Meghan Buum

From: Joyce Hagen Mundy
Sent: Wednesday, November 30, 2016 1:38 PM
To: Meghan Buum
Subject: FW: Homestead development concerns
Attachments: 20161129153643070.pdf; D21E2B53-F34A-4BD4-9405-F1DEE059D9E2.pdf

Please add attached to the PC packet for tonight.

From: Wes Jordan
Sent: Wednesday, November 30, 2016 1:22 PM
To: Joyce Hagen Mundy
Subject: FW: Homestead development concerns

For the P/C packet

From: Cory Childress [mailto:cory@evan-talanhomes.com]
Sent: Tuesday, November 29, 2016 5:16 PM
To: info@tweakkc.com
Cc: Melissa Prenger; Wes Jordan; Keith Bredehoeft; Doug Sloter
Subject: Homestead development concerns

Hi SueAnn -

I wanted to follow up with you to address the concerns that were brought up by yourself and some of the other neighbors during our meeting at the city on 11/16/16. The recap of the meeting was to come up with some solutions for the following:

1. Address the grading plan to attempt to reduce the elevation on lots 9,10 and 11.
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Here is my proposal and I would be happy to speak with you on the phone and/or meet with you (or any of the neighbors) in person to make sure everything is clear of what I am proposing.

1. BHC Rhodes has provided us with an alternative grading plan (see attached) that lowers the grade on lots 9,10 and 11 by approximately 12'. This is the most they could reasonably lower the grade and still direct water flow adequately. This also removes the berm and creates a swale which should work better and also be more aesthetically pleasing for all. This plan removes approximately 2,300 square yards of soil.
2. This will be addressed with a slight berm with the city's approval of the final design.
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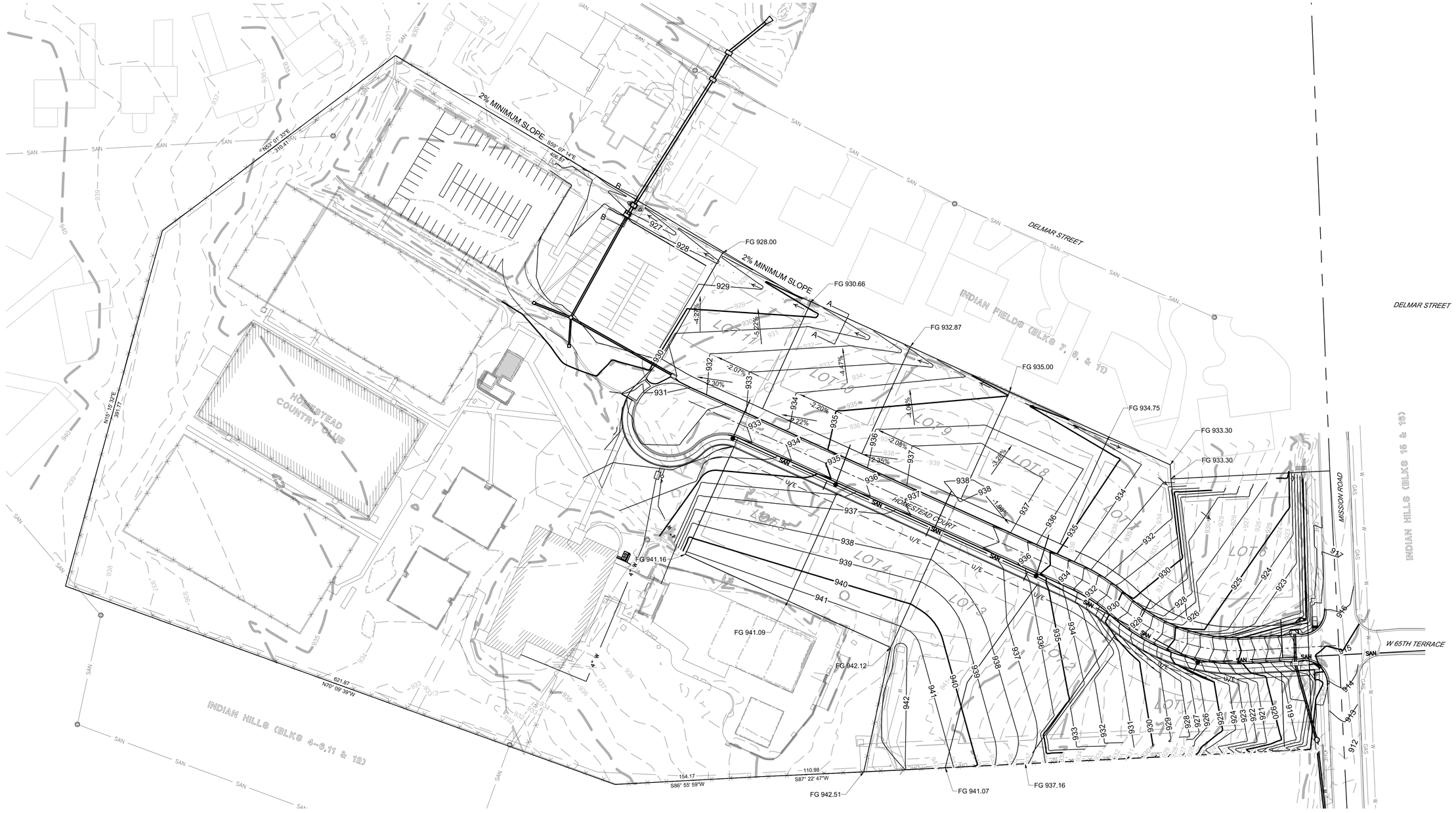
I feel that each of these proposals provide reasonable solutions to the concerns brought up at the last meeting. I understand we may not be able to make everyone completely happy but please understand that I am attempting to try my best to create a positive relationship with all of the neighbors. I am sorry for any frustration that has arisen through this process but I feel that we are on track now with open communcation. At the end of the day this is about creating a community that we can all be proud of.

I have copied Mellisa Prenger, Wes Jordan and Keith Bredehoeft on this email so that they can be in the loop of our communication and if they have anything to add they can chime in as well.

Cory Childress
816.289.1122



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11. FOR FURTHER DETAIL ON DETENTION AND OVERFLOW AREA SEE SHEET 11.

LEGEND

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N

SCALE: 1"=50'
0 50 100

Rev.	Date	Description	By	App.

PATRICK J. JOYCE
LICENSED
20352
KANSAS
PROFESSIONAL ENGINEER

BHC RHODES
Civil Engineering • Surveying • Utilities
7101 College Blvd., Suite 400
Overland Park, Kansas 66210
p. (913) 663-1900 f. (913) 663-1633
BHC RHODES is a trademark of Burns&McDonnell of Kansas, P.A.

Prepared For:
EVAN TALAN DEVELOPMENT
1920 W 143RD
SUITE 150
LEAWOOD, KS 66224
913-232-5151

HOMESTEAD COURT
65TH TERR AND MISSION ROAD
PRAIRIE VILLAGE, KS

GRADING PLAN

Design: JDO	Drawn: JDO
Checked:	LTB
Issue Date:	09/01/2015
Project Number:	020330

5 of 27

5

Nov 28, 2016 - 1:24pm Plotted By: dalton.signer V:\020330\PWD\Eng\Sheet\Public Improvements\020330-SHTS-SITE-GRAD ASBuilt.dwg Layout: GRADING PLAN

AMENDMENT TO
HOMESTEAD ESTATES
DECLARATION OF RESTRICTIONS

THIS AMENDMENT ("**Amendment**") is made and entered into as of November 30, 2016 by EVAN-TALAN DEVELOPMENT, LLC, a Kansas limited liability company, as the developer of the real property described below (the "**Developer**").

