THIS IS A DRAFT AND WILL BE REPLACED BY THE FINAL, SIGNED ORDINANCE OR RESOLUTION ADOPTED BY CITY COUNCIL.

AN ORDINANCE

AMENDING CHAPTER 35, UNIFIED DEVELOPMENT CODE, OF THE CITY CODE OF SAN ANTONIO, TEXAS, BY CORRECTING CLERICAL AND FORMATTING ITEMS; MAKING MAJOR AMENDMENTS; MAKING MINOR AMENDMENTS; CLARIFYING ITEMS; AND AMENDING DEFINITIONS; PURSUANT TO SECTION 35-111 OF THE UNIFIED DEVELOPMENT CODE, AND PROVIDING FOR PUBLICATION.

* * * * *

WHEREAS, in response to regulations enacted by the U.S. Environmental Protection Agency ("EPA") in November 1990 requiring the City of San Antonio to develop storm water drainage plans, services, and programs, on May 13, 1993, the City Council passed Ordinance No. 77949 in order to provide funding to meet federal storm water regulations and to protect the public health and safety from loss of life and property caused by surface water overflows, surface water stagnation, and pollution arising from nonpoint source runoff within the city; and

WHEREAS, Ordinance No. 77949 established a schedule of storm water drainage rates based on the cost of providing drainage service to benefitted properties within the San Antonio city limits and directed the San Antonio Water System ("SAWS") to collect the drainage fees as an agent for the City using its billing system; and

WHEREAS, the storm water drainage system was not integrated into the SAWS sewer system, but was a City operated municipal separate storm sewer system ("MS4") dedicated to providing collection and conveyance of storm water, rain water, flood water, or other surface water into area rivers and basins consistent with state and federal regulations implemented to protect surface water quality; and

WHEREAS, Chapter 552, Subchapter C of the Local Government Code, known as the Municipal Drainage Utility Systems Act, permits municipalities to establish a municipal drainage utility system to protect the public safety in municipalities from loss of life and property caused by surface water stagnation, and pollution arising from nonpoint source runoff within the boundaries of the established service area; and

WHEREAS, by Ordinance No. 86711, Appendix A, adopted on September 25, 1997, the City Council declared the drainage of the City to be a public utility to be known as the City of San Antonio Drainage Utility ("Drainage Utility"), pursuant to the authority of Chapter 402, Subchapter C of the Local Government Code (now Chapter 552, Subchapter C); and

WHEREAS, in Ordinance No. 86711, Appendix A, the City Council dedicated to the Drainage Utility all present and future City owned property (real and personal), facilities, materials, and supplies constituting the City's drainage system to be used for the purpose of the Drainage Utility; and

WHEREAS, Ordinance No. 86711 authorized the assessment on every benefitted property within the service area of the Drainage Utility, the "storm water drainage service fee", a monthly usage fee originally created by Ordinance No. 77949; and

WHEREAS, the storm water drainage fee has been increased seven times since 1993 and most recently in Ordinance No. 2015-09-10-0761, adopted on September 10, 2015, in order to support the Drainage Utility's cost of service; and

WHEREAS, the City Council finds that pursuant to the Local Government Code, Section 552.045:

(a) it has the authority to establish a revised schedule of drainage charges imposed on all benefitted properties within the City limits based on the requirements outlined in Subchapter C, Chapter 552, Texas Local Government Code ("Subchapter C");

(b) the Drainage Utility will continue to provide drainage service to all benefitted properties within the City limits supported by drainage charges, subject to certain properties exempted in accordance with Subchapter C;

(c) the Drainage Utility will offer drainage service on nondiscriminatory, reasonable, and equitable terms; and

WHEREAS, approval of this Ordinance is a continuation of the City policy to implement and provide for the safety and welfare of its citizens; and

WHEREAS, the San Antonio City Council adopted the revised Unified Development Code on May 3, 2001 and reenacted the Unified Development Code, 2005 Edition on September 22, 2005; and

WHEREAS, Section 35-111 requires that requests for amendments to City Code, Chapter 35, the "Unified Development Code" be submitted every five years to the Zoning Commission and the Planning Commission; and

WHEREAS, public hearings were held after notice and publication regarding these amendments to the Unified Development Code at which time parties in interest and citizens were given an opportunity to be heard; and

WHEREAS, on October 19, 2015 the Board of Adjustment held a public hearing and made recommendations pertaining to these amendments; and

WHEREAS, on October 20, 2015 the Zoning Commission held a public hearing and made recommendations pertaining to these amendments; and

WHEREAS, on October 21, 2015 the Historic Design and Review Commission held a public hearing and made recommendations pertaining to these amendments; and

WHEREAS, on October 28, 2015 the Planning Commission held a public hearing and made recommendations pertaining to these amendments; **NOW THEREFORE**,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SAN ANTONIO:

SECTION 1. Chapter 35 of the City Code of San Antonio, Texas, the Unified Development Code, is hereby amended by adding language that is underlined (added) and deleting the language that is stricken (~~deleted~~) to the existing text as set forth in this Ordinance.

SECTION 2. Chapter 35 of the City Code of San Antonio, Texas is hereby amended as follows:

Chapter 35, Article II, Section 35-202 is amended as follows:

Sec. 35-202. Conventional and Enclave Subdivision.

STATEMENT OF PURPOSE

The purpose of this section is to establish criteria and procedures for the processing of ~~single-family residential~~ subdivisions consisting of ~~"conventional subdivisions" with public streets and~~ "enclave subdivisions" with private streets constructed to public street standards and "conventional subdivisions" with public streets. This conventional use pattern has been the dominant pattern of development in many areas in Texas and the United States during the past fifty (50) years while the enclave subdivision is a predecessor to older municipal and county codes in Texas which allow for the subdivision of property with private streets. Conventional and enclave subdivisions often may feature curvilinear streets and culs-de-sac, few points of access into the subdivision, and large yards

(a) **Applicability.** The provisions of this section apply to any application for subdivision plat approval for a ~~conventional~~ subdivision with public streets or ~~an enclave subdivision with~~ private streets within a base zoning district or within the ETJ, except as otherwise provided in this chapter. For the purpose of this chapter as it applies in the ETJ, the term "conventional" applies to subdivisions with public streets and the term "enclave" applies to subdivisions with private streets following public street standards. The description "enclave" shall be prominently indicated on the subdivision plat when a subdivision with private streets is proposed following the standards outlined below.

* * * * *

(c) **Size and Location of Site.** There is no minimum size for conventional or enclave subdivisions. Enclave subdivisions within a base zoning district ~~but there~~ shall be a maximum size ~~limit~~ of one hundred fifty (150) acres ~~for enclave subdivisions~~.

* * * * *

(n) **Outdoor Storage.** Conventional and enclave subdivisions shall comply with the outdoor storage standards of this chapter. The provisions of this subsection do not apply to the city's extraterritorial jurisdiction.

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Chapter 35, Article II, Section 35-209 is amended as follows:

Sec. 35-209 Form Based Development.

(a) **General to All Plans.**

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(2) **Process.**

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D. The CRC shall issue a recommendation for approval or denial of master development pattern plans, zoning site plans, ~~plats, and~~ building plans, and, if requested, plats to the approval authority for the respective application.

* * * * *

(3) **Variances and Special Exceptions.**

A. Variances shall be granted only by the board of adjustment or planning commission. Variances to subsections 35-209(b), 35-209(c)(1)(F), 35-209(c)(6), 35-209(c)(7), and 35-209(c)(8) shall be heard by the planning commission. All other variances shall be heard by the board of adjustment. Notwithstanding the preceding or anything else herein to the contrary, exceptions to subsection 35-209(e) will be considered "special exceptions" to be heard by the board of adjustment.

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(c) **Development Patterns.**

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(8) **Thoroughfare Requirements.**

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B. **Thoroughfares**

8. **Alleys.**

a. All lots in T5 and T6 (other than T5-1, T6-1, and T6-2) shall be accessed from an alley. Exemptions shall be made for lots in an infill development pattern that do not abut a pre-existing alley, if lots meet at least one (1) of the following conditions:

* * * * *

D. **Public Frontages.**

1. Public frontages shall be designed as shown in tables (tables 209-6E, 209-6F and 209-18) and allocated within transect zones as specified in table 209-18.

2. Within the public frontages, the prescribed type of streetscape trees and street lights shall be as shown in table 209-6 (public frontage), 209-8

(street lights), 209-21 (street trees and streetscape trees) and 209-18 (summary).

~~3. Public frontage streetscape trees shall avoid placement within utility easements.~~

E. **Public Frontages by Transect.**

1. The public frontage in T1 and T2 (tables 209-6E, 209-6F and 209-18) shall include trees of various species as listed in table 209-21, naturalistically clustered, as well as understory. The introduced landscape shall consist primarily of native species requiring minimal irrigation, fertilization and maintenance (table 209-21).

2. The public frontage in T3 (tables 209-6E, 209-6F and 209-18) shall include trees of various species as listed in table 209-21, (no more than twenty-five (25) percent of any single species), naturalistically clustered, as well as low maintenance understory. The overall number of trees shall be determined by the ratio of one (1) tree per thirty (30) linear feet lot frontage. The introduced landscape shall consist primarily of native species and shall be established by drip irrigation (table 209-21). ~~Single trees shall require a tree well of at least one hundred (100) square feet (e.g. five (5) feet by twenty (20) feet); c~~Clustered tree wells shall be approved on a site by site basis. Parts of the tree well may be capped with pervious or impervious materials as permitted by approval of the city arborist.

3. The public frontage in T4 (tables 209-6E, 209-6F and 209-18) shall include trees of various species as listed in table 209-21, (no more than twenty-five (25) percent of any single species), naturalistically clustered, or regularly spaced in allee pattern with shade canopies of a height that, at maturity, clears first floor owning but remains predominantly clear of building frontages. The overall number of trees shall be determined by the ratio of one (1) tree per thirty (30) linear feet lot frontage. The introduced landscape shall consist primarily of durable species tolerant of soil compaction (table 209-21). ~~Single trees shall require a tree well of at least one hundred (100) square feet (e.g. five (5) feet by twenty (20) feet);~~ Clustered ~~clustered~~ tree wells are also an option and shall be approved on a site by site basis. The number of trees required shall be reduced by twenty (20) percent if understory is provided. Parts of the tree well may be capped with pervious or impervious materials as permitted by approval of the city arborist.

4. The public frontage in T5 (tables 209-6E, 209-6F and 209-18) shall include trees of various species as listed in table 209-21, (no more than twenty-five (25) percent of any single species), naturalistically clustered, or regularly spaced in allee pattern with shade canopies of a height that, at maturity, clears first floor, but remains predominantly clear of building frontages. The overall number of trees shall be determined by the ratio of one (1) tree per thirty (30) linear feet lot frontage. The introduced landscape shall consist primarily of durable species tolerant of soil compaction (table 209-21). ~~Single trees shall require a tree well of at least~~

~~one hundred (100) square feet (e.g. five (5) feet by twenty (20) feet);~~ Clustered ~~clustered~~ tree wells shall be approved on a site by site basis. Parts of the tree well may be capped with pervious or impervious materials as permitted by approval of the city arborist.

5. The public frontage in T6 (tables 209-6E, 209-6F and 209-18) shall include trees of various species as listed in table 209-21, (no more than twenty-five (25) percent of any single species), naturalistically clustered, or regularly spaced in allee pattern with shade canopies of a height that, at maturity, clears the first floor (unless such height conflicts with government rule, law, ordinance or other policy) ~~three (3) stories~~ but remains predominantly clear of building frontages. The overall number of trees shall be determined by the ratio of one (1) tree per thirty (30) linear feet lot frontage. The new landscape shall consist primarily of durable species tolerant of soil compaction (table 209-21). ~~Single trees shall require a tree well of at least one hundred (100) square feet (e.g. five (5) feet by twenty (20) feet);~~ Clustered ~~clustered~~ tree wells shall be approved on a site by site basis. Parts of the tree well may be capped with pervious or impervious materials as permitted by approval of the city arborist.

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(10) **Specific Designations.**

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8. Stepback Frontage/Cornice Line. A designation of mandatory stepback frontage requiring that building heights not exceed a specific height along the entire length of the frontage and through a specific depth of the building. Such designation may permit a Cornice Line in lieu of a stepback.

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(e) **Building-Scale Plans.**

(2) General to T2—T6 and SD.

A. Building Disposition.

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8. Setbacks for principal buildings shall be as shown in table 209-18. Notwithstanding the preceeding, if one (1) or more of the following conditions is present, then the Maximum setbacks for principal buildings shall be increased to the extent necessary to accommodate such existing easement(s) or to comply with such conflicting governmental law(s), rule(s), ordinance(s) or policy:~~. Maximum setbacks for principal buildings shall be increased in accordance with the following provisions:~~

~~a. A maximum setback for a principal building shall be increased by fifty (50) percent if one (1) or more of the following conditions is present:~~

i. Recorded easement held by the City of San Antonio, Bexar County, Texas Department of Transportation, City Public Service Energy, San Antonio Water System or other utility provider (including telephone or cable television) is present and would prevent compliance with the setback requirements hereunder. ~~between the minimum and maximum setbacks and the easement holder has provided written verification that the easement cannot be relocated or removed,~~

ii. A governmental law, rule, ordinance, or policy would prevent compliance with the setback requirements hereunder.

iii.~~ii.~~ Structure designated as a City of San Antonio historic landmark, National Register landmark, state historic landmark, or state archaeological landmark is present between the minimum and maximum setbacks and will be preserved,

iv.~~iii.~~ An existing slope exceeding ten (10) percent is present between the minimum and maximum setbacks and will be maintained, or

v.~~iv.~~ An existing pedestrian connection to the river is present and will be retained or a new pedestrian connection to the river will be constructed between the minimum and maximum setbacks.

vi.~~v.~~ If a significant or heritage tree is present between the minimum and maximum setbacks and will be preserved.

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B. Building Configuration.

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3. Where minimum stories of two (2) or more are prescribed by table 209-18, single-story buildings are permitted if they conform to all of the following requirements:

a. The single-story buildings are no more than forty (40) percent of a linear block face

b. The single-story buildings are not located within sixty (60) feet from a street intersection

c. The building is replacing a single story building that is being demolished in connection with the development of the new building.

C. Building Function.

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4. Manufacturing, production, warehousing, wholesale, storage, processing, assembly, and extraction functions shall be determined to be light or heavy within the context of FBZD based on the following performance criteria. If a function conforms with all of the criteria listed in subsection (e)(2)(c)(4)(a) through (m), it shall be determined to be light industrial. If

it does not conform to one (1) or more of the criteria, it shall be determined to be heavy industrial.

a. The use of vehicles with two (2) or more rear axles and/or vehicles that require a Texas commercial drivers license is limited to:

   i. The hours between 6:00 a.m. and 6:00 p.m.

   ii. Fifteen (15) trips per day.

b. The commercial use of vehicles with one (1) rear axle, excluding employees' personal vehicles, is limited to:

   i. The hours between 4:00 a.m. and 10:00 p.m.

   ii. Fifteen (15) trips between 4:00 a.m. and 10:00 p.m. per day.

c. No outdoor storage, outdoor disposal containers (unless located in a rear alley and adequately screened), outdoor operations, or outdoor loading docks.

~~d. Between the hours of 6:00 a.m. and 6:00 p.m., noise levels measured at the property line do not exceed:~~

~~i. The existing background broadband sound pressure level by more than seven (7) dBA.~~

~~ii. A broadband sound pressure level greater than sixty (60) dBA.~~

~~e. Between the hours of 6:01 p.m. and 5:59 a.m., noise levels measured at the property line do not exceed:~~

~~i. The existing background broadband sound pressure level by more than three (3) dBA.~~

~~ii. A broadband sound pressure level greater than forty-five (45) dBA.~~

d.~~f.~~ Exterior lighting conforms to the following criteria:

   i. Lighting fixtures are shielded with a cutoff of less than ninety (90) degrees. All structural parts of the fixture providing the ninety (90) degree cutoff angle are permanently affixed to the general light structure.

   ii. Fixtures with a lamp or lamps rated at a total of more than one thousand eight hundred (1,800) lumens, and flood lamps rated at a total of more than nine hundred (900) lumens, do not emit any direct light above a horizontal plane through the lowest direct-light-emitting part of the fixture.

   iii. All lighting is aimed, located, designed, shielded, fitted and maintained so as not to project light into a neighboring use or property.

   ~~iv. Flood lamps and the light source they emit are not visible from the thoroughfare.~~

   ~~v. All exterior lighting and all lighting or glare resulting from industrial processes are installed and/or shielded in such a~~

~~manner that the light source is obscured to prevent glare on thoroughfares and other properties.~~

e.~~g.~~ At any time and at any point on the property line, ground vibrations do not exceed the limits of displacement prescribed in table 209-16.

f.~~h.~~ No air contaminants (such as, but not limited to, dust, ash, vapor, carbon, pollen, or other air pollutants) are discharged into the air.

g.~~i.~~ No smoke is discharged into the atmosphere.

h.~~j.~~ No refuse is incinerated.

i.~~k.~~ No liquids are disposed onto the site or into adjacent drainage systems, except for sanitary waste.

j.~~l.~~ At the property line, odor does not exceed toxic odor thresholds established by ASTM International E679-04.

k.~~m.~~The following materials are prohibited:

i. Radioactive or fissionable materials.

ii. Forbidden materials as defined in 49 CFR Ch. 1, § 173.21.

iii. Forbidden explosives as defined in 49 CFR Ch. 1, § 173.54.

iv. Materials classified as 1.1 Explosives (with a mass explosion hazard) as defined in 49 CFR Ch. 1, § 173.50.

v. Materials classified as 1.2 Explosives (with a mass projection hazard) as defined in 49 CFR Ch. 1, § 173.50.

vi. Materials classified as 4.2 Spontaneously combustible material as defined in 49 CFR Ch. 1, § 173.124.

D. Parking Standards.

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4. Parking lots shall be masked at the frontage(s) by a building or streetscreen. In lieu of a building or streetscreen, parking lots ~~in T2, T3, and T4~~ may be masked at the frontage(s) by dense native landscaping that will achieve a minimum height of three (3) feet and form an opaque visual barrier at maturity.

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8. Primary use parking lots may be permitted on A-Grid streets with a Specific Use Authorization in accordance with table 209-13B if the primary use parking lot would facilitate the development of surrounding lots where parking placement is limited due to lot size, shape, configuration, location, or access. Primary use parking lots permitted by a specific use authorization shall comply with the following requirements as well as any standards, conditions, or requirements imposed by city council in the zoning ordinance or required by this chapter to protect the public interest and welfare.

a. Parking areas shall not be located within ten (10) feet of the primary frontage or within the minimum front building setback, whichever is greater.

b. Primary use parking lots shall be masked along the primary, secondary, and river frontages by a streetscreen.

c. Parking lot shading and screening shall be required and shall be installed in accordance with the standards outlined in 35-511(c)(7) and (e)(3).

d. Exterior lighting shall conform to the following criteria:

i. Lighting fixtures are shielded with a cutoff of less than ninety (90) degrees. All structural parts of the fixture providing the ninety (90) degree cutoff angle are permanently affixed to the general light structure.

ii. Fixtures with a lamp or lamps rated at a total of more than one thousand eight hundred (1,800) lumens, and flood lamps rated at a total of more than nine hundred (900) lumens, do not emit any direct light above a horizontal plane through the lowest direct-light-emitting part of the fixture.

iii. All lighting is aimed, located, designed, shielded, fitted and maintained so as not to project light into a neighboring use or property.

~~iv. Flood lamps and the light source they emit are not visible from the thoroughfare.~~

E. Architectural Standards.

1. Streetscreens shall be made of brick, stucco, ~~or~~ masonry or other material that complements ~~to match~~ the facade of the principal building.

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G. Sign Standards.

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(4) **Specific to General Urban Zones (T4).**

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D. (T4) Parking Standards.

1. All parking areas shall be located in the second and/or third lot layers.

2. Parking areas in the second lot layer are only allowed as follows:

~~a. At mid-block location. Mid-block locations shall be a minimum of sixty (60) feet from either street intersection and shall be masked at the frontage by a liner building or streetscreen~~

~~b. In parking structures above the first story.~~

a. As Primary Use Parking Lots.

b. As Parking Structures that are masked with a Streetscreen; or

c. Above the first floor of Parking Structures that are masked with a Liner Building.

~~3. Garages shall be located in the third lot layer as illustrated by table 209-10D and table 209-10E.~~

3.~~4.~~ Parking may be accessed from the primary frontage by means of a driveway.

4. Parking structures shall have either of the following along the primary frontage and (to the extent the property has river frontage) along the river frontage: (i) a Liner Building, or (ii) a Streetscreen.

For river frontage only, if a Streetscreen is used to mask a Parking Structure, the Streetscreen must be the full height of the Parking Structure. Additionally, for the river frontage only, if a Liner Building is used to mask a Parking Structure, then: (i) the Liner Building must be the full height of the Parking Structure, or (ii) a full height Streetscreen must be installed above the Liner Building to mask any parking above the height of the Liner Building

In the event a Streetscreen or Liner Building is used to mask a Parking Structure on the Primary Frontage, the height of such Liner Building or Streetscreen shall be as otherwise provided herein.

~~5. Parking structures shall have a liner building of at least two (2) stories in height and twenty-five (25) feet in depth on the primary and secondary frontages, or the primary and river frontages for properties with river frontage. In lieu of a liner building, at least the first and second stories of a parking structure shall be enclosed. The first story shall be enclosed to a minimum depth of twenty-five (25) feet and the façade detailed as a shopfront. The second story shall be enclosed and the façade detailed in accordance with the (T4) Architectural Standards.~~

* * * * *

(5) Specific to Urban Center Zones (T5).

A. (T5) Building Disposition.

1. Stoops, lightwells, balconies, bay windows and terraces may encroach one hundred (100) percent of the depth of the first lot layer.

2. Awnings, arcades, and galleries may encroach the sidewalk to within two (2) feet of the curb but must clear the sidewalk vertically by at least eight (8) feet.

3. Loading docks, service entrances, and service yards shall be located in the third lot layer and shall only be accessed through the alley when an abutting alley is provided on the MDPP. If an alley is not provided on the MDPP or if the subject property is exempt from the requirement of alley access per 35-209(c)(8)B8, ~~the alley is pre-existing and meets one (1) or more of the conditions in 35-209(c)(8)B.8f., -~~loading docks, service

entrances, and service yards may be accessed from the primary or secondary frontage by means of a driveway.

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D. (T5) Parking Standards.

1. All parking areas shall be located in the second and/or third lot layer as illustrated in table 209-10D and table 209-10E.

2. Parking areas in the second lot layer are only allowed as follows:

a. As Primary Use Parking Lots;

~~a. At mid block location. Mid block locations shall be a minimum of sixty (60) feet from either street intersection and shall be masked at the frontage by a liner building or streetscreen~~

b. As Parking Structures that are masked with a Streetscreen; or

~~b. In parking structures above the first story.~~

c. Above the first floor of Parking Structures that are masked with a Liner Building.

~~3. Garages shall be located in the third lot layer~~

3.~~4.~~ Parking shall be accessed from an alley when an abutting alley is provided on the MDPP. If an alley is not provided on the MDPP or if the subject property is exempt from the requirement of alley access per 35-209(c)(8)B.8., ~~the alley is pre-existing and meets one (1) or more of the conditions in 35-209(c)(8)B.8.f.~~ parking may be accessed from the primary or secondary frontages by means of a driveway.

4.~~5.~~ Primary pedestrian entrances to all parking lots and parking structures shall be directly from a frontage line. Parking structures may also be entered by pedestrians directly from a principal building.

5.~~6.~~ The vehicular entrance, exit, or entrance/exit of a parking lot or garage shall be no wider than thirty (30) feet at the frontage line; provided, however, the preceding restriction shall not apply to commercial garages available to the general public for parking.

6.~~7.~~ When a form based parking plan is provided within the long pedestrian shed of a regional center, the effective parking available for calculating the intensity on each lot may be increased by a multiplier of thirty (30) percent without increasing parking requirements cited in table 209-14.

7. Parking Structures shall have either of the following along the primary frontage and (to the extent the property has river frontage) along the river frontage: (i) a Liner Building, or (ii) a Streetscreen.

For river frontage only, if a Streetscreen is used to mask a Parking Structure, the Streetscreen must be the full height of the Parking Structure. Additionally, for the river frontage only, if a Liner Building is used to mask a Parking Structure, then: (i) the Liner Building must be the full

height of the Parking Structure, or (ii) a full height Streetscreen must be installed above the Liner Building to mask any parking above the height of the Liner Building.

In the event a Streetscreen or Liner Building is used to mask a Parking Structure on the Primary Frontage, the height of such Liner Building or Streetscreen shall be as otherwise provided herein.

~~8. Parking structures shall have a liner building of at least two (2) stories in height and twenty-five (25) feet in depth on the primary and secondary frontages, or the primary and river frontages for properties with river frontage. In lieu of a liner building, at least the first and second stories of a parking structure shall be enclosed. The first story shall be enclosed to a minimum depth of twenty-five (25) feet and the façade detailed as a shopfront. The second story shall be enclosed and the façade detailed in accordance with the (T5) Architectural Standards.~~

E. (T5) Architectural Standards.

1. The facades on retail frontages shall be detailed as shopfronts.
2. The exterior finish materials on all facades shall be limited to stone, brick, masonry, corrugated metal, composite aluminum panel, and/or stucco. Clapboard and cement fiber siding may be used, but are not permitted on the first story of the primary facade. For accent, external insulation finishing system (EIFS), river rock, glass block, ironwork and/or tile may be used on no more than twenty-five (25) percent of each elevation.
3. Balconies, galleries and arcades shall be made of concrete, painted wood/wood composite or metal.
4. Buildings may have flat roofs enclosed by parapets or sloped roofs.
5. Streetscreens shall be located parallel to a frontage line as shown in table 209-10D.

~~6. Disposal receptacles shall be stored in the second or third lot layer.~~

6.~~7.~~ Disposal receptacles shall be screened completely from public view at ground level.

a. Screening shall consist of a solid wall and be a minimum of six (6) feet in height, or a height sufficient to obscure the area or equipment requiring the screening, whichever is less.

b. Screening materials shall conform to transect zone standards as prescribed in subsection 35-209(e)(5)(E)(2).

7.~~8.~~ The maximum length of an individual wall plane that faces a street shall be fifty (50) feet, except under the following conditions:

* * * * *

G. (T5) Sign Standards.

1. Address Numbers. Numbers shall be metal, ceramic or paint.

2. Configuration. The following configurations are allowed in T5 in addition to the configurations allowed in subsection (e)(3)(G)(6).

a. Blade Signs. Blade signs hung from an architectural element shall be centered on that element. Blade signs projecting from the wall may project a maximum of five (5) feet. The top of the blade sign shall be between nine (9) feet and twelve (12) feet above the sidewalk. The blade sign shall be thirty-two (32) inches tall maximum. Blade signs shall be no more than four (4) feet wide nor project more than five (5) feet from the wall. No blade sign shall exceed six (6) feet square feet. Brackets and other suspension devices shall match the sign style and shall not be computed as part of the allowable size of the sign.

i. Parking garages that provide publicly-usable parking spaces may have a blade illuminated blade sign not exceeding twenty four (24) square feet.

b. Vertical Corner Signs. Vertical corner signs are permitted at the corners of blocks. They may project perpendicular from one (1) side of the building or at a forty-five (45) degree angle to the corner. Vertical corner signs shall be constructed of either signboards or metal, and they may be lit either with gooseneck lights ~~or~~ with surface neon, reversed halo letters, or internally illuminated with push-though clear acrylic letters minimum of ¾ inch deep. Internally illuminated signs must have opaque boxes with only the sign text and/or logo illuminated. Vertical corner signs shall be mounted a minimum of twelve (12) feet from the sidewalk, measured to the bottom of the sign. The height of the sign shall not exceed fifteen (15) ~~ten (10)~~ feet in height. Vertical corner signs shall be mounted twelve (12) feet maximum away from the exterior wall of the building and shall be a maximum of three (3) feet wide.

c. Cornice Signs. Buildings may have one sign consisting of the building's name integrated into the architecture of one façade as part of a cornice, parapet, or immediately below the building's roof. The maximum height of any letter in the cornice sign may not exceed thirty (24) inches in buildings from 2 to 4 stories in height and thirty (36) inches buildings over 4 stories. Buildings with cornice signs may have only one blade sign in addition to a sign designating a publicly usable parking garage.

(6) Specific to Urban Core Zones (T6).

A. (T6) Building Disposition.

1. Stoops, lightwells, balconies, and bay windows may encroach one hundred (100) percent of the depth of the first lot layer.

2. Awnings, arcades, and galleries may encroach the sidewalk to within two (2) feet of the curb but must clear the sidewalk vertically by at least eight (8) feet.

3. Loading docks, service entrances, and service yards shall be located in the third lot layer and shall only be accessed through the alley when an abutting alley is provided on the MDPP. If an alley is not provided on the MDPP or ~~the alley is pre-existing and meets one (1) or more of the conditions in 35-209(c)(8)B.8.f.~~ if the subject property is exempt from the requirement of alley access per 35-209(c)(8)B8, loading docks, service entrances, and service yards may be accessed from the primary or secondary frontage by means of a driveway.

* * * * *

D. (T6) Parking Standards.

1. All parking areas shall be located in the second and/or third lot layer as illustrated in table 209-10D and table 209-10E.

2. Parking areas in the second lot layer are only allowed as follows:

   a. As Primary Use Parking Lots;

   ~~a. At mid block location. Mid block locations shall be a minimum of sixty (60) feet from either street intersection and shall be masked at the frontage by a liner building or streetscreen~~

   b. As Parking Structures that are masked with a Streetscreen; or

   ~~b. In parking structures above the first story.~~

   c. Above the first floor of Parking Structures that are masked with a Liner Building.

3. Parking shall be accessed from an alley when an abutting alley is provided on the MDPP. If an alley is not provided on the MDPP or if the subject property is exempt from the requirement of alley access per 35-209(c)(8)B.8., ~~the alley is pre-existing and meets one (1) or more of the conditions in 35-209(c)(8)B.8.f.~~ parking may be accessed from the primary or secondary frontages by means of a driveway.

4. Primary pedestrian entrances to all parking lots and parking structures shall be directly accessed from a frontage line. Parking structures may also be entered by pedestrians directly from a principal building.

5. The vehicular entrance, exit, or entrance/ exit of a parking lot or garage shall be no wider than thirty (30) feet at the frontage line; provided, however, the preceding restriction shall not apply to commercial garages available to the general public for parking.

6. When a form based parking plan is provided within the long pedestrian shed of a regional center, the effective parking available for calculating the intensity on each lot may be increased by a multiplier of thirty (30) percent without increasing parking requirements cited in table 209-14.

7. Parking Structures shall have either of the following along the primary frontage and (to the extent the property has river frontage) along the river frontage: (i) a Liner Building, or (ii) a Streetscreen.

For river frontage only, if a Streetscreen is used to mask a Parking Structure, the Streetscreen must be the full height of the Parking Structure. Additionally, for river frontage only, if a Liner Building is used to mask a Parking Structure, then: (i) the Liner Building must be the full height of the Parking Structure, or (ii) a full height Streetscreen must be installed above the Liner Building to mask any parking above the height of the Liner Building.

In the event a Streetscreen or Liner Building is used to mask a Parking Structure on the Primary Frontage, the height of such Liner Building or Streetscreen shall be as otherwise provided herein.

~~7. Parking structures shall have a liner building of at least two (2) stories in height and twenty-five (25) feet in depth on the primary and secondary frontages, or the primary and river frontages for properties with river frontage. In lieu of a liner building, at least the first and second stories of a parking structure shall be enclosed. The first story shall be enclosed to a minimum depth of twenty-five (25) feet and the façade detailed as a shopfront. The second story shall be enclosed and the façade detailed in accordance with the (T5) Architectural Standards.~~

E. (T6) Architectural Standards.

1. The facades on retail frontages shall be detailed as shopfronts.
2. The exterior finish materials on all facades shall be limited to stone, brick, masonry, composite aluminum panel, and/or stucco. Clapboard and cement fiber siding may be used, but are not permitted on the first story of the primary facade. For accent, external insulation finishing system (EIFS), river rock, glass block, ironwork and/or tile may be used on no more than twenty-five (25) percent of each elevation.
3. Balconies, galleries and arcades shall be made of concrete, painted wood/wood composite or metal.
4. Buildings may have flat roofs enclosed by parapets, or sloped roofs.
5. Streetscreens shall be located parallel to a frontage line as shown in table 209-10D.

~~6. Disposal receptacles shall be stored in the second or third lot layer.~~

6.~~7.~~ Disposal receptacles shall be screened completely from public view at ground level.

a. Screening shall consist of a solid wall and be a minimum of six (6) feet in height, or a height sufficient to obscure the area or equipment requiring the screening, whichever is less.

b. Screening materials shall conform to transect zone standards as prescribed in subsection 35-209(e)(6)(E)(2).

7.~~8.~~ The maximum length of an individual wall plane that faces a street shall be fifty (50) feet, except under the following conditions:

* * * * *

G. (T6) Sign Standards.

1. Address Numbers. Numbers shall be metal, ceramic or paint.

2. Configuration. The following configurations are allowed in T5 in addition to the configurations allowed in subsection 35-209(e)(3)(G)(6):

a. Blade Signs. Blade signs hung from an architectural element shall be centered on that element. Blade signs projecting from the wall may project a maximum of five (5) feet. The top of the blade sign shall be between nine (9) feet and twelve (12) feet above the sidewalk. The blade sign shall be thirty-two (32) inches tall maximum. Blade signs shall be no more than four (4) feet wide nor project more than five (5) feet from the wall. No blade sign shall exceed eight (8) square feet. Brackets and other suspension devices shall match the sign style and shall not be computed as part of the allowable size of the sign.

i. Parking garages that provide publicly-usable parking spaces may have a blade illuminated blade sign not exceeding twenty four (24) square feet.

b. Vertical Corner Signs. Vertical corner signs are permitted at the corners of blocks. They may project perpendicular from one (1) side of the building or at a forty-five (45) degree angle to the corner. Vertical corner signs shall be constructed of either signboards or metal, and they may be lit either with gooseneck lights ~~or~~ with surface neon, reversed halo letters, or internally illuminated with push-though clear acrylic letters minimum of ¾ inch deep. Internally illuminated signs must have opaque boxes with only the sign text and/or logo illuminated. Vertical corner signs shall be mounted a minimum of twelve (12) feet from the sidewalk, measured to the bottom of the sign. The height of the sign shall not exceed fifteen (15) ~~ten (10)~~ feet in height. Vertical corner signs shall be mounted twelve (12) feet maximum away from the exterior wall of the building and shall be a maximum of three (3) feet wide.

c. Cornice Signs. Buildings may have one sign consisting of the building's name integrated into the architecture of one façade as part of a cornice, parapet, or immediately below the building's roof. The maximum height of any letter in the cornice sign may not exceed thirty (24) inches in buildings from 2 to 4 stories in height and thirty (36) inches buildings over 4 stories. Buildings with cornice signs may have only one blade sign in addition to a sign designating a publicly usable parking garage.

* * * * *

(g) Definitions. The definitions in this subsection 35-209(g) are specific to subsections 35-209 and 35-357.

* * * * *

Context: surroundings made up of the particular combination of elements that create specific habitat.

Cornice Line: horizontal articulation along approximately 85% or more of a building façade accomplished by one or more of the following: (i) a projecting architectural element, (ii) a change in material from the building façade below the Cornice Line and/or the building façade above the Cornice Line, or (iii) a discernable change in the arrangement of windows or other architectural features.

Corridor: a lineal geographic system incorporating transportation and/or greenway trajectories. A transportation corridor may be a lineal urban transect zone.

* * * * *

Light Court: a private frontage parallel to the sidewalk that provides direct access to levels below grade in patio or walkway form.

Liner Building: a functional ancillary building with a minimum depth of twenty-five (25) feet, specifically designed to mask the primary use of a single function over ninety thousand (90,000) square feet on the ground floor, a primary function parking lot, or a Parking ~~parking~~ Structure ~~structure~~ from a frontage using a mix of residential, office and/or commercial functions. The building shall cover the entirety of the frontage line(s). Pedestrian and vehicular access shall be allowed as stated in subsection 35-209(f). For clarification, if the Liner Building is being used in connection with a Parking Structure, the Liner Building may be recessed within the Parking Structure.

Linear Corridor: a civic space, park, green, square or plaza, minimum two (2) blocks in length, that is longer than it is wide and follows the trajectories of natural corridors or the built environment.

* * * * *

Manufacturing: premises available for the creation, assemblage and/or repair of artifacts, using table-mounted electrical machinery and including their retail sale.

Massing Break: an architectural technique to create the perception that an individual building mass is broken into smaller units.

Master development pattern plan: master development plan submittal that contains one (1) or more development patterns per the requirements of section 35-357.

* * * * *

Street Tree: tree on private frontage.

Streetscreen: a ~~freestanding~~ wall (whether freestanding or part of a façade) built along the frontage line, or parallel to a frontage line, often for the purpose of masking a parking lot or parking structure from the thoroughfare. Unless otherwise provided herein, Streetscreens should be between three and one-half (3.5) and eight (8) feet in height and constructed of a material complementing ~~matching~~ the adjacent building façade, if present. Streetscreens shall have openings no larger than is necessary to allow automobile and pedestrian access. In addition, all Streetscreens over four (4) feet high should be thirty (30) percent permeable or otherwise articulated to avoid blank walls.

Substantial Modification: alterations to a building that are valued at more than fifty (50) percent of the replacement cost of the entire building, if new.

* * * * *

Chapter 35, Article III, Section 35-305 is amended as follows:

Sec. 35-305. – Zoning District Boundaries.

* * * * *

(h) In order to correct survey errors in courses or distances, scrivener errors, or clerical errors, if a parcel is rezoned and a remainder strip of less than fifty (50) feet is inadvertently not included in the rezoning, the entire parcel will be considered rezoned.

* * * * *

Chapter 35, Article III, Section 35-310.01 is amended as follows:

Sec. 35-310.01. - Generally.

* * * * *

(d) An application approval of a subdivision plat within the incorporated areas of the city must comply with Table 310-2, below, where the proposed subdivision abuts an existing subdivision which was recorded and substantially developed as of the effective date of this chapter (hereinafter the "existing subdivision"). The lots abutting the existing subdivision ("buffer lots") must comply with the lot and building dimensions of Table 310-1 for the "R-20" zoning district and be at least one-hundred (100) feet in depth (as measured from front lot line to the rear lot line) and comply with the minimum area requirements identified in Table 310-2. Open space and passive recreation areas may be allowed on such required buffer lots provided, however, that no vehicular parking areas, driveways, or structures associated with such passive recreation shall be located within fifty (50) feet of the perimeter of the existing subdivision. No private or public street or ingress/egress easement shall be allowed or constructed within one-hundred (100) feet of the perimeter of the existing subdivision. ~~following minimum lot sizes:~~

Table 310-1
Lot and Building Dimensions Table

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
	LOT DIMENSIONS						BUILDING ON LOT				BUILDING		
Zoning District	Lot Size (min)	Lot Size (max)	Density (max) (units/acre)	Street Frontage (min)	Width (min)	Width (max)	Front Setback (min) * * * *	Front Setback (max)	Side Setback (min)	Rear Setback (min)	Height (max) (feet/# of stories)	Size - Individual Building Size	Size - Aggregate Building Size

												(max)	(max)
RP	10 acres		0.1	—	—	—	15	—	5	—	35/2-½	—	—
RE	43,560		1	100	120	—	15	—	5	30	35/2-½	—	—
R-20	20,000		2	65	90	—	10	—	5	30	35/2-½	—	—
R-6[1]	6,000		7	30	50	150	10	—	5	20	35/2-½	—	—
R-5[1]	5,000		9	30	45	150	10	—	5	20	35/2-½	—	—
R-4[1]	4,000		11	20	35	150	10	—	5	20	35/2-½	—	—
R-3[1]	3,000[7]		—	15	20	—	10	35	5	10	35/3	70% of lot area	—
RM-6[1]	6,000		7	15	15	150	10	—	5	20	35/3	—	—
RM-5[1]	5,000		9	15	15	100	10	—	5	10	35/3	—	—
RM-4[1]	4,000		11	15	15	80	10	—	5	10	35/3	—	—
MF-18[1, 4]	—		18	50	50	—	—	20[3, 4, 6]	5	10	35	—	—
"MF-25"[1, 4, 8]	—		25	50	50	—	—	20[3, 4, 6]	5	10	35	—	—
"MF-33"[1, 4, 8]	—		33	50	50	—	—	20[3, 4, 6]	5	10	45	—	—
"MF-40"[1, 4, 8]	—		40	50	50	—	—	20[3, 4, 6]	5	10	60	—	—
"MF-50"[1, 4, 8]	—		50	50	50	—	—	20[3, 4, 6]	5	10	—	—	—
"MF-65"[1, 4]	—		65	50	50	—	—	20[3, 4, 6]	5	10	—	—	—
O-1[10]	—		—	50	50	—	—	35	20[2]	30[2]	25	10,000	90,000
O-1.5	—		—	50	50	—	—	35	20[2]	30[2]	60	—	—
O-2	—		—	50	—	—	25	80	20[2]	30[2]	—	—	—
NC[10]	—		—	20	—	—	—	15	10[2]	30[2]	25	3,000	5,000

C-1[10]	—		—	50	50	—	—	20	10	30	25	5,000	15,000
C-2	—		—	20	—	—	—	—	10^2	30^2	25	—	—
C-2P[10]			—	20	—	—	—	35	10^2	30^2	25	—	—
C-3	—		—	20	—	—	—	—	30^2	30^2	35	—	—
D[9]	—		—	—	—	—	—		—	—	—	—	—
L				80	—	—	25	—	30^2	30^2	35	—	—
I-1	—		—	80	80	—	30	—	30^2	30^2	60	—	—
I-2	—		—	100	100	—	30	—	50^2	50^2	60	—	—
UD-Single-family	—	10,000	—	15	15	150	10	20	0	10	35/2-½		
UD-Multi-family-15	—	—	15	50	50	—	10	20	5	10	35		15 units
UD-Multi-family-33			33	50	50		10	20	5	10			150 units
UD Major Node				20			0	35	10^2	30^2	35		
UD Minor Node				20			0	35	10^2	30^2	25	6,000	
RD-Single-family	43,560		1	100	120		15		5	30	35/2-½		
RD Major Node				20			0	35	10^2	30^2	25		
RD Minor Node				20			0	35	10^2	30^2	25	6,000	
FR-Single-	25 acres*		0.04				15		5		35/2-½		35/2-½

family												
FR-Ag Commercial	25 acres*					15		5		35/2-½		35/2-½
FR Minor Node**			50					10^2	30^2			6,000	
FR Village Center	2 acres			300					10^2	30^2			
MI-1				80	80		***		30^2	50^2	60		
MI-1 Minor Node**				50			***		10^2	30^2		6,000	
MI-1 Village Center	2 acres			300			***		10^2	30^2			
MI-2				100	100		***		50^2	50^2	150		
MI-2 Minor Node**				50			***		10^2	30^2		6,000	
MI-2 Village Center	2 acres			300			***		10^2	30^2			

* Exception allowed for pre-existing lots of record.
** See regulations for location standards.
*** See Table 35-310.18-1 and 35-310.19 for minimum setback standards on specific street classifications.
**** Subdivision recreation facilities provided for the primary use of the subdivision's residents and located on property with a single-family zoning category shall be exempt from the front setbacks of Table 310-1.
Rules for Interpretation of Table 310-1:

Generally. The requirements for the parameters set forth in columns (B) through (N), above, relate to the zoning district specified in the row under column (A), above. A dash (—) indicates that the requirement does not apply within the particular zoning district. Except for column (B), (C), (D), (M), and (N) or otherwise notated the dimensions specified in columns (B) through (N) are expressed in linear feet. The dimensions specified in columns (B), (C), (D), (M), and (N) are expressed in square feet or acres unless otherwise provided. Rules of interpretation and additional standards for setback and height requirements are set forth in the lot layout, height and density/intensity standards (sections 35-515 to 35-517 of this chapter).
Column (B) and (C): Minimum lot size column (B) and maximum lot size column (C) applies only to Conventional Option, single-family detached developments (see section 35-201 of this chapter). The minimum lot size figures are expressed in square feet, unless otherwise indicated. Additional rules of interpretation are set forth in subsection (d) of this section for minimum lot area.
Column (D): The maximum density requirements (column (D)) are expressed in dwelling units per gross acre. Additional rules of interpretation are set forth in section 35-515 of this chapter.
Column (E): Frontage is defined as the distance where a property line is common with a street right-of-way line. For irregular shaped lots, see subsection 35-515(c)(4).
Column (F): Minimum lot width is defined as the width of the lot at the front setback line. For irregular shaped lots, lot width shall be measured at the front building line rather than the front setback line.
Column (G): Maximum lot widths apply only to detached single-family residential development.
Column (J): The side setback requirements in the "RM-4," "RM-5," "RM-6," "R-3," "R-4," "R-5" and "R-6" districts may be reduced in accordance with section 35-373 of this article. Additional setbacks are required for height increases as set forth in subsection 35-517(d).
Column (K): Rear setback requirements shall not apply to any use in the "NC," "O-1," "O-1.5," "O-2," "C-1," "C-2," or "C-3" zoning districts which abuts an alley or another structure within any of these districts. Notwithstanding the requirements of Table 310-1, an "MF-18," "MF-25,"" MF-33," "MF-40" or "MF-50" zoning district adjoining a platted subdivision zoned single-family residential use shall have a minimum rear setback of forty (40) feet, and parking areas shall be located at least five (5) feet from any fence along the rear property line.
Column (L): Height. The vertical dimension measured from the average elevation of the finished lot grade at the front of the building to the highest point of ceiling of the top story in the case of a flat roof; to the deckline of a mansard roof; and to the average height between the plate and ridge of a gable, hip or gambrel roof. All dimensions are in feet provided, however, that for zoning districts "RP" through "RM-4," the first number refers to feet and the second number refers to stories. A "story" is that part of a building between the surface of a floor and the ceiling immediately above. Additional height may be provided pursuant to subsection 35-517(d).
Column (M): Dimensions are in square footage. See sections 35-310.17 and 35-310.18 for specific rules of interpretation. Additional square footage may be available if a specific use authorization is

approved, in accordance with these provisions.

Column (N): The aggregate square footage refers only to nonresidential square footage. Where residential uses are permitted, (1) the square footage of nonresidential uses within the contiguous boundaries of the district may not exceed the aggregate square footage, and (2) the aggregate square footage may be exceeded where the square footage exceeding the maximum aggregate square footage is devoted to residential uses.

Note (1) - column (A): See sections 35-372, 35-373, 35-515, and 35-516 of this chapter for standards applicable to zero lot line dwellings and uses other than detached single-family dwellings.

Note (2) - columns (J) and (K): Applies only to the setback area measured from a lot line which abuts a residential use or residential zoning district. The side or rear setback shall be eliminated where the use does not abut a residential use or residential zoning district or the two districts are separated by a public right-of-way. The indicated setback would not apply if the subject property adjoins a residentially zoned property (single-family or multi-family) which is occupied by an existing nonresidential use such as a public or private use school, church, park and/or golf course.

Note (3) - Public and parochial school facilities and religious institutions whose primary activity is worship shall be exempt from the mandatory maximum front setback provision.

Note (4) - Single-family lot development within an "MF" multi-family zoning district shall meet the minimum lot requirements for an "R-4" zoning district.

Note (5) - Maximum front setback for "RD" and "UD" commercial uses shall not apply to flag lots or properties with primary frontage on expressways and parkways.

Note (6) - For a lot with one hundred (100) feet or more of frontage along a public or private street the maximum front setback of twenty (20) feet in "MF-18," "MF-25," " "MF-33"," "MF-40," and "MF-50" may be extended to ninety (90) feet provided that no parking or drives other than egress/ingress drives shall be located within twenty (20) feet of the front property line. For a lot with less than fifty (50) feet of frontage on a public street the front setback shall be at least twenty (20) feet and shall be measured from the point at which the lot first becomes wider than fifty (50) feet in width.

Note (7) - May vary in accordance with subsection 35-410.05a(b)(3).

Note (8) - When multi-family units (apartments) are developed in a non-multifamily zoning district as stand alone apartments the buildings and lot shall conform to the standards of development (setback, yards, buffer, landscaping, etc.) for one of the following "MF-18," "MF-25," "MF-33," "MF-40" or "MF-50" zoning districts. The specific district shall be determined by the density to which the apartments are being developed.

Note (9) - Site planning and architectural criteria for the "D" Downtown Zoning District can be found in the Downtown Design Guide in Appendix G of this chapter.

Note (10) - Buildings shall contain ground level fenestration (transparent windows and openings at street level) of not less than 30%. Parking areas for new buildings or structures shall be located behind the

front façade of the principal use or principal building. For "O-1"and "C-1", parking shall be located behind the front facade of the principal use or principal building, provided that up to two (2) rows of parking may be located to the front of the principal use or principal building.

* * * * *

Table 310-2
DESIGN REGULATIONS

Zoning of Adjacent Subdivision	*Minimum Required Area of Buffer Lots*
R-20	20,000 square feet ~~R-20~~
RE	20,000 square feet ~~R-20 or RE~~

* * * * *

Chapter 35, Article III, Section 35-310.06 is amended as follows:

Sec. 35-310.06. "RM-6," "RM-5," and "RM-4" Mixed Residential.

STATEMENT OF PURPOSE

These districts provide areas for medium to high-density~~, single-family~~ residential uses ~~mixed with a variety of housing types~~ where adequate public facilities and services exist with capacity to serve development. These districts are composed mainly of areas containing a mixture of single-family, two-family and multi-family dwellings and open space where similar residential development seems likely to occur. The district regulations are designed to encourage a suitable neighborhood environment for family life by including among the permitted uses such facilities as schools and churches; and to preserve the openness of the area by requiring flexible ~~certain minimum~~ yard and area standards. Mixed residential districts provide flexible ~~minimum lot size and~~ density requirements in order to allow for market and design flexibility while preserving the neighborhood character and permitting applicants to cluster development in order to preserve environmentally sensitive and agricultural land areas.

These districts implement the following policies of the master plan:

- *Urban Design, Policy 1a: Based on a comprehensive land use plan, encourage more intensive development in and near neighborhood centers with less intensive development between neighborhood centers, and implement these changes through zoning.*

- *Urban Design, Policy 1c: Encourage patterns of urban development that provide a full range of housing choices and promote a sense of community, urban vitality and the efficient provision of infrastructure.*

• *Urban Design, Policy 1a: Define, preserve and promote neighborhood centers which include schools, libraries, stores, transit centers and community service facilities in accessible, pedestrian friendly environments.*

• *Urban Design, Policy 1a: Define, preserve and promote neighborhood centers which include schools, libraries, stores, transit centers and community service facilities in accessible, pedestrian friendly environments.*

• *Urban Design, Policy 5b: Encourage resident and employment growth within walking distance of the downtown area and neighborhood centers in order to support an inter-modal transportation system.*

(a) **Lot and Building Specifications.**

(1) **Density Allowances for ~~Single Lot~~ RM-Development.** For lots zoned ~~When a single residential lot is rezoned to~~ "RM-4," "RM-5" or "RM-6" ~~after January 1, 2011~~, the maximum density requirements (units per acre) of Table 310-1 may be exceeded provided:

a. The minimum lot size for the district is met, and

b. The maximum number of dwellings is limited to two (2) units for RM-6, three (3) units for RM-5, and four (4) units for RM-4.

~~(2) **Multiple Lot RM-Development.**~~

~~a. **R-3 Lots Permitted.** In all multiple lot "RM-4," "RM-5" and "RM-6" districts fifteen (15) percent of the lots may be developed as "R-3" lots so long as they meet or exceed the minimum lot criteria for "R-3" lots contained in section 35-310.05a of this chapter. Lots provided under this criteria shall only be used for the development and construction of single-family attached dwellings, single-family detached dwellings, townhouses, and zero-lot line houses (cottages and garden homes).~~

~~b. **Minimum Lot Size.**~~

~~i) The minimum lot size provisions of Table 310-1 shall only apply to single-family detached dwellings.~~

~~ii) Maximum density requirements of Table 310-1 shall apply during review of RM- zoned development using the gross area definition for multiple lot subdivisions.~~

~~(b) **Development Requirements for Ten or More Lots.**~~

~~(1) Development of ten (10) or more "RM-6," "RM-5," and "RM-4" mixed residential lots in any one project shall have no more than eighty (80) percent of the lot consisting of one (1) type of housing as outlined in (2) below. The remaining twenty (20) percent of the lots may be developed in any combination of one (1) or more of the housing types not used in the eighty (80) percent limit defined above.~~

~~(2) Where development of ten (10) or more "RM-6," "RM-5," and "RM-4" mixed residential lots in any one project is planned pursuant to a housing site plan the housing types listed below shall be subject only to the density restrictions in the~~

zoning district (Table 310-1, column (C)) and shall not be subject to the front, side and rear setback requirements of Table 310-1 (section 35-310.01 of this chapter):

A. Single-family attached dwellings.

B. Duplexes.

C. Triplexes.

D. Quadraplexes.

E. Townhouses.

F. Zero-lot line houses.

G. Cottages.

H. Housing facilities for older persons.

(3) **Housing Site Plan (HSP) Required.** RM-zoning requires an approved HSP for all the lots that make up any development of ten (10) or more lots with RM-zoning.

A. **Requirement for Site Plan:**

i. "RM-6," "RM-5," and "RM-4" mixed residential zoned property must submit with the plat application a housing site plan (HSP) which conforms to the provisions of subsections (b) and (c) which will be utilized as the basis for issuing building permits. The housing site plan shall be submitted in accordance with subsection (c) to the same or larger scale as the plat designating housing type for each lot. The housing site plan shall be recorded with the plat.

ii. Existing platted property zoned "RM-6," "RM-5," and "RM-4" mixed residential shall submit a housing site plan (HSP) if the number of lots in the project includes ten (10) or more units.

B. **Contents.** The HSP must be reviewed and meet the requirements of mixed residential for percentage of housing types. This HSP must be submitted with the platting process for review and approval and be then included with the application package for the first building permit(s). A proposal for all one type of development on ten (10) or more lots is an automatic disapproval of the HSP and disapproval of the plat or building permit. The HSP shall be recorded with the plat and subsequent amendments may be approved through the amending plat process. The HSP shall provide the following information:

1. Gross density calculation.

2. Site zoning district(s), an HSP is not required for PUD districts.

3. Percentage of lots to be reviewed under R-3 zoning, if applicable.

4. Lots must meet the 80%/20% criteria of subsection 35-310.06(b).

5. Legal description of all lots, if not available from the attached plat.

6. Existing and proposed easements.

7. Approximate building footprints.

8. Building setbacks.

~~9. Approximate driveway locations.~~

~~10. Building heights.~~

~~11. Indication of street frontage requirements and minimum lot width.~~

~~12. Owner/developer name and address.~~

~~13. Engineer name and address.~~

~~14. Plat name and ID number.~~

* * * * *

Chapter 35, Article III, Section 35-310.07 is amended as follows:

Sec. 35-310.07. – "MF-18", "MF-25", "MF-33", "MF-40", "MF-50" and "MF-65" Multi-Family"

* * * * *

General Provisions. See subsection 35-517(d) relating to additional setback for building height increases. An increase of up to ten (10) percent of the allowable gross units per acre shall be permitted in the MF-40, MF-50 and MF-65 districts where the minimum required ~~all~~ on-site visitor and resident parking is provided in a structured parking garage in accordance with section35-384(c). When utilizing the provisions of this section for structured and non-structured parking, structured parking is not subject to the maximum parking requirements per Section 35-526(b)(5). Non-structured parking spaces are permitted but shall not exceed 20% of the minimum number of parking spaces.

* * * * *

Chapter 35, Article III, Section 35-310.08 is amended as follows:

Sec. 35-310.08. - "NC" Neighborhood Commercial.

* * * * *

(2) ~~**Design.**~~

~~A. Parking areas for new buildings or structures shall be located in the rear of the principal use or principal building. This subsection shall not apply to buildings which exist at the time of a rezoning to "NC.""~~

~~B. Buildings shall contain ground level fenestration (transparent windows and openings at street level) which shall conform to the commercial urban design standards, subsection 35-204(o)(6) of this chapter.~~

~~C. Buildings shall be articulated so that facades which face public streets and exceed fifty (50) feet in horizontal length shall include vertical piers or other vertical visual elements to break the plane of the facade. Such vertical piers or any other vertical visual elements shall be between~~

~~fifteen (15) feet and forty (40) feet apart along the facade. This provision shall not apply to the conversion of a residential building to a commercial use.~~

* * * * *

Chapter 35, Article III, Section 35-310.09 is amended as follows:

Sec. 35-310.09. - "O-1," O-1.5" and "O-2" Office Districts.

* * * * *

a) **"O-1" Office Districts.**

(1) **General Provisions.**

* * * * *

~~C. **Design.**~~

~~1. Parking shall be located to the rear of the principal use or principal building, provided that up to two (2) rows of parking may be located to the front, or to the side abutting a residential use, of the principal use or principal building.~~

~~2. Buildings shall contain ground level fenestration (transparent windows and openings at street level) consistent with the commercial urban design standards, subsection 35-204(o) of this chapter.~~

~~2. Buildings shall be articulated so that facades, which face public streets and exceed fifty (50) feet in horizontal length, shall include vertical piers or other vertical visual elements to break the plane of the facade. Such vertical piers or any other vertical visual elements shall be between fifteen (15) feet and forty (40) feet apart along the facade. This provision shall not apply to the conversion of a residential building to a commercial use.~~

* * * * *

Chapter 35, Article III, Section 35-310.10 is amended as follows:

Sec. 35-310.10. - "C-1," "C-2," "C-2P," and "C-3" Commercial Districts.

* * * * *

(1) **Lot and Building Specifications.** See subsections (a)(1), (b)(1), (c)(1) and (d)(1), below. ~~In addition to the provisions set forth below, the following restrictions shall apply to the scale of buildings in each commercial district. Individual buildings shall not exceed the maximum square footage established in column (B) of Table 310.10-1. Buildings on lots adjoining on the same side of a block face shall not exceed the maximum square footage established in column (C) of Table 310.10-1. Buildings shall conform to the design standards established in column (D) of Table 310.10-1.~~

~~**Table 310.10-1**~~

~~(A) District~~	~~(B) Maximum Building Size (sf) (Individual)~~	~~(C) Maximum Building Size (sf) (Aggregate)~~	~~(D) Design Standards~~
~~C-1~~	~~5,000~~	~~15,000~~	~~RP, F~~
~~C-2~~	~~N/A~~	~~N/A~~	~~N~~
~~C-2P~~	~~N/A~~	~~N/A~~	~~RP, F~~
~~C-3~~	~~N/A~~	~~N/A~~	~~N~~

~~**Key:**~~

~~"Aggregate" refers to the total square footage located within a contiguous district.~~

~~"RP" means that parking shall be located in the rear of the principal use or principal building.~~

~~"F" means that buildings shall contain ground level fenestration (transparent windows and openings at street level) which conform to the commercial urban design standards, subsection 35-204(o)(6) of this chapter.~~

~~"N" specific standards are not required, but may be imposed as a condition of granting a specific use authorization consistent with the criteria established in section 35-423 of this chapter.~~

* * * * *

(d) **Alcohol Restricted Districts.**

(1) The district regulations within the "C-2NA" district are the same as in the "C-2" districts, except that no sales of alcoholic beverages for on-premises or off-premises consumption shall be permitted.

(2)District regulations within the "C-3R" district are the same as in "C-3" districts except that no sales of alcoholic beverages for on-premises consumption shall be permitted.

(3)District regulations within the "C-3NA" districts are the same as in "C-3" districts except that no sales of alcoholic beverages for on-premises or off-premises consumption shall be permitted.

(e) **Noise Restricted Districts.**

(1) The district regulations within the “C-2NR” district are the same as in the “C-2” districts, except that no external sound systems or outside live music shall be allowed.

(2) The district regulations within the “C-3NR” district are the same as in the “C-3” districts, except that no external sound systems or outside live music shall be allowed.

* * * * *

Chapter 35, Article III, Section 35-310.11 is amended as follows:

35-310.11. - "D" Downtown.

* * * * *

(a) Location Criteria.

The "D" downtown district shall be permitted only in the Downtown Business District, as defined in Appendix A ~~encompasses the city's central business district~~, which is the area originally settled and the locus of economic activity in the region. This shall include the area described as follows: Start at the intersection of Salado and El Paso Streets; north on Salado to its intersection with Frio Street; thence northeast in a straight line to the intersection of IH-10 and Cadwallader; south on IH-10 to IH-35; northeast on IH-35 to a perpendicular point connecting with Cherry Street; south on Cherry Street to César E. Chávez Boulevard ~~Durango~~ Boulevard; west on César E. Chávez Boulevard ~~Durango~~ to the San Antonio River; south along the San Antonio River to Arsenal Street; west on Arsenal to El Paso Street; and then west on El Paso to Salado.

* * * * *

Chapter 35, Article II, Section 35-311 is amended as follows:

Sec. 35-311. Use Regulations.

* * * * *

(b) **Uses Not Mentioned.**

* * * * *

(2) **Uses Preempted by State Statute.** Notwithstanding any provision of this section to the contrary, uses which are required to be permitted in any zoning district by state statute may be permitted in accordance with state law whether or not the use is included in the Use Matrix.

Example: NAICS 5413 (Architectural Engineering, and Related Services) is coded under "Office, General." Assume that the Use Matrix sets out a classification for "Laboratories, Testing," which is NAICS 54138 (a subheading of 5413 ~~54183~~). The latter 5-digit number is more specific than the 4-digit code. Accordingly, testing laboratories are not included

within the same classification as general offices. However, if testing laboratories had not been separately listed, they would be permitted in all districts where general offices are permitted.

* * * * *

(4) **Rules of Construction.** The director may determine that a use is materially similar if:

A. The use is listed as within the same structure or function classification as the use specifically enumerated in the Use Matrix, as determined by the most recently updated Land- Based Classification Standards ("LBCS") of the American Planning Association. The director shall refer to the following documents in making this determination, which documents are hereby incorporated by this reference and which shall be maintained on file in the office of the department of ~~planning and~~ development services: American Planning Association, Land-Based Classification Standards, LBCS Structure Dimension with Detail Descriptions ~~(September 13, 1999)~~; American Planning Association, Land-Based Classification Standards, LBCS Function Dimension with Detail Descriptions ~~(September 13, 1999)~~; American Planning Association, Land-Based Classification Standards, LBCS Tables ~~(September 13, 1999)~~; and American Planning Association, Land-Based Classification Standards ~~(April 18, 1999)~~. The use shall be considered materially similar if it falls within the same LBCS classification (subject to subsection (5), below), and meets the requirements of subsection C., below.

B. If the use cannot be located within one of the LBCS classifications pursuant to subsection A., above, the director shall refer to the most recently updated North American Industry Classification Manual (Executive Office of the President, Office of Management and Budget~~, 1997~~)("NAICS"). The use shall be considered materially similar if it falls within the same industry classification of the NAICS (subject to subsection (5), below), and meets the requirements of subsection C., below.

C. The proposed use shall not generate trips exceeding other uses proposed in the zoning district by more than ten (10) percent, as determined by the most recently updated Institute of Transportation Engineers, Trip Generation ~~(5th ed., 1991)~~(the "ITE Manual"), which document is hereby incorporated by this reference. If the trip generation is not listed in the ITE Manual, the use shall be considered materially similar.

(5) **Construction of LBCS and NAICS.** In order to assist in interpretation of the Use Matrix, the LBCS and NAICS numbers precede each use in the Use Matrix. In interpreting the Use Matrix, the following rules of construction shall apply:

A. If a use is listed for a specific classification, while a more general classification within the same industry classification is also listed for another use, the specific classification governs.

B. ~~Governs.~~ The specific use is not permitted in all districts where the uses coded to the general classification are permitted simply because they share a similar NAICS code number. The numbers increase as the classifications get more specific.

C. Some uses are listed separately, but fall within the same LBCS or NAICS classification. The uses within one (1) such classification are not permitted in all of the zoning districts as the others simply because they fall within the same LBCS or NAICS classification.

* * * * *

TABLE 311-1 RESIDENTIAL USE MATRIX																				
PERMITTED USE	RP	RE	R-20	NP-15	NP-10	NP-8	R-6	RM-6	R-5	RM-5	R-4	RM-4	MF-18	MF-25	MF-33	MF-40	MF-50 & MF-65	ERZD	LBCS FUNCTION	LBCS STRUCTURE
Assisted Living Facility, Boarding Home Facility or Community Home with six (6) or fewer residents		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	1230	
Assisted Living Facility, Boarding Home Facility or Community Home with seven (7) or													P	P	P	P	P	P		

more residents																				
Athletic Fields (Noncommercial And Supplemental To The Residential Use)	S	S	S	S	S	S	S	S	S	S	S	S	P	P	P	P	P	P	5370	
Automobile Non-Commercial Parking																		NA	2110	
Automobile Commercial Parking	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Bed and Breakfast, see § 35-374			S	S	S	S	S	S	S	S	S	S	S	S	P	P	P	P	1310	
Bus Shelter (Max Size 6'×13')	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P		
Bus Stop	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		
Cemetery, Columbarium Or Mausoleum	S	S	S				S		S		S							S	6700	
Childcare Daycare Center	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	6562	
Child Care, Licensed Child Care	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	6562	
Child Care - Registered Child Care Home	S	P	P	P	P	P	P	P	S	S	S	S	S	S	S	S	S	P	6562	
Child-Care Institution	S	S	S	S	S	S		S		S	S	S	S	S	S	S	P	P	6561	

(Basic)																				
Church, Temple, Mosque (facilities that are for worship or study of religion)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	6600	
Dwelling - 1 Family (Attached or Townhouse)							P	P	P	P	P	P	P	P	P	P	P	P	1000	1120
Dwelling - 1 Family (Detached)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	1000	1110
Dwelling - 2 Family								P		P		P	P	P	P	P	P	P	1000	1121
Dwelling - 3 Family								~~P~~		P		P	P	P	P	P	P	P	1000	1203
Dwelling - 4 Family								~~P~~		~~P~~		P	P	P	P	P	P	P	1000	1204
Dwelling - College Fraternity or Sorority (Off Campus)														P	P	P	P	P	1000	P
Dwelling - School Dormitories or Housing (Off Campus)														P	P	P	P	P	1000	P
Dwelling - HUD-Code Manufactured Homes	S	S	S	S	S	S	S	S	S	S	S	S						P	1000	1150
Dwelling (loft and/or													P	P	P	P	P	P		

ARH)																			
Dwelling - Multi-Family (18 Units/Acre Maximum)													P	P	P	P	P	P	1000	1210
Dwelling - Multi-Family (25 Units/Acre Maximum)														P	P	P	P	P	1000	1220
Dwelling - Multi-Family (33 Units/Acre Maximum)															P	P	P	P	1000	1230
Dwelling - Multi-Family (40 Units/Acre Maximum)																P	P	S* ~~P~~	1000	1240
Dwelling - Multi-Family (50 Units/Acre Maximum in MF-50; 65 Units/Acre Maximum in MF-65)																	P	S* ~~P~~	1000	1250
Dwelling, Zero Lot Line							P	P	P	P	P	P	P	P	P	P	P	P	1000	1122
Residential Market ~~Farming and Truck~~ Garden (incidental to a primary residential use)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	9100	

Foster Family Home			P	P	P	P	P	P	P	S	P	S						P	6560	
Foster Group Home	S	S	S	S	S	S	S	S	S	S	S	S						P	6562	
Golf Course (see § 35-346 "G" district)																		S	5370	
Housing Facilities for Older Persons (see § 35-373(e))								P		P		P	P	P	P	P	P	P		
Nursing Facility												P	P	P	P	P	P	P	1250	
Park – Public or Private	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	5500	
Public Safety Facilities	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	6400	
Radio/Television Station With Transmitter Tower	S	S	S	S	S													P	4231	
Recreation Facility, Neighborhood		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	6340	
Residential Greenhouse (incidental to a primary residential use)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	9140	
School - Private (Includes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	6100	

Church Schools, Private Schools K-12, College or University)																				
School - Public Includes All ISD Schools K-12, Open Enrollment Charter Schools, Public College or University	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	6100	
~~School - University Or College (Private)~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~	~~S~~					~~P~~	~~6130~~		
Storage (moving pods) (see 35-A101)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		
Transit Center													P	P	P	P	P	P	4133	
Transitional Home												S	S	S	S	S	S	P		
Transit Park & Ride													P	P	P	P	P	S	4133	
Transit Transfer Center (Max Size 14'×33' and total footprint no larger than 30'×40')	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	4133	

Transit Station													S	S	S	S	S	S	4133	
Urban Farm	P	P	P	P	P	P	S	S	S	S	S	S	P	P	P	P	P	P	8100	
Wireless Communication System	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	4233	

* An Engineering Report in lieu of a site plan shall be submitted showing adjacent wastewater main capacity.

Table 311-1a Residential Use Matrix

Permitted Use	Urban	Rural	Farm And Ranch	Mixed Industrial
Assisted Living Facility, Boarding Home Facility, or Community Home	P	P	P	
Athletic Fields (Noncommercial and Supplemental to the Residential Use)	See Nonresidential Matrix			
Automobile Noncommercial Parking	S			
Automobile Commercial Parking	S			
Bed and Breakfast, see § 35-374	P	P	P	
Bus Shelter (Max size 6'×13')	P	P	P	P
Bus Stop	P	P	P	P
Cemetery, Columbarium or Mausoleum	See Nonresidential Matrix			
Child Care - Daycare Center	S	S		
Child Care - Licensed Child Care	S	S		
Child Care - Registered Child Care Home	P	P		
Child - Care Institution (Basic)	S	S		
Church, Temple, Mosque (facilities that are for worship or study of religion)	See Nonresidential Matrix			
Dwelling - 1 Family (Attached or Townhouse)	P	P		
Dwelling - 1 Family (Detached)	P	P	P	

Dwelling - 2 Family	P	P		
Dwelling - 3 Family	P	P		
Dwelling - 4 Family	P	P		
Dwelling - Accessory (Carriage Houses, Granny Flats, Echo Homes)	P	P	P	
Dwelling - College Fraternity (Off Campus)	P	S	S	
Dwelling - School Dormitories or Housing (Off Campus)	P	S	S	
Dwelling - HUD-Code Manufactured Homes (Residential)		P	P	
Dwelling (loft and/or ARH)	P			
Dwelling - Multi-Family (18 Units/Acre Maximum)	P			
Dwelling - Multi-Family (25 Units/Acre Maximum)	P			
Dwelling - Multi-Family (33 Units/Acre Maximum)	P			
Dwelling - Multi-Family (40 Units/Acre Maximum)				
Dwelling - Multi-Family (50 Units/Acre Maximum)				
Dwelling - Zero Lot Line	P			
Dwelling - Townhouse	P			
Farming and Truck Garden	P	P	P	
Foster Family Home	P	P	P	
Foster Group Home	S	S	S	
Golf Course (Accessory to a Residential Subdivision)	See Nonresidential Matrix			
Museum	P	P	S	
Nursing Facility	P	S		
Radio/Television Station with Transmitter Tower	See Nonresidential Matrix			
Recreation Facility (Public and Noncommercial)	See Nonresidential Matrix			
Rooming House	See Nonresidential Matrix			
School - Private (Includes Church Schools, Private Schools K-12, Privately Owned College or University, Trade or Specialty School)	See Nonresidential Matrix			
School - Public (Includes All ISD Schools K-12, Open Enrollment Charter Schools,	See Nonresidential Matrix			

Public College or University				
Storage (moving pods) (see 35-A101)	P	P	P	P
Transit Center	P			P
Transit Park & Ride	P			P
Transit Transfer Center (Max Size 14'×33' and total footprint no larger than 30'×40')	P			P
Transit Station	S			S
Transitional Home	S	S	S	S
University or College (Private)	See Nonresidential Matrix			
Wireless Communication System	See Nonresidential Matrix			

TABLE 311-2 NONRESIDENTIAL USE MATRIX

	PERMITTED USE	O-1 & O-1.5	O-2*	NC	C-1	C-2	C-3	D	L	I-1	I-2	ERZD	(LBCS Function)
Agriculture	Greenhouse	P	P	P	P	P	P	P	P	P	P	P	9140
Agriculture	Indoor Growing	P	P	P	P	P	P	P	P	P	P	P	9140
Agriculture	Urban Farm	P	P	P	P	P	P	P	P	P	P	P	8100
Alcohol	Alcohol - Bar And/Or Tavern Without Cover Charge 3 or More Days Per Week			S	S	S	P	P	P			P	2540
Alcohol	Alcohol - Bar And/Or Tavern With Cover Charge 3 or More Days Per Week						S	P				P	2540
Alcohol	Alcohol - Nightclub Without Cover Charge 3 or More Days Per Week						P	P	P				2540
Alcohol	Alcohol - Nightclub With Cover Charge 3 or More Days Per Week						S	P					2540

Alcohol	Alcohol - Beverage Manufacture Or Brewery - Alcohol										P	NA	3110
Alcohol	Alcohol - Distillation, Storage									P	P	NA	3110
Alcohol	Alcohol - Microbrewery						P	P	P	P		S	3110
Alcohol	Alcohol - Beverage Retail Sales (Liquor Store)					P	P	P				P	2150
Alcohol	Alcohol - Wine Boutique					P	P	P	P			P	
Alcohol	Alcohol - Winery With Bottling						P		P				
Amusement	Amusement And/Or Theme Park - Outdoor Rides						P	S				P	5310
Amusement	Animal Racetrack And/Or Rodeo Arena								S	S		S	5130
Amusement	Billiard Or Pool Hall - No Alcohol In "C-2"					P	P	P				P	5380
Amusement	Bingo Parlor					S	P					P	5300
Amusement	Carnival And/Or Circus - Circus (more than 2 weeks, time limit set by city council on individual case consideration)						S	S	S			S	5300
Amusement	Dance Hall						P	P				P	5110
Amusement	Entertainment Venue (Indoor)					P	P	P	P	P		P	5110
Amusement	Entertainment Venue (Outdoor)						S	S	P	P		P	5110
Amusement	Fairground And/Or Stadium							S	S	S		S	5300
Amusement	Go-Cart Track						S		P			S	5300
~~Amusement~~	~~Laser Hide And Seek Games - Indoors~~					~~P~~	~~P~~	~~P~~				~~P~~	~~5300~~
~~Amusement~~	~~Laser Hide And Seek Games - Outdoors Permitted~~						~~S~~		~~P~~			~~P~~	~~5300~~

~~Amusement~~	~~Miniature Golf~~					~~P~~	~~P~~	~~S~~				~~P~~	~~5340~~
Amusement	Museum - public or private	P	P	P	P	P	P	P	P	P		P	5200
Amusement	Racing - Motor Vehicle									S		S	
Amusement	Live Entertainment Without Cover Charge 3 or More Days Per Week (Not Including Food Service Establishments)						S	P				P	5300
Amusement	Live Entertainment With Cover Charge 3 or More Days Per Week (Not Including Food Service Establishments)						S	P				P	5300
Amusement	Racing - Motor Vehicle									S		S	
Amusement	Theater - Indoor Permitting Over 2 Screens And/Or Stages						P	P				P	5110
Amusement	Theater - Indoor With 2 Or Less Screens And/Or Stages				S	P	P	P				P	
Amusement	Theater - Outdoor Including Drive-In And Amphitheaters								P			P	5110
Amusement	Video Games - Coin Or Token Operated			S	P	P	P	P				P	5320
Animal	Animal Clinic			P	P	P	P	P	P			S	2418
Animal	Animal and pet services (no outdoor training, boarding, runs, pens or paddocks)			P	P	P	P	P	P			P	2720
Animal	Animal and pet services (outdoor training, boarding, runs, pens or paddocks permitted)								P	P		S	2720
Animal	Animal - Equestrian Center and Riding Trails (see also 35-348)						S		S			S	
Animal	Animal - Pound Or Shelter								P	P		S	
Animal	Breeder - Small Animal Only								S	P		NA	

Animal	Cemetery - Pets (Limited To Small Animals)					P	P		P			S	6730
Animal	Stockyard										S	NA	9300
Animal	Veterinary Hospital - Large And Small Animal									P		S	2418
Animal	Veterinary Hospital - Small Animal								P	P		S	2418
Auto	Auto and Light Truck Repair (includes motorized vehicles such as motorcycles and all-terrain vehicles)						P		P			NA	2110
Auto	Truck And Heavy Equipment - Auction									P		S	
Auto	Ambulance Service						S	P	P			P	4150
Auto	Auto - Glass Tinting					P	P		P			P	2115
Auto	Auto - Manufacture										P	NA	3770
Auto	Auto And Light Truck - Oil, Lube And Tune Up					P	P		P			NA	2110
Auto	Auto And Light Truck Auction								S	P		P	2110
Auto	Auto And Light Truck Repair						P		P			NA	
Auto	Motor Vehicle Sales (full service)						P		P			NA	
Auto	Motor Vehicle Sales						P		P			S	2110
Auto	Auto - Rental						P		P	P	P	NA	
Auto	Auto - Rental (Pick Up And Drop Off Only in "C-2," "D" and "ERZD")					P	P	P	P	P		P	
Auto	Auto Alarm And Radio - Retail (Install. Incidental To Sales In "C-2")					P	P					P	2115
Auto	Auto Alarm And Radio - Retail (Sales And Installation						S		P			P	

	As A Primary Use)												
Auto	Auto Glass Sales - Installation Permitted						P		P	P		P	2110
Auto	Auto Muffler - Installation And Sales Only						P		P	P		S	2115
Auto	Auto Paint And Body - Repair With Outside Storage Of Vehicles And Parts Permitted But Totally Screened From View Of Adjacent Property Owners And Public Roadways						S		P	P		NA	
Auto	Auto Parts Retail - No Outside Storage In "C-2"					P	P		P			P	2115
Auto	Auto State Vehicle Inspection Station					P	P	P	P	P	P	P	2100
Auto	Auto Upholstery - Sales And Installation Completely Enclosed						P		P			P	2100
Auto	Carwash - see supplemental use regulations					S	P		P	S		S	2110
Auto	Limousine Service - Dispatch And Office Use Only No Servicing Of Vehicles Onsite					P	P	P	P	P		S	4155
Auto	Parking And Transient Vehicle Storage - Related To A Delivery (Auto, Truck, Trailer And Marine)(Each Vehicle Limited To 24 Hours Maximum Parking Time Within Any 48 Hour Period In "C3," "D" And "L")						S	S	P	P	P	S	9900
Auto	Parking And/Or Storage - Long Term								P	P	P	NA	
Auto	Parking Lot - Commercial, Subject to 35-384(b) (Parking Lots Requiring Demolition of Dwelling Units) and (d) (Surface	S	P	S	S	P	P	P	P	P	P	NA	2110

	Parking Design Standards)												
Auto	Parking Lot - Noncommercial, Subject to 35-384(b) (Parking Lots Requiring Demolition of Dwelling Units)	P	P		S	P	P	P	P	P	P	S	2100
Auto	Parking Garage - Commercial or Noncommercial, Subject to 35-384(c) (Parking Structure Design Standards)	S	P			P	P	P	P	P	P	S	
Auto	Taxi Service - Parking And Dispatch (No Washing Or Mechanical Service Permitted)						P	P	P	P		S	4155
Auto	Taxi Service - Parking And Dispatch (Washing Or Mechanical Service Permitted)								P	P		S	
Auto	Tire Repair - Auto And Small Truck (Sale And Installation Only, No Mechanical Service Permitted)					P	P	S	P			S	2100
Auto	Truck Repair And Maintenance						S		S	P	P	NA	2000
Auto	Truck Stop Or Laundry - Full Mechanical Service And Repair Permitted									P	P	NA	
Auto	Truck Stop Or Laundry - Tire Repair Permitted								S	P	P	S	2000
Auto	Vehicle Storage - See "Auto Parking And/Or Storage Long Term"	-	-	-	-	-	-	-	-	-	-	-	2110
Auto	Wrecker Service								P	P		NA	2100
Beverage	Beverage Manufacture - Non-Alcohol									P		S	
Church Temple,	Church Temple, Mosque (facilities that are for worship	P	P	P	P	P	P	P	P	P	P	P	6600

Mosque	or study of religion												
Dry Goods - Wholesale	Dry Goods - Wholesale							S	P	P		P	3510
Dwelling	Dwelling - 1 Family (Single-family)							P				P	1100
Dwelling	Dwelling - 1 Family Attached (townhome), see 35-373							P				P	1100
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 6 Dwellings Per Gross Acre, see also 35-381			P	P	P		P				P	
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 10 Dwellings Per Gross Acre, see also 35-381					P		P				P	
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 20 Dwellings Per Gross Acre, see also 35-381							P				P	
Dwelling	Dwelling - Attached Apartments/Condominiums							P					
Dwelling	Live-Work Units, subject to 35-381			P	P	P		P				P	
Dwelling	Loft (see definition of Dwelling, Loft 35-A101)	S	S		P	P	P	P	S	S			
Dwelling	Housing (Temporary Or Permanent) For On-Premises Caretaker			S	P	P	P	P	P	P	P	P	
Government	Armory							S	S	S	S	S	6300
Government	Correction Institution						S	S	S	S		P	6222
Government	Public Safety Facilities	P	P	P	P	P	P	P	P	P	P	P	6400
Housing	Bed and Breakfast, Boarding Home, Hotel (see Service												

	Category)												
Industrial	Batching Plant									P	P	S	
Industrial	Batching Plant - Temporary In "C-3" And "L" (6 Months Maximum)						S	S	S	P	P	S	3330
Industrial	Bookbinder						P		P	P		P	2135
Industrial	Cabinet Or Carpenter Shop						S		P	P		S	3210
Industrial	Can Recycle Collection Station - No Shredding						S		P	P	P	P	3600
Industrial	Coffee Roasting									P	P	P	3110
Industrial	Construction Contractor Facility - screening required for outdoor storage from public ROWs and adjacent property except in "I-2" (see also Service category, construction trades contractors)						S		S	P	P	S	7100
Industrial	Creamery									S	P	S	3110
Industrial	Dry Cleaning - Plant						P		P	P	P	NA	2600
Industrial	Electronic Component - Fabrication									P	P	S	3360
Industrial	Laundry - Plant						P		P	P		S	2600
Industrial	Lumber Yard And Building Materials						S		P	P	P	S	2126
Industrial	Machine Shop						S		P	P	P	S	7200
Industrial	Pecan Shelling								S	P	P	P	3110
Industrial	Printer - Large Scale						S		P	P		S	2400
Industrial	Rock Crusher									S	P	S	2120
Industrial	Rug Cleaning								P	P	P	S	2120
Industrial	Water Well Drilling Contractor									S	P	S	7230
Industrial	Welding Shop - Limited To						S		S	P	P	P	2100

	Three Employees And Screening Of Outside Storage In "C-3"												
Manufacturing	Abrasive - Manufacturing									P	P	NA	2610
Manufacturing	Acetylene Gas - Manufacturing And Storage										P	S	2613
Manufacturing	Air Products - Manufacturing									S	P	S	3400
Manufacturing	Artificial Limb Assembly					P	P	S	P	P	P	P	3400
Manufacturing	Asbestos Products - Manufacturing										P	NA	3330
Manufacturing	Asphalt Products - Manufacturing										P	NA	3330
Manufacturing	Bag Cleaning									P	P	S	2100
Manufacturing	Battery - Manufacturing										P	NA	3360
Manufacturing	Beverage - Manufacturing Or Processing									S	P	S	3110
Manufacturing	Biomedical Products - Manufacturing										S	NA	3000
Manufacturing	Boat And Marine - Manufacturing										P	S	2600
Manufacturing	Boiler And Tank Works										P	S	3350
Manufacturing	Broom, Brush - Manufacturing								P	P		S	3400
Manufacturing	Building Specialties - Wholesale Outside Storage Permitted								S	P		S	3510
Manufacturing	Bulk Plant Or Terminal (Includes Bulk Storage of Petro Chemicals)										S		
Manufacturing	Can Manufacture										P	NA	
Manufacturing	Candle - Manufacturing									S	P	S	3400
Manufacturing	Candy - Manufacturing								S	P		S	3110
Manufacturing	Canvas Products -								S	P	P	S	3400

	Manufacturing												
Manufacturing	Chemical - Manufacturing Or Processing									S	S	NA	3320
Manufacturing	Chemical/Drug - Wholesale And Storage								P	P		NA	3600
Manufacturing	Clothing Manufacture - Chemical Process										P	NA	3130
Manufacturing	Clothing Manufacture - Non-Chemical Process								P	P	P	S	3130
Manufacturing	Concrete Products - Manufacturing									S	P	S	3330
Manufacturing	Cotton Compress, Ginning And Bailing										P	NA	9510
Manufacturing	Drug - Manufacturing									P	P	S	3000
Manufacturing	Electronic Component - Manufacturing									S	P	NA	3360
Manufacturing	Electroplating										P	S	3400
Manufacturing	Felt Products - Manufacturing										P	S	3400
Manufacturing	Glass Manufacture										P	S	3330
Manufacturing	Grain - Drying										P	S	3600
Manufacturing	Grain - Milling										P	S	3100
Manufacturing	Hatchery										P	S	9240
Manufacturing	Hazardous Materials Storage										S	NA	4000
Manufacturing	Hosiery - Manufacturing									P	P	S	3320
Manufacturing	Ice Cream - Manufacturing								P	P	P	P	3110
Manufacturing	Ice Plant - Manufacturing And Processing									P	P	P	3100
Manufacturing	Insulation Products - Manufacturing And Processing										P	NA	3330
Manufacturing	Mattress - Manufacturing								P	P	P	S	3340

	And Rebuilding												
Manufacturing	Metal Forging Or Rolling Mill										S	NA	3340
Manufacturing	Metal Products - Fabrication									S	P	S	2140
Manufacturing	Millinery - Manufacturing								P	P		P	3400
Manufacturing	Millwork And Wood Products - Manufacturing									S	P	S	3210
Manufacturing	Moving And Transfer Company - With Trucks Attached To Trailers For A Total Exceeding 24 Feet In Length								P	P	P	S	4141
Manufacturing	Novelty And Souvenir - Manufacture								S	P	P	S	3400
Manufacturing	Nuclear Or Radioactive Instrumentation - Manufacturing									S	S	NA	3360
Manufacturing	Office Equipment, Furniture - Manufacture								P	P	P	S	2120
Manufacturing	Oil Well Supplies And Machinery - Manufacturing.										P	NA	3350
Manufacturing	Packing And Gasket - Manufacturing										P	NA	3000
Manufacturing	Packing Plant - No Rendering										P	NA	9200
Manufacturing	Paints, Etc. - Manufacturing And Processing										P	NA	3320
Manufacturing	Paper Products - Manufacturing										P	NA	3200
Manufacturing	Petroleum - Manufacturing Or Processing										S	NA	3310
Manufacturing	Planing Mill										S	S	2120
Manufacturing	Plastic / Vinyl - Manufacturing Or Processing									S	P	NA	3220

Manufacturing	Playground Equipment - Manufacturing								P	P	P	S	3400
Manufacturing	Poultry Processing - Caged Hen Operation										P	NA	9240
Manufacturing	Poultry Processing And Live Poultry Storage - Completely Enclosed										P	NA	9240
Manufacturing	Processing - Other Than Food									S	P	S	3000
Manufacturing	Refrigeration Equipment - Manufacturing									S	P	NA	3360
Manufacturing	Rendering Plant										S	NA	9200
Manufacturing	Sand Or Gravel - Storage And Sales									P	P	P	8000
Manufacturing	Shoe - Manufacturing								S	P	P	S	3140
Manufacturing	Shoe - Wholesale (Manufacturing Permitted)								S	P		S	
Manufacturing	Shoe Polish - Manufacturing										P	NA	3320
Manufacturing	Sign Manufacture								S	P	P	S	3440
Manufacturing	Stone Curing, Monument - Manufacturing									P	P	P	3330
Manufacturing	Textile - Manufacturing										P	S	3130
Manufacturing	Tile - Manufacturing										P	NA	3330
Manufacturing	Tile, Roofing And Waterproofing Products - Manufacturing										P	NA	3330
Manufacturing	Tobacco - Processing										P	S	3120
Manufacturing	Tool - Manufacturing									S	P	S	3400
Manufacturing	Toy - Manufacturing									P	P	S	3420
Manufacturing	Trailer - Manufacturing									P	P	S	3400
Manufacturing	Venetian Blind - Cleaning And Fabrication								S	P	P	S	2100

Manufacturing	Vulcanizing, Recapping									S	P	NA	3320
Manufacturing	Water Distillation									S	P	S	3110
Manufacturing	Wire Products - Manufacturing									P	P	S	3400
Manufacturing	Wood Processing By Creosoting Or Other Preserving Treatment										P	NA	3210
Manufacturing	Wool Pulling And Scouring										P	NA	3000
Medical	Medical - Surgical Supplies Wholesale						P	S	P	P		P	3510
Processing	Cosmetics - Manufacturing Or Processing									P		S	2600
Processing	Food And Food Products - Processing								S	P	P	S	3110
Processing	Punch Concentrate - Processing And Mixing								S	P	P	P	3110
Processing	Punch Concentrate Products - Mixing Only					S	P		P	P	P	P	3110
Processing	Used Automotive Parts Recycler										S	NA	
Processing	Recycling Facility Without Outside Storage And/Or Processing (Excluding Metal Recycling Entity)									P	P	S	
Processing	Recycling Facility With Outside Storage And/Or Processing (Excluding Metal Recycling Entity)										P	NA	
Processing	Metal Recycling Entity Without Outside Storage and/or Processing									S	S	S	
Processing	Metal Recycling Entity With Outside Storage and/or Processing										S	NA	
Recreation	Archery Range – Outdoor Permitted								S	P	P	P	5300

Recreation	Archery Range – Indoor Only					P	P	P	P	P	P	P	5300
Recreation	Athletic Fields – Indoor Only ~~Noncommercial~~	S	P~~S~~	P~~S~~	P	P	P	P~~S~~	P	P		P	5370
Recreation	Athletic Fields – Outdoor Permitted ~~Commercial~~	S	P ~~S~~	S	S	S	P	P~~S~~	P	P		P	5370
Recreation	Bowling Alley						P	P	P			P	5380
Recreation	Fitness Center/Health Club, Gymnasium, Natatorium, Sport Court – Indoor Only		P ~~S~~	P	P	P	P	P	P	P		P	5370
Recreation	Fitness Center/Health Club, Gymnasium, Natatorium, Sport Court – Outdoor Uses Permitted		P	S	S	S	P	P	P	P		P	5370
Recreation	Golf Course (See § 35-346 "G" District)											S	5370
Recreation	Golf Driving Range					S	P		P	S		S	5370
~~Recreation~~	~~Gymnasium – Commercial~~					~~S~~	~~P~~	~~P~~	~~P~~	~~P~~		~~P~~	
~~Recreation~~	~~Gymnasium~~				~~P~~	~~P~~	~~P~~	~~P~~	~~P~~	~~P~~	~~P~~	~~P~~	~~5370~~
Recreation	Park – Public Or Private	P	P	P	P	P	P	P	P ~~S~~	P ~~S~~	P ~~S~~	P	5500
Recreation	Performing Art Center - Digital Display Monitor							S					
~~Recreation~~	~~Recreational Facility – Community Wide~~					~~P~~	~~P~~	~~P~~				~~P~~	
Recreation	Recreational Facility – Neighborhood (see Definition in Appendix A)			P	P	P	P					P	5370
Recreation	Gun ~~Rifle and Pistol~~Range – Indoor Only						S	S	P ~~S~~	P ~~S~~	P	P ~~S~~	5300
Recreation	Gun ~~Rifle and Pistol~~ Range – Outdoor Permitted								S	S	S	S	5300
~~Recreation~~	~~Skateboard Track~~						~~S~~	~~S~~	~~P~~			~~P~~	~~5390~~

~~Recreation~~	~~Skating Rink - Ice Or Roller Skating~~						~~P~~	~~P~~	~~P~~			~~P~~	~~5390~~
Recreation	Stable And Equestrian Center								P			S	5300
~~Recreation~~	~~Tennis, Racquetball, Handball, Volleyball Or Basketball (Outside Courts Permitted)~~		~~P~~		~~S~~	~~S~~	~~P~~	~~P~~	~~P~~			~~P~~	
~~Recreation~~	~~Tennis, Racquetball, Handball, Volleyball Or Basketball - (Outside Courts Not Permitted)~~		~~P~~		~~S~~	~~P~~	~~P~~	~~P~~	~~P~~			~~P~~	~~5370~~
Recreation	Recreational Vehicle Park						S		P			P	
Retail	Air Conditioners - Retail (Incidental To Other Onsite Retail Items In "D")						P	P	P			P	2120
Retail	Antique Store - Retail			P	P	P	P	P	P			P	2145
Retail	Apothecary - See (Drugstore - Apothecary)												
Retail	Apparel And Accessory Store - Retail			P	P	P	P	P				P	2133
Retail	Appliance and Electronics - Retail (Appliance Sales Incidental To Other Onsite Retail Items in "C-1" and "D")				P	P	P	P				P	2125
Retail	Art Gallery		P	P	P	P	P	P				P	2142
Retail	Bakery - Retail			P	P	P	P	P				P	2151
Retail	Bookstore		P	P	P	P	P	P				P	2135
Retail	Business Machines - Retail		P		S	P	P	P				P	2130
Retail	Camera, Photographic Equipment And Supplies - Retail			P	P	P	P	P				P	2132
Retail	Candy, Nut And Confectionery - Retail			P	P	P	P	P				P	2153
Retail	Computer and Software-			P	P	P	P	P				P	2131

	Retail												
Retail	Convenience Store - Limited to Maximum 3,000 Square Foot Total Floor Area in "I-1"			P	P	P	P	P	P	P		P	2152
Retail	Convenience Store (With Carwash)					S	P		P	P	P	S	2152
Retail	Convenience Store (With Gasoline)					P	P	S	P	P	P	NA	2152
Retail	Convenience Store (With Gasoline And Carwash)					S	P		P	P	P	NA	2152
Retail	Dairy Products - Retail			P	P	P	P	P				P	2150
Retail	Drugstore - Apothecary		P	P	P	P	P	P				P	2161
Retail	Dry Goods - Retail			P	P	P	P	P	P			P	2133
Retail	Farm Supplies						S		P	P		P	2140
Retail	Feed, Seed, Fertilizer Sales - No Outside Storage In "C-3"						P		P	P		P	2140
Retail	Fish Market - Retail			P	P	P	P	P				P	2153
Retail	Flea Market - Indoor						P		P			P	2100
Retail	Flea Market - Outdoor								S	P		P	2100
Retail	Floor Covering - Retail (Incidental To Other Onsite Retail Items In "D")					P	P	P	P			P	2120
Retail	Florist - Retail		S	P	P	P	P	P	P			P	2141
Retail	Food Locker Plant - Retail								S	P		S	2120
Retail	Fruit And Produce - Retail			P	P	P	P	P				P	2154
Retail	Furniture Sales - Retail			S	P	P	P	P				P	2121
Retail	Gift Shop - Retail		S	P	P	P	P	P				P	2140
Retail	Glass - Retail					P	P	P	P			P	2120
Retail	Grocery Store - Limited to Maximum 3,000 Square Foot Total Floor Area in "NC"			P	P	P	P	P				P	2151

Retail	Hardware Sales - Retail (Limited to Maximum 3,000 Square Foot Total Floor Area in "NC")			P	P	P	P	P				P	2122
Retail	Headshop, see also Section 35-377						S					P	2143
Retail	Hobby Store - Retail (Limited to Maximum 3,000 Square Foot Total Floor Area in "NC")			P	P	P	P	P				P	2134
Retail	Home Improvement Center						P	S	P			P	
Retail	Jewelry Store - Retail		S	P	P	P	P	P				P	2140
Retail	Landscaping Materials - Sales And Storage								P	P		S	2123
Retail	Leather Goods Or Luggage Store - Retail			P	P	P	P	P				P	2130
Retail	Medical - Surgical Supplies Retail					P	P	P	P			P	2130
Retail	Milliner - Custom			P	P	P	P	P	P	P		P	3400
Retail	Music Store			P	P	P	P	P				P	2135
Retail	Newsstand		P	P	P	P	P	P				P	2140
Retail	Nursery - Retail (Growing Plants On-Site Permitted)					P	P		P			S	
Retail	Nursery - Retail (No Growing Plants On-site Permitted)				P	P	P	P				S	2100
Retail	Office Equipment And Supply - Retail		S		P	P	P	P	P			P	2120
Retail	Paint And Wallpaper Store - Retail And Wholesale					P	P	P	P	S		P	2120
Retail	Pet or pet supply store			P	P	P	P	P	P			P	2710
Retail	Plumbing Fixtures - Retail (Incidental To Other Onsite Retail Items In "D")					P	P	P	P			P	2120

Retail	Rug Or Carpet - Retail				P	P	P	P	P			P	2120
Retail	Secondhand Merchandise - Retail No Outside Storage Or Display Of Inventory Permitted)					P	P	P	P			P	2145
Retail	Shoe - Retail			P	P	P	P	P				P	2140
Retail	Silk Screening - Retail					P	P	P				P	2140
Retail	Sporting Goods - Retail			P	P	P	P	P				P	2134
Retail	Stamps And Coin Sales - Retail			P	P	P	P	P				P	2140
Retail	Stationary Products - Retail	S	P	P	P	P	P	P				P	2140
Retail	Tamale - Preparation Retail (Less Than 2,000 Square Feet In "C-1" And "C-2")			S	S	P	P	P	P			P	2153
Retail	Thrift Store - Retail See (Secondhand Merchandise)												2145
Retail	Tobacco Store - Retail		P	P	P	P	P	P				P	2143
Retail	Toy Store - Retail			P	P	P	P	P				P	2130
Retail	Trophy Sales, Engraving And Assembly			P	P	P	P	P	P			P	2140
Retail	Variety Store - Retail				P	P	P	P				P	2130
Sales	Boat - Sales And Service						P		P			S	
Sales	Machinery, Tools And Construction Equipment Sales And Service						S		P	P	P	S	2120
Sales	Farm Equipment Sales, Service Or Storage								P	P	P	S	2120
Sales	Oil Well Supplies And Machinery Sales - Used										P	NA	2120
Sales	Portable Building Sales					S	S		P	P	P	P	2120
School	School - Business or Commercial Trade		P			P	P	P				P	6142
~~School~~	~~School - Private University~~		~~S~~			~~S~~	~~P~~	~~P~~	~~P~~			~~P~~	~~6130~~

	~~Or College~~												
School	School - Public University Or College	P	P	P	P	P	P	P	P			P	6130
School	School - Montessori				S	P	P	P				P	6100
School	School - Nursery (Public And Private)		P	P	P	P	P	P				P	6110
School	School - Private Pre-Kindergarten Through 12th Grade and College or University	P	P	P	P	P	P	P				P	9900
School	School - Public Pre-Kindergarten Through 12th Grade	P	P	P	P	P	P	P				P	9900
School	Vocational Trade (No Outside Storage & Training Area Permitted)						P	P				S	6140
School	Vocational Trade (Outside Storage & Training Area Permitted)								P	P	P	S	6140
Service	Air Conditioning/Refrigeration - Service And Repair						S		P	P		P	2120
Service	Altering/Repairing Of Apparel			P	P	P	P	P				P	2600
Service	Ammunition - Manufacturing, Loading And Storage										S	S	2100
Service	Appliance - Repair Major					P	P		P			P	
Service	Appliance - Repair Small			P	P	P	P					P	2125
Service	Assisted Living Facility, Boarding Home Facility, or Community Home with no more than sixteen (16) residents			P	P	P	S	P				P	1230
Service	Auditorium		P			P	P	P				P	5110
Service	Bail Bond Agency					S	S		S	S		P	2220

Service	Bank, Credit Union	P	P	S	S	P	P	P	P			P	2210
Service	Barber or Beauty Shop		P	P	P	P	P	P				P	2600
Service	Bed And Breakfast, see § 35-374	S	P	S	P	P		P				P	1310
Service	Bicycle - Repair			P	P	P	P	P				P	2113
Service	Boat And Marine - Storage (Outside Permitted)						S		P			S	
Service	Body Piercing						P					P	2600
Service	Caterers and Catering Shop (No On-Premises Food Services)				P	P	P	P	P	P			
Service	Cemetery Or Mausoleum				S	S	S	S				NA	6700
Service	Charitable - food and/or clothing bank					P	P	P	P			P	
Service	Charitable - food service establishment (no charge for meals)					P	P	P	P			P	
Service	Construction Trades Contractors-screening required for outdoor storage from public ROWs and adjacent property except in "I-2" (see also Industrial category, contractor facility use)								P	P	S	S	7300
Service	Copy Service - Blueprinting And Photocopying	P	P	P	P	P	P	P				S	2414
Service	Cosmetics - Permanent			P	P	P	P	P				P	2600
Service	Day Care Center - Child And/Or Adult Care		S	P	P	P	P	P	S			P	6562
Service	Dry Cleaning - Limited To Five Employees					P	P	P	P	P		S	2600
Service	Dry Cleaning - Pickup Station Only		P	P	P	P	P	P	P			P	2600
Service	Electric Repair - Heavy								P	P		P	7330

	Equipment												
Service	Electric Repair - Light Equipment						S		P	P		P	7330
Service	Electronic Equipment - Repair			P	P	P	P	P	P			S	2125
Service	Elevator Maintenance - Service							P	P	P		S	2450
Service	Employment Agency	P	P		S	P	P	P				P	2423
Service	Extended Stay Hotel /Motel, Timeshares, Or Corporate Apartment					S	P	P	P			P	
Service	Exterminators								S	P		S	2451
Service	Food Service Establishment Without Cover Charge 3 or More Days Per Week (With or Without Accessory Live Entertainment)		P	P	P	P	P	P	P	P		P	2150
Service	Food Service Establishment With Cover Charge 3 or More Days Per Week (With or Without Accessory Live Entertainment)						S	P				P	2150
Service	Food, Mobile Food Court (subject to 35-399)					P	P	S	P			S	2550
Service	Food, Mobile Vending (Base Operations)								P	P	P	S	
Service	Funeral Home Or Undertaking Parlor						P	P	P			S	6710
Service	Furniture Repair/Upholstering			P	P	P	P	P	P			S	2121
Service	Gasoline Filling Station (Without Repair Or Carwash)					P	P	S	P	P	P	NA	2116
Service	Gasoline Filling Station (With Repair)						P		P	P	P	NA	
Service	Gasoline Filling Station (With Repair And/Or					S	P	S	P	P	P	NA	

	Carwash)												
Service	Gasoline Filling Station - Fleet						S		P	P	P	NA	
Service	Group Day Care Limited To 12 Individuals	P	P	P	P	P	P	P	P			P	6562
Service	Gunsmith					P	P	P	P			S	2134
Service	Hotel					S	P	P	P			P	
Service	Hotel taller than 35 feet when unable to achieve additional height pursuant to § 35-517(d) Setbacks for Height Increases						S	P				P	6500
Service	Human Services Campus						S	S				P	6500
Service	Ice Machine (over 120 square feet)					P	P		P	P		P	
Service	Janitorial/Cleaning Service					P	P	P	P	P		S	2452
~~Service~~	~~Laboratory - Research~~						~~P~~	~~P~~	~~P~~	~~P~~		~~S~~	~~2416~~
Service	Laboratory – Research Or Testing	P	P				P	P	P	P		S	2416
Service	Laundry And Dry Cleaning - Self Service			P	P	P	P	P				S	2600
Service	Laundry- Limited To Max Of Five Employees					P	P	P	P	P		S	2600
Service	Laundry Or Dry Cleaning - Pickup Station Only		P	P	P	P	P	P	P			P	2600
Service	Lawnmower Repair And Service - No Outside Storage In "C-2"					P	P		P			S	2100
Service	Library	P	P	P	P	P	P	P				P	4242
Service	Linen Or Uniform Supply, Diaper Service (Pickup And Supply Only)						P		P	P		S	2100
Service	Loan Office	P	P		P	P	P	P				P	

Service	Locksmith		P	P	P	P	P	P				P	2100
Service	Manufactured Home / Oversize Vehicle Sales, Service Or Storage								S	P		S	2100
Service	Massage - Parlor						P	P				P	6520
Service	Massage - Therapeutic	S	P	P	P	P	P	P	P			P	3400
Service	Medical - Chiropractor Office	P	P	P	P	P	P	P				P	6511
Service	Medical - Clinic (Physician And/Or Dentist)	P	P	P	P	P	P	P				P	6511 6512 6514
Service	Medical - Clinic Physical Therapist	S	P	P	P	P	P	P				P	6520
Service	Medical - Hospital Or Sanitarium					S	P	P	S			S	6530
Service	Medical - Hospital taller than 35 feet when unable to achieve additional height pursuant to § 35-517(d) Setbacks for Height Increases					S	S	P	S			S	6530
Service	Medical - Laboratory Dental Or Medical		S	P	P	P	P	P	P			S	6513
Service	Medical - Optical Goods Retail	S	P	P	P	P	P	P				P	2163
Service	Medical - Optical Goods Wholesale						P	P	P	P		P	3510
Service	Medical - Optometry Office	P	P	P	P	P	P	P				P	2410
Service	Mortuary - Preparation Only						S		P			S	6700
Service	Movie and/or Game Rentals			P	P	P	P	P				P	2336
Service	Nursing Facility				P	P	P					P	1250
Service	Office Call Center	P	P			P	P	P	P	P		P	
Service	Office Data Processing & Management	P	P			P	P	P	P	P		P	
Service	Office Professional	P	P	P	P	P	P	P	P	P		P	2400

Service	Palm Reading			P	P	P	P	P				P	2600
Service	Party House, Reception Hall, Meeting Facilities					S	P	P	P	S		P	
Service	Pawn Shop						P	P	P			P	2140
Service	Picture Framing			P	P	P	P	P				P	2140
Service	Post Office	P	P	P	P	P	P	P	P	P		P	6310
Service	Radio or Television Station Studio	P	P		P	P	P	P	P	P		P	
Service	Reading Room	P	P	P	P	P	P	P				P	5300
Service	Record Storage Facility (electronic and/or paper)		P			P	P	P	P	P		P	
Service	Reducing Salon				P	P	P	P				P	6511
Service	Rental - Event Specialties (no outside storage and or display allowed)					P	P	S	P			S	
Service	Rental - Tool, Equipment and Event Specialties (fenced & screened outside storage and display permitted)						P	S	P	P	S	S	2140
Service	Rooming House				P	P	P	P				P	
Service	Self-Defense Instruction			P	P	P	P	P	P			P	6140
Service	Shoe - Repair			P	P	P	P	P				P	2600
Service	Sign Shop - No Outside Storage					P	P	P	P			P	3440
Service	Specified Financial Institution (see § 35-394)				S	S	S					P	
Service	Studio - Fine Or Performing Arts	S	P	P	P	P	P	P				P	6145
Service	Studio - Interior Decorating	P	P	P	P	P	P	P				P	2413
Service	Studio - Photographic			P	P	P	P	P				P	
Service	Studio - Sound And Recording						P	P	P			P	

Service	Tailor Shop			P	P	P	P	P				P	2600
Service	Tattoo Parlor/Studio						P					P	2600
Service	Taxidermist								P	P		S	2140
Service	Temporary Common Worker Employer						S	P		P		P	
Service	Transitional Home					S	S	S	S	S		P	
Service	Tree Cut And Trim Service						S		P	P		S	2000
Service	Watch Repair		P	P	P	P	P	P				P	2140
Social	Club - Private (see definition "Club" in 35-A101)					S	P	P				P	6830
Social	Clubhouse - Civic And Fraternal Organizations. Including Lodges And Meeting Halls				P	P	P	P				P	6830
Storage	Carting, Crating, Hauling, Storage									P	P	S	3600
Storage	Cold Storage									P	P	S	3600
Storage	Fur Dyeing, Finishing And Storing							S	P	P		S	3600
Storage	Moving Company								P	P	P	S	4140
Storage	Pipe Storage									P	P	P	
Storage	Self Service Storage	S	S			P	P	P	P	P	P	P	2321
~~Storage~~	~~Storage, Climate Controlled~~	~~S~~	~~S~~			~~P~~	~~P~~		~~P~~	~~P~~	~~P~~	~~S~~	
Storage	Storage, Moving Pod (see definition in Appendix A)	P	P	P	P	P	P	P	P	P	P	S	
Storage	Storage - Outside (Screening From Public ROWs And Adjacent Property Required)						S		S	S	P	S	
Storage	Storage - Outside (Open With No Screening Required)								S	S	P	S	
Storage	Storage - Outside (Under Roof and Screened)								P	P	S	S	9900

Storage	Storage Shipping Container (see definition in Appendix A. Requires registration affidavit with Development Services Dept.)	S	S	S	S	S	S	S	P	P	P	S	
Transportation	Airport - Non-Governmental									S	S	S	4113
Transportation	Bus Shelter (Max size 6'×13')	P	P	P	P	P	P	P	P	P	P	P	
Transportation	Bus Stop	P	P	P	P	P	P	P	P	P	P	P	
Transportation	Freight Depot								S	P	P	S	4140
Transportation	Heliport (see also Chapter 3 City Code)		S					S		S	S	S	4110
Transportation	Helistop (see also Chapter 3 City Code)		S			S	S	S		S	S	P	4110
Transportation	Horse-Drawn Carriage (Base Operations) – Indoor Carriage Storage and/or Animal Boarding only (see also Chapters 5 and 33 of the City Code)						P	P	P	P		P	9372
Transportation	Horse-Drawn Carriage (Base Operations) – Outdoor Carriage Storage and/or Animal Boarding allowed (see also Chapters 5 and 33 of the City Code)						S	S	P	P		S	9372
Transportation	Passenger Depot						S	S	P	P	P	P	4120
Transportation	Transit Bus Maintenance Facility								S	P		NA	
Transportation	Transit Bus Storage Facility								S	P		NA	
Transportation	Transit Center	P	P	P	P	P	P	P	P	P	P	S	4133
Transportation	Transit Park & Ride	S	S	P	P	P	P	P	P	P	P	S	4133
Transportation	Transit Station	S	S	S	S	S	S	S	S	S	S	S	4133
Transportation	Transit Transfer Center (Max Size 14'×33' and total footprint no larger than 30'×40')	P	P	P	P	P	P	P	P	P	P	S	4133
Utilities	Radio/Television Antenna, subject to § 35-385(b)	P	P	P	P	P	P	P	P	P	P	S	

Utilities	Radio/Television Antenna, unable to comply with § 35-385(b)	S	S	S	S	S	S	S	S	S	S	S	
Utilities	Small Wind Energy Systems, subject to § 35-398(a)	S	P	S	S	S	P	P	P	P	P	S	
Utilities	Solar Farm, Photovoltaic, subject to § 35-398(b)	S	S	S	S	S	S	S	P	P	P	S	
Utilities	Telephone Equipment Infrastructure	S	S	S	S	S	S	P	P	P	P	P	4234
Utilities	Wireless Communication System, subject to § 35-385(e)	P	P	P	P	P	P	P	P	P	P	S	4233
Utilities	Wireless Communication System, subject to § 35-385(d)	S	S	S	S	S	S	S	S	S	S	S	4233
Utility	Sanitary Landfill, Solid Waste Facility										S	NA	4345
Warehouse	Office Warehouse (Flex Space) - Outside Storage Not Permitted except in the I-2 district ~~(warehouse/wholesaling use not to exceed 25% of the gross floor area in C-3 district)~~ ~~(office/showroom/retail uses not to exceed 25% of the gross floor area in the I-2 district)~~						P		P	P	P	S	3600
Warehousing	Warehousing							S	P	P	P	S	3600
Wholesale	Bakery - Wholesale								S	P		P	3520
Wholesale	Barber And Beauty Equipment - Wholesale						P	P	P			P	3510
Wholesale	Camera, Photographic Equipment And Supplies - Wholesale						S	P	P	P		S	3510
Wholesale	Dairy Equipment Sales - Wholesale									P	P	P	3510

Wholesale	Dairy Products - Wholesale									P		P	3520
Wholesale	Drug Sales - Wholesale								P	P		P	3520
Wholesale	Fish Market - Wholesale								P	P		P	3520
Wholesale	Florist - Wholesale						P	P	P	P		P	3520
Wholesale	Food Products - Wholesale And Storage								P	P		P	3520
Wholesale	Fruit And Produce - Wholesale								S	P		P	3520
Wholesale	Furniture Sales - Wholesale						P		P	P		P	3510
Wholesale	Glass - Wholesale						P		P	P		P	2120
Wholesale	Grocery - Wholesale									P	P	P	3520
Wholesale	Hardware Sales - Wholesale								P	P		P	3510
Wholesale	Office Equipment And Supply - Wholesale (Incidental To Other Onsite Retail Items In "D")						P	P	P	P		P	3520
Wholesale	Paper Supplies - Wholesale (Incidental To Onsite Retail Items In "C-3" And "D")						P	P	P	P	P	P	3520
Wholesale	Nursery - Plant Wholesale Onsite Growing Permitted						P		P			S	9140
Wholesale	Plumbing Fixtures - Wholesale						S	S	P	P		P	3510
Wholesale	Shoe - Wholesale No Manufacturing						P	P	P			P	3520
Wholesale	Sporting Goods - Wholesale (Incidental To Onsite Retail Items In "D")							P	P	P		P	3510
Wholesale	Stone Monument - Retail And Wholesale								P	P		P	2130
Wholesale	Tamale - Preparation Wholesale (Less Than 2,000 Square Foot In "C-1" And C-2)				S	S	P	P	P	P		P	3520

* For uses permitted by right ("P") in the "O-2" district, please see 35-310.09(c)(1)(D).

TABLE 311-2a NONRESIDENTIAL USE MATRIX													
		Urban		Rural		Farm		Mixed Industrial					
	PERMITTED USE	UD Major Node	UD Minor Node	RD Major Node	RD Minor Node	FR Ag Commercial	VILLAGE CENTER FR/ FR Minor Node	MI - 1	MI-1 Minor Node	VILLAGE CENTER - M1	MI - 2	MI-2 Minor Node	VILLAGE CENTER - M2
Alcohol	Alcohol - Bar And/Or Tavern Without Cover Charge 3 or More Days Per Week	P	S	P	S		P		S	P		S	P
Alcohol	Alcohol - Bar And/Or Tavern With Cover Charge 3 or More Days Per Week	S	S	S	S		S		S	S		S	S
Alcohol	Alcohol - Nightclub Without Cover Charge 3 or More Days Per Week	P		P			P			P			P
Alcohol	Alcohol - Nightclub With Cover Charge 3 or More Days Per Week	S		S			S			S			S
Alcohol	Alcohol - Beverage Manufacture Or Brewery - Alcohol										P		
Alcohol	Alcohol - Distillation, Storage										P		
Alcohol	Alcohol - Microbrewery	P		P			P			P	P		P
Alcohol	Alcohol - Beverage Retail Sales (Liquor Store)	P		P			P			P			P
Alcohol	Wine Boutique	P		P			P			P			P

Alcohol	Alcohol - Winery With Bottling					P					P			
Amusement	Animal Racetrack And/Or Rodeo Arena							S						
Amusement	Entertainment Venue (Indoor)	P	P	P	P	P	P	P	P	P	P	P	P	
Amusement	Entertainment Venue (Outdoor)	P	S	P	S	P	S	P	S	P	P	S	P	
Amusement	Fairground And/Or Stadium					P		S						
~~Amusement~~	~~Miniature Golf~~	~~P~~		~~P~~										
Amusement	Amusement And/Or Theme Park - Outdoor Rides	S		S										
Amusement	Billiard Or Pool Hall	P		P						P			P	
Amusement	Bingo Parlor	P		P		S	S							
Amusement	Carnival And/Or Circus - Temporary use (more than 2 weeks, time limit set by city council on individual case consideration)	S		S		S		S			S			
Amusement	Dance Hall	P		P		P	P	P						
Amusement	Go-Cart Track	S		S		P		P						
~~Amusement~~	~~Laser Hide And Seek Games - Indoors~~	~~P~~		~~P~~				~~P~~			~~P~~			
~~Amusement~~	~~Laser Hide And Seek Games - Outdoors Permitted~~					~~P~~		~~P~~						
Amusement	Live Entertainment Without Cover Charge 3 or More Days Per Week (Not Including Food Service Establishments)	S		S										

Amusement	Live Entertainment With Cover Charge 3 or More Days Per Week (Not Including Food Service Establishments)	S		S										
Amusement	Museum - public or private	P	P	P	P	P	P	P	P	P			P	
Amusement	Racing - Motor Vehicle							S			S			
Amusement	Theater - Indoor permitting Over 2 Screens And/Or Stages	P		P										
Amusement	Theater - Indoor With 2 Or Less Screens And/Or Stages	P		P						P			P	
Amusement	Theater - Outdoor Including Drive-In And Amphitheaters					P	P	P						
Amusement	Video Games - Coin Or Token Operated	P	S	P	S				S	P		S	P	
Animal	Animal Clinic	P	P	P	P	P	P	P	P	P		P		
Animal	Animal and pet services (no outdoor boarding, runs, pens or paddocks)	P	P	P	P	P	P	P	P	P		P		
Animal	Animal and pet services (outdoor boarding, runs, pens or paddocks permitted)					P	P	P						
Animal	Animal - Equestrian Center And Riding Trails					S		S						
Animal	Animal - Pound Or Shelter							P						
Animal	Breeder - Small Animal Only					P		S						
Animal	Cemetery - Pets (Limited To Small					P		P						

	Animals)															
Animal	Stockyard								S							
Animal	Veterinary Hospital - Large And Small Animal					P			P							
Auto	Truck And Heavy Equipment - Auction															
Auto	Ambulance Service	S		S					P							
Auto	Auto - Glass Tinting	P		P					P							
Auto	Auto And Light Truck - Manufacture											P				
Auto	Auto And Light Truck - Oil, Lube And Tune Up	P		P						P	P	P		P		
Auto	Auto And Light Truck Auction								S							
Auto	Auto And Light Truck Repair	S		S						P	P	P		P		
Auto	Auto - Rental	P		P												
Auto	Auto - Rental (Pickup And Drop Off Only)	P		P							P			P		
Auto	Auto Alarm And Radio - Retail (Install. Incidental To Sales In "UD")	P		P							P			P		
Auto	Auto Alarm and Radio - Retail (Sales And Installation As A Primary Use)	S		S					P							
Auto	Auto Glass Sales - Installation Permitted	S		S					P			P				
Auto	Auto Muffler - Installation And Sales Only	S		S					P			P				
Auto	Auto Paint And Body - Repair With Outside	S		S					P			P				

	Storage Of Vehicles And Parts Permitted But Totally Screened From View Of Adjacent Property Owners And Public Roadways															
Auto	Auto Parts Retail - No Outside Storage In "UD"	P		P				P		P			P			
Auto	Auto State Vehicle Inspection Station	P		P					P	P	P		P			
Auto	Auto Upholstery - Sales And Installation Completely Enclosed	S		S				P			P					
Auto	Carwash - See supplemental use regulations	P		P				P								
Auto	Limousine Service - Dispatch And Office Use Only No Servicing Of Vehicles Onsite	P		P				P								
Auto	Motor Vehicle Sales (full service)	S		S				S			P					
Auto	Motor Vehicle Sales	S		S				S								
Auto	Parking And Transient Vehicle Storage - Related To A Delivery (Auto, Truck, Trailer And Marine)							P			P					
Auto	Parking And/Or Storage - Long Term							P			P					
Auto	Parking (as primary use; surface lot or structured), see §35-384	P	P	P	P			P			P					
Auto	Taxi Service - Parking And Dispatch (No Washing Or Mechanical Service	S		S				P								

	Permitted)															
Auto	Taxi Service - Parking And Dispatch (Washing Or Mechanical Service Permitted)			S				P								
Auto	Tire Repair - Auto And Small Truck (Sale And Installation Only, No Mechanical Service Permitted)	P		P				P								
Auto	Truck Repair And Maintenance	S		S				P			P					
Auto	Truck Stop Or Laundry - Full Mechanical Service And Repair Permitted							P			P					
Auto	Truck Stop Or Laundry - Tire Repair Permitted							P			P					
Auto	Vehicle Storage - See "Auto Parking And/Or Storage Long Term"										P					
Auto	Wrecker Service							P								
Auto Manufacturing	Auto Manufacturing Assembly Operations (< 5 acres in MI-1)							P			P					
Auto Manufacturing	Electronic Component Manufacturing (< 5 acres in MI-1)							P			P					
Auto Manufacturing	Metal Fabrication (< 5 acres in MI-1)							P			P					
Auto Manufacturing	Plastics Manufacturing (< 5 acres in MI-1)							P			P					
Auto Manufacturing	Auto Parts Sequencing And Assembly (< 5 acres in MI-1)							P			P					
Beverage	Beverage Manufacture															

	- Non-Alcohol													
Church, Temple, Mosque	Church, Temple, Mosque (facilities that are for worship or study of religion)	P	P	P	P	P	P		P	P		P		
Dry Goods - Wholesale	Dry Goods - Wholesale							P						
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 6 Dwellings Per Gross Acre, see also 35-381	P	P											
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 10 Dwellings Per Gross Acre, see also 35-381	P	P											
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 20 Dwellings Per Gross Acre, see also 35-381	P	P											
Dwelling	Dwelling - Attached Apartments/Condominiums With Maximum Density Of 50 Dwellings Per Gross Acre, see also 35-381	P												
Dwelling	Housing (Temporary Or Permanent) For On-Premises Caretaker	P	P	P	P	P	P	P	P	P	P	P	P	
Dwelling	Live-Work Units, subject to 35-381	P	P											
Farm And Ranch	Bulk Grain And Feed Storage					P	S	P						
Farm And Ranch	Farming (Crops And Livestock)	P	P	P	P	P	P	P	P	P	P	P	P	

Farm And Ranch	Farmers Cooperative					P	P	P						
Farm And Ranch	Farmers Market					P	P	P						
Farm And Ranch	Greenhouse - Non-Retail	P	P	P	P	P	P	P	P	P	P	P	P	
Farm And Ranch	Greenhouse - Retail	P	P	P	P	P	P	P	P	P	P	P	P	
Farm And Ranch	Indoor Growing	P	P	P	P	P	P	P	P	P	P	P	P	
Farm And Ranch	Orchard	P	P	P	P	P	P	P	P	P	P	P	P	
Farm And Ranch	Ranch	P	P	P	P	P	P	P	P	P	P	P	P	
Farm And Ranch	On-Site Storage of Farm Equipment					P	P	P						
Farm And Ranch	Retail - Crafts						P		P					
Farm And Ranch	Urban Farm	P	P	P	P	P	P	P	P	P	P	P	P	
Government	Armory							S			S			
Government	Correction Institution							S						
Government	Public Safety Facilities	P	P	P	P	P	P	P	P	P	P	P	P	
Industrial	Batching Plant										P			
Industrial	Batching Plant - Temporary In "UD" And "RD" (6 Months Maximum)	S		S							P			
Industrial	Bookbinder							S						
Industrial	Cabinet Or Carpenter Shop							S						
Industrial	Can Recycle Collection Station - No Shredding	S		S				S			P			

Industrial	Coffee Roasting											P			
Industrial	Construction Contractor Facility - screening required for outdoor storage from public ROWs and adjacent property (see also Service category, construction trades contractors)								S			P			
Industrial	Creamery											P			
Industrial	Dry Cleaning - Plant											P			
Industrial	Electronic Component - Fabrication								P			P			
Industrial	Laundry - Plant														
Industrial	Lumber Yard And Building Materials								P			P			
Industrial	Machine Shop								P			P			
Industrial	Pecan Shelling					S			S			P			
Industrial	Printer - Large Scale								P			P			
Industrial	Rock Crusher								S			P			
Industrial	Rug Cleaning								P			P			
Industrial	Water Well Drilling Contractor								S			P			
Industrial	Welding Shop					S			S			P			
Manufacturing	Abrasive - Manufacturing											P			
Manufacturing	Acetylene Gas - Manufacturing And Storage											P			
Manufacturing	Air Products - Manufacturing											P			
Manufacturing	Artificial Limb Assembly			S					P			P			

Manufacturing	Asbestos Products - Manufacturing											P				
Manufacturing	Asphalt Products - Manufacturing											P				
Manufacturing	Bag Cleaning											P				
Manufacturing	Battery - Manufacturing											P				
Manufacturing	Beverage - Manufacturing Or Processing											P				
Manufacturing	Biomedical Products - Manufacturing											S				
Manufacturing	Boat And Marine - Manufacturing											P				
Manufacturing	Boiler And Tank Works											P				
Manufacturing	Broom, Brush - Manufacturing								S							
Manufacturing	Building specialties - Wholesale Outside Storage Permitted								S							
Manufacturing	Bulk Plant Or Terminal											S				
Manufacturing	Can Manufacture											P				
Manufacturing	Candle - Manufacturing											P				
Manufacturing	Candy - Manufacturing								S							
Manufacturing	Canvas Products - Manufacturing								S			P				
Manufacturing	Chemical - Manufacturing Or Processing											S				
Manufacturing	Chemical/Drug - Wholesale And Storage								P							
Manufacturing	Clothing Manufacture -											P				

	Chemical Process															
Manufacturing	Clothing Manufacture - Non-Chemical Process								S			P				
Manufacturing	Concrete Products - Manufacturing											P				
Manufacturing	Cotton Compress, Ginning And Bailing											P				
Manufacturing	Drug - Manufacturing											P				
Manufacturing	Electronic Component - Manufacturing											P				
Manufacturing	Electroplating											P				
Manufacturing	Felt Products - Manufacturing											P				
Manufacturing	Glass Manufacture											P				
Manufacturing	Grain - Drying											P				
Manufacturing	Grain - Milling											P				
Manufacturing	Hatchery											P				
Manufacturing	Hazardous Materials Hauling Or Storage											S				
Manufacturing	Hosiery - Manufacturing											P				
Manufacturing	Ice Cream - Manufacturing								P			P				
Manufacturing	Ice Plant - Manufacturing And Processing											P				
Manufacturing	Insulation Products - Manufacturing And Processing								P			P				
Manufacturing	Petro Chemicals Bulk Storage											P				
Manufacturing	Mattress - Manufacturing And								S			P				

	Rebuilding															
Manufacturing	Metal Forging Or Rolling Mill											S				
Manufacturing	Metal Products - Fabrication											P				
Manufacturing	Millinery - Manufacturing								S							
Manufacturing	Millwork And Wood Products - Manufacturing											P				
Manufacturing	Moving And Transfer Company - With Trucks Attached To Trailers For A Total Exceeding 24 Feet In Length								P			P				
Manufacturing	Novelty And Souvenir - Manufacture								S			P				
Manufacturing	Nuclear Or Radioactive Instrumentation - Manufacturing											S				
Manufacturing	Office Equipment, Furniture - Manufacture								P			P				
Manufacturing	Oil Well Supplies And Machinery - Manufacturing.											P				
Manufacturing	Packing And Gasket - Manufacturing											P				
Manufacturing	Packing Plant - No Rendering											P				
Manufacturing	Paints, Etc. - Manufacturing And Processing											P				
Manufacturing	Paper Products - Manufacturing											P				
Manufacturing	Petroleum - Manufacturing Or											S				

	Processing															
Manufacturing	Pipe Storage											P				
Manufacturing	Planing Mill											S				
Manufacturing	Plastic/Vinyl - Manufacturing Or Processing											P				
Manufacturing	Playground Equipment - Manufacturing											P				
Manufacturing	Poultry Processing - Caged Hen Operation											P				
Manufacturing	Poultry Processing And Live Poultry Storage - Completely Enclosed											P				
Manufacturing	Processing - Other Than Food											P				
Manufacturing	Refrigeration Equipment - Manufacturing											P				
Manufacturing	Rendering Plant											S				
Manufacturing	Sand Or Gravel - Storage And Sales											P				
Manufacturing	Shoe - Manufacturing								S			P				
Manufacturing	Shoe - Wholesale (Manufacturing Permitted)								S							
Manufacturing	Shoe Polish - Manufacturing											P				
Manufacturing	Sign Manufacture								S			P				
Manufacturing	Stone Curing, Monument - Manufacturing											P				
Manufacturing	Storage - Outside (Open With No Screening Required)								S			P				

Manufacturing	Storage - Outside (Screening From Public Rows And Adjacent Property Required)							S			P				
Manufacturing	Textile - Manufacturing										P				
Manufacturing	Tile - Manufacturing										P				
Manufacturing	Tile, Roofing And Waterproofing Products - Manufacturing										P				
Manufacturing	Tobacco - Processing										P				
Manufacturing	Tool - Manufacturing										P				
Manufacturing	Toy - Manufacturing										P				
Manufacturing	Trailer - Manufacturing										P				
Manufacturing	Venetian Blind - Cleaning And Fabrication							S			P				
Manufacturing	Vulcanizing, Recapping										P				
Manufacturing	Water Distillation										P				
Manufacturing	Wire Products - Manufacturing										P				
Manufacturing	Wood Processing By Creosoting Or Other Preserving Treatment										P				
Manufacturing	Wool Pulling And Scouring										P				
Medical	Medical - Surgical Supplies Wholesale							P							
Processing	Cosmetics - Manufacturing Or Processing														
Processing	Food And Food Products - Processing					S	S	P			P				

Processing	Punch Concentrate - Processing And Mixing							S			P			
Processing	Used Automotive Parts Recycler										S			
Processing	Punch Concentrate Products - Mixing Only							P			P			
Processing	Recycling Facility Without Outside Storage And/Or Processing (excluding metal recycling entity)							P			P			
Processing	Recycling Facility With Outside Storage And/Or Processing (excluding metal recycling entity)										P			
Processing	Metal recycling entity Without Outside Storage and/or Processing							S			S			
Processing	Metal recycling entity With Outside Storage and/or Processing										S			
Recreation	Archery Range – Outdoor Permitted					P	P	P			P			
Recreation	Archery Range – Indoor Only	P		P		P	P	P	P	P	P	P	P	
Recreation	Athletic Fields - ~~Noncommercial~~	P	S	P	S	P	P	P	S			S		
~~Recreation~~	~~Athletic Fields – Commercial~~	~~P~~	~~S~~	~~P~~	~~S~~			~~P~~	~~S~~			~~S~~		
Recreation	Bowling Alley	P		P				P						
Recreation	Fitness Center/Health Club, Gymnasium, Natatorium, Sport Court – Indoor Only	P	P	P	P		P		P	P		P	P	
Recreation	Golf Course (See § 35-													

	346 "G" District)													
Recreation	Golf Driving Range							P						
~~Recreation~~	~~Gymnasium - Commercial~~	~~P~~		~~P~~				~~P~~						
Recreation	Fitness Center/Health Club, Gymnasium, Natatorium, Sport Court – Outdoor Uses Permitted	P	S	P	S		P		P	S		P	S	
~~Recreation~~	~~Gymnasium~~	~~P~~		~~P~~				~~P~~						
Recreation	Park – Public or Private	P	P	P	P	P	P	~~S~~P	P	P	~~S~~P	P	P	
~~Recreation~~	~~Recreational Facility - Private Community Wide~~	~~P~~		~~P~~										
~~Recreation~~	~~Recreational Facility - Private Neighborhood~~	~~P~~	~~P~~	~~P~~	~~P~~									
~~Recreation~~	~~Recreational Facility - Public Community Wide~~	~~P~~		~~P~~										
~~Recreation~~	~~Recreational Facility - Public Neighborhood~~	~~P~~	~~P~~	~~P~~	~~P~~									
Recreation	Recreational Facility – Neighborhood (see Definition in Appendix A)	P	P	P	P	P	P							
Recreation	~~Rifle and Pistol~~ Gun Range – Indoor Only					P	P	P			P			
Recreation	~~Rifle and Pistol~~ Gun Range – Outdoor Permitted					S		S			S			
~~Recreation~~	~~Skateboard Track~~	~~S~~		~~S~~		~~S~~		~~P~~						
~~Recreation~~	~~Skating Rink - Ice Or Roller Skating~~	~~P~~		~~P~~		~~S~~	~~S~~	~~P~~						
Recreation	Stable And Equestrian Center					P		P						

~~Recreation~~	~~Tennis, Racquetball Or Handball - Noncommercial (Outside Courts Permitted)~~	~~P~~	~~S~~	~~P~~	~~S~~	~~P~~	~~P~~	~~P~~	~~S~~			~~S~~		
~~Recreation~~	~~Tennis, Racquetball Or Handball - Commercial (Outside Courts Not Permitted)~~	~~P~~	~~S~~	~~P~~	~~S~~			~~P~~	~~S~~			~~S~~		
~~Recreation~~	~~Tennis, Racquetball Or Handball - Commercial (Outside Courts Permitted)~~	~~S~~	~~S~~	~~S~~	~~S~~			~~P~~	~~S~~			~~S~~		
~~Recreation~~	~~Tennis, Racquetball Or Handball - Noncommercial (Outside Courts Not Permitted)~~	~~P~~	~~S~~	~~P~~	~~S~~			~~P~~	~~S~~			~~S~~		
Recreation	Recreational Vehicle Park					S		P						
Retail	Air Conditioners - Retail (Incidental To Other Onsite Retail Items In "UD" and "RD")	P		P						P			P	
Retail	Antique Store - Retail	P	P	P	P	P	P		P	P		P	P	
Retail	Apothecary - See (Drugstore - Apothecary)	*	*							*			*	
Retail	Apparel And Accessory Store - Retail	P	P	P	P				P	P		P	P	
Retail	Appliance and Electronics - Retail (Appliance Sales Incidental To Other Onsite Retail Items in "UD and "RD")	P		P						P			P	
Retail	Art Gallery	P	P	P	P				P	P		P	P	

Retail	Bakery - Retail	P	P	P	P		P		P	P		P	P	
Retail	Bookstore	P	P	P	P		P		P	P		P	P	
Retail	Business Machines - Retail	P		P						P			P	
Retail	Camera, Photographic Equipment And Supplies - Retail	P	P	P	P				P	P		P	P	
Retail	Candy, Nut And Confectionery - Retail	P	P	P	P				P	P		P	P	
Retail	Catering Shop	P	P	P	P				P	P		P	P	
Retail	Computer and Software - Retail	P	P	P	P				P	P		P	P	
Retail	Convenience Store	P	P	P	P	P	P		P	P		P	P	
Retail	Convenience Store (With Carwash)	P		P		P	P		P	P		P	P	
Retail	Convenience Store (With Gasoline)	P		P		P	P		P	P		P	P	
Retail	Convenience Store (With Gasoline And Carwash)	P		P		P	P		P	P		P	P	
Retail	Dairy Products - Retail	P	P	P	P	P	P		P			P		
Retail	Drugstore - Apothecary	P	P	P	P		P		P	P		P	P	
Retail	Dry Goods - Retail	P	P	P	P				P	P		P	P	
Retail	Farm Supplies					P	P	P						
Retail	Feed, Seed, Fertilizer Sales - No Outside Storage In "UD" and "RD"	S		S		P	P	P						
Retail	Fish Market - Retail	P	P	P	P					P			P	
Retail	Flea Market - Indoor	S		S				P						
Retail	Flea Market - Outdoor							S						
Retail	Floor Covering - Retail	P		P						P			P	

Retail	Florist - Retail	P	P	P	P		P		P	P		P	P	
Retail	Food Locker Plant - Retail					S	S	S						
Retail	Fruit And Produce - Retail	P	P	P	P	P	P	P	P	P		P	P	
Retail	Furniture Sales - Retail	P		P										
Retail	Gift Shop - Retail	P	P	P	P				P	P		P	P	
Retail	Glass - Retail	P		P				P		P				
Retail	Grocery Store	P	P	P	P		P		P	P		P	P	
Retail	Hardware Sales - Retail	P	P	P	P		P		P	P		P	P	
Retail	Head Shop	S		S										
Retail	Hobby Store - Retail	P	P	P	P				P	P		P		
Retail	Home Improvement Center	P		P				S						
Retail	Jewelry Store - Retail	P	P	P	P				P	P		P		
Retail	Landscaping Materials - Sales And Storage					P	P	P						
Retail	Leather Goods Or Luggage Store - Retail	P	P	P	P		P		P	P		P		
Retail	Medical - Surgical Supplies Retail	P		P						P			P	
Retail	Milliner - Custom	P	P	P	P				P	P		P	P	
Retail	Music Store	P	P	P	P				P	P		P		
Retail	Newsstand	P	P	P	P		P		P	P		P	P	
Retail	Nursery - Retail (Growing Plants On-site Permitted)	P	P	P	P	P	P	P	P	P	P	P	P	
Retail	Nursery - Retail (No Growing Plants On-site Permitted)	P	S	P	S	P	P		S	P		S	P	
Retail	Office Equipment And Supply - Retail	P		P						P				

Retail	Paint And Wallpaper Store - Retail And Wholesale	P		P						P					
Retail	Pet or Pet Supply Store	P	P	P	P				P	P		P			
Retail	Plumbing Fixtures - Retail	P		P						P					
Retail	Rug Or Carpet - Retail	P		P						P					
Retail	Secondhand Merchandise - Retail No Outside Storage Or Display Of Inventory Permitted)	P		P						P					
Retail	Shoe - Retail	P	P	P	P				P	P		P			
Retail	Silk Screening - Retail	P		P						P					
Retail	Sporting Goods - Retail	P	P	P	P				P	P		P			
Retail	Stamps And Coin Sales - Retail	P	P	P	P				P	P		P			
Retail	Stationary Products - Retail	P	P	P	P				P	P		P	P		
Retail	Tamale - Preparation Retail	P	S	P	S			P	S			S			
Retail	Thrift Store - Retail See (Secondhand Merchandise)	*	*												
Retail	Tobacco Store - Retail	P	P	P	P				P	P		P	P		
Retail	Toy Store - Retail	P	P	P	P				P	P		P			
Retail	Trophy Sales, Engraving And Assembly	P	P	P	P				P	P		P	P		
Retail	Variety Store - Retail	P	P	P	P				P	P		P	P		
Sales	Boat - Sales And Service							S							
Sales	Machinery, Tools And Construction Equipment Sales And							S			P				

	Service														
Sales	Farm Equipment Sales, Service Or Storage					P	P	P			P				
Sales	Oil Well Supplies And Machinery Sales - used					S	S	S			P				
Sales	Portable Building Sales							S			P				
School	School - Business or Commercial Trade	P		P		P	P	P							
School	School - Private University Or College	P		P		P	P	P							
School	School - Public University Or College	P		P		P	P	P							
School	School - Montessori	P	P	P	P	P	P		P			P			
School	School - Nursery (Public And Private)	P	P	P	P	S	S		P			P			
School	School - Private Pre-Kindergarten Through 12th Grade	P	P	P	P	P	P		P			P			
School	School - Public Pre-Kindergarten Through 12th Grade	P	P	P	P	S	S		P			P			
School	Vocational Trade (No Outside Storage & Training Area Permitted)	P	P	P	P	P	P	P	P		P	P			
School	Vocational Trade (Outside Storage & Training Area Permitted)					P	P	P	S		P	S			
Service	Air Conditioning/Refrigeration - Service And Repair							P							
Service	Altering/Repairing Of Apparel	P	P	P	P				P	P		P			
Service	Ammunition - Manufacturing,										S				

	Loading And Storage														
Service	Appliance - Repair Major	P		P				S							
Service	Appliance - Repair Small	P	P	P	P				P			P			
Service	Assisted Living Facility, Boarding Home Facility or Community Home with no more than 16 residents	P	P	P	P										
Service	Auditorium	P		P											
Service	Bail Bond Agency	S	S	S	S				S			S			
Service	Bank, Credit Union	P	S	P	S		S		S	P		S	P		
Service	Barber Or Beauty Shop	P	P	P	P		P		P	P		P	P		
Service	Bicycle - Repair	P	P	P	P				P			P			
Service	Boat And Marine - Storage (Outside Permitted)							S							
Service	Caterers (No On-Premises Food Services)	P	P	P	P				P			P			
Service	Body Piercing	P		P											
Service	Cemetery Or Mausoleum				S	S	S								
Service	Charitable - Food And/Or Clothing Bank	P		P											
Service	Construction Trades Contractors- screening required for outdoor storage from public ROWs and adjacent property (see also Industrial category, contractor facility use)							P			P				
Service	Copy Service - Blueprinting And	P	P	P	P					P			P		

	Photocopying														
Service	Cosmetics - Permanent	P	P	P	P				P			P			
Service	Day care Center - Child And/Or Adult Care	P	P	P	P		P		P	P		P	P		
Service	Dry Cleaning - Limited To Five (5) Employees	P		P				P		P			P		
Service	Dry Cleaning - Pickup Station Only	P	P	P	P		P	P	P	P		P	P		
Service	Electric Repair - Heavy Equipment							P							
Service	Electric Repair - Light Equipment							P							
Service	Electronic Equipment - Repair	P	P	P	P			P	P			P			
Service	Elevator Maintenance - Service							P							
Service	Employment Agency	P		P						P			P		
Service	Exterminators							P							
Service	Extended Stay Hotel or Timeshares	P	P	P	P			P		P					
Service	Food Service Establishment Without Cover Charge 3 or More Days Per Week (With or Without Accessory Live Entertainment)	P	P	P	P		P		P	P		P	P		
Service	Food Service Establishment With Cover Charge 3 or More Days Per Week (With or Without Accessory Live Entertainment)	S	S	S	S		S		S			S			
Service	Food, Mobile Food Court (subject to 35-399)	P	P						P	P		P	P		

Service	Food, Mobile Vending (Base Operations)							P			P				
Service	Funeral Home Or Undertaking Parlor	S		S	S			P	S			S			
Service	Furniture Repair/Upholstering	P		P				P							
Service	Gasoline Filling Station (Without Repair Or Carwash)	P		P		P	P		P	P		P	P		
Service	Gasoline Filling Station (With Repair)	P		P		P	P		P	P		P	P		
Service	Gasoline Filling Station (With Repair And/Or Carwash)	P		P		P	P		P	P		P	P		
Service	Gasoline Filling Station - Fleet							P			P				
Service	Group Day Care Limited to 12 Individuals	P	P	P	P										
Service	Gunsmith	S		S			S	P							
Service	Hotel	P	P	P	P										
Service	Hotel taller than 35 feet when unable to achieve additional height pursuant to §35-517(d) Setbacks for Height Increases	S													
Service	Human Services Campus	S		S											
Service	Ice Machine (over 120 square feet)	P		P			P	P		P					
Service	Janitorial/Cleaning Service	P		P				P							
Service	Laboratory - Research	S		S				P							
Service	Laboratory - Testing	S		S				P							

Service	Laundry And Dry Cleaning - Self Service	P	P		P	P				P	P		P	P		
Service	Laundry- Limited To Max Of Five (5) Employees	P			P		P		P		P			P		
Service	Laundry Or Dry Cleaning - Pickup Station Only	P	P		P	P	P	P		P	P		P	P		
Service	Lawnmower Repair And Service - No Outside Storage In "UD" or "RD"	P			P						P			P		
Service	Library	P	P		P	P		P		P	P		P	P		
Service	Linen Or Uniform Supply, Diaper Service (Pickup And Supply Only)	P			P				P		P			P		
Service	Loan Office	P	P		P	P		P			P			P		
Service	Locksmith	P	P		P	P				P	P		P	P		
Service	Manufactured Home / Oversize Vehicle Sales, Service Or Storage								P							
Service	Massage - Parlor															
Service	Massage - Therapeutic	P	P		P	P				P	P		P	P		
Service	Medical - Chiropractor Office	P	P		P	P		P		P	P		P			
Service	Medical - Clinic (Physician And/Or Dentist)	P	P		P	P		P		P	P		P	P		
Service	Medical - Clinic Physical Therapist	P	P		P	P				P	P		P	P		
Service	Medical - Hospital Or Sanitarium	P			P				S							
Service	Medical - Laboratory Dental Or Medical	P			P				P							

Service	Medical - Optical Goods Retail	P	P	P	P				P	P		P	P	
Service	Medical - Optical Goods Wholesale							P						
Service	Medical - Optometry Office	P	P	P	P		P		P	P		P	P	
Service	Mortuary - Preparation Only							S						
Service	Movie Rentals	P	P	P	P				P	P		P	P	
Service	Nursing Facility	P	P	P	P									
Service	Office Call Center	P		P				P						
Service	Office Data Processing & Management	P		P				P						
Service	Office, Professional	P	P	P	P		P	P	P	P		P	P	
Service	Palm Reading	P	P	P	P				P	P		P	P	
Service	Party House, Reception Hall, Meeting Facilities	P		P				P						
Service	Pawn Shop	P		P						P				
Service	Picture Framing	P	P	P	P				P	P		P	P	
Service	Post Office	P	P	P	P	P	P		P	P		P	P	
Service	Radio or Television Station Studio	P		P		S	S	S			S			
Service	Reading Room	P	P	P	P				P	P		P	P	
Service	Record Storage Facility (Electronic And/Or Paper)	P		P				P						
Service	Reducing Salon	P		P						P			P	
Service	Rental - Event Specialties (No Outside Storage And/Or Display Allowed)	P		P				P						
Service	Rental - Tool, Equipment, And Event	S		S				P						

	Specialties (Fenced And Screened; Outside Storage And Display Permitted)													
Service	Rooming House	P	P	P	P									
Service	Self-Defense Instruction	P	P	P	P				P	P		P	P	
Service	Shoe - Repair	P	P	P	P				P	P		P	P	
Service	Sign Shop - No Outside Storage	P		P	P			P						
Service	Skilled Nursing Facility	P	P	P	P									
Service	Specified Financial Institution (see § 35-394)	S	S	S	S				S			S		
Service	Storage, Climate Controlled	P		P	P			P		P	P		P	
Service	Storage, Cold							P			P			
Service	Storage, Moving Pod (See Definition In Appendix A)	P	P	P	P	P	P	P	P	P	P	P	P	
Service	Storage Shipping Container (See Definition In Appendix A. Requires Registration Affidavit With Development Services Dept.)	S	S	S	S	S	S	P	S	S	P	S	S	
Service	Studio - Fine Or Performing Arts	P	P	P	P				P			P		
Service	Studio - Interior Decorating	P	P	P	P				P	P		P		
Service	Studio - Photographic	P	P	P	P				P	P		P		
Service	Studio - Sound And Recording	P		P				P						
Service	Tailor Shop	P	P	P	P		P		P	P		P		

Service	Tattoo Parlor/Studio	P		P						P				
Service	Taxidermist					S		P						
Service	Temporary Common Worker Employer							P						
Service	Tree Cut And Trim Service					S		P						
Service	Watch Repair	P	P	P	P				P	P		P	P	
Social	Club - Private	P		P		P	P			P			P	
Social	Clubhouse - Private Including Lodges And Meeting Halls	P		P		P	P			P			P	
Storage	Carting, Crating, Hauling, Storage										P			
Storage	Cold Storage										P			
Storage	Fur Dyeing, Finishing And Storing							S						
Storage	Moving Company							P			P			
Storage	Self Service Storage	P	P	P	P			P		P	P		P	
Storage	Storage - Outside (Under Roof And Screened)							P			P			
Transportation	Airport - Non-Governmental					S					S			
Transportation	Bus Shelter (Max Size 6'x13')	P	P	P	P	P	P	P	P	P	P	P	P	
Transportation	Bus Stop	P	P	P	P	P	P	P	P	P	P	P	P	
Transportation	Freight Depot					P		S			P			
Transportation	Heliport					S		S			P			
Transportation	Helistop	S		S		S		S			P			
Transportation	Passenger Depot	S		S		S		P			P			
Transportation	Transit Bus							P						

	Maintenance Facility													
Transportation	Transit Bus Storage Facility							P						
Transportation	Transit Center	P	P	P	P		P	P	P	P	P	P	P	
Transportation	Transit Park & Ride	P	P	P	P		P	P	P	P	P	P	P	
Transportation	Transit Station	S	S	S	S		S	S	S	S	S	S	S	
Transportation	Transit Transfer Center (Max Size 14'x33' And Total Footprint No Larger Than 30'x40')	P	P	P	P		P	P	P	P	P	P	P	
Utilities	Radio/Television Antenna, subject to § 35-385(b)	P	P	P	P	P	P	P	P	P	P	P	P	
Utilities	Radio/Television Antenna, unable to comply with § 35-385(b)	S	S	S	S	S	S	S	S	S	S	S	S	
Utilities	Small Wind Energy Systems, subject to §35-398(a)	S	S	S	S	P	P	P	P	P	P	P	P	
Utilities	Solar Farm, Photovoltaic, subject to §35-398(b)	S	S	P	P	P	P	P	P	P	P	P	P	
Utilities	Telephone Equipment Infrastructure	S		S		S	S	P			P			
Utilities	Wireless Communication Systems	S		S		S	S	S			P			
Utility	Sanitary Landfill, Solid Waste Facility										S			
Warehouse	Office Warehouse (Flex Space) - Outside Storage Not Permitted							P			P			
Warehousing	Warehousing							P			P			
Wholesale	Bakery - Wholesale							S						

Wholesale	Barber And Beauty Equipment - Wholesale								P							
Wholesale	Camera, Photographic Equipment And Supplies - Wholesale								P							
Wholesale	Dairy Equipment Sales - Wholesale						P	P	P			P				
Wholesale	Dairy Products - Wholesale						P	P	S							
Wholesale	Drug Sales - Wholesale								S							
Wholesale	Fish Market - Wholesale						S	S	P							
Wholesale	Florist						P	P	P							
Wholesale	Food Products - Wholesale And Storage						P	P	P							
Wholesale	Fruit And Produce - Wholesale						P	P	P							
Wholesale	Furniture Sales - Wholesale								P							
Wholesale	Glass - Wholesale								P							
Wholesale	Grocery - Wholesale								S			P				
Wholesale	Hardware Sales - Wholesale								P							
Wholesale	Office Equipment And Supply - Wholesale								P							
Wholesale	Nursery - Plant Wholesale Onsite Growing Permitted						P	P	P							
Wholesale	Paper Supplies - Wholesale								P			P				
Wholesale	Plumbing Fixtures - Wholesale								P							
Wholesale	Shoe - Wholesale No Manufacturing								P							

Wholesale	Sporting Goods - Wholesale							P							
Wholesale	Stone Monument - Retail And Wholesale							P							
Wholesale	Tamale - Preparation Wholesale							P							

* * * * *

Chapter 35, Article III, Section 35-320 is amended as follows:

DIVISION 3. - SPECIFIC USE AUTHORIZATION ~~PERMITS~~ AND CONDITIONAL ZONING DISTRICTS

Sec. 35-320. - Specific Use Authorization ~~Permit~~.

