

# **FINAL DRAINAGE REPORT I-70/I-71 INTERCHANGE (PROJECT 4R)**

**FRA-70/71-12.68/14.86**

**PID # 105523**

**Prepared By:  
GPD Group  
1801 Watermark Drive  
Columbus, Ohio 43215**

January 31, 2019

## Table of Contents

1. Introduction and Overview	1
2. Floodplain	1
3. Methodology	1
4. Ditch Analysis	2
5. Inlet Spacing Design	2
6. Proposed Drainage Systems	2
7. Post Construction Storm Water Management	3

## Appendices

APPENDIX A – DRAINAGE CRITERIA (LD-35)
APPENDIX B – FEMA FLOODPLAIN MAPPING
APPENDIX C – PROPOSED DRAINAGE AREAS
APPENDIX D – DITCH ANALYSIS
APPENDIX E – INLET SPACING DESIGN
APPENDIX F – STORM SEWER SYSTEM
APPENDIX G – MOT DRAINAGE CALCULATIONS
APPENDIX H – 50 YEAR SAG CHECK
APPENDIX I – GRATE CAPACITY CHECK
APPENDIX J – ROCK CHANNEL PROTECTION

---

## 1. Introduction and Overview

---

The FRA-70/71-12.68/14.86 project is located within the Scioto River Watershed. Storm runoff is conveyed to the river by storm sewer, open channel or overland flow. Runoff can be broken into three separate general areas based on the eventual outlet from the site. These drainage areas are further broken down for specific storm sewers and outlets.

The first existing major drainage area includes the storm sewer systems and ditches on I-70 west of I-71/SR-315. The existing storm sewers and ditches in the vicinity west of the Souder Street Bridge drain to the 48” storm sewer trunk along West Mound Street. The Ramp C5/Ramp C3 infield ditch drains to the catch basin on the west of SB-315 then to the pump station located in the infield of proposed Ramp C5 and NB-71.

The second existing major drainage area is near NB-71 and the EB-70 to NB-315 loop ramp (Ramp BC) just west of the Scioto River. The NB-71 inlets drain east into the river via sets of separate short storm sewer runs. The Ramp BC infield ditches and inlets drain to storm sewer systems that contain gatewells located prior to the outlets. These gatewells help prevent river floodwaters from entering the storm sewers.

The last existing major drainage area is located on I-70/I-71 corridor east of the Scioto River. This area consists of barrier and curb inlets that drain to the Olentangy-Scioto Interceptor System (OSIS) or 24” storm sewer on Short Street, or the 96” storm sewer that skews under I-70/I-71 near High and Short Streets.

The FRA-70/71-12.68/14.86 (PID 105523) project will replace most of the existing storm sewers within the project limits and re-use others where possible. Please note that proposed drainage network has been designed to remove the connection of freeway drainage to the OSIS. All freeway drainage east of the Scioto River drains to the river itself, to the 96” storm sewer, or to the manufactured storm system built in Project 2B. In addition, some existing drainage structures will be either abandoned or removed due to roadway realignments or widening.

---

## 2. Floodplain

---

This project lies near the FEMA designated floodplain, Map Number 39049C0309K. Please refer to [Appendix B](#) for the FEMA FIRM floodplain mapping. The gatewells in the vicinity of I-71 northbound ramp prevent floodwaters from entering the project storm sewers.

---

## 3. Methodology

---

The Ohio Department of Transportation Location and Design Manual Volume 2, Drainage Design (ODOT L&D Vol. 2) regulations were adhered to for the hydraulic design of the FRA-70/71-12.68/14.86 (PID 105523) project.

The contributing drainage areas have been delineated and can be found in [Appendix C](#). Existing topographic mapping was obtained from project specific aerial mapping supplemented with field

survey for contributing areas within the project limits. Offsite contributing areas were delineated using Lidar mapping. The proposed plan, profiles and cross sections of the roadway plans were also considered when determining the drainage areas. These drainage areas and their corresponding runoff coefficients were carried to the respective ditch or spread calculations and ultimately the storm sewer calculations.

---

## 4. Ditch Analysis

---

Ditch analysis calculations have been completed and provided in Appendix D for all locations where the proposed realignments/improvements will require re-grading of the existing ditches. A map of the drainage areas is included in Appendix C.