WITNESSETH:

WHEREAS, the Developer is the developer of the residential area in the City of Prairie Village, Johnson County, Kansas, commonly known as "Homestead Estates"; and

WHEREAS, the Developer has previously executed a certain document entitled Homestead Estates Declaration of Restrictions and caused such document to be recorded in the Office of the Register of Deeds of Johnson County, Kansas (the "**Recording Office**") in Book 201505 at Page 003049 (the "**Declaration**"); and

WHEREAS, the Declaration places certain covenants and restrictions upon the following described residential lots (the "**Lots**") and the following described common areas:

> Lots 1 through 11, and Tracts A and B, Homestead Estates Final Plat, a subdivision in City of Prairie Village, Johnson County, Kansas.

WHEREAS, the Developer desires to amend the Declaration as provided herein;

NOW, THEREFORE, the parties hereto declare and agree as follows:

A. Capitalized terms used in this Amendment but not defined herein shall have the meanings set forth in the Declaration.

B. Section 5(c) of the Declaration is hereby amended to read in its entirety as follows:

5(c) All final grading of each Lot shall be completed by the Owner in connection with construction of the residence and shall be in accordance with the master grading plan approved by the City and the specific site grading plan for the Lot approved by or for the Developer and the City. No landscaping, berms, fences or other structures shall be installed or maintained at any time that impede the flow of surface water as set forth in the approved grading plan. Water from sump pumps shall be drained away from adjacent residences (actual and future). No changes in the final grading or drainage of any Lot shall be made by or for the Owner (whether by actual grading or installation of any fences, patios, swimming pools, or other structures) without the prior written consent of the Developer and the City. The foregoing provisions of this subsection (c) may not be amended or terminated without the express written consent of the City. The Developer shall have no liability or responsibility to any builder, Owner or other party for the failure of a builder or Owner to final grade or maintain any Lot in accordance with the master grading plan or any approved lot grading plan or for the quality or composition of any soil or subsurface material. The Developer does not represent or guarantee to any Owner or other person that any grading plan for the Lots which the Developer, the City, or any engineer or other party may approve or supply shall be sufficient or adequate or that the Lots will drain properly or to any Owner's or other person's satisfaction.

C. Pursuant to Section 20(b) of the Declaration, this Amendment shall become effective as an amendment of the Declaration and binding upon all of the Lots upon (a) the execution hereof by the Developer, and (b) the recordation hereof in the Recording Office.

D. The execution of this Amendment may occur in counterparts with only one copy of the main body hereof being recorded together with the various signature and acknowledgment pages from such counterparts.

IN WITNESS WHEREOF, the parties hereto have caused this Amendment to be duly executed.

THE DEVELOPER:

EVAN-TALAN DEVELOPMENT, LLC

By:_____
Name: Cory Childress
Title: President

STATE OF KANSAS)
) ss.
COUNTY OF JOHNSON)

This instrument was acknowledged before me, a Notary Public, on November 30, 2016 by **Cory Childress**, as President of EVAN-TALAN DEVELOPMENT, LLC, a Kansas limited liability company.

My Commission Expires:

_____
[SEAL]

_____
Notary Public in and for said County and State

Print Name:_____

Meghan Buum

From: Joyce Hagen Mundy
Sent: Wednesday, November 30, 2016 1:39 PM
To: Meghan Buum
Subject: FW: Homestead development concerns
Attachments: 020330-SHTS-SITE-GRAD (2016-11-29).pdf

Importance: High

Please add attached to PC packet for tonight. THANKS!

From: Wes Jordan
Sent: Wednesday, November 30, 2016 1:18 PM
To: Joyce Hagen Mundy
Subject: FW: Homestead development concerns

Updated info for the P/C packet

From: Melissa Prenger
Sent: Wednesday, November 30, 2016 11:00 AM
To: Keith Bredehoeft; info@tweakkc.com; Wes Jordan
Cc: Cory Childress; Doug Sloter; Patrick Joyce; Chris Brewster
Subject: RE: Homestead development concerns

Good Morning All,
I am forwarding the plan with the cross sections to show the new ditch section on lots 7-10. The berm will be developed on lot 11 illustrated by section AA.

Melissa Prenger, PE
Sr Project Manager
City of Prairie Village
913-385-4655 || mprenger@pvkansas.com

From: Keith Bredehoeft
Sent: Wednesday, November 30, 2016 9:32 AM
To: info@tweakkc.com
Cc: Cory Childress; Melissa Prenger; Wes Jordan; Doug Sloter
Subject: Re: Homestead development concerns

Hello Sue,
Just wanted to follow up to Cory's email.

Cory should be able to provide cross sections of the modified channel at the north property line today as well. We asked that they lower the channel from the property line to make it better than is is today. The cross sections will help in understanding this. We will still have a berm close to the drainage inlet but the channel will be regarded and lowered in this location. This grading change along with a drainage easement and/or deed restrictions will allow for the city to ensure proper function of this channel into the future.

I am happy to discuss with you. My cell is 913-909-3696.

Thanks
Keith

Sent from my iPhone

On Nov 29, 2016, at 5:15 PM, Cory Childress <cory@evan-talanhomes.com> wrote:

> Hi SueAnn -
>
> I wanted to follow up with you to address the concerns that were brought up by yourself and some of the other neighbors during our meeting at the city on 11/16/16. The recap of the meeting was to come up with some solutions for the following:
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Cory Childress
816.289.1122