See section 35-423 of this chapter.

* * * * *

Chapter 35, Article III, Section 35-338 is amended as follows:

Sec. 35-338. "RIO" River Improvement Overlay Districts.

* * * * *

(f) **Administration.** River improvement overlay districts shall be governed in accordance with division 5 of article IV of this chapter, except that proposed changes to the boundary of a "RIO" shall be first submitted to the HDRC for review and recommendation before going to the Zoning Commission.

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Chapter 35, Article III, Section 35-341 is amended as follows:

Sec. 35-341. – "MXD" Mixed-Use District.

*** * * * ***

(b) **Use Regulations.**

(1) Except for the use specified in subsection (i) below, the Use Matrix is not applicable to a mixed use district provided, however, that no building permit shall be issued unless the requested uses conform to an approved zoning site plan. A zoning site plan shall include:

A. Legal description and exhibit of the property at appropriate scale showing the area to be zoned "MXD."

B. The location of all land use categories. Categories may include single-family residential, mixed residential (one (1) to four (4) residential units per structure), multi-family residential, commercial, office, institutional, and parks/open space. Multiple categories may be designated where a lot or building is sited to include two (2) or more categories of uses. Site plan must show both non-residential and residential land use categories. Land use categories and corresponding zoning districts shall be consistent with any approved land use designation within adopted Neighborhood, Community, Perimeter or Sector Plan.

C. The location of all existing and proposed streets.

~~(2) A "MXD" zoning site plan that does not provide for a mix of residential and nonresidential uses located within the same building or on the same lot shall not be approved~~.

(2) ~~(3)~~ The zoning site plan shall be submitted with the application for rezoning to "MXD" for review by the zoning commission and approval by the city council. The approved zoning site plan shall accompany all subsequent development applications (including, but not limited to, master development plan, plats and building plans). Subsequent development applications that do not conform to the approved "MXD" zoning site plan shall not be approved.

* * * * *

Chapter 35, Article III, Section 35-343 is amended as follows:

Sec. 35-343. – "IDZ" Infill Development Zone.

(c) **Lot and Building Specifications.**

*** * * * ***

(2) **Building Location.** The requirements of this subsection shall apply to the construction of new buildings within the "IDZ" district whether used as an overlay or a base district. The provisions of this subsection shall not apply to the reuse and/or rehabilitation of existing structures provided however that these requirements shall apply to any additions, expansion or enlargement of any existing buildings.

* * * * *

B. **Residential.** On blocks where over fifty (50) percent of the blockface is occupied with existing single-family, duplex, triplex, and/or quadraplex residential units, the front setback within IDZ for uses zoned for single-family, duplex, triplex, and quadraplex uses shall be within ten (10) percent of the median setback of existing buildings on the block face. No new or existing building shall be erected, constructed or expanded to extend within the public right-of-way or within five (5) feet of the rear lot line. If there is a public street right-of-way, the front facade shall front the street. A 900 series lot, as defined in 35-A101, may be provided in lieu of

the required front or rear setbacks provided that the 900 series lot provides a lot width at least equivalent to the minimum required setback distance.

On blocks where fifty (50) percent or less of the blockface is occupied with existing single-family, duplex, triplex, and/or quadraplex residential units, or the block is being redeveloped for over fifty (50) percent of the block face, the front, side and rear setback provisions of the zoning regulations (article III) shall not apply to an approved infill development zone provided, however, that no new or existing building shall be erected, constructed or expanded to extend within the public right-of-way or within five (5) feet of the rear lot line. A 900 series lot, as defined in section 35-A101, may be provided in lieu of the required five-foot setback from the rear lot line provided that the 900 series lot provides a lot width at least equivalent to the required setback distance.

* * * * *

(k) **Parking.** The minimum vehicle parking requirements in Section 35-526(b) ~~of the parking standards~~ shall not apply to infill development. Where parking is provided, Sections 35-526(c) through 35-526(f) ~~All other the parking standards~~ shall apply to infill development.

* * * * *

Chapter 35, Article III, Section 35-344 is amended as follows:

Sec. 35-344.01 "PUD" Planned Unit Development Districts established prior to January 1, 2016. ~~**District**~~

* * * * *

(a) **Applicability and Evaluation Criteria.** This section shall be apply to all Planned Unit Development Districts established prior to January 1, 2016. Planned Unit Development Districts established subsequent to January 1, 2016, shall comply with Section 35-344.02 of this Chapter. In order to foster the attractiveness of a planned unit development and its surrounding neighborhoods and thereby preserve property values, and in order to provide an efficient road and utility network, ensure the movement of traffic, implement comprehensive planning, and better serve the public health, safety, and general welfare, the following criteria shall be utilized by the planning commission in reviewing PUD plans. These criteria shall neither be regarded as inflexible requirements nor are they intended to discourage creativity or innovation.

(1) Insofar as practicable, the landscape shall be preserved in its natural state by minimizing tree and soil removal.

(2) Proposed buildings shall be sited harmoniously to the terrain and to other buildings in the vicinity that have a visual relationship to the proposed buildings.

(3) With respect to vehicular and pedestrian circulation and parking, special attention shall be given to the location and number of access points to public streets, width of interior drives and access points, general interior circulation, separation of pedestrian and vehicular traffic, and the arrangement of parking areas that are safe and convenient and, insofar as practicable, do not detract from the design of proposed structures and neighboring properties.

(4) Private streets and gates shall conform to article V of this chapter.

(5) Planned unit developments in the ETJ shall comply with the provisions contained in this section with the exception of subsections (c) related to density, (d) related to height and yard requirements, and (j) related to PUD plans. In addition, planned unit developments in the ETJ are exempt from the zoning procedures contained in this section.

(6) The description "planned unit development" or "PUD" shall be prominently indicated in the subdivision plat name.

(b) **Minimum Size.** There is no minimum size for a planned unit development.

(c) **Permitted Uses and Density.**

(1) Uses. A planned unit development may include residential, commercial and industrial uses; cluster housing; common areas; unusual arrangements of structures on-site; or other combinations of structures and uses that depart from standard development. The uses permitted in a "PUD" are those designated in the approved PUD plan. Density limits are used to determine the maximum number of permitted dwelling units.

Planned unit developments containing one (1) single zoning district shall be annotated with the zoning district (PUD "RE," PUD "R-20," etc.) and may be developed to the density indicated in the maximum density table in subsection (2) below.

Planned unit developments which contain more than one (1) zoning district shall have each zoning district annotated as (PUD "RE," PUD "R-20," etc.) and each individual district may be developed to the density indicated in the maximum density table in subsection (2) below.

(2) Density Table. The PUD plan shall divide the PUD into land use categories and shall indicate the uses permitted in each category. For residential land use categories, the maximum number of dwelling units permitted per acre for each land use category is as follows:

Land Use Category	*Maximum Density*
"RE"	1

"R-20"	2
"R-6"	5
"RM-6"	5
"R-5"	6
"RM-5"	6
"R-4"	7
"R-3"	10
"RM-4"	7
"MF-18"	18
"MF-25"	25
"MF-33"	33
"MF-40"	40
"MF-50"	50
"MF-65"	65

Total allowable density is calculated by multiplying the amount of net usable acres times the appropriate number above. Floodplains (100-year), steep slopes, non-buildable areas and existing easements are not used to determine net acreage.
Example: On a twelve (12) acre tract with one and one-half (1½) acres of unusable space, with an "R-6" zoning district. Usable acreage ten and one-half (10½) times table number (5) allows fifty-two and one-half (52½) units. The maximum number of units that may be built may not be further increased by using the provisions of vivision 6 flexible zoning of this article.

(3) Attached Dwelling Units. Dwelling units may be attached in all PUD districts except for land use categories designated "RE" and "R-20."

(4) Lots. There is no minimum area requirement for lots and lots need not front onto a street. Lot boundaries may coincide with structure boundaries except where perimeter lot setbacks are required.

(d) **Height and Yard Requirements.**

(1) Height Limitation. The maximum height of structures shall be as prescribed below; however, any portion of a structure may exceed this limit provided such portion is set back from the side and rear lot lines, or setbacks if required, one (1) foot for each two (2) feet of height in excess of the maximum building height. Distance credit shall be permitted for space occupied by structures of conforming height extending from the lot lines or setbacks as applicable.

Structures devoted to the following uses:	*Shall be restricted to the following height:*
Dwelling, one family; Dwelling, single-family; Duplex; Dwelling, one-family attached; Dwelling, Single-Family Detached; Dwelling, two-family (duplex); Dwelling, two-family attached; Dwelling, three-family (triplex); Dwelling, four-family (quadraplexes)	35 ft~~/2.5 stories~~
Multi-Family not exceeding 25 units/acre	45
Multi-Family not exceeding 33 units/acre	60
Multi-Family not exceeding 40 units/acre	84
Multi-Family not exceeding 65~~50~~ units/acre	—
Commercial Buildings~~ (LBCS Structure Classification 2100 – 2593, 3000, 4000)~~, except as otherwise listed below	35
Malls, shopping centers, or collection of shops - regional center (enclosed mall with two (2) or more anchors) or super regional center (similar to regional, but with three (3) or more anchors)	45
Light Industrial uses (uses permitted in the "L" district~~LBCS Structure Classification 2610, 2700~~)	35
General Industrial uses (uses permitted in the "I-1" and "MI-1" districts~~LBCS Structure Classification 2610, 2700~~)	60
Mixed use buildings may be as tall as allowed by the most intense use included in the structure pursuant to this table	

(2) Fences.

A. Along collector and arterial streets, fences or walls within a PUD may extend to a height of eight (8) feet subject to the clear vision area requirements for fences in subsection 35-514.

B. No such fence or wall, or portion thereof, shall exceed one hundred (100) horizontal feet in length unless one (1) of the following architectural features visible from the paved surface of the street is provided as part of the fence:
   1. A column or pillar; or
   2. Articulation of the surface plane wall by incorporating plane projections or recesses having a depth of at least one (1) foot and extending a horizontal distance not less than three (3) or more than twenty (20) feet.

C. The provisions of subsection B., above, shall not apply to a fence or wall constructed of brick, masonry, or wrought iron ~~fences~~ consisting of at least fifty (50) percent open voids. The square footage of the fence shall be measured by taking the total square footage of an area defined by the length of the fence and its average height. The percent of open voids shall then be derived by dividing the total square footage of the open voids by the total square footage of the area calculated above, and multiplying this figure by one hundred (100). The fence's framing (the vertical posts supporting the fence from the ground and no more than three (3) horizontal cross bars between the posts, or brick or stone pillars) shall not be included in the calculation of the total square footage, provided the framing posts and cross bars do not exceed a four-inch width and the posts are spaced at least eight (8) feet apart.

(e) **Required Setbacks.**

(1) ~~For Single-Family or Multi-Family~~ **Residential including Multi-Family Uses**. Required PUD perimeter setbacks ~~within the city limits or the ETJ for residential uses in a PUD~~ shall be twenty (20) feet.

(2) **Nonresidential Uses**. Required PUD perimeter setbacks ~~within the city limits or the ETJ for nonresidential uses in a PUD~~ shall be the same as for the applicable zoning district which the nonresidential use would be allowed in if it were not a PUD~~within the city limits of the City of San Antonio~~.

The PUD perimeter setback lines shall be indicated on the PUD plan prior to receiving approval of the PUD plan. The planning commission may approve lesser setbacks after considering physical features such as the location of trees, waterways, steep slopes, easements, other buffers and/or compatibility of the PUD with adjacent land uses provided such setbacks meet the requirements of the current adopted International Building Code.

No setbacks are required for residential or nonresidential interior lots provided the requirements of the current adopted International Building Code or the International Residential Code are met. Provisions of Section 35-373(c) Zero Lot Line Development do not apply in a PUD.

(3~~2~~) If access to a garage is provided from the front or side of a lot, then the garage shall maintain a setback as indicated in subsection 35-516(g) of this chapter.

(f) **Infrastructure Requirements.**

(1) Streets and Sidewalks. Streets within a PUD may be public or private. Vehicular circulation may also be provided by internal private drives. Private drives must meet the requirements for fire lanes as per the International Fire Code Appendix D for width, lengths turnarounds, and parking requirements whether for a commercial or residential base zoning. A building permit must be obtained for private drives, and would include site plan review and inspection for flatwork/civil work within the public ROW. However, the planning commission may require dedication and construction of public streets through or into a PUD through the platting process. Public or private streets shall conform to the transportation standards of this chapter (see section 35-506 of this chapter).

(2) Utilities. All utility systems shall comply with the utilities standards of this chapter. Water and sanitary sewer systems within a PUD may be publicly or privately owned; however, the maintenance of private systems shall be the responsibility of the PUD community association. Public utility systems shall be approved by the applicable agency or city department.

(3) Easements. Publicly owned and/or maintained utilities shall be placed in public streets or easements which are a minimum of sixteen (16) feet in width unless a narrower width is approved by the applicable utility. Dead-end easements shall not be permitted unless a city approved vehicular turnaround is provided at the end of each such easement.

(4) Garbage Collection. If in the opinion of the solid waste management director, private streets in a PUD are arranged so that garbage may be collected without creating a safety hazard, the city will collect the garbage provided proper indemnification is received from the community association or individual property owners. Garbage collection locations shall be subject to the approval of the solid waste management director. In the event the city does not collect garbage within a PUD, all units within the PUD may be exempted from payment of garbage fees upon furnishing of evidence ensuring acceptable removal of all garbage and refuse by private means. To receive such exemption, written application must be submitted to and approved by the finance director ~~of finance~~.

(g) **Parks/Open Space.**

(1) Residential. Each residential PUD plan shall provide for a minimum amount of parks/open space as required by the parks/open space standards (35-503) of this chapter. Residential PUDs may not use a fee in lieu for meeting parks/open space requirements.

(2) Commercial. All commercial and industrial PUDs will contain a minimum of twenty (20) percent of parks/open space.

(3) Mixed-Use. Mixed-use developments shall be divided into separate residential and commercial areas which must separately meet the requirements of this paragraph and subsection 35-344(c)(2). Mixed use buildings that include residential use shall meet the residential requirements of this subsection.

(4) Reduction in Parks/Open Space. At its discretion, the planning commission may approve a decrease in the amount of required parks/open space when the PUD plan includes unique design features or amenities which achieve an especially attractive and desirable development such as, but not limited to, terraces, sculpture, water features, preservation and enhancement of unusual natural features, or landscape sculpture (areas which are intensely landscaped).

(h) **Parking Requirements.** Off-street parking and truck loading facilities shall be provided in accordance with parking standards of this chapter. Parking shall be prohibited on any private street or private drive, excluding driveways on interior lots less than twenty-eight (28) feet in width, and if utilized on streets twenty-eight (28) feet or wider, the parking must be clearly distinguishable from the movement lanes.

(i) **Common Areas and Facilities.** Provisions shall be made for a property owners' association that is designated as the representative of the owners of property in a residential subdivision. The property owners' association shall have the direct responsibility to provide for the operation and maintenance of all common areas and facilities, including private streets and sidewalks, which are a part of the PUD. The applicant shall submit the dedicatory instrument(s) covering the establishment, maintenance, and operation of a residential subdivision. The dedicatory instrument(s) shall establish a plan for the use and permanent maintenance of the common areas/facilities and demonstrate that the property owners' association is self-perpetuating and adequately funded by regular assessment and/or special assessment to accomplish its purposes. The dedicatory instrument(s) shall include provisions that provide the city with permission for access at any time without liability when on official business, and further, to permit the city to remove obstructions if necessary for emergency vehicle access and assess the cost of removal to the owner of the obstruction. ~~The dedicatory instrument(s) must be approved by the city attorney as to legal form prior to any plat recordation and shall be recorded at the same time as the plat.~~

"Property owners' association" means an incorporated or unincorporated association that;

A. Is designated as the representative of the owners of property in a residential subdivision;
B. Has a membership primarily consisting of the owners of property covered by the dedicatory instrument for the residential subdivision; and
C. Manages or regulates the residential subdivision for the benefit of the owners of property in the subdivision.

"Dedicatory instrument" means each governing instrument covering the establishment, maintenance, and operation of a residential subdivision. The term includes restrictions or other similar instruments that subject property to restrictive covenants, bylaws, or similar instruments governing the administration or operation of a property owners' association; allow for properly adopted rules and regulations of the property owners' association; and authorize enactment of lawful amendments to the covenants, bylaws, rules, or regulations.

"Property owners' association" means the designated representative of the owners of property in a subdivision and may be referred to as a "homeowners association," "community association," "civic association," "civic club," "association," " committee," or similar term contained in the dedicatory instrument.

"Regular assessment" means an assessment, a charge, a fee, or dues that each owner of property within a residential subdivision is required to pay to the property owners' association on a regular basis and that is designated for use by the property owners' association for the benefit of the residential subdivision as provided by the dedicatory instrument.

"Special assessment" means an assessment, a charge, a fee, or dues, other than a regular assessment, that each owner of property within a residential subdivision is required to pay to the property owners' association, according to the procedures required by the dedicatory instrument, for:

A. Defraying, in whole or part, the cost whether incurred before or after the assessment, of any construction or reconstruction, unexpected repair, or replacement of a capital improvement in common areas owned by the property owners' association, including the necessary fixtures and personal property related to the common areas;
B. Maintenance and improvement of common areas owned by the property owners' association; or
C. Other purposes of the property owners' association as stated in its articles of incorporation or the dedicatory instrument for the residential subdivision.

(j) **PUD Plan.** After the PUD zoning is granted, a PUD plan shall be submitted to and approved by the planning commission prior to approval of any plats or the issuance of any building permits or certificates of occupancy. The PUD plan shall incorporate any conditions imposed with the granting of the PUD zoning. ~~The PUD plan shall also delineate the measures that will be taken by the developer and/or owner to disclose to buyers of properties within PUDs of the increased financial responsibilities for the cost and responsibility for the maintenance of any private streets and other commonly owned facilities.~~

(1) Public Hearing. Upon submission of the PUD plan, the director of development services shall distribute copies to appropriate city departments and agencies for review. Upon receipt of all required items and reviews, the director of development services shall schedule a public hearing by the planning commission on the proposed plan and shall provide written notice of the hearing to the owners of real property lying within two hundred (200) feet of the PUD boundaries. The notice shall be mailed at least ten (10) days prior to the public hearing date.

(2) Plan Approval. After the public hearing the commission may approve the plan as submitted, amend and approve the plan as amended, or disapprove the plan. If approved, the plan with any amendments shall be signed by the chairman and secretary of the commission. A copy of the approved PUD plan shall be distributed to the development services director and other appropriate departments/agencies for use in issuing permits.

(3) Amendments for any PUD plan shall be consistent with subsection k below.

(k) **Amendments.** Amendments may be classified as minor or major in accordance with the following:

(1) Minor amendments to the previously approved PUD plan may be made without requiring resubmission of the entire application. For purposes of this subsection, "minor amendments" are amendments which:

A. Permit equal or fewer dwelling units, floor area, lot coverage or impervious surface than that requested on the original application;

B. Reduce the impact of the development; or

C. Reduce the amount of land involved from that indicated in the notices of the hearing.

D. A minor amendment shall not, in any case, permit:

i. An increase in the overall density of the PUD by more than ten (10) percent;

ii. A different land use than that requested in the original or amended PUD Plan;

iii. A larger land area than indicated in the original or amended PUD Plan.

E. A minor amendment shall not reduce or eliminate conditions adopted in this chapter or otherwise adopted by city council ordinance or planning commission approval for a PUD approval.

(2) Amendments not classified as minor amendments above shall be classified as major amendments and shall require resubmission of the application to the Planning Commission.

(3) Major amendments shall be considered by the planning commission following the same procedure required for the initial approval of the plan, including payment of the plan review fee.

(l~~k~~) **Time Limit.**

(1) Applications. The director of development services shall provide a written response indicating whether or not the planned unit development application is complete within five (5) working days after submittal. The applicant shall file a written response to any staff comments or resolve outstanding issues prior to final approval of completeness. This response shall occur within thirty (30) days of the notification date of staff comments unless a time extension is requested and granted in writing. The maximum limit on an extension is six (6) months from the original staff comment date. The appellate agency for purposes of completeness review shall be the planning commission.

PUD plan application approval shall expire, and shall be void for all purposes if a PUD plan is not approved in accordance with this chapter within two (2) years from the date of acceptance of the complete application. Upon expiration of the PUD plan application, a new PUD plan number, application, and fee shall be required ~~if~~ when PUD plan approval is still sought.

(2) PUD Approval and Completion. A PUD plan, deemed complete and approved, shall remain valid for a period of six (6) years from the date of the last recorded plat or the date of planning commission approval if no plats are recorded. Time extensions for up to one year may be granted by the planning commission if it finds that additional time is warranted. Failure to initiate development within the approved time period shall void the approved PUD plan and no building permits or

utility connections shall be issued until a new application and plan have been submitted and approved.

(3) Amendments. An approved/completed PUD may be amended in the future subject to any applicable criteria or requirements of this chapter.

Sec. 35-344.02 "PUD" Planned Unit Development Districts established subsequent to January 1, 2016.

(a) **Applicability**. The provisions of this section apply to any application for rezoning of a tract, parcel or land area to a Planned Unit Development District after January 1, 2016 with the exception of those Planned Unit Development subdivisions established within the ETJ prior to January 1, 2016 and annexed into the city after January 1, 2016.

(b) **Initiation**. A proceeding for approval of a planned unit development zoning district shall be initiated by filing an application with the director of development services. The application must meet the following minimum criteria:

(1) The application shall include a site plan that is prepared to scale. The site plan must be drawn with dimensions and a graphic scale must be provided.

(2) To provide adequate information for city council to make an informed decision on a request for a planned unit development zoning district, each site plan shall illustrate the following:

A. PUD Perimeter Setback lines

B. Refer to Appendix B: Application Submittal for PUD Plan for remaining requirements.

(c) **Completeness Review.** The director of development services shall conduct a completeness review as set forth in section 35-402 of this chapter. The appellate agency for purposes of completeness review (see subsection 35-402(c) of this chapter) shall be the zoning commission.

(d) **Decision.** The procedure for approving a planned unit development zoning district boundary shall be as required for a rezoning (subsection 35-421(d)) and as further provided herein.

(e) **Evaluation Criteria.** In order to foster the attractiveness of a planned unit development and its surrounding neighborhoods and thereby preserve property values, and in order to provide an efficient road and utility network, ensure the movement of traffic, implement comprehensive planning, and better serve the public health, safety, and general welfare, the following criteria shall be utilized by the zoning commission and city council in reviewing PUD plans in conjunction with the request for PUD zoning. These criteria shall neither be regarded as inflexible requirements nor are they intended to discourage creativity or innovation.

(1) Insofar as practicable, the landscape shall be preserved in its natural state by minimizing tree and soil removal.

(2) Proposed buildings shall be sited harmoniously to the terrain and to other buildings in the vicinity that have a visual relationship to the proposed buildings.

(3) With respect to vehicular and pedestrian circulation and parking, special attention shall be given to the location and number of access points to public streets, width of interior drives and access points, general interior circulation, separation of pedestrian and vehicular traffic, and the arrangement of parking areas that are safe and convenient and, insofar as practicable, do not detract from the design of proposed structures and neighboring properties.

(4) Private streets and gates shall conform to article V of this chapter.

(f) **Minimum Size.** There is no minimum size for a planned unit development.

(g) **Permitted Uses and Density.**

(1) **Uses.** A planned unit development may include residential, commercial and industrial uses; cluster housing; common areas; unusual arrangements of structures on-site; or other combinations of structures and uses that depart from standard development. The uses permitted in a "PUD" are those designated in the approved PUD plan. Density limits are used to determine the maximum number of permitted dwelling units.

Planned unit developments containing one (1) single zoning district shall be annotated with the zoning district (PUD "RE," PUD "R-20," etc.) and may be developed to the density indicated in the maximum density table in subsection (2) below.

Planned unit developments which contain more than one (1) zoning district shall have each zoning district annotated as (PUD "RE," PUD "R-20," etc.) and each individual district may be developed to the density indicated in the maximum density table in subsection (2) below.

(2) **Density Table.** The PUD plan shall divide the PUD into land use categories and shall indicate the uses permitted in each category. For residential land use categories, the maximum number of dwelling units permitted per acre for each land use category is as follows:

Land Use Category	*Maximum Density*
"RE"	1
"R-20"	2

"R-6"	5
"RM-6"	5
"R-5"	6
"RM-5"	6
"R-4"	7
"R-3"	10
"RM-4"	7
"MF-18"	18
"MF-25"	25
"MF-33"	33
"MF-40"	40
"MF-50"	50
"MF-65"	65

Total allowable density is calculated by multiplying the amount of net usable acres times the appropriate number above. Floodplains (100-year), steep slopes, non-buildable areas and existing easements are not used to determine net acreage.
Example: On a twelve (12) acre tract with one and one-half (1½) acres of unusable space, with an "R-6" zoning district. Usable acreage ten and one-half (10½) times table number (5) allows fifty-two and one-half (52½) units. The maximum number of units that may be built may not be further increased by using the provisions of division 6 flexible zoning of this article.

(3) **Attached Dwelling Units.** Dwelling units may be attached in all PUD districts except for land use categories designated "RE" and "R-20."

(4) **Lots**. There is no minimum area requirement for lots and lots need not front onto a street. Lot boundaries may coincide with structure boundaries except where perimeter lot setbacks are required.

(h) **Height and Yard Requirements.**

(1) **Height Limitation.** The maximum height of structures shall be as prescribed below; however, any portion of a structure may exceed this limit provided such

portion is set back from the side and rear lot lines, or setbacks if required, one (1) foot for each two (2) feet of height in excess of the maximum building height. Distance credit shall be permitted for space occupied by structures of conforming height extending from the lot lines or setbacks as applicable.

Structures devoted to the following uses:	*Shall be restricted to the following height:*
Dwelling, one family; Dwelling, single-family; Duplex; Dwelling, one-family attached; Dwelling, Single-Family Detached; Dwelling, two-family (duplex); Dwelling, two-family attached; Dwelling, three-family (triplex); Dwelling, four-family (quadraplexes)	35 ft
Multi-Family not exceeding 25 units/acre	45
Multi-Family not exceeding 33 units/acre	60
Multi-Family not exceeding 40 units/acre	84
Multi-Family not exceeding 65 units/acre	—
Commercial Buildings except as otherwise listed below	35
Malls, shopping centers, or collection of shops - regional center (enclosed mall with two (2) or more anchors) or super regional center (similar to regional, but with three (3) or more anchors)	45
Light Industrial uses (uses permitted in the "L" district	35
General Industrial uses (uses permitted in the "I-1" and "MI-1" districts	60
Mixed use buildings may be as tall as allowed by the most intense use included in the structure pursuant to this table	

(2) **Fences.**

A. Along collector and arterial streets, fences or walls within a PUD may extend to a height of eight (8) feet subject to the clear vision area requirements for fences in subsection 35-514.

B. No such fence or wall, or portion thereof, shall exceed one hundred (100) horizontal feet in length unless one (1) of the following architectural features visible from the paved surface of the street is provided as part of the fence:

1. A column or pillar; or

2. Articulation of the surface plane wall by incorporating plane projections or recesses having a depth of at least one (1) foot and extending a horizontal distance not less than three (3) or more than twenty (20) feet.

C. The provisions of subsection B., above, shall not apply to a fence or wall constructed of brick, masonry, or wrought iron ~~fences~~ consisting of at least fifty (50) percent open voids. The square footage of the fence shall be measured by taking the total square footage of an area defined by the length of the fence and its average height. The percent of open voids shall then be derived by dividing the total square footage of the open voids by the total square footage of the area calculated above, and multiplying this figure by one hundred (100). The fence's framing (the vertical posts supporting the fence from the ground and no more than three (3) horizontal cross bars between the posts, or brick or stone pillars) shall not be included in the calculation of the total square footage, provided the framing posts and cross bars do not exceed a four-inch width and the posts are spaced at least eight (8) feet apart.

(i) **Required Setbacks.**

(1) **Residential including Multi-Family Uses.** Required PUD perimeter setbacks shall be twenty (20) feet.

(2) **Nonresidential Uses.** Required PUD perimeter setbacks shall be the same as for the applicable zoning district which the nonresidential use would be allowed in if it were not a PUD.

The City Council may approve lesser setbacks after considering physical features such as the location of trees, waterways, steep slopes, easements, other buffers and/or compatibility of the PUD with adjacent land uses provided such setbacks meet the requirements of the current adopted International Building Code.
No setbacks are required for residential or nonresidential interior lots provided the requirements of the current adopted International Building Code or the International Residential Code are met. Provisions of Section 35-373(c) Zero Lot Line Development do not apply in a PUD.

(3) If access to a garage is provided from the front or side of a lot, then the garage shall maintain a setback as indicated in subsection 35-516(g) of this chapter.

(j) **Infrastructure Requirements.**

(1) **Streets and Sidewalks.** Streets within a PUD may be public or private. Vehicular circulation may also be provided by internal private drives. Private drives must meet the requirements for fire lanes as per the International Fire Code Appendix D for width, lengths turnarounds, and parking requirements whether for a commercial or residential base zoning. A building permit must be obtained for private drives, and would include site plan review and inspection for flatwork/civil work within the public ROW. However, the planning commission may require dedication and construction of public streets through or into a PUD through the platting process. Public or private streets shall conform to the transportation standards of this chapter (see section 35-506 of this chapter).

(2) **Utilities.** All utility systems shall comply with the utilities standards of this chapter. Water and sanitary sewer systems within a PUD may be publicly or privately

owned; however, the maintenance of private systems shall be the responsibility of the PUD community association. Public utility systems shall be approved by the applicable agency or city department.

(3) **Easements.** Publicly owned and/or maintained utilities shall be placed in public streets or easements which are a minimum of sixteen (16) feet in width unless a narrower width is approved by the applicable utility. Dead-end easements shall not be permitted unless a city approved vehicular turnaround is provided at the end of each such easement.

(4) **Garbage Collection.** If in the opinion of the solid waste management director, private streets in a PUD are arranged so that garbage may be collected without creating a safety hazard, the city will collect the garbage provided proper indemnification is received from the community association or individual property owners. Garbage collection locations shall be subject to the approval of the solid waste management director. In the event the city does not collect garbage within a PUD, all units within the PUD may be exempted from payment of garbage fees upon furnishing of evidence ensuring acceptable removal of all garbage and refuse by private means. To receive such exemption, written application must be submitted to and approved by the finance director.

(k) **Parks/Open Space.**

(1) **Residential.** Each residential PUD plan shall provide for a minimum amount of parks/open space as required by the parks/open space standards (35-503) of this chapter. Residential PUDs may not use a fee in lieu for meeting parks/open space requirements.

(2) **Commercial.** All commercial and industrial PUDs will contain a minimum of twenty (20) percent of parks/open space.

(3) **Mixed-Use.** Mixed-use developments shall be divided into separate residential and commercial areas which must separately meet the requirements of this paragraph and subsection 35-344(c)(2). Mixed use buildings that include residential use shall meet the residential requirements of this subsection.

(4) **Reduction in Parks/Open Space.** At its discretion, the city council may approve a decrease in the amount of required parks/open space when the PUD plan includes unique design features or amenities which achieve an especially attractive and desirable development such as, but not limited to, terraces, sculpture, water features, preservation and enhancement of unusual natural features, or landscape sculpture (areas which are intensely landscaped).

(l) **Parking Requirements**. Off-street parking and truck loading facilities shall be provided in accordance with parking standards of this chapter. Parking shall be prohibited on any private street or private drive, excluding driveways on interior lots less than twenty-eight (28) feet in width, and if utilized on streets twenty-eight (28) feet or wider, the parking must be clearly distinguishable from the movement lanes.

(m) **Common Areas and Facilities.** Provisions shall be made for a property owners' association that is designated as the representative of the owners of property in a residential subdivision. The property owners' association shall have the direct responsibility to provide for the operation and maintenance of all common areas and facilities, including private streets and sidewalks, which are a part of the PUD. The

applicant shall submit the dedicatory instrument(s) covering the establishment, maintenance, and operation of a residential subdivision. The dedicatory instrument(s) shall establish a plan for the use and permanent maintenance of the common areas/facilities and demonstrate that the property owners' association is self-perpetuating and adequately funded by regular assessment and/or special assessment to accomplish its purposes. The dedicatory instrument(s) shall include provisions that provide the city with permission for access at any time without liability when on official business, and further, to permit the city to remove obstructions if necessary for emergency vehicle access and assess the cost of removal to the owner of the obstruction.

"Property owners' association" means an incorporated or unincorporated association that;

A. Is designated as the representative of the owners of property in a residential subdivision;
B. Has a membership primarily consisting of the owners of property covered by the dedicatory instrument for the residential subdivision; and
C. Manages or regulates the residential subdivision for the benefit of the owners of property in the subdivision.

"Dedicatory instrument" means each governing instrument covering the establishment, maintenance, and operation of a residential subdivision. The term includes restrictions or other similar instruments that subject property to restrictive covenants, bylaws, or similar instruments governing the administration or operation of a property owners' association; allow for properly adopted rules and regulations of the property owners' association; and authorize enactment of lawful amendments to the covenants, bylaws, rules, or regulations.

"Property owners' association" means the designated representative of the owners of property in a subdivision and may be referred to as a "homeowners association," "community association," "civic association," "civic club," "association," " committee," or similar term contained in the dedicatory instrument.

"Regular assessment" means an assessment, a charge, a fee, or dues that each owner of property within a residential subdivision is required to pay to the property owners' association on a regular basis and that is designated for use by the property owners' association for the benefit of the residential subdivision as provided by the dedicatory instrument.

"Special assessment" means an assessment, a charge, a fee, or dues, other than a regular assessment, that each owner of property within a residential subdivision is required to pay to the property owners' association, according to the procedures required by the dedicatory instrument, for:

A. Defraying, in whole or part, the cost whether incurred before or after the assessment, of any construction or reconstruction, unexpected repair, or replacement of a capital improvement in common areas owned by the property owners' association, including the necessary fixtures and personal property related to the common areas;

B. Maintenance and improvement of common areas owned by the property owners' association; or

C. Other purposes of the property owners' association as stated in its articles of incorporation or the dedicatory instrument for the residential subdivision.

(n) **Amendments.** Alterations to a PUD plan shall be classified as either minor or major amendments. Minor amendments may be approved by the development services director. Major amendments shall be considered by the zoning commission and city council following the same procedure required for the initial approval of the plan, including payment of the application fee. The following criteria shall be used to identify a major amendment:

(1) A change which would include a land use not previously permitted under the approved PUD zoning.

(2) A change which would alter the land use type adjacent to a PUD boundary.

(3) A change which would increase the overall density of the PUD by more than ten (10) percent. However, in no instance may the overall density of the PUD exceed that permitted by the base zoning district.

(4) A change which the director of development services determines would significantly alter the general character or overall design of the plan.

* * * * *

Chapter 35, Article III, Section 35-345 is amended as follows:

Sec. 35-345. "MPCD" Master Planned Community Districts.

* * * * *

(e) **Amendments to "MPCD" Master Site Plan.**

(1) Revisions to a previously approved "MPCD" master site plan shall be classified as minor or major changes. An application for a major or minor change to "MPCD" site plan shall be subject to subsection 35-412(c) completeness review provisions of this chapter. Within five (5) working days after filing the proposed revisions, required items and information, the director of planning and development services shall provide a written response indicating whether or not the submitted revised "MPCD" site plan has been accepted as a minor or major revision. If it is determined by the director of ~~planning and~~ development services that the revised submittal is considered a minor change then said submittal shall be processed by the director of ~~planning and~~ development services and shall not require review by the zoning commission or approval by the city council. The applicant may appeal a conditional acceptance by the director of ~~planning and~~ development services using the same process as the initial "MPCD" site plan submittal described in subsection (c) of this section. If it is determined by the director of ~~planning and~~ development services that the proposed revision is a major change then said proposed major revisions shall be processed in the same manner as the initial "MPCD" site plan submittal described in subsection (c) of this section. Major amendments to an MPCD site plan constitutes a new project with respect to the area of the project that is being modified.

* * * * *

Chapter 35, Article III, Section 35-350 is amended as follows:

Sec. 35-350. – "QD" Quarry District.

* * * * *

(c) **Operating Standards.**

* * * * *

(2) **Natural Buffer.** A natural area shall be maintained around the perimeter of the property within the district and no grading, removal, or disturbance of native plant material shall be allowed within fifty-five (55) feet of any perimeter property line of the property within the district or public right-of-way, except that such natural area shall not be required where the property owner adjacent to the perimeter of the property within the district grants a recorded irrevocable easement for non-development on such adjacent property equal to the buffer area that would otherwise be required. ~~except~~ Such easements may contain, as required, ~~for establishing required~~ berms and fencing and ~~for~~ an eighteen-foot-wide access road for the purpose of establishing and maintaining fencing, landscaping, access and/or security patrol.

* * * * *

Chapter 35, Article III, Section 35-354 is amended as follows:

35-354. "MH" Manufactured Housing District.

* * * * *

(c) **Manufactured Homes on Individual Lots.**

* * * * *

(2) HUD-Code manufactured homes shall be permanently affixed to a foundation with a visible foundation system and skirting acceptably similar in appearance to foundations of site built residences. The foundation shall form a complete enclosure under exterior walls. Wheels and axles shall be removed. All units must also have ~~covered front and rear entries, and~~ site built steps and porches.

* * * * *

Chapter 35, Article III, Section 35-355 is amended as follows:

35-355. "MHC" Manufactured Housing Conventional District.

* * * * *

(c) **Manufactured Homes Design and Installation Criteria.**

* * * * *

(2) HUD-Code manufactured homes shall be permanently affixed to a foundation with a visible foundation system and skirting acceptably similar in appearance to foundations of site built residences. The foundation shall form a complete enclosure under exterior walls. Wheels and axles shall be removed. All units must also have ~~covered front and rear entries, and~~ site built steps and porches.

* * * * *

Chapter 35, Article III, Section 35-356 is amended as follows:

35-356. "MHP" Manufactured Housing Park District.

* * * * *

(c) **Manufactured Homes on Individual Lots.**

* * * * *

(2) HUD-Code manufactured homes shall be permanently affixed to a foundation with a visible foundation system and skirting acceptably similar in appearance to foundations of site built residences. The foundation shall form a complete enclosure under exterior walls. Wheels and axles shall be removed. All units must also have ~~covered front and rear entries, and~~ site built steps and porches.

* * * * *

Chapter 35, Article III, Section 35-373 is amended as follows:

Sec. 35-373. Attached Dwellings.

* * * * *

(b) Townhouse Development.

(1) No front yard or side yard is required.

(2) A rear setback shall not be required when the townhouse lot abuts an alley or driveway having a minimum right-of-way width of twenty-four (24) feet which is used to provide ingress and egress to such townhouse development. On townhouses and lots that do not abut at the rear, an alley or driveway having a minimum width of twenty-four (24) feet, a twelve-foot rear setback shall be required.

(3) One ~~Six~~ hundred (100 ~~600~~) square feet of contiguous open area shall be provided on each individual lot. The one ~~six~~ hundred (100 ~~600~~) square foot of open area may be used for children's play area and/or patio and may be located in front or to the rear of the townhouse. On corner lots or where side yards are present the one ~~The six~~ hundred (100 ~~600~~) square foot of contiguous area may include the side yard as long as it is not separated by a fence from the remaining portion of the one ~~The six~~ hundred (100 ~~600~~) square foot of space. The "contiguous open area" may consist of lawns, landscaped areas and/or walkways, but shall not include parking or driveways.

(4) The minimum lot depth shall be eighty (80) feet.

(5) Townhouses shall not be subject to the minimum lot size for RM districts in Table 310-1.

(6) Except in the "TOD" district, no townhouse development shall exceed a density of more than forty (40) ~~twenty (20)~~ units per gross acre.

(7) The minimum lot width shall be fifteen (15) feet. ~~The total dwelling units in any single townhouse structure shall not exceed ten (10) nor be less than two (2).~~

(8) Each townhouse shall have either an attached garage, a detached garage, or there shall be a common non-commercial parking lot for the townhouse development. Parking shall not be required in an approved IDZ zoning district.

(9) A townhouse shall have a maximum of three (3) floors in any zoning district and shall have a maximum of four (4) floors where in an approved IDZ zoning district, or the Downtown (D) zoning district.

(10) Section 35-343(m) Urban Design does not apply to townhomes.

* * * * *

Chapter 35, Article III, Section 35-374 is amended as follows:

Sec. 35-374. Bed and Breakfast

* * * * *

~~(h) **Cleaning Requirements.** The owner/operator shall provide clean linens and towels as necessary, as well as adequate heating, ventilation, water, and sewage disposal. The owner/operator shall maintain the outside area in a clean and sanitary manner and shall properly clean the premises and facilities during the guest's stay and after each guest has departed.~~

* * * * *

Chapter 35, Article III, Section 35-378 is amended as follows:

Sec. 35-378. – Home Occupations.

(a) **General Requirements.** Home occupations are permitted in any dwelling unit subject to the following provisions:

* * * * *

(8) No direct on-premises selling of goods shall be allowed; however, telephone soliciting is permitted. Direct on-premise selling of cottage foods and whole, non-cut produce is permitted.

* * * * *

(b) **Prohibited Uses.** The following uses are prohibited as home occupations:

* * * * *

(4) Restaurants, catering, or the preparation of food for resale, except for cottage foods and whole, non-cut produce as defined in this chapter.

* * * * *

Chapter 35, Article III, Section 35-382 is amended as follows:

Sec. 35-382. – Residential Greenhouses.

Residential Greenhouses are permitted provided that:

(a) Any on-premises sales comply with home occupation standards of Section 35-378, ~~They have no on-premises sales (either retail or wholesale),~~

(b) Any signage complies with this Chapter and Chapter 28, ~~They display no advertising signs on the property,~~

(c) Accessory structures do not exceed a total of six hundred (600) square feet in size,

(d) The accessory structure or greenhouse shall meet the requirements in section 35-370, and

(e) There is no outdoor storage of equipment or other materials.

* * * * *

Chapter 35, Article III, Section 35-389 is amended as follows:

Sec. 35-389. Subdivision Sales Offices.

* * * * *

(d) **Signs.** Advertising signs, limited to four (4) in number, and restricted to identification of the land developer and to advertising of residences for sale will be permitted. The signs are allowed to be installed on any lot within the defined subdivision. The signs are permitted on a temporary basis for a two year period or until sales of ninety-five (95) percent of the houses in the subdivision have been consummated, whichever is greater. Such signs shall be limited to two hundred eighty-eight (288) square feet in area and shall not be of neon or flashing type. Also, temporary signs advertising individual homes for sale will be permitted when limited to a maximum of twelve (12) square feet.

* * * * *

Chapter 35, Article III, Section 35-392 is amended as follows:

Sec. 35-392. Illumination of Uses

(a) Lighting facilities used to light signs, parking areas, or for other purposes, including high-intensity residential lighting and light from residentially used properties, shall be so arranged that the source of light is concealed from adjacent residential properties and does not interfere with traffic.

1. All lighting fixtures installed on any residential property and which include or exceed zero (0) foot-candles, measured at the property line, shall be fitted to render them full cutoff (no light output emitted above ninety (90) degrees at any lateral angle around the fixture).

(b) Lights illuminating off-street parking or loading areas shall comply with the following standards as a protection against excessive glare and light spilling over to adjacent properties.

(1) ~~(c)~~ When a light source has elements such as shields, reflectors, or refractor panels which direct and cut off the light at a cutoff angle that is less than ninety (90) degrees, the maximum permitted height shall be thirty (30) feet.

(2) ~~(d)~~ When a light source has a cutoff angle of ninety (90) degrees or greater, the maximum permitted height shall be fifteen (15) feet.

* * * * *

Chapter 35, Article III, Section 35-398 is amended as follows:

* * * * *

Sec. 35-398.01 Ice Machines Over 120 Square Feet

(a) **Applicability.** These supplemental use regulations shall be required for both accessory and stand-alone ice machines over 120 square feet.

(b) **Platting or Plat Exception Required.** The property upon which an ice machine over 120 square feet is located shall be platted or meet one of the plat exceptions listed in 35-430(c)

(c) **Permit and Applicable Building Codes.** All ice machines over 120 square feet shall require commercial building permits, and shall meet all applicable building and building-related code, as applicable.

(d) **Site Design Requirements.**

1. The placement of the ice machine shall not impede traffic, nor visually impair any motor vehicle operation entering or leaving the parking lot from a street.
2. The ice machine shall not be located within any required building setback, buffer yard, access easement, drainage easement, floodplain, driveway, utility easement, and/or fire lane.

3. A minimum of one (1) stacking or parking space per ice machine shall be required. Such parking or stacking space shall be of sufficient size to accommodate an oversized vehicle as defined in this chapter.
4. Where the ice machine is an accessory use, the location of the ice machine shall not reduce existing parking to an amount below the required minimum parking spaces for the principal use on the lot.
5. All signage shall comply with Chapter 28, Signs and Billboards
6. Permanently located (those with traditional permanent foundations), non accessory ice machines, where platting is required, shall meet site work related UDC requirements for traffic, sidewalk, tree canopy, landscaping, and irrigation if the size of the ice machine is over 150 square feet in size.
7. Non-permanently located (those with tie downs) and/or accessory ice machines are not required to comply with traffic, sidewalk, and landscaping/irrigation requirements. All ice machine projects are required to comply with the city tree ordinance for tree preservation.

* * * * *

Chapter 35, Article III, Section 35-399.03 is amended as follows:

~~**Sec. 35-399.03. - Relocation of Buildings and Structures.**~~

~~Not withstanding any provision of this chapter to the contrary, the relocation of any residential building or structure shall not be undertaken unless and until a special exception is approved by the board of adjustment.~~

~~(a) To be granted a request for a special exception to move or relocate a building or structure the request must meet the conditions set forth in subsection 35-482(h) of this chapter.~~

~~(b) The relocation of any building and/or structures, is subject to the following conditions:~~

~~(1) Each house must be comparable in size and quality of construction and in condition to the average of the other homes in the area.~~
~~(2) The applicant shall comply with article VI (historic preservation and urban design) of this chapter and with all other applicable codes and ordinances.~~
~~(3) The use shall comply to such other conditions, as the board may deem proper in harmony with subsection 35-801(g) of this chapter.~~
~~(4) Permits may be granted under this subsection for building, which the city's historic and design review commission has found to have historic and/or architectural significance and where said commission has made a favorable recommendation as to the relocation site. Such exception shall contain appropriate conditions as to repairs to be made. Provision of other codes of the city or of other chapters of the City Code shall not be waived.~~

~~(c) **Certificates of Occupancy.** In cases in which structure relocations are permissible, certificates of occupancy shall not be issued by the director of planning and development services until all applicable provisions of subsection (a) above and chapter 6, article VII~~

~~of the City Code and all other applicable requirements for issuance of certificate of occupancy required by deferral, and state law and City Charter and ordinances are complied with.~~

* * * * *

Chapter 35, Article III, Section 35-399.04 is amended as follows:

Sec. 35-399.04. Fence Height Modifications. ~~Ornamental-Iron Front Yard Fences.~~

Section 35-514 of the Unified Development Code limits the height of ~~predominantly open~~ fences. ~~within front yards to four (4) feet. Ornamental-iron fences between four (4) feet and six (6) feet in height may be allowed on residential lots.~~ Fence heights higher than those prescribed in Section 35-514 may be allowed, but only after consideration and approval of a special exception by the board of adjustment~~*~~. In no case shall the board of adjustment grant a special exception on a residentially zoned property for a fence higher than eight (8) feet, nor shall the board of adjustment grant a special exception on a commercially or industrially zoned property for a fence higher than nine (9) feet. Requests for fences higher than these allowances shall require a variance.

~~*1. If, however, the subject property is zoned historic, within a historic district or designated as a historic landmark, a request for an ornamental-iron front yard fence taller than four (4) feet in height shall be considered by the board of adjustment as a variance, rather than as a special exception, but only after review and consideration by the historic and design review commission pursuant to chapter 35, article IV, division 5.~~

~~*2. If the subject property is within an overlay district which includes design standards that limit the height and design of front yard fences, a request for an ornamental-iron front yard fence taller than four (4) feet in height shall be considered by the board of adjustment as a variance, rather than as a special exception.~~

(a) **General Requirements.** Any ~~front yard~~ fence approved by the board of adjustment for a height modification as a special exception must adhere to the following conditions:

1. Application for a special exception for ~~an ornamental-iron front yard fence over four (4) feet in~~ height shall be filed by the owner or authorized agent with the department of ~~planning and~~ development services.
2. A site plan drawn to scale shall be submitted with the application indicating the size, design, construction materials and location of the fence on the property.
3. ~~On a corner lot, or near a driveway junction with a street, the~~The fence shall not be erected within the fence clear vision area designated by Section 35-514(a)(2). ~~in back of the area designated by this chapter for clear vision area/intersection sight distance~~.
4. The tallest element of the fence shall not exceed ~~six (6)~~ eight (8) feet in height on residentially zoned properties or nine (9) feet in height for commercially and industrially zoned properties, as measured from the grade on the outside of the fence. For the purposes of this condition, the tallest element shall include the top of any column, pillar or post, but shall not include any fixtures or other decorative features attached to the top of any columns, pillars or posts.

~~5. Any portion of the fence over three (3) feet in height must be constructed of ornamental iron bars, or other forged iron bars. If vertical bars/ballisters are part of the design, each shall be no wider than one (1) inch, and the design shall provide a minimum of five and one-half (5½) inches of spacing between vertical bars/ballisters. The overall design of that area of the fence above three (3) feet in height shall be a minimum of seventy (70) percent open.~~

~~6. Columns, pillars or posts at a maximum width of eighteen (18) inches each and spaced a minimum of eight (8) feet apart, measured from center of post to center of post, are permitted. The distance between columns/pillars/posts may be less than eight (8) feet if necessary for structural soundness or to accommodate a gate. However, columns/pillars/posts shall be at least three (3) feet apart where accommodating a pedestrian gate, and at least eight (8) feet apart where accommodating a vehicle gate, both measured from the inside edges of the two columns/pillars/posts. Regardless of the space between columns/pillars/posts, the seventy (70) percent openness criteria and the clear vision area requirements shall be maintained.~~

5. If the property is zoned historic, is located within a historic district, or is designated as a historic landmark, the design of the fence must be approved by the Historic Preservation Officer (or their designee) prior to the granting of the requested special exception.

6. If the property is located within a Neighborhood Conservation District or Corridor Overlay District, the design of the fence must meet all requirements of that district in order to be considered for a special exception.

7. The applicant shall comply with all other applicable codes and ordinances, including engineering requirements, as applicable.

(b) In granting a special exception for ~~a front yard ornamental iron fence over four (4) feet in~~ height, the board of adjustment may require the fence conform to such other conditions as the board may deem necessary to protect the character of the zoning district and neighborhood in which the lot is located, including limitations on building materials, design, and open space requirements.

(c) In granting a special exception for ~~a front yard ornamental iron fence over four (4) feet in~~ height, the board of adjustment shall take into account the size and scale of the fence as it would relate to the scale of the neighborhood, as well as abutting roadways and land uses.

(d) To be granted a request for a special exception, the request must meet the conditions set forth in subsection 35-482(h) of this chapter.

(e) If a special exception for ~~a front yard ornamental iron fence over four (4) feet in~~ height is approved by the board of adjustment, the applicant/property owner shall secure all necessary permits prior to erecting the fence.

* * * * *

Chapter 35, Article IV, Section 35-402 is amended as follows:

Sec. 35-402. - Completeness Review.

The provisions of this section apply to any application under this Chapter, unless otherwise provided in the provisions pertaining to the regulations for the specific application or permit.

* * * * *

(c) **Review Procedures**

* * * * *

(3) **Review By Applicable Director and Appeal - Default Procedure.**

A. Unless a different procedure is described in this article, the provisions of this subsection shall apply to the review of an application for completeness.

B. Not later than five (5) working days after the applicable director shall determine, in writing, whether the application is complete and shall immediately transmit the determination to the applicant. If the written determination is not made within five (5) days after receipt of the application, the application shall be deemed complete for purposes of this chapter. Upon receipt of any resubmittal of the application, a new five-day period shall begin, during which period the applicable director shall determine the completeness of the application. If the application is determined not to be complete, the applicable director's determination shall specify those parts of the application which are incomplete and shall indicate the manner in which they can be made complete, including a list and thorough description of the specific information needed to complete the application. The applicant shall submit materials to the applicable director in response to the list and description. The applicant shall have 35 calendar days to provide the supplemental information before the application will be closed with a decision for denial.

* * * * *

(5) **Limitation on Further Information Requests.** After the applicable director accepts an application as complete or following a determination by the appellate agency that the application is complete, the applicable director or the reviewing agency shall not subsequently request of an applicant any new or additional information which was not specified in Appendix "B." The applicable director or the reviewing agency may, in the course of processing the application, request the applicant to clarify, amplify, correct, or otherwise supplement the information required for the application. The applicant has 35 calendar days to provide the supplemental information before the application will be closed with a decision for denial.

The provisions of this subsection shall not be construed as requiring an applicant to submit, with his or her initial application, the entirety of the information which the reviewing agency may require in order to take final action on the application. Prior to accepting an application, the applicable director shall inform the applicant of any information included in Appendix "B" that will subsequently be required from the applicant in order to complete final action on the application.

* * * * *

Chapter 35, Article IV, Section 35-403 is amended as follows:

Sec. 35-403. - Notice Provisions.

* * * * *

(b) **Contents of Notice.** The notice shall state the time, date and place of hearing and a description of the property subject to the application. The notice shall include, at a minimum, the following:

- The street address, if the street address is unavailable, the legal description by NCB/CB, block, and lot metes and bounds or a general description of the location of the property, either using block numbers, nearby street intersections or approximate distances from intersections.
- The current zoning district, if any; and
- The category of permit requested and a brief description of the proposed development including density or building intensity, revised zoning classification (if any), and uses requested.

In Table 403-1, the method for providing notice is provided in column (A) and the types of permits affected are set forth in columns (B) through (J). In Table 403-1, an asterisk (*) indicates that the type of notice prescribed in column (A) is required for the category of development order prescribed in columns (B) through (L) ~~(J)~~, while a dash (—) indicates that the notice is not required.

Table 403-1
Notice Requirements

(A)	(B)	(C)	(D) ~~(C)~~	(E) ~~(D)~~	(F) ~~(E)~~	(G) ~~(F)~~	(H) ~~(G)~~	(I) ~~(H)~~	(J) ~~(I)~~	(K) ~~(J)~~	(L) ~~(K)~~

Type of notice	Amendments to Master Plan	text changes to the Community, Neighborhood, Perimeter or Sector Plans	Rezoning	Master Development Plan	Items Requiring Public Hearing Before the Board of Adjustment	Subdivision Plat, Major	Subdivision Plat, Minor	Certificate of Appropriateness (Not Including Administrative Approval Certificates)	Permits, Orders or Approvals Not Mentioned Requiring Public Hearing	Request for Demolition of a Historic Landmark or Potential Historic Landmark	Historic Designation Application Approved by Historic Preservation Officer
Publication: Publication in an official newspaper of general circulation before the 15th day before the date of the hearing.	*	*	*	—	*	*(5) ~~(6)~~	(5) ~~(6)~~	—	*	—	—
Mail: Written notice of the public hearing shall be sent.	—	*(1)(2)	*(1)(2) ~~(3)~~	—	*(1)(2)	(5) ~~(6)~~	(5) ~~(6)~~	—	*(1)	*(1)(2)	*(2) (7) ~~(8)~~
Internet: Post notice on the city's Internet website until the process has been completed.	*(6) ~~(7)~~	*	*	*(6) ~~(7)~~	*	*(6) ~~(7)~~	*(6) ~~(7)~~	*	*	*	—
Signage: Post a sign on the property subject to the application. Signs to be installed and provided by the city	—		*(3)(4) ~~(4)(5)~~	—	—	—	—	*	—	*	—

Notes:

(1) Notice shall be sent to each owner, as indicated by the most recently approved municipal tax roll, of real property, within two hundred (200) feet of the property. Notice for zoning cases shall be sent prior to the tenth day before the date of the public hearing at the zoning commission. Notice for demolition applications shall be sent prior to the seventh day before the date of the public hearing at the historic design and review commission. Notice shall not be required for text amendments to the Community, Neighborhood, Perimeter or Sector Plans .

(2) Notice shall be sent to registered neighborhood associations within two hundred (200) feet of the project.

~~(3) Notice shall be sent to members of the planning team, as defined by subsection 35-420(b)(3), for the affected neighborhood, community or perimeter plan, as applicable.~~

(**3**~~4~~) The sign shall measure not less than eighteen by twenty-four inches and shall contain:
City's name,
Zoning Case #_____or HDRC Case #_____,
Name of Case Manager, and
Contact telephone number.
The sign shall be constructed of corrugated plastic sign stock and shall be in a highly visible fluorescent style color with contrasting colors. Lettering shall be a block font in as large a type as permitted by the sign size.

(**4**~~5~~) The requirement for the posting of signs on individual lots and properties shall be waived for city initiated area-wide rezoning consisting of six (6) or more individual lots. However, signs will be placed at the general location of the boundary of the area-wide zoning project and its intersection with major arterial and collector streets that provide ingress/egress to the area subject to rezoning.

(**5**~~6~~) Notice for replat applications shall be sent in accordance with Local Government Code Ch 212.015.

(**6**~~7~~) Notice will include project name, number of acres, and approximate location.

(**7**~~8~~) The historic preservation officer shall notify all property owners within a proposed historic district boundary of the date, time, place and purpose of the historic and design review commission hearing at least thirty (30) days prior to the historic and design review commission hearing on the historic district designation.

* * * * *

(d) **Minor Application and Zoning Site Plan Amendments Not Requiring Renotification.**

(4) **Zoning Intensity.** For purpose of notification the following table of intensity of zoning shall be used. The intensity ranges shall constitute all districts on the following table that lie between the existing zoning district of the subject property and the requested zoning district for the subject property. Consideration of such a recommendation shall not require renotification. ~~Upon request of the property owner, imposition of a "NA" or "R" suffix on a request for a rezoning to the "C-2" or "C-3" districts shall not require renotification. An applicant may not amend a rezoning request to multi-family without renotification. Flex Districts (UD, RD, RF MI-1 and MI-2), overlay districts and special districts shall require renotification.~~

A. The following requests for zoning shall require renotification:

i. Amending a zoning request to or from any multi-family district,

ii. Amending a zoning request to or from any Flex district (UD, RD, FR MI-1 and MI-2)
iii. Adding or removing an overlay district,
iv. Amending a zoning request to or from any Special district; or
v. Amending any zoning request outside the range of Table 403-2.

B. The following requests for zoning shall not require renotification:
i. Amending a zoning request to decrease the density of a multi-family district, notwithstanding (d) (4) A. i above,
ii. Amending a zoning request to change a use in an IDZ base or overlay district that will decrease density or intensity consistent with Table 403-2; or
iii. Request of the property owner for imposition of "NA" or "R" suffix for "C-2" or "C-3" districts.

Table 403-2
Intensity Ranges

"RP"
"RE"
"R-20"
"R-6"
"R-5"
"R-4"
"R-3"
"RM-6"
"RM-5"
"RM-4"
"MF-18"
"MF-25"
"MF-33"
"MF-40"
"MF-50"
"MF-65"
"NC"
"O-1"
"C-1"
"O-1.5"
"C-2NA," "C-2P", "C-2NR"
"C-2"
"O-2"
"C-3NA"
"C-3R", "C-3NR"
"C-3"
"D"
"L"
"I-1"
"I-2"

* * * * *

Chapter 35, Article IV, Section 35-404 is amended as follows:

Sec. 35-404. Public Hearings Procedures.

* * * * *

(b) **Meetings.** The planning commission, zoning commission, and historic and design review commission shall hold regularly scheduled public hearings to receive and review public input on those items required by this chapter. On those items where it has review authority, the zoning commission or planning commission shall recommend that the city council approve, approve with conditions or deny such items. If a comprehensive plan, rezoning, or other land use regulation requiring final approval of the city council, or amendment thereto, or other development approval, has been duly submitted to the zoning commission or planning commission, and said commission has continued such action at two (2) consecutive meetings, such action, at the option of the applicant, shall be deemed to be a negative recommendation. In the event that said commission fails to pass a motion at two (2) consecutive meetings, such action shall be deemed to be a negative recommendation. The director shall thereupon submit the proposed land use regulation or amendment thereto or other development approval to the city council for its consideration.

Except as otherwise specified in this chapter, ~~section 35-421,~~ if an applicant wishes to postpone an item after submittal for consideration by the commission or city council, then the applicant shall provide a written request either prior to the commission or city council meeting or at the meeting as a verbal request at the dais, and pay any required withdrawal or postponement fees which shall be non-refundable.

* * * * *

Chapter 35, Article IV, Section 35-412 is amended as follows:

Section 35-412– Master Development Plan

*** * * * ***

(i) **Scope of Approval**

(1) An approved master development plan shall remain valid in accordance with the following time frame:

A. **Initial Validation**. A MDP shall expire unless a ~~the~~ plat within the MDP boundary is approved and recorded within five (5) years ~~twenty-four (24) months~~ of the acceptance date, or unless there is at least five hundred thousand dollars ($500,000.00) in project expenses if the MDP is one thousand (1,000) acres or less, or at least one million dollars ($1,000,000.00) in project expenses if the MDP is more than one thousand (1,000) acres. Project expenses shall be spent during the first five (5) years ~~twenty-four (24) months~~ from the MDP approval ~~acceptance~~ date.

B. Maintaining Validity. An MDP shall expire following initial validation unless at least one plat within the MDP boundary is recorded every five (5) years from

the last recorded plat. ~~and the plat used to validate the MDP shall be recorded within thirty-six (36) months of the plat approval date. The minimum platted area must be at least twenty (20) acres or eight (8) percent of the net area of the MDP, or a MDP shall expire unless there is at least five hundred thousand dollars ($500,000.00) in project expenses if the MDP is one thousand (1,000) acres or less or at least one million dollars ($1,000,000.00) in project expenses if the MDP is more than one thousand (1,000) acres.~~ Project expenses may be used in lieu of recording a plat every five (5) years and may be used every five (5) years from the last validated expenditure; however, the expenses for a recorded validated plat may not be used in subsequent validations. The expenses must be for a tract of land within the MDP boundary that has not been platted and recorded.

Project expenses shall be defined to include "infrastructure expenses" as provided in Appendix A of the UDC. It is noted that this section uses the word "paid" in the past tense.

Project expenses shall also be defined to include the Local Government Code definition of progress toward completion as defined in § 245.005(c). It is noted that this section speaks in the past tense when referencing actions that were part of progress toward completion.

This Section is applicable to any MDP that is valid as of the effective date of this Section. These previously validated MDPs shall expire unless the ongoing platting or project expense requirements of 412(i)(1)(B) are satisfied, provided that the initial five (5) years shall start as of the effective date of this Section. This Section does not allow an MDP that expired prior to the adoption of this code to become valid.

~~B.~~

~~Further, an approved master development plan shall expire unless fifty (50) percent of the net area within the approved master development plan is the subject of final plats or development within ten (10) years from the date of approval of the master development plan, or an MDP shall expire unless there is at least five million dollars ($5,000,000.00) in project expenses within ten (10) years from the date of approval of the master development plan. The remaining fifty (50) percent must obtain final plat approval or be developed within ten (10) years after the initial fifty (50) percent of the net area within the master development plan has been platted or developed. Unless specific provisions to the contrary exist in an individual ordinance or city municipal code provision, the filing of a minor amendment to a master development plan (see subsection 35-412(gh)(2), plat, or replat will not result in a loss of permit rights and abandonment of the original master development plan provided that the required area of acreage within the master development plan platted or value of infrastructure expenses do not fall below the amounts indicated above as a result of the amendment or replat.~~

* * * * *

Chapter 35, Article IV, Section 35-413 is amended as follows:

Sec. 35-413. Reserved.~~PUD Plan.~~

~~(a) Public Hearing. Upon submission of the PUD plan, the director of development services shall distribute copies to appropriate city departments and agencies for review. Upon receipt of all required items and reviews, the director of development services shall schedule a public hearing by the planning commission on the proposed plan and shall provide written notice of the hearing to the owners of real property lying within two hundred (200) feet of the PUD boundaries. The notice shall be mailed at least ten (10) days prior to the public hearing date.~~

~~(b) Plan Approval. After the public hearing the commission may approve the plan as submitted, amend and approve the plan as amended, or disapprove the plan. If approved, the plan with any amendments shall be signed by the chairman and secretary of the commission. A copy of the approved PUD plan shall be distributed to the development services director and other appropriate departments/agencies for use in issuing permits.~~

~~(c) Plan Changes. Alterations to a PUD plan shall be classified as either substantial or non-substantial amendments. Non-substantial amendments may be approved by the development services director. Substantial amendments shall be considered by the planning commission following the same procedure required for the initial approval of the plan, including payment of the plan review fee. The following criteria shall be used to identify a substantial amendment:~~

~~(1) A change which would include a land use not previously permitted under the approved PUD zoning.~~

~~(2) A change which would alter the land use type adjacent to a PUD boundary.~~

~~(3) A change which would increase the overall density of the PUD by more than ten (10) percent. However, in no instance may the overall density of the PUD exceed that permitted by the base zoning district.~~

~~(4) A change which the director of development services determines would significantly alter the general character or overall design of the plan.~~

* * * * *

Chapter 35, Article IV, Section 35-420 is amended as follows:

Sec. 35-420. Comprehensive, Neighborhood, Community, ~~and~~ Perimeter and Sector Plans.

STATEMENT OF PURPOSE
Neighborhoods are an essential building block of local planning. The master plan provides strong policies encouraging neighborhood participation in the planning and land development process. Neighborhood planning is an important process when it is participatory and inclusive. At the same time, the master plan requires development approval processes to be fair and equitable, and for permitting to be streamlined.

(a) **Applicability.** The provisions of this section govern the development of neighborhood, community, ~~and~~ perimeter, and sector plans. There are four (4) ~~three (3)~~ categories of plans that may be adopted pursuant to this section, as set forth in subsections (1) through (4) ~~(3)~~ below. For purposes of this section, a "plan" shall mean and refer to any neighborhood plan, community plan, ~~or~~

perimeter plan, sector plan or any plan adopted pursuant to Texas Local Government Code Chapter 213 ~~V.T.C.A. Local Government Code Ch. 219~~, unless otherwise indicated.

(1) **Neighborhood Plans.** Neighborhood plans may include at least one (1) neighborhood unit. A neighborhood unit may encompass an area which includes residences, businesses, parks, schools, undeveloped land, and other community facilities. Populations should generally range from four thousand (4,000) to ten thousand (10,000) people depending on the geographic area and boundaries. A neighborhood unit usually contains at least one thousand five hundred (1,500) housing units. Neighborhood plans may be incorporated into community plans and shall function as building blocks in the development of community plans.

(2) **Community Plans.** Based on the master plan policy for sector planning, the community building and neighborhood planning program includes a citywide system of community areas in order to develop community plans. The objective of dividing the entire city into community areas is to establish a framework for: developing community plans that impact and service all citizens of San Antonio; creating a citywide service system that fosters community-based partnerships and civic awareness that improves neighborhoods; and providing a means for articulating community values that is readily available to public and private entities which shape the future development of the community. The proposed community areas shall be identified by the department of planning and community development based on the city's current population, and boundaries based on community association areas, the parks and recreation system plan service areas, creeks, freeways, major arterials, and census tracts.

(3) **Perimeter Plans.** Perimeter plans are similar to community plans but may cover land areas that lie within the corporate limits, the city's ETJ and that portion of the county outside of the city's present ETJ. Perimeter plans shall serve as amendments to the city's master plan for those areas lying within the city limits and shall be subject under state law to the zoning ordinances of the City of San Antonio. All other areas covered by the perimeter plan outside of the corporate limits of the city shall be for general guidance for the subdivision of land and implementation of the major thoroughfare plan.

(4) **Sector Plans.** Sector plans are components of the City's Master Plan Polices, but also provide appropriate guidance for land use, transportation, and public facilities planning in each of the City's sector areas. Sector plans shall serve as amendments to the city's master plan for those areas lying within the city limits and shall be subject under state law to the zoning ordinances of the City of San Antonio. All other areas covered by the sector plan outside of the corporate limits of the city shall be for general guidance for the subdivision of land and implementation of the major thoroughfare plan.

* * * * *

(f)Comprehensive, Neighborhood, Community, Perimeter and Sector Plan Amendments ~~Subsequent Applications~~

(1) Applicability. The provisions of this section apply to any application for a change to the future land use component of adopted plans or for changes to the text of Community, Neighborhood, Perimeter or Sector Plans. The comprehensive master plan is the city's long-range approved plan. The Neighborhood, Community, Perimeter and Sector Plans are elements of the comprehensive plan. An amendment to the master plan should demonstrate that a substantial public need exists and the amendatory ordinance must bear a substantial relationship to the public health, safety, morals, or general welfare or protect and preserve historical and cultural places and areas. Each application for a change to the city's long range plan must follow the city's comprehensive plan and should not redetermine as an original matter the city's master plan policies.

(2) Initiation. Plans are prepared to address needs of the Planning area, existing development patterns, and opportunities for growth over the next five or more years. As such, physical, market and development conditions will continue to evolve within the planning areas. These variables can result in necessary changes to an adopted plan. All petitions, recommendations or proposals for changes in the future land use component of adopted plans or changes to the text of the plan shall be filed with the planning commission. Text amendments may be proposed by any person. A proposed amendment may be initiated by:

A. The city council by resolution; or

B. An application properly signed and filed by the owner or, with the owner's specific written consent, a contract purchaser or owner's agent of a property included within the boundaries of a proposed amendment, unless otherwise provided for by this chapter.[3][1] When an amendment is initiated, an application for such amendment shall be submitted to the director. The applicant may file an application for subdivision plat approval concurrent with an application for an amendment.

C. The director of development services pursuant to an annexation service plan or to correct an administrative error in the rezoning or amendment of a tract of land pursuant to this chapter.

(3) Completeness Review. The director of development services shall conduct a completeness review as set forth in section 35-402 of this chapter within two (2) working days of application submittal. The appellate agency for purposes of completeness review (see subsection 35-402(c) of this chapter) shall be the planning commission.

(4) **Decision.** Upon certification by the director that the application is complete and required fees have been paid, the application shall be deemed complete and referred to the planning commission for its review and recommendation.

A. **Type of Hearing.** The public hearings before the planning commission and city council shall be conducted in accordance with section 35-404, above.

B. **Planning Commission.** The planning commission, after public notice in accordance with Table 35.403-1, Notice Requirements, shall hold at least one (1) public hearing on such application and as a result thereof shall transmit a resolution report to the city council. All applications for an amendment which have been considered by the planning commission shall be presented by the applicant to the city council within six (6) months from the date of the commission's final consideration. In the event the applicant fails to present the application for an amendment to the city council within the prescribed period, a new original application and fees shall be required. A new application shall not be submitted to the planning commission for consideration prior to the expiration of the six-month time period specified in subsection (5), below. See subsection 35-404(b) for rules relating to failure of the planning commission to submit a recommendation.

C. **City Council.** After the resolution of the planning commission is submitted to the city council as provided in subsection B above the council shall consider an amendment after a public hearing in relation thereto, at which parties in interest and citizens shall have an opportunity to be heard. Before the fifteenth day prior to the date of the hearing, notice of the time and place of the hearing shall be published in an official newspaper or a newspaper of general circulation in the city. After the receipt of the final report of the planning commission, the city council shall approve or deny the amendment.

All applications for an amendment which have been considered by the planning commission shall be presented by the applicant to the city council within six (6) months from the date of the commission's final consideration. In the event the applicant fails to present the application to the city council within the prescribed period, a new original application and fees shall be required. A new application shall not be submitted to the planning commission for consideration prior to the expiration of the six-month time period specified in subsection (5), below. See subsection 35-404(b) for rules relating to failure of the planning commission to submit a recommendation.

(5) Postponement of a Case by Applicant.

A. Prior to the city publishing notice of the amendment in the newspaper, an applicant may request in writing that the case not be scheduled for a public hearing date. In such cases, the applicant shall have six (6) months from the

date of the written request to schedule the case. After expiration of the six-month period, the applicant will have to submit a new application with new fees for further consideration of an amendment on the subject property.

B. If a written request for postponement is submitted by the applicant after the city has published the case in the newspaper, the fees paid shall be non-refundable and the case will not be rescheduled for a public hearing date until the postponement fee has been paid by the applicant. In such cases, the applicant shall have six (6) months from the date of the written request for postponement to reactivate the case. After expiration of the six-month period, the applicant will have to submit a new application with new fees for further consideration of an amendment on the subject property. In no instance shall a postponement extend beyond six (6) months from the date of the commission's final consideration.

C. If a request for postponement is not received by 4:30 p.m. on the seventh day prior to the public hearing date, the case shall remain on the public hearing agenda and will require the applicant to personally request such a postponement in front of the planning commission or city council.

(6) Subsequent Applications.

A. Applicability. The provisions of this subsection shall not apply to any application which is initiated by the city council.

B. Withdrawal of an Application.

1. Withdrawal without time penalty. An applicant may withdraw an application up to the time that it is called forward and the city staff begins presentation of the application during a duly advertised public meeting without a time penalty on resubmission of another application for the property whether by the original applicant or a new applicant.

2. Withdrawal with time penalty. An applicant may withdraw an application after it has been called forward for discussion and staff has begun presentation however such withdrawal shall be penalized by imposing an automatic six-month time period following the date of withdrawal before the same or another application for the same property can be submitted for processing.

3. Waiver of time penalty in subsection 2. above for resubmission. At the time of withdrawal of an application the planning commission may consider a request by the applicant to bring the application or a modification of the application back prior to the expiration of six (6) months

subject to all notifications and postings of the case being observed. If the planning commission fails to approve such resubmission prior to continuing with the next agenda item the six-month submission limitation shall stand.

4. Request of relief of time penalty. If new relevant and substantial evidence which could not have been secured at the time set for the original hearing shall be produced by applicant, under a sworn affidavit to that effect, then in that event, the planning commission may elect to hear and consider such application prior to the expiration of the time penalty.

C. Denial of Amendment. It is further provided that no application for the amendment of any lot, lots or block of land situated in the city shall be received or filed with the planning commission of the city and no hearing held thereon, if within one (1) year prior thereto the city council, after consideration and hearing, has denied an application for an amendment of the same property.

(7) Amendments. Any subsequent amendments to future land use or text changes to the Community, Neighborhood, Perimeter or Sector Plans requires a new application and shall be processed as set forth in subsections (2) through (4) of this section.

* * * * *

Chapter 35, Article IV, Section 35-421 is amended as follows:

35.421. Zoning Amendments.

*** * * * ***

(d) **Consistency.** For all applications for rezoning, the development services department, based on the information provided by the applicant, shall make a determination regarding consistency with the policies contained in the master plan of the city or if applicable the land use element of a neighborhood, community, ~~or~~ perimeter, or sector plan adopted pursuant to section 35-420 of this chapter, within five (5) working days.

(1) If the development services department makes a determination that the requested rezoning is inconsistent with the master plan policies or the land use element of the applicable neighborhood, community, or sector plan ~~or~~ perimeter ~~plan~~, then the application for rezoning shall not be deemed complete until a completed application for a master plan amendment is filed with the development services ~~planning and community development~~ department. The requested rezoning shall not

be considered by the City Council ~~zoning commission~~ until the planning commission has considered the master plan amendment request.

(2) If the development services department determines that the requested change is consistent with the master plan policies or the land use element of the applicable neighborhood, community or perimeter plan, then the zoning case may be deemed complete without an amendment to the master plan of the city.

(3) The appellate agency for purposes of consistency determination shall be the planning commission.

Commentary: The master plan is the comprehensive plan for the physical development of the city, as prescribed in the City Charter. The master plan includes any unit or part of such plan separately adopted and any amendment to such plan or part thereof. Neighborhood, community, ~~and~~ perimeter and sector plans are components of the master plan.

(e) **Decision.** Upon certification by the director that the application is complete and required fees have been paid, the application shall be deemed complete and referred to the zoning commission for its review and recommendation as provided by V.T.C.A. Local Government Code § 211.007.

(3) **City Council.** After the final report of the zoning commission is submitted to the city council as provided in subsection B above the council shall consider a master plan amendment after a public hearing in relation thereto, at which parties in interest and citizens shall have an opportunity to be heard. Before the fifteenth day prior to the date of the hearing, notice of the time and place of the hearing shall be published in an official newspaper or a newspaper of general circulation in the city. After the receipt of the final report of the zoning commission, the city council shall approve or deny the rezoning or text amendment in accordance with with V.T.C.A. Local Government Code § 211.007.

If the proposed rezoning is inconsistent with the land use plan of a neighborhood plan, community plan, ~~or~~ perimeter plan, or sector plan, an application for an amendment to the neighborhood plan, community plan, ~~or~~ perimeter plan, or sector plan, shall be submitted by the applicant.

Amendments to both the official zoning map and the neighborhood plan, community, ~~or~~ perimeter plan, or sector plan, may be considered concurrently.

An affirmative vote of at least three-fourths (¾) of all members of the city council is required to approve a proposed change to a regulation or boundary if the change is protested. The protest must be written and signed by the owners of at least twenty (20) percent of either the area of the lots or land covered by the proposed change or the area of the lots or

land immediately adjoining the area covered by the proposed change and extending two hundred (200) feet therefrom. In computing the percentage of land area, the area of streets and alleys shall be included in the computation. Written protests must be received by the director at the department of ~~planning and~~ development services offices no later than 4:00 p.m. of the previous business day prior to the posted date and time for the zoning hearing on the city council's agenda. If the written protests appear to be at least twenty (20) percent of either the area of the lots or land covered by the proposed change or the area of the lots or land immediately adjoining the area covered by the proposed change and extending two hundred (200) feet there from the applicant shall be entitled to, but is not required to request an automatic continuance if all members of the city council are not present.

* * * * *

(g) **Postponement of a Case by Applicant.**

(1) Prior to the city publishing the zoning case in the newspaper, an applicant may request in writing that the case not be scheduled for a public hearing date. In such cases, the applicant shall have six (6) months from the date of the written request to schedule the case. After expiration of the six-month period, the applicant will have to submit a new application with new fees for further consideration of a zoning change on the subject property.

(2) If a written request for postponement is submitted by the applicant after the city has published the case in the newspaper, the fees paid shall be non-refundable and the case will not be rescheduled for a public hearing date until the postponement fee has been paid by the applicant. In such cases, the applicant shall have six (6) months from the date of the written request for postponement to reactivate the case. After expiration of the six-month period, the applicant will have to submit a new application with new fees for further consideration of a zoning change on the subject property. In no instance shall a postponement extend beyond six (6) months from the date of the commission's final consideration.

(3) If a request for postponement is not received by 4:30 p.m. on the seventh day prior to the public hearing date, the case shall remain on the public hearing agenda and will require the applicant to personally request such a postponement in front of the zoning commission or city council.

* * * * *

Chapter 35, Article IV, Section 35-422 is amended as follows:

35-422. Conditional Zoning.

* * * * *

(e) **Criteria.**

(1) **Permitted Uses.** Notwithstanding any provisions of this chapter to the contrary, a conditional zoning district may be permitted as provided in this section so long as the criteria for approval of a rezoning are met (see subsection 35-421(d)). A conditional use permitted in a "UD," "RD," "MI-1," or "MI-2" district shall meet all development standards of that district, including location criteria. Any use which requires a specific use authorization as set forth in Tables 311-1 and 311-2 may be permitted in a less intense zoning district (as specified in the Intensity Ranges Table 403-2) pursuant to a conditional zoning district and Table 422-1. Uses permitted by right in the districts set forth in column (A) of Table 422-1 below, may be permitted pursuant to a conditional zoning district approved within the zoning districts set forth in column (B) of Table 422-1, as follows:

* * * * *

Chapter 35, Article IV, Section 35-423 is amended as follows:

Sec. 35-423. - Specific Use Authorization.

* * * * *

(a) **Applicability.** The provisions of this section apply to any application for approval of a specific use authorization. Specific use authorizations are those uses which are generally compatible with the land uses permitted by right in a zoning district, but which require individual review of their location, design and configuration and the imposition of conditions in order to ensure the appropriateness of the use at a particular location within a given zoning district. Only those uses that are enumerated as specific use authorizations in a zoning district, as set forth in the use matrix (section 35-311), shall be authorized by the city council. A specific use authorization shall not be required for a use allowed as a permitted use in a given zoning district. Up to two (2) Specific Use Authorizations can be authorized by the city council for properties within the Edwards Recharge Zone District, if the uses are permitted by right in the base zoning district.

* * * * *

Chapter 35, Article IV, Section 35-424 is amended as follows:

Sec. 35-424. – Ministerial Permits or Approvals.

* * * * *

(g) **Manufactured Home Park Plan.**

(1) **Applicability.** The director of ~~planning and~~ development services shall not issue building or repair permits or certificates of occupancy for structures in manufactured home parks within the incorporated areas of the city until a plan has been approved in the manner prescribed by this division and duly filed in the office of the director of ~~planning and~~ development services. The city will withhold all public improvements and services from manufactured home parks, including wastewater, water, gas and electric service until a manufactured home park has been approved in the manner prescribed by this subsection.

Property to be developed as a manufactured home park shall be platted prior to obtaining any building permits or utility services. Such plats shall be annotated with a statement that it is a "manufactured home community" or a "recreational vehicle park," and shall annotate the plan with same name as the subdivision plat.

(2) **Initiation.** Each applicant seeking approval of a manufactured home park shall submit a manufactured home park site plan to the director of ~~planning and~~ development services. ~~The manufactured home park plan shall not be accepted unless it contains the information required by Appendix "B" to this chapter.~~

(3) **Site Plan.** A zoning site plan, prepared to scale, illustrating the proposed land uses by location, type (residential, office, commercial, light industry), density and size shall accompany an application for rezoning to "MHP" for review by the zoning commission and consideration by the city council. The approved zoning site plan shall accompany all subsequent development applications (including, but not limited to, master development plan, plats, and building plans). Subsequent development applications that do not conform to the approved "MHP" zoning site plan shall not be approved.

(4) ~~(3)~~ **Completeness Review.** See section 35-402~~(c)~~ of this chapter.

~~(4) **Decision.** Upon receipt of a manufactured home park plan, the director of planning and development services shall distribute copies to various departments and agencies as the director deems appropriate for their review. The departments/agencies receiving copies of the plan shall submit their comments and recommendations for approval or disapproval in writing back to the director of planning and development services within thirty (30) days of receipt of the plan.~~

~~Within forty-five (45) days of the date of submission of the manufactured home park plan, the director of planning and development services shall submit the plan with his recommendation and comments received from other city departments and agencies to the planning commission for consideration. The planning commission may approve the plan as submitted, amend and approve the plan as amended or disapprove the plan.~~

(5) **Amendments to "MHP" Site Plan.**

(a) **Initiation.** Revisions to a previously approved "MHP" zoning site plan shall be classified as minor or major changes. The applicant for site plan amendment shall submit a site plan that is consistent with the requirements of section 35-424(g) above. The submittal shall include the site plan approved with the original application and a revised copy with annotation of the requested changes. The revised site plan shall be prepared to scale and shall include a block for a signature by the property owner and the development services director to indicate acceptance of the revised site plan and, if applicable, shall include appropriate signature and seals of the design professional (i.e. architect, engineer, surveyor) who prepared the site plan. The site plan shall be processed only upon payment of the plan amendment fee indicated in 35-C102

(b) **Completeness Review.** See section 35-402 of this chapter.

(c) **Major Amendments.** A major amendment shall require a new application for rezoning pursuant to the procedures of 35-421. A major amendment to an "MHP" site plan shall include:

i. Any increase in the total number of residential units for the entire "MHP."
ii. Any increase in the total acreage within the "MHP."
iii. Any increase in the cumulative traffic impacts of the entire "MHP" upon outlying transportation infrastructure.
iv. Any increase in the total sewer capacity required for the "MHP" as measured in equivalent dwelling units.
v. Any increase in the total water capacity required for the "MHP" as measured in equivalent dwelling units.

(d) **Minor Amendments.** Any other revision to an "MHP" site plan not described as a major amendment above shall be deemed a minor change. After the five-day completeness review process, a site plan revision deemed by the director as a minor amendment shall undergo a technical review by staff not to exceed thirty-five (35) days and shall not require review by the zoning commission nor approval by the city council. If approved, the director shall sign the amendment indicating official acceptance in the required signature block.

~~**(5)Approval Criteria.** The manufactured park plan shall comply with the manufactured home and recreational vehicle parks regulations (section 35-382) of this chapter.~~

~~**(6) Amendments.** After favorable action by the planning commission, minor changes to the plan that do not increase the density or affect platting, the general character or overall design of the manufactured home park plan may be approved by the director of planning and development services.~~

~~Major changes shall be submitted for consideration by the planning commission following the same procedure required for the original adoption of he plan. The planning commission shall interpret what constitutes a major change in the plan.~~

~~**(7) Scope of Approval.** See subsection (a)(8) of this section. Subdivision plat approval may also be required prior to issuance of a building permit.~~

~~**(8) Recording Procedures.** If the manufactured home park plan is approved, the director of planning and development services shall retain one (1) copy on file in the department of planning and development services and distribute one (1) copy to the director of planning and development services and other departments/agencies as appropriate.~~

~~**(9) Permit for Temporary Use at Construction Sites.**~~

- ~~Authorization may be issued by the director of planning and development services to permit an individual manufactured home to be temporarily located~~

~~on a lot upon which a building permit has been previously issued for construction of any building or structure.~~

- ~~A certificate of occupancy related to construction shall not be issued by the director of planning and development services until the manufactured home has been removed from the premises and further, that the certificate of occupancy shall not be issued until the electrical connection which served the manufactured home has been removed from the lot in question.~~

- ~~A temporary permit issued pursuant to this section shall be void upon issuance of the certificate of occupancy, or twelve (12) months after issuance of the building permit, whichever time is shorter.~~

- ~~In any case in which construction is not completed within the twelve-month period, the director of planning and development services, after due consideration and determination that active construction is being accomplished, may issue an extension of time for the temporary permit, not to exceed a six-month period.~~

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Chapter 35, Article IV, Section 35-430 is amended as follows:

Sec. 35-430 Applicability and General Rules.

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(c) **Plat Exceptions.** In accordance with V.T.C.A. Local Government Code §§ 212.004 and 212.0045 the platting exceptions set forth below are established. Applicants exempt from subdivision plat approval may be subject to development plat approval requirements pursuant to section 35-432 of this article. Habitable uses within the regulatory floodplain shall always require platting. The applicant for plat exception shall provide proof of ownership in the form of a warranty deed and a current tax certificate with indication of no taxes due. The department of development services may issue building permits, and public utility providers may provide utility service, on any unplatted parcel otherwise subject to this section for the following activities:

(1) The division of land into parts greater than five (5) acres within the city limits of the City of San Antonio, where each part has access and no public improvement is being dedicated, shall not require a subdivision plat. For purposes of this subsection, access shall mean a minimum frontage of fifteen (15) feet onto a public street or recorded access easement of fifteen (15) feet onto a public street. Public improvement shall mean creation of new streets, alleys or the extension of off-site utilities or the installation of drainage improvements. This subsection relates to an unplatted parcel of land within the city and limited to single-family or agricultural uses.

(2) The division of land into parts greater than ten (10) acres in the ETJ of the City of San Antonio, where the owner does not lay out part of the tract for streets, alleys, squares,

parks, or other parts of the tract intended to be dedicated to public use or for the use of purchasers or owners of lots fronting on or adjacent to the street, alley squares, parks, or other parts shall not require a subdivision plat.

(3)~~(4)~~Uninhabitable uses that are to be retained in an undeveloped state shall not require a subdivision plat, provided: (1) the division does not create more than three (3) parcels, (2) each parcel contains a minimum area of five thousand (5,000) square feet, (3) the division does not involve the creation of any streets or alleys, and (4) no utility services shall be provided to the parcels, provided however, that the director of development services may exempt other uninhabitable uses from subdivision plat requirements upon determining that the uses are consistent with the intent of these provisions. ~~*Commentary: The intent of this subsection is to allow the division of land without platting so long as the land remains undeveloped. Platting is required at the time utility services or building permits are requested unless one (1) of the other plat exceptions applies.*~~

(4)~~(3)~~Each tract greater than ten (10) acres in size is eligible for up to three (3) single-family utility connections provided all tracts are held under common ownership, each tract has access and no public improvement is being dedicated. For purposes of this subsection, access shall mean each tract has a minimum frontage of fifteen feet on an existing public or platted private street or irrevocable access easement.

(5)~~(11)~~The provision of utility service to not more than three (3) detached single family dwelling units on an unplatted tract or antiquated plat shall not require a subdivision plat provided all of the following requirements are met:

(a) The tract is located outside the city limits within the extraterritorial jurisdiction of the city;
(b) The tract has a minimum of fifteen (15) feet of frontage on a public street or a recorded irrevocable access easement;
(c) The tract was created prior to January 1, 2005;
(d) The tract has a minimum area of five thousand (5,000) square feet for each dwelling unit, additional County requirements may be imposed where on-site sewage facility is proposed;
(e) The tract is held under single ownership;
(f) No dwelling unit will be located within a regulatory floodplain; and
(g) No public utility extension is required.
~~(h) No major thoroughfare dedication is required.~~

~~When major thoroughfare dedication is required, the owner of an unplatted parcel abutting a designated major thoroughfare may voluntarily execute a street dedication instrument in accordance with form "S" in Appendix "B" in lieu of public dedication through platting when necessary. Any further subdivision shall require approval of a subdivision plat as provided herein. (The intent of this subsection is to allow the division of land in the ETJ without platting so long as the land remains limited to three single family units.)~~

(6) The provision of building permit and/or utility service to not more than one (1) detached single family dwelling unit on an unplatted tract or antiquated plat shall not require a subdivision plat provided all of the following requirements are met:

a) The tract is located inside the city limits of the city;

a) The tract has a minimum of fifteen (15) feet of frontage on a public street or a recorded irrevocable access easement;

b) The tract must have an existing lot(s), block and NCB number.

c) The tract was created prior to January 1, 2005;

d) The tract has a minimum square footage required by the zoning classification in place at the time of the request;

e) The tract is held under single ownership;

f) No dwelling unit will be located within a regulatory floodplain; and

g) No public utility extension is required.

(7)~~(8)~~ Replacement and/or repair of a preexisting or existing single family dwelling unit or related accessory structure shall not require a subdivision plat if: ~~if it was damaged, destroyed or ruined by flooding, fire, windstorm or other natural disaster. This exception shall only apply in such cases where reconstruction does not increase the building footprint or height by more than ten (10%) percent.~~

a) The applicant provides evidence that single-family development and/or single-family improvements had received electrical service for more than (5) years prior to the date of application; and

b) Expansion of a preexisting or existing single family dwelling unit by up to 1,000 square feet or related accessory structure shall not require a subdivision plat.

(8)~~(13)~~ An existing single-family residence can add a second residential structure provided that all requirements of Section 35-371 are met. ~~they utilize the same electrical meter and the occupant is family.~~ In addition, the applicant will need to comply with all zoning, building and on-site sewage facility requirements.

(9) The land for which a building permit or utility service is being requested is a lot or the last remaining portion of a lot previously platted under the jurisdiction of the county or city.

(10) A tract of land greater than five (5) acres in size is eligible for one (1) single-family utility connection provided the tract is held under common ownership, and no public improvements are being dedicated. For purposes of this subsection, the tract shall have a minimum frontage of fifteen (15) feet on an existing public or platted private street or irrevocable access easement. Property must conform to existing zoning standards.

(11)~~(5)~~ Nonhabitable uses as defined by the International Building Code or Residential Code and accessory uses that are subordinate to another use shall not require a subdivision plat. Nonhabitable ~~Other uninhabitable~~ uses may include ~~includeing,~~: ~~but not limited to,~~ pumps, oil wells, sheds, security lights, traffic devices, monuments, signs/billboards, utility equipment huts, communication towers, or

public infrastructure shall not require a subdivision plat. This shall also include fences as well as unenclosed structures such as porches, carports, decks, gazebos and pavilions.

(12)~~(6)~~ Public parks and golf courses owned, operated, or maintained by a governmental entity shall not require a subdivision plat. This exception shall not include athletic facilities such as stadiums, natatoriums, concession facilities or similar improvements within park facilities.

(13)~~(7)~~ Temporary construction ~~field~~/subdivision sales offices or seasonal type uses shall not require a subdivision plat. These uses may be permitted in any zoning district incidental to a construction project. The office or shed shall not contain sleeping or cooking accommodations and shall be removed within thirty (30) working days after final completion of the construction project with a maximum period of three (3) years; and the applicant can reapply for a new permit. Temporary uses are as defined in Section 35-391 of the UDC and subdivision sales office as defined in Section 35-389 of the UDC.

(14)~~(10)~~ The division of any tract of land into parcels which are to be used solely for agricultural, mining, or quarrying purposes shall not require a subdivision plat, provided: (1) each parcel contains a minimum area of twenty (20) acres, and (2) no utility services shall be provided to a habitable ~~an inhabitable~~ use.

(15)~~(12)~~ Sewer and water service to existing buildings. If existing buildings on an unplatted tract are occupied, sewer and water services may be provided if all of the following conditions are met:

a. The applicant provides evidence that single-family and/or non single-family development and/or single-family and/or non single-family improvements had received electrical service for more than (5) years prior to the date of application for sewer and/or water services;
b. The site is not subject to major thoroughfare dedication;
c. If applicable, existing building(s) shall comply with the floodplain ordinance;
d. Service is restricted to existing uses; and
e. Impact fees are paid at the time of application for service.

(16)~~(14)~~ Requests for permits within a lawfully permitted ~~the~~ existing building's footprint including remodeling, general repair and maintenance, roofing, ADA accessibility, trade permits, and similar improvements, shall not require a subdivision plat. ~~area of an otherwise lawfully permitted structure.~~

(17)~~(15)~~ A commercial and/or multi family ~~The~~ lot is located within the original thirty-six (36) square mile area of San Antonio, and the boundaries of the lot were recorded in the Deed and Plat Records of Bexar County prior to June 14, 1927 and the lot remains in its original configuration. It shall be the obligation of the applicant for plat exception to provide documentation of the lot's recording prior to June 14, 1927.

* * * * *

(f) **Performance Agreements.**

* * * * *

(2) **Performance Agreement and Site Improvement Time Extension Granted by the director ~~Director of Development Services~~ or Planning Commission.**

(1) Application Requirements.

A. Site improvement construction must have begun.

B. A proper application must be submitted in writing, including the justification for such extension, to the director of development services at least thirty (30) days prior to the time limit in the performance agreement.

C. A Performance Guarantee Extension must be provided, if applicable. Whether an extension agreement is approved by the director or the planning commission, for:

i. Recorded Plats. An applicant must file a guarantee extension within thirty (30) days of the granting of an agreement extension or the agreement extension becomes null and void.

ii. Unrecorded Plats. If the plat is unrecorded and no performance guarantee previously provided, no guarantee extension is required.

(2) Procedure.

A. The city attorney's office shall have ten (10) working days for review of the guarantee as to form, and

B. The director shall have five (5) working days for review and approval/denial of the guarantee.

C. Any re-submittal of a revised guarantee for shall have the same review periods as under subsections A and B, above.

D. The applicant and the city may agree to an extension of such time periods.

(3) Fees. A subdivider shall pay any fees associated with time extensions to the director.

(4) Approval of Extensions.

A. May be granted by the director after consultation with all affected departments and utilities for:

i. Sidewalk Improvements. Unless subject to subsection 35-506(q)(4), a time extension of three (3) years from the

expiration of a performance agreement may be granted upon submission to and approval by the director of:

(a) Plan showing uncompleted sidewalks; and,
(b) Time schedule for completion; and,
(c) Updated cost estimate to complete.

ii. Other Site Improvements. A time extension of one (1) year from the expiration of a performance agreement may be granted upon completion of at least seventy-five (75) percent of the required site improvements and approval by the director.

B. May be granted by the planning commission if an applicant is unsuccessful or ineligible for approval under A, above, and the planning commission decision to approve/deny is made at least thirty (30) days prior to the expiration of any current performance agreement or guarantee, however such extension shall not exceed three (3) years.

(5) Effect. Notwithstanding any extensions approved or required hereunder, approved plats shall expire if not recorded within seven (7) years of approval.

~~An applicant may request a performance agreement time extension provided that site improvement construction has started and is submitted with a written request and justification to the director of development services at least thirty (30) days prior to the time limit set out in the performance agreement. Any applicant requesting a performance agreement time extension for a recorded plat shall provide a performance guarantee extension in order for an extension to be granted, unless the plat has not been recorded. Such guarantee must be filed within thirty (30) days of the granting of the extension or the extension shall become null and void. Once filed, the city attorney's office shall have fifteen (15) working days to review the guarantee as to form. Within the same fifteen (15) working days' period, the director of development services shall review the guarantee for approval or denial. If denied, the applicant may at his/her option revise any nonconforming aspects. However, if the guarantee is revised and resubmitted, the director of development services and city attorney's office shall have an additional fifteen (15) working days from the latest date of submission to review and approve or deny the revised guarantee. Such time periods shall not prevent the applicant and the city from agreeing to extend the city's response time contained in this subsection. Any fees associated with time extensions granted under this subsection shall be paid by the subdivider to the director of development services. The director of development services is authorized to approve time extensions which meet the following criteria after consultation with all affected departments and utilities:~~

~~A. Sidewalk improvements. Except for sidewalks subject to subsection 35-506(q)(4), a three-year time extension from the expiration of the performance agreement may be granted provided a plan indicating the uncompleted sidewalks, a time schedule for completion, and an updated cost estimate for completion is submitted and approved by the director of development services.~~

~~B. Other site improvements. A one-year time extension from the expiration of the performance agreement may be granted provided at least seventy-five (75) percent of the required site improvements are completed and approved by the director of development services.~~

~~C. Time extension requests that are not eligible for approval or are not approved by the director of development services may be considered by the planning commission provided that:~~

~~1. A decision to either approve or disapprove the extension is made by the planning commission at least thirty (30) days prior to the expiration of any current performance agreement or guarantee;~~

~~2. Any extension approved by the planning commission shall not exceed three years;~~

~~3. Any plat not recorded within six (6) years from the date of plat approval, including any time extensions, shall expire; and~~

~~4. A guarantee of performance in an amount sufficient to cover the cost of remaining site improvements shall be required in order for an extension to be approved. Such guarantee must be filed and approved within thirty (30) days of the approval of the extension or the extension shall become null and void.~~

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Chapter 35, Article IV, Section 35-431 is amended as follows:

Sec. 35-431. - Application for Plat Identification Number/Letters of Certification.

* * * * *

(b) **Initiation.**

(1) **Certifying Departments.** A request for letters of certification and required items shall be filed by the applicant with the following entities ~~departments~~ (hereinafter "certifying entities ~~departments~~ "):

A. Department of planning and community development.

B. Office of historic preservation.

C. SAWS or other entity/entities providing water and/or wastewater service to the project.

D. CPS Energy or other entity/entities providing electric and/or natural gas service to the project.

E. Department of parks and recreation. Nonresidential plats at the discretion of the development services director in consultation with the director of the parks and recreation department may not be submitted to the parks and recreation department for review and comment on park or open space dedication. Nonresidential plats will be submitted to the parks and recreation department for information purposes only. If the parks and recreation department should find a plat that they wish to comment on they may do so by submitting such comment to the attention of the development services director at least twenty-four (24) hours prior to the planning commission meeting at which the plat is to be heard.

F. Applicable county.

G. Department of development services.

(2) **Referral.** ~~The applicant shall circulate the plat to reviewing agencies and departments for identification of any rights-of-way and easements which may be required:~~

If rights-of-way and/or easements for telephone, cable television, or internet service are provided, ~~required~~ the applicant shall depict them on the plat. Where applicable, a completed request for review form shall be required from Bexar Metro 911 and/or the City Aviation Department.
~~prepare instruments dedicating the rights-of-way/easements to the appropriate agencies and departments. The instruments shall be filed for record in the county deed records prior to approval of the development plat. In addition to the certifying departments, copies of the requests for plat review along with required information shall be distributed to AT & T, Cable Television, aviation department, City South Management Authority (CSMA), Bexar Metro 911, and San Antonio River Authority. A letter of certification is not required from these departments~~

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(d) **Decision.** A letter of certification shall be issued digitally by the reviewing agency and maintained in the City's application tracking system prior to subdivision plat approval. The following procedures shall apply to the issuance of a letter of certification:

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~~(i)**Recording Procedures.** A letter of certification is not recorded. A letter of certification shall be maintained by the applicant and presented with the proposed application for subdivision plat approval.~~

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Chapter 35, Article IV, Section 35-433 is amended as follows:

Sec. 35-433. - Development Plat.

(a) **Applicability.**

(1) Pursuant to V.T.C.A. Local Government Code § 212.041, the city hereby chooses by ordinance to be covered by Subchapter ~~subch.~~ B of V.T.C.A. Local Government Code Ch. 212.

(2) A boundary survey is required for any person who:

A. Is required or elects to file a subdivision plat within the city limits of San Antonio; and
B. Is not required to file a subdivision plat as required in sections 35-431 and 35-432.

(3) A development plat is not required where:

A. The person is required or elects to file a subdivision plat within the city limits of San Antonio; or
B. One (1) of the exceptions established in subsections 35-430(c)(3~~2~~)—(c)(15~~9~~) applies; or
C. The tract is greater than five (5) acres if inside the City Limits, has access with a minimum frontage of fifteen (15) feet onto a public right-of-way, public street, platted private street or recorded irrevocable access easement, and which requires no public dedications. Providing further that the owner agrees not to further subdivide without filing a subdivision plat and a request for utilities shall not serve more than three (3) dwelling units.

* * * * *

Chapter 35, Article IV, Section 35-434 is amended as follows:

Section 35-434 Plat Deferral.

(a) **Applicability.** The director of development services ~~planning commission~~ may grant a deferral of the requirement to plat for a subdivision of four (4) or fewer lots to allow a submittal for a building permit and/or utility services prior to plat approval. The time period for which the platting requirement may be deferred shall not exceed one hundred eighty (180) days. An application to defer platting may be filed if the following conditions are met:

(1)The proposed plat is not part of an approved ~~a~~ planned unit development and/or other city approved applicable plan.
(2)The proposed project will not require a floodplain development permit.
(3)The proposed project is not a replat which requires a public hearing involving notification.
(4)Construction will not encroach onto an existing or proposed easement, right-of-way, or building setback.
(5)The proposed plat will not require a variance to this chapter.
(6)The proposed project is not contingent upon a change in zoning district.
(7)Construction will not occur over the Edwards Aquifer recharge zone.
(8)All of the proposed lots have existing frontage and access to a public street.

(9)All utilities are existing and no public improvements will be required with the proposed plat.
(10)Does not involve closure or vacating of a public right-of-way.
(11)Applicant shall secure on-site sewage facility approval from the applicable county if required.

(b) **Initiation.** To request a plat deferral, a plat application and a letter of application signed by the landowner or his authorized agent shall be filed with the director of ~~planning and~~ development services. The letter and supporting documentation shall conform to the requirements of Appendix "B."

(c) **Completeness Review.** The director of ~~planning and~~ development services shall review the plat deferral application for completeness as set forth in subsection 35-432(c) of this chapter. The appellate agency for purposes of completeness review (see subsection 35-402(c) of this chapter) shall be the planning commission.

(d) **Decision.**

(1) Review. The application letter and supporting data shall be reviewed by the ~~department of planning and~~ development services department (streets, trees and TIA), office of historic preservation, transportation and capital improvements and other appropriate departments/agencies within thirty (30) days of receipt of all required documents and fees. Upon receipt of the comments of the reviewing agencies the director of ~~planning and~~ development services shall consider ~~forward~~ the application ~~to the planning commission~~ and may grant or deny a request to defer platting.

(2) Conditions. All plat deferrals shall be subject to the following conditions:

- Recommendations of departments/agencies providing services prior to platting as approved by the director of development services ~~planning commission~~ and consistent with the criteria set forth in article V of this chapter.
- The required subdivision plat shall be formally filed with the director of development services ~~planning commission~~ within one hundred eighty (180) days and shall be considered by the director ~~commission~~ within thirty (30) days thereafter.
- No permanent electrical service or certificate of occupancy shall be issued until the plat is duly approved and recorded in the office of the county clerk.
- If no utility service or building permit is issued within one hundred eighty (180) days, the plat deferral shall become null and void and the platting fees shall not be returned.

(e) **Approval Criteria.** See subsection 35-432(e) of this chapter.

(f) **Subsequent Applications.** See subsection 35-432(f) of this chapter.

~~(g) **Amendments.** See subsection 35-432(g) of this chapter.~~

(g)~~(h)~~ **Scope of Approval.** A plat deferral may be revoked if any of the conditions set forth below apply.

(1) **Deferral Conditions Not Applicable.** If any of the conditions relating to applicability of plat deferral, as set forth in subsection (a) hereto, are found and determined not to apply to the proposed application, or if the applicant requests a variance, the director may revoke the plat deferral.

Revocation of a plat deferral shall render any electric service and/or building permit null and void until such time as a plat is approved and recorded. The applicant may appeal the decision of the director to the planning commission within thirty (30) days after notification of revocation of a plat deferral.

(2) **Plat Deferral - Failure to Submit Plat.** If final submittal for plat approval is not complete within one hundred eighty (180) days of the date the plat deferral was granted~~, by~~ the director shall authorize the termination ~~planning commission, staff will schedule the plat deferral for commission to consider and adopt a resolution authorizing the termination~~ of electric service and/or revocation of the building permits until such time as a plat is approved and recorded.

~~(i) **Recording Procedures.** See subsection 35-432(i) of this chapter.~~

* * * * *

Chapter 35, Article IV, Section 35-437 is amended as follows:

Sec. 35-437. Performance Agreement.

When site improvements, other than gas and electric lines, are required in conjunction with a plat, a performance agreement to ensure construction of the site improvements shall be executed by the applicant and filed with the planning commission together with the plat. Such instrument shall be substantially the same as form "F" in Appendix "B," section 35-121 and shall be filed with the City of San Antonio when a guarantee of performance is required. A request for an extension of time for plat recordation shall include a request for an extension of the performance agreement.

(a) **Guarantee of Performance.** As is provided for in subsection 35-432(i), an approved plat may be filed for record before the required site improvements are completed if one (1) of the following guarantees of performance is approved and filed with the City of San Antonio within three (3) years after the plat has been approved by the planning commission: a performance bond, an irrevocable trust agreement, an irrevocable ~~a or~~ standby letter of credit, or a cash or cashier's check. A guarantee of performance may be submitted before plat approval; however, for plat recordation the plat must meet the requirements of this section. In no event shall an applicant self-insure, notwithstanding that the applicant is a surety company, trust institution, or bank. All site improvement estimates submitted to the director of development services shall detail the specific improvements needed, and shall bear the official seal and signature of a professional engineer attesting to the accuracy of the dollar amounts contained in the estimate. Any guarantee submitted shall clearly state the procedure and complete contact information

for collection should a claim or draw be necessary, and shall cover the time period from submittal and approval to three (3) years, or three (3) years and ninety (90) days in the case of a letter of credit, from the date of plat approval.

* * * * *

(2) **Irrevocable Trust Agreement.** The subdivider shall cause to be placed in a trust account on deposit with a "Trust Institution", as defined by the Texas Finance Code, Title 3. Financial Institutions and Businesses, that is licensed to do business in the State of Texas, (specifically, a bank, trust company, savings bank, savings association or credit union as selected by the subdivider and approved by the director of development services) a sum of money equal to the cost estimate, as approved by the director of development services, of all uncompleted and unaccepted site improvements (other than gas and electric lines) required by these regulations. The trust account must be drawable in Texas and shall be established by agreement which shall be substantially in the same form as form "J" set out in Appendix "B", subsection 35-B121 The director of development services is authorized to sign the agreement on behalf of the city and the city attorney shall approve same as to form.

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(b) **Substituting Guarantees.** When a subdivider has given security in any of the forms hereinabove provided, and fifty (50) percent of the required site improvements have been completed and approved in writing by the director of development services, the subdivider may substitute for the original guarantee, a new single guarantee in an amount equal to the cost of the remaining site improvements. The cost estimate shall be approved by the director of development services. Such new guarantee need not be in the same form as the original guarantee so long as such guarantee is one that is listed in subsection (a). However, in no event shall the substitution of one security for another in any way change or modify the terms and conditions of the performance agreement or the obligation of the subdivider as specified in the performance agreement. Additionally, a guarantee (not including irrevocable trust agreements) may not be substituted more than two (2) times (not to include a one-time substitution approved by the director of development services upon the granting of a time extension) and in no event shall the amount of a substituted guarantee be less than ten (10) percent of the total amount of the original guarantee amount. For irrevocable trust agreements, subdivider may withdraw from the irrevocable trust amount when fifty (50) percent or more of the remaining cost estimate has been completed and approved in writing by the director of development services. Subdivider may not withdraw more than four (4) times (not to include a one-time substitution approved by the director of planning and development services upon the granting of a time extension) during the life of the irrevocable trust. In no event shall the amount of the irrevocable trust be less than twenty (20) percent of the total amount of the original cost estimate until all improvements have been completed and approved.

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(d) Release Upon Completion of Site Improvements. Upon completion of the required site improvements and final inspection by the director of development services, and county engineer if the site is located in the extraterritorial jurisdiction of the city, an

instrument releasing the applicant from the provisions of the performance agreement and the performance guarantee shall be filed with the City of San Antonio. Such release shall be substantially the same as form "L" in Appendix "B", subsection 35-B121. If a Warranty Bond is required under subsection B35-501(h), release of any Performance Bond is conditioned upon acceptance of such Warranty Bond. If the necessary permits required to complete the site improvements (including, but not limited to, floodplain development permits) are denied by the city and are no longer required to serve the lots within the subdivision, the director of development services shall approve and release the performance agreement and guarantee as provided herein.

* * * * *

Chapter 35, Article IV, Section 35-440 is amended as follows:

Sec. 35-440. Replatting Without Vacating Preceding Plat.

(a) **Applicability.** Pursuant to V.T.C.A. Local Government Code § 212.014, a replat of a subdivision or part of a subdivision may be recorded and is controlling over the preceding plat without vacation of that plat if either: ~~if the replat~~

(1) the replat is the only instrument by which any covenants and restrictions therein are recorded, and the replat:

(A~~1~~) Is signed and acknowledged by only the owners of the property being replatted;

(B ~~2~~) Is approved, after a public hearing on the matter at which parties in interest and citizens have an opportunity to be heard, by the municipal authority responsible for approving plats; and

(C ~~3~~) Does not attempt to amend or remove any covenants or restrictions.

or, (2) the replat is NOT the only instrument by which any covenants and restrictions therein are recorded, and:

(A) the replat is signed and acknowledged by each owner and only the owners of the property being replatted;

(B) the municipal authority responsible for approving plats holds a public hearing on the matter at which parties in interest and citizens have an opportunity to be heard;

(C) the replat does not amend, remove, or violate, or have the effect of amending, removing, or violating, any covenants or restrictions that are contained or referenced in a dedicatory instrument recorded in the real property records separately from the preceding plat or replat;

(D) the replat does not attempt to amend, remove, or violate, or have the effect of amending, removing, or violating, any existing public utility easements without the consent of the affected utility companies; and

(E) the municipal authority responsible for approving plats approves the replat after determining that the replat complies with this chapter and rules adopted under Section 212.002 and this section in effect at the time the application for the replat is filed.

* * * * *

(d) **Decision.** Pursuant to V.T.C.A. Local Government Code §§ 212.002, 212.014, and 212.0146, the municipal authority responsible for approving plats shall approve the replat after determining that the replat complies with this chapter and rules adopted under Section 212.002 and this section in effect at the time the application for the replat is filed. ~~§ 212.014, a replat shall be approved by the planning commission in the same manner as a major subdivision.~~

* * * * *

(j) **Affidavits.** Applications for replat approval shall be accompanied by a signed affidavit of no conflict with existing covenants or restrictions. Such affidavit shall be in substantially the same form as the appropriate sample form in 35-B121.

* * * * *

Chapter 35, Article IV, Section 35-443 is amended as follows:

Sec. 35-443. – Replats Subject to Low-Density Zoning.

* * * * *

(j) **Public Hearing**. On ~~The planning commission on~~ plat applications where notification is required, such application shall be scheduled for one (1) ~~two (2)~~ planning commission meeting ~~meetings; the first meeting shall be~~ to solicit public comment~~,~~ and ~~the second meeting shall be~~ for consideration.

* * * * *

Chapter 35, Article IV, Section 35-451 is amended as follows:

Sec. 35-451. Certificate of Appropriateness.

* * * * *

(d) **Decision.**

(1) **Commission Review.** The commission shall make its written final recommendation to either approve, deny, or approve with stipulations the application within sixty (60) days after the historic preservation officer's receipt of the completed application. Applications forwarded to the commission shall include all required

materials and documents from the applicant. If the commission does not make its final recommendation within a sixty-day period, the application shall be deemed recommended by the commission for approval and the city manager or her designee shall either approve, deny or approve with conditions the application within five (5) days of the applicant's demand. The sixty-day time period may be extended up to three additional times, with each time not exceeding thirty (30) days, with the concurrence of the applicant if additional time is required for the preparation of information or for research required by the commission. In cases involving demolition applications, the Historic Preservation Officer may extend this timeline consistent with Section 35-455(d).

(2) **City Manager Review.** Upon receipt of the recommendation by the commission, or on their own initiative, the city manager or designee may implement such recommendation by notifying the applicant within ten (10) business days from receipt of such recommendation that the application has been approved, conditionally approved, or disapproved. The city manager designee for this purpose shall be the historic preservation officer, unless the city manager chooses to designate otherwise. The city manager or designee shall also submit a copy of the decision to the commission for its information, to the department of planning and development services for issuance of permits, and to other departments, as applicable. The city manager or designee shall assure the decision is based on the criteria established by the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation, and was considered by the commission in the determination as to issuance or denial of any certificate.

* * * * *

Chapter 35, Article IV, Section 35-452 is amended as follows:

Sec. 35-452. Certificate of Appropriateness for Administrative Approval.

* * * * *

(d) **Decision.** Applications for ordinary repair and maintenance may be approved by the City Manager or their designee ~~director of planning and development services upon recommendation from the historic preservation officer~~. The decision may be appealed in the same manner as set forth in section 35-481.

* * * * *

Chapter 35, Article IV, Section 35-455 is amended as follows:

Sec. 35-455. Demolition Permit Applications.

* * * * *

(d) **Decision.**

(1) **Other Demolition Permits.** If the property is not a historic landmark, contributing property, or an intrusion in the district, the historic preservation officer shall determine whether or not the building, object, site, or structure may have historic, cultural, architectural, or archaeological significance within thirty (30) days after receipt of the completed application. In making this determination, the historic preservation officer shall apply the appropriate definitions in Appendix A of this chapter, as well as any applicable standards or guidelines adopted by the city council. ~~and shall notify the director of planning and development services in writing~~. If the building, object, site, or structure is determined to have no cultural, historical, architectural, or archaeological significance, a demolition permit may be issued immediately, provided such application otherwise complies with the provisions of the demolition ordinance and all city code requirements. The historic preservation officer shall retain a written statement summarizing the reasons for their determination for such period as required under applicable record retention laws as followed by the city clerk's office. If the building, object, site, or structure is determined by the historic preservation officer to have historic, cultural, architectural, or archaeological significance, the historic preservation officer shall make such information available to the historic and design review commission for review and recommendation as to significance. If the historic and design review commission concurs in the significance, the historic and design review commission shall recommend that the building, object, site, or structure be designated as a historic landmark. Following such determination, the applicant may request a demolition permit by following the procedures for historic landmarks or properties within a historic district as prescribed in this section.

* * * * *

Chapter 35, Article IV, Section 35-477 is amended as follows:

Sec. 35-477. Tree Permits.

* * * * *

(b) **Initiation.**

(1) **Application to City Arborist.** A valid application for permit must be filed and approved with the city arborist before:

A. Mitigating, removing, or destroying any significant or heritage trees, or areas of tree canopy that are required to be counted for calculating minimum tree preservation percentages as provided in the tree preservation standards; or

B. Any person conducts a regulated activity, as defined in subsection 35-523(a), on property that may result in the removal or destruction of any such tree.

(2) **Affidavit.** In lieu of a tree preservation plan, an applicant may submit a notarized tree affidavit with fees and required information verifying that no significant, ~~or~~ heritage trees, or tree canopy required to be counted for calculating minimum tree preservation

requirements will be damaged or removed as a result of the application or receipt of the approval requested.

* * * * *

(i) **Scope of Approval**. A tree ~~preservation~~ permit shall remain valid for one of the two ~~the longer of~~:

(1) The period of validity of the permit or authorization that triggered the requirement for obtaining the tree preservation plan and tree permit approval (i.e. building permit, plat, etc.); or
(2) One hundred eighty (180) days from the date of issuance if the tree permit approval was for a stand alone activity (tree removal) not associated with any other permit. ~~was obtained solely for the removal of trees~~

* * * * *

Chapter 35, Article IV, Section 35-480 is amended as follows:

35-480. Generally.

* * * * *

(d) **Recommendation From Other Public Agencies.** The board of adjustment shall receive and consider recommendations from public and semi-public agencies before rendering a decision in any case before the board. To this end, the board shall, in addition to the other requirements of this chapter, notify all agencies deemed to have an interest in the case. All items requiring consideration by other city boards or commissions shall be submitted for consideration to said bodies, for a date prior to board of adjustment consideration. For the purposes of this section, submittal and review by an appropriate subcommittee of the applicable board or commission shall be deemed to meet this requirement. Additionally, pre-application conferences between the applicant and the department staff ~~shall be required~~are recommended prior to submission of any item for consideration by the board.

* * * * *

(f) **Subsequent Applications.** The following time limitations shall be imposed so that no application for a variance, special exception, or appeal shall be received or filed with the board of adjustment:

- If within the previous twelve (12) months an application for a variance, special exception, or appeal was received, considered and denied on the same lot, lots or blocks of land.
- If within the previous six-month period an application for a variance or special exception was withdrawn from consideration by the applicant or the applicant's representative before the board of adjustment.

The aforementioned time limitations may be waived for variances and special exceptions if new substantial evidence is presented to the board of adjustment and only after receiving nine (9) affirmative votes shall the time limitation be waived. If granted, a new application shall be filed in the office of the director.

* * * * *

Chapter 35, Article IV, Section 35-481 is amended as follows:

35-481. Appeals to the Board of Adjustment

* * * * *

(e) **Appeal from Board of Adjustment.** An appeal from a board of adjustment decision shall be filed pursuant to V.T.C.A. Local Government Code § 211.011. The date the decision is filed in the board's office shall be the date board takes action to approve the minutes for the meeting in which the decision that is being appealed took place. During the pendency of an appeal to district court the proceeding will not be stayed except as provided by V.T.C.A. Local Government Code § 211.011.

* * * * *

Chapter 35, Article IV, Section 35-482 is amended as follows:

35-482. Zoning Variances.

* * * * *

~~(f) **Subsequent Applications.** The following time limitations shall be imposed so that no application for a variance shall be received or filed with the board of adjustment:~~

- ~~If within the previous twelve (12) months an application for a variance or exception was received, considered and denied on the same lot, lots or blocks of land.~~
- ~~If within the previous six-month period an application for a variance or exception was withdrawn from consideration by the applicant or his representative before the board of adjustment.~~

~~The aforementioned time limitations may be waived if new substantial evidence is presented to the board of adjustment and only after receiving nine (9) affirmative votes shall the time limitation be waived. If granted, a new application shall be filed in the office of the director of planning and development services following the procedures outlined in section 35-403, notice provisions.~~

(g) **Scope of Approval.** Where a variance is granted by the board and no building is started pursuant to such variance within twelve (12) six (6) months after the date of the hearing thereon, the variance becomes null and void and of no force or effect. Due to construction or financing timelines, weather, or other extenuating circumstances, the Board of Adjustment may, upon application, grant up to two (2) twelve (12) month extensions of variance approval if the application for extension is filed within 2 (two) months of the expiration of the variance approval; however, in no case shall a granted variance be modified to an extent greater than which was already granted with an application for extension. Property that is not properly platted shall be subject to the condition that platting shall be accomplished prior to the variance taking effect.

* * * * *

Chapter 35, Article IV, Section 35-483 is amended as follows:

Sec. 35-483. Subdivision Variances.

* * * * *

(f) **Subsequent Applications.** The following time limitations shall be imposed so that no application for a variance shall be received or filed with the planning commission.

• If within the previous twelve (12) months an application for a variance or exception was received, considered and denied on the same lot, lots or blocks of land.

• If within the previous six-month period an application for a variance or exception was withdrawn from consideration by the applicant or his representative before the planning commission.

The aforementioned time limitations may be waived if new substantial evidence is presented to the Planning Commission ~~board of adjustment~~ and only after receiving five (5) affirmative votes shall the time limitation be waived. If granted, a new application shall be filed in the office of the director of ~~planning and~~ development services following the procedures outlined in section 35-403, notice provisions.

(g) **Scope of Approval.** A variance granted by the planning commission shall remain valid for three (3) years from the date of plat approval. The force and effect of the variance shall become null and void unless the planning commission grants an extension in accordance with subsection 35-430(f)(2). Per Section 35-483(a), except for those administrative exemptions provided by section 35-501, variances shall be granted only with respect to the standards for subdivision plat approval, and not for the process for obtaining subdivision plat approval.

* * * * *

Chapter 35, Article IV, Section 35-484 is amended as follows:

Sec. 35-484. Development Plat Variances.

* * * * *

(f) **Subsequent Applications.** The following time limitations shall be imposed so that no application for a variance shall be received or filed with the planning commission.

• If within the previous twelve (12) months an application for a variance or exception was received, considered and denied on the same lot, lots or blocks of land.

• If within the previous six-month period an application for a variance or exception was withdrawn from consideration by the applicant or his representative before the planning commission.

The aforementioned time limitations may be waived if new substantial evidence is presented to the planning commission and only after receiving five (5) ~~nine (9)~~ affirmative votes shall the time limitation be waived. If granted, a new application shall be filed in the office of the director of ~~planning and~~ development services following the procedures outlined in section 35-403, notice provisions.

(g) **Scope of Approval.** Where a variance is granted by the planning commission and no building permit is granted within six (6) months after the date granted ~~of the hearing thereon~~, the variance becomes null and void and of no force or effect. The planning commission may extend this time period for successive six-month periods, for a total time period not exceeding two (2) years, if the applicant files a request for an extension prior to the expiration thereof.

* * * * *

Chapter 35, Article IV, Section 35-490 is amended as follows:

Sec. 35-490. Types of Violations.

Any act of commission or omission contrary to the commands or directives of this chapter, or any breach of any duty imposed by this chapter, shall constitute a violation hereof. An offense under this section is a Class C misdemeanor, unless specifically indicated otherwise. Each day's violation of any provision of this Chapter shall constitute a separate offense.

Chapter 35, Article IV, Section 35-491 is amended as follows:

Sec. 35-491. ~~- Civil~~ Enforcement.

* * * * *

(c) **Penalties.**

(1) **Violation of Subdivision Plat or Development Standards.** The criminal penalty for violation of any section or other part of articles I, II, and V, and article IV, division 4 of this chapter is hereby established so that the minimum fine shall be twenty-five dollars ($25.00) and the maximum fine shall be five hundred dollars ($500.00) ~~one thousand dollars ($1,000.00),~~ unless specifically indicated otherwise. Each day a violation is permitted to exist shall constitute a separate offense. A civil penalty for violation of articles I, II, and V, and article IV, division 4 of this chapter may not exceed one thousand dollars ($1,000.00) a day.

(2) **Zoning Violations.** The criminal penalty for violation of any section or other part of article III of this chapter is hereby established so that the minimum fine shall be one hundred dollars ($100.00) and the maximum fine shall be two thousand dollars ($2,000.00), provided, however, in the event a defendant has once previously been convicted under article III, the defendant shall be fined an amount no less than two hundred dollars ($200.00) and shall be fined no less than three hundred dollars ($300.00) for a third conviction and for each conviction thereafter. Each day a violation is permitted to exist shall constitute a separate offense. A civil penalty for violation of article III of this chapter may not exceed one thousand dollars ($1,000.00) a day.

(3) **Civil Penalties Regarding Article VI, Historic Preservation.** The civil penalties for violation of any section or other part of article VI of this chapter is as follows:

A. Any person who constructs, reconstructs, alters, restores, renovates, relocates, stabilizes, repairs or demolishes any building, object, site, or structure in violation of any section or other part of article VI ~~article VII~~ shall be required to restore the building, object, site, or structure to its appearance or setting prior to the violation. Any action to enforce this provision shall be brought by the City of San Antonio. This civil remedy shall be in addition to, and not in lieu of, any criminal prosecution and penalty.

* * * * *

(4) **Criminal Penalties Regarding Article VI, Historic Preservation.** Any persons, firm or corporation violating any section of other part of article VI of this chapter shall be guilty of a misdemeanor, and each shall be deemed guilty of a separate violation for each day during which any violation hereof is committed. Upon conviction, each violation shall be punishable by a fine not to exceed two thousand dollars ($2,000.00) ~~one thousand dollars ($1,000.00)~~ per day for each day of each violation.

(d) **Remedies.**

* * * * *

(4) **Repayment Obligation.** Whenever the city, under subsection (a), shall expend funds to correct a violation of this code, the city shall be entitled to repayment by the violator, and may take any appropriate action, including filing a lien against the property, to secure such repayment.

* * * * *

Chapter 35, Article IV, Section 35-492 is amended as follows:

Sec. 35-492. - Violation of Conditions.

* * * * *

(b) **Revocation of Permit.** The director of ~~planning and~~ development services is authorized to issue any administrative order necessary to terminate or suspend a use found, as a result of the administrative process noted in section 35-406, to be in violation of a condition.

(c) **Civil Action.** The director of ~~planning and~~ development services may request the city attorney to institute a civil action as prescribed in subsection 35-491(a) of this chapter regardless of whether a criminal or administrative action is taken against the permit holder.

* * * * *

Chapter 35, Article IV, Section 35-493 is amended as follows:

Sec. 35-493. - Violations of Tree Preservation Standards.

(a) Inside City Limits.

~~(1) Violation Defined.~~ It shall be a violation of this division for any person to intentionally or knowingly remove or destroy, or allow the removal or destruction of a significant or heritage tree or area of canopy, located on any property to which this chapter applies, or for any person to knowingly or intentionally perform any regulated activity in a manner that does not conform to the requirements of this chapter. Any act or omission contrary to the requirements or directives of this chapter, or any breach of any duty imposed by this chapter shall constitute a violation hereof. In addition to enforcement by the city arborist, this section shall be enforceable by and pursuant to the authority provided in section 35-491 of this chapter.

~~**(2) Penalty.** Any person who commits a violation of this chapter shall be subject to a civil penalty of up to one thousand dollars ($1,000.00) per violation, or a criminal penalty of up to two hundred dollars ($200.00) per violation per day and may be required to attend one or more training seminars. For the purpose of calculating penalties, each day on which a violation is found to exist shall constitute a separate and sanctionable offense.~~

(b) Outside City Limits. Whenever a violation of this chapter is believed to have occurred or to be occurring outside the corporate limits of the city but within the city's ETJ, criminal penalties shall not be sought, however, enforcement against such violations is hereby authorized pursuant to and under the authority granted by V.T.C.A. Local Government Code § 212.001 et seq.

(c) Work Commencing Before Issuance of a Tree Permit. Any person who commences any work requiring a tree permit before obtaining such permit shall be subject to a ~~fine of two thousand dollars ($2,000.00) or an additional fee equal to the~~ fee as established in Appendix "C", but not less than two thousand dollars ($2,000.00), for commencing development without a tree permit.

* * * * *

Chapter 35, Article IV, Section 35-498 is amended as follows:

~~Sec. 35-498. - Violations of Military Lighting Overlay District Regulations.~~

~~**(a) Violations Defined.** It shall be unlawful for any person, firm or corporation to erect, construct, enlarge, alter, repair, move, improve or convert any illumination device of any type, or cause the same to be done, contrary to or in violation of any provision of this chapter. Any person, firm or corporation shall be deemed guilty of a separate offense for each and every day or portion thereof during which any violation of any provision of this chapter is committed, continued, or permitted.~~

~~**(b) Enforcement.** The director shall give written notice of noncompliance to the owner/tenant or their agent or other person in control of the property on which an outdoor lighting violation exists. Service shall be made on the owner/tenant or their agent or other person in control of the property:~~

~~**(1)** In person or by registered or certified mail, return receipt requested; or~~

~~**(2)** If personal service cannot be obtained or the address of the owner/tenant or their agent or other person in control of the property is unknown, by posting a copy of the notice on the premises on which the violation exists or by publishing the notice in a newspaper with general circulation in the city.~~

~~**(c) Penalties.** Any person who violates the provisions of this chapter upon conviction shall be guilty of a Class C misdemeanor and shall pay such penalties as the court may decide not to exceed five hundred dollars ($500.00). Each day's continued violation shall constitute a separate violation. Payment of any penalty herein provided shall not relieve a person, firm or corporation from the responsibility of correcting the conditions consisting of the violation.~~

* * * * *

Chapter 35, Article V, Section 35-501 is amended as follows:

Sec. 35-501. - General Provisions.

* * * * *

(g) **Americans With Disabilities Act.**

(1) **Infrastructure.** Infrastructure construction and improvements of facilities shall comply with the Americans with Disabilities Act of 1990 (42 U.S.C subsection 12181 et seq., Pub. L 101-336 and implementing regulations at 28 C.F.R. parts 35 and 36) and the latest version of the Texas Accessibility Standards of the Texas Department of Licensing and Regulation. Applicants should consult the ADA Technical Assistance Manual from the U.S. Department of Justice on the Internet at http://www.usdoj.gov/crt/ada/taman3.html, and Technical Assistance Manual for State and Local Governments @ http://www.usdoj.gov/crt/ada/taman2.html and the latest version of the Texas Accessibility Standards available at http://www.tdlr.texas.gov/ab/abtas.htm.

(2) **Multi-Family Housing.** Multi-family housing development shall comply with section 804 (f)(5)(C) Fair Housing Amendments Act of 1988 and the implementing regulations codified at 24 CFR 100.205. Applicants should consult the Fair Housing Accessibility Guidelines from the U.S. Department of Housing and Urban development on the Internet at http://www.hud.gov/fhefhag.html. See also HUD Fair Housing Assistance Providers Web site: http://www.hud.gov/fairhsg1.html.

(h) **Extended Warranty Bond.**

(1) General. All subdivisions requiring public streets and/or drainage improvements within the City of San Antonio and the extraterritorial jurisdiction shall be subject to a minimum one-year maintenance bond.

Prior to acceptance of subdivision improvements, the developer shall provide the city, or county if within the ETJ, an extended warranty bond or cashier's check meeting the requirements and timeline set out below.

Release of any Performance Bond is conditioned upon acceptance of a Warranty Bond, when applicable.

(2) **Bond Requirements.** An extended warranty bond submitted under this chapter shall meet the following requirements:

A. Issued by a corporate surety listed at the time of bond submission on the United States Department of the Treasury's listing of Approved Sureties and be approved by the director of development services;

B. The bond shall be in the form shown in Appendix B121, section (f), subsection (8), Form H or a form acceptable to the county if within the ETJ. ~~The bond shall be of a form acceptable to the city, or county if within the ETJ;~~

C. The amount of the bond shall be based on construction costs submitted by a license engineer in the State of Texas. Construction costs shall detail the specific improvements and amounts covered and shall bear the official seal and signature of the professional engineer attesting to the accuracy of the dollar amounts;

D. The warranty bond amount submitted shall be a minimum ten (10) percent value of the construction costs, but no less than twenty-five thousand dollars ($25,000.00);

E. The expiration date of the bond shall be at least one (1) year from the warranty start date specified in subsection 35-501(h)(5);

* * * * *

Chapter 35, Article V, Section 35-502 is amended as follows:

Sec. 35-502. Traffic Impact Analysis and Roughly Proportionate Determination Study.

* * * * *

(b) **Traffic Generation Reports**

* * * * *

(2) **Trip Analysis**

* * * * *

C. **Traffic Impact Analysis and Proportional Mitigation Determination Report.** A traffic impact analysis (TIA) and a proportional mitigation determination report shall be required when the property is subject to master development planning, development permitting, or rezoning; and

i. The proposed development generates seventy-six (76) PHT or more;

ii. The change to an existing TIA or existing zoning results in an increase of at least seventy-six (76) PHT or ten (10) percent of the total PHT for the proposed development, whichever is greater;

iii. (When a building permit submitted for the development is of an intensity at least ten (10) ~~five (5)~~ percent greater (in the number of PHT) than assumed in the previously completed TIA;

iv. A previously completed TIA for the subject area was completed more than five (5) years prior to the submittal date of current application; or

v. When the number of access points are reduced or relocated.

vi. When a development generates less than 76 PHT, the applicant shall fill out a peak hour trip generation form, and may perform a Rough Proportionate Determination to determine potential Right-Of-Way dedication and turn lane requirements, or may make the dedication as required by the code.

vii. A Traffic Circulation Study for renovation of existing schools (Public, Private) is required.

TIA Requirements. A TIA shall be performed by the property owner (or its agent) according to the scope and format established in Appendix "B", subsection 35-B122(a).

(c) **TIA Levels and Study Areas.**

Table 502-1:
TIA Study Area

TIA Level	*PHT*	*Study Area*
STUDY LEVEL	N/A	Within limits of MDP and/or PUD and those major thoroughfares immediately surrounding the MDP and/or PUD.

1	76--250	All intersections of the proposed development with the adjacent roadway system and those roadways and intersections located outside of the proposed development where the number of inbound or outbound PHT at relevant intersections is at least 76 PHT, but in no case shall this include roadways or intersections greater than one and one-half (1.5) miles from the boundary of the proposed development (measured along the city's existing or proposed roadway network).
2	251--1,000	
3	1,001 or more	
Traffic Circulation Study	N/A	Within adjacent roadway system
Note: TIA levels are for fee purposes only.		

* * * * *

(f) **Mitigation Improvements and Roughly Proportionate Determination.**

*** * * * ***

Table 502-2
Minimum Areas to be Addressed in Roughly Proportionate Determination

ROUGHLY PROPORTIONATE DETERMINATION ITEMS	
Item	*UDC Section*
Right-of-way dedication for adjacent exterior streets	506(d)(1)
Improvements to substandard streets	506(d)(9)
Projecting streets	506(e)(2)
Right-of-way dedication and construction of designated major thoroughfare plan streets	506(e)(8)
Dedication of arterial	506(g)
Upgrade existing traffic signals	506(k)
New traffic signal construction	506(k)
Other improvements identified in the TIA	502(c)
Right-of-way dedication and construction of left and/or right turn lanes	502(d)(2)
School Flashers, Signage, Markings, Ramps Transit Amenities (bus shelters, bus stop, transit station, transit center) Traffic Control Calming Features	506(t)(3)
Bicycle Facilities	506(d)(4)

* * * * *

(3) Following the identification of mitigation improvements and any other improvements necessitated by and attributable to the development, the applicant shall utilize the methodology developed and approved by the city to determine if the mitigation improvements identified are roughly proportionate to the impact of the proposed development.

A. At the conclusion of the TIA, the applicant will summarize all of the mitigation improvements identified in the TIA and the approximate total cost of all mitigation improvements including design, engineering and construction. Mitigation improvements that only serve the proposed development (such as site plan related recommendations and traffic signals that only serve the proposed development ~~right-turn lanes into and out of a development~~) that provide minimal to no benefits to the study area roadway network shall not be included in the cost of the mitigation improvements (when compared to the maximum amount of improvements attributable to the proposed development). Half credit will be given for right or left turn lanes into the development and for acceleration lanes out of the development.

* * * * *

Chapter 35, Article V, Section 35-503 is amended as follows:

35-503. Parkland Dedication Requirement.

* * * * *

(a) Applicability

* * * * *

(3) The provisions of this section do not apply to:

* * * * *

A. A proposed subdivision located within:

* * * * *

(4) When a non residential use is proposed (examples include: public or private schools, assisted living facilities, nursing homes, churches, "D" – downtown district, and ROW).

* * * * *

(b) Required Parkland.

(1) Required parkland shall be reserved for any development in the development areas set forth in column "A" of Table 503-1, below, based upon the number of dwelling units in the proposed development corresponding to the development areas as set forth in column "B" in Table 503-1 hereto.

Table 503-1
Required Parkland

(A) *Type and Location of Development Projects*	*(B)* *Required Parkland (Acres per Dwelling)**
In the city – "RE", "R-20", "NP-15", "NP-10", "NP-8", ~~"R-15", "R-10", "R-8",~~ "R-6", "RM-6", "R-5", "RM-5", "R-4", "R-3", "RM-4", "MH", TND, "PUD", "DR"	1 per 70
In the city – "MF-18", "MF-25", "MF-33", "MF-40", "MF-50" and "MF-65"	1 per 114
In the ETJ - Single-family developments	1 per 70
In the ETJ - Multi-family developments	1 per 114

* * * * *

(c) **Parkland Characteristics.**

* * * * *

(3) **Parks and Open Space.**

A. Applicants may set aside parkland as parks or open space to be maintained privately by an approved organization that meets the requirements of subsection (e) and the minimum size requirements stated below:

Table 503-2

Zoning District	*Minimum Dedication Size (in sq. ft)*	*Minimum Area (Length times Width) ~~Width~~*
ETJ	10,000	100' x 100'
"RE", "R-20"	20,000	100' x 100'
"NP-15", "NP-10", "NP-8", "R-6", "RM-6"	10,000	100' x 100'
"R-5", "RM-5"	10,000	100' x 100'
"R-4", "RM-4", "R-3"	10,000	100' x 100'
"MH", "MHP"	10,000	100' x 100'
"MF-18", "MF-25", "MF-33", "MF-40", MF-50, "MF-65"	10,000	100' x 100'

* * * * *

Chapter 35, Article V, Section 35-504 is moved, amended and renumbered to create Appendix H as follows:

Sec. 35-504. Reserved ~~Stormwater Management.~~

~~STATEMENT OF PURPOSE~~

~~*The purpose of this section is to provide adequate measures for the retention, detention and distribution of stormwater in a manner that minimizes the possibility of adverse impacts on both water quantity and water quality during development. Innovative runoff management practices designed to meet the provisions of this chapter, enhance the recharge of groundwater, and maintain the function of critical environmental features are encouraged. The city recognizes that watercourses and their associated watersheds within the City of San Antonio's jurisdiction represent significant and irreplaceable recreational and aesthetic resources and contribute to the economic and environmental health of the city. In addition, all of the watersheds within the city are vulnerable to concentrated surface water runoff, disturbance of wildlife habitat, non-point source pollution and sedimentation resulting from development activities and should be developed in a sensitive and innovative manner.*~~

~~*This section implements the following policies of the master plan:*~~

~~*• Natural Resources, Policy 1d: Encourage retention of the 100-year floodplains as natural drainageways without permanent construction, unnecessary straightening, bank clearing or channeling.*~~
~~*• Natural Resources, Policy 1d: Adopt strong stormwater management practices throughout the drainage area which include site specific measures such as:*~~

~~*On-site stormwater retention and detention;*~~
~~*Reduction in impervious cover;*~~
~~*Natural bank contouring;*~~
~~*Floodplain preservation and buffering;*~~
~~*Preservation of riparian habitat;*~~
~~*Stormwater harvesting sites for reuse purposes.*~~

~~*• Urban Design, Policy 1g: Prepare design and construction policies and standards for utility and transportation infrastructure, capital improvement projects, public facilities and development projects that reinforce neighborhood centers and provide diverse, pedestrian-friendly neighborhoods.*~~

~~(a) Applicability. The provisions of this section shall apply to any application for subdivision plat, master development plan, or building permit approval except as otherwise provided by this chapter. A stormwater management plan shall be provided as set forth in Appendix "B," section 35-B119 of this chapter.~~
~~(b) Stormwater Management Program.~~

~~(1) Regional Stormwater Management Program (RSWMP).~~

~~A. The City of San Antonio has determined that regional stormwater management is preferable to site specific stormwater mitigation. The regional stormwater management program provides for the administration, planning, design, construction, and operational management of regional stormwater facilities~~

(RSWF). Regional stormwater management uses a watershed-wide approach to analyze potential flooding problems, identify appropriate mitigation measures and select site locations and design criteria for RSWF. These RSWF include, but are not limited to, regional detention and retention ponds, watershed protection, land purchase, waterway enlargement, channelization, and improved conveyance structures. The regional stormwater management program allows developers to participate in the program rather than constructing the on-site detention controls required by this section, where the resulting use of a RSWF will not produce a significant adverse impact to other properties due to the increased runoff from the proposed development.

B. All developers shall participate in the RSWMP in one (1) of three (3) ways:

1. Payment of a fee in lieu of on-site detention (except in areas designated by the director of public works as "mandatory detention areas"). The fee schedule is included in Appendix "C," section 35C-109.
2. Construction of on-site or off-site measures (typically stormwater detention facilities) to mitigate increases in runoff resulting from the proposed development.
3. Construction or participation in the construction of an off-site RSWF to mitigate increased stormwater runoff anticipated from ultimate development of the watershed.

C. To determine a significant adverse impact for the purposes of this section, the following criteria will be used to analyze the receiving stormwater facilities within two thousand (2,000) linear feet of the project, to the nearest downstream RSWF, or to the nearest floodplain with an ultimate analysis accepted by the city, whichever is less. For lots less than three (3) acres in size, adverse impact analyses need only extend to where tributary drainage areas equal one hundred (100) or more acres.

1. The stormwater surface elevation (WSE) in receiving facility [natural or improved] drainage systems within two thousand (2,000) linear feet of the proposed development may not be increased by the proposed development unless the increased WSE is contained within easements or rights-of-way or the receiving systems have sufficient capacity to contain the increased WSE without increasing flooding to habitable structures.
2. Ultimate development runoff at low water crossings during regulatory (five-year, twenty-five-year and 100-year frequency) storm events must not classify the low water crossing as "Dangerous to Cross" based on Figure 504-2. If the ultimate WSE exceeds this criterion, the crossings may be improved to the standards of this chapter in lieu of providing onsite stormwater control measures or paying a fee.
3. Three (3) development conditions shall be analyzed with each adverse impact analysis.

Existing Conditions. This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site, or the watershed, to other properties or drainage systems.

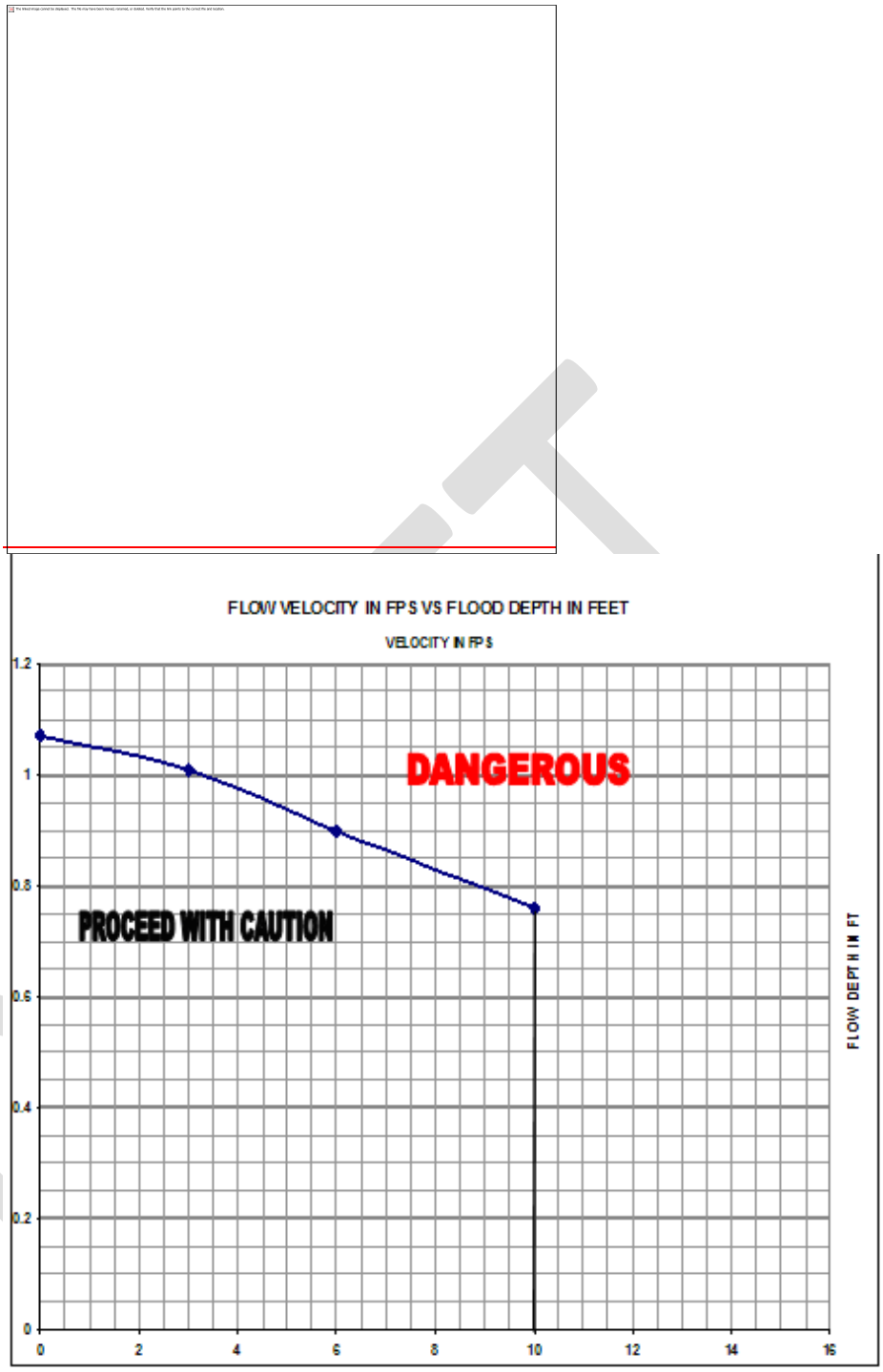
~~Proposed Conditions. This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact to other properties or drainage systems.~~

~~Ultimate Conditions. This refers to ultimate development conditions within the watershed. In addition to being used to design proposed drainage facilities (subsection "(2) System Criteria," below), this condition shall also be used to determine if the increased runoff from the ultimate development of the watershed results in an adverse impact to other properties or drainage systems.~~

~~In addition to verifying low water crossing capacity (item 2, above), this analysis shall be used to assist the city in identifying watershed wide stormwater management issues.~~

~~4. Minimum standards for identifying Dangerous Roadway conditions are identified in figure 504-2.~~

~~Note: The City of San Antonio contends that any runoff crossing a roadway creates a potentially dangerous condition. Figure 504-2 represents the maximum flow over roadways that the city will accept in adverse impact analyses signed and sealed by the licensed professional engineers.~~



~~Figure 504-2 Dangerous Roadway Conditions During Flood Events~~

~~5. The City of San Antonio may reject a developer's request to participate in the RSWMP by payment or mitigation and require on-site detention. The city's decision will be based on the knowledge of significant adverse impacts that would be created by ultimate development of the watershed regardless of the distance from the development to the area of concern. The city may also reject a request for participation when it is not in the~~

best interests of the RSWMP. The developer is recommended to meet with the stormwater engineering division of the department of public works to discuss participation options prior to commencing design of a project. This preliminary meeting in no way relieves the developer of his responsibility to prepare the necessary engineering documentation to support his request for participation.

D. The stormwater development fee in lieu of on-site detention must be paid prior to a plat being released for recordation by the City of San Antonio or the issuance of a building permit. The fee shall be determined in accordance with the provisions of section 35-C109, stormwater management fees.

(2) System Criteria. All stormwater management facilities, or combination of facilities, shall be designed for ultimate development. Facilities with drainage areas under one hundred (100) acres shall be designed for a twenty-five-year storm. Facilities with drainage areas over one hundred (100) acres or areas within a FEMA designated floodplain shall be designed for a 100-year storm or a twenty-five-year storm plus freeboard (based on Table 504-9) if that elevation is higher. Detention facilities and streets are exceptions to the frequency criteria cited above. Detention facility outflows will be designed for five-year, twenty-five-year and 100-year frequency storms. Refer to subsection 35-504(g) for specific drainage design criteria for streets.

(3) Responsibility to Accept Stormwater. The owner or developer of property to be developed shall be responsible for the conveyance of all stormwater flowing through the property. This responsibility includes the stormwater flowing onto the property by any other developed property as well as the drainage naturally flowing through the property by reason of topography. Future upstream development shall be accounted for by assuming ultimate development when sizing drainage systems as specified in this section.

(4) Positive Overflow Pathways. Stormwater management facilities for local drainage systems will be designed to ensure that a positive overflow pathway is provided to the nearest 100-year conveyance facility. The overflow pathway must be delineated on a plan that shows all existing structures in the vicinity impacted by the overflow pathway.

(5) Maintenance.

A. Maintenance of publicly owned facilities will be the responsibility of the city. Maintenance of private facilities is the responsibility of the property owner or the community association and must be specified in the maintenance schedule submitted to the city. A maintenance schedule for both publicly owned and privately owned facilities must be approved by the director of public works prior to the approval of construction drawings.

B. Authorized personnel from the City of San Antonio shall conduct periodic inspections of these facilities and structures. Any required repairs will be consistent with current construction standards. Maintenance issues identified by the city or state during inspections shall be the responsibility of the current owner.

(6) New Development. Peak stormwater runoff rates from all new development shall be less than or equal to the peak runoff rates from the site's predevelopment

conditions for the five-year, twenty-five-year and 100-year design storm events, except as provided in subsection 35-504(b)(1), above.

(7) Redevelopment. Peak stormwater runoff rates from an area of redevelopment due to zoning or replatting shall be less than or equal to the peak runoff rates produced by existing development conditions for the five-year, twenty-five-year and 100-year design storm events, except as provided in subsection 35-504(b)(1), above.

(8) The City of San Antonio (COSA) encourages the installation of low impact development (LID) features such as engineered swales, engineered infiltration storm sewer systems, bioretention, and engineered wetlands. For all developments proposed within the COSA jurisdictional boundaries, these features may be considered on-site detention features to the extent that they reduce the stormwater runoff expected downstream as a result of such developments. It shall be the developer's responsibility to demonstrate that said LID features provide such benefit. Credit toward RSWMP fees will be considered and approved on a case by case basis by the department of public works.

(c) Method of Computing Runoff.

