR personnel do not transport or house animals – this will not be a replacement for sheltering services
  - If the owner cannot be reached, Animal Services staff will assist as they currently do
  - Responding to a lost pet will be placed on hold if SFR staff are called out to an emergency
  - Animal Services will still be available for on-call, after-hours issues if needed—this program does not eliminate that function

Collaboration Opportunity



- As Sachse develops, staff will explore creative collaborations to offer low-cost services to residents
- This program is unique because it trains SFR personnel to handle pets, utilizing the 24-7 nature of their work to the better serve Sachse residents
- Opportunity for Animal Services to partner with public safety
- Opportunity to provide two new locations where residents can check for lost pets during the evenings and weekends when the Shelter is closed
- The intent is to make it easier to identify lost pets and reunite them with their owners

Microchipping Event for Program Launch

- To celebrate the launch of the program, the City will host a **free** microchipping event in partnership with the Friends of Rescue Animals (FRAS) organization, which currently supports the Sachse Animal Shelter
- The event will be held on Saturday, May 2, from 10 AM to 1 PM at Fire Station #2

Next Steps

- Sachse Safe Paws will officially launch on May 2, in tandem with the microchipping event
- Staff will promote the event on the City's social media platforms to make residents aware of the opportunity
- Be on the lookout for a special promotional video from with Sparky

Questions?

G. Discussion Items

Subject: **3. Receive the Sachse Public Library's 2025 year end review presentation.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion, Reports
Fiscal Impact	None
Recommended Action	Receive the Sachse Public Library's 2025 year end review presentation.
Goals	Provide a high quality of life environment for families; individuals; businesses; and other organizations in Sachse.

BACKGROUND

Sachse Public Library Manager Randall Cross will present highlights and key metrics from 2025.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Receive the Sachse Public Library's 2025 year end review presentation.

File Attachments
1. Presentation_Sachse Public Library_2025 Year End Review

2025 Year End Review
Sachse Public Library

City Council

April 20, 2026

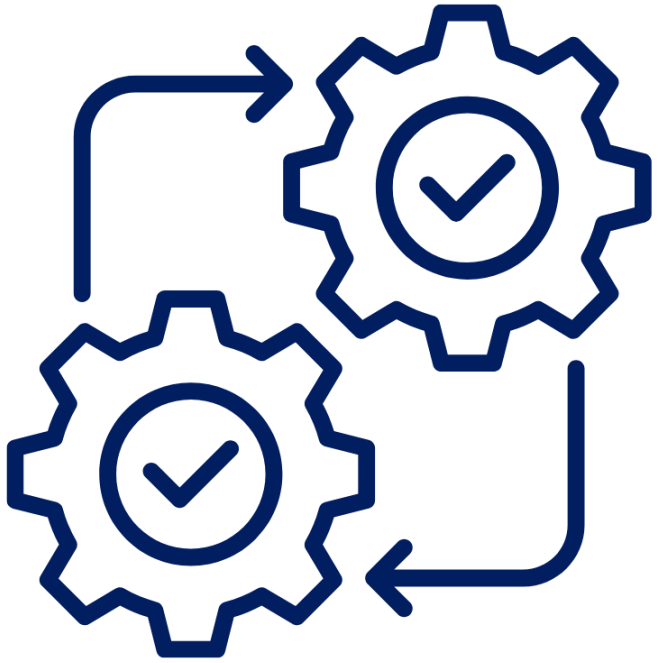
New in 2025

- Sustaining New Growth
  - FY 24-25 was the first, full fiscal year with the Library's expanded hours
  - Focus on maintaining a high level of service while sustaining increases in program attendance, daily visitors, and materials circulation
- Greater Collaboration within Leisure Services
  - Library and Community Center Summer Kickoff Event
  - Story Walk for Park and Recreation Month
  - Grandparents Day, led by Community Center, involved Animal Services, Library, and Senior Activity Center
  - Animal Services blanket drive and adoption promotion

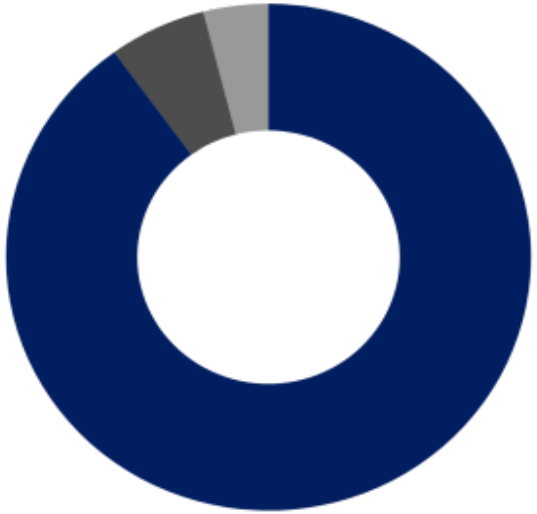
New in 2025

- New Library Newsletter
  - Monthly news and events in a mobile-friendly format
  - Welcome message to new patrons and event e-blasts
- Library Volunteers
  - Continued to refine the volunteer program with new ways to attract and engage participants
  - Volunteers contributed more than 900 service hours in 2025, double the previous year
- Libby: the New Reading App
  - Adopted Libby by OverDrive as the Library's primary means to enjoy eBooks and audiobooks

Why Libby?



Kindle Integration



Market Share

User Experience

2025 Additional Metrics

Physical items checked out

Visits to the Library

Attendees to Library events

New borrowers registered

What to Expect in 2026

- Summer Reading Program with Kickoff Event (May 29) and Summer Finale (July 31)
  - 2026 theme: Unearth a Story
- Return of E-Reads Texas program to offer even greater access to eBooks and audiobooks (launching very soon)
- Growing the Library of Things
  - Available now
    - New STEM kits: Raspberry Pi computers, snap circuits, and coding bots
    - Toniebox & Yoto Player kits for screen-free, audio-based learning
  - Coming this year
    - Expanding kits to teens and adults

SACHSE PUBLIC LIBRARY

2025 YEAR END REVIEW

The City of SACHSE

G. Discussion Items

Subject: **4. Discuss and review applications for the 2026 City of Sachse Scholarship.**

Meeting	April 20, 2026 - City Council Meeting
Access	Public
Type	Discussion
Fiscal Impact	None
Recommended Action	Discuss, review, and provide direction for a recipient for the 2026 City of Sachse Scholarship.
Goals	Provide excellent government services to Sachse citizens.

BACKGROUND

The City of Sachse's contract with Community Waste Disposal (CWD) provides for $1,000 to be used for a scholarship to a local high school senior residing in Sachse. This is the 13th year of the City of Sachse Scholarship. Staff received 11 applications, reviewed the submittals, and narrowed those down to the top three candidates for the City Council to review and select the next recipient.

POLICY CONSIDERATIONS

There are no policy considerations affiliated with this item.

RECOMMENDATION

Discuss, review, and provide direction for a recipient for the 2026 City of Sachse Scholarship.

File Attachments
None