



# CORE ENGINEERING GROUP

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Date: April 5, 2018 (REV 6/23/2018)

Project Number: 100.043

## MEMORANDUM

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**To:** El Paso County DSD **From:** Richard Schindler

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**Re:** Drainage Memo for Lorson Boulevard Construction from JCC to Stingray Ln (CDR 18-006)

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The following drainage memorandum is to provide drainage calculations for storm sewer design on Lorson Boulevard construction between Jimmy Camp Creek and Stingray Lane. Lorson Boulevard is a non-residential collector street and the proposed construction is approximately 2,400 feet and is built to a 40' wide asphalt street with curb & gutter on both sides. The proposed ROW width is an 80' minimum width with a utility/landscape tract on the north side. The south side is currently unplatted and does not contain any 100-year floodplain.

### Existing Conditions:

The adjacent areas north of the proposed Lorson Boulevard have been developed and consist of The Meadows at Lorson Ranch Filing No. 4, Allegiant at Lorson Ranch, and The Meadows at Lorson Ranch Filing No. 3. The adjacent area west of JCC has been developed as Carriage Meadows South at Lorson Ranch and the area to the east of Stingray Lane is currently being developed at Lorson Ranch East Filing No. 1. The adjacent area south of Lorson Boulevard is unplatted at this time. There is one existing Detention/WQ Pond within the project area called Pond C1. Pond C1 has been sized to accept runoff from Lorson Boulevard per the approved MDDP1 for Lorson Ranch and the final drainage report for Allegiant at Lorson Ranch. Pond C1 is a combined detention/WQ pond on the south side of Lorson Boulevard with a dual stage outlet that drains south to the East Tributary of JCC. There are no anticipated modifications to be made to Pond C1 for this construction.

### Proposed Conditions:

Basin 3.1 – Basin 3.1 was taken from the final drainage report for The Meadows at Lorson Ranch Filing No. 4. This 2.05 acre basin drains the north side of Lorson Boulevard from a high point at Jimmy Camp Creek and flows east in the proposed curb/gutter to an existing 24' wide CDOT Type R inlet located in the NW corner of Kearsarge Drive and Lorson Boulevard. The existing inlet was sized for the runoff from this basin and the storm sewer drains southeast to Pond C1.

Basin D1 – Basin D1 is a 1.91 acre drainage basin taken from the Allegiant at Lorson Ranch final drainage report. This 1.91 acre basin drains the north side of Lorson Boulevard from a high point at Stingray Lane and flows west in the proposed curb/gutter to an existing 25' wide CDPT Type R inlet located in the NE corner of Old Glory Drive and Lorson Boulevard. The existing inlet was sized for the runoff from this basin and the storm sewer drains southwest to Pond C1.

Basin A – Basin A is a 5.0 acre drainage basin that drains the south side of Lorson Boulevard and future residential areas. The basin is bounded on the east side by a high point in Stingray Lane and the west side by a high point at the Jimmy Camp Creek Bridge. All flow on the south side of Lorson Boulevard flows to a low point just north of Pond C1 at proposed Inlet DP-2. The flow from this basin is estimated to be 11.4cfs and 20.2cfs in the 5/100-year storm events.

Basin B – Basin B is a 3.7 acre drainage basin that drains the north side of Lorson Boulevard and adjacent residential areas. The basin is bounded on the east side by a high point in Stingray Lane and the west side at Kearsarge Drive. The runoff flows to a low point in Lorson Boulevard just north of Pond C1 at proposed Inlet DP-1. The flow from this basin is estimated to be 11.3cfs and 23.1cfs in the 5/100-year storm events.

Inlet DP1 – Inlet DP1 is located at a low point in Lorson Boulevard on the north side and accepts runoff from Basin B. This inlet is sized per Urban Drainage Excel Spreadsheets in a sump condition. The proposed inlet is a 15' wide CDOT Type R inlet. The inlet collects 11.3cfs in the 5-year storm event and 20.3cfs in the 100-year storm event. Approximately 2.8cfs of runoff in the 100-year storm event that overtops the crown and is collected by Inlet DP2. Inlet DP1 flows south to Inlet DP2 in a proposed 18" storm sewer at a 1% slope. The street slope is 0.6% and the street capacity is 10.6cfs/32.1cfs for half the street in the 5/100-year storm events. Since half the drainage basin flows to one side of the inlet the street capacities are not exceeded.