(1) Calculation Methods.

A. For drainage areas less than six hundred forty (640) acres, the basis for computing runoff shall be the rational formula or some other method provided it is acceptable to the director of public works. Hydraulic calculations shall be performed by using the U.S. Army Corps of Engineers HEC-2 "Water Surface Profiles" or HEC-RAS "River Analysis System" computer models. Normal depth channel calculations are permissible for constructed open channels with a uniform geometric cross section where 1) there is no potential for the water surface elevations to be controlled by backwater and 2) the channel is not in a FEMA floodplain.

B. For drainage areas six hundred forty (640) acres or greater, the basis for computing runoff shall be a unit hydrograph method, preferably the Soil Conservation Service (SCS) Dimensionless Unitgraph method as contained in the U.S. Army Corps of Engineers Hydrologic Engineering Center HEC-1 "Flood Hydrograph Package," which document shall be maintained on file with the director of public works and is hereby incorporated by this reference. For the SCS method, antecedent moisture condition II shall be used in the runoff model. Design rainfall values listed in Table 504-4 shall be used for hydrograph calculations.

C. Open channel hydraulic calculations shall be performed by using the U.S. Army Corps of engineers HEC-2 "Water Surface Profiles" or HEC-RAS "River Analysis System" computer models, which documents shall be maintained on file with the director of public works and is hereby incorporated by this reference.

D. Certain watersheds have hydrologic and hydraulic models that are available through and maintained by the City of San Antonio. Developments proposed within the limits of these watersheds must have the models updated by the consultant to reflect changes in flow, channel configuration (including alterations to vegetation) and channel structures. The consultants' models must use the same computer program that was used in the existing model e.g. HEC-RAS models will not be accepted where the original model used HEC-2. The

updated models shall be submitted to the director of public works for incorporation into the master models. The City of San Antonio will periodically update the master models to reflect current watershed development conditions. The updated models will be made available for use and distribution as the latest existing condition models for the watershed.

(2) Time of Concentration.

A. Overland (sheet) flow, shallow concentrated flow and channel flows are components that need to be considered in the calculation of time of concentration. The following methods are recommended for time of concentration calculation.

B. Overland flow - flow over plane surfaces: Maximum allowable time is twenty (20) minutes. Minimum is five (5) minutes. The overland flow time chart from "Design" by Elwyn E. Seelye may be used to calculate overland flow times. Note that the minimum time has been reduced to five (5) minutes.

C. Shallow concentrated flow - overland flow usually becomes shallow concentrated flow after a maximum of three hundred (300) feet: Use Manning's equation to estimate travel time for defined swales, bar ditches and street sections, etc. Figure 3-1 from TR-55 "Urban Hydrology for Small Watersheds," SCS 1986, may be used where a geometric section has not been defined.

D. Channel flow: Use existing computer models where available or Manning's equation if data is not available. Non-floodplain channel velocities for ultimate watershed development should not be less than six (6) fps when estimating time of concentration.

(3) Runoff Coefficients. Runoff coefficients (C value) for use in the rational formula shall not be less than the values shown in Tables 504-1A or 504-1B, as appropriate.

Table 504-1A
Runoff Coefficients (C) - Percentage

Character of Area	SLOPE			
	Up to 1%	Over 1% up to 3%	Over 3% up to 5%	Flow over 5%
Business or commercial areas (90% or more impervious), Existing Pavement / Buildings or Zoning Districts O, C, I-1, I-2	95	96	97	97
Densely developed areas (80% to 90% impervious) or Zoning Districts D, MX, NC, TOD, Use Pattern TND	85	88	91	95
Closely built residential areas and school sites or Zoning Districts MF, R-4	75	77	80	84
Undeveloped areas * - Present land is undeveloped and ultimate land use is unknown. C values for use in ultimate development calculations.	68	70	72	75

Large lot residential area or Zoning Districts R20, RE	55	57	62	64
Undeveloped areas * - Existing conditions. See Table 504-1(b)				
Average residential area or Zoning Districts R-5, R-6	65	67	69	72

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Table 504-1B
Runoff Coefficients (C) - Percentage

Character of Area	SLOPE			
	Up to 1%	Over 1% up to 3%	Over 3% up to 5%	Flow over 5%
Cultivated or Range (Grass Cover < 50% of Area)	44	47	53	55
Range (Grass Cover 50 - 75% of Area)	37	41	49	53
Forest or Range (Grass Cover > 75% of Area)	35	39	47	52

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* Areas included within parks, green belts or regulatory floodplains shall be considered to remain undeveloped per Table 504-1B.

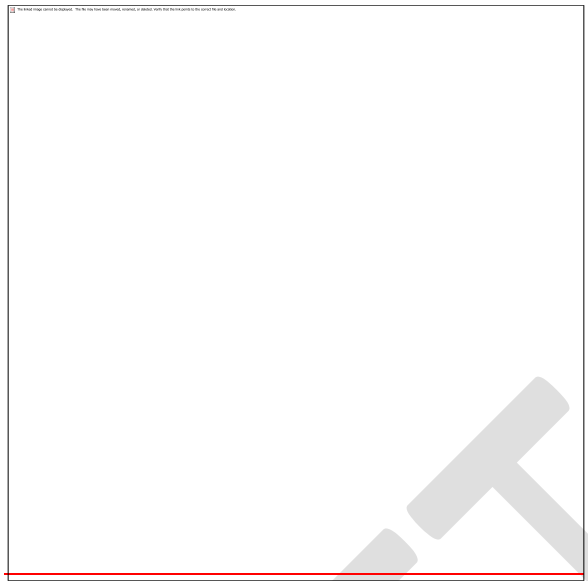
(4) Rainfall Intensity. Use Figure 504-1 or Table 504-2 to determine rainfall intensity.

Table 504-2 Rainfall Intensities (inches/hour)

TIME	FREQUENCY						
MINUTES	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	7.2	8.4	9.413	11.1	12.432	13.542	18.204
6	6.684	7.836	8.83	10.331	11.648	12.877	17.258
7	6.277	7.381	8.365	9.722	11.025	12.341	16.497
8	5.944	7.009	7.982	9.224	10.512	11.894	15.864
9	5.666	6.696	7.658	8.806	10.079	11.514	15.327
10	5.427	6.427	7.38	8.447	9.707	11.184	14.862
11	5.22	6.194	7.137	8.136	9.382	10.893	14.453
12	5.038	5.988	6.923	7.862	9.095	10.635	14.09
13	4.877	5.805	6.731	7.618	8.839	10.403	13.763

14	4.731	5.641	6.558	7.399	8.608	10.192	13.468
15	4.6	5.48	6.4	7.2	8.4	10	13.2
16	4.458	5.296	6.159	6.959	8.088	9.551	12.765
17	4.328	5.129	5.942	6.741	7.806	9.147	12.368
18	4.209	4.977	5.743	6.541	7.549	8.781	12.005
19	4.099	4.836	5.562	6.357	7.314	8.449	11.672
20	3.998	4.707	5.395	6.188	7.098	8.146	11.364
21	3.904	4.587	5.241	6.031	6.898	7.867	11.079
22	3.816	4.476	5.098	5.886	6.713	7.61	10.814
23	3.734	4.372	4.965	5.749	6.541	7.373	10.566
24	3.658	4.275	4.841	5.622	6.38	7.153	10.335
25	3.586	4.184	4.725	5.503	6.229	6.947	10.117
26	3.518	4.098	4.616	5.39	6.088	6.756	9.913
27	3.453	4.017	4.514	5.284	5.955	6.576	9.72
28	3.393	3.941	4.417	5.184	5.83	6.408	9.538
29	3.335	3.868	4.326	5.089	5.711	6.25	9.365
30	3.28	3.8	4.24	5	5.6	6.1	9.2
31	3.209	3.723	4.155	4.905	5.501	6.003	9.025
32	3.142	3.65	4.074	4.814	5.407	5.911	8.87
33	3.078	3.58	3.997	4.727	5.318	5.823	8.722
34	3.018	3.514	3.924	4.644	5.233	5.739	8.581
35	2.96	3.45	3.854	4.565	5.152	5.658	8.446
36	2.906	3.39	3.787	4.49	5.074	5.581	8.317
37	2.853	3.332	3.723	4.418	4.999	5.507	8.194
38	2.803	3.277	3.662	4.349	4.928	5.435	8.075
39	2.755	3.224	3.604	4.283	4.859	5.367	7.961
40	2.709	3.173	3.548	4.219	4.793	5.301	7.852
41	2.665	3.124	3.494	4.158	4.729	5.238	7.747
42	2.623	3.077	3.442	4.099	4.668	5.176	7.646
43	2.582	3.032	3.392	4.043	4.609	5.117	7.548
44	2.543	2.989	3.345	3.988	4.552	5.06	7.454
45	2.505	2.947	3.298	3.936	4.497	5.005	7.363
46	2.469	2.907	3.254	3.885	4.444	4.952	7.275

47	2.434	2.868	3.211	3.836	4.393	4.9	7.19
48	2.4	2.83	3.169	3.788	4.343	4.85	7.108
49	2.368	2.794	3.129	3.743	4.295	4.802	7.028
50	2.336	2.759	3.09	3.698	4.248	4.754	6.951
51	2.306	2.724	3.052	3.655	4.203	4.709	6.876
52	2.276	2.691	3.016	3.613	4.159	4.664	6.804
53	2.247	2.659	2.98	3.573	4.117	4.621	6.733
54	2.22	2.628	2.946	3.534	4.075	4.579	6.665
55	2.193	2.598	2.913	3.496	4.035	4.538	6.598
56	2.167	2.569	2.88	3.459	3.996	4.499	6.534
57	2.141	2.541	2.849	3.423	3.958	4.46	6.471
58	2.117	2.513	2.819	3.388	3.921	4.422	6.41
59	2.093	2.486	2.789	3.354	3.885	4.386	6.35
60	2.07	2.46	2.76	3.32	3.85	4.35	6.3
120	1.285	1.555	1.775	2.175	2.55	2.9	4.05
180	0.933	1.14	1.317	1.633	1.9	2.2	3.133
360	0.552	0.668	0.767	0.95	1.083	1.25	1.767
720	0.315	0.383	0.45	0.533	0.625	0.733	1.033
1440	0.185	0.223	0.25	0.313	0.375	0.417	0.571



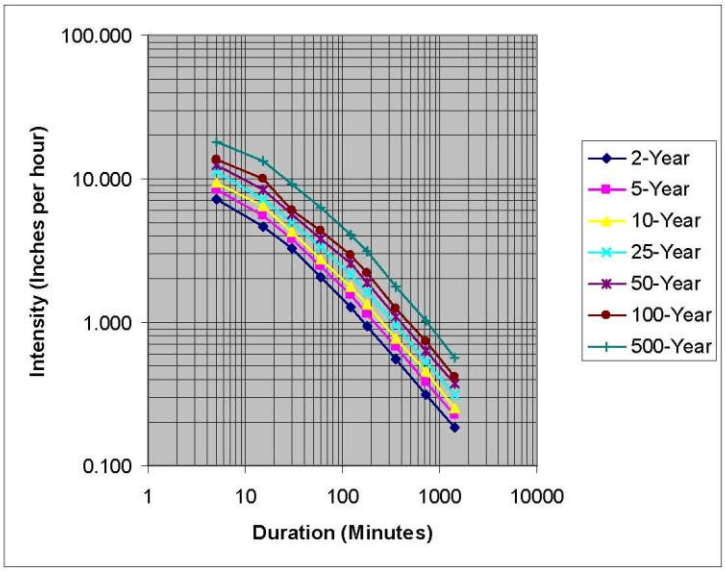
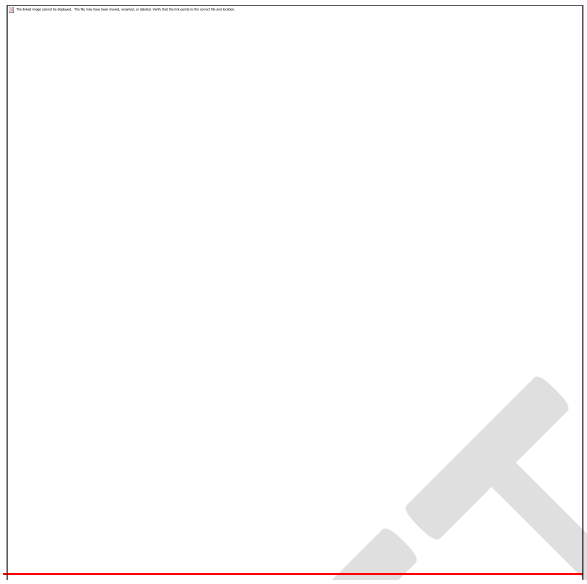


Figure 1. Rainfall Intensities plotted against Duration on Log-Log scale.



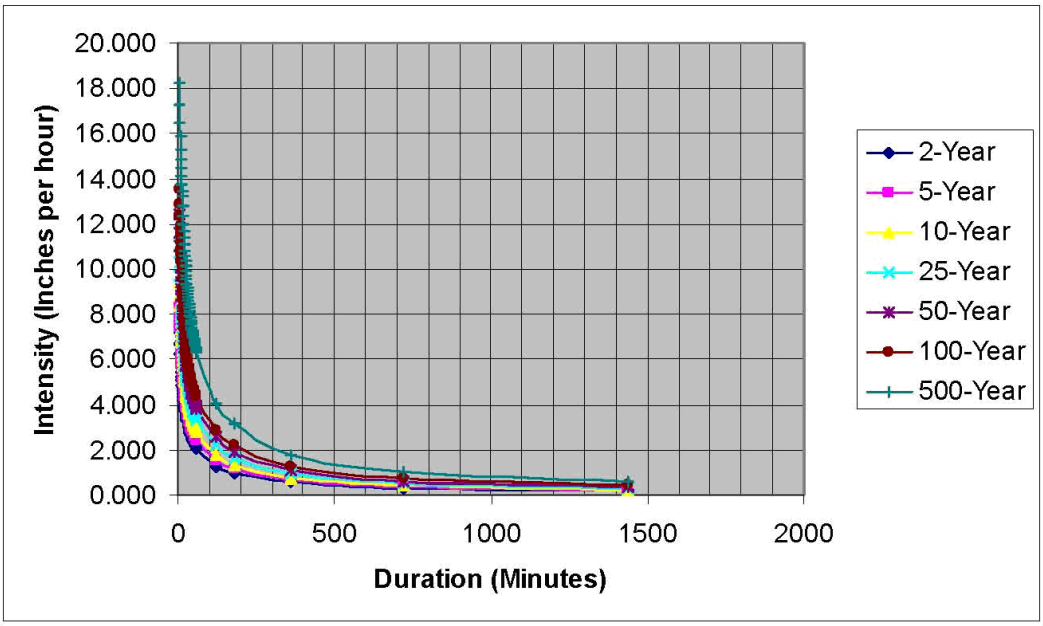


Figure 2. IDF Curves for Bexar County

~~(5) SCS Curve Numbers. The SCS curve numbers adopted for use by the City of San Antonio are shown in Table 504-3. The hydrologic soil groups are listed in the latest version of the United States Natural Resources Conservation Service [formerly the Soil Conservation Service], "Urban Hydrology for Small Watersheds," Technical Release No. 55 (TR-55), which document is hereby incorporated by this reference. Soil types that relate to the hydrologic soil group may be found in the latest version of the United States Natural Resources Conservation Service "Soil Survey-Bexar County, Texas" which document is hereby incorporated by this reference. Soil types may also be based on a Geotechnical Engineering Report.~~

Table 504-3
SCS Curve Number by Soil Type

Hydrologic Soil Group	Description	SCS Curve Number
A	Soils having a low runoff potential due to high infiltration rates. These soils consist primarily of deep, well drained sand and gravels.	25
B	Soils having a moderately low runoff potential due to moderate infiltration rates. These soils consist primarily of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.	55
C	Soils having moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impedes the downward movement of water or soils with moderately fine to fine texture.	70
D	Soils having a high runoff potential due to very slow infiltration rates. These soils consist primarily of clays with high swelling potential, soils with permanently high water tables, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious parent material.	77

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(6) Percent Impervious Cover. The percent impervious cover for typical land use types in San Antonio are presented in Table 504-4.

Table 504-4
Percent Impervious Cover by Land Use

Land Use Category		Average Percent Impervious Cover
Residential	1/8 acre Residential Lots, or Garden or townhouse apartments, or Zoning Districts R-4, R-5, RM-4, RM-5; TND/TOD Use Patterns	65—85%
	¼ acre Residential Lots or Zoning District R-6, RM-6	38%
	1/3 acre Residential Lots or Zoning District R-15	30%
	½ acre Residential Lots or Zoning Districts R-20	25%
	1 acre Residential Lots or Zoning Districts RP, RE	20%
Industrial or Zoning Districts L, I-1, I-2		72—85%
Business or Commercial, or Zoning Districts NC, O, C		85—95%

Densely developed (apartments), or Zoning Districts MF	65—85%
Streets, Roads, and Parking Areas	98%

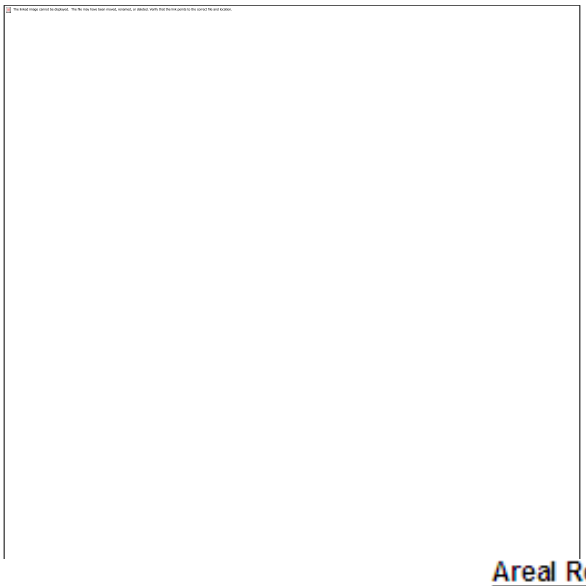
(7) Design Rainfall and Areal Reduction.

1. Design Rainfall. A twenty-four-hour rainfall distribution shall be applied for runoff calculations. Rainfall intensities as adopted for the City of San Antonio are given in Table 504-5. The lag value for a sub-area shall be calculated as 0.6 times the time of concentration.

Table 504-5
Design Rainfall Values (inches)

USGS Adjusted Rainfall Values (pre-areal reduction)						
Frequency of Storm	5-year	10-year	25-year	50-year	100-year	500-year
Exceedance probability	0.2	0.1	0.04	0.02	0.01	0.002
Storm Duration						
Duration	Frequency					
	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.68	0.78	0.93	1.04	1.13	1.52
15 minute	1.40	1.60	1.80	2.10	2.50	3.30
1 hour	1.85	2.76	3.32	3.85	4.35	5.80
2 hour	2.37	3.55	4.35	5.10	5.80	8.10
3 hour	3.26	3.95	4.90	5.70	6.60	9.40
6 hour	3.80	4.60	5.70	6.50	7.50	10.60
12 hour	4.40	5.40	6.40	7.50	8.80	12.40
24 hour	5.00	6.00	7.50	9.00	10.00	13.70

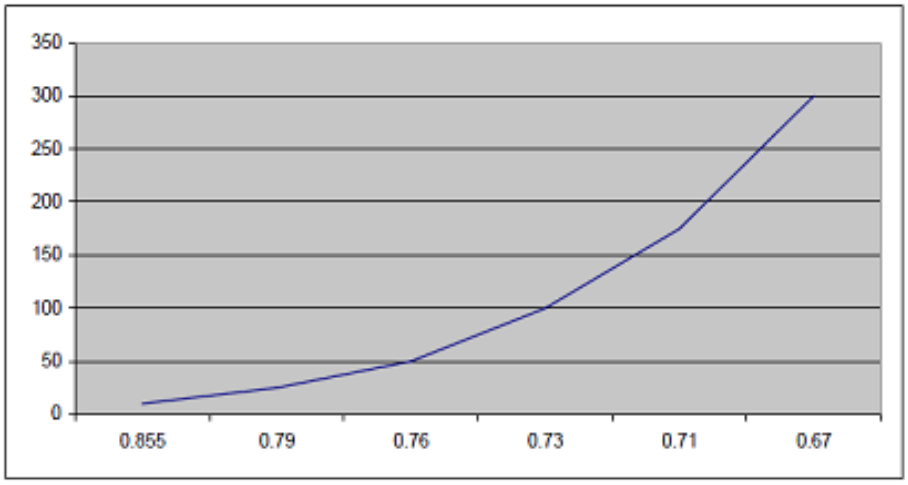
2. Areal Reduction. Calculated stormwater runoff at a given point may be reduced by the factors shown in Table 504-5.1 based upon the tributary area (in square miles) draining to said point.



Areal Reduction Factors **

(for use in calculating Point Rainfall for Bexar County)

Area (sq mi)	Base ARF for Area
10	0.855
25	0.79
50	0.76
100	0.73
175	0.71
300	0.67



** Source: 2007 Watershed "Hydrology Technical Support Data Notebooks" on file with the San Antonio River Authority

~~(8) Routing of Runoff. Routing of the runoff hydrograph through the channel from one (1) subarea calculation point to the next in the HEC-1 shall be computed using one (1) of the following methods:~~

~~A. Overbank/channel storage not significant: Use normal depth channel routing.~~
~~B. Overbank/channel storage is significant: use the Muskingum method where a hydraulic model is not available. Use Modified Puls Storage method where a hydraulic model is available to develop storage/out flow relationship.~~

C. Kinematic wave method for channel reaches where inflow from overbank runoff or multiple point sources (Example: storm sewer outfalls) is significant and where hydrograph attenuation is insignificant.

Channel routing methodologies currently being applied in the existing HEC-1 model of the watershed shall not be replaced with a different methodology without approval or direction from the director of public works.

(9) Manning's Roughness Coefficient. Manning's roughness coefficients ("N" values) for use in routing methods or in hydraulic calculations shall be consistent with the values listed in Table 504-6.

Table 504-6
Manning's Roughness Coefficient

Channel Description	Manning's "N" Value
Concrete Lined Channel	0.015
Grass Lined Channel with regular maintenance	0.035
Grass Lined Channel without recent maintenance	0.050
Vegetated Channel with trees, little or no underbrush	0.055
Natural Channel with trees, moderate underbrush	0.075
Natural Channel with trees, dense underbrush	0.090
Natural Channel with dense trees and dense underbrush	0.100

-

Overbank Description	Manning's "N" Value
Pasture	0.035—0.055
Trees, little or no underbrush, scattered structures	0.060—0.075
Dense vegetation, multiple fences and structures	0.075—0.090

-

The "N" value to be used in Manning's Formula shall conform to the following for design purposes:

A. Earth channels—0.035
B. Concrete lined channels—0.015
C. Reinforced concrete pipe—0.013
D. Concrete box culverts—0.013
E. Corrugated metal pipe:

i. Unpaved ½" corrugated—0.024

ii. Unpaved one (1) inch corrugated 0.027

F. Asphaltic concrete 0.018

Any other "N" value shall be based on generally accepted engineering principles.

(d) Drainage Easements/Rights-of-Way.

(1) Applicability. Where a subdivision is traversed by a watercourse, drainageway, natural channel or stream, there shall be provided an easement or right-of-way conforming substantially to the limit of such watercourse, plus additional width as outlined below.

(2) Requirements. Easement or right-of-way requirements are specified in the following subsections of this section for particular stormwater management facilities:

A. Subsection (d)(3) Natural Watercourses or Floodplains;
B. Subsection (f)(3) Regional Detention Facilities;
C. Subsection (h)(6)(c) Concrete Lined Channels;
D. Subsection (h)(7)(c) and (d) Vegetated Earth Channels;
E. Subsection (i)(c) Storm Sewers.

(3) Natural Watercourses or Floodplains. Easements for natural watercourses shall be the 100-year floodplain or the twenty-five-year plus freeboard (see Table 504-9 of this section) whichever is less. In floodplain areas where ongoing maintenance is required or the floodplain will be reserved for use by the public, the drainage easements shall be maintained by a public entity and the property will be dedicated to the city as a multi-use drainage easement. A drivable access way shall be provided in floodplain easements for the length of the easement when regular maintenance of the floodplain is required. Diversion of stormwater away from the natural watercourse will not be allowed except within the boundaries of the property controlled by the developer, provided that the diverted water is returned to the watercourse within which it would naturally have been flowing prior to leaving the developer's property. An analysis of the timing of the diverted hydrograph on watersheds greater than twenty (20) acres, as it reenters the receiving watercourse, must be performed to show that the peak flowrate in the receiving watercourse has not been increased as a result of the diversion.

(4) Maintenance Access Right-of-Way. An unobstructed access right-of-way connecting the drainage easement with an alley or roadway parallel to or near the easement shall be provided at a minimum spacing of one (1) access right-of-way at approximately one thousand-foot intervals. The access right-of-way shall be a minimum of fifteen (15) feet in width and shall be maintained clear of obstructions that would limit maintenance vehicular access. If the flow line of the designed channel incorporates grade control structures or vehicular bridges that would prevent maintenance equipment from accessing that portion of the channel, additional access points may be required. Channel design, earthen or concrete, shall have ramps in the side slopes near the access points that would allow maintenance equipment to descend to the floor level of the channel. The maximum allowable ramp slope for vehicular access is seven to 1 (7:1). Access points adjacent to

roadways or alleys shall be provided with a post and cable feature with padlock to prevent unauthorized use.

(5) Lot and Property Line Crossings. In those cases where drainage easements cross lot and property lines, a statement shall be added to the plat that no fencing or structures that will interfere with adequate drainage flow will be allowed on or across such lines. Fencing may be allowed across drainage easements only in accordance with the following restrictions:

A. Bottom of fence shall be a minimum of the flow depth, plus freeboard (see Table 504-9 of this section) above design flow line of channel or drain.

B. A hinged gate will be placed across the entire width of the drainage easement. Access must be provided to stormwater operations staff at all times to allow access to the easement for the city crews to perform maintenance.

C. Fence posts located within the easement must be structurally designed to resist damage from the stormwater flows and impact from debris.

D. A floodplain development permit will be required to construct a fence within an easement within the 100-year floodplain.

(6) Interceptor Easements. Drainage easements for proper conveyance of upstream stormwater runoff shall be required on all subdivision plats where upstream contributing area exceeds the criteria indicated below. Interceptor drains shall be constructed prior to the issuing of building permits on any lot that would intercept natural drainage.

A. Interceptor drainage easements and channels shall be provided for residential subdivisions where the drainage area to the back of platted lots exceeds the depth of two (2) average residential lots with equivalent zoning.

B. Interceptor drainage easements shall be required on nonresidential subdivision plats where the off-site drainage area contributing to the proposed development exceeds three (3) acres. If necessary, an amending plat may be used to correct drainage easements in conjunction with building permits.

(7) Lower Elevation of Site. All developments shall provide for adequate drainage outfall at the lower end of the site into an existing street, alley, drainage, easements or right-of-way, or to the centerline of an existing natural drain. Where proposed street, storm sewer, or open channel does not discharge into a natural low or into an existing adequate drainage easement then facilities and drainage easements of adequate width to contain the design discharge shall be constructed and dedicated to the centerline of an existing natural low within the same watershed. However, where the natural low lies within the developer's property, the developer will be required only to plat an easement to the centerline of the natural low, provided that the easement is adequate to accommodate the facilities that will be built in conjunction with the future development of that property.

(e) Site Design and Grading.

(1) All land disturbing or land filling activities or soil storage shall be undertaken in a manner designed to minimize surface runoff, erosion and sedimentation, and to safeguard life, limb, property and the public welfare in accordance with the NPDES (TPDES) construction site regulation ordinance, Ordinance No. 94002, as amended, and the document entitled "Complying with the Edwards Aquifer Rules; Technical Guidance on Best Management Practices," by Michael E. Barrett, Ph.D.,

P.E. Center for Research in Water Resources, Bureau of Engineering Research, University of Texas at Austin, (RG-348, June 1999), which documents are hereby incorporated by this reference.

(2) Erosion and sedimentation controls in accordance with the specifications established by the director of public works in compliance with the National Pollution Discharge Elimination System (NPDES) permitting requirements for the city are required.

(3) Projects shall not be considered complete until restoration has been made in accordance with NPDES requirements.

(4) Where possible, multiple uses of drainage facilities and open space shall be incorporated by the owner or developer of a new subdivision. Alternative uses such as public recreation, horse/bike/hiking trails, walking paths, nature preserves, wildlife habitat areas, etc. are encouraged subject to the approval of the director of public works.

(5) A note must be placed on the plat for residential lots, which states that finished floor elevations must be a minimum of eight (8) inches above final adjacent grade. A grading plan shall be prepared and submitted to the City of San Antonio, which indicates typical lot grading for all lots in the subdivision using typical FHA lot grading types (A, B and C). A more detailed grading plan is also acceptable. No more than two (2) average residential lots may drain onto another lot unless a drainage easement is dedicated to contain the runoff.

(f) Stormwater Detention and Other Stormwater Management Facilities. For projects with an increased impervious area of greater than 0.1 acres that elect not to participate or are not eligible to participate in the regional stormwater management program as described in subsection 35-504(b)(1), then stormwater detention shall be required for all new developments or redevelopment of individual parcels of property to mitigate peak flow rates to predevelopment or existing development conditions as stated in subsections (b)(6) and (b)(7) of this section.

(1) Maximum Outflow Rate. The maximum allowable outflow rate from the detention facility must be restricted to the flow rate from the undeveloped or existing development tract for the five-year, twenty-five-year and 100-year frequency. Best management practices shall be used in the design of detention facilities in accordance with this section. The timing of the hydrograph released from the detention facility must be checked against the timing of the flow rate in the first open watercourse to prevent any increase in the peak flow rate in the receiving watercourse. For detention basins constructed in-line on an existing watercourse, the creation of the basin shall not increase flood elevations in the channel upstream of the new development boundaries.

(2) On-Site Detention and Water Quality (including Low Impact Development) Features.

(i) On-site stormwater management features must be privately owned and shall be maintained by the community association or property owner. A maintenance schedule shall be submitted to the public works department and approved by the director of public works prior to approval of construction plans. The City of San Antonio will have the right to do periodic inspections of privately owned and maintained detention facilities to ensure that the maintenance schedule is being implemented.

(ii) Where a detention facility accepts flows from public facilities such as city rights-of-way the detention facility will be considered a detention facility serving a public purpose and will be dedicated to the city upon completion and a drainage easement will be dedicated to provide for access to the facility. When a regional detention facility accepts flow from an area exceeding three hundred (300) acres, the facility shall be considered serving a public purpose and shall be dedicated to the city.

(3) Regional Detention Facilities. General locations and sizes of regional detention facilities have been identified in the master drainage plan for the major watersheds in the city's jurisdiction. The ownership of regional detention facilities may either be public or private. The creation of regional detention facilities designed to service one (1) or several developments is encouraged, but not required. In watersheds where public regional detention facilities exist, mitigation of increased stormwater runoff from new construction may utilize these facilities if the new construction is eligible to participate in the RSWMP. Temporary detention may be required for the development until sufficient capacity in the outfall channel is provided to accommodate increased flows. Maintenance of publicly owned facilities will be the responsibility of the city. Maintenance of private facilities is the responsibility of the property owner or the community association and must be specified in the maintenance schedule submitted to the city. A maintenance schedule for both publicly owned and privately owned facilities must be approved by the director of public works prior to approval of construction drawings.

Drainage easements will be provided for all regional detention facilities. The easement will encompass the 100-year pool elevation plus all structural improvements (levees, dykes, berms, outfall structures etc.) necessary to contain the pool. The easement will extend, at a minimum, to the toe of the downstream embankment. Maintenance access (fifteen-foot minimum) will be provided around the facility, outside the limits of the 100-year pool elevation. Ramps, as necessary, with a maximum slope of seven to one (7:1) will be provided for access to the flow line of the facility.

(4) Easement Requirements.

A. Drainage easements will be required for all stormwater management facilities accepting runoff from properties other than the lot on which the facility exists or will be constructed. Maintenance of the detention facility shall be the responsibility of the property owner or the property owner's association.

B. Full detention basin design may be deferred until the building permit stage IF the property owner submits a "request for detention deferral" demonstrating an understanding of the implications of such design deferral AND the following notes are placed on the subdivision plat AND supporting documentation is provided.

1. "Stormwater detention is required for this property. The engineer of record for this subdivision plat has estimated that an area of approximately _____ acres and a volume of approximately _____ acre feet will be required for this use. This is an estimate only and detailed analysis may reveal different requirements."

2. "No building permit shall be issued for this platted property until a stormwater detention system design has been approved by the City of San Antonio or Bexar County for commercial properties within the ETJ."

C. For regional detention facilities, the easement will encompass the 100-year pool elevation plus all structural improvements (levees, dykes, berms, outfall structures etc.) necessary to contain the pool. The easement will extend, at a minimum, to the toe of the downstream embankment. The easement shall also extend to a minimum of fifteen feet outside both the 100-year pool and the structural improvements to facilitate maintenance as well as public safety.

(5) Access Ramps. Ramps, as necessary, with a maximum slope of seven to one (7:1) will be provided for access to the flow line of all public detention facilities.

(6) Multi-Use Facilities. Multi-use facilities are encouraged, but not required (multi-use facilities allows for water quality, satisfy NPDES requirements, enhance around water recharge, provide open space, provide recreation or other amenities, and/or provide habitat) and may be utilized so long as the facility meets the standards set forth in subsection (a) of this section and does not increase the rate or volume of erosion above that which would result from the use of a facility without multiple uses. The use of multi-use detention facilities to alleviate existing flooding problems, enhance and provide amenities for older neighborhoods, and support the revitalization of economically depressed areas is encouraged in public and private redevelopment initiatives.

(7) Permanent Wet Pool or Pumped Detention Systems. Stormwater retention with permanent wet pool or pumped detention systems will not be acceptable methods of stormwater mitigation unless the facility will remain privately owned, operated, and maintained. The city will approve the use of a pumped facility for private use under the following conditions:

A. A gravity system is not feasible from an engineering and economic standpoint.
B. At least two (2) pumps are provided each of which is sized to pump the design flow rate.
C. The selected design outflow rate must not aggravate downstream flooding.
D. Controls and pumps shall be designed to prevent unauthorized operation and vandalism.
E. Adequate assurance is provided that the system will be operated and maintained on a continuous basis.

(8) Location of Detention Facilities and Surrounding Development. Stormwater detention facilities shall be located in topographically depressed areas where possible. When necessary, dams may be constructed to detain flows. All proposed dams shall conform to the following items:

A. All dams over six (6) feet above existing natural around shall be approved by the Dam Safety Team of the TNRCC for safety. All other new dams shall be designed in accordance with acceptable design criteria as approved by the director of public works, or his authorized representative.
B. All hydrology and hydraulic properties of a dam will be reviewed by the department of public works with regard to spillway design, freeboard hydraulics, backwater curves and downstream effects due to the dam site.

C. The spillway section of any earthen dam with a height greater than six (6) feet shall be large enough to pass a PMP (probable maximum precipitation) flood, as defined by the NRCS, without overtopping the crest of the dam in accordance with TNRCC regulations.

D. A 100-year frequency flood shall be routed through the proposed dam and all land subject to flooding shall be dedicated as drainage easement or right-of-way. An unobstructed fifteen-foot access easement around the periphery of the flooded area shall be dedicated as drainage easement for facilities that require regular mowing or other ongoing maintenance, at the discretion of the director of public works. An unobstructed fifteen-foot access right-of-way shall be established which connects the drainage easement adjacent to the dam structure to a road or alley.

E. Development below existing dams will take into account the original design conditions of the existing dam. Dam breach analysis checks will be required, dependent upon location of development with respect to dam site.

F. All spillway discharges shall be adequately routed to the centerline of the natural low below the dam site. The adequate routing of spillway discharges pertains to the hydraulic routing of the 100-year frequency flood for dedication of drainage easement limits. Probable maximum precipitation (PMP) defined PMP on definition section flood routing or breaches will only be considered for safety considerations (that is, the placement of building and the setting of minimum floor slab elevations below the dams). Any proposed concrete dam structure need not have spillway capable of routing a PMP flood, however, it shall be shown to be structurally capable of withstanding any range of flood conditions with regard to possible failure due to sliding, overturning, and structural integrity, up to and including the PMP flood.

(g) Streets.

(1) Generally.

A. Design of streets shall consider public safety and limit potential conflicts between stormwater conveyance, traffic, parking, pedestrian access, ADA requirements, and bicycle traffic.

B. Streets draining a watershed greater than one hundred (100) acres must be designed for the 100-year frequency storm.

C. Streets may be used for stormwater drainage only if the calculated stormwater flow does not exceed the flows outlined in Table 504-7 or the velocity does not exceed ten (10) feet per second.

D. Where streets are not capable of carrying stormwater, as outlined above, inlets or curb openings discharging to drainage channels or storm sewers shall be provided. Partial flow past the inlet will be allowed when the capacity of all downstream street systems can accommodate the flow.

E. Street width shall not be widened beyond the width as determined by the street classification for drainage purposes.

F. Stormwater conveyance on streets shall be designed to account for the cumulative impact of peak flows and runoff volumes on the system as the stormwater progresses downgrade.

G. Curb cuts for driveways on all streets shall be designed for compatibility with the stormwater conveyance function of streets.

H. Potential flooding problems or conflicts at the connection points where new or modified drainage systems (including streets, storm sewers, etc.) and the existing portions of the downstream street system and stormwater conveyance system shall be identified and resolved either in the design of the new or modified drainage system or in modifications to the existing system.

I. Dwelling units located on the downhill side of a T-intersection with a street or drainage channel discharging onto the intersection shall be sited so as to avoid obstruction of the drainage patterns.

(2) Primary and Secondary Arterial Streets. An arterial street is a street so designated on the current major thoroughfare plan. One (1) lane in each direction on arterial streets shall remain passable with a flow depth not to exceed 0.30 feet during a twenty-five-year storm event. The maximum depth of water in the street section must not exceed seven (7) inches (the height of a standard city curb).

(3) Local "B" and Collector Streets. A maximum flow depth to the top of curb on a standard local "B" and collector street section will be allowed during a twenty-five-year storm event. A collector street is a street with a width of forty-four (44) feet or more and not shown as an arterial street on the current major thoroughfare plan.

(4) Local "A" Streets. Local "A" streets shall be designed on a basis of a five-year frequency. A twenty-five-year frequency storm must be contained within the street right-of-way.

(5) Alleys. Alleys shall be designed for five-year frequency within the limits of the alley pavement/curbs and twenty-five-year frequency within the right-of-way/easement to carry stormwater.

(6) Traditional Street Design. Traditional street design shall conform to the storm frequency requirements of the standard street designs listed above as follows:

A. Trails, Alleys and Lanes - Use alley design criteria.

B. Local Street or Avenue - Use local "A" street design criteria.

C. Main Street – Use local "A," local "B" or collector street design criteria depending on the pavement widths. Use local "A" criteria where pavement width is less than thirty-four (34) feet.

D. Boulevard or Parkway - Use arterial street design criteria.

No flow capacity tables are provided for the traditional street designs due the variety of geometric properties associated with these streets. Drainage calculations specific to a proposed traditional street design must be submitted for approval with every project where a traditional street design is proposed.

(7) All-Weather Crossings.

A. Where proposed streets cross existing or proposed watercourses, all-weather crossings shall be required. Culverts or bridges shall be adequate to allow passage of the design storm identified in subsection 35-504(b)(1).

B. All crossings, culverts and bridges shall be designed for an H-20-44 or HS-20 loading.

(8) Unflooded Public Road Access.

A. During a design storm event (see "subsection 35-504(b)(2) System Criteria") unflooded access (within the "Proceed with Caution" range per figure 504-2)

~~shall be available from each proposed new development to an adjacent public street during a regulatory flood event.~~

~~B. Additionally, unflooded access shall be accessible to an arterial street that is not adjacent to the development or to a distance of one-quarter mile, whichever is less, during a future conditions twenty (20) percent annual chance (five-year) flood event.~~

~~C. The director of public works may waive criterion b of this requirement for developments under three (3) acres in size.~~

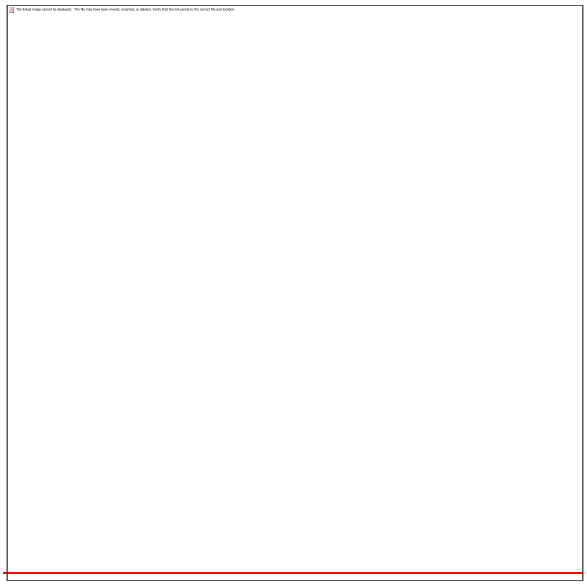
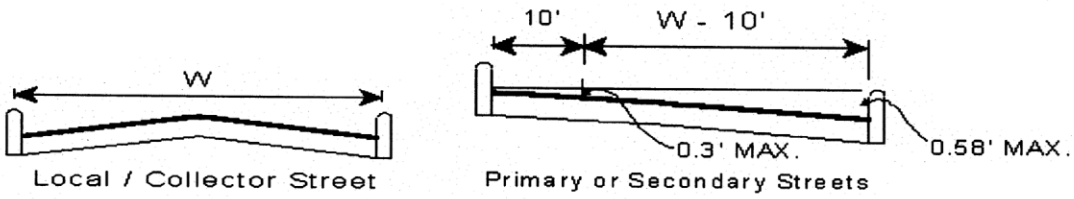


Figure 504-2 Table 504 - 7 Storm Drainage, street Velocities & Capacities, Manning's N=0.018



STORM DRAINAGE
STREET VELOCITIES AND CAPACITIES
Manning's n=0.018

Slope %	LOCAL TYPE "A" W= 30'		LOCAL TYPE "B" W=40'		COLLECTOR W=44'		SECONDARY (W/MEDIAN) Maximum Water Depth = 7" W=24' Min. and 29' Max.		PRIMARY & Secondary (W/O MEDIAN) Maximum Water Depth = 7" W=24' Min. and 29' Max.	
	Q cfs	V f/s	Q cfs	V f/s	Q cfs	V f/s	Q cfs	V f/s	Q cfs	V f/s
0.40	35.4	2.8	47.8	2.9	44.1	2.7	20.6	2.5	19.2	2.3
0.45	37.5	3.0	50.7	3.0	46.8	2.8	21.9	2.7	20.4	2.4
0.50	39.6	3.2	53.4	3.2	49.3	3.0	23.1	2.8	21.5	2.5
0.55	41.5	3.3	56.0	3.4	51.7	3.1	24.2	2.9	22.5	2.7
0.60	43.3	3.5	58.5	3.5	54.0	3.3	25.3	3.1	23.6	2.8
0.65	45.1	3.6	60.9	3.7	56.2	3.4	26.3	3.2	24.5	2.9
0.70	46.8	3.8	63.2	3.8	58.4	3.5	27.3	3.3	25.4	3.0
0.75	48.5	3.9	65.4	3.9	60.4	3.7	28.3	3.4	26.3	3.1
0.80	50.0	4.0	67.6	4.1	62.4	3.8	29.2	3.5	27.2	3.2
0.85	51.6	4.1	69.6	4.2	64.3	3.9	30.1	3.7	28.0	3.3
0.90	53.1	4.3	71.7	4.3	66.2	4.0	30.9	3.8	28.8	3.4
0.95	54.5	4.4	73.6	4.4	68.0	4.1	31.8	3.9	29.6	3.5
1.00	55.9	4.5	75.5	4.5	69.8	4.2	32.6	4.0	30.4	3.6
1.50	68.5	5.5	92.5	5.5	85.4	5.2	40.0	4.9	37.2	4.4
2.00	79.1	6.4	106.8	6.4	98.6	6.0	46.1	5.6	43.0	5.1
2.50	88.5	7.1	119.4	7.2	110.3	6.7	51.6	6.3	48.1	5.7
3.00	96.9	7.8	130.8	7.8	120.8	7.3	56.5	6.9	52.7	6.2
3.50	104.7	8.4	141.3	8.5	130.5	7.9	61.0	7.4	56.9	6.7
4.00	111.9	9.0	151.1	9.1	139.5	8.5	65.2	7.9	60.8	7.2
4.50	118.7	9.5	160.2	9.6	148.0	9.0	69.2	8.4	64.5	7.6
5.00	125.1	10.0	168.9	10.0	156.0	9.5	72.9	8.9	68.0	8.0
5.50	116.0	10.0	153.0	10.0	163.6	9.9	76.5	9.3	71.3	8.4
6.00	108.0	10.0	143.0	10.0	157.0	10.0	79.9	9.7	74.5	8.8
6.50	102.0	10.0	134.0	10.0	148.0	10.0	81.0	10.0	77.5	9.1
7.00	96.0	10.0	127.0	10.0	140.0	10.0	76.0	10.0	80.4	9.5
7.50	91.0	10.0	120.0	10.0	132.0	10.0				
8.00	87.0	10.0	115.0	10.0	126.0	10.0				
8.50	83.0	10.0	110.0	10.0	120.0	10.0				
9.00	79.0	10.0	105.0	10.0	115.0	10.0				
9.5	76.0	10.0	101.0	10.0	111.0	10.0				
10	73.0	10.0	97.0	10.0	106.0	10.0				

~~(h) Drainage Channels and Watercourses. This section addresses proposed improvements or modifications to drainage channels and watercourses required to convey stormwater runoff from or through the proposed development. Refer to subsection 35-504(b)(1) for storm frequency design criteria.~~

(1) Watercourses to Remain Unobstructed. Except as authorized by a development plan approved by the director of public works or his designee, no person shall place or cause to be placed any obstruction of any kind in any watercourse within the city and its ETJ. The owner of any property within the city, through which any watercourse may pass, shall keep the watercourse free from any obstruction not authorized by a development plan.

(2) Channel Modifications.

A. Modifications to existing watercourses or newly created open channels may be designed as earth channels, sod channels or as concrete lined channels. Liners other than sod or concrete which enhance the aesthetics or habitat value of the watercourse and which reduce future maintenance requirements are encouraged. Preliminary planning for the applicability of other channel liners shall be reviewed with the director of public works or his representative prior to the submittal of construction plans for approval.

B. Natural Unimproved Waterways. Runoff that results from upstream development and is discharged to an unimproved waterway can cause flood damage to properties adjacent to the waterway. Natural undeveloped waterways do not receive regular maintenance. Design of natural waterways shall take into consideration fluvial geomorphologic principals and practices and other erosion control measures. Consulting engineers and development review officials shall work to resolve potential downstream impact issues.

(3) Maintenance. Design of new channels or alterations to existing channels shall consider future maintenance requirements. A maintenance schedule for any private channel shall be submitted to and approved by the director of public works prior to approval of construction plans. Maintenance requirements of concrete channels consist of de-silting activities, prevention of vegetation establishment in construction joints, and repair of concrete as necessary. Maintenance of earthen channels includes regular observation and repair, as necessary, of erosion, scouring, and removal of silt deposits, as necessary to maintain design parameters. Developers shall be responsible for maintaining newly planted channels until coverage is established throughout eighty-five (85) percent of the area. This area shall include slopes, floor, and any attendant maintenance easement. New earthen channels shall be planted with drought resistant, low growth, native species grasses, which will allow unobstructed passage of floodwaters. Johnson grass, giant tagweed and other invasive species shall not be allowed to promulgate in channels. Suggested species shall include, but not be limited to, common bermuda, coastal bermuda, buffalo grass, sideoats grama, seep muhly, little bluestem, and indian grass. Mowing frequencies vary with the vegetation growth rates, but is required when the grass exceeds the design roughness coefficient of the channel.

(4) Multiple Uses. Planned multiple use of a watercourse is allowed (e.g. bike paths or greenbelt). If multiple use of the watercourse is to be incorporated, the applicant shall form a property owners' association that shall assume maintenance responsibility for private amenities. The appropriate government agency will be responsible for maintenance of public amenities. The applicant shall provide overlay easements for public or private use.

(5) Velocity Criteria. Table 504-8 shall be used to determine maximum permissible channel velocity.

Table 504-8 Velocity Control

Velocity (fps)	Type of Facility Required	Hydraulic Radius (ft.)	Correction Factor	Maximum Permissible Velocity (fps)
1 to 6 (Maximum Average Velocity = 6 fps)	Vegetated Earthen Channel	0 – 1 1 – 3 3 – 5 5 – 8 8 – 10 Over 10	0.8 0.9 1.05 1.15 1.225 1.25	5 5.5 6.3 6.9 7.35 7.5
*6 to 12	Turf Reinforcement Mat (TRM)	NA	NA	12
6 to 8	Concrete Retards	NA	NA	NA
> 8	Concrete Lining or Drop Structures	NA	NA	NA

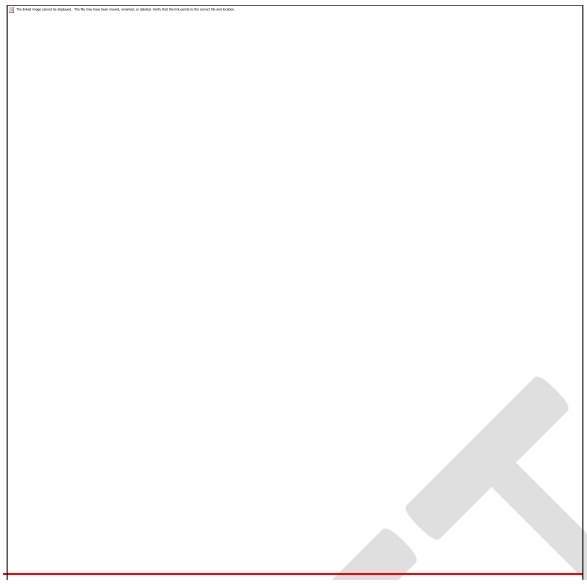
* If Turf Reinforcement Mat (TRM) is proposed, please see City of San Antonio Standard Specifications for Construction Item 554 for submittal requirements. The improvement plan sheets should include the location of placement, details, and manufacturer's installation instructions.

A. Where velocities are in the supercritical range, allowance shall be made in the design for the proper handling of the water.

B. Ensure that the channel will contain the hydraulic jump (sequent depth) throughout the extent of the supercritical profile. An exception to this criteria is where concrete lined lateral channels discharge down the side slopes of channels. These channels may be designed for normal depth plus freeboard provided velocity controls are established at the main channel flow line.

C. Ensure that the energy grade of the channel will not result in upstream flooding at existing or proposed lateral facility connections.

(6) Retard Spacing. Retard spacing shall be computed as follows when using the city standard retard section Figure 504-3 and the following equations:



35-504(h) continued

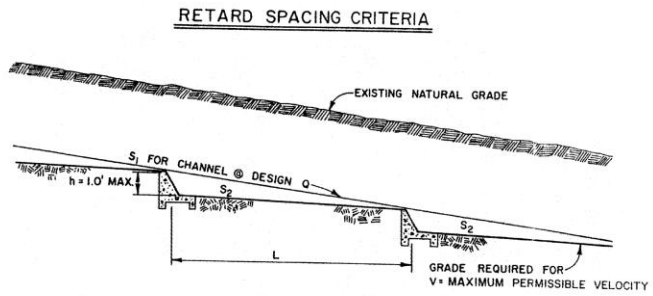


Figure 504-3

~~L = 1.0' ÷ (S1 - S2)~~

~~Where: L = Distance required between retards in feet.~~
~~S1 = Actual slope of channel in ft./ft.~~
~~S2 = Slope of proposed channel for maximum permissible velocity established from Table 504-8, i.e.:~~
~~and~~
~~$S2 = [(NV) \div (1.486R^{2/3})]^2$~~
~~Where: V = maximum permissible velocity established from Table 504-8~~
~~N = .035~~
~~R = area/wetted perimeter~~

~~(7) Concrete Lined Channels. The design of concrete lined channels shall comply with the following general requirements:~~

~~A. Freeboard consistent with Table 504-9 will be applied to the twenty-five-year design.~~

~~B. From the top of the concrete lining to the top of the ditch, a side slope not steeper than three (3) horizontal to one (1) vertical shall be required; nor shall the slope be less than twelve to one (12:1). The minimum slope of concrete lined channels shall be 0.4 percent, or 0.1 percent with a minimum "cleaning" velocity of two (2) feet per second (2 fps) during an existing conditions two-year storm event.~~

C. For normal conditions, the concrete lining shall be a minimum of five (5) inches thick and reinforced with No. 3 round bars at twelve (12) inches on center each way. Where surcharge, nature of ground, height and steepness of slope, etc., become critical, design shall be in accordance with latest structural standards. All concrete lining shall develop a minimum compressive strength of not less than three thousand (3,000) pounds per square inch in twenty-eight (28) days. The depth of all toe downs shall be thirty-six (36) inches upstream, twenty-four (24) inches downstream, and eighteen (18) inches for side slopes. The city's construction inspector may permit an eighteen-inch toe down in rock subgrade in lieu of the above toe down requirements. The horizontal dimensions of toe downs shall not be less than six (6) inches.

D. Maximum concrete riprap side slopes shall be one and one-half (1½) horizontal to one (1) vertical, unless soil tests made by a geotechnical engineer show that a greater slope, or a special design, will be stable. Where vehicular traffic may travel within a horizontal distance equal to one-half (½) the vertical rise of the slope, a two-foot surcharge load shall be included in the design.

E. Fencing will be required adjacent to the channel where channel vertical wall heights exceed two (2) feet. Fencing will also be required adjacent to the channel where channel side slopes exceed two to one (2:1) and the channel depth is greater than two (2) feet. The fencing must not cause sight distance problems for motorists.

F. Vertical walls will not be permissible for depths greater than two (2) feet unless properly fenced or enclosed. Walls will have a minimum thickness of six (6) inches.

G. Easements or rights-of-way for concrete lined channels shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. "Extreme limits" of the channel shall mean the side slope intercept with the natural ground or proposed finished ground elevation.

H. A minimum "n" value of roughness coefficient of 0.015 shall be used for a wood float type surface finish. This "n" value is as used in Manning's formula.

Table 504-9
Drainage Freeboard for Concrete
Lined and Earth Channels for Twenty-Five-Year Storm

Design Depth of Flow	Required Freeboard
0 to feet 5 feet	0.5 foot
5 to 10 feet	10% of design depth
10 feet and over	1.0 foot

(8) Vegetated Earth Channels.

A. Freeboard consistent with Table 504-9 will be applied to the twenty-five-year design.

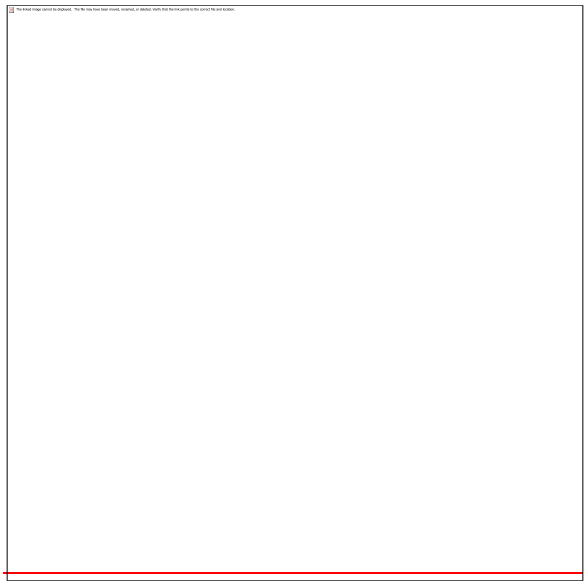
B. The side slope shall not be steeper than three (3) horizontal to one (1) vertical.

~~C. Easements or rights-of-way for improved earth channels shall conform to the requirements stated in subsection (d) of this section and shall extend a minimum of two (2) feet on one (1) side and fifteen (15) feet for an access road on the opposite side of the extreme limits of the channels when such channels do not parallel and adjoin an alley or roadway. When such channels do parallel and adjoin an alley or roadway, the easement or right-of-way shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. Where utilities are installed in the access road of the drainage right-of-way, the right-of-way shall extend two (2) feet on one (1) side and seventeen (17) feet on the opposite side of the design limits of the channel. These seventeen (17) feet are to provide an access way along the channel with a maximum cross slope of one (1) inch per foot toward the channel. Where designed channel bottoms exceed one hundred (100) feet in width, the fifteen-foot extra width shall be provided on both sides of the channel.~~

~~D. Interceptor drainage easements shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. Refer to Figure 504-4.~~

~~E. Improved earthen channels will be vegetated by seeding or sodding. Eighty-five (85) percent of the channel surface area must have established vegetation before the City of San Antonio will accept the channel for maintenance.~~

~~F. For vegetated earthen channels with slopes less than 0.5 percent or bottom widths greater than thirty (30) feet, concrete pilot channels shall be provided. The minimum bottom width of the pilot channel shall be four (4) foot. The minimum [earthen] slope draining toward the pilot channel shall be one (1) percent.~~



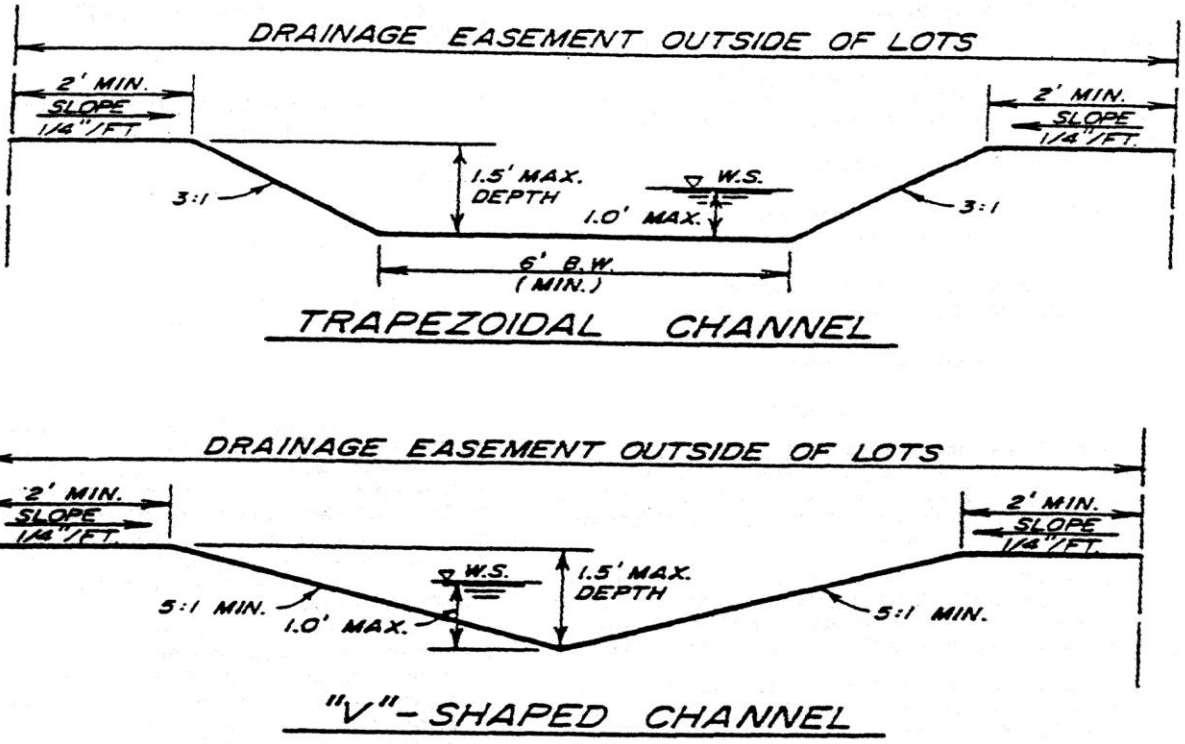


Figure 504-4

35-504(h)(8) continued

~~(9) Channel Bends and Turns - Freeboard. Allowance for extra freeboard shall be made when the centerline radius of the channel is less than three (3) times the bottom width. Where sharp bends or high velocities are involved and the flow regime is sub-critical, the applicant shall use the following formula for computing the extra freeboard:~~

~~$d_2 - d_1 = V^2(T + B) \div 2gR$~~

~~Where: d_1 = depth of flow at the inside of the bend in feet.~~
~~d_2 = depth of flow at the outside of the bend in feet.~~
~~B = bottom width of the channel in feet.~~
~~V = the average approach velocity in the channel in feet per second.~~
~~T = width of flow at the water surface in feet.~~

g = 32.2 feet/second squared.
R = the center line radius of the turn or bend in feet.

A. The quantity d_2-d_1 divided by two (2) shall be added to the normal depth of flow before adding the required freeboard in calculating required right-of-way widths.

B. Where sharp turns are used without curved sections, the depth required shall be large enough to provide for all head losses. Allowance shall be made for any backwater head that may result.

C. For normal design conditions no extra freeboard is required where centerline radius of channel should be at least three (3) times the bottom width. For critical and super-critical flow regimes, the extra freeboard calculated with the above formula shall be doubled.

(i) Storm Sewers.

(1) For all ordinary conditions, storm sewers shall be designed on the assumption that they will flow full under the design discharge; however, whenever there are constrictions, turns, submerged or inadequate outfall, etc., the hydraulic and energy grade lines shall be computed and plotted in profile. The energy grade line (EGL) shall be below the top of curb and the hydraulic grade line (HGL) shall be below the gutter elevation of the drainage structure. In all cases adequate outfalls shall be provided.

(2) No storm sewers shall be less than twenty-four (24) inches in diameter.

(3) Minimum easement widths for storm sewers will be the greater of fifteen (15) feet or six (6) feet on both sides of the extreme limits of the storm sewer width (e.g. the easement width for a three (3) barrel ten foot wide box culvert with six inch walls would be (3 x 10')+(4 x 0.5')+(2 x 6') = 44').

(j) Inlets and Openings.

(1) Drop Curb Openings – Sidewalk Does Not Abut Opening. Where drop curb openings are used to take stormwater off the streets and into drains, the length of the curb opening can be calculated from the weir formula using the coefficient of 3.087 in the following formula:

$L = Q \div Ch^{3/2}$

Where: L = the length of drop curb opening required in feet.
Q = amount of flow in CFS based on twenty-five-year design frequency.
C = 3.087.
h = head of weir in feet.

Gutter line depressions will be permitted where such depressions will not hamper the flow of traffic. For amount of curb exposure, conform to City of San Antonio inlet standards.

(2) Curb or Drop Inlets. Where drop inlets are use, the city standard inlets with adequate reinforcing steel may be used. All other types or designs shall be subject to the approval of the director of public works in consultation with the director of planning and development services. The following formulas for inlet capacity are based on drop inlets in sag points. Inlet capacities on grades will be considered less,

~~the amount of which depends on street grades, deflections, cross slopes, depressions, etc.~~

~~(3) Grate Inlets. The flow of water through grate openings may be treated as the flow of water through a rectangular orifice. The following formula may be used for determining grate capacity:~~

~~$Q = CA\ (2gh)^{1/2}$~~

~~Where: Q = discharge in cubic feet per second.~~
~~C = orifice coefficient of discharge (taken as 0.70).~~
~~g = acceleration due to gravity (32.2 ft./sec.^{2})~~
~~h = head on the grate in feet.~~
~~A = net area of the openings in the grate in square feet.~~

~~This formula gives the theoretical capacity of the grate inlet. Since grate inlets are subject to considerable clogging, capacity of the grate inlet will be taken as one-half (½) on the value given by this formula.~~

~~(4) Curb Opening Inlets. The capacity of curb opening inlets will depend on whether or not the opening is running partially full or submerged. If the depth of flow at the curb opening inlet is such as to cause a partially full opening, a weir effect will develop and the following formula will apply:~~

~~$Q = C_w L(h)^{3/2}$~~

~~Where: Q = the discharge of capacity in cubic feet per second.~~
~~C_w = the weir coefficient of discharge (3.087).~~
~~L = the length of curb opening in feet.~~
~~h = the head or depth of water at the opening in feet.~~

~~If the depth of flow at the curb opening is such as to fully submerge the opening, the orifice effect will develop and the formula used shall be identical to that given under grate inlets with the exception that the head, h, on the curb opening orifice shall be taken as the depth from the top of the water surface to the center of orifice or opening; one hundred (100) percent efficiency will be allowed for curb opening inlets.~~

~~(Ord. No. 97568 § 2) (Ord. No. 98697 § 1 and 6) (Ord. No. 2006-11-30-1333, § 2, 11-30-06) (Ord. No. 2009-01-15-0001, § 2, 1-15-09) (Ord. No. 2009-08-20-0661, § 3, 8-20-09) (Ord. No. 2010-11-18-0985, § 2, 11-18-10) (Ord. No. 2012-10-18-0829, § 2, 10-18-12)~~

* * * * *

Chapter 35, Article V, Section 35-506 is amended as follows:

Sec. 35-506. – Transportation and Street Design.

* * * * *

(a) **Applicability.**

(1) **Generally.** The provisions of this division shall apply to:

* * * * *

C. Any ministerial permit where one (1) or more of the following applies:

1. Applications for building permits for new structures or development on a vacant lot where there are no existing structures or development.

2. Applications for a building permit for all new structures, additions, and renovations/remodels on a developed lot with existing buildings, or a single building on several lots under one (1) owner. For existing structure(s), the provisions of this division apply where the cost of the repair or improvement amounts to twenty-five (25) percent or more of the assessed valuation of the building/structure(s) as set forth by the city tax roll for the entire lot, or if provided by applicant, other proof of valuation such as published by the ~~planning and~~ development services department's calculated building valuation based on construction type, occupancy and square footage, or proof of recent purchase price of the structure(s). Existing renovations and remodels where the cost of repairs or improvements are less than fifty thousand dollars ($50,000) are not subject to the provisions of this section. Additional building permit applications that are submitted within a year's time frame by a single owner shall have the project valuations added to determine applicability of this division. This is not intended to apply to multiple tenant finish-outs in one (1) year caused by tenants moving in and out of multi-leased buildings where the building owner has not intended to remodel the structure.

3. Applications for a building permit for an existing building where a change of occupancy/use increases the required minimum number of vehicle parking stalls by ten (10) percent over the original occupancy/use, or a parking lot is being modified that adds at least ten (10) percent new parking spaces.

4. Application for a commercial building permit where a new or additional driveway is proposed.

* * * * *

(3) **Variance.** A variance to the requirements of this section may be granted by the planning commission if the commission finds that there are special circumstances or conditions, unique to the land involved, such that strict application of these requirements would be unreasonable and the granting of the variance would not be detrimental to the public health, safety, or welfare. No variance shall be granted that reduces the number of traffic lanes or waives the construction of any traffic lane required by the major thoroughfare plan unless constructing the lanes exceeds the Roughly Proportionate Determination amount established under 35-501(b). Application for a variance shall be submitted in writing to the development services director accompanied by the variance fee specified in Appendix "C" to this chapter and an eight and one-half by eleven (8½ ×

11) inch site plan indicating the location of the variance request and the location of existing sidewalks and curbs within a one ~~two~~ thousand-foot radius.

* * * * *

(b) **Improvements Required.**

* * * * *

(2) **Street Layout.** The arrangement, character, extent, width, grade and location of all streets shall conform to the master plan and the major thoroughfare plan and shall be considered in their relation to existing and planned streets, to topographical conditions, to public safety and convenience, and in their appropriate relation to the proposed uses of the land to be served by such streets. The street layout shall be devised for the most advantageous development of the entire neighborhood or regional development.

* * * * *

(d) **Cross-Section and Construction Standards.**

(1) **Streets.**

A. Tables 506-3 and 506-4 provide the standards for all existing and future streets.

B. The subdivider shall dedicate and construct all interior streets within the subdivision plat and shall provide dedication and construction for exterior streets based upon tables 506-3 and 506-4.

C. The director of ~~planning and~~ development services shall include the dedication and construction of rights-of-way for exterior streets in the roughly proportionate determination as described in subsection 35-501(b).

Table 506-3
Conventional Street Design Standards

Street Type	*Marginal Access*	*Alley*	*Access to Conservation Subdivision*	*Local Type A*	*Local Type B*	*Collector*	*Secondary Arterial*[1]	*Primary Arterial*[2]
R.O.W. (min.)[1, 2, 9, ~~10~~]	36'	24'	34'	50'	60'	70—90'	86—110'	120' [10, ~~11~~]
Pavement Width	26'	18—24'	24'[7]	28' - 34'	40'	44—55'	48—81'	48—81'
Design Speed (mph)	30	20	30	30	30—35	40—45	45	45

Grade (max.)[3] ICL	12%	12%	12%	12%	12%	7%	5%	5%
Grade (max.)[3] ETJ	10%	10%	10%	10%	10%	7%	5%	5%
Grade (min.)[4]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Centerline Radius (min.)	100'	50'	100'	100'	100'	400'	700'	1,200'
Curb	NR	NR	NR	Yes	Yes	Yes	Yes	Yes
Median	NR	NR	NR	NR	NR	NR	16' min.	16' min.
Sidewalk Width (see subsection (q)(5))[5]	NR	NR	4/6[9~~8~~] one side only	4'[8]	4[8] /6[13~~9~~]	4[8] /6[9]	4[8] /6[9]	4[8] /6[9]
Bicycle Facilities[5, ~~6~~]	NR	NR	NR	NR	NR	Yes[5]	Yes [5]	Yes [5]
Streetscape Planting	NR	NR	NR	NR	NR	Yes	Yes	Yes
Planting Strips or Sidewalk Buffer[8, 11, 12]	NR	NR	NR	NR	3' Min.[13]	3' Min.	3' Min	3' Min.

Notes and Rules of Interpretation:

NR designates the item is "not required."

ICL designates inside city limits.

ETJ designates within the extraterritorial jurisdiction Table 506-3 is required for conventional option subdivisions (see section 35-202) or subdivisions not subject to Table 506-4, below, except for access to conservation subdivision (section 35-203).

[1]For secondary arterial type B streets the minimum width of right-of-way shall be 70 feet and at intersections with other major arterials on the major thoroughfare plan 86 feet to 110 feet as determined by the director of development services.

[2]For primary arterial type B streets the minimum width of right-of-way shall be 70 feet and at intersections with other major arterials illustrated on the major thoroughfare plan the right-of way shall be 86 feet to 120 feet subject to the findings of the TIA as determined by the director of ~~planning and~~ development services.

[3]Refer to 35-506(d)(3) for grades exceeding maximum values specified in the table.

[4]0.4% Optional with concrete curb and gutter.

[5] Bicycle facilities are required on all collector and arterial roadways. Bicycle path and sidewalks can be combined to provide for a multi-use path. See subsection 35-506(d)(4). Selection as to the type of facility to be constructed will need to be coordinated with the Transportation and Capital Improvements (TCI) Traffic & Transportation Planning Division-Traffic Engineering Group.

~~[6] When designated on bicycle master plan as approved by city council.~~

[6][7] Entry portion without parking.

[7][8] In residential areas sidewalks shall be located to provide improved safety, to improve walkway intersection alignment and to reduce sidewalk conflicts with utility poles and mail boxes.

[8][9] Sidewalks shall be four (4) foot in width with a planting strip or six (6) foot in width without a planting strip. Sidewalks may be four (4) foot in width without a planting strip when houses are fronting on a Local Type B street.

[9][10] R.O.W. width and construction design of state maintained streets and certain inner-city streets and certain primary arterials (approved by city council ordinance) pertaining to R.O.W. dedication and design standards within the CRAG area boundary shall take precedence over the standard UDC street R.O.W. and design provisions outlined in Table 506-3 above.

[10][11] 120 feet is the maximum right-of-way width but may be varied in accordance with the adopted major thoroughfare plan.

[11] Meandering sidewalks may have up to twenty five percent (25%) of the total block length of the sidewalk within the minimum planting strip area. This does not apply to multi-use or bicycle facilities.

[12] Stamped concrete, painted buffer, or other permeable material as shown on the approved city detail, may be used to satisfy the sidewalk buffer width requirement. Alternative materials may be approved by the Director of TCI.

[13] Sidewalks shall be six (6) foot in width, with or without a planting strip, along street type Local B where the residential lots do not front the street.

Table 506-4
Traditional Street Design Standards

Street Type	*Trail*	*Alley*	*Lane*	*Local*	*Avenue*	*Main Street*	*Boulevard*	*Parkway*
R.O.W. (min.)	14'	20'	38'	48'	82'	58'	124'	86'
Pavement Width[1]	8'—	10'—	16'—	22'—	27'—	28'—	44'—	44'+

	14'	12'	18'	27'	48'	36'	70'	
Design Speed (mph)	N/A	20	30	30	35	40	45	45
Grade (max.) Grade (min.) [3][4]	Follow AAS HTO	10% 0.5%	10% 0.5%	10% 0.5%	7% 0.5%	7% 0.5%	5% 0.5%	5% 0.5%
Curb Radius	N/A	15'	15'	15'	25'	25'	25'	25'
Centerline Radius[1][2]	95'	50'	90'	90'	250'	300'	500'	1,000'
Curb	NR	NR	Yes	Yes	Yes	Yes	Yes	NR
Median	NR	NR	NR	NR	16' min.	NR	16' min.	16' min.
Sidewalk Width (see subsection (q)(5)) [4][5]	NR	NR	4'[6][7]/6'[6][7]	4'[6][7]/6'[6][7]	4'[6][7]/6'[6][7]	4'[6][7]/6'[6][7]	4'[6][7]/6'[6][7]	4'[6][7]/6'[6][7]
Bicycle facilities[2][3], [5][6]	NR	NR	NR	NR	Yes	Yes	Yes	Yes Path
Streetscape Planting	Yes	NR	Yes	Yes	Yes	Yes	Yes	Yes
Planting Strips or Sidewalk Buffer[7]	NR	NR	6'	6'	6'	City Option	6—11'	7—20'

Notes and Rules of Interpretation:

NR designates the item is "not required."

R.O.W. width and construction design of state maintained streets and certain inner-city streets and certain primary arterials (approved by city council ordinance) pertaining to R.O.W. dedication and design standards within the CRAG area boundary shall take precedence over the standard UDC street R.O.W. and design provisions outlined in Table 506-4 above.

Table 506-4 applies only to the following development options: Commercial Center (section 35-204), Commercial Retrofit (section 35-206), Traditional Neighborhood development (section 35-207), and Transit-oriented development (section 35-208), except as provided in footnote 5, below.

~~[1]See Table 506-4A below. The smaller street width with on-street parking prohibited, or the larger street width coupled with on-street parking on one (1) or both sides of the street, may be provided if the adjoining buildings are provided with (1) an NFPA 13D fire sprinkler system for Single-Family Dwelling Units, One-Family Attached Dwelling Units, Two-Family (Duplex) Dwelling Units, Two-Family Attached Dwelling Units; (2) an NFPA 13R fire sprinkler system for Multi-Family buildings; or (3) an NFPA 13 fire sprinkler system for Commercial Building.~~

[1][2]Lesser radius can be approved by the director of development services.

[2]~~3~~Bike path and sidewalks can be combined. See subsection 35-506(d)(4).

[3]~~4~~Optional 0.4% with concrete curb and gutter.

[4]~~5~~Any provision in Table 506-3 (entitled "conventional street design standards") notwithstanding, interior streets in a subdivision that would otherwise be required to comply with the provisions of Table 506-3 may instead comply with the provisions of Table 506-4 (entitled "traditional street design standards"), regarding pavement width requirements only, provided that the connectivity ratio (see subsection (e), below and subsection 35-207(g) of this chapter) shall comply with the requirements for a Traditional Neighborhood development. The proposed development shall comply with footnote 1 hereto. Pursuant hereto, street types in such subdivisions shall comply with Table 506-4 as follows: An Alley shall be required to meet the street width standards for an Alley as provided in Table 506-4; a Conservation Access street shall be required to meet the street width standards for a Lane; a Local Type A street shall be required to meet the street width standards for a street; a Local Type B street shall be required to meet the street width standards for an Avenue; a Collector street shall be required to meet the street width standards for a Main street; a Secondary Arterial shall be required to meet the street width standards for a Boulevard; and Primary Arterial shall be required to meet the street width standards for a Parkway.

[5]~~6~~When designated on bicycle master plan as approved by city council.

[6]~~7~~Sidewalks shall be four (4) foot in width with a three (3) foot planting strip or six (6) foot in width without a planting strip. Sidewalks may be four (4) foot in width without a planting strip when houses are fronting on an Avenue.

[7] Stamped concrete, painted buffer, or other permeable material as shown on the approved city detail, may be used to satisfy the sidewalk buffer width requirement. Alternative materials may be approved by the Director of TCI.

Table 506-4A
Street Width Options for Traditional Street Design Standards

Street Type	A	B	C	~~D~~	D~~E~~	E~~F~~	F~~G~~	G~~H~~
	Street Width	Parking	Directional	~~Fire Sprinklers~~	Alleys	Max. Block	Connections	Turning Radius
Lane	18'	None	1-Way	~~No~~	No	300'	27'	25—50'
Local	24'	1 Side	2-Way	~~No~~	Yes	35-207(f)	NR	25—50'
Local	27'	Both Sides	2-Way	~~No~~	No	35-207(f)	NR	25—50'
Lane	16'	None	1-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'

Lane	18'	None	2-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'
Lane	18'	1-Side	1-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'
Local	22'	None	2-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'
Local	22'	1-Side	2-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'
Local	25'	Both Sides	2-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'
Local	26'	Both Sides	2-Way	~~Yes~~	Yes	35-207(f)	NR	25—50'

Notes and rules of interpretation:

R.O.W. width and construction design of state maintained streets and certain inner-city streets and certain primary arterials (approved by city council ordinance) pertaining to R.O.W. dedication and design standards within the CRAG area boundary shall take precedence over the standard UDC street R.O.W. and design provisions outlined in Table 506-4A above.

Column A (Street Width) refers to the width of the street from curb face to curb face.

Column B (Parking) indicates whether on-street parking is permitted, whether on both sides or only one (1) side of the street.

Column C (Directional) refers to the directional flow of traffic.

~~Column D (Fire Sprinklers) refers to whether fire sprinklers are required. See footnote 1 of Table 506-4, above~~.

Column D~~E~~ (Alleys) indicates whether alleys are required. Alleys are permitted for any street classification.
Column E~~F~~ (Max. Block) refers to the maximum block length. Maximum block length is not subject to an administrative exception (see subsections 35-501(b) and 35-207(f) of this chapter).

Column F~~G~~ (Connections) indicates the width of streets connecting to the street from intersection to intersection. The connecting street must be located at each end of the block. "NR" means that a connecting street of minimum width is not required.

Column G~~H~~ (Turning Radius) refers to the minimum inside and outside turning radii (see "Figure 506-1 Turning Radius Design," below).

This diagram below provides the minimum turning radius for a pumper truck. The minimum inside radius is 25' and the minimum outside radius is 50'.

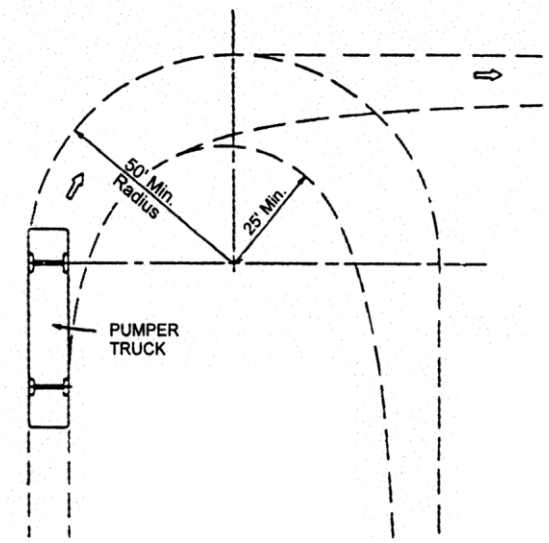


Figure 506-1

Turning Radius Design

Table 506-4A.1
Enhanced Street Design Standards

	Enhanced Local B	Modified Collector	Rural Roadway	Enhanced Secondary Arterial	Enhanced Primary Arterial	Super Arterial Type A	Super Arterial Type B
R.O.W. (min.)	60'	86' – 110'	120'	120'—142'	144'—166'	200—250'	200'—250'
Pavement Width	44'	48'	24'—36'	48'—84'	72'—120'	44'—136'	48'—136'
Design Speed (mph)	40	45	40'—45'	45'	45'	45'—55'	45'—55'
Grade (max)[3]	7%	7%	5%	5%	5%	5%	5%
Grade (min.)	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Centerline Radius (min.)	700'	700'	700'	700'	1200'	1200'	1200'
Curb	Yes	Yes	NR	Yes	Yes	Yes	Yes
Shoulder	NR	NR	8' on	NR	NR	10' on each	10' on

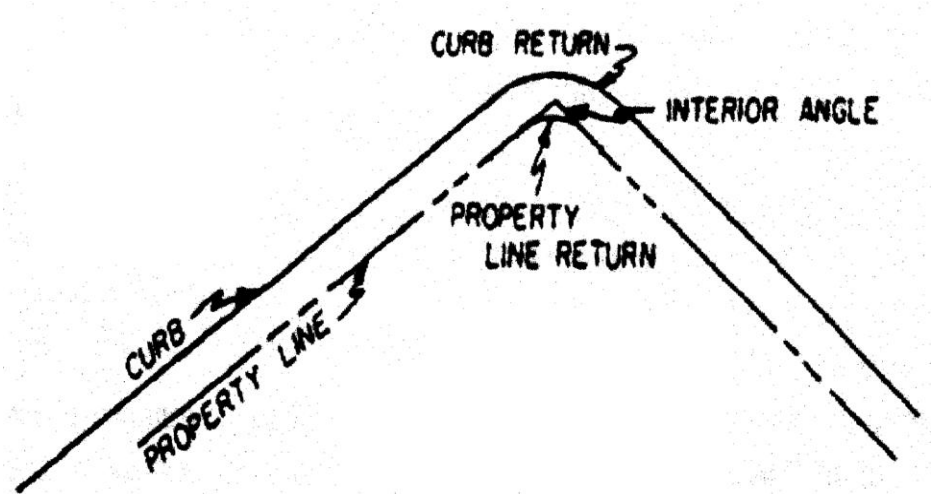
Width (min.)			each side			side for outside lanes, 4' on each side for inside lane (without curb)	each side for outside lanes, 4' on each side for inside lane (without curb)
Median Width (min.)	16’	16’	NR	6'—18'	6'—28'	48'	48'
Sidewalk Width, min. (see subsection (q)(5))[5]	4[8] /6[9]	4[8] /6[9]	NR	10'	10'	NR	NR
Bicycle facilities[5,6]	NR	Yes	NR	Yes	Yes	NR	NR
Streetscape Planting	NR	Yes	NR	Yes	Yes	NR	NR
Planting strips width (min.)[9, 12]	3’	3’	NR	3'~~4’~~	3'~~4’~~	NR	NR
Drainage & clear zone	NR	NR	68'—80'	NR	NR	NR	NR

Notes and Rules of Interpretation:
See notes and rules of interpretation for Table 506-3

Table 506-4B
Curb Return and Property Line Table
Minimum Radii for Curb (Corner) Returns (CR) and Property Line Returns (PLR)

Interior Angles in Degrees	*Local "A" w/ Local "A"*		*Local "A" w/ Local "B"*		*Local "B" w/ Collector*		*Collector w/ Collector*		*Collector w/ Arterial*		*Arterial w/ Arterial*	
	CR	*PLR*	*CR*	*PLR*	*CR*	*PLR*	*CR*	*PLR*	*CR*	*PLR*	*CR*	*PLR*
120-106	15′	5′	20′	10′	40’ ~~25′~~	30’ ~~15′~~	25′	15′	35’ ~~25′~~	25’ ~~15′~~	30′	15′
105-91	15′	5′	20′	10′	40’ ~~25′~~	30’ ~~15′~~	25′	15′	35’ ~~25′~~	25’ ~~15′~~	35′	20′
90	15	5′	20′	10′	25′	15′	25′	15′	25′	15′	50′	35′
89-76	20′	10′	25′	15′	45’	35’	40’	30’	45’	35’	55′	40′

			~~30′ 20′~~	~~30′ 20′~~	~~30′ 20′~~	
75-60	25′ 15′	30′ 20′	45’ 35’ ~~35′ 25′~~	40’ 30’ ~~35′ 25′~~	45’ 35’ ~~35′ 25′~~	60′ 45′



Curb Return Illustration

* * * * *

(4) **Bicycle Facilities**. Bike facilities ~~paths~~, when required within the city limits, may be constructed with development of the abutting property at the time building permit acquired.

When identified on the city council approved bike ~~facilities~~ master plan roadways requiring bicycle facilities shall be constructed in accordance with the American Association of State Highway and Transportation Officials "Guide for the Development of Bicycle Facilities~~.~~" with additional guidance from the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide.

(5) ~~Intersection~~ **Sight Distance**. To ensure safety of motorists and other travelers, it is necessary that drivers who are entering an intersection or rounding a horizontal curve have an adequate view of approaching motorists. To preserve this ~~This~~ view, ~~is required over a clear vision area, which is a right triangle where one (1) side is called "intersection sight distance" and the adjacent side is the distance between the driver and the path of the vehicles approaching from the side. The clear vision area is~~ that portion of a property over which motorists must see to safely judge and execute a driving maneuver into the intersection and onto the street or driving around a curve must be identified and preserved. Clear vision areas must be free of visual obstructions, e.g. structures, walls, fences, and vegetation, which are higher than three (3) feet and lower than eight (8) feet above the pavement. The American Association of State Highway and Transportation officials (AASHTO) Policy on Geometric Design of Highways and Streets, or latest revision thereof contains methods to determine sight distance and shall be used to create clear vision easements to identify and protect the clear vision areas. There are two types of sight distance measurements to be calculated to determine clear

vision areas that shall be identified on the plat in a clear vision easement if the area falls on property outside of a right-of-way or private street lot:

A. **Intersection Sight Distance.** This applies to intersections of two (2) or more streets as well as junctions of driveways and streets. The location of the decision point on the intersection sight distance triangle is dependent upon the road classification of the major street. If the major street is classified as a Collector, Arterial, or Freeway, the decision point will be measured a minimum of eighteen (18) feet behind the curb line or edge of pavement (if the major street has no curb). Otherwise, the decision point will be measured a minimum of fourteen and one-half (14.5) feet from behind the curb line or edge of pavement (if the major street has no curb). The decision point distance may be increased if the preferred distance for intersection sight distance in the latest version of AASHTO is higher. ~~Clear vision areas must be free of visual obstructions, e.g. structures, walls, fences, and vegetation, which are higher than three (3) feet and lower than eight (8) feet above the pavement. The American Association of State Highway and Transportation officials (AASHTO) Policy on Geometric Design of Highways and Streets, or latest revision thereof determines this length of the required intersection sight distance.~~

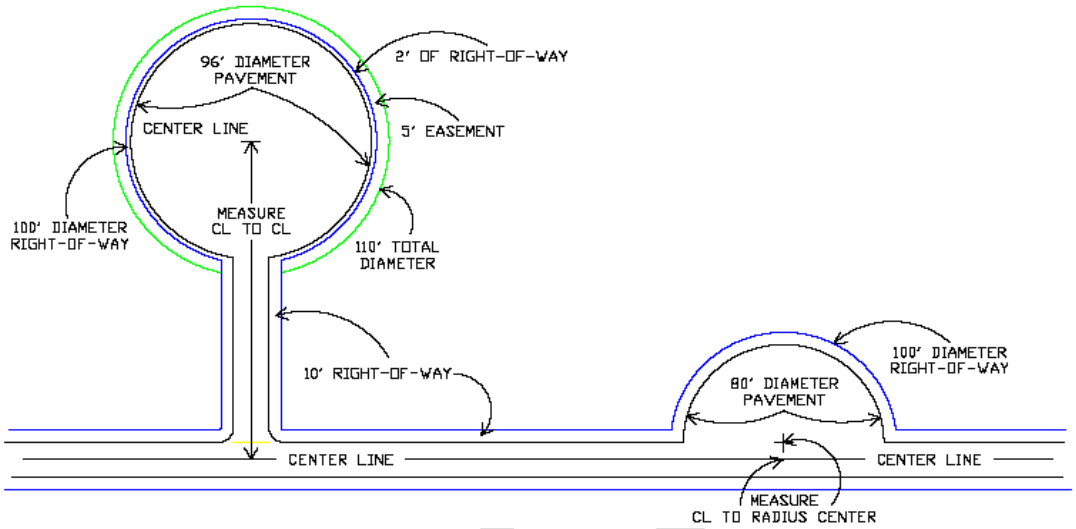
B. **Horizontal Sight Offset.** The horizontal sight offset shall be calculated relative to the stopping sight distance along the curve and radius of the horizontal curve.

C. **Vertical Curve Sight Distance.** Sight distance along a vertical curve shall be checked to ensure the K-value is sufficient for stopping sight distance. In addition, the sight line elevation for stopping sight distance of a vertical curve on a horizontal curve shall be established and identified on the construction plans to be cleared to maintain site vision during construction.

(6) **Cul-De-Sac Streets.** Cul-de-sac street design and fire hydrant layout shall be as required by the currently adopted International Fire Code (for optional turnaround types other than cul-de-sacs the design criteria of the International Fire Code shall be applicable).

Within the city limits, residential ~~Residential~~ cul-de-sac streets greater than one hundred fifty (150) feet from the centerline of the cross street's pavement to the center point of the cul-de-sac turnaround shall be designed with a minimum one-hundred-foot diameter right-of-way and a minimum ninety-six-foot diameter pavement surface. A five-foot irrevocable easement for utility service and sidewalk construction and use shall be provided on residential lots adjacent to the right-of-way. The five-foot easement combined with the two-foot of additional unpaved right-of-way shall provide a total parkway behind the cul-de-sac curb line of seven (7) feet for sidewalk and utility construction as needed.

In the ETJ or when ~~If~~ the developer elects not to provide the easement above, ~~then~~ the cul-de-sac meeting the distance criteria above shall be dedicated and constructed utilizing a one-hundred-ten-foot diameter right-of-way and a ninety-six-foot diameter pavement surface. If a streetlight is being installed in the cul-de-sac right-of-way, additional right-of-way dedication may be necessary to avoid conflicts with sidewalk construction.



Measurements for the Application of Cul-De-Sac Applications

This provision does not apply to cul-de-sac streets of less than one hundred fifty (150) feet in length or emergency turnarounds. Cul-de-sacs less than one hundred fifty (150) feet in length shall provide a minimum of eighty (80) feet of pavement width with one hundred (100) feet of right-of-way

Cul-De-Sac Type	*Pavement Width (Min.)*	*Right-of-Way (Min)*
>=150' Length	96'	110'
>=150' Length with 5-foot additional easement around cul-de-sac right-of-way	96'	100'
<150' Length	80'	100'

* * * * *

(9) **Substandard Existing Streets.**

*** * * * ***

B. **Sidewalks, Curbs and Pavement Construction.** For purposes of this section, pavement cross-section includes the following: width of ROW, sidewalks, curbs, bicycle facilities, and the pavement structural section.

1. Where platted property or property meeting a plat exception under 35-430(c) is adjacent or contiguous to an existing publicly maintained street and the pavement cross-section of the existing street is less than the minimum required by this chapter for the development accessing the existing street, no ~~building~~ permit for the property shall be issued or any utility connected until the pavement cross-section has been improved to the minimum pavement cross-section required by this chapter. If the

property does not access the street and the minimum street cross-section is only lacking sidewalk, refer to 35-506(q) to determine if sidewalk is required.

2. Where property is being platted adjacent or contiguous to an existing publicly maintained street and is using the street for access and the pavement cross-section of the existing street is less than the minimum required by this chapter, no plat shall be recorded until the pavement cross-section has been improved to the minimum pavement cross-section required by this chapter, or a guarantee of performance has been executed and filed as provided in section 35-437. If the minimum pavement cross-section is only lacking sidewalk, refer to 35-506(q) to determine if sidewalk is required.

3. If a property is being platted adjacent or contiguous to an existing privately maintained street or paper street and is using the street for access, the property owner must coordinate with the entity responsible for maintaining the street to access the street for daily access. A note on the plat shall be added to the plat informing the public that the development has access to a street that is privately maintained or not maintained.

4. Minimum Construction Required. Where the roughly proportionate determination (determination study under section 35-502) has determined that the applicant's development would not generate enough traffic to require mitigation for right-of way dedication or improvements to the pavement cross section, the provisions of this subsection shall not apply. In such cases, the safety lane requirements of 35-506(d)(11) shall be met.

C. **Exceptions.**

1. In cases where an existing fence and landscaping is present, the planning and development services director shall require dedication of the additional right-of-way but may allow existing landscaping and fences to remain until such time as construction is required in accordance with subsection B. The director shall evaluate the condition of the existing fencing and the character of the landscaping and may direct additional reconstruction of the fence or new plantings. In such cases the landscaping required by the director shall not be greater than that required by this chapter for new projects.

2. The provisions of this subsection shall not apply within the infill development zone "IDZ" as stated in subsection 35-343(e) provided that ADA standards are met.

~~3. Paper Streets. Where subdivisions are adjacent or contiguous to platted rights-of-way and no street exists, (including paper streets) no building permit shall be granted or any utility connected until one-half (½) of the road is constructed adjacent to the proposed development.~~

~~4. Minimum Construction Required. Where the roughly proportionate determination (determination study under section 35-502) has determined that the applicant's development would not generate enough traffic to~~

~~require mitigation for right-of-way dedication or improvements to the pavement cross-section, the provisions of this subsection shall not apply. In such cases, sidewalk ADA standards and a minimum fourteen-feet clear pavement width within the street for emergency access are required and no building permit shall be issued for properties adjacent to paper streets until Exception 3 listed above is met.~~

3.~~5.~~ CRAG Area. Right-of-way and pavement width requirements in established neighborhoods within the CRAG area may be reduced by the director of development services based on existing encroachments.

(10) **Curbs and Parkways. ~~Pavement.~~** ~~Curbs shall be required on both sides of all interior streets. Curbs and pavement are required on the development side of all adjacent streets except:~~

A. Curb and Gutter. Concrete curbs or monolithic curbs and gutters shall be constructed on both sides of a street in accordance with the City of San Antonio standard details where indicated in Table 506-3 or Table 506-4 except:

1.~~A~~ When the director of ~~planning and~~ development services or county engineer in consultation with the director of transportation and capital improvements ~~public works~~ determines that the curbs will interfere with or disrupt drainage.

2.~~B~~ When the director of ~~planning and~~ development services or county engineer in consultation with the director of transportation and capital improvements ~~public works~~ determines that public construction that would require curb replacement will take place on the street within three (3) years.

~~C. On local type A streets in single-family or two-family residential subdivisions within the "RP" and "RE" zoning districts.~~

~~D. On streets in residential subdivisions where no adjacent lots are platted if approved by the director of planning and development services, such as streets adjacent to walls where no sidewalk is required under 35-506(q) or drainage ways.~~

3.~~E~~ Where the director of ~~planning and~~ development services determines that preservation of trees warrants the elimination, reduction in width, or modification to the curb requirements in accordance with the tree preservation standards.

4.~~F~~ On streets utilizing a county road section as allowed in 35-506(b)(1) ~~When densities of less than two (2) units per acre exist and a county section for local streets~~ is proposed in the ETJ.

5. When one-half of an arterial section is proposed to be constructed, one side of the curb may not be constructed if the proposed pavement width is less than 36 feet.

B. Medians and Dividers.

1. Medians and dividers having curbs shall be constructed in accordance with the approved cross section. The parkway slope requirements of C below shall be met.

2. For streets without curb, slopes shall meet the preferred requirements specified in the latest version of the "TxDOT Roadside Design Manual" at a minimum.

C. Parkways.

1. Landscaping, walls or fences placed in the parkway for aesthetic purposes shall not obstruct sight distance. ROW permits from the appropriate permitting authority must be obtained before adding any of these improvements in the ROW.

2. Parkway slopes between a curb and back of sidewalk for standard parkways shall have a slope of one-quarter (0.25) inch per foot toward the street.

3. Parkway slopes outside of the area noted above, shall continue a slope of one-quarter (0.25) inch per foot toward the street except in heavy cuts. In heavy cuts, a slope of one (1) inch per foot toward the street outside of the area mentioned above is preferred; however, the slope shall not exceed a slope of four (4) inches per foot toward the street.

4. Parkway slopes inside a curbed median shall meet the requirement of subsection C3 above.

5. For streets without curb, slopes shall meet the preferred requirements specified in the latest version of the "TxDOT Roadside Design Manual" at a minimum.

6. Deviations from this section are considered an exception and not a variance.

* * * * *

(12) **Design Speed.**

* * * * *

B. **Special Considerations.** The following minimum design speeds shall be used for the following street types or specified condition:

1. Local Type B:

i. If houses are fronting this street, the design speed shall be thirty (30) miles per hour.

ii. If no houses are fronting this street, the design speed shall be thirty-five (35) miles per hour.

iii. If street has a median, the design speed shall be forty (40) miles per hour.

2. Collector:

i. If street has a ~~raised~~ median, the design speed shall be forty-five (45) miles per hour.

ii. If street does not have a ~~raised~~ median, the design speed shall be forty (40) miles per hour.

3. Turn bay design. Turn bays shall be designed in accordance with the TxDOT design manual for the minimum taper and storage lengths. The deceleration length shall be determined using one of the following:

i. Using a differential speed of twenty (20) miles per hour from the street's design speed if using the TxDOT Design Manual tables; or

ii. Using a differential speed of ten (10) miles per hour from the street's design speed if the stopping sight distance is calculated based on the design topographic conditions.

* * * * *

(e) **Connectivity.**

* * * * *

(5) **Dead-End Streets.** Dead-end streets shall be prohibited except as short stubs to permit future expansion. A "short stub" is defined as being the average depth of the adjacent lot(s) within the subdivision, being a maximum of one hundred fifty (150) feet. Stub outs greater than 150 feet as measured from intersecting street ROW line (see Figure 506-6.1) ~~one (1) lot in depth~~ may be allowed with the dedication of a turnaround easement and construction of the turnaround facility. At a minimum, the pavement design of the turnaround facility shall be 2" HMAC and 8" of Grade 1 or Grade 2 flexible base.~~For adjacent lots greater than one-half (½) acre, a stub street may require a turnaround easement.~~

A recorded easement may be used to address this provision of future street extensions. It is specifically noted however that such easements are for unique situations where a stub out enters a retail center zoned either "C-2, "C-3" and "D." Such easements on or through properties zoned "L," "I-1" or "I-2" would normally not be conducive to such an easement but could be considered on an individual basis if the best interest of the public and adjoining property be met.
The use of an easement may be permitted provided it provides for each of the following:

A. The easement shall be approved by the city (development services director and the city attorney's office) prior to recordation in the Bexar County Deed Records.

B. The document provides for an irrevocable access easement granted in perpetuity to the general public and the City of San Antonio.

C. The easement's geometry and width shall equal the UDC's R.O.W width and design standards such as slope and curvature and be above the 100-year floodplain.

D. The easement shall be accompanied by a maintenance agreement that the owner of the property shall maintain the easement in a safe and operable condition and shall correct any safety hazards or eminent needs if such is determined to be required by the city in order to protect the public utilizing the easement.

* * * * *

(7) **Secondary/Additional Access.** ~~At least one (1) access point into a single-family residential subdivision shall be provided for every two thousand six hundred forty (2,640) feet (one-half mile) of frontage.~~ Where a single-family residential or multi-family subdivision exceeds one hundred twenty-five (125) dwelling units and has a minimum of four hundred (400) feet of frontage, additional access points to an existing and/or proposed collector and/or arterial street shall be required. ~~a secondary access will be required. The secondary access shall meet the same requirements as the primary access (an entry for emergency purposes only shall not be allowed in place of a secondary access.)~~

A. **Buildable lots or dwelling units.** Developments exceeding one hundred twenty-five (125) buildable lots or dwelling units shall provide secondary access.

1. For multi-phase developments with a Master Development Plan or Planned Unit Development Plan that has been approved by the City of San Antonio, the construction of the permanent secondary access point(s) may be deferred under the following conditions while development is on-going:

i. When subdivision plats associated with the Master Development Plan or Planned Unit Development Plan exceed 125 buildable lots or dwelling units but are less the 250 buildable lots, a temporary emergency access road should be identified in accordance with subsection (B). If a performance bond is issued, the cost of the temporary access shall be included in the performance bond. As a condition of releasing the performance bond, the cost of temporary access must be included in the extended warranty bond except when there are private streets. The construction of a temporary access road will be required at the end of the warranty period for the most recent associated subdivision plat that exceeded 125 buildable lots or dwelling units cumulative in the development if construction of a connecting unit has not started; or

ii. When subdivision plats associated with the Master Development Plan or Planned Unit Development exceed 250 buildable lots or dwelling units but are less than 500 buildable lots, a temporary access road must be constructed in accordance with subsection (B).

iii. When more than 500 buildable lots or dwellings units are proposed, permanent additional access point(s) must be constructed or have a Performance Agreement in place per 35-437.

2. Temporary emergency access shall not be allowed for developments without a Master Development Plan or multi-phase Planned Unit Development Plan.
3. Permanent secondary/additional access must be constructed no later than at the time of construction of the infrastructure associated with the final plat for development.

B. **Temporary Emergency Access Road.** When allowed in subsection (A), the following minimum criteria shall apply to the construction of the temporary emergency access road:

1. Pavement/Drainage Design:

i. Locate within a Private Easement;
ii. Minimum 20 feet unobstructed width;
iii. Designed to support 75,000 pounds of total load;
iv. 6-inch moisture conditioned subgrade, geotextile reinforcing fabric underlayment, or lime-treatment may be used for subgrade as determined by the project engineer;
v. 6-inch aggregate base Type A, Grade 1 or Grade 2;
vi. 1.5-inch Type D HMAC, 2-inch Type C HMAC, or Two-Course Chip Seal following TxDOT Specifications;
vii. Finished surface to follow natural grade of the land to the extent practicable up to a maximum slope of 12%; and
viii. Provisions for surface drainage shall also be provided where necessary, as determined by the project engineer.

2. Other Criteria:

i. Minimum Vertical Clearance shall be 13 feet and 6 inches;
ii. A crash gate or knox box gate may be used in accordance with section 35-506(j)(7); and
iii. Signage as required to identify the emergency access location and route must be provided.

C. **Schools.** Schools shall be provided an additional access based on building permit. Temporary access roads cannot serve as additional access for a school.

D. **Gated Subdivision.**

If the development has a gated entrance, the additional access point shall function in the same full access manner as the primary access (i.e., entries for emergency purposes only, exit only, or entrance only shall not be considered an additional permanent access point).

E. **Exceptions.**

1. If the primary access point is located off a street that does not provide thru access, the additional access point to be used for secondary access may not be located off the same street of the primary access. An administrative exception may be granted by the director of Development Services in accordance with TCI Director for inside city limits and with the county engineer for the ETJ, in accordance with subsection (2) below:

2. Developments containing a Collector or larger street, shall be extended to connect to another Collector or larger street unless one of the following is encountered:
   i. A Conservation Easement blocks the connection;
   ii. Existing Development does not have a projecting Collector Street to connect to;
   iii. An easement and/or intervening parcel where the easement holder and/or landowner will not grant access under any circumstance;
   iv. Floodplains within the limits of the development have not been modified to add additional developable area; or
   v. When minimum access spacing requirements do not allow for additional access points within the frontage of the property.
   vi. Other conditions will require a variance to this section of the code.

* * * * *

(f) **Street Intersections.** Streets shall intersect at an angle of not less than sixty (60) or more than one hundred twenty (120) degrees.

A. The centerline offset of intersections shall be at least:

1.~~A.~~ One hundred twenty-five (125) feet at local type A streets intersecting with local type A streets.~~;~~

2.~~B~~ One hundred fifty (150) feet or the minimum distance to accommodate a turn lane as required under subsection 35-502(e)(2)~~(a)(7(9)(d)~~ at streets intersecting with a collector.~~;~~

3.~~C~~ Two hundred (200) feet or the minimum distance to accommodate a turn lane as required under subsection 35-502(e)(2)~~(a)(7(9)(d)~~ where collectors intersect with one another.~~;~~

4.~~D~~ Four hundred (400) feet or the minimum distance to accommodate a turn lane as required under subsection 35-502(e)(2)~~(a)(7(9)(d)~~ where collectors intersect with an arterial.

B. The minimum straight tangent length for a curvilinear street or a street segment coming out of curve that will be stopped controlled heading into an intersection shall be at least:

1. Twenty-five (25) feet measured at a ninety (90) degree angle from the intersecting projected ROW for Local Type streets.

2. Fifty (50) feet measured at a ninety (90) degree angle from the intersecting projected ROW for Collector streets.

3. One hundred (100) feet measured at a ninety (90) degree angle from the intersecting projected ROW for Arterial streets.

* * * * *

(h) **Street Names, ~~and~~ Signage, and Pavement Markings.**

* * * * *

(3) **ETJ.** Within the city's extraterritorial jurisdiction, street name signs shall be installed at all intersections within and abutting the subdivision. Such signs shall be manufactured and installed by the subdivider in accordance to specifications of, and subject to plan reviews and inspections by the county ~~city~~ department of public works.

(4) **Warning and Regulatory Traffic Signs.** ~~Within the city limits,~~ Regulatory ~~regulatory~~ and warning traffic signs shall be installed within and abutting the subdivision in accordance with the "Texas Manual on Uniform Traffic Control Devices (TMUTCD)," as required by the city's development services department or county's department of public works. Such signs shall be manufactured and installed by the subdivider in accordance to specifications of, and subject to plan reviews and inspections by the city's development services department or county's department of public works. Warning and regulatory signs shall not be accepted by the city until the street has been accepted for maintenance by the city.

(5) **Street Name Changes.**

Requests for public street name changes and street memorial designations within the city limits shall be submitted to the development services department. An application and processing fee as specified in Appendix "C" shall be paid to the director of development services for each street name change request in accordance with Chapter 6, Division 6, Changing of Name of Street, of the City Code of San Antonio, Texas ~~prior to consideration of the request by the city council~~. Additionally, an installation fee as specified in Appendix "C" for each sign that needs to be changed per each street intersection shall also be paid at the time of application submittal ~~prior to the city council consideration~~. The installation fee shall be refunded if the request is not approved.

(6) **Pavement Markings.** Pavement markings shall be installed within the scope of the subdivision in accordance with the latest version of the "Texas Manual on Uniform Traffic Control Devices (TMUTCD)," as required by the city's development services department or county's department of public works. Such markings shall be manufactured and installed by the subdivider in accordance to specifications of, and subject to plan reviews and inspections by the city's development services department or county's department of public works.

(7) **Raised Blue Pavement Markers.** Raised blue pavement markers in accordance with the latest version of the "Texas Manual on Uniform Traffic Control Devices (TMUTCD)," shall be installed in the center of a street or safety lane at fire hydrant locations as required by the city's development services department or county's department of public works.

* * * * *

(i) **Street Lights.**

* * * * *

(2) In subdivisions in residential ~~within the "RP" or "RE"~~ zoning districts, which do not exceed one (1) ~~two (2)~~ dwelling unit ~~units~~ per acre, the director of ~~planning and~~ development services may waive the requirement for streetlights for public street intersections or mid-block areas where he finds that the area does not require such lighting for safe pedestrian or vehicular traffic.

* * * * *

(j) **Private Streets.**

(1) **Applicability.**

A. Private streets are permitted within planned unit developments, the business park "BP" zoning district, and manufactured home/recreational vehicle parks subject to the design criteria and standards of this section.

B. Private streets are only allowed within an enclave subdivision subject to being designed and constructed to the standards of a public street.

C. Private streets shall be located within a private street lot identified as "Lot 999."

D. The subdivision plat name shall prominently indicate the type of private street development (e.g., "planned unit development", "PUD" "Enclave).

(2) **Design Standards**. With the exception of enclave subdivisions, the ~~The~~ design standards and construction specifications of private streets shall be the same as for public streets except as noted below:

A. A right-of-way of fifty (50) feet for a local type A streets and sixty (60) feet for local type B streets shall not be required.

i. Private street lot should extend a minimum of two (2) feet outside of the face of curb.

ii. Regulatory sign easements shall be provided if regulatory and warning signs cannot be located within the private street lot.

B. The paved street width, exclusive of curb exposures, shall be a minimum of twenty-seven (27) feet for local type A streets and thirty (30) feet for local type B streets.

(3) **Certification.** Upon completion of construction, the director of ~~planning and~~ development services and county in the ETJ shall be provided with a written

certification signed by a licensed professional engineer certifying that the private streets and sidewalks (as applicable) were designed and installed as required by the provisions of this chapter.

(4) **Maintenance.** Private streets and sidewalks shall be owned and maintained by a corporation, community association, or other legal entity established for this purpose.

A. The applicant shall record a dedicatory instrument covering the establishment, maintenance, and operation of a residential subdivision subsequent to the recordation of the subdivision plat. The applicant shall include with the homeowners' association (HOA) dedicatory instrument a plan for the use and permanent maintenance of the common areas/facilities and demonstrate that the property owners' association is self-perpetuating and adequately funded by regular assessment and/or special assessment to accomplish its purpose. The dedicatory instrument(s) shall include provisions that provide the city or county with permission for access at any time without liability when on official business, and further, to permit the city or county to remove obstructions if necessary for emergency vehicle access and assess the cost of removal to the owner of the obstruction.

B. Any HOA requesting that the city acquire their private streets shall produce documentation that the maintenance schedule set forth in the HOA's original pavement management plan as part of the HOA documents has been followed.

* * * * *

(6) **Parking on Private Streets.** Parking shall be limited to one designated side of the street ~~prohibited~~ on any private street with pavement less than twenty-eight (28) feet in width in accordance with Table 506-4a of this Chapter. The HOA documents may require the HOAs to identify and enforce a no parking restriction in fire lanes throughout the community. ~~and, if utilized on streets thirty (30) feet wide or wider, it must be clearly distinguishable from the movement lanes.~~

(7) **Gated Subdivision Streets.** When a gate will be installed on a private street, the following provisions shall be met:

A. Master Key Security System. An access security system shall be provided on all gates. The security system shall include the following for the specified type of gate:

i. Electric Operated Gates:

1. In the ETJ, a siren operated sensor in conformance with the "Bexar County Rules for the Regulation of Electric-Operated Gates" is required; and

2. A gate override in case of power failure; or

3. Inside the city limits,

a. An access provided to the school district, and police department; and

b. A Knox box for the fire department.

ii. Non-electric Operated Gates:

1. A Knox box. In the ETJ, provide key or code of the knox box to Bexar County Office of Emergency Management.

B. Queuing. At gated entrances where traffic can queue into public streets, the gate and entrance design must provide for sufficient storage capacity so that no vehicles will queue into the public street. Queuing at a gated entrance shall be designed as follows:

i. The Poisson distributed probability model shows that no vehicles will queue into the public street with a ninety-five (95) percent confidence level. The minimum entryway vehicle storage length shall be forty (40) feet measured from the call box to the public right-of-way as shown in Figure 506-11.

ii. The subdivider shall provide for vehicle turnaround capability based on the single unit design (SU-30) vehicle as provided in the 2011 AASHTO Green Book or latest revision thereof or be able to make a three-point turning movement to prevent a motorist from backing on to the public street.

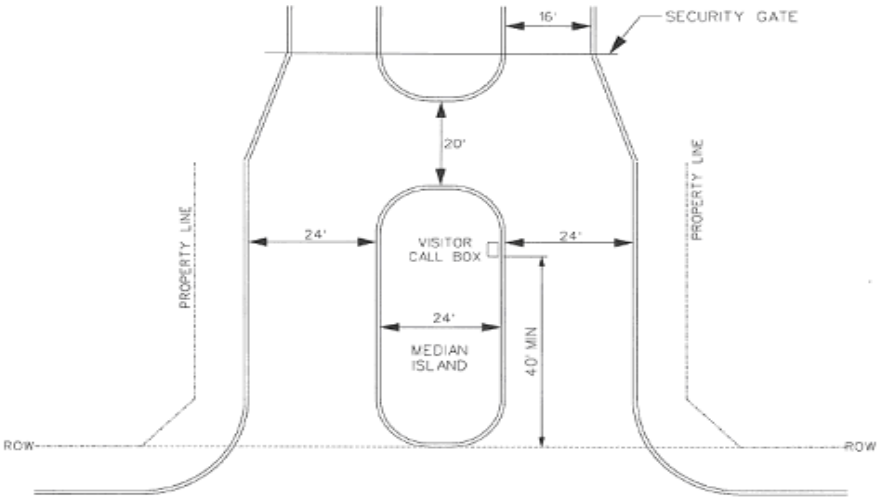


Figure 506-11. Standard Entryway Detail

C. Connectivity. The street system shall comply with the connectivity standards (subsection (e) of this section).

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(l) **Horizontal Curvature.**

*** * * * ***

(3) **"Elbow" Configurations**. An alternative design required by subsection (d) of this section may be used in lieu of the centerline radius of a Local Type street prescribed by subsection (d) of this section. The angle of the elbow configuration shall comply with subsection (f). The point of radius may be relocated along the lines indicated by letters on the figure below (lines AX, AY and AZ). The point of radius shall not exceed a distance of one-half of the typical pavement width ~~fifteen (15) feet~~ from point A. The point of radius of the elbow shall be shown on the plat. The interior curve shall have a minimum property line radius of twenty-five (25) feet. The point of radius may be shifted along the street centerline (lines AX and AZ) see Figure 506-6.

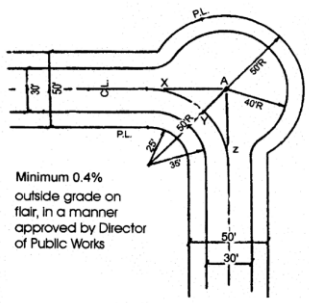


Figure 506-6

* * * * *

(m) **Pavement and Median Transition.** Where cross-section changes occur, appropriate pavement transition shall be provided. Transition shall be described as a ratio of lateral transition width to transition length in feet. The following formulas shall be used in computing appropriate transition:

(1) **Streets with a Design Speed of Less Than 45 MPH.** ~~**Local Street to Local Street, Local Street to Collector, Collector to Collector**~~

$$L = WS^2/60$$

Where: L = Transition length in feet measured along the centerline of the street.
W = Transition width measured as the difference in pavement width from the centerline to the pavement edge of the two (2) cross-sections.
S = Design speed for the street found in table 506-3 or table 506-4.

(2) **Streets with a Design Speed of 45 MPH or higher.** ~~**Arterial Streets Except Freeways**~~

$$L = SW$$

Where: L = Transition length in feet measured along the centerline of the street.
S = Design speed for the street found in Table 506-3 or Table 506-4.

W = Transition width measured as the difference in pavement width from the centerline to the pavement edge of the two (2) cross-sections.

(3) **Median or Center Dividers.** Median or center dividers will also be transitioned. Median transition shall generally parallel the pavement transition to a point where the median width is four (4) feet at which point the median shall be rounded off with a two-foot radius. Median or divider transition shall be designed so that abrupt offsets are not created at intersections.

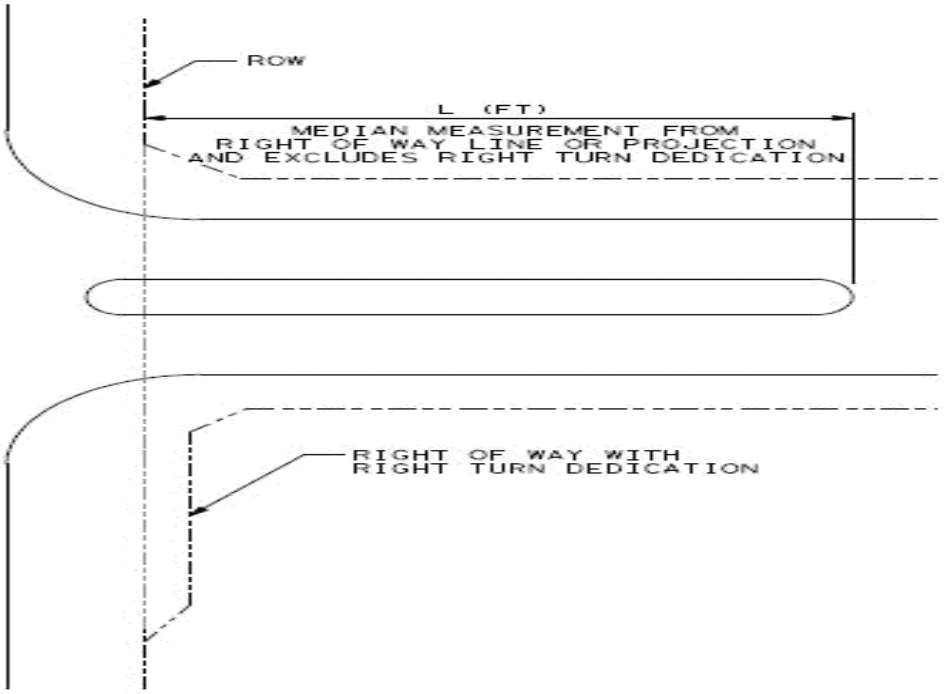
* * * * *

(n) **Medians.**

(1) **Openings.** Medians shall be continuous. Openings in the median may be provided for public streets or major driveways (having one hundred (100) peak hour trips (PHT) or more) provided the spacing between median openings is in accordance with table 506-5.1, will not obstruct an intersection clear vision easement or stopping sight line distance, meets the minimum spacing requirements, and will not impact an existing intersection as specified in 35-502(d). When medians are open, left turn bays and median radii shall be provided in accordance with subsection 35-502(e)(2) ~~and curbed~~. Existing medians shall be modified to conform to these requirements where necessitated by the traffic generated by the proposed development, as set forth in the traffic impact analysis (see subsection 35-502(e)(2) of this chapter). Where existing streets are improved, dual left turn lanes can be approved if supported by a TIA (see section 35-502).

In determining if a median opening request should be approved, the city will require a traffic engineering analysis by a licensed professional engineer. The median opening analysis shall be at the expense of the requestor.

Figure 506-6.1 Methodology to Measure Median Opening Distance from a Projected Right-of-way Line of an Intersecting Freeway or Arterial:



* * * * *

(2) **Special Purpose Medians**. Dividers constructed for aesthetic purposes such as entrances for subdivisions or landscaping shall be permitted. The minimum width for such dividers is fourteen (14) feet with minimum twenty (20) feet of pavement width on either side of the median. The divider shall maintain the full width for a minimum twenty-five (25) feet but not more than fifty (50) feet after which an appropriate transition shall be provided in accordance with standards for pavement and median transition (subsection (m), above). The length of the median ~~twenty-five (25) feet~~ shall be measured from the edge of pavement of the ultimate width of the intersecting roadway. The nose or rounded portion of the divider shall be placed a minimum of two (2) feet off the edge of the traveled roadway of the intersecting street unless the turning radius of vehicular traffic or conflicts with an ADA street crossing indicates other modifications to the median nose are required. No signs, walls or fences, trees, shrubs or other ground cover shall be placed in the median which will obstruct the driver's sight distance (See Figure 506-7). The median design and exceptions to pavement width adjacent to median must be approved by the director of ~~planning and~~ development services in consultation with the director of public works. In addition, the director shall seek concurrence from the applicable county authority for all proposed medians located in the ETJ.

Landscaping shall be in accordance with current landscaping standards (section 35-511) design standards. In addition, appropriate maintenance agreements shall be made with the director of ~~planning and~~ development services.

* * * * *

(p) **Pavement Standards.**

* * * * *

(5) **Roadbed Soil.** A soil investigation must be performed for the design of pavement structures by a geotechnical engineer licensed in the State of Texas in accordance with the City's Design Guidance manual. The number of borings and locations shall be sufficient to accurately determine the stratum along the route. Any existing soil information that is available either from the city or from private sources will be evaluated and, if determined to be applicable and valid, will be allowed in place of new soil tests.

Roadbed soil having a plasticity index (P.I.) greater than twenty (20) shall be treated with lime to reduce the P.I. below twenty (20). Application rate of lime shall be determined based on laboratory testing. In no case shall the lime be less than fifteen (15) pounds/S.Y. for six (6) inches of lime treated subgrade. Lime treated subgrade will be included as a "structural layer" within the pavement design calculations. Proposals for stabilization alternatives in place of the use of lime will be considered upon submittal of an engineering report verifying adequate stabilization of the highly plastic soil.

Where the roadbed is in a rock excavation a "structural layer" within the pavement design calculations can be used that is equivalent to a structural layer for lime stabilized subgrade. If a roadbed structural layer is used in the pavement calculation for rock subgrade an engineering report will be provided to public works addressing the consistency of the subgrade prior to base placement.

* * * * *

~~(8) Curb and Gutter. Concrete curbs or monolithic curbs and gutters constructed in accordance with the City of San Antonio standard details shall be provided where indicated on the typical cross sections provided in subsection (d) of this section.~~

~~(9) Medians and Dividers. Medians and dividers having curbs shall be constructed in accordance with the approved cross section. Where divider strips on primary and secondary streets are constructed without curbs, they shall be graded to a slope of one-quarter (0.25) inch per foot from the center of the divider strip to a point seven (7) inches from above the edge of pavement and from that point to the edge of pavement.~~

~~(10) Parkways. Parkway slopes shall be one-quarter (0.25) inch per foot toward the street except in heavy cuts, where a maximum of one (1) inch per foot shall be permitted. Landscaping, walls or fences placed in the parkway for aesthetic purposes shall not obstruct sight distance.~~

* * * * *

(q) **Sidewalk Standards.**

* * * * *

(1) **Applicability.**

A. Sidewalks shall be required on both sides of all ~~internal~~ streets and the subdivision side of all adjacent or perimeter streets except as specified in subsection (2) below.

B. All nonresidential, residential corner and reverse residential street lots shall have sidewalks provided on both street frontages.

C. Sidewalks shall be required as part of the street improvements at the following locations: ~~only on one (1) side of subdivision entry streets unless residential lots are platted or planned to be platted on both sides of the street.~~

i. along the entry street of a gated private street subdivision where a pedestrian access gate is provided;

ii. the rear of a reverse residential street lot.

iii. drain crossings.

iv. along the street frontage of existing developed lots when streets are extended.

D.~~C.~~ Sidewalks located in the right-of-way in place at the time of platting or permitting that meets the criteria under 506(a)(1)C2 for sidewalks to be evaluated, which ~~that~~ do not meet minimum standards of this chapter, Americans with Disabilities Act and Texas Accessibility ~~ADA~~ Standards ~~standards~~ requirements shall be reconstructed to meet the most stringent minimum ~~ADA~~ standards.

E.~~D.~~ All sidewalk construction shall conform to the latest most stringent criteria of the Americans with Disabilities Act (ADA) and the Texas Accessibility Standards (TAS) (see subsection 35-501(g~~e~~) herein).

(2) **Sidewalk Exemptions.** Sidewalks shall not be required in the following situations:

A. When the director of ~~planning and~~ development services or county engineer, in consultation with the director of transportation and capital improvements ~~public works~~, determines that the sidewalks will interfere with or disrupt existing drainage systems.

B. When the director of ~~planning and~~ development services or county engineer, in consultation with the director of transportation and capital improvements ~~public works~~, determines that public construction which would require sidewalk replacement will take place on the street within three (3) years.

C. On local type A streets in single- or two-family residential subdivisions with a density less than one (1)~~1.0~~ residential unit ~~units~~ per acre.

D. On streets utilizing the county road cross section as allowed in 35-506(b)(1).~~On streets in residential subdivisions where no adjacent lots are platted, if approved by the director of planning and development services, such as streets adjacent to walls or drainage ways.~~

E. Where the director of ~~planning and~~ development services or county engineer, in consultation with the director of transportation and capital improvements, determines that preservation of trees warrants the ~~elimination,~~ reduction in

width~~,~~ or modification to the sidewalk and curb requirements in accordance with the tree preservation standards.

~~F. In developed blocks, where the area is residentially zoned for single-family detached dwellings, and where both of the following conditions exist:~~

~~a. Seventy (70) percent or more of the improved lots fronting the street in any one (1) block face do not have sidewalks; and~~

~~b. A connecting sidewalk does not exist on both sides of the subject property for which construction permits are being sought.~~

(3) **Planting Strips or Sidewalk Buffer .** When required by Table 506-3 or 506-4 above or identified in construction plans, sidewalks shall be defined by placing a planting ~~planted~~ strip or sidewalk buffer ~~of not less than three (3) feet~~ between the back of the curb (BOC) and the street edge of the sidewalk in accordance with the minimum planting strip required by Table 506-3 or 506-4.

(4) **Performance Agreement and Time of Construction.**

A. All sidewalks noted in subsection (1)(C) above shall be included as part of the performance agreement required by section 35-437 of this chapter ~~with exception to sidewalks along street frontage of lots within the city limits for which building permits will be required. All sidewalks within a subdivision must be completed when ninety-five (95) percent of the lots within the subdivision are built out, excluding lots for which a building permit is pending.~~

B. Sidewalks shall be constructed within five years of the abutting roadway construction except as specified in section A above. If roadway construction is not required prior to the issuance of building permits for lots within the City and prior to building construction for lots located outside the City, then the sidewalks shall be constructed prior to building occupancy.

(5) **Width.** Except as otherwise specified in Americans with Disabilities Act (ADA) or Texas Accessibility Standards (see subsection 35-501(g) herein), sidewalks shall have a minimum unobstructed width as follows:

A. In residential areas within the city limits and ETJ the minimum width of sidewalks adjoining a planting strip shall be four (4) feet. In nonresidential areas the minimum width of sidewalks shall be six (6) feet. Sidewalk width does not include curb width.

B. The minimum width of sidewalks located within the boundaries of the "D" downtown district shall be not less than six (6) feet.

(6) **Location.** Changes in the sidewalk location for a maximum linear distance of two hundred (200) feet are permitted to be approved by the field inspector without amending the street plan or utility layout provided such plans are annotated with a note stating that intent and does not relocate an ADA access ramp. If a pedestrian access easement is required, the easement shall be recorded prior to final acceptance. During

the plat review process, reviewing agencies may designate areas where prior approval of the agency is necessary for any alteration to the sidewalk location. No other changes shall be allowed without the approval of all agencies that approved the original utility layout.

(7) **Continuity.** Sidewalks shall not be installed in such a manner that they conflict with or are obstructed by power lines, telephone poles, fire hydrants, traffic/street signs, mail boxes, trees, buildings, barriers, light poles, or any other structure. The grades of sidewalks shall be such that changes of grades greater than ten (10) percent are not encountered within blocks. When there is an existing or anticipated obstruction, the sidewalk shall be installed around the object with a one (1) foot buffer around the object and shall provide the required sidewidth width. When utility layouts are required as part of a plat, the location and extent of sidewalks within the subdivision shall be shown on the utility layout and shall be subject to the approval of the director of ~~planning and~~ development services in consultation with the director of transportation and capital improvements ~~public works~~ and the utility agencies. In the ETJ, all sidewalk along a publicly maintained street or a street proposed to be publicly maintained must be contained within the ROW.

* * * * *

(r) **Access and Driveways.**

(1) **Applicability.** The provisions of this section shall apply to all driveways. A lot which is a part of an approved plat which does not otherwise limit access and which was approved by the city and filed for record as of the effective date of this section, and which does not have sufficient frontage to meet the driveway approach spacing requirements in this section, shall be allowed one (1) driveway approach.

(2) **Single-Family Residential Subdivisions.**

A. **Frontage and Access off a Collector or Major Thoroughfare.** Residential lots having direct access on a Collector or Major Thoroughfare may be platted only if: ~~Where a subdivision abuts a collector or major thoroughfare, lots for single-family residential use in the ETJ or in residential zoning districts shall not have direct access. The sole exception shall be lots~~

i. All lots are greater than one (1) acre in size, have a minimum lot frontage of one hundred (100) feet and ~~which~~ provide for permanent vehicular turn around on the lot to prevent backing onto the roadway. ~~and this restriction should be~~ A note ~~noted~~ shall be on the plat stating a permanent vehicular turn around shall be provided on each lot to prevent a vehicle from backing onto the roadway.

ii. Access points which would permit vehicular access to ~~existing~~ lots less than one acre in size from the thoroughfare or collector may ~~shall~~ be ~~prohibited~~ allowed if ~~.~~ ~~However, if conditions are such that vehicular access to such lots cannot be provided other than from the roadway, the director of planning and development services may permit the creation of~~ a marginal access street or easement to serve two (2) or more lots spaced a minimum of two hundred (200) feet apart or 200 feet from an existing driveway or street is constructed. The marginal access street or easement

shall be designed to permit entry to the roadway without requiring a motorist to execute a backing maneuver. Marginal access streets or easements shall be included on the subdivision plat and shall be constructed or bonded in accordance with Section 35-437 before recordation of the plat.

B. **Marginal Access Streets**. Where the subdivider furnishes a marginal access street on the subdivision side of an existing, improved primary or secondary arterial, the subdivider shall not be required to furnish any pavement, curbs, or sidewalks for the primary or secondary arterial. (see also: subsection 35-506(q)(5))

~~(~~C.~~)~~ ~~Collector sections are required for a minimum of forty (40) feet off of an arterial to prevent construction of residential driveways closer than forty (40) feet from the arterial's end of property line return, or if a local type B section is designed, a~~ A residential lot shall be located ~~not side the arterial for~~ a minimum of forty (40) feet from an arterial right-of-way.

(3) **Commercial, Industrial and Medium or High Density Residential Developments.** Lots proposed for ~~in~~ commercial, industrial and multi-family ~~medium or high-density~~ residential developments in the ETJ or in the "MF," "NC," "O," "C," "I-1," or "I-2" zoning districts may have vehicular access from a thoroughfare or collector. However, the number of access points permitted will be based on the following criteria and following the driveway spacing requirements in subsection (7) below, if applicable.~~:~~

~~(~~A~~)~~ For lots with less than two hundred (200) feet of unrestricted frontage, one (1) access point may be permitted;

~~(~~B~~)~~ For ~~for~~ lots with ~~a frontage of~~ two hundred (200) feet or more of unrestricted frontage, one (1) access point for every two hundred (200) feet of unrestricted frontage may ~~will~~ be permitted.

C ~~Driveway spacing will be in accordance with subsection (7) below, if applicable~~. All lots proposed for commercial, development in the ETJ or in "NC," "O," and "C" zoning districts with less than four hundred (400) feet fronting an arterial street shall provide for shared cross access with adjacent lots fronting the arterial, by means of platted common access easement across the lot or recorded deed covenant providing common access across the lot with adjacent lot(s).

(4) **Additional Access Points.** The director of ~~planning and~~ development services (or the Texas Department of Transportation, or county authority, if appropriate) is authorized to permit additional access points under the following conditions:

(A) The additional land; and access points are necessary to ensure the property owner beneficial use of the land; and

(B) The resulting additional ingress and egress of vehicles will not seriously disrupt the flow of traffic on the thoroughfare.

(5) **Location of Access Points**. The specific location of access points will be determined by the director of ~~planning and~~ development services (or by the Texas

Department of Transportation or county authority, if appropriate) at such time as a site plan is reviewed prior to the issuance of a building permit. The location shall be based on the following criteria:

(A) The location shall minimize conflicts with vehicle turning movements;

(B) The location shall be located as far as practicable from intersections; and

(C) The location shall be not less than fifty (50) feet from another driveway location.

If this standard is not possible, based upon the frontage of the property, the location shall be directed as far as practicable from the other driveway locations. Driveways along an arterial within four hundred (400) feet of a major intersection, such as the intersection of two (2) arterial streets or the intersection of a collector and an arterial street, may be restricted to right turn movements.

(D) Not located within an auxiliary lane.

(6) **Driveway Throat or Vehicle Storage Length.** For purposes of this subsection, "throat length" means the length of extending from the entry into the site at the property line, to the first conflict or intersection with a parking aisle. Vehicle storage length means the length of a driveway, service lane, bay, or other passageway for motor vehicles which is designed to minimize queuing onto surrounding streets. Throat length shall be designed in accordance with the anticipated storage length for entering and exiting vehicles to prevent vehicles from backing into the flow of traffic on the public street or causing unsafe conflicts with on-site circulation. Throat length and vehicle storage length shall not be less than the standards set forth in Table 506-7 unless approved by the director of development services. These measures generally are acceptable for the principal and secondary access to a property and are not intended for minor driveways such as residential driveways serving less than four (4) homes, or a commercial/industrial driveway with less than four hundred (400) ADT, or forty (40) average peak hour volume of vehicles, not located on a major roadway (see note under Table 506-7) or thoroughfare. The throat length may be reduced to no less than twenty (20) feet measured from the outside of the right-of-way by the director of development services by administrative exception. Throat lengths of less than twenty (20) feet from the outside of the right-of-way may be only be approved in accordance with section 35-482.

Table 506-7
Minimum Driveway Throat Lengths for Collectors and Arterials*

Land Use	*Throat Length or Vehicle Storage Length*
Shopping Centers > 200,000 GLA or nonresidential developments > 400 PHT per driveway	Throat length two hundred (200) feet or as required by the TIA
Nonresidential development between 200 and	Throat length seventy-five (75) feet or as

400 PHT per driveway	required by the TIA
Nonresidential development less than 200 PHT per driveway or other major driveways not otherwise enumerated in this table	Throat length forty-foot minimum
Residential subdivision entryway (Private, gated entries)	Poisson distributed probability model at a ninety-five (95) percent confidence level. In addition, the subdivider shall provide for vehicle turnaround capability based on the single unit design vehicle as provided in the AASHTO Green Book, or latest revision thereof. The minimum entryway vehicle storage length shall be forty (40) feet measured from the call box to the public right-of-way. See Figure 506-11
Single-lane drive-in banks	Sufficient to accommodate minimum queue of six (6) vehicles
Drive-in banks with more than one (1) lane	Sufficient to accommodate minimum queue of four (4) vehicles per service lane
Single-lane drive-through car washes	Sufficient to accommodate minimum queue of twelve (12) vehicles
Automatic or self-serve car washes with more than one (1) bay	Vehicle storage of sixty (60) feet per bay
Fast-food restaurants with drive-through window service	Sufficient to accommodate minimum queue of eight (8) vehicles per service lane
Gasoline service stations with pump islands perpendicular to the pavement edge	Minimum thirty-five (35) feet between pump islands and right-of-way
Dry-cleaning establishments with drive-through window service	Sufficient to accommodate minimum queue of three (3) vehicles

* Note: May include local B roadways with traffic volumes above eight thousand (8,000) vpd where a major driveway (over 40 PHT) is being proposed that would affect exterior traffic.

Commentary: The throat lengths in Table 506-7 are provided to assure adequate stacking space within driveways for general land use intensities. This helps prevent vehicles from stacking into the thoroughfare as they attempt to access the site. High traffic generators, such as large shopping plazas, need much greater throat length than smaller developments or those with unsignalized driveways. These standards refer to the primary access drive.

(7) **Spacing and Location on Major Thoroughfares.** This subsection applies to driveway approach spacing and location along or adjacent to major thoroughfares.

A. Where a traffic impact analysis is required, driveways shall be spaced in such a manner as to avoid reducing the traffic LOS below that established in the section 35-502 traffic impact analysis. A subdivision of land into two (2) or

more lots fronting a major thoroughfare may not automatically increase the number of driveway approaches allowed over those allowed prior to the subdivision.

B. Along either side of any corner commercial or industrial property a ~~the~~ driveway approach when allowed ~~approaches~~ shall be located so as to maintain a minimum distance from the corner of the intersecting roadways. The minimum distance from the corner to the intersecting roadway is referred to as corner clearance. Corner clearance is measured along the property line from the property line return or flare. Corner clearance shall be established on a plat by providing a one (1) foot vehicular non-access easement. The easement shall extend a minimum of:

i. one hundred twenty-five (125) feet; or

ii. ~~equal to~~ ninety (90) percent of the length of the property along the roadway upon which the proposed driveway approach is to be located and restricted to a right in/out driveway and cannot be located within the limits of the right turn deceleration or acceleration lanes~~, or one hundred twenty-five (125) feet, whichever distance is less. Corner clearance is measured along the property line from the property line return or flare~~.

iii. The corner clearance may be reduced by the director of development services to allow a driveway for development where a driveway may not otherwise be allowed.

(8) **Alignment.** Major driveway approaches, with peak hour trips greater than one hundred (100) pht, accessing major thoroughfares shall attempt to meet the following guidelines:

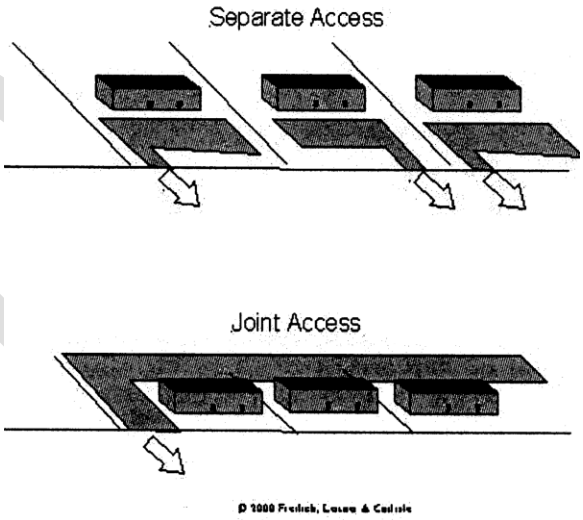


Figure 506-10

A. Align with opposing driveway approaches if any, or shall be offset by one hundred seventy-five (175) feet or more to provide adequate left turn storage capacity in advance of each driveway approach and to avoid the overlap of left turn lanes.

B. Shared among different property owners or users when necessary to maintain minimum spacing requirements.

C. Planned, when possible, to match existing openings in medians. In addition, no cuts through the left turn reservoir of a median shall be permitted in order to provide left turn movements for driveway approaches accessing major thoroughfares or median divided roadways.

(9) **Parking Approaches**. For minor driveways, parking aisles shall be located a minimum of twenty (20) feet from the intersection of the driveway approach and the thoroughfare property line.

(10) **Driveway Approaches.** Driveway approach materials may be asphalt, concrete or other materials as approved by the development services director. Inside the city limits or when a curb is provided in the ETJ, residential ~~Residential~~ driveway approaches materials shall be concrete. Both residential and commercial driveway approaches shall conform to the latest edition of the City of San Antonio Sidewalk and Driveway Design and Construction Guidelines compiled by the department of public works. Commercial two-way driveways and residential driveway approaches may have a width greater than that specified by the guideline if approved by the development services director.

* * * * *

(s) ~~Gated Subdivision Streets.~~ Reserved

~~(1) Pavement Management. The applicant shall include with the homeowners' association (HOA) documents a forecast and schedule of street maintenance costs prepared by a licensed professional engineer, licensed as such by the State of Texas. A maintenance account with seed money shall be established by the developer to enable the HOA to meet the maintenance schedule until the HOA is self-sufficient. Any HOA requesting that the city acquire their private streets shall produce documentation that the maintenance schedule set forth in the HOA's original pavement management plan as part of the HOA documents has been followed.~~

~~(2) Fire Lanes. The HOA documents shall require the HOAs to identify and enforce a no parking restriction in fire lanes throughout the community.~~

~~(3) Master Key Security System. A master key security system shall be provided on all gates. The security system shall include the following for the specified type of gate:~~

~~A. Electric Operated Gates:~~

~~(1) A gate override in case of power failure; and~~

~~(2) A siren operated sensor in conformance with the "Bexar County Rules for the Regulation of Electric-Operated Gates"; or~~

~~(3) Inside the city limits,~~

~~(i) A master key provided to the fire department, the school district, and police department; or~~

~~(ii) A Knox box.~~

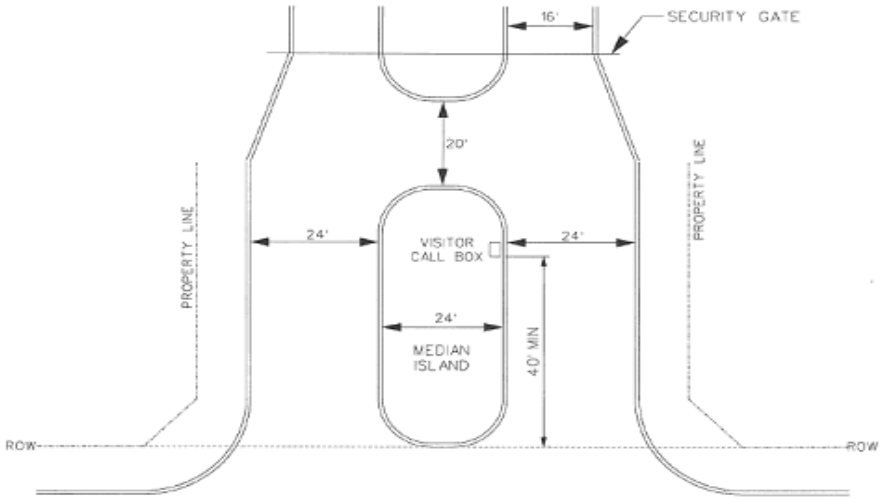
~~B. Non-electric Operated Gates:~~

~~(1) A Knox box.~~

~~(4) Queuing. At gated entrances where traffic can queue into public streets, the gate and entrance design must provide for sufficient storage capacity so that no vehicles will queue into the public street. Queuing at a gated entrance shall be designed as follows:~~

~~A. The Poisson distributed probability model shows that no vehicles will queue into the public street with a ninety-five (95) percent confidence level. The minimum entryway vehicle storage length shall be forty (40) feet measured from the call box to the public right-of-way as shown in Figure 506-11.~~

~~B. The subdivider shall provide for vehicle turnaround capability based on the single unit design vehicle as provided in the 2004 AASHTO Green Book or latest revision thereof or be able to make a three-point turning movement.~~



~~(5) Connectivity. The street system shall comply with the connectivity standards (subsection (e) of this section).~~

(t) **Traffic Calming.** The purpose of this section, is to protect the public health, safety and general welfare by ensuring that speeds on local streets are suitable for their intended purpose. The city hereby finds and determines that long blocks, wide street cross sections and uninterrupted traffic flows can encourage speeding on local and collector streets. Accordingly, these design standards will slow traffic on local streets while allowing flexibility in design and offering applicants the choice of treatment that works best for the streets in a proposed development.

(1) **Applicability**. The provisions of this subsection shall apply to local and collector streets when any traffic control devices are proposed and shall be approved by both the city and the county when located in the ETJ.

* * * * *

Chapter 35, Article V, Section 35-510 is amended as follows:

Sec. 35-510. Buffers.

* * * * *

(a) **Applicability.**

(1) **Activities Subject to Buffer Regulations.** This section shall apply to any of the following, except where exempted pursuant to subsection (2), below.

* * * * *

D. Expansion of an existing parking lot ~~within the street yard~~ by more than two thousand (2,000) square feet or ten (10) percent in area whichever is greater.

* * * * *

(4) **Reduction in Required Bufferyards.** Table 510-2 indicates net minimum bufferyard widths. Such minimum widths shall be provided in a linear fashion along abutting properties where applicable. The width of the bufferyard at any point along its length may be greater or less than the minimum required by Table 510-2 provided that the total calculated area of the bufferyard must remain the same and further provided that the minimum width of the buffer yard at any point is not less than fifty (50) percent of the minimum width indicated by Table 510-2. The net bufferyard area for a property to be developed shall be reduced by no more than fifty (50) percent where:

* * * * *

Table 510-1
Required Bufferyards

	Adjoining Zoning District											*Adjoining Street Classification*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*
Zoning District	*RP***	*RE, R-20,* ***NP-15, NP-10, NP-8***	*R-6, R-5, R-4,* ***R-3,*** *RM-6, RM-5, RM-4, DR***	***MF-18,*** *MF-25, MF-33***	*MF-40, MF-50,* ***MF-65***	*NC*	*O-1,* ***O-1.5,*** *C-1, C-2,* ***C-2P***	*O-2, C-3, BP,* ***MXD, MPCD***	*D*	*L, I-1*	*I-2*	*Major Arterial*	*Minor Arterial*	*Collector*
(1) RP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(2) RE, R-20, **NP-15, NP-10, NP-8**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(3) R-6, R-5, R-4, **R-3,** RM-6, RM-5, RM-4, DR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(4) **MF-18,** MF-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	F	A	N/A	N/A

25, MF-33														
(5) MF-40, MF-50, **MF-65**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A
(6) NC	C	C	B	N/A	N/A	N/A	N/A	N/A	N/A	E	E	B	A	A
(7) O-1, **O-1.5**, C-1, C-2, **C-2P**	C	C*	B	N/A	N/A	A	N/A	N/A	N/A	E	E	B	A	A
(8) O-2, C-3, BP, **MXD, MPCD**	C	C *	C	C	N/A	A	N/A	N/A	N/A	N/A	D	B	B	A
(9) D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
(10) L, I-1	E	E	D	E	E	E	E	N/A	N/A	N/A	N/A	C	C	B
(11) I-2	F	F	F	F	F	E	E	D	N/A	N/A	N/A	C	C	B

* * * * *

Chapter 35, Article V, Section 35-511 is amended as follows:

Sec. 35-511. Landscaping.

* * * * *

(a) **Applicability.**

(1) **Generally.** This section shall apply to any of the following, except where exempted pursuant to subsection (3) ~~(2)~~, below:

A. The construction or erection of any new occupiable building or structure for which a building permit is required.

B. Any enlargement exceeding one thousand (1,000) square feet or ten (10) percent in area, whichever is greater, of the exterior dimensions of an existing building for which a building permit is required.

C. Any construction or reconstruction (complete removal of the pavement structure including surface course and base material) of a ~~new~~ parking lot ~~regardless of size~~.

D. Expansion of an existing parking lot ~~within the street yard~~ by more than two thousand (2,000) square feet or ten (10) percent in area whichever is greater. Parking lots in residential zoning districts shall be subject to the requirements of subsection (e) of this section.

* * * * *

(3) **Exemptions.** This section shall not apply to the following situations:

A. Single-family, duplex, triplex or four-plex residential uses located within a residential zoning district.

B. Agricultural uses.

C. The reconstruction of an existing building of which fifty (50) percent or less of the floor area was destroyed or ruined by flooding, fire, windstorm or act of God. This exemption shall apply only where reconstruction of that building will not result in an increase in building size or paving area of the parking facilities to be provided.

D. The reconstruction of an existing parking lot which consists of fifty (50) percent or less of the existing surface area. In no case shall an expansion of parking lot be considered an exemption for the purposes of this section.

* * * * *

(c) **Mandatory Criteria.**

* * * * *

(2) **Acceptable Landscape Materials.**

A. No artificial plant materials shall be used to satisfy the requirements of this section.

B. Plant materials required by this section shall be consistent with Appendix E and shall comply with the minimum size requirements of Table 511-1 at the time of installation. Plant height shall be measured from the average grade level of the immediate planting area to the top horizontal plane of the shrub at planting, for single trunk trees, the measurement shall be taken at six (6) inches above grade level, and for multi-trunk trees, the tree shall be measured from the average grade level of the immediate planting area.

C. Planting areas shall consist of permeable surface areas only. The permeable surface areas for shrubs may be included within permeable surface areas required for trees.

D. In satisfying the requirements of this section, the use of four (4) inches of organic mulch material shall be provided at the time of planting.

* * * * *

TABLE 511-1

	Minimum Caliper at the Time of Planting	*Minimum Height at the Time of Planting*	*Minimum Planting Area*
Trees	1 ½ inches for single trunk trees	Not applicable unless multi-trunk trees, in which case the tree shall be a minimum of six (6) feet in height at the time of planting	Trees shall be planted in a pervious area of not less than One hundred sixty-two (162) square feet or 18' x 9' as required in parking areas; Two trees: shall have an area of not less than 215 square feet. Each additional tree shall increase pervious planting area by 54 square feet. ~~Stand Alone: One hundred (100) square feet~~

Small Trees	1½ inches for single trunk trees	Six (6) feet for multi-trunk trees	Twenty-five (25) square feet (all trees planted for parking lot shading requirements and/or mitigation shall be planted in a pervious area not less than 162 square feet or 9' x 18' as required by Sections 35-511(C)(7)(C), 35-523(m)(1)
Large Shrubs	Not applicable	Two (2) feet	Nine (9) square feet
Small to medium Shrubs	Not applicable	One (1) foot	Eight (8) square feet

Reference 35-511(C)(7)(C): Trees shall be planted within an island not less than nine (9) feet wide by eighteen (18) feet deep or 162 square feet.

35-523 (m)(1): Mitigation or replacement trees required by this section must have a minimum caliper of one and one-half (1.5) inches measured six (6) inches above grade at the time of installation and, shall be planted in a pervious area of at least one hundred sixty-two (162) square feet per tree.

* * * * *

(6) **Irrigation.** Landscaped areas shall be irrigated with a system that is suitable for the type of plantings installed. An irrigation system will be required on projects when any one (1) of the following are used to meet the requirements of this chapter:

A. An area greater than two thousand (2,000) square feet of new landscape; or

B. More than ten (10) trees will be installed; or

C. Projects which exceed four thousand three hundred (4,300) square feet of impervious surface.

If an irrigation system is not required as above, a hose bib must be installed within one hundred (100) feet of the newly installed plant material. No irrigation is required for turf areas. Where an irrigation system is required, the irrigation system shall comply with the requirements of 30 TAC Chapter 344, §§ 344.60, 344.61, & 344.62. ~~344.72 – 344.77~~ An in ground irrigation system consisting of water lines, water emitters and a controller is required to have a separate water service if the San Antonio Water System is the purveyor. In addition to the above irrigation requirements the following is required:

* * * * *

Chapter 35, Article V, Section 35-514 is amended as follows:

Sec. 35-514. Fences.

(a) **General.**

(1) No fence may be constructed, repaired, or expanded within the city limits without first obtaining a building permit for such work, with the exception of any fence work specifically exempted by Chapter 10, Section 6(e) of the City Code.