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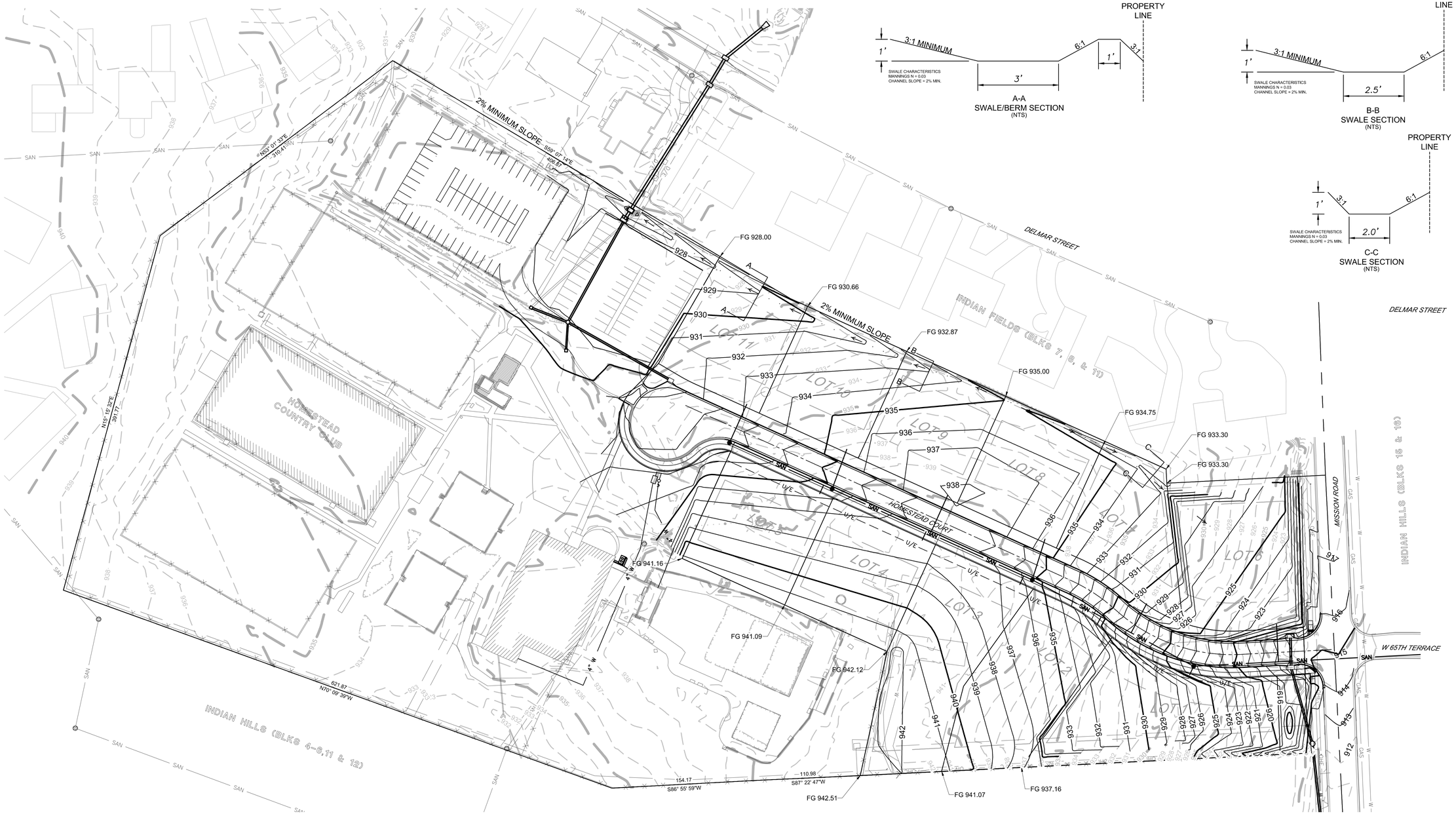

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- PROPOSED STORM SEWER
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- PROPOSED ASPHALT

SCALE: 1"=50'
0 50 100

Rev.	Date	Description	By	App.

PATRICK J. JOYCE
LICENSED
20352
KANSAS
PROFESSIONAL ENGINEER

BHC RHODES
Civil Engineering • Surveying • Utilities
7101 College Blvd., Suite 400
Overland Park, Kansas 66210
p. (913) 663-1900 f. (913) 663-1633
BHC RHODES is a trademark of Bucher, Willis & Ratliff Corporation, P.A.

Prepared For:
EVAN TALAN DEVELOPMENT
1920 W 143RD
SUITE 150
LEAWOOD, KS 66224
913-232-5151

HOMESTEAD COURT
65TH TERR AND MISSION ROAD
PRAIRIE VILLAGE, KS

GRADING PLAN

Design:	JDO
Drawn:	JDO
Checked:	LTB
Issue Date:	09/01/2015
Project Number:	020330

5 of 27

5

Nov 29, 2016 - 5:11pm Plotted By: dalton.signer V:\020330\DWG\Eng\Sheet\Public Improvements\020330-SHTS-SITE-GRAD ASBuilt.dwg Layout: GRADING PLAN

Renaissance Infrastructure Consulting

2 New Century Pkwy
New Century, KS 66031
P: 913.317.9500
www.ric-consult.com

MEMO

To: Keith Bredehoeft, P.E.
Prairie Village, KS

From: Curtis R. Talcott, P.E.

CC: Patrick Joyce, P.E.
BHC Rhodes

Date: November 18, 2016

Re: Homestead Country Club – Stormwater Management Study

Renaissance Infrastructure has completed a review of the Post Mass Grading Stormwater Management Study for Homestead Country Club submitted by BHC Rhodes dated November 18, 2016. The revisions to the study met the intent and requirements of the original study. We recommend acceptance of the stormwater study by the City of Prairie Village. The City will need to monitor development of the site to make sure proposed impervious area for Lots 4, 5, 9, 10 & 11 does not exceed 27,350 sq. ft. The proposed impervious area for Lots 1, 2, 3, 6 & 7 should not exceed 36,865 sq. ft.

Post study

POST MASS GRADING STORMWATER MANAGEMENT STUDY

FOR

HOMESTEAD COUNTY CLUB
&
HOMESTEAD ESTATES

Project Location:
6510 W Mission Road
Prairie Village, KS 66208

Date: November 8, 2016

11-8-16

BHC RHODES
CIVIL ENGINEERS · SURVEYORS

Approved

By: _____
City of Prairie Village

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LIST OF FIGURES

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1.0 STUDY INTRODUCTION

This Post Mass Grading Stormwater Management Report serves as a follow-up to the pre-construction Stormwater Management Report for the Homestead Country Club and Homestead Estates project. The pre-construction report was last submitted to the City of Prairie Village on August 31, 2015. This report is written after the public improvements have been constructed, including plan changes to date, but prior to any new home construction. This study analyzes the effect of the developer's request to potentially increase the overall size of the planned homes as well as the size of the proposed driveways. This study will analyze the effects of this potential increase on stormwater runoff and the ability of the site features to contain this runoff within the standards set forth by the City of Prairie Village. This study focuses primarily on the areas of and site drainage features of Homestead Estates that would drain North, ultimately under Delmar, with some recommendations for areas that drain easterly. The analysis includes pipe capacity of the recently constructed pipe network serving the new development as well as a recently constructed berm along the north side of Lots 9, 10 and 11 designed to direct runoff into said pipe network.

The Homestead Country Club and Homestead Estates project is located at 6510 Mission Road, Prairie Village, Kansas. The 14.48-acre site is situated in Section 16, Township 12, Range 25 East within Johnson County. The project site is bound by residences to the north, west, and south. Mission Road lies adjacent to the east side of the project site and separates the site from the City of Mission Hills. The site lies entirely within the Brush Creek Watershed and the delineated 100-year floodplain boundary lies less than 300 feet from the eastern edge of the site.

2.0 EXISTING DRAINAGE STUDY

An analysis of the existing drainage study showed that all proposed homes were to have an impervious footprint of 2800 sq. ft. with 1476 sq. ft. driveways. The drainage basin of Homestead Estates project can be divided into 2 basins, see **Exhibit 1.** Basin A is situated to the West of the development and Basin B is situated on the East Side of Homestead Estates. Basin A flows into a stormwater collection system that is conveyed to the North between two residences located at 4101 & 4105 Delmar Drive. Basin B flows easterly to Mission Road.

