

2 Drainage Policy and Criteria

2.1 Drainage and Water Quality Design Requirements

All drainage improvements and projects shall be designed and constructed in accordance with the current regulations, standards and specifications adopted by the City of New Braunfels. Any capital improvement or development project within the City of New Braunfels jurisdiction is required to comply with the requirements outlined in this manual. When necessary, properly sized easements shall be granted across all contiguous property owned by the property owner.

A drainage report is required to be submitted by the property owner or its agent according to the requirements of this manual. The Engineering Division prior to issuance of a permit must approve the report. The type of development and report shall be based on the location and additional impervious cover of the development as shown in Table 2-1.

Table 2-1: Development Categories

Category	Criteria
Type 1 Development	Less than one acre of land; and < 1,000 SF additional impervious cover
Type 2 Development	Less than one acre of land; and 1,000 – 4,999 SF additional impervious cover; or Agricultural development (not including feedlots)
Type 3 Development	≥ 5,000 SF additional impervious cover; or Development within FEMA designated Special Flood Hazard Area

If any onsite and offsite stormwater structure related to the development is known to be at or above design capacity, the development will be considered a Type 3 Development.

Drainage report requirements are outlined below. An electronic media copy of the report is required in addition to a paper copy at time of city acceptance of infrastructure improvements.

2.1.1 Type 1 Drainage Report

A Type 1 Development is any development or redevelopment that disturbs less than one acre of land and creates less than 1,000 square foot of additional impervious cover. The Type 1 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

- A. Applicant contact information (e.g. name, address, phone number, and email address)
- B. Site location map
- C. Detailed site drawing or sketch showing any existing features or infrastructure and proposed disturbance
- D. Temporary erosion control plan

2.1.2 Type 2 Drainage Report

A Type 2 Development is any development or redevelopment that disturbs less than one acre of land, and creates more than 1,000 but less than 5,000 square foot of additional impervious cover. Type 2 Developments also include any agricultural development not including feedlots. The Type 2 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

- A. Applicant contact information (e.g. name, address, phone number, and email address)
- B. Site location map
- C. Detailed site drawing or sketch of the affected area scaled to 1" = 50' (or less) on minimum 11" x 17" paper showing the following:
 - 1. Existing drainage ways and easements
 - 2. Runoff flow directions
 - 3. Floodplain boundaries
 - 4. Proposed grading and development
 - 5. Proposed drainage and erosion control facilities
 - 6. A copy of the survey plat showing the lot layout, streets, and utility and drainage easements
- D. Temporary erosion control plan
- E. If any on-site and off-site stormwater structure related to this development is known to be at or above design capacity, the development will be considered a Type 3 Development

2.1.3 Type 3 Drainage and Water Quality Report

A Type 3 Development is any development or redevelopment greater than or equal to 5,000 square feet of additional impervious cover, not Type 1 or Type 2, or any development within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area. A Type 3 Drainage and Water Quality Report shall be prepared by a professional engineer licensed in the State of Texas, experienced in civil engineering, and having a thorough knowledge of the hydraulic analysis and design. The report shall be signed and sealed, per Texas Board of Professional Engineers, by the person responsible for the report. The Type 3 Drainage and Water Quality Report shall consist of the following:

- A. Applicant contact information (e.g. name, address, phone number, and email address)
- B. Site location map
- C. A copy of the final plat showing the lot layout, streets, and utility and drainage easements
- D. Construction drawings adhering to all applicable codes and regulations including details and specifications
- E. Drainage and Water Quality Report as outlined in **Section 2.2 – Type 3 Drainage and Water Quality Report Criteria**
- F. Temporary and permanent erosion control plan as outlined in **Section 12 – Site Erosion Control**
- G. Approval letters from other agencies with jurisdiction or permit requirements for the site location

2.1.4 Preliminary Drainage Report

A Preliminary Drainage Report of the storm drainage system is required with a preliminary plat. The report shall include the following:

- A. Preliminary Drainage Site Plan including: plat boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the plat; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries. Drainage infrastructure includes channels, storm sewer, detention, retention and water quality facilities.
- B. Conformance with the Master Drainage Plan Report (if applicable) specified in Section 2.1.5. The report may require updating for development plat submittals and changes in the drainage design.