---

## 5. Inlet Spacing Design

---

Barrier and curb inlets are provided throughout the project. Inlet spacing calculations are provided in Appendix E. On highways, spreads were limited to be contained within the proposed shoulders and not to extend onto the traveled lanes. Many curb heights are proposed to be four inches, thus maximum depths of flow were limited to three inches. Inlets were also provided upstream of bridges and immediately after bridges to prevent concentrated flow onto embankments.

---

## 6. Proposed Drainage Systems

---

The proposed drainage systems will be similar to the existing drainage systems and consist of ditch catch basins and curb and barrier inlets. Proposed drainage areas will outlet at the same locations as their corresponding existing drainage areas in order to prevent surging of existing storm sewers. These outlets include:

1. The existing 48" storm sewer southwest of the EB-70 bridge over Souder Street
2. The existing 15" storm sewer crossing WB-70 just east of the WB-70 bridge over Souder Street
3. The ditch off the west side of Ramp C3 and east side of Harmon Avenue near the Buchanan Drive intersection
4. The ditch catch basin west of SB-315 just south of the Ramp C5 bridge over SR-315. This basin drains to a storm sewer that enters the pump station in the infield of Ramp C5 and NB-71.
5. Gatewell 6 near Ramp A5 Station 5004+55 RT
6. Gatewell 5 near Ramp A5 Station 5009+96 LT
7. Existing headwall near Ramp A5 Station 5017+79 LT, under bridge over the Scioto River
8. Existing manhole near SR-315 NB Station 724+65 RT that drains to a storm sewer that enters the pump station in the infield of Ramp C5 and NB-71.

9. Proposed headwall near I-70 EB Station 155+71 RT, just west of the Lower Scioto Greenway
10. Proposed manhole near Ramp C5 Station 5084+31 RT, into project 2B outfall system
11. Existing manhole on the 96" storm sewer near station 182+95 LT (I-70 EB)
12. Existing manhole on the 96" storm sewer near station 185+76 RT (I-70 EB)

---

## **7. Post Construction Storm Water Management**

---

Per Task 8.2.2.5 of the MAJOR PROJECT SCOPE OF SERVICES, Post Construction BMP calculations are not required by GPD Group as this task has been determined to be incorporated in the overall I-70/I-71 corridor.

*O:\2012\2012048\FRA\105523\drainage\docs\105523 Final Drainage Report Stage 3.docx*

---

## APPENDIX A – DRAINAGE CRITERIA (LD-35)

---

**PROJECT INFORMATION:**

Franklin	I-70/I-71	12.68/14.86	105523
<b>COUNTY</b>	<b>ROUTE</b>	<b>SECTION</b>	<b>PID</b>

**PIPE POLICY:**

The Pipe Policy of ODOT L&D Vol. 2 will be used for this project.

<http://www.dot.state.oh.us/Divisions/Engineering/Hydraulics/Location%20and%20Design%20Volume%202/Pages/LandD-Vol-2.aspx>

**POST CONSTRUCTION BMP POLICY:**

The Post Construction BMP Policy of N/A will be used for this project. Post Construction BMPs will be incorporated in the overall I-70/I-71 corridor project per the Scope of Services.

**DRAINAGE WATERSHED(S):**

Scioto River

**PROJECT SPECIFIC INFORMATION AFFECTING DRAINAGE:**

Existing gatewells located along Ramp A5 and NB-71 west of the Scioto River control backflow of floodwaters into storm sewer systems. The gatewells will not be affected by this project and be utilized for drainage areas for which they are utilized today.

The existing Olentangy-Scioto Interceptor System (OSIS) along Short Street is a combined sewer system that will not be disturbed during this project.

The existing 96" storm sewer trunk that skews under the I-70/I-71 corridor near High and Short Streets will not be affected other than adjusting some manholes to grade and tying into the trunk in two locations. No additional drainage areas will be added to the system.