(2) **Fence Clear Vision Area.** ~~All fences constructed within the city limits or ETJ shall comply with the clear vision area provisions in section 35-506, Transportation and Street Design, (d) Cross-Section and Construction Standards, 5. Intersection Sight Distance.~~

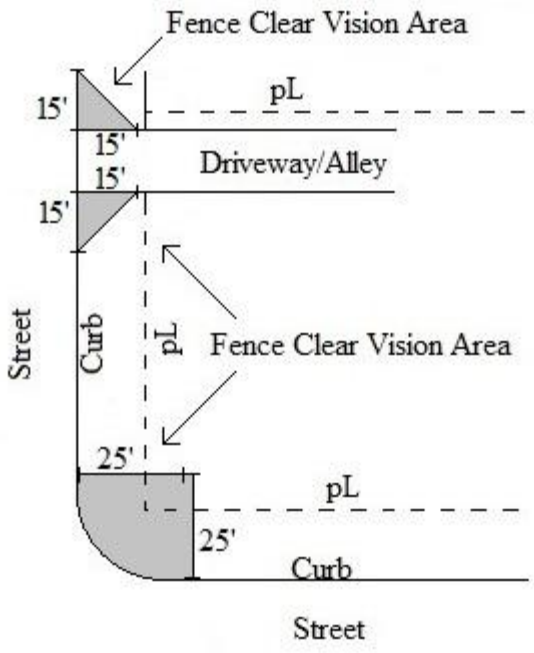
a. **Street Intersections on Residential Corner Lots.** No fence exceeding three (3) feet in height within the city or ETJ shall be erected, constructed, or built on a corner lot within the area formed by measuring twenty-five (25) feet in each direction from the street curb.

b. **Driveway, Accessway, or Alley Intersections on Residential Lots.** No fence exceeding three (3) feet in height within the city or ETJ shall be erected, constructed, or built within a triangle formed by measuring fifteen (15) feet in each direction from the point where a driveway, accessway, or alley intersects with the street curb.

c. **Administrative Exception.** Subsections a. and b. above notwithstanding, where it can be demonstrated that a lesser fence clear vision area would be required utilizing the standards of Section 35-506(d)(5) Intersection Sight Distance, an administrative exception may be granted to allow a lesser fence clear vision area than otherwise would be required for a similarly situated property.

d. **Variances.** Variances to this section may be permissible in accordance with Section 35-482.

e. **Review.** All fence clear vision areas are subject to review by the Development Services Department.



(3) Freestanding walls, not an integral load bearing portion of a structure, whether constructed of masonry or wood framing, shall be considered fencing. Walls connected to a building and designed as a visual and noise barrier between a loading dock or similar use and a residential use, shall not be considered fencing and may extend to a height of sixteen (16) feet and a distance of fifty-five (55) feet from the building. Walls to be constructed in excess of ~~six~~ eight (~~6~~8) feet in height shall require certification by a licensed engineer that the foundation and support structure are designed to sustain wind loads in accordance with the International Building Code.

(4) All solid screen fences allowed to be constructed in excess of ~~six~~ eight (~~6~~8) feet in height shall require certification by a licensed engineer that the foundation and support structure are designed to sustain wind loads in accordance with the International Building Code.

(5) If the subject property is within a historic district, corridor overlay or a neighborhood conservation district the historic preservation officer (or their designee) or the director of development services (or their designee)~~planning and community development~~ shall ~~must~~ make a finding of compliance and compatibility with the provisions of the historic, corridor and/or neighborhood conservation district prior to issuance of a building permit for any fence.

(6) All fences shall be constructed of wood, chain link, stone, rock, concrete block, pre-cast concrete panels, masonry brick, brick, decorative wrought iron or other material(s) which are similar in durability. The following materials shall not be used for fencing:

a. Cast-off, secondhand, or other items not originally intended to be used for constructing or maintaining a fence.

b. Plywood less than five-eighths (5/8) inch thick, plywood not of a grade approved by the Development Services Director ~~code enforcement manager~~, particle board, paper, and visqueen plastic, plastic tarp, or similar material.

c. Barbed wire, razor wire, and other similar fencing materials capable of inflicting significant physical injury; provided, however, that barbed wire may be permitted by right within a governmental facility and through an administrative exception of the development services director for private nonresidential facilities where all of the following findings of fact are made:

1. The barbed wire, where proposed to be located, will not be capable of inflicting significant physical injury to the general public,

2. The fence proposed with barbed wire is located behind a minimum setback line except where surrounded by established industrial uses,

3. The barbed wire is demonstrated by the applicant as a requirement for facility operations and for secured areas within the facility,

4. The barbed wire conforms with the requirements of section 6-2 of the building code.

d. Sheet, roll or corrugated metal.

(7) Variances to this section shall be in accordance with section 35-482

(8) Retaining walls shall not be considered a fence however shall conform to the following requirements:

a. Retaining walls on private property shall be in conformance with the International Building Code.

b. Retaining walls along or within public rights-of-way shall be in conformance with the International Building Code, article IX of chapter 6 of the City Code and where greater than three (3) feet in height shall include plans designed, signed and sealed by a licensed engineer.

c. Where a barrier is required by the International Building Code to be located on the top of a retaining wall, such barrier shall not be considered a fence.

(9) Fences used to display a message shall comply with chapter 28, "Signs and Billboards."

(b) **Fencing Alternatives.**

(1) **Sport Court Fencing.** Fencing, screening and/or back stops for sport courts such as basketball, tennis, batters cages, etc. shall be constructed only in the side or rear yard and shall be located no closer than ~~twenty (20)~~five (5) feet to a side or rear property line of an adjacent single-family use or residential zoning district and/or a public or private street. The maximum height for sport court fencing shall be limited to twelve (12) feet in height ~~in accordance with section 6-2 of the building code~~.

(2) **Large Lot Fencing.** Predominantly open fencing at a maximum height of six (6) feet may be permitted in the front yard of ~~single-family~~ any residential lot~~s~~ with at least twenty thousand (20,000) square feet in area by right and on all other ~~single-family~~ residential ~~zoned~~ lots regardless of lot size by special exception pursuant to section 35-

399.04. Where permitted by right each of the following conditions must be met to construct a six-foot predominantly open fence in the front yard:

A. The primary building ~~is located at least forty (40) feet from the front property line~~ meets the minimum required building setback for the district in which it is located; and

B. The lot has at least one hundred (100) feet of street frontage.

(3) **Fencing of Vacant Lots or Parking Lots.** A predominantly open fence not exceeding a height of six (6) feet may be constructed on a vacant lot or parking lot. However, at such time that a house or structure is constructed on the lot, that portion of the fence constructed in the front yard shall be removed or reduced in height to a maximum of three (3) feet in height for a solid fence and four (4) feet in height for a predominantly open fence unless said lot and fence meet the criteria to allow a higher fence as outlined in this chapter.~~of (2)A., B. and C. above.~~

(4) **Combined Fence.** As defined in section 35-A101 "Fence (combined)" may be permitted in the front yard up to the height allowed for a predominantly open fence provided that the solid portion shall not exceed three (3) feet in height.

(5) **Planned Development.** A planned unit development (PUD) district may designate side and rear yard fence heights up to eight feet in height through a PUD plan adopted by the planning commission pursuant to section 35-413

~~(c) **Fence Design.**~~

~~(1) No fence or wall, other than the wall of a permitted structure, shall be erected or altered in any front yard (that area which lies between the front lot line and that of the nearest principal structure) to exceed a height of four (4) feet with the fence or wall to be so constructed that vision will not be obscured above a height of three (3) feet. Except as otherwise permitted in this chapter no fence or wall, other than the wall of a permitted structure, shall be erected or altered in any side or rear yard to exceed a height of six (6) feet. This subsection shall not apply to fences erected as required by chapter 16, article VII of this Code (Salvage Yards and Auto Dismantlers), or in section 35-510 of this chapter.~~

~~(2) The provisions of subsection (1) above shall not apply to a fence constructed of brick, masonry, or iron fencing which consists of at least fifty (50) percent open voids. The square footage of the fence shall be measured by taking the total square footage of an area defined by the length of the fence and its average height. The percent of open voids shall then be derived by dividing the total square footage of the open voids by the total square footage of the area calculated above, and multiplying this figure by one hundred (100). The fence's framing (the vertical posts supporting the fence from the ground and no more than three (3) horizontal cross bars between the posts, or brick or stone pillars) shall not be included in the calculation of the total square footage, provided the framing posts and cross bars do not exceed a four-inch width and the posts are spaced at least eight (8) feet apart.~~

~~(3) Fences used to display a message shall comply with chapter 28, "Signs and Billboards."~~

(c~~d~~) **Height Limitation.**

(1) Except for the provisions in section (b) above no fence ~~constructed~~ shall exceed the following table of heights. In addition, the maximum permitted fence height shall not exceed that of the maximum permitted fence height for the abutting property except as provided in section (~~d~~c)(2). The board of adjustment may allow fences of greater height by special exception, subject to Section 35-399.04 of this chapter or by variance subject to Section 35-482 if the height of the fence exceeds that height allowances for a special exception. The height shall be the vertical distance measured from the lowest adjacent ground level (either inside or outside the fence) to the top of the tallest element of the fence material, excluding decorative features affixed to the top of any column, pillar or post. The height of any existing retaining walls, either an integral part of a fence or upon which a fence may be erected, shall be calculated in the height of the fence, except in the following instances:

A. The retaining wall is necessary for structural soundness/integrity of building construction on the lot; or

B. The retaining wall is abutting a drainage easement or drainage infrastructure.

Table of Heights
Maximum Permitted Fence Heights

Permitted Use	*Front Yard*	*Side Yard*	*Rear Yard*
Single-Family or Mixed Residential Use	3'0" solid fence 5'0" combined or predominantly open fence Except as provided by (b)(2)	6'0"	6'0"
Multi-Family Use (see also subsection 35-514(f) below)	3'0" solid fence 5'0" combined or predominantly open fence	6'0"	6'0"
Commercial & Office Use	3'0" solid fence 5'0" combined or predominantly open fence	6'0"	6'0"
Industrial Use[1]	8'0"[1]	8'0"[1]	8'0"[1]
~~Parking Lots, Vacant Lots,~~ Government Facilities, Churches, Schools, Swimming Pools, Stormwater	~~3'0" solid fence~~ ~~6'0" combined or~~	~~6'0"~~	~~6'0"~~

Management Facilities, & Parks (Public property, including parks, require HDRC review)	~~predominantly open (see also subsection 35-514(b)(3) above)~~ 8'0"	8'0"	8'0"
Vacant Lots, Parking Lots	3'0" solid fence 6'0" combined or predominantly open (see also subsection 35-514(b)(3) above)	6'0"	6'0"

Footnotes:
[1] This subsection shall not apply to fences erected as required by Chapter 16, Article VII of the Code (Salvage Yards and Auto Dismantlers), or in § 35-510 of this chapter. Buffer fences shall be limited in height in accordance with section 6-2 of the building code.

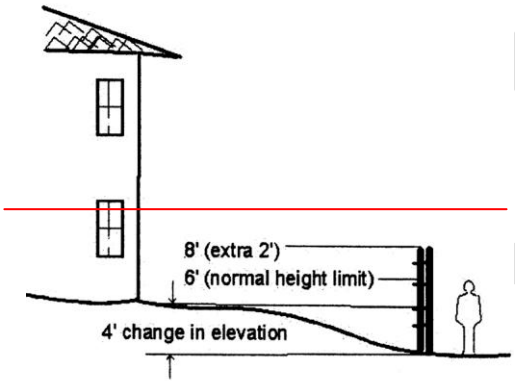


Figure 1: Additional height where home on adjacent lot is 4' higher (subsection (a)(2)B)

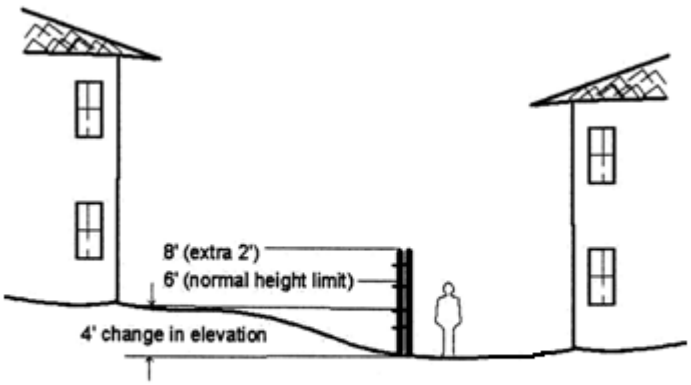


Figure 1: Additional height allowed pursuant to Section 35-514(c)(2)A

(2) Notwithstanding the provisions of subsection (~~d~~c)(1), above, a fence may be erected or altered up to a height of eight (8) feet where:

A. The ground floor elevation ~~within twenty (20) feet or less~~ of either the principal dwelling on the property or the principal dwelling on an ~~either one of the two (2) adjoining~~ abutting lot~~s~~ is at least four (4) feet higher than the elevation at the ~~adjoining~~ shared lot line; or

B. The fence is erected along a side or rear lot line which ~~adjoins~~ abuts an alley or a street with a classification other than a local street~~collector street or arterial street (in which case streetscape planting shall be provided in accordance with section 35-512 of this chapter) as part of a multiple lot residential subdivision~~; or

C. The fence is a sound barrier or ~~fence required by TXDOT or~~ a security fence ~~required by the Department of Homeland Security~~ for a public or institutional use; or

D. The additional fence height is permitted by the city council pursuant to a rezoning or specific use authorization; or

E. The fence is located on a side or rear lot line of a single-family, duplex, or mixed-residential use which abuts a multi-family residential, commercial, industrial, or park use ~~"C-2," "C-3" or more intensive use that does not require a buffer yard~~.

F. In any side or rear yard where a slope is present, the height of a fence may be adjusted to allow the top of the fence to be level, and perpendicular to the support posts at a height greater than six (6) feet, provided that the height of the fence at the highest elevation does not exceed eight (8) feet. In order to maintain a uniform appearance, whenever a fence higher than 6 feet is allowed by this subsection, all side and rear yard fences may be allowed up to 8 feet in height above grade.

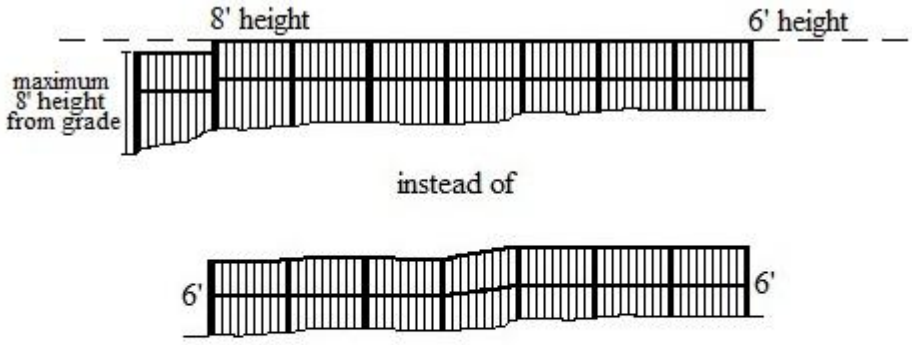
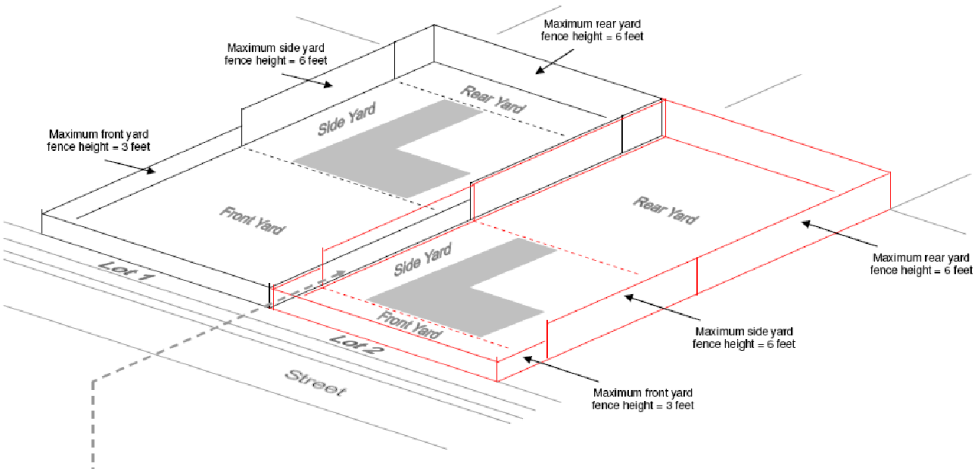


Figure 2: Example of Additional Height allowed pursuant to Section 35-514(c)(2)F.

(3) Notwithstanding the provisions of subsection (~~d~~c)(1), above, a fence may be erected or altered up to the height of the adjacent building where the fence is located entirely on the interior of a lot behind all required building setback lines, attached to the main structure, and used for security purposes or for part of the intended use of the primary structure, such as fencing for outdoor display, for example an outdoor garden area, or lumber yard attached to a home improvement store or a secure, enclosed courtyard area for residents of an assisted living facility.

(4) The following illustration shall be used to determine applicable front, side and rear fence standards:



Notice:
The side yard fence of lot 2 runs along the front yard fence of lot 1. In this area the fence on lot 2 is allowed a 6 feet maximum height, even though the fence on lot 1 is only allowed a 3 feet maximum height.

(~~d~~e) **Fencing Requirements for Uses Adjoining Single-Family Residential Uses.**

(1) All property zoned for nonresidential or multi-family residential uses including residential districts with conditional uses or specific use authorizations for nonresidential uses, excluding property located within the mixed-use district "MXD" or infill development zone "IDZ," shall erect and maintain solid screen (opaque) fencing along the property boundaries adjacent to an existing single-family residential use.

(2) As a minimum, the fencing shall consist of solid screen materials and shall be at least six (6) feet in height except where a lower height is required by subsection (~~d~~c) above. The fencing shall be required to be constructed and finished prior to obtaining the first certificate of occupancy for the newly zoned property.

(3) With the zoning applicant's consent, the city council may modify or exempt the requirements of (~~d~~e)(1) or approve alternative screening measures, such as landscaped buffer yards, when considering a change in zoning, including conditional use and specific use authorization cases.

(4) The fencing requirements of section 35-514 shall apply in zoning cases initiated by the City of San Antonio unless a statement specifically exempting the property from the fence provisions is included in the ordinance approving the zoning.

(ef) **Multi-Family Dwellings.** Multi-family dwellings consisting of twenty-five (25) or more units may erect fences higher than permitted in subsection (cd) within the front yard in accordance with the following criteria:

(1) Fencing shall be limited to a maximum height of six (6) feet and shall be constructed of wrought iron or similar material ~~with a minimum spacing of three (3) inches between vertical bars~~.

(2) Solid screen fencing may be erected within the front yard along side property lines if a three-foot landscape area is provided and maintained outside the fence if it abuts a more restrictive zoning district. The landscape area shall contain a minimum of five (5) shrubs per twenty-five (25) linear feet and shall include ground cover.

~~(3) All requests for fencing in accordance with this subsection shall be reviewed by the fire and public works departments for accessibility of fire equipment and maintenance of clear vision areas.~~

(fg) **Residential Subdivision Perimeter Fencing.**

(1) **Legislative Findings and Purpose.** The city council finds that it is necessary for the public welfare to impose standards to improve and preserve the quality of a subdivision's perimeter fences in residential neighborhoods in order to avoid blighting influences on neighborhoods and public safety problems.

(2) **Applicability.** The requirements of this subsection apply only to fences located along the perimeter of a tract or parcel subject to an application for subdivision plat approval which adjoins a collector or arterial street or a platted multiple lot residential subdivision that adjoins a collector or arterial street.

(3) **Standards.**

A. A fence constructed of wooden boards shall include at least one (1) of the following architectural or landscaping elements for every fifty (50) lineal feet:

1. An offset or column extending at least twelve (12) inches vertically and six (6) inches horizontally from the remainder of the fence; or

2. The fence shall be articulated by means of a recess or a projection extending not less than twelve (12) inches horizontally from the remainder of the fence; or

3. Climbing vines, shrubs or trees shall be planted along the base of that portion of the fence that fronts a public street. The remaining setback area between the fence and property line shall be landscaped with grass or other low ground cover. All plants shall be irrigated and maintained consistent with the provisions of section 35-511 of this article. Only living vegetation may be used to meet these landscaping requirements.

B. All fences shall be maintained by a homeowners association established consistent with the requirements of subsection 35-503(f)(2), above, so as not to create a hazard, public nuisance or blight in the surrounding neighborhood.

* * * * *

Chapter 35, Article V, Section 35-515 is amended as follows:

Sec. 35-515. - Lot Layout Regulations.

* * * * *

(b) **Blocks.**

* * * * *

(3) **Block and Street Length.**

A. **Block Length.** The length of a block where homes front a street within a subdivision or site plan shall be measured from the edge of the property line of the street siding the furthest lot of the block width or to the center of a cul-de-sac, 90° Elbow, or 90° Knuckle.

(i) A street's block length shall not exceed seven hundred (700) feet when the street is a:

- Local type B (with houses fronting),
- Local type A which serves as an entrance street to the proposed neighborhood, or
- Part of a TND use pattern (see subsection 35-207(f)).

(ii) A street's block length shall not exceed one thousand two hundred (1,200) feet when the street is a:

- Block that ends with a cul-de-sac
- Local type A

(iii) Block lengths do not apply to the following unless they transition into a street with houses fronting:

- Local type B
- Collectors or avenues
- Secondary arterials or main streets
- Primary arterials or boulevards
- Freeways or parkways

(iv) In the ETJ, dead end streets or streets with no outlet exceeding seven hundred fifty (750) feet shall provide a fire apparatus turnaround with a spacing not to exceed 750 feet. This provision shall also apply to phased street construction when a street outlet has not been constructed.

B. **Street Length.** The maximum overall length of streets with homes fronting shall not exceed three thousand (3,000) feet. The overall street length shall be measured from the center of the two furthest intersecting streets or from its

intersection with a higher tier street whichever is less. There is no limit to the street length of a street without home fronting.

C. Maximum street or block lengths, except subsection 35-515(b)(3)(A)(i), may be exceeded in accordance with subsection 35-506(st) of this chapter.

(c) **Lots.**

* * * * *

(4) **Frontage**. All lots shall front on a public or private street or platted irrevocable ingress/egress easement and shall have a minimum frontage width as indicated in section 35-310. ~~Where a platted irrevocable ingress/egress easement is utilized for frontage, the private street provisions of section 35-506 for street name and design standards shall be met. Neither the use of an irrevocable ingress/egress easement nor use of a private street shall be allowed to satisfy the major thoroughfare plan requirements.~~ Frontage of a lot shall be determined by the property line of the lot adjacent to the right-of-way of the street upon which the property's address is based. Single-family residential lots shall not front on a collector street, arterial street, or parkway except as specified under subsection 35-506(r)(2). On irregular shaped lots, a minimum street frontage of fifteen (15) feet shall be required. ~~Single-family residential lots shall not front on a collector street, arterial street, or parkway except as specified under subsection 35-506(r)(2).~~ An "irregular shaped lot" includes any lot located on a cul-de-sac or adjoining a curved section of a roadway with a centerline radius of less than two hundred (200) feet. Where a platted irrevocable ingress/egress easement is utilized for frontage, the private street provisions of section 35-506 for street name and design standards shall be met. The ingress/egress easement shall have a plat note prominently displaying: "No structure, fences, walls, or other obstructions shall be placed within the limits of the ingress/egress easement shown on this plat." The ingress/egress easement does not have to be named if;

- It provides access to only a single structure, and the entrance to the ingress/egress easement is from a named road; then the easement will be treated as a driveway and an address assigned at the drive from the named road.
- It provides access to multiple business/family structures and all structures are visible from the named road and can be easily located and addressed with specific addresses off the name road.

Neither the use of an irrevocable ingress/egress easement nor use of a private street shall be allowed to satisfy the major thoroughfare plan requirements.

* * * * *

Table 515-1

(A) *Zoning District or Use Pattern*	*(B)* *Maximum Percent of Front Yard*

TND, TOD, MXD, D, ~~IDZ~~	30%
R-6, RM-6, R-5, RM-5, R-4, RM-4, R-3, MF-25, MF-33, MF-40, MF-50, NC	50%

* * * * *

(h) **Flag Lots.**

(1) Not more than the following number of flag lots may be authorized to allow for the more efficient use of irregularly shaped parcels of land, or where the integrated nature of multiple buildings on a site dictates the need for such lots. Flag lots may be used to better use irregularly shaped properties or sites with physical limitations. Flag lots shall not be permitted where they will increase the number of lots that take their access from collector or arterial streets. Table 310-1 and/or section 35-353 are superseded by the development standards of this section when applied to flag lots as follows:

Table 515-2
Maximum Number of Flag Lots

Size of Subdivision	Maximum Number or Percentage (%) of Flag Lots
10 or fewer lots	2 lots
11—50	20%
51 or more	20%

(2) The minimum driveway width shall be ten (10) feet.

(3) Notwithstanding the provisions above, access to not more than four (4) lots may be provided by a shared driveway.

(4) The minimum frontage at the right-of-way line for any flag lot shall be fifteen (15) ~~equal to the minimum required driveway width plus four (4)~~ feet. The flag pole portion of the lot shall not be considered in determining the area of the lot related to on-site sewage facility suitability.

(5) On flag lots the maximum front setback line shall be measured from the nearest point at which the lot meets the minimum width (as required in Table 35-310-1) parallel to the street on which the lot fronts.

* * * * *

Chapter 35, Article V, Section 35-516 is amended as follows:

Sec. 35-516. – Setback and Frontage Regulations.

* * * * *

(g) **Garages and Carports.** There shall be a minimum of twenty (20) feet between the back of a sidewalk or the property line and any garage entry accessed from a street right-of-way. The garage setback requirement for garages accessed from an alley shall be in accordance with section 25-370. Carports may be erected behind the minimum front setback required in the applicable zoning district, so long as twenty (20) feet of total parking area depth is maintained within the lot. The minimum twenty (20) feet between back of sidewalk or property line and any garage access does not apply to townhouses, and does not apply to properties zoned IDZ where the front building setback is less than twenty (20) feet in compliance with Section 35-343(c)(2).

* * * * *

Chapter 35, Article V, Section 35-523 is amended as follows:

Sec. 35-523. – Tree Preservation.

* * * * *

(a) **Applicability.**

* * * * *

(4) **Trees Exempt.** This division shall not apply to:

* * * * *

D. Trees or areas of tree canopy located in the clear vision area, as defined in the street improvement standards, Section 35-506(d)(5), Intersection Sight Distance.

* * * * *

(b) **Administration.** The provisions of this section shall be implemented by the city arborist under the direction of the director of planning and development services. The city arborist shall oversee regulation of the maintenance and removal of significant or heritage trees or areas of tree canopy and shall enforce and administer the provisions of this section.

The city arborist shall work closely with all city departments and governmental entities and licensees, and franchisees thereof in order to promote and ensure the maximum protection of trees by the implementation and administration of this section. City departments with which the city arborist is authorized to interact pursuant to subsection (p) of this section include, but are not limited to the following:

(1) Department of ~~planning and~~ development services shall coordinate:

A. tree preservation in the review of master development plans, planned unit development plans, subdivision plats, permits and any grading filling and spoil activities when applicable.

B. Maximize ~~and maximize~~ the preservation of tree(s) or areas of tree canopy through the implementation of the city's landscape and streetscape standards and through the approval process contained in this chapter.

(2) In accordance with Section 35-104(b), all city departments or its agencies or instrumentalities ~~Public works and capital improvement management services (CIMS) departments~~ shall maximize the preservation of trees or areas of tree canopy ~~during public works and CIMS projects~~ for public improvements such as, but not limited to, utility installation, street construction and maintenance, drainage construction and maintenance, grading, filling, placement of soil, etc. and coordinate any projects that modify natural drainage areas in a way that negatively affects trees on private property or public property.

* * * * *

(e) **Final Tree Canopy Cover.**

* * * * *

(1) **Standards.** Developments of all sites must provide a minimum final tree canopy cover as listed below for the entire gross project area outside of the regulatory floodplain.

A. Minimum final tree canopy coverage shall be provided at the percentages indicated below:
   i. Single-family residential thirty-eight (38) percent;
   ii. Multi-family and nonresidential twenty-five (25) percent;
   iii. CRAG area fifteen (15) percent;

B. The final tree canopy requirements shall be accomplished after meeting all preservation requirements and other planting requirements as set forth in this chapter;

C. When the Final Tree Canopy is required at platting the city arborist may allow the applicant to defer the minimum tree canopy cover requirements as follows:

   a) To the building permit phase of the development if inside of city limits

   b) Or, to the building phase in ETJ with plans depicting final canopy cover of preserved trees and newly planted trees and the method to assure that the requirements will be met before the issuance of a building permit (35-B123, 35-B125, 35-B107, 35-477, 35-476) (note: per section 35-523(f)(3) Table 523-1B, when using the Tree Stand Delineation option, Tree Save areas must be designated as such when the area is platted)

c) Or, with a guarantee of performance executed and filed with the City of San Antonio.

The city arborist shall determine the probable maximum amount of tree mitigation required (measured in dollars) that may be attributable to the development.

~~C. The city arborist may allow the applicant to defer the minimum tree canopy cover requirements to the building permit phase of the development with plans depicting final canopy cover of preserved trees and newly planted trees and the method to assure that the requirements will be met before the issuance of a building permit or with a guarantee of performance executed and filed with the City of San Antonio. The city arborist shall determine the probable maximum amount of tree mitigation required (measured in dollars) that may be attributable to the development.~~

(f) **Minimum Tree Preservation Requirements.** To comply with the minimum final tree canopy cover requirements of subsection (e) an applicant shall elect either to perform a tree survey to identify trees for preservation in accordance with the provisions of this subsection below or to conduct a tree stand delineation as an alternative to the tree survey technique.

(1) **Protected Tree Designations**. The significant or heritage tree designations establish a threshold trunk size, measured in diameter at breast height (DBH), for various tree species for purposes of applying the requirements of this chapter. A significant or heritage tree is defined by DBH as set forth below. Multi-trunk trees are to be measured with the largest trunk counting for full DBH inches plus 50% of the DBH sum of the additional trunks, if the tree is classified as significant. (Tree species listed below shall have at least one (1) trunk greater than five (5") for small tree species and at least one (1) trunk greater than ten (10") for large tree species to be considered significant). The value of the largest trunk is the value given to the small tree species listed below.

* * * * *

C. **Non-native Trees.** Non-native invasive tree species are not protected and will be omitted from the tree survey. Non-native invasive tree species means the following tree species:

i. Chinese Pistache (Pistacia chinesis);
ii. Chinaberry (Melia azedarach);
iii. Chinese Tallow (Sapium sebiferum);
iv. Tree of Heaven (Ailanthus altissima);
v. Salt Cedar (Tamerix species).
vi. Japanese Ligustrum (Ligustrum japonicum).
vii. Nandina (Nandina domestica).
viii. Paper Mulberry (Broussonetia papyrifera)

* * * * *

(2) **Tree Survey Methodology.**

A. **Standards.** Table 523-1A establishes the minimum percentage of all diameter inches of significant or heritage trees or tree stand delineation canopy area that must be preserved or mitigated. In environmentally sensitive areas the minimum percentage shall include the understory of the preserved trees. For all development projects ~~single family dwellings~~, ~~developers and builders~~ applicants may elect to preserve trees at the MDP, platting or permitting stage; if an applicant ~~developer or builder~~ elects to preserve trees at the MDP or platting stage, this method must be used throughout completion of the project.

* * * * *

(10) **Historic Trees.** In order to protect historic trees, as defined, the city arborist shall defer the approval of tree preservation plans to review by the historic preservation officer who shall seek the advice of the Historic and Design Review Commission ~~historic design and review commission~~ in instances where a historic tree is proposed to be removed. The commission may recommend additional replacement standards, recommend a cash payment to be deposited to the tree mitigation fund to offset the cost of future tree planting on public property, or recommend that the application for permit and tree preservation plan be denied. Provided, however that no later than thirty (30) days after the final application for removal of the historic tree was received, the historic preservation officer shall advise the applicant by certified mail, return requested, or hand delivery of his decision. The final application will be deemed approved if not acted upon by the historic preservation officer before the expiration of the thirty-day time period herein established. Such action may be appealed pursuant to section 35-481 of this chapter.

* * * * *

(g) **Mitigation/Alternative Mitigation Methods.** Significant or heritage trees may be removed in excess of the minimum preservation requirement contained in subsection (f) provided the excess removal is properly mitigated. If mitigation is required to compensate for removing trees in excess of the number of diameter inches allowed to be removed within the surveyed area to be calculated for tree preservation under the minimum preservation requirements, the mitigation may be achieved in one (1) of the ways prescribed in table 523-2, below:

Table 523-2 Mitigation

(A) *Method*	*(B)* *Description*	*(C)* *Restrictions*
Establishment and maintenance of new trees at the required ratio on-site	Significant 1:1 Heritage 3:1 All tree species of Ash (all Fraxinus species) Hackberry	No more than twenty-five (25) percent of the replacement trees shall be of the same species for the purposes of

	(all Celtis species) Huisache, Ashe Juniper and Mesquite will be mitigated at 1:1.	mitigation. Replacement trees must be at least one and one-half (1.5) caliper ~~DBH~~.
Payment to the tree mitigation fund	In lieu of meeting the minimum preservation or final canopy standards of this section, a payment to the tree mitigation fund may be provided in accordance with 35-C110	See subsection (o) tree mitigation fund for the authorized collection and disbursement of these funds.
Protection and maintenance of smaller trees within surveyed area	Protection and maintenance of existing trees within the surveyed area that are smaller than the size requirements for a protected tree.	Such trees must be at least two and one-half (2½) inches DBH. See column B ratios for diameter-inches required.
Protection and maintenance of natural areas within the surveyed area	Protection and maintenance of existing natural areas, i.e., prairie, etc.	Area(s) must contain desirable plants as determined by the city arborist and/or by Texas Parks and Wildlife Dept.

In considering a mitigation method, the city arborist may weigh the value of smaller trees, clumps of trees, and natural vegetation that could be retained to meet the requirements of this section, such as mitigation method above, or the amount of vegetation to be retained on the site and/or added according to a landscape plan to determine the extent additional trees may not be required. For these reasons, indiscriminate clearing of smaller trees and shrubs or understory is discouraged. Small tree species shall be mitigated based on the one trunk that is five (5) inches or greater for significant status and the one trunk that is twelve (12) inches or greater for heritage status. Small tree species that achieve heritage status shall be mitigated on a 1:1 basis.

* * * * *

(i) **Tree Preservation Incentives.**

* * * * *

(11) **Heritage Tree Canopy Credit.** A canopy cover credit of two (2) times the tree canopy area of a heritage tree preserved beyond the minimum preservation requirements may be counted toward meeting the final tree canopy coverage using the tree survey or tree stand delineation method. To use this credit when using the tree stand delineation method a heritage tree survey is required. The minimum root protection zone requirements shall be met to receive this credit. A heritage tree with a tree warranty does not receive two (2) times the tree canopy area credit.

* * * * *

(j) **Root Protection Zone.**

* * * * *

(1) **Root Protection Zone.** A root protection zone must be established around the trunk of each tree preserved or mitigation tree. For multi-family and nonresidential construction the root protection zone shall be an area defined by an average radius extending outward from the trunk of the tree a distance of one (1) linear foot for each inch (DBH). The root protection zone area shall be preserved at natural grade, with natural groundcover. No cutting, filling, trenching, root disturbance, soil disturbance, or construction impacts (including installation of silt fencing that exceeds a depth of three (3) inches) shall occur closer to the trunk than one-half (½) the root protection zone radius except in parking areas where approved alternative materials and methods are used, construction may be as close as five (5) feet from the root flares on one (1) side of the tree. Filling shall be allowed to accomplish water conservation goals established by the City of San Antonio or by a public utility. Native understory vegetation within the root protection zone shall be preserved, however this requirement does not apply to root protection zone areas that have been landscaped using native, drought tolerant plants. The root protection zone may be shifted and clustered as long as there is no construction closer to the trunk than one-half (½) the root protection zone radius. The construction of sidewalks shall be allowed in the root protection zone, as long as excavation does not exceed three (3) inches.

* * * * *

(l) **General Maintenance.** Significant trees, heritage trees, ~~or~~ mitigation trees, or trees planted to meet tree canopy requirements must be maintained in a healthy condition at all times. The property owner is responsible for irrigating, fertilizing, pruning and other maintenance of all trees as needed. Except for residential development, mitigation trees that are planted on the property and that die within twelve (12) months of final inspection are subject to the mitigation requirements set forth in subsection (g) ~~(e)~~ at a ratio of one-inch mitigation for every one (1) inch of a significant, heritage, or mitigation trees that dies. However, a significant or heritage or mitigation tree that dies from other than natural causes shall be mitigated at a ratio as defined in table 523-2. Any tree that dies must be replaced with another living tree of the same category type or better within ninety (90) days after notification by the city. The director of ~~planning and~~ development services may extend this time period up to an additional ninety (90) days due to weather considerations. If the plants have not been replaced after appropriate notification and/or extension, the property owner shall be in violation of this section. If a public utility disturbs trees, it shall make every reasonable effort to preserve the trees and return them to their prior location and condition after the utility work is completed. If nonetheless, trees die, replacement is not the responsibility of the property owner if the death or destruction of the trees is due to the action of a public utility.

(m) **General Planting Standards.**

* * * * *

(4) Plant materials required by this section shall be consistent with Appendix E and must comply with the following minimum size requirements at the time of installation:

A. In satisfying the requirements of this section, the use of mulch material shall be provided at the time of planting.

B. Each replacement tree must be planted at least thirty (30) inches away from any impervious surface.

C. Plant areas must be protected from vehicular traffic through the use of concrete curbs, wheel stops or other permanent barriers.

* * * * *

(o) **Tree Mitigation Fund.**

* * * * *

(3) **Use of Funds.** The funds collected from civil penalties and mitigation fees in the fund shall be utilized to pay for the planting of trees, to include a maintenance period not to exceed three years. Generated funds may be used by the city forester to plant trees on public or private properties. Trees planted with mitigation funds shall not be used to meet any municipal code requirements for preservation, mitigation, landscaping, buffers, streetscape or other requirements. Trees planted with Tree Mitigation Funds are considered mitigation trees as defined in Appendix A of the UDC. The funding of tree preservation including the yearly digital imagery and planting programs shall be administered by the parks and recreation department and city forester. The director of the parks and recreation department shall seek the advice of the parks and recreation board in regard to the selection of projects to be funded. A portion of the fund may be used, on an annual basis, to fund activities directed towards educating the public on the importance of trees in the environment, ecological issues and pollution prevention.

* * * * *

(p) **Public Projects.** Municipal and utility entities shall obtain a tree permit before any vegetation is removed or new construction activity takes place (as specified in Section 35-B127). Special attention will be given to the preservation of trees in public rights-of-way that are to help satisfy the objectives of the streetscape planting standards of this article (section 35-512). The city arborist shall approve an application for the reasonable removal of a protected tree in connection with construction, maintenance or repair of public facilities in or above a public street, alley, rights-of-way, easement or other public land.

(1) **Preservation.** A minimum of twenty-five (25) percent of all diameter inches of protected trees within the project boundary/limits must be preserved, and shall be in accordance with 35-523(h).

(2) **Calculations of Preservation Ratios.** All percentages relating to preservation stated within this section shall be based the initial tree survey. Any subsequent redevelopment of public property must minimally preserve the applicable percentage of the total diameter inches of protected trees as indicated in the initial tree survey.

(q) **Tree Canopy Investment Fund.**

* * * * *

(3) **Use of Funds.** The funds collected shall be utilized to pay for the planting and maintenance of trees to include a maintenance period not to exceed three (3) years. Generated funds may be used by the city forester to plant trees on public or private properties and the yearly digital imagery to proactively enhance the city's tree canopy area. Trees planted utilizing funds from the Tree Canopy Fund are protected trees, and if approved to be removed, shall be mitigated at 1:1 unless heritage-size which are mitigated at 3:1 (with the exception of species listed in table 523-2, column B, row 1 which will be mitigated at 1:1) and are to be maintained by the project applicant. In addition, ten (10) percent of the funds collected will be kept in a separate budget line to be used for any litigation necessary in the enforcement of this section. The program is to be administered by the parks and recreation department. The director of the parks and recreation department and the city forester shall seek the advice of the parks and recreation board on the selection of projects to be funded.

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Chapter 35, Article V, Section 35-526 is amended as follows:

35-526. – Parking and Loading Standards

* * * * *

(b) **Table of Off-Street Parking Requirements**

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(8) Bicycle Parking Spaces. Bicycle spaces shall, at a minimum, equal ten (10) percent of the number of the minimum required vehicle spaces required for a given use, but no more than twenty four (24) shall be required. Bicycle parking may be short or long term in nature, and shall not create any obstruction to public walkways, bus stops and/ or entrances and exits to buildings.

* * * * *

TABLE 526-3a
Parking in Residential Use Districts

Permitted Use	Minimum Vehicle Spaces	Maximum Vehicle Spaces
ACCESSORY USES (SUPPLEMENTAL TO THE RESIDENTIAL USE)	N/A	N/A
ASSISTED LIVING, BOARDING HOME, OR COMMUNITY HOME WITH 6 OR FEWER RESIDENTS	0.3 per resident	1 per resident
ASSISTED LIVING, BOARDING HOME, OR COMMUNITY HOME WITH 7 OR MORE RESIDENTS	0.3 per resident plus 1 space for each employee	1 per resident plus 1 space for each employee
ATHLETIC FIELDS (NONCOMMERCIAL AND SUPPLEMENTAL TO THE RESIDENTIAL USE)	N/A	N/A
AUTOMOBILE NONCOMMERCIAL PARKING (Board of Adjustment)	1.5 per unit	2 per unit
BED and BREAKFAST	0.3 per room	1 per room
CEMETERY or MAUSOLEUM	N/A	N/A
CHILD - CARE INSTITUTION (BASIC)	1 per 375 sf GFA	1.5 per 375 sf GFA
CHURCH, TEMPLE, MOSQUE	1 per 8 seats	1 per 1.5 seats
DAY CARE CENTER (commercial or non-profit)	1 per 375 sf GFA	1.5 per 375 sf GFA
DWELLING - 1 FAMILY (Attached or townhouse) cluster parking allowed	1 per unit	N/A
DWELLING - 1 FAMILY (Detached) cluster parking allowed	1 per unit	N/A
DWELLING - 2 FAMILY cluster parking allowed	1 per unit	2 per unit
DWELLING - 3 FAMILY cluster parking allowed	1.5 per unit	2 per unit
DWELLING - 4 FAMILY cluster parking allowed	1.5 per unit	2 per unit
DWELLING - ACCESSORY (Carriage houses, Granny flats, Echo homes) cluster parking allowed	1 per unit	N/A
DWELLING - COLLEGE FRATERNITY (off Campus)	1 per 2 beds	1 per bed
DWELLING - School dormitories or housing (off Campus)	1 per 2 beds	1 per bed
DWELLING - HUD-CODE MANUFACTURED HOMES (residential) cluster parking allowed	1 per unit	N/A

DWELLING - MULTI-FAMILY (25 units maximum)	1.5 per unit	2 per unit
DWELLING - MULTI-FAMILY (30 units maximum)	1.5 per unit	2 per unit
DWELLING - MULTI-FAMILY (40 units maximum)	1.5 per unit	2 per unit
DWELLING - MULTI-FAMILY (50 units maximum)	1.5 per unit	2 per unit
DWELLING - R.O.W. HOUSE, ZERO LOT LINE (cluster parking allowed)	1 per unit	NA
DWELLING - TOWNHOUSE (cluster parking allowed)	1 per unit	NA
RESIDENTIAL MARKET GARDEN ~~FARMING and TRUCK GARDEN~~	N/A	2 spaces ~~N/A~~
FOSTER FAMILY HOME	1 per 250 sf GFA	1 per 200 sf GFA
FOSTER GROUP HOME	1 per 375 sf GFA	1.5 per 375 sf GFA
GOLF COURSE (accessory to a residential subdivision)	N/A	N/A
GREENHOUSE	N/A	2 spaces
GROUP DAY CARE HOME	1 per 375 sf GFA	1.5 per 375 sf GFA
MUSEUM	1 per 1,000 sf GFA	1.5 per 1,000 sf GFA
NURSERY (1 acre minimum)	N/A	N/A
RADIO/TELEVISION STATION WITH TRANSMITTER TOWER	1 per employee	N/A
RECREATION FACILITY (PUBLIC AND NONCOMMERCIAL)	1 per 600 sf GFA	1 per 500 sf GFA
REGISTERED FAMILY HOME (12 children maximum)	1 per 375 sf GFA	1.5 per 375 sf GFA
SCHOOL - PRIVATE (includes Church schools, private schools K-12, privately owned college or university, trade or specialty school)	according to use	according to use
SCHOOL - PUBLIC (includes all ISD schools K-12, open enrollment charter schools, public college or university	according to use	according to use
URBAN FARM	2 spaces	
UNIVERSITY or COLLEGE (private)	1 per 4 students	1 per 2 students
WIRELESS COMMUNICATION SYSTEM	N/A	N/A

TABLE 526-3b
Parking in Nonresidential Use Districts

	Permitted Use	Minimum Vehicle Spaces	Maximum Vehicle Spaces
ACCESSORY	ACCESSORY USES - secondary or incidental to primary use	N/A	N/A
ALCOHOL	ALCOHOL - bar, lounge, tavern, nightclub, or dance hall Building area gross square footage (GSF)* * Gross square footage of entire building including accessory uses such as offices, kitchens, restrooms, storage areas, mechanical and dressing rooms.	1 per 100 sf of GSF	1 per 75sf of GSF
ALCOHOL	ALCOHOL - beverage manufacture or brewery - alcohol	1 per 1,500 sf GFA	1 per 300 sf GFA
ALCOHOL	ALCOHOL - distillation, storage	1 per 600 sf GFA	1 per 350 sf GFA
ALCOHOL	ALCOHOL - microbrewery	1 per 2 seats	1 per 1.5 seats
ALCOHOL	ALCOHOL - beverage retail sales (Exclusive of bars, lounges, taverns, nightclubs, dance halls or sexually oriented businesses.)	1 per 300 sf GFA	1 per 200 sf GFA
ALCOHOL	ALCOHOL - winery with bottling	1 per 1,500 sf GFA	1 per 300 sf GFA
AMUSEMENT	ANIMAL RACETRACK and/or RODEO ARENA	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA
AMUSEMENT	CARNIVAL and/or CIRCUS	1 per 600 sf outdoor recreation area	1 per 500 sf outdoor recreation area
AMUSEMENT	CARNIVAL and/or CIRCUS (temporary for not more than 60 days)	1 per 600 sf outdoor recreation area	1 per 500 sf outdoor recreation area
AMUSEMENT	FAIRGROUND and/or STADIUM	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA
AMUSEMENT	MINIATURE GOLF	1 per hole	2 per hole
AMUSEMENT	AMUSEMENT and/or THEME PARK - outdoor rides	1 per 600 sf outdoor recreation area	1 per 500 sf outdoor recreation area

AMUSEMENT	BILLIARD OR POOL HALL - no alcohol in "C-2"	5 per 1,000 sf GFA	6 per 1,000 sf GFA
AMUSEMENT	BINGO PARLOR	5 per 1,000 sf GFA	6 per 1,000 sf GFA
AMUSEMENT	CARNIVAL and/or CIRCUS - temporary use (time set by city council on individual case consideration)	1 per 600 sf outdoor recreation area	1 per 500 sf outdoor recreation area
AMUSEMENT	DANCE HALL	1 per 2 seats	1 per 1.5 seats
AMUSEMENT	GO-CART TRACK	1 per 6 seats of 1 per 30 sf of GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA if no permanent seats
AMUSEMENT	LASER HIDE AND SEEK GAMES - indoors	1 per 6 seats of 1 per 30 sf of GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA if no permanent seats
AMUSEMENT	LASER HIDE AND SEEK GAMES - outdoors permitted	1 per 6 seats of 1 per 30 sf of GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA if no permanent seats
AMUSEMENT	RACING - auto or truck track	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA
AMUSEMENT	THEATER - indoor permitting over 2 screens and/or stages	1 per 6 seats	1 per 4 seats
AMUSEMENT	THEATER - indoor with 2 or less screens and/or stages	1 per 6 seats	1 per 4 seats
AMUSEMENT	THEATER - outdoor including drive-in and amphitheaters	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA
AMUSEMENT	VIDEO GAMES - coin or token operated	1 per device	N/A
ANIMAL	ANIMAL - equestrian center and riding trails	1 per 1,500 sf GFA	1 per 300 sf GFA
ANIMAL	ANIMAL - pound or shelter	1 per employee	N/A
ANIMAL	BREEDER - small animal only	1 per 1,500 sf GFA	1 per 300 sf GFA
ANIMAL	CEMETERY - pets (limited to small animals)	N/A	N/A
ANIMAL	DOG TRAINING - indoor	1 per 1,500 sf GFA	1 per 300 sf GFA

ANIMAL	DOG TRAINING - outdoor permitted	1 per 1,500 sf GFA	1 per 300 sf GFA
ANIMAL	KENNEL - boarding and breeding (see health and environmental)	1 per 1,500 sf GFA	1 per 300 sf GFA
ANIMAL	PET GROOMING - small animals only	1 per 300 sf GFA	1 per 200 sf GFA
ANIMAL	SMALL ANIMAL CLINIC - no outside runs	1 per employee	N/A
ANIMAL	SMALL ANIMAL HOSPITAL - outside runs are permitted	1 per employee	N/A
ANIMAL	STOCKYARD	1 per 1,500 sf GFA	1 per 300 sf GFA
ANIMAL	VETERINARY HOSPITAL - large and small animal (outside runs, pens and paddocks permitted)	1 per employee	N/A
ANIMAL	VETERINARY HOSPITAL - large and small animal (no outside runs, pens and paddocks permitted)	1 per employee	N/A
ANIMAL	VETERINARY HOSPITAL - small animal (outside runs, pens and paddocks permitted)	1 per employee	N/A
ANIMAL	VETERINARY HOSPITAL - small animals (no outside runs, pens and paddocks permitted)	1 per employee	N/A
AUTO	TRUCK AND HEAVY EQUIPMENT - auction	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AMBULANCE SERVICE	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO - glass tinting	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO - manufacture	1 per 1,500 sf GFA	1 per 300 sf GFA
AUTO	AUTO AND LIGHT TRUCK - oil, lube and tune up	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO AND LIGHT TRUCK AUCTION	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service

			building
AUTO	AUTO AND LIGHT TRUCK REPAIR	1 per 500 sf GFA including service bays, wash tunnels and retail areas, plus 2 additional spaces for each inside service bay	1 per 375 sf GFA including service bays, wash tunnels and retail areas, plus 2 additional spaces for reach inside service bay
AUTO	AUTO AND VEHICLE SALES - new and used-small scale (no more than 15 vehicles currently licensed and in running condition on-site at any given time for storage and/or sale	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO AND VEHICLE SALES - new and used-large scale	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO - rental (pickup and drop off only in "C-2")	1 per 1,000 sf GFA	1 per 200 sf GFA
AUTO	AUTO ALARM AND RADIO - retail (install. incidental to sales in "C-2")	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO GLASS SALES - installation permitted	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO MUFFLER - installation and sales only	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
AUTO	AUTO PAINT AND BODY - repair with outside storage limited to 3 vehicles (all outside storage of parts to be totally screened)	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	AUTO PAINT AND BODY - repair with outside storage of vehicles and parts permitted but totally screened from view of adjacent property owners and public roadways	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	AUTO PARTS RETAIL - no outside storage in "C-2"	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas

AUTO	AUTO PARTS RETAIL - w/installation and no outside storage	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	AUTO STATE VEHICLE INSPECTION STATION	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	AUTO UPHOLSTERY - sales and installation completely enclosed	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	CARWASH	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	LIMOUSINE SERVICE -dispatch and office use only no servicing of vehicles onsite	N/A	N/A
AUTO	PARKING AND TRANSIENT VEHICLE STORAGE - related to a delivery (auto, truck, trailer and marine)(each vehicle limited to 24 hours maximum parking time within any 48 hour period in "C3," "D" and "L")	N/A	N/A
AUTO	PARKING AND/OR STORAGE - long term	N/A	N/A
AUTO	PARKING LOT - noncommercial	N/A	N/A
AUTO	PARKING LOT or GARAGE - commercial	N/A	N/A
AUTO	TAXI SERVICE - parking and dispatch (no washing or mechanical service permitted)	N/A	N/A
AUTO	TAXI SERVICE - parking and dispatch (washing or mechanical service permitted)	N/A	N/A
AUTO	TIRE REPAIR - auto and small truck (sale and installation only, no mechanical service permitted)	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas

AUTO	TRUCK REPAIR AND MAINTENANCE	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	TRUCK STOP OR LAUNDRY - full mechanical service and repair permitted	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	TRUCK STOP OR LAUNDRY - tire repair permitted	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	VEHICLE STORAGE - see "AUTO PARKING AND/OR STORAGE LONG TERM"	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
AUTO	WRECKER SERVICE	N/A	N/A
BEVERAGE	BEVERAGE MANUFACTURE - non-alcohol	1 per 1,500 sf GFA	1 per 300 sf GFA
CHURCH	CHURCH	1 per 8 seats	1 per 1.5 seats
DRY GOODS - wholesale	DRY GOODS - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
DWELLING	APARTMENT or EXTENDED STAY HOUSING - see (HOUSING - extended stay hotel or timeshares)		
DWELLING	DWELLING - attached apartments/condominiums with maximum density of 6 dwellings per gross acre (allowed ratio of 1 sq. ft. of residential floor use to 1 sq. ft. of nonresidential floor use)	1 per unit	1.9 per unit
DWELLING	DWELLING - attached apartments/condominiums with maximum density of 10 dwellings per gross acre (allowed ratio of 1 sq. ft. of residential floor use to 1 sq. ft. of nonresidential floor use)	1 per unit	1.9 per unit
DWELLING	DWELLING - attachments apartments/condominiums with maximum density of 20 dwellings per gross acre	1 per unit	1.9 per unit

	(allowed ratio of 2 sq. ft. of residential floor use to 1 sq. ft. of nonresidential floor use)		
DWELLING	DWELLING - attached apartments/condominiums with maximum density of 50 dwellings per gross acre (allowed ratio of 4 sq. ft. of residential floor use to 1 sq. ft. of nonresidential floor use)	1 per unit	1.9 per unit
DWELLING	DWELLING OTHER - see (HOUSING)		
DWELLING	GROUP DAY CARE - SEE (HOUSING - group day care limited to 12 individuals)		
DWELLING	HOTEL - SEE (HOUSING - hotel)		
DWELLING	MOTEL - see (HOUSING - motel)		
FABRIC	ELECTRONIC COMPONENT - fabrication	1 per 1,500 sf GFA	1 per 300 sf GFA
GOV.	ARMORY	N/A	N/A
GOV.	CORRECTION INSTITUTION	1 per employee on maximum shift, 1 per service vehicle	1 per employee on maximum shift, 1 per service vehicle
HOUSING	HOUSING - extended stay hotel or timeshares	1 per unit	1.9 per unit
HOUSING	HOUSING - group day care limited to 12 individuals	0.3 per room	1 per room
HOUSING	HOUSING - hotel	0.8 per room plus 1 per 800 sf of public meeting area and restaurant space	1 per room plus 1 per 400 sf of public meeting area and restaurant space
HOUSING	HOUSING - motel	0.8 per room plus 1 per 800 sf of public meeting area and restaurant space	1 per room plus 1 per 400 sf of public meeting area and restaurant space
INDUST	BATCHING PLANT	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	BATCHING PLANT - temporary in "C-3" and "L" (6 months maximum)	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	BOOKBINDER	1 per 1,500 sf GFA	1 per 300 sf GFA

INDUST	CABINET or CARPENTER SHOP	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	CAN RECYCLE COLLECTION STATION - no shredding	1 per employee	N/A
INDUST	COFFEE ROASTING	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	CONTRACTOR FACILITY	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	CREAMERY	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	DRY CLEANING - plant	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	LAUNDRY - plant	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	LUMBER YARD and BUILDING MATERIALS	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
INDUST	MACHINE SHOP	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	PECAN SHELLING	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	PRINTER - large scale	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	RUG CLEANING	1 per 1,500 sf GFA	1 per 300 sf GFA
INDUST	WELDING SHOP - limited to three (3) employees and screening of outside storage in "C-3"	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ABRASIVE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ACETYLENE GAS - manufacturing and storage	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	AIR PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ARTIFICIAL LIMB ASSEMBLY	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ASBESTOS PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ASPHALT PRODUCTS - manufacturing	1 per 1,000 sf GFA	1 per 200 sf GFA
MANF.	BAG CLEANING	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BATTERY - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BEVERAGE - manufacturing or processing	1 per 1,500 sf GFA	1 per 300 sf GFA

MANF.	BIOMEDICAL PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BOAT AND MARINE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BOILER and TANK WORKS	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BROOM, BRUSH - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	BUILDING SPECIALTIES - wholesale outside storage permitted	1 per 600 sf GFA	1 per 350 sf GFA
MANF.	BULK PLANT or TERMINAL (Includes Bulk Storage of Petro Chemicals)	N/A	N/A
MANF.	CAN MANUFACTURE	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CANDLE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CANDY - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CANVAS PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CHEMICAL - manufacturing or processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CHEMICAL/DRUG - wholesale and storage	1 per 600 sf GFA	1 per 350 sf GFA
MANF.	CLOTHING MANUFACTURE - chemical process	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CLOTHING MANUFACTURE - non-chemical process	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	CONCRETE PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	COTTON COMPRESS, GINNING and BAILING	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	DRUG - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ELECTRONIC COMPONENT - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ELECTROPLATING	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	FELT PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	GLASS MANUFACTURE	1 per 1,500 sf GFA	1 per 300 sf GFA

MANF.	GRAIN - drying	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	GRAIN - milling	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	HATCHERY	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	HAZARDOUS MATERIALS HAULING or STORAGE	1 per employee	N/A
MANF.	HOSIERY - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ICE CREAM - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	ICE PLANT - manufacturing and processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	INSULATION PRODUCTS - manufacturing and processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PETRO CHEMICALS BULK STORAGE	1 per employee	N/A
MANF.	MATTRESS - manufacturing and rebuilding	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	METAL FORGING or ROLLING MILL	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	METAL PRODUCTS - fabrication	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	MILLINERY - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	MILLWORK AND WOOD PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	MOVING and TRANSFER COMPANY - with trucks attached to trailers for a total exceeding 24 feet in length	N/A	N/A
MANF.	NOVELTY and SOUVENIR - manufacture	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	NUCLEAR or RADIOACTIVE INSTRUMENTATION - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	OFFICE EQUIPMENT, FURNITURE - manufacture	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	OIL WELL SUPPLIES and MACHINERY - manufacturing.	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PACKING and GASKET - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PACKING PLANT - no rendering	1 per 1,500 sf GFA	1 per 300 sf GFA

MANF.	PAINTS, ETC. - manufacturing and processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PAPER PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PETROLEUM - manufacturing or processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PLANING MILL	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PLASTIC / VINYL - manufacturing or processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PLAYGROUND EQUIPMENT - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	POULTRY PROCESSING - caged hen operation	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	POULTRY PROCESSING AND LIVE POULTRY STORAGE - completely enclosed	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	PROCESSING - other than food	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	REFRIGERATION EQUIPMENT - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	RENDERING PLANT	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	SAND or GRAVEL - storage and sales	1 per 600 sf GFA	1 per 350 sf GFA
MANF.	SHOE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	SHOE - wholesale (manufacturing permitted)	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	SHOE POLISH - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	SIGN MANUFACTURE	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	STONE CURING, MONUMENT - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	STORAGE - outside (open with no screening required)	1 per 600 sf GFA	1 per 350 sf GFA
MANF.	STORAGE - outside (screening from public R.O.W.s and adjacent property required)	1 per 600 sf GFA	1 per 350 sf GFA
MANF.	TEXTILE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA

MANF.	TILE - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	TILE, ROOFING AND WATERPROOFING PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	TOBACCO - processing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	TOOL - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	TOY - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	TRAILER - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	VENETIAN BLIND - cleaning and fabrication	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	VULCANIZING, RECAPPING	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	WATER DISTILLATION	1 per employee	N/A
MANF.	WELL DRILLING CONTRACTOR	1 per 1000 sf GFA	1 per 200 sf GFA
MANF.	WIRE PRODUCTS - manufacturing	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	WOOD PROCESSING by CREOSOTING or OTHER PRESERVING TREATMENT	1 per 1,500 sf GFA	1 per 300 sf GFA
MANF.	WOOL PULLING and SCOURING	1 per 1,500 sf GFA	1 per 300 sf GFA
MEDICAL	MEDICAL - surgical supplies wholesale	1 per 600 sf GFA	1 per 350 sf GFA
PROCESSING	COSMETICS - manufacturing or processing	1 per 1,500 sf GFA	1 per 300 sf GFA
PROCESSING	FOOD AND FOOD PRODUCTS - processing	1 per 1,500 sf GFA	1 per 300 sf GFA
PROCESSING	PUNCH CONCENTRATE - processing and mixing	1 per 1,500 sf GFA	1 per 300 sf GFA
PROCESSING	PUNCH CONCENTRATE PRODUCTS - mixing only	1 per 1,500 sf GFA	1 per 300 sf GFA
PROCESSING	USED AUTOMOTIVE PARTS RECYCLER	1 per employee	N/A
RECREATION	ARCHERY RANGE - outdoor	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats

RECREATION	ARCHERY RANGE - indoor	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	ATHLETIC FIELDS - noncommercial	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	ATHLETIC FIELDS - commercial	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	BOWLING ALLEY	2 per lane	4 per lane
RECREATION	GOLF COURSE - private (see residential use table)	N/A	6 per hole
RECREATION	GOLF COURSE - publicly owned	N/A	6 per hole
RECREATION	GOLF DRIVING RANGE	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	RECREATIONAL FACILITY - private community wide	1.5 per 1,000 sf GFA	10 per 1,000 sf GFA
RECREATION	RECREATIONAL FACILITY - private neighborhood	1.5 per 1,000 sf GFA	10 per 1,000 sf GFA
RECREATION	RECREATIONAL FACILITY - public community wide	1.5 per 1,000 sf GFA	10 per 1,000 sf GFA
RECREATION	RECREATIONAL FACILITY - public neighborhood	1.5 per 1,000 sf GFA	10 per 1,000 sf GFA
RECREATION	RIFLE AND PISTOL RANGE - indoor	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	RIFLE AND PISTOL RANGE - outdoor permitted	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	SKATEBOARD TRACK	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	SKATING RINK - ice or roller skating	5 per 1,000 sf GFA	7 per 1,000 sf GFA
RECREATION	STABLE AND EQUESTRIAN CENTER	1 per 1,500 sf GFA	1 per 300 sf GFA

RECREATION	TENNIS, RACQUETBALL or HANDBALL - noncommercial (outside courts permitted)	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	TENNIS, RACQUETBALL or HANDBALL - commercial (outside courts not permitted)	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	TENNIS, RACQUETBALL or HANDBALL - commercial (outside courts permitted)	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	TENNIS, RACQUETBALL or HANDBALL -noncommercial (outside courts not permitted)	1 per 6 seats or 1 per 30 sf GFA if no permanent seats	1 per 4 seats or 1 per 50 sf of GFA is no permanent seats
RECREATION	RECREATIONAL VEHICLE PARK	N/A	N/A
RETAIL	AIR CONDITIONERS - retail (incidental to other onsite retail items in "D")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	ANTIQUE STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	APOTHECARY - see (DRUGSTORE - apothecary)	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	APPAREL AND ACCESSORY STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	APPLIANCE - retail (incidental to other onsite retail items in "D")	1 per 400 sf GFA	1 per 200 sf GFA
RETAIL	ART GALLERY	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	BAKERY - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	BOOKSTORE	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	BUSINESS MACHINES - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	CAMERA, PHOTOGRAPHIC EQUIPMENT AND SUPPLIES - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	CANDY, NUT and CONFECTIONERY - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	CATERING SHOP	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	CONVENIENCE ICE HOUSE - retail convenience store	6 per 1,000 sf GFA	10 per 1,000 sf GFA

RETAIL	CONVENIENCE STORE - w/ gas sales	6 per 1,000 sf GFA	10 per 1,000 sf GFA
RETAIL	DAIRY PRODUCTS - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	DRUGSTORE - apothecary	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	DRY GOODS - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FARM SUPPLIES	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FEED, SEED, FERTILIZER SALES - no outside storage in "C-3"	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FISH MARKET - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FLEA MARKET - indoor	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FLEA MARKET - outdoor	1 per 375 sf GFA of sales and service building	1.5 per 375 sf GFA of sales and service building
RETAIL	FLOOR COVERING - retail (incidental to other onsite retail items in "D")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FLORIST - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FOOD LOCKER PLANT - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FOOD STORE - limited in "C-1" to maximum 3000 sq. ft. total floor area	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FRUIT and PRODUCE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	FURNITURE SALES - retail	1 per 600 sf GFA	1 per 200 sf GFA
RETAIL	GIFT SHOP - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	GLASS - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	GROCERY STORE - retail (limited to maximum 3000 sq. ft. total in "C-1")	1 per 300 sf GFA	1 per 150 ~~200~~ sf GFA
RETAIL	HARDWARE SALES - retail (limited to maximum 3000 sq. ft. total in "C-1")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	HEAD SHOP	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	HOBBY STORE - retail (limited to maximum 3000 sq. ft. total in "C-1")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	HOME IMPROVEMENT CENTER	1 per 400 sf GFA of sales	1.5 per 375 sf GFA of sales and service

		and service building	building
RETAIL	JEWELRY STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	LANDSCAPING MATERIALS - sales and storage	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
RETAIL	LEATHER GOODS or LUGGAGE STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	MEDICAL - surgical supplies retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	MILLINER - custom	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	MUSIC STORE	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	NEWSSTAND	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	NURSERY - retail (growing plants on-site permitted)	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	NURSERY - retail (no growing plants on-site permitted)	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	OFFICE EQUIPMENT and SUPPLY - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	PAINT and WALLPAPER STORE - retail and wholesale	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	PET SHOP - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	PLUMBING FIXTURES - retail (incidental to other onsite retail items in "D")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	RUG or CARPET - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	SECONDHAND MERCHANDISE - retail no outside storage or display of inventory permitted)	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	SHOE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	SILK SCREENING - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	SPORTING GOODS - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	STAMPS and COIN SALES - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	STATIONARY PRODUCTS - retail	1 per 300 sf GFA	1 per 200 sf GFA

RETAIL	TAMALE - preparation retail (less than 2,000 sq. ft. in "C-1" and "C-2")	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	THRIFT STORE - retail see (SECONDHAND MERCHANDISE)	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	TOBACCO STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	TOY STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	TROPHY SALES, ENGRAVING AND ASSEMBLY	1 per 300 sf GFA	1 per 200 sf GFA
RETAIL	VARIETY STORE - retail	1 per 300 sf GFA	1 per 200 sf GFA
SALES	BOAT - sales and service	1 per 600 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
SALES	MACHINERY, TOOLS AND CONSTRUCTION EQUIPMENT SALES AND SERVICE	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
SALES	FARM EQUIPMENT SALES, SERVICE or STORAGE	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
SALES	OIL WELL SUPPLIES and MACHINERY SALES - used	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
SALES	PORTABLE BUILDING SALES	1 per 300 sf GFA	1 per 200 sf GFA
SCHOOL	SCHOOL - private university or college	1 per 4 students	According to use ~~1 per 2 students~~
SCHOOL	SCHOOL - public university or college	1 per 4 students	According to use ~~1 per 2 students~~
SCHOOL	SCHOOL - Montessori	1 per classroom	According to use ~~2 per 2 students~~
SCHOOL	SCHOOL - nursery (public and private)	1 per classroom	According to use ~~2 per 2 students~~
SCHOOL	SCHOOL - private pre-kindergarten through 12th grade	1 per classroom	According to use ~~2 per 2 students~~
SCHOOL	SCHOOL - public pre-kindergarten through 12th grade	1 per classroom	According to use ~~2 per 2 students~~
SERVICE	AIR CONDITIONING / REFRIGERATION - service and repair	1 per 300 sf GFA	1 per 200 sf GFA

SERVICE	ALTERING/REPAIRING OF APPAREL	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	AMMUNITION - manufacturing, loading and storage	1 per 1,500 sf GFA	1 per 300 sf GFA
SERVICE	APPLIANCE - repair major	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	APPLIANCE - repair small	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	AUDITORIUM	1 per 6 seats or 1 per 30 sf if no permanent seating	1 per 4 seats or 1 per 50 sf if no permanent seating
SERVICE	ASSISTED LIVING FACILITY, BOARDING HOME FACILITY, OR COMMUNITY HOME WITH NO MORE THAN 16 RESIDENTS	0.3 spaces per bed plus 1 space for each employee	1 per bed plus 1 space for each employee
SERVICE	BANK, CREDIT UNIONS, SAVINGS and LOAN	1 per 200 sf GFA for the portion of building used by the financial institution and 1 per 300 sf of GFA of office lease space	1 per 100 sf GFA for the portion of building used by the financial institution and 1 per 300 sf of GFA of office lease space
SERVICE	BARBER or BEAUTY SHOP	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	BICYCLE - repair	1 per 375 sf GFA of sales and service building	1.5 per 375 sf GFA of sales and service building
SERVICE	BOAT AND MARINE - storage (outside permitted)	1 per 600 sf GFA	1 per 350 sf GFA
SERVICE	BODY PIERCING	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	CEMETERY or MAUSOLEUM	N/A	N/A
SERVICE	COPY SERVICE - blueprinting and photocopying	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	COSMETICS - permanent	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	DAY CARE CENTER - child and/or adult care	1 per 375 sf GFA	1.5 per 375 sf GFA
SERVICE	DRY CLEANING - limited to five (5) employees	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	DRY CLEANING - pickup station only	1 per 300 sf GFA	1 per 200 sf GFA

SERVICE	ELECTRIC REPAIR - heavy equipment	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	ELECTRIC REPAIR - light equipment	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	ELECTRONIC EQUIPMENT - repair	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	ELEVATOR MAINTENANCE - service	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	EMPLOYMENT AGENCY	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	EXTERMINATORS	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	FOOD - FAST FOOD WITH DRIVE THROUGH LANE(S)	1 per 150 sf GFA	1 per 40 sf GFA
SERVICE	FOOD, MOBILE FOOD COURT	2 per mobile food establishment unit	5 per mobile food establishment unit
SERVICE	FOOD - restaurant or cafeteria	1 per 100 sf GFA	1 per 40 sf GFA
SERVICE	FOOD - take out, maximum 15 occupants (including employees and customers)	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	FUNERAL HOME or UNDERTAKING PARLOR	1 per 4 seats	1 per 2 seats
SERVICE	FURNITURE REPAIR / UPHOLSTERING	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	GASOLINE FILLING STATION - w/o repair service (car wash allowed)	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
SERVICE	GASOLINE FILLING STATION - with repair service and/or car wash	1 per 500 sf GFA including service bays, wash tunnels and retail areas	1 per 375 sf GFA including service bays, wash tunnels and retail areas
SERVICE	GUNSMITH	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	GYMNASIUM - commercial	1.5 per 1000 sf GFA	10 per 1,000 sf GFA
SERVICE	JANITORIAL / CLEANING SERVICE	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	LABORATORY - research	1 per 1,000 sf GFA	1 per 200 sf GFA
SERVICE	LABORATORY - testing	1 per 1,000 sf GFA	1 per 200 sf GFA
SERVICE	LAUNDRY and DRY CLEANING - self service	1 per 300 sf GFA	1 per 200 sf GFA

SERVICE	LAUNDRY- limited to max of five (5) employees	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	LAUNDRY or DRY CLEANING - pickup station only	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	LAWNMOWER REPAIR AND SERVICE - no outside storage in "C-2"	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	LIBRARY	1 per 300 sf GFA	1 per 125 sf GFA
SERVICE	LINEN or UNIFORM SUPPLY, DIAPER SERVICE (pickup and supply only)	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	LOAN OFFICE	1 per 1,000 sf GFA	1 per 200 sf GFA
SERVICE	LOCKSMITH	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	MANUFACTURED HOME / OVERSIZE VEHICLE SALES, SERVICE or STORAGE	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
SERVICE	MASSAGE - parlor	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MASSAGE - therapeutic	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - chiropractor office	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - clinic (physician and/or dentist)	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - clinic physical therapist	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - hospital or sanitarium	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - laboratory dental or medical	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL - optical goods retail	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	MEDICAL - optical goods wholesale	1 per 600 sf GFA	1 per 350 sf GFA
SERVICE	MEDICAL - optometry office	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MEDICAL – skilled nursing facilities	0.3 per bed	1 per bed
SERVICE	MORTUARY - embalming and preparation only	1 per 400 sf GFA	1 per 100 sf GFA
SERVICE	MOVIE RENTALS	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	NURSING FACILITY	0.3 per bed	1 per bed

SERVICE	Office Call Center, Office Data Processing & Management, Record Storage Facility	1 parking space per 300 sf of GFA of office space plus 1 space for every 5,000 sf of GFA dedicated to storage or data equipment	1 parking space per 140 sf of GFA of office space plus 2 spaces for every 5,000 sf of GFA dedicated to storage or data equipment
SERVICE	PALM READING	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	PAWN SHOP	1 per 300 sf GFA	1 per 150 sf GFA
SERVICE	PICTURE FRAMING	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	POST OFFICE	1 per employee	N/A
SERVICE	PROFESSIONAL OFFICE	1 per 300 sf GFA	1 per 140 sf GFA
SERVICE	READING ROOM	1 per 300 sf GFA	1 per 125 sf GFA
SERVICE	REDUCING SALON	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	ROOMING HOUSE	1 per guest room plus 2 spaces for owners section	N/A
SERVICE	SCHOOL - business college	1 per 200 sf	1 per 150 sf
SERVICE	SCHOOL - trade (no outside storage and training area permitted)	1 per 200 sf	1 per 150 sf
SERVICE	SCHOOL - trade (outside storage and training area permitted)	1 per 200 sf	1 per 150 sf
SERVICE	SELF-DEFENSE INSTRUCTION	1 per 200 sf	1 per 150 sf
SERVICE	SHOE - repair	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	SIGN SHOP - no outside storage	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	STUDIO - fine or performing arts	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	STUDIO - interior decorating	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	STUDIO - photographic	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	STUDIO - sound and recording	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	TAILOR SHOP	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	TATTOO PARLOR/STUDIO	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	TAXIDERMIST	1 per 300 sf GFA	1 per 200 sf GFA

SERVICE	TOOL RENTAL - fenced and screened outside storage permitted	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	TOOL RENTAL - outside storage permitted	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	TREE CUT AND TRIM SERVICE	1 per 300 sf GFA	1 per 200 sf GFA
SERVICE	WATCH REPAIR	1 per 300 sf GFA	1 per 200 sf GFA
SOCIAL	CLUB - private	1 per 3 persons	N/A
SOCIAL	CLUBHOUSE - private including lodges and meeting halls	1 per 3 persons	N/A
STORAGE	CARTING, CRATING, HAULING, STORAGE	1 per 600 sf GFA	1 per 350 sf GFA
STORAGE	COLD STORAGE	1 per 600 sf GFA	1 per 350 sf GFA
STORAGE	FUR DYEING, FINISHING and STORING	1 per 1,500 sf GFA	1 per 300 sf GFA
STORAGE	ICE CREAM TRUCK STORAGE	N/A	N/A
STORAGE	MOVING COMPANY	N/A	N/A
STORAGE	PIPE STORAGE	1 per 600 sf GFA	1 per 350 sf GFA
STORAGE	SELF-SERVICE STORAGE	4 spaces plus 2 for manager's quarters	N/A
STORAGE	STORAGE - outside (under roof and screened)	1 per 600 sf GFA	1 per 350 sf GFA
TRANSPORTATION	AIRPORT - non-governmental	1 per 666 emplanements	N/A
TRANSPORTATION	FREIGHT DEPOT	N/A	N/A
TRANSPORTATION	HELIPORT	1 per 4 seating accommodations for waiting passengers plus 0.5 per employee	N/A
TRANSPORTATION	HELISTOP	N/A	N/A
TRANSPORTATION	PASSENGER DEPOT	1 per employee	N/A
UTILITIES	RADIO or TELEVISION STATION WITHOUT TRANSMISSION TOWER	1 per service employee	N/A
UTILITIES	TELEPHONE EQUIPMENT	1 per service employee	N/A

	INFRASTRUCTURE		
UTILITIES	WIRELESS COMMUNICATION SYSTEMS	1 per service employee	N/A
UTILITY	SANITARY LANDFILL, SOLID WASTE FACILITY	1 per employee	N/A
WAREHOUSE	OFFICE WAREHOUSE (FLEX SPACE) - outside storage not permitted	1 per 2,000 sf GFA	1 per 200 sf GFA
WAREHOUSING	WAREHOUSING	1 per 5,000 sf GFA	1 per 350 sf GFA
WHOLE.	BAKERY - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	BARBER and BEAUTY EQUIPMENT - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	CAMERA, PHOTOGRAPHIC EQUIPMENT AND SUPPLIES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	DAIRY EQUIPMENT SALES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	DAIRY PRODUCTS - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	DRUG SALES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	FISH MARKET - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	FLORIST	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building
WHOLE.	FOOD PRODUCTS - wholesale and storage	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	FRUIT and PRODUCE - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	FURNITURE SALES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	GLASS - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	GROCERY - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	HARDWARE SALES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	NURSERY - plant wholesale onsite growing permitted	1 per 500 sf GFA of sales and service building	1 per 375 sf GFA of sales and service building

WHOLE.	OFFICE EQUIPMENT and SUPPLY - wholesale (incidental to other onsite retail items in "D")	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	PAPER SUPPLIES - wholesale (incidental to onsite retail items in "C-3" and "D")	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	PLUMBING FIXTURES - wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	SHOE - wholesale no manufacturing	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	SPORTING GOODS - wholesale (incidental to onsite retail items in "D")	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	STONE MONUMENT - retail and wholesale	1 per 600 sf GFA	1 per 350 sf GFA
WHOLE.	TAMALE - preparation wholesale (less than 2,000 sq. ft. in C-1 and C-2)	1 per 600 sf GFA	1 per 350 sf GFA

Chapter 35, Article VI, Section 35-605 is amended as follows:

Sec. 35-605 Designation Process for Historic Districts.

* * * * *

(c) ~~(d)~~ **Historic District Guidelines.** The city council may, from time to time, designate specific guidelines for particular historic districts. The designation shall include the formal name of the district, a legal description of the boundaries of the district, and a cross-reference to the design guidelines.

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Chapter 35, Article VI, Section 35-614 is amended as follows:

Sec. 35-614. – Demolition.

* * * * *

(a) **Applicability.** The provisions of this section apply to any application for demolition of a historic landmark (including those previously designated as historic exceptional or historic significant) or a historic district.

(1) **Historic Landmark.** No certificate shall be issued for demolition of a historic landmark unless the applicant provides sufficient evidence to support a finding by the commission of ~~demonstrates clear and convincing evidence supporting an~~ unreasonable economic hardship on the applicant. In the case of a historic landmark, if an applicant fails to prove unreasonable

economic hardship, the applicant may provide to the historic and design review commission additional information regarding loss of significance as provided is subsection (c)~~(3)~~ in order to receive a historic and design review commission recommendation for a certificate for demolition.

(2) **Entire Historic District.** If the applicant wishes to demolish an entire designated historic district, the applicant must provide sufficient evidence to support a finding by the commission ~~he has to provide clear and convincing evidence~~ of economic hardship on the applicant if the application for a certificate is to be approved.

(3) **Property Located in Historic District and Contributing to District Although Not Designated a Landmark.** No certificate shall be issued for property located in a historic district and contributing to the district although not designated a landmark unless the applicant provides sufficient evidence to support a finding by the commission ~~of demonstrates clear and convincing evidence supporting an~~ unreasonable economic hardship on the applicant if the application for a certificate is disapproved. When an applicant fails to prove unreasonable economic hardship in such cases, the applicant may provide additional information regarding loss of significance as provided is subsection (c)~~(3)~~ in order to receive a certificate for demolition of the property.

(b) **Unreasonable Economic Hardship.**

(1) **Generally.** The historic and design review commission shall be guided in its decision by balancing the historic, architectural, cultural and/or archaeological value of the particular landmark or eligible landmark against the special merit of the proposed replacement project. The historic and design review commission shall not consider or be persuaded to find unreasonable economic hardship based on the presentation of circumstances or items that are not unique to the property in question (i.e. the current economic climate).

(2) **Burden of Proof.** The historic and design review commission shall not consider or be persuaded to find unreasonable economic hardship based on the presentation of circumstances or items that are not unique to the property in question (i.e. the current economic climate). When a claim of unreasonable economic hardship is made, the owner must provide sufficient evidence to support a finding by the commission ~~prove by a preponderance of the evidence~~ that:

A. The owner cannot make reasonable beneficial use of or realize a reasonable rate of return on a structure or site, regardless of whether that return represents the most profitable return possible, unless the highly significant endangered, historic and cultural landmark, historic and cultural landmarks district or demolition delay designation, as applicable, is removed or the proposed demolition or relocation is allowed;

B. The structure and property cannot be reasonably adapted for any other feasible use, whether by the current owner or by a purchaser, which would result in a reasonable rate of return; and

C. The owner has failed to find a purchaser or tenant for the property during the previous two (2) years, despite having made substantial ongoing efforts during that period to do so. The evidence of unreasonable economic hardship introduced by the owner may, where applicable, include proof that the owner's affirmative obligations to maintain the structure or property make it impossible for the owner to realize a reasonable rate of return on the structure or property.

(3) **Criteria.** The public benefits obtained from retaining the cultural resource must be analyzed and duly considered by the historic and design review commission.

As evidence that an unreasonable economic hardship exists, the owner may submit the following information to the historic and design review commission by affidavit:

A. For all structures and property:

i. The past and current use of the structures and property;

ii. The name and legal status (e.g., partnership, corporation) of the owners;

iii. The original purchase price of the structures and property;

iv. The assessed value of the structures and property according to the two (2) most recent tax assessments;

v. The amount of real estate taxes on the structures and property for the previous two (2) years;

vi. The date of purchase or other acquisition of the structures and property;

vii. Principal balance and interest rate on current mortgage and the annual debt service on the structures and property, if any, for the previous two (2) years;

viii. All appraisals obtained by the owner or applicant within the previous two (2) years in connection with the owner's purchase, financing or ownership of the structures and property;

ix. Any listing of the structures and property for sale or rent, price asked and offers received;

x. Any consideration given by the owner to profitable adaptive uses for the structures and property;

xi. Any replacement construction plans for proposed improvements on the site;

xii. Financial proof of the owner's ability to complete any replacement project on the site, which may include but not be limited to a performance bond, a letter of credit, an irrevocable ~~a~~ trust for

completion of improvements, or a letter of commitment from a financial institution; and

xiii. The current fair market value of the structure and property as determined by a qualified appraiser.

xiv. Any property tax exemptions claimed in the past five (5) years.

* * * * *

(c) **Loss of Significance.** When an applicant fails to prove unreasonable economic hardship the applicant may provide to the historic and design review commission additional information which may show a loss of significance in regards to the subject of the application in order to receive historic and design review commission recommendation of approval of the demolition.

If, based on the evidence presented, the historic and design review commission finds that the structure or property is no longer historically, culturally, architecturally or archeologically significant it may make a recommendation for approval of the demolition. In making this determination, the historic and design review commission must find that the owner has provided sufficient evidence to support a finding by the commission ~~established by a preponderance of the evidence~~ that the structure or property has undergone significant and irreversible changes which have caused it to lose the historic, cultural, architectural or archeological significance, qualities or features which qualified the structure or property for such designation. Additionally, the historic and design review commission must find that such changes were not caused either directly or indirectly by the owner, and were not due to intentional or negligent destruction or a lack of maintenance rising to the level of a demolition by neglect.

The historic and design review commission shall not consider or be persuaded to find loss of significance based on the presentation of circumstances or items that are not unique to the property in question (i.e. the current economic climate).

For property located within a historic district, the historic and design review commission shall be guided in its decision by balancing the contribution of the property to the character of the historic district with the special merit of the proposed replacement project.

(d) **Documentation and Strategy**

(1) Applicants that have received a recommendation for a certificate shall document buildings, objects, sites or structures which are intended to be demolished with 35mm slides or prints, preferably in black and white, and supply a set of slides or prints or provide a set of digital photographs in RGB Color to the historic preservation officer. Digital photographs must have a minimum dimension of 3000 x 2000 pixels and resolution of 300 dpi. ~~to the historic preservation officer~~

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Chapter 35, Article VI, Section 35-619 is amended as follows:

Sec. 35-619. Non-Contributing Structures.

Requests for determination of whether an object, building, structure or sign are contributing or non-contributing to a historic landmark or historic district shall be made on an application obtained from the historic preservation officer through the office of historic preservation. The historic preservation officer shall review the application for completeness and shall make a determination whether the subject of the application is contributing or non-contributing within thirty (30) days of deeming the application complete. The historic preservation officer shall retain, for such period as required under applicable record retention law, a written statement summarizing the reasons for the determination. The historic preservation officer may, at his or her discretion, present the application ~~form~~ to the historic and design review commission for their recommendation.

* * * * *

Chapter 35, Article VI, Section 35-634 is amended as follows:

Sec. 35-634. Cemeteries.

(a) All applicants for permits, excluding burial permits, affecting cemeteries shall be referred to the city historic preservation officer for the purpose of determining whether or not the cemetery is historically, culturally, architecturally, or archaeologically exceptional or significant. If the cemetery is determined by the city historic preservation officer to be exceptional or significant, any proposed change, excluding burials, must be presented to the historic and design review commission for approval of planned work. If a court of competent jurisdiction has granted permission for cancellation or destruction of such cemetery, any plans for new construction must be approved thereafter by the historic and design review commission before construction commences. The historic and design review commission shall be governed in its recommendations by regulations set forth in Texas state law for cemeteries excluding burial permits.

(b) Public and private development projects must comply with the Texas Health and Safety Code regarding the archaeological procedures for the impact to, or removal of, interred human remains (Texas Health and Safety Code, Title 13, Part 2, Chapter 22).

* * * * *

Chapter 35, Article VI, Section 35-672 is amended as follows:

Sec. 35-672. Neighborhood Wide Design Standards.

* * * * *

(a) **Pedestrian Circulation.** Pedestrian access shall be provided among properties to integrate neighborhoods.

(1) Provide sidewalks that link with existing sidewalks on adjoining properties If no sidewalk currently exists on an adjoining property, the applicant will have discretion in the placement of the sidewalk provided the following criteria are met:

A. Provide a sidewalk connection from one (1) side of the applicant's property to the other, parallel to the river bank or public right-of way.~~, on the street sides of the property in all river improvement overlay districts~~

B. Provide a connection from the street level sidewalk to the Riverwalk at cross streets and bridges and other designated access points. This requirement may be waived if there is already a public connection from the street level to the Riverwalk.

C. In order to preserve the rural character of "RIO-6," the HPO, in coordination with the development services department, may waive the requirement of sidewalks.

• In "RIO-3," the width of the pathway along the river shall match those widths established in the historic Hugman drawings. If there are no sidewalks in the Hugman drawings, the path will not exceed eight (8) feet in width.

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Chapter 35, Article VI, Section 35-673 is amended as follows:

Sec. 35-673. Site Design Standards.

* * * * *

(c) **Topography and Drainage.** The natural contours of occasional hillsides and riverbanks contribute to the distinct character of the San Antonio River and shall be considered in site designs for new development. Site plans shall minimize the need for cut and fill. It should be considered as an opportunity for positive enhancements through the creative use of terraces and retaining walls.

* * * * *

(8) **San Antonio River Authority Coordination.** Coordination with the San Antonio River Authority regarding direct access adjacent to the San Antonio River within RIO-1, RIO-2, RIO-4, RIO-5, and RIO-6, landscaping and maintenance boundaries, and storm water control measures as required in Sections 35-672, 35-673, and 35-678, as applicable, is required prior to a submission for a certificate of appropriateness from the Office of Historic Preservation or plat approval, as applicable, for properties that fall within the RIO Overlay District as defined in UDC 35-338. This section shall apply to newly developed properties and redevelopment of properties.

a. Access to the San Antonio River within RIO-1, RIO-2, RIO-4, RIO-5, and RIO-6 shall comply with the following:

i. All tie in points shall provide plans sufficient to show materials and grading for review by SARA;

ii. Removal of existing park trail hardscape shall require SARA approval;

iii. Development shall make it clear for users of the park to discern public access points from private access points;

iv. If during construction the park trail must be temporarily closed, an alternative engineered route shall be identified and temporary signage in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) provided and maintained for the duration of the project;

v. Acceptance of park trail access point(s) shall be the responsibility of SARA.

b. Landscaping and maintenance boundaries shall be defined in accordance with the final maintenance agreement entered into between the developer and SARA, which may occur after HDRC approval is granted.

c. Developments shall manage site storm water through LID components consistent with Section 35-210 of this Chapter and shall also comply with the following:

i. Storm water runoff shall pass to the river through discharge pipes or outfalls that are below water level or through an approved LID feature. Overland flow onto the park is discouraged and shall be reviewed on a case-by-case basis. Modification of this subsection shall require approval by SARA and the Director of Transportation and Capital Improvements, or their designee;

ii. Open concrete chutes shall be prohibited;

iii. Runoff from pools or other non-storm water producing sources shall be treated prior to discharging into the river.

* * * * *

(o) Bicycle Parking. On-site bicycle parking helps promote a long term sustainable strategy for development in RIO districts. Bicycle parking shall be placed in a well lit and accessible area. UDC bicycle parking requirements in UDC 35-526 can be met through indoor bicycle storage facilities in lieu of outdoor bike rack fixtures.

(p) **New Elevator and building access.** In order to prevent queuing and inhibition of pedestrian flow on the Riverwalk pathway, a landing that is at minimum 6 feet in depth

shall be provided between an elevator or building access point or doorway and the Riverwalk pathway. The width of the landing shall further comply with ADA (Americans with Disabilities Act) and/or TAS (Texas Accessibility Standards) requirements.

* * * * *

Chapter 35, Article VI, Section 35-678 is amended as follows:

Sec. 35-678. Signs and Billboards in the RIO.

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(k) **Prohibited Signs.** The following signs are prohibited:

* * * * *

(7) Roof mounted signs, except in the cases of landmark signs or unless approved in accordance with standards set forth in subsections (b) and (c) of this section. Contributing roof mounted signs may be resurfaced with an approved certificate of appropriateness. The square footage of roof mounted signs shall be included in the total allowable signage for the building;

(8) Pole-mounted cabinet signs and pylon signs; ~~Pole Signs;~~

* * * * *

Chapter 35, Article VI, Section 35-679 is amended as follows:

Sec. 35-679. Other Requirements and Regulations.

* * * * *

(d) **Monuments, Markers, Memorials, and Acknowledgements.** Monuments, markers or memorial plaques are not permitted on the riverside of property abutting the river, or within the publicly owned right-of-way without the express written consent of the historic preservation officer ~~historic and design review commission~~. The following standards shall apply:

(1) ~~A.~~ Texas historical markers are permitted, but must be mounted to walls or structures. Pole mounted THC markers are not permitted in "RIO-3."

(2) ~~B.~~ Monuments and memorial plaques must commemorate an event or person significant to the Riverwalk or the history of the Riverwalk. To assure that the significance of an event or person has withstood the test of time, memorial plaques may commemorate an event ten (10) years or older a person ten (10) years or more posthumously.

(3) ~~C.~~ Memorial gifts, such as benches, fountains or art etc. may from time to time be accepted as gifts by the city, plaques acknowledging the gift, shall be bronze and

no larger the ten inches by four inches (10" x 4"). Memorial plaques for a gift of a tree or other plantings are not permitted.

(4) ~~D.~~ Placement of monuments, memorials and markers will be under the jurisdiction of the director of parks and recreation, rather than the director of planning, after consultation with the historic preservation officer ~~historic and design review commission~~.

(5) ~~E.~~ Plaques recognizing donors for significant improvements or plaques acknowledging the naming of significant improvements such as, but not limited to, pocket parks, footbridges, fountains, grottos, gardens, gazebos, boat landings, overlooks and other significant features may be placed along the San Antonio River. The plaques may be no larger than four (4) square feet and must be made of either cast bronze, cast aluminum (or other suitable metal), carved stone, or tile. Language utilized (in recognition of an individual, corporation or foundation) on a plaque must contain language substantially similar to "sponsored by, underwritten by, a gift from."

(e) **Vending in the Riverwalk Area.**

(1) **Definitions**. The following definitions apply to this subsection 35-679(e) in addition to those definitions contained in Appendix "A":

* * * * *

Vend shall have the meaning provided in Appendix A. ~~means offering goods, merchandise, or services in exchange for compensation; accepting compensation in exchange for goods, merchandise, or services; or distribution or display of merchandise or commercial advertising matter.~~

* * * * *

Chapter 35, Article VI, Section 35-680 is amended as follows:

Sec. 35-680. Demolition of Historic Features in the River Improvement ~~Riverwalk~~ Overlay Districts.

Demolition of architectural features, artwork, furniture, and other items shown on the Robert Hugman plans as well as other historic Riverwalk construction dating back to Spanish Colonial times and including works by the WPA, the CCC and the National Youth Administration constitutes an irreplaceable loss to the quality, character, ambiance and atmosphere of the San Antonio Riverwalk in the river improvement overlay districts. Accordingly, these procedures provide criteria to prevent unnecessary damage to the unique character of the city's Riverwalk areas and character.

(a) **Applicability.** The provisions of this section apply to any application for demolition of important architectural features on or immediately adjacent to the river and or the Riverwalk in the river improvement overlay districts.

Items shown on the Robert Hugman Plans for the Riverwalk in "RIO-3."

~~No certificate shall be issued for demolition of any~~ Items ~~items~~ shown on the Robert Hugman Plans for the Riverwalk in "RIO-3~~.~~" must be preserved including but ~~This prohibition against demolition of Hugman features includes but is~~ not limited to staircases, walkways, furniture, bridges, tile and other artwork, light fixtures, handrail ornaments, boat landings, fountains, waterways, water features, retaining walls and the overall landscaping plan for placement of planting beds, and the ~~. This prohibition shall also apply to~~ earlier, hand-built river retention walls found in "RIO-3" as identified in the city records and commonly known as the Tobin walls and the Stucco walls. Appropriate ~~However, appropriate~~ penetrations of these historic retention walls will be permitted subject to commission approval.

Heritage Trees. Removal or damage to heritage trees such as large Cypress trees and other, old significant trees at top of bank or along the Riverwalk is prohibited in all river improvement overlay districts. Except where the tree is damaged due to disease, age or physical condition and must be removed for the safety reasons. Then with a recommendation from the city arborist, or the official urban forester, the historic and design review commission may grant approval for demolition.

* * * * *

Chapter 35, Article VII, Section 35-712 is amended as follows:

Sec. 35-712. Recognition of Rights Derived from Texas Local Government Code Chapter 245.

*** * * * ***

(b) **Recognition of Statutory Rights**

* * * * *

(3) **Basis for Statutory Rights**

* * * * *

A. **Master Development Plan (MDP)** ~~/ Preliminary overall area development plan (POADP).~~ Rights under Chapter 245 will be recognized for the project that is the subject of a MDP~~/POADP~~ that has been approved by the city and maintains validity in accordance with 35-412(i) ~~by the city~~. ~~A property owner or developer may elect to continue a project under the City Code provisions in effect on September 1, 1997 or to take advantage of changes to this chapter that enhance or protect the project without forfeiting any rights under this chapter provided that information describing the project giving fair notice of the project to the city is provided with a MDP/POADP application in accordance with this chapter or by requesting recognition of rights for an existing and valid MDP/POADP and providing information describing the project to provide fair notice of the project to the city in accordance with this chapter. The rights recognized for projects located within an approved MDP/POADP will expire unless a final plat is approved within two (2) years from the approval of the MDP/POADP that plats, at least eight (8) percent of the net area of the~~

~~POADP area or an expenditure of at least five hundred thousand dollars ($500,000.00) in project expenses has been made if the master development plan is one thousand (1,000) acres or less or an expenditure of at least one million dollars ($1,000,000.00) has been made if the master development plan is more than one thousand (1,000) acres.~~

B. Preliminary overall area development plan (POADP). A property owner or developer may elect to continue a project under the City Code provisions in effect on September 1, 1997 or to take advantage of changes to this chapter that enhance or protect the project without forfeiting any rights under this chapter ~~provided that information describing the project giving fair notice of the project to the city is provided with a MDP/POADP application in accordance with this chapter or~~ by requesting recognition of rights for an existing and valid ~~MDP/~~POADP ~~and providing information describing the project to provide fair notice of the project to the city in accordance with this chapter.~~ The rights recognized for projects located within an approved ~~MDP/~~POADP will expire unless a final plat is approved within two (2) years from the approval of the ~~MDP/~~POADP that plats, at least eight (8) percent of the net area of the POADP area or an expenditure of at least five hundred thousand dollars ($500,000.00) in project expenses has been made if the ~~master development plan~~ POADP is one thousand (1,000) acres or less or an expenditure of at least one million dollars ($1,000,000.00) has been made if the ~~master development plan~~ POADP is more than one thousand (1,000) acres.

Further, the rights for projects within an approved ~~MDP/~~POADP will expire unless fifty (50) percent of the net area within ~~within~~ the approved ~~MDP/~~POADP is the subject of final plats or development within ten (10) years from the date of approval of the ~~MDP/~~POADP. For a POADP existing prior to September 1, 1997 that meets the requirements of subsection 35-1027(j) of the 1987 UDC, the rights for projects will expire ten (10) years from the date of approval of the ~~MDP/~~POADP or September 25, 2007, whichever is later. Rights may continue to be recognized once the aforementioned criteria have been fulfilled provided a plat is recorded every five years thereafter. ~~The remaining fifty (50) percent must obtain final plat approval or be developed within ten (10) years after the initial fifty (50) percent of the net area within the MDP/POADP has been platted or developed unless specific provisions to the contrary exist in an individual ordinance or City Code provision.~~ The filing of a minor amendment to a ~~MDP/~~POADP, a plat, or a replat will not result in a loss of rights to the entire ~~MDP/~~POADP provided that the required area of acreage within the ~~MDP/~~POADP platted or the value of project expenses do not fall below the amounts indicated above as a result of the minor amendment, plat, or replat. A plat or replat that changes the project within a particular area of an ~~MDP/~~POADP will cause rights for that area to terminate. An expired or invalid ~~MDP/~~POADP may not be the basis for accrual of statutory rights under V.T.C.A. Local Government Code Ch. 245 or any other right of claim based on common law. Neither shall any endeavor of project that does not meet the requirements of section 35-1027 of the 1987 UDC as amended nor any permit that has expired in accordance with the dormancy provisions of any state statute or provision of the

City Code be used as a basis for approval of permit rights, development rights, or statutory rights.

POADP is defined as a preliminary overall development plan that was submitted to the City prior to June 4, 2001

C.~~B.~~ **Plat Applications.** Rights under Chapter 245 will be recognized for the project that is the subject of an application for a plat identification number/letters of certification that has been filed with the department of development services, provided all necessary fees have been paid. The rights recognized for a project located within such a plat application will expire unless the plat application is heard by and approved by the director of development services or the planning commission within two (2) years from the date the initial application and information describing the project giving fair notice of the project to the city is provided with the plat application in accordance with this chapter. Neither an expired nor a withdrawn plat application may be relied upon as a permit application for the assertion of statutory rights under Chapter 245 or any other right or claim based on common law. If after the expiration or the withdrawal of a plat application the applicant wishes future plat approval of the subject property, a new plat application shall be filed, new application fees shall be required and a new plat number shall be assigned.

D.~~C.~~ **Plats**. Rights under Chapter 245 will be recognized for projects associated with the property which is the subject of a plat that has been approved by the city planning commission or director of development services if information describing the project giving fair notice of the project to the city is provided with the plat application in accordance with this chapter. The rights recognized for a project located within an approved plat will expire unless the plat is recorded in the Bexar County Deed Records within three (3) years from the date of approval by the city planning commission or director of development services.

E.~~D.~~ **Building Permits.** A building permit may be relied on as a basis for rights under Chapter 245 for projects identified in the site plan submitted to the city as part of the building permit application provided that information describing the project giving fair notice of the project to the city is provided with the permit application in accordance with this chapter. However, rights that are based on a building permit will expire unless construction authorized by the building permit is begun within six (6) months from the date the building permit is issued.

F.~~E.~~ **Rights under Chapter 245.** Rights accrued under this section shall not extend beyond the time periods prescribed herein except by the granting of a variance from the time limits as provided herein. Under no circumstances shall the extension of a time limit extend the rights conferred herein except through the variance provision of this section.

* * * * *

Chapter 35, Article VIII, Section 35-801 is amended as follows:

Sec. 35-801. Board of Adjustment.

* * * * *

(k) **Findings of Fact.** Every decision of the zoning board of adjustment shall be based upon findings of fact and every finding of fact shall be supported in the record of its proceedings. The enumerated conditions required to exist on any matter upon which the board is required to pass under this article or to affect any variance or special exception in this chapter shall be construed as limitations on the power of the board to act. A mere finding or recitation of the enumerated conditions unaccompanied by findings of specific facts shall not be deemed findings of fact and shall not be deemed compliance with this article.

(1) **Power to Make Special Exceptions.** The zoning board of adjustment may make special exceptions to the terms of this chapter only as specifically provided for in ~~section 35-209(a)(3) and division 8 of article III of~~ this chapter; however, the board shall not grant a special exception unless it makes specific findings that:

A. The exception will be in harmony with the spirit and purposes of his chapter.
B. The public welfare and convenience will be substantially served.
C. The neighboring property will not be substantially injured by such proposed use.
D. The exception will not alter the essential character of the district and location which the property for which the exception is sought.
E. The exception will not weaken the general purpose of this chapter or the regulations herein established for the specific district.

(2) **Record of Action.** The above findings of the board shall be incorporated into the official minutes of the board meeting in which the special exception is authorized.

(l) **Recommendation From Other Public Agencies.** The board of adjustment shall receive and consider recommendations from public and semipublic agencies, as applicable, before rendering a decision in any case before the board. To this end, the board shall, in addition to the other requirements of this chapter, notify all agencies deemed to have an interest in the case.

* * * * *

Chapter 35, Article VIII, Section 35-803 is amended as follows:

Sec. 35-803. – Historic and Design Review Commission.

*** * * * ***

(c) **Composition and Qualifications.** In appointing members of the commission, the city council shall make appointments that are sensitive to the preservation and development goals of the city and will enable the city to retain compliance as a certified local government under the rules incorporating the provisions of the U.S. Historic Preservation Act of 1966, as amended, and Title 13, Texas Historic Commission, chapter 15, ~~specifically 13 TAC 15.6(f)(3)(C),~~ so that all members shall have a demonstrated "interest, competence, or knowledge in historic preservation."

* * * * *

(j) **Quorum.**

(1) A quorum of the commission shall require six (6) members present. The affirmative votes of a majority of the members present is required for action, except in the case of an application for demolition which shall require a two-thirds (2/3) majority of the members present for a recommendation of approval.

(2) Except when considering an application for demolition or a question of procedure or qualification, when a motion to approve, deny, or approve with conditions fails to pass with the requisite number of five votes, such outcome shall be deemed to be the approval of a motion to reconsider the question, and an automatic continuance to the next regularly scheduled meeting of the commission. If the commission has continued an item at two (2) consecutive meetings, such action, at the option of the applicant, shall be deemed to be a negative recommendation.

(3) Subpart (2) shall apply only when an application has been heard and the chair calls for motions, and so long as no subsequent motions on the application are made.

(k) **Conflicts of Interest.** No member of the commission shall vote or participate as a member in any matter that materially affects the property, income, or business interest of that member or in which the member holds a substantial interest. Such member shall refrain from all discussions of the matter with other commissioners, not be present when the matter is considered, not vote on the matter, and file all required written recusal documents prior to consideration of the item. ~~give notice of abstention from voting prior to the taking of a vote.~~

* * * * *

Chapter 35, Article VIII, Section 35-808 is amended as follows:

Sec. 35-808. Zoning Commission.

* * * * *

(g) **Meetings.** Regular meetings shall be held the first and third Tuesdays of each month at 1:00 p.m. The place, day and/or hour of meetings may be changed by vote of the commission at any regular meeting. Special meetings may be called by the chairman. All meetings of the commission shall be open to the public and shall provide notice in accordance with the Texas Open Meetings Act. Zoning Applications and any amendments to zoning regulations shall require compliance with Texas Open Meetings Act, Texas Local Government Code 211.007, and Unified Development Code Section 35-403. ~~Regular meetings shall be held the~~

~~first and third Tuesdays of each month at 1:00 p.m., and notice of each meeting shall be given in accordance with the Texas Open Meetings Act. Special meetings may be called by the chairman, provided written notice thereof is mailed to each member at least forty-eight (48) hours prior to the time thereof. Zoning applications shall be considered only at regular meetings except for city initiated applications to permanently rezone areas with temporary zoning designations or zoning designations under previously adopted zoning ordinances which may be considered at special meetings held in or adjacent to the area under consideration for rezoning. Other matters shall be considered only at regular or special meetings. All meetings of the commission shall be open to the public. The place, day and/or hour of meetings may be changed by vote of the commission at any regular meeting. Notice of such action shall be published in the official city newspaper one (1) time at least ten (10) days prior to the effective date.~~

* * * * *

Chapter 35, Appendix A, Section 35-A101 is amended as follows:

Sec. 35-A101. Definitions and Rules of Interpretation.

*** * * * ***

(b) **Definitions.** Words with specific defined meanings are as follows:

*** * * * ***

Alteration. Any change affecting the exterior appearance of an existing structure or improvement by additions, reconstruction, remodeling, or maintenance; or any structural changes involving changes in form, texture, materials, or color; or, as applied to a building or structure, a change or rearrangement in the structural parts of the existing facilities, or an enlargement, whether by extending on a side or by increasing the height, or the moving from one location to another.

Ambulatory Surgical Center. See Clinic, dental or medical.

Amusement and recreation uses. Establishments primarily engaged in providing amusement or entertainment for a fee or admission charge. These include dance halls and party houses; studios; theaters and cinemas; musical entertainment; bowling alleys; billiards and pool establishments; racetracks; sports arenas, rings, ball fields, and courts; swimming pools; carnivals and circuses; fairgrounds; stadiums; expositions and amusement parks; skating rinks; golf courses; horse shows; arenas, and stables; coin-operated devices and game parlors.

*** * * * ***

Athletic field. ~~Within the context of section 35-523 athletic field means an on-site~~A sports playing field used primarily for organized sports, such as baseball, football, or soccer, for public or private schools, parks, or youth or other amateur athletic associations ~~or for use as a sports playing field off-site for a public or private school in association with youth sports~~. Athletic field shall not include such uses as sport courts or professional sports stadiums.

* * * * *

Bus shelter (public operated system). A roofed structure located on or adjacent to the right-of-way of a street, and which is designed and used primarily for the weather protection and convenience of waiting bus passengers.

Bus stop (public operated system). A fixed location where passengers board and alight usually identified by a sign.

* * * * *

Certificate of appropriateness. A document issued by the city manager, or their designee, stating that the proposed work is appropriate and in conformance with any applicable standards and guidelines. ~~The official notice of action issued by the city manager, or his or her designee, charged with the jurisdiction for permitting or denying the appropriateness of proposed office of historic preservation applications, including changes or additions to historic structures or districts.~~

* * * * *

Clinic, dental or medical. A building in which ~~ten (10) or more physicians and/or dentists or their allied professional assistants carry on their profession; or a building which contains~~ one (1) or more physicians, dentists, and other health and dental professionals ~~and their assistants~~ carry on their profession. Medical clinics may include ~~and~~ a laboratory, medical radiological equipment, and/or an apothecary limited to the sale of pharmaceutical and medical supplies. A clinic may also provide operating rooms for out-patient surgical procedures. Additionally, establishments regulated as Ambulatory Surgical Centers and providing out-patient surgical care, as defined in Chapter 135 of the Texas Administrative Code, shall be considered a medical clinic for the purposes of this chapter. ~~A clinic shall not include in-patient care or operating rooms for major surgery~~.

* * * * *

Common worker. An individual who performs labor involving physical tasks that do not require a particular skill, training in a particular occupation, craft, or trade, or practical knowledge of the principles or processes of an art, science, craft, or trade.

Community Garden. An area of land managed and maintained by a group of individuals to grow and harvest food crops, including fruits and vegetables, and/or non-food ornamental crops, such as flowers, for personal or group use, consumption, sale, or donation. Community gardens may be divided into separate plots for cultivation by one or more individuals or may be farmed collectively by members of the group and may include common areas maintained and used by group members.

Community home. A facility which complies with Chapter 123 Community Homes for Disabled Persons Location Act of the Texas Human Resources Code, and as amended; and which is:

• A community-based residential home operated by:(1)the Texas Department of Mental Health and Mental Retardation; (2) a community center organized under Subchapter A, chapter 534,

Health and Safety Code, that provides services to persons with disabilities; (3) an entity subject to the Texas Non-Profit Corporation Act (Article 1396-1.01 et seq., Vernon's Texas Civil Statutes); or (4) an entity certified by the Texas Department of Human Services as a provider under the medical assistance program serving persons in intermediate care facilities for persons with mental retardation; or

• An assisted living facility with six (6) or fewer residents licensed under Chapter 247 of the Texas Health and Safety Code, provided that the exterior structure retains compatibility with the surrounding residential dwellings. By definition an unlicensed facility is not considered an assisted living facility. See also section 35-376.

* * * * *

Comprehensive land use category. Land use categories designated in the comprehensive/master planning process. The following shall be the designated comprehensive land use categories for neighborhood, community, sector, ~~and~~ perimeter plans and any other element of the Comprehensive plan:

Low density residential estate - includes large lot singe-family detached houses on individual estate-sized lots or in conservation subdivisions. This form of development should be located away from major arterials, and can include certain nonresidential uses such as schools, places of worship, and parks that are centrally located for convenient neighborhood access. Permitted zoning districts: R-20, RE, RP and RD, as well as IDZ with uses and density permitted in R-20, RE, RP, and RD.

Low density residential - includes single-family detached houses on individual lots at typical suburban densities. This form of development should be located away from major arterials, and can include certain nonresidential uses such as schools, places of worship, and parks that are centrally located for convenient neighborhood access. Permitted zoning districts: R-5, R-6, NP-8, NP-10, NP-15, and UD, as well as IDZ with uses and density permitted in R-5, R-6, NP-8, NP-10, NP-15, and UD.

Medium density residential - accommodates a range of housing types including single-family attached and detached houses on individual lots, duplexes, triplexes, fourplexes, and low-rise, garden-style apartments with more than four (4) dwelling units per building. Cottage homes and very small lot single-family houses are also appropriate within this land use category. Detached and attached accessory dwelling units such as granny flats and garage apartments are allowed when located on the same lot as the principal residence. Certain nonresidential uses, such as schools, places of worship and parks, are appropriate within these areas and should be centrally located to provide easy accessibility. Permitted zoning districts: R-3, R-4, RM-4, RM-5, RM-6, MF-18 and UD, as well as IDZ with uses and density permitted in R-3, R-4, RM-4, RM-5, RM-6, MF-18 and UD.

High density residential - includes low-rise to mid-rise apartments with more than four (4) dwelling units per building. High density residential provides for compact development including apartments, condominiums and assisted living facilities. This form of development is typically located along or near major arterials or collectors. Certain nonresidential uses, such as schools, places of worship and parks, are appropriate within these areas and should be centrally located to provide easy accessibility. This classification may be used as a transitional buffer between lower density residential uses and

nonresidential uses. High density residential uses should be located in a manner that does not route traffic through other, lower-density residential uses. Permitted zoning districts: MF-25, MF-33 and UD, as well as IDZ with density permitted in MF-25, MF-33, and UD.

Very high density residential - includes mid-rise to high-rise apartments with more than four dwelling units per building. Very high density residential provides for apartments, condominiums and assisted living facilities at urban densities. This form of development is typically located along or near high capacity roadways including major arterials and collectors. Parking areas should be contained in structured parking garages beneath apartments, wrapped by apartments, or placed to the rear of the lot. Very high density residential development should be located in close proximity to compact, pedestrian-oriented retail and service uses. This classification may be used as a transitional buffer between lower density residential uses and nonresidential uses. Very high density residential uses should be located in a manner that does not route traffic through other, lower density residential uses. Permitted zoning districts: MF-40, MF-50, and MF-65, as well as IDZ with density permitted in MF-40, MF-50 and MF-65.

Office - includes medium-intensity professional, personal, business, and non-profit uses that provide services to the local community, or house small to medium sized administrative functions for local, regional, national, and international entities. Examples of office uses include attorney offices, dentist or physician offices, administrative offices of construction or engineering firms, computer training centers, and local non-profit housing provider headquarters. Office uses should be found on, or adjacent to, arterials. Permitted zoning districts: O-1, O-1.5 and O-2.

Neighborhood commercial - includes smaller intensity commercial uses such as small-scale retail or offices, professional services, convenience retail, and shop front retail that serves a market equivalent to a neighborhood. Neighborhood commercial uses should be located at the intersection of residential streets and arterials, and within walking distance of neighborhood residential areas, or along arterials where already established. Permitted zoning districts: NC, C-1, and O-1.

Community commercial - includes offices, professional services, and retail uses that are accessible to bicyclists and pedestrians. This form of development should be located at nodes on arterials at major intersections or where an existing commercial area has been established. Parking areas should be located behind the building, with the exception of one row of parking facing the street. Additionally, all off-street parking and loading areas adjacent to residential uses should include landscape buffers, lighting and signage controls. Examples of community commercial uses include cafes, offices, restaurants, beauty parlors, neighborhood groceries or markets, shoe repair shops and medical clinics. Permitted zoning districts: O-1.5, C-1, C-2, C-2P and UD.

Regional commercial - includes high density land uses that draw customers from a larger region. Regional commercial uses are typically located at intersection nodes along expressways or major arterial roadways or adjacent to high-capacity mass transit system stations. These commercial nodes are typically twenty (20) acres or greater in area. Regional Commercial uses should incorporate well-defined entrances, shared internal circulation, limited curb cuts to expressways and arterial streets, sidewalks and shade trees in parking lots, landscaped yards between the parking lot and street, and well-designed, monument signage. Examples of regional commercial uses include movie theaters, wholesale plant nurseries, automotive repair shops, fitness centers, home improvement

centers, hotels and motels, mid to high rise office buildings, and automobile dealerships. Permitted zoning districts: O-1.5, O-2, C-2, C-2P, C-3 and UD.

Mixed use - includes a concentrated blend of residential, retail, professional service, office, entertainment, leisure and other related uses at urban densities to create a pedestrian-oriented environment. Mixed use incorporates high quality architecture and urban design features such as attractive streetscapes, parks/plazas, and outdoor cafes. Parking areas should be located behind buildings. This classification requires a mix of uses in the same building. Examples of mixed use uses include small offices (dentists, insurance professionals, non-profits, etc.), small retail establishments (cafes, shoe repair shops, gift shops, antique stores, hair salons, drug stores, etc.) and high-density residential uses. Permitted zoning districts: IDZ, MXD, MPCD, TOD and FBZD.

* * * * *

Cosmetics - intradermal (permanent makeup). The practice of applying permanent makeup generally to the eyebrows, eyelids, and lips.

Cottage Food. Food produced and sold direct to consumers by a home-based business in accordance with Texas Health & Safety Code Chapter 437.

Council. The city council of the City of San Antonio.

* * * * *

Density, maximum. The maximum number of dwelling units that may be constructed where indicated in this chapter, stated as gross density unless otherwise indicated. When calculating the number of dwelling units that may be constructed, pursuant to density limitations otherwise provided in this Code, the City will employ standard practices for rounding the number to the nearest whole number.

* * * * *

Downtown Business District. For the purposes of this chapter, "downtown business district" shall include the area described as follows: Start at the intersection of Salado and El Paso Streets; north on Salado/Haven for Hope Way to its intersection with Frio Street; thence northeast in a straight line to the intersection of IH-10 and Cadwallader; south on IH-10 to IH-35; northeast on IH-35 to a perpendicular point connecting with Cherry Street; south on Cherry Street to César E. Chávez Boulevard; west on César E. Chávez Boulevard to the San Antonio River; south along the San Antonio River to Arsenal Street; west on Arsenal to El Paso Street; and then west on El Paso to Salado.

~~The area originally settled and the locus of economic activity in the region. This shall include the area described as follows: Start at the intersection of Salado and El Paso Streets; north on Salado/Haven for Hope Way to its intersection with Frio Street; thence northeast in a straight line to the intersection of IH-10 and Cadwalader; south on IH-10 to IH-35; northeast on IH-35 to~~

~~a perpendicular point connecting with Cherry Street; south on Cherry Street to Cesar E. Chavez Boulevard; west on Cesar E. Chavez Boulevard to the San Antonio River; south along the San Antonio River to Arsenal Street; west on Arsenal to El Paso Street; and then west on El Paso to Salado.~~

* * * * *

Dwelling, multi-family. A dwelling or group of dwellings on one (1) lot containing separate living units for five (5) or more families, but which may have joint services or facilities.

Dwelling, single-family attached (townhouse). A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and with a yard or public way on not less than two sides. ~~A building that has one family dwelling units erected in a row as a single building on adjoining lots, each being separated from the adjoining unit or units by a firewall (constructed in accordance with city codes and ordinances), along the dividing lot line, and each such building being separated from any other building by space on all sides. Each unit maintains a separate lot.~~

Dwelling, single-family detached. A one-family dwelling that is not attached to any other dwelling by any means and is surrounded by open space or yards.

* * * * *

Entablature. A horizontal, continuous lintel on a classical building supported by columns or a wall, comprised of the architrave, frieze, and cornice.

Entertainment Venue (Indoor). Any building, structure, or portion thereof, that include activities for amusement. These include, but are not limited to: Haunted House Attractions, Bounce House Attractions, Laser Tag, Miniature Golf, Skating Rinks, and Skateboard Tracks. Uses in this category shall be contained entirely within a building or structure. This use does not include Theme Parks, Go Cart Tracks, Carnivals/Circuses, Theaters, and Performing Arts Venues.

Entertainment Venue (Outdoor). Any plot of land that includes activities for amusement. These include, but are not limited to: Haunted House Attractions, Bounce House Attractions, Laser Tag, Miniature Golf, Skating Rinks, Skateboard Tracks, Cornfield Maze, or Hayride. This use does not include Theme Parks, Go Cart Tracks, Carnivals/Circuses, Theaters, and Performing Arts Venues.

Ephemeral stream. A stream or drain that flows only during and for short periods following precipitation and flows in low areas that may or may not have a well-defined channel.

* * * * *

Extended Stay Hotel/Motel or Corporate Apartment. A building containing rooms intended or designed to be used or which are used, rented, or hired out to be occupied temporarily for an extended period of time by guest and where a kitchen and dining area are provided within the room or complex of rooms rented by the tenant.

* * * * *

Fence (combined). A fence with at least eighteen (18) inches, but no more than thirty-six (36) inches, of the lower portion of the fence (measured from the ground up) ~~is~~ composed of an allowable solid material ~~(wood, stone and/or masonry)~~ with the upper portion of the fencing being constructed with openings equal to fifty (50) percent of the total area of the open portion of the fence calculated by the length times the height of the open section of the fence.

Fence (screening). A fence constructed without any surface voids for the purpose of blocking a person's visual view from a public street or adjacent property.

* * * * *

Group home. See assisted living facility, boarding home or community home as applicable. See also § 35-376.

Gun Range. Any land or structure where there are facilities of any sort for the firing of handguns, rifles, or other firearms.

Gymnasium. A place, hall, building for gymnastics. A gymnasium may include trampoline equipment, or a fully enclosed trampoline park.

* * * * *

Historically significant site in need of tax relief to encourage preservation. A building, site, or structure together with the land necessary for access and use which is determined by the historic and design review commission to be in substantial need of rehabilitation or restoration and is one (1) or more of the following:

(a) Designated a National Historic Landmark;

(b) Listed on the National Register of Historic Places; or

(c) Located in a National Register Historic District and certified by the Secretary of Interior as being of historic significance to the district; or

(d) Designated as a Recorded Texas Historic Landmark by the Texas Historical Commission; or

(e) Designated a State Archaeological Landmark; or

(f) Designated as a ~~an exceptional or significant~~ landmark by the city as provided in this chapter; or

(g) Located in a historic district designated by the city and certified by the historic and design review commission as being of historic significance to the district.

* * * * *

Hood. A protective and sometimes decorative cover over doors, windows, or chimneys.

Horse. Drawn Carriage (Base Operations). A location with a principal building or structure from where carriage operators originate and return to for carriage storage and animal boarding. Carriages may be drawn by other large animals in accordance with Chapters 5 and 33 of the City Code.

Horticulturist. A qualified professional who has studied the science or art of cultivating plants especially for ornamental use.

* * * * *

Infrastructure expenses. Infrastructure expenses shall include engineering costs, impact fees, platting fees (including the amount of bond, irrevocable trust agreement, or irrevocable letter of credit posted with the city to assure compliance with platting requirements), as well as necessary development costs actually paid (if such costs actually paid exceed or are necessary but not included in infrastructure costs covered by the bond, irrevocable trust agreement or irrevocable letter of credit) including off-site infrastructure costs that are necessary for plat approval of a specific parcel of real property. Further, a property owner or developer shall be allowed to include as infrastructure expenses, costs incurred by voluntary compliance with development ordinances including by way of example but not limitation, tree survey costs.

* * * * *

Lot (Platted). A designated ~~parcel or~~ area of land established by plat to be used, developed or built upon as a unit.

* * * * *

Lot, flag. A lot not meeting minimum frontage requirements consistent with the illustration shown in subsection 35-515(h).

Lot, irregular. A lot of such a shape or configuration that technically meets the area, frontage, and width requirements of this chapter but meets these requirements by incorporating unusual elongations, angles, curvilinear lines unrelated to topography or other natural land features or which fronts a cul-de-sac, eyebrow, elbow, or other curved portion of a street.

Lot, reversed corner. A corner lot, the exterior side lot line of which is a continuation of the front lot line of the lot abutting immediately to the rear.

* * * * *

Mitigation tree. A tree used for the purpose of mitigating the destruction or removal of a protected or heritage tree pursuant to the requirements of the tree preservation standards. A mitigation tree must have a caliper of at least one and one half (1 ½) ~~two and one-half (2½)~~ inches.

* * * * *

Mulch. Non-living organic ~~and inorganic~~ materials customarily used in landscape design to retard erosion, retain moisture, maintain even soil temperature, control weeds, and enrich the soil. Mulch used for tree canopy, streetscape, buffer, mitigation, and landscape requirements shall be organic wood material.

* * * * *

Multi-trunk tree. A tree having two (2) or more main trunks arising from the root collar or from the main trunk. Multi-trunk trees are to be measured with the largest trunk counting for full DBH inches plus 50% of the DBH sum of the additional trunks, if the tree is classified as significant. ~~and measured for DBH by adding the entire DBH of the largest trunk to the sum of the remaining trunks at one-half (½) of their DBH.~~ Where no trunk is greater than one (1) inch DBH, the tree will not be protected regardless of the sum of the DBH inches of trunks calculated by the above method.

* * * * *

Nameplate. A sign not exceeding one (1) square foot in area indicating the name and/or address of a building or the name of an occupant thereof and/or the practice of a permitted occupation therein.

Natatorium. A place, hall, building in which a swimming pool as a primary use is located.

National Historic Preservation Act (NHPA). 16 U.S.C. Part 470.

* * * * *

Office warehouse/flex space. A building configured to accommodate a combination of office, showroom, wholesale, and warehousing functions, the exact proportions of each use being subject to user modifications over time. Showroom space may provide for regular transaction of business and for the display of uncontainerized merchandise in a finished building setting. Retail sales of products inside the premises may be permitted as accessory to this use. Flex space buildings are typically located in business or industrial parks and usually have a footprint exceeding ten thousand (10,000) square feet. They are usually designed with loading docks to the rear and parking in the front. Building facades visible from public streets and public entries are often treated with a higher quality of architectural finish than the other sides. A single-purpose building with incidental storage space shall not be considered an office warehouse/flex space use.

Off-Lot Easement. An easement that is within the boundary of the plat, but is not on the lot(s) or entirely on the lot(s) being platted, and is identified by a heavy dashed line rather than a solid line.

Off-site facility. Any structure, facility, equipment, or installation, the purpose and function of which is to receive wastewater from a development's internal collection system and to transport, treat, and ultimately discharge that wastewater to a receiving stream at a permanent location determined by the board.

* * * * *

Park (public). Land and facilities, such as playgrounds, fountains, or swimming pools, used or to be used as a neighborhood park, community park, large urban park, sports complex, special use facility, or urban space as defined in the parks and recreation system plan, regardless of location, including both the acquisition of such land, the construction of improvements thereon and the expenditure of funds incidental thereto, including but not necessarily limited to planning, engineering and design of the park and improvements, utility relocation, provision of improvements, utility relocation, provision of pedestrian and vehicular access thereto and purchase of equipment, the need for which are attributable to new residential development.

Park (private). Land and facilities, such as playgrounds, fountains, swimming pools, plazas, community gardens, and campgrounds (not to include recreational vehicle parks or parking) used for recreational purposes or open space purposes by the public, members, or patrons (either with or without paying a fee), and maintained by a private entity.

Parking lot. An off-street, ground-level open area for the temporary storage of motor vehicles. A "parking lot" does not include an area used exclusively for the display of motor vehicles for sale as part of an automobile dealership.

* * * * *

Parsonage or parish house. A residence for a minister, priest or rabbi in connection with the operation of a church.

Passenger Depot. Establishments in this classification operate over long distances between metropolitan areas, although some provide additional regional transportation services. This use may include temporary storage or parking of bus or rail rolling stock, facilities for passenger boarding and alighting, as well as ticketing facilities, toilets, food service, and limited retail uses.

Passive recreation. Recreational activities that have a minimal impact on the natural environment (e.g. bird watching, hiking) and do not require built structures (e.g. recreation buildings, sports fields); therefore, are compatible with preserving natural resource functions such as wildlife habitat and floodplain protection. Passive recreational activities are non-organized, non-motorized, and do not have adverse impacts to natural, cultural, open space, or agricultural values.

* * * * *

Plat. A complete and exact map representing a tract of land, showing the boundaries and location of individual lots, easements, and streets which has been approved by the planning commission and recorded in the deed and plat records in the office of the county clerk. A plat includes a replat.

* * * * *

Processing and warehousing. The storage of materials in a warehouse or terminal and where such materials may be combined, broken down or aggregated for trans-shipment or storage purposes where the original material is not chemically or physically changed.

Produce. Fresh fruits or vegetables.

Project. An endeavor over which the city exerts its jurisdiction and for which one or more permits are required to initiate, continue, or complete the endeavor. Within the context of section 35-710 (permit rights), "project" shall mean an endeavor over which the city exerts its jurisdiction and for which a preliminary overall area development plan, a plat, plat application or a building permit is required to initiate or continue the endeavor. Within the context of permit rights which existed prior to September 1, 1997, project shall mean an endeavor over which a regulatory agency exerts its jurisdiction and for which one (1) or more permits are required to initiate or continue the endeavor.

* * * * *

Public right-of-way (2). An area or strip of land, either public or private, occupied or intended to be occupied by a street, walkway, railroad, utility line, drainage channel, or other similar uses.

Public Safety Facilities. These facilities shall include police, fire, sheriff, and emergency medical service facilities and shall include the facilities of both the City of San Antonio, Bexar County, and other fire and law enforcement providers. A public safety facility may include overnight accommodations for employees, areas for storage of vehicles and emergency response equipment and may or may not be open to the general public. Public safety facilities shall not include hospitals, emergency care clinics, or ambulance services as identified in Tables 311-2 and 2a.

Pyramidal roof. A pyramid-shaped roof with four (4) sides of equal slope and shape.

* * * * *

Residential driveway approach. A driveway which provides access to property on which a single-family residence, duplex, or multi-family building containing five (5) or fewer dwelling units is located.

Residential Greenhouse. An accessory building to a residence made of translucent material, in which plants are cultivated.

Residential Market Garden. A garden at one's residence that grows produce incidental to a residential use. Excess produce may be sold onsite or elsewhere. Sales on the property must be conducted out of sight of the general public.

Residential property. A building, site, or structure whose use after rehabilitation or restoration (for ad valorem tax exemption) will be for residential uses, i.e., for single-family, duplex, three- or four-family dwelling.

* * * * *

School, public. A building or structure, including accessory buildings, grounds, or areas, owned and operated by school or university which is part of a school district or system organized pursuant to Article VII of the Texas Constitution, including any public school organized under V.T.C.A. Education Code Titles 2, and any "General academic teaching institution" or "institution of higher education" as defined in V.T.C.A. Education Code § 61.003, and which are used for teaching, research, or the preservation of knowledge.

School, public or private college or university. A building or structure, including accessory buildings, grounds, or areas, operated by a college or university that is accredited by the Southern Association of Colleges and Schools.

School, private. A building or structure, including accessory buildings, grounds, or areas, owned and operated by a private organization that provides elementary, secondary or high school education (including alternative specialized services for physically or mentally disabled) below the university level.

School, vocational (technical, construction or industrial trades). A profit or not for profit entity providing instruction and training in a skilled trade such as mechanics, carpentry, plumbing, service, construction, industrial or other skill related to assembling, processing, manufacturing, repair, etc.

* * * * *

Specified sexual activity means actual and simulated human genitals in a state of sexual stimulation or arousal, even if completely and opaquely covered, actual or simulated human masturbation, sexual intercourse, sodomy, fellatio, cunnilingus, fondling or other erotic touching of human genitals, pubic region, buttock or female breast, and excretory functions as part of or in connection with the above described activity or any act of bestiality, sadomasochism or physical contact with a person's own or another person's specified anatomical area.

Sport Court. A hard or paved surface accompanied by sporting equipment such as nets or goals, which is used primarily for the playing of sports such as tennis or basketball. A patio, porch, pool, or driveway shall not be considered a sport court.

Sport Court Fence. An enclosure constructed of chain link or soft mesh netting material, which is permanently affixed and surrounds a sport court wholly or in part and which serves to protect abutting and adjacent properties from impacts from sporting equipment. Guard rails required by

the International Building Code shall not constitute a sport court fence. Temporary protective netting which can be removed when not in use shall not constitute a sport court fence.

Stabilization. The act or process of applying measures designed to reestablish a weather-resistant enclosure and the structural stability of an unsafe or deteriorated building, object, site, or structure while maintaining the essential form as it exists at present.

Stables. A building or structure where large domesticated animals are provided short or long term boarding and/or shelter, including access to food, water and grooming. Stables may be enclosed, partially enclosed or predominately open structures; stables not completely enclosed shall be subject to the separation requirements from dwellings identified in Chapter 33 of the City Code.

Stadium. A commercial structure with tiers of seats rising around a field or court, intended to be used primarily for the viewing of athletic events. Sports arena may also be used for entertainment and other public gathering purposes, such as conventions, circuses, or concerts.

Start of construction. Start of construction means for all new construction and substantial improvements, the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within one hundred eighty (180) days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation for a foundation; or the placement of manufactured home on a foundation. Permanent construction includes land preparation, such as clearing, grading and filling; includes the installation of streets and/or walkways; excavation for a basement, footings, piers, or foundations or the erection of temporary forms; the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. The start of construction period is valid for one hundred eighty (180) days. Any delay beyond this period would require resubmission of added data and the permit application.

* * * * *

Street yard. The area of a lot or parcel which lies between the property line along a dedicated street and the actual wall line of the building or, if no building exists, to the rear property line. Such building wall lines extend outward from the corners of the buildings.

Structural alteration. Any change in either the primary structural frame or secondary members of a building, such as bearing walls, fire walls, columns, beams, and girders, or any change in the dimensions or configurations of the roof height or building footprint.

Structure. A walled and roofed building, including a gas or liquid storage tank, which is principally above ground, as well as a manufactured home.

* * * * *

Substantial rehabilitation. Certified improvements to a historic building in which the cost of the project is equal to or greater than thirty (30) percent ~~fifty (50) percent~~ of the appraised pre-rehabilitation improvement value of the property and which constitutes major work on enhancing existing mechanical or structural systems that preserve the historical integrity, while extending the life of the building.

* * * * *

Transit station (public operated system). A building, structure, or area designed located on a busway or a light rail line and used for passenger pickup, drop off, embarking, or changing transportation modes. Facilities and improvements may include shelters, benches, signs, structures, and other improvements which provide security, weather protection, and access to nearby services.

* * * * *

Truck wash (laundry). A facility that provides for the washing, drying, vacuuming and detailing of vehicles with a weight in excess of four thousand (4,000) pounds. (Truck washes (laundry) may be attendant operated or self operated as provided for in section 35-311, Table 311-2 of this chapter.)

Trust Institution. A bank, credit union, foreign bank, savings association, or trust company that is authorized by its charter to conduct a trust business.

* * * * *

Underground storage tank. Any one (1) or combination of underground storage tanks and any connecting underground pipes used to contain an accumulation of regulated substances, the volume of which, including the volume of the connecting underground pipes, is ten (10) percent or more below grade.

* * * * *

Unusual and compelling circumstances. Those uncommon and extremely rare instances, factually detailed, which would warrant a historic and Design Review Commission recommendation due to the evidence presented.

Urban Farm. A tract of land within city limits, not at one's own residence, on which produce is raised and sold on-site or elsewhere. This can include farming and/or greenhouses on vacant lots or acreage. A farmstand or market may be located on the site. In addition to holding a market, an urban farm may host educational events and/or serve as an event venue, provided that sufficient off-street parking is provided.

Use. The purpose for which land or structures thereon is designed, arranged or intended to be occupied or used, or for which it is occupied, maintained, rented or leased.

* * * *

Variety store - retail. A retail store that sells inexpensive items, often with a single price for all items in the store. Typical merchandise includes cleaning supplies, toys, household goods and gardening equipment.

Vend. Offering goods, merchandise, or services in exchange for compensation; accepting compensation in exchange for goods, merchandise, or services; or distribution or display of merchandise or commercial advertising matter.

Veneer. A thin layer of material, such as wood, brick, or stone, applied to a different material or to a type of construction not ordinarily associated with it, e.g. a facing of brick applied to a frame house.

* * * * *

Chapter 35, Appendix B, Section 35-B101 is amended as follows:

Sec. 35-B101. Specifications for Documents to be Submitted.

* * * * *

(c) **Information Required.** No application for development approval shall be accepted unless the following information and data required is included. The required information and data is set forth in Table B101-1 ~~B-1~~, below, and any specific regulations set forth in section 35-B102 et seq.

TABLE B101-1

	A	*B*	*C*	*D*	*E*	*F*	*G*
	(A) Material/Information	*Master Development Plan*	*PUD Plan*	*Major Plat Application*	*Minor Plat Application*	*Development Plat Application*	*Specific Use Authorization*
A.	GENERAL						
	(1) Proposed name of subdivision or development if not within a previously	*	*	*	*		

	platted subdivision. The proposed name shall not duplicate the name of any plat previously recorded in the County.						
	(2) City assigned Master Development Plan ID number.	*	*	*	*		
	(3) City assigned Plat ID number.			*	*		
	(4) ERZD designation note as applicable.			*	*		
B.	OWNERSHIP						
	(1) Name and address of owner of record, developer and designer.	*	*	*	*		
	(2) The names of all adjacent property owners as shown on current tax records.	*	*				
	(3) Certificate of agency or power of attorney if other than owner.	*	*	*	*		
	(4) Names and lot numbers of adjacent plats.			*	*		
	(5) A table shall be provided on each sheet of the plat indicating the lots on which required ADA passing space are required. The passing space shall meet then current ADA regulations concerning size slopes and distance separation.			*	*		
C.	APPROVALS						
	(1) Signature blocks prepared for the dated signatures of the chairperson and secretary (director of development service or assignee) of the authorized approval entity.	*	*	*	*	*	
D.	LEGAL						
	(1) Owner's certificate of consent including a legal description of the boundaries of the proposed development and the dedication of public ways or spaces. This certificate shall be signed, dated, and notarized prior to recording the			*	*		

	instrument.						
	(2) Proposed covenants on the property, if any, including a map and legal description of area affected.		*				
	(3) Copies of maintenance agreements for privately owned drainage facilities.			*	*		
E.	PROPERTY SURVEY AND TOPOGRAPHIC						
	(1) Two points identified by Texas Planes Coordinates.	*	*	*	*		
	(2) Basis of bearings used and a north point.	*	*	*	*		
	(3) Boundary of the development and total acreage encompassed, thereby described and mapped at an appropriate scale.	*	*				
	(4) Legal description and exhibit of the property, an exhibit of current recorded status of the property to include but not limited to a replat, amending plat, antiquated plat, building setback line replat, lot line removal replat, and/or in the case of arbitrary lots evidence that said property falls within the original 36 square mile area of the City of San Antonio, at appropriate scale showing the boundary. Description may be related to the USGS, state grid north, if two (2) adjacent corners are shown.			*	*		
	(5) Topographic contour intervals of no greater than ten (10) feet.	*					
	(6) Existing topography with maximum contour interval of ten (10) feet when ground slope exceeds ten (10) percent; two (2) feet for slopes between five (5) percent and up to ten (10) percent, and ~~except~~ where existing ground is on a slope of less than five (5) percent then either one (1) foot contours or spot elevations		*	*	*		

	~~elevation~~ shall be provided where necessary.						
	(7) All monuments erected, and corners established in the field. The material of which the monuments, corners, or other points are made shall be noted at the representation thereof or by legend, except that lot corners need not be shown. Guarantee by the owner or developer of placement of corner monuments for each lot may be by noting on the plat that such lot monumentation shall occur at completion of all onsite infrastructure construction.			*	*	*	
F.	PLANNING						
	(1) Date of preparation.	*	*	*	*		
	(2) Graphic and written scale and north arrow.	*	*	*	*		
	(3) A location map at a scale of not less than 1" = 2,000' indicating the location and distance in relation to adjacent streets and all surrounding major thoroughfares. The location map is to be located in the top left hand corner of the sheet.	*	*	*	*		
	(4) Total area of property.	*	*	*	*		
	(5) All existing easements or right-of-way and street names, including those contiguous to the development area, their nature, width, and the volume and page number of their recording.			*	*	*	*
	(6) All existing easements or right-of-way with street names impacting the development area, their nature and width.	*	*			*	*
	(7) The location and widths of all proposed public and private streets within the development's boundaries.			*	*	*	*

	(8) The approximate location and widths of all proposed public and private streets within the development's boundaries.		*			*	*
	(9) The approximate location and widths of all proposed public and private streets major thoroughfares, collectors and local b streets within the development's boundaries. For Master Plans (MDPs) 100 acres or less, the double line representation of all streets shall be required. (See exhibit "A")	*				*	*
	(10) The location of all proposed uses or zoning districts as applicable and the maximum allowable intensity (residential density or nonresidential FAR).		*				
	(11) The location and general nature of proposed uses and proposed intensity (residential density or nonresidential FAR).	*					
	(12) Notation of any restrictions required by the City Council in accordance with this Ordinance.		*				
	(13) Notation of any restrictions required as part of the platting process in accordance with this Ordinance.			*	*		
	(14) The location of all entrances onto existing and/or proposed adjacent roadways, whether existing or proposed.	*	*				
	(15) The location and dimensions of all proposed or existing lots.		*	*	*		
	(16) The location, dimensions, and area of all parcels of land proposed to be set aside for park or playground use or other public use, or for the use of property owners in the proposed subdivision, where applicable.	*	*	*	*		
	(17) A development phasing schedule including the sequence for each phase; approximate size in area of each phase;	*	*				

	and, proposed phasing of construction of public improvements, recreation and common open space areas.						
	(18) The schematic location of all existing and proposed streets, as well as proposed access points. For master development plans (MDPs) greater than 100 acres and more than one (1) sheet is necessary to accommodate the entire site, single line representation of all streets not listed in subsection (9) shall be allowed or the engineer can choose to submit a supplemental for his development showing all streets in double line representation. Additional supplemental plans shall be submitted as additional segments of the original master plan are developed. (See Exhibit "B")	*	*			*	*
	(19) The schematic location of the pedestrian circulation system including walkways and bicycle paths, where applicable.	*	*				
	(20) (Conservation subdivisions only) A slope analysis of the proposed development site, showing slopes for the following percent of existing grades: 0—10%, 10—20%, 21—30%, 31—40%, and slopes exceeding 40%, including a tabulation of the number of acres in each slope percentage.	*	*				
	(21) A delineation of EARZ, wetlands and floodplains. Conservation subdivisions and PUD Plans shall also delineate woodlands.	*	*				
	(22) The location, acreage, category and type of improvements, if any, for active and passive open space, including Greenbelt and active recreation space areas, private recreational areas.	*	*				
	(23) Tabulation of the number of acres in						

	the proposed development, showing the total number of lots, and area of open space for the site including the following:						
	a. Square footage of all buildings and structures.		*				*
	b. For nonresidential uses, multi-family dwellings, and any portion of a site located within the EARZ, the approximate location and area of impervious cover.		*				*
	c. Square footage of all paved or otherwise hard surfaced streets, parking facilities, including curb and gutters, walks, loading areas, and asphalt or concrete aprons for solid waste containers, signs or outdoor mechanical equipment.						*
	(24) A final statement in tabular form which sets forth the following data, when such data is applicable to a given development plan: (note: this information shall not be required to be shown on the plat)						
	a. Total number of dwelling units, by development phase;	*	*				
	b. Residential density and units per acre;	*	*				
	c. Total floor area and floor area ratio for each type of use;		*				
	d. Total area in passive open space;		*				
	e. Total area in active developed recreational open space; and		*				
	f. Total number of off-street parking and loading spaces.		*				
	(25) Traffic Impact Analysis (section 35-502)	*	*	*	*		
	(26) Utilities Plan		*	*			

	(27) Historical/Archaeological Survey Report	*	*	*	*		
	(28) An exhibit indicating the area of each lot in square feet for all single-family lots (gross and net excluding easements, flag poles) using on-site sewage [septic tank] disposal			*	*		
G.	DESIGN						
	(1) Sufficient data to determine readily and reproduce accurately on the ground the location, bearing and length of every street and alley line, lot line, building line, easements required hereunder or of record in Bexar County or ascertainable by physical inspection of the property, and boundary lines of reserved or dedicated areas. All linear dimensions shall be in feet and hundredths thereof. The maximum allowable error of linear closure shall not be in excess of 1:10,000. In closed traverses, the sum of the measured angles shall vary with the theoretical sum by a difference not greater than an average of seven and one-half (7½) seconds per angle, or the sum of the total shall not differ from the theoretical sum by more than ninety (90) seconds, whichever is smaller. Said information shall be provided on ~~tracing cloth or~~ reproducible Mylar and on digital media. ~~a diskette in ArcInfo or ArcView software, or a computer file with a ".dfx" format which is translatable to ArcView.~~			*	*		
	(2) Location of property lines, existing easements, burial grounds, railroad rights-of-way, watercourses; location, width, and names of all existing or platted streets or other public ways within or immediately adjacent to the tract; names of adjacent property owners or subdivision name when	*		*	*		

	adjacent property is a platted subdivision from the latest certified assessment rolls						
	(3) Final location, arrangement and dimensions of all proposed and existing lots.			*	*		
	(4) Lots and open space numbered as approved by the City. Open space shall be designated by a 900 series lot # and the size in acreage shall be provided. *Commentary: Information Bulletin (IB) 510 describes the process for the assignment of legal descriptions to properties.*		*	*	*		
	(5) .Layout shall show setbacks for areas located in the ETJ. (setbacks are not required for plats inside the city limits).		*	*	*		*
	(6) Off-street parking and loading areas and structures, including the number of spaces; dimensions of spaces and aisles; and landscaping for parking areas.		*				*
	(7) Location, sizes, elevations, and slopes of existing sewers, water mains, culverts, and other underground structures within the tract and immediately adjacent thereto; existing permanent building and utility poles on or immediately adjacent to the site and utility rights-of-way, as part of a request for LOC			*	*		
	(8) Preliminary proposals for connection with existing water supply and sanitary sewage systems, or alternative means of providing water supply and sanitary waste treatment and disposal; preliminary provisions for collecting and discharging surface water drainage, as part of a request for LOC			*	*		
	(9) All roadway locations and dimensions, their names, numbers, and rights-of-way with profiles and cross sections of all proposed streets showing			*	*		

	proposed cuts and fills, as part of a request for LOC.						
	(10) Location and size of existing water and sewer mains together with intended water sources and sewage disposal sites, as part of a request for LOC			*	*		
	(11) Location of existing springs or public water supply, as part of a request for LOC			*	*		
	(12) Location of proposed water and sewer lines, as part of a request for LOC.			*	*		
	(13) Location of proposed fire hydrants, as part of a request for LOC.		*	*	*		
	(14) A tree affidavit/permit application (section 35-B123)			*	*		
	(15) The location, dimensions and type of all walls, fences (other than fences on private residential lots) and landscaping.						*
	(16) Tree stand delineation (Section 35-B125 General)	*					
	(17) Location and size in acres of school sites, amenity center areas, or non-single family lots as applicable.	*	*	*	*		
	(18) The exterior boundaries as indicated from deeds or other instruments of the development area giving lengths and bearings of the boundary lines. If the proposed development is bounded by a watercourse, a closing meander traverse of that boundary shall be made and shown on the site plan. Where curving boundaries are used, sufficient data to establish the boundary on the ground shall be given; including the curve's radius, central angle, and arc length.	*	*	*	*	*	
	(19) A stormwater management plan	*	*	*	*	*	*1

	(section 35-B119)						
	(20) Signage, Pavement Markings, Street, alley and cross walkway plans (section 35-B120)			*			
	(21) Habitat compliance form consistent with section 35-B133 for properties greater than two (2) acres in size	*	*	*	*	*	

*1. Specific use permits shall only require a stormwater management plan when the site is located over the Edwards Recharge Zone (ERZD).

* * * * *

(e) **Digital Plat Requirements.**

(1) **Generally.**

A. Plat information shall be provided to the City of San Antonio in two (2) forms — as hard copy subdivision plat sheets and as plat digital data. The purpose of the plat digital data requirement is to coordinate with the city's GIS program ~~and is to be used for information only. Unlike the hard copy subdivision plat, which represents a legal document, the plat digital data may be subjected to adjustment by the city and would have no legal significance. However, the plat digital data may be used~~ to assist city officials in analyzing, understanding, interpreting and presenting the data.

B. Digital data of subdivision plats will consist of graphical elements representing the hard copy subdivision plat. The applicant shall provide digital data twice during the subdivision review process — initially, when the subdivision plat is submitted to the department of development services ~~public works~~ for plat ~~plan~~ review, and secondly, before the subdivision plat is approved by the planning commission. Additional digital submittals are required if changes occur between the second digital submittal and the recordation of the plat. The final digital submittal would reflect the graphical elements of the recorded plat.

C. The initial digital data submittal shall include the subdivision boundary, as a minimum. The digital media ~~diskette~~ shall bear a label similar to that of the final digital media ~~diskette~~, as described in subsection (e)~~(a)~~(7), below, with the exception of the plat number.

D. The final digital data media ~~diskette(s)~~ may be submitted with the final subdivision plat documents to the department of ~~planning and~~ development services. The final digital data media ~~diskette(s)~~ must be submitted before the subdivision plat is considered complete and ready for the planning commission consideration.

* * * * *

(3) **Data Layer/Level Requirements.** Data will be separated into the following feature categories, each residing on its own unique level or layer. Any layer name or level number is acceptable as long as each feature set is on its own individual layer or level.

Layer and Level Element Types

Feature	*Element Types*
Subdivision Boundary Data	Lines and Curves
Control Points and Ties to Boundary Text	Points and Cells
Text*	Text
Primary Lot Line Data	Lines and Curves
Right-of-Way Centerline Data	Lines and Curves
Right-of-Way Data	Lines and Curves
Easement Data	Lines and Curves

(*Subdivision plat certification data is not required to be included in the plat digital data until final plat submittal.)

* * * * *

(5) **Formats for Graphical Data.** Any of three (3) formats are allowed for digital plat data submitted to the development services ~~public works~~ department — DXF (generic), DWG (AutoCAD), and DGN (Microstation).

A. **DGN (Microstation) (Bentley).** This is the graphics format used by the City of San Antonio, so no conversion is required when data is provided in this format. The Microstation software used to produce these files should be the most current or prior version of the product. Files produced using software over two (2) releases old may not be accepted. DGN files created on digital media ~~diskette~~ for delivery to the city will be created as ASCII files. No reference files will be attached to DGN files submitted to the city.

* * * * *

(7) **Media Requirements and File Creation.** The city will accept files on digital media. ~~DOS 3.5" High Density (1.4 Mb) diskettes or on 650 Mb CD's.~~ Files created ~~on diskette or CD~~ for delivery to the city will be produced using Windows output formats. Digital media ~~WinZip may be used to compress the files being submitted. Diskettes and CD's~~ will be labeled with the following information:

Plat number, subdivision name, number of files (sheets), on the digital media ~~diskette or CD, disk~~ creation date, company name, ~~and~~ contact name and phone number.

~~(8)**Fees for City Workstation Operator Services.** If the submitting organization elects to submit the hard copy only, the city will produce digital data from the hard copy as part of the map checking process, but will charge the submitting organization at the rate of thirty dollars ($30.00) per hour for workstation operator services.~~

(8) ~~(9)~~ **City's Use of Digital Data.** The city staff utilizes the final digital data to create the geometry and global position of the newly established subdivision. ~~may make minor corrections to the digital data if the file needs correcting due to minor differences between the hard copy plats and the digital data, or if other minor errors, such as layering errors are detected. In instances where differences exist, the information provided on the hard copy plats will take precedence over the digital information. The digital information has no legal significance.~~

* * * * *

Chapter 35, Appendix B, Section 35-B103 is amended as follows:

Sec. 35-B103. Development Plat Application.

* * * * *

(c) **Contents.** The development plat shall be prepared as a boundary survey showing:

(1) All of the information required by Table B101-1 ~~B-1~~ of this appendix;

* * * * *

Chapter 35, Appendix B, Section 35-B109 is amended as follows:

Sec. 35-B109. Master Development Plan.

* * * * *

(c) Contents. The master development plan shall include the following information:

(1) The information required by Table B101-1 ~~B-1~~ of this appendix.

* * * * *

Chapter 35, Appendix B, Section 35-B111 is amended as follows:

Sec. 35-B111. Specific Use Authorization Site Plan.

* * * * *

(b) Contents. The following minimum information shall be shown on the site plan required by this appendix:

(1) All of the information required by Table B101-1 ~~B-1~~ of this appendix.

* * * * *

Chapter 35, Appendix B, Section 35-B113 is amended as follows:

Sec. 35-B113. Planned Unit Development (PUD) Plans.