2.1.5 Master Drainage Plan Report

A Master Drainage Plan Report shall be provided with a subdivision master plan and planned development. The report shall include the following:

- A. Existing Drainage Site Plan including: development boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; and floodplain and floodway boundaries. Drainage infrastructure includes channels, storm sewer, detention, retention and water quality facilities.
- B. Existing Watershed Map including: development boundary; existing drainage area and all sub areas; 2-foot contours; and existing runoff flow directions.
- C. Preliminary Drainage Site Plan including: development boundary; proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries.
- D. Master Drainage Plan Summary including how drainage and water quality resulting from the proposed development will be managed and how proposed drainage infrastructure will impact adjacent property owners.

2.2 Type 3 Drainage and Water Quality Report Criteria

The planning and design of drainage systems should ensure that problems are not transferred from one location to another. Grading and other construction activities may not change the terrain in such a way to cause damage to public or private property from drainage or flood problems, increased runoff, or increased erosion or sediment movement.

Existing drainage between developed lots will remain the responsibility of the affected property owners. Commercial developments are required to drain surface runoff from an individual lot to a public right-of-way or to a drainage system contained in an easement. Residential lot-to-lot drainage of sheet flows should be avoided, and residential developments are encouraged to direct surface runoff to a public right-of-way or to a drainage system contained in an easement.

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The Engineering Division shall not approve any drainage report pertaining to proposed construction, platting or other development where the proposed activity or change in the land would result in post-development discharge from the site exceeding discharge under pre-developed conditions (for new development) or existing conditions (for re-development). Downstream capacity shall not be exceeded as a result of development. Exemptions from this provision are as follows:

- A. Additional drainage improvements are not required if drainage improvements have been provided for the fully developed condition, which includes the proposed development.
- B. Prior written approval of a Stormwater Connection Fee from the City Engineer.

No proposed development shall be constructed which impedes or constricts runoff from an upstream watershed based on fully developed conditions. Therefore drainage computations shall be provided to verify no adverse impact upstream or downstream.

2.3 Freeboard

Freeboard is the vertical distance between the design water surface and the elevation of the drainage facility, such as the top of channel, ditch or detention pond. Freeboard is intended to provide a factor of safety and prevent the fluctuation of the water surface from overflowing the drainage facility. Freeboard requirements are shown in [Table 2-2](#). Freeboard is not required where parking areas are designed to serve as detention facilities; however, site design should consider safety and drainage overflow location.

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Table 2-2: Freeboard Requirements

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Drainage Facility	Frequency	Minimum Freeboard
Street right-of-way	100-year	None
Channels and creek improvements	100-year	1.0 ft
Swales and ditches ¹	25-year	0.5 ft
Detention ponds and reservoirs	100-year	1.0 ft
Bridges and culverts	25-year	See note 2
Floodways and floodplains	100-year	2.0 ft (See note 3)

¹ Swales or ditches are considered to have drainage areas of 128 acres or less.

² Bridges and culverts shall be designed to withstand the 100-year event, but the water level may reach roadway level at the 25-year design level if no public safety issues are involved.

³ Floodways and floodplains shall have a minimum of 2-feet freeboard or the minimum freeboard established in the most recently adopted Floodplain Ordinance.

2.4 Drainage Easements and Rights-of-way

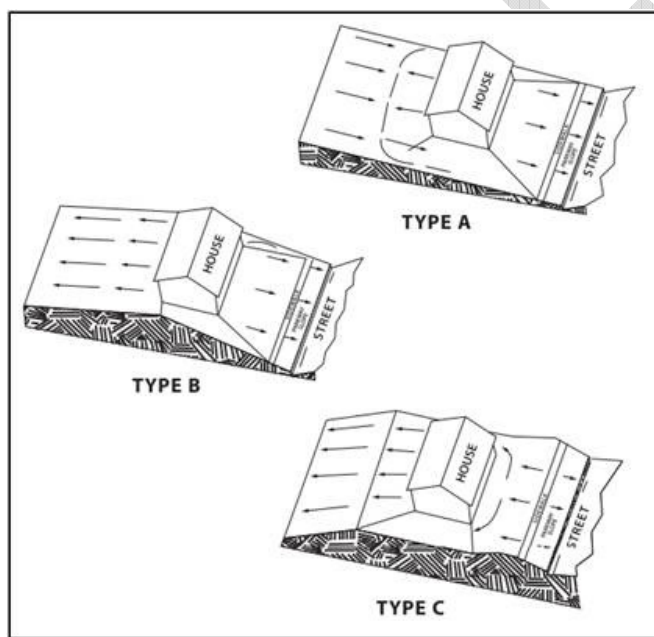
All private drainage and water quality facilities must have an associated drainage easement, restrictive covenant, or similar recorded instrument that clearly identifies ownership and the party responsible for maintenance. Drainage easements and rights-of-way shall be dedicated to the City as required in the Code of Ordinances.