---

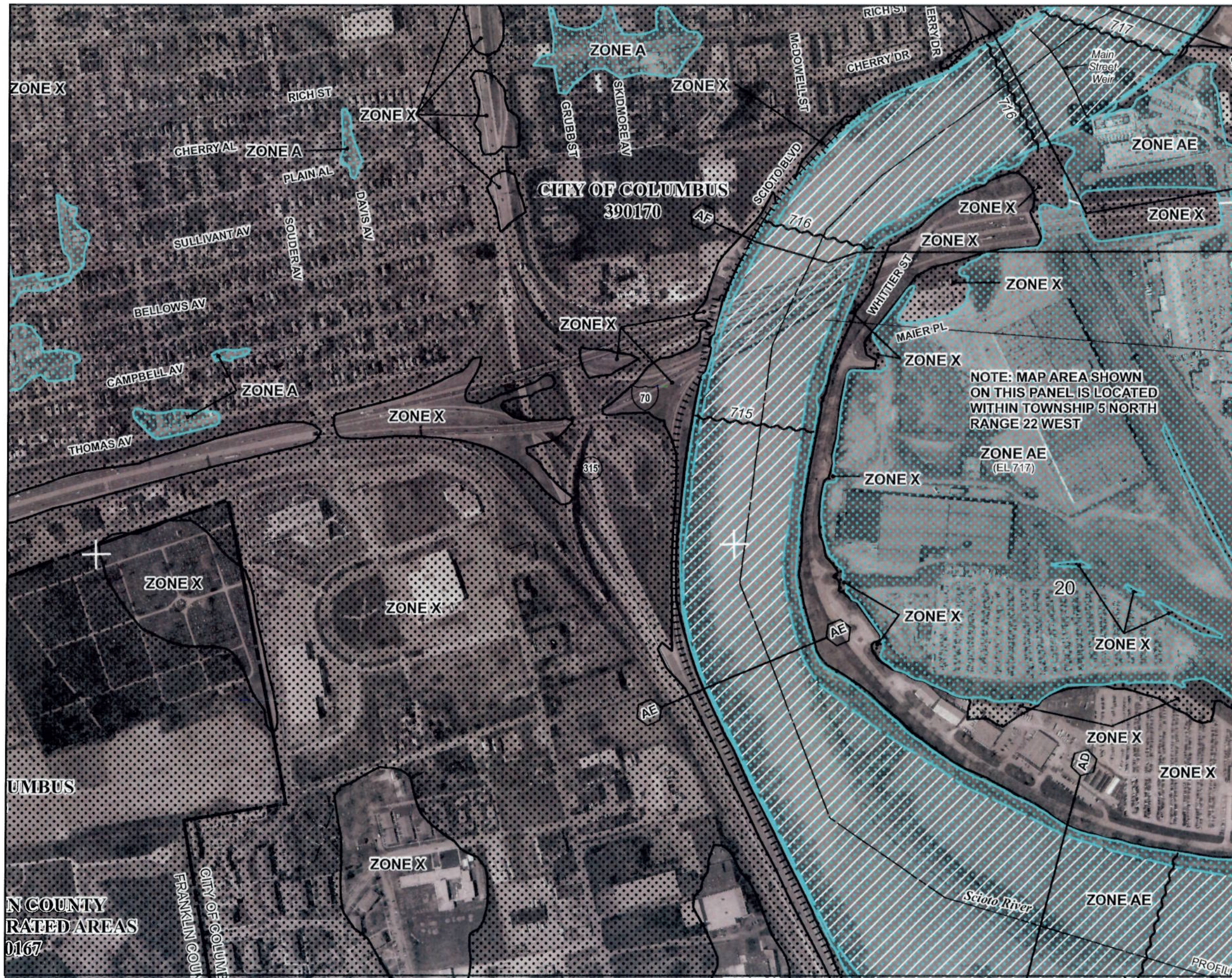
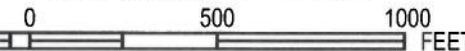
## APPENDIX B – FEMA FLOODPLAIN MAPPING

---





MAP SCALE 1" = 500'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0309K

**FIRM**  
FLOOD INSURANCE RATE MAP  
FRANKLIN COUNTY,  
OHIO  
AND INCORPORATED AREAS

PANEL 309 OF 465

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLUMBUS, CITY OF	390170	0309	K
FRANKLIN COUNTY	390167	0309	K

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
39049C0309K

MAP REVISED  
JUNE 17, 2008

Federal Emergency Management Agency

