

Addendum
to the
Drainage Report

for

**Castlegate Subdivision
Section 4, Phase 2
College Station, Texas**

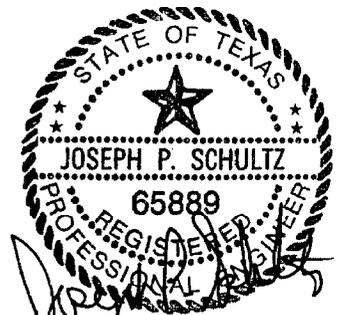
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3-14-03

ADDENDUM TO THE DRAINAGE REPORT FOR CASTLEGATE SUBDIVISION – SECTION 4, PHASE 2

INTRODUCTION

The purpose of this addendum is to provide the hydrological effects of the proposed storm sewer modifications for *Castlegate Subdivision, Section 4, Phase 2*, and to verify that these modifications to the storm drainage system meet the requirements set forth by the City of College Station Drainage Policy and Design Standards. The residential structure constructed at 2305 Kendall Green Circle is located in the utility easement, and it is adjacent to the existing 42" storm sewer pipe. Since there is not adequate space along the residence for excavation to repair the pipe in the future, a modification to the storm sewer pipe is required.

DESCRIPTION OF MODIFICATIONS

The proposed modifications call for slip-lining a portion of the 42" RCP Pipe #415 with 97 feet of 36" PVC liner pipe. This 36" liner pipe will extend a minimum of 10 feet past the front and back corners of the residential structure. The liner pipe will be A2 Liner Pipe as manufactured by Contech Construction Products, Inc. Lining the 42" RCP should prevent erosion and scour due to any potential future separation of joints along the 42" line. The first joint of 42" RCP at Junction Box No. 404 may be left in place. The second and third joints of 42" RCP will be removed. This 16 foot opening will be used to insert the 36" PVC pipe (in 10 foot sections) into the remaining 42" RCP. Spacers will be attached to the top of the 36" PVC pipe to keep it positioned against the bottom of the 42" pipe. The 36" PVC pipe will have flowable cement grout placed in the annular space between it and the 42" pipe to permanently hold it in place. The 36" PVC pipe will extend across the opening where the 42" pipe was removed, and this portion of exposed 36" PVC pipe will be wrapped with #10 gauge wire mesh and backfilled with Portland Cement Concrete (3000 psi minimum) at a minimum thickness of 12" around the 36" PVC pipe. This will provide additional permanent support for the 36" pipe. The location of the 36" PVC liner pipe and the cross sections of the different backfilling requirements are shown on the revised plan sheet 6 of the construction drawings for Castlegate Subdivision, Section 4, Phase 2.

HYDRAULIC ANALYSIS

The existing 42" Pipe No. 415 has a slope of 0.56%. The 42" Pipe Nos. 416, 417 and 418 upstream of this pipe have a slope of 0.4%. During the initial design of the storm sewer for this subdivision, it was determined that a 42" diameter pipe was required because a 36" diameter pipe could not sufficiently carry the runoff from the 100-year storm event. The headwater elevation on Pipe No. 418 from this runoff would have been greater than the ground elevation at the street right-of-way at Inlet No. 413. Because of this, the runoff at this inlet would not have been contained within the right-of-way as required by the City of College Station Drainage Policy. The selection of the 42" diameter pipe resulted in excess capacity available in these pipe sections, therefore, the attached hydrology data shows that even though the pipe diameter is reduced to 36", the 10- and 100-year storm events still pass since the Manning's Roughness Coefficient PVC material is $n = 0.009$ (as per manufacturer's specifications), and the initial analysis was performed using $n = 0.014$ for

the reinforced concrete pipe. Using $n = 0.014$ for RCP as required by the Drainage Policy is conservative. An 'n' value of 0.012 or 0.013 is widely used for evaluating the flow in concrete pipe. Additionally, the 0.009 value for PVC is within the City recommendation of $n = 0.008$ for PVC pipe, as given in the Drainage Policy. The 36" pipe will flow 85.7% full for the 100-year storm event, while the 42" pipe is 90.8% full.

CONCLUSIONS

The modifications of this section of pipe will not affect the previous storm sewer analysis performed for this project, and they will meet the requirements of the City of College Station Drainage Policy and Design Standards. The modifications will provide additional stability to the 42" RCP that was encroached upon by the construction of the house.