Inlet DP2 – Inlet DP2 is located at a low point in Lorson Boulevard on the south side and accepts runoff from Basin A. This inlet is sized per Urban Drainage Excel Spreadsheets in a sump condition. The proposed inlet is a 20' wide CDOT Type R inlet. The inlet collects 11.4cfs in the 5-year storm event and 23.0cfs (20.2+2.8) in the 100-year storm event. Inlet DP2 flows south to Pond C1 in a proposed 24" storm sewer at a 3.4% slope. A sedimentation forebay is proposed for the 24" storm sewer as it enters Pond C1. The street slope is 0.6% and the street capacity is 10.6cfs/32.1cfs for half the street in the 5/100-year storm events. Since half the drainage basin flows to one side of the inlet the street capacities are not exceeded.

Pond C1 – Pond C1 was built in 2008 as part of the Allegiant at Lorson Ranch subdivision in accordance with the MDDP1 for Lorson Ranch. It detains and treats runoff from several subdivisions north of Lorson Boulevard and it is designed to accept runoff from Lorson Boulevard as well. Pond C1 does not require any modifications other than the sedimentation forebay required at the new 24" storm sewer outfall entering the pond.

Cc: Maps, drainage calcs.

From: Richard L. Schindler, P.E.

**Standard Form SF-1. Time of Concentration-Proposed**

Calculated By: Richard Schindler

Job No: 100.043

Date: April 5, 2018

Project: Lorson Boulevard FDR

Checked By: Richard Schindler

Sub-Basin Data				Initial Overland Time (ti)				Travel Time (tt)					tc Check (urbanized Basins)		Final tc
BASIN or DESIGN	C <sub>s</sub>	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	ti minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	tt minutes	Computed tc Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
A	0.90	5.00	15.0	30.00	2.00%	0.32	1.57	2080.0	0.70%	1.25	27.62	29.20	2110.00	21.72	29.20
B	0.70	3.70	15.0	50.00	4.00%	0.26	3.23	400.0	0.70%	1.25	5.31	8.54	450.00	12.50	8.54

**Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)**

Calculated By: Leonard Beasley  
Date: April 5, 2018  
Checked By: Richard Schindler

Job No: 100.043  
Project: Lorson Boulevard  
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff			Street		Pipe			Travel Time			Remarks		
		Area Design	Area (A)	Runoff Coeff. (C)	t <sub>c</sub>	CA	i	Q	t <sub>c</sub>	∑ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity		t <sub>t</sub>	
			ac.			min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft		ft/sec	min
A			5.00	0.90	29.00	4.50	2.53	11.4														
B			3.70	0.70	8.50	2.59	4.37	11.3														



**Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)**

Calculated By: Leonard Beasley

Date: APRIL 5, 2018

Checked By: rls

Job No: 100.043

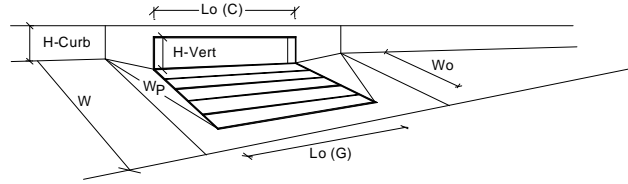
Project: Lorson Blvd

Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff			Street		Pipe			Travel Time		Remarks		
		Area Design	Area (A)	Runoff Coeff. (C)	$t_c$	CA	i	Q	$t_c$	$\Sigma(CA)$	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length		Velocity	t
			ac.	min.		in/hr	cfs	min	in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min			
A			5.00	0.95	29.00	4.75	4.25	20.2													
B			3.70	0.85	8.50	3.15	7.34	23.1													