* * * * *

(c) Contents. The PUD plan shall include the following:

(1) All of the information required by Table B101-1 ~~B-1~~ of this appendix.

* * * * *

Chapter 35, Appendix B, Section 35-B119 is amended as follows:

Sec. 35-B119. - Stormwater Management Plan. (Moved to Appendix H)

~~(a) **Number of Copies.** The applicant shall provide two (2) blue-line or black-line copies of the plat together with two (2) copies of construction drawings.~~

~~(b) **Format.** Plats shall be drawn in India ink on Mylar on sheets eighteen (18) inches wide and twenty-four (24) inches long, with a margin of two and one-half (2½) inches on the left side of the sheet, and appropriate margins on the other three (3) sides. Plats shall be drawn at a scale of one hundred (100) feet to one (1) inch unless a smaller scale is approved by the director of planning and development services. Plats which include one-half (½) acre or less in area shall be drawn at a scale of fifty (50) feet to one (1) inch.~~

~~Where more than one (1) sheet is necessary to accommodate the entire area to be subdivided, an index sheet showing the entire subdivision at an appropriate scale shall be attached to the plat.~~

~~(c) **Contents.** To standardize the review process and minimize the time for approval by the city during review of the plat and construction drawings for a subdivision, a complete submittal regarding the analysis of existing drainage conditions and the design of modifications or new drainage facilities is necessary. The owner of the property to be developed is required by the director of public works to provide, at the owners expense and as a condition of construction plan approval, a stormwater management report for the total development area to be ultimately constructed. The stormwater management report shall contain all of the necessary support data, methodologies used in calculations, and conclusions. A checklist is below that will be used by the city reviewer as a guide during the evaluation of all stormwater management reports submitted to the city. The purpose of the checklist is to expedite the review process for both the engineer and the city, and to aid the engineer in the preparation of reports for the city's review. The stormwater management report shall be submitted to the director of public works through the director of planning and development services prior to approval of any construction plans.~~

(d) **Report.** The stormwater management plan shall include two (2) copies of a written report that includes the following information, as applicable:

- A vicinity map of the site and affected reach of the outfall channel.
- A detailed map of the area and the outfall channel with all pertinent physiographic information.
- A watershed map showing the existing and proposed drainage area boundary along with all sub area delineations and all areas of existing and proposed development.
- Discharge calculations specifying methodology and key assumptions used including a table of discharges at key locations.
- Hydraulic calculations specifying methodology used, assumptions and values of the design parameters.
- Profiles of the affected channels, including water surface elevations for the specified design frequencies, all existing and proposed bridge, culvert and pipeline crossings, the location of all tributary and drainage confluences, and the location of all hydraulic structures.
- Detention basin design calculations, including those used for design of the control structure.
- Right-of-way and easement requirements, and a map showing locations of all rights-of-way and easements.
- A soils report which addresses erosion and slope stability of new or altered channels and detention facilities.
- A computer diskette of all existing and proposed condition HEC-1 and HEC-2 models used in analysis.
- A checklist for the submittal package is included as Attachment 1 below. A checklist for the preparation of a HEC-2 model is included as Attachment 2 below.

ATTACHMENT
DRAINAGE SUBDIVISION CHECKLIST

Included in submittal

1. U.S.G.S. Quadrangle map showing overall drainage areas, runoff coefficients, time of concentration, intensity and Q's.

2. Subdivision Master Drainage Plan with overall interior drainage area of subdivision showing drainage area, time of concentration runoff coefficients, intensities, and Q's for the street and alley flows and also channel and underground system design.

3. Subdivision plat showing interior drainage areas, time of concentration, runoff coefficients, intensities, Q's for street and alley flows and also channel and underground system design.

4. DRAINAGE CALCULATIONS REQUIRED FOR:

_____A. Open channel design

_____B. Underground systems

~~_____C. Box culverts~~

~~_____D. Pipe culverts~~

~~_____E. Hydraulic jump~~

~~_____F. Super elevation in channel bends~~

~~_____G. Retard spacing~~

~~_____H. Backwater curves with cross sections~~

~~_____I. Draw down curves with cross sections~~

~~_____J. Energy dissipaters~~

~~_____K. Hydraulic grade lines of pipes~~

~~_____L. (1) Inlets on grades _____(2) Inlets in sump~~

~~_____M. Drop curb openings~~

~~_____N. Sidewalk culverts~~

~~_____O. AR2/3 calculations with cross sections~~

~~_____P. Weir formulase structures~~

~~_____Q. Orifice formulas~~

~~_____R. Grade to drain channels~~

~~_____S. Upstream pickup and flared section~~

~~_____T. Downstream Backwater control and flare to match downstream condition~~

~~_____U. Show required free board~~

~~_____V. Improper "N" value~~

~~_____W. Improper velocity used~~

~~_____X. Improper easement width~~

~~_____Y. Show access road on each sodded channel~~

~~_____Z. Improper runoff coefficient used~~

~~_____A-A. Improper time of concentration used~~

~~_____B-B. Improper Q's used~~

~~_____C-C. Steel calculations for box culvert~~

~~_____D. Street Q's for 5 yr.(30' street) and 25 yr. (greater than 44' street) frequency showing street capacities are correct based on Figure IX in Subdivision Regulations~~

~~_____5. SUBDIVISION PLAT showing all interior drainage easements, outfall drainage easements, U.S.G.S. contour map and all other necessary drainage information.~~

~~_____A. Show outfall drainage easements to the centerline of existing natural low~~

~~_____B. Show finished fill contours~~

~~_____C. Show interceptor drainage easements~~

~~_____6. TYPICAL DETAILS ON PLANS REQUIRED FOR:~~

~~_____A. Box culvert with headwalls or wing walls~~

~~_____B. Pipe culverts with headwalls or wing walls~~

~~_____C. Culvert headwalls shown with proper safety measures~~

~~_____D. Drop curb openings~~

~~_____E. (1) Inlets on grade _____(2) Inlets on sump~~

~~_____F. Drop structures~~

~~_____G. Retards~~

~~_____H. Sidewalks over drains~~

~~_____I. Guard post installations~~

~~_____J. Guard rail on structures~~

~~_____K. Header curb~~

~~_____L. Energy dissipaters~~

~~_____M. Junction boxes~~

~~_____N. Concrete lined channels with free board~~

~~_____O. Earth sodded channels with free board~~

~~_____P. Other concrete structures:~~

~~_____Q. Grade to drain sections~~

~~_____R. Transition sections~~

~~_____S. Fencing for vertical wall channels greater than 2' deep~~

~~_____T. Other: _____~~

~~U. Side slope~~

~~V. Note: Adjacent lots shall be graded to provide access and drainage to adjacent street and drainage systems.~~

~~7. COMPLETE STREET PLANS AND PROFILES~~

~~8. COMPLETE DRAINAGE PLAN AND PROFILE INCLUDING THE FOLLOWING REQUIREMENTS:~~

~~A. Proposed flowline slopes with grades and elevations shown every 50' in profile~~

~~B. Proposed top of channel profile~~

~~C. Existing ground right and left profile at property line~~

~~D. Finished fill profiles~~

~~E. Locations and size of culverts~~

~~F. Drop structures~~

~~G. Retards~~

~~H. Grade to drain profiles~~

~~I. Flowline elevations at every 50' station and at each structure and change in grade~~

~~J. Junction boxes~~

~~K. Channel plan views~~

~~L. Channel sections~~

~~M. Pipes with hydraulic grade lines on profile~~

~~N. Cross sections of existing natural channels or lows which are not to be improved, but left in natural state and dedicated to high water calculated~~

~~O. Angles, bearings, distances, etc., for structures, channels, etc.~~

~~P. Lot grading layout drains~~

~~Q. Culvert structural details~~

~~9. UNIT AND STORM HYDROGRAPHS FOR MAJOR STREAMS (OVER 2,000 ACRES)~~

~~10. DRAINAGE EASEMENTS TO THE CENTERLINE OF NATURAL LOW~~

~~11. COST ESTIMATE~~

~~12. ENGINEER'S SEAL~~

_____13. OTHER

Attachment 2
CITY OF SAN ANTONIO
HEC-2 SUBMITTAL CHECKLIST

Floodplain submittal checklist supersedes this attachment for projects in the FEMA Floodplain.

Project _____ Engineer _____ Stream _____ Date _____

The purpose of this checklist is to aid the engineer in the preparation of HEC-2 studies and reports and to expedite the City of San Antonio's review procedure.

Submission Package

_____ Signed, sealed, and dated by a engineer certified to practice in the State of Texas

_____ Signed checklist

_____ 3½" diskette with all input files

_____ Copy of condensed printouts

Narrative

_____ Table of Contents

_____ Abstract or executive summary

_____ Introduction

_____ Project description and history

_____ Location

_____ Scope and objective of analysis

_____ Previous and related studies that may affect this analysis

_____ Methodology

_____ Sources of discharges

_____ Bridge routines

_____ Base or effective models (mention source)

_____ Revised base model

_____ Proposed model

_____ Summary, conclusions, and recommendations

_____ Water surface elevation impacts

Tables

_____ Water surface comparison table at each cross section

_____ Floodway table

_____ Cross section numbering table (if stationing changes)

_____ Exhibits

_____ Vicinity Map

_____ Plan view of project reach

_____ Water surface profiles for design storm

_____ Channel cross sections showing limits of drainage easements and property lines.

_____ Bridge cross sections

_____ Plan view of bridge

_____ Photographs (if available)

Appendices

_____ Pertinent correspondence (meeting notes, etc.)

_____ Survey and/or Certified "As-Built" information for all revisions to base model

_____ Sample calculations

Name of submitter_____ Date_____

(e)

Certification. The stormwater management report must include a letter signed and sealed by a professional engineer with text descriptions, exhibits, calculations and models.

The stormwater management plan shall include a performance bond executed as follows:

State of Texas X
_____X
County of Bexar X

KNOW ALL MEN BY THESE PRESENTS:

That we, _____/_____/_____, the undersigned developer as principal, and _____/_____/_____, as surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of San Antonio, a municipal corporation of the County of Bexar and State of Texas, in the full and just sum

of $_____, for the payment of which will and truly to be made, we hereby bind ourselves and our respective heirs, administrators, executors and assigns jointly and severally, firmly by these presents.

Whereas, the principal had petitioned the Floodplain Administrator of the City of San Antonio for permission to _____/_____/_____ within the jurisdiction of the City of San Antonio which is shown on plans entitled _____/_____/_____, and which is more particularly described as follows, to wit:

WHEREAS, plans and a floodplain development permit for such development were approved by the Floodplain Administrator; and

WHEREAS, the Floodplain Ordinance of the City of San Antonio requires that the site improvements set out below be completed by the principal in conformance with the standards established by that ordinance within three (3) years of the date on which the Floodplain Development Permit was approved _____

_____

_____

_____ and

WHEREAS, the aforesaid ordinance requires that a guarantee of performance that such site improvements will have been completed and will have been accepted by the City within three (3) years of the date on which the Floodplain Development Permit was approved; and

WHEREAS, the undersigned developer has elected to provide to the City of San Antonio such a guarantee of performance;

NOW THEREFORE, the condition of this obligation is such that if the principal shall, on or before the _____ day of _____, 19_____, construct or cause to be constructed the above mentioned improvements in accordance with the requirement of the City of San Antonio Floodplain Ordinance, then this obligation shall be void; otherwise the obligations under this bond shall remain in full force and effect.

IN TESTIMONY WHEREOF, WITNESS OUR HAND AND SEAL this _____ day of _____, 19_____.

DEVELOPER AND PRINCIPAL

BY: _____

TITLE: _____

BY:
ATTORNEY-IN-FACT

~~APPROVED AND ACCEPTED THIS _____ day of _____, 19_____.~~

~~CITY OF SAN ANTONIO~~

~~BY: _____~~

~~TITLE: _____~~

~~APPROVED AS TO FORM: _____ CITY ATTORNEY~~
~~PE Registration Number~~

~~(Ord. No. 97568 §§ 1 and 2) (Ord. No. 98697 § 1)~~

* * * * *

Chapter 35, Appendix B, Section 35-B120 is amended as follows:

Sec. 35-B120. Signage, Pavement Markings, Street, Alley, and Cross Walkway Plans.

* * * * *

(c) **Contents**. The plans and profiles for street, alley, cross walkway and drainage easement improvements submitted shall include the following information:

(1) Typical sections showing the proposed pavement width, type, thickness and crown; the proposed curb and gutter type, location in relation to center line and exposure; the proposed parkway grading slopes; the proposed locations and type of wheelchair ramps; location of traffic signal conduit; and construction details of all drainage including dimensions, reinforcing and components such as grates and manhole covers. The information shall be given for each different type of streets and alleys in the subdivision.

(2) Alignment of each street, alley, cross walkway and drainage easement showing a beginning and ending station; each deflection angle of the center line and the station of the point of intersection; the station of the point of curvature and the point of tangency of each curve; the station and angle of intersection of each intersection with another street, alley or drainage easement; the station and radius of each curb return; the location of adjacent right-of-way lines; location and station of city limit or county lines; the location and limits of sidewalks and curbs of each street; the location and size of existing trees to remain in ROW; the location of each drainage structure; the location and size of all storm sewers; and the length, width, and thickness of cement stabilized base.

(3) The top of curb grade at each curb end, each fifty-foot station and each end of each curb return; the center line grade at each end and at each fifty-foot station of alleys and drainage ditches; the gradient of each tangent grade and the location and length of each vertical curve; the direction of storm drainage flow at each intersection; the flow line elevations of each drainage structure; the flow line elevation of each storm sewer at each point of change of grade, each end, and the intervening gradients. The profiles of streets, alleys and drainage ditches shall show the natural ground at adjacent property lines and the proposed center line.

(4) Scale, north arrow, date and plat number of the associated plat. Plans and profiles shall be drawn to scales of one (1) inch equals fifty (50) feet horizontally and one (1) inch equals five (5) feet vertically, unless different scales are approved by the director of planning and development services.

(5) Signage and pavement marking plans shall show the locations of street signs, warning, and regulatory signs, pavement markings and raised pavement markers and provide a summary table listing sign types, pavement markings types, and pavement marker types using TMUTCD designations with quantities.

(6) All signage, pavement markings, street and alley plans and profiles shall bear the seal of a licensed professional engineer.

* * * * *

Chapter 35, Appendix B, Section 35-B121 is amended as follows:

35-B121. Subdivision Plat Applications.

*** * * * ***

(b) **Format.** Plats shall be drawn in ink on Mylar on sheets eighteen (18) inches wide and twenty-four (24) inches long, with a margin of two and one-half (2½) inches on the left side of the sheet, and appropriate margins on the other three (3) sides. Plats shall be drawn at a standard engineering scale of 1 inch equals 10, 20, 30, 40, 50, 60 or 100 feet, dependent upon the size of the platted parcel(s) and availability of sheet space. When choosing drawing scale, the ultimate goal is ease of readability and clarity of reproduction. City staff may require a change of drawing scale as deemed necessary for adequate legibility. ~~Plats shall be drawn at a scale of one hundred (100) feet to one (1) inch unless the director of development services approves a smaller scale. Plats that include one-half (½) acre or less in area shall be drawn at a scale of fifty (50) feet to one (1) inch.~~ The plat boundary line shall be a solid continuous line type with a heavy pen weight to distinguish said boundary line from all other lines. Where more than one (1) sheet is necessary to accommodate the entire area to be subdivided, an index sheet showing the entire subdivision at an appropriate scale shall be attached to the plat.

(c) **Contents.** The plat applications shall include the following:

(1) All of the information required by Table B101-1 ~~B-1~~ of this appendix.

* * * * *

(22) All notes placed on the proposed plat (this is applicable to all types of plat applications) shall be approved by ~~a certifying and/or reviewing agency and~~ the director of ~~planning and~~ development services ~~director~~ for form and content. In addition, all ~~All~~ notes shall be subject to review by the city attorney or the city attorney's designee for legal sufficiency. *Commentary: Information Bulletin (IB) 526 was created in 2010 and identifies the standard plat notes that have been vetted through a stakeholder public process, and any future text changes shall be vetted through the same public process. Amending and BSL plats will not be eligible for limited review, if the plat notes do not conform to IB 526.*

(23) Private infrastructure. All private infrastructure and amenities created by the plat, including but not limited to stormwater management, parks, open spaces, common areas, landscaping, easements, streets and alleys must be dedicated to an appropriate entity with the power and authority to maintain the improvements. The legal instrument providing for permanent maintenance of the common areas/facilities by said entity shall be recorded prior to or contemporaneously with the plat.

(24) All easements known to the applicant, in effect at the time of platting, and created prior to the subdivision or development of any tract of land shall be shown on the subdivision plat or development plat with appropriate notations indicating the name of the holder of the easement, the purpose of the easement, the dimensions of the easement tied to all adjacent lot lines, street rights-of-way and plat boundary lines and the recording reference of the instruments creating and establishing the easement.

If an easement has not been defined by accurate survey dimensions, such as an "over and across" easement, the city's preference is that the easement be defined as to the limits and location of the easement through the property within the plat boundaries, and all easements shall be noted on the plat, including the name of the easement owner, the nature or type of easement, the location and width if described in the instrument creating the easement, and the Deed and Plat Records recording information of the appropriate county, if applicable. Failure to define the easement area by survey dimensions shall not be a basis for rejection of the plat.

Additionally, for all undefined utility easements, the applicant shall accurately depict the centerline location of all existing pipelines or other utility facilities placed in conformance with the easement owners' rights on the subdivision or development plat.

* * * * *

(f) **Certification and Forms.**

* * * * *

(6) **Form F: Performance Agreement.**

_____
Name

_____
Address

_____
City and Zip Code

I, _____ as _____ do hereby agree that if the proposed plat _____ (number and name) _____, filed by me is approved by the Planning Commission of the City of San Antonio, Texas, the Director of Development Services of the City may

retain the plat in his possession without recording same for a maximum period of three (3) years from the date of plat approval, by which time I will have completed all site improvements and same will have been accepted by the City of San Antonio and County if Applicable, or until I have filed with the Finance Department for the City of San Antonio one (1) of the following forms guaranteeing that all such improvements will be constructed within three (3) years of the date of plat approval and shall be payable to the City of San Antonio. The form of the guarantee of performance shall be as follows:

(1) A performance bond, meeting the requirements set out in Chapter 35 of the City Code, and which will be substantially in the form set out in Exhibit B of Chapter 35, in an amount equal to the cost estimate, as approved by the Director of Development Services, of the uncompleted and unaccepted site improvements.

(2) An irrevocable trust agreement, meeting the requirements set out in Chapter 35 of the City Code and which will be substantially in the form set out in Appendix B to Chapter 35, in an amount equal to the cost estimate, as approved by the Director of Development Services, of the uncompleted and unaccepted site improvements.

(3) Cash or cashier's check in the full amount of the uncompleted and unaccepted site improvements deposited with the Director of Development Services.

(4) An irrevocable standby letter of credit drawable in the State of Texas on a federally insured commercial bank and meeting the requirements set forth in Chapter 35 of the City Code and which will be substantially in the form set out in Appendix B to Chapter 35, in an amount equal to the cost estimate, as approved by the Director of Development Services, of the uncompleted and unaccepted site improvements. The irrevocable letter of credit shall not expire prior to three (3) years and ninety (90) days from the date of plat approval.

In any event, I fully understand and agree that, in addition to the requirement for a performance bond, irrevocable trust agreement, irrevocable standby letter of credit, and/or cash or cashier's check deposit to guarantee completion and acceptance of the site improvements before the plat is recorded, as hereinbefore stated, I, the undersigned subdivider and my heirs, or assigns, successors, or subsequent purchasers having any right, title or interest in the property described as _____ or any part thereof, shall be liable to the City of San Antonio that all site improvements will be completed and, except for planned residential district bufferyards and public benefit features, accepted by the City within the time provided herein. However, should the completion of such site improvements be delayed by reason of strikes, riots, acts of God, acts of the public enemy, injunction or other court action, or any other cause similar to those enumerated beyond my control, I shall be entitled to an extension of time equal to the time of such delay, which extension of time is to be fixed finally by written certificate made by the Director of Development Services. It is expressly declared that no such allowance of time will be made unless claimed by me and allowed and certified in writing by the Director of Development Services at the end of each period of such delay.

I further fully understand and agree that periodically until the expiration of three (3) years from the date of plat approval, the Director of Development Services shall review the cost

estimate to complete the uncompleted site improvements outstanding at that date to determine the adequacy of any performance guarantee. Should the Director of Development Services conclude that the sum set out in such performance guarantee is inadequate to provide for the completion of the uncompleted site improvements he shall require either a substitute or an additional guarantee to cover the newly estimated cost.

Should such necessary additional or substitute guarantee fail to be provided to the Director of Development Services within thirty (30) days of the request for same, I understand and agree that the Director of Public Works and Development Services shall refuse to accept a performance guarantee under any form which is related to the plat of a subdivision in which I have a principal or subsidiary interest. Such a plat once it has been approved by the Planning Commission may be recorded only in the manner prescribed in Chapter 35 of the City Code.
In addition, I further fully understand and agree that, if after the expiration of the time periods referred to herein, the site improvements have not been satisfactorily completed and accepted, the Director of Development Services shall refuse to accept a performance guarantee, under any form, which is related to a plat in which I have an interest.

In any event, I agree that approval of the plat shall expire after three (3) years from date of approval unless I have either had all site improvements accepted by the City and recorded the plat, or requested a time extension for plat recordation and provided an approved performance guarantee.

Executed this _____ day of _____, _____.

_____
Subdivider

By: _____

Title: _____

FORM F - EXHIBIT A

STATE OF TEXAS X

_____ X

COUNTY OF BEXAR X

KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, the recording of a plat requires either the completion of all site improvements and their acceptance by the City of San Antonio ("City"), a municipal corporation of the County of Bexar and the State of Texas, (and the County of Bexar, if applicable), or the execution of a Performance Agreement and the filing with the Finance Department for the City one (1) of the therein listed Performance

Guarantees guaranteeing that such improvements will be constructed within three (3) years of the date of plat approval and is payable to the City; and,

WHEREAS, I _____, as _____, have previously entered into such a Performance Agreement with the City, regarding the proposed plat (number and name) _____, under which agreement the City agreed to record my plat before completion of all site improvements in exchange for my filing the above Agreement and Guarantee; and,

WHEREAS, such Performance Agreement, dated _____/_____/_____, is set to expire before all such site improvements have been constructed;

NOW THEREFORE, I fully understand and agree that the terms of such Agreement and Guarantee shall be extended until _____/_____/_____, as permitted by the Planning Commission. In Witness Whereof, the parties have caused their representatives to set their hands this day _____/_____/_____.

_____

Principal: _____ City:

_____

By: _____ Title:

* * * * *

(8) **Form H: Performance Bond.**

State of Texas X
X
County of Bexar X

Performance Bond

Known all men by these presents:

Subdivider: _____

Surety: _____

Surety's Texas Address for Demand: _____

Surety's Phone Number: _____

Bond Amount: _____

Subdivision Plat (No. and Name): _____

Date of Planning Commission Approval: _____

Site Improvements: _____

This Performance Bond is given to the City of San Antonio in satisfaction of the guarantee of performance requirements of Article 4 of the Unified Development Code of the City of San Antonio. The rights and obligations of Subdivider, Surety, and the City of San Antonio are governed by the terms and conditions set forth on Exhibit A, which is incorporated into this bond for all purposes as if fully set forth.

In Witness Whereof, the parties have caused their representatives to set their hands.
/Subdivider Name/a Texas corporation /Surety Name/, a Texas corporation

By: _____ By: _____

Printed Name: _____ Printed Name: _____

Title: _____ Printed Name: _____

Date: _____ Date: _____

Approved and accepted this _____ day of _____

City of San Antonio,
a Texas municipal corporation

By: _____

Printed Name: _____

Title: _____

Date: _____

Approved as to form on behalf of City Attorney

(ATTACHMENT: Power of Attorney)

Exhibit A: Performance Bond Terms and Conditions

Whereas, the Subdivider petitioned the Planning Commission of the City of San Antonio for permission to develop a subdivision within the jurisdiction of the City;

Whereas, the Subdivision Plat, which shows the subdivision, was approved by the Planning Commission on the Date of Planning Commission Approval;

Whereas, the City's Unified Development Code ("UDC") requires that the site improvements ("Site Improvements") set out below be completed by Subdivider in conformance with the UDC within three years from the Date of Planning Commission Approval;

Whereas, the UDC requires that an approved subdivision plat may not be filed for record in the office of the county clerk until such Site Improvements have been completed and have been accepted by the City of San Antonio, or until there is provided to the City of San Antonio a guarantee of performance that such Site Improvements will have been completed and will have been accepted by the city within three years of the date on which the plat was approved; and

Whereas, the Subdivider has elected to provide to the City of San Antonio such a guarantee of performance in lieu of waiting to record the Subdivision Plat until all Site Improvements have been completed.

Now therefore, the Subdivider, as principal, and Surety, as surety, jointly and severally guarantee to the City of San Antonio, a municipal corporation of the County of Bexar and State of Texas ("City"), full payment of the Bond Amount if the required Site Improvements are not completed and accepted by City within three years of the Date of Planning Commission Approval or such extended deadline for performance as Subdivider may obtain in conformity with the UDC. Subdivider and Surety bind themselves and their respective heirs, administrators, executors, and assigns, jointly and severally, firmly to this bond.

If the Site Improvements are not timely completed, the City of San Antonio need only make written demand on the Surety at the Surety's Texas Address for Demand for City's estimate of the cost of completing the Site Improvements. The Demand cannot exceed the Bond Amount. If the City demands less than the full Bond Amount but is unable to complete the Site Improvements, it may make multiple draws until the Site Improvements are completed or until it has drawn the full Bond Amount. If upon completion of the Site Improvements City still has unspent Surety funds, City must refund the unspent funds to Surety.

Changes in the nature or extent of Site Improvements do not impair Surety's obligations, but nothing increases the Bond Amount without Surety's written consent.

If, within three years of the Date of Planning Commission Approval or such extended deadline for performance as Subdivider may obtain in conformity with the UDC, Subdivider constructs or causes to be constructed the Site Improvements according to the requirements of the UDC, then this obligation terminates. Otherwise the obligation under this bond remains in full force and effect.

*** * * * ***

(9) **Form J: Irrevocable Trust Agreement.**

City of San Antonio Irrevocable Trust Agreement Securing Subdivider's Performance of Development-Related Obligations.

This Irrevocable Trust Agreement is entered into among Subdivider, Trustee, and City as of the effective date stated below.

Subdivider:

Subdivider's Address:

Trustee Name and Texas Address: Irrevocable Trust Institution as defined by the Texas Finance Code, Title 3. Financial Institutions and Businesses, Subtitle F

Trustee's Phone Number:

City: City of San Antonio

City's Address: P.O. Box 839966,
San Antonio, Texas 78283-3966 (Attention: Director, Development Services)

Irrevocable Trust Amount:

Irrevocable Trust Account Number:

Subdivision Name:

Plat No.:

County:

1. This is an irrevocable Trust Agreement Securing Subdivider's Performance of 1. Development-Related Obligations under the Unified Development Code of the City of San Antonio, Texas ("UDC"). The Terms and Conditions of Subdivider irrevocable Trust Agreements ("Terms and Conditions") contained in the UDC are incorporated into this Agreement for all purposes as if fully set forth. A copy of the Terms and Conditions are attached for convenience, but in case of a conflict, the text of the UDC controls. If the terms and conditions contained in the UDC change during the pendency of this irrevocable trust, the terms and conditions in effect at the beginning of this trust continue to govern it unless all parties agree otherwise in writing.

2. Subdivider and Trustee each acknowledge receipt of the Terms 2. and Conditions of Subdivider Trust Agreements contained in the UDC.

3. Subdivider has delivered to Trustee the Irrevocable Trust Amount in 3. immediately available funds and U.S. currency. Trustee acknowledges receipt of the Irrevocable Trust Amount in

immediately available funds and U.S. currency and accepts the obligations of this Irrevocable Trust as set out in the Terms and Conditions of Subdivider Irrevocable Trust Agreements contained in the UDC.

In Witness Whereof, the parties have caused their representatives to set their hands to be effective as of the following effective date:

City of San Antonio, _____/Subdivider, a Texas municipal corporation

By: _____ By: _____

Printed Name: _____ Printed Name: _____

Title: _____ Title: _____

Approved as to Form:

_____

City Attorney's Office

/Trustee/,
a "Trust Institution" as defined by the Texas Finance Code, Title 3. Financial Institutions and Businesses, Subtitle F

By: _____

Printed Name: _____

Title: _____

Terms and Conditions of Subdivider Irrevocable Trust Agreements

1. Scope of Terms and Conditions.
These terms and conditions govern all Irrevocable Trust Agreements Securing Subdivider's Performance of Development-Related Obligations that are entered into under the Unified Development Code of the City of San Antonio, Texas.

2. Subdivider Undertaking.
Subdivider pledges to City to fulfill its infrastructure-related obligations arising from the Subdivision independently of this Irrevocable Trust. This Trust is merely intended to secure Subdivider's obligations, not replace or satisfy them.

3. Irrevocable Trust, Withdrawals.
Trustee must hold the Irrevocable Trust Amount in trust for City to secure Subdivider's infrastructure-related obligations arising from the Subdivision. All withdrawals must be approved by the Director of Development Services, and may be withdrawn as follows:

By Subdivider:

Subdivider may withdraw from the Irrevocable Trust Amount when 50 % or more of the remaining cost estimate has been completed and approved in writing by the Director of Development Services. The Director of Development Services shall not approve any withdrawal until subdivider delivers an engineer's certification, from a licensed engineer in the state of Texas, attesting to the accuracy of the dollar amounts of the construction cost of the remaining improvements. Subdivider may not withdraw more than four times (not to include a one time substitution approved by the director of development services upon the granting of a time extension) during the life of the irrevocable trust. In no event shall the amount of the trust be less than twenty (20) percent of the total amount of the original cost estimate until all improvements have been completed and approved.

To make a withdrawal, Subdivider must deliver to Trustee a Draw Request Form signed by the Subdivider and Director of Development Services acknowledging completion of some or all of Subdivider's infrastructure-related obligations. Draw Request Forms shall be substantially in the same form as Form V in Appendix B of the Unified Development Code. Developer's and City's acknowledgment must state the dollar value of the completed infrastructure-related obligations.

By City:

City may withdraw from the Irrevocable Trust Amount to complete Subdivider's infrastructure-related obligations if Subdivider has failed to timely fulfill those obligations. Trustee must honor any attempted draw by the City if the draw is in writing and represents to the Trustee that Developer has failed or refused, or anticipatorily breached its obligation, to timely complete its infrastructure-related obligations arising from the Subdivision. City may withdraw as much as is reasonably necessary to fulfill Subdivider's infrastructure-related obligations arising from the Subdivision. City may make multiple draws. Draw Request Forms shall be substantially in the same form as Form W in Appendix B of the Unified Development Code.

4. Accounting by City.
If City withdraws any part of the Irrevocable Trust Amount, within 60 days of completing Subdivider's infrastructure-related obligations arising from the Subdivision, City must deliver to Subdivider an accounting of the money spent. Subdivider acknowledges that the statutory formalities applicable to contracting by City may make the City's cost of completion higher than that Subdivider would have incurred had it completed the work itself.

5. Federal Deposit Insurance.
Trustee must keep the Irrevocable Trust Amount in an interest-bearing ;enn; account or accounts at federally-insured commercial bank or banks. Trustee must spread the Trust Amount over as many different institutions as necessary to assure the entire Irrevocable Trust Amount is covered by federal deposit insurance.

6. Termination of Irrevocable Trust.
This Irrevocable Trust Agreement terminates only when the City delivers a written release of trust to Trustee, with a copy to Subdivider. City has 45 days after engineering certification, including seal, of completion of Subdivider's infrastructure-related obligations arising from the

Subdivision in which to deliver a written release of the trust. If City fails to do so timely, Subdivider may sue for a release of the irrevocable trust.

7. Interpleader.
If Trustee is joined as a party to a lawsuit arising out of this Irrevocable Trust, Trustee may interplead the funds remaining in Trust with any court of competent jurisdiction in Bexar County, Texas. Upon so doing, Trustee is absolved of liability both to City and to Subdivider for all sums interpleaded and for all sums previously paid to City under this Agreement. Upon depositing the funds into the court registry pursuant to an interpleader, Trustee is entitled to recover from the sums deposited its reasonable and necessary attorneys fees actually incurred in making the interpleader.

8. Integration.
Subdivider may contract separately with Trustee regarding all aspects of this trust relationship not covered by this agreement, including Trustee's fees and any indemnity Trustee may wish to be provided, but not such agreements may contradict this Agreement or impair the city's rights under it. This Agreement is a fully integrated statement of City's rights as to Trustee and Subdivider. There are no oral or other written agreements to which City is a party governing the terms of this irrevocable trust. Without limiting the generality of the above, City need not pay any fee to Trustee, and City cannot lawfully, and will not, indemnify Trustee in any respect.

9. Public Information.
All parties acknowledge that this instrument is public information within the meaning of Chapter 552 of the Texas Government Code and accordingly may be disclosed to the public. Nothing in this agreement waives an otherwise applicable exception to disclosure.

10. Prohibited Interests in Contracts.
10.01. The Charter of the City of San Antonio and its Ethics Code prohibit a City officer or employee, as defined in Section 2-52 of the Ethics Code, from having a financial interest in any contract with the City or any City agency such as city owned utilities. An officer or employee has a "prohibited financial interest" in a contract with the City or in the sale to the City of land, materials, supplies or service, if any of the following individual(s) or entities is a party to the contract or sale:

(i) a City officer or employee;
(ii) his parent, child or spouse;
(iii) a business entity in which the officer or employee, or his parent, child or spouse owns (i) 10% or more of the voting stock or shares of the business entity, or (ii) 10% or more of the fair market value of the business entity;
(iv) a business entity in which any individual or entity above listed is a (i) subcontractor on a City contract, (ii) a partner, or (iii) a parent or subsidiary business entity.

10.02. Subdivider and Trustee each warrant and certify as follows:
(i) They and their respective officers, employees and agents are neither officers nor employees of the City.
(ii) They have tendered to the City a Discretionary Contracts Disclosure Statement in compliance with the City's Ethics Code.

10.03. Subdivider and Trustee acknowledge that City's reliance on the above warranties and certifications is reasonable.

(9) **Form J-1: Irrevocable Trust Agreement Draw Request Form (Subdivider).**

Draw Request Form (Subdivider)

Date: _____/_____/_____
Plat No. _____/_____/_____
Subdivider's Name:
Address:
Phone Number:
Trustees' Name:
Address:
Phone Number:
Escrow Total (Start of Trust): _____ 20% Reserve Amount: _____
Escrow Total (Current): _____ Total Request for this Draw: _____

Construction Item	Previous Draw Totals/Amounts	Request for this Draw
_____	_____	_____
_____	_____	_____
_____	_____	_____

I hereby certify that all the information stated herein is true and accurate, and is based on construction costs bearing the signature and seal of a licensed engineer in the state of Texas (original cost estimate and cost estimate for remaining work attached). This draw request is submitted for reimbursement of funds. All completed work has been done in accordance with the standards and procedures outlined in the City of San Antonio Unified Development Code. I understand that I cannot obtain additional monies from the trust escrow account without the approval of the Director of Development Services, and that approval of any work completed does not constitute acceptance of any improvements. I also understand that a 20% reserve based on the original certified estimate will not be released until all work is complete and approved by the Director of Development Services (and County Engineer if located in the Extra Territorial Jurisdiction).

Subdivider's Signature _____

Print Name:

Title:

Date:

State of Texas X
X
County of Bexar X

Before me, a notary public for the State of Texas, personally appeared _____, known to me to be the person whose name is subscribed to the foregoing document and, being by me first duly sworn, declared that the statements therein contained are true and correct on this the _____/_____/_____ day of _____/_____/_____, 20_____.

_____
Notary Public in and for the State of Texas

My commission expires: _____

The property that is the subject of this trust escrow account was inspected on _____/_____/_____ (date). The draw amount is acceptable and approved.

City of San Antonio Signature _____ Date _____

Print Name:

Title:

(9) **Form J-2: Draw Request Form (City)**

Draw Request Form (City)

Date: _____/_____/_____
Plat No. _____/_____/_____

Subdivider's Name:

Address:

Phone Number:

Trustees' Name:

Escrow Total (Start of Irrevocable Trust): _____ 20% Reserve Amount: _____

Escrow Total (Current): _____

Total Request for this Draw: _____

Construction Items to be completed		Request for this Draw
_____	_____	_____
_____	_____	_____
_____	_____	_____

This draw request is submitted to Trustee for release of funds associated with the plat number indicated above. The subdivider named above has failed, refused, or anticipatorily breached its obligation to timely complete its infrastructure related obligations arising from the subdivision of the plat identified above.

City of San Antonio Signature _____ Date _____

Print Name:

Title:

*** * * * ***

(10) **Form K: Irrevocable Letter of Credit.**

Irrevocable Standby Letter of Credit

No. _____

Date: _____

Expiration Date: _____

Beneficiary:

City of San Antonio
City Hall
P.O. Box 839966
San Antonio, TX 78283-3966

Applicant: _____

Applicant Name: _____

Applicant Address: _____

City, State, Zip, Country

Plat No. _____ Plat Approval Date: _____

To City of San Antonio:

We hereby issue our Irrevocable Standby Letter of Credit No. _____ in your favor up to the aggregate amount of U.S. $ _____/_____/_____ (_____/_____/_____ and _____/100 U.S. Dollars) ("Stated Amount") available by draft(s) drawn on us at sight, marked "Drawn under Irrevocable Standby Letter of Credit No. _____ of (Bank Name), San Antonio, Texas" accompanied by the following:

Beneficiary's written statement purportedly signed by its City Manager, the Director of Development Services, or their authorized representative reading as follows: "The undersigned is an authorized representative of the City of San Antonio (hereinafter "Beneficiary") and has the authority to make the following statement: Beneficiary hereby certifies that the funds drawn under this letter of credit are drawn in accordance with City of San Antonio Unified Development Code and associated provisions regarding performance guarantees of site improvements."

Partial Drawings are permitted however the aggregate amount of all drawings may not exceed the Stated Amount.

This Letter of Credit sets forth in full the terms of our undertaking and such undertaking shall not in any way be modified, amended or amplified by reference to any document, instrument or agreement referred to herein or to which this letter of credit relates unless agreed to in writing by (Bank Name) and the City of San Antonio. Notwithstanding the above, the amount owing under this Letter of Credit may be amended by substituting another Letter of Credit that also meets all the criteria provided in this chapter.

Except as expressly stated herein, this undertaking is not subject to any agreement, condition or qualification. The obligation of (Bank Name) under this Irrevocable Letter of Credit is the individual obligation of (Bank Name), and is in no way contingent upon reimbursement by applicant with respect thereto.

We hereby engage with you that documents drawn under and in compliance with the terms of this Irrevocable Standby Letter of Credit will be duly honored if presented for payment to (Bank Name), (Physical Address of Bank) on or before the expiration date of this Letter of Credit.

This Letter of Credit is subject to the International Standby Practices 1998, International Chamber of Commerce Publication No. 590 ("ISP98"), and as to matters not addressed by ISP98 is subject to and governed by Texas State Law and applicable U.S. Federal Law.

Bank Name _____
(Authorized bank signature)

Print: _____

Title: _____

Attest:
By: _____

Print: _____

Title: _____

Approved as to form: _____
City Attorney's Office

* * * * *

(19) **Form T: Warranty Bond.**

Warranty Bond

State of Texas X
X
County of Bexar X

KNOW ALL MEN BY THESE PRESENTS:

THAT _____ as Principal, and _____, a corporation organized under the laws of _____, as Surety, do hereby expressly acknowledge themselves to be held and firmly bound to pay unto the City of San Antonio, a municipal corporation of the County of Bexar and the State of Texas, the sum of _____ dollars ($ _____), for the payment of which sum will truly be made unto said City of San Antonio, and its successors, and said Principal and Surety do hereby bind themselves, their heirs, administrators, executors, assigns and successors jointly and severally firmly by these presents.

Principal has agreed to build and construct (name/number of plat), and the associated improvements, in conformance with the standards established by the San Antonio Unified Development Code and both of which are hereby expressly made a part of this bond as though the same were written embodied herein.

WHEREAS, under the San Antonio Unified Development Code, it is provided that the Principal, as subdivider, will maintain and keep in good repair, the work herein contracted to be done and performed, for a period of one (1) year from the date of the acceptance of said work (or longer as required by other City Ordinance, such as for Tax Increment Financing), and to do all necessary repairing and/or reconstructing in whole or in part of said improvements that should be occasioned by settlement of foundation, defective workmanship or materials furnished in the construction or any part thereof or any of the accessories thereto constructed by the subdivider. It is understood that the purpose of this section is to cover all defective conditions arising by reason of defective material, labor or workmanship, and charge the same against the Principal, as subdivider, and Surety on this obligation and that both Principal and Surety shall be subject to liquidation damages for each day's failure to correct any defective conditions. Now, therefore, if the Principal shall keep and perform by maintaining said work and keep the same in repair for the maintenance period of one (1) year (or longer as required by other City Ordinance), as provided, then this bond shall be null and void and have no further effect, but if default shall be made by the Principal in the performance of its duty to so maintain and repair said work, then this bond shall have full force and effect, and the City of San Antonio shall have and recover from the Principal and Surety damages resulting from such condition; and it is further agreed that this obligation shall be a continuing one against the Principal and Surety and that successive recoveries may be made until the full amount shall have been exhausted; and it is further understood that the obligation herein to maintain said work shall continue throughout said maintenance period, and the same shall not be changed, diminished or in any manner affected from any cause during said time.

Principal and Surety both acknowledge that this agreement is entered into in San Antonio, Bexar County, State of Texas. The construction of this agreement and the rights remedies, and obligations arising there under are governed by the laws of the State of Texas. Both Principal and Surety hereby agree that the Texas conflicts of law rules do not control this agreement and will not be used to cause the application of the laws of a jurisdiction other than the State of Texas. The obligations performable by both Principal and Surety are performable in San Antonio, Bexar County, Texas.

Additionally, Surety agrees that the City of San Antonio will satisfy any legal or contractual requirements arising from or in connection with this performance bond by directing such action to the Texas office listed below. Surety shall not waive or amend this office without the prior consent in writing of the City of San Antonio.

IN WITNESS WHEREOF, said Principal has caused this bond to be executed and Surety has caused this bond to be executed by its attorney in fact and said attorney in fact, (print name), has hereunto set his or her hand, the _____ day of _____, 20 _____.

Name of Principal Name of Surety
By (print name) By (print name)

Title _____ Title _____

Address _____ Address _____

Phone _____ Phone _____

The name, address and phone number of the Resident Agent of Surety is: (must be Texas office)

*Power of Attorney attached

NOTE: Date of Maintenance Bond shall not be prior to date of acceptance of the improvements

* * * * *

(21) **Form V: Draft for Cash or Cashier's Check Warranty Deposit.**

State of Texas X
X Know all men by these present

County of Bexar X

Cash Warranty Deposit

Subdivider's Texas Address
For Notice ("Address"):

Deposit Amount:

Subdivision Plat (No. and Name):

Site Improvements
(Streets, Drainage, Sidewalks):

This Cash **or Cashier's Check** Warranty Deposit is given to the City of San Antonio in satisfaction of the warranty requirements of Article 5 of the Unified Development Code of the City of San Antonio. The rights and obligations of Subdivider and the City of San Antonio are governed by the terms and conditions set forth on Exhibit A, which is incorporated into this deposit for all purposes as if fully set forth.

In Witness Whereof, the parties have caused their representatives to set their hands.

/Subdivider Name/, a corporation	City of Antonio, a Texas municipal corporation
By: _____	By: _____
Printed Name: _____	Printed Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

* Warranty Start Date:

Warranty End Date:

* Warranty period shall begin on the date the plat is recorded or the date of preliminary field approval of the improvements, whichever is later in time.

Exhibit A: Cash **or Cashier's Check** Warranty Deposit Terms and Conditions

Whereas, the UDC requires that Site Improvements inspected as complete by the City of San Antonio, a municipal corporation of the County of Bexar and State of Texas ("City") be guaranteed to remain in good repair and to remain in compliance with the UDC for a period of one year after the date of City's Warranty Start Date.

Whereas, the UDC further requires that Subdivider post security to provide assurance to the City that Subdivider's guarantee will be honored.

Whereas, the Subdivider has elected to provide such assurance to the City in the form of a cash deposit **or Cashier's Check** in the Deposit Amount.

Now therefore, Subdivider posts the Deposit Amount with City as security for Subdivider's guarantee that the required Site Improvements will remain in good repair and condition in accordance with the Plans and the then current regulations of the City of San Antonio applicable to the Site Improvements (collectively, the "Applicable Requirements") for one (1) year from the Warranty Start Date, which shall be the date the plat is recorded or the date of preliminary field approval of the Site Improvements, whichever is later in time ("Warranty Period").

If the City determines that the Site Improvements need maintenance or repair to conform with the Applicable Requirements within the Warranty Period, City shall notify Subdivider at the

Address specifying such required repairs and provide the City's estimate of the cost of such required maintenance or repairs. If Subdivider fails to commence such repairs within thirty (30) days after receipt of such notice or fails to diligently pursue and complete such repairs, City may make or provide for the maintenance or repairs and recover the cost from the Deposit Amount. City may make multiple draws until all necessary maintenance or repairs are completed or until it has drawn the full Deposit Amount. If the Deposit Amount has not been fully spent, City must refund the unspent portion of the Deposit Amount to Subdivider at the completion of the Warranty Period within thirty days.

Subdivider shall immediately notify City of any change to the Address, and such notice shall be directed to the Director of Development Services, P.O. Box 839966, San Antonio, Texas 78283.

Subdivider may contract separately with outside entities regarding aspects of this Cash or Cashier's Check Warranty Deposit not covered by this document but no such agreement may contradict this Cash Warranty Deposit or impair the City's rights under it. This document is a fully integrated statement of City's rights as to Subdivider and the Deposit Amount. There are no oral or other written agreements to which City is a party governing the terms of this Cash or Cashier's Check Warranty Deposit.

* * * * *

(22) **Form V-1: Cash/Cashier's Check Warranty Deposit Acknowledgement.**

CASH/CASHIER'S CHECK WARRANTY DEPOSIT ACKNOWLEDGEMENT

The undersigned hereby acknowledges and agrees that a _____ (cash deposit, cashier's check) in the amount of $ _____, submitted on _____ (dd/mm/yyyy) by the Undersigned to the City of San Antonio in accordance with §501(h)(3) of Chapter 35 of the City of San Antonio Code of Ordinances ("UDC"), is intended solely as a warranty deposit for Plat _____ (number and name), filed with the City of San Antonio on _____ (date filed), in fulfillment of the Developer/Subdivider's obligations under that Section.

The undersigned further acknowledges and agrees that this warranty deposit will be governed by all applicable sections of the UDC, and will operate solely as a maintenance guarantee for the required site improvements by _____ (Developer/Subdivider), as indicated on Plat _____ (number and name), and will only be released to _____ (Developer/Subdivider), or their designated agent in accordance with UDC §§35-501(h) and 35-B121(f)(21), and that notwithstanding any agreements between the Undersigned and _____ (Developer/Subdivider), neither the Undersigned nor any other third parties shall have any interest in this warranty deposit, per UDC §§35-501(h) and 35-B121(f)(21).

In Witness Whereof, the parties have caused their representatives to set their hands.

Undersigned City of Antonio, a Texas municipal corporation

By: _____ By: _____

Printed Name: _____ Printed Name: _____

Company Name: _____ Title: _____

Date: _____ Date: _____

* * * * *

(2322) Form W: Draft for Cash or Cashier's Check Performance Deposit.

State of Texas X
X Know all men by these present
County of Bexar X

Cash or Cashier's Check Performance Deposit

Subdivider's Texas Address
For Notice ("Address"):

Deposit Amount:

Date of Planning Commission Approval:

Subdivision Plat (No. and Name):

Site Improvements:

This Cash or Cashier's Check Performance Deposit is given to the City of San Antonio in satisfaction of the Performance requirements of Article 4 of the Unified Development Code of the City of San Antonio. The rights and obligations of Subdivider and the City of San Antonio are governed by the terms and conditions set forth on Exhibit A, which is incorporated into this deposit agreement for all purposes as if fully set forth.

In Witness Whereof, the parties have caused their representatives to set their hands.

/Subdivider Name/, a corporation	City of Antonio, a Texas municipal corporation
By: _____	By: _____
Printed Name: _____	Printed Name: _____
Company Name: _____	Title: _____
Date: _____	Date: _____

Exhibit A: Cash **or Cashier's Check** Performance Deposit Terms and Conditions

Whereas, the Subdivider petitioned the Planning Commission of the City of San Antonio for permission to develop a subdivision within the jurisdiction of the City;

Whereas, the Subdivision Plat, which shows the subdivision, was approved by the Planning Commission on the Date of Planning Commission Approval;

Whereas, the City's Unified Development Code ("UDC") requires that the site improvements ("Site Improvements") be completed by Subdivider in conformance with the UDC within three years from the Date of Planning Commission Approval;

Whereas, the UDC requires that an approved subdivision plat may not be filed for record in the office of the county clerk until such Site Improvements have been completed and have been accepted by the City of San Antonio, or until there is provided to the City of San Antonio a guarantee of performance that such Site Improvements will have been completed and will have been accepted by the city within three years of the date on which the plat was approved; and

Whereas, the Subdivider has elected to provide to the City of San Antonio such a guarantee of performance in lieu of waiting to record the Subdivision Plat until all Site Improvements have been completed.

Now therefore, Subdivider posts the Deposit Amount with City as security for Subdivider's guarantee that the required Site Improvements shall be completed and (if applicable) accepted by City within three years of the Date of Planning Commission Approval or such extended deadline for performance as Subdivider may obtain in conformity with the UDC.

If the Site Improvements are not timely completed, City may make or provide for the completion of the Site Improvements utilizing the Deposit Amount. City shall notify Subdivider at the Address and provide the City's estimate of the cost of completion. Subdivider acknowledges that the statutory formalities applicable to contracting by City may make the City's cost of completion higher than what Subdivider would have incurred had it completed the work itself. City may make multiple draws until all necessary maintenance or repairs are completed or until it has drawn the full Deposit Amount. If upon completion of the Site Improvements City still has unspent Deposit Amount funds, City must refund the unspent funds to Subdivider. Changes in the nature or extent of Site Improvements do not impair Subdivider's obligations, but nothing increases the Bond Amount without Subdivider's written consent.

If, within three years of the Date of Planning Commission Approval or such extended deadline for performance as Subdivider may obtain in conformity with the UDC, Subdivider constructs or causes to be constructed the Site Improvements according to the requirements of the UDC, then this obligation terminates and unspent funds shall be returned to Subdivider. Otherwise the obligation under this deposit remains in full force and effect.

Subdivider shall immediately notify City of any change to the Address, and such notice shall be directed to the Director of Development Services, P.O. Box 839966, San Antonio, Texas, 78283.

Subdivider may contract separately with outside entities regarding aspects of this Cash or Cashier's Check Performance Deposit not covered by this document but no such agreement may contradict this Cash or Cashier's Check Performance Deposit agreement or impair the City's

rights under it. This document is a fully integrated statement of City's rights as to Subdivider and the Deposit Amount. There are no oral or other written agreements to which City is a party governing the terms of this Cash or Cashier's Check Performance Deposit.

* * * * *

(24) **Form W-1: Cash/Cashier's Check Performance Deposit Acknowledgement.**

CASH/CASHIER'S CHECK PERFORMANCE DEPOSIT ACKNOWLEDGEMENT

The undersigned hereby acknowledges and agrees that a _____ (cash deposit, cashier's check) in the amount of $ _____, submitted on _____ (dd/mm/yyyy) by the Undersigned to the City of San Antonio in accordance with §437(a) of Chapter 35 of the City of San Antonio Code of Ordinances ("UDC"), is intended solely as a performance deposit for Plat _____ (number and name), filed with the City of San Antonio on _____ (date filed), in fulfillment of the Developer/Subdivider/Applicant's obligations under that Section.

The undersigned further acknowledges and agrees that this performance deposit will be governed by all applicable sections of the UDC, and will operate solely as a guarantee for performance of required site improvements by _____ (Developer/Subdivider/Applicant), as indicated on Plat _____ (number and name), and will only be released to _____ (Developer/Subdivider/Applicant), or their designated agent in accordance with UDC §§35-437(d) and 35-B121(f)(22), and that notwithstanding any agreements between the Undersigned and _____ (Developer/Subdivider/Applicant), neither the Undersigned nor any other third parties shall have any interest in this performance deposit, per UDC §§35-437(f) and 35-B121(f)(22).
In Witness Whereof, the parties have caused their representatives to set their hands.

Undersigned	City of Antonio, a Texas municipal corporation
By: _____	By: _____
Printed Name: _____	Printed Name: _____
Company Name: _____	Title: _____
Date: _____	Date: _____

* * * * *

(25) **Form X: Legal Declaration: Subdivision Common Areas And Facilities**

City of San Antonio
Development Services
Department
Land Entitlements Section

FORM X
LEGAL DECLARATION:
SUBDIVISION COMMON AREAS
AND FACILITIES

For: _____ Subdivision Plat #: _____

THE STATE OF TEXAS §

COUNTY OF BEXAR §

BEFORE ME, the undersigned authority, on this day personally appeared _____ who, being duly sworn by me, deposes and says:

(1) That my name is _____ and that I am _____ of _____ the entity that owns the real property described below, hereinafter referred to as the "Property".

(2) That the property is identified by the following legal description (which should match the plat filing):

_____
_____
_____
_____
_____
_____
_____

(3) That _____ is the "Declarant" of the Property and declares that the Property shall be held, sold and conveyed subject to restrictions, covenants, and conditions which shall be deemed to be covenants with the land and imposed to benefit and burden each lot and other portion of the Property in order to maintain within the Property a planned community of high standards. Such covenants will be binding on all parties having heirs, personal representatives, successors, and assigns, and shall inure to the benefit of each owner thereof.

(4) That the Declarant and every Owner of a lot by virtue of ownership of such lots shall be a member of the _____ Homeowner Association hereinafter referred to as the "Association".

(5) That the Association shall establish a maintenance fund and shall use the proceeds of such funds in providing for normal, recurring maintenance charges for the common areas/facilities for the use and benefit of all members of the Association. The Association shall, in addition, establish and maintain an adequate reserve fund for periodic maintenance, repair and replacement of improvements to the common maintenance areas/facilities. The fund shall be established and maintained out of regular annual assessments.

(6) That Declarant hereby assigns its right of ingress and egress across and over the property to the City of San Antonio for purposes of conducting official City business; which may include removal of obstructions during emergency situations in which case the City shall not be held liable for its repair, replacement, or any future maintenance.

For: _____

By: _____

_____

_____

LANDOWNER – APPLICANT

THE STATE OF TEXAS §

COUNTY OF BEXAR §

BEFORE ME, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that (s)he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office this _____ day of _____, 20____.

_____

NOTARY PUBLIC

_____

Typed or Printed Name of Notary

MY COMMISSION EXPIRES: _____

Upon Recordation, Please Return to:

_____

_____

_____

* * * * *

(26) Forms Y-1 and Y-2: Re-Plat Application Affidavit

FORM Y-1 RE-PLAT APPLICATION AFFIDAVIT

USE THIS FORM IF ORIGINAL PLAT IS NOT THE ONLY INSTRUMENT BY WHICH COVENANTS AND RESTRICTIONS THEREIN ARE RECORDED

_____

_____

(date)

City of San Antonio
Development Services
Attn: Land Entitlements
1901 South Alamo
San Antonio, Texas 78204

Re-plat Application Affidavit for _____ Subdivision, plat number _____.

Know all men by these presents that I (we), the undersigned, hereby acknowledge that I am (we are) the owner(s)/proprietor(s) of all the lots embraced by the above plat number approved by the City of San Antonio on _____, and recorded in Volume _____, Page _____, County Deed and Plat Records.

I (we) further hereby attest that the proposed replat _____ (plat name) does not amend, remove or violate, or have the effect of amending, removing, or violating any covenants or restrictions that are contained or referenced in a dedicatory instrument recorded in the real property records separately from the preceding plat or replat. In addition, the replat does not attempt to amend, remove, or violate, or have the effect of amending, removing, or violating, any and existing public utility easements without the consent of the affected utility companies.

Property owner/Agent

State of Texas §
§
County of Bexar §

Before me, the undersigned authority, a notary public for the State of Texas, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledge to me that he executed the same for the purpose and consideration therein expressed.

Given under my hand and seal of office, this the _____ day of _____, 20_____.

(SEAL)

_____

FORM Y-2 RE-PLAT APPLICATION AFFIDAVIT

USE THIS FORM IF ORIGINAL PLAT IS THE ONLY INSTRUMENT BY WHICH COVENANTS AND RESTRICTIONS THEREIN ARE RECORDED

_____

(date)

City of San Antonio
Development Services
Attn: Land Entitlements

1901 South Alamo
San Antonio, Texas 78204

Re-plat Application Affidavit for _____ Subdivision, plat number _____.

Know all men by these presents that I (we), the undersigned, hereby acknowledge that I am (we are) the owner(s)/proprietor(s) of all the lots embraced by the above replat number out of the plat recorded in Volume _____, Page _____, County Deed and Plat Records.

I (we) further hereby attest that the proposed replat _____ (plat name) does not attempt to amend or remove any covenants or restrictions.

Property owner/Agent

State of Texas §
§
County of Bexar §

Before me, the undersigned authority, a notary public for the State of Texas, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledge to me that he executed the same for the purpose and consideration therein expressed.

Given under my hand and seal of office, this the _____ day of _____, 20____.

(SEAL)

* * * * *

Chapter 35, Appendix B, Section 35-B122 is amended as follows:

Sec. 35-B122. – Traffic Impact Analysis

* * * * *

(b) Study level TIAs shall consist of the following:

* * * * *

(7) **Conclusions and Recommendations.**

A. A summary of the conclusions and recommendations for the transportation network required to serve the proposed development.

B. Identification of peak hour trip (PHT) levels that will trigger mitigation actions identified.

C. A statement that each subsequent TIA submitted for the proposed development will be compared to the results of the Study Level TIA to determine if the overall roadway network remains adequate to serve the proposed development.

* * * * *

Chapter 35, Appendix B, Section 35-B123 is amended as follows:

Sec. 35-B123. Tree Permit-Tree Preservation Plan Option.

(a) **Number of Copies.** The applicant shall submit a tree preservation permit ~~/affidavit~~ application with three (3) sets of tree preservation plans, a survey showing the location of all significant, heritage, or mitigation trees, including clusters, an inventory with calculations, and tree protection notes as provided herein. The applicant shall also provide a Habitat Compliance Form consistent with section 35-B133, as applicable.

* * * * *

Chapter 35, Appendix B, Section 35-B124 is amended as follows:

Sec. 35-B124. Tree Permit-Tree Preservation Plan Option.

* * * * *

(b) **Format.**

(1) A vicinity map, project name, street address (or plat #, parcel #, or legal description), date, scale, north arrow and the names, addresses and telephone numbers of the person(s) preparing the plan,

(2) Any aerial photograph that cannot be plotted on a single sheet shall be plotted with appropriate match lines on two (2) or more sheets. A tree preservation survey sheet may also include the tree area calculations and the tree protection notes at the discretion of the applicant. It is the applicant's responsibility to insure that all parts of the tree preservation plan are transferred to each appropriate person concerned with the development project.

(3) Any proposed site work associated with a tree affidavit where there are protected significant, and heritage trees, and areas of tree canopy, the applicant shall provide tree protection notes and tree protection details.

(4) Prior to commencement of any site work, where there are protected significant, and heritage trees, and areas of tree canopy the applicant shall request a pre-construction conference with the city arborist in order to review procedures for protection and management of all significant, heritage or mitigation trees or areas of tree canopy.

* * * * *

Chapter 35, Appendix B, Section 35-B125 is amended as follows:

Sec. 35-B125. Tree Permit-Tree Stand Delineation Plan Option.

As an alternative option to the tree preservation plan, a tree stand delineation plan may be submitted. The tree stand delineation plan shall include at a minimum a current aerial, satellite, photographic, or digital imagery in color and stored and analyzed by computer generated software such as but not limited to ArcView or AutoCAD with a minimum resolution of six-inch pixels with a scale of one inch equals four hundred feet (1" = 400'), and additional information contained herein. The applicant shall also provide a habitat compliance form consistent with section 35-B133, as applicable.

(a) **Number of Copies.** The applicant shall submit a tree preservation permit ~~/affidavit~~ application with three (3) sets of the tree stand delineation plan.

* * * * *

Chapter 35, Appendix B, Section 35-B127 is amended as follows:

Sec. 35-B127. Tree Permit-Public Project Preservation Plan.

*** * * * ***

(c) **Contents.** The tree preservation plan shall include the following information:

(1) A current aerial photographs (where applicable) at a minimum of six-inch pixel with an overlay of the project alignment and all easements;

(2) A vicinity map, existing grades and proposed grades, location of project lines, and dimensions of the project rights-of-ways and/or all easements, and delineation of the proposed limit of clearance;

(3) Project name, street address, legal description, date, scale, north arrow and the names, addresses and telephone numbers of the person(s) preparing the plan;

(4) The location, species and size in diameter inches of each Significant or Heritage tree, or areas of canopy ~~trees~~ within the project area as defined in subsection 35-523(f). Each tree is to be given a unique number which cross references or identifies the trees in the inventory;

(5) Location of any mitigation trees to be planted within the project area;

(6) Approximate centerlines of existing watercourses and the location of the 100-year floodplain; approximate location of significant drainage features and any major topographical features; including

environmentally sensitive areas such as steep slopes and riparian buffers with the applicable sixty- or thirty-foot preserve area;

(7) The location and width of existing and proposed streets and alleys, utility easements, driveways, parkways, and sidewalks on or adjacent to the project;

(8) A summary table indicating the total number, diameter inches, and species of protected trees to be removed within the project area;

(9) Description of tree and tree clusters that may be impacted by any construction activity or fifteen (15) feet from any proposed improvements;

(10) Location and dimensions of all staging areas and/or designated parking areas for the parking and maintenance of all vehicles, trailers, construction equipment, and related items as well as stockpile areas for the storage of construction supplies and materials;

(11) For applications that require boring of utilities, show bore pit areas so that the minimum distance of the bore is outside the canopy of the trees or tree clusters and that the minimum depth of the bore shall be thirty-six (36) ~~twenty-four (24)~~ inches or greater; and

(12) Tree and understory preservation notes, specifications, and details.

* * * * *

Chapter 35, Appendix B, Section 35-B131 is amended as follows:

Sec. 35-B131. Application for Plat Identification Number/Letters of Certification.

*** * * * ***

(b) **Data Required for Letters of Certification.** To obtain the required letters of certification, an applicant for plat approval shall submit the following data to the certifying agencies/departments. All data shall be annotated with the plat number of the associated plat.

* * * * *

(6) **Bexar County.**

A. Digital copy of plat.

B. Two (2) sets of storm water management plans.

C. Two (2) copies of TIA and disk of analysis.

D. Address plat.

E. If applicable, the following item(s):

1. Two (2) sets of utility plans.
2. One (1) copy of approved POADP, MDP, PUD.
3. Final Geotech report.
4. Three (3) sets of streets and drainage plans.
5. Two (2) copies of cost estimates streets and drainage.
6. One (1) digital copy of construction plans.
7. Site evaluation form with required soil analysis.
8. Water purveyor documentation/letter.
9. Plan showing the proposed on-site sewage facility (OSSF) on the property and supporting documents required under 30 TAC §285.4(c) detailing the site's suitability for on-site sewage facility systems.

* * * * *

Chapter 35, Appendix C, Section 35-C103 is amended as follows:

Sec. 35-C103. Subdivision and Platting Fees.

The following fees are established for plats and subdivision related matters. Platting fees shall be paid at the time of plat application. Any adjustments to the platting fees and other plat related fees shall be paid at the time of formal plat filing. Other fees shall be paid at the time of application.

(A) *Permit, Development Order, Document or Action*	*(B)* *Fee Amount*
Major subdivision plat fees	
Single-family development base fee	$625.00
Plus a per lot fee	$80.00
Non-single-family development base fee	$625.00
Plus a per acre fee	$550.00
Per lot addressing fee	$5.00
Minor subdivision plats (not to exceed four (4) lots)	
All fees include a per lot fee	$80.00

Plus a flat fee based upon the number of acres	
0—3 acres	$595.00
3.01—10 acres	$805.00
10.01—20 acres	$1,075.00
>20 acres (fee includes the below base and per acre fee, plus the lot fee) base fee	$1,610.00 Plus $110.00 per acre fee for each acre over twenty (20)
Replat - public hearing	$250.00
Planning commission application fee	$200.00
Certificate of platting determination	$150.00
Subdivision filing fee	$250.00
Subdivision refund fee	$75.00
Subdivision special request fee (per reviewer, per hour, one-hour minimum)	$250.00
Custom map request fee	$100.00
Subdivision preliminary meeting per hour per discipline (2 hr minimum)	$100.00
Tree save areas	Platting fees shall be waived for designated tree save areas meeting the provisions for tree save areas in article V of this chapter.
BSL (building setback line) replat (excludes notification fee)	$200.00
Development plat, per plat	$563.00
Amending plat fee	$600.00
Amendment address plat fee	$50.00

Amending plat fees (to eliminate a lot line, change the name of the plat or owner, correct a volume and/or page, and/or correct the legal description)	$250.00
Administrative exception code variance request UDC	$350.00
Plat deferral fee, per request	$500.00
Time extension fee	$300.00
Vacating declaration fee	$350.00
Replat - public hearing	$250.00
Replat fee, with notification fee	$600.00
Recordation handling fee	$30.00
Emergency add-on fee	$500.00
Plan amendment fee, per amendment	$525.00
Plat and plan review per hour/reviewer	$100.00
Street name change application fee	$250.00, plus postage
Street name change installation fee (per sign)	Estimate
Postponement of planning commission hearing fee, per processed postponement	$400.00
Completeness Review Resubmittal - Plat Review Fee	$50.00/Resubmittal
Inspection for which no fee is specifically indicated (per hour, one-hour minimum)	$100.00
After-hours inspection fee (per hour, one-hour minimum)	$100.00
Additional plan review (i.e. revised) - per reviewer - one-hour minimum	$100.00

* This does not include lots or acres reserved for parks or open space pursuant to section 35-503 of this chapter.

* * * * *

Chapter 35, Appendix E, is amended as follows:

Appendix E: San Antonio Recommended Plant List—All Suited to Xeriscape Planting Methods

TREES				
Small: Fifteen (15) to twenty-five (25) Feet; **Medium:** Twenty (25) to Forty (40) Feet; **Large:** Forty (40) Feet and Higher (60'+)				
Common Name	**Scientific Name**	**Height**	**Remarks**	**Shade Area**
Anacacho, Orchid tree*	Bauhania congesta	S—M	Semi-Evergreen, tree-shrub, white flower clusters	275
Anaqua*, Sandpaper tree	Ehretia anacua	M—L	Evergreen broadleaf; white flower clusters	875
Arizona Cypress	Cupressus arizonica	M—L	Evergreen conifer; gray green foliage; pyramidal shape	875
Texas Ash*, Green Ash	Fraxinus sp.	M—L	Deciduous; fast growing	875
Ashe Juniper*	Juniperus ashei	S—M	Evergreen conifer; green foliage, females fruit	275
Bald Cypress**	Taxodium distichum	L	Deciduous conifer; fine textured foliage; fall color	875 ~~1200~~
Big Tooth Maple**	Acer grandidentatum	M	Deciduous: full to partial sun: Medium water, fall color: no	550
Black Willow**	Salix nigra	M—L	Deciduous; riparian species	875
Bur Oak*	Quercus macrocarpa	L	Deciduous; large acorns and leaves, good shade tree	1200
Carolina Buckthorn*	Rhamnus caroliniana	S—M	Semi-Evergreen; sun-shade, glossy leaves, reddish fruit	275
Cedar Elm*	Ulmus crassifolia	M—L	Deciduous; narrow canopy, good shade tree for R.O.Ws	875
Chinquapin Oak*	Quercus muhlenbergii	M—L	Deciduous; round-topped tree; bold foliage	875
Condalia, Brazil Tree, Bluewood Condalia*	Condalia hookeri, C. viridis	S—M	Evergreen; delicate foliage; very drought tolerant; sun-shade, good shade tree	275

Cottonwood**	Populus deltoides	L+	Deciduous; large leaves, females fluffy seeds, not recommended for parking lots	1200
Crabapple, Texas*	Mollis texana	S—M	Deciduous, full to partial sun, spring flowering tree	275
Desert Willow*	Chilopsis linearis	S	Deciduous; pink tubular flowers; willow-like foliage, very drought tolerant	275 ~~n/a~~
Deodar Cedar	Cedrus deodara	L	Evergreen; spreading pyramidial shape	1200
Ebony, Texas*	Pithecellobium flexicaule	S	Evergreen; sun; white flowers	n/a
Escarpment Black Cherry*	Prunus serotina var. eximia	M—L	Deciduous; sun to shade; fall foliage	875
Eve's Necklace*	Sophora affinis	M—L	Deciduous; sun-shade; white to pink flowers	875
Goldenball Lead Tree*	Leucaena retusa	S—M	Deciduous; delicate foliage; fragrant yellow flowers	275
Hackberry*	Celtis spp.	M—L	Deciduous; prolific; wildlife favorite	875
Honey Locust	Gleditsia triacanthos	M	Deciduous; thornless varieties available	550
Huisache*	Acacia farnesiana	M	Deciduous; delicate foliage; fragrant yellow flowers	550
Italian Stone pine	Pinus pinea	L	Drought tolerant, needs room to grow	875
Kidneywood*	Eysenhardtia polystachya	S	Deciduous; delicate tree-shrub; fragrant white flowers	n/a
Lacy Oak*	Quercus laceyi	M	Deciduous; sun-partial shade; hill county native, good shade tree	550
Live Oak*	Quercus virginiana	M—L	Evergreen-like; good shade tree	875
Mesquite*	Prosopis glandulosa	S—M	Deciduous; lacy spreading form	550 ~~275~~
Monterrey Oak	Quercus polymorpha	S—M	Evergreen-like; good shade tree	875
Montezuma cypress**	Taxodium	L	Semi-evergreen: full sun: low	875

	mucronatum		water	
Mexican Buckeye*	Ungnadia speciosa	S	Deciduous; pink-red spring flowers	275 ~~n/a~~
Pecan*	Carya illinoensis	L+	Deciduous; needs lots of space; sensitive to root impact	1200
Persimmon, Texas*	Diospyros texana	S—M	Deciduous; sun-shade, smooth bark; females has black pulpy fruit	275
Plum, Mexican*	Prunus mexicana	S	Deciduous; sun to shade; white flowers, fruit	n/a
Possum Haw*	Ilex decidua	S—M	Deciduous; sun-shade; female has red fruit	275
Retama, Paloverde*	Parkinsonia texana	S—M	Deciduous; fast growing, yellow flowers	275
Red Oak, Shumard*	Shumard Quercus shumardii	L	Deciduous; fall color, good shade tree	1200
Red Oak, Texas*	Quercus texana	M	Deciduous; fall color, good shade tree	550
Redbud, Texas, Oklahoma, Mexican*	Cercis canadensis var texana	S—M	Deciduous; sun-shade, red/pink or white flowers	275
Rusty Blackhaw*	Viburnum rufidulum	S	Deciduous; fall color, white flower clusters	n/a
Silk-tassle*	Garrya ovata	S	Evergreen; sun-shade	n/a
Spiny Hackberry*	Celtis pallida	S	Evergreen; greenish white flowers, yellow orange fruit	n/a
Sycamore, Mexican	Platanus mexicana	L+	Deciduous; large leaves, good shade tree	1200
Sycamore,Texas*	Platanus glabrata	L+	Deciduous; large leaves, good shade tree	1200
Texas Mountain Laurel*	Sophora secundiflora	S	Evergreen, part shade to full sun; fragrant purple flowers	275 ~~n/a~~
Texas Pistache*	Pistacia texana	S	Semi-Evergreen; full sun to part-shade; red fruit	n/a
Wafer Ash, Hop tree*	Ptelea trifoliata	S	Semi-Evergreen; sun-shade; light green foliage	n/a
Western Soapberry*	Sapindus drummondii	M—L	Deciduous; full to partial sun; good shade tree, cluster large	875

			yellow flowers	
Wild Olive*	Cordia boisserieri	S—M	Semi-Evergreen; large white flowers, hardy to 14°F	275
Yaupon Holly*	Ilex vomitora	S—M	Evergreen; sun-shade; female has red fruit	275

* Texas Native

** no credit for planting these trees for parking lot shading, these species do not thrive in these conditions

* * * * *

Chapter 35, Appendix F, Section 35-F124 is amended as follows:

APPENDIX F - FLOODPLAINS AREAS OF SPECIAL FLOOD

Sec. 35-F124. - Allowable Development Within the Regulatory Floodplain

* * * * *

(e) Demonstrate that the development will not increase the regulatory 1% annual chance floodplain velocities above six (6) fps. No increase in velocity will be permitted if predevelopment velocities in the floodplain exceed six (6) fps unless proven that the existing channel/creek is stable (i.e. rocky bottom channel/creek) and no signs of erosion or scour are occurring in predevelopment conditions.

* * * * *

(f) (12) Wetland reestablishment, ~~or~~ mitigation, or environmentally friendly design criteria (i.e. Natural channel design, Low-Impact Development, etc set forth by the San Antonio River Authority and/or U.S. Army Corps of Engineers).

(f) (18) 1% annual chance floodplain reclamation where the watershed drainage area is less than three hundred twenty (320) acres when the floodplain storage volume lost due to fill is offset by comparable excavation within the same floodplain (see subsections 35-F124(d) and 35-F124(f)(27). In addition, all federal, state, or local permits shall be obtained, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334 (see subsections 35-F122 (a)(3)).

(f) (21) 1% annual chance floodplain reclamation in overbank areas subject to extensive shallow (0'-3') flooding where velocities in the overbank area are less than three (3) fps and where floodplain storage volume lost to reclamation is offset by comparable excavation within the same creek floodplain (see subsections 35-F124(d) and 35-F124(f)(27).) Where a maximum amount of fill allowed in the overbank areas is no more than 3 feet with engineered slope stability calculations.

* * * * *

Chapter 35, Appendix F, Section 35-F142 is amended as follows:

APPENDIX F - FLOODPLAINS AREAS OF SPECIAL FLOOD

Sec. 35-F142. - Specific Standards

*** * * * ***

(a) **Residential Construction.**

(1) Construction of habitable structures within the regulatory floodplain (base flood) is not allowed. New construction and substantial improvement of any residential structure shall have the lowest floor (including basement) elevated one (1) foot above the regulatory floodplain with the lowest adjacent grade at or above the regulatory floodplain. A registered professional engineer, architect, or land surveyor shall submit a certification to the floodplain administrator that the standard of this ordinance [reference Section 35-F132 (b)], is satisfied.

*** * * * ***

Chapter 35, is amended by adding Appendix H, Stormwater Design Criteria Manual as follows:

Appendix H

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

JANUARY 2016

STORM WATER DESIGN CRITERIA MANUAL

OLMOS DAM

SAN ANTONIO RIVER TUNNEL INLET

SAN ANTONIO RIVER – ESPADA PARK

Table of Contents

FIGURES

TABLES

INTRODUCTION

1.1 Preface

The purpose of this Storm Water Design Criteria Manual (SWDCM) is to provide the design engineer with the criteria necessary to design drainage facilities in and around the San Antonio area. This SWDCM establishes the standard principles and practices for the planning, design, construction, maintenance, and management of drainage facilities. It is not the intent of this SWDCM to limit the design capabilities or engineering judgment of the design engineer.

Should an error be found within the manual or changes are needed within a section of the manual, please submit these errors and changes to Director of TCI for consideration and inclusion into the next manual update.

1.2 Acronyms And Abbreviations

AASHTO	American Association of State Highway Officials
AC	Asphalt Concrete
ACPA	American Concrete Pipe Association
ADA	Americans with Disabilities Act
AEP	Annual Exceedance Probability
ASTM	American Society for Texting Materials
BFE	Base Flood Elevation
BMP	Best Management Practice
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvements Program
CIPP	Cast-in-Place Pipe
City	City of San Antonio
CLOMR	Conditional Letter of Map Revision
CLOMR-F	Conditional Letter of Map Revision – Fill
CMP	Corrugated Metal Pipe
CoSA	City of San Antonio
CRS	Community Rating System
CWA	Clean Water Act
DSD	Development Services Department
EARZ	Edwards Aquifer Recharge Zone
EGL	Energy Grade Line
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency

FHWA	Federal Highway Administration
FILO	Fee in Lieu of Detention
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
fps	feet per second
Fr	Froude Number
GIS	Geographic Information System
gpm	gallons per minute
HDPE	High Density Polyethylene
HEC-RAS	Hydraulic Engineering Center, River Analysis System
HGL	Hydraulic Grade Line
hp	horsepower
ICL	Inside City Limits
ID	Inside Diameter
ITS	Intelligent Transportation System
Inv.	Invert
JD	Jurisdictional Delineation
LID	Low Impact Development
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision – Fill
MBC	Multi Box Culvert
MDP	Master Development Plan
MCC	Motor Control Center
NFIP	National Flood Insurance Program
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PCCP	Portland Cement Concrete Pavement
pcf	pounds per cubic foot
PLC	Programmable Logic Controller
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PMR	Physical Map Revision
PUD	Planned Unit Development

RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
ROW	Right of Way
RSWF	Regional Storm Water Facilities
RSWMP	Regional Storm Water Management Program
SARA	San Antonio River Authority
SAWS	San Antonio Water System
SCS	Soil Conservation Service (changed to NRCS)
SFHA	Special Flood Hazard Area
SWMP	Storm Water Management Plan
TAS	Texas Accessibility Standards
TCI	Transportation & Capital Improvements
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
Typ.	Typical
TxDOT	Texas Department of Transportation
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDOT	United States Department of Transportation
USFW	United States Fish & Wildlife Agency
USGS	United States Geological Survey
VFD	Variable Frequency Drives
V.T.C.A.	Vernon's Texas Codes Annotated
WOUS	Waters of the United States

DRAINAGE POLICY

2.1 Introduction

The drainage policy for the City of San Antonio has changed over the years to provide for the orderly development of drainage improvements to enhance the health, safety, and welfare of its citizens, their property, and the environment. The City has implemented a comprehensive storm water management program through guidance provided by the Drainage Regulation Review Committee in February 1996 with a regional approach to meet the policies of the City Master Plan.

2.2 Statement Of Policy

The purpose of this manual is to provide adequate measures for the retention, detention, and distribution of storm water in a manner that minimizes the possibility of adverse impacts on both water quantity and water quality during development. Innovative runoff management practices designed to meet the provisions of this manual enhance the recharge of groundwater, and maintain the function of critical environmental features are encouraged. The city recognizes that watercourses, and their associated watersheds, within the City of San Antonio's jurisdiction represent significant, irreplaceable, recreational, and aesthetic resources and contribute to the economic and environmental health of the city. As all of the these watersheds are susceptible to concentrated surface water runoff, disturbance of wildlife habitat, non-point source pollution, and sedimentation from development activities they should be developed in a sensitive and innovative manner.

This manual implements the following policies of the master plan (Section 121 of City Charter, Resolution 97-05-01 approved May 14, 1997, Ordinance 86100 approved May 29, 1997):

- Natural Resources, Policy 1d: Encourage retention of the 100-year floodplains as natural drainage ways without permanent construction, unnecessary straightening, bank clearing, or channeling.
- Natural Resources, Policy 1d: 2. Adopt strong storm water management practices throughout the drainage area which include site specific measures such as:
  - On-site storm water retention and detention;
  - Reduction in impervious cover;
  - Natural bank contouring;
  - Floodplain preservation and buffering;
  - Preservation of riparian habitat;
  - Storm water harvesting sites for reuse purposes.

Urban Design, Policy 1g: Prepare design and construction policies and standards for utility and transportation infrastructure, capital improvement projects, public facilities, and development projects that reinforce neighborhood centers and provide diverse, pedestrian-friendly neighborhoods.

If principles cannot be met, please visit with the Director of TCI or his authorized representative.

2.3 Principles

Listed below are a few guiding principles to consider while developing drainage for the project site:

- Preserve floodplain and riparian buffers.
- Enhance the health, safety, and welfare of its citizens with multi-use facilities.
- Develop cost effective solutions.
- Develop drainage facilities for easier or reduced maintenance.
- Enhance recharge.
- Minimize impacts to existing drainage facilities.

2.4 Basic Knowledge

Prior to designing any project, the design engineer should gather and examine existing information of the project area within the watershed under consideration. From this information the design engineer can then determine if the upstream area will impact the project site or if the proposed development will impact existing downstream drainage systems or structures.

2.5 Planning

The planning of a project should consider the guiding principles stated above. There are many other guiding principles to consider during the planning of a development or a capital improvement project, including integrated planning by engineer, architect, landscape architect, and other applicable professionals to maximize multi-use features and on-site storm water management performance.

2.6 Technical Criteria

The storm drainage planning and design should follow the criteria within this manual.

The following two items should be considered during the design process.

1)

Diversion of storm water away from the natural watercourse will not be allowed, except within the property boundaries controlled by the developer under the following conditions: a) The storm water is returned to its natural flowing watercourse prior to leaving the developer's property, b) For watersheds greater than twenty (20) acres, a timing analysis of the existing and diverted hydrograph must be performed to confirm that the peak flow rate has not been increased at the point that it reenters the watercourse, as a result of the diversion.

2)

All developments shall provide adequate drainage outfall at the lower end of the site into an existing street, alley, drainage, easements or right-of-way, or to the centerline of an existing natural drain. Where a proposed street, storm drain, or open channel does not discharge into a natural low or into an existing adequate drainage easement, then facilities and drainage easements of adequate width — to contain the design discharge — shall be constructed and dedicated to the centerline of an existing natural low within the same watershed. However, when the natural low lies within the developer's property, the developer will only be required to plat an easement to the centerline of the natural low; provided that the easement is able to accommodate the facilities that will be built in conjunction with future development of that property.

2.7 Floodplain Management

Floodplain management has changed over the years due to the National Flood Insurance Act of 1968. Changes from the program included USGS maps being used with the delineation of floodplains, HUD issuing flood insurance maps in the late 1970's, and the founding of FEMA in 1979. The National Flood Insurance Program was ultimately placed under FEMA. As the City began participating in this action in the late 1970's, flood insurance can be purchased through insurance carriers for buildings in Bexar County.

Floodplain management is used to minimize flooding of buildings, reduce flood losses, and improve the quality of life — and safety of the citizens of Bexar County.

2.8 Implementation

The provisions of this manual shall apply to any application for subdivision plat, master development plan, capital improvement project, or building permit approval except as

otherwise provided by Chapter 35 of the UDC. A storm water management plan shall be provided as set forth in Appendix "A" of this manual.

2.9 References

- City of San Antonio. *Master Plan Policies*. Department of Planning & Community Development, City of San Antonio, San Antonio, Texas, Adopted: May 29, 1997. Retrieved from http://www.sanantonio.gov/Portals/0/Files/Planning/NPUD/master_plan.pdf

DRAINAGE LAW

3.1 INTRODUCTION

This chapter briefly references the laws and related policies that affect hydrologic and hydraulic designs for all public and private projects within the City of San Antonio and its Extraterritorial Jurisdiction (ETJ). These laws and policies include Federal, State, and Local Codes and regulations. Not all laws, statues, codes, or regulations are included.

3.2 FEDERAL LAWS AND REGULATIONS

3.2.1 The Code of Federal Regulations

The Code of Federal Regulations (CFR) is the codification of the general and permanent rules and regulations.

3.2.2 National Flood Insurance Program

The NFIP was established under the National Flood Insurance Act (NFIA) in 1968 to reduce future flood losses through local floodplain management. NFIP requires participating cities, counties, or states, to adopt floodplain management ordinances containing certain minimum requirements intended to reduce future flood losses.

3.2.3 National Environmental Policy Act

NEPA was passed in 1969, 42 United States Code (U.S.C.) 4321-4347, to establish a national policy to prevent or eliminate damage to the environment and improve the understanding of the ecological systems and natural resources that are important to the Nation.

3.2.4 Rivers And Harbors Act

Rivers and Harbors Act of 1899 – Allows the US Army Corps of Engineers (USACE) to regulate the navigable waters of the United States (WOUS). Section 9 (33 USC 401) prohibits the construction of any dam or dike across any navigable WOUS without a permit from the USACE. Section 10 (33 USC 403) prohibits the unauthorized obstruction, alteration, work affecting the course, location, condition, or physical capacity of any WOUS is unlawful unless the work has been reviewed and approved by the USACE.

3.2.5 The Federal Water Pollution Control Act

The Federal Water Pollution Control Act, 33 USC 1251-1387, was adopted in 1948 and, after amendments in 1972 and 1977, became known as the Clean Water Act (CWA). This act was enacted for the regulation of pollutants in the WOUS with the objective of restoring and maintaining the chemical, physical, and biological integrity of the nations' waters. This Act operates by authorizing water quality standards for surface water, requiring permits for point discharges of pollutants into WOUS. The EPA is the primary agency tasked with

enforcing the CWA, although it also works in conjunction with State Environmental Agencies and the USACE.

3.2.6 Section 402 of the CWA

National Pollutants Discharge Elimination System - NPDES was established by the EPA in 1990 and contains regulations for point source Storm Water Discharge. The purpose of this legislation is to improve the quality of the nation's rivers, lakes, and streams by setting limits for point source discharging pollutants into waters of the United States and establishes monitoring and reporting requirements.

3.2.7 Section 404 of the CWA

Section 404 makes it unlawful to discharge dredged or fill material into WOUS without first receiving authorization from the USACE. The types of 404 Permits include Nationwide Permits, General Permits, and Individual Permits.

3.2.8 Endangered Species Act (ESA)

The ESA was passed by congress in 1973, its purpose was to protect and recover imperiled species and the ecosystem upon which they depend. It is administered by the U.S. Fish and Wildlife Service.

3.3 STATE STATUTES AND RULES

3.3.1 Texas Water Code – Section 11.086

Texas Statutes – Section 11.086(a) No person may divert or impound the natural flow of surface waters in this state, or permit a diversion or impounding by him to continue, in a manner that damages the property of another by the overflow of the water diverted or impounded. (b) A person whose property is injured by an overflow of water caused by an unlawful diversion or impounding has remedies at law and in equity and may recover damages occasioned by the overflow. (c) The prohibition of Subsection (a) of this section does not in any way affect the construction and maintenance of levees and other improvements to control floods, overflows, and freshets in rivers, creeks, and streams or the construction of canals for conveying water for irrigation or other purposes authorized by this code. However, this subsection does not authorize any person to construct a canal, lateral canal, or ditch that obstructs a river, creek, bayou, gully, slough, ditch, or other well-defined natural drainage. (d) Where gullies or sloughs have cut away or intersected the banks of a river or creek to allow floodwaters from the river or creek to overflow the land nearby, the owner of the flooded land may fill the mouth of the gullies or sloughs up to the height of the adjoining banks of the river or creek without liability to other property owners. Amended by Acts 1977, 65th Leg., p. 2207, ch. 870, Sec. 1, eff. Sept. 1, 1977.

3.3.2 Texas Water Code – Section 16.236

Texas Statutes – Section 16.236 – Construction of Levee Without Approval of Plans; The commission shall make and enforce rules and orders and shall perform all other acts necessary to provide for the safe construction, maintenance, repair, and removal of levees located in this state.

3.3.3 Texas Commission on Environmental Quality – Chapter 213

Title 30 of the Texas Administrative Code Chapter 213 Edwards Aquifer Subchapter A. TAC Chapter 213 became effective on April 24, 2008 and its purpose was to regulate activities having the potential for polluting the Edwards Aquifer and hydrologically connected surface streams in order to protect existing and potential uses of groundwater and maintain Texas Surface Water Quality Standards. The activities addressed are those that pose a threat to water quality. Consistent with Texas Water Code, Section 26.401, the goal of this chapter is that the existing quality of groundwater not be degraded.

3.3.4 Texas Commission on Environmental Quality – Chapter 299

Title 30 of the Texas Administrative Code Chapter 299 for Dams and Reservoirs. This chapter applies to design, review, and approval of construction plans and specifications; and construction, operation and maintenance, repair, removal, emergency management, site security, and enforcement of dams that (1) have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet, as described in paragraph (2) of this subsection; (2) have a height greater than six feet and a maximum storage capacity greater than or equal to 50 acre-feet.

3.4 LOCAL CODES/ORDINANCES/COURT ORDERS

3.4.1 City of San Antonio Texas Unified Development Code

3.4.2 City of San Antonio Flood Plain Ordinance 57969

3.4.3 Bexar County Flood Damage Prevention

Court Order was approved by Commissioners. Court sometime in the 1980's and it includes the minimum standards deemed necessary to minimize or eliminate flood damage to the areas within Bexar County and outside of incorporated cities.

3.4.4 Aquifer Protection Ordinance 81491

Approved on January 12, 1995, by the San Antonio City Council amending Chapter 34, Article VI, of the City Code by adding a new Division 6 thereunder tilted "Aquifer Recharge Zone and Watershed Protection". This ordinance requires that for all projects in the

Edwards Aquifer Transition or Recharge Zone submit to the SAWS Resource Protection Division an Aquifer Protection Plan for approval prior to development.

3.4.5 (Ord. No. 97568 § 2) Storm Water Management Plan Checklist

3.4.6 (Ord. No. 2006-11-30-1333, § 2, 11-30-06) Maintenance

Maintenance of Sidewalks, parkways, curbs, downspouts, and driveways by abutting owners.

3.4.7 (Ord. No. 2009-08-20-0661, § 3, 8-20-09) Amendments to Chapter 19 and 35

Amendments of the City Code for further technical amendments to Chapter 35 Unified Development Code.

3.4.8 Ordinance No. 2010-11-18-0985

Requires that developers provide a one year warranty bond for public streets and public drainage improvements. The one year warranty period shall begin on the date the plat is recorded or the date of preliminary field approval of the improvements, whichever is later in time.

3.4.9 (Ord. No. 2013-01-31-0074) Amending FILO Ordinance of 1997

This Ordinance amends the methodology for calculating the fee-in-lieu-of onsite detention; increasing fees to all land use categories; and amending Article V, Chapter 35 of the Unified Development Code.

3.4.10 (Ord. No. 2014-06-19-0472) Amendments to Chapter 34

This Ordinance amends chapter 34 for the purpose of updating program requirements to reduce or eliminate the discharge of harmful pollutants into the SAWS Sanitary Sewer System and the City's Storm Water System in compliance with current State and Federal regulations.

PLANNING

4.1 Introduction

This chapter will touch on the aspects of planning in regard to drainage.

Planning for different components of a project is crucial to the success of the project, whether the project is a residential subdivision, commercial development, or a capital improvement project. The Design Engineer must consider the impacts to the existing drainage systems as well as the aesthetics of the planned improvements.

The City of San Antonio had commissioned a study in the 1950's to determine drainage improvement needs throughout the City of San Antonio (City Drainage Master Plan). These improvements cost hundreds of millions of dollars and a number of the improvements were funded over the years through bond programs and other funding sources. In more recent years, following the development of the Digital Flood Insurance Rate Maps (DFIRM) for Bexar County, a number of additional flooding issues were realized throughout Bexar County. These flooding issues were studied and a Regional Drainage Master Plan was developed to address these issues.

The following should be considered during the development of the project:

Multi-use facilities are encouraged, but not required. Multi-use facilities allow for water quality, satisfy National Pollutant Discharge Elimination System (NPDES) requirements, enhance ground water recharge, provide open space, provide recreation or other amenities, and/or provide habitat. Multi-use facilities may be utilized so long as the facility meets the standards set forth in Chapter 2.8 of this manual and does not increase the rate or volume of erosion above that which would result from the use of a facility without multiple uses. Utilization of multi-use detention facilities to alleviate existing flooding problems, enhance and provide amenities for older neighborhoods, and support the revitalization of economically depressed areas is encouraged in public and private redevelopment initiatives.

4.2 Regional Drainage Master Plan (Watershed Master Plan)

The Bexar Regional Watershed Management (BRWM) is a partnership among Bexar County, the City of San Antonio, the San Antonio River Authority and 20 suburban cities to address flood management and water quality concerns on a regional basis.

An Inter Local Agreement for Bexar Regional Watershed Management program was approved in May 2003 and amended in April 2010 between the managing partners (Bexar County, the City of San Antonio, and the San Antonio River Authority). The oversight and

implementation process for this program includes elected officials, entity staff at all levels, and most importantly, a citizens' advisory process. The program was set up to develop and implement efficient and economic flood control throughout Bexar County.

A number of potential Capital Improvement Projects have been identified through the BRWM Watershed Master Plans. A number of these projects within the Watershed Master Plan have been funded and constructed.

4.3 Regional Storm Water Management Program (RSWMP)

This section represents the policies of the RSWMP and understanding this section will enable the design engineer to provide utility and transportation infrastructure, capital improvement projects, public facilities, and development projects meeting the policies of the UDC.

4.3.1A RSWMP Overview

The City of San Antonio determined that regional storm water management is preferable to site-specific storm water mitigation. The regional storm water management program provides for the administration, planning, design, construction, and operational management of regional storm water facilities (RSWF). Regional storm water management uses a watershed-wide approach to analyze potential flooding problems, identify appropriate mitigation measures and select site locations and design criteria for RSWF. These RSWF include, but are not limited to, regional detention and retention ponds, watershed protection, land purchase, waterway enlargement, channelization, and improved conveyance structures. The regional storm water management program allows developers to participate in the program rather than constructing the on-site detention controls required by this section, when the City has determined that the increased runoff from the proposed development will not produce a significant adverse impact to other properties.

4.3.1B RSWMP Participation

All developers shall participate in the RSWMP in one (1) of three (3) ways:

1. Payment of a fee in lieu of on-site detention (except in areas designated by the Director of TCI as "mandatory detention areas"). The fee schedule is included in UDC Appendix "C," section 35C-109.
2. Construction of on-site or off-site measures (typically storm water detention facilities) to mitigate increases in runoff resulting from the proposed development.
3. Construction or participation in the construction of an off-site RSWF to mitigate increased storm water runoff anticipated from ultimate development of the watershed.

4.3.1C Adverse Impact

To determine a significant adverse impact for the purposes of this section, the following criteria will be used to analyze the receiving storm water facilities within two thousand (2,000) linear feet of the project, to the nearest downstream RSWF, or to the nearest floodplain with an ultimate analysis accepted by the city, whichever is less. For lots less than three (3) acres in size, adverse impact analyses need only extend to where tributary drainage areas equal one hundred (100) or more acres.

1. The storm water surface elevation (WSE) in receiving facility [natural or improved] drainage systems within two thousand (2,000) linear feet of the proposed development may not be increased by the proposed development unless the increased WSE is contained within easements or rights-of-way or the receiving systems have sufficient capacity to contain the increased WSE without increasing flooding to habitable structures.

2. Ultimate development runoff at low water crossings during regulatory (five (5), twenty-five (25), and one hundred (100) year frequency) storm events must not classify the low water crossing as "Dangerous to Cross" based on Figure 4.3.1.C. If the ultimate WSE exceeds this criterion, the crossings may be improved to the standards of this chapter in lieu of providing onsite storm water control measures or paying a fee.
3. Three (3) development conditions shall be analyzed with each adverse impact analysis.

   Existing Conditions. This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site, or the watershed, to other properties or drainage systems.

   Proposed Conditions. This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact to other properties or drainage systems.

   Ultimate Conditions. This refers to ultimate development conditions within the watershed. In addition to being used to design proposed drainage facilities (subsection "4.3.2 System Criteria," below), this condition shall also be used to determine if the increased runoff from the ultimate development of the watershed results in an adverse impact to other properties or drainage systems.

   In addition to verifying low water crossing capacity (item 2, above), this analysis shall be used to assist the city in identifying watershed wide storm water management issues.

4. Minimum standards for identifying Dangerous Roadway conditions are identified in Figure 4.3.1C below.

   Note: The City of San Antonio contends that any runoff crossing a roadway creates a potentially dangerous condition. Figure 4.3.1C represents the maximum flow depth over roadways that the City will accept in adverse impact analyses signed and sealed by the licensed professional engineers.

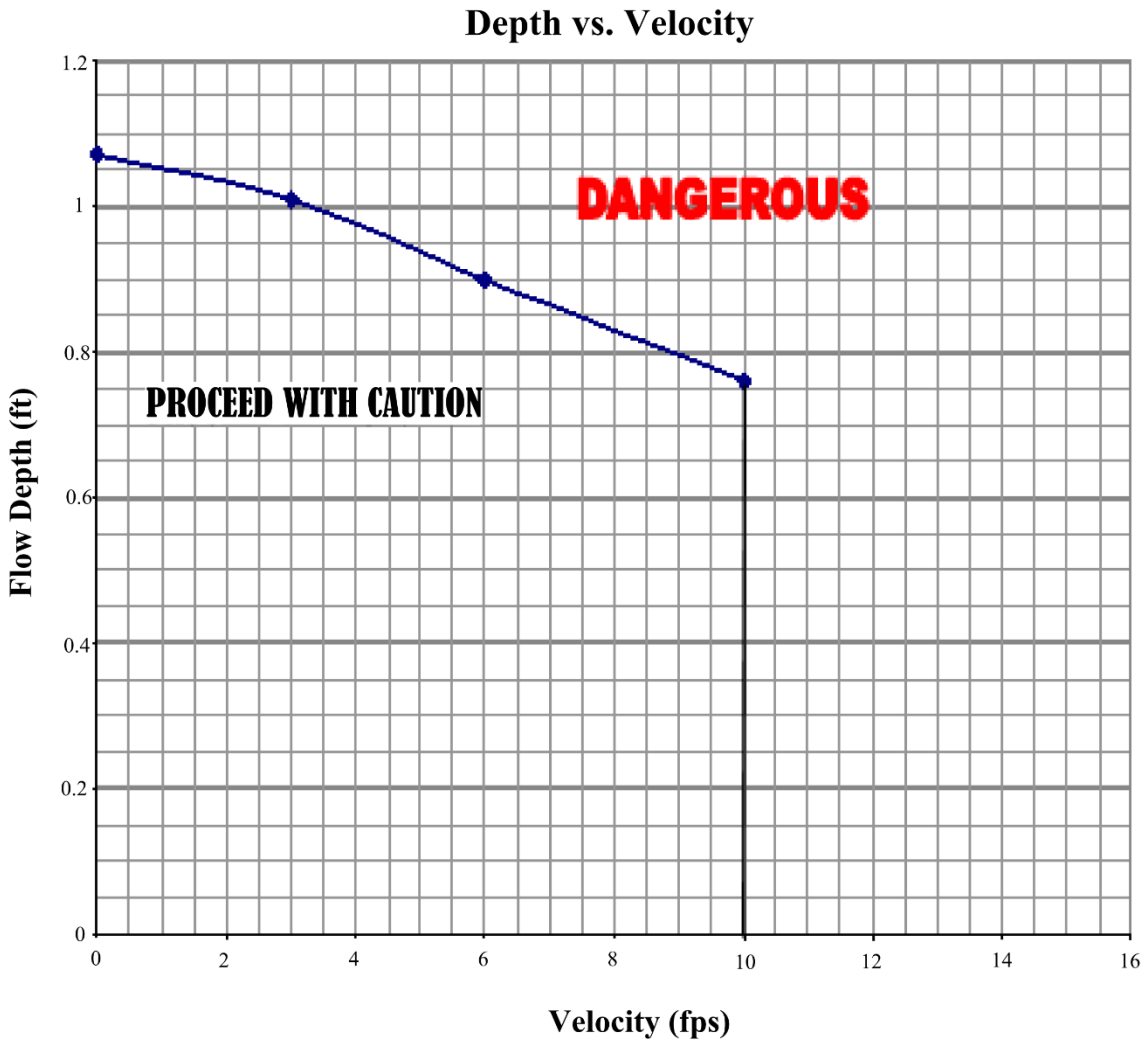


Figure 4.3.1C 1 – Roadway Flow Depth vs. Velocity

5. The City of San Antonio may reject a developer's request to participate in the RSWMP by payment or mitigation and require on-site detention. The City's decision will be based

on the knowledge of significant adverse impacts that would be created by ultimate development of the watershed regardless of the distance from the development to the area of concern. The City may also reject a request for participation when it is not in the best interests of the RSWMP. The developer is recommended to meet with TCI Storm Water Division to discuss participation options prior to commencing design of a project. This preliminary meeting in no way relieves the developer of his responsibility to prepare the necessary engineering documentation to support his request for participation.

4.3.1D Fee In Lieu Of

The storm water development fee in lieu of on-site detention must be paid prior to a plat being released for recordation by the City of San Antonio or the issuance of a building permit. The fee shall be determined in accordance with the provisions of UDC Section 35-C109, storm water management fees.

4.3.2 System Criteria

All storm water management facilities, or combination of facilities, shall be designed for ultimate development. Facilities with drainage areas less than one hundred (100) acres shall be designed for a twenty-five (25) year storm. Facilities with drainage areas over one hundred (100) acres or areas within a FEMA designated floodplain shall be designed for a one hundred (100) year storm or a twenty-five (25) year storm plus freeboard (based on Table 9.3.14) if that elevation is higher. Detention facilities and streets are exceptions to the frequency criteria cited above. Detention facility outflows will be designed for five (5) year, twenty-five (25) year and one hundred (100) year frequency storms. Refer to subsection 6.2 for specific drainage design criteria for streets.

4.3.3 Responsibility to Accept Storm Water

The owner or developer of property to be developed shall be responsible for the conveyance of all storm water flowing through the property. This responsibility includes the storm water flowing onto the property by any other developed property as well as the drainage naturally flowing through the property by reason of topography. Future upstream development shall be accounted for by assuming ultimate development when sizing drainage systems as specified in this section. Existing detention facilities may be accounted for in the ultimate analysis and shall be incorporated in the models if included.

4.3.4 Positive Overflow Pathways

Storm water management facilities for local drainage systems will be designed to ensure that a positive overflow pathway is provided to the nearest one hundred (100) year conveyance facility. The overflow pathway must be delineated on a plan that shows all existing structures in the vicinity impacted by the overflow pathway.

4.3.5 Maintenance

Maintenance of publicly owned facilities will be the responsibility of the City. Maintenance of private facilities is the responsibility of the property owner or the community association and must be specified in the maintenance schedule submitted to the City. A maintenance schedule for both publicly owned and privately owned facilities must be approved by the Director of TCI prior to the approval of construction drawings.

4.3.6 Inspection

Authorized personnel from the City of San Antonio or Bexar County within the ETJ shall conduct periodic inspections of these facilities and structures. Any required repairs will be consistent with current construction standards. Maintenance issues identified by the City, County, or State during inspections shall be the responsibility of the current owner.

4.3.7 New Development

Peak storm water runoff rates from all new development shall be less than or equal to the peak runoff rates from the site's predevelopment conditions for the five (5), twenty-five (25), and one hundred (100) year design storm events, except as provided in section 4.3.1 above.

4.3.8 Redevelopment

Peak storm water runoff rates from an area of redevelopment due to zoning or replatting shall be less than or equal to the peak runoff rates produced by existing development conditions for the five (5), twenty-five (25) and one hundred (100) year design storm events, except as provided in section 4.3.1 above.

4.3.9 Low Impact Development

The City of San Antonio encourages the installation of low impact development (LID) features such as bioretention, permeable pavement with storage, engineered swales, engineered infiltration storm drain systems, and engineered wetlands. For all developments proposed within the City of San Antonio jurisdictional boundaries, these features may be considered on-site detention features to the extent that they reduce the storm water runoff expected downstream as a result of such developments. It shall be the developer's responsibility to demonstrate that said LID features provide such benefit. Credit toward RSWMP fees will be considered and approved on a case by case basis by the Director of TCI.

4.4 Subdivision/Development

This section represents the policies of the City of San Antonio Unified Development Code as it relates to drainage and is included as a reference for the design engineer.

4.4.1 Major Plat

A Major Plat is a subdivision of property into five (5) or more lots or has infrastructure that is required to facilitate the development of the property. If there is an alteration of an existing floodplain or any drainage facility or other infrastructure is required, then the platting of property will fall under a Major Plat. A Storm Water Management Plan Report is required for the plat. Should the Storm Water Management Plan Report show no adverse impact within the reach downstream of the proposed development per section 4.3.1C and the City has reviewed and concurs with the findings; the developer may participate in the RSWMP by payment of the "Fee in Lieu of" (FILO) instead of providing detention.

4.4.2 Minor Plat

A Minor Plat is a subdivision of property into four (4) or less lots and no infrastructure is required to facilitate the development of the property. A Storm Water Management Plan Report is required for the plat. Should the Storm Water Management Plan Report show no adverse impact within the reach downstream of the proposed development per section 4.3.1C and the City has reviewed and concurs with the findings; the developer may participate in the RSWMP by payment of the "Fee in Lieu of" (FILO) instead of providing detention.

4.4.3 Replat

A replat is for property that was previously platted and the property will be reconfigured or further subdivided. A Storm Water Management Plan Report is required for the replat. If the previous plat had paid a fee to participate in the FILO and the Storm Water Management Plan Report show no adverse impact within the reach downstream of the proposed replat per section 4.3.1C and the City has reviewed and concur with the findings, the developer may continue to participate in the FILO, by paying any additional fees if required.

4.4.4 Amending Plat

An Amending Plat is for correcting an error on a previously approved or recorded plat. There should be no changes to drainage facilities or infrastructure. A letter will be required with the plat submittal that there are not changes to drainage facilities or infrastructure.

4.4.5 Master Development Plan (MDP)

The Master Development Plan is a conceptual long range development plan that provides an overall view for residential or commercial development. The MDP requires a Storm Water Management Plan Report to show what impacts the development might have on existing infrastructure and floodplains. The SWMP Report may require updating if the report is referenced during plat reviews. In addition, if the MDP SWMP Report is submitted with a plat review, a letter identifying what pages of the report are relevant to the plat area along with an exhibit identifying where the platted area is in relation to the overall MDP area will be required.

4.4.6 Planned Unit Development (PUD)

The Planned Unit Development is considered under the Master Development Plan. The streets within a PUD may be public or private. Drainage facilities shall conform to storm water management standards. A Storm Water Management Plan Report is required for the PUD.

4.4.7 Enclave

An Enclave subdivision will have private streets. The private streets are design and constructed to public street standards. Drainage facilities shall conform to storm water management standards. A Storm Water Management Plan Report is required for the Enclave subdivision.

4.4.8 Master Plan Community District (MPCD)

The Master Plan Community District is considered under the Master Development Plan. The streets within a MPCD may be public or private. Drainage facilities shall conform to storm water management standards. A Storm Water Management Plan Report is required for the MPCD.

4.4.9 Master Development Pattern Plan (MDPP)

The Master Development Pattern Plan is considered under the Master Development Plan. Drainage facilities shall conform to storm water management standards. A Storm Water Management Plan Report is required for the MDPP.

4.4.10 Inner City Reinvestment/Infill Policy (ICRIP)

A development within the ICRIP target area and fit into one of the following two categories; Residential, Mixed use Development; or Commercial/Industrial Development with drainage facilities shall conform to storm water management standards. A Storm Water Management Plan Report is required for the development. The development may qualify for Waivers of City and SAWS fees. If the development within the ICRIP area is less than twenty thousand (20,000) square feet then the development is exempt from the FILO fee. If the development within the ICRIP area is greater than twenty thousand (20,000) square feet then the development is subject to fifty percent (50%) of the FILO fee.

4.4.11 Infill Development Zone (IDZ)

A development within the IDZ area shall comply with the storm water management standards with the following exception. The reuse of an existing building or the development of an existing parcel or lot of less than ten thousand (10,000) square feet. The development within an IDZ area is exempt from the FILO fee.

4.4.12 Redevelopment Projects

A development project that redevelops an existing site shall conform to storm water management standards. A Storm Water Management Plan Report is required for the

redevelopment. If the existing site included some impervious cover prior to 1997 and the development is eligible for the FILO, then the fee would be paid on additional impervious cover. The exception to the FILO fee would be if the redevelopment is within an ICRIP or IDZ areas.

4.5 Planning For The Floodplain

There are a number of floodplains across the county that may impact a development or the development may impact the floodplain. The engineer should consider, during the planning of the development, to minimize the impacts to the floodplain.

Where the floodplain is part of the development, and where possible, multiple uses of drainage facilities and open space shall be incorporated by the owner or developer of a new subdivision. Alternative uses such as:

- public recreation
- horse/bike/hiking trails
- walking paths
- nature preserves
- wildlife habitat areas, etc.

are encouraged subject to the approval of the Director of TCI.

The above alternative uses should enhance the floodplain and provide a benefit to the development.

4.6 Planning For Drainage Systems

There are many components that may make up the drainage system within a development. These components should work together to provide an economical solution for the conveyance of storm water to an outfall location.

Should the conveyance of the storm water require the alteration of the natural water course, the following will apply.

Diversion of storm water away from the natural watercourse will not be allowed, except within the property boundaries controlled by the developer provided that the diverted water is returned to its natural flowing watercourse prior to leaving the developer's property. A timing analysis of the diverted hydrograph on watersheds greater than twenty (20) acres, as it reenters the receiving watercourse, must be performed to show that the peak flow rate has not been increased as a result of the diversion.

Where possible, multiple uses of drainage facilities and open space shall be incorporated by the owner or developer of a new subdivision. Alternative uses such as:

- public recreation
- horse/bike/hiking trails
- walking paths
- nature preserves
- wildlife habitat areas, etc.

are encouraged subject to the approval of the Director of TCI.

The above alternative uses should enhance the drainage facilities and provide a benefit to the development.

4.6.1 Storm Water Management Plan Checklist

The Storm Water Management Plan Checklist is provided in Appendix A as a reference.

4.7 Planning For Storage

Storage of storm water may be needed for a proposed development or for the mitigation of an existing flooding problem. There are different storage solutions available to the design engineer. These may include regional storage facility, surface or underground storage facilities, or natural surface areas.

Some of the items that need to be considered during the planning process are:

- Is the development/site within a mandatory detention area?
- Is there a regional detention close to the development/site?
- What are the downstream drainage system capacities/restrictions?
- Is the storage facility private or public?
- Who will maintain the facility? (property owner, homeowners association, or public agency)
- What permits are required?

The following should be considered during the planning process for surface storage facilities.

Where possible, multiple uses of drainage facilities and open space shall be incorporated by the owner or developer of a new subdivision. Alternative uses such as public recreation, horse/bike/hiking trails, walking paths, nature preserves, wildlife habitat areas, etc. are encouraged subject to the approval of the Director of TCI.

Storm water detention facilities shall be located in topographically depressed areas where possible. When necessary, dams may be constructed to detain flows.

For developments that require a subdivision plat and a storage facility is required/needed, the following deferral may be considered with the approval of Director of TCI. The deferral is for the final design and construction of the storage facility to be completed before any additional development occurs on the property.

Full detention basin design may be deferred until the building permit stage IF the property owner submits a "request for detention deferral" demonstrating an understanding of the implications of such design deferral AND the following notes are placed on the subdivision plat AND supporting documentation is provided.

1. "Storm water detention is required for this property. Building permits for this property shall be issued only in conjunction with necessary storm water detention approved by the City of San Antonio. The property may be eligible to post a fee in lieu of detention (FILO) if offsite drainage conditions allow but only when approved by the City of San Antonio. Maintenance of on-site storm water detention shall be the sole responsibility of the lot owners and/or property owners association and their successors or assignees."

2. "No building permit shall be issued for this platted property until a storm water detention system design has been approved by the City of San Antonio or Bexar County for commercial properties within the ETJ."

4.8 Planning For Transportation

The streets and highways within the San Antonio area provide the connections for private and public transportation. The streets are used for different modes of transportation, but are also used for the collection and conveyance of storm water. Arterial streets shall remain passable during a storm event as described in Chapter 6.2.1.1. All culvert and bridge crossings shall be "all weather crossings" to allow safe passage of all modes of transportation during a storm event as described in Chapters 10.1 and 11.1 respectively.

4.9 Planning For Open Space

A viable system of natural open space that serves to protect and conserve cultural resources, riparian areas, significant natural features, and preserve floodplains will help reduce erosion, provide recharge, improve water quality, and help reduce impacts of development.

These open space areas shall be covered by some form of easement and deed restrictions for allowed uses. These uses shall be compatible with the open space and may provide some low-impact forms of recreation such as walking, bicycling and nature watching are encouraged.

Should a drainage facility traverse or be adjacent to an open space, every effort should be made to make sure that the facility is compatible with the open space.

4.10 Planning For LID

Low Impact Development is a land development approach which manages storm water runoff close to its source. It can be a cost effective tool for managing storm water while meeting multiple goals and enhancing the site. Technical guidance for the overall site and specific BMP design is found in the San Antonio River Basin Low Impact Development Technical Design Guidance Manual.

4.11 Planning For Dams

Dams are used for the capture of storm water, which may contain an outlet structure.

The storm water impounded by a dam may impact upstream or adjacent property owners. A drainage easement as described in Chapter 15.5, shall be required to cover the storm water impoundment area.

An overflow structure should be considered for storms greater than the design storm and to eliminate the overtopping of the dam.

Upstream of an existing or proposed dam, the elevations of structures should be placed such that the finished floor is at a minimum of one foot above the top elevation of the dam and above the backwater elevation.

Downstream of an existing or proposed dam, placement of structures immediately downstream should be avoided and elevation of structures should be placed such that the finished floor is at a minimum of one foot above the backwater or breach water surface elevation.

If a dam is proposed, impacts to development and infrastructure, both upstream and downstream shall be evaluated.

4.12 Maintenance Standards

The following section is intended to provide guidance on general maintenance responsibilities and designation for Public and Private Drainage Easements. It is not meant to address rights or responsibilities associated with emergency situations.

An easement is a grant of one or more property rights by a property owner to another person or entity. Private drainage easements are typically necessary when storm water is to be conveyed across private property from a separate private property up to a contributing drainage area of 100 acres. Public drainage easements are typically necessary when the off-

site contributing drainage area exceeds 100 acres or if the contributing area is a FEMA designated floodplain. Additionally, public drainage easements are typically necessary when storm water is to be conveyed across private property from public property, public rights-of-way and easements, or public infrastructure to an established channel, creek, or other public drainage system.

Drainage easements are a form of utility easement and per the Unified Development Code are required to be labeled or designated "public" or "private". Maintenance is action taken to restore or preserve the design functionality of any facility or system. The granting and acceptance of an easement does not confer ownership but rather confers the right to use a landowner's property in some specific way. Per the Unified Development Code, the City of San Antonio assumes no responsibility for the maintenance, installation or improvement of pipes or storm water systems within an enclave or planned unit development. There is also a general duty under state law for property owners to keep their property free from nuisance and in a reasonably safe condition.

Drainage easements allow the City of San Antonio to perform certain maintenance and make repairs to drainage structures, at its option and as necessary, so that the overall safety and health of the city related to drainage can be maintained. The property owner retains ownership of the property and, similar to other utility easements on private property, also retains responsibility for normal care and maintenance.

For example, the City of San Antonio will remove a blockage in a channel within a public drainage easement, but will not remove a standing tree on a channel bank outside of the conveyance area. Additionally, the City of San Antonio may not remove a blockage in the conveyance area until that blockage has the potential to significantly affect water flow. Other examples of normal care and routine maintenance for owners includes, but is not limited to, litter collection, nuisance mowing, or other items that do not impede drainage. Examples of typical storm water conveyance maintenance undertaken by the City of San Antonio are managing significant overgrowth of vegetation (greater than 24-inches to 36-inches depending on grass species type), debris removal, channel restoration, and removal of downed trees in the conveyance area.

A. Maintenance of publicly owned facilities will be the responsibility of the city. Maintenance of private facilities is the responsibility of the property owner or the community association and must be specified in the maintenance schedule submitted to the city. A maintenance schedule for both publicly owned and privately owned facilities must be approved by the Director of TCI prior to the approval of construction drawings.

B. Authorized personnel from the City of San Antonio shall conduct periodic inspections of these facilities and structures. Any required repairs will be consistent with current construction standards. Maintenance issues identified by the city or state during inspections shall be the responsibility of the current owner.

C. An unobstructed access right-of-way connecting the drainage easement with an alley or roadway, parallel to or near the easement, shall be provided at a minimum spacing of one (1) access right-of-way at approximately one thousand (1,000) foot intervals. The access right-of-way shall be a minimum of fifteen (15) feet in width and shall be kept clear of obstructions that would limit maintenance vehicular access. Additional access points may be required if the flow line of the designed channel incorporates grade control structures of vehicular bridges that may block channel access to maintenance equipment. Channel design, earthen or concrete, shall have ramps in the side slopes near the access points that allow maintenance equipment to descend to the floor level of the channel. The maximum allowable ramp slope for vehicular access is seven to one (7:1). Access points adjacent to roadways or alleys shall be provided with a post and cable feature with padlock to prevent unauthorized use.

D. Design of new channels or alterations to existing channels shall consider future maintenance requirements. A maintenance schedule for any private channel shall be submitted to and approved by the Director of TCI prior to approval of construction plans. Maintenance requirements of concrete channels consist of de-silting activities, prevention of vegetation establishment in construction joints, and repair of concrete as necessary. Maintenance of earthen channels includes regular observation and repair, as necessary, of erosion, scouring, and removal of silt deposits, as necessary to maintain design parameters. Developers shall be responsible for maintaining newly planted channels until coverage is established throughout eighty-five percent (85%) of the area. This area shall include slopes, floor, and any attendant maintenance easement. New earthen channels shall be planted with drought resistant, low growth, native species grasses, which will allow unobstructed passage of floodwaters. Johnson grass, giant ragweed and other invasive species shall not be allowed to promulgate in channels. Suggested species shall include, but are not limited to, common bermuda, coastal bermuda, buffalo grass, sideoats grama, seep muhly, little bluestem, and indian grass. Mowing frequencies vary with the vegetation growth rates, but is required when the grass exceeds the design roughness coefficient of the channel.

4.13 References

- City of San Antonio Development Services. *Interactive Development Process Manual*. City of San Antonio, San Antonio, Texas. Retrieved from http://www.sanantonio.gov/dsd/pdf/DPM/0_Coversheet_Intro.pdf

- City of San Antonio Department of Public Works. *Fee In-Lieu-Of (FILO) Program*. City of San Antonio, San Antonio, Texas, April 2013. Retrieved from http://www.sanantonio.gov/dsd/pdf/FILO_Final.pdf

HYDROLOGY

5.1 Introduction

Hydrology is the study of water, its source, distribution, quantity, quality, and movement. For the purpose of this Storm Water Design Criteria Manual (SWDCM), the hydrology guidance will be limited to surface hydrology; the portion of the hydrologic cycle that deals specifically with precipitation, infiltration, and surface runoff.

This chapter describes the specific precipitation data which has been defined by federal and state agencies and regionalized to Bexar County. This chapter will also address infiltration and surface runoff by providing guidance on Methods of Analysis (Chapter 5.3) that range from small local analysis (i.e. Rational Method) to the hydrograph methods as well as guidance on probable maximum precipitation, with equation parameters specific for this region. The selection of these methods will be determined by drainage area size and purpose of the study. The proper application of these methods will generate discharge values that may be used for planning, design, mitigation, or regulation. Other methods of proven engineering use may be used with approval from the Director of TCI or his authorized representative.

5.2 Method of Analysis

5.2.1 Basin Delineation

A watershed or drainage basin is an area that drains storm water runoff to a designated point. Drainage basins are defined by its geographical terrain. The basin delineation is one of the most important parameters in the hydrologic model. When defining the basin boundary the design engineer should use the most recent topography data. In San Antonio and its ETJ, this may include:

- High accuracy LiDAR based contours, as generated by public or private agencies
- On-the-ground topographic survey data
- Historical topography maps, including USGS Quad. maps for pre-developed conditions
- Roadway construction plans
- Aerial Photos
- Underground infrastructure plans

The design engineer should follow standard engineering practice when delineating basin boundaries.

All basin delineation should consider previously defined drainage basins as found by the regions DFIRM data sets, Master Development Plans, or previous approved drainage studies. While the DFIRM data set was defined for the regions FEMA re-study, errors that may be found should be corrected. These basins can be accessed on-line at the San Antonio River Authority's Digital Data & Modeling Repository website (D2MR, website link may change, please refer to SARA staff for access to system).

Basin delineations defined by computer software should be reviewed carefully. Software including AutoCAD, Microstation, ESRI – GIS, and others have the capability to define basins. These basins are created by source data such as a Digital Elevation Model (DEM), a Triangular Irregular Network (TIN) or Raster grid files. The data set should be detailed enough to define the basin; it may require the use of break lines or fault lines to create certain features. Generally when DEM or Raster is used to generate basin delineation the resulting basin will create jagged or zigzagged basin boundary. The design engineer should verify that this resulting basin has the correct level of accuracy for the individual study.

5.2.2 Selection of Rational or Hydrograph Method

For drainage areas less than 200 hundred (200) acres, the basis for computing runoff shall be the rational formula (as defined in Section 5.3) or some other method provided it is acceptable to the Director of TCI.

For drainage areas 200 hundred (200) acres or greater, the basis for computing runoff shall be a unit hydrograph method (as defined in Section 5.6), preferably the Soil Conservation Service (SCS) Dimensionless Unit Hydrograph method as contained in the U.S. Army Corps of Engineers Hydrologic Engineering Center HEC-HMS "Hydrologic Modeling Systems".

5.2.3 Selection of Method for Detention Ponds

For detention ponds with drainage areas of twenty (20) acres or less, the basis for computing runoff shall be the modified rational method. When the drainage area of a detention pond is greater than twenty (20) acres the unit hydrograph method shall be used. The unit hydrograph method shall be used when multiple detention ponds within a watershed are being modeled, regardless of drainage area, unless approved by the Director of TCI.

5.3 Rational Method

The Rational Method is appropriate for estimating peak discharge for small areas up to (200) acres with no significant flood storage. This method provides a peak discharge value but no time-series of flow or flow volume:

(Equation 5.3.1)

$$Q = C\ I\ A$$

Q = Peak Discharge (cfs)
C = Runoff coefficient
I = Average rainfall intensity (in./hr.)
A = Drainage area (acres)

Runoff coefficients (C) may need to be calculated as a weighted runoff coefficient where multiple values are present in one drainage area.

To determine the intensity (I) it is necessary to calculate the Time of Concentration (Tc). This value is used to identify the rainfall intensity found in Figure 5.5.1A of this manual.

5.4 Time of Concentration

The following methods are recommended for time of concentration calculation:

(Equation 5.4)

$$T_c = T_t + T_{sc} + T_{ch}$$

T_c = Time of Concentration
T_t = Sheet flow over plane surface
T_{sc} = Shallow Concentrated Flow
T_{ch} = Open Channel Flow

5.4.1 Overland Flow

Flow over plane surfaces: Maximum allowable time is twenty (20) minutes. Minimum is five (5) minutes.

- The overland flow time chart from "Design" by Elwyn E. Seelye may be used to calculate overland flow times. Note that the minimum time has been reduced to five (5) minutes.

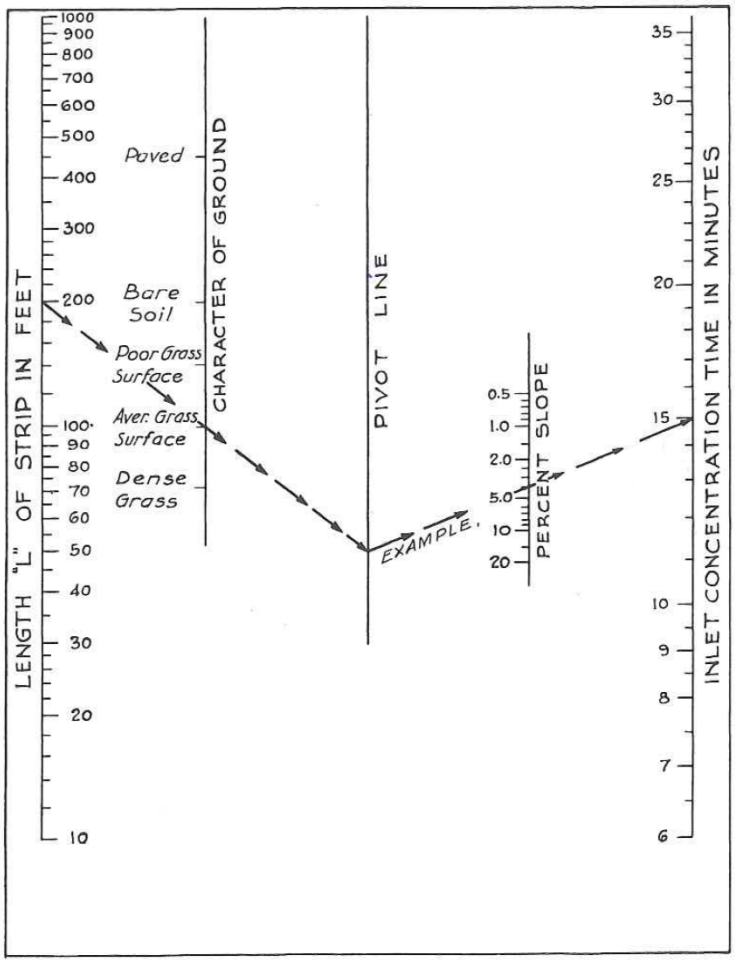


Figure 5.4.1 – Overland Flow Time *(Source: "DESIGN" by Elwyn Seelys Figure. H)*

- TR-55 "Urban Hydrology for Small Watersheds," SCS 1986 may be used, please consider the maximum (20 min.) and minimum (5 min.) when defining the flow length (L).

(Equation 5.4.1)

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

T_t = travel time (hr.)
n = Manning's roughness coefficient
L = flow length (ft.)
P_2 = 2-year, 24-hour rainfall*
s = slope of hydraulic grade line (land slope, ft/ft)

*in San Antonio and its ETJ please use 4.44 inches for the two (2) -year, twenty-four (24)-hour rainfall value

Table 5.4.1 - Roughness Values for sheet flow

Roughness Coefficient (Manning's n) for sheet flow	
Surface Description	n[1]
Smooth surface (concrete, asphalt, gravel or baresoil)	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 [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods[3]:	-
Light underbrush	0.40
Dense underbrush	0.80

1. The n values are composite of information compiled by Engman (1968)
2. Included species such as weeping lovegrass, bluegrass, bufallo grass, blue gamma grass, and native grass mixtures
3. When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

5.4.2 Shallow Concentrated Flow

Overland flow usually becomes shallow concentrated flow after a maximum of three hundred (300) feet: Use Manning's equation to estimate travel time for defined swales, bar ditches, street sections, etc. or Figure 5.4.2 from TR-55 "Urban Hydrology for Small Watersheds," SCS 1986, may be used where a geometric section has not been defined.

(Equation: 5.4.2)

$$T_{sc} = \frac{L_{sc}}{3600\ K\ S_{sc}^{0.5}}$$

T_{sc} = shallow concentrated flow time (hr.)
L_{sc} = shallow concentrated flow length (ft.)
K = 16.13 for unpaved surface; 20.32 for paved surface
S_{sc} = shallow concentrated flow slope (ft./ft.)

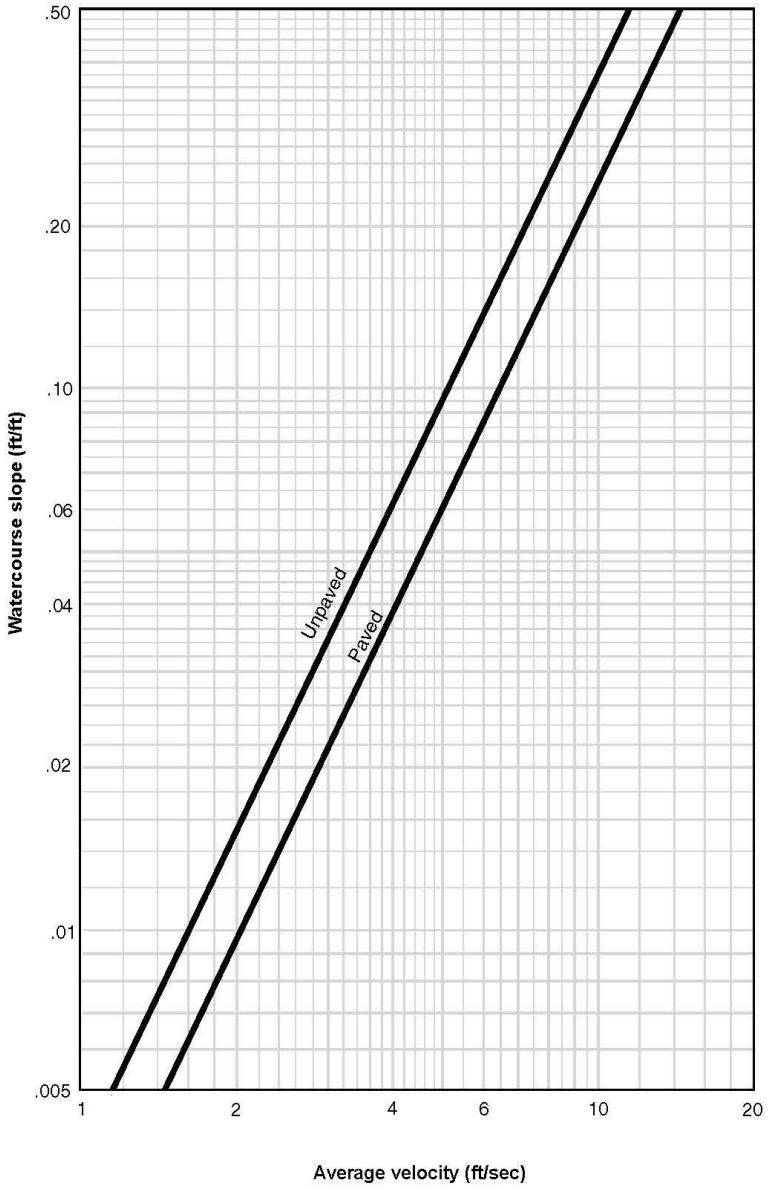


Figure 5.4.2 - Average Velocities for Estimating Travel Time for Shallow Concentrated Flow (Source: NRCS Technical Release 55 – Figure 3-1)

5.4.3 Channel Flow

Use existing computer models where available or Manning's equation if the data is not available. When estimating the time of concentration, non-floodplain channel velocities for ultimate watershed development should not be less than six (6) fps.

(Equation 5.4.3)

$$T_{ch} = \frac{L_{ch}}{3600\ 1.49/n\ R^{2/3}\ S_{ch}^{1/2}}$$

T_{ch} = channel flow time (hr.)
L_{ch} = channel flow length (ft.)
S_{ch} = channel flow slope (ft. /ft.)
n = Manning's roughness coefficient
R = channel hydraulic radius (ft.) and is equal to a/P_w
a = cross sectional area ($ft.^2$)
P_w = wetted perimeter (ft.)

5.5 Rainfall Data

5.5.1 Rainfall Intensity-Duration

Use Table 5.5.1A to determine rainfall intensity.

Table 5.5.1.A – Rainfall Intensity Duration

TIME MINUTES	FREQUENCY						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	7.200	8.400	9.413	11.100	12.432	13.542	18.204
6	6.684	7.836	8.830	10.331	11.648	12.877	17.258
7	6.277	7.381	8.365	9.722	11.025	12.341	16.497
8	5.944	7.009	7.982	9.224	10.512	11.894	15.864
9	5.666	6.696	7.658	8.806	10.079	11.514	15.327
10	5.427	6.427	7.380	8.447	9.707	11.184	14.862
11	5.220	6.194	7.137	8.136	9.382	10.893	14.453
12	5.038	5.988	6.923	7.862	9.095	10.635	14.090
13	4.877	5.805	6.731	7.618	8.839	10.403	13.763
14	4.731	5.641	6.558	7.399	8.608	10.192	13.468
15	4.600	5.480	6.400	7.200	8.400	10.000	13.200
16	4.458	5.296	6.159	6.959	8.088	9.551	12.765
17	4.328	5.129	5.942	6.741	7.806	9.147	12.368
18	4.209	4.977	5.743	6.541	7.549	8.781	12.005
19	4.099	4.836	5.562	6.357	7.314	8.449	11.672
20	3.998	4.707	5.395	6.188	7.098	8.146	11.364
21	3.904	4.587	5.241	6.031	6.898	7.867	11.079
22	3.816	4.476	5.098	5.886	6.713	7.610	10.814
23	3.734	4.372	4.965	5.749	6.541	7.373	10.566
24	3.658	4.275	4.841	5.622	6.380	7.153	10.335
25	3.586	4.184	4.725	5.503	6.229	6.947	10.117
26	3.518	4.098	4.616	5.390	6.088	6.756	9.913
27	3.453	4.017	4.514	5.284	5.955	6.576	9.720
28	3.393	3.941	4.417	5.184	5.830	6.408	9.538
29	3.335	3.868	4.326	5.089	5.711	6.250	9.365
30	3.280	3.800	4.240	5.000	5.600	6.100	9.200
31	3.209	3.723	4.155	4.905	5.501	6.003	9.025
32	3.142	3.650	4.074	4.814	5.407	5.911	8.870
33	3.078	3.580	3.997	4.727	5.318	5.823	8.722
34	3.018	3.514	3.924	4.644	5.233	5.739	8.581
35	2.960	3.450	3.854	4.565	5.152	5.658	8.446
36	2.906	3.390	3.787	4.490	5.074	5.581	8.317
37	2.853	3.332	3.723	4.418	4.999	5.507	8.194
38	2.803	3.277	3.662	4.349	4.928	5.435	8.075
39	2.755	3.224	3.604	4.283	4.859	5.367	7.961
40	2.709	3.173	3.548	4.219	4.793	5.301	7.852
41	2.665	3.124	3.494	4.158	4.729	5.238	7.747
42	2.623	3.077	3.442	4.099	4.668	5.176	7.646
43	2.582	3.032	3.392	4.043	4.609	5.117	7.548
44	2.543	2.989	3.345	3.988	4.552	5.060	7.454
45	2.505	2.947	3.298	3.936	4.497	5.005	7.363
46	2.469	2.907	3.254	3.885	4.444	4.952	7.275
47	2.434	2.868	3.211	3.836	4.393	4.900	7.190
48	2.400	2.830	3.169	3.788	4.343	4.850	7.108
49	2.368	2.794	3.129	3.743	4.295	4.802	7.028
50	2.336	2.759	3.090	3.698	4.248	4.754	6.951
51	2.306	2.724	3.052	3.655	4.203	4.709	6.876
52	2.276	2.691	3.016	3.613	4.159	4.664	6.804
53	2.247	2.659	2.980	3.573	4.117	4.621	6.733
54	2.220	2.628	2.946	3.534	4.075	4.579	6.665
55	2.193	2.598	2.913	3.496	4.035	4.538	6.598
56	2.167	2.569	2.880	3.459	3.996	4.499	6.534
57	2.141	2.541	2.849	3.423	3.958	4.460	6.471
58	2.117	2.513	2.819	3.388	3.921	4.422	6.410
59	2.093	2.486	2.789	3.354	3.885	4.386	6.350
60	2.070	2.460	2.760	3.320	3.850	4.350	6.300
120	1.285	1.555	1.775	2.175	2.550	2.900	4.050
180	0.933	1.140	1.317	1.633	1.900	2.200	3.133
360	0.552	0.668	0.767	0.950	1.083	1.250	1.767
720	0.315	0.383	0.450	0.533	0.625	0.733	1.033
1440	0.185	0.223	0.250	0.313	0.375	0.417	0.571

5.5.2 Rainfall Depth-Duration-Frequency

5.5.2.1 Design Rainfall

For the Design Rainfall, a twenty-four (24) hour rainfall distribution shall be applied for hydrograph based runoff calculations. Rainfall intensities as adopted for the City of San Antonio are given in Table 5.5.2.1.

Table 5.5.2.1 - Design Rainfall Values (inches)

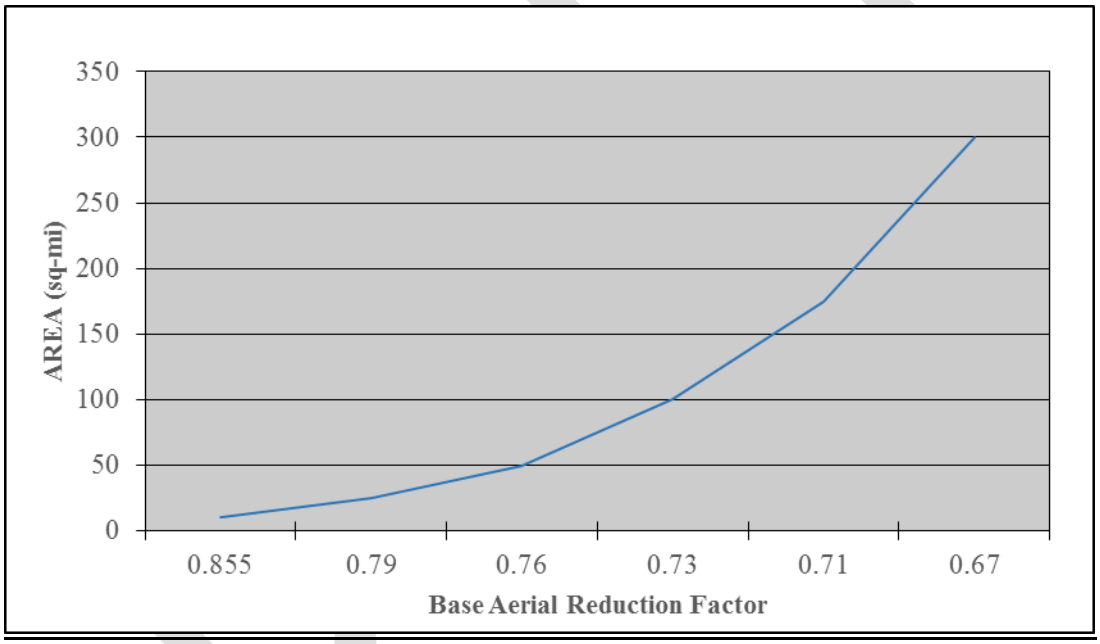
USGS Adjusted Rainfall Values (pre-areal reduction)								
Frequency of Storm	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**500-year**
Exceedance probability	1	0.5	0.2	0.1	0.04	0.02	0.01	0.002
Storm Duration								
Duration	**Frequency**							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.54	0.61	0.70	0.78	0.93	1.04	1.13	1.52
15 minute	1.00	1.15	1.37	1.60	1.80	2.10	2.50	3.30
30 minute	1.46	1.64	1.90	2.12	2.50	2.80	3.05	4.60
1 hour	1.81	2.07	2.46	2.76	3.32	3.85	4.35	6.30
2 hour	2.22	2.57	3.11	3.55	4.35	5.10	5.80	8.10
3 hour	2.41	2.80	3.42	3.95	4.90	5.70	6.60	9.40
6 hour	2.86	3.31	4.01	4.60	5.70	6.50	7.50	10.60
12 hour	3.26	3.78	4.60	5.40	6.40	7.50	8.80	12.40
24 hour	3.85	4.44	5.36	6.00	7.50	9.00	10.00	13.70

5.5.2.2 Areal Reduction Factor

Calculated storm water runoff at a given point may be reduced by factors shown in Table 5.5.2.2 based on the tributary area (in square miles) draining to said point.

Table 5.2.2.2 - Areal Reduction Factors

Areal Reduction Factors (for use in calculating Point Rainfall for Bexar County)**	
Area (sq mi)	Base ARF for Area
10	0.855
25	0.79
50	0.76
100	0.73
175	0.71
300	0.67
***Source: 2007 Watershed Hydrology Technical Support Data Notebooks on file with San Antonio River Authority*	



5.5.3 Runoff Coefficient

Runoff coefficients (C value) for use in the rational formula shall not be less than the values shown in Table 5.5.3A, as appropriate

Table 5.5.3A - Runoff Coefficient (C value) - percentage

Character of Area	SLOPE			
	Up to 1%	Over 1% up to 3%	Over 3% up to 5%	Over 5%
Business or commercial areas (90% or more impervious), Existing Pavement / Buildings or Zoning Districts O, C, I-1, I-2	95	96	97	97
Densely developed areas (80% to 90% impervious) or Zoning Districts D, MX, NC, TOD, Use Pattern TND	85	88	91	95
Closely built residential areas and school sites or Zoning Districts MF, R-4	75	77	80	84
Undeveloped areas * - Present land is undeveloped and ultimate land use is unknown. C values for use in ultimate development calculations.	68	70	72	75
Large lot residential area or Zoning Districts R20, RE	55	57	62	64
Undeveloped areas * - Existing conditions.	-	-	-	-
Average residential area or Zoning Districts R-5, R-6	65	67	69	72
Cultivated or Range (Grass Cover < 50% of Area)	44	47	53	55
Range (Grass Cover 50—75% of Area)	37	41	49	53
Forest or Range (Grass Cover > 75% of Area)	35	39	47	52

*Areas included within parks, green belts, or regulatory floodplains shall be considered to remain undeveloped per this table

5.6 Hydrograph Method

5.6.1 Sub-Basin

5.6.1.1 Loss Method

5.6.1.1.1 SCS Curve Number Loss

The SCS curve numbers adopted for use by the City of San Antonio are shown in Table 5.6.1.1.1.1. The hydrologic soil groups are listed in the latest version of the United States Natural Resources Conservation Service [formerly the Soil Conservation Service], "Urban Hydrology for Small Watersheds," Technical Release No. 55 (TR 55); this document is hereby incorporated by this reference. Soil types that relate to the hydrologic soil group may be found in the latest version of the United States Natural Resources Conservation Service "Soil Survey-Bexar County, Texas;" this document is hereby incorporated by this reference. Soil types may also be based on a Geotechnical Engineering Report.

Table 5.6.1.1.1.1 - SCS Curve Number by Soil Type

Cover Description	Hydrologic Condition	Curve Number (CN) for Hydrologic Soil Group			
		A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.)	Good	39	61	74	80
Meadow (continuous grass, protected from grazing and generally mowed for hay)		30	58	71	78
Brush (brush-weed-grass mixture with brush the major element)	Good	30	48	65	73
Woods	Good	30	55	70	77

Table 5.6.1.1.1.2 - Percent Impervious Cover by Land Use

Land Use Category		Average Percent Impervious Cover
Residential	1/8 acre Residential Lots, or Garden or townhouse apartments, or Zoning Districts R-4, R-5, RM-4, RM-5; TND/TOD Use Patterns	65—85
	¼ acre Residential Lots or Zoning District R-6, RM-6	38
	1/3 acre Residential Lots or Zoning District R-15	30
	½ acre Residential Lots or Zoning Districts R-20	25
	1 acre Residential Lots or Zoning Districts RP, RE	20
Industrial or Zoning Districts L, I-1, I-2		72—85
Business or Commercial, or Zoning Districts NC, O, C		85—95
Densely developed (apartments), or Zoning Districts MF		65—85
Streets, Roads, and Parking Areas		98

5.6.1.2 Transform Method

5.6.1.2.1 SCS Unit Hydrograph

A method developed by the Natural Resource Conservation Service (formally known as the Soil Conservation Service) for constructing unit hydrographs. This method is based on empirical data from small agriculture watersheds across the United States. For the SCS

method, antecedent moisture condition II shall be used in the runoff model. Design rainfall values listed in Table 5.5.2.1 shall be used for hydrograph calculations. The method requires the determination of the SCS lag time and time to peak, the peak discharge is calculated by the following equation:

(Equation 5.6.1.2a)

$$\mathbf{Q}_p = \frac{484\ A}{t_p}$$

$\mathbf{Q_p}$ = peak discharge (cfs.)
A = drainage area (mi.^{2})
$\mathbf{t_p}$ = time to peak (hr.)

(Equation 5.6.1.2b)

$$\mathbf{t}_p = \frac{\Delta t}{2} + \mathbf{t}_{lag}$$

$\mathbf{t_p}$ = time to peak (hr.)
Δt = the duration of rainfall (hr.) = 0.133 $\mathbf{t_c}$
$\mathbf{t_{lag}}$ = lag time from the centroid of rainfall to peak discharge, estimated at 0.6 $\mathbf{t_c}$ (hr.)

Table 5.6.1.2.1 – SCS Dimensionless Unit Coordinates

Coordinates of SCS Dimensionless unit hydrograph			
t/t_p	Q/Q_p	t/t_p	Q/Q_p
0	0	1.4	0.750
0.1	0.015	1.5	0.660
0.2	0.075	1.6	0.560
0.3	0.160	1.8	0.420
0.4	0.280	2.0	0.320
0.5	0.430	2.2	0.240
0.6	0.600	2.4	0.180
0.7	0.770	2.6	0.130
0.8	0.890	2.8	0.098
0.9	0.970	3.0	0.075
1.0	1.000	3.5	0.036
1.1	0.980	4.0	0.018

1.2	0.920	4.5	0.009
1.3	0.840	5.0	0.004

5.6.1.2.2 Snyder Unit Hydrograph

The Synder Unit Hydrograph is a method developed from analysis of ungauged watersheds in the Appalachian Highlands in the United States. Required parameters are the standard lag (hr.) and the peaking coefficient.

(Equation 5.6.1.2.2a)

$$\mathbf{Q}_p = \frac{640\ C_p\ A}{t_{lag}}$$

Q_p = Snyder peak discharge (cfs.)
C_p = peaking coefficient; range from 0.5 – 0.9
A = Drainage Area (mi.^{2})
t_{lag} = Snyder lag time (hr.)

(Equation 5.6.1.2.2b)

$$T_{lag} = C_t \left(\frac{LL_{ca}}{\sqrt{S}}\right)^{0.33}$$

T_{lag} = Snyder lag time (hr.)
C_t = basin coefficient based on the level of development in the watershed
L = length of the main stream from the outlet to the watershed divide
L_{ca} = length of the centroid along the flow path
S = Slope of the longest path (L)

(Equation 5.6.1.2.2c)

$$C_t = 1.4224e^{-0.0088x}$$

x = the percentage of development

Note:Typically C_t range for this area is 1.1 to 1.4.

5.6.1.2.3 Clark Unit Hydrograph

The Clark Unit Hydrograph is derived by two major parameters; the translation or movement of runoff and the attenuation or reduction of runoff as it moves through the watershed. These two parameters are defined at its basis with the following equation:

(Equation: 5.6.1.2.3)

$$\frac{dS}{dt} = I_t - O_t$$

$\frac{dS}{dt}$ = time rate of change in storage at time ($_t$)

I_t = average inflow at time ($_t$)

O_t = outflow from storage at time ($_t$)

To use this method in HEC-HMS the parameters of translation and attenuation are defined by the watersheds time of concentration (t_c) and Basin Storage coefficient (R).

- **The Translation** is derived by the time of concentration (t_c), and is defined by Equation 5.4 in this manual, the TR-55 method of calculation. The t_c is provided as a unit of time in hours (hr.)
- **The Attenuation** is the Basin Storage coefficient (R), a measure of the storage within the individual watershed. The larger the R value, the larger the attenuation. This value can be defined by calibration. R is given as a unit of time (hr.)

5.6.1.3 Baseflow Method

5.6.1.3.1 None

For a majority of the perennial streams in San Antonio and its ETJ, the hydrology models will not account for any base flow condition. It is recommended that the design engineer visit the study stream to observe average conditions.

5.6.1.3.2 Constant Monthly Baseflow

As defined in the HEC-HMS technical Manual of March 2000 "[the base flow parameter is] best estimated empirically, with measurements of channel flow when storm runoff is not occurring. In the absence of such records, field observation may help establish the average flow…for most urban channels and for smaller streams in the western and southwestern US, the baseflow contribution may be negligible."

5.6.2 Reach – Routing

Routing of the runoff hydrograph through the channel from one (1) subarea calculation point to the next in the HEC-HMS shall be computed using one (1) of the methods listed below.

Channel routing methodologies that are currently being applied in the existing HEC-HMS model of the watershed shall not be replaced with a different methodology without approval or direction from the Director of TCI.

For use in routing methods, Manning's roughness coefficients ("N" values) shall be consistent with the values listed in Table 9.2.4.1

(Equation: 5.6.2)

$$I - O = \frac{dS}{dt}$$

$\frac{dS}{dt}$ = time rate of change in storage at time t

I = average inflow

O = outflow from storage

5.6.2.1 Muskingum

If overbank/channel storage not significant, use Muskingum/normal depth channel routing.

5.6.2.2 Muskingum-Cunge 8 Point Cross Section

If overbank/channel storage is not significant and a hydraulic model is not available, use the Muskingum-Cunge eight (8) point cross section Method.

5.6.2.3 Modified Puls

Use the Modified Puls Storage Method where a hydraulic model is available to develop storage/out flow relationship.

5.6.2.4 Kinematic Wave

The Kinematic Wave Method for channel reaches where inflow from overbank runoff or multiple point sources (Example: storm drain outfalls) is significant and where hydrograph attenuation is insignificant.

5.7 Probable Maximum Flood

For information on calculating the Probable Maximum Flood (PMF), please refer to the National Oceanic and Atmospheric Administration (NOAA) Hydro-meteorological Report (HMR) 51 & 52 and the various USGS report for the probable maximum flood peak discharges in Texas. When defining the PMF please contact the City of San Antonio TCI staff

and also refer to the Texas Commission on Environmental Quality (TCEQ) Dam Safety program for additional guidance.

5.8 References

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- PBS&J. (May 2005). *Technical Memorandum: Snyder Unit Hydrograph Parameter Guidelines* – San Antonio River Basin, Regional Watershed Modeling System.
- USDA. *Urban Hydrology for Small Watersheds - Technical Release No. 55*. U.S. Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, June 1986.
- TXDOT. Hydrology. Chapter 4 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised 2011. (Accessed April 2014)
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San Antonio River Authority. (September 2013) *San Antonio River Basin Regional Modeling Standards for Hydrology and Hydraulic Modeling.*

PAVEMENT DRAINAGE

6.1 Introduction

The design of new streets and the improvement of existing streets shall consider public safety and limit potential conflicts between storm water conveyance, vehicular traffic, parking, pedestrian access, ADA requirements, and bicycle traffic. Storm water conveyance on streets shall be designed to account for the cumulative impact of peak flows and runoff volumes on the system as the storm water progresses downgrade.

Potential flooding problems or conflicts at connection points where new or modified drainage systems (including streets, storm drains, etc.) and existing portions of the downstream street system and storm water conveyance system shall be identified and resolved, either in the design of the new or modified drainage system or in modifications to the existing system. Appropriate longitudinal and cross slope serve to move any accumulated water off the roadway as quickly and effectively as possible.