Castlegate Subdivision
Pipe Calculations - Section 4, Phase 2 - Revised 3-14-2003

Pipe #	Size (in)	Length (ft)	Slope (%)	Inlet Invert Elev (ft)	Outlet Invert Elev (ft)	10 year storm						100 year storm					
						*Actual Flow (cfs)	Design Flow (cfs)	V ₁₀ (fps)	% Full	Travel Time, t ₁₀		*Actual Flow (cfs)	Design Flow (cfs)	V ₁₀₀ (fps)	% Full	Travel Time, t ₁₀₀	
										(sec)	(min)					(sec)	(min)
422	18	26.1	1.40	325.80	325.43	7.07	11.42	7.4	81.0	4	0.06	7.57	12.23	7.4	88.9	4	0.06
419	27	23.9	0.60	320.34	320.20		14.68	6.0	59.3	4	0.07		21.75	6.4	79.9	4	0.07
421	24	308.5	1.10	324.93	321.54	13.27	21.43	8.0	79.6	39	0.64	14.14	22.84	8.0	85.7	39	0.64
420	24	90.2	1.10	321.44	320.45	13.27	21.43	8.0	79.6	11	0.19	14.14	22.84	8.0	85.7	11	0.19
418	42	187.9	0.40	318.95	318.20		27.42	6.0	47.9	31	0.52		54.97	7.0	76.3	27	0.52
417	42	381.0	0.40	318.10	316.58		27.42	6.0	47.9	64	1.06		54.97	7.0	76.3	54	1.06
416	42	203.3	0.40	316.48	315.67		27.42	6.0	47.9	34	0.56		54.97	7.0	76.3	29	0.56
415	42	150.3	0.56	315.57	314.73		42.10	7.6	56.0	20	0.33		74.75	8.1	90.8	19	0.33
**415B	36	97.0	0.56	314.73	314.19		42.10	10.6	54.9	9	0.15		74.75	11.6	85.7	8	0.15
412	42	35.3	0.90	313.64	313.32		56.20	9.8	57.8	4	0.06		89.85	10.5	83.3	3	0.06
414	18	26.1	1.50	320.35	319.96	6.61	10.68	7.6	73.8	3	0.06	7.05	11.39	7.7	78.1	3	0.06
413	24	117.0	1.25	319.46	318.00	14.10	22.77	8.5	79.3	14	0.23	15.10	24.39	8.5	85.9	14	0.23

*These values reflect the actual flow for the 18" & 24" pipes. The design flow for these pipe sizes reflects a 25% reduction in pipe area. (Refer to attached calculation for specific information.)

** 36" PVC pipe, n = 0.009 (per manufacturer's specifications)

Pipe 415 - 36" PVC Liner Pipe
10 Year Storm
Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	42.1000 cfs
Slope	0.0056 ft/ft
Manning's n	0.0090

Computed Results:

Depth	19.7631 in
Area	7.0686 ft ²
Wetted Area	3.9744 ft ²
Wetted Perimeter	60.0806 in
Perimeter	113.0973 in
Velocity	10.5929 fps
Hydraulic Radius	9.5257 in
Percent Full	54.8976 %
Full flow Flowrate	72.0958 cfs
Full flow velocity	10.1995 fps

Pipe 415 - 36" PVC Liner Pipe
100 Year Storm
Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	74.7500 cfs
Slope	0.0056 ft/ft
Manning's n	0.0090

Computed Results:

Depth	30.8613 in
Area	7.0686 ft ²
Wetted Area	6.4499 ft ²
Wetted Perimeter	85.2023 in
Perimeter	113.0973 in
Velocity	11.5893 fps
Hydraulic Radius	10.9009 in
Percent Full	85.7259 %
Full flow Flowrate	72.0958 cfs
Full flow velocity	10.1995 fps

ENGINEER'S COST ESTIMATE
 2305 KENDALL GREEN CIRCLE
 COLLEGE STATION, TEXAS

17-Mar-03

"Scope of Work" Item No.	A	B	C	Total
	Supervision & Labor	Equipment	Materials	
1	\$360	\$90	\$0	\$450
2	\$220	\$0	\$50	\$270
3	\$220	\$90	\$50	\$360
4	\$600	\$950	\$0	\$1,550
5	\$300	\$430	\$0	\$730
6	\$2,040	\$2,150	\$8,802	\$12,992
7	\$440	\$0	\$100	\$540
8	\$2,040	\$0	\$1,480	\$3,520
9	\$1,020	\$1,390	\$1,100	\$3,510
10	\$440	\$540	\$0	\$980
Total	\$7,680	\$5,640	\$11,582	\$24,902

Equipment & Labor	\$13,320
Materials	\$11,582
Subtotal	\$24,902
Engineering	\$2,750
Total	\$27,652

The following items will be required but are not included in the scope of work:

1. Removal and replacement of grass sod and landscaping.
2. Removal and replacement of irrigation system.
3. Removal and replacement of wooden fence (if necessary).
4. Repair and replacement of existing concrete driveway, if damaged during construction.