2.5 Finished Floor Elevations

The elevation of the lowest floor shall be elevated 10 inches above the finished grade of the surrounding ground as prescribed in the building regulations and Code of Ordinances. Finished grades shall be sloped to direct stormwater away from the structure. Developments adjacent to stormwater conveyance structures must be elevated 12 inches above the 100-year water flow elevation (in the conveyance structure) to the same elevation that a development adjacent to a 100-year floodplain would be required to meet. Driveways serving houses on the downhill side of the street shall have properly sized swales before entering the garage.

A grading plan shall be prepared and submitted to the City at final plat and building permit, which indicates typical lot grading for all lots in the subdivision using typical Federal Housing Administration (FHA) lot grading types (A, B and C). See Figure 2-1. No more than two (2) residential lots may drain onto another lot unless a drainage easement is dedicated and free of obstructions to contain the runoff. An alternate grading plan may be submitted for large lot or commercial subdivisions.

Figure 2-1: Typical Federal Housing Administration Lot Grading



Where residential lots are located on the downhill side of a T-intersection, cul-de-sac, or elbow, the street intersection shall be graded so to avoid water flowing over the curb and driveway, and out of the right-of-way. Detailed calculations shall be required at permit to show that the discharges are contained within the right-of-way.

2.6 Stormwater Mitigation

It is the intent of this manual, in concert with applicable ordinances, to provide all development under its jurisdiction the option of providing mitigation or demonstrating that no mitigation is in the best interest of the watershed and paying a share of the cost to participate with a stormwater connection fee.

Mitigation through detention, retention, or some other technique must be designed, constructed, and maintained to reduce the post-development discharge rates to below that of pre-development/existing rates for the two (2), ten (10), twenty-five (25), and one-hundred (100) year design storms. Participation in neighborhood or regional mitigation is an acceptable option.

Demonstration that no mitigation is in the best interest of the watershed shall be accomplished by showing no adverse impact due to any increased runoff from the proposed development for the design storms. Approval of a Stormwater Connection Fee is required in compliance with Chapter 143 of the Code of Ordinances. The property owner, or his/her designee, shall meet with the Engineering Division to discuss mitigation and/or Stormwater Connection Fee options prior to commencing the project.

For stormwater mitigation, the following two development conditions shall be analyzed with each adverse impact analysis:

- A. 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.
- B. 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.

2.7 Drainage Facility Design

Drainage design in the urban environment should also consider appearance as an integral part of the design and structures should generally blend with the natural surroundings as much as possible to maintain the aesthetics of the natural area.

The City requires preservation of the natural floodplains. The protection of existing trees and vegetation should be maximized during development of drainage plans. Whenever possible, the replacement of the trees destroyed by drainage and flood protection procedures is encouraged.

Computations to support all drainage designs shall be submitted to the Engineering Division for review in an easy to follow format. On-site pre-development stormwater runoff computations shall be based upon conditions representing the existing land conditions with respect to soil type, percentage cover, and cover type as indicated by current aerial imagery and supporting documentation. Design of structures shall use fully developed sub-basin conditions for the prescribed design storms based on the sub-basin zoning. If zoning does not exist, then the engineer shall assume the ultimate development based on the most recently adopted Future Land Use Plan.

If a development activity changes stormwater runoff characteristics in a manner that creates a point or points of concentrated flow, where previously there was sheet flow or lesser intensity flow pattern, or any increase in discharge rates or velocities for the 2, 10, 25 and 100-year frequency storms, the flow shall outfall into right-of-way or drainage easement that has the capacity for the discharge. An impact analysis is required to verify the capacity and/or required size of the downstream facility clearly demonstrating no adverse impact.

In development of engineered retaining walls greater than three feet, drainage facilities shall be designed in such a manner as to prevent the freefall of stormwater from natural drainage patterns and sheet flow conditions.

The design requirements and criteria are specified in following chapters. Modeling and calculations shall be included in drainage report submittals to ensure the specified criteria are met for all drainage infrastructure improvements. Infrastructure that is within TxDOT right-of-way and requires dual permitting from both the City and TxDOT shall be designed in compliance with the more conservative requirements.