In Basin A, the existing drainage study had the conveyance system between the previously mentioned homes sized to meet the demand of the 100-year event. That is the local rainfall event that would have a probability of exceedance, in any given year, of 1 percent. The design methodology for pipe sizing and determining the 100-year event was taken from the February 15, 2011 Kansas City Metropolitan Chapter American Public

Works Association (APWA) Standard Specifications & Design Criteria Section 5600. Peak flows at inlets were determined using the rational formula, Q=kCIA. Where "Q" is the peak runoff to the pipe system in cubic feet second (cfs). "C" is the runoff coefficient based on impervious cover, "I" is the intensity in inches per hour per section 5602-6 of the APWA reference. "k" is the antecedent precipitation coefficient based on storm frequency which can be found in Table 5602-1 of the APWA reference.

Results from the original drainage study showed that the pipe system in Basin A had adequate capacity to convey the 100-year storm to Delmar Drive based on the calculations and assumptions within the study. The pipe crossing Delmar was shown to purge stormwater from the inlet throats on both sides of Delmar in the same 100-year event but was shown to have 10-year return event capacity. It should be noted that 10-year capacity is considered adequate for residential collector streets per APWA standards.

The grading plan for Basin A has the undeveloped lots 9, 10 & 11 all planned to drain towards the newly constructed street with some small drainage swale on the back side of said lots draining towards the northwest. Lots 4 and 5 also were shown to drain towards the street.

3.0 AS CONSTRUCTED CONDITIONS

As the site was constructed, an additional double throated area inlet was added between structure 103 & 102, labeled 103A, see **Exhibit 2**. An earthen drainage berm was also added to the back side of Lots 9, 10 and 11, extending from the high point at the rear of the lots down past inlet 103A. The grading of lots 9, 10 & 11 was also revised during construction so that only the front side of the lots would drain to the street and the back side would drain towards said swale. The City of Prairie Village stipulated that the drainage from the roofs on lots 9, 10 & 11 would all be required to drain towards the street.

As of the date of this study, no homes have been constructed on the Homestead Estates property.

4.0 FUTURE CONSTRUCTION

4.1 DETENTION REQUIREMENTS

Due to market demands, the developer has expressed a desire to potentially increase the total impervious area of the homes and some driveways over the assumptions from the original study. Originally the study had assumed a building footprint square footage of 2800 sq. ft. and a driveway square footage of 1476 sq. ft. The revisions proposed are to have a maximum home size of 3800 sq. ft. and up to 2850 sq. ft. driveways. This would mean an increase in total impervious area from the original study therefore this study's purpose is to analyze this proposed change.

The original drainage study noted that the overall development had a reduction in impervious area from the original Homestead Country Club. This allowed the development to not require detention. In order to keep this assumption true, the amount of impervious area for Basin A and B cannot go over a certain threshold. The new homes constructed in Basin A (Lots 4,5,9,10 &11) cannot exceed a cumulative total (Home + Driveways + other impervious areas) of **27,350 sq. ft**. impervious area. Impervious areas being non-pervious concrete, impermeable roofing materials, asphalt or any other cover that prevents water absorption into the soil. Similarly the homes in Basin B (Lots 1,2,3,6,7 & 8) cannot exceed a cumulative total of **36,865 sq. ft.** of impervious area. The restrictions on these lots mean that not all lots can be constructed to the desired 3800 sq. ft. with 2890 sq. ft. driveways per lot. However the no detention assumption remains valid with any combination of impervious area as long as total impervious is less than the cumulated total impervious area reported previously.

4.2 PIPE ANALYSIS

A primary area of concern is Line 300 (referenced as **P301A** on **Exhibit 2**) which conveys stormwater between 2 existing homes. For the desired increase in impervious area from larger homes the capacity of the system had to be analyzed under the new assumptions with the increased impervious areas. Basin A was the only basin analyzed for this as it is the only basin that must flow between existing residential homes prior to reaching the public right-of-way. When recalculating the "C" values for the basins it was found that the original study used highly conservative numbers for "C" values. This does not present an issue for the original study, however for the purposes of this study "C" values were calculated based on APWA guidance. This means that when calculated for this study, even with the increased impervious areas from increased size homes and driveways, many of the "C" values were calculated to be lower than what was originally used in the previous drainage study. Notably the residential properties to the north of the development, south of Delmar, were assumed to be totally impervious, this assumption was recalculated to meet the APWA standard. It should also be noted that the various drainage areas were recalculated and some were found to be slightly larger than what was originally assumed. The changes in the grading plan that occurred during construction were also considered, see **Exhibit 2** for revised grading, inlet locations, basin recalculations and pipe system improvements. As of the date of this study it is understood that Lot 4 has been permitted with a 3800 sq. ft. home and a 2850 sq. ft. driveway, this lot was assumed to have these features for the purposes of this study. This will, however, take a large portion of the excess capacity and the remaining lots were assumed to not cross the 27,350 threshold previously given with the total remaining available impervious area divided equally among them. The pipe capacity for the 10 and 100-year events are shown respectively in **Table 1 and Table 2, in Appendix A.** Line 300, is shown to have adequate capacity to meet the 100-year requirement. Like the

original study, water purged from the inlets in the Delmar right-of-way, but to a lesser extent.

4.3 GRASS BERM / SWALE ANALYSIS

A grass-lined swale was constructed during the development of the Homestead Estates to divert stormwater runoff in Drainage Area 6 to the 6-foot by 4-foot double throated area inlet, structure 103A (referenced as Inlet 103 in **Tables 1 and 2**). This portion of the report analyzes the capacity of the grass swale in comparison to the stormwater runoff that would travel through the swale in a design storm.

AutoCAD Civil 3D was utilized in conjunction with field measurements to determine the minimum slope of the swale and cut a cross-section of the grass-lined swale to determine the dimensions of the swale which can be seen in **Exhibit 2**. The drainage area used to analyze the swale consisted of 1.45 acres, 0.67 of which were impervious. This impervious area includes areas of the homes even though the homes are required to drain to the street per the City of Prairie Village.

A series of storms were analyzed to determine the flows that can be reasonably assumed to occur on the site. The 10-minute, 500-year storm, the 30-minute, 500-year storm, and the 24 hour, 500-year storms were all analyzed. The cross-section and minimum slope were used to create a model of the swale in the Civil3D Express software and the PondPack V8i software was used to determine the peak flows with the appropriate Huff distribution with first quartile distributions for high intensity, short duration storms (less than 6 hours) and 3rd quartile for 24 hour storms. The modeling also utilized an SCS type 2, 24hour distribution which was found to generate the largest flow which was utilized for modeling of swale performance.

Analysis determined that the swale can sufficiently handle the 24-hour, 500-year design storm. This storm is beyond the city requirement but used as a reference to its overall capacity. Refer to **Exhibit 3** for the cross-section of the swale along with the capacity of the swale at different depths.