## INLET IN A SUMP OR SAG LOCATION

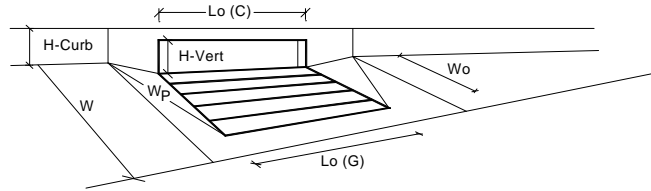
Project = Lorson Blvd FDR #100.043  
 Inlet ID = Inlet DP-1



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> = 3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No = 1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth = 6.5	8.0	inches <input checked="" type="checkbox"/> Override Depths
<b>Grate Information</b>	MINOR	MAJOR	
Length of a Unit Grate	L <sub>o</sub> (G) = N/A	N/A	feet
Width of a Unit Grate	W <sub>g</sub> = N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> = N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>r</sub> (G) = N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) = N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) = N/A	N/A	
<b>Curb Opening Information</b>	MINOR	MAJOR	
Length of a Unit Curb Opening	L <sub>o</sub> (C) = 15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> = 6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> = 6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta = 63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> = 2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>r</sub> (C) = 0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) = 3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) = 0.67	0.67	
<b>Grate Flow Analysis (Calculated)</b>	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef = N/A	N/A	
Clogging Factor for Multiple Units	Clog = N/A	N/A	
<b>Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>wi</sub> = N/A	N/A	cfs
Interception with Clogging	Q <sub>wc</sub> = N/A	N/A	cfs
<b>Grate Capacity as an Orifice (based on UDFCD - CSU 2010 Study)</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> = N/A	N/A	cfs
Interception with Clogging	Q <sub>oc</sub> = N/A	N/A	cfs
<b>Grate Capacity as Mixed Flow</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> = N/A	N/A	cfs
Interception with Clogging	Q <sub>mc</sub> = N/A	N/A	cfs
<b>Resulting Grate Capacity (assumes clogged condition)</b>	Q <sub>Grate</sub> = N/A	N/A	cfs
<b>Curb Opening Flow Analysis (Calculated)</b>	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef = 1.31	1.31	
Clogging Factor for Multiple Units	Clog = 0.04	0.04	
<b>Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>wi</sub> = 12.45	21.18	cfs
Interception with Clogging	Q <sub>wc</sub> = 11.90	20.25	cfs
<b>Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> = 30.33	33.57	cfs
Interception with Clogging	Q <sub>oc</sub> = 29.00	32.11	cfs
<b>Curb Opening Capacity as Mixed Flow</b>	MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> = 18.07	24.80	cfs
Interception with Clogging	Q <sub>mc</sub> = 17.28	23.72	cfs
<b>Resulting Curb Opening Capacity (assumes clogged condition)</b>	Q <sub>Curb</sub> = 11.90	20.25	cfs
<b>Resultant Street Conditions</b>	MINOR	MAJOR	
Total Inlet Length	L = 15.00	15.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	T = 39.3	52.1	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> = 2.7	4.2	inches
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>	Q <sub>a</sub> = 11.9	20.3	cfs
<b>WARNING: Inlet Capacity less than Q Peak for MAJOR Storm</b>	Q <sub>PEAK REQUIRED</sub> = 11.3	23.1	cfs

