GODSEY ENGINEERING
109 Shooting Club Road
Boerne, Texas 78006
Texas Firm Registration No. F-5593
(830) 249-5688 phone
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January 21, 2019

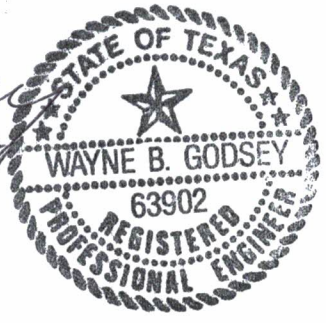
Nick Colonna
Planning and Zoning Department
City of Boerne

Re: Boerne Station Business Park
Ebner St.
Development Plat Submittal

In accordance with your January 15 email, please find attached additional drainage calculations as requested. Please contact me if you have any questions or need additional information.

Sincerely,

Wayne B. Godsey, P.E. 1/21/19
GODSEY ENGINEERING



Cc: Travis Roberson

Subject: Boerne Station Business Park Detention Waiver Request
From: Nick Colonna <nColonna@boerne-tx.gov>
Date: 1/15/2019, 4:19 PM
To: "wayne@godseyengineering.com" <wayne@godseyengineering.com>
CC: "donnieb@gvtc.com" <donnieb@gvtc.com>, "sterling@boernersurveying.com" <sterling@boernersurveying.com>, "travis@rsthornton.com" <travis@rsthornton.com>, Laura Talley <LTalley@ci.boerne.tx.us>

Wayne,

I hope this message finds you well.

Per my voice mail, staff is in receipt of your waiver request to not provide detention at the Boerne Station Business Park. After reviewing the letter, the following analysis is being requested in order for the Planning and Zoning Commission (P and Z) to better assess the waiver request. The deadline to submit for the February 4th 2019 P and Z agenda is this Friday January 18, 2019.

Items requested:

- The existing conditions;
- (A) The flows for existing conditions;
- Proposed conditions;
- (B) Flows for the proposed conditions;
- (C) The impact of the flows ;
- (D) The percentage of increase/decrease on the overall watershed for a 100 year storm;
- (D) The overall increase/decrease for a 100 year storm; and
- (E) A statement stating that the new calculations indicate no adverse impact to the overall watershed.

Please be aware that the platting review and approval for this project will continue to move forward.

Also, let me know if you have any questions.

Thank you,

Nick

Nick A. Colonna,AICP
Assistant Director
City of Boerne - Planning and Community Development
830-248-1501 ext. 1106

Boerne Station Business Park
Ebner Street
January 18, 2019

Drainage Analysis

A **Existing condition site runoff**

Q = CiA

C = 0.31 (agricultural, 10% impervious cover)
Tc = 10 minutes (grass)
A = 0.9 acres

	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
Intensity (in/hr)	5.249	6.805	7.823	9.115	10.26	11.179
Q (cfs)	1.5	1.9	2.2	2.5	2.9	3.1

B **Proposed condition site runoff**

Q = CiA

C = 0.66 (office, 70% impervious cover)
Tc = 5 minutes (paved)
A = 0.9 acres

	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
Intensity (in/hr)	6.724	8.703	10.011	11.632	13.084	14.195
Q (cfs)	4.0	5.2	5.9	6.9	7.8	8.4

C **Impact of flows**

The maximum increase in runoff from the site is estimated to be 5.3 cfs for the 100 year event.
The current direction of runoff flow is to the east onto the adjacent property.
The proposed direction of runoff will be to the street via the parking lot.
Development of the site will reduce the runoff onto the adjacent property to the east.
There will be no adverse impacts on the property to the east of this development.

D **Increase in runoff on the overall watershed for the 100 year event**

The overall watershed to be considered is at Aransas Pass Street and is based on a drainage analysis performed in 2000 for the City of Boerne in conjunction with the reconstruction of Aransas Pass Street. A copy of that analysis is attached.

The area to the north of Ebner was modeled for ultimate development conditions using a runoff coefficient of 0.88. The residential areas to the south of Ebner were modeled using a residential runoff coefficient of 0.77. The runoff coefficient is recalculated to represent current existing and proposed conditions. See attached calculations.