5.0 CONCLUSIONS

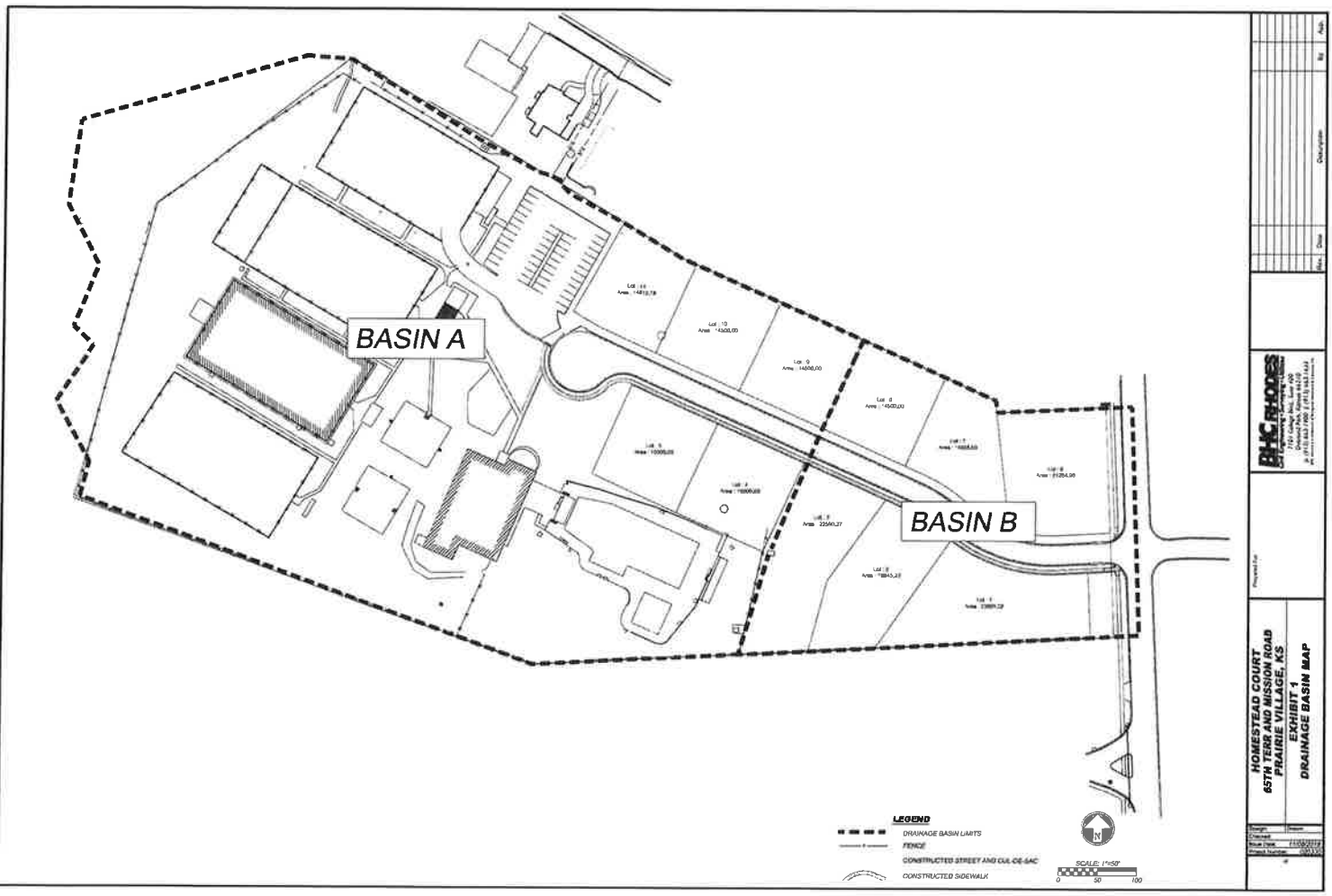
This Post Mass Grading Stormwater Management Report serves as a follow-up to the pre-construction Stormwater Management Report for the Homestead Country Club and Homestead Estates project. Post Mass Grading conditions were investigated to determine the state of the constructed stormwater management system.

The study found that the storm pipe system which conveys stormwater runoff from a large portion of the project site north under Delmar Street and eventually to Brush Creek is sufficient during the 10-year design storm. The 100-year design storm, however, shows

some purging of stormwater in the Delmar right-of-way. This overflow would not threaten any homes as it will drain to the north in the established swale.

The study also confirmed, with a Civil3D Express model, that the grass swale located along the north property boundary in Drainage Area 6 has the capacity to handle the 500-year storm over the 24-hour duration.

APPENDIX A – REFERENCE DOCUMENTS


BASIN A
BASIN B
LEGEND
DRAINAGE BASIN LIMITS
FENCE
CONSTRUCTED STREET AND CUL-DE-SAC
CONSTRUCTED SIDEWALK
SCALE: 1"=50'
0
50
100
HOMESTEAD COURT
65TH TERR AND MISSION ROAD
PRAIRIE VILLAGE, KS
EXHIBIT 1
DRAINAGE BASIN MAP

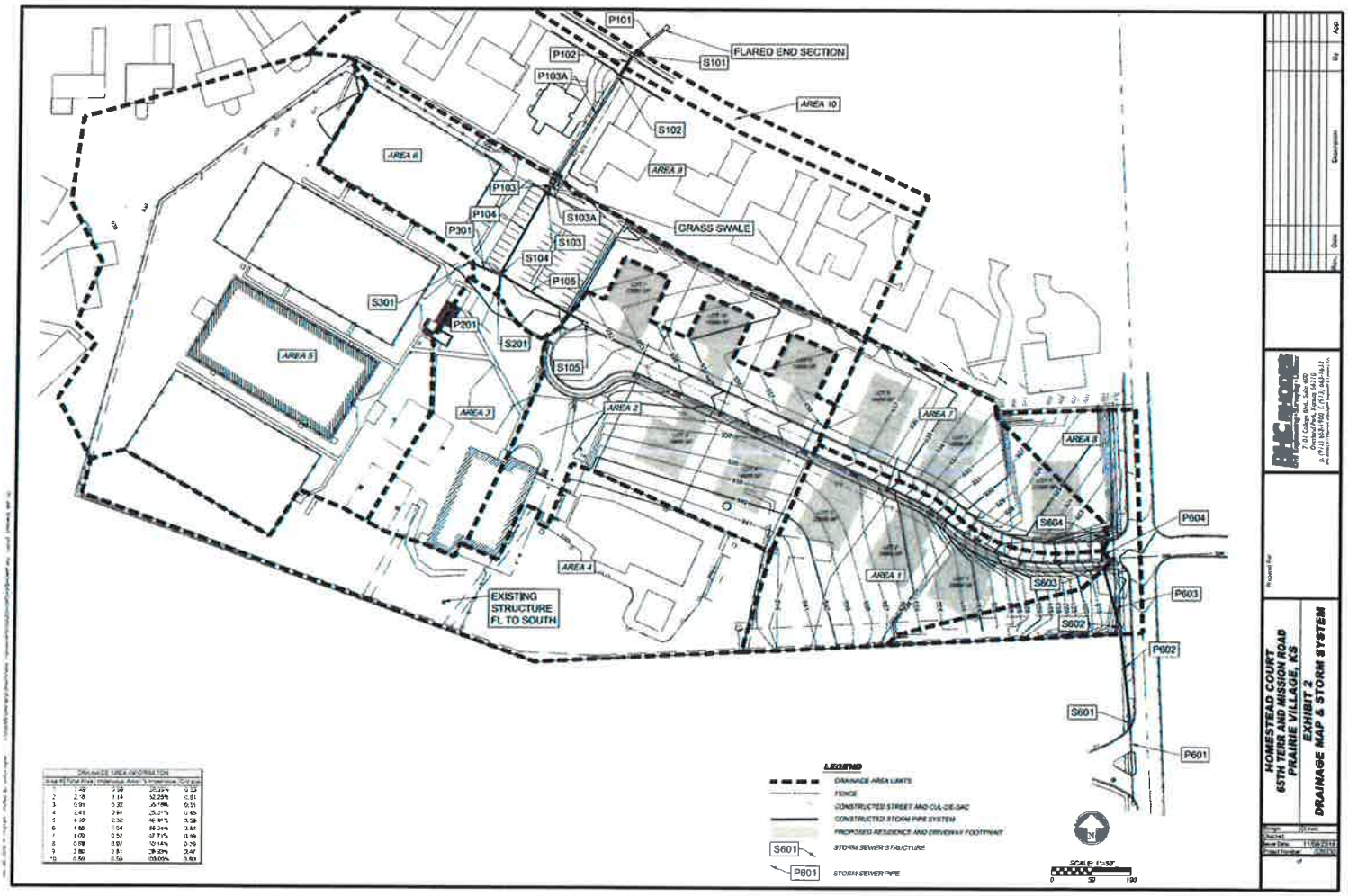
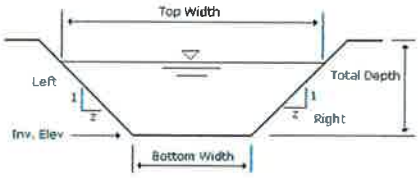
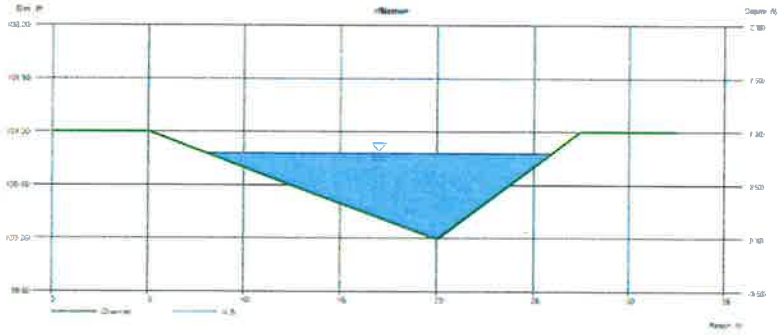