## INLET IN A SUMP OR SAG LOCATION

Project = Lorson Boulevard #100.043  
 Inlet ID = Inlet DP-2



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.5	8.0	inches
	<input checked="" type="checkbox"/> Override Depths		
Grate Information	MINOR	MAJOR	
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
	N/A	N/A	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	20.00	20.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Grate Flow Analysis (Calculated)	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	N/A	N/A	
Clogging Factor for Multiple Units	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)	MINOR	MAJOR	
Interception without Clogging	N/A	N/A	cfs
Interception with Clogging	N/A	N/A	cfs
Grate Capacity as an Orifice (based on UDFCD - CSU 2010 Study)	MINOR	MAJOR	
Interception without Clogging	N/A	N/A	cfs
Interception with Clogging	N/A	N/A	cfs
Grate Capacity as Mixed Flow	MINOR	MAJOR	
Interception without Clogging	N/A	N/A	cfs
Interception with Clogging	N/A	N/A	cfs
<b>Resulting Grate Capacity (assumes clogged condition)</b>	<b>N/A</b>	<b>N/A</b>	<b>cfs</b>
Curb Opening Flow Analysis (Calculated)	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	1.33	1.33	
Clogging Factor for Multiple Units	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)	MINOR	MAJOR	
Interception without Clogging	15.79	26.87	cfs
Interception with Clogging	15.27	25.98	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	MINOR	MAJOR	
Interception without Clogging	40.44	44.76	cfs
Interception with Clogging	39.09	43.28	cfs
Curb Opening Capacity as Mixed Flow	MINOR	MAJOR	
Interception without Clogging	23.50	32.26	cfs
Interception with Clogging	22.72	31.18	cfs
<b>Resulting Curb Opening Capacity (assumes clogged condition)</b>	<b>15.27</b>	<b>25.98</b>	<b>cfs</b>
Resultant Street Conditions	MINOR	MAJOR	
Total Inlet Length	20.00	20.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	39.3	52.1	ft.>T-Crown
Resultant Flow Depth at Street Crown	2.7	4.2	inches
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
<b>Q<sub>a</sub></b>	<b>15.3</b>	<b>26.0</b>	<b>cfs</b>
<b>Q<sub>PEAK REQUIRED</sub></b>	<b>11.4</b>	<b>23.0</b>	<b>cfs</b>

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

# Hydraflow Plan View





# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		22.70	24 c	63.0	5686.50	5689.02	4.000	5688.19	5690.71	0.30	5690.71	End
2		11.30	18 c	22.7	5690.87	5691.10	1.013	5692.23	5692.46	0.21	5692.67	1

Project File: 100.043-5YR.stm	Number of lines: 2	Run Date: 03-19-2018
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NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs.