Existing condition 100 year runoff rate = 57.2 cfs
Proposed condition 100 year runoff rate = 59.4 cfs
Increase = 2.2 cfs
Increase = approx. 4%

E **Impact of 100 year flowrate increase/decrease**

As shown, the increase in the 100 year runoff rate (at the south end of Aransas Pass) is approximately 2.2 cfs or 4%. Based on the 2000 drainage analysis, Aransas Pass St. has a capacity of approx. 83.7 cfs at this location.

It is my opinion that the development of the Boerne Station Business Park will not have an adverse impact to the overall watershed and that Aransas Pass can adequately accommodate the increase in flow.

ARANSAS PASS STREET
DRAINAGE DESIGN

BOERNE, TEXAS

Prepared for:
City of Boerne, Texas

Prepared by:
Godsey Engineering
Boerne, Texas

December, 2000

ARANSAS PASS STREET
DRAINAGE DESIGN

INTRODUCTION

The purpose of this report is to provide the City of Boerne with drainage calculations to allow for the reconstruction of Aransas Pass Street at appropriate slopes and grades to provide for adequate drainage capacity. Existing runoff patterns in the area experience flows overtopping the roadway and flooding in the yards of homes located on the east side of Aransas Pass Street. Reconstruction will include concrete curbs to control the drainage in the street.

DESIGN INFORMATION

Topographic information utilized in this study comes from several sources. Two foot interval contours were obtained from the Topographic Map of Boerne, Texas, dated March, 1970, sheets 2 and 3 and utilized for watershed delineation. Watershed areas were determined conservatively based on ultimate development and anticipated directions of ultimate runoff patterns, refer to Exhibit No. 1. Survey data provided by the City of Boerne includes cross-sections of Aransas Pass Street at 20 foot intervals. Additional survey data along Ebner Street was collected as part of this study. All field survey data is based on an assumed datum. No right-of-way or property surveys were prepared.

Design storms considered are the 5 year, 10 year and 25 year storm events. Rainfall data for these events was obtained from the City of Boerne Subdivision Ordinance based on storm durations equal to the time of concentration at each design point. Design points are located at the intersection of Ebner Street and Aransas Pass Street, Point 01, and near the southerly end of Aransas Pass Street where the street grades are the flattest, Point 02.

Peak runoff from each watershed was calculated using the "Rational Formula" in accordance with applicable city regulations. The runoff coefficient, "C", was determined based on anticipated ultimate development. Watershed area located to the north of Ebner Street was assumed to have ultimate development characteristics of Neighborhood-Business-Office (NBO) zoning (C = 0.88). Remaining watershed area was considered residential (C = 0.77). The

approximate slope of the land in the watershed area is 1% to 3%. A composite runoff coefficient was calculated for the downstream discharge point. Calculations for the composite runoff coefficients are included the Appendix.

Time of Concentration (Tc) for each watershed is the time for runoff to travel from the hydraulically most distant point of a watershed to the point of outlet. The Tc determines the rainfall intensity used for each watershed. The Tc for each watershed was calculated utilizing methods developed by the NRCS in Technical Release 55 (TR-55) utilizing overland sheet flow, shallow concentrated flow and channelized flow. Flow characteristics were conservatively calculated based on ultimate development and drainage improvements including channels and street flows. A travel time was computed for each applicable flow condition described above and summed together to arrive at the Tc for each watershed. Printouts of the Tc calculations are included in the Appendix.

A summary of watershed characteristics for each watershed are as follows:

Watershed	Area (acres)	Total Area (acres)	Tc (minutes)	Runoff Coefficient "C"
01	14.5	14.5	20.0	0.88
02	4.2	18.7	23.4	0.86

Rainfall intensities were taken from Table J, page 52 of the Boerne Subdivision Ordinance, using the appropriate storm duration for the 5 year, 10 year and 25 year storm events. Where the Tc was different from those listed in the Rainfall Intensity table, the formula $\mathbf{I = B/(Tc + d)^e}$ was utilized (obtained from the Kendall County, Texas Development Guidelines and Regulations Rules Book). Boerne subdivision regulations require that minor streets be designed to accommodate the 5 year storm event and all other streets to be designed for the 10 year storm event. Rainfall intensities and peak flowrates for each design point are as follows:

Design Point	I_5 (inch/hr)	I_{10} (inch/hr)	I_{25} (inch/hr)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)
01	4.56	5.54	6.54	58.2	70.7	83.5
02	4.46	5.16	6.00	71.7	83.0	96.5

STREET DESIGN

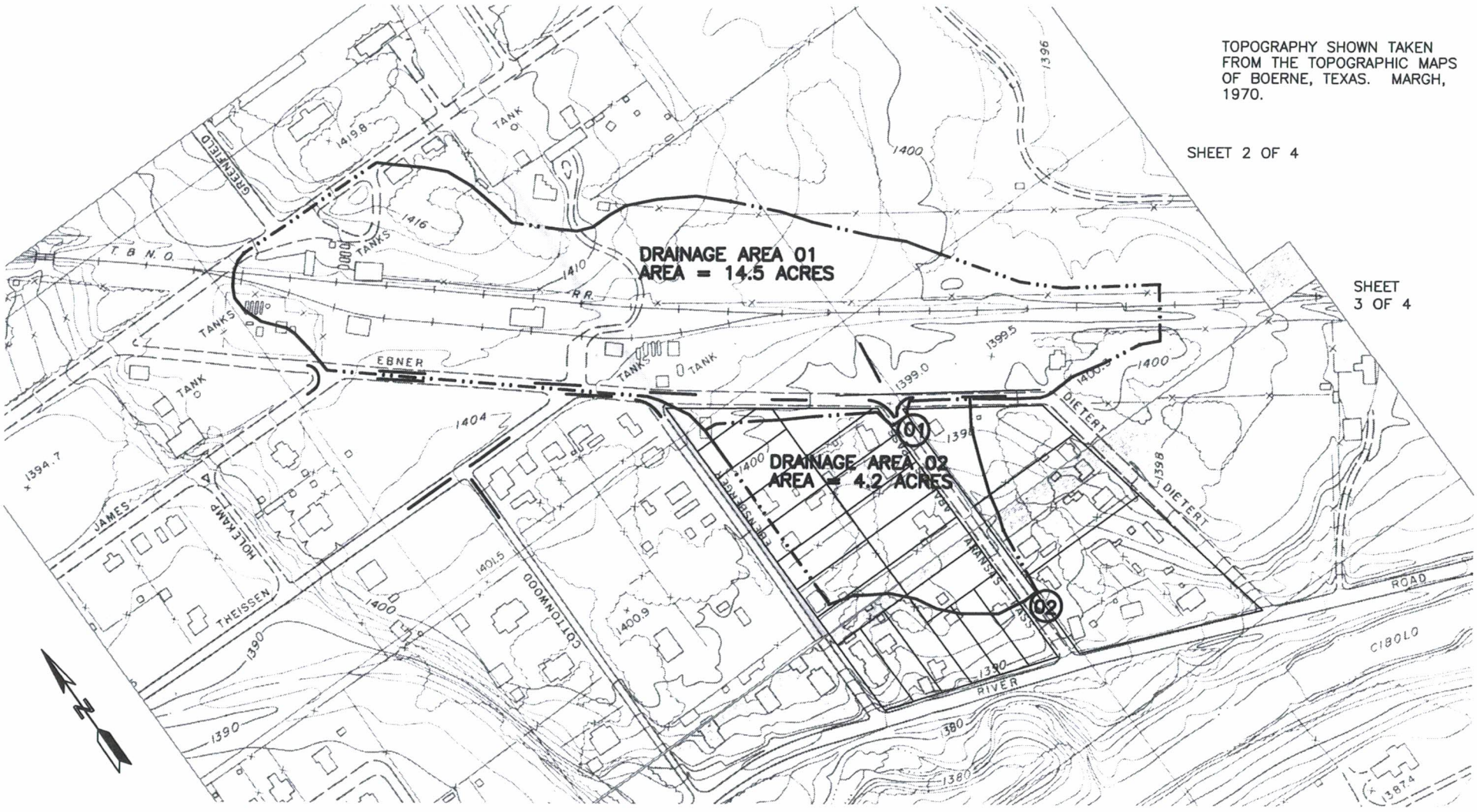
Based on available right-of-way width of 40 feet, a 30 foot street section was selected. A typical curb height of 7-1/2 inches was utilized. All top of curb elevations have been set below the elevation at the right-of-way line to ensure that runoff will enter the street. Hydraulics for the proposed street cross-section were calculated using Manning's Equation for channelized flow. A roughness coefficient of 0.018 was chosen for an asphalt surface. Refer to Exhibit No. 2 for a proposed plan and profile view of Aransas Pass Street and Exhibit No. 3 for a typical street cross-section. Street capacities at respective critical slope locations are as follows:

Design Point	Slope (%)	Capacity (cfs)
01	1.50	92.9
02	1.20	83.7

CONCLUSIONS

Based on the design information and assumptions presented in this report, the proposed street grades and elevations shown on Exhibit No. 2, along with the proposed street cross-section shown on Exhibit No. 3, Aransas Pass Street will accommodate the runoff expected from a 10 year storm event. This exceeds the required capacity stated in the Boerne Subdivision Regulations for a minor street (required to accommodate the peak runoff from a 5 year storm event).

It should be noted that this design effort does not include any required driveway penetrations, retaining walls, property acquisitions, certified property line surveys or improvements to Ebner Street. Ebner Street currently slopes towards the intersection with Aransas Pass Street, however, without curbs or adequate roadside ditches, the runoff appears to cross the street and enter the lots along the south side of the street. Future improvements to Ebner should intercept these flows and direct them to the intersection with Aransas Pass Street. In addition, existing curb returns at River Road are approximately 25 feet apart and will require reconstruction to accommodate the proposed 30 foot street width.



LEGEND

WATERSHED DIVIDE

DIRECTION OF FLOW

(01) RUNOFF CALCULATION POINT

SCALE: 1" = 200'
DECEMBER, 2000

EXHIBIT NO. 1
DRAINAGE AREA MAP
ARANSAS PASS STREET

GODSEY ENGINEERING

Texas Firm No. F-5593

109 Shooting Club Road, Boerne, Texas 78006 830/249-5688

Job Title Boerne Station Business Park Date 1/18/19

Description Drainage Calculations Sheet No. 1 of

A. Exist. condition T_c (site only)

$$T_{sheet} = \frac{L_N}{42\,S^{0.5}} = \frac{300' \times 0.1}{42\,(0.007)^{0.5}} = 8.5 \text{ min}$$

$$T_{shallow} = \frac{L_N}{60\,S^{0.5}} = \frac{50' \times 0.1}{60\,(.007)^{0.5}} = 1.0$$

$T_c = 9.5$ use 10 min

B. Prop. condition T_c (site only)

$$T_{shallow} = \frac{L_N}{60\,S^{0.5}} = \frac{350' \times 0.02}{60 \times 0.007^{0.5}} = 1.4 \text{ min}$$

Use 5 min

D. "Overall" Watershed Analysis

Revise "C" values per current conditions:

(The runoff calculations in the 2000 drainage report were for ultimate conditions. These calculations are for current & proposed conditions)

1. EXISTING:

-North of Ebner St (~25% impervious)		C = 0.40	13.6 ac
-South of Ebner	(medium residential)	C = 0.48	4.2 ac
-Site (EXISTING)		C = 0.31	0.9 ac
			18.7 ac

$C_{ave.} = 0.414$

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109 Shooting Club Road, Boerne, Texas 78006 830/249-5688

Job Title _____ Date _____

Description _____ Sheet No. 2 of

D. (continued)

2. Proposed:

North of Ebner	C = 0.40	13.6 acres
South of Ebner	C = 0.48	4.2 acres
Site (prop.)	C = 0.66	0.9 ac
		18.7 ac

$C_{Ave} = 0.430$

3. Compare 100 yr event runoff rates:

$Q = CiA$

Existing $Q = 0.414 \times 7.39 \times 18.7 = 57.2$ cfs

Prop. $Q = 0.430 \times 7.39 \times 18.7 = 59.4$ cfs

Increase = 2.2 cfs

Increase = 4%