P101
P102
P103A
S101
FLARED END SECTION
AREA 10
S102
AREA 6
AREA 9
P103
P104
P301
S103A
S103
S104
P105
GRASS SWALE
S301
P201
S201
S105
AREA 5
AREA 3
AREA 2
AREA 7
AREA 8
S604
P604
AREA 4
AREA 1
S603
P603
S602
P602
EXISTING STRUCTURE FL TO SOUTH
S601
P601
LEGEND
DRAINAGE AREA LIMITS
FENCE
CONSTRUCTED STREET AND CUL-DE-SAC
CONSTRUCTED STORM PIPE SYSTEM
PROPOSED RESIDENCE AND DRIVEWAY FOOTPRINT
STORM SEWER STRUCTURE
STORM SEWER PIPE
SCALE: 1"=50'
0
50
100
HOMESTEAD COURT
65TH TERR AND MISSION ROAD
PRAIRIE VILLAGE, KS
EXHIBIT 2
DRAINAGE MAP & STORM SYSTEM

EXHIBIT 3: SWALE DIMENSIONS AND SWALE CAPACITY

Section	Item	Input
Channel	Section Type =	Trapezoidal
	[illegible]	[illegible]
	Side Slope z [illegible] =	[illegible]
	Tail Depth (ft) =	[illegible]
	[illegible]	[illegible]
	Slope (%) =	[illegible]
	[illegible]	[illegible]
Calcs	Compute by =	[illegible] vs Depth
	Increments =	[illegible]