Where proposed streets cross existing or proposed watercourses, all-weather crossings shall be required. Culverts or bridges shall be adequate to allow passage of the design storm identified in Chapters 10.3.1 and 11.3.1.

6.2 Design Guidelines

6.2.1 Design Frequency and Spread

Streets draining a watershed greater than one hundred (100) acres must be designed for the 100-year ultimate design frequency storm. Street width shall not be widened beyond the width as determined by the street classification for drainage purposes. The width of pavement, maximum and minimal longitudinal street grades, and maximum and minimum pavement cross slopes shall follow UDC 35-506 Transportation and Street Design based on their street classifications.

6.2.1.1 Street Classification – Primary and Secondary Arterial Streets

An Arterial Street is a street designated on the current major thoroughfare plan. One (1) lane in each direction on arterial streets shall remain passable with a flow depth not to exceed 0.30 feet in the passable lane during a twenty-five (25)-year ultimate storm event or the one hundred (100) year ultimate if the street drains a watershed greater than one hundred (100) acres. The maximum depth of water in the street section must not exceed seven (7) inches (the height of a standard city curb).

The Roadway Spread, also known as ponding width, is dependent on the depth of water at the curb, longitudinal slope, cross slope, and roadway pavement material.

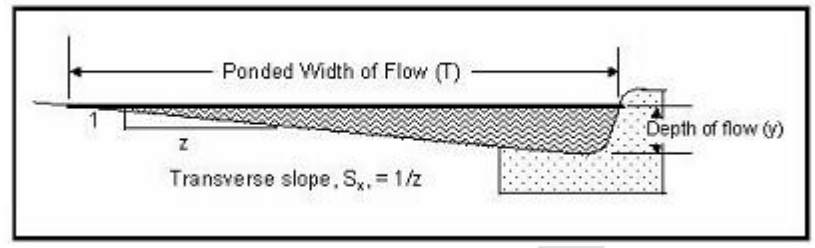


Figure 6.2.1.1 - Gutter Flow (Source TxDOT, 2000)

The depth of flow in a gutter section with a longitudinal slope (S) is taken as the uniform (normal) depth of flow. Manning's Equation is used as a basis for this determination. Ordinarily, it would not be possible to solve for uniform depth of flow directly from Manning's Equation. For Equation 6.2, the portion of wetted perimeter represented by the vertical (or near-vertical) face of the curb is ignored. This is a justifiable expedient which does not appreciably alter the resulting estimate of depth of flow in the curb section.

(Equation 6.2)

$$y=1.243(QnS_x / S^{1/2})^{3/8}$$

y = depth of water in the curb section (ft.)
Q = gutter flow rate (cfs.)
n = Manning's roughness coefficient
S = longitudinal slope (ft./ft.)
$\mathbf{S_x}$ = pavement cross slope (ft./ft.)

6.2.1.2 Street Classification – Local "B" and Collector Streets

A maximum flow depth to the top of curb on a standard Local "B" and Collector Street section will be allowed during a twenty-five (25)-year ultimate storm event. A Collector Street is a street with a width of forty-four (44) feet or more and not shown as an Arterial Street on the current major thoroughfare plan.

6.2.1.3 Street Classification – Local "A" Streets

Local "A" streets shall be designed on a basis of a five-year ultimate frequency. A twenty-five-year ultimate frequency storm must be contained within the street right-of-way.

6.2.1.4 Street Classification – Alleys

Alleys shall be designed for five (5)-year ultimate frequency within the limits of the alley pavement/curbs, and twenty-five (25)-year ultimate frequency within the right-of-way or easement to carry storm water.

6.2.1.5 Street Classification – Traditional Street Design

Traditional street design shall conform to the storm frequency requirements of the standard street designs listed above as follows:

- Trails, Alleys, and Lanes - Use alley design criteria.
- Local Street or Avenue - Use Local "A" street design criteria.
- Main Street - Use Local "A," Local "B," or Collector Street design criteria depending on the pavement width. Use Local "A" criteria where pavement width is less than thirty-four (34) feet.
- Boulevard or Parkway - Use Arterial Street design criteria.
- A County section with no curbs and with bar ditches - Design street section to contain the twenty five (25)-year ultimate frequency storm within the right-of-way.

6.2.2 Street Capacity

Streets may be used for storm water drainage only if the calculated storm water flow does not exceed the maximum flow depth and velocity allowable for the streets roadway classification as outlined above.

Where streets are not capable of carrying their design criteria storm water discharge inlets or curb openings are then required. The inlets or openings will discharge into a drainage channel or storm drain system. If there is not one available, one shall be provided. Partial flow past the inlet will be allowed when the capacity of all downstream street systems can accommodate the flow. The Inlets and Storm Drain System design criteria requirements are outlined in Chapters 7 and 8.

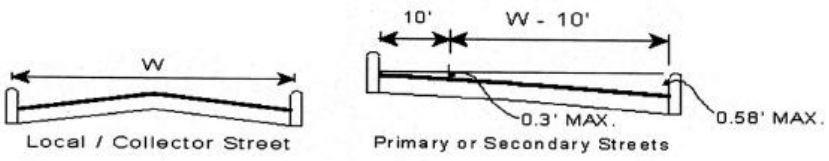
Curb cuts for driveways on all streets shall be designed for compatibility with the storm water conveyance function of streets. The design criteria maximum frequency must be contained within the right-of-way. Considerations will be given to cross streets as well as drive ways draining to streets.

Where Dwelling units are located on the downhill side of a T-intersection, Cul-de-sac, or knuckle with a street or drainage channel discharging onto it, the street intersection shall be graded so to avoid water flowing over the curb and out of the right-of-way. Detailed calculations will be required at these locations to show that the discharges are contained within the right-of-way.

No flow capacity tables are provided for the traditional street designs due the variety of geometric properties associated with these streets. When proposing street designs, drainage calculations specific to a proposed street design must be submitted for approval.

Table 6.2.2.1 - Manning's Roughness Coefficient

Pavement Description	Manning's "n" Value
Concrete Pavement (wood float type surface finish)	0.015
Asphalt Pavement	0.018



Slope	28' Pvm't Width c=.28' wp=29.16 A=12.32 r=0.42		30' Pvm't Width c=0.3' wp=31.16 A=12.9 r=0.41		40' Pvm't Width c=0.4' wp=41.16 A=15.2 r=0.37		44' Pvm't Width c=0.44' wp=45.16 A=15.84 r=0.35		Secondary with Median 24' Pvm't wp=24.68 A=8.16 r=0.33		Primary (w/o & w/) Median 36' Pvm't wp=29.58 A=8.41 r=0.28	
	Q(cfs)	Vel.	Q(cfs)	Vel.	Q(cfs)	Vel.	Q(cfs)	Vel.	Q(cfs)	Vel.	Q(cfs)	Vel.
0.40	36.22	2.94	37.41	2.90	40.85	2.69	41.13	2.60	20.37	2.50	18.99	2.26
0.45	38.42	3.12	39.68	3.08	43.33	2.85	43.63	2.75	21.61	2.65	20.14	2.39
0.50	31.07	2.52	41.83	3.24	45.67	3.00	45.99	2.90	22.78	2.79	21.23	2.52
0.55	42.47	3.45	43.87	3.40	47.90	3.15	48.23	3.05	23.89	2.93	22.26	2.65
0.60	44.36	3.60	45.82	3.55	50.03	3.29	50.38	3.18	24.95	3.06	23.25	2.76
0.65	46.17	3.75	47.69	3.70	52.07	3.43	52.44	3.31	25.97	3.18	24.20	2.88
0.70	47.91	3.89	49.49	3.84	54.04	3.56	54.41	3.44	26.95	3.30	25.12	2.99
0.75	49.59	4.03	51.23	3.97	55.94	3.68	56.32	3.56	27.90	3.42	26.00	3.09
0.80	51.22	4.16	52.91	4.10	57.77	3.80	58.17	3.67	28.81	3.53	26.85	3.19
0.85	52.80	4.29	54.54	4.23	59.55	3.92	59.96	3.79	29.70	3.64	27.68	3.29
0.90	54.33	4.41	56.12	4.35	61.28	4.03	61.70	3.90	30.56	3.74	28.48	3.39
0.95	55.82	4.53	57.66	4.47	62.96	4.14	63.39	4.00	31.40	3.85	29.26	3.48
1.00	57.27	4.65	59.16	4.59	64.59	4.25	65.04	4.11	32.21	3.95	30.02	3.57
1.50	70.14	5.69	72.45	5.62	79.11	5.20	79.66	5.03	39.45	4.83	36.77	4.37
2.00	80.99	6.57	83.66	6.49	91.34	6.01	91.98	5.81	45.55	5.58	42.45	5.05
2.50	90.55	7.35	93.53	7.25	102.13	6.72	102.83	6.49	50.93	6.24	47.47	5.64
3.00	99.19	8.05	102.46	7.94	111.87	7.36	112.65	7.11	55.79	6.84	52.00	6.18
3.50	107.14	8.70	110.67	8.58	120.84	7.95	121.68	7.68	60.26	7.38	56.16	6.68
4.00	114.53	9.30	118.31	9.17	129.18	8.50	130.08	8.21	64.42	7.89	60.04	7.14
4.50	121.48	9.86	125.49	9.73	137.02	9.01	137.97	8.71	68.33	8.37	63.68	7.57
5.00	116.06	10.00	124.11	10.00	144.43	9.50	145.43	9.18	72.03	8.83	67.13	7.98
5.50	107.83	10.00	115.33	10.00	151.48	9.97	152.53	9.63	75.54	9.26	70.40	8.37
6.00	100.85	10.00	107.87	10.00	142.98	10.00	157.02	10.00	78.90	9.67	73.53	8.74
6.50	94.83	10.00	101.44	10.00	134.51	10.00	147.73	10.00	80.80	10.00	76.54	9.10
7.00	89.59	10.00	95.84	10.00	127.12	10.00	139.63	10.00	76.32	10.00	79.42	9.44
7.50	84.97	10.00	90.91	10.00	120.61	10.00	132.50	10.00	72.37	10.00	82.21	9.78
8.00	80.88	10.00	86.54	10.00	114.83	10.00	126.16	10.00	68.87	10.00	81.72	10.00
8.50	77.21	10.00	82.62	10.00	109.66	10.00	120.48	10.00	65.74	10.00	74.62	10.00
9.00	73.91	10.00	79.09	10.00	105.00	10.00	115.36	10.00	62.92	10.00	68.49	10.00
9.50	70.92	10.00	75.90	10.00	100.77	10.00	110.73	10.00	60.37	10.00	63.15	10.00
10.00	68.20	10.00	72.99	10.00	96.93	10.00	106.50	10.00	58.04	10.00	58.47	10.00

Figure 6.2.2.1 - Storm Drainage, Flow Velocities & Capacities for Typical Conventional Street Sections

6.2.3 High Velocity Flow

Streets may be used for storm water drainage only if the calculated storm water flow does not exceed ten (10) feet per second.

6.2.4 Longitudinal Slope

Longitudinal slopes of a roadway are determined by its street classification as described in Sections 6.2.1. Table 506-3 and Table 506-4 contained in the UDC under Section 35-506 shall be used as the latest design standards.

6.2.4.1 Minimum

All proposed streets, both inside the City Limits and in the Extraterritorial Jurisdiction, shall have a minimum Longitudinal Slope of 0.5%. An optional 0.4% longitudinal slope can used with a concrete curb and gutter.

6.2.4.2 Maximum

The maximum Longitudinal Slope for Primary and Secondary Arterial Streets will be 5% both ICL and within the ETJ. The maximum slope for Collector Streets will be 7% both ICL and within the ETJ. The maximum slope for Local 'A', Local 'B', and alleys will be 12% ICL. The maximum slope for Local 'A', Local 'B', and alleys will be 10% in the ETJ. The maximum slope for a Traditional Street Parkway or Boulevard will be 5%. The maximum slope for a Traditional Street Main Street or Avenue will be 7%. The maximum slope for a Traditional Street Local, Lane, Alley, and County Section will be 10%. Grades over ten (10) percent in the extra-territorial jurisdiction shall be approved by the county fire marshal.

6.2.5 Cross Slope

The minimum and maximum street cross slopes are as described below. If not found below, then the cross slope will follow the latest version of AASHTO's guidelines for "A Policy on Geometric Design of Highways and Streets".

6.2.5.1 Minimum

All proposed streets must have a minimum cross slope of 2%. A slope less than 2% may be used to re-direct storm water runoff at street intersections, Cul-de-sacs, or into receiving drainage structures.

6.2.5.2 Maximum

All proposed streets should have a maximum cross slope of 4%. Cross slope at intersections may exceed 4% depending on the slope of the intersecting streets. Streets with super elevation should follow the latest version of AASHTO's guidelines for "A Policy on Geometric Design of Highways and Streets," and meet all the requirements identified in Section 6.2.1 (depth of flow at curb, one passable lane in each direction, flow contained within right-of-way - all that apply).

6.2.6 Inverted Crown

Streets with inverted crowns will be acceptable if approved by the Director of TCI.

6.2.6.1 Maximum Flow Depth

Streets with a proposed inverted crown section will meet the same maximum depth based on their street classification as described above.

6.2.8 Flow In Sag – Vertical Curves

When street flow approaches a low point in the roadway the maximum depth design criteria(s) above should be checked to provide that the design runoff remains within the allowable limits (depth of flow at curb, one passable lane in each direction, flow contained within right-of-way, and all others that apply). If the maximum design criteria exceed any of the design parameters, additional inlets or curb openings are required to reduce the flow upstream of the low point.

6.2.9 Unflooded Public Road Access

During a design storm event unflooded access (within the "Proceed with Caution" range per Figure 4.3.1C) shall be available from each proposed new development to an adjacent public street during a regulatory flood event. Additionally, unflooded access shall be accessible to an arterial street that is not adjacent to the development or to a distance of one-quarter (1/4) mile, whichever is less, during a future conditions twenty percent (20%) annual chance (five-year ultimate) flood event. The director of TCI may waive the design criteria above for developments under three (3) acres in size.

6.3 References

AASHTO. *A Policy on Geometric Design of Highways and Streets - 1994*. American Association of State Highway and Transportation Officials, Washington, DC, 1995.

TxDOT. *Roadway Design Manual*. Texas Department of Transportation, Revised October 2002.

STORM DRAIN SYSTEMS

7.1 Introduction

The street system, roadside ditch, swale or channel may direct flow into an inlet, grate, or other collection structure into the storm drain system. This storm drain system will be comprised of inlets, pipes, junction boxes, bends, outlets, and other appurtenances. These systems may include water quality devices to meet state and federal water quality standards. This chapter describes the general guidelines needed to provide an adequate storm drain system and minimize impacts to both upstream and downstream properties.

The following shall be considered during the design of the storm drain systems.

For all ordinary conditions, storm drains shall be designed on the assumption that they will flow full under the design discharge; however, when there are constrictions, turns, submerged, or inadequate outfall, etc., the hydraulic and energy grade lines shall be computed and plotted in profile. The Energy Grade Line (EGL) shall be below the top of curb and the Hydraulic Grade Line (HGL) shall be below the gutter elevation of the drainage structure. In all cases adequate outfalls shall be provided, including review of point source discharges.

The EGL and HGL will be required on all storm drain systems.

7.2 Hydraulics Of Storm Drainage Systems

7.2.1 Flow Type Assumptions

The design procedures assume that the flow within each segment of the underground drainage system is steady and uniform. Also the average velocity within each segment is considered to be constant.

7.2.2 Partial Flow vs. Pressure Flow

There are two types of considerations for sizing storm drain lines under steady uniform flow assumption. The first is referred to as partial or open channel flow design. The flow depth within the conduit is less than the height of the conduit; so the HGL will be within the conduit. The second is referred to as pressure flow design or full flow. The conduit is fully flowing, and the HGL may be at the soffit or above the soffit of the conduit. See Figure 7.2.4.

For partial flow the design engineer should check for possible hydraulic jumps within the system if the flow is supercritical. If a hydraulic jump occurs within the system, the upper conduits could change to pressure flow or the hydraulic jump could move downstream within the conduit to another design point.

The design may have both partial and pressure flow segments within the same drainage system.

The drainage system should be designed for full flow as this will increase the efficiency of the storm drain system.

7.2.3 Hydraulic Capacity

The hydraulic capacity is controlled by the conduits size, shape, and frictional resistance. Use Manning's Formula for the design of all conduits.

(Equation 7.2.3a)

$$\mathbf{Q = AV}$$

Q = flow (cfs.)
A = cross section area (sq. ft.)
V = velocity of flow (ft./sec.)

(Equation 7.2.3b)

$$\mathbf{Q = \frac{1.49}{n} AR^{0.67} S_f^{0.5}}$$

Q = flow (cfs.)
A = cross section area (sq. ft.)
n = roughness coefficient of conduit
R = hydraulic radius = A/**WP** (ft.)
WP = wetted perimeter (ft.)
$\mathbf{S_f}$ = frictional slope of conduit (ft./ft.)

The "n" value to be used in Manning's Formula shall conform to Table 7.2.3 for design purposes. Any other "n" value shall be based on generally accepted engineering principles.

Table 7.2.3 - Manning's Roughness Coefficient

Type of Culvert	Roughness or Corrugation	Manning's n
Concrete Pipe	Smooth	0.013
Concrete Box	Smooth	0.013
Corrugated Metal Pipe, Pipe-Arch - Unpaved	2-2/3 by 1/2 inch Annular	0.024
Corrugated Metal Pipe, Pipe-Arch - Unpaved	3 by 1 inch Annular	0.027

7.2.4 Hydraulic Grade Line and Energy Grade Line

The HGL is the water surface of an open channel or the water surface of a conduit with partial flow. For a conduit with pressure flow, the HGL would be the level of water surface that would rise within a vertical tube at any point along the conduit.

The EGL is an imaginary line that is the measure of total energy along the open channel or conduit carrying water. This total energy includes elevation head, velocity head, and pressure head. The EGL is a velocity head ($V^2/2g$) above the HGL. The EGL is always increasing in the upstream conduit. The EGL should not be above the finished grade, or top of curb, at any point along the conduit.

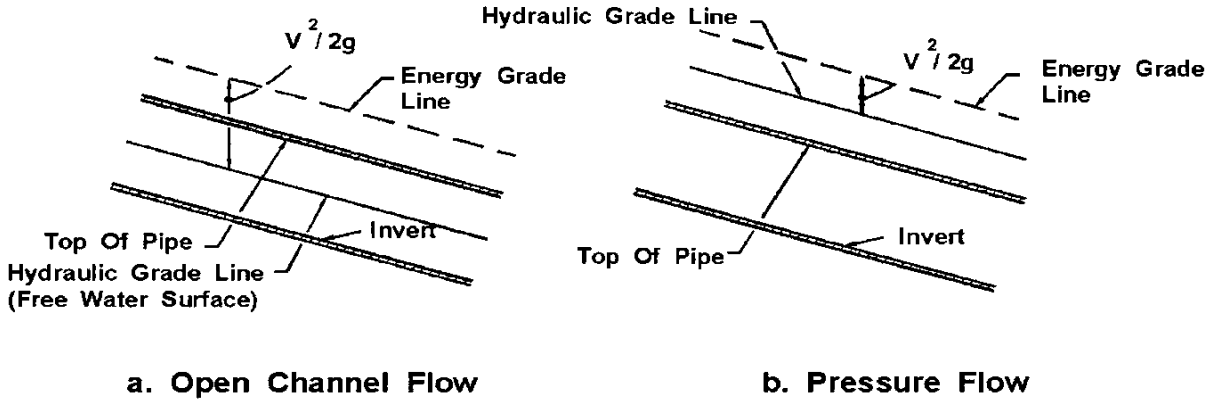


Figure 7.2.4 - Hydraulic and Energy Grade Line in a conduit *(Source FHWA HEC No. 22)*

7.2.5 Storm Dain Inlets and Outfalls

7.2.5.1 Inlets

The drainage system will include inlets on streets, parking areas, and other areas to direct flow into the underground system. For inlets on streets, the HGL at the inlet should be below the gutter and the EGL not be above the top of curb or ponding depth. For area inlets the EGL should not be higher than the ponding depth.

An inlet could also be a pickup structure that channelizes flow from an upstream channel into the underground system. Careful analysis of the junction between the downstream underground system and the upstream channel should be performed to check both the HGL and EGL.

7.2.5.2 Outfalls

The outfall for the storm drain system should discharge into a natural low, existing storm drainage system, or a channel. The start of the EGL for the storm drain system begins at the outfall. The design engineer should determine the tail water for the downstream drain to

find the impact on the proposed outfall. There are two conditions for determining the starting point for the HGL at the outfall. The tail water may be above the critical depth of the outfall conduit or between the critical depth and invert of the outfall conduit. The starting point for the HGL should be either the tail water elevation or the average of critical depth plus the height of the storm drain conduit, whichever is greater. The design engineer will consider an exit loss at the outlet.

If the outfall of the storm drain system is into a river, stream, or creek, the design engineer should consider the coincidental probability of the peaks of both systems occurring at the same time. The tail water for the receiving stream should be checked with the peak of the storm drain system.

7.2.6 Energy Losses

The energy losses for the storm drain system include frictional, exit, entrance, bend, and manhole and junction losses. These losses add to the hydraulic gradient along the storm drain system.

7.2.6.1 Pipe Friction Losses

The frictional loss from the conduit is one of the losses. The head loss due to friction is determined by the following formulas:

(Equation 7.2.6.1a, Friction Loss Formula)

$$H_f = S_f L$$

H_f = Friction loss (ft.)
S_f = Friction slope (ft./ft.)
L = Length of pipe (ft.)

Should the conduit have partial flow, then the frictional slope will match the pipe slope. For pressure flow or full flow of the conduit, the formula below can be used to determine the frictional slope of the conduit:

(Equation 7.2.6.1b, Pressure Flow Formula)

$$S_f = \left[Q\left(\frac{n}{1.49}\right) / \left(AR^{2/3}\right)\right]^2$$

S_f = Friction slope (ft./ft.)
Q = flow (cfs.)
n = roughness coefficient of conduit
A = cross section area (sq. ft.)

R = hydraulic radius = A/WP (ft.)
WP = wetted perimeter (ft.

7.2.6.2 Exit Losses

The exit loss from the storm drain outlet should be determined by the following formula:

(Equation 7.2.6.2, Exit Loss Formula)

$$\mathbf{H_o = 1.0\left[\left(\frac{V_o^2}{2g}\right) - \left(\frac{V_d^2}{2g}\right)\right]}$$

H_o = Exit loss (ft.)
V_o = Velocity of outfall conduit (fps)
g = Acceleration due to gravity (ft./s^2 (32.2 ft./s^2))
V_d = Velocity of downstream channel (fps)

7.2.6.3 Bend Losses

This loss is for a bend located in the conduit run and not at a junction or manhole structure. Use the following formula to determine the bend loss:

(Equation 7.2.6.3, Bend Loss Formula)

$$\mathbf{H_b = 0.0033(\Delta)\left(\frac{V^2}{2g}\right)}$$

H_b = Bend loss (ft.)
Δ = Angle of curvature in degrees
V = Velocity of the conduit (fps)
g = Acceleration due to gravity (ft./s^2 (32.2 ft./s^2))

7.2.6.4 Transition Losses

These losses are used where box culverts have a transition in width, height, or both width and height. The energy loss for expansions or contraction in open channel or partial flow must use the following formulas:

(Equation 7.2.6.4a)

$$\mathbf{H_c = K_c\left[\left(V_2^2/2g\right) - \left(V_1^2/2g\right)\right]}$$

$$\mathbf{H_e = K_e\left[\left(V_1^2/2g\right) - \left(V_2^2/2g\right)\right]}$$

H_c = Contraction loss (ft.)
H_e = Expansion loss (ft.)
K_c = Contraction coefficient (0.5 K_e)

K_e = Expansion coefficient
V_1= Velocity upstream of transition (fps)
V_2= Velocity downstream of transition (fps)
g = Acceleration due to gravity (ft./s^2 (32.2 ft./s^2))

Energy loss for expansions or contraction in pressure flow conditions will use the following formulas:

(Equation 7.2.6.4b)

$$H_c = K_c\left(V_2^2/2g\right)$$

$$H_e = K_e\left(V_1^2/2g\right)$$

H_c = Contraction loss (ft.)
H_e = Expansion loss (ft.)
K_c = Contraction coefficient (Tables 7.2.E)
K_e = Expansion coefficient (Tables 7.2.C and 7.2.D)
V_1 = Velocity upstream of transition (fps)
V_2 = Velocity downstream of transition (fps)
g = Acceleration due to gravity (ft./s^2 (32.2 ft./s^2))

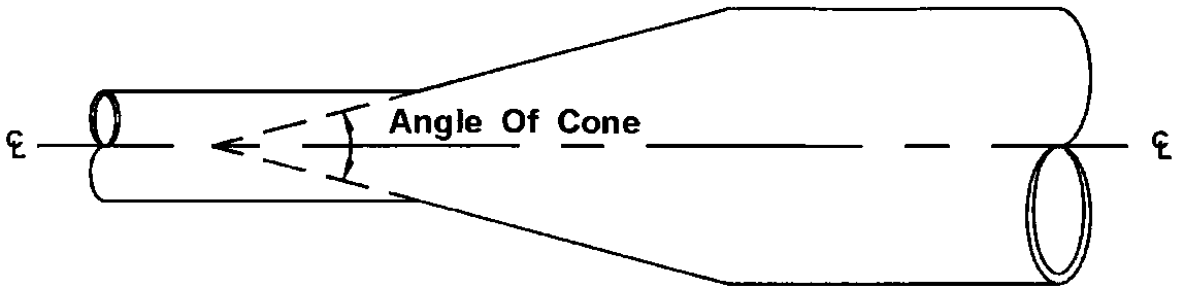


Figure 7.2.6.4 - Angle of Cone for change in pipe diameter *(Source FHWA HEC 22)*

Table 7.2.6.4A - *(Source FHWA HEC 22)*

Typical Values for K_e for Gradual Enlargement of Pipes in Non-Pressure Flow	
D_2/D_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	0.17	0.40	0.86	1.02	1.06	1.04	1.00

Table 7.2.6.4B - *(Source ASCE Manuals and Reports of Engineering Practice No. 77)*

Typical Values of K_c for Sudden Pipe Contractions	
D_2/D_1	K_c
0.2	0.5
0.4	0.4
0.6	0.3
0.8	0.1
1.0	0.0
D_2/D_1 = Ratio of diameter of smaller pipe to larger pipe.	

Table 7.2.6.4C - *(Source ASCE Manuals and Reports of Engineering Practice No. 77)*

Values of K_e for Determining Loss of Head due to Sudden Enlargement in Pipes.													
D_2/D_1	Velocity, V_1, in feet Per Second												
	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0	15.0	20.0	30.0	40.0
1.2	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08
1.4	0.26	0.26	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.20
1.6	0.40	0.39	0.38	0.37	0.37	0.36	0.36	0.35	0.35	0.34	0.33	0.32	0.32
1.8	0.51	0.49	0.48	0.47	0.47	0.46	0.46	0.45	0.44	0.43	0.42	0.41	0.40
2.0	0.60	0.58	0.56	0.55	0.55	0.54	0.53	0.52	0.52	0.51	0.50	0.48	0.47
2.5	0.74	0.72	0.70	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.60	0.58
3.0	0.83	0.80	0.78	0.77	0.76	0.75	0.74	0.73	0.72	0.70	0.69	0.67	0.65
4.0	0.92	0.89	0.87	0.85	0.84	0.83	0.82	0.80	0.79	0.78	0.76	0.74	0.72
5.0	0.96	0.93	0.91	0.89	0.88	0.87	0.86	0.84	0.83	0.82	0.80	0.77	0.75
10.0	1.00	0.99	0.96	0.95	0.93	0.92	0.91	0.89	0.88	0.86	0.84	0.82	0.80
∞	1.00	1.00	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.88	0.86	0.83	0.81
D_2/D_1 = ratio of diameter of larger pipe to smaller pipe *V_1 = Velocity in smaller pipe (upstream of transition)*													

Table 7.2.6.4D - *(Source ASCE Manuals and Reports of Engineering Practice No. 77)*

Values of K_e for Determining Loss of Head due to Gradual Enlargement in Pipes.											
D_2/D_1	Angle of Cone										
	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
1.8	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	0.46	0.60	0.67	0.72
D_2/D_1 = ratio of diameter of larger pipe to smaller pipe *Angle of cone is the angle in degrees between the sides of the tapering section*											

Table 7.2.6.4E - *(Source ASCE Manuals and Reports of Engineering Practice No. 77)*

Values of K_e for Determining Loss of Head due to Sudden Contraction.													
D_2/D_1	Velocity, V_1, in feet Per Second												
	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0	15.0	20.0	30.0	40.0
1.1	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.60
1.2	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.10	0.11
1.4	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.20
1.6	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.24
1.8	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.32	0.29	0.27
2.0	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.33	0.31	0.29
2.2	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.38	0.37	0.37	0.35	0.33	0.30
2.5	0.42	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.39	0.38	0.37	0.34	0.31
3.0	0.44	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.41	0.40	0.39	0.36	0.33
4.0	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.44	0.43	0.42	0.41	0.37	0.34
5.0	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.45	0.45	0.44	0.42	0.38	0.35

10.0	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45	0.43	0.40	0.36
∞	0.49	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.45	0.44	0.41	0.38
D_2/D_1 = ratio of diameter of larger pipe to smaller pipe *V_1 = Velocity in smaller pipe (downstream of transition)*													

7.2.6.5 Junction Losses

For junction losses the design engineer can use the losses found in the University of Missouri Engineering Bulletin No. 41 "Pressure Changes at Storm Drain Junctions." The bulletin was a result of flume model testing.

The conduit junction losses within this section is for the connection of a lateral pipe to a larger storm drain trunk line without an access manhole. The following formula is a form of the momentum equation.

(Equation 7.2.6.5)

$$\mathbf{H_j = \{[(Q_o V_o) - (Q_i V_i) - (Q_l V_l \cos \theta_j)]/[0.5g(A_o + A_i)]\} + h_i - h_o}$$

$\mathbf{H_j}$ = Junction loss (ft.)
$\mathbf{Q_o}$, $\mathbf{Q_i}$, $\mathbf{Q_l}$ = Outlet, inlet, and lateral flows (cfs)
$\mathbf{V_o}$, $\mathbf{V_i}$, $\mathbf{V_l}$ = Outlet, inlet, and lateral velocity
$\mathbf{h_o}$, $\mathbf{h_i}$ = Outlet and inlet velocity head (ft.)
$\mathbf{A_o}$, $\mathbf{A_i}$ = Outlet and inlet cross sectional area ($ft.^2$)
$\boldsymbol{\theta}_j$ = Angle between the inflow trunk line and lateral pipe

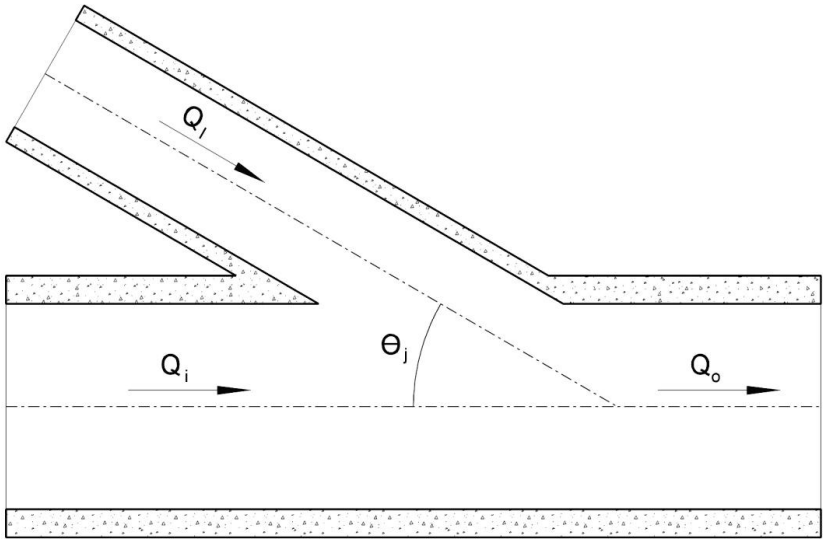


Figure 7.2.6.5 - Interior angle for pipe junction without manhole (Source FHWA HEC 22)

7.2.6.6 Inlet and Manhole Losses

The conduit junction losses within this section are for the connection of a lateral pipe(s) to a larger storm drain trunk line with an access manhole or junction box.

There are a number of ways to determine the losses within a junction. It is up to the design engineer to determine the appropriate loss method.

7.2.6.6.1 Missouri Charts

The instructions and charts from the University of Missouri Engineering Bulletin No. 41 "Pressure Changes at Storm Drain Junctions" is provided in the Appendix B of this manual as a reference for the design engineer should there be special configuration of manholes and junction boxes within the storm drain system. The University of Missouri Engineering Bulletin No. 41 "Pressure Changes at Storm Drain Junctions" was the results of flume model testing.

7.2.6.6.2 FHWA Inlet and Access Hole Energy Loss

FHWA has been developing and refining the methods to determine the energy losses within access manholes (junction box) and inlets. The effort has been supported by research and laboratory analysis to improve the methods. These methods calculate the energy level through the manhole.

The FHWA method follows the following three steps. For more information on this method see reference FHWA HEC-22 Urban Drainage Design Manual.

STEP 1: Determine an initial access hole energy level (E_{ai}) based on inlet control (weir and orifice) or outlet control (partial and full flow) equations.

STEP 2: Adjust the initial access hole energy level based on benching, inflow angle(s), and plunging flows to compute the final calculated energy level (E_a).

STEP 3: Calculate the exit loss from each inflow pipe and estimate the energy grade line (EGL_o), which will then be used to continue calculations upstream.

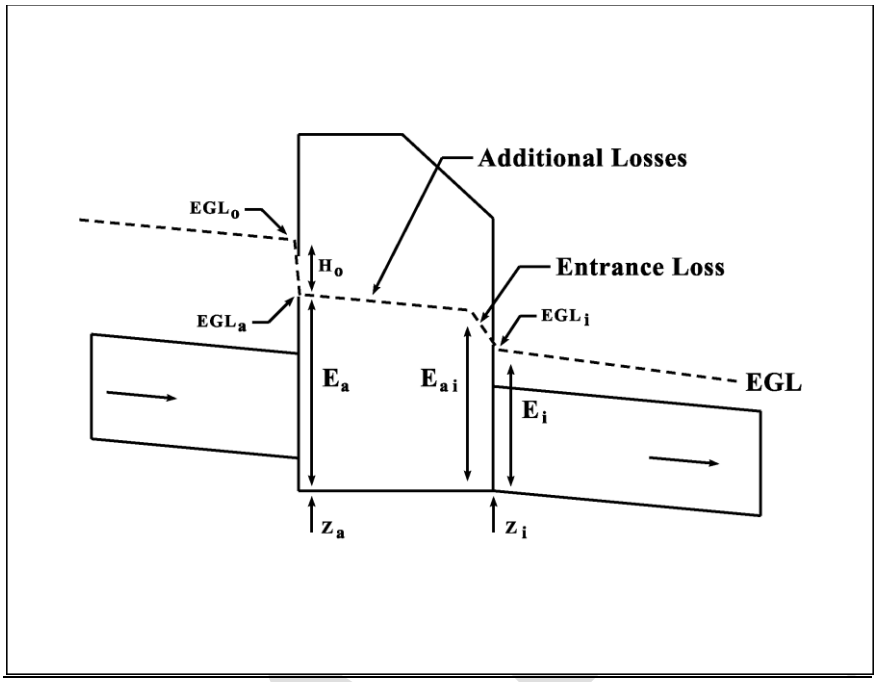


Figure 7.2.6.6.2 Sketch of FHWA access hole method *(Source FHWA HEC-22, 3rd Edition)*

7.2.6.6.3 Energy Loss Method (FHWA HEC-22, 2nd Edition)

A number of modeling programs use this method to calculate the energy loss for a junction.

When the inflow conduit invert is above the water surface elevation in the manhole, then the energy loss method does not apply to this upstream conduit.

(Equation: 7.2.6.6.3a)

$$H_{ah} = K\left(\frac{V_o^2}{2g}\right)$$

$$K = K_o C_D C_d C_Q C_p C_B$$

H_{ah} = Energy loss head

K = adjusted loss coefficient

K_o = initial head loss coefficient based on relative access hole size

C_D = correction factor for pipe diameter (pressure Flow only)

C_d = correction factor for Flow depth

C_Q = correction factor for relative Flow

C_p = correction factor for plunging Flow

C_B = correction factor for benching

V_o = velocity of outlet pipe

K_o: The initial head loss coefficient is based on the relative access hole size and the angle of deflection between the inflow and outflow conduits.

(Equation: 7.2.6.6.3b)

$$K_o = 0.1\left(\frac{b}{D_o}\right)(1 - \sin\theta) + 1.4\left(\frac{b}{D_o}\right)^{0.15} \sin\theta$$

K_o = initial head loss coefficient based on relative access hole size

θ = angle between the inflow and outflow pipes (figure 7.2.6.6.3A)

b = access hole or junction diameter

D_o = outlet pipe diameter

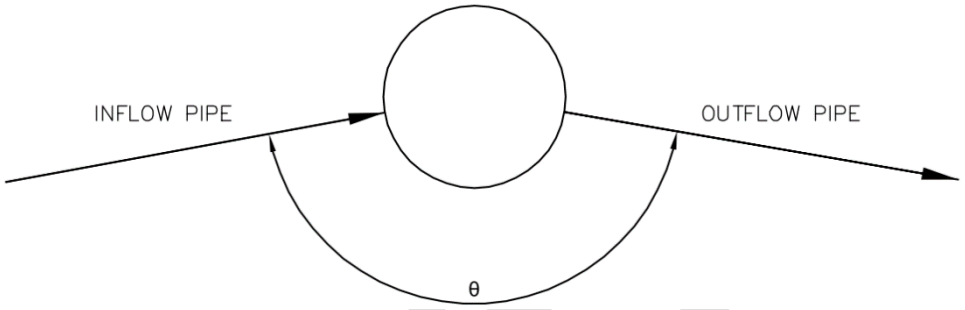


Figure 7.2.6.6.3.A - Deflection angle

C_D: When the depth of flow within the manhole relative to the diameter of the outlet conduit ratio, d_{aho}/D_o, is greater than 3.2, the correction factor for the conduit diameter is as follows.

(Equation: 7.2.6.6.3c)

$$C_D = \left(\frac{D_o}{D_i}\right)^3$$

C_D = correction factor for pipe diameter (pressure Flow only)

D_o = outgoing pipe diameter

D_i = inflowing pipe diameter

C_d: The correction factor for flow depth is used when the depth of flow within the manhole relative to the diameter of the outlet conduit ratio, d_{aho}/D_o, is less than 3.2. If the ratio is greater than 3.2, then the value of C_d is set to 1. The correction factor for flow depth is as follows.

(Equation: 7.2.6.6.3d)

$$C_d = 0.5\left(\frac{d_{aho}}{D_o}\right)^{0.6}$$

C_d = correction factor for Flow depth

d_{aho} = water depth in access hole above the outlet pipe invert

D_o = outlet pipe diameter

C_Q: The correction factor for relative flow is a function of the angle of the incoming flow and the percentage of flow coming in throught the conduit of intrest. The correction factor will be different for each upstream conduit. The correction factor for relative flow is applicable where the conduits are approximately the same elevation, otherwise the value of C_Q is equal to 1.

(Equation: 7.2.6.6.3e)

$$C_Q = (1 - 2\sin\theta)\left(1 - \frac{Q_i}{Q_o}\right)^{0.75} + 1$$

C_Q = correction factor for relative Flow

θ = the angle between the inflow and outflow pipes (figure 72.6.6.3.B)

Q_i = Flow in the inflow pipe

Q_o = Flow in the outflow pipe

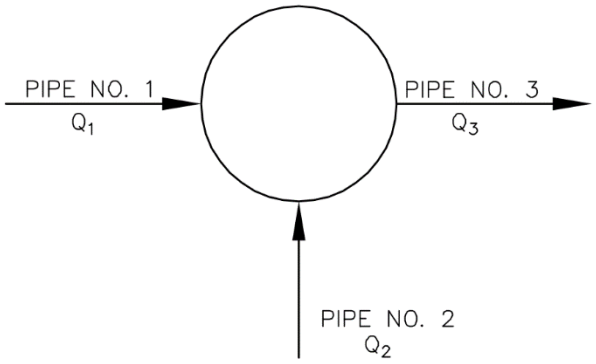


Figure 7.2.6.6.3.B - Relative flow effect

C_p: The correction factor for plunging flow is where the inflow one of the conduits plunges into the water surface within the manhole. This correction factor is applied to the inflow conduit and the outflow are at the bottom of the manhole and when $h > d_{aho}$. Flows from a grate inlet or curb opening are considered plunging flow. If there are no plunging flow within the manhole, the correction factor is set to 1.

(Equation: 7.2.6.6.3f)

$$C_p = 1 + 0.2\left(\frac{h}{D_o}\right)\left(\frac{h - d_{aho}}{D_o}\right)$$

C_p = correction for plunging Flow

h = vertical distance of plunging Flow from the Flow line of the higher elevation inlet pipe to the center of the outflow pipe

D_o = outlet pipe diameter

d_{aho} = water depth in access hole relative to the outlet pipe invert

C_B: The correction factor for benching in the manhole is obtained from Table 7.2.6.6.3. The benching directs flow through the manhole. See Figure 7.2.6.6.3C

Table 7.2.6.6.3 - Correction for Benching

Bench Type	Correction Factors, C_B	
	Submerged*	Unsubmerged**
Flat or Depressed Floor	1.00	1.00
Half Bench	0.95	0.15
Full Bench	0.75	0.07
**pressure Flow, $d_{aho}/D_o \geq 3.2$*		
***free surface Flow, $d_{aho}/D_o \leq 1.0$*		

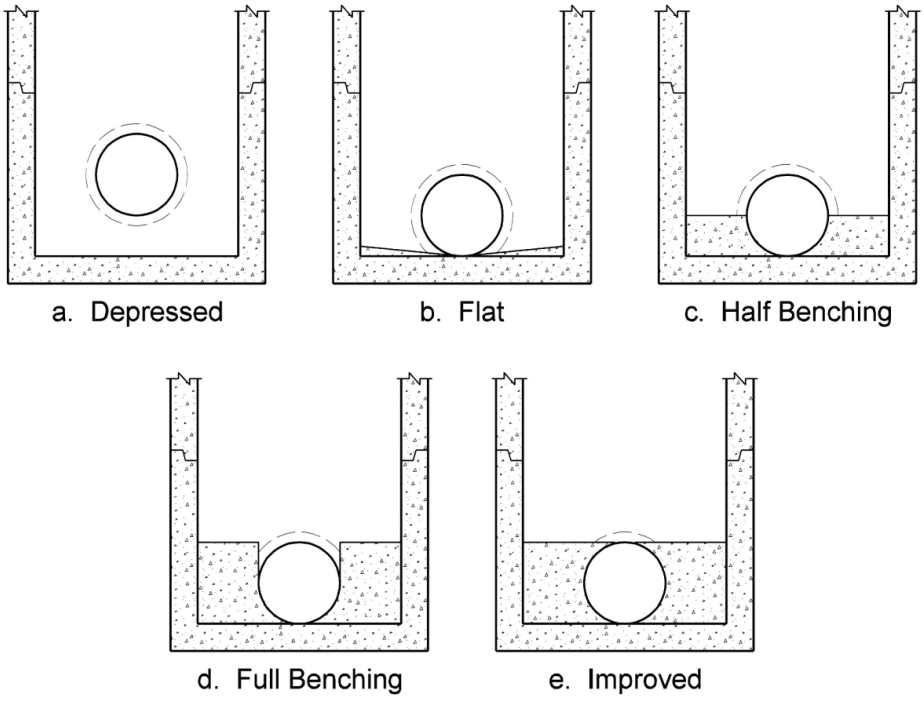


Figure 7.2.6.6.3.C - Manhole benching methods *(Source FHWA HEC-22, 3rd Edition)*

7.3 Design Guidelines

7.3.1 Design Frequency

The system must be designed for the ultimate twenty-five (25)-year storm if the cumulative drainage area within the system is less than one hundred (100) acres. If the cumulative drainage area within the system is more than one hundred (100) acres, the system should be designed for the ultimate one hundred (100)-year storm.

7.3.2 Time of Concentration and Discharge

The rational formula should be used to determine the discharges through the storm drain system. The time of concentration is the time required for water to travel from the most hydraulically distant point in the watershed to the point under consideration. The time of concentration is comprised of overland flow, sheet flow, and gutter flow to the first inlet. Then from the first inlet there is additional time in the underground drainage system to the design points which should be considered. With the total time of concentration to the point of interest in the storm drain system the designer can select the intensity value for use in the rational formula.

7.3.3 Velocity and Grade Considerations

The minimum cleaning velocity for a storm drain line is three (3) fps for a 5 year event is recommended. Use the following formula to determine the minimum slope required for a velocity of three (3) fps.

(Equation: 7.3.3)

$$S = K_u\left[(nV)/D^{0.67}\right]^2$$

S = pipe slope (ft./ft.)
K_u = 2.87
n = Manning's N
V = Cleaning velocity (ft./sec.)
D = diameter of conduit (ft.)

The maximum velocity for a storm drain line in a twenty-five (25)-year event should follow Table 7.3 below. Velocities above the maximum shall be approved by the Director of TCI.

Table 7.3 - Maximum Velocity

Type	Maximum Permissible Velocity
Laterals	No limit
Main trunk lines	15 fps

The minimum slope for the storm drain line is 0.3% or as approved by the Director of TCI.

7.3.4 Pipe/Box Size and Placement

No storm drains shall be less than twenty-four (24) inches in diameter. For laterals and at driveway and roadway crossings, the minimum pipe/culvert size shall be twenty-four (24) inches in diameter unless the option for multiple smaller sized culverts is approved by the Director of TCI. A minimum (15) inches in diameter culvert pipe may be used for driveways accessing a county road section when required within the city limits or by the County Engineer in the County or ETJ.

If a storm drain accepts storm water from offsite area, the storm drain should not be placed below/underneath buildings or structures unless approved by the Director of TCI. If a proposed building or structure is over an existing storm drain, the storm drain should be relocated around the exterior of the building or structure.

Minimum cover over pipes and boxes should be maintained to make sure the structural stability of the conduit under live and impact loads. Pipes shall have a minimum cover per the manufactures design requirements.

7.3.5 Multiple Conduits Spacing and Placement

Should multiple parallel precast box culverts be used for a storm drain line, the spacing between adjacent boxes shall be six (6) inches. An increase in this dimension will require additional consideration of the fill material between the boxes.

Should multiple conduits, other than multiple parallel precast box culverts mentioned above, be used, the minimum spacing between conduits should be one (1) foot to allow for the compaction of backfill around the conduits.

Flow equalizers may be needed between multiple conduits to equalize the HGL where laterals or other conduits tie into the drainage system. The equalizer opening should have the same area as the incoming conduit.

7.3.6 Access Spacing

The maximum distance between access points in a storm drain line shall be five hundred (500) feet.

7.3.7 Manholes

Manholes to be used on box culvert storm drain lines shall have a manhole ring with a locking or bolted cover and with an inside diameter of thirty (30) inches for maintenance access.

7.3.8 Junction Boxes

Junction boxes shall be constructed at locations of laterals, changes in grade or alignment of pipes. The riser should have a manhole ring with a locking or bolted cover and with an inside diameter of thirty (30) inches for maintenance access. At the spring line of the pipe, the inside wall of the junction box must be a minimum of the outside diameter of the pipe, plus six (6) inches on each side of the pipe. If the pipe is at a skew to the junction box wall, additional distance is required. When an upstream conduit is smaller than the downstream conduit, it is preferable to match conduit soffits, unless the upstream conduit needs to miss a conflict such as a utility or minimum conduit cover.

7.3.9 Materials and Specifications

7.3.9.1 Pipe Material

The pipe material must have a minimum service life of fifty (50) years.

Reinforced concrete pipe is preferred. The use of HDPE or PVC, or corrugated metal pipe will not be allowed crossing under public streets or within public street ROW unless approved by the Director of TCI. If use is allowed by the Director of TCI, corrugated metal pipe must be checked for corrosion resistance. Asphalt lining or bituminous interior coated corrugated metal pipe will not be allowed.

7.3.9.2 Minimum Structural Loads

The minimum live load should be HS 20 for streets and E 80 for railways. Heavier live load may be needed in special cases, and the design engineer should determine the required live load.

7.3.9.3 Mud Slab

A mud slab is a base slab of low strength concrete used to level up or stabilize the bottom of an excavation for the placement of multiple inlets, multiple boxes, or other structures. The mud slab is from two (2) to six (6) inches thick, but may be thicker if needed.

7.3.10 Outfalls

The outfall of a storm drain system should be to an existing low or proposed channel. The discharge velocity from the outfall should not cause erosion to the existing low or proposed channel. Velocity controls should be used when erosion is possible of the existing low or proposed channel. The outfall of the storm drain should be positioned in the existing low or proposed channel in the downstream direction to reduce the turbulence and erosion. The design engineer should meet with TCI Storm Water Division to discuss a solution, if a defined low does not exist for the discharge of the outfall. Should the discharge from an outfall cross a sidewalk area, discharge will not be allowed over the sidewalk. A channel section will be provided under the sidewalk.

7.3.10.1 Velocity Controls

Energy dissipation at the outlet may be required to prevent erosion of the channel bottom and banks. The use of baffle blocks, USBR Type VI impact basin, Contra Costa Basin, rock riprap basin, and rock riprap aprons may be used to reduce the velocity of the discharge from the storm drain conduit. See Chapter 10.4.3 for use of different energy dissipators.

The velocity at the end of the outlet structure should be a maximum of six (6) ft/sec. Sandy soils may require a discharge velocity less than six (6) ft/sec. The design engineer should be aware of the types of soils at the outfall location and design accordingly.

7.3.11 French Drains

French drains are used to control ground water or surface water. The French drain consists of a perforated pipe with a fabric sock around the exterior of the pipe to keep soil particles from entering the pipe. The pipe is installed in a trench filled with gravel.

A project may encounter a perched water table that will impact the street design section. A French drain may be needed to intercept the ground water that will impact the street section. The French drain should be placed in the parkway between the curb and property line, and should outfall into a drainage inlet, pipe, or channel. The outfall should not drain onto the street, as this could cause street failure or cause an unsafe condition.

7.4 Maintenance Considerations

A few items to consider during the design of a storm drain system would be the minimum cleaning velocity to keep sediment in suspension during a storm, access points along the trunk line for ease of maintenance personnel to clean and inspect the system, and access to outfall or intake structures for cleaning and inspection. See Chapter 4.12 for additional guidance on maintenance standards.

7.5 References

- FHWA. *Hydraulic Design of Energy Dissipators for Culverts and Channels*. Hydraulic Engineering Circular No. 14. 3rd edition. FHWA-NHI-06-086. Federal Highway Administration, Department of Transportation, Washington, DC, July 2006.
- FHWA. *Urban Drainage Design Manual*. Hydraulic Engineering Circular No. 22, 3rd edition, FHWA-NHI-10-009. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2009.
- ASCE. *Design and Construction of Urban Storm Water Management Systems*. ASCE Manuals and Reports of Engineering Practice No. 77, WEF Manual of Practice FD-20. American Society of Civil Engineers, New York, NY, 1992.
- University of Missouri. *Pressure Changes at Storm Drain Junctions - Engineering Bulletin No. 41*. University of Missouri, Columbia, MO, 1958.

FHWA. *Hydraulic Design of Highway Culverts*. Hydraulic Design Series No. 5, FHWA-IP-85-15. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1985.

INLETS

8.1 Introduction

Where inlets are proposed, the City of San Antonio standard inlets with adequate reinforcing steel shall be used. All other types or designs shall be subject to the approval of the Director of TCI. This Chapter describes the considerations and design criteria for different types of storm water inlets.

8.2 Inlet Types

Inlets may be incorporated into LID design per Section 4.3.9.

8.2.1 Curb Inlet

A Curb Inlet is a vertical opening in the curb covered by a top slab or the upper unit. The City of San Antonio standard details shall be used.

8.2.2 Grate Inlet

A Grate Inlet is a concrete box with a metal grate on the top that sits on the box. Use of the materials and following the dimensions that are called out in the City of San Antonio Standard Detail is recommended. Any modifications to the standard details will need to be approved by the Director of TCI. Additionally, where bicycle traffic occurs, grates should be bicycle safe.

8.2.3 4-Way Inlet

A 4-Way Inlet has four sides with normal six (6) inch high rectangular openings, with a 6 inch concrete top slab and a minimum 5 foot Concrete Apron around the inlet. Use of the materials and following the dimensions that are called out in the City of San Antonio Standard Detail is recommended. The maximum height of opening for the inlet is nine (9) inches, unless approved by the Director of TCI.

8.2.4 Combination Curb Inlet and Grate Inlet

A Combination Curb Inlet and Grate is an Inlet that has a curb opening with a concrete slab and a metal grate in the gutter portion of the section. These inlets are very useful in sag conditions because if clogged by debris the curb openings act as relief valves for the clogged grates.

8.2.5 Combination Grate and 4-Way Inlet

A Combination Grate and 4-Way inlet is the combination of the inlet described in part 8.2.3 with a grate in place of the top slab. These inlets are very useful in sag conditions where flow approaches a low spot from multiple directions.

8.2.6 Drop Curb Opening

A Drop Curb Opening is a cut in the curb in order to allow water to drain off the roadway and into a drainage swale. The Curb Openings are located where there is no cover over the opening and the sidewalk does not abut the curb. These inlets are also known as over-side drains or curb slots. The openings come in a variety of forms from metal curb lines to concrete saw tooth openings. In most cases, an opening in the curb connects to a scour-resistant channel or concrete chute to prevent erosion.

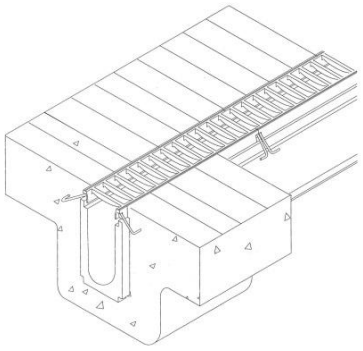
8.2.7 Sidewalk Drains

A Sidewalk Drain is a rectangular opening across a pathway typically made of concrete with a steel cover to convey runoff from one side to the other of the pathway. These types of inlets are typically used across sidewalks in the downtown area to capture the roof runoff from downspouts and discharge them onto the roadways. They can be used in other situations, a typical detail can be found on the City of San Antonio Standard Miscellaneous Details I in the Roadway Standards.

8.2.8 Slotted Drain

A Slotted Drain Inlet is composed of a length of usually circular pipe with a slot cut in the top on which a metal grate opening is mounted on (see figure below). The grate is flush with the pavement at the surface and the throat is reinforced for structural integrity. The designer should ensure structural integrity if used along a roadway.

Slotted Drain Figure



8.3 Design Guidelines

The minimum design frequency for storm drain inlets is based on the maximum design frequency of the infrastructure that is being conveyed to the inlet or opening. Inlets and openings will be located and sized to meet the design criteria of the roadways they service, the ponds they drain to and from, and other drainage system conveyance features that they are a part of. The following formulas for inlet capacities and design guidelines are based on drop inlets on grade and at sag points. Inlet capacities for on grade inlets are less than that of inlets in sump. The capacity of on grade inlets depends on street grades, deflections, cross slopes, depressions, etc. The capacity of inlets in a sag are dependent on the water depth at the curb opening and the height of the curb opening.

8.3.1 Curb Inlets on Grade

The capacity of inlets on grade will depend on interception capacity and the amount of carry over that is allowed. If curb inlet extensions are used with the curb inlet, they shall be place on the up gradient end of the curb inlet. If more than one extension is proposed then verification of the hydraulic capacity of the block out openings will be required to verify that the extensions have sufficient capacity to convey the required design storm to the primary curb inlet. The minimum length of curb inlet opening is 5 feet.

The following procedure is used to design curb inlets on-grade:

1. Compute depth of flow and ponded width (T) in the gutter section at the inlet.
2. Determine the ratio of the width of flow in the depressed section (W) to the width of total gutter flow (T) using Equation 8.3.1.a. Figure 8.3.1 shows the gutter cross section at an inlet.

(Equation 8.3.1a)

$$E_0 = \frac{K_W}{K_W + K_0}$$

E_0 = ratio of depression flow to total flow

K_W = conveyance of the depressed gutter section (cfs)

K_0 = conveyance of the gutter section beyond the depression (cfs).

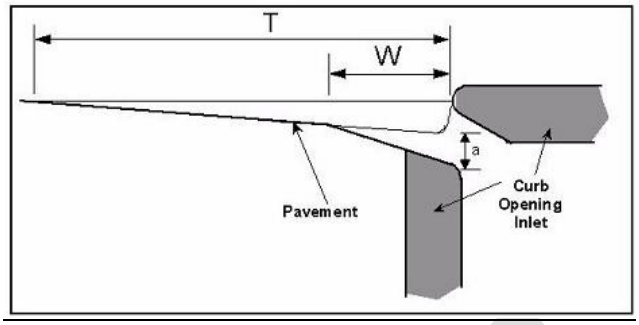


Figure 8.3.1 - Gutter Cross-Section Diagram

Use Equation 8.3.1.b to calculate conveyance, K_W and K_0.

(Equation 8.3.1.b)

$$\mathbf{K = \frac{zA^{5/3}}{nP^{2/3}}}$$

K = conveyance of cross section (cfs)
z = 1.486
A = area of cross section (sq.ft.)
n = Manning's roughness coefficient
P = wetted perimeter (ft.).

Use Equation 8.3.1.c to calculate the area of cross section in the depressed gutter section.

(Equation 8.3.1.c)

$$\mathbf{A_W = WS_x\left(T - \frac{W}{2}\right) + \frac{1}{2}aW}$$

A_W = area of depressed gutter section (sq.ft)
W = depression width for an on-grade curb inlet (ft.)
Sx = cross slope (ft./ft.)
T = calculated ponded width (ft.)

a = curb opening depression depth (ft.).

Use Equation 8.3.1.d to calculate the wetted perimeter in the depressed gutter section.

(Equation 8.3.1.d)

$$\mathbf{P_W = \sqrt{(WS_X + a)^2 + W^2}}$$

P_W = wetted perimeter of depressed gutter section (ft.)
W = depression width for an on-grade curb inlet (ft.)
Sx = cross slope (ft./ft.)
a = curb opening depression depth (ft.).

Use Equation 8.3.1.e to calculate the area of cross section of the gutter section beyond the depression.

(Equation 8.3.1.e)

$$\mathbf{A_O = \frac{S_X}{2}(T - W)^2}$$

A_0 = area of gutter/road section beyond the depression width (ft^2)
Sx = cross slope (ft./ft.)
W = depression width for an on-grade curb inlet (ft.)
T = calculated ponded width (ft.)

Use Equation 8.3.1.f to calculate the wetted perimeter of the gutter section beyond the depression.

(Equation 8.3.1.f)

$$\mathbf{P_O = T - W}$$

P_0 = wetted perimeter of the depressed gutter section (ft.)

T = calculated ponded width (ft.)
W = depression width for an on-grade curb inlet (ft.).

Use Equation 8.3.1.g to determine the equivalent cross slope (S_e) for a depressed curb opening inlet.

(Equation8.3.1.g)

$$S_e = S_x + \frac{a}{W} E_o$$

Se = equivalent cross slope (ft./ft.)
Sx = cross slope of the road (ft./ft.)
a = gutter depression depth (ft.)
W = gutter depression width (ft.)
Eo = ratio of depression flow to total flow.

Calculate the length of curb inlet required for total interception using Equation 8.3.1.h.

(Equation 8.3.1.h)

$$L_r = zQ^{0.42} S^{0.3} \left(\frac{1}{nS_e}\right)^{0.6}$$

Lr = length of curb inlet required (ft.)
z = 0.6
Q = flow rate in gutter (cfs)
S = longitudinal slope (ft./ft.)
n = Manning's roughness coefficient
Se = equivalent cross slope (ft./ft.).

If no bypassflow is allowed, the inlet length is assigned a nominal dimension of at least L_r, which should be an available (nominal) standard curb opening length. The exact value of L_r should not be used if doing so requires special details, special drawings, structural design, and costly construction.

If bypass flow is allowed, the inlet length is rounded down to the next available standard (nominal) curb opening length.

Determine bypass flow. In bypass flow computations, efficiency of flow interception varies with the ratio of actual length of curb opening inlet supplied (L_a) to required length (L_r) and with the depression to depth of flow ratio. Use Equation 8.3.1.i to calculate bypass flow.

(Equation 8.3.1.i)

$$Q_{CO} = Q\left(1 - \frac{L_a}{L_r}\right)^{1.8}$$

Qco = carryover discharge (cfs)
Q = total discharge (cfs)
La = design length of the curb opening inlet (ft.)
Lr = length of curb opening inlet required to intercept the total flow (ft.).

In all cases, the bypass flow must be accommodated at some other specified point in the storm drain system.

Calculate the intercepted flow as the original discharge in the approach curb and gutter minus the amount of bypass flow.

8.3.2 Curb Inlets in Sump

To calculate the capacity of a Curb Inlet you must first calculate if the inlet is fully submerged or partially full. This will depend on the depth of flow at the curb. If the depth of flow at the curb opening inlet is such as to cause a partially full opening, a weir effect will develop and the following formula will apply. The minimum length of curb inlet opening is 5 feet.

(Equation 8.3.2.a)

$$Q = CL(h)^{3/2}$$

Q = amount of flow in CFS
C = the weir coefficient 3.087
L = the length of drop curb opening required in feet.

h = the head or depth of water at the opening in feet (should include inlet depression 'a').

If the depth of flow at the Curb Inlet is such as to fully submerge the opening, the orifice effect will develop and the formula used shall be identical to that given under grate inlets with the exception that the head, h, on the curb opening orifice shall be taken as the depth from the top of the water surface to the center of orifice or opening; one hundred (100) percent efficiency will be allowed for curb opening inlets.

(Equation 8.3.2.b)

$$\mathbf{Q = CA(2gh)^{1/2}}$$

Q = discharge in cubic feet per second.
C = orifice coefficient of discharge (taken as 0.70).
g = acceleration due to gravity (32.2 ft./sec.^{2})
h = head on the opening in feet from top of water surface to the center of opening
A = net area of the openings in square feet.

Curb Inlet Extensions are not allowed in sump conditions. The Hydraulic Grade Line shall be designed below the gutter elevation of the drainage structure with the Energy Grade Line below the top of curb.

8.3.3 Grate Inlets on Grade

The interception capacity of Grate Inlets on grade depends on the cross slope, longitudinal slope, depth of flow, Manning's Roughness coefficient, and the net area of grate opening. The depth of water over the grate shall be calculated based on the cross section. A clogging factor will be applied to Grate Inlets on grade based on equation 8.3.3.h below.

Use the following procedure for grate inlets on-grade:

1. Compute the ponded width of flow (T).
2. Choose a grate type and size.
3. Find the ratio of frontal flow to total gutter flow (E_O) for a straight cross-slope using

Equation 8.3.1.a. No depression is applied to a grate on-grade inlet.

4. Find the ratio of frontal flow intercepted to total frontal flow, R_f, using Equations 8.3.3.a, 8.3.3.b, and 8.3.3.c.

If $v > v_O$, use the Equation below (8.3)

(Equation 8.3.3.a)

$$\mathbf{R_f = 1 - K_u(v - v_O)}$$

If $v < v_O$, use Equation below (8.4)

(Equation 8.3.3.b)

$$\mathbf{R_f} = 1.0$$

$\mathbf{R_f}$ = ratio of frontal flow intercepted to total frontal flow

$\mathbf{K_u}$ = 0.09

v = approach velocity of flow in gutter (ft./s)

$\mathbf{v_o}$ = minimum velocity that will cause splash over grate (ft./s)

For triangular sections, calculate the approach velocity of flow in gutter (v) using the Equation below.

(Equation 8.3.3c)

$$\mathbf{v = \frac{2Q}{Ty} = \frac{2Q}{T^2 S_X}}$$

v = approach velocity of flow in gutter (ft./s)
Q = flow rate in gutter (cfs)
$\mathbf{S_x}$ = cross slope of the road (ft./ft.)
T = calculated ponded width (ft.)
$\mathbf{T_y}$ = max ponded depth (ft.)

Otherwise, compute the section flow area of flow and calculate the velocity using Equation 8.3.3.d.

(Equation 8.3.3.d)

$$\mathbf{v = \frac{Q}{A}}$$

v = approach velocity of flow in gutter (ft./s)
Q = flow rate in gutter (cfs)
A = the section flow area of flow (ft^2)

Calculate the minimum velocity (v_O) that will cause splash over the grate using the appropriate equation in Table 10-2 below.

Table 8.3.3 - Splash-Over Velocity Calculation Equations (English)

Grate Configuration	Typical Bar Spacing (in.)	Splash-over Velocity Equation
Parallel Bars	2	$vo = 2.218+4.031L-0.649L^2+0.056L^3$
Parallel Bars	1.2	$vo = 1.762+3.11L-0.451L^2+0.033L^3$
Parallel bars w/ transverse rods	2 parallel / 4 transverse	$vo = 0.735+2.437L-0.265L^2+0.018L^3$

$\mathbf{v_O}$ = splash-over velocity (ft./s or m/s)
L = length of grate (ft.)

5. Find the ratio of side flow intercepted to total side flow, R_S.

(Equation: 8.3.3.e)

$$R_S = \frac{1}{\left[1 + \frac{zv^{1.8}}{S_X L^{2.3}}\right]^{-1}}$$

R_s = ratio of side flow intercepted to total flow

z = 0.15

S_x = transverse slope

v = approach velocity of flow in gutter (ft./s)

L = length of grate (ft.).

6. Determine the efficiency of grate, E_f.

(Equation 8.3.3.f)

$$E_f = [R_f E_O + R_s(1 - E_O)]$$

R_f = ratio of frontal flow intercepted to total frontal flow

E_o = ratio of depression flow to total flow.

R_s = ratio of side flow intercepted to total flow

7. When calculating the interception capacity of the grate, Q_i a reduction factor (C) due to clogging should be included. If the interception capacity is greater than the design discharge, skip step 9.

(Equation 8.3.3.g)

$$Q_i = CE_f Q = CQ[R_f E_O + R_s(1 - E_O)]$$

C= *Clogging Factor (see equation 8.3.3.h)*

E_f = ratio of grate efficiency

R_f = ratio of frontal flow intercepted to total frontal flow

E_O = ratio of depression flow to total flow.

R_s = ratio of side flow intercepted to total flow

8. Calculate the clogging factor for grate inlets on grade with multiple units using the equation below.

(Equation 8.3.3.h)

$$C = \frac{KCo}{N}$$

C= *Multiple Unit Clogging Factor for an inlet with multiple units*

C_o = single unit clogging factor (50%)

e = decay ratio (0.5 for grate inlets)

N= number of units

K= *clogging coefficient from Table 8.3 below*

Table 8.3.a - Clogging Coefficients for Multiple Units

N =	1	2	3	4	5	6	7	8	>8
Grate Inlet (K)	1.0	1.5	1.8	1.9	1.9	2.0	2.0	2.0	2.0

9. Determine the bypass flow (CO) using this Equation. Remember to include the varying clogging factor for grate inlets in series.

(Equation 8.3.3.i)

$$CO = Q - Q_i$$

10. Depending on the bypass flow, select a larger or smaller inlet as needed. If the bypass flow is excessive, select a larger configuration of inlet and return to step 3. If the interception capacity far exceeds the design discharge, consider using a smaller inlet and return to step 3.

8.3.4 Grate Inlets In Sump

Grates should be designed assuming a clogging factor of 50%. When calculating the capacity of a grate inlet the net area of opening should be used, minus 50% for the clogging assumed above when calculating its capacity. The flow of water through grate openings may be treated as the flow of water through a rectangular orifice. Use equation 8.3.2.b to calculate the inlet capacity.

(Equation 8.3.2.b)

$$Q = CA(2gh)^{1/2}$$

Q = discharge in cubic feet per second.
C = orifice coefficient of discharge (taken as 0.70).
g = acceleration due to gravity (32.2 ft./sec.^{2})
h = head on the grate in feet.
A = 50% of net area of the openings in the grate in square feet.

8.3.5 4-Way Inlet

4-Way Inlets are typically proposed in sump situations. If they are fully submerged then use equation 8.3.2b to calculate the inlet capacity. The head, h, on the inlet opening orifice shall be taken as the depth from the top of the water surface to the center of orifice or opening.

8.3.6 Combination Curb Inlet and Grate Inlet

The capacity of the grate portion should be calculated based on whether the inlet is fully submerged or it is partially submerged. If the grate portion of the inlet is fully submerged then the capacity will be calculated using the orifice equation (assuming 50% clogging). If the grate portion of the inlet is not partially submerged then it should be calculated as a weir. The capacity of the curb inlet opening portion will also be calculated using the orifice equation if it is fully submerged or by using the weir equation if is not. The depth of flow along the curb needs to be calculated prior to making the determination of partially submerged or fully submerged. The minimum length of curb inlet is 5 feet.

8.3.7 Combination Grate and 4-Way Inlet

The capacity of the grate portion should be calculated based on whether the inlet is fully submerged or it is partially submerged. If the grate portion of the inlet is fully submerged then the capacity will be calculated using the orifice equation (assuming 50% clogging). If the grate portion of the inlet is not partially submerged then it should be calculated as a weir. The capacity of the curb inlet openings should also be calculated using the orifice equation if they are fully submerged or by using the weir equation if they are not. The depth of flow approaching the combination inlet needs to be calculated prior to making the determination of partially submerged or fully submerged.

8.3.8 Drop Curb Opening on Grade

A drop curb opening is a curb opening where there is no cover over the opening and the sidewalk does not abut the curb opening. Where drop curb openings are used to take storm water off the streets and into drains, the length of the curb opening can be calculated following the steps in Section 8.3.1 above. The minimum length of curb opening is 5 feet.

8.3.9 Drop Curb Opening in Sump

A drop curb opening is a curb opening where there is no cover over the opening and the sidewalk does not abut the curb opening. Where drop curb openings are used to take storm water off the streets and into drains, the length of the curb opening can be calculated from

the weir formula using the coefficient of 3.087 using equation 8.3.2.a. The minimum length of curb opening is 5 feet.

Gutter line depressions will be permitted where such depressions will not hamper the flow of traffic. For amount of curb exposure, conform to City of San Antonio inlet standards.

8.3.10 Sidewalk Drains

Slope of a Sidewalk Drain should match the slope of the sidewalk that it crosses. The capacity of the opening will be determined by using Manning's Equation.

8.3.11 Slotted Drain

The throat of a slotted drain should be reinforced. The amount of reinforcement will be dependent on the anticipated loads that it will be subject to. Slotted drains should be oriented parallel to the flow so as to maximize the hydraulic efficiency. Slotted drains will only be allowed within public right-of-ways with the approval of the Director of TCI. The capacity of slotted drains will be calculated using the orifice.

8.4 Materials and Specifications

8.4.1 Cast In Place

Cast in Place Inlets shall meet all the requirements found in latest version of the City of San Antonio Standard Specifications' Item 307 "Concrete Structures".

8.4.2 Pre Cast

Pre-Cast Inlets shall meet all the requirements found in latest version of the City of San Antonio Standard Specifications' Item 403 "Storm Drain Junction Boxes and Inlets" or ASTM C478.

8.4.3 Minimum Structural Loads

The minimum live load should be HS 20 for streets and E 80 for railways. Heaver live load may be needed in special cases, and the designer should determine the required live load.

8.4.4 Grate

All Grates should meet all the requirements found in the latest version of the City of San Antonio Standard Specifications' Item 407 "Cast Iron Castings". Steel Grates and Frames need to be galvanized with hold down bolts.

8.4.5 Sidewalk plates

Sidewalk plates can be found on the City of San Antonio Standard Roadway Details "Miscellaneous Construction Standards 1".

8.4.6 Sidewalk Pipe Railing

All Sidewalk Pipe Railing shall be made of Galvanized Steel Pipe and shall conform to the requirements of the Standard Specifications for Steel for Bridges and Buildings, ASTM A 36, or approved equal. Additional specifications can be found in the latest version of the City of San Antonio Standard Specifications' Item 522 "Sidewalk Pipe Railing".

8.4.7 Mud Slab

A mud slab is a base slab of low strength concrete used to level up or stabilize the bottom of an excavation for the placement of multiple inlets, multiple boxes or other structures. The mud slab is from two (2) to six (6) inches thick, or thicker if needed. The mud slab shall be wide enough and long enough to encompass all proposed inlet bottoms.

8.5 References

- TXDOT. Storm Drains. Chapter 10 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised May 2014. Retrieved from http://onlinemanuals.txdot.gov/txdotmanuals/hyd/index.htm
- City of San Antonio. *Standard Specifications for Construction*. City of San Antonio, San Antonio, Texas, June 2008. Retrieved from http://www.sanantonio.gov/TCI/CurrentVendorResources/StandardSpecificationsandDetails.aspx
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- UDFCD. *Urban Storm Drainage Criteria Manual Volume 1*. Urban Drainage and Flood Control District, Denver, Colorado, April 2008.
- FHWA. *Urban Drainage Design Manual*. Hydraulic Engineering Circular No. 22, 3rd edition, FHWA-NHI-10-009. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2009.1

OPEN CHANNELS

9.1 Introduction

This chapter addresses proposed improvements or modifications to drainage channels and watercourses required to convey storm water runoff from or through the proposed development. Refer to section 9.3.1 for storm frequency design criteria.

Except as authorized by a development plan approved by the Director of TCI or his designee, no person shall place or cause to be placed any obstruction of any kind in any watercourse within the City and its ETJ. The owner of any property within the City, through which any watercourse may pass, shall keep the watercourse free from any obstruction not authorized by a development plan.

Planned multiple-use of a watercourse is allowed (e.g. bike paths or greenbelt). If multiple use of the watercourse is to be incorporated, the applicant shall form a property owners' association that shall assume maintenance responsibility for private amenities. The appropriate government agency will be responsible for maintenance of public amenities.

9.2 Hydraulics Of Open Channel Flow

Hydraulic calculations shall be performed by using the U.S. Army Corps of Engineers HEC-RAS "River Analysis System" computer models. Normal depth channel calculations are permissible for constructed open channels with a uniform geometric cross section where 1) there is no potential for the water surface elevations to be controlled by backwater and 2) the channel is not in a FEMA floodplain.

Certain watersheds have hydrologic and hydraulic models that are available through the San Antonio River Authority website, Digital Data & Modeling Repository (D2MR). Developments proposed within the limits of these watersheds must have the models updated by the design engineer to reflect changes in flow, channel configuration (including alterations to vegetation) and channel structures. The design engineer's models must use the same computer program that was used in the existing model e.g. HEC-RAS or FEMA latest accepted models. The updated models shall be submitted to the Director of TCI.

The influence of gravity on fluid motion in an open channel flow can be expressed in a dimensionless quantity called a Froude Number (Fr). The Froude Number is expressed in the following equation.

(Equation 9.2)

$$\mathbf{Fr} = \frac{\mathbf{V}}{\sqrt{\mathbf{gd}}}$$

V = Mean velocity (fps)
g = Acceleration of gravity = 32.2 ft/s^2
d = Hydraulic depth (ft.)

The hydraulic depth is defined as the cross sectional area of the channel perpendicular to the flow divided by the free water surface.

9.2.1 Energy

Conservation of energy is a basic principal in open channel flow. As shown in Figure 9.2.1, the total energy at a given location in an open channel is expressed as the sum of the potential energy head (elevation), pressure head, and kinetic energy head (velocity head). The total energy at given channel cross section can be represented as:

(Equation 9.2.1.a)

$$\mathbf{E_t} = \mathbf{Z} + \mathbf{y} + \left(\frac{\mathbf{V^2}}{\mathbf{2g}}\right)$$

$\mathbf{E_t}$ = Total energy (ft.)
Z = Elevation above a given datum (ft.)
y = Flow depth (ft.)
V = Mean velocity (ft.)
g = Gravitational acceleration = 32.2 ft/s^2

Written between an upstream cross section designated 1 and a downstream cross section designated 2, the energy equation becomes the following:

(Equation 9.2.1.b)

$$\mathbf{Z_1} + \mathbf{y_1} + \frac{\mathbf{V_1^2}}{\mathbf{2g}} = \mathbf{Z_2} + \mathbf{y_2} + \frac{\mathbf{V_2^2}}{\mathbf{2g}} + \mathbf{h_L}$$

$\mathbf{h_L}$ = Head or energy loss between Section 1 and 2 (ft.)

The terms in the energy equation are illustrated in Figure 9.2.1. The energy equation states that the total energy head at an upstream cross section is equal to the total energy head at a downstream section plus the energy head loss between the two sections.

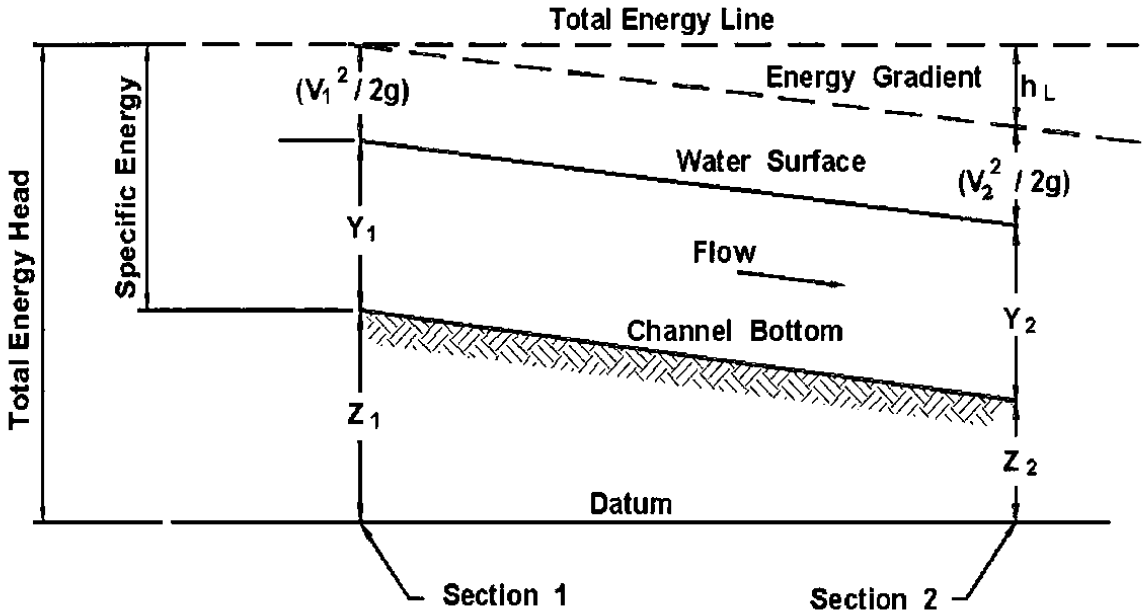

Figure 9.2.1 Total energy in open channels
(Source FHWA, HEC-22 Urban Drainage Design Manual, 3ed)

9.2.2 Specific Energy

The *specific energy* of flow in a channel section is defined as the energy per pound of water measured with respect to the channel bottom. Specific energy, *E* (expressed as head in feet), is given by the following:

(Equation 9.2.2.a)

$$\mathbf{E = y + \frac{V^2}{2g} = y + \left(\frac{Q^2}{2gA^2}\right)}$$

y = depth (ft)
V = mean velocity (ft/sec)
g = acceleration of gravity = 32.2 ft/sec2
Q = discharge (cfs)
A = area of channel cross section (ft^2)

9.2.3 Flow Classification

9.2.3.1 Types of Flow in Open Channels

Open channel flow can be characterized in many ways. Types of flow are commonly characterized by variability with respect to time and space. The following terms are used to identify types of open channel flow:

Steady flow—conditions at any point in a stream remain constant with respect to time (Daugherty and Franzini 1977).

Unsteady flow—flow conditions (e.g., depth) vary with time

Uniform flow—the magnitude and direction of velocity in a stream are the same at all points in the stream at a given time (Daugherty and Franzini 1977). If a channel is uniform and resistance and gravity forces are in exact balance, the water surface will be parallel to the bottom of the channel for uniform flow.

Varied flow—discharge, depth, or other characteristics of the flow change along the course of the stream. For a steady flow condition, flow is termed *rapidly varied* if these characteristics change over a short distance. If characteristics change over a longer stretch of the channel for steady flow conditions, flow is termed *gradually varied*.

9.2.3.2 Critical Flow

Critical flow in an open channel or covered conduit with a free water surface is characterized by the following conditions (Fletcher and Grace 1972)

1. The specific energy is a minimum for a given discharge.
2. The discharge is a maximum for a given specific energy.
3. The specific force is a minimum for a given discharge.
4. The velocity head is equal to half the hydraulic depth in a channel of small slope.
5. The Froude number is equal to 1.0 (see Equation 9.2.)
6. The velocity of flow in a channel of small slope is equal to the celerity of small gravity waves in shallow water.

If the critical state of flow exists throughout an entire reach, the channel flow is critical flow, and the channel slope is at critical slope, *Scr*. A slope less than *Scr* will cause subcritical flow, and a slope greater than *Scr* will cause supercritical flow. A flow at or near the critical state may not be stable. In design, if the depth is found to be at or near critical, the shape or slope should be changed to achieve greater hydraulic stability.

To simplify the computation of critical flow, dimensionless curves have been given for rectangular, trapezoidal, and circular channels in Figure 9.2.3.2. Critical velocity, *Vc*, can be calculated from the critical hydraulic depth, *dc*. For a rectangular channel, the flow depth is equal to hydraulic depth, (*yc* = *dc*), and the critical flow velocity is:

(Equation 9.2.3.2)

$$\mathbf{V = \left(gYc^{1/2}\right)}$$

V = mean velocity (ft/sec)
g = acceleration of gravity = 32.2 ft/sec2
Yc = Critical Depth

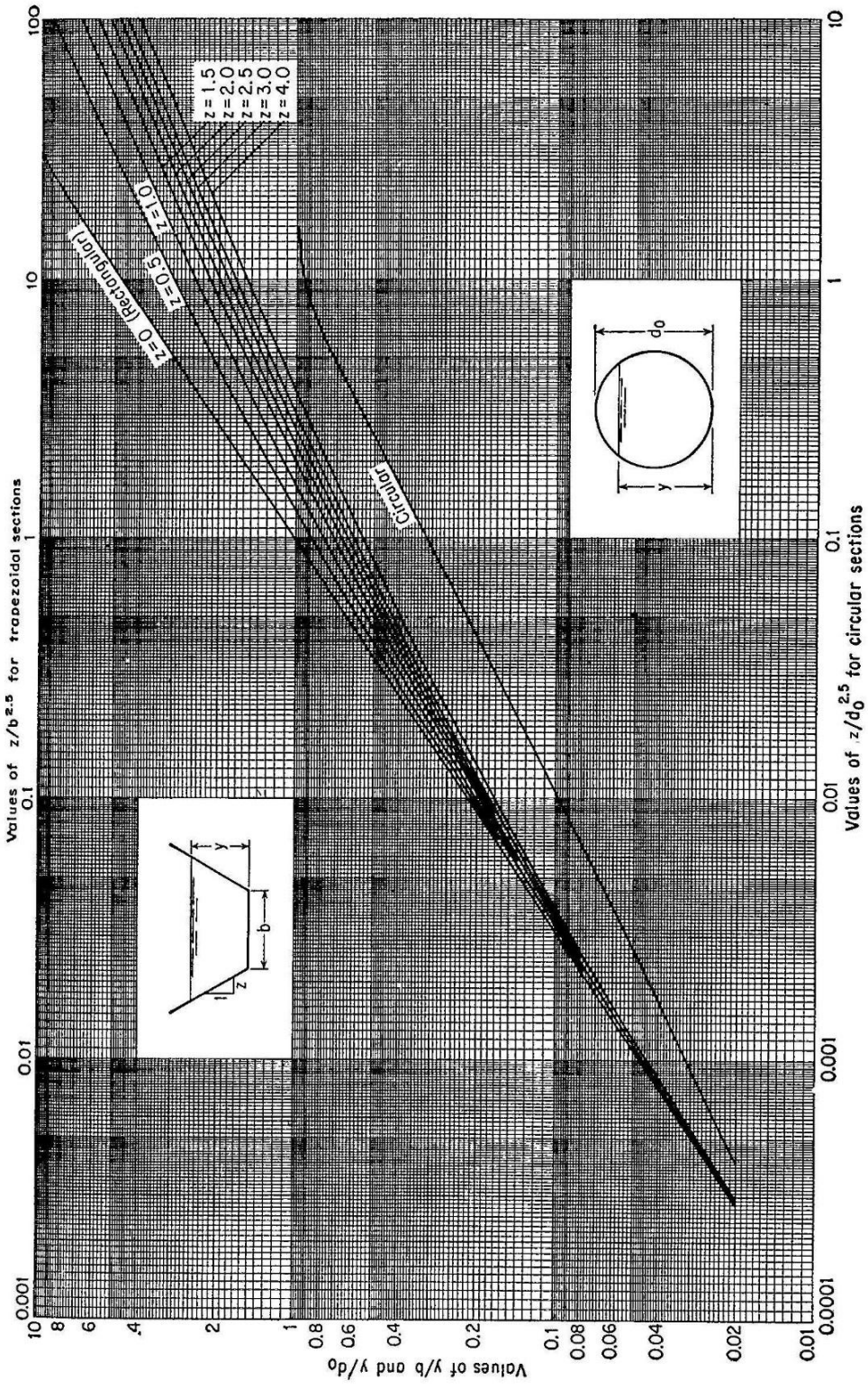
Values of z/b^2.5 for trapezoidal sections
Values of z/d_o^2.5 for circular sections
Values of y/b and y/d_o
z = 1.5
z = 2.0
z = 2.5
z = 3.0
z = 4.0
z=0 (Rectangular)
z=0.5
z=1.0
Circular
y
b
z
1
d_o

Figure 9.2.3.2 - Curves for Determining the Critical Depth in Open Channels

9.2.3.3 Subcritical Flow

Flows with a Froude number less than 1.0 are *subcritical* flows and have the following characteristics relative to critical flows :

1. Flow velocity is lower.
2. Flow depth is greater.
3. Hydraulic losses are lower.
4. Erosive power is less.
5. Behavior is easily described by relatively simple mathematical equations.
6. Surface waves can propagate upstream.

Most stable natural channels have *subcritical* flow regimes. Consistent with the philosophy that the most successful artificial channels utilize characteristics of stable natural channels, major drainage design should seek to create channels with *subcritical* flow regimes.

9.2.3.4 Supercritical Flow

Flows with a Froude number greater than 1.0 are supercritical flows and have the following characteristics relative to critical flows:

1. Flows have higher velocities.
2. Depth of flow is shallower.
3. Hydraulic losses are higher.
4. Erosive power is greater.
5. Surface waves propagate downstream only.

Supercritical flow in an open channel in an urban area creates hazards that the designer must consider. The minimum design depth of a channel shall be the frictional depth plus freeboard, or sequent depth without freeboard, whichever is greater.

9.2.4 Uniform Flow

9.2.4.1 Manning's Equation

Manning's Equation describes the relationship between channel geometry, slope, roughness, and discharge for uniform flow:

(Equation 9.2.4.1.a)

$$\mathbf{Q} = \left(\frac{\mathbf{1.486}}{\mathbf{n}}\right)\mathbf{AR^{2/3}S^{1/2}}$$

Q = discharge (cfs)
n = roughness coefficient
A = area of channel cross section (ft^2)
P = wetted perimeter (ft.)
R = hydraulic radius = A/P (ft.)
S = channel bottom slope (ft./ft.)

Manning's Equation can also be expressed in terms of velocity by employing the continuity equation, $Q = VA$, as a substitution in Equation 9.2.4.1.a, where V is velocity (ft/sec).

For wide channels of uniform depth, where the width, b, is at least twenty-five (25) times the depth, the hydraulic radius can be assumed to be equal to the depth, y, expressed in feet, and, therefore:

(Equation 9.2.4.1.b)

$$\mathbf{Q} = \left(\frac{\mathbf{1.486}}{\mathbf{n}}\right)\mathbf{by^{5/3}S^{1/2}}$$

(Equation 9.2.4.1.c)

$$\mathbf{y} = \frac{\mathbf{Q^{0.6}n^{0.6}}}{\mathbf{1.27b^{0.6}S^{0.3}}}$$

(Equation 9.2.4.1.d)

$$\mathbf{S} = \frac{((\mathbf{Qn})^2)}{(\mathbf{2.2b^2y^{3.33}})}$$

Manning's roughness coefficients ("n" values) for use in hydraulic calculations shall be consistent with the values listed in Table 9.2.4.1.

Table 9.2.4.1 - Manning's Roughness Coefficient

Channel Description	Manning's "n" Value
Concrete Lined Channel (wood float type surface finish)	0.015
Grass Lined Channel with regular maintenance	0.035
Grass Lined Channel without recent maintenance	0.050
Vegetated Channel with trees, little or no underbrush	0.055
Natural Channel with trees, moderate underbrush	0.075
Natural Channel with trees, dense underbrush	0.090
Natural Channel with dense trees and dense underbrush	0.100
Overbank Description	**Manning's "n" Value**
Pasture	0.035-0.055
Trees, little or no underbrush, scattered structures	0.060-0.075
Dense vegetation, multiple fences and structures	0.075-0.090

9.2.5 Gradually Varied Flow

When not flowing full, water surface profiles within a culvert are generally calculated using equations that describe Gradually Varied Flow (GVF) conditions. The GVF equations account for gravitational and frictional forces acting on the water, and are used to calculate water depths throughout the culvert. A GVF profile is also known as a water depth profile and applies to steady-state, or constant flow, conditions.

Limitations of Gradually Varied Flow equation:

1. Steady State Flow
2. One Dimensional (can only calculate average cross sectional water velocity)

Steady flow—conditions at any point in a stream remain constant with respect to time *(Daugherty and Franzini 1977)*.

9.2.6 Rapidly Varied Flow

If water depth or velocity change abruptly over a short distance and the pressure distribution is not hydrostatic, the water surface profile is characterized as Rapidly Varying Flow (RVF). The occurrence of RVF is usually a local phenomenon. RVF can often be observed near the inlet and outlet of culverts, and wherever hydraulic jumps occur.

9.2.7 Hydraulic Jump

The hydraulic jump is a natural phenomenon that occurs when supercritical flow is forced to change to subcritical flow by an obstruction to the flow. This abrupt change in flow

condition is accompanied by considerable turbulence and loss of energy. The hydraulic jump can be illustrated by use of a specific energy diagram as shown in Figure 9.2.7. The flow enters the jump at supercritical velocity, V_1, and depth, y_1, that has a specific energy of $E = y_1 + V_1^2/(2g)$. The kinetic energy term, $V^2/(2g)$, is predominant. As the depth of flow increases through the jump, the specific energy decreases. Flow leaves the jump area at subcritical velocity with the potential energy, y, predominant.

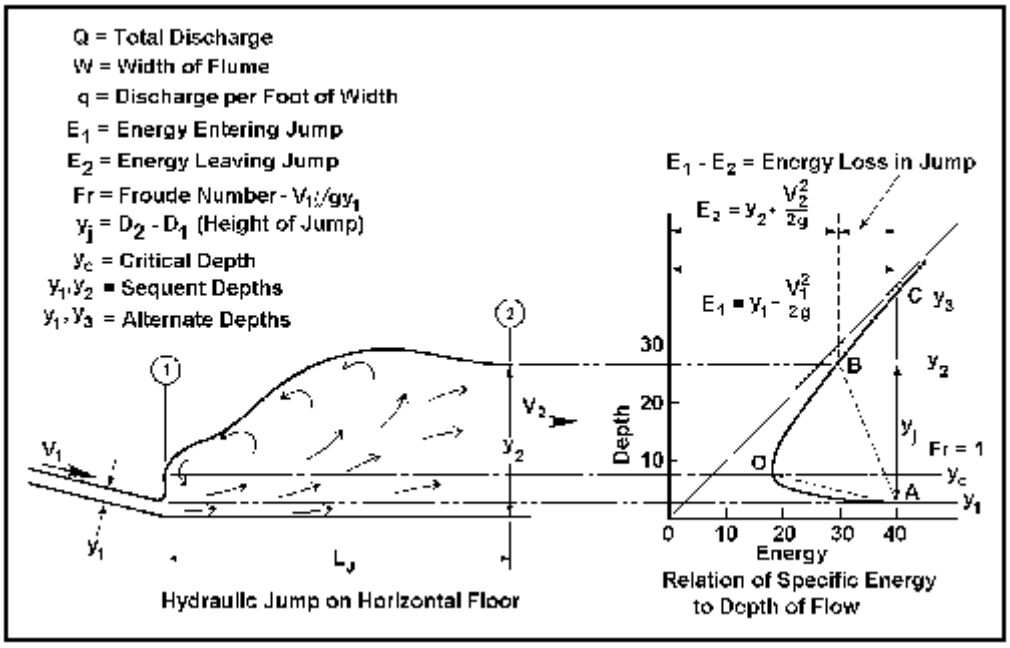

Figure 9.2.7 - Hydraulic Jump *(Source FHWA, HEC-14 Hydraulic Design of Energy Dissipators, 3ed)*

9.2.7.2 Types of Hydraulic Jump

When the upstream Froude number, Fr, is 1.0, the flow is at critical and a jump cannot form. For Froude numbers greater than 1.0, but less than 1.7, the upstream flow is only slightly below critical depth and the change from supercritical to subcritical flow will result in only a slight disturbance of the water surface. On the high end of this range, Fr approaching 1.7, the downstream depth will be about twice the incoming depth and the exit velocity about half the upstream velocity.

The Bureau of Reclamation (USBR, 1987) has related the jump form and flow characteristics to the Froude number for Froude numbers greater than 1.7, as shown in Figure 9.2.7.2. When the upstream Froude number is between 1.7 and 2.5, a roller begins to appear, becoming more intense as the Froude number increases. This is the prejump range with very low energy loss. The water surface is quite smooth, the velocity throughout the cross section uniform, and the energy loss in the range of 20 percent.

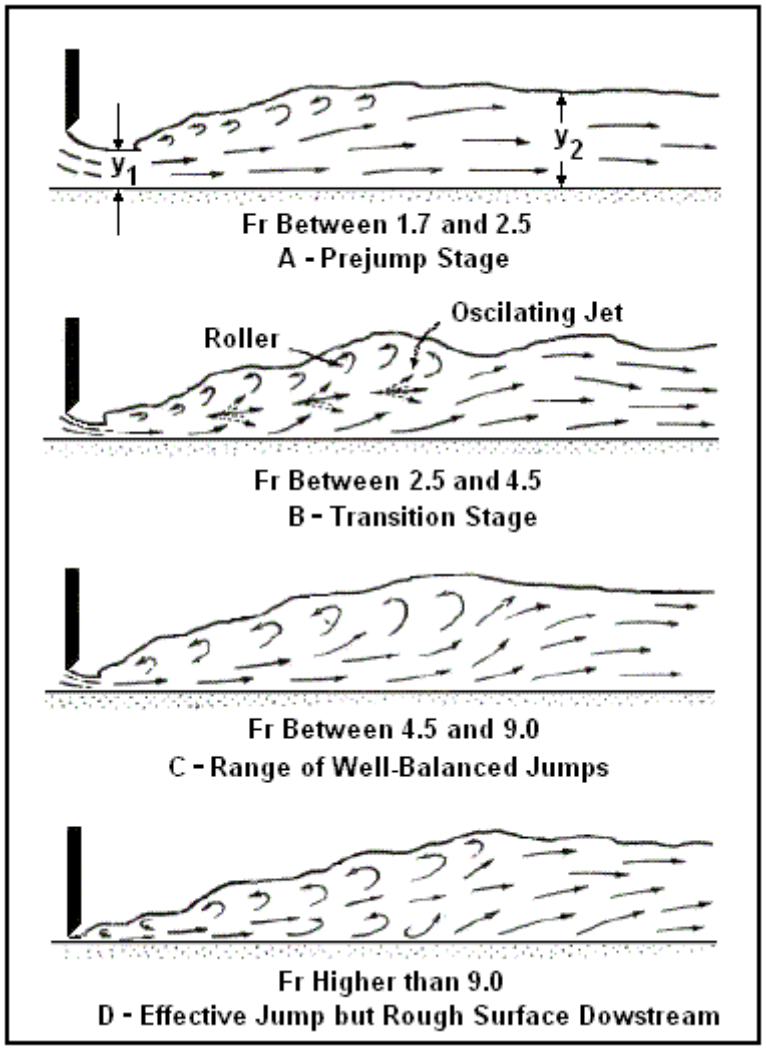

Figure 9.2.7.2 - Jump Forms Related to Froude Number (USBR, 1987)
(Source FHWA, HEC-14 Hydraulic Design of Energy Dissipators, 3ed)

An oscillating form of jump occurs for Froude numbers between 2.5 and 4.5. The incoming jet alternately flows near the bottom and then along the surface. This results in objectionable surface waves that can cause erosion problems downstream from the jump.

A well balanced and stable jump occurs where the incoming flow Froude number is greater than 4.5. Fluid turbulence is mostly confined to the jump, and for Froude numbers up to 9.0 the downstream water surface is comparatively smooth. Jump energy loss of 45 to 70 percent can be expected.

With Froude numbers greater than 9.0, a highly efficient jump results but the rough water surface may cause downstream erosion problems.

The hydraulic jump commonly occurs with natural flow conditions and with proper design can be an effective means of dissipating energy at hydraulic structures. Expressions for computing the before and after jump depth ratio (conjugate depths) and the length of jump are needed to design energy dissipators that induce a hydraulic jump. These expressions are related to culvert outlet Froude number, which for many culverts falls within the range 1.5 to 4.5.

9.2.7.3 Hydraulic Jump In Horizontal Channels

The hydraulic jump in any shape of horizontal channel is relatively simple to analyze (Sylvester, 1964). Figure 9.2.7.3 indicates the control volume used and the forces involved. Control section 1 is before the jump where the flow is undisturbed, and control section 2 is after the jump, far enough downstream for the flow to be again taken as parallel. Distribution of pressure in both sections is assumed hydrostatic. The change in momentum of the entering and exiting stream is balanced by the resultant of the forces acting on the control volume, i.e., pressure and boundary frictional forces. Since the length of the jump is relatively short, the external energy losses (boundary frictional forces) may be ignored without introducing serious error. Also, a channel may be considered horizontal up to a slope of 18 percent (10 degree angle with the horizontal) without introducing serious error. The momentum equation provides for solution of the sequent depth, y_2, and downstream velocity, V_2. Once these are known, the internal energy losses and jump efficiency can be determined by application of the energy equation.

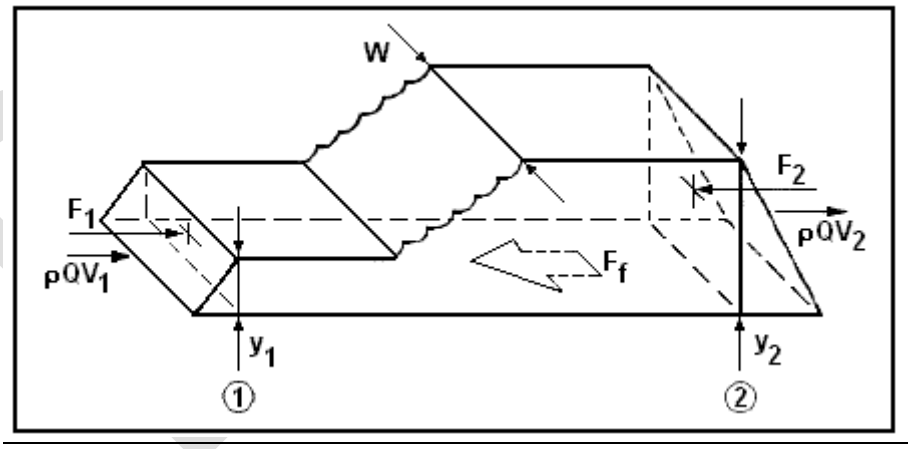

Figure 9.2.7.3. Hydraulic Jump in a Horizontal Channel
(Source FHWA, HEC-14 Hydraulic Design of Energy Dissipators, 3ed)

The general form of the momentum equation can be used for the solution of the hydraulic jump sequent-depth relationship in any shape of channel with a horizontal floor. Defining a momentum quantity as, $M = Q^2/(gA) + AY$ and recognizing that momentum is conserved through a hydraulic jump, the following can be written:

(Equation 9.2.7.3)

$$\frac{Q^2}{(gA_1)} + A_1Y_1 = \frac{Q^2}{(gA_2)} + A_2Y_2$$

Q = channel discharge (ft^3/s)

A_1, A_2 = cross-sectional flow areas in sections 1 and 2, respectively (ft^2)

Y_1,Y_2 = depth from water surface to centroid of cross-section area (ft)

9.3 Design Guidelines

9.3.1 Design Frequency

The channel(s) shall be designed for the ultimate twenty-five (25) year storm with freeboard if the drainage area to the channel is less than one hundred (100) acres. For freeboard requirements see 9.3.14. If the drainage area to the channel is more than one hundred (100) acres, the channel shall be designed for the ultimate one hundred (100) year storm.

9.3.2 Natural Channels

Runoff that results from upstream development and is discharged to an unimproved waterway can cause flood damage to properties adjacent to the waterway. Natural undeveloped waterways do not receive regular maintenance. Design of natural waterways shall take into consideration fluvial geomorphologic principals and practices and other erosion control measures. Design engineers and development review officials shall work to resolve potential downstream impact issues.

A drivable access way shall be provided in floodplain easements for the length of the easement when regular maintenance of the floodplain is required.

9.3.3 Constructed Channels

Modifications to existing watercourses or newly created open channels may be designed as earthen channels or as concrete lined channels. Liners other than grass or concrete which enhance the aesthetics or habitat value of the watercourse and which reduce future maintenance requirements are encouraged. Preliminary planning for the applicability of other channel liners shall be reviewed with the Director of TCI or his representative prior to the submittal of construction plans for approval.

9.3.3.1 Earthen

The design of earthen channels shall comply with the following general requirements:

A. Freeboard consistent with Table 9.3.14 will be applied to the twenty-five (25) year design.

B. The side slope shall not be steeper than three (3) horizontal to one (1) vertical.

C. A fifteen (15) foot access road on one side of the extreme limits of the channels is required when channels do not parallel and adjoin an alley or roadway. Where utilities are installed in the access road of the channel, the access road will be widen to seventeen (17) feet. "Extreme Limits" of the channel shall mean the side slope intercept with the natural ground or proposed finished ground elevation. Where designed channel bottoms exceed one hundred (100) feet in width, the fifteen-foot access road shall be provided on both sides of the channel. The access road will slope toward the channel with a maximum cross slope of one (1) inch per foot. Additionally, the top of utility manholes within the access road to match the finish ground surface.

D. Earthen interceptor drains are for proper conveyance of upstream storm water sheet flow only. See Section 9.3.10.

E. Earthen channels shall be vegetated. See Section 16.2.1.

F. Channels with longitudinal slopes less than 0.5 percent or bottom widths greater than thirty (30) feet, concrete pilot channels shall be provided. The minimum bottom width of the pilot channel shall be six (6) feet. The minimum [earthen] slope draining toward the pilot channel shall be one (1) percent.

G. Ensure that the channel will contain the hydraulic jump (sequent depth) throughout the extent of the supercritical profile. An exception to this criteria is where concrete lined lateral channels discharge down the side slopes of channels. These channels may be designed for normal depth plus freeboard provided velocity controls are established at the main channel flow line.

H. Ensure that the energy grade of the channel will not result in upstream flooding at existing or proposed lateral facility connections.

Example: Improved channel through the proposed development with a channel flare to accept upstream storm water should be checked with a backwater model to ensure that the hydraulic grade line and energy grade line match the pre-project conditions on the adjoining/upstream property.

9.3.3.2 Concrete

The design of concrete lined channels shall comply with the following general requirements:

A. Freeboard consistent with Table 9.3.14 will be applied to the twenty-five (25) year design.

B. From the top of the concrete lining to the top of the ditch, a side slope not steeper than three (3) horizontal to one (1) vertical shall be required; nor shall the slope be less than twelve to one (12:1). The minimum longitudinal slope shall be 0.4 percent,

or 0.1 percent with a minimum "cleaning" velocity of three (3) feet per second (3 fps) during an existing conditions five (5) year storm event.

C. The depth of all toe downs shall be thirty-six (36) inches upstream, twenty-four (24) inches downstream, and eighteen (18) inches for side slopes. The City's construction inspector may permit an eighteen-inch toe down in rock subgrade in lieu of the above toe down requirements. The horizontal dimensions (thickness) of toe downs shall not be less than six (6) inches.

D. Riprap side slopes shall not be steeper than one and one-half (1½) horizontal to one (1) vertical, unless soil tests made by a geotechnical engineer show that a greater slope, or a special design, will be stable. Where vehicular traffic may travel within a horizontal distance equal to one-half (½) the vertical rise of the slope, a two-foot surcharge load shall be included in the design.

E. Fencing will be required adjacent to the channel where channel vertical wall heights exceed two (2) feet. Fencing will also be required adjacent to the channel where channel side slopes exceed two to one (2:1) and the channel depth is greater than two (2) feet. The fencing must not cause sight distance problems for motorists.

F. Vertical walls will not be permissible for depths greater than two (2) feet unless properly fenced or enclosed. Walls will have a minimum thickness of six (6) inches.

G. Ensure that the channel will contain the hydraulic jump (sequent depth) throughout the extent of the supercritical profile. An exception to this criterion is where concrete lined lateral channels discharge down the side slopes of channels. These channels may be designed for normal depth plus freeboard provided velocity controls are established at the main channel flow line.

H. Ensure that the energy grade of the channel will not result in upstream flooding at existing or proposed lateral facility connections.

Example: Improved channel through the proposed development with a channel flare to accept upstream storm water should be checked with a backwater model to ensure that the hydraulic grade line and energy grade line match the pre-project conditions on the adjoining/upstream property.

I. A fifteen (15) foot access road on one side of the extreme limits of the channels is required when channels do not parallel and adjoin an alley or roadway. Where utilities are installed in the access road of the channel, the access road will be widen to seventeen (17) feet. The access road will slope toward the channel with a maximum cross slope of one (1) inch per foot.

J. The top of utility manholes within the access road to match the finish ground surface

9.3.4 Channel Geometry

The constructed channel geometry may be triangular, rectangular or trapezoidal in shape. The side slopes should not exceed the requirements in 9.3.3.1 or 9.3.3.2. In areas where traffic safety may be of concern, the channel side slope should be 4H:1V or flatter or other vehicular protection devices may be required.

For natural channels, the channel geometry may be irregular in shape. The channel sections should be checked for areas of erosion and provide corrective measures with the natural channel design.

9.3.5 Channel Slope

The channel slope for constructed earthen channels shall meet the requirements of 9.3.3.1.F. The design engineer should consider the channel stability of the design slope to determine if additional protection will be needed to protect the bottom and side slopes.

For concrete channels, the channel slope shall meet the requirements of 9.3.3.2.B. For steep channel slopes, the flow maybe supercritical and the total depth of the channel should contain the sequent depth.

9.3.6 Channel Drops

9.3.6.1 Earthen Channels with Drops.

Retard spacing shall be computed as follows when using the City standard retard section. See Figure 9.3.6.1 and the following equations for spacing criteria:

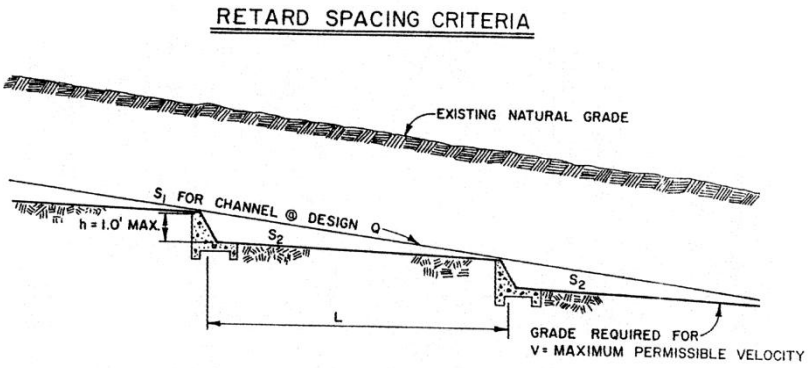

Figure 9.3.6.1 - Retard Spacing Criteria

(Equation 9.3.6.1.a)

$$\mathbf{L = \frac{1.0'}{S_1 - S_2}}$$

L = Distance required between retards in feet.

$\mathbf{S_1}$ = Actual slope of channel in ft./ft.

$\mathbf{S_2}$ = Slope of proposed channel for maximum permissible velocity established from Table 9.3.8

And

(Equation 9.3.6.1.b)

$$\mathbf{S_2 = \frac{NV^2}{(1.486R^{2/3})^2}}$$

V = maximum permissible velocity established from Table 9.3.8

N = channel n-value – normally 0.035

R = area/wetted perimeter

9.3.6.2 Concrete Channels with Drops

The design engineer should analyze channel drops to determine if the flow is or will become super critical along the channel. If the channel becomes super critical, the depth of the channel should contain the sequent depth.

9.3.7 Baffle Chutes

For concrete chutes on earthen side slopes, the following should be used for the design of the baffle blocks on the chute drop. The approach velocity to the chute should be less than critical velocity. The chute slope should fall between 2H:1V to 4H:1V. The maximum flow should be 60 cfs per foot of chute width.

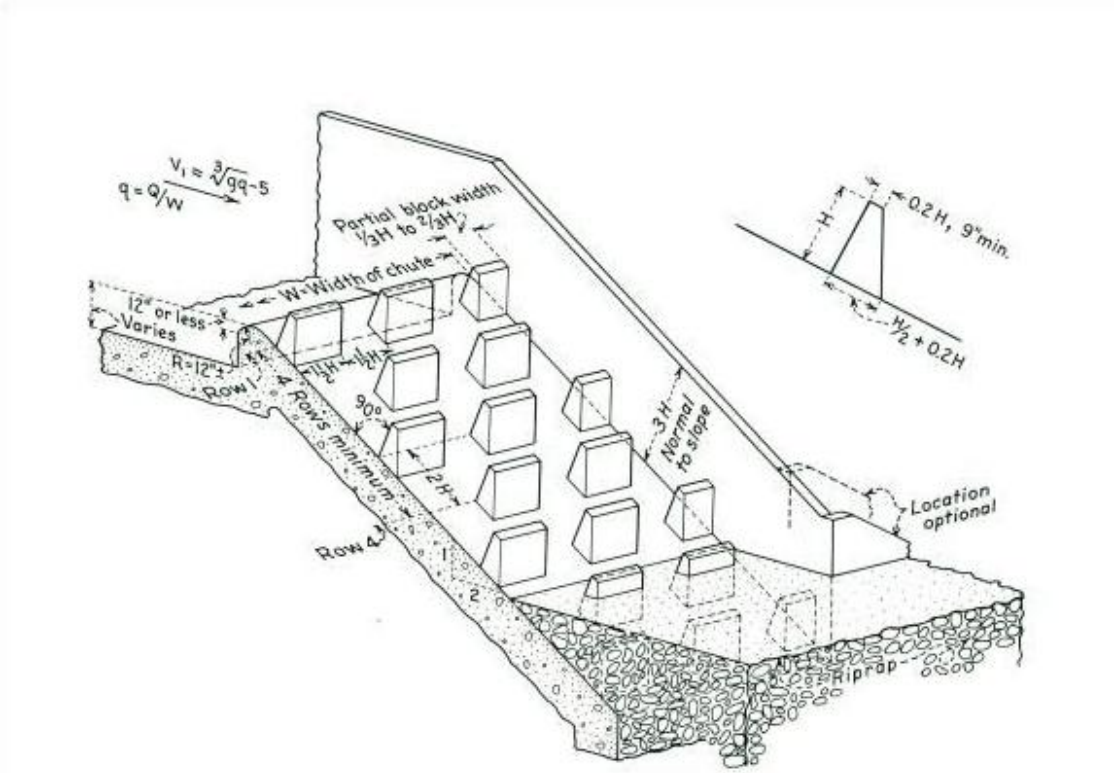

Figure 9.3.7 USBR Type IX Baffled Apron Peterka, 1978,
(Source FHWA, HEC-14 Hydraulic Design of Energy Dissipators)

The height of the blocks, H should range from 0.8 times the critical depth to 0.9 times critical depth. The width and spacing of the baffle block should be 1.5H, but not less than H. The chute blocks are to extend across the total width of the chute. The subsequent rows of blocks should be offset so the blocks lines up with the spacing of the upstream block. The spacing of the row of blocks should be 2H.

9.3.8 Channel Velocity

The following Table 9.3.8 shall be used to determine maximum permissible channel velocity.

Where velocities are in the supercritical range, allowance shall be made in the design for the proper handling of the storm water.

Table 9.3.8 - Velocity Control

Velocity (fps)	Type of Facility Required	Hydraulic Radius (ft.)	Correction Factor	Maximum Permissible Velocity (fps)

1 to 6 (Maximum Average Velocity = 6 fps)	Vegetated Earthen Channel	0-1 1-3 3-5 5-8 8-10 Over 10	0.8 0.9 1.05 1.15 1.225 1.25	5 5.5 6.3 6.9 7.35 7.5
***6 to 12**	Turf Reinforcement Mat (TRM)	N/A	N/A	12
6 to 8	Concrete Retards	N/A	N/A	N/A
>8	Concrete Lining or Drop Structures	N/A	N/A	N/A
**If Turf Reinforcement Mat (TMR) is proposed, please see City of San Antonio Standard Specifications for Construction Item 554 for submittal requirements. The improvement plan sheets should include the location of the placement, details, and manufacturer's installation instructions.*				

* If Turf Reinforcement Mat (TRM) is proposed, please see City of San Antonio Standard Specifications for Construction Item 554 for submittal requirements. The improvement plan sheets should include the location of placement, details, and manufacturer's installation instructions. The use of velocity protection devices other than TRM shall be submitted to and approved by the Director of TCI prior to approval of construction plans.

9.3.9 Low Flow Channels

Earthen channels with longitudinal slopes less than 0.5 percent or bottom widths greater than thirty (30) feet, concrete pilot channels shall be provided. The minimum bottom width of the pilot channel shall be six (6) feet. The minimum [earthen] slope draining toward the pilot channel shall be one (1) percent.

9.3.10 Interceptor Channel

Interceptor channels for proper conveyance of upstream storm water sheet flow shall be required on all subdivision plats where upstream contributing area exceeds the criteria indicated below. Interceptor channels shall be constructed prior to the issuing of building permits on any lot that would intercept natural drainage.

A. Interceptor channels shall be provided for residential subdivisions where the drainage area to the back of platted lots exceeds the depth of two (2) average residential lots with equivalent zoning.

B. Interceptor channels shall be required on nonresidential subdivision plats where the off-site drainage area contributing to the proposed development exceeds three (3) acres.

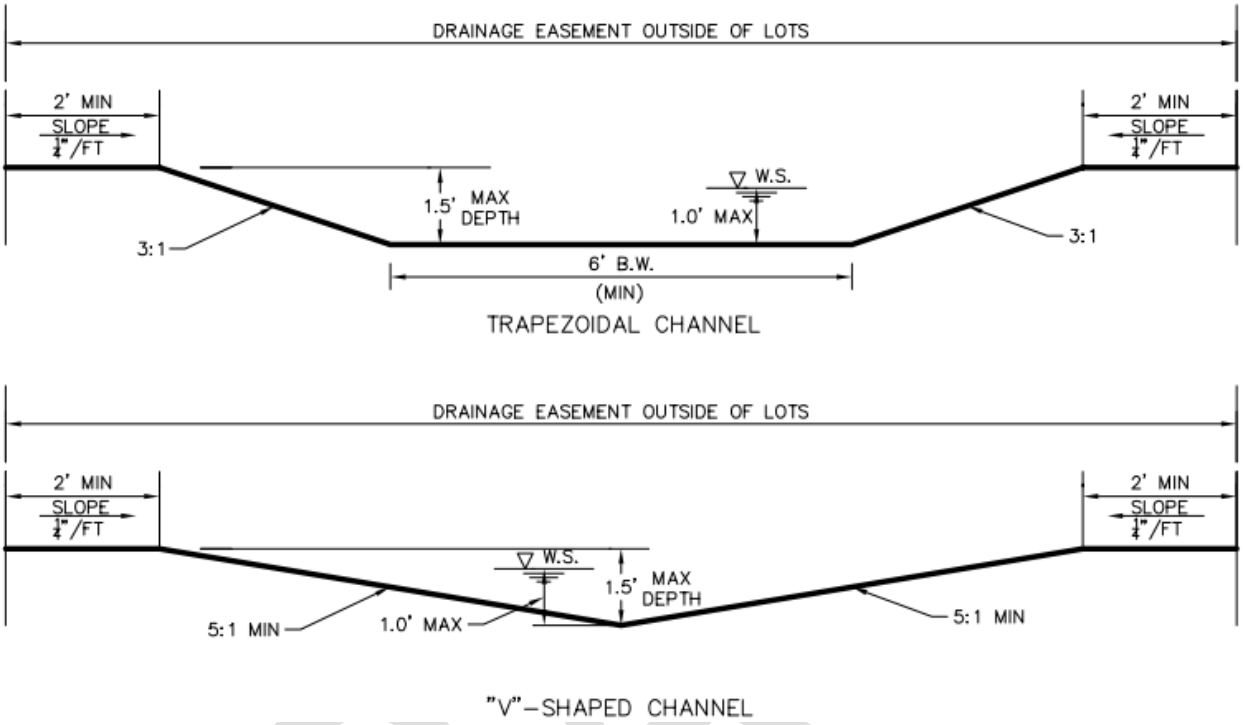

Figure 9.3.10 - Standard for interceptor drains for intercepting sheet flow

9.3.11 Channel Transitions

Channel transitions can occur upstream and downstream of a culvert or bridge, with the contraction and expansion of the flow. The expansion and contraction coefficients at these transitions should be increased to account for the energy loss. An analysis of the water surface through a channel transition should be modeled if the flow is subcritical or supercritical to determine any increase in water surface that may exceed the top of channel or impact to adjoining properties.

Another channel transition to be analyzed is a drop curb opening discharging into the downstream channel. The modeling of the transition is necessary to determine if the hydraulic grade line at the property line is below the gutter and the energy line at the property line is below the top of curb.

9.3.12 Channel Linings

The design of flexible linings described in sections 9.3.12.1, 9.3.12.2, 9.3.12.3, and 9.3.12.4 can be found in FHWA HEC-15, Design of Roadside Channels with Flexible Linings.

9.3.12.1 Grass

The grass lined channel should have grasses as described in 17.2.1 and with good, deep root structure to stabilize the soil from erosive velocities.

9.3.12.2 Turf Reinforcement

There are a number of turf reinforcement mats (TRM) and high performance turf reinforcement mats (HPTRM) that is available to the design engineer. Selection and installation of the TRM or HPTRM is critical to the stability of the earthen channel. The TRM will provide scour protection and enhance the vegetative root and stem development.

9.3.12.3 Rubble Rip Rap

Rock rip rap or rubble rip rap can be used to protect against erosion downstream of energy dissipators or at other locations along the channel bottom or side slopes. The rock rip rap is placed on a filter blanket and should be hard, durable, and angular. The filter blanket is to keep the subgrade soil from migrating into the rock rip rap. The thickness of the rip rap section should be between 1.5 to 3 times the mean rip rap diameter and no less than the largest rock size. The rip rap should have a proper distribution of sizes in the gradation so that the smaller stones will fill the voids of the larger stones.

9.3.12.4 Gabions

Gabions are rock filled wire baskets or mattresses. The gabions can be used similar to rock rip rap, but usually the size of rocks are of a smaller diameter. A filter blanket below the basket or mattress is required to keep the subgrade soil from migrating into the gabions. The gabions shall be installed per the manufacturer's instructions and proper anchoring and toe downs are required.

9.3.12.5 Concrete

The lining of a channel with concrete may be necessary for erosive velocities, or confined channel areas.

For normal conditions, the concrete lining shall be a minimum of five (5) inches thick and reinforced with No. 3 round bars at twelve (12) inches on center each way. Where surcharge, nature of ground, height and steepness of slope, etc., become critical, design shall be in accordance with latest structural standards. All concrete lining shall develop a minimum compressive strength of not less than three thousand (3,000) pounds per square inch in twenty-eight (28) days.

9.3.13 Channel Stability

A stable earthen channel is essential for low maintenance. The velocities shown in table 9.3.8 should not be exceeded without additional surface treatment.

There are areas within Bexar County that have non-cohesive soils and are susceptible to erosion. These non-cohesive soils may need additional surface treatment. To increase the soil stability within these soil types, a lesser velocity or different channel geometry may be needed.

9.3.14 Freeboard

Table 9.3.14 - Drainage Freeboard for Concrete Lined and Earth Channels for Twenty-Five-Year Storm

Design Depth of Flow	Required Freeboard
0 to 5 feet	0.5 foot
5 to 10 feet	10% of design depth
10 feet and over	1.0 foot

Freeboard for earthen channels consistent with Table 9.3.14 will be applied to the twenty-five-year design.

See section 9.3.15 for additional freeboard required at channel bends and turns.

9.3.15 Super Elevation

Channel Bends and Turns - Freeboard. Allowance for extra freeboard shall be made when the centerline radius of the channel is less than three (3) times the bottom width or for super-critical flow regime. Where bends or high velocities are involved and the flow regime is sub-critical, the applicant shall use the following formula for computing the extra freeboard:

(Equation 9.3.15)

$$d_2 - d_1 = V^2(T + B) / 2gR$$

d1 = depth of flow at the inside of the bend in feet.
d2 = depth of flow at the outside of the bend in feet.
B = bottom width of the channel in feet.
V = the average approach velocity in the channel in feet per second.
T = width of flow at the water surface in feet.
g = 32.2 feet/second squared.
R = the center line radius of the turn or bend in feet.

A. The quantity d_2-d_1 divided by two (2) shall be added to the normal depth of flow before adding the required freeboard in calculating required right-of-way widths.

B. Where sharp turns are used without curved sections, the depth required shall be large enough to provide for all head losses. Allowance shall be made for any backwater head that may result.

C. For critical and super-critical flow regimes, the extra freeboard calculated with the above formula shall be doubled.

9.3.16 Utilities – Scour And Buoyancy

Utilities should be checked for scour depth and buoyancy of conduits that are within a floodplain or drainage channel.

9.3.16.1 Scour

The scour analysis for the underground utility line will determine the maximum probable depth of bed scour that could expose or undercut the line. Should the analysis show the depth of scour to impact the utility line, concrete encasement or other measures may be needed to mitigate the scour.

(Equation 9.3.16.1)

$$d_s = d_m\left(\frac{V_m}{V_c} - 1\right)$$

d_s = Scour Depth below stream bed (ft.)

d_m = Mean Depth (ft.) - depth of flow in channel

V_m = Mean velocity (fps) – velocity of flow in channel

V_c = Shear velocity (fps) – competent velocity

Table 9.3.16.1 - Tentative guide to competent velocities for erosion of cohesive materials*
(after Neill, 1973, Source USBR "Computing Degradation and Local Scour", 1984)

Depth of flow (ft)	Competent mean velocity		
	Low values - easily erodible material (ft/s)	Average values (ft/s)	High values - resistant material (ft/s)
5	1.9	3.4	5.9
10	2.1	3.9	6.6
20	2.3	4.3	7.4
50	2.7	5.0	8.6

* Notes: (1) This table is to be regarded as a rough guide only, in the absence of data based on local experience. Account must be taken of the expected condition of the material after exposure to weathering and saturation. (2) It is not considered advisable to relate the suggested low, average, and high values to soil shear strength or other conventional indices, because of the predominating effects of weathering and saturation on the erodibility of many cohesive soils. (D)

9.3.16.2 Buoyancy

The buoyancy analysis will determine the stability of the conduit in the stream bed to resist floatation. If the analysis shows possible floatation of the conduit, additional anchorage should be added.

(Equation 9.3.16.2)

$$\frac{\pi}{4}\left(B_c^2 - d^2\right)w_p + H(B_c)\left(1 - \frac{1}{g_e}\right)w_e \geq SF\left(\frac{\pi}{4}B_c^2 w_w\right)$$

Bc = outside pipe diameter (ft)
d = inside pipe diameter (ft)
wp = unit weight of pipe material in air (lb/ft^3)
H = soil cover over pipe (ft)
ge = specific gravity of backfill particles
we = bulk unit weight of dry backfill (lb/ft^3)
SF = safety factor
ww = unit weight of water (lb/ft^3)

The following design values are suggested:
wp = 150 lb/ft^3
ge = 2.65
we = 110 lb/ft^3
SF = 1.5 if overburden is used to offset buoyancy
ww = 62.4 lb/ft^3

9.4 Maintenance Considerations

See Chapter 4.12 for additional guidance on maintenance standards.

9.4.1 Access

A drivable access way shall be provided in drainage easements for the length of the easement when regular maintenance of the floodplain is required.

Maintenance Access Right-of-Way. An unobstructed access right-of-way connecting the drainage easement with an alley or roadway parallel to or near the easement shall be provided at a minimum spacing of one (1) access right-of-way at approximately one thousand-foot intervals. The access right-of-way shall be a minimum of fifteen (15) feet in width and shall be maintained clear of obstructions that would limit maintenance vehicular access. If the flow line of the designed channel incorporates grade control structures or vehicular bridges that would prevent maintenance equipment from accessing that portion of the channel, additional access points may be required. Channel design, earthen or concrete, shall have ramps in the side slopes near the access points that would allow maintenance equipment to descend to the floor level of the channel. The maximum allowable ramp slope for vehicular access is seven to one (H7:V1). Access points adjacent to roadways or alleys shall be provided with a post and cable feature with padlock to prevent unauthorized use.

9.4.2 Schedule

Design of new channels or alterations to existing channels shall consider future maintenance requirements. A maintenance schedule for any private channel shall be submitted to and approved by the Director of TCI prior to approval of construction plans. Maintenance requirements of concrete channels consist of de-silting activities, prevention of vegetation establishment in construction joints, and repair of concrete as necessary. Maintenance of earthen channels includes regular observation and repair, as necessary, of erosion, scouring, and removal of silt deposits, as necessary to maintain design parameters. Developers shall be responsible for maintaining newly planted channels until coverage is established throughout eighty-five (85) percent of the area. This area shall include slopes, floor, and any attendant maintenance easement. New earthen channels shall be planted with grass species per section 17.2.1. Mowing frequencies vary with the vegetation growth rates, but is required when the grass exceeds the design roughness coefficient of the channel.

9.5 References

9.5.1 Reference Citations

A. FHWA. *Urban Drainage Design Manual*. Hydraulic Engineering Circular No. 22, 3rd edition, FHWA-NHI-10-009. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2009.

B. UDFCD. Major Drainage in *Urban Storm Drainage Criteria Manual Volume 1*. Urban Drainage and Flood Control District, Denver, Colorado, April 2008.

C. FHWA. *Hydraulic Design of Energy Dissipators for Culverts and Channels*. Hydraulic Engineering Circular No. 14. 3rd edition. FHWA-NHI-06-086. Federal Highway Administration, Department of Transportation, Washington, DC, July 2006.

D. US Bureau of Reclamation. *Computing Degradation and Local Scour – Technical Guideline for Bureau of Reclamation*. Bureau of Reclamation, U.S. Department of the Interior, Denver, Colorado, Jan. 1984.

9.5.2 References

- FHWA. *Design of Roadside Channels with Flexible Linings*. Hydraulic Engineering Circular No. 15, 3rd edition, FHWA-NHI-05-114. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2005.
- UDFCD. Major Drainage in *Urban Storm Drainage Criteria Manual Volume 1*. Urban Drainage and Flood Control District, Denver, Colorado, April 2008.
- FHWA. *Urban Drainage Design Manual*. Hydraulic Engineering Circular No. 22, 3rd edition, FHWA-NHI-10-009. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2009.
- AWWA. *Concrete Pressure Pipe*. AWWA Manual M9, Third Edition. American Water Works Association, Denver, CO, 2008.
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CULVERTS

10.1 Introduction

The function of a culvert is to convey surface water under a highway, railroad, or other embankment. In addition to the hydraulic function, the culvert must carry construction, highway, railroad, or other traffic and earth loads. This chapter describes the hydraulic aspects of culvert design, construction and operation of culverts, and references structural aspects as they are related to the hydraulic design.

Any culvert with a clear opening of more than twenty (20) feet, measured along the center of the roadway between inside of end walls, is considered a bridge by FHWA and is designated as a bridge class culvert.

Culverts are available in a variety of sizes, shapes, and materials. These factors, along with several others, affect their capacity and overall performance. Sizes and shapes may vary from small circular pipes to extremely large box culvert sections that are sometimes used in place of bridges.

The material selected for a culvert is dependent upon various factors, including durability, structural strength, roughness, bedding condition, abrasion and corrosion resistance, and water tightness. The more common culvert materials used are concrete and steel (smooth and corrugated).

Another factor that significantly affects the performance of a culvert is its inlet configuration. The culvert inlet may consist of a culvert barrel projecting from the roadway fill or mitered to the embankment slope. Other culvert inlets have headwalls, wingwalls, and apron slabs or standard end sections of concrete.

A careful approach to culvert design is essential, both in new land development and retrofit situations, because culverts often significantly influence upstream and downstream flood risks, floodplain management, and public safety.

All-weather crossings will be required where proposed streets cross existing or proposed water courses. Culverts should be capable of allowing passage of the design storm identified in Chapter 10.3.1.

10.2 Hydraulics Of Culverts

The placement of a culvert within a stream, creek, or channel should be such that the centerline of the culvert closely aligns with the center line of the stream; while this will minimize the impact to the stream it may also skew the culvert to the roadway centerline.

The placement of culvert(s) should be modeled with an appropriate hydraulic model to determine impacts both upstream and downstream of the crossing.

Existing culverts downstream of a site must be analyzed for project impacts if the culvert is within the reach downstream of the proposed development per section 4.3.1C.

10.3 Design Guidelines

10.3.1 Design Frequency

The culvert(s) should be designed for the ultimate twenty-five (25) year storm if the drainage area to the culvert crossing is less than one hundred (100) acres. If the drainage area to the culvert(s) is more than one hundred (100) acres, the system should be designed for the ultimate one hundred (100) year storm. Channels upstream and downstream of culverts must contain the design storm and freeboard.

10.3.2 Inlet Control

Inlet or entrance control occurs when a culvert is capable of carrying more flow than the inlet will accept and the culvert is hydraulically steep (critical depth is greater than normal depth).

When the culvert is under inlet control, the control section is just inside the entrance of the culvert. If the flow of the culvert is a free surface flow, then critical depth will occur at or near the control section. Downstream of the control section and a free surface flow, the flow will be supercritical and a hydraulic jump may occur within the culvert.

Inlet control can become outlet control when the tail water depth is above the soffit or crown of the culvert entrance and a full flow condition exists in the culvert.

TxDOT uses a fifth-degree polynomial equation based on regression analysis to define the inlet control headwater for a given flow. This equation is used for the ratio of HWi/D greater than one-half (0.5) and less than three (3). The following equations from TxDOT are provided as a reference.

(Equation 10.3.2.a)

$$\mathbf{HW_{ic} = \left[a + bF + cF^2 + dF^3 + eF^4 + fF^5\right]D - 0.5DS_o}$$

HW_{ic} = inlet control headwater (ft.)
D = rise of the culvert (ft.)
a to f = regression coefficients for each type of culvert, see TxDOT manual for coefficients
S_o = culvert slope (ft./ft.)
F = function of average outflow discharge, culvert rise and width

(Equation 10.3.2.b)

$$F = 1.8113\frac{Q}{WD^{1.5}}$$

W = width of the culvert (ft.)

For the ratio of HW_i/D greater than three (3), use Equations 10.3.2.c and 10.3.2.d on the following page to estimate the headwater. Equation 10.3.2.c is an orifice equation.

(Equation 10.3.2.c)

$$HW_i = \left[\frac{Q}{k}\right]^2 + \frac{D}{2}$$

HW_i = inlet control headwater (ft.)
Q = design discharge (cfs)
k = orifice equation constant
D = culver rise (ft.)

(Equation 10.3.2.d)

$$k = 0.6325\frac{Q_{3.0}}{D^{0.5}}$$

$Q_{3.0}$ = discharge (cfs)

10.3.3 Outlet Control

Outlet or exit control occurs when a culvert is not capable of carrying as much flow as the inlet will accept and the culvert is hydraulically mild slope (normal depth is greater than critical depth).

When the culvert is under outlet control, the hydraulic grade line inside the culvert at the entrance exceeds critical depth. The headwater of a culvert with outlet control is determined by the frictional slope, entrance and exit geometry, and tail water level.

(Equation 10.3.3.a)

$$HW_{oc} = h_e + h_{vi} + \sum h_f - S_o L + H_o - h_{va}$$

HW_{oc} = headwater depth due to outlet control (ft.)
h_{va} = velocity head of flow approaching the culvert entrance (ft.)
h_{vi} = velocity head in the entrance (ft.)
h_e = entrance head loss (ft.)
h_f = frictional head losses (ft.)
S_o = culvert slope (ft./ft.)
L = culvert length (ft.)
H_o = depth of hydraulic grade line just inside the culvert at outlet (ft.)

(Equation 10.3.3.b)

$$h_v = \left[\frac{v^2}{2g}\right]$$

h_v = velocity head (ft.)
v = velocity (fps)
g = gravitational acceleration (32.2 ft./s^2)

When tail water controls, the following formula includes the exit loss.

(Equation 10.3.3.c)

$$H_o = TW + h_{TW} + h_o - h_{vo}$$

H_o = water surface at outlet
h_{vo} = velocity head inside culvert at outlet (ft.)
h_{TW} = velocity head in tail water (ft.)
h_o = exit head loss (ft.)

The outlet depth, H_o is the hydraulic grade line inside the culvert outlet. The conditions in Table 10.3.3 will determine the outlet depth.

Table 10.3.3 - Outlet Depth Conditions
(Source TxDOT, Hydraulic Design Manual, 2011)

If	And	Then
Tailwater depth (TW) exceeds critical depth (d_c) in the culvert at outlet	Slope is hydraulically mild	Set H_o using Equation 10.3.3.c, using the tailwater as the basis.
Tailwater depth (TW) is lower than critical depth (dc) in the culvert at outlet	Slope is hydraulically mild	Set Ho as critical depth.
Uniform depth is higher than top of the barrel	Slope is hydraulically steep	Set H_o as the higher of the barrel depth (D) and depth using Equation 10.3.3.c.

Uniform depth is lower than top of barrel and tail-water exceeds critical depth	Slope is hydraulically steep	Set Ho using Equation 10.3.3.c.
Uniform depth is lower than top of barrel and tail-water is below critical depth	Slope is hydraulically steep	Ignore, as outlet control is not likely.

10.3.4 Energy Losses through Culvert

There are four (4) different flow conditions that are considered occurring within the culvert, free surface flow, full flow in conduit, full flow at outlet and free surface flow at inlet, and free surface at outlet and full flow at inlet. These conditions are further explained on the following pages.

10.3.4.1 Free Surface Flow – Type A

With a free surface flow occurring in the culvert a standard step backwater can be used to calculate the water surface through the culvert to the entrance. With this condition the backwater profile is based on the outlet depth. Normal depth is within the culvert.

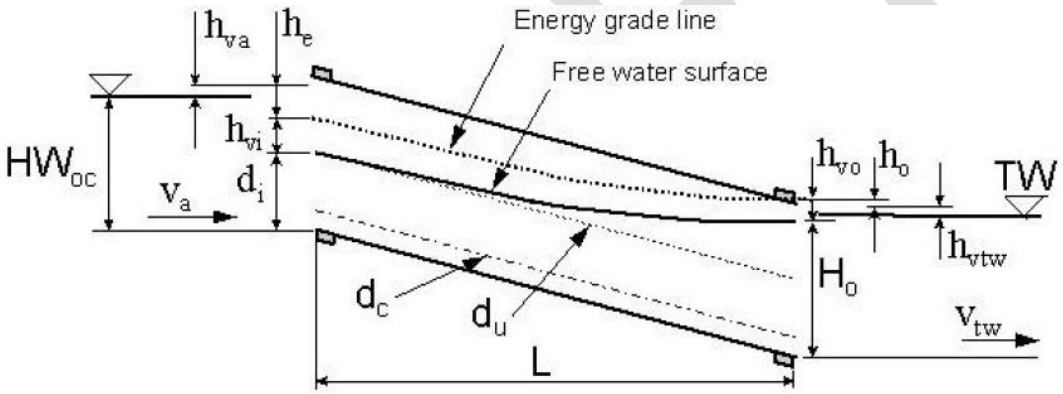


Figure 10.3.4.1 - Outlet Control Headwater for Culvert with Free Surface
(Source TxDOT, Hydraulic Design Manual, 2011)

The headwater may be affected only when the culvert is in subcritical flow, backwater from the culvert outlet is present, and if the culvert is on a steep slope with a tail water higher than critical depth and lower than the soffit of the culvert outlet.

10.3.4.2 Full Flow in Conduit – Type B

If the full flow condition exists within the length of the culvert then the hydraulic grade line will be at above the soffit. The hydraulic grade line at the culvert outlet is based on the outlet depth (H_o) being at or above the soffit at the outlet.

Use the Equation 10.3.4.2.c on the following page to calculate the frictional slope of the culvert. If the frictional slope is less than the culvert slope, the hydraulic grade line may drop below the soffit of the culvert. If this condition exists then the culvert flow may be Type BA.

The frictional loss through the culvert is determined by Equation 10.3.4.2.a.

To determine the hydraulic grade line at the upstream end of the culvert, at the inlet use Equation 10.3.4.2.b. To obtain the headwater elevation the entrance loss will need to be calculated. See Energy Balance at Inlet section.

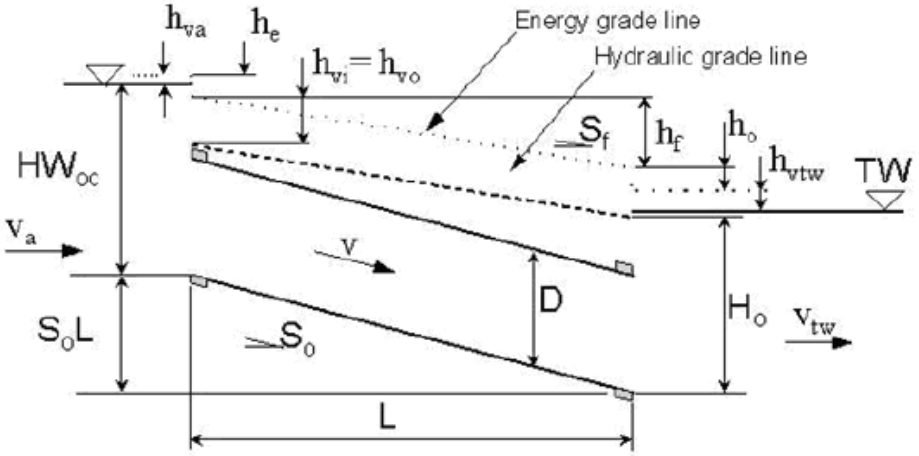


Figure 10.3.4.2 - Outlet Control, Fully Submerged Flow
(Source TxDOT, Hydraulic Design Manual, 2011)

(Equation 10.3.4.2.a)

$$h_f = S_f L$$

h_f = head loss due to friction in the culvert barrel, ft.
S_f = friction slope, ft. (See Equation 10.3.2.2.3)
L = length of culvert containing full flow, ft.

(Equation 10.3.4.2.b)

$$H_i = H_o + h_f - S_o L$$

H_i = depth of hydraulic grade line at inlet (ft.)
Hf = friction head losses (ft.) (calculated using Equation 10.3.2.2.1)
So = culvert slope (ft./ft.)
L = culvert length (ft.)
Ho = outlet depth (ft.)

(Equation 10.3.4.2.c)

$$S_f = \left(\frac{Qn}{1.486R^{2/3}A}\right)^2$$

S_f = friction slope (ft./ft.)
Q = flow in pipe (cfs)
n = Manning's 'n'-value
A= Area of the pipe (ft^2)
R= Hydraulic Radius (A/P_W) (ft.)

10.3.4.3 Full Flow at Outlet and Free Surface Flow at Inlet – Type BA

If the frictional slope is less than the culvert slope and the outlet depth (H_o) is greater than the soffit of the culvert at the outlet then the culvert may flow full for a portion of its length.

First determine the length of full flow using Equation 10.3.4.3.a.

(Equation 10.3.4.3.a)

$$L_f = \frac{H_o - D}{S_o - S_f}$$

L_f = length over which full flow occurs (ft.)
S_o = culvert slope (ft./ft.)
S_f = friction slope (ft./ft.)
H_o = outlet depth (ft.)
D = Conduit barrel height (ft.)

Should the length L_f be greater than the culvert length, the culvert is flowing full for its entire length, see Type B calculations on the previous page. If the length of L_f is less than the culvert length, a free surface flow begins a point along the culvert at a distance of L_f from the culvert outlet. From this point up to the culvert inlet the water surface can be calculated using the standard step backwater method.
With the water surface (H_i) or d_i (shown on Figure 10.3.4.3 below) at the culvert inlet, the headwater elevation at the entrance can be calculated. See Energy Balance at Inlet section 10.3.5 on following page.

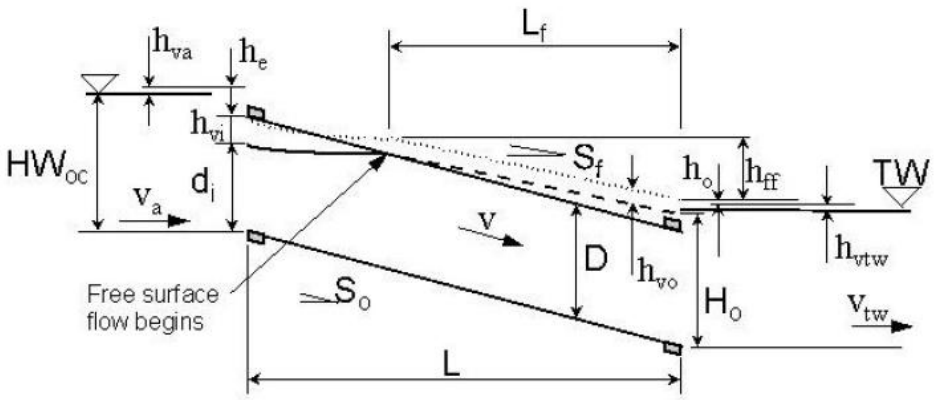


Figure 10.3.4.3 - Point at Which Free Surface Flow Begins
(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.4.4 Free Surface at Outlet and Full Flow at Inlet – Type AB

If the frictional slope is greater than the culvert slope and the outlet water surface H_o is less than the culvert soffit at the outlet, calculate the H_i using the following steps.

Step 1 – Start with the outlet depth H_o and
Step 2 – Use a standard step backwater to determine the point along the conduit where the water surface will intersect the soffit.
Step 3 – At this point along the culvert length, the remaining culvert length L_f is substituted for L in the Equation 10.3.4.2.b to determine h_{ff} in Figure 10.3.4.4.
Step 4 – With the hydraulic grade line at the culvert inlet, the headwater elevation at the entrance can be calculated. See Energy Balance at Inlet section for further calculations.

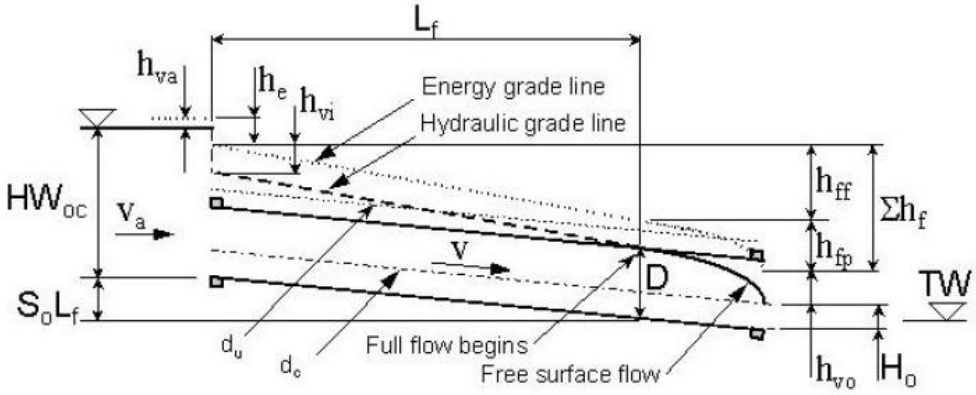


Figure 10.3.4.4 - Headwater due to Full Flow at Inlet and Free surface at Outlet
(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.5 Energy Balance at Inlet

The culvert inlet headwater (HW_{oc}) can be calculated using the energy Equation 10.3.5.a below. With the hydraulic grade line at the culvert entrance (calculated from section 10.3.4) the velocity head at the entrance (h_{vi}) can be calculated.

(Equation 10.3.5.a)

$$\mathbf{HW_{oc} = H_i + h_{vi} + h_e - h_{va}}$$

HW_{oc} = headwater depth due to outlet control (ft.)
h_{va} = velocity head of flow approaching the culvert entrance (ft.)
h_{vi} = velocity head in the entrance (ft.) (calculated using Equation 10.3.3.b)
h_e = entrance head loss (ft.) (calculated using Equation 10.3.5.b)
H_i = depth of hydraulic grade line just inside the culvert at inlet (ft.)

Generally the approach velocity of the upstream channel to the culvert inlet can be assumed to be zero (0), thus the headwater and energy grade line are equal. This is a conservative approach for a headwater depth. The design engineer can calculate the approach velocity and determine the appropriate headwater.

The entrance loss should be calculated using Equation 10.3.5.b on the following page.

(Equation 10.3.5.b)

$$\mathbf{h_e = C_e\left[\frac{V_i^2}{2g}\right]}$$

h_e = entrance loss
C_e = entrance loss coefficient
V_i = flow velocity inside culvert inlet (fps)

The values of C_e are shown below on Table 10.3.5.

Table 10.3.5 - Entrance Loss Coefficients (C_e)

(Source FHWA "Hydraulic Design of Highway Culverts",3rd ed.)

Type of Structure and Design of Entrance	**Coefficient C_e**
Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = D/12)	0.2
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
Pipe or Pipe-Arch Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of D/12 or B/12	
or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of D/12 or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2

10.3.6 Determination of Outlet Velocity

The outlet velocity is based on the discharge and the cross sectional area at the outlet. See Equation 10.3.6.

(Equation 10.3.6)

$$v_o = \frac{Q}{A_o}$$

v_o = outlet velocity (ft/s)
Q = culvert discharge (cfs)
A_o = cross-sectional area of flow at outlet (ft^2)

There are a few conditions to consider for determining the depth (d_o) at the outlet.

If the tail water at the outlet is above the culvert outlet soffit or the culvert is flowing full due to the culvert capacity is less than the discharge, then the depth (d_o) is equal to the barrel rise (D) and the full cross sectional area of the culvert is used. See Figure 10.3.6.B on the following page.

If the tail water at the outlet is below the culvert outlet soffit, determine the critical depth of the culvert. Set the depth (d_o), to the higher of tail water or critical depth.

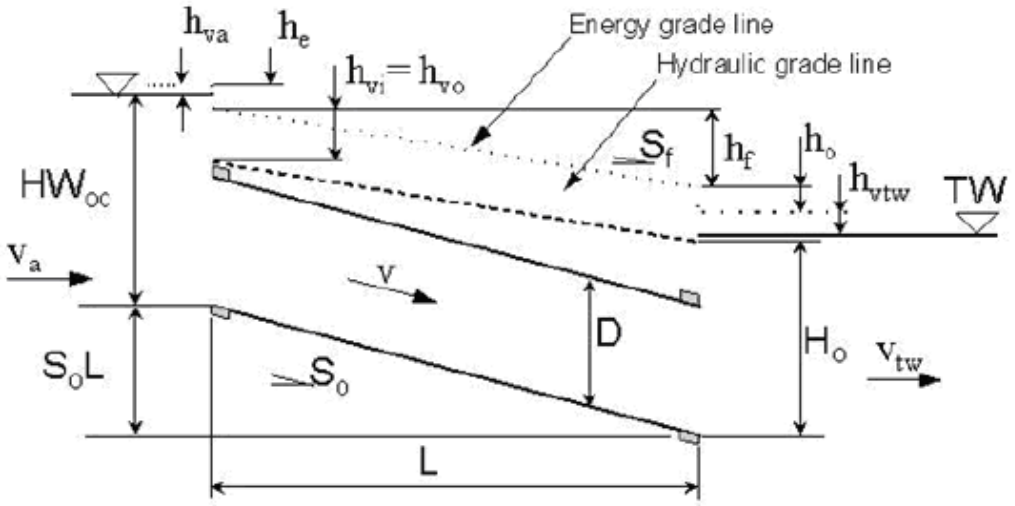


Figure 10.3.6.A - Cross Sectional Area based on the Higher of Critical Depth and Tailwater
(Source TxDOT, Hydraulic Design Manual, 2011)

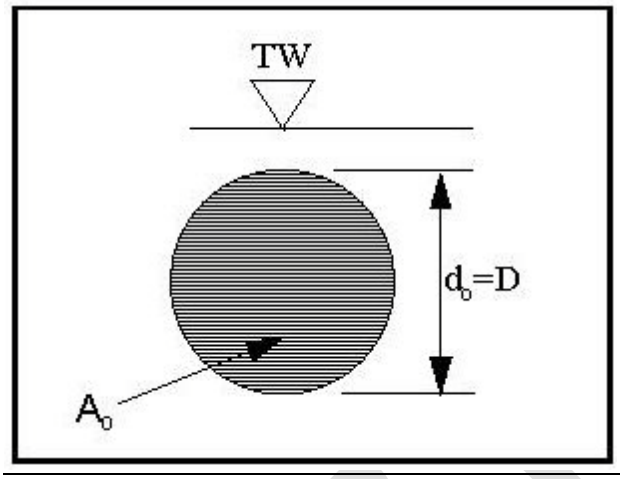


Figure 10.3.6.B - Cross Sectional Area Based on Full Flow
(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.7 Depth Estimation Approaches

For inlet control under steep slope conditions, estimate the depth at the outlet using one of the following approaches:

- Use a step backwater method starting from critical depth (d_c) at the inlet and proceed down-stream to the outlet. If the tail water is lower than critical depth at the outlet, calculate the velocity resulting from the computed depth at the outlet. If the tail water is higher than critical depth, a hydraulic jump within the culvert is possible. Section 10.3.11, Hydraulic Jump in Culverts, below discusses a means of estimating whether the hydraulic jump occurs within the culvert. If the hydraulic jump does occur within the culvert, determine the outlet velocity based on the outlet depth, $d_o = H_o$.
- Assume uniform depth at the outlet. If the culvert is long enough and tail water is lower than uniform depth, uniform depth will be reached at the outlet of a steep slope culvert. For a short, steep culvert with tail water lower than uniform depth, the actual depth will be higher than uniform depth but lower than critical depth. This assumption will be conservative; the estimate of velocity will be somewhat higher than the actual velocity. If the tail water is higher than critical depth, a hydraulic jump is possible and the outlet velocity could be significantly lower than the velocity at uniform depth.