2.8 Stream Bank Erosion Hazard Setbacks

Erosion hazard setback zone determination is necessary for the banks of streams in which the natural channel is to be preserved. The purpose of the setbacks is to reduce the amount of structural damage and stream degradation caused by the erosion of the bank. With the application of stream bank erosion hazard setbacks, an easement is dedicated to the City such that no structure can be located, constructed, or maintained in the area encompassing the erosion hazard setback.

The City allows for stream bank stabilization as an alternative to dedicating the erosion hazard setback zone. Stream bank erosion hazard setbacks may extend beyond the limits of the regulatory floodplain and are shown in Table 2-3.

Table 2-3: Stream Bank Erosion Hazard Setbacks

Contributing Drainage Area (square miles)	Setback Distance from Stream Centerline (feet)
0-1	0
1-5	50
5 or more	100

A map delineating the contributing drainage area sizes along each stream in the City's jurisdiction is included for reference in **Appendix C**. For the purpose of this manual, any watercourse that was included in the rivers and stream data set published in the United States Geological Survey (USGS) National Hydrography Dataset (NHD) in 2013 was considered a stream.

2.9 Water Quality Controls

Temporary water quality best management practices (BMPs) shall be required when any disturbance could result in appreciable erosion that could result in measurable accumulation of sedimentation in

dedicated streets, alleys, any waterway or other private properties during construction activities. Site erosion control requirements are provided in **Section 12**.

Development and redevelopment located over the Edwards Aquifer regulatory zones shall comply with the latest TCEQ published rules and technical design guidance for the Edwards Aquifer. Permanent water quality BMPs for development outside of the Edwards Aquifer regulated zones shall be designed to provide adequate treatment of the water quality volume in the City's jurisdiction as defined in **Section 13**.

2.10 Maintenance of Drainage Facilities

The property owner or designee will maintain the hydraulic integrity of drainage systems not dedicated to the City. The City will maintain the hydraulic integrity of drainage systems dedicated to and accepted by the City. Maintenance of the floodplain, drainage easements, and water quality features shall be explicitly stated in a recorded instrument.

2.10.1 Maintenance Schedule

A maintenance schedule supported by engineering or scientific published documents shall be submitted to the Engineering Division prior to approval of construction plans for public and private facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage and water quality improvements to ensure that the maintenance schedule is being implemented.

2.10.2 Maintenance Access

Access shall be provided for all channels to allow equipment access for maintenance. Access shall have a width of at least 12 feet and a cross slope no greater than two percent. Maintenance ramps used for access shall have a vertical grade no steeper than 6:1. Access shall be provided within dedicated right-of-way or within the drainage easement dedicated for the channel.

2.11 Pumped Drainage Facilities

The City of New Braunfels discourages the use of Pumped Drainage Facilities. A Pumped Drainage Facility is defined as any drainage system not wholly utilizing gravity outflow. Facility designs considered under this section's guidelines must first demonstrate that a gravity system is not feasible from both an engineering and economic standpoint. A feasibility analysis is required to be submitted prior to permit application. The applicant must have expressed written approval from the City Engineer and Engineering Division with permit application.

Pumped Drainage Facilities will only be acceptable in commercial applications and must meet all other drainage requirements outlined in this manual. All approved Pumped Drainage Facilities must be privately owned and maintained. The owner assumes responsibility for any damage to property as a result of a system's normal operation or failure.

2.11.1 Design Requirements

If approved by the Engineering Division, Pumped Drainage Facilities design submittals should include the following items:

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- A. Pump discharge shall be used for a maximum of 50% of the total required basin capacity, not including freeboard. The remaining volume must discharge by gravity.
- B. A minimum of two (2) pumps will be provided, each of which is sized to pump the designed flow rate.
- C. Provide an emergency power source for the drainage facility pumps.
- D. Design should include but not be limited to controls, pumps, cycling and anti-vandalism measures.
- E. Facility discharge must be into an existing right-of-way or drainage easement that has the capacity for the increase discharge.
- F. Provide an armored gravity emergency outflow structure designed to allow the outflow of the 100-year design storm, assuming the pond is full and the discharge is 100% clogged. At minimum, the emergency overflow shall engage when ponding exceeds the 100-year water surface elevation plus freeboard.

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2.11.2 Maintenance and Operations

A maintenance and operations plan shall be submitted to the Engineering Division prior to approval of construction plans for all facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage improvements to ensure that the maintenance schedule is being implemented.

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