Trapezoidal Section



Depth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NOAA Atlas 14, Volume 8, Version 2
Location name: Prairie Village, Kansas, USA*
Latitude: 39.0115°, Longitude: -94.6306°
Elevation: 920.98 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular | PF graphical | Maps & aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.402 (0.324-0.507)	0.472 (0.379-0.595)	0.589 (0.472-0.744)	0.689 (0.549-0.873)	0.832 (0.643-1.08)	0.946 (0.714-1.23)	1.06 (0.776-1.40)	1.18 (0.831-1.59)	1.35 (0.912-1.84)	1.48 (0.973-2.03)
10-min	0.589 (0.474-0.742)	0.691 (0.556-0.871)	0.863 (0.691-1.09)	1.01 (0.804-1.28)	1.22 (0.942-1.58)	1.39 (1.05-1.80)	1.56 (1.14-2.06)	1.73 (1.22-2.33)	1.98 (1.34-2.69)	2.17 (1.43-2.97)
15-min	0.718 (0.578-0.905)	0.843 (0.677-1.06)	1.05 (0.843-1.33)	1.23 (0.981-1.56)	1.49 (1.15-1.92)	1.69 (1.28-2.20)	1.90 (1.39-2.51)	2.11 (1.48-2.84)	2.41 (1.63-3.29)	2.64 (1.74-3.62)
30-min	1.01 (0.813-1.27)	1.19 (0.954-1.50)	1.49 (1.19-1.88)	1.74 (1.39-2.20)	2.11 (1.63-2.73)	2.40 (1.81-3.12)	2.70 (1.97-3.56)	3.01 (2.11-4.04)	3.43 (2.32-4.68)	3.77 (2.48-5.17)
60-min	1.33 (1.07-1.67)	1.56 (1.26-1.97)	1.97 (1.58-2.48)	2.32 (1.85-2.93)	2.82 (2.18-3.66)	3.23 (2.44-4.21)	3.65 (2.67-4.83)	4.10 (2.88-5.50)	4.71 (3.18-6.43)	5.19 (3.42-7.13)
2-hr	1.64 (1.33-2.06)	1.94 (1.57-2.43)	2.45 (1.97-3.07)	2.89 (2.32-3.63)	3.54 (2.76-4.56)	4.06 (3.09-5.27)	4.61 (3.39-6.06)	5.19 (3.67-6.92)	5.99 (4.08-8.12)	6.62 (4.39-9.02)
3-hr	1.85 (1.51-2.31)	2.19 (1.78-2.73)	2.78 (2.25-3.47)	3.30 (2.65-4.13)	4.05 (3.17-5.21)	4.67 (3.57-6.04)	5.32 (3.93-6.97)	6.00 (4.26-7.99)	6.96 (4.76-9.41)	7.72 (5.13-10.5)
6-hr	2.23 (1.82-2.76)	2.66 (2.17-3.29)	3.39 (2.76-4.20)	4.04 (3.27-5.02)	4.99 (3.93-6.38)	5.76 (4.43-7.41)	6.58 (4.90-8.57)	7.45 (5.33-9.85)	8.66 (5.96-11.6)	9.62 (6.44-13.0)
12-hr	2.63 (2.16-3.23)	3.15 (2.58-3.87)	4.04 (3.30-4.97)	4.81 (3.91-5.94)	5.95 (4.71-7.54)	6.87 (5.31-8.75)	7.83 (5.86-10.1)	8.85 (6.37-11.6)	10.3 (7.12-13.7)	11.4 (7.68-15.2)
24-hr	3.09 (2.55-3.76)	3.66 (3.02-4.46)	4.65 (3.83-5.68)	5.52 (4.51-6.76)	6.78 (5.40-8.53)	7.81 (6.07-9.87)	8.88 (6.69-11.4)	10.0 (7.25-13.0)	11.6 (8.08-15.3)	12.8 (8.72-17.0)
2-day	3.62 (3.00-4.37)	4.20 (3.48-5.08)	5.21 (4.31-6.31)	6.10 (5.02-7.41)	7.41 (5.94-9.26)	8.48 (6.64-10.7)	9.61 (7.29-12.2)	10.8 (7.89-14.0)	12.5 (8.78-16.4)	13.8 (9.45-18.2)
3-day	3.97 (3.31-4.79)	4.56 (3.79-5.49)	5.56 (4.62-6.71)	6.46 (5.33-7.81)	7.77 (6.26-9.66)	8.85 (6.96-11.1)	9.99 (7.61-12.7)	11.2 (8.21-14.4)	12.9 (9.11-16.9)	14.3 (9.80-18.7)
4-day	4.27 (3.57-5.13)	4.86 (4.05-5.83)	5.87 (4.88-7.06)	6.77 (5.60-8.16)	8.08 (6.52-10.0)	9.16 (7.22-11.4)	10.3 (7.86-13.0)	11.5 (8.45-14.8)	13.2 (9.34-17.2)	14.5 (10.0-19.0)
7-day	5.03 (4.22-6.00)	5.66 (4.74-6.75)	6.72 (5.62-8.03)	7.65 (6.36-9.16)	8.98 (7.27-11.0)	10.0 (7.95-12.4)	11.2 (8.56-14.0)	12.3 (9.10-15.7)	13.9 (9.93-18.0)	15.2 (10.6-19.8)
10-day	5.70 (4.80-6.77)	6.40 (5.38-7.60)	7.56 (6.34-9.00)	8.55 (7.13-10.2)	9.95 (8.06-12.1)	11.1 (8.77-13.6)	12.2 (9.37-15.2)	13.4 (9.89-16.9)	15.0 (10.7-19.3)	16.2 (11.3-21.0)
20-day	7.61 (6.44-8.97)	8.56 (7.24-10.1)	10.1 (8.53-12.0)	11.4 (9.56-13.5)	13.1 (10.7-15.8)	14.5 (11.5-17.6)	15.8 (12.2-19.5)	17.1 (12.7-21.4)	18.9 (13.5-24.0)	20.2 (14.1-26.0)
30-day	9.21 (7.83-10.8)	10.4 (8.81-12.2)	12.2 (10.4-14.4)	13.7 (11.6-16.2)	15.8 (12.8-18.8)	17.3 (13.8-20.8)	18.7 (14.5-22.9)	20.2 (15.0-25.1)	22.0 (15.9-27.9)	23.4 (16.5-30.0)
45-day	11.3 (9.61-13.2)	12.7 (10.8-14.8)	14.9 (12.6-17.4)	16.6 (14.0-19.5)	18.9 (15.4-22.4)	20.6 (16.5-24.6)	22.1 (17.2-26.9)	23.7 (17.7-29.3)	25.6 (18.5-32.2)	26.9 (19.0-34.4)
60-day	13.0 (11.2-15.2)	14.6 (12.5-17.0)	17.0 (14.5-19.9)	18.9 (16.0-22.2)	21.4 (17.5-25.3)	23.1 (18.6-27.6)	24.8 (19.3-30.0)	26.3 (19.7-32.4)	28.2 (20.4-35.3)	29.5 (20.9-37.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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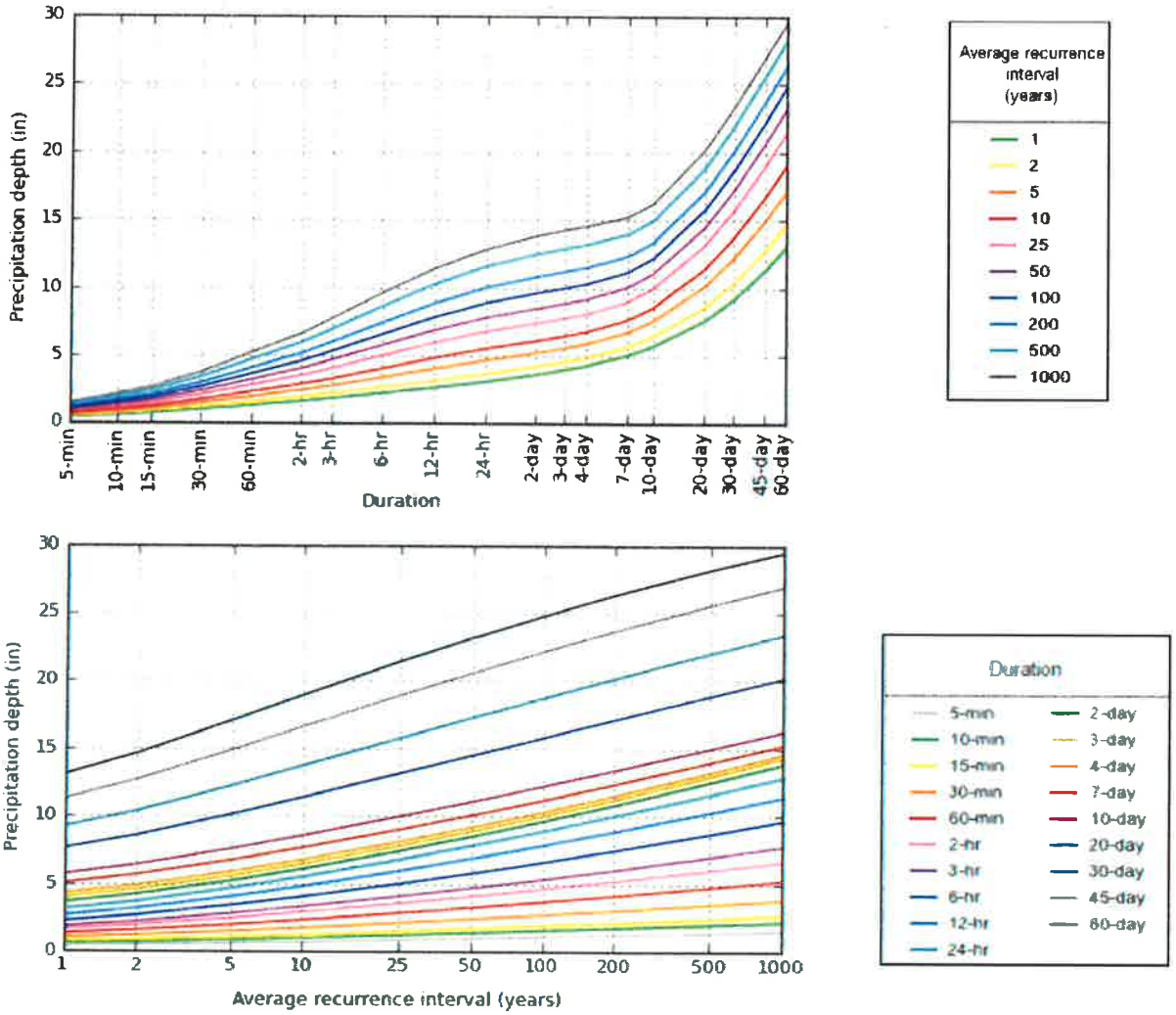
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.0115°, Longitude: -94.6306°