10.3.8 Direct Step Backwater Method

The free flow water surface water within a culvert can be determined with the Direct Step Method describe in TxDOT "Hydraulic Design Manual". An increment (or decrement) of water depth (δd) is chosen and the corresponding distance over which the depth of change

is computed. This method can be used for either supercritical or subcritical flow within a culvert.

10.3.9 Subcritical Flow and Steep Slope

If the culvert has a free water surface with a subcritical flow at the outlet and the culvert has a steep slope, then the water depth δd is negative in the computation (decrement). If the depth of flow reaches critical depth before reaching the culvert entrance, then the culvert is under inlet control. A hydraulic jump may occur in the culvert. If the depth of flow calculated at the culvert entrance is higher than the culvert critical depth, use Equation 10.3.5.a

10.3.10 Supercritical Flow and Steep Slope

If the culvert has supercritical flow and a steep slope, then begin the computation starting at the culvert entrance with critical depth and proceed downstream for the water surface computation. Use a decrement water depth δd in the computation. If the tail water is higher than the culvert critical depth a backwater may occur within the culvert.

10.3.11 Hydraulic Jump in Culverts

An example of a momentum and energy plot is shown in Figure 10.3.11 on the following page. For a given discharge there are two possible depths; the first is **less than critical depth** (supercritical flow) and the other is **greater than critical depth** (subcritical flow), a sequent (or conjugate) depth. Both depths will have the same momentum with different specific energy. If you have a supercritical flow in a culvert, the possibility of hydraulic jump can occur with the proper configuration. There will be a loss in energy, ΔE as a result of the hydraulic jump.

(Equation 10.3.11)

$$\mathbf{M} = \frac{\mathbf{Q^2}}{\mathbf{gA}} + \mathbf{A\bar{d}}$$

M = momentum function
Q = discharge (cfs)
g = gravitational constant (32 ft./sec^2)
A = section area of flow (sq. ft.)
$\bar{\mathbf{d}}$ = distance from water surface to centroid of flow area (ft.)

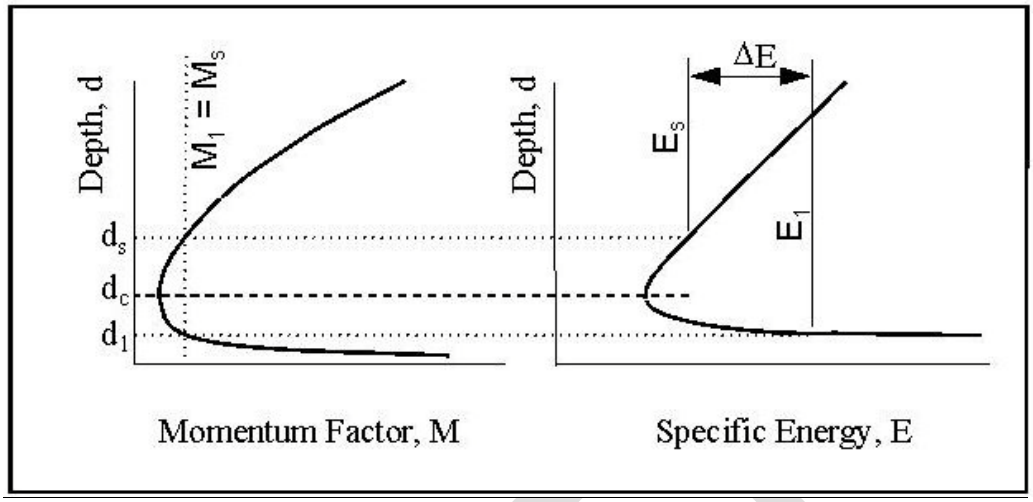


Figure 10.3.11 - Momentum Function and Specific Energy
(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.12 Sequent Depth

If the culvert has a free surface flow and is supercritical, sequent depth can be calculated. For slopes greater than ten percent (10%) a more complex solution is required and is provide in FHWA HEC-14 "Hydraulic Design of Energy Dissipators".

To determine sequent depth within a rectangular culvert, use Equation 10.3.12.a below.

(Equation 10.3.12.a)

$$d_s = 0.5 d_1 \left(\sqrt{1 + \frac{8 {v_1}^2}{g d_1}} - 1 \right)$$

d_s = sequent depth (ft.)
d_1 = depth of flow (supercritical) (ft.)
v_1 = velocity of flow at depth d (fps)

For a circular culvert the calculation to determine sequent depth is not a direct solution. An iterative solution of Equation 10.3.12.b, shown below, is used to calculate a discharge that will equal the design discharge.

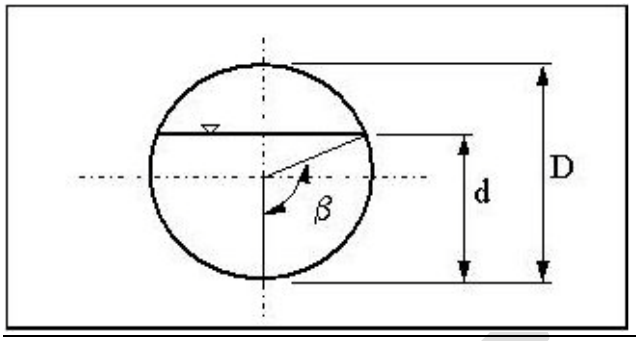


Figure 10.3.12 - Determination of Angle β *(Source TxDOT, Hydraulic Design Manual, 2011)*

(Equation 10.3.12.b)

$$Q^2 = \frac{g\left(A_s\bar{d}_s - A_1\bar{d}_1\right)}{{}^1/_{A_1} - {}^1/_{A_s}}$$

Q = discharge (cfs)
$\mathbf{A_s}$ = area of flow at sequent depth (sq.ft.)
$\mathbf{A_s\bar{d}_s}$ = first moment of area about surface at sequent depth (cu.ft.)
$\mathbf{A_1\bar{d}_1}$ = first moment of area about surface at supercritical flow depth (cu.ft.)

(Equation 10.3.12.c)

$$A\bar{d} = \frac{D^3}{24}(3\sin\beta - \sin\beta^3 - 3\beta\cos\beta)$$

$\mathbf{A\bar{d}}$ = first moment of area about water surface (cu.ft.)
D = conduit diameter (ft.)
β = angle shown in Figure 10.3.12 and calculated using Equation 10.3.12.d.

(Equation 10.3.12.d)

$$\beta = \cos^{-1}\left(1 - \frac{2d}{D}\right)$$

(Equation 10.3.12.e)

$$A = \frac{D^2}{8}\left[2\cos^{-1}\left(1 - \frac{2d}{D}\right) - \sin\left(2\cos^{-1}\left(1 - \frac{2d}{D}\right)\right)\right]$$

10.3.13 Roadway Overtopping

When roadway overtopping occurs on an existing roadway, the design engineer should check the depth of flow over the roadway for the design storm and compare the depth to

Figure 4.3.1C. A new development should not increase the depth of flow from the "Proceed with Caution" to "Dangerous" conditions. If this condition occurs then some culvert or other drainage improvements may be needed to mitigate this "Dangerous" condition.

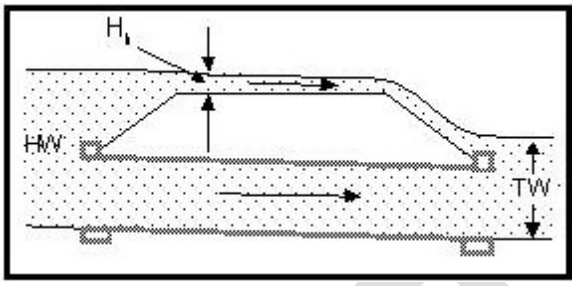


Figure 10.3.13.A - Culvert with Overtopping Flow
(Source TxDOT, Hydraulic Design Manual, 2011)

When the calculation of the culvert headwater, assuming the total discharge is going through the culverts, is above the low point of the roadway, a weir condition will develop. The calculation of the amount of flow that passes through the culvert and the remaining portion of flow that overtops the roadway is an iterative process.

Use the Weir Equation 10.3.13 to determine the average depth between headwater and low roadway elevation (H_h) for the roadway. The normal discharge coefficient for roadways should be 2.9.

(Equation 10.3.13)

$$Q = k_t C L H_h^{1.5}$$

Q = discharge (cfs)
k_t = over-embankment flow adjustment factor (see Figure 10.3.11.B)
C = discharge coefficient
L = horizontal length of overflow, ft. This length should be perpendicular to the over-flow direction.
H_h = average depth between headwater and low roadway elevation (ft.)

If the tail water is sufficiently high, the adjustment factor k_t would reduce the discharge over the roadway. For values of H_t/H_h below 0.8, the adjustment factor k_t is one (1). For roadway embankments as shown in Figure 10.3.13.D may need to be broken down into segments for the computation of the weir flow.

The use of HEC-RAS or other approved model can be used to determine the flow through the culvert and over the roadway.

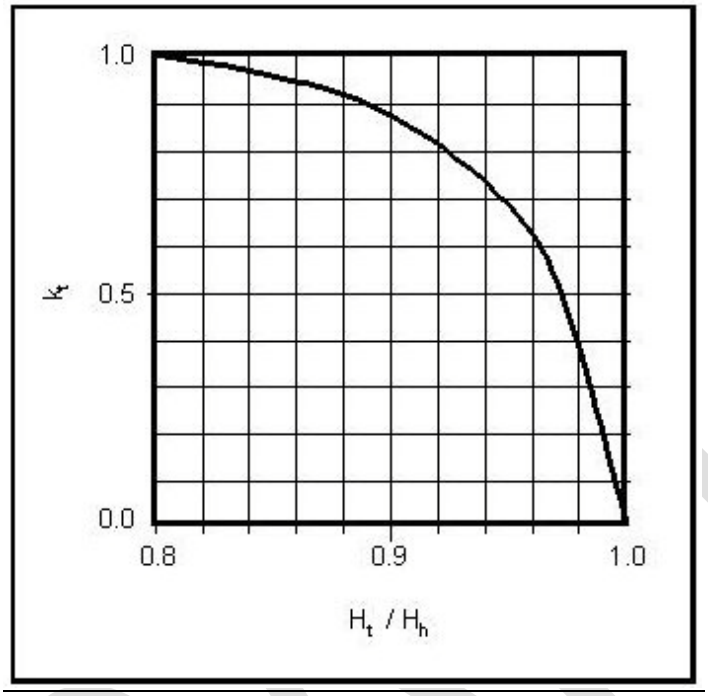


Figure 10.3.13.B - Over-Embankment Flow Adjustment Factor
(Source TxDOT, Hydraulic Design Manual, 2011)

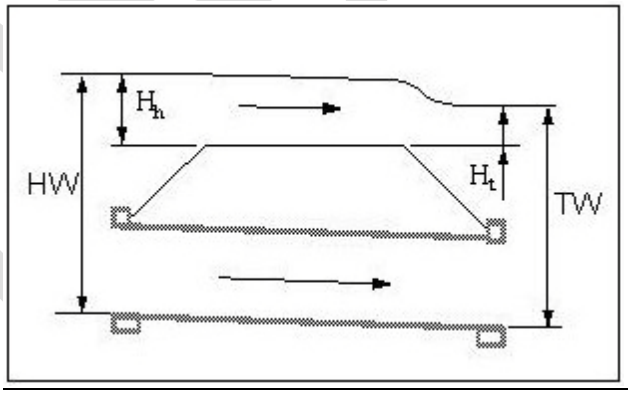


Figure 10.3.13.C - Roadway Overtopping with High Tailwater
(Source TxDOT, Hydraulic Design Manual, 2011)

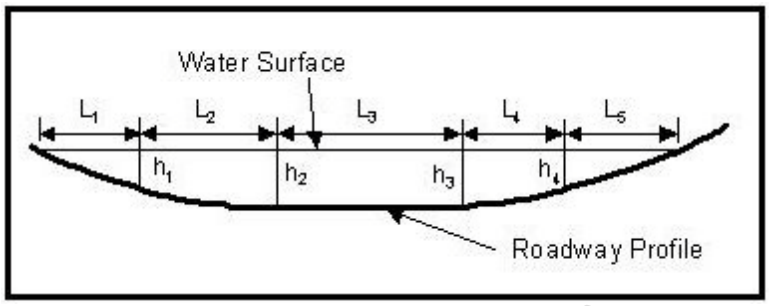


Figure 10.3.13.D - Cross Section of Flow over Embankment
(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.14 Performance Curves

The performance curve is a combination of inlet and outlet control that will vary with the discharge.

A sample plot of the headwater versus discharge for inlet and outlet control of a culvert is shown in Figure 10.3.14 below. With varying discharge the culvert system may change from inlet control to outlet control. This information is useful for a risk assessment or routing a hydrograph through a detention basin with a culvert outlet.

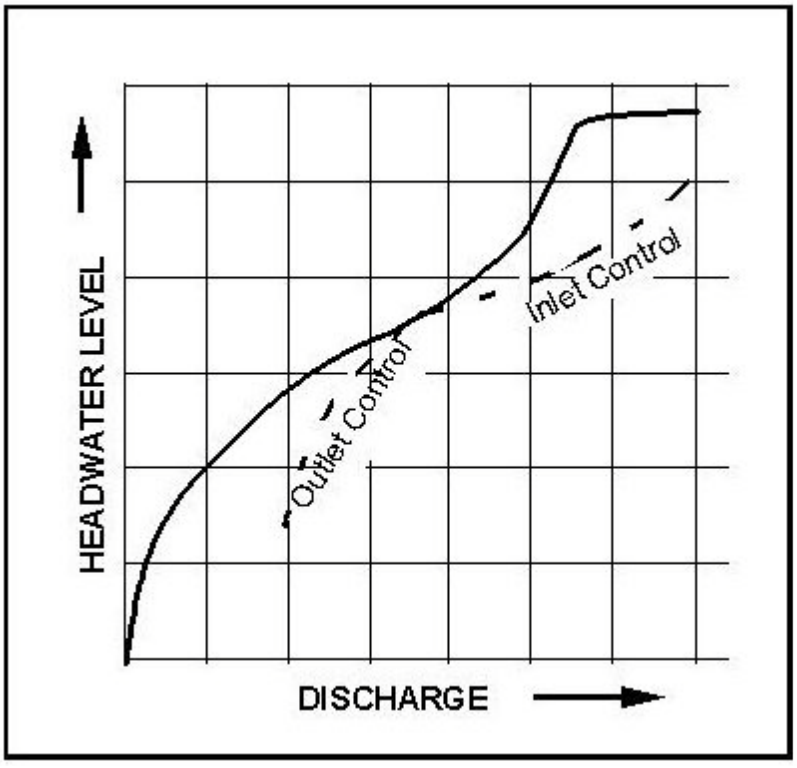


Figure 10.3.14 - Typical Performance Curve

(Source TxDOT, Hydraulic Design Manual, 2011)

10.3.15 Exit Loss Considerations

An exit loss should be considered at the hydraulic interface between the tail water and the culvert outlet. The exit loss coefficient varies from one-half (0.5) to one (1). The starting hydraulic grade line (H_o) at the interface between the outside and inside of the culvert outlet is based on Equation 10.3.15.a below.

(Equation 10.3.15.a)

$$H_o = TW + \frac{v_{TW}^2}{2g} + h_o - \frac{v_o^2}{2g}$$

H_o = outlet depth - depth from the culvert flow line to the hydraulic grade line inside the culvert at the outlet (ft.)
v_o = culvert outlet velocity (fps)
v_{TW} = velocity in outfall (tail water velocity) (fps)
h_o = exit loss (ft.)

(Equation 10.3.15.b)

$$h_o = K\frac{v_o^2 - v_{TW}^2}{2g}$$

K = loss coefficient which typically varies from 0.5 to 1

10.3.16 Materials and Specifications

10.3.16.1 Pipe Material

The pipe material selected must meet all the requirements found in the latest version of the City of San Antonio Standard Specifications. The use of HDPE pipe or PVC will not be allowed crossing under City streets or within street ROW unless approved by the Director of TCI.

Corrugated metal pipe must be checked for corrosion resistance. The use of corrugated metal pipe will not be allowed crossing under City streets or within street ROW unless approval of the Director of TCI. Asphalt lining or bituminous interior coated corrugated metal pipe will not be allowed.

10.3.16.2 Minimum Structural Loads

All roadway crossings, culverts, and bridges shall be designed for an H-20-44 or HS-20 loading. All train crossings, culverts, and bridges shall be designed for a minimum of E80 or as designated by the railroad.

10.3.16.3 Mud Slab

A mud slab is a base slab of low strength concrete used to level up or stabilize the bottom of an excavation for the placement of multiple boxes or other structures. The mud slab is from two (2) to six (6) inches thick, or thicker if needed.

10.3.17 Railing

The design engineer should determine the railing needed for the culvert inlet or outlet. The railing should meet applicable AASHTO, ADA or TAS design standards.

10.3.17.1 Hand Rail

A hand rail should be used on culvert headwalls and wingwalls if the lateral drop-off is more than two (2) feet. If a traffic rail is used on top of the culvert headwall, a hand rail may still be needed on top of the traffic rail where the sidewalk abuts the culvert headwall.

10.3.17.2 Traffic Rail

A traffic rail may be needed if the roadway is not curbed.

If overtopping of the culvert from a design storm is possible, the traffic railing should be design to minimize obstruction to the storm overtopping.

10.3.17.3 Guard Rail

If there are no curb or traffic railing on the culvert headwall, the placement of guard rail should be used to keep vehicular traffic from encountering the lateral drop-offs at the edge of pavement. A guard rail may still be needed if a traffic railing is attached to the culvert headwall due to other conditions at the headwall location.

10.4 Velocity Protection And Control Devices

10.4.1 Excess Velocity

Excess velocity discharge from a culvert to earthen channel or in some instances in concrete lined channel should be minimized with the use of protection or control devices.

10.4.2 Velocity Protection Devices

The velocity protection device used in an earthen channel should not take the place of a velocity control device but may complement a velocity control device.

There are a number of products available to the design engineer to stabilize an earthen channel, including soil retention blankets, articulated concrete blocks, and revetment mattresses. The use of these stabilizing products should be based on the velocity from the culvert outlet structure and the soil erodibility.

10.4.3 Velocity Control Devices

The velocity control device is used to reduce excessive velocity of the culvert outlet to six (6) feet per second or less for earthen channels.

There are a number of control devices that the design engineer can select from. Table 10.4.3 is a list of possible energy dissipators to use on a project. The table has appropriate control device for super critical or subcritical flow. For dissipators not contained within the manual, refer to FHWA Hydraulic Engineering Circular No. 14 for design computations.

Table 10.4.3 Energy Dissipators and Limitations

HEC-14 Chapter	Dissipator Type	Froude Number[a] (Fr)	Allowable Debris[b]			Tailwater (TW)
			Silt/ Sand	Boulders	Floating	
4	Flow transitions	N/A	H	H	H	Desirable
5	Scour hole	N/A	H	H	H	Desirable
6	Hydraulic jump	>1	H	H	H	Required
7	Tumbling flow[c]	>1	M	L	L	Not needed
7	Increased resistance[d]	N/A	M	L	L	Not needed
7	USBR Type IX baffled apron	<1	M	L	L	Not needed
7	Broken-back culvert[d]	>1	M	L	L	Desirable
7	Outlet weir	2–7	M	L	M	Not needed
7	Outlet drop/weir	3.5–6	M	L	M	Not needed
8	USBR Type III stilling basin	4.5–17	M	L	M	Required
8	USBR Type IV stilling basin	2.5–4.5	M	L	M	Required
8	SAF stilling basin	1.7–17	M	L	M	Required
9	CSU rigid boundary basin	<3	M	L	M	Not needed
9	Contra Costa basin	<3	H	M	M	<0.5D
9	Hook basin	1.8–3	H	M	M	Not needed
9	USBR Type VI impact basin[e]	N/A	M	L	L	Desirable
10	Rip-rap basin	<3	H	H	H	Not needed
10	Rip-rap apron	N/A	H	H	H	Not needed
11	Straight drop structure[f]	<1	H	L	M	Required
11	Box inlet drop structure[g]	<1	H	L	M	Required
12	USACE stilling well	N/A	M	L	N	Desirable

[a] *At release point from culvert or channel*
[b] *Debris notes: N = None, L = Low, M = Moderate, H = Heavy*
[c] *Internal: Bed slope must be in the range of 4% <S_o< 25%*
[d] *Internal: Check headwater for outlet control*
[e] *Discharge, Q < 400 ft^3/s and Velocity, V < 50 ft/s*
[f] *Drop <15 ft*
[g] *Drop <12 ft*
N/A = not applicable
Source: FHWA - Hydraulic Design of Energy Dissipators for Culverts and Channels, HEC-14

10.4.3.1 Broken Back Design

TxDOT has a complete design procedure for the use of a broken back culvert. These are used for steep culverts (culvert slope is greater than critical slope) and where the outlet section of the culvert is sufficient length and on a mild slope to make sure that the hydraulic jump occurs within the culvert. See Figures 10.4.3.1.A and 10.4.3.1.B below.

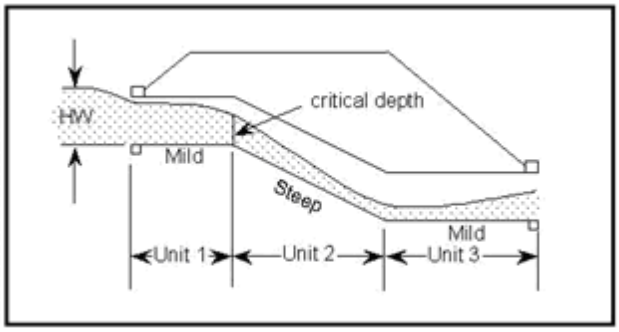


Figure 10.4.3.1.A - Three Unit Broken Back Culvert
(Source TxDOT, Hydraulic Design Manual, 2011)

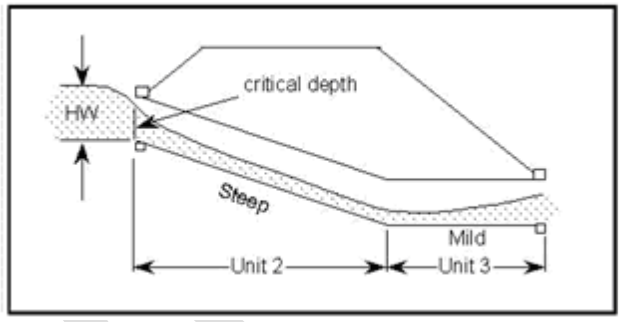


Figure 10.4.3.1.B - Three Unit Broken Back Culvert
(Source TxDOT, Hydraulic Design Manual, 2011)

The maintenance of this design should consider the location of possible silting within the culvert.

10.4.3.2 Stilling Basin

The stilling basin is used as an energy dissipator to trigger a hydraulic jump within the basin. The basin requires a tail water condition. These stilling basins normally operate within Froude numbers from 1.7 to 17. The Saint Anthony Falls (SAF) stilling basin is shown in Figure 10.4.3.2.A on the following page.

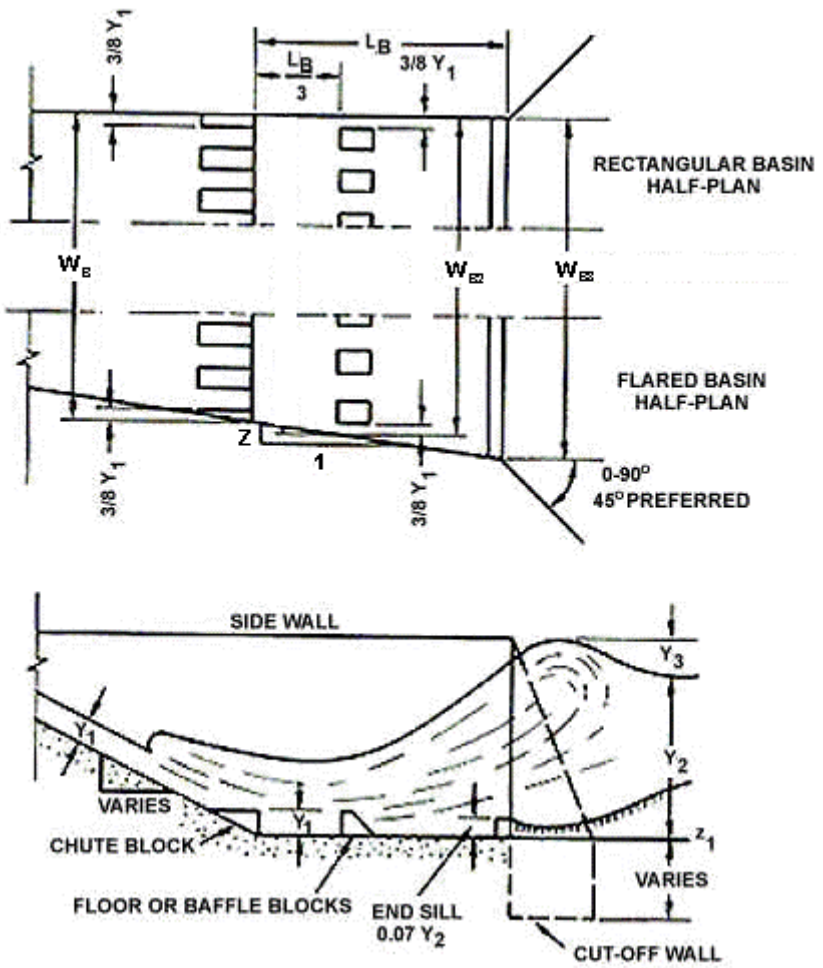


Figure 10.4.3.2.A - SAF Stilling Basin

(Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

The following is for the design of a SAF stilling basin. For the design of other stilling basins, refer to FHWA HEC14.

The following are seven (7) design steps used for a SAF basin.

Step 1. Determine the velocity and depth at the culvert outlet. For the culvert outlet, calculate culvert brink depth (y_o) velocity (V_o) and (Fr_o.) For subcritical flow, use Figure 10.4.3.2.B or Figure 10.4.3.2.C found on the following pages. For supercritical flow, use normal depth in the culvert for y_o. (See FHWA HDS 5 (Normann, et al., 2001) for additional information on culvert brink depths.)

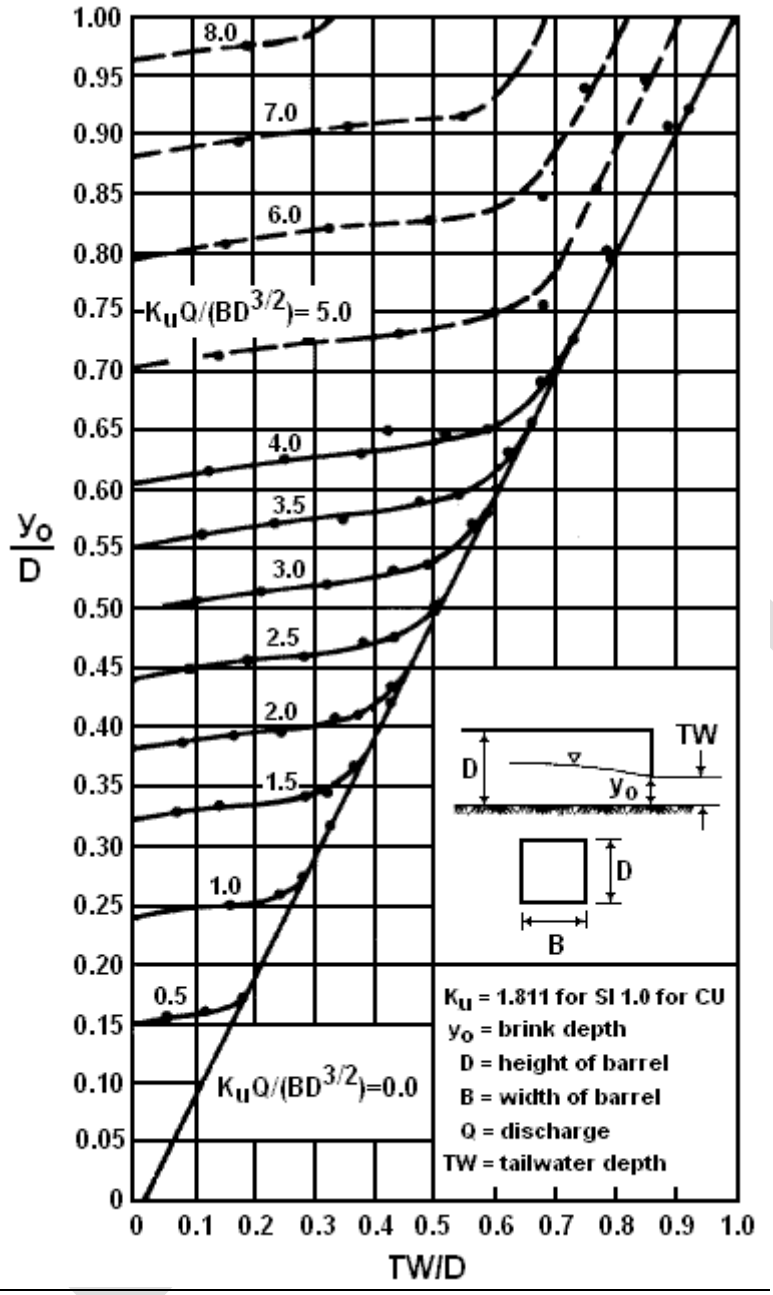


Figure 10.4.3.2.B - Dimensionless Rating Curves for the Outlets of rectangular Culverts on Horizontal and Mild Slopes

(Simnos, 1970, Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

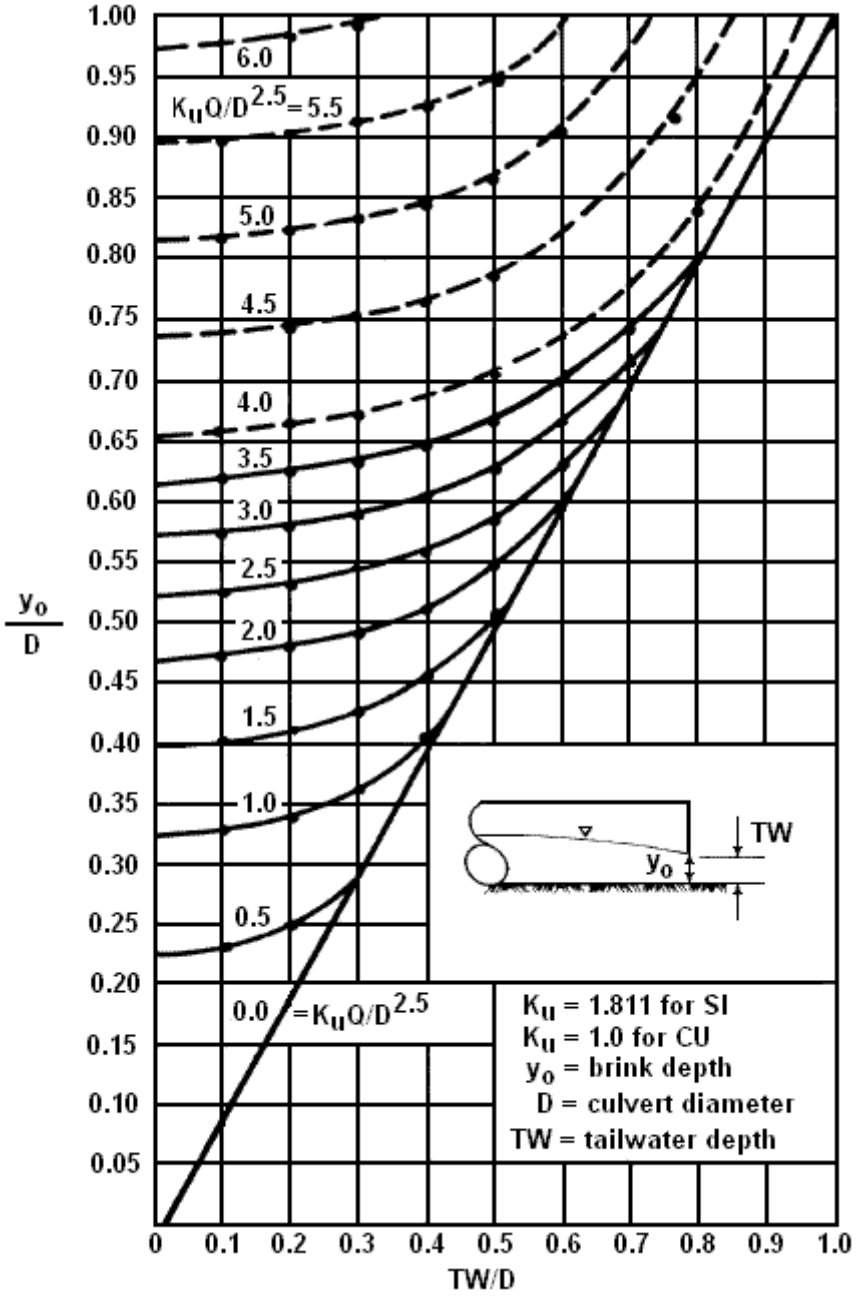


Figure 10.4.3.2.C - Dimensionless Rating Curves for the Outlets of Circular Culverts on Horizontal and Mild Slopes

(Simnos, 1970, Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

Step 2. Determine the velocity and TW depth in the receiving channel downstream of the basin.

Step 3. Estimate the conjugate depth for the culvert outlet conditions using Equation 10.4.3.2.a to determine if a basin is needed. Substitute y_o and Fr_o for y_1 and Fr_1,

respectively. The value of C is dependent, in part, on the type of stilling basin to be designed. However, in this step the occurrence of a free hydraulic jump without a basin is considered so a value of one (1) is used. Compare y2 and TW. If y2 < TW, there is sufficient tail water and a jump will form without a basin. The remaining steps are unnecessary.

(Equation 10.4.3.2.a)

$$y_2 = \frac{C_{TW} y_1}{2}\left(\sqrt{1 + 8Fr_1^2} - 1\right)$$

y_2 = conjugate depth (ft.)
y_1 = depth approaching the jump (ft.)
C_{TW} = ratio of tail water to conjugate depth (TW/y_2)
Fr_1 = approach Froude number

Step 4. The design engineer should select a basin width (W_B). For box culverts, W_B must equal the culvert width (W_o). For circular culverts, the basin width is taken as the larger of the culvert diameter and the value calculated according to the following Equation:

(Equation 10.4.3.2.b)

$$W_B = 1.7 D_o \left(\frac{Q}{g^{0.5} D_o^{2.5}}\right)$$

W_B = basin width (ft.)
Q = design discharge (fps)
D_o = culvert diameter (ft.)

The basin can be flared to fit an existing channel as indicated on Figure 10.4.3.2. The sidewall flare dimension z should not be greater than 0.5, i.e., 0.5:1, 0.33:1, or flatter.

Step 5. Compute conjugate depth (C) is a function of Froude number as given by the following set of equations. Depending on the Froude number, C ranges from 0.64 to 1.08 implying that the SAF basin may operate with less tail water than the USBR basins, though tail water is still required.

(Equation 10.4.3.2.c – When $1.7 < FR_1 < 5.5$**)**

$$C = 1.1 - \frac{Fr_1^2}{120}$$

(Equation 10.4.3.2.d – When $5.5 < FR_1 < 11$**)**

$$C = 0.85$$

(Equation 10.4.3.2.e – When $11 < FR_1 < 17$**)**

$$C = 1.0 - \frac{Fr_1^2}{800}$$

The determination of the basin length, L_B, using Equation 10.4.3.2.f below.

(Equation 10.4.3.2.f)

$$L_B = \frac{4.5 y_2}{C Fr_1^{0.76}}$$

Step 6. Determine the needed radius of curvature for the slope changes entering the basin using Equation 10.4.3.2.g found below. The design engineer should determine if this step is required for the transition between the channel or culvert at the top of the drop to the transition slope and from the transitions slope to the bottom of the stilling basin floor. The curved slope change would provide improved flow conditions at the top and bottom of the drop.

If the transition slope is 1H:0.5V or steeper, use a circular curve at the transition with a radius defined by Equation 10.4.3.2.g (Meshgin and Moore, 1970). It is also advisable to use the same curved transition going from the transition slope to the stilling basin floor.

(Equation 10.4.3.2.g)

$$r = \frac{y}{e^{\frac{1.5}{Fr^2}} - 1}$$

r = radius of the curved transition (ft.)
Fr = Froude number
y = depth approaching the curvature (ft.)

For the curvature between the culvert outlet and the transition, the Froude number and depth are taken at the culvert outlet. For the curvature between the transition and the stilling basin floor, the Froude number and depth are taken as Fr_1 and y_1.

Step 7. Sizing the basin elements (chute blocks, baffle blocks, and an end sill), the following guidance is recommended. The height of the chute blocks (h_1) is set equal to y_1.

The number of chute blocks is determined by Equation 10.4.3.2.h, below, rounded to the nearest integer.

(Equation 10.4.3.2.h)

$$N_c = \frac{W_B}{1.5 y_1}$$

N_c = number of chute blocks

Block width and block spacing are determined by the equation on the following page:

(Equation 10.4.3.2.i)

$$W_1 = W_2 = \frac{W_B}{2N_c}$$

W_1 = block width (ft.)
W_2 = block spacing (ft.)

Equations 10.4.3.2.h and 10.4.3.2.i will provide N_c blocks and N_c spaces between those blocks. A one-half block (.05) is placed at the basin wall so there is no space at the wall. The height, width, and spacing of the baffle blocks are shown in Figure 10.4.3.2.A. The height of the baffles (h_3) is set equal to the entering flow depth (y_1). The width and spacing of the baffle blocks must account for any basin flare. If the basin is flared as shown in Figure 10.4.3.2.A, the width of the basin at the baffle row is calculated according to the following equation:

(Equation 10.4.3.2.j)

$$W_{B2} = W_B + \left(\frac{2zL_B}{3}\right)$$

W_{B2} = basin width at the baffle row (ft.)
L_B = basin length (ft.)
z = basin flare, z:1 as defined in Figure 10.4.3.2.A (z=0.0 for no flare)

The top thickness of the baffle blocks should be set at $0.2h_3$ with the back slope of the block on a 1:1 slope. The number of baffles blocks is calculated using the following equation :

(Equation 10.4.3.2.k)

$$N_B = \frac{W_{B2}}{1.5 y_1}$$

N_B = number of baffle blocks (rounded to an integer)

Baffle width and spacing are determined using the following equation:

(Equation 10.4.3.2.l)

$$W_3 = W_4 = \frac{W_{2B}}{2N_B}$$

W_3 = baffle width (ft.)
W_4 = baffle spacing (ft.)

Equations 10.4.3.2.k and 10.4.3.2.l will provide N_B baffles and N_B-1 spaces between those baffles. The remaining basin width is divided equally for spaces between the outside baffles and the basin sidewalls. No baffle block should be placed closer to the sidewall than $3y_1/8$. Verify that the percentage of W_{B2} obstructed by baffles is between forty and fifty-five percent (40-55%). The distance from the downstream face of the chute blocks to the upstream face of the baffle block should be LB/3.

The height of the final basin element is calculated using the following equation:

(Equation 10.4.3.2.m)

$$h_4 = \frac{0.07y_2}{C}$$

h_4 = height of the end sill (ft.)

The end sill will extend across the basin.

Wingwalls should be equal in height and length to the stilling basin sidewalls. The top of the wingwall should have a 1H:1V slope. Flaring wingwalls are preferred to perpendicular or parallel wingwalls. The best overall conditions are obtained if the triangular wingwalls are located at an angle of forty-five degrees (45°) to the outlet centerline.

The stilling basin sidewalls may be parallel (rectangular stilling basin) or diverge as an extension of the transition sidewalls (flared stilling basin). The height of the sidewall above the floor of the basin is given by the equation below :

(Equation 10.4.3.2.n)

$$h_5 \geq y_2\left(1+\frac{1}{3C}\right)$$

h_5 = height of the sidewall (ft.)

A cutoff wall should be used at the end of the stilling basin to prevent undermining. The depth of the cutoff wall must be greater than the maximum depth of anticipated erosion at the end of the stilling basin. The cutoff wall, toe down, to be a minimum depth of twenty-four (24) inches.

10.4.3.3 Contra Costa Basin

The Contra Costa Basin could be used for a culvert outlet with some tail water. The Contra Costa Basin was developed at the University of California, Berkeley, in conjunction with the Contra Costa County, California. This basin is best suited to where the depth of flow at the outlet is equal to one-half (0.5) the culvert height.

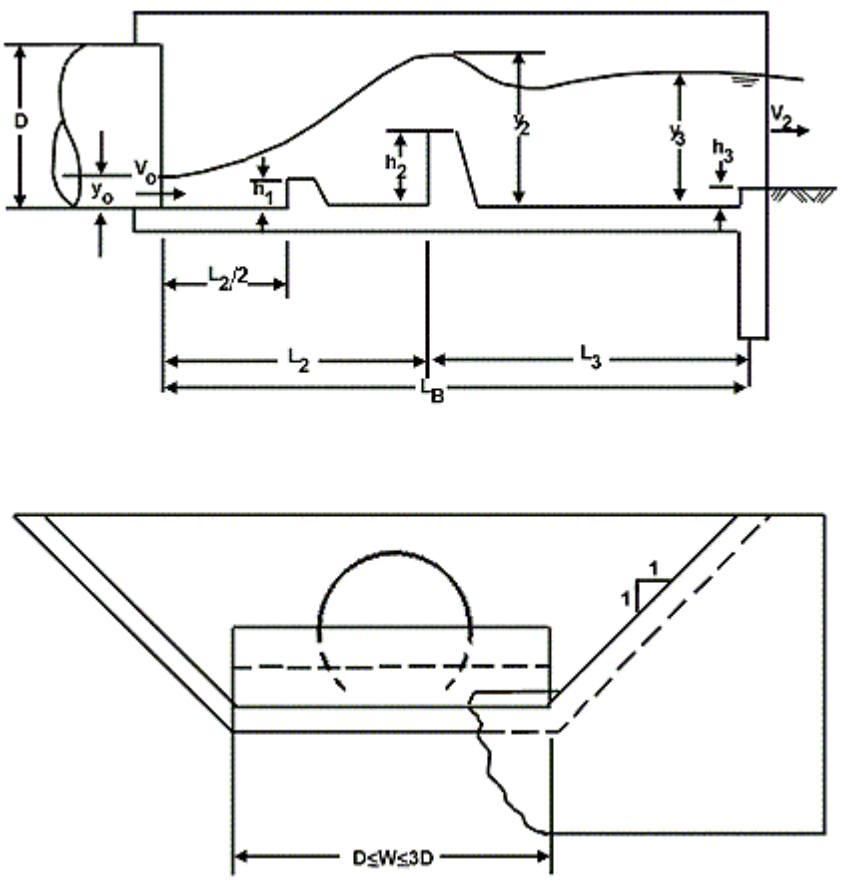


Figure 10.4.3.3.A - Contra Costa Basin (Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

The following equation was tested with L_2/h_2 ratios from 2.5 to 7, and is in terms of culvert exit velocity (Vo) and depth (yo) for a circular culvert.

(Equation 10.4.3.3.1)

$$\frac{L_2}{h_2} = 1.2Fr^2\left(\frac{h_2}{y_o}\right)^{-1.83}$$

y_o = outlet depth (ft.)
V_o = outlet velocity (ft/s)
Fr = $Vo/(g\ y_o)^{1/2}$
h_2 = height of large baffle (ft.)
L_2 = length from culvert exit to large baffle (ft.)

The following are steps for designing a Contra Costa basin:

Step 1. Determine the flow conditions at the outfall of the culvert for the design discharge. If the depth of flow at the outlet, y_o, is D/2 or less, the Contra Costa basin is applicable.

Step 2. Compute equivalent depth, y_e, and Froude number, Fr.

y_e = y_o for rectangular culvert
y_e = (A/2)1/2 for other shapes
Fr = $V_o / (g y_e)1/2$

Step 3. The width of the basin floor, W_B, is selected to conform to the natural channel, but must be $1W_o$ to $3W_o$. If there is no defined channel, the width should be no greater than 3 times the culvert width. The basin side slopes should be 1:1.

Step 4. Assume a value of L_2/h_2 between 2.5 and 7. If L_2/h_2 = 3.5, use Equation 10.4.3.3.3 to determine h_2. Use Equation 10.4.3.3.2-A or Equation 10.4.3.3.2-B for other values. Calculate L_2 = 3.5 h_2. Calculate the first baffle height, h_1 = 0.5h_2 and position, L_1 = 0.5L_2.

The following equation is generalized from the previous equation for other shapes by substituting y_e (equivalent flow depth) for y_o.

(Equation 10.4.3.3.2-A)

$$\frac{L_2}{h_2} = 1.35 Fr^2 \left(\frac{h_2}{y_e}\right)^{-1.83}$$

(Equation 10.4.3.3.2-B)

$$\frac{h_2}{y_e} = \left(\frac{1.35 Fr^2}{\frac{L_2}{h_2}}\right)^{0.546}$$

y_e = equivalent depth, $(A/2)^{1/2}$ (ft.)
A = outlet flow area (ft^2)
V_o = outlet velocity (ft./s)
Fr = $V_o/ (g\ y_e)^{1/2}$

With use of recommended L_2/h_2 = 3.5 value, we get:

(Equation 10.4.3.3.3)

$$\frac{h_2}{y_e} = 0.595 Fr^{1.092}$$

Step 5. Determine the length from the large baffle to the end sill (L_3) using Equation 10.4.3.3.4 below. If necessary, repeat the procedure until a dissipator is defined which optimizes the design requirements.

(Equation 10.4.3.3.4)

$$\frac{L_3}{L_2} = 3.75\left(\frac{h_2}{L_2}\right)^{0.68}$$

The height of the small baffle (h_1) is one-half (0.5) the height of the large baffle (h_2). The position of the small baffle is half way between the culvert outlet and the large baffle or $L_2/2$. The height of the end sill (h3) may vary from $0.06y_2$ to $0.10y_2$.

For basins with $W_b/W_o = 2$ (end width is twice the outlet width), an approximate maximum water surface depth (y2) without tail water, can be obtained by using the

(Equation 10.4.3.3.5)

$$\frac{y_2}{h_2} = 1.3\left(\frac{L_2}{h_2}\right)^{0.36}$$

Step 6. Estimate the approximate maximum water surface depth without tail water (y_2) using the above Equation 10.4.3.3.5 which is for $W_B = 2W_o$. Set the end sill height, h_3, between $0.06y_2$ and $0.1y_2$. If the above dimensions are compatible with the topography at the site, the dimensions are final. If not, a different value of L_2/h_2 is selected and the design procedure repeated.

Step 7. Determine the basin exit depth, $y_3 = y_c$ and exit velocity, $V_2 = V_c$. $Q^2/g = (A_c)^3/T_c = [y_c(W_B + y_c)]^3/(W_B + 2y_c)$ (substituting for A_c and T_c using the properties of a trapezoid).

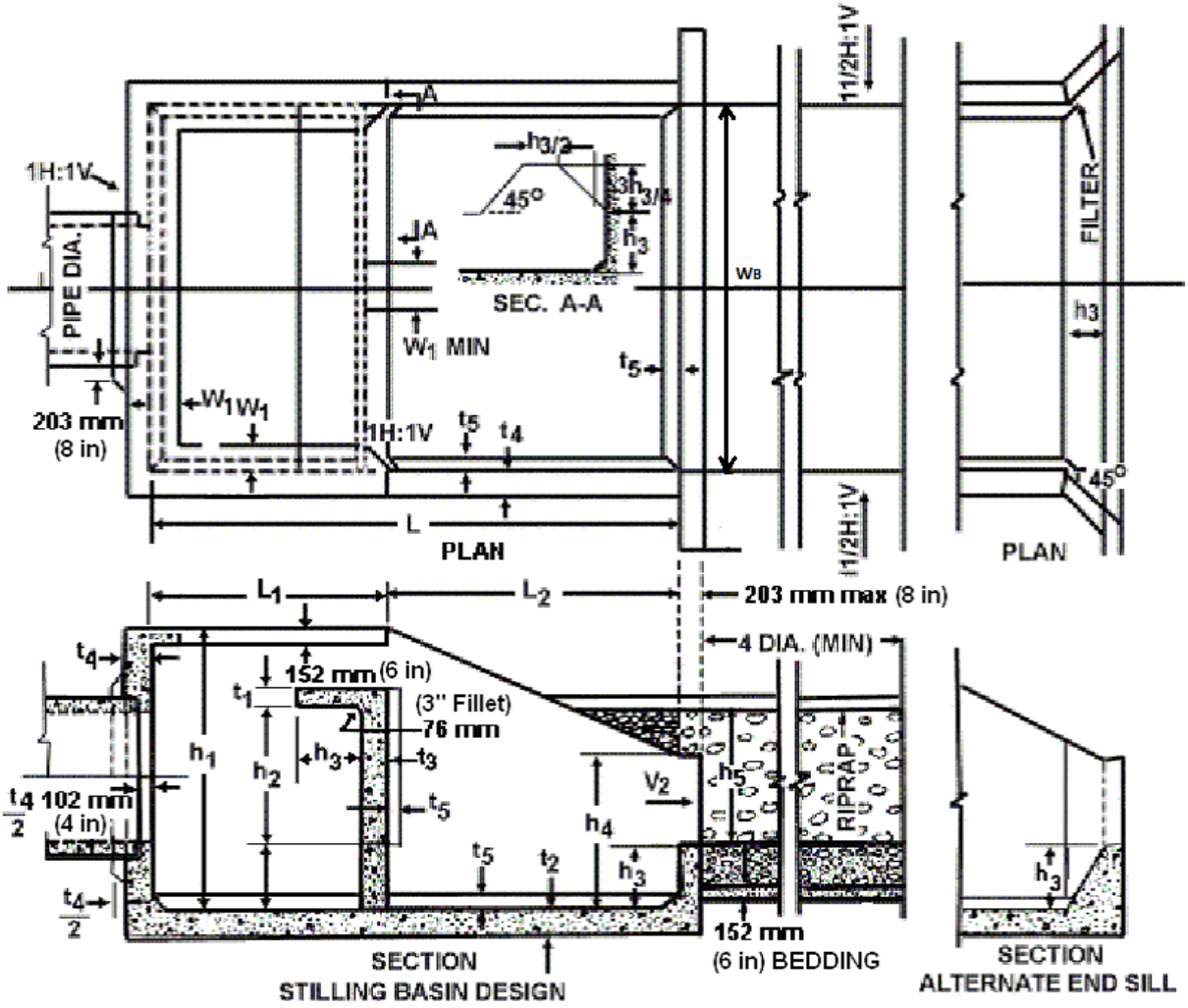
$V_c = Q/A_c$

Step 8. Riprap may be necessary downstream especially for the low tail water cases. Two (2) or three (3) foot toe down is a recommended minimum.

10.4.3.4 USBR Type VI Impact Basin

The U.S. Bureau of Reclamation Type VI impact basin requires no tail water to function. The outflow hits the vertical hanging baffle and provides the necessary energy dissipation.

Figure 10.4.3.4.A - USBR Type VI Impact Basin



(Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

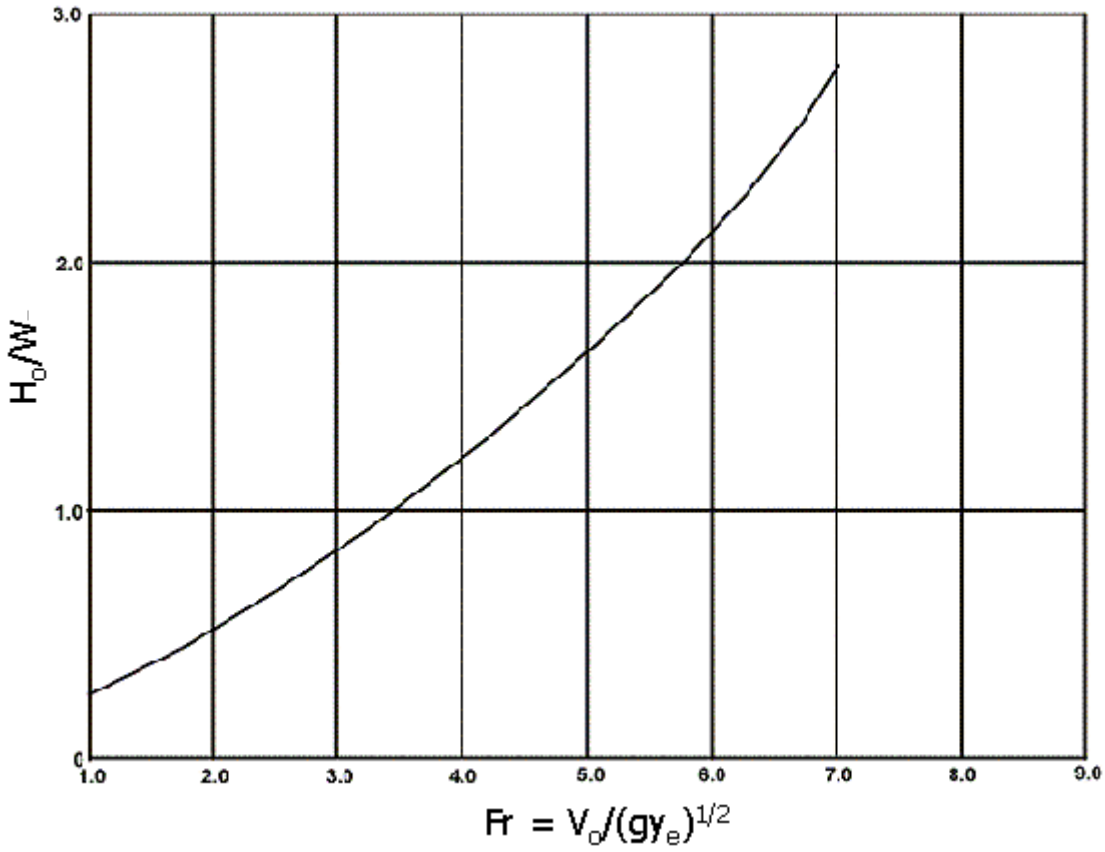


Figure 10.4.3.4.B - Design Curve for USBR Type VI Impact Basin
(Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

Table 10.4.3.4. - USBR Type VI Impact Basin Dimensions (ft)

(Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

W_B	h_1	h_2	h_3	h_4	L	L_1	L_2
4	3.08	1.50	0.67	1.67	5.42	2.33	3.08
5	3.83	1.92	0.83	2.08	6.67	2.92	3.83
6	4.58	2.25	1.00	2.50	8.00	3.42	4.58
7	5.42	2.58	1.17	2.92	9.42	4.00	5.42
8	6.17	3.00	1.33	3.33	10.67	4.58	6.17
9	6.92	3.42	1.50	3.75	12.00	5.17	6.92
10	7.58	3.75	1.67	4.17	13.42	5.75	7.58
11	8.42	4.17	1.83	4.58	14.58	6.33	8.42
12	9.17	4.50	2.00	5.00	16.00	6.83	9.17
13	10.17	4.92	2.17	5.42	17.33	7.42	10.17
14	10.75	5.25	2.33	5.83	18.67	8.00	10.75
15	11.50	5.58	2.50	6.25	20.00	8.50	11.50
16	12.25	6.00	2.67	6.67	21.33	9.08	12.25
17	13.00	6.33	2.83	7.08	21.50	9.67	13.00
18	13.75	6.67	3.00	7.50	23.92	10.25	13.75
19	14.58	7.08	3.17	7.92	25.33	10.83	14.58
20	15.33	7.50	3.33	8.33	26.58	11.42	15.33

W_B	W_1	W_2	t_1	t_2	t_3	t_4	t_5
4	0.33	1.08	0.50	0.50	0.50	0.50	0.25
5	0.42	1.42	0.50	0.50	0.50	0.50	0.25
6	0.50	1.67	0.50	0.50	0.50	0.50	0.25
7	0.50	1.92	0.50	0.50	0.50	0.50	0.25
8	0.58	2.17	0.50	0.58	0.58	0.50	0.25
9	0.67	2.50	0.58	0.58	0.67	0.58	0.25
10	0.75	2.75	0.67	0.67	0.75	0.67	0.25
11	0.83	3.00	0.67	0.75	0.75	0.67	0.33
12	0.92	3.00	0.67	0.83	0.83	0.75	0.33
13	1.00	3.00	0.67	0.92	0.83	0.83	0.33
14	1.08	3.00	0.67	1.00	0.92	0.92	0.42
15	1.17	3.00	0.67	1.00	1.00	1.00	0.42
16	1.25	3.00	0.75	1.00	1.00	1.00	0.50
17	1.33	3.00	0.75	1.08	1.00	1.00	0.50
18	1.33	3.00	0.75	1.08	1.08	1.08	0.58
19	1.42	3.00	0.83	1.17	1.08	1.08	0.58
20	1.50	3.00	0.83	1.17	1.17	1.17	0.67

The recommended design procedure for the USBR Type VI impact basin is as follows:

Step 1. Determine the maximum discharge (Q (cfs)) and velocity (V_o (ft./s) and check against design limits. Calculate the flow area at the end of the approach pipe, A (ft^2). Calculate equivalent depth, $y_e = (A/2)^{1/2}$ (ft).

$$\mathbf{A = {Q}/{V_o}}$$

$$\mathbf{y_e = \left({A}/{2}\right)^{1/2}}$$

Step 2. Calculate the Froude number (Fr) and the energy at the end of the pipe (H_o (ft)).

$$\mathbf{Fr = {V_o}/{(gy_e)^{1/2}}}$$

$$\mathbf{H_o = y_e + {V_o}^2/(2g)}$$

Step 3. Determine H_o/W_B from Figure 10.4.3.4.B. Calculate the required width of basin (W_B (ft)).

$W_B = H_o / (H_o/ W_B)$

Step 4. Obtain the remaining dimensions of the USBR Type VI impact basin from Table 10.4.3.4 using W_B obtained from Step 3.

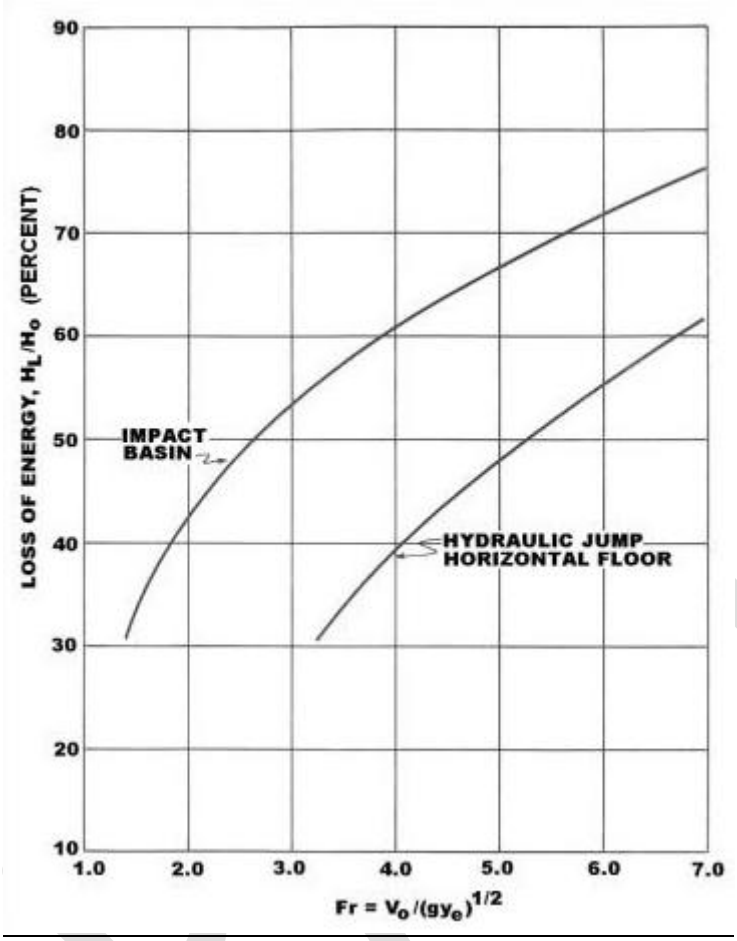


Figure 10.4.3.4.C - Energy Loss of USBR Type VI Impact Basin versus Hydraulic Jump
(Source FHWA, Hydraulic Design of Energy Dissipators for Culverts and Channels, 2006)

Step 5. Determine exit velocity, $V_B = V_2$, by trial and error using an energy balance between the culvert exit and the basin exit. Determine if this velocity is acceptable and whether or not riprap protection is needed downstream. Use Figure 10.1.3.4.C to determine H_L/H_o percent by using the calculated Fr from Step 2. $H_B = Q/(W_B V_B) + V_B^2/(2g) = H_o(1 - H_L/H_o)$

This equation is a cubic equation yielding three (3) solutions, two (2) positive and one (1) negative. The negative solution is discarded. The two positive roots yield a subcritical and supercritical solution. Where low or no tail water exists, the supercritical solution is taken. Where sufficient tail water exists, the subcritical solution is taken.

10.4.3.5 Baffle Blocks

Baffle blocks should be used to reduce the subcritical velocity to six (6) feet per second or less. A minimum of two (2) rows of block should be used. The distance from the culvert to

the first row of blocks should be a minimum of the culvert height. The height of blocks should be a minimum of one (1) foot or critical depth (d_c). The width of the block and spacing of blocks should match the height of block. The second row of blocks should be offset so the block lines up with the spacing of the first row of blocks. The blocks should extend across the total bottom width of the culvert outlet structure.

10.5 Special Applications - Detours

10.5.1 Detour culverts

A detour route may be required during the reconstruction of an existing roadway. The detour route is a temporary relocation of the road during construction. If an existing roadway has a culvert crossing to be reconstructed, the detour roadway culverts should have the same conveyance as the existing crossing as a minimum. The design should also consider soil protection of the embankment to prevent erosion around the culverts and the temporary roadway.

10.5.2 Risk

The detour stream crossing is usually design to a lower frequency storm. The design engineer should consider a number of risk factors for the hydraulic design of the culverts. The risk factors to be considered during the design should include the probability of flooding during the use of the detour, the risk to life and property from backwater and washouts, traffic requirements, school bus routes, and emergency routes.

The following equation relates the probability of occurrence to the flood event.

(Equation 10.5.2)

$$\mathbf{R = 1 - (1 - AEP)^n}$$

R = Risk – probability of occurrence
AEP = Annual Exceedance Probability of the flood event
n = length of time required for the detour (year)

The above equation generated the curves in Figure 10.5.2. The figure represents the risk versus flood event. As an example, if you were to design the detour culverts for a five (5)-year storm (20% AEP) and the project construction length was one (1)-year, the odds are four to one (4:1) against the occurrence, or twenty percent (20%) risk. If you design the detour culverts for a ten (10)-year storm (10% AEP) with the same project length, then the odds are nine to one (9:1) against the occurrence or ten percent (10% risk). Designing to a higher frequency storm will lower the risk of flood occurrence.

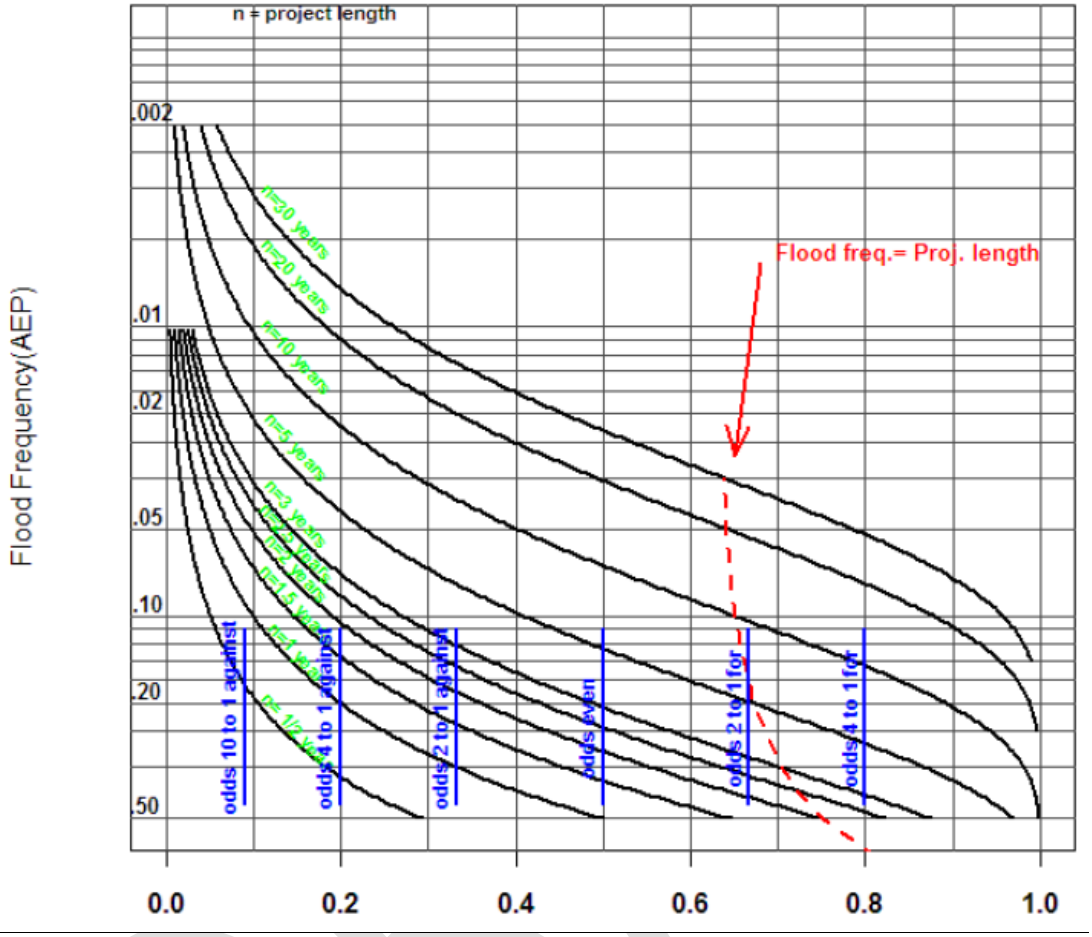


Figure 10.5.2 - Flood Frequency vs. Risk
(Source TxDOT, Hydraulic Design Manual, 2011)

10.5.3 Engineering Requirements

Should a detour road be required for a project and the detour crosses over a low requiring a culvert, the licensed engineer should design the detour road culverts.

10.6 References

10.6.1 Reference Citations

A. TXDOT. Culverts. Chapter 8 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised 2011. (Accessed April 2014)

B. FHWA. *Hydraulic Design of Energy Dissipators for Culverts and Channels*. Hydraulic Engineering Circular No. 14. 3rd edition. FHWA-NHI-06-086. Federal Highway Administration, Department of Transportation, Washington, DC, July 2006.

10.6.2 References

- TXDOT. Culverts. Chapter 8 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised 2011. (Accessed April 2014)
- FHWA. *Hydraulic Design of Energy Dissipators for Culverts and Channels*. Hydraulic Engineering Circular No. 14. 3rd edition. FHWA-NHI-06-086. Federal Highway Administration, Department of Transportation, Washington, DC, July 2006.

BRIDGES

11.1 Introduction

The function of a bridge is similar to a culvert, in that it is to convey surface water under a highway, railroad, or other embankment. This chapter describes the hydraulic aspects of bridge design, construction and operation of bridges, and makes references to structural aspects only as they are related to the hydraulic design. The hydraulic design must consider channel and abutment scour at different bridge components. Also impact from floating debris must be considered for the structural design of the bridge components.

Where proposed streets cross existing or proposed watercourses, all-weather crossings shall be required. Bridges shall be adequate to allow passage of the design storm identified in Section 11.3.1 of this chapter.

11.2 Hydraulics Of Bridges

The design engineer will analyze both existing and proposed bridges. The HEC-RAS model is recommended to analyze a bridge. Other models may be used with the approval of the Director of TCI.

A proposed bridge may increase the depth of flow upstream of the encroachment. Modifications of the channel downstream and upstream of the proposed bridge may be needed to reduce the upstream impact. A drainage easement, meeting the requirements of Chapter 15, should encompass any channel improvement needed for the bridge and increase in water surface.

Section 1 should be located downstream of the bridge at a point where the expansion of flow from the bridge is expected to occur. Section 2 should be located a short distance downstream of the bridge. Section 3 should be located a short distance upstream of the bridge. Ineffective flow areas should be placed on section 2 and 3 to represent the roadway embankment. Section 4 should be located upstream of the bridge at a point where the start of contraction is expected to occur.

Typical contraction and expansion values at bridge sections is 0.3 and 0.5 respectively. Abrupt transitions will have higher values. The contraction and expansion values should be used on Sections 2, 3, and 4.

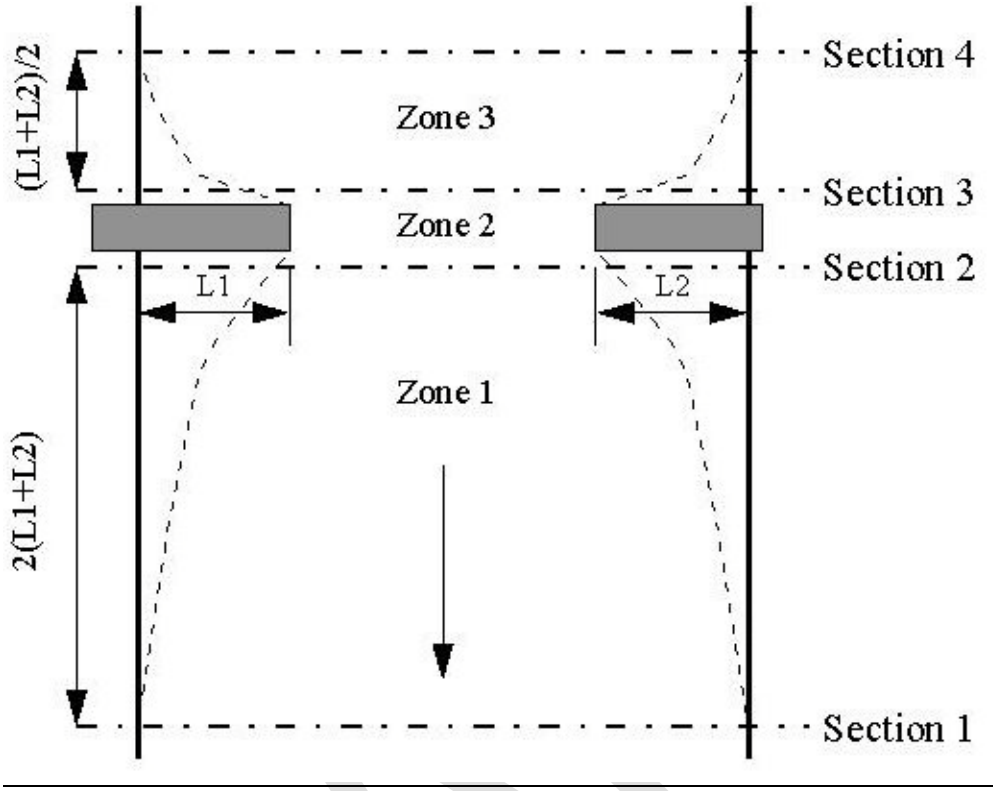


Figure 11.2 - Cross Section Locations at Bridge or Culvert
(Source TxDOT Hydraulic Design Manual)

11.2.1 Low Flow

There are three (3) classes of flow for low flow conditions. Low flow exists when the water surface is below the low chord of the bridge opening. See Figure 11.2.1.

Class A low flow exists when the water surface is subcritical from Sections 1 to 4.

There are four (4) methods available between sections 2 and 3. These methods are energy equation, momentum balance, Yarnell equation, and FHWA WSPRO method.

Class B low flow exists when the water surface passes through critical depth within the bridge constriction between section 2 and 3. The flow upstream and downstream of the bridge can be either subcritical or supercritical.

Class C low flow exists when the water surface is supercritical from section 1 to 4.

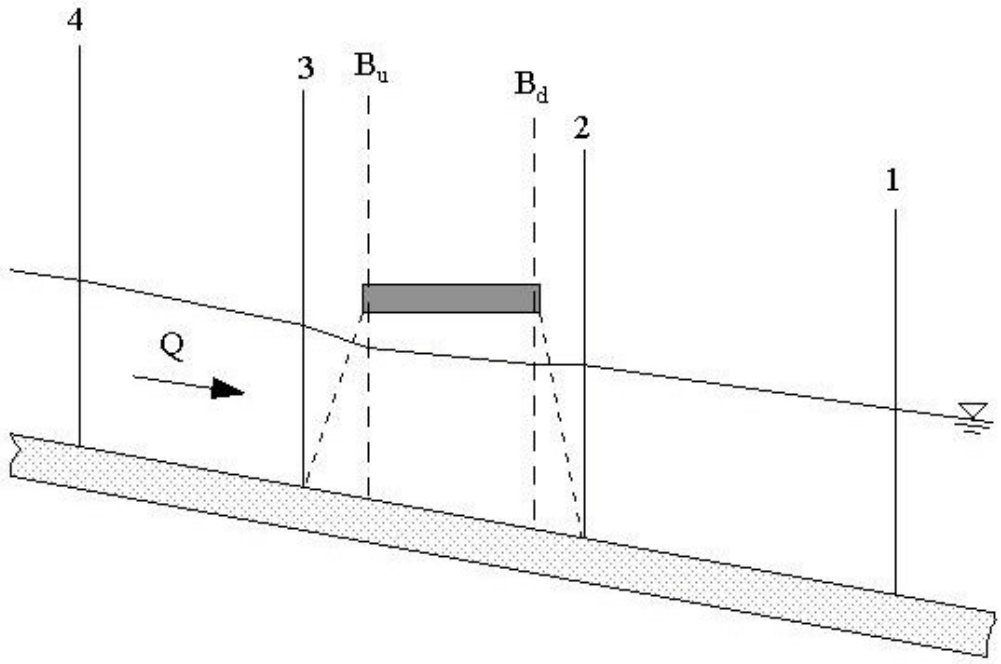


Figure 11.2.1 - Bridge Profile with Cross Section Location
(Source TxDOT Hydraulic Design Manual)

11.2.2 High Flow

High flow exists when the water surface comes into contact with the maximum low chord of the bridge opening. The computation would be by the Energy equation or by hydraulic equations for pressure and or weir flow.

11.2.2.1 Energy Equation

This method is based on balancing the energy equation in three (3) steps through the bridge. These steps are energy losses based on the friction losses along the channel, contraction losses on the upstream side of the bridge, and expansion losses on the downstream side of the bridge.

11.2.2.2 Pressure and Weir Flow

Pressure flow occurs when the upstream water surface comes in contact with the low cord of the bridge and a backwater conditions occur. If the downstream side of the bridge low cord is not in contact with the bridge, then a sluice gate type of equation is used (FHWA, 1978). See Figure and Equation 11.2.2.2A on the following page.

(Equation 11.2.2.2A)

$$\mathbf{Q = CA_b\left[2g\left(y_3 - \frac{D_b}{2} + \alpha_3\frac{v_3^2}{2g}\right)\right]^{0.5}}$$

Q = Total discharge through the bridge opening (ft.^{3}/s)
C = Coefficients of discharge for pressure flow
$\mathbf{A_b}$ = Net area of the bridge opening at section BU (ft.^{2})
$\mathbf{y_3}$ = Hydraulic depth at section 3
$\mathbf{D_b}$ = Vertical distance from maximum bridge low chord to the mean river bed elevation at section BU (ft.)
g = Gravitational acceleration (32.2 ft./s^2)
$\boldsymbol{\alpha_3}$ = kinetic energy correction coefficient (FHWA HDS-1 1978)
$\mathbf{v_3}$ = Velocity upstream at section 3

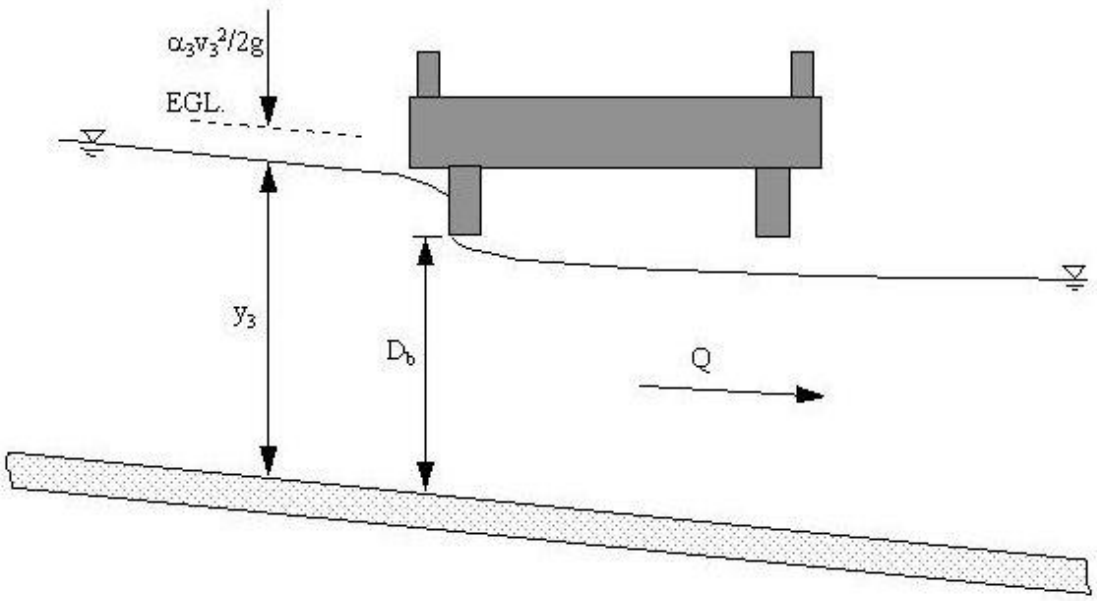


Figure 11.2.2.2.A - Sluice Gate Type Pressure Flow
(Source TxDOT Hydraulic Design Manual)

The orifice equation will be used if both up and downstream of the bridge are submerged. See Figure 11.2.2.2B on the following page.

(Equation 11.2.2.2B)

$$\mathbf{Q = CA(2gH)^{0.5}}$$

C = Coefficient of discharge for fully submerged pressure flow. Typical value of C is 0.8

H = The difference between the energy gradient elevation upstream and the water surface elevation downstream (ft.)

A = Net area of the bridge opening (ft^2)

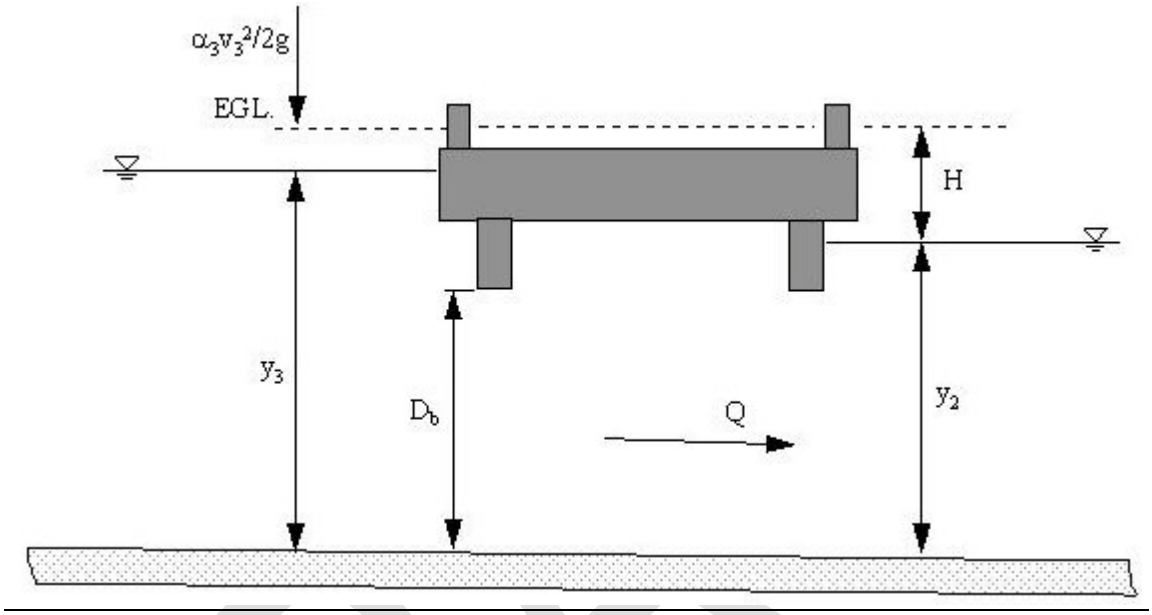


Figure 11.2.2.2.B - Orifice Type Pressure Flow
(Source TxDOT Hydraulic Design Manual)

Should flow be over the bridge and the roadway approaching the bridge, then the standard weir equation is used to calculate flow. See Figure 11.2.2.2.C.

(Equation 11. 2.2.2C)

$$\mathbf{Q = CLH^{3/2}}$$

Q = Total flow over the weir ($ft.^3/s$)

C = Coefficients of discharge for weir flow

L = Effective length of the weir (ft.)

H = Difference between energy upstream and road crest (ft.)

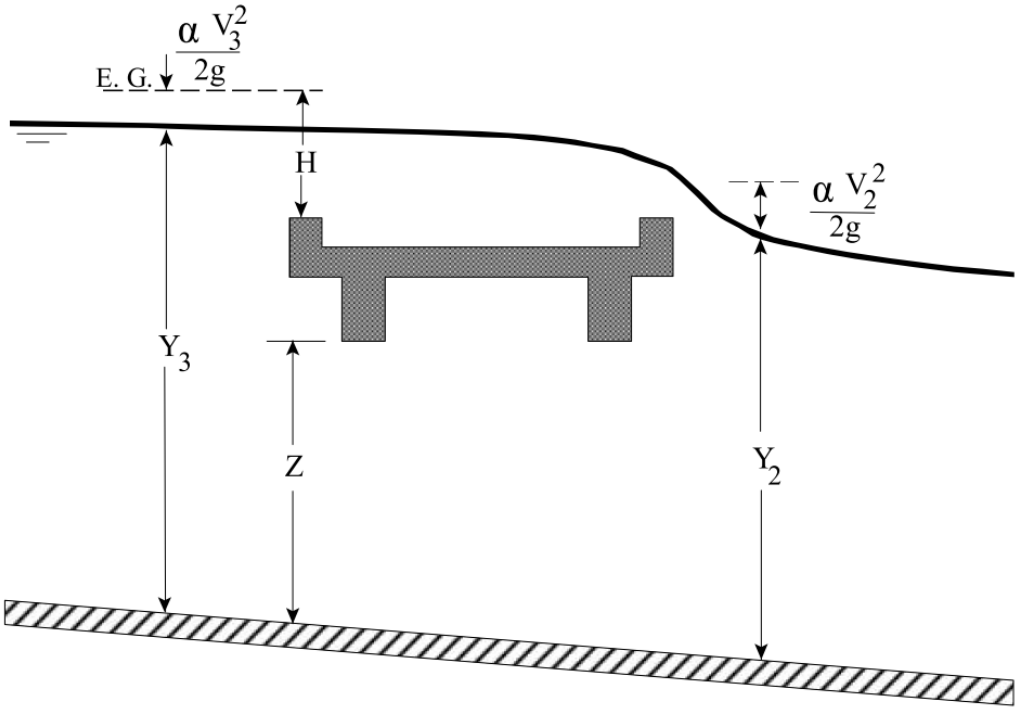


Figure 11.2.2.2.C - Pressure and Weir Flow
(Source USACE HEC-RAS Reference Manual)

For more information regarding hydraulic computations, refer to USACE HEC-RAS Reference Manual.

11.3 Design Guidelines

11.3.1 Design Frequency

The design frequency for bridges is the ultimate twenty-five (25) year storm for upstream drainage area less than one hundred (100) acres with a freeboard based on section 11.3.2 or the ultimate one hundred (100) year storm for upstream drainage area greater than one hundred (100) acres.

11.3.2 Freeboard

Freeboard at a bridge is the vertical distance between the design water surface elevation and the low-chord of the bridge. The bridge low-chord is the lowest portion of the bridge deck superstructure. The purpose of freeboard is to provide room for the passage of floating debris, extra area for conveyance in the event that debris build-up on the piers reduces hydraulic capacity of the bridge, and a factor of safety against the occurrence of waves or floods larger than the design flood. The minimum freeboard is one (1) foot for the ultimate one hundred (100) year storm. For drainage areas less than one hundred (100) acres, the

ultimate twenty-five (25) year storm freeboard will range from 6" to 1 ft depending on channel depth please refer to Table 9.3.14.

11.3.3 Supercritical Flow

For supercritical flow conditions in a stream or channel, the design engineer should confirm that the bridge opening is clear of bridge piers or other projections and does not impact the flow. If bridge piers or other projections are within the bridge opening, then hydraulic jumps within the bridge structure should be considered and the impacts should be included in the bridge design.

11.3.4 Scour

Consideration of the scour of soil around a bridge from a storm event(s) is critical to the longevity of the structure. The total scour at a bridge crossing is comprised of three (3) components. These are long term aggradations and degradation, contraction scour, and local scour at piers and abutments. The long term aggradations and degradation should be checked to determine the additional stream bed losses that may impact the bridge scour analysis.

Bridge scour analysis for contraction scour and local scour at piers and abutments must be performed using the HEC-RAS model or other modeling that has been approved by the Director of TCI. Scour analysis will not be needed if the channel is concrete lined.

For slope protection at abutments should be checked, after performing the scour analysis, for slope stability and sliding of the slope protection. The slope protection could impact the stability of the bridge.

11.3.5 Minimum Clear Height

The design engineer should consider the minimum clear height from the channel bottom to the bottom of the bridge beams to be six (6) feet. Additional height should be considered for passage of maintenance vehicles under the bridge to minimize the number of channel access ramps.

11.3.6 Bridge Deck Drains

Bridge deck drains should achieve the following:

- Minimize the spread of water into the traffic lanes
- Prevent the accumulation of significant depth of water to reduce hydroplaning
- Integration of the drain into the structural deck
- Reduce drain hazards to bicyclists
- Maintenance of the deck drains
- Provide sufficient longitudinal grade
- Avoid zero longitudinal grade and sag vertical curves on the bridge

- Intercept all flow from curbed street before it reaches bridge

11.3.6.1 Constant Grade Bridges

The following calculations are for determining possible inlet spacing on a constant grade bridge. If the slope is less than 0.003 ft./ft., a check should be performed using the calculations for flat bridges. Calculations start from the high end and work down slope. The rest of the bridge specifications are assumed to be known.

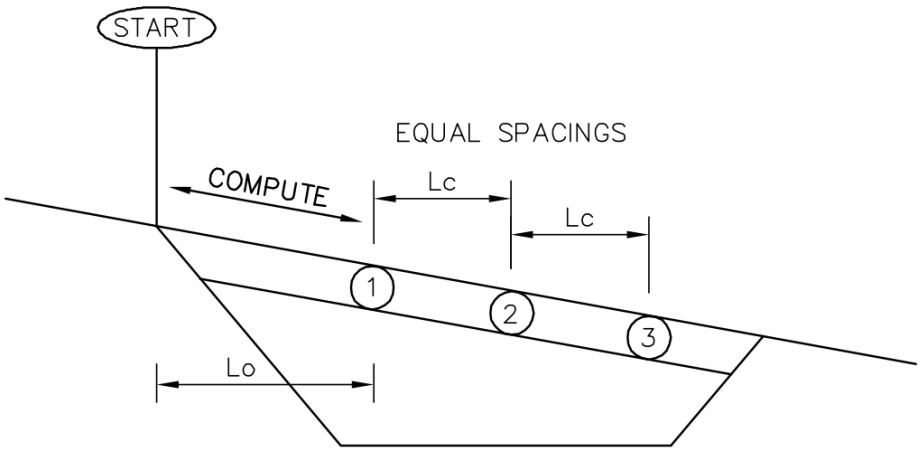


Figure 11.3.6.A Constant Grade Bridge

Flow for initial inlet:

(Equation 11.3.6.1A)

$$L_0 = \frac{43560Q}{CiW_p}$$

i = Design rainfall intensity (in./hr.)
Q = Gutter flow ($ft.^3/s$)
L_0 = Distance to first inlet (ft.)
C = Rational runoff coefficient (usually 0.9 from imperfections in pavement)
W_p = Width of pavement contributing to gutter flow (ft.)

Flow for subsequent inlets:

(Equation 11.3.6.1B)

$$L_c = \frac{43560QE}{CiW_p}$$

L_c = Constant distance between inlets (ft.)
E = Capture efficiency for proposed inlets, which can be found in manufacturers' literature.

If L_0 is greater than the length of the bridge, only end treatment drainage is needed. Caution is needed, as the discharge point for the inlets must be considered in the placement as well. The discharge should not be onto structural elements, over traveled ways, or unprotected ground that has a possibility of erosion.

11.3.6.2 Flat Bridges

The following calculations are for determining possible inlet spacing on flat bridges. Flat bridges are generally discouraged in order to prevent ponding on the bridge surface.

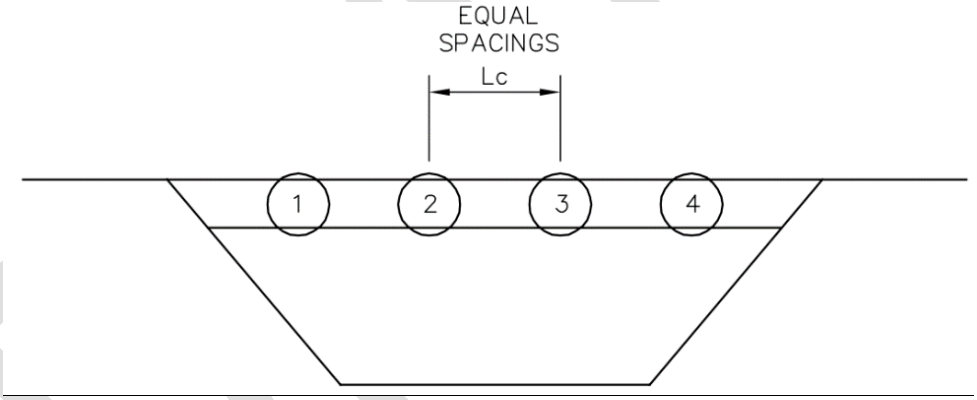


Figure 11.3.6.B - Horizontal Bridge

(Equation 11.3.6.2A)

$$L_c = \frac{1312}{(nCiW_p)^{0.67}} S_x^{1.44} T^{2.11}$$

i = Design rainfall intensity (in./hr.)
L_c = Constant inlet spacing (ft.)
C = Rational runoff coefficient (usually 0.9 from imperfections in pavement)
W_p = Width of pavement contributing to gutter flow (ft.)
n = Manning's N
S_x = Gutter cross-slope (ft.)

T = Design spread (width of gutter flow) (ft.)

If L_c is greater than the length of the bridge, only end treatment drainage is needed. If L_c is less than the bridge length, then compute the total needed inlet perimeter as follows:

(Equation 11.3.2B)

$$\mathbf{P = \frac{(CiW_p)^{0.33} T^{0.61}}{102.5 S_x^{0.06} n^{0.67}}}$$

11.3.7 Roadway Overtopping

Avoid overtopping of the bridge deck from a design storm. If overtopping of the bridge is possible, the design engineer should check the bridge for floatation and provide proper anchorage of the deck and super structure components.

11.3.8 Bridge Railing

The bridge railing should be traffic rated.

If overtopping of the bridge from a design storm is possible, the bridge railing should be design to minimize obstruction to the storm overtopping.

Should a bridge railing be on the exterior of the bridge with a sidewalk adjacent to the railing, a hand rail may be needed on top of the bridge railing.

11.3.9 Structural Loads

All roadway crossings, culverts, and bridges shall be designed for an H-20-44 or HS-20 loading.

All train crossings, culverts and bridges should be designed for a minimum of E80 or as designated by the railroad.

11.3.9.1 Deck

The bridge deck may need to be checked for uplift forces from floatation or from hydraulic jumps in supercritical flow through the bridge.

11.3.9.2 Piers/Columns

The bridge columns should be design for force of the water on the bridge structure and additional impact loading from debris on both the columns and deck.

11.4 References

11.4.1 Reference Citation

1) City of El Paso Engineering Department. *Drainage Design Manual*. City of El Paso, El Paso, Texas, June 2008, page 181.

11.4.2 References

- FHWA. *Evaluating Scour at Bridges*, 4th edition. Hydraulic Engineering Circular No. 18, FHWA-NHI-01-001. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, May 2001.
- USACE. *HEC-6 - Scour and Deposition in Rivers and Reservoirs – User's Manual*. U.S. Army Corp of Engineers, Hydrologic Engineering Center, Davis, California, 1991.
- TXDOT. Bridges. Chapter 9 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised May 2014. Retrieved from http://onlinemanuals.txdot.gov/txdotmanuals/hyd/index.htm
- FHWA. *Design of Bridge Deck Drainage*. Hydraulic Engineering Circular No. 21, FHWA-SA-92-010, Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1993.
- USACE. *HEC-RAS River Analysis System – Hydraulic Reference Manual Version 4.1*. U.S. Army Corp of Engineers, Hydrologic Engineering Center, Davis, California, Jan. 2010.
- FHWA. *Hydraulics of Bridge Waterways*. Hydraulic Design Series No. 1. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, March 1978

PUMP STATIONS

12.1 Introduction

This chapter describes the general guidelines for the design of a pump station.

Pumped detention systems will not be acceptable methods of storm water mitigation unless the facility will remain privately owned, operated, and maintained. The City of San Antonio will approve the use of a pumped facility for private use under the following conditions:

Condition 1: A gravity system is not feasible from an engineering and economic standpoint.

Condition 2: At least two (2) pumps are provided, each of which are sized to pump the design flow rate.

Condition 3: The selected design outflow rate must not aggravate downstream flooding.

Condition 4: Controls and pumps are designed to prevent unauthorized operation and vandalism.

Condition 5: Adequate verification is provided that the system will be operated and maintained on a continuous basis.

12.1.1 Purpose of a Pump Station

The purpose of a pump station is to lift storm water runoff from a wet well to a receiving stream or outfall. The pump station should be the considered the least desirable method for movement of storm water. The gravity system should be the primary and preferred means of discharging flow from a storm drain system. A pump station may also be used in a water quality basin to discharge treated water into a receiving stream.

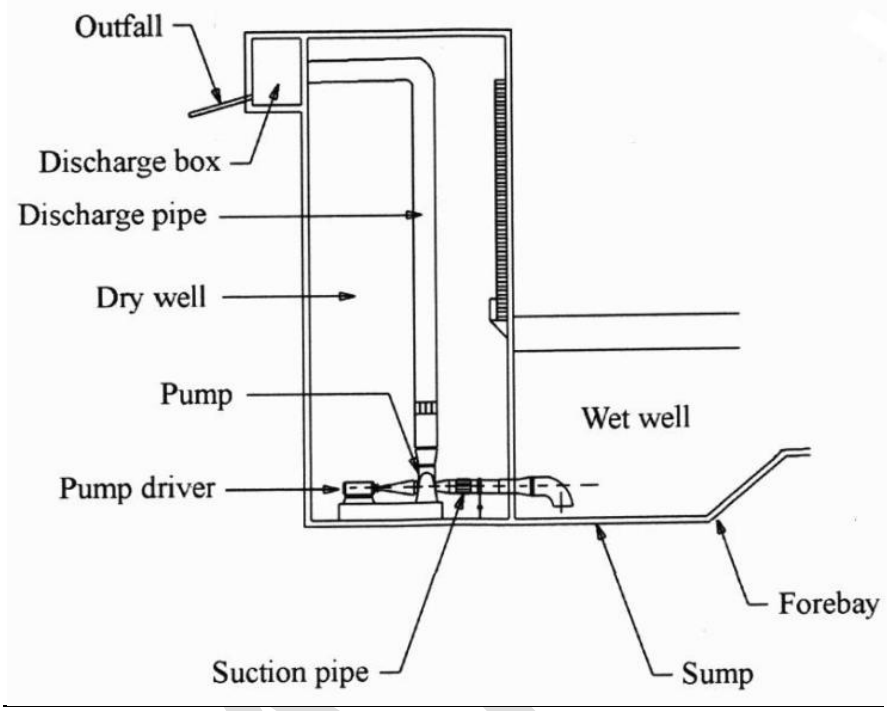


Figure 12.1.1.A - Sump Area with Drywell

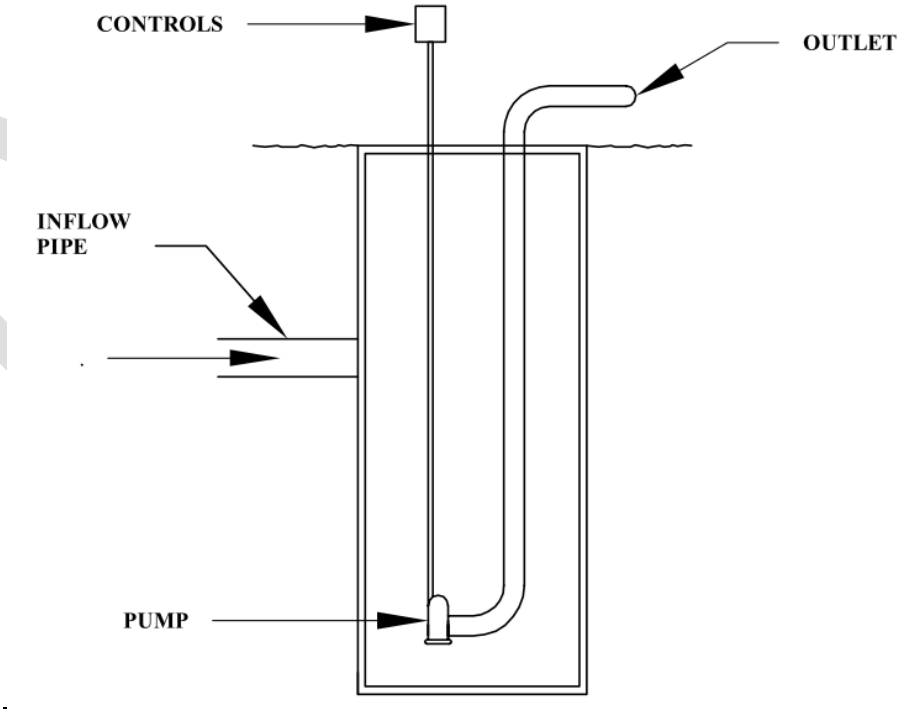


Figure 12.1.1.B - Wet Well

During the pump station planning the design engineer should contact manufacturer representatives for pumps and generators if needed for the site. Contractors who have experience in pump station construction are a good source of information.

12.1.2 Security and Access Considerations

12.1.2.1 Security

The pump station or pump wet well should be protected with fences, gates, and locks to prevent illegal entry.

12.1.2.2 Access

Adequate access must be provided to the pump station or pump wet well. This access should be available for service and maintenance vehicles during a storm event. See Chapter 16.4 Pump Stations for drainage easement requirements.

12.1.3 Safety and Environmental Considerations

12.1.3.1 Safety

Standard OSHA rules and other industrial standards of safety should be followed for installation as well as maintenance of a pump station. Access, lighting, ventilation and traffic control should be considered for all instances dealing with a pump station.

12.1.3.2 Hazardous Spills

Hazardous spills should be handled appropriately according to known safety standards for a spill of that type. Personnel should be able to have access to appropriate materials to contain and/or clean all spills.

12.2 Pump Station Components

12.2.1 Overview of Components

A full discussion of the design and specifications of a pump station can be had with the use of a common reference for designing pump stations, FHWA Hydraulic Engineering Circular number 24 (HEC-24). Appropriate specialists for the different components should be consulted early in the design process. The following are various necessary components that the design engineer should pay particular attention to.

Property: An entire pump station generally requires more footprint than merely the pumps and wet well or sump. Other necessary parts of the station include the electrical service, system controller, motor control center cabinets - which must be in a separate, dry room - and standby power generation. Other considerations may be on-site storage and parking. A required consideration is maintenance access to the pumps and the standby generator; not

just personnel access, but the ability and room to bring in suitable vehicles and equipment such as a boom crane to lift out pumps, generator, and electrical cabinets for repair or replacement.

- **Arrangement**: The wells and pumps may not need to be in the same place as the control house. An example of this is a set of wells with submerged pumps and discharge conduits located in a wide median of a depressed section of interstate highway. The control house with the electrical service, standby generator, motor control center, and control circuitry is located along the frontage road out of the depressed section and away from buried or overhead utilities.
- **Wet Well**: The wet well receives the inflow of storm water prior to pumping. It must also be designed with a trash collection rack, room for sedimentation collection without diminishing the design capacity, and sump pump to remove the bottom storage below the main pump level.
- **Electrical**: The appropriate electrical service for a pump station is usually 277/480-volt, three (3-)phase AC. For a typical pump station, the electrical service equipment includes large metal cabinets for the electrical metering, main circuit breaker, a transfer switch to isolate the station from the utility when the standby generator is powering the station, and the electrical distribution panel. The details of the electrical service equipment are the province of the electrical engineer. However, the design engineer must understand that clearances and air space around electrical equipment are not options; they are mandatory safety requirements which may increase the footprint of the pump station, but cannot be ignored.
- **Standby Power**: The normal source of standby power is either a diesel or natural gas engine/generator set. Fuel cells are not suitable for pump stations because of the hours long start-up time they require. Battery technology is improving to the point where solar or wind power may become viable. Natural gas over diesel is preferred, as sitting diesel can possible gel, become contaminated by moisture over the time period of non-use, as well as have interrupted delivery during critical moments.
- **Pumps**: Pump selection depends on station layout, required pump rate, wet well depth, and pump maintenance considerations. Pump selection includes the size, type, and number of pumps. Pump sizes are usually selected to use multiple pumps rather than a single pump of appropriate size. Smaller pumps are usually less expensive to buy and operate, and with multiple pumps the loss of one will not shut down the entire pump station. A single, large pump is more likely to have long term maintenance problems from the frequent start up required to handle flows from smaller events. The sump pump is a much smaller pump, usually designed to handle small amounts of trash or debris loading without failing.
- **Motors**: Pump motors for department pump stations are usually 480-volt, three-phase electric motors. However, the specific voltage selected depends on the power available from the utility and on what pump-motor combinations are commercially available. The size

of each motor depends on the pump size, flow rate, pressure head, and duty cycle. The hydraulic engineer specifying the pumps must work together with the electrical engineer specifying the motors and the control system to insure compatibility of components.

- **Control and Communication Systems**: The control system for a pump station is more than the sensor and circuitry to activate the pumps when the water in the wet well reaches a predetermined height. The control system includes a large cabinet for the motor control center (MCC) to operate and protect all the motors in the station, separate cabinets for the variable frequency drives (VFD) for the pump motors or any motor that may be expected to operate at less than full speed, and a separate cabinet for the programmable logic controller (PLC). The PLC monitors all signals and controls the sequence of operations of the pumps, activation of the standby generator when necessary, deactivation when the flood event has passed, and operation of any night security lighting. The PLC may also include automatic communication with the District and/or Maintenance Office to report the station's status regarding water levels, pump readiness, utility electrical power status, standby generator battery status, fuel status, security, and other concerns. The PLC can be integrated with the Intelligent Transportation System (ITS) to warn motorists of water over the roadway in the event of extreme rain events that exceed the capacity of the pump station. The design of the controls and communications is also the province of the electrical designer. However, the design is dependent on the input information from the hydraulic designer such as wet well capacity, allowed pump discharge rate, desired pump discharge rate, and specific communications.
- **Control Board**: The pump station should have a central control board for starting or stopping some processes and verifying the various components' conditions, whether "running", "standby", or "off". In addition, although the station may be operated by a control system (PLC or other), a manual override for each component is highly recommended for maintenance and testing. This must be designed by the electrical engineer with input from maintenance personnel.
- **Structures**: The structure must meet requirements for public safety, safety codes, local extreme weather conditions, site security, and maintenance operations. Maintenance requirements may be oversized doors to move equipment in and out or a movable roof to allow crane access. Aesthetics and the possibility of future expansion should also be considered.
- **Discharge Conduits**: The collected waters are usually discharge to a storm drain system, although sometimes the discharge point is a wetland, mud flat, or creek. The designer must also consider whether the receiving location is suitable for the anticipated pump rate, whether it is available during flood events, and whether flood water discharge from the pump station are allowed.
- **Acceptance test**: A full run acceptance test should be performed successfully before the pump station is accepted. A full run test procedure consists of running the pumps at maximum capacity for at least 6 hours and testing the control systems. During this

procedure, the standby generator should be used to power the full station for at least 6 hours which will test the pumps and generator at full load. The discharge conduits can be arranged with a diverter or bypass to pour the pumped water back into the wet well to maintain the full run test.

- **Scheduled Maintenance**: Pump stations, unlike other hydraulic structures, require scheduled cleaning and maintenance. The trash rack should be cleaned after each storm, while the wet well sump must be cleaned whenever the sediment reaches a set point. The standby generator must be exercised at least once a month for a minimum of 30-minutes run time. The entire system including pumps should be exercised under full load at the same schedule to assure reliability. The discharge diverter or bypass from the acceptance test should be maintained so that it can be used in the scheduled maintenance monthly test.

12.3 Pump Station Hydrology

12.3.1 Methods for Design

In order to design a pump station effectively, the inflow hydrology must be known. The hydrology developed for the associated storm drain system usually will not serve as a firm basis for discharge determination into the pump station. A hydrograph is required because the time component is critical in understanding the inflow which governs the sizing of the wet well. The designer needs to know not only the peak inflow, but the timing and volume. The difference between the input and the output hydrographs is the storage requirements of the pump station wet well. The hydrograph should consider the storage abilities of the storm drain system, which may reduce the required size of the wet well. Governmental regulations or the physical limitations of the receiving waters determine the output discharge from the pump station.

The design frequency for a pump station will be ultimate twenty-five (25) year storm if the drainage area to the pumps is less than one hundred (100) acres. If the drainage area to the pumps is more than one hundred (100) acres, the system should be designed for the ultimate one hundred (100) year storm.

12.3.2 Procedure to Determine Mass Inflow

A mass inflow curve represents the cumulative inflow volume with respect to time. In order to determine a mass inflow curve, the hydraulic designer must first develop an inflow hydrograph based on a design storm. The most typical design method is the NRCS Dimensionless Unit Hydrograph and the procedure can be found in the FHWA Hydraulic Engineering Circular 24 (HEC-24).

12.4 Pump Station Hydraulic Design Guidelines

12.4.1 Storage Design Guidelines

The storage volume of the wet well should be less than the total volume of the wet well because allowances should be made for a sump and for freeboard. The sump is the volume of the wet well below the required minimum water level, which is the pump cutoff elevation. The wet well must maintain water above the pump inlet to keep the pump from attempting to pump dry or sucking air. The sump must also have room below the pump intake level for sedimentation and heavy trash that wash into the system.

The top of the storage volume determines the maximum water level, the level in the wet well above which the water should not be allowed to exceed. Any freeboard above the maximum water level is not included in the calculated storage volume. Pumping is initiated at or below the maximum water level, and is stopped when the water drops to the minimum water level.

Other spaces outside of the wet well which store storm water before flooding occurs can also be considered part of the available storage volume. These include sumps, pipes, boxes, inlets, manholes, and ditches of the storm drain system. The storm drain system can represent a significant storage capacity.

The pump station schematic shown in figure 12.4.1.A is typical for roadway crossing under a railroad bridge, with the outfall being higher than the low point of the roadway. The typical cross sections shown in figure 12.4.1.B is the drainage system leading to the pump station.

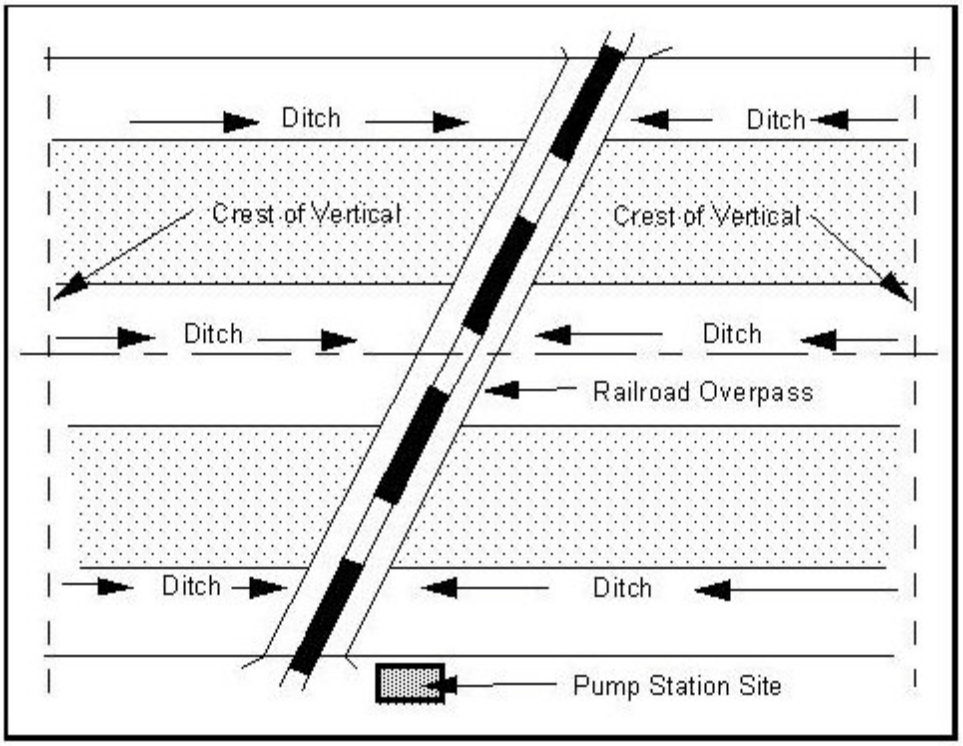


Figure 12.4.1.A - Pump Station Schematic
(Source TxDOT, Hydraulic Design Manual, 2011)

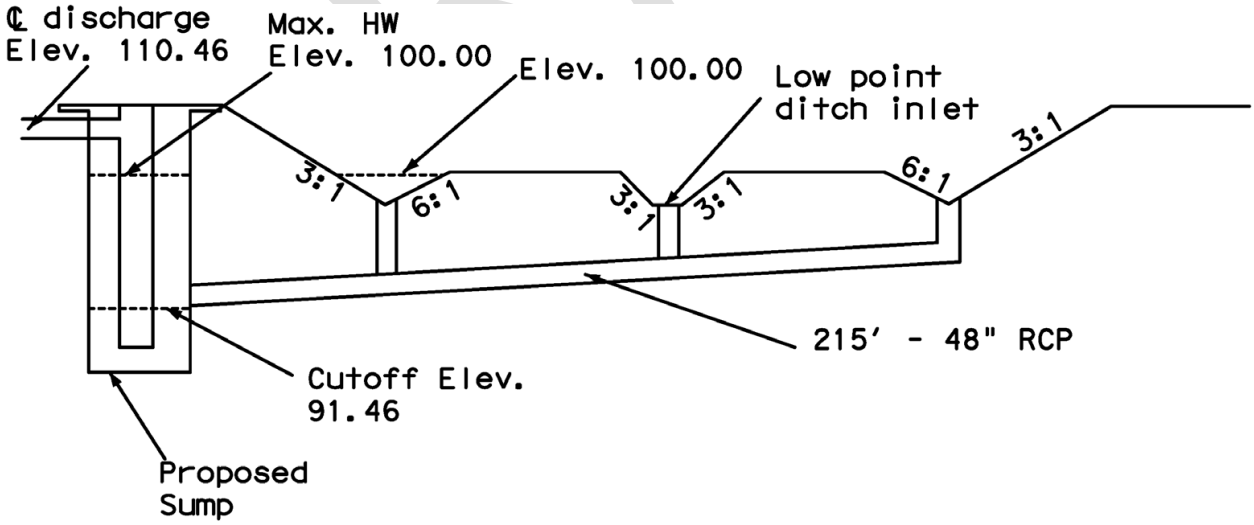


Figure 12.4.1.B - Typical Cross Section

(Source TxDOT, Hydraulic Design Manual, 2011)

12.4.2 Pump Selection

The selected rate of discharge from the pump station determines the number and size of pumps required for the facility. However, pump selection is a matter of economic analysis by the designer. A decision must be made using several manufacturers' technical data and whether a single or number of pumps would be necessary. A backup pump is required, and will be of the same discharge rating. A slightly lower pump rate than the allowable discharge is fine but the lower rate requires a larger wet well volume.

The designer must also consider the cost of construction and physical restrictions for the wet well. Enlarging the wet well and using fewer pumps might be a reasonable alternative to a larger wet well. In situations where one pump may be able to supply the entire discharge necessary, a minimum of two smaller pumps is recommended for reliability and maintenance. Multiple pumps also offer the opportunity for a staggered startup of pumps. Manufacturer's printed technical data and a sales or technical representative can be invaluable sources at this stage of the design in selecting the right pumps. The final design and pump selection must be based on all the considerations together.

12.5 Maintenance Considerations

12.5.1 Operation

During pump station operation, all OSHA and local safety requirements must be adhered to. An entry plan should be developed as part of the operation and maintenance procedures for the pump station. The plan should identify measures to be taken prior to and during any visit to the pump station, including monitoring of environmental conditions, especially air quality.

All semantics, product information, and operational manuals should be provided by the contractor or engineer to the owner upon completion and acceptance of the pump station.

12.5.2 Maintenance Schedule

An operation and maintenance schedule should identify the frequency of inspection in regards to the need for debris and sediment removal, as the build-up may cause a reduction in pump efficiency and possible failure. A provision should be added for future pump maintenance and/or removal due to failure or reduced durability of the pump due to possible unforeseen circumstances. FHWA Hydraulic Engineering Circular No. 24 (HEC-24) has a general list of problems, causes, and solutions available. A full performance test should be periodically performed to check the continued operating efficiency of the pumping station. See Chapter 4.12 for additional guidance on maintenance standards.

12.6 References

12.6.1 Reference Citations

(1) TXDOT. Pump Stations. Chapter 11 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised May 2014. Retrieved from http://onlinemanuals.txdot.gov/txdotmanuals/hyd/index.htm

12.6.2 References

- TXDOT. Pump Stations. Chapter 11 in *Hydraulic Design Manual*. Texas Department of Transportation, Revised May 2014. Retrieved from http://onlinemanuals.txdot.gov/txdotmanuals/hyd/index.htm
- FHWA. *Highway Stormwater Pump Station Design*. Hydraulic Engineering Circular No. 24 FHWA-NHI-01-007, Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 2001.

STORAGE FACILITIES

13.1 Introduction

For the City of San Antonio, storm water storage facilities cover many different criteria. Storage facilities are used to reduce flood risk and mitigate peak flows to pre-development conditions so downstream water elevations do not increase. Developers should contact the TCI Department for information on whether the property is within the mandatory detention areas prior to starting a project. For properties not located within the mandatory detention areas, any development with an increase in impervious area greater than one hundred (100) square feet has the options of participating in the Regional Storm Water Management Program (RSWMP) per section 4.3.1B. A water quality feature can be incorporated into a storage basin provided it does not interfere with basin functionality. All storage facilities should be designed with public health and safety in mind.

The following should be considered during the design of the storage facility.

For projects with an increased impervious area of greater than one hundred (100) square feet, that elect not to participate or are not eligible to participate in the regional storm water management program as described in section 4.3 storm water detention shall be required for all new development(s) or redevelopment of individual parcels of property to mitigate peak flow rates to predevelopment or existing development conditions as stated in UDC subsections 4.3.7 and 4.3.8.

Best management practices shall be used in the design of detention facilities in accordance with this Chapter. The timing of the hydrograph released from the detention facility must be checked against the timing of the flow rate in the first open watercourse to prevent increase(s) in the peak flow rate in the receiving watercourse. For detention basins constructed in-line on an existing watercourse, the creation of the basin shall not increase flood elevations in the channel upstream of the new development boundaries.

Where a detention facility accepts flows from public facilities such as City rights-of-way, the facility will be considered as serving a public purpose; it will be dedicated to the City of San Antonio upon completion and a drainage easement will be provided for access to the facility. When a regional detention facility accepts flow from an area exceeding three hundred twenty (320) acres, the facility is to be considered as serving a public purpose and shall be dedicated to the City upon completion and a drainage easement will be provided for access to the facility.

13.1.1 Security, Access, and Safety Considerations

13.1.1.1 Security

Due to legal considerations, most storage facilities have gated fencing to keep them in good condition.

13.1.1.2 Access

Easy maintenance access should be considered with easements and access ramps.

An unobstructed fifteen (15)-foot access easement around the periphery of the flooded area shall be dedicated as a drainage easement for facilities that require regular mowing or other ongoing maintenance, at the discretion of the Director of TCI. An unobstructed fifteen (15)-foot access right-of-way shall be established; this will connect the drainage easement adjacent to the storage facility to a road or alley.

Access ramps with a maximum slope of seven to one (7:1), with a maximum cross slope of 2%, will be provided for access to the flow line of all storage facilities.

13.1.1.3 Safety

Several considerations can help promote safety. Placing removable and efficient grates or bars on inlet/outlet pipes, fencing, and even lowering flow velocities into/out of the facility can help promote public safety. Even with locating the facility away from busy areas, the design engineer should still maintain easy access.

13.2 Sink Holes

Sink holes are one of several karst surface expressions that meet the TCEQ definition of a sensitive feature. Several methods are available to deal with sink holes depending on their location, both before and during construction. Due to the possibility of being a recharge feature, an approved geologic assessment of the space and surrounding area by or for TCEQ will be required before any action can be taken. For public safety, a detention basin may replace the function of the sinkhole if no endangered species are impacted. For further information, see TCEQ documents RG-348 and RG-348 Appendix A.

13.3 Detention Basins

The primary function of a detention basin is to store and gradually release storm water runoff by way of a control structure or other release mechanism. The basin can be above or below ground, existing as collection and conveyance facilities, impoundments, and underground tanks. Detention basins are the most common type of storage facility and are usually 'dry-pond' types, which release all of the detained runoff over a short, specified length of time (usually twenty-four (24) or forty-eight (48) hours).

13.3.1 Design types

There are four common types of detention basin: in-line detention storage, off-line detention, on-line detention, and on-site detention.

In-line detention: This type of storage occurs within a channel right-of-way and only near the headwaters of a watershed or sub-area, with only the immediate landowner(s) draining to it. The channel is either oversized and/or changed to elevate the water surface inside it by a control structure or increasing roughness in order to slow the storm water and prevent downstream flooding.

Off-line detention: This type of detention diverts a portion of a hydrograph from a nearby channel only when specific parameters are met. These usually are adjacent to a channel and have a side weir as a control structure, allowing overflow from the open channel.

On-line detention: This type of detention passes the entire hydrograph through itself. This is often used to delay the time-to-peak discharge and is the best at controlling the rising limb of the hydrograph. These can be on-site detention basins as well, with those that are open to a channel being referred to as "flow-through" detention basins.

On-site detention: This type of detention is within the development itself, usually only accepting storm water from the development itself (unless the development is right in the path of the areas' storm water, which makes it on-line) and restricting the outfall to the receiving channel. Mandatory detention areas tend to be this type.

13.3.2 Design Guidelines

The following steps are only guidelines; depending on the size of project, several steps can be removed.

1.) Select a location and prepare a general layout for the detention basin.
2.) Determine the inflow hydrographs and maximum allowable outflow rates.
3.) Establish the maximum allowable water elevation in the basin and determine tail water condition in the outfall channel.
4.) Estimate the detention volume needed and size the outflow structure. Determine the relationship between storage, discharge, and elevation.
5.) Route the design one hundred (100) year ultimate inflow hydrograph through the basin and outflow structure with appropriate tail water condition.
6.) Adjust the detention volume and outflow structure, if necessary, until the allowable one hundred (100) year ultimate is not exceeded and the detention basin fills to or near the design maximum allowable water surface elevation.
7.) Route the other design frequencies through the basin and make appropriate adjustment to the outflow structure. Recheck the one hundred (100) year ultimate after any changes made to the outflow structure.
8.) Verify storm drains, street drainage, and channels entering the basin will function as intended, relative to the design water levels in the detention basin.

9.) Consider an emergency spillway or overflow structure for a rainfall event larger than the design storm or in the event of a blocked outfall pipe.

10.) Investigate potential geotechnical and structural problems and establish an erosion control plan.

11.) Establish the easement limits, including access for maintenance and space for multi-use.

13.3.2.1 Location

The preferred location for a detention basin is the lowest area of the property. However, overland and storm drain flow should also be considered (if the basin will be picking up more than just the local flows), as well as its function in respect to the floodplain (with consideration to timing and backwater elevations; is it receiving all or part of the upstream flows).

13.3.2.2 Design Frequencies

The City of San Antonio restricts the outflow rates to the undeveloped or existing five (5) year, twenty-five (25) year, and one hundred (100) year frequencies, 24 hour storm. The designed basin should not increase flood elevations upstream of the new development. See Chapter 5 "Hydrology" for approved methods of developing flows for the needed frequencies.

13.3.2.3 Features

Several features are necessary for a detention basin. Inflow structure(s), outflow structure(s), layout, outfalls, and the areas' calculated flow (both upstream and downstream of the basin). See this chapter for layouts, inflow, and outflow structures; Chapter 7 for outfalls; and Chapter 5 on calculating required flows.

13.3.2.4 Routing Methods

For most basins, the use of HEC-HMS is preferred as it gives a good look at the outflow hydrograph in relation to the main channel's hydrograph as well as peak timing. HEC-RAS is more difficult, but can give a better idea of where to place control structures for the basin. Solid documentation and calculations will need to be provided to the City by the design engineer, regardless of what routing methods are used.

13.3.2.5 Freeboard

A detention basin should be designed to contain the one hundred (100) year ultimate water surface below the top of basin. The design engineer should determine if additional freeboard is required to mitigate a larger storm event from overtopping the basin.

Should the detention facility or basin meet the TCEQ requirements for a dam under their review, then the design of the dam shall meet the TCEQ freeboard requirements.

13.3.2.6 Layouts

The layout of the basin should consider the location of the inlet to be at the opposite end of the basin from the outlet to minimize the approach velocity at the outlet. The outlet shall drain to a defined low.

For earthen side slopes, the maximum slope should not be steeper than 3H: 1V.

The bottom of a detention basin should be sloped toward the outlet. For detention basins with an earthen bottom, a minimum slope of 0.5 percent should be maintained. A concrete pilot channel should be used for slopes less than 0.5 percent with a minimum width of six (6) feet.

Access ramps into open detention basins should be located for ease of access for maintenance personnel. A maximum slope of seven to one (7H:1V) with a maximum cross slope of 2% will be provided. For underground detention basins, access manholes should be located to allow inspection and maintenance of the underground structure.

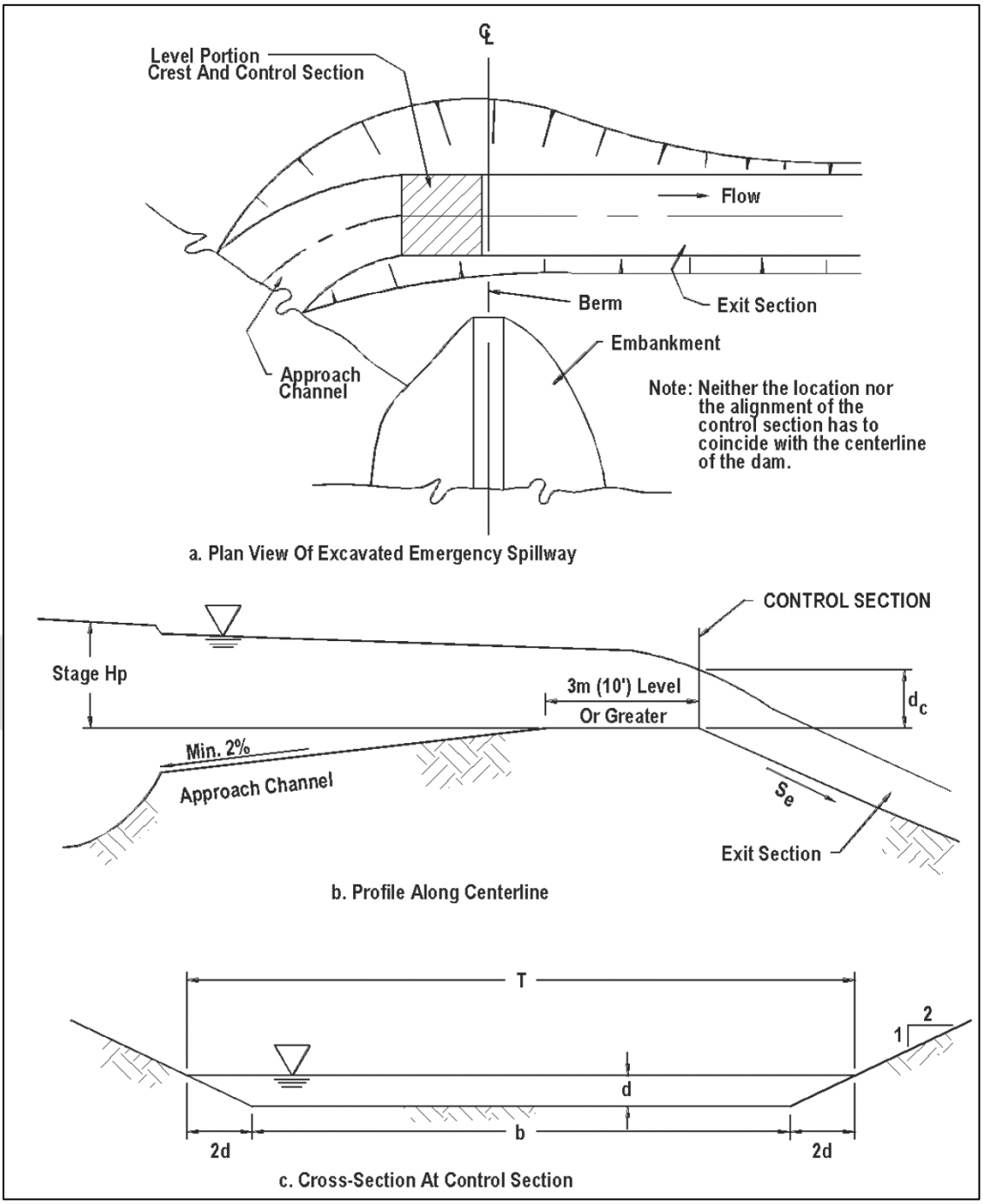
The discharge from the outflow structure, overflow structure, and auxiliary/emergency spillway shall not cause adverse downstream impact to adjacent properties and or structures.

13.3.2.7 Overflow

An overflow structure should be provided for a rainfall event larger than the design storm or in the event of a blocked outfall pipe. The overflow discharge shall drain to a defined low.

13.3.2.8 Auxiliary/ Emergency Spillways

The purpose of an auxiliary/emergency spillway is to provide a controlled overflow relief for storm flows in excess of the design discharge for the storage facility. A suitable auxiliary/emergency spillway section for a detention facility is a broad crested weir, cut through the original ground next to the embankment. The transverse cross section of the weir is typically trapezoidal in shape. Please refer to Figure 13.3.2.8a. The invert of the spillway at the outfall should be at an elevation 1 to 2 ft above the



maximum design storage elevation.

Figure 13.3.2.8a - Auxiliary/Emergency Design Schematic
(Source FWA, Urban Drainage Design Manual, Sept. 2009)

The following equation presents the relationship for computing the flow through a broad-crested auxiliary/emergency spillway.

(Equation 13.3.2.8)

$$Q = C_{sp} b H_p^{1.5}$$

Q = Emergency spillway discharge (cfs)
C_{sp} = Discharge coefficient
b = Width of the emergency spillway (ft.)
H_p = Effective head on the emergency spillway (ft.)

The discharge coefficient, C_{sp}, in equation 13.3.2.8 varies as a function of spillway bottom width and effective head, Figure 13.3.2.8b illustrates this relationship, Table 13.3.2.8 provides a tabulation of auxiliary/emergency spillway design parameters.

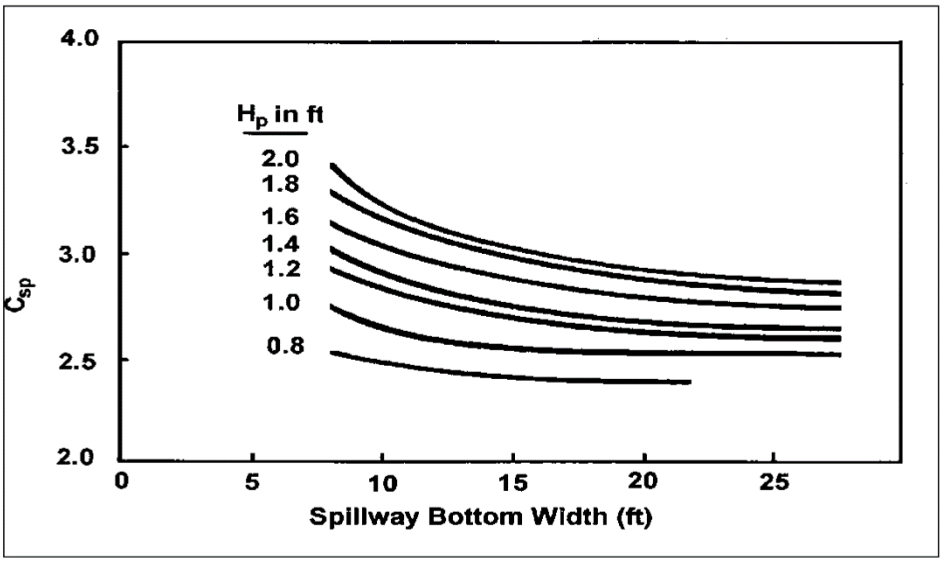


Figure 13.3.2.8b - Discharge coefficients for Spillways
(Source FWA, Urban Drainage Design Manual, Sept. 2009)

Table 13.3.2.8 - Spillway Design Parameters

Emergency Spillway Design Parameters													
H_D (ft)		Spillway Bottom Width, b, feet											
		8	10	12	14	16	18	20	22	24	26	28	30
0.8	Q	14	18	21	24	28	32	35	-	-	-	-	-
	V_c	3.6	3.6	3.6	3.7	3.7	3.7	3.7	-	-	-	-	-
	S_c	3.2	3.2	3.2	3.2	3.1	3.1	3.1	-	-	-	-	-
1.0	Q	22	26	31	36	41	46	51	56	61	66	70	75
	V_c	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2
	S_c	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
1.2	Q	31	37	44	50	56	63	70	76	82	88	95	101
	V_c	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.7	4.6	4.6	4.6	4.6
	S_c	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6
1.4	Q	40	48	56	65	73	81	90	98	105	113	122	131
	V_c	4.9	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	S_c	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.6	Q	51	62	72	82	92	103	113	123	134	145	155	165
	V_c	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4
	S_c	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
1.8	Q	64	76	89	102	115	127	140	152	164	176	188	200
	V_c	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S_c	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
2.0	Q	78	91	106	122	137	152	167	181	196	211	225	240
	V_c	5.8	5.8	5.8	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	S_c	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

NOTE:

1. For a given H_D, decreasing exit slope from S_c decreases spillway discharge, but increasing exit slope from S_c does not increase discharge.

2. If a slope S_e steeper than S_c is used, velocity V_e in the exit channel will increase according to the following relationship:

$$V_e = V_c(S_e/S_c)^{0.3}$$

3. After Maryland SCS

13.4 Retention Basins

The function of true retention basins is to provide storage of storm water runoff, and release via evaporation and infiltration only. Those retention basins that provide for a slow release of storm water over an extended period of several days or more are referred to as extended detention facilities. Retention facilities may also be used for recreation, pollutant removal, groundwater recharge, aesthetics, or even water supply. Like detention basins, they can be above or below ground. Most facilities are designed for both storm water impoundment and quality control.

Storm water retention with or without permanent wet pool will not be acceptable methods of storm water mitigation unless the facility will remain privately owned, operated, and maintained.

13.4.1 Design Guidelines

13.4.1.1 Design Frequencies

The design frequency should be the one hundred (100) year ultimate, 24 hour storm.

13.4.1.2 Routing Methods

The routing method is similar to detention basins, but with a zero discharge.

13.4.1.3 Freeboard

The basin should contain the one hundred (100) year ultimate water surface.

13.4.1.4 Overflow

An overflow structure should be provided for storms greater than the one hundred (100) year ultimate and for multiple storms over a short period of time. The overflow discharge shall drain to a defined low.

13.5 Downstream Flow Analysis

A downstream flow analysis should be performed with the routed storm through the storage facility. The length of reach downstream of the storage facility to be analyzed should be to a point where the drainage area of the stream will be ten times the drainage area to the basin.

13.6 Structures

13.6.1 Dams

All hydrology and hydraulic properties of a dam will be reviewed by the TCI Department with regard to spillway design, freeboard hydraulics, backwater curves, and downstream effects due to the dam site.

13.6.1.1 Existing Dam

Development below existing dams will take into account the original design conditions of the existing dam.

13.6.1.2 Proposed Dam

All dams, as defined by section 13.6.1.5 shall be approved by the Dam Safety Team of the TCEQ for safety. All other new dams shall be designed in accordance with acceptable design criteria as approved by the Director of TCI, or his authorized representative.

13.6.1.3 Breach Analysis

For Dams defined by the TCEQ, a breach analysis checks will be required.

13.6.1.4 Emergency Action Plan

An emergency action plan should be provided if the dam is regulated by TCEQ.

13.6.1.5 Approval of TCEQ Dam Safety Program

The design engineer should determine if the proposed or existing dam or reservoir would be regulated by TCEQ and require their approval.

The following is from the Texas Administrative Code, Title 30 – Environmental Quality, Part 1 – Texas Commission on Environmental Quality, Chapter 299 – Dams and Reservoirs, Subchapter A – General Provisions, Rule §299.1 – Applicability.

(a) This chapter applies to design, review, and approval of construction plans and specifications; and construction, operation and maintenance, inspection, repair, removal, emergency management, site security, and enforcement of dams that:

(1) have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet, as described in paragraph (2) of this subsection;

(2) have a height greater than six feet and a maximum storage capacity greater than or equal to 50 acre-feet;

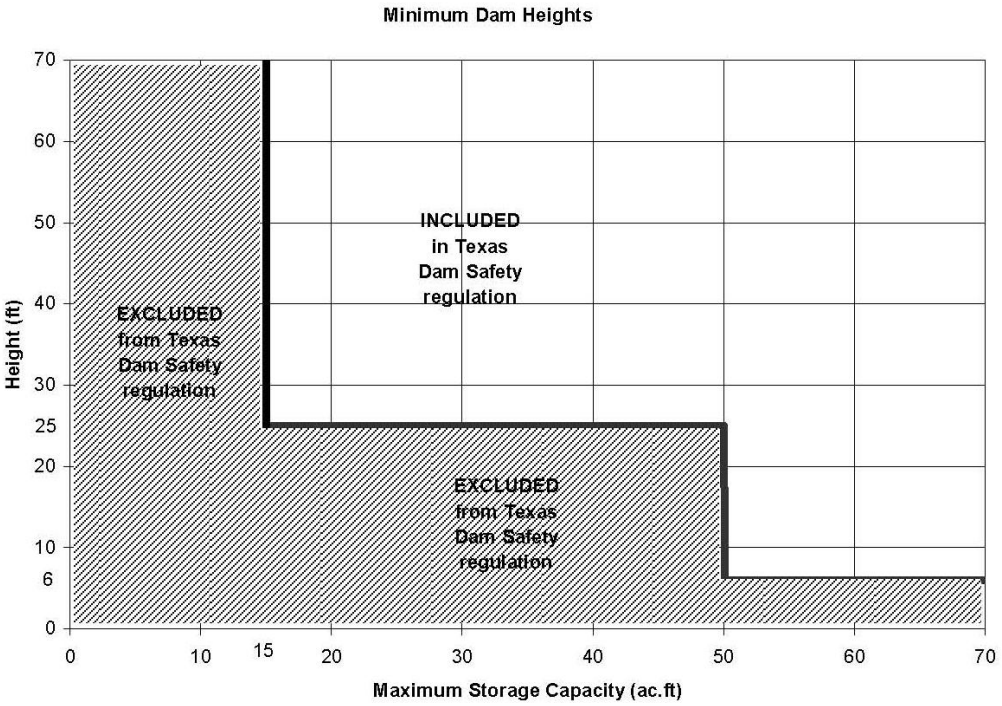


Figure 30 TAC § 299.1(a)(2)

(3) are a high- or significant-hazard dam as defined in §299.14 of this title (relating to Hazard Classification Criteria), regardless of height or maximum storage capacity; or

(4) are used as a pumped storage or terminal storage facility.

(b) This chapter provides the requirements for dams, but does not relieve the owner from meeting the requirements in Texas Water Code (TWC), Chapter 11, and Chapters 213, 295, and 297 of this title (relating to Edwards Aquifer; Water Rights, Procedural; and Water Rights, Substantive; respectively). All applicable requirements in those chapters will still apply.

(c) This chapter does not apply to:

(1) dams designed by, constructed under the supervision of, and owned and maintained by federal agencies such as the Corps of Engineers, International Boundary and Water Commission, and the Bureau of Reclamation;

(2) embankments constructed for roads, highways, and railroads, including low-water crossings, that may temporarily impound floodwater, unless designed to also function as a detention dam;

(3) dikes or levees designed to prevent inundation by floodwater;

(4) off-channel impoundments authorized by the commission under TWC, Chapter 26; and

(5) above-ground water storage tanks (steel, concrete, or plastic).

(d) All dams must meet the requirements in this chapter, including dams that do not require a water right permit, other dams that are exempt from the requirements in Subchapter C of this chapter (relating to Construction Requirements), and dams that are granted an exception as defined in §299.5 of this title (relating to Exception).

13.6.2 Inflow Structure

The inflow structure could be the outlet from a storm drain system, roadway culvert, scupper, chute or channel. The discharge velocity at outlets into an earthen basin should be check for erosion control. The basin hydraulics should be analyzed for the impacts to the inflow structure and upstream drainage system.

13.6.3 Outfall Structure

All spillway discharges shall be adequately routed to the centerline of the natural low below the dam site. The adequate routing of spillway discharges pertains to the hydraulic routing of the one hundred (100) year storm event for dedication of drainage easement limits. Probable Maximum Precipitation (PMP) for flood routing or breaches will only be considered for safety considerations (that is, the placement of building and the setting of minimum floor slab elevations below the dams). Any proposed concrete dam structure need not have a spillway capable of routing a PMP flood; however, it shall be shown to be structurally capable of withstanding any range of flood conditions with regard to possible failure due to sliding, overturning, and structural integrity, up to and including the PMP flood.

13.6.3.1 Primary Spillway

The primary spillway is the outfall structure for the design storms.

13.6.3.2 Secondary Spillway (Auxiliary Spillway)

The spillway section of any earthen dam, as defined in section 13.6.1.5 shall be large enough to pass a PMP flood, as defined by the NRCS, without overtopping the crest of the dam in accordance with TCEQ regulations.

13.6.4 Pumps

Pumped detention systems are not be acceptable methods of storm water mitigation, unless the facility is to remain privately owned, operated, and maintained. The City will approve the use of a pumped facility for private use under the following conditions:

13.6.4.1 Condition 1

A gravity system is not feasible from an engineering and economic standpoint.

13.6.4.2 Condition 2

At least two (2) pumps are provided each of which is sized to pump the design flow rate.

13.6.4.3 Condition 3

The selected design outflow rate must not aggravate downstream flooding.

13.6.4.4 Condition 4

Controls and pumps should be designed to prevent unauthorized operation and vandalism.

13.6.4.5 Condition 5

Adequate assurance is provided that the system will be operated and maintained on a continuous basis.

13.7 Maintenance Considerations

13.7.1 Operation

Most detention basins will not require an operational plan. The exception is ones that have a pump system or gates to control the discharge. These exceptions will require an operational plan. These plans should be submitted to the City and approved by the Director of TCI.

13.7.2 Maintenance Schedule

13.7.2.1 Regional Detention Facilities

Maintenance of publicly owned facilities will be the responsibility of the City. Maintenance of private facilities is the responsibility of the property owner or the community association and must be specified in the maintenance schedule submitted to the City. A maintenance schedule for both publicly owned and privately owned facilities must be approved by the Director of TCI prior to approval of construction drawings. See Chapter 4.12 for additional guidance on maintenance standards.

13.7.2.2 On-Site Storm Water Management Features

On-site storm water management features must be privately owned and shall be maintained by the community association or property owner. A maintenance schedule shall be submitted to the Department of TCI and approved by the Director of TCI prior to approval of construction plans. The City of San Antonio will have the right to do periodic inspections of privately owned and maintained detention facilities to confirm that the maintenance schedule is being implemented.

13.8 Certification

13.8.1 Detention Pond Plan Conformance Form

The design engineer should complete a "Detention Pond Plan Conformance" form after the completion of the detention pond and provide the completed form to the City.

13.8.2 As-Built Plans for Dams

As-Built plans should be provided upon completion of the dam and impoundment area if required by the owner or by TCEQ requirements.

13.9 References

13.9.1 Reference Citation

A. Harris County Flood Control District. Stormwater Detention Basins. Section 6 in *Policy Criteria & Procedure Manual for Approval and Acceptance of Infrastructure*. Harris County Flood Control District, Houston, Texas, October 2004, updated December 2010. Retrieved from http://www.hcfcd.org/dl_manuals.html

13.9.2 References

- Harris County Flood Control District. *Policy Criteria & Procedure Manual for Approval and Acceptance of Infrastructure*. Harris County Flood Control District, Houston, Texas, October 2004, updated December 2010. Retrieved from http://www.hcfcd.org/dl_manuals.html
- TCEQ. *Complying with the Edwards Aquifer Rules – Technical Guidance on Best Management Practices*. RG-348. Texas Commission on Environmental Quality, Field Operations Division, Austin, Texas, July 2005.
- TCEQ. *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer (Revised) – Appendix A to RG-348 – Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices*. RG-348A. Texas Commission on Environmental Quality, Chief Engineer's Office, Water Programs, Austin, Texas, September 2007.
- TCEQ. *Hydrologic and Hydraulic Guidelines for Dams in Texas*. GI-364. Texas Commission on Environmental Quality, Field Operations Support Division, Dam Safety Program, Austin, Texas, January 2007.
- TCEQ. *Design and Construction Guidelines for Dams in Texas*. RG-473. Texas Commission on Environmental Quality, Field Operations Support Division, Dam Safety Program, Austin, Texas, August 2009.
- FHWA. *Urban Drainage Design Manual*. Hydraulic Engineering Circular No. 22, 3rd edition, FHWA-NHI-10-009. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Sept. 2009.

DRAINAGE EASEMENTS

14.1 Introduction

This chapter provides the general guidelines for easements needed for the storm drainage facilities.

The dedication or acquisition of drainage easements to cover drainage system components is necessary to allow the orderly development and transfer of storm water across properties. Where a subdivision is traversed by a watercourse, drainage way, natural channel, or stream, an easement conforming substantially to the limit of such watercourse shall be provided, including additional width as outlined below.

Easement requirements are specified in the following subsections of this chapter for particular storm water management facilities:

A. Subsection 14.3.2 Natural Channels
B. Subsection 14.5 Storage Facilities
C. Subsection 14.3.1.2 Concrete Channels
D. Subsection 14.3.1.1 Improved Earth Channels
E. Subsection 14.2 Storm Drain Systems
F. Subsection 14.4 Pump Stations

Drainage easements will be required for all storm water management facilities accepting runoff from properties other than the lot on which the facility exists or will be constructed.

Drainage easements may be designated “Public Drainage Easement” or “Private Drainage Easement”. A private drainage easement is typically necessary when storm water is to be conveyed across private property from a separate private property up to a contributing drainage area of 100 acres. A Public drainage easement is typically necessary when the off-site contributing drainage area exceeds 100 acres or if the contributing area is a FEMA designated floodplain. Additionally, drainage easements are typically necessary when storm water is to be conveyed across private property from public property, public rights-of-way and easements, or public infrastructure to an established channel, creek, or other public drainage system.

14.2 Storm Drain Systems

Minimum easement widths for storm drains will be the greater of fifteen (15) feet or six (6) feet on both sides of the extreme limits of the width of storm drain lines or components. See Figure 14.2.

Example: The easement width for a three (3) barrel ten (10)-foot wide box culvert with six (6)-inch walls would be (3 x 10')+(4 x 0.5')+(2 x 6') = 44'.

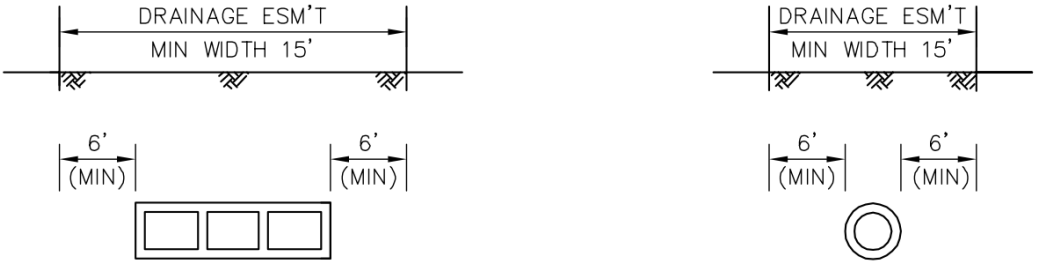


Figure 14.2 - Storm Drain System Easement

14.3 Open Channels

14.3.1 Constructed Channels

Constructed channels are created by the movement of earth material by mechanical means and the earth material may be covered by vegetation or other material to minimize erosion.

14.3.1.1 Improved Earth Channels

Easements for improved earth channels shall extend a minimum of two (2) feet on one (1) side and fifteen (15) feet for an access road on the opposite side of the extreme limits of the channels do not parallel and adjoin an alley or roadway. When such channels do parallel and adjoin an alley or roadway, the easement shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. Where utilities are installed in the access road of the drainage easement, the easement shall extend two (2) feet on one (1) side and seventeen (17) feet on the opposite side of the extreme limits of the channel. See Figure 14.3.1.1. "Extreme Limits" of the channel shall mean the side slope intercept with the natural ground or proposed finished ground elevation. Where designed channel bottoms exceed one hundred (100) feet in width, the fifteen (15)-foot extra width shall be provided on both sides of the channel.

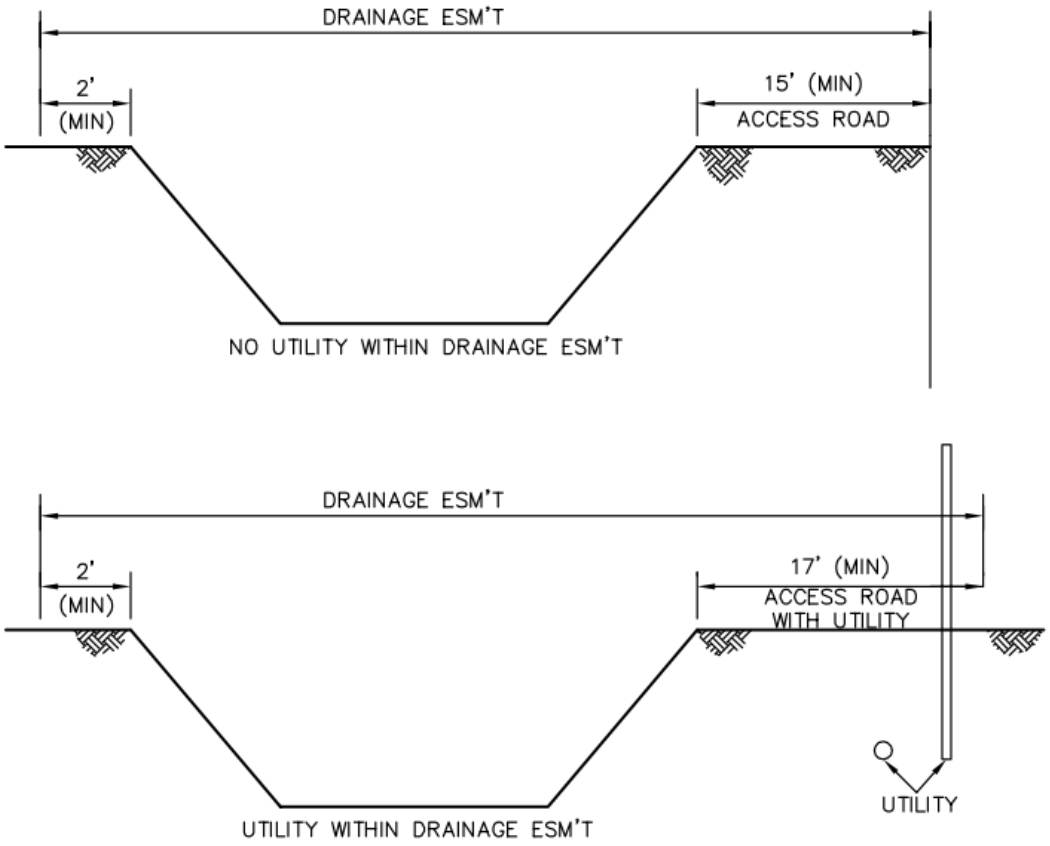


Figure 14.3.1.1 - Earth Channel Easement

14.3.1.2 Concrete Channels

Easements for concrete lined channels, except for concrete flumes (see Section 14.3.1.4), shall extend a minimum of two (2) feet on one (1) side and fifteen (15) feet for an access on the opposite side of the extreme limits of the channel. When such channels do parallel and adjoin an alley or roadway, the easement shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. See Figure 14.3.1.2.