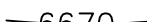




# Storm Sewer Summary Report

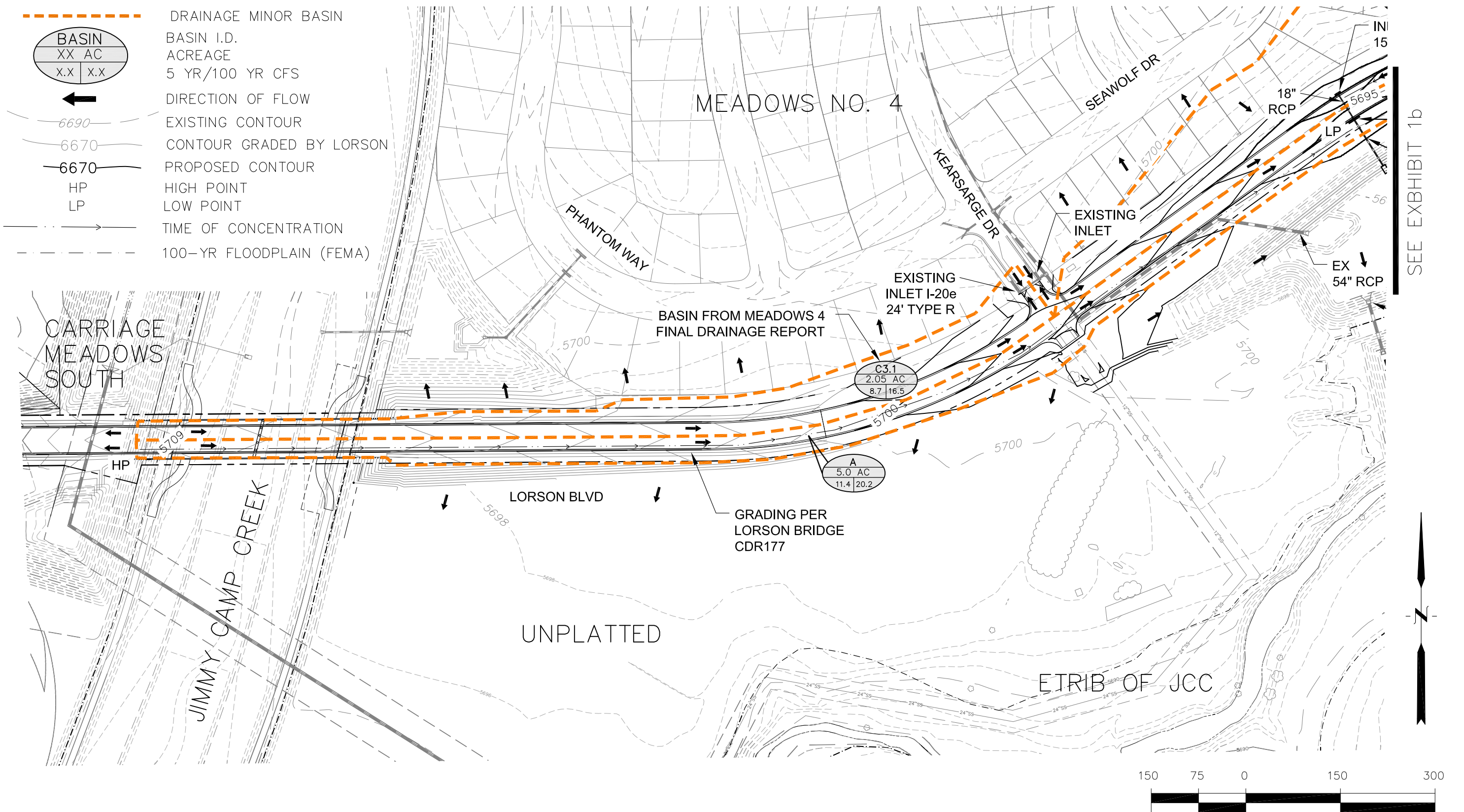
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		43.30	24 c	63.0	5686.50	5689.02	4.000	5688.47	5690.99	n/a	5690.99	End
2		20.30	18 c	22.7	5690.87	5691.10	1.013	5692.37*	5693.22*	0.62	5693.84	1

Project File: 100.043-100YR.stm	Number of lines: 2	Run Date: 03-19-2018
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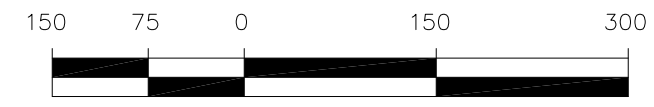
NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown).

# LEGEND

-  DRAINAGE MINOR BASIN
-  BASIN I.D.  
ACREAGE  
5 YR/100 YR CFS
-  DIRECTION OF FLOW
-  6690 EXISTING CONTOUR
-  6670 CONTOUR GRADED BY LORSON
-  6670 PROPOSED CONTOUR
-  HP HIGH POINT
-  LP LOW POINT
-  TIME OF CONCENTRATION
-  100-YR FLOODPLAIN (FEMA)