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Wed Nov 2 16:47:42 2016

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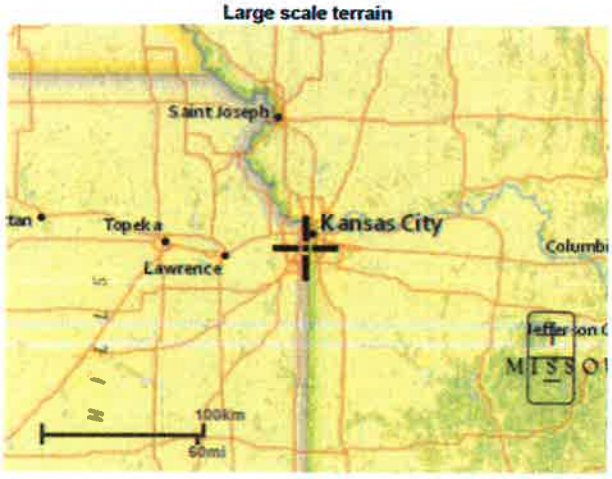
Maps & aerials

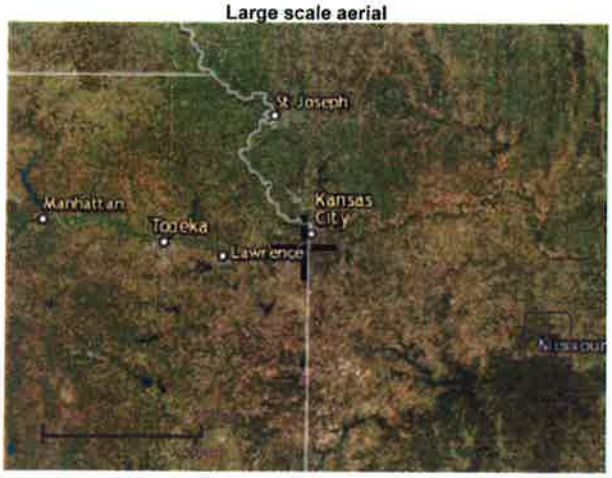
Small scale terrain

Large scale terrain



Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions? HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B – SUPPORT CALCULATIONS

As-Built Stormwater Management Study
Homestead Country Club
Prairie Village, KS

TABLE 1: STORM PIPE CALCULATIONS – 10 YEAR DESIGN STORM

Design Storm:	10
"K" Value:	1.00
"F" Factor:	1.00

Runoff Calculations														Pipe Properties											
Inlet #	Area (acres)	"C" Value	Cumul. Area (acres)	Cumul. CxA	Tc	Intensity	Runoff To Inlet	Cumul. Runoff	Pipe Cap.	Pipe Vel.	Up Piped Inlets	Up Area (acres)	Up CxA	Up Inlet	Down Inlet	Pipe Type	"n" Value	Pipe Size	Length	Slope %	Drop in Inlet	FL Up	FL Down	Inlet Top	HGL Elev.
LINE 100																								DS TAILWATER @ STR #	FREE
101	0.50	0.90	13.23	7.40	5.0	7.35	3.31	54.39	94.33	13.34		0.00	0.00	101		RCP	0.013	36	50.00	2.00	0.16	913.55	912.55	919.15	916.57
102	2.80	0.47	12.73	6.95	8.1	6.50	8.55	45.15	88.23	12.48		0.00	0.00	102	101	RCP	0.013	36	32.00	1.75	0.16	914.27	913.71	919.25	916.98
103	1.85	0.51	9.93	5.63	6.9	6.82	6.44	38.42	144.51	20.44		0.00	0.00	103	102	PEP	0.012	36	173.50	4.00	0.50	921.37	914.43	928.00	923.84
104	4.99	0.58	8.08	4.69	10.1	6.05	17.51	28.37	75.46	10.68	201	0.91	0.46	104	103	PEP	0.012	36	122.85	1.09	1.00	923.21	921.87	929.12	925.29
105	2.18	0.61	2.18	1.33	6.8	6.83	9.08	9.08	33.78	10.75		0.00	0.00	105	104	PEP	0.012	24	125.67	1.90	N/A	926.60	924.21	931.00	927.89
																				Drop in Inlet 104	1.72				
LINE 200																									
201	0.91	0.51	0.91	0.46	6.8	6.35	2.95	2.95	8.71	7.10		0.00	0.00	201	104	PEP	0.012	15	30.37	1.55	N/A	925.40	924.93	929.75	926.23

TABLE 2: STORM PIPE CALCULATIONS – 100 YEAR DESIGN STORM

Design Storm:	100
"K" Value:	1.25
"F" Factor:	1.00

Runoff Calculations														Pipe Properties											
Inlet #	Area (acres)	"C" Value	Cumul. Area (acres)	Cumul. CxA	Tc	Intensity	Runoff To Inlet	Cumul. Runoff	Pipe Cap.	Pipe Vel.	Up Piped Inlets	Up Area (acres)	Up CxA	Up Inlet	Down Inlet	Pipe Type	"n" Value	Pipe Size	Length	Slope %	Drop in Inlet	FL Up	FL Down	Inlet Top	HGL Elev.
LINE 100																								DS TAILWATER @ STR #	FREE
101	0.50	0.90	13.23	7.40	5.0	10.32	5.81	95.45	94.33	13.34		0.00	0.00	101		RCP	0.013	36	50.00	2.00	0.16	913.55	912.55	919.15	917.88
102	2.80	0.47	12.73	6.95	8.1	9.17	15.08	79.60	88.23	12.48		0.00	0.00	102	101	RCP	0.013	36	32.00	1.75	0.16	914.27	913.71	919.25	919.33
103	1.85	0.51	9.93	5.63	6.9	9.61	11.33	67.62	144.51	20.44		0.00	0.00	103	102	PEP	0.012	36	173.50	4.00	0.50	921.37	914.43	928.00	924.82
104	4.99	0.58	8.08	4.69	10.1	8.56	30.95	50.14	75.46	10.68	201	0.91	0.46	104	103	PEP	0.012	36	122.85	1.09	1.00	923.21	921.87	929.12	926.09
105	2.18	0.61	2.18	1.33	6.8	9.62	15.99	15.99	33.78	10.75		0.00	0.00	105	104	PEP	0.012	24	125.67	1.90	N/A	926.60	924.21	931.00	928.38
																				Drop in Inlet 104	1.72				
LINE 200																									
201	0.91	0.51	0.91	0.46	6.8	8.96	5.20	5.20	8.71	7.10		0.00	0.00	201	104	PEP	0.012	15	30.37	1.55	N/A	925.40	924.93	929.75	926.55

TABLE 3: TIME OF CONCENTRATION CALCULATIONS

TIME OF CONCENTRATION						
Area #	S (%)	D (ft)	T_i (min)	L (ft)	T_t (min)	T_c (min)
1						
2	2.68	100	6.30	310	0.52	6.82
3	2.05	100	8.35	246	0.41	8.76
4						
5	1.32	100	8.56	655	1.56	10.12
6	2.42	100	6.19	395	0.66	6.85
7						
8						
9	3.39	100.00	7.51	372	0.62	8.13
10						5.00