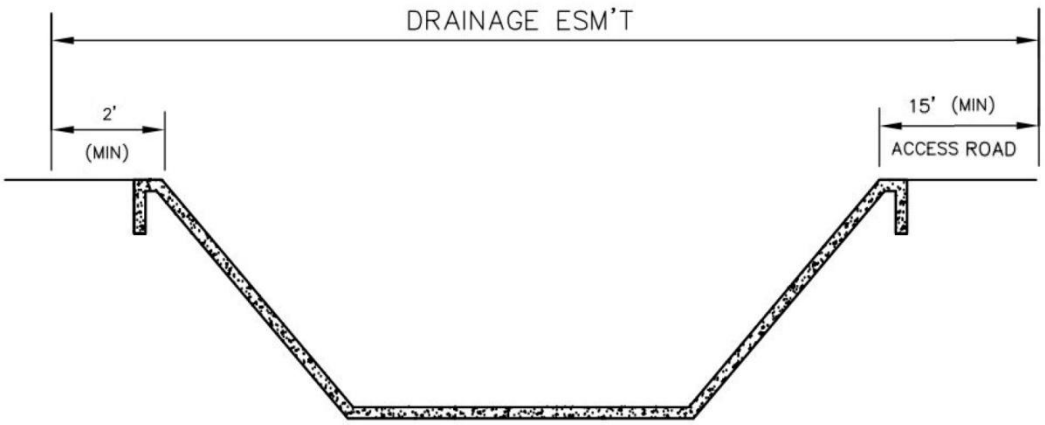


Figure 14.3.1.2 - Concrete Channel Easement

14.3.1.3 Interceptor Channels

Drainage easements for proper conveyance of upstream storm water runoff shall be required on all subdivision plats where upstream contributing area exceeds the criteria indicated below. Interceptor drains shall be constructed prior to the issuing of building permits on any lot that would intercept natural drainage.

- Interceptor drainage easements and channels shall be provided for residential subdivisions where the drainage area to the back of platted lots exceeds the depth of two (2) average residential lots with equivalent zoning.

- Interceptor drainage easements shall be required on nonresidential subdivision plats where the off-site drainage area contributing to the proposed development exceeds three (3) acres.

Interceptor drainage easements shall extend a minimum of two (2) feet on both sides of the extreme limits of the channel. See Figure 14.3.1.3.

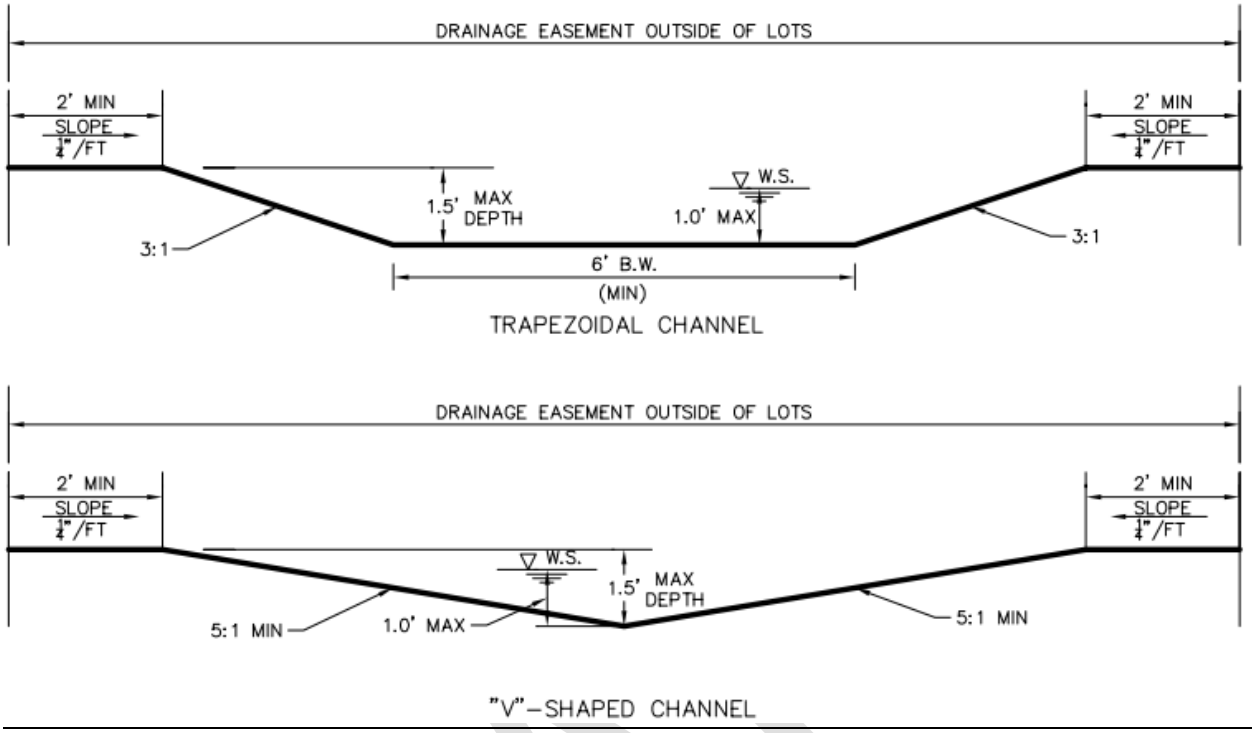


Figure 14.3.1.3 - Interceptor Channel Easement

14.3.1.4 Concrete Flumes

Side-lot flumes are concrete-lined channels that convey storm water runoff between residential lots from street to street or from a street to a storm drain, drainage channel, natural creekway, or floodplain. Easements for side-lot flumes shall extend a minimum of two (2) feet on one (1) side and ten (10) feet for access on the opposite side.

Private side-lot flumes shall have appropriate easement widths as determined by the developer's engineer.

14.3.2 Natural Channels

The limits of easements for natural watercourses shall be the ultimate one hundred (100) year floodplain or the ultimate twenty-five (25) year plus freeboard whichever is less. In floodplain areas where ongoing maintenance is required or the floodplain will be reserved for use by the public, the drainage easements shall be maintained by a public entity and the property will be dedicated to the city as a public drainage easement. See Figure 14.3.2.

14.3.3 Maintenance Access Drainage Easement

An unobstructed access drainage easement connecting the channel drainage easement with an alley or roadway, parallel to or near the easement shall be provided at a minimum spacing of one (1) access easement at approximately one thousand (1,000)-foot intervals. The access easement shall be a minimum of fifteen (15) feet in width and shall be kept clear

of obstructions that would limit maintenance vehicle access. Additional access points may be required if the flow line of the designed channel incorporates grade control structures or vehicular bridges that may block channel access to maintenance equipment.

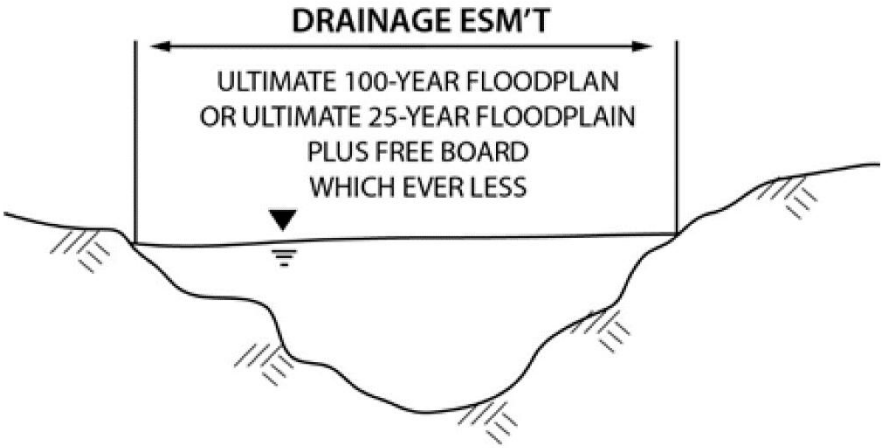


Figure 14.3.2 - Natural Channel Easement

14.4 Pump Stations

A drainage easement will be required for all storm water pump stations. Additional ten (10) foot minimum drainage easement in width shall be required around the pump station for maintenance. All pump stations not included in a street right-of-way or within the storage facilities drainage easement and not adjacent to a public street will require a drainage easement for a fifteen (15) foot width access to the pump station.

14.5 Storage Facilities

Drainage easements will be required for all storm water management facilities accepting runoff from properties other than the lot on which the facility exists or will be constructed.

For regional detention facilities, the drainage easement will encompass the one hundred (100) year pool elevation in addition to all structural improvements (levees, dikes, berms, outfall structures, etc.) necessary to contain the pool. The easement will extend, at a minimum, to the toe of the downstream embankment. The easement shall also extend to a minimum of fifteen (15) feet outside both the one-hundred (100) year pool and the structural improvements to facilitate maintenance as well as public safety.

A one hundred (100) year storm event shall be routed through the proposed dam or basin and all land subject to flooding shall be dedicated as drainage easement. An unobstructed fifteen (15) foot access easement around the periphery of the flooded area shall be dedicated as drainage easement for facilities that require regular mowing or other ongoing

maintenance, at the discretion of the Director of TCI. An unobstructed fifteen (15) foot access shall be established, which connects the drainage easement adjacent to the dam structure to a road or alley and the access to be dedicated as a drainage easement.

The adequate routing of spillway discharges pertains to the hydraulic routing of the one hundred (100) year frequency flood for dedication of drainage easement limits.

LOTS / UNFLOODED ACCESS

15.1 Introduction

This chapter is for additional drainage criteria for a lot or lots within a development. The proper grading of a lot(s) is necessary so there is no impact to adjoining property or to the proposed development.

15.2 Standard Lot Grading

A note shall be placed on all plats stating that residential finished floor elevations must be a minimum of eight (8) inches above final adjacent grade. A grading plan shall be prepared and submitted to the City, which indicates typical lot grading for all lots in the subdivision using typical FHA lot grading types (A, B, and C). See Figure 15.2. A more detailed grading plan is also acceptable. No more than two (2) average residential lots may drain onto another lot, unless a drainage easement is dedicated to contain the runoff.

See Section 6.2.2 where Dwelling units are located on the downhill side of a T-intersection, Cul-de-sac, or knuckle.

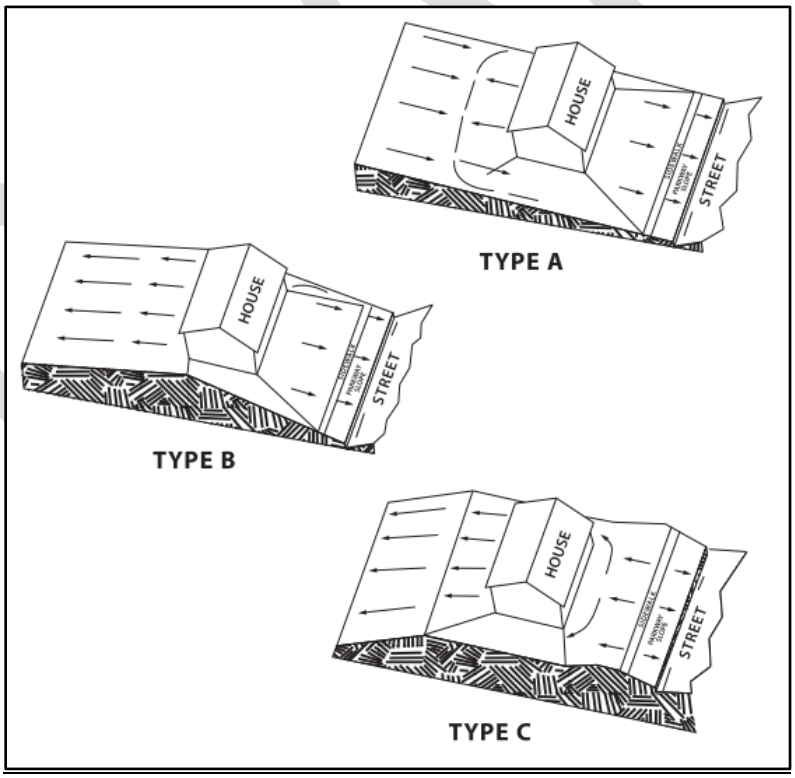


Figure 15.2 - Typical FHA Lot Grading

15.3 Unflooded Access

15.3.1 Proposed Development

During a design storm event unflooded access (within the "Proceed with Caution" range per Figure 4.3.1C) shall be available from each proposed new development to an adjacent public street during a regulatory flood event.

15.3.2 Unflooded Access Distance on Existing Public Street

Additionally, unflooded access shall be accessible to an arterial street that is not adjacent to the development or to a distance of one-quarter mile, whichever is less, during a future conditions twenty (20) percent annual chance (five-year) flood event.

15.3.3 Exception

The Director of TCI may waive criterion 15.3.2 of this requirement for developments under three (3) acres in size.

15.4 Interceptor Channels

Interceptor channels for proper conveyance of upstream storm water sheet flow shall be required on all subdivision plats where upstream contributing area exceeds the criteria indicated on the following items. (See Figure 9.3.10.) Interceptor channels shall be constructed prior to the issuing of building permits on any lot that would intercept natural drainage.

A. Interceptor channels shall be provided for residential subdivisions where the drainage area to the back of platted lots exceeds the depth of two (2) average residential lots with equivalent zoning.

B. Interceptor channels shall be required on nonresidential subdivision plats where the off-site drainage area contributing to the proposed development exceeds three (3) acres.

15.5 Lot and Property Line Crossings

In cases where drainage easements cross lot and property lines, a statement shall be added to the plat that no fencing or structures that will interfere with adequate drainage flow will be allowed on or across such lines. Fencing may be allowed across drainage easements only in accordance with the following restrictions:

A. Bottom of fence shall be a minimum of the flow depth, plus freeboard (see Table 9.3.14) above design flow line of channel or drain. Any fencing extending below the depth stated above shall be hinged or otherwise designed to allow the design flow to pass. Design details shall be provided.

B. A hinged gate will be placed across the entire width of the drainage easement. Access must be provided to storm water operations staff at all times to allow access to the easement for the city crews to perform maintenance.

C. Fence posts located within the easement must be structurally designed to resist damage from the storm water flows and impact from debris.

D. A floodplain development permit will be required to construct a fence within an easement within the one hundred (100) year floodplain.

VEGETATION

16.1 Introduction

This chapter provides information on methods and recommendations for plant materials to be used for the vegetation or revegetation of drainage facilities within the San Antonio area. Establishment of a robust vegetative cover is critical to the proper functioning of drainage facilities, such as grass-lined channels, earthen detention basins, earthen retention ponds, and wetlands. Vegetation serves multiple purposes, including stabilization of facilities, prevention or reduction of erosion, removal of pollutants in storm water runoff, and improvement of wildlife habitat. The modified subtropical climate, prevalence of introduced weeds or Johnson Grass, and variety of soil types encountered in the San Antonio area virtually mandate the prompt implementation of a temporary and/or permanent revegetation plan to meet TPDES requirements.

During the design and construction processes and thereafter, existing vegetation should be maintained and preserved intact in order to minimize the effects of construction activities and the changes to the flow characteristics of the existing waterways.

16.2 General Guidelines For Recommended Vegetation

16.2.1 Grasses

New or improved earthen channels, earthen retention facilities, and earthen detention facilities will be vegetated by seeding or sodding. Eighty-five percent (85%) of the disturbed surface area must established vegetation before the City will accept the channel for maintenance if the facility is within a public easement. Facilities that are within private easements shall also meet the same seeding and sodding requirements.

New earthen facilities and alterations to existing facilities shall be planted with drought resistant, low growth, native species grasses which will allow unobstructed passage of floodwaters. Recommended grasses and groundcover can be found in Appendix E "San Antonio Recommended Plant List - All Suited to Xeriscape Planting Methods" found in the current City of San Antonio Unified Development Code. Johnson grass, giant ragweed and other invasive species shall not be allowed to promulgate in earthen facilities.

16.2.2 Woody Plantings

16.2.2.1 Trees

While allowing for reasonable improvement of land within the City and City's ETJ, it is stated public policy of the City to maintain, to the greatest extent possible, existing trees and to

add to the tree population to promote a high tree canopy goal. The planting of additional trees and preservation of existing trees in the City and the City's ETJ is intended to accomplish a variety of goals. These goals can be found in Sec. 35-523 of the UDC. Recommended trees can be found in Appendix E "San Antonio Recommended Plant List - All Suited to Xeriscape Planting Methods" found in the current City of San Antonio Unified Development Code.

16.2.2.2 Shrubs

Recommended shrubs can be found in Appendix E "San Antonio Recommended Plant List - All Suited to Xeriscape Planting Methods" found in the current City of San Antonio Unified Development Code.

16.3 Tree Preservation Requirements

The City of San Antonio Tree Preservation requirements can be found in the latest version of the City of San Antonio UDC.

16.4 Preparation Of A Planting Plan

A mitigation plan will be required if the above minimum preservation requirements are not met. See latest version of the City of San Antonio Tree Ordinance for requirements.

16.5 References

- City of San Antonio. San Antonio Recommended Plant List—All Suited to Xeriscape Planting Methods. Appendix E in *Unified Development Code*. Retrieved from http://www.sanantonio.gov/dsd/udc.asp
- University of Texas at San Antonio. *Technical and Field Guide: Management Practices for Natural Waterways*. University of Texas at San Antonio, City of San Antonio, San Antonio, Texas, February 2008.
- International Society of Arboriculture
- Texas Parks and Wildlife
- USACE

SOFTWARE

17.1 Introduction

Hydrology and Hydraulics software are tools used by engineers to analyze, study, and design water resources features and infrastructure. The software used by engineers is a critical portion of local studies. This chapter will attempt to serve as a base line for the most available software used by local engineers as well as City of San Antonio staff. Additional and specialized software may be acceptable for use, with the approval of the office of the Director of TCI or his authorized representative.

The following software are acceptable.

- HEC Products
  - HEC-HMS
  - HEC-RAS
- XP Solutions
  - XPSWMM
  - XPSTORM
- Auto Desk
  - AutoCAD - HydraFlow
- Esri
  - ArcGIS
- Bentley
  - MicroStation - Geopak
  - FlowMaster
  - CulvertMaster
  - PondPack
  - STORMCAD
- Misc.
  - HAHNHAUS
  - Hy-8
  - WINSTORM

DATA SOURCES

18.1 Introduction

This chapter will identify commonly used data sources for use in studies. These sources are subject to change and may or may not be a free resource. These include City of San Antonio, Bexar County, SARA, FEMA, etc.

18.2 City of San Antonio

For general geo-spatial information about San Antonio that include individual shape-file and geodatabase for political boundaries, roadways, special zones and districts, library locations, park boundary, trails and even 2-foot contours. This data can be found in the City of San Antonio GIS department website. Please note the following link may change. http://www.sanantonio.gov/GIS/GISData.aspx

18.3 Bexar County

The Bexar County website contains a GIS portal (http://bexar.maps.arcgis.com/home/**)** to allow users to view and access GIS data. GIS data can be retrieved via the Open Data Portal section (http://www.bexar.org/569/GIS-Open-Data)

18.4 San Antonio River Authority

The SARA website contains useful sources of GIS data sets. The first is the Digital Data Model Repository (D2MR) (http://gis.sara-tx.org/D2MR/), used to access Hydrology, Hydraulic and geo-spatial data (GIS and CADD data available). To access data a user will need to create a user name and password.

Additionally SARA hosts 1-foot LiDAR based contours for all of Bexar County, broken into panels a user can access GIS data shape-files from the following link (http://www.sara-tx.org/public_services/gis_information/contours.php)

18.5 Federal Emergency Management Agency

For the latest Flood Insurance Rate Map please refer to the FEMA Map Service Center (https://msc.fema.gov/portal) Data found in the Map Service Center includes FIRM maps and the latest Letters of map Changes (LOMC) approved by FEMA.

18.6 U.S. Army Corps of Engineers

To access the latest hydrology and hydraulic modeling software please refer to the US Army Corps of Engineers Hydrologic Engineering Center website. http://www.hec.usace.army.mil/

18.7 Texas Natural Resources Information System

To access State wide data set please refer to the Texas Natural Resource Information System (TNRIS) website. http://www.tnris.org/

18.8 U.S. Department of Agriculture – Natural Resources Conservation Service

For information on the NRCS please refer to the following website (http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/)

18.9 U.S. Fish & Wildlife Service

For contact information for the US Fish and Wildlife Serve please refer to the following: http://www.fws.gov/

DEFINITIONS

19.1 Introduction

The following definitions are used within this manual. A number of definitions were copied from the UDC Appendix A Definitions that relate to drainage and this manual. The UDC definitions are indicated by an asterisk symbol.

1% annual chance floodplain, (formerly 100-year floodplain)*: The land within a community subject to a one (1) percent or greater chance of flooding in any given year. These areas are typically designated as a Federal Emergency Management Agency (FEMA) Zone A, AE, AH, or AO on FEMA Flood Insurance Rate Maps (FIRM Panels).

All weather surface (parking and vehicular access)*: Vehicular "all weather surfaces" shall constitute: poured concrete on prepared subgrade; hot laid asphalt on a prepared base course; single, double, or triple asphalt surface treatment (consisting of applications of asphaltic material, each covered with aggregate) on a prepared base course. Brick/concrete block/tile/flagstone set in mortar or on a prepared base course. The director of planning and development services shall determine if other materials may fit within this category of surface; however, in no case shall a material be considered a "all weather surface" if such surfaces generates or produces any dust or particulate matter that could be airborne to adjacent properties such as occurs with compacted base materials.

All weather surface (pedestrian walkways and access)*: All weather surfaces shall constitute poured concrete, hot laid asphalt, or tile/ flagstone/brick/concrete block. The director of planning and development services shall determine if other materials may fit within this category of surface. For pedestrian application crushed granite, marble and rock slag may be considered an "all weather surface".

All weather surface (temporary access)*: All weather surfaces for temporary construction access or event access such as "homes shows", carnivals, etc., shall be permitted by the director of planning and development services and may be poured concrete, hot or cold laid asphalt or tile/brick/flagstone/concrete block, compacted base material, crushed granite, or gravel for a period not to exceed one hundred twenty (120) days.

Area of flood inundation*: Sites that are subject to flooding as a result of water ponding in the controlled storage areas of dams, detention and retention ponds.

Area of shallow flooding*: A designated AO, AH, or VO zone on a community's flood insurance rate map (FIRM) with a one (1) percent chance or greater annual chance of flooding to an average depth of one (1) to three (3) feet where a clearly defined channel

does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of special flood hazard*: The land in the floodplain within a community subject to a one (1) percent or greater chance of flooding in any given year. This area is also known as the 100-year floodplain. The area is designated as a Federal Emergency Management Agency Zone A, AE, AH, AO on the flood insurance rate maps.

Base flood*: The flood having a one (1) percent chance of being equaled or exceeded in any given year. (100-year frequency flood).

Basement*: Any area of the building having its floor subgrade (below ground level) on all sides.

Best management practices (BMP)*: An effective integration of storm water management systems, with appropriate combinations of landscape conservation, enhancement, structural controls, impervious cover, schedules of activities, prohibitions of practices, maintenance procedures and other management practices which provide an optimum way to convey, store and release runoff, so as to reduce peak discharge, remove pollutants, and enhance the environment.

Capital improvements*: Public facilities which have a life expectancy of three (3) or more years that are owned and operated by the city, and are treated as capitalized expenses according to generally accepted accounting principles. This definition does not include costs associated with the operation, administration, maintenance, or replacement of capital improvements.

Capital improvements program*: The list of recommended capital improvements to be constructed during the forthcoming five-year period submitted pursuant to section 118 of the City Charter.

Canopy tree*:A canopy tree is either a medium or large deciduous tree, with a mature height of more than twenty-five (25) feet at maturity.

CLOMR*: A conditional letter of map revision. A CLOMR will be submitted for FEMA approval for all proposed physical changes to the floodplain that will result in a change to the floodplain boundary.

Conservation easement*: A non-possessory interest of a holder in real property that imposes limitations or affirmative obligations designed to:

- Retain or protect natural, scenic, or open-space values of real property or assure its availability for agricultural, forest, recreational, or open-space use;
- Protect natural resources;
- Maintain or enhance air or water quality; or

- Preserve the historical, architectural, archeological, or cultural aspects of real property.

(Source: V.T.A. Natural Resources Code § 183.001).

Dam: Any barrier or barriers, with any appurtenant structure, constructed for the purpose of either permanently or temporarily impounding water.

(Source: TCEQ Chapter §§299.2.(14))

Detention*: The temporary storage of storm runoff, which is used to control the peak discharge rates, and which provides gravity settling of pollutants.

Detention time*: The amount of time a parcel of water actually is present in a storm water basin. Theoretical detention time for a runoff event is the average time a parcel of water resides in the basin over the period of release from the BMP.

Development*: Any manmade change in improved and unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or, drilling operations or storage of equipment or materials.

Development plan*: The proposal for development including such drawings, documents and other information necessary to illustrate completely the proposed development. The development plan shall specifically include such information as required by this chapter.

Drainage system*: All streets, gutters, inlets, swales, storm drains, channels, streams, or other pathways, either naturally occurring or manmade, which carry and convey storm water during rainfall events.

Easement*: A grant of one (1) or more of the property rights by the property owner to and/or for the use by the public, a corporation, or another person or entity.

Easement, utility*: An easement granted for installing and maintaining utilities, across, over or under land together with the right to enter thereon with machinery and other vehicles necessary for the maintenance of utilities.

Edwards Aquifer Recharge Zone (EARZ)*: That area where the stratigraphic units constituting the Edwards Aquifer out crop, and including the outcrops of other formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features would create a potential for recharge of surface waters into the Edwards Aquifer. The recharge zone is identified as that area designated as such on official maps located in the offices of the Texas Commission on Environmental Quality (TCEQ) and the Edwards Aquifer Authority.

Edwards Aquifer Transition Zone*: That area where geologic formations out crop in proximity to and south and southeast of the recharge zone and where faults, fractures, and other geologic features present a possible avenue for recharge of surface water to the

Edwards Aquifer, and including portions of the Del Rio Clay, Buda Limestone, Eagle Ford Group, Austin Chalk, Pecan Gap Chalk, and Anacacho Limestone. The transition zone is identified as that area designated as such on official maps in the offices of the Texas Commission on Environmental Quality (TCEQ) and the Edwards Aquifer Authority.

Elevated building*: Elevated building means a non-basement building (i) built, in the case of a building in Zones AE, A, A99, AO, AH, X, and D, to have the top of the elevated floor, elevated above the ground level by means of pilings, columns (posts and piers), or shear walls parallel to the floor of the water and (ii) adequately anchored so as not to impair the structural integrity of the building during a flood of up to the magnitude of the base flood. In the case of Zones AE, A, A99, AO, AH, X, D, "elevated building" also includes a building elevated by means of fill or solid foundation perimeter walls with openings sufficient to facilitate the unimpeded movement of flood waters.

Erodible soils*: Soils rated as Austin Silty Clay, bracket clay loam, Brackett-Austin complex (Austin only), Gullied land, Houston clay, Houston-Sumter clays, Houston Black clay, Houston Black gravelly clay, San Antonio clay loam, Venus loam, Venus clay loam, Webb fine sandy loam, Webb soils in the Soil Survey.

Existing construction*: For the purposes of determining rates, structures for which the "start of construction " commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before the date. "Existing construction" may also be referred to as "existing structures."

Existing manufactured home park or subdivision*: A manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by a community.

Filtration basin*: Filtration basins are secondary treatment structures that follow sedimentation basins and release storm water runoff through a filter media to remove additional pollutants.

First flush*: At least the first one-half (½) inch of runoff from a storm event which flushes off and contains a disproportionately large loading of the accumulated pollutants from impervious and non-impervious surfaces.

Flood fringe*: That portion of the floodplain outside of the floodway.

Flood insurance rate map (FIRM)*: Flood rate insurance map (FIRM) means an official map of a community, on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

Flood insurance study*: The official report provided by the Federal Emergency Management Agency. The report contains flood profiles, water surface elevation or the base flood, as well as the flood boundary map.

Flood or flooding*: Flood or flooding means a general and temporary condition of partial or complete inundation of normally dry land areas from:

1) The overflow of inland or tidal waters.
2) The unusual and rapid accumulation of runoff of surface waters from any source.

Floodplain*: Any land area susceptible to being inundated by water from any source (see definition of flooding). The 100-year floodplain is also known as the area of special flood hazard.

Floodplain, 100-year*: See 1% annual chance floodplain.

Floodplain management*: The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain management regulations*: Zoning ordinances, subdivision regulations, bonding codes, health regulations, special purpose ordinances (such as a floodplain ordinance, grading ordinance and erosion control ordinance) and other applications or police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

Floodplain standards or floodplain ordinance*: See Appendix F, Floodplains.

Flood proofing*: Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Flood protection system*: Those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent or the areas within a community subject to a "special flood hazard" and the extent or the depths or associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Floodway*: The channel or a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood. The floodway is the 100-year floodplain in the City of San Antonio.

Freeboard*: Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of storm water management. "Freeboard" tends to compensate for the many

unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed.

Highest adjacent grade*: The highest natural elevation of the ground surface, prior to construction, next to the proposed walls of a structure.

Impervious*: See impervious cover.

Impervious cover*: Roads, parking areas, buildings, pools, patios, sheds, driveways, private sidewalks, and other impermeable construction covering the natural land surface; this shall include, but not [be] limited to, all streets and pavement within the subdivision. "Percent impervious cover" is calculated as the area of impervious cover within a lot, tract, or parcel or within the total site being developed, divided by the total area within the perimeter of such lot, tract, parcel or development. Vegetated water quality basins, vegetated swales, other vegetated conveyances for overland drainage, and public sidewalks shall not be calculated as impervious cover.

Infrastructure*: Any physical system or facility that provides essential services such as transportation, utilities, energy, telecommunications, waste disposal, park lands, sports, buildings, housing facilities and the management and use of resources regarding the same. Infrastructure includes drainage systems, irrigation systems, sidewalks, roadways, drain systems, water systems, driveways, trails, parking lots, and other physical systems or facilities as generally described above that may not be specifically enumerated in this definition.

Intermediate floodplain*: Any channel, creek, stream, branch, or watercourse for surface water drainage that drains an area greater than three hundred twenty (320) acres but less than six hundred forty (640) acres.

Intermittent stream*: A stream that flows only during wet periods of the year (or thirty (30) to ninety (90) percent of the time) and flows in a continuous, well-defined channel.

Levee*: A manmade structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

LOMR*: A letter of map revision. A LOMR will be submitted for FEMA approval for all changes to the floodplain boundary that are delineated on the current flood insurance rate maps.

Lot, 900 series*: These lots specifically exclude the construction of all residential and nonresidential structures. The series is designed to allow for designation of permeable or impermeable open space and may include but not be limited to parkland required by section 35-503, storm water management facilities, water quality ponds, driveways,

gazebos, playgrounds, private streets, utility easements and private ingress/egress easements.

Lowest floor*: The lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking or vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirement of Section 60.3 of the National Flood Insurance Program regulations.

Low risk flood area*: Low risk flood area as used in section 35-F145 refers to the River Bend area of the San Antonio Riverwalk. For floodplain management purposes, low risk flood areas are defined as either the areas outside the one (1) percent annual chance floodplain and inside the 0.2 percent annual chance floodplain or areas of shallow flooding.

Major floodplain*: Any channel, creek, stream, branch, or watercourse for surface water drainage that drains six hundred forty (640) acres or more.

Manufactured home or manufactured housing*: A HUD-Code manufactured home. For purposes of the floodplain ordinance, a "manufactured home" means a structure transportable in one (1) or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle".

Manufactured home park or subdivision*: For purposes of the floodplain ordinance, a parcel (or contiguous parcels) of land divided into two (2) or more manufactured home lots for rent or sale.

Mean sea level*: For purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

Minor floodplain*: Any channel, creek, stream, branch, or watercourse for surface water drainage that drains an area greater than one hundred (100) acres but less than three hundred twenty (320) acres.

Natural waterway: A waterway that results from implementation of management practices that allow for adequate conveyance of storm water (stream discharge), optimize plant and wildlife diversity, and maintain high water quality within the waterway while promoting a natural riparian environment.

Net area*: Mean total acreage within a master development plan less the area within the 100-year floodplain and the area dedicated to conservation easement, natural area (such as greenbelt) and parks.

New construction*: For the purpose of determining insurance rates, structures for which the "start of construction" commenced on or after the effective date of an initial FIRM or after December 31, 1974, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, "new construction" means structures for which the "start of construction" commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

New manufactured home park or subdivision*: A manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of floodplain management regulations adopted by a community.

Overland flow*: Storm water runoff that is not confined by any natural or manmade channel such as a creek, drainage ditch, storm drain, or the like. Also known as "sheet flow", this involves the movement of runoff in a thin layer (usually less than one (1) inch in depth) over a wide surface, which begins when water ponded on the surface of the land becomes deep enough to overcome surface retention forces.

Pervious pavement*: A pavement system with traditional strength characteristics, but which allows rainfall to percolate through it rather than running off. A permeable pavement system utilizes either porous asphalt, pervious concrete, or plastic pavers interlaid in a running bond pattern and either pinned or interlocked in place. Porous asphalt consists of an open graded course aggregate held together by asphalt with sufficient interconnected voids to provide a high rate of permeability. Pervious concrete is a discontinuous mixture of Portland cement, coarse aggregate, admixtures, and water which allow for passage of runoff and air. Examples of permeable pavement systems include Grasspave2®, Gravelpave2®, Turfstone®, and UNI Eco-stone®. (See Watershed Management Institute, Inc. and U.S. Environmental Protection Agency, Office of Water, Operation, Maintenance and Management of Storm Water Management (Aug. 1997), at 2-32; Booth and Leavitt, Field Evaluation of Permeable Pavement Systems for Improved Storm Water Management, 65 J. Am. Planning Ass'n 314 (Summer 1999), at 314-325.

Public right-of-way*: A strip of land acquired by reservation, dedication, forced dedication, prescription, or condemnation and used or intended to be used, wholly or in part, as a public street, alley, walkway, drain or public utility line.

Public right-of-way (2)*: An area or strip of land, either public or private, occupied or intended to be occupied by a street, walkway, railroad, utility line, drainage channel, or other similar uses.

Redevelopment: Any new development to already developed real estate.

Regional Detention Facility: A detention facility accepting flow from an area exceeding three hundred twenty (320) acres.

Regional storm water improvements (RSI)*: Means regional detention and retention ponds, watershed protection, land purchase, waterway enlargement, channelization, and improved conveyance structures.

Regulatory Flood Event: A flood event that has a one (1) percent or greater chance of flooding in any given year assuming ultimate development has occurred throughout the watershed.

Regulatory floodplain*: The land within the community subject to a one (1) percent or greater chance of flooding in any given year assuming ultimate development has occurred throughout the watershed. For the purposes of this section the regulatory floodplain is limited to the reach of the stream which is designated as an area of special flood hazard on the currently effective FEMA Flood Insurance Rate Maps (FIRM Panels). NOTE: As the city's floodplain ordinance (Appendix F of the Unified Development Code) is approved by FEMA as a condition of participation in the National Flood Insurance Program (NFIP), the city's regulatory floodplain is considered FEMA's regulatory floodplain. (note: to be consistent with Appendix F, section 106)

Repetitive loss. Flood-related damages sustained by a structure on two (2) separate occasions during a ten-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds twenty-five (25) percent of the market value of the structure before the damage occurred.

Reservation, reserve, or reserve strip*: Any division of property that:

(a) Prohibits or interferes with the orderly extension of streets, bicycle or pedestrian ways, sanitary drain water mains, storm water facilities or other utilities or improvements between two abutting properties; or

(b) Plats an area so as to leave an undevelopable or unmarketable strip of land less than two hundred seventy (270) feet deep off of an arterial right-of-way that could otherwise circumvent construction and dedication requirements.

Right-of-way*: Property that is publicly owned or upon which a governmental entity has an express or implied property interest (e.g. fee title, easement, etc.) held for a public purpose. Examples of such public purpose include, by way of example and not limitation, a highway, a street, sidewalks, drainage facilities, drainage and water facilities.

Sedimentation basins*: Sedimentation basins remove pollutants by creating conditions under which suspended solids can settle out of the water column.

Sheet flow*: See Overland flow.

Shrub, large*. An upright plant growing to a mature height of more than ten (10) feet for use a natural ornamentation or screening.

Shrub, medium*. An upright plant growing to a mature height of five (5) to ten (10) feet.

Shrub, small*. An upright plant growing to a mature height of less than five (5) feet.

Start of construction*: Start of construction means for all new construction and substantial improvements, the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within one hundred eighty (180) days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation for a foundation; or the placement of manufactured home on a foundation. Permanent construction includes land preparation, such as clearing, grading and filling; includes the installation of streets and/or walkways; excavation for a basement, footings, piers, or foundations or the erection of temporary forms; the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. The start of construction period is valid for one hundred eighty (180) days. Any delay beyond this period would require resubmission of added data and the permit application.

Storm water drainage fees*: A method or mix of methods for providing adequate, stable and equitable funding for a comprehensive storm water or drainage program. The financing mechanisms included in the method may include, but not be limited to, user fees, new development impact fees, or surcharges on other utility fees.

Streamside management zone (SMZ)*: A streamside management zone (SMZ) includes forested buffers adjacent to streams or bodies of water, including intermittent and perennial streams, river, lake, slough, pond, creek, reservoir, watershed, or wetland (ephemeral streams are excluded). The minimum width of an SMZ on each side and above the head of streams or adjacent to bodies of water shall be fifty (50) feet from each bank. The total SMZ width includes average stream channel width plus buffer width.

Street, private*: Any street not dedicated to the public and to be maintained by a private entity. Informal maintenance or improvements performed by the city, such as the utilization of waste material to temporarily maintain or improve a private street, do not constitute an acceptance of ownership or obligation by the city.

Substantial damage*: Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed fifty (50) percent of the market value of the structure before the damage occurred. Substantial

damage also means flood-related damages sustained by a structure on two (2) separate occasions during a ten-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds twenty-five (25) percent of the market value of the structure before the damage occurred.

Substantial improvement*: Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds fifty (50) percent of the market value of the structure before "start of construction" of the improvement. This includes structures which have incurred "repetitive loss" or "substantial damage", regardless of the actual repair work performed. The term does not, however, include either: (1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary conditions or (2) Any alteration of a "historic structure", provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Substantial rehabilitation*: Certified improvements to a historic building in which the cost of the project is equal to or greater than fifty (50) percent of the appraised pre-rehabilitation improvement value of the property and which constitutes major work on enhancing existing mechanical or structural systems that preserve the historical integrity, while extending the life of the building.

Swale*: A low lying or depressed stretch of land without a defined channel or tributaries.

Top of bank*: For purposes of determining river improvement overlay riverside setbacks in section 35-673, the point, stage or elevation at which water overflows the natural or man made banks of the river; alternately, the vertical point along the river where an abrupt change in slope is evident, and where the water level is generally able to overflow the natural bank or man made edge and enter adjacent floodplains (if any) during flows at or exceeding the average annual high water stage.

Understory*: Assemblages of natural low level woody, herbaceous and ground cover species.

Unflooded access*: Means that vehicular traffic has safe access to a property from a public street in times of flood (regulatory 100-year flood). A property will be considered to have unflooded access to an existing street if flow depths for access on the street adjacent to the property do not exceed one (1) foot and fall within the safe range on Figure 4.3.1C "Dangerous Conditions on Crossing During Floods."

Violation*: For purposes of the floodplain ordinance, the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other

certifications, or other evidence of compliance required in this chapter is presumed to be in violation until such time as that documentation is provided.

Water surface elevation*: The height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas.

Watercourse*: A natural or manmade channel through which storm water flows.

Watershed*: The area drained by a given stream, river, watercourse, or other body of water.

Wetland*: See Texas Natural Resources Code § 221.001.

[Commentary: this statute presently defines "wetland" as follows: "land that: (A) has a predominance of hydric soil; (B) is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and (C) under normal circumstances does support a prevalence of that vegetation.]

APPENDIX

APPENDIX A
CHECKLIST

A.1 Storm Water Management Plan Checklist

To standardize the review process and minimize the time for approval by the city during review of the plat and construction drawings for a subdivision, a complete submittal regarding the analysis of existing drainage conditions and the design of modifications or new drainage facilities is necessary. The owner of the property to be developed is required by the Director of TCI to provide, at the owner's expense and as a condition of construction plan approval, a storm water management report for the total development area to be ultimately constructed. The storm water management report shall contain all of the necessary support data, methodologies used in calculations, and conclusions. The checklist below will be used by the city reviewer as a guide during the evaluation of all storm water management reports submitted to the city. The purpose of the checklist is to expedite the review process for both the engineer and the city, and to aid the engineer in the preparation of reports for the city's review. The storm water management report shall be submitted to the Director of TCI through the director of planning and development services prior to approval of any construction plans.

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS
Storm Water Engineering Review Team
Submittal Review Checklist / Comments

Date:	Engr. of Record:
Project:	Contact Name:
Type / City ID No.:	Phone Number:
Design Firm:	email:
REVIEWER:	QA/QC:
Phone Number:	Team Leader:
Email:	SWE ID:

SUBMITTAL TYPE	SUBMITTED / REVIEWED
☐ Major Plat ☐ Minor Plat	☐ I. Storm Water Management Plan (SWMP)
☐ MDP/ MPCD ☐ PUD	☐ II. Construction Plans ☐ III. Plat
☐ Building Permit ☐ RIO Zoning	☐ IV. Floodplain Analysis
☐ Low Impact Development (LID)	☐ CLOMR ☐ LOMR ☐ Other

To expedite review, please reference all City approved Plans, Plats, Building Permits or Floodplain Analyses associated with this development. Please provide as much information as available.

Parent Projects:	**NUMBER**	**NAME**	**DATE**	**Approved SWMP***
MDP (MPCD)+:				☐
PUD+:				☐
Plat:				☐
Flood Study:				☐
Building Permits:				
Site:				☐
Foundation:				☐
Shell:				☐

*Approved Storm Water Management Plan with included Adverse Impact Analysis. (Please note that further adverse impact analysis may be required.)

+ MDP = Master Development Plan, MPCD = Master Planned Community District, PUD = Planned Unit Development

For Resubmittals:

1. Please respond to each set of the comments with a cover letter. Concurrent reviews require separate resubmittal packages.
2. Submit one (1) signed/sealed copy and one (1) digital copy in the resubmittal package accompanied by original redlines if applicable.
3. Include certification that no changes or additions were made to plans or the report other than those addressing said comments. If other changes were made, please include a description of those changes.

I. Storm Water Management Plan (SWMP)

			STAFF USE ONLY		
	N/A	Included	Complete	Incomplete	Comments
A. GENERAL					
1. Signed, sealed & bound **Storm Water Management Plan (SWMP)** (one (1) hard copy and one (1) digital copy)					
2. **Introduction & Executive Summary** of existing conditions, proposed project, and methods used for analysis					
3. ***Adverse Impact Statement***: *"The increased runoff resulting from proposed development will not produce a significant adverse impact to other properties, habitable structures or drainage infrastructure systems to a point 2,000 feet downstream. Downstream conditions (including actual curb depth) in this reach have been field verified by myself or members of my staff. Therefore, the owner requests to participate in the Regional Storm Water Management Program by paying a fee-in-lieu-of onsite detention."*					
4. **Regional Storm Water Management Program Participation Form**					
5. **Project Location Map**					
6. **Digital Flood Insurance Rate Map (DFIRM)** with site superimposed					

7. ***Grading Plan*** *(Also required in construction plans)*
• *Lots grading properly according to FHA Lot Grading Type (A, B, C)*
• *Driveway Detail, reference to critical Type "C" lots*
• Check T-intersections, cul-de-sacs, and knuckles to make sure runoff is contained in streets
• Interceptor channels are required when:
  ○ Offsite drainage area flowing onto site is greater than 3 acres, or
  ○ Offsite drainage area flowing onto site is greater than 2 average residential lot depths					

8. **Aerial map** • *To expedite review, delineate site boundaries, point 2,000 ft downstream, all downstream storm water facilities and other pertinent physiographic information.*					

9. **Onsite Drainage Area Map(s)** (to scale) for **Existing**, **Proposed**, **and Ultimate Conditions**: • *Show Time of Concentration (Tc) pathways* • *Show individual and overall drainage areas for the site. Indicate area of each watershed* • *Show computation points and points of discharge; Table of hydrologic calculations for each individual and cumulative drainage area and points of discharge. Include acreage, runoff coefficients, Tc values, and rainfall intensities for the 5, 25, & 100-yr storm events, as applicable.*					
10. ***Overall Drainage Area Map(s)*** *(to scale) for* ***Existing***, ***Proposed***, *and* ***Ultimate Conditions****:* • *Include point 2,000 ft downstream (For lots less than three (3) acres in size adverse impact analysis need only extend to where tributary drainage areas equal to 100 acres)* • *Show Time of Concentration (Tc) pathways* • *Show individual and overall drainage areas for the site. Indicate area of each watershed* • *Show computation points and points of discharge* • *Table of hydrologic calculations for each individual and cumulative drainage area and points of discharge. Include acreage, runoff coefficients, Tc values, and rainfall intensities for the 5, 25, & 100-yr storm events, as applicable*					
11. **Impervious Cover Exhibit(s)**: Indicate existing and proposed impervious cover					
12. **Floodplain Submittal** is required if property is within, abutting, or adjacent to a floodplain, see Floodplain Section below.					
13. Verify if site is in a **Mandatory Detention Area**					
B. HYDROLOGY					

1. **Description of Method for Hydrologic Analysis Detailed runoff calculations include:**
• Hydrologic Calculation Methods (Reference Chapter 5, Hydrology):
  ○ Rational Method: Drainage area ≤ 200 acres
  • Detailed Time of Concentration (Tc) calculations;
  • Weighted runoff coefficients; Rainfall intensities;
  • Peak flow for Q5, Q25, Q100
  ○ SCS or other Hydrograph Method allowed for drainage areas > 20 acres and required for drainage areas > 200 acres
• Typical SCS programs used: HEC-HMS, Pond Pack, Hydraflow. XPStorm, etc.
• Provide all electronic files
• Detailed Time of Concentration/Lag Time calculations
• SCS curve number (CN) value: provide detailed calculations & Soil Survey Map or Geotechnical Report to support
  ○ Soil Survey Map of area (site delineated, soil type & acreage of each soil group)
• % Impervious Cover detailed calculations and exhibit
• Verify rainfall depths					

	• Routing Values: Provide detailed calculations (types of routing are Modified Puls or Muskingam Cunge) ○ Verify Reach lengths for routing and velocities					
2.	**Table comparing the Existing, Proposed, & Ultimate Condition Peak Flows (5, 25 and 100yr)**					
C. HYDRAULICS						
1.	**General:** • Storm water infrastructure for drainage areas < 100 ac, design for the Q25 • For all storm water facilities with drainage area ≥ 100ac, design for Q100					
2.	**Street Capacity:** • Local 'A': Q5 contained within top of curb, Q25 contained within ROW • Collector/Local 'B": Q25 contained within top of curb • Primary/Secondary Arterial: Q25 contained within top of curb & one lane in each direction shall remain passable with a flow depth not to exceed 0.3 ft • For drainage area > 100 acres, Q100 contained within top of curb. Use actual curb heights in calculations for existing streets (non-standard curbs, street overlays, etc.)					
3.	**Dead end street draining to unpaved surface:** • Runoff velocity < 6 fps. • Ensure runoff will flow into drainage easement					

4.	**Storm Drain:**
	• Inlets designed for 25yr capacity
	• HGL/EGL: provide detailed calcs (including junction losses). Show on S.D. profiles
	• EGL: below top of curb and top of junction box or, if approved by City, specify bolted manhole covers.
	• HGL: below gutter
	• Min easement: 15 ft min or 6 ft from pipe limits
	• Minimum Pipe Slope: 0.3%
	• Minimum Cleaning Velocity: 3 fps for 5-yr (20% ac) storm
	• Maximum Permissible Velocity:
	  ○ Maximum Velocity for Trunk lines: 15 fps
	  ○ Maximum Velocity for Laterals: No limit
	• Slopes or velocities outside the allowable range may require additional certifications at permitting or final inspection and/or additional warranties.
	• Reinforce Concrete Pipe required under public streets
	• Pipe Diameter
	  ○ Trunk Lines: Minimum 24 in diameter
	  ○ Laterals and driveway crossings: <24 in diameter may be allowed on a case-by-case basis					

5.	**Channels:** (provide detailed calculations) • If Drainage area < 100ac : Contain W.S. for Q25 plus freeboard (see Table 9.3.14) • If Drainage area ≥ 100ac : Contain W.S. for Q100 or Q25 plus freeboard, whichever is greater					

• Channel bend freeboard calculations (if centerline radius is < 3 times the bottom width)
• Verify if the channel has adequate drainage easement
• Include a channel maintenance schedule for new channels
• Verify Manning's Roughness Coefficient (n) (Reference Table 9.2.4.1)
• Earthen channel:
  o Verify 15 ft access easement on one side
  o Max 6 fps except as shown in Table 9.3.8
  o Pilot channel required if slope < 0.5%
  o Maximum 3:1 side slopes
• Concrete channel:
  o Verify 15 ft access easement on one side, 2 ft easement on the other
  o Minimum longitudinal slope: 0.4% or 0.1% with minimum cleaning velocity of 3 fps for existing Q5
  o For trapezoidal channels, maximum 1.5:1 side slope without geotech design
  o Handrails or fencing required for channels with vertical walls or side slopes > 2:1 when wall height exceeds 2 ft
  o Check outfall velocities
• Side-Lot Flumes:
  o Public Easements: verify 10 ft access easement on one side, 2 ft easement on the other
  o Private Easements: verify 2 ft easement on either side
  o Slope and velocity requirements are the same as for concrete channels.
• Turf Reinforcement Matting: 6 fps < V < 12 fps. If > 12 fps, engineer's report should certify that material is appropriate for velocity. Include manufacturer spec's & installation instructions. Engineer to certify at final inspection that material was installed correctly.
• Interceptor channel: Drainage easement shall extend a min of 2 ft on both sides of the channel
• Handrails or fencing required on vertical headwalls greater than 2 ft in height and wing walls with slopes steeper than 2:1					

6. **Outfalls / Outlets / Transitions**
• When one channel discharges into another channel verify that storm water will be contained within the receiving channel. Verify that the outfall velocity into the receiving channel will not result in runoff jumping out of the receiving channel.
• Concrete rip rap or other velocity control/erosion protection measures may be required at pipe/channel and channel/channel intersections and transitions.
• If outfall velocity exceeds 6 fps at transition to earthen channel or other non-paved surface, provide energy dissipators or other velocity control measures
  o Verify that the proposed energy dissipator type is appropriate for the outfall conditions (Reference Chapter 10, Table 10.4.3)
  o Detailed calculations are required when energy dissipators are proposed
  o Provide retard spacing and concrete transition length where applicable
• Hydrograph timing & analysis of backwater may affect outfall and dissipator calculations
	—				

D. ADVERSE IMPACT ANALYSIS						
1. **Narrative** • Provide an Adverse Impact Analysis and an Adverse Impact Statement • Discuss in detail the downstream conditions • Discuss if drainage patterns have changed from the previously approved MDP, if applicable						
2. **If site work permit ONLY with no increase in impervious cover –** Demonstrate that drainage patterns are not obstructed. Grading plan required. Detailed adverse impact analysis may be required.						
3. **Provide detailed hydrologic & hydraulic calculations from proposed development to 2,000 ft downstream** • Verify hydrologic calculation method • Compare existing, proposed, and ultimate peak flows • Reference Checklist Section B						
4. **Street Capacity:** • Local 'A': Q5 contained within top of curb, Q25 contained within ROW • Collector/Local 'B": Q25 contained within top of curb • Primary/Secondary Arterial: Q25 contained within top of curb & one lane in each direction shall remain passable with a flow depth not to exceed 0.3 ft • For drainage area > 100 acres, Q100 contained within top of curb. Use actual curb heights in calculations for existing streets (non-standard curbs, street overlays, etc.) • Velocity < 10 fps						
5. **Curb Inlets:** • Opening capacity detailed calculations for Q25 • HGL/EGL: provide detailed calcs (including junction losses). • EGL: below top of curb • HGL: below gutter line						
6. **Storm Drain:** • HGL/EGL: provide detailed calcs (show losses). Show on storm drain profiles. • EGL: should be below junction box lid/manhole						
7. **Channels: (provide detailed calculations for Ultimate Q & Channel Capacity):** • Contain ultimate Q25 plus freeboard or ultimate Q100, whichever is greater, within drainage easement/ROW & does not flood habitable structures.						
8. **Culvert:** • Runoff should not overtop an existing structure under the roadway for the existing, proposed, and ultimate of the 5, 25, & 100 yr condition **OR**… • A new culvert should be designed for the 25 yr ultimate for drainage areas ≤ 100 acres or 100-year for drainage areas greater than 100 acres						
9. **Low Water Crossings** (Provide detailed calculations and discuss): • Low Water Crossing must not be classified as "Dangerous" during regulatory (5, 25, or 100 yr frequency) storm events • If the WSE exceeds this criterion the crossing may be improved in lieu of providing onsite						

mitigation measures or paying a fee-in-lieu of detention. This is to be considered on a case by case basis and may require a developer agreement.					
10. **Underground Utilities in Floodplain:** • Provide buoyancy and scour calculations for the 5, 25, and 100 yr storm events • Show any required concrete capping or encasement in construction plans					
E. DETENTION					
1. **Provide Drainage Area Map(s)** (to scale) for **Existing and Proposed Conditions:** • Also include ultimate conditions, if applicable (phased construction, basin serving multiple lows, etc.) • Include Time of Concentration/Lag time flow paths • Modified Rational Method may be used for drainage areas up to 20 acres • SCS Method to be used for drainage areas > 20 acres (i.e. HEC-HMS, Pond Pak, Hydraflow, etc.) • SCS Method to be used for modeling multiple ponds, regardless of drainage area					
2. **Provide results in tabular format with detailed calculations for allowable/existing, proposed, and ultimate discharges from the structure**					
3. **Post- development discharges** from the pond for the 5, 25, and 100 yr must be equal to or less than existing conditions					
4. Provide inflow and **outflow hydrographs** for 5, 25, and 100 yr (proposed, ultimate)					
*5. Provide **required storage** for the 5, 25, and 100 yr (proposed, ultimate)*					
6. **Include stage vs. discharge and stage vs. storage tables**					
7. **Provide outlet rating curve**					
8. **Provide Pondpack, Hydraflow Hydrographs, or other applicable calculation files on CD**					
9. **Verify if pond qualifies as a TCEQ dam.** (Reference Chapter 13 for dam requirements)					
10. **Verify basin side slopes:** • Maximum 3:1 for earthen berm/side slopes • Concrete side slopes/walls may require structural details or geotech analysis depending on slope and height (see concrete channel wall requirements)					
11. **Check hydraulics of outlet structure:** • Verify weir and orifice size(s) and elevation(s) • Check effect of tail water elevation on outfall hydraulics • Outfall velocity: maximum 6 fps (sandy soils may require a discharge velocity less than 6 fps) • Provide energy dissipation if needed (include calculations and construction details)					

12. **Verify design water surface elevations are below the top of pond:** • 100 yr proposed/ultimate or 25 yr proposed/ultimate plus freeboard • If TCEQ dam, provide auxiliary spillway					
13. **Restrictor plates** may be required for ponds with phased development					
14. **Provide pond grading on subdivision plat**					
15. **Provide detention pond construction plans** (signed & sealed), including but not limited to: • Pond grading • Notes for establishing vegetation • Pond details, including cross-sections with design water surface elevations • Outfall structure (pipe, weir, etc.) details • Restrictor plate details, as applicable					
16. **Deferred Detention:** • Detailed detention analysis and construction of ponds may be allowed on a case by case basis • Preliminary detention calculations are still required at platting					
17. **Regional Storm Water Detention Facilities**: • Provide 15 ft easement around top of bank and/or 100 yr flood inundation pool for maintenance [and public safety] purposes					
18. **Public Detention Facilities:** • Provide access ramps with a maximum slope of 7:1 for access to the flow line of the facility (also recommended for private facilities)					
19. **Provide a signed Maintenance Agreement**					
20. **Drainage Easements for Detention Ponds:** • Show detention pond easements on the plat when the detention is being designed and constructed as part of the plat • Detention pond easements generally shall not be provided on the plat when detention is deferred					
21. **Detention Pond Conformance Letter:** • Submit letter to TCI after pond is constructed • Plat recordation, building permit approval, or certificate of occupancy may be withheld until letter is submitted by applicant and accepted by TCI • Plat recordation will not be withheld when deferring detention					
F. OTHER					

II. CONSTRUCTION PLANS

Refer to Standard Details and Design Guidance Manual

	N/A	Included	STAFF USE ONLY: Complete	STAFF USE ONLY: Incomplete	Comments
A. STREET PLANS					
1. **Signed and sealed Construction Plans** • Submit one (1) hard copy and one (1) digital copy with original submittal and resubmittals; • Once the plans are approved, additional hard copies of the plans may be requested for distribution to the City inspectors.					
2. **Slope to inlet:** min = 0.5% ; max = 4% • Positive drainage provided to all inlets, including those located at the low point of (i.e. in the sag of) a vertical curve					
3. **Provide flow arrow for washout crowns**					
4. **Provide flow arrows and detailed grading at T-intersections, cul-de-sacs, and knuckles** as needed to make sure runoff is contained in streets					
B. DRAINAGE PLANS					
1. **Signed and sealed Construction Plans** • Submit one (1) hard copy and one (1) digital copy with original submittal and resubmittals; • Once the plans are approved, additional hard copies of the plans may be requested for distribution to the City inspectors.					
2. **Standard notes:** • Improved earthen channels and detention ponds will be vegetated by seeding or siding. Eighty five percent (85%) of the channel surface area must have established vegetation before the City of San Antonio will accept the channel for maintenance • All concrete lining shall develop a min. compressive strength of 3,000 psi in 28 days • For normal conditions, the concrete lining shall be a minimum of five (5) inches thick and reinforced with **No. 4 round bars @ 18 inches on center each way or welded wire fabric of 6"x6" – W/D6 x W/D6.** Where surcharge, nature of ground, height and steepness of slope, etc. become critical, design shall be in accordance with latest structural standards. All concrete lining shall develop a minimum compressive strength of not less than three thousand (3,000) pounds per square inch in twenty-eight (28) days. The depth of all toe downs shall be 36 inches upstream, 24 inches downstream, and 18 inches for side slopes. The City's Construction Inspector may permit an 18" toe down in rock sub grade in lieu of the above toe down requirements. The horizontal dimensions of toe downs shall not be less than six (6)					

inches.					
3. **Storm Drain:** • Minimum easement required (15ft) or 6 ft from extreme limits of pipe • Minimum 2' vertical/horizontal clearance between storm drain pipes and other utilities, or provide concrete encasement					
4. **Junction box:** • Minimum 6 in clearance from O.D. of pipe to inside of junction box wall • Invert of junction box to be shaped with concrete fill (2,500 psi min) to ensure drainage to outlet pipe					
C. STANDARD DETAIL SHEETS					
1. **Junction Box:** • Check for standard junction box detail • If proposed span larger than standard, reinforcement and concrete wall thickness calculations and a signed and sealed detail must be provided					
2. **Curb inlets** shall be per City standard details. Inlet extensions are acceptable as follows: • Maximum of one (1) extension allowed for inlets on grade • Inlet extensions are typically not allowed for sump inlets • If proposing multiple extensions on grade or extensions for sump inlets, additional capacity calculations or non-standard detailed drawings may be required					
3. **Pipe Bedding and Backfill Details** *(See special detail)* • Note on 2nd layer (Rocks not larger than 1 in)					
4. **Provide concrete collars at all tie-ins**					
5. **Grout should be added to spring line**					
6. **Weep Holes**: • Required in rip rap and on headwalls 5ft and higher • Place weep holes 6" above the toe at 10 ft o.c. • Geo-fabric is to be placed behind the riprap to hold the gravel (1 cubic foot per weep hole)					
D. UTILITY LAYOUT					
1. **Lateral tie-ins** from properties to public storm drain systems • Laterals < 24 in may be approved on a case by case basis					
2. **Utilities in the Floodplain**: • Check if any proposed underground utility lines are in floodplain • Buoyancy and scour calculations may be required					

• Concrete capping or encasement may be required					
E. GRADING PLAN					

1. ***Grading Plan****:*
• Lots grading properly according to FHA Lot Grading Type (A, B, C)
• Driveway Detail, reference to critical Type "C" lots
• Check T-intersections, cul-de-sacs, and knuckles to make sure runoff is contained in streets
• Interceptor channels are required when:
  ○ Offsite drainage area flowing onto site is greater than 3 acres, or
  ○ Offsite drainage area flowing onto site is greater than 2 average residential lot depths					

F. OTHER					

III. PLAT

			STAFF USE ONLY		
	N/A	Included	Complete	Incomplete	Comments
A. GENERAL					
1. Provide one (1) hard copy and one (1) digital copy of the **Subdivision Plat**					
2. **Existing Contours**					
3. **Finished/proposed Contours:** • Street only if no significant site grading • Provide detention pond contours on plat, unless detention is deferred					
3. **Label & dimension all drainage easements** • Public easements: ≥100 acre drainage area or conveying runoff from public ROW or facilities; and/or containing FEMA floodplain • Private easements: <100 acre drainage area and/or not conveying runoff from public ROW or facilities, except for some side-lot flumes • Side-lot flumes: 10 ft access required for public easements; minimum 2 ft either side of channel for private easements		—			
4. **Verify continuation of Streets & Channels**					
5. **Delineate DFIRM 100 Yr Floodplain** • Provide drainage easement to include the worst case of the FEMA 100 yr and the lesser of the Ultimate 100 yr or the Ultimate 25 yr plus freeboard floodplain or a combination thereof					
6. **NOTE:** Temporary easement to expire upon incorporation into platted public street ROW.					
7. **NOTE:** No structures, fences, walls, or other obstructions that impede drainage shall be placed within the limits of the drainage easements shown on this plat. No landscaping or other type of modifications, which alter the cross-sections of the drainage easements, as approved, shall be allowed without the approval of the Director of TCI. The City of San Antonio and Bexar County shall have the right of ingress and egress over grantor's adjacent property to remove any impeding obstructions placed within the limits of said drainage easement and to make any modifications or improvements within said drainage easements.					
8. **NOTE**: Finish floor elevations must be a minimum of (8) inches above final adjacent grade (for residential lots only).					

9. **NOTE:** Minimum finished floor elevations for residential and commercial lots shall be elevated at least one (1) foot higher than the computed water surface elevation for the 100 year ultimate development.					
10. **NOTE**: The maintenance of the detention pond and outlet structure shall be the responsibility of the lot owners or home owners association their successors or assignees and not the responsibility of the City of San Antonio and or Bexar County.					
11. To expedite the review of elevation certificates, indicate the specific minimum finish floor elevation for all lots adjacent to FEMA floodplains.					
12. **Deferred Detention**: Areas within the City Limits. • Provide NOTE: Storm water detention is required for this property. Building permits for this property shall be issued only in conjunction with necessary storm water detention approved by the City of San Antonio. The property may be eligible to post a fee-in-lieu-of onsite detention (FILO) if offsite drainage conditions allow but only when approved by the City of San Antonio. Maintenance of onsite storm water detention shall be the sole responsibility of the lot owners and/or property owners association and their successors or assignees. • Provide preliminary calculations of estimated detention basin size.					
13. **Easement Requirements:** • Easements will be required for all detention facilities accepting runoff from properties other than the lot on which the detention pond exists or will be constructed. When detention is deferred, in lieu of providing an easement on the plat, TCI may require that a note be placed on the plat specifying which lot(s) will provide detention for other lots. TCI may require that an easement be established by separate instrument at building permit. • For regional detention facilities the easement shall extend to a minimum of fifteen feet outside both the 100 yr pool and the structural improvements to facilitate maintenance as well as public safety.					
B. OTHER					

IV. FLOODPLAIN SUBMITTAL

			STAFF USE ONLY		
	N/A	Included	Complete	Incomplete	Comments
A. COSA FLOODPLAIN STUDY					
1. **Provide one (1) hard copy and one (1) digital copy of signed and sealed floodplain study.**					
2. **Narrative:** • Table of Contents and abstract or executive summary • Introduction that includes project description and history, location, scope and objective of analysis, previous and related studies that may affect this analysis • Summary, conclusions, and recommendations. Include the impact on the floodplain's Q, WSEL & velocity.					
3. **Provide analysis of the following:** • 25 yr existing and ultimate development plus required freeboard condition hydrologic and hydraulic analyses • 100 yr existing and ultimate development condition hydrologic and hydraulic analyses					
4. **Vicinity map**					
5. ***Overall Aerial Drainage Area Map(s)*** *(signed and sealed):* • Show Time of Concentration (Tc) pathways • Show individual and overall drainage areas. Indicate area of each watershed • Show computation points and points of discharge • Show runoff coefficients and impervious cover percentage					
6. **Topographic Work Map(s)** (signed and sealed): • Existing conditions work map; showing existing contours, plan view of project limits, effective/existing cross sections, effective floodplain limits, property lines, etc. • Proposed conditions work map; showing the existing and proposed contours where necessary, proposed cross sections, project limits, property lines, revised floodplain limits with drainage easements, etc.					
7. **Grading Plan** (existing and finished contours) signed and sealed					
8. **Channel Cross Sections** (existing superimposed on proposed) show the drainage easement, Manning's coefficients, property lines, structures, etc.)					
9. **Plotted water surface profiles for the ultimate flows (if applicable)**					

10. **Easement for Floodplain** • Provide drainage easement to include the worst case of the FEMA 100 yr (1% annual chance) and the lesser of the Ultimate 100 yr or the Ultimate 25 yr plus freeboard floodplain or a combination thereof • Drainage easements that include FEMA floodplain shall be noted as public easements on plats and other easement documents					
11. **Provide detailed Hydrology calculations**, see checklist Section I.B.					
12. **Channel outfalls perpendicular to the floodplain:** • Channel outfall must be taken to the invert of the floodplain or show the velocity to be less than 6 fps going down the side slope. • 36 in toe-down required. • Floodplain development permit is required if within the city limits					
13. **Provide a summary table (or tables) of the hydraulic model**					
14. **CD of all HEC-HMS, HEC-RAS, XP-SWMM, and/or other models used in analyses**					
15. Is this development over the **Edwards Aquifer Recharge Zone?**					
16. **Flood plain Development Permit Application** (1 copy)					
17. **Elevation Certificates** (if applicable)					
18. **Unflooded vehicular access** must be available to the development from a public street.					
19. **If site is in ETJ, Bexar County is the Floodplain administrator** • COSA Floodplain Development Permit is not required • Coordinate necessary forms and submittal requirements with the County • Bexar County signs the FEMA forms • Verify drainage easement for ultimate conditions					
20. **Contour Data:** • If using agency provided 2 ft aerial contours or 1 ft Lidar contours, field verification is required					
21. **Floodplain Reclamation:** • Account for storage volume lost (with comparable excavation within the same creek floodplain) when reclamation of ineffective flow OR shallow flooding (overbank) areas is proposed • If more than 320 acres drain to site, improvements to site may require an administrative exception					
22. **Master Development Plans (MDP):** • Provide hydraulic analysis of floodplains that are adjacent to this MDP or if no hydraulic study is being done provide the following note on the MDP with signatures of the Owner and Engineer: "The Floodplain limits on this Master Development Plan are estimated and subject					

to change. Approval of subdivision plats associated with this Master Development Plan is subject to the review and approval of a Storm Water Management Plan in accordance with the City of San Antonio Unified Development Code." • **Note that MDP's are conceptual in nature and ONLY conditional approvals shall be given. One condition is that at the time of platting, more detailed downstream analysis will be provided by the engineer.**					
B. FEMA CLOMR / LOMR					
1. **Provide the applicable items listed in the COSA Floodplain Study above**					
2. **MT-2 Form 1, Sec D:** • Provide Owners and Engineer's original signature					
3. **MT-2 Form 2, Sec A:** • Provide an attached explanation if sediment transport is not considered					
4. **MT-2 Form 2, Sec B.4:** • Model names in this section must match the models listed in the CD					
5. ***Detailed Map Revision Study:*** • Include 10, 50, 100 and 500 yr analyses					
6. If applicable, provide **As-Built Grading Plan** with engineer's seal and signature.					
7. Recommend providing **Check-RAS output**					
8. **Provide models for effective, corrected effective, proposed, and ultimate (future) conditions**					
9. **Provide existing and proposed FEMA DFIRM Maps with the following:** • Existing – Label Map "Effective" and show the site boundaries • Proposed – Label Map "Revised/ Proposed", show site boundaries, show only the proposed floodplain limits, floodplain must tie in with the existing floodplain upstream and downstream, show the proposed streets centerline only and label, show the upstream and downstream limits of study					
10. Verify that **Environmental Site Assessment (ESA)** has been submitted (COSA will not review)					
C. OTHER					

			STAFF USE ONLY		
V. OTHER COMMENTS	**N/A**	**Included**	**Complete**	**Incomplete**	**Comments**

APPENDIX B
MISSOURI CHARTS

This Appendix presents methods and charts for determining pressure changes at inlets, square and round junction boxes (manholes) on storm drain systems flowing full. The following instructions and charts are from the University of Missouri Engineering Bulletin No. 41 "Pressure Changes at Storm Drain Junctions"

The University of Missouri Engineering Bulletin No. 41 "Pressure Changes at Storm Drain Junctions" was the results of flume model testing.

Figure B.2 Chart 2 through Figure B.7 Chart 7 each dealt with a rectangular inlet box admitting grate flow and having a specific arrangement of pipelines. Figure B.8 Chart 8 through Figure B.10 Chart 10, supplemented by Figure B.3 Chart 3, apply to square and round manholes with various pipeline arrangements but with no flow admitted through the top of the junction structure. Since no one chart presents a complete solution for manholes, the following explanation of methods for the determination of pressure changes is divided into sections relating to the particular configuration instead of into sections relating to each chart, as was done in the case of inlets.

Pressure change coefficients are presented in Figure B.3 Chart 3 for use in determining the elevation of the pressure line of an in-line pipe upstream from a manhole with through flow only. The pressure change coefficient is controlled primarily by the relative diameters of the upstream and outfall pipes, and secondarily by the distance across the open manhole if the outfall pipe entrance is square-edged. Rounding the outfall entrance eliminates the effects of manhole size relative to the pipe and reduces the coefficients to a limited degree. Manhole cross-section shape is not significant. Thus, the values of Figure B.3 Chart 3 apply equally to round, square, or rectangular manholes. Shaping of the bottom of a manhole to continue a portion of the lower sector of the pipe cross-section through from pipe to pipe is ineffective in reducing losses.

The nomenclature used for all manhole types is given in Figure B.1 Chart 1.

B.1 General Instructions for use of Design Charts

Several operations are common to use of the design charts for various types of junctions. Instructions for performing these recurring procedures are consolidated in the following General Instructions. In the detailed instructions for use of the individual charts, references to these General Instructions are made by number (Gen. Instr. 1, etc.). The General Instructions follow.

1. Determine and tabulate the elevation of the outfall pipe pressure line at the branch point or inlet center (refer to Figure B.1 Chart 1).

This elevation is obtained by adding to the elevation of the pressure line at the preceding structure downstream the pipe friction loss

(Equation B.1a)

$$\mathbf{h_f = LS_f}$$

$\mathbf{h_f}$ = friction loss (ft.)

L = length from center to center of structures (ft.)

$\mathbf{S_f}$ = friction (or resistance) loss per ft. at the given rate of flow for the given pipe flowing full.

2. Calculate the mean velocity head of the flow in the outfall pipe.

(Equation B.1b)

$$\mathbf{h_v = \frac{V_o^2}{2g} = \frac{1}{2g}\left(\frac{Q}{Area}\right)^2}$$

$\mathbf{h_v}$ = velocity head (ft.)

g = acceleration of gravity = 32.2 ft./sec^2.

Q = rate of flow in pipe flowing full (cfs)

Area = Area of pipe = 0.7854 D^2 (ft^2)

D = pipe diameter (ft.)

3. Calculate the required flow rate and size ratios.
   Examples: Q_U/Q_O, Q_L/Q_O, Q_G/Q_O, etc.
   D_U/D_O, D_L/D_O, B/D_O, etc.
4. Estimate the depth of water in a rectangular inlet with flow into the inlet from a top grate, either alone or combining with flow from an upstream pipe.
   d = total depth of water (ft.)
   = (outfall pressure line elevation minus inlet bottom elevation) $+\mathbf{K}\frac{\mathbf{V_o^2}}{\mathbf{2g}}$
   K = the pressure change coefficient for the inlet water depth (This is estimated as detailed for each type of inlet. Such estimates are not necessary for inlets with in-line or off-set opposed laterals.)
5. Use the coefficients K from the charts for inlets and junctions with square-edged entrance to the outfall pipe (entrance flush with box side, with sharp edges).
6. Use reduced coefficients K, where applicable, for a rounded entrance to the outfall pipe (rounded on ¼ circle arc of approximate radius $^1/_8$ D_O) or for an entrance formed by the socket end of a standard tongue-and-groove concrete pipe.
   Figure B.2 Chart 2-insignificant effect; make no reduction.
   Figure B.3 Chart 3-read directly from chart.

Figure B.4 Chart 4-reduce K_U by 0.1 for usual proportions of grate flow; by 0.2 for Q_G about 0.5 Q_o.

Figure B.5 Chart 5-reduce K_U and K_L in same manner as Chart 4.

Figure B.6 Chart 6-insignificant effect; make no reduction.

Figure B.7 Chart 7-insignificant effect; make no reduction.

Figure B.8 Chart 8 , Figure B.9 Chart 9, and Figure B.10 Chart 10-see specific instructions for each case.

7. Calculate pressure change.

   To calculate the change of pressure at a junction, working upstream from the outfall pipe to an upstream pipe, the design chart applying to the type of junction involved is selected. The pressure change coefficient for a specific upstream pipe is read from the chart for the particular flow rate and size ratios already calculated. The pressure change is calculated from

   (Equation B.1c)

$$\mathbf{h = K\frac{V_o^2}{2g}}$$

   The coefficient is a dimensionless number, and therefore, the change of pressure will be in feet.

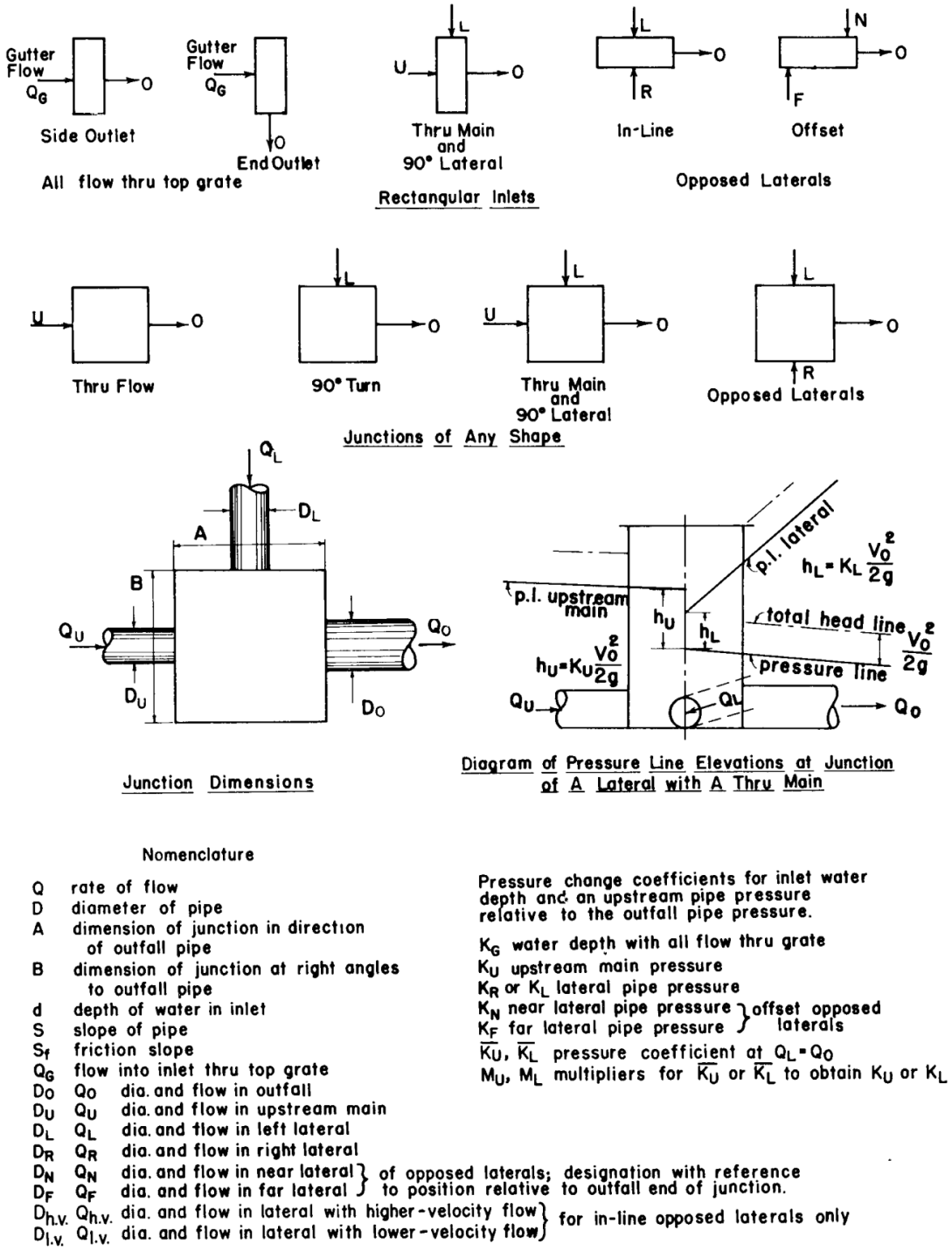
8. Apply the pressure change.

   The pressure change, in feet, for each upstream pipe is added to the outfall pipe pressure line elevation at the branch point to obtain the elevation of each pressure line for further calculations upstream along that pipe. In some cases the upstream pressure line at the branch point will be at a lower elevation than the downstream pressure line. Where this less common situation may occur with a particular type of junction, it is mentioned in the instructions for use of the specific chart.

9. Determine the elevation of the water surface.

   The elevation of the water surface in a junction or an inlet (with or without grate flow) receiving flow from a pipe or pipes will correspond to that of the upstream in-line pipe pressure line. At a junction with offset opposed laterals, the water surface will correspond to the elevation of the far lateral pipe pressure line. At a junction with in-line opposed laterals, the water surface will correspond to the elevation of the pressure line of the higher-velocity lateral pipe.

Each of the inlet and junction types for which design charts were derived from the analytical and experimental investigation are now listed separately the chart number appropriate for each is stated, and detailed instructions are given for determination of the change of pressure through use of the chart.



Nomenclature

Q	rate of flow
D	diameter of pipe
A	dimension of junction in direction of outfall pipe
B	dimension of junction at right angles to outfall pipe
d	depth of water in inlet
S	slope of pipe
S_f	friction slope
Q_G	flow into inlet thru top grate
D_O Q_O	dia. and flow in outfall
D_U Q_U	dia. and flow in upstream main
D_L Q_L	dia. and flow in left lateral
D_R Q_R	dia. and flow in right lateral
D_N Q_N	dia. and flow in near lateral } of opposed laterals; designation with reference
D_F Q_F	dia. and flow in far lateral } to position relative to outfall end of junction.
$D_{h.v.}$ $Q_{h.v.}$	dia. and flow in lateral with higher-velocity flow } for in-line opposed laterals only
$D_{l.v.}$ $Q_{l.v.}$	dia. and flow in lateral with lower-velocity flow }

Pressure change coefficients for inlet water depth and an upstream pipe pressure relative to the outfall pipe pressure.

K_G	water depth with all flow thru grate
K_U	upstream main pressure
K_R or K_L	lateral pipe pressure
K_N	near lateral pipe pressure } offset opposed laterals
K_F	far lateral pipe pressure }
$\overline{K_U}$, $\overline{K_L}$	pressure coefficient at $Q_L = Q_O$
M_U, M_L	multipliers for $\overline{K_U}$ or $\overline{K_L}$ to obtain K_U or K_L

Figure B.1 Chart 1 - Manhole Junction Types & Nomenclature *(Source University of Missouri E.S.B. #41)*

B.2 CHART 2 –Rectangular Inlet With Grate Flow Only

Pressure change coefficients are presented in this chart for use in determining the elevation of the water surface in a rectangular inlet with all inflow entering through a top grate. Separate curves are included for the outfall pipe connected at the box end (short dimension) and the box side (long dimension). The coefficient K_G depends on the pipe position and the depth of water in the inlet.

To use the chart:

1. Note whether outlet is at end or side.
2. Determine outfall pipe pressure line elevation – Gen. Instr. 1.
3. Calculate outfall velocity head – Gen. Instr. 2.
4. Estimate a value for water depth d.
    a. Outfall pressure line elevation minus inlet bottom elevation plus $K_G \frac{V_O^2}{2g}$ equals d.
    b. Estimate K_G as follows:
        For pressure line to bottom, not over 2 pipe diameters
        i. 7.0 for end outlet
        ii. 5.0 for side outlet
        For higher pressure lines
        iii. 4.0 for end outlet
        iv. 3.0 for side outlet
5. Calculate the estimated relative water depth d/D_O.
6. Enter Figure B.2 Chart 2 at this depth d/D_O and read K_G from the curve for the particular outfall pipe location.
7. Calculate h_G as indicated on the diagram on the chart and by Gen. Instr. 7.
8. Add h_G to the elevation of the outfall pressure line at the inlet center to obtain the water surface elevation in the inlet.
9. From this water surface elevation subtract the elevation of the inlet bottom to obtain a more precise value for the water depth d.
10. Repeat the above procedure with the improved value of d from step (9), if necessary. Such repetition may not be necessary if the estimated d/D_O of step (5) was reasonable accurate.
11. Check to be sure the inlet water elevation is below the top of the inlet so that inflow may be admitted.

Note: The designer may consider the use of K_G = 1.5 and K_E = 0.5 for design instead of Chart 2. K_E is the entrance loss. The high values of K_G for curb inlet or grate is questionable.

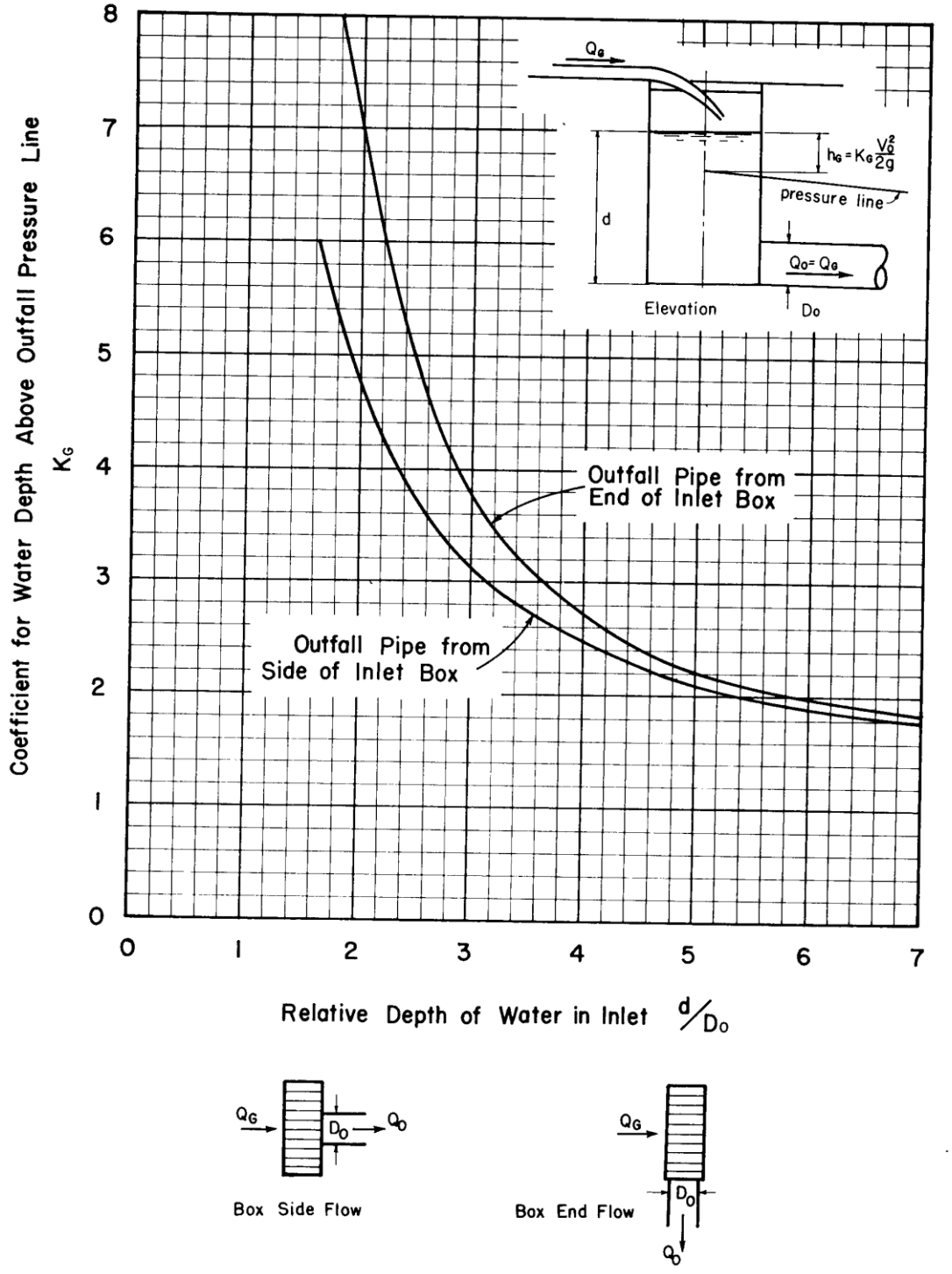


Figure B.2 Chart 2 - Rectangular inlet with grate flow only *(Source University of Missouri E.S.B. #41)*

B.3 CHART 3 – Flow Straight Through Any Junction

Pressure change coefficients are presented in this chart for use in determining the elevation of the pressure line of an upstream in-line pipe relative to that of the outfall. The pipe centerlines must be parallel and not offset more than would permit the area of the smaller pipe to fall entirely within that of the larger if projected across the junction box along the pipe axis. The shape of the junction in plan is not significant in determining the pressure change. The effects of junction size and outfall pipe entrance conditions are included in the chart. Negative pressure changes occur with an upstream pipe smaller than the outfall pipe. That is, at the junction center the upstream pressure line is below the outfall pressure line for this case. No flow other than that from the upstream in-line pipe may be involved where this chart applies.

To use the chart:

1. Determine the outfall pipe pressure line elevation – Gen. Instr. 1
2. Calculate the velocity head in the outfall – Gen. Instr. 2.
3. Calculate the size ratios D_U/D_O and A/D_O – Gen. Instr. 3.
4. Note whether the outfall pipe entrance is to be square-edged or rounded (note Gen. Instr. 6).
5. Enter Figure B.3 Chart 3 at the pipe size ratio D_U/D_O and read K_U at the curve for the proper value of A/D_U for a square-edged entrance condition, or at the dashed curve for a rounded entrance.
6. Calculate h_U (positive or negative) as indicated on the diagrams on the chart and by Gen. Instr. 7.
7. Add a positive h_U to (or subtract a negative h_U from) the elevation of the outfall pressure line at the junction center to obtain the elevation of the upstream pipe pressure line at the same location.
8. The water surface elevation in the junction corresponds to that of the upstream pipe, whether above or below the outfall pressure line.
9. Check to be sure the water surface elevation in the junction is below the top of the junction box so that overflow may not occur.

Comments: For a square-edged entrance to the outfall pipe, values of A/D_U less than 1 do not appreciably reduce the values of K_U shown for $A/D_U = 1$. K_U increases for distances A/D_U greater than 3, but such values are not usual in storm drain construction. For rounded entrances, the curve shown will apply with sufficient accuracy for all values of A/D_U up to 3.

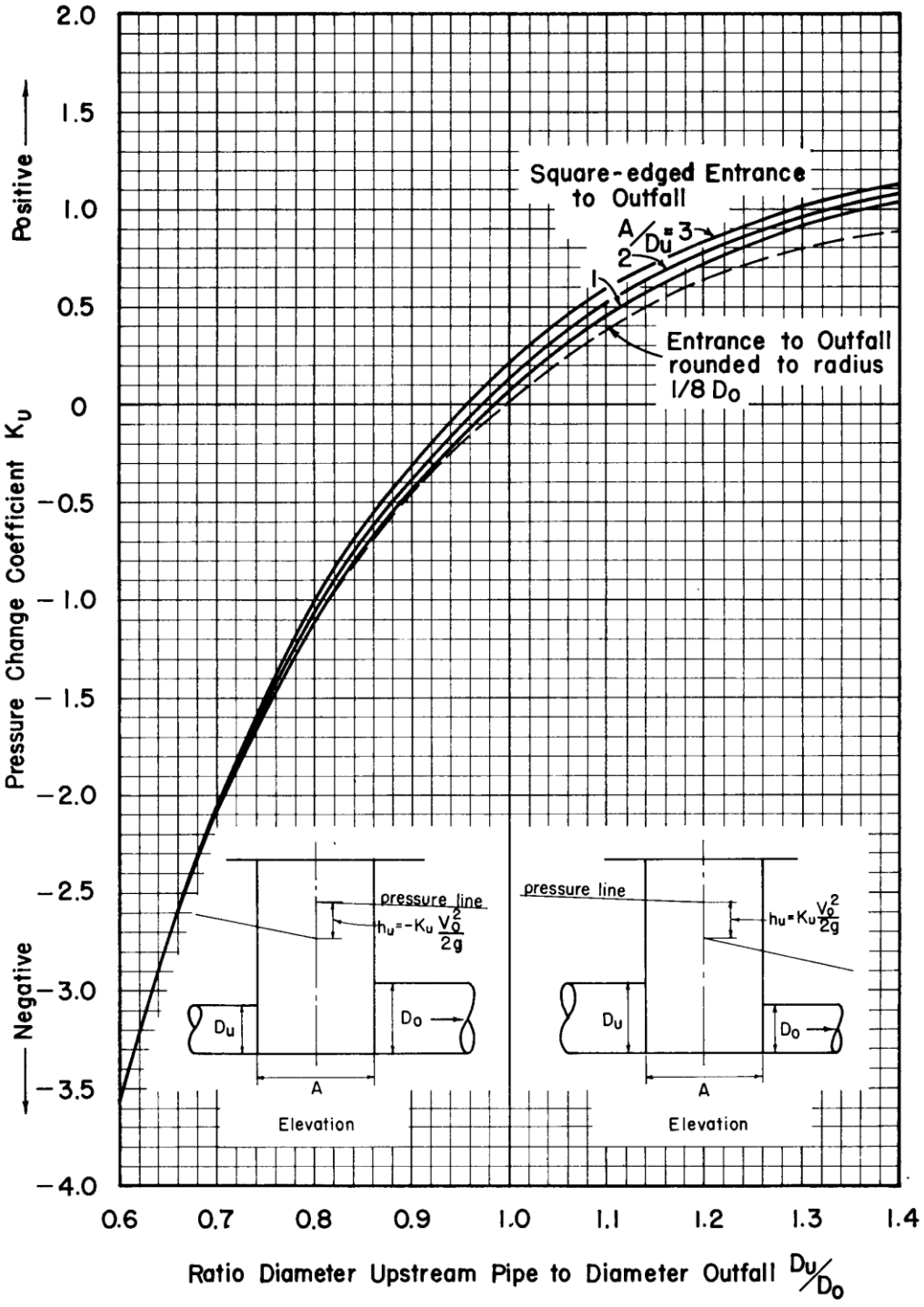


Figure B.3 Chart 3 - Flow Straight Through any Junction

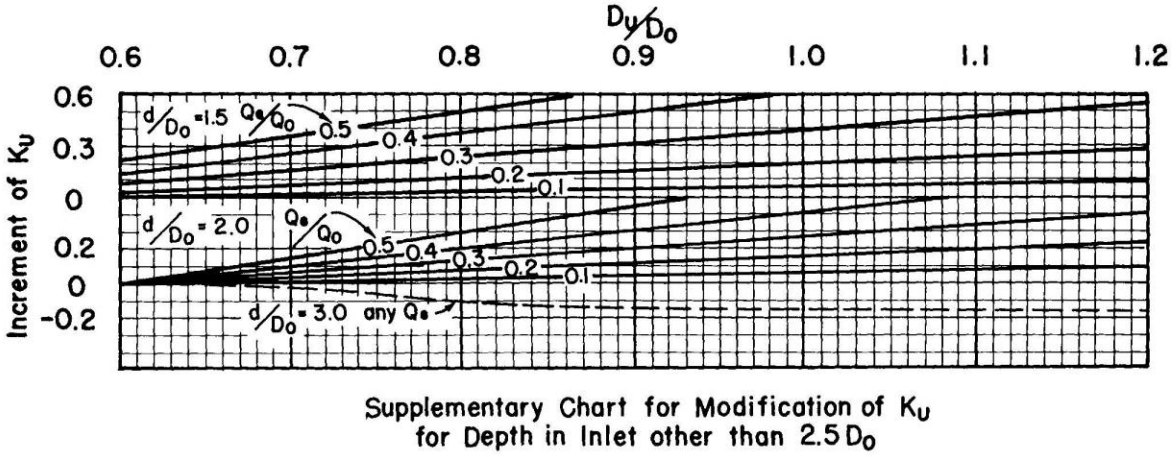
(Source University of Missouri E.S.B. #41)

B.4 CHART 4 – Rectangular Inlet With Through Pipeline and Grate Flow

Pressure change coefficients are presented in this chart for use in determining the common elevation of the upstream in-line pipe pressure line and the water surface in the inlet. The in-line pipes connect at the inlet sides (long dimension) and must meet the alignment requirement stated for Figure B.3 Chart 3. As much as half the total flow may enter through a top grate. The main graph of Figure B.4 Chart 4 includes effects of various proportion of grate flow for a relative water depth d/D_O of 2.5. Increments of K_U for other relative depths are shown in the supplemental graphs; positive increments for d/D_O less than 2.5 and negative for greater depths.

To use the chart:

1. Determine the outfall pipe pressure line elevation – Gen. Instr. 1.
2. Calculate velocity head in the outfall – Gen. Instr. 2.
3. Calculate the ratios D_U/D_O and Q_U/Q_O – Gen. Instr. 3. (The grate flow ratio $Q_G/Q_O = 1 – Q_U/Q_O$).
4. Estimate a value for the water depth d.
    a. Follow Gen. Instr. 4.
    b. Estimate $K = 3\ Q_G/Q_O$.
5. Calculate the corresponding relative water depth d/D_O.
6. If the estimated d/D_O is approximately 2.5, enter the lower graph on Figure B.4 Chart 4 at the pipe size ratio D_U/D_O and read K_U at the curve or interpolated curve for Q_U/Q_O; Then proceed as in step (9).
7. If the estimated d/D_O is other than 2.5, follow step (6), then enter the upper graph on Figure B.4 Chart 4 at the given D_U/D_O and determine the increment of Ku required to account for the effects of the estimated relative water depth d/D_O.
8. Add K_U from step (6) and the increment from step (7) to determine the total value of K_U. Note that negative values of K_U, may occur.
9. For a rounded outfall pipe entrance or one consisting of a pipe socket, reduce K_U, according to Gen. Instr. 6.
10. Calculate h_U as indicated on the diagram on the chart and by Gen. Instr. 7.
11. Add h_U, to the elevation of the outfall pressure line at the inlet center to obtain the elevation of the upstream in- line pipe pressure line at the same location. The water surface elevation will correspond.
12. From this water surface elevation subtract the elevation of the inlet bottom to obtain a more precise value for the water depth d.
13. Repeat the above procedure with the improved value of d from (12), if necessary. Such repetition may not be necessary if the original estimated d/D_O of step (5) was reasonably accurate.
14. Check to be sure the inlet water elevation is below the top of the inlet so that inflow may be admitted.



Supplementary Chart for Modification of K_u for Depth in Inlet other than $2.5\,D_o$

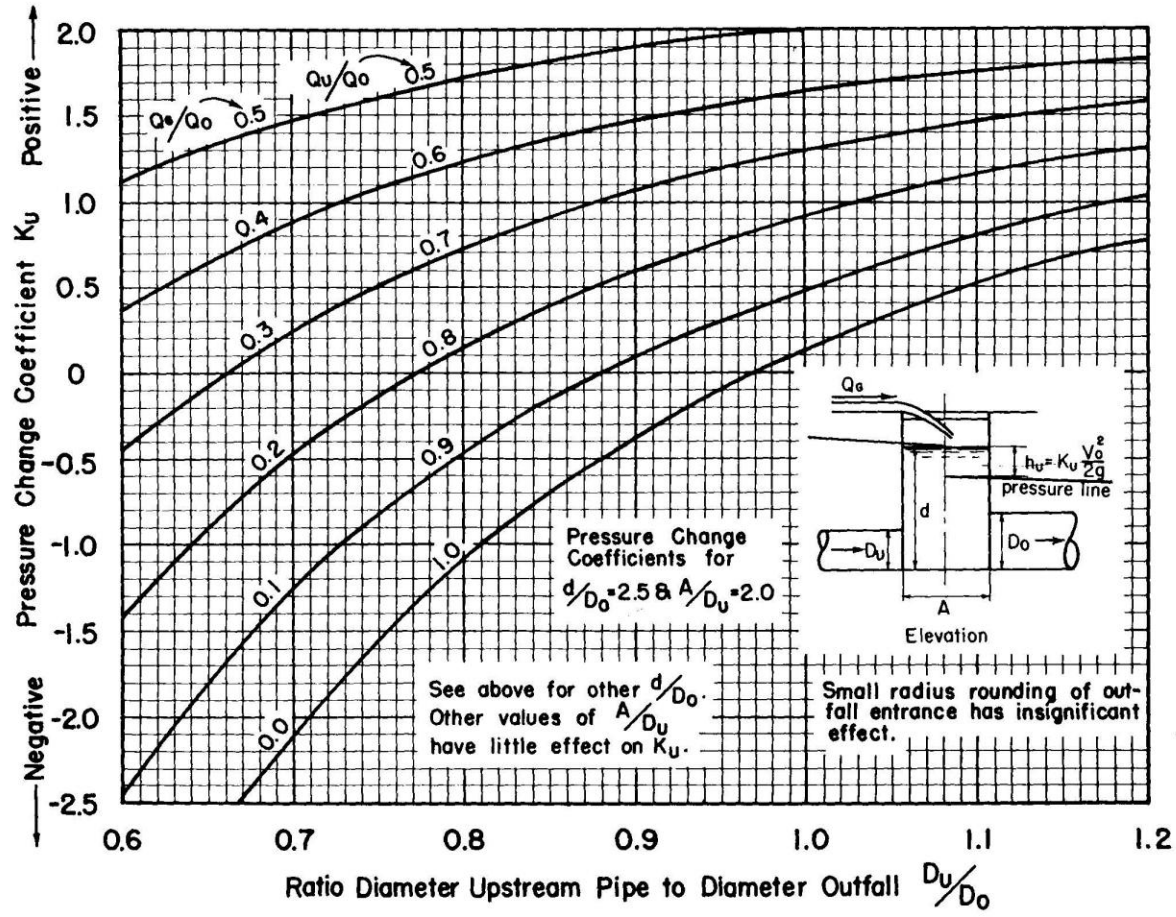


Figure B.4 Chart 4 - Rectangular Inlet With Through Pipeline And Grate Flow

(Source University of Missouri E.S.B. #41)

B.5 CHART 5 – Rectangular Inlet With In-line Upstream Main and 90° Lateral Pipe (With or Without Grate Flow)

Pressure change coefficients are presented in this chart for use in determining the common elevation of the two upstream pipe pressure lines and the water surface in the inlet. Flow into the combination inlet and junction box is supplied by an upstream main, in-line with the outfall and flowing through the short dimension of the inlet, and a 90° lateral pipe connected at one end of the inlet box, supplemented by flow through a top grate. The main graph of Figure B.5 Chart 5 applies directly for no flow into the inlet through the grate. Increments of K_U and K_L for grate flow conditions are shown in the supplementary graphs of the upper portion of the chart.

To use the chart:

1. Determine the outfall pipe pressure line elevation - Gen. Instr. 1.
2. Calculate the velocity head in the outfall - Gen. Instr. 2.
3. Calculate the ratios D_U/D_O, Q_U/Q_O, and Q_G/Q_O - Gen. Instr. 3.
4. If no grate flow is involved, enter the lower graph on Figure B.5 Chart 5 at the pipe size ratio D_U/D_O and read K_U (or K_L) at the curve or interpolated curve for Q_U/Q_O; then proceed as in step (10).
5. With grate flow, estimate a value for the water depth d.
    a. Follow Gen. Instr. 4.
    b. Estimate K = 1.5.
6. Calculate the corresponding relative water depth d/D_O.
7. Enter the lower graph and obtain K_U (or K_L) as in step (4), this value applying for Q_G/Q_O = O.
8. Enter the appropriate upper graph on Figure B.5 Chart 5, for the particular d/D_O nearest that estimated in step (6), at the given D_U/D_O and determine the increment of K_U (or K_L) at the curve for Q_G/Q_O. This increment accounts for the effects of grate flow and is always a positive value, even when K_U of step (7) is negative.
9. Add K_U from step (7) and the increment from step (8) to obtain the total value of K_U. Note that in unusual cases the total value of K_U may be negative.
10. For a rounded outfall pipe entrance or one consisting of a pipe socket, reduce K_U, and K_L according to Gen. Instr. 6.
11. Calculate h_U (also equal to h_L) as indicated by the diagram on the chart and by Gen. Instr. 7.
12. Add h_U to the elevation of the outfall pressure line at the branch point to obtain the elevation of the upstream in-line pipe pressure line at this point. The elevations of the lateral pipe pressure line and the water surface in the inlet will correspond.
13. From this water surface elevation subtract the elevation of the inlet bottom to obtain a more precise value for the water depth d.

14. Repeat the above procedure with the improved value of d from step (13), if necessary. Such repetition may not be necessary if the original estimated d/D_O of step (6) was reasonably accurate.
15. Check to be sure the inlet water surface elevation is below the top of the inlet so that inflow may be admitted.

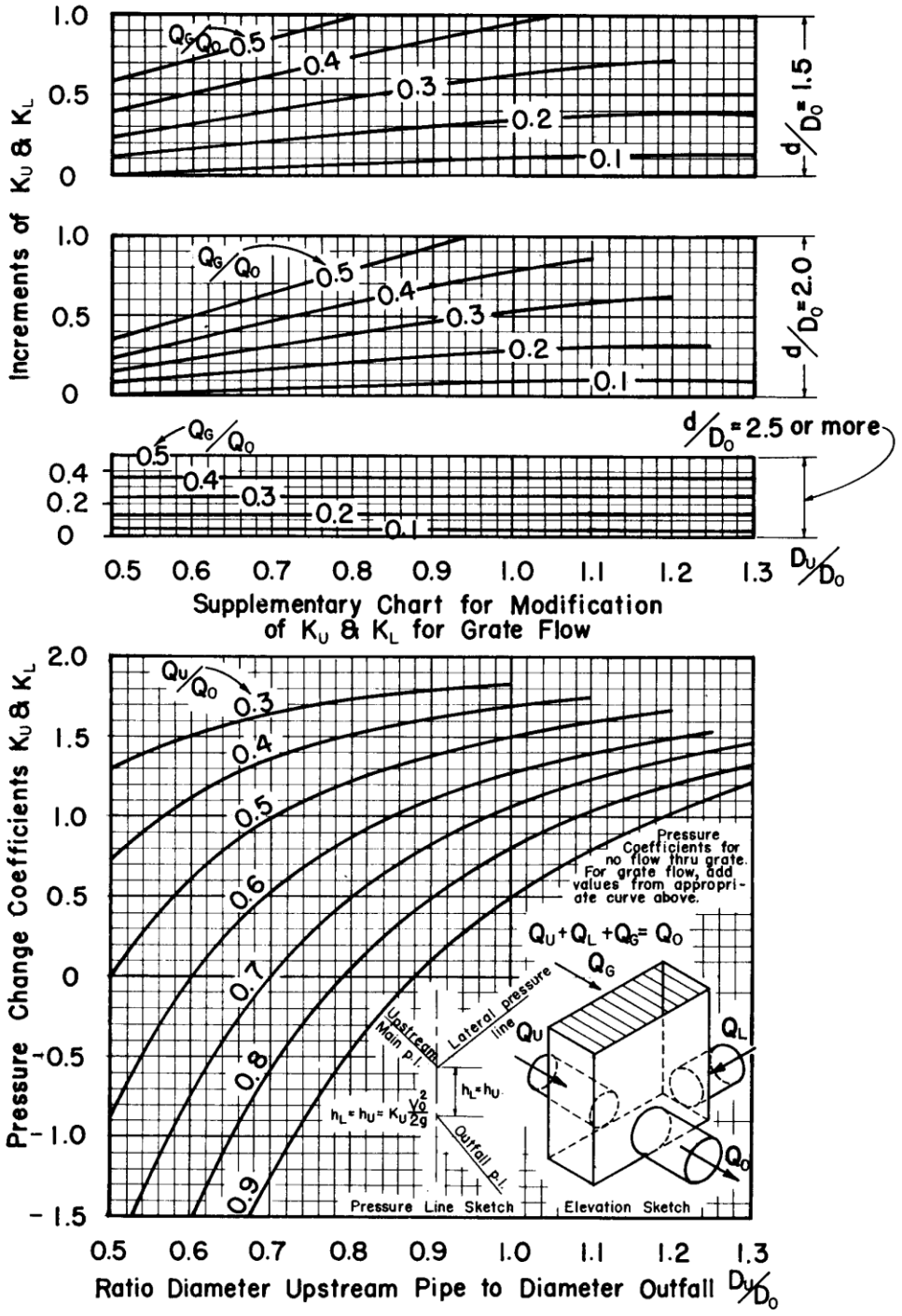


Figure B.5 Chart 5 - Rectangular Inlet With In-line Upstream Main And 90° Lateral Pipe (With or Without Grate Flow) *(Source University of Missouri E.S.B. #41)*

B.6 CHART 6 – Rectangular Inlet With In-Line Opposed Lateral Pipes Each at 90° to Outfall (With or Without Grate Flow)

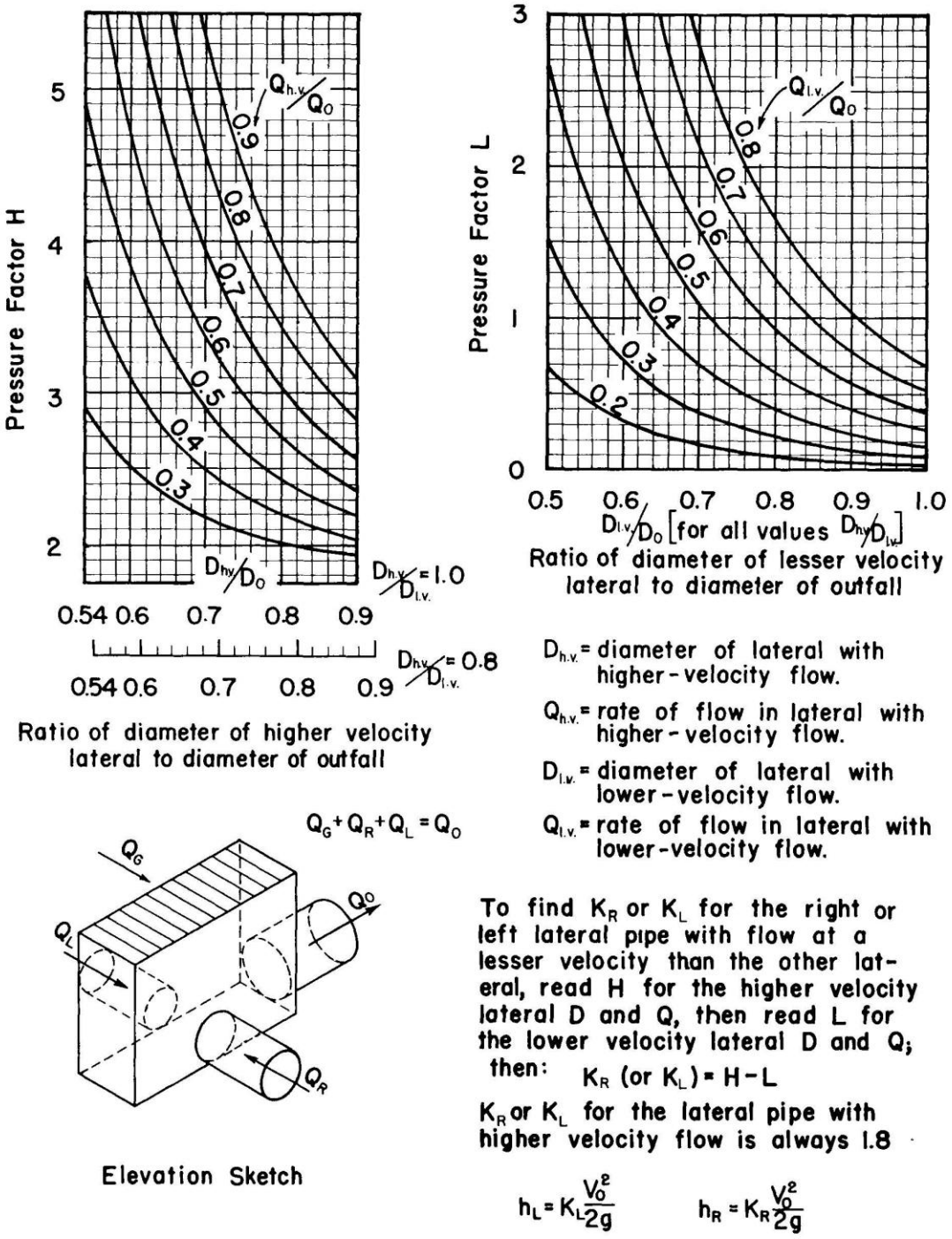
Pressure change coefficients are presented in this chart for use in determining the elevation of the pressure line of the lateral carrying the lower-velocity flow of two in-line opposed lateral pipes supplying a combination junction and inlet box. The pressure change coefficient for the higher-velocity lateral is a constant and so is not read from the chart. An inlet of this type may be used at a low point of street grade where lateral pipes supply flow from up-grade inlets in both directions, and the outfall pipe is located at right angles to the two lateral lines.

The chart may be used for cases with all probable ratios of flow rates in the two laterals, with or without grate flow. For this type of inlet and junction, the pressure changes are not modified by the depth of water in the inlet. The water surface elevation here will correspond to the pressure line of the higher-velocity lateral.

To use the chart:

1. Determine the outfall pipe pressure line elevation - Gen. Instr. 1.
2. Calculate the velocity head in the outfall - Gen. Instr. 2.
3. Calculate the velocities in each of the laterals to determine which is the higher-velocity and which the lower-velocity lateral.
4. Calculate the ratios Q_G/Q_O, Q_{hv}/Q_O, Q_{lv}/Q_O, D_{hv}/D_O, D_{lv}/D_O and D_{hv}/D_{lv} - Gen. Instr. 3.
5. Determine H from the left-hand graph on Figure B.6 Chart 6. Enter the graph at the pipe size ratio D_{hv}/Do (note the two scales) and read H at the curve or interpolated curve for Q_{hv}/Q_O. In entering the graph, note that unequal size laterals (D_{hv}/D_{lv}, not equal to 1.0), effect an offset of the scale for D_{hv}/D_O. Interpolation between the two scales shown is used for intermediate values. Extrapolation beyond the scales is satisfactory.
6. Determine L from the right-hand graph on Figure B.6 Chart 6. Enter the graph at the pipe size ratio D_{lv}/D_O (note only one scale is involved) and read L at the curve or interpolated curve for Q_{lv}/Q_O.
7. Calculate $K_{lv} = H - L$ with grate flow involved. With no grate flow, $K_{lv} = (H - L) - 0.2$.
8. $K_{hv} = 1.8$ with grate flow involved. With no grate flow, $K_{hv} = 1.6$.
9. Calculate $h_{lv} = K_{lv}\frac{V_O^2}{2g}$ and $h_{hv} = K_{hv}\frac{V_O^2}{2g}$
10. Add h_{lv} to the elevation of the outfall pipe pressure line at the branch point to obtain the elevation of the lower-velocity lateral pressure line at this point; similarly, add h_{hv} to the outfall pipe pressure line elevation to obtain the elevation of the higher-velocity lateral pressure line at the branch point.
11. Determine the water surface elevation in the inlet, which is equal to the lower of the two lateral Pressure line elevations (that of the higher-velocity lateral).

12. Check to be sure the inlet water surface elevation is below the top of the inlet so that inflow may be admitted.



$D_{h.v.}$ = diameter of lateral with higher-velocity flow.

$Q_{h.v.}$ = rate of flow in lateral with higher-velocity flow.

$D_{l.v.}$ = diameter of lateral with lower-velocity flow.

$Q_{l.v.}$ = rate of flow in lateral with lower-velocity flow.

To find K_R or K_L for the right or left lateral pipe with flow at a lesser velocity than the other lateral, read H for the higher velocity lateral D and Q, then read L for the lower velocity lateral D and Q; then: K_R (or K_L) = H − L

K_R or K_L for the lateral pipe with higher velocity flow is always 1.8

$$h_L = K_L \frac{V_o^2}{2g} \qquad h_R = K_R \frac{V_o^2}{2g}$$

Figure B.6 Chart 6 - Rectangular Inlet With In-line Opposed Lateral Pipes Each at 90° To Outfall (With or Without Grate Flow) *(Source University of Missouri E.S.B. #41)*

B.7 CHART 7 - Rectangular Inlet With Offset Opposed Lateral Pipes Each at 90° to Outfall (With or Without Grate Flow)

Pressure change coefficients are presented in this chart for use in determining the elevations of the pressure lines of each of the two horizontally offset opposed lateral pipes supplying a combination junction and inlet box. The inlet is used in the same situations as those to which Figure B.6 Chart 6 applies, but the pressure rise of the lower velocity lateral is restricted by locating the lateral pipes to enter opposite sides of the inlet box with their centerlines horizontally offset a distance not less than the sum of the two lateral pipe diameters. One lateral enters one side of the box near the outfall pipe end, and one, designated the far lateral, enters the opposite side near the other end.

This chart is used for all probable ratios of flow rates in the two laterals, with or without grate flow. For this type of inlet the pressure changes are not modified by the depth of water in the inlet. The water surface elevation here will correspond to the pressure line of the far lateral.

To use the chart:

1. Determine the horizontal distance between the centerlines of the opposed flow laterals at the inlet; if more than the sum of the pipe diameters, this chart will apply.
2. Determine the outfall pipe pressure line elevation at the branch points - Gen. Instr. 1. An average elevation applicable to both is sufficiently precise.
3. Calculate the velocity head in the outfall - Gen. Instr. 2.
4. Calculate the ratios Q_F/Q_O, Q_N/Q_O, D_F/D_O, and D_N/D_O, observing the nomenclature of Figure B.1 Chart 1- Gen. Instr. l.
5. Calculate the factors $\left(\frac{Q_F}{Q_O}\right)\left(\frac{D_O}{D_F}\right)$ and $\left(\frac{Q_N}{Q_O}\right)\left(\frac{D_O}{D_N}\right)$ noting that the pipe size relations are the reciprocals of the usual ratios.
6. For the far lateral, enter the left-hand graph of Figure B.7 Chart 7 at the abscissa value from step (5) and read K_F at the curve or interpolated curve for D_F/D_O.
7. For the near lateral, obtain K_N, from the right hand graph by a similar procedure.
8. For an inlet with grate flow, calculate h_F and h_N by multiplying the outfall velocity head by the corresponding coefficient K_F or K_N.
9. For a junction without grate flow, calculate h_F and h_N by multiplying the outfall velocity head by the corresponding reduced coefficients (K_F - 0.2) or (K_N - 0.2).
10. Add h_F and h_N to the elevation of the downstream (outfall pipe) pressure line to obtain the elevations of the pressure lines of the two laterals at their branch points.
11. Determine the water surface elevation in the inlet, which is equal to the far lateral pressure line elevation.
12. Check to be sure the inlet water surface elevation is below the top of the inlet so that inflow may be admitted.

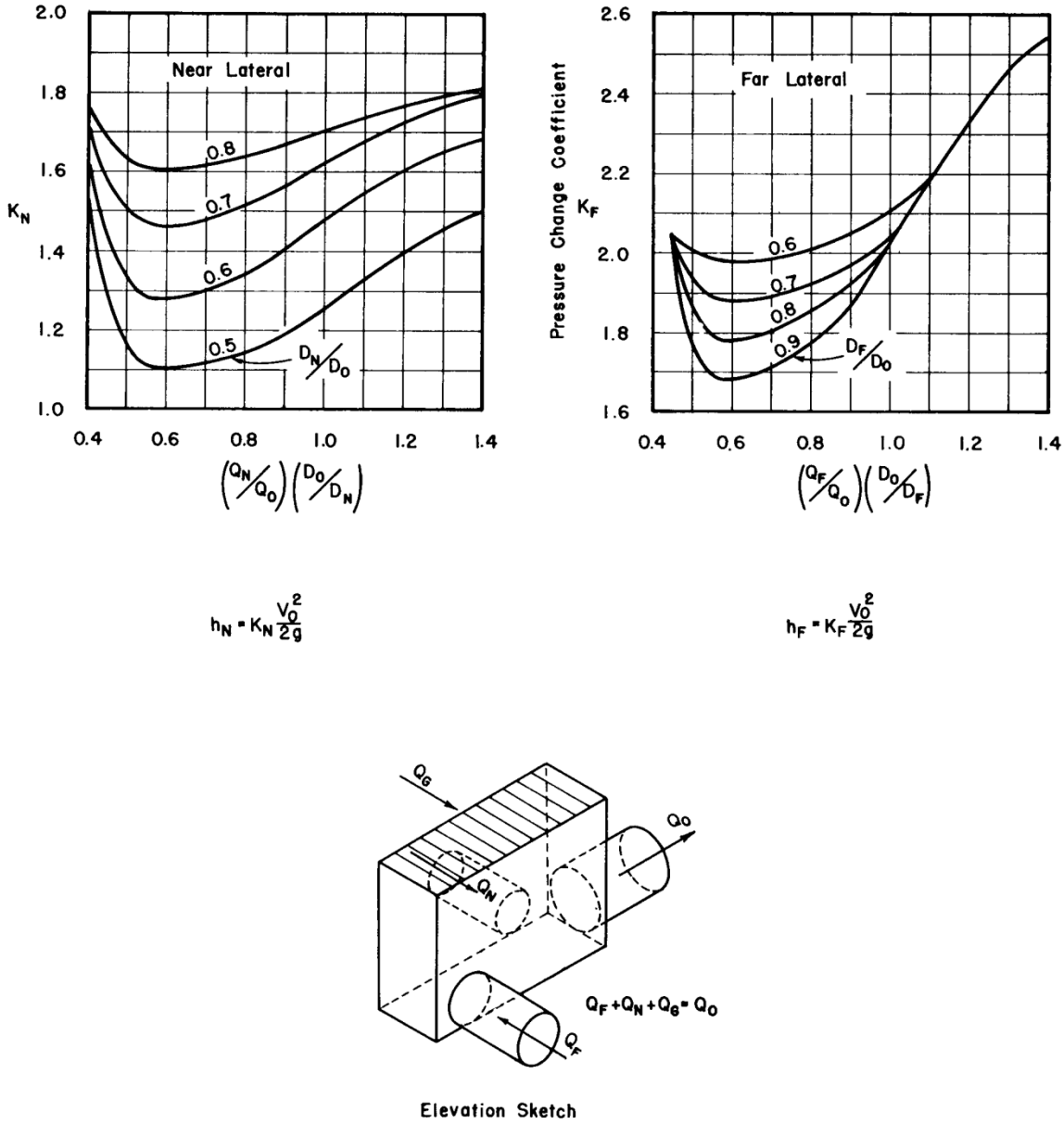


Figure B.7 Chart 7 - Rectangular Inlet With Offset Opposed Lateral Pipes each at 90° To Outfall (With Or Without Grate Flow) *(Source University of Missouri E.S.B. #41)*

B.8 CHART 8 – Junction Box (manhole) 90° Deflection – Lateral Coefficient

A. Square Manhole at 90° Deflection - Figure B.8 Chart 8

Pressure change coefficients are presented in this chart for use in determining the elevation of the pressure line of an upstream pipe connected by means of a square manhole to an outfall pipe at a 90° angle. The manhole conditions covered by this chart do not involve an upstream pipe in-line with the outfall pipe. For this and other manhole charts, the lateral pipe is designated by the subscript L irrespective of its right-hand or left-hand position. The coefficients given by the chart apply directly to manholes having a square-edged entrance to the outfall pipe. Coefficients for a rounded entrance are obtained by reduction of the chart values as stated below. The design of manholes with deflector devices is discussed separately.

To use the chart:

1. Determine the outfall pipe pressure line elevation - Gen. Instr. 1.
2. Calculate the velocity head in the outfall - Gen. Instr. 2.
3. Calculate the ratios D_L/D_O and B/D_O - Gen. Instr. 3.
4. Enter the lower graph of Figure B.8 Chart 8 at the pipe size ratio D_L/D_O and read $\overline{K_L}$ at the curve or interpolated curve for the manhole size ratio B/D_O. For all flow from a lateral, $K_L = \overline{K_L}$.
5. For a rounded outfall pipe entrance or one formed by a pipe socket reduce the chart value of $\overline{K_L}$ by 0.3 as defined by Gen. Instr. 6.
6. Calculate the charge of pressure $h_L = K_L \left(\frac{{V_O}^2}{2g}\right)$ (always positive for 90° deflections).
7. Add h_L to the elevation of the outfall pressure line at the branch point to obtain the elevation of the lateral pipe pressure line at this point.
8. The water surface elevation in the manhole will be above the lateral pipe pressure line. To determine the water-surface elevation use Figure B.9 Chart 9 as instructed in steps (12) through (18) of the instructions for a square manhole at the junction of a 90° lateral with a through main.
9. Check to be sure the water surface elevation is above the pipe crowns to justify using these charts and that it is sufficiently below the top of the manhole to indicate safety from overflow.

B. Round Manhole at 90° Deflection - Figure B.8 Chart 8

Pressure change coefficients may also be obtained from this chart for use in determining the elevation of the pressure line of an upstream pipe connected by means of a round manhole to an outfall pipe at a 90° angle.

To use the chart:

1. Proceed as instructed in steps (1) through (4) for a square manhole at a 90° deflection to obtain a base value of $\overline{K_L}$ for the particular values of D_L/D_O and B/D_O.

2. To provide for the effects of the round manhole cross section, reduce $\overline{K_L}$ in accordance with the following table:

Reductions of $\overline{K_L}$ for $\frac{D_L}{D_O}$

DL/D0= / B/D0	0.6	0.8	1.0	1.2
1.75	0.4	0.3	0.2	0.0
1.33	0.3	0.2	0.1	0.0
1.10	0.2	0.1	0.0	0.0

The reduced values apply for a sharp-edged entrance to the outfall pipe.

3. With a well-rounded entrance to the outfall pipe from a round manhole, reduce $\overline{K_L}$ of step (1) by 0.3 with no further reduction for manhole cross section shape.
4. Follow steps (6) through (9) as detailed for square manholes at a 90° deflection.

C. Deflectors in Square or Round Manholes at 90° Deflection - Figure 7.2.6.6.1.8 Chart 8

Pressure change coefficients are presented in this chart for use in determining the elevation of the pressure line of an upstream pipe connected to an outfall pipe at a 90° angle by means of a square or round manhole modified by flow deflectors. Deflectors in a manhole effectively eliminate the effects related to the shape of the manhole. The basic types of deflector walls which may be constructed in square or round manholes to effect a reduction of the pressure loss are detailed and described in the comprehensive report of the investigation.

The deflectors which are most easily constructed and are as effective as more complex types provide a vertical wall to guide the flow toward the outfall pipe. The wall need not be higher than the outfall pipe diameter and must fill in that part of the manhole opposite the lateral pipe exit so that it is flush with the side of the outfall pipe. Three basic types of such deflector walls are possible and are included in the curves of Figure B.8 Chart 8. These three are (1) walls parallel to the outfall pipe centerline or 0° walls, (2) inclined walls, limited to an angle of about 15° to the outfall centerline if an upstream in-line pipe is to be used, and (3) walls at 45° to both the lateral and outfall pipes, or walls curved on a radius of about the manhole dimension extending from lateral to outfall, and therefore to be used only when no upstream in-line pipe is involved. Rounding of the corner formed between the deflector wall and the manhole floor is not required, and may be detrimental in some cases.

To use the chart:

1. Determine the outfall pipe pressure line elevation-Gen. Instr. 1.
2. Calculate the velocity head in the outfall-Gen. Instr. 2.
3. Classify the type of deflector used:

a. Parallel wall - 0°
b. Inclined wall - 5° to 15°
c. 45° or curved wall.

4. Calculate the ratios D_L/D_O and B/D_O. No distinction between square and round manholes is necessary.
5. If B/D_O is 1.5 or less, enter the lower graph of the chart at the ratio D_L/D_O and read $\overline{K_L}$ at the curve for the appropriate deflector type. In the case of a parallel wall, use the curve for B/D_O = 1.00.
6. If B/D_O is more than 1.5 and less than 2.0, use the same dashed curve for 45° or curved deflectors, use the curve for B/D_O = 1.10 for 5° to 15° angle deflectors, and use the curve for B/D_O = 1.20 for 0° angle deflectors.
7. A rounded entrance to the outfall pipe or one formed by a pipe socket is less effective in reducing the pressure change with deflectors than when deflectors are not used. A reduction of $\overline{K_L}$ by 0.l may be justified.
8. Calculate the change of pressure: $h_L = K_L\left(\frac{V_O^2}{2g}\right)$ (for $Q_L = Q_O$, $K_L = \overline{K_L}$).
9. Add h_L to the elevation of the outfall pressure line at the branch point to obtain the elevation of the lateral pipe pressure line at this point.
10. The water-surface elevation in the manhole will be above the lateral pipe pressure line. To determine the water surface elevation use Figure B.9 Chart 9 as instructed in steps (2) through (8) for deflectors in a manhole at the junction of a 90° lateral with a through main.
11. Check to be sure the water surface elevation is above the pipe crowns to justify using these charts and that it is sufficiently below the top of the manhole to indicate safety from overflow.

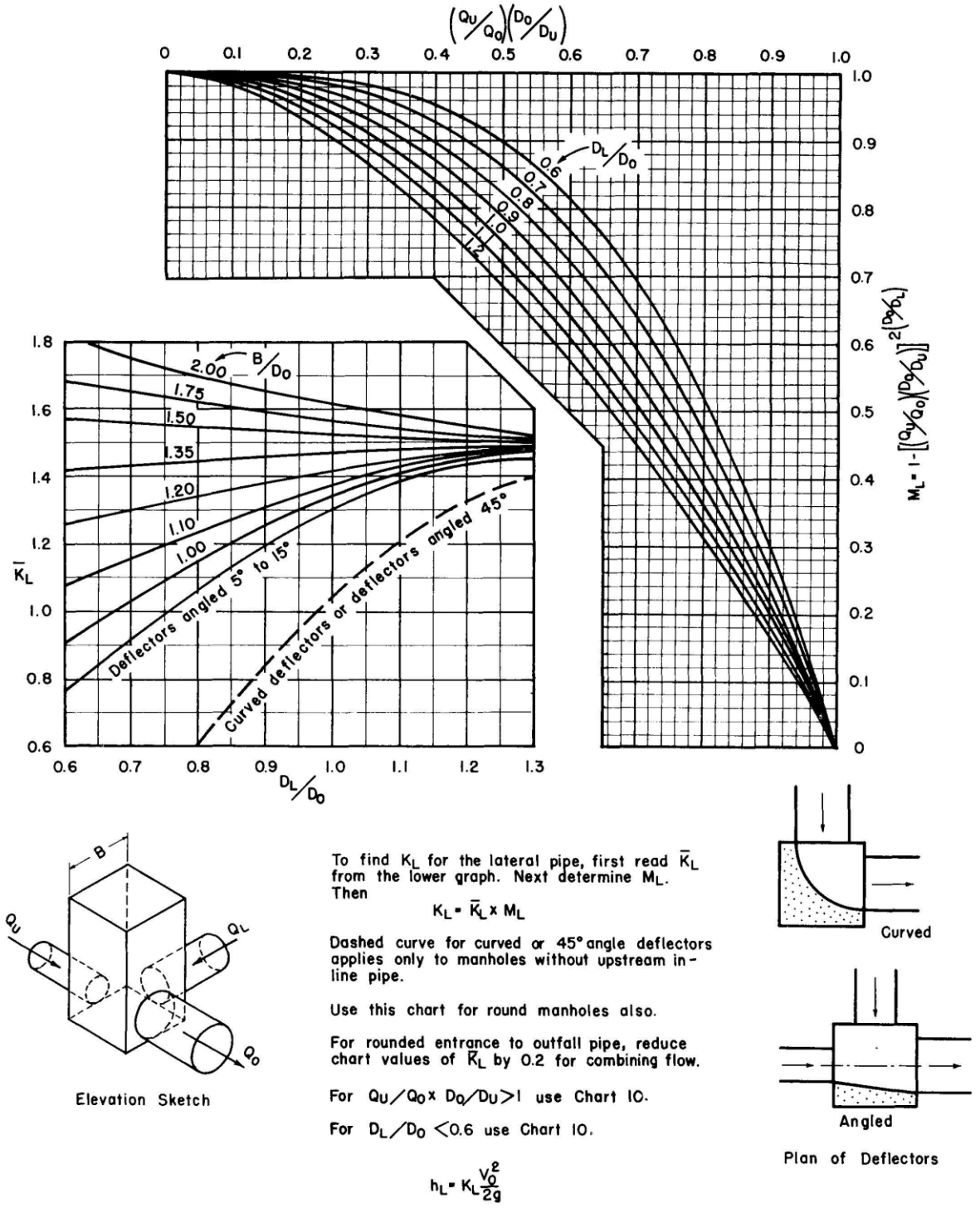


Figure B.8 Chart 8 - Square or Round Manhole At 90° Deflection Or On Through Pipeline At Junction Of 90° Lateral Pipe (Lateral Coefficient)

(Source University of Missouri E.S.B. #41)

B.9 CHART 8 and CHART 9

A. Square Manhole on Through Pipeline at Junction of a 90° Lateral Pipe -Charts 8 & 9 (Larger Size Laterals: $D_L / D_O > 0.6$)

Pressure change coefficients for use in determining the elevation of the pressure line of the 90° lateral pipe are obtained from Figure B.8 Chart 8, and the coefficients for the upstream in-line pipe are obtained from Figure B.9 Chart 9. The diameter of the lateral pipe must be at least 0.6 of the diameter of the outfall pipe to permit use of these charts. Pressure changes at junctions of smaller laterals may be obtained through use of Figure B.10 Chart 10. The coefficients given by the charts apply directly to a square-edged entrance to the outfall pipe. Coefficients for a rounded entrance are obtained by reduction of the chart values as stated below. The design of manholes with deflector devices is discussed separately.

To use the charts:

1. Determine the outfall pressure line elevation - Gen. Instr. 1.
2. Calculate the velocity head in the outfall - Gen. Instr. 2.
3. Calculate the ratios Q_U/Q_O, D_U/D_O, and D_L/D_O. If D_L/D_O is less than 0.6, use Figure B.10 Chart 10 instead of Figure B.8 Chart 8 and Figure B.9 Chart 9.
4. Calculate the ratio B/D_O and note if the outfall entrance is rounded.
5. Calculate the factor $\left(\frac{Q_U}{Q_O}\right)\left(\frac{D_O}{D_U}\right)$; if this is greater than 1.00, use Figure B.10 Chart 10 instead of Figure B.8 Chart 8 and Figure B.9 Chart 9.

For lateral pipe:

6. Enter the lower graph of Figure B.8 Chart 8 at the ratio D_L/D_O and read $\overline{K_L}$ at the curve or interpolated curve for the ratio B/D_O.
7. For a rounded outfall pipe entrance or one formed by a pipe socket as defined by Gen. Instr. 6, reduce the chart value of $\overline{K_L}$ by 0.2.
8. Determine the factor ML by entering the upper graph of Figure B.8 Chart 8 at the value of the factor $\left(\frac{Q_U}{Q_O}\right)\left(\frac{D_O}{D_U}\right)$ and at the curve or interpolated curve for D_L/D_O.
9. Calculate $K_L = M_L \times \overline{K_L}$.
10. Calculate the lateral pipe pressure change
11. Add h_L to the elevation of the outfall pipe pressure line at the branch point to obtain the elevation of the lateral pipe pressure line at this point.

For upstream in-line pipe:

12. Enter the lower graph of Figure B.9 Chart 9 at the ratio D_L/D_O and read $\overline{K_U}$ at the curve or interpolated curve for B/D_O.

13. For a rounded entrance to the outfall pipe or one formed by a pipe socket, reduce $\overline{K_U}$ by 0.2.
14. Determine the factor MU from the upper graph of Figure B.9 Chart 9.
15. Calculate $K_U = M_U \times \overline{K_U}$.
16. Calculate the upstream in-line pipe pressure change: $h_U = K_U \left(\frac{{V_O}^2}{2g}\right)$
17. Add h_U to the elevation of the outfall pipe pressure line at the branch point to obtain the elevation of the upstream in-line pipe pressure line at this point.

For water surface:

18. The water-surface elevation in the manhole will correspond to the upstream in-line pipe pressure line at the branch point.
19. Check to be sure that the water surface elevation is above the pipe crowns to justify using these charts and that it is sufficiently below the top of the manhole to indicate safety from overflow.

B. Round Manhole on Through Pipeline At Junction of a 90° Lateral Pipe-Charts 8 and 9 (Larger Size Laterals: $D_L / D_O > 0.6$)

Pressure change coefficients may also be obtained from Figure B.8 Chart 8 and Figure B.9 Chart 9 for use in determining the elevations of the pressure lines of the 90° lateral pipe and the upstream in-line pipe connected by a round manhole to an outfall pipe.

To use the charts:

1. Proceed as instructed by steps (1) through (6) for a square manhole at a similar junction to obtain a base value of $\overline{K_L}$.

For lateral pipe:

2. To provide for the effects of the round manhole cross-section, reduce $\overline{K_L}$ in accordance with the following table:

Reduction of $\overline{K_L}$ for $\frac{D_L}{D_O}$

DL/D0= / B/D0	0.6	0.8	1.0	1.2
1.75	0.4	0.3	0.2	0.0
1.33	0.3	0.2	0.1	0.0
1.10	0.2	0.1	0.0	0.0

The reduced values apply for a sharp-edged entrance to the outfall pipe.

3. With a well-rounded entrance to the outfall pipe from a round manhole, reduce $\overline{K_L}$ obtained in step (2) by 0.1.

4. Determine the factor ML from the upper graph of Figure B.8 Chart 8 and proceed as instructed in steps (8) through (11) for a square manhole to complete the determination of the elevation of the lateral pipe pressure line.

For upstream in-line pipe:

5. Proceed as instructed in steps (12) through (17) for a square manhole at a similar junction to obtain the elevation of the upstream in-line pipe pressure line. Note that no reduction of $\overline{K_L}$ is to be made for effects of the round manhole cross-section.

For water surface:

6. Proceed as instructed by steps (18) and (19) for a square manhole at a similar junction.

C. Deflectors in Square or Round Manholes on Through Pipeline at Junction of a 90° Lateral Pipe-Charts 8 and 9 (Larger Size Laterals: $D_L / D_O > 0.6$)

Pressure change coefficients are also presented in Figure B.8 Chart 8 and Figure B.9 Chart 9 for use in determining the elevations of the pressure lines of the lateral and in-line pipes at a junction of this type, with either a square or a round manhole modified by flow deflectors. Deflectors in a manhole effectively eliminate the effects related to the shape of the manhole. Deflector types are described in the instructions for use of Figure B.8 Chart 8 for a manhole with deflectors at a 90° deflection of a storm drain. The curved and 45° deflectors cannot be used in a manhole on a through pipeline because of the space required for through in-line flow.

To use the charts:

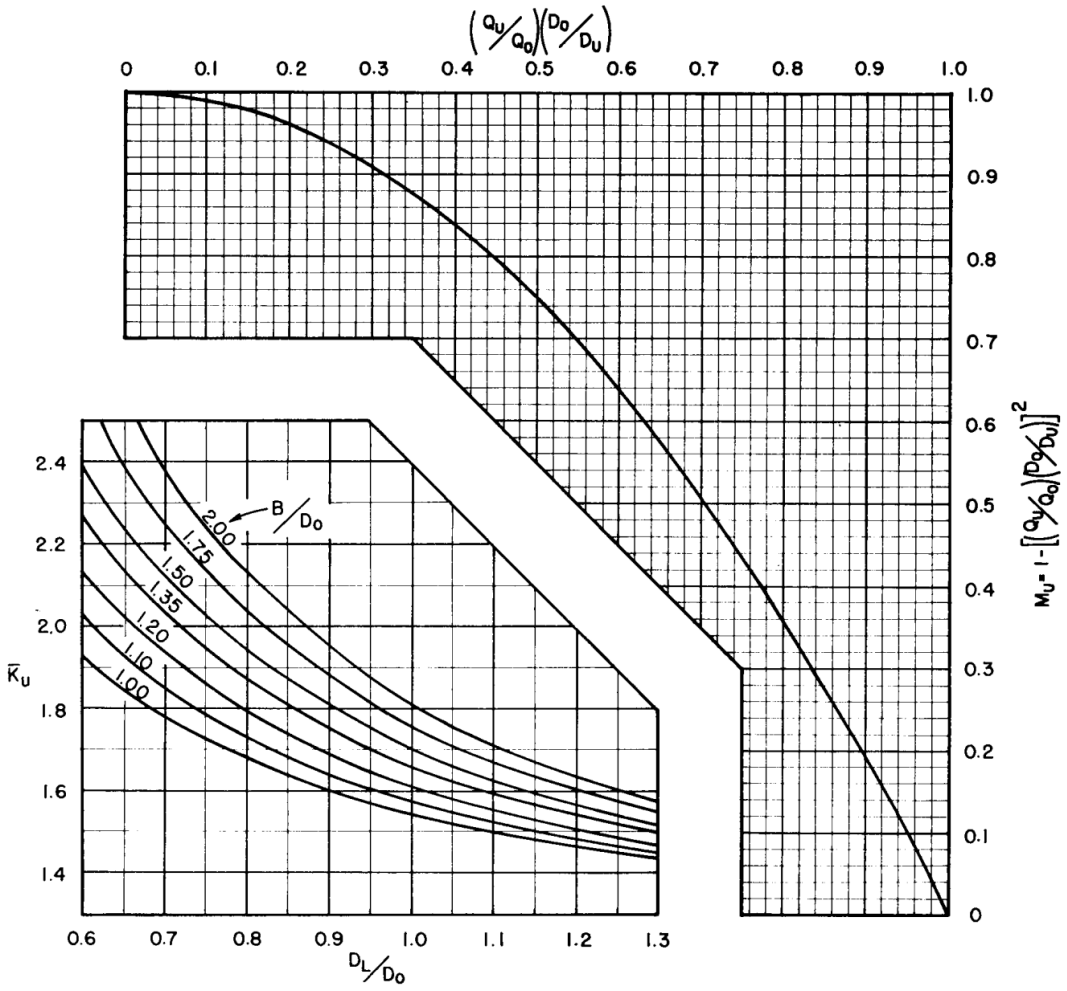
1. Proceed as instructed in steps (1) through (9) for deflectors in a manhole at a 90° deflection, disregarding references to 45° or curved walls. Through use of Figure B.8 Chart 8 these steps will give the elevation of the lateral pipe pressure line at the branch point. As noted in the instructions for a manhole of this type without deflectors, Figure B.10 Chart 10 must be used when $D_L/D_O < 0.6$ or $\left(\frac{Q_U}{Q_O}\right)\left(\frac{D_O}{D_U}\right) > 1.00$.

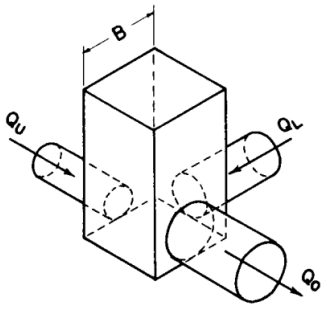
For upstream in-line pipe:

2. Enter the lower graph of Figure B.9 Chart 9 at the ratio D_L/D_O and read $\overline{K_U}$ for all manhole sizes and any deflector wall angle from 0° to 15° at the curve for $B/D_O = 1.00$.
3. For a rounded entrance to the outfall pipe or one formed by a pipe socket, reduce $\overline{K_U}$ by 0.1.
4. Determine the factor M_U from the upper graph of Figure B.9 Chart 9.
5. Calculate $K_U = M_U \times \overline{K_U}$.
6. Calculate the upstream in-line pipe pressure change $h_U = K_U\left(\frac{V_O{}^2}{2g}\right)$.
7. Add h_U to the elevation of the outfall pipe pressure line at the branch point to obtain the elevation of the upstream in-line pipe pressure line at this point.

For water surface:

8. The water-surface elevation in the manhole will correspond to the upstream in-line pipe pressure line at the branch point.
9. Check to be sure that the water-surface elevation is above the pipe crowns to justify using these charts and that it is sufficiently below the top of the manhole to indicate safety from overflow.





Elevation Sketch

To find K_U for the upstream main, first read $\bar{K}_U$ from the lower graph. Next determine M_U. Then

$$K_U = \bar{K}_U \times M_U$$

For manholes with deflectors at 0° to 15°, read $\bar{K}_U$ on curve for $B/D_O = 1.0$

Use this chart for round manholes also.

For rounded entrance to outfall pipe, reduce chart values of $\bar{K}_U$ by 0.2 for combining flow.

For deflectors refer to sketches on Chart 8.

For $Q_U/Q_O \times D_O/D_U > 1$ use Chart 10

For $D_L/D_O < 0.6$ use Chart 10

$$h_U = K_U \frac{V_O^2}{2g}$$

Figure B.9 Chart 9 - Square Or Round Manhole On Through Pipeline At Junction Of A 90° Lateral Pipe (In-line Pipe Coefficient) *(Source University of Missouri E.S.B. #41)*

B.10 CHART 10 - Square or Round Manhole on Through Pipe Line at Junction of 90° Lateral Pipe (Smaller Size Laterals $D_L / D_O < 0.6$)

Pressure change coefficients are presented in Figure B.10 Chart 10 for use in determining the common elevation of the pressure lines of the lateral and in-line pipes at a junction of this type for cases of pipe sizes or flow divisions outside the range over which Figure B.8 Chart 8 and Figure B.9 Chart 9 may be applied. Figure B.8 Chart 8 and Figure B.9 Chart 9 are more reliable within their range and should be used if possible. Neither manhole shape nor size nor relative size of lateral pipe modify the coefficients of Figure B.10 Chart 10. The chart may also be used for direct connection of a 90° lateral to a main without use of a manhole. The coefficients of the chart apply directly to a square-edged entrance to the outfall pipe. Coefficients for a rounded entrance are obtained by reduction of the chart values as stated below. Deflectors in the manhole are not effective in the ranges covered by Figure B.10 Chart 10, and therefore need not be used.

To use the chart:

1. Determine the outfall pipe pressure line elevation - Gen. Instr. 1.
2. Calculate the velocity head in the outfall - Gen. Instr. 2.
3. Calculate the ratios D_L / D_O, D_U / D_O, and Q_U / Q_O – Note that use of Figure B.8 Chart 8 and Figure B.9 Chart 9 is advisable if the size and flow factors are within their range. Figure B.10 Chart 10 should not be used for $Q_U / Q_O < 0.7$ if other solutions are possible.
4. Note whether the outfall entrance is to be rounded or formed by a pipe socket as defined by Gen. Instr. 6.
5. Enter Figure B.10 Chart 10 at the ratio D_U / D_O and read K_U (also equal to K_L) at the curve or interpolated curve for Q_U / Q_O.
6. 6. If $\left(\frac{Q_U}{Q_O}\right)\left(\frac{D_O}{D_U}\right)$ was found to be greater than 1.00 in an attempt to use Figure B.8 Chart 8 and Figure B.9 Chart 9, K_U of step (5) will be negative in sign, thus providing a check on proper use of the charts.
7. For rounded entrance from the manhole to the outfall pipe use the reduced values from the chart.
8. Calculate the change-of pressure $h_U = h_L = K_U\left(\frac{{V_O}^2}{2g}\right)$, h_U and h_L are positive or negative depending on the sign of K_U as read from the chart.
9. Add a positive h_U to or subtract a negative h_U from the elevation of the outfall pipe pressure line at the branch point to obtain the elevation of the upstream in-line pipe pressure line at this point.
10. The elevation of the lateral pipe pressure line at the branch point and the water surface elevation in the manhole will correspond to the upstream in-line pipe pressure line elevation found in step (9).
11. Check to be sure that the water-surface elevation is above the pipe crowns to justify using these charts and that it is sufficiently below the top of the manhole to indicate safety from overflow.

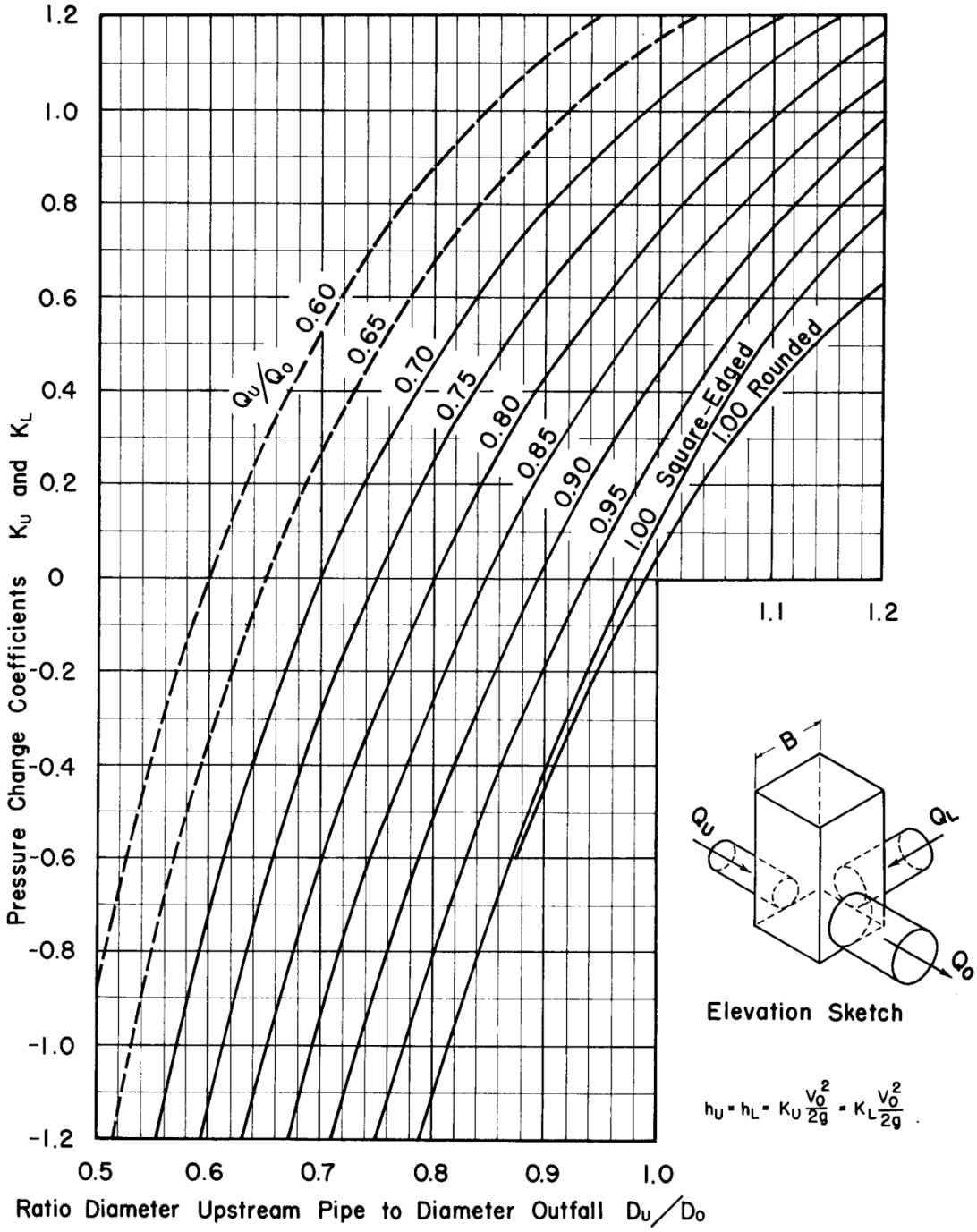


Figure B.10 Chart 10 - Square Or Round Manhole On Through Pipeline At Junction Of A 90° Lateral Pipe (For Conditions Outside Range Of Figure B.8 Chart 8 and Figure B.9 Chart 9) *(Source University of Missouri E.S.B. #41)*

B.11 References

- University of Missouri. *Pressure Changes at Storm Drain Junctions - Engineering Bulletin No. 41*. University of Missouri, Columbia, MO, 1958.

SECTION 3. All other provisions of Chapter 35 of the City Code of San Antonio, Texas shall remain in full force and effect unless expressly amended by this ordinance.

SECTION 4. Should any Article, Section, Part, Paragraph, Sentence, Phrase, Clause, or Word of this ordinance, for any reason be held illegal, inoperative, or invalid, or if any exception to or limitation upon any general provision herein contained be held to be unconstitutional or invalid or ineffective, the remainder shall, nevertheless, stand effective and valid as if it had been enacted and ordained without the portion held to be unconstitutional or invalid or ineffective.

SECTION 5. Notice of these changes to the Unified Development Code shall require the publication in an official newspaper of general circulation in accordance with Chapter 35, Article IV, Division 1, Table 403-1.

SECTION 6. The publishers of the City Code of San Antonio, Texas are authorized to amend said Code to reflect the changes adopted herein and to correct typographical errors and to index, format and number paragraphs to conform to the existing code.

SECTION 7. This ordinance shall become effective January 1, 2016.

PASSED AND APPROVED this 17th day of December, 2015.

M A Y O R
Ivy R. Taylor

ATTEST:

Leticia M. Vacek, City Clerk

APPROVED AS TO FORM:

Martha G. Sepeda, Acting City Attorney