SEE EXHIBIT 1b



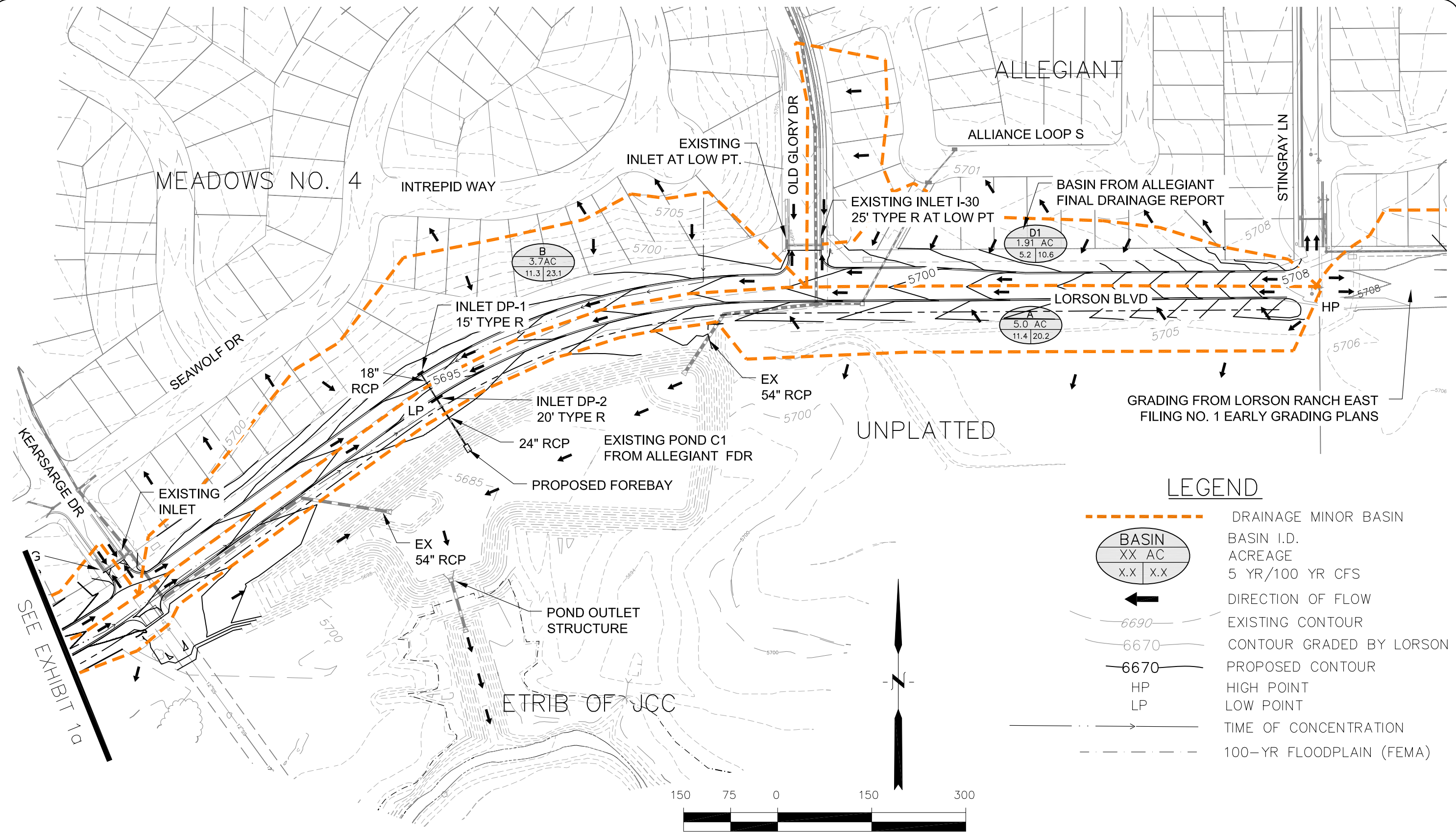
SCALE: 1"=150'



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## LORSON BOULEVARD DEVELOPED CONDITIONS

DATE: JUNE 23, 2018	JOB NO: 100.043
SCALE: AS SHOWN AS SHOWN	FIGURE NO: 1a



**LEGEND**

- DRAINAGE MINOR BASIN
- | BASIN |     |
|-------|-----|
| XX    | AC  |
| x.x   | x.x |

 BASIN I.D.  
ACREAGE  
5 YR/100 YR CFS
- DIRECTION OF FLOW
- EXISTING CONTOUR
- CONTOUR GRADED BY LORSON
- PROPOSED CONTOUR
- HP HIGH POINT
- LP LOW POINT
- TIME OF CONCENTRATION
- 100-YR FLOODPLAIN (FEMA)



SCALE: 1"=150'

**CORE**  
ENGINEERING GROUP

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**LORSON BOULEVARD  
DEVELOPED CONDITIONS**

DATE: JUNE 23, 2018	JOB NO: 100.043
SCALE: AS SHOWN AS SHOWN	FIGURE NO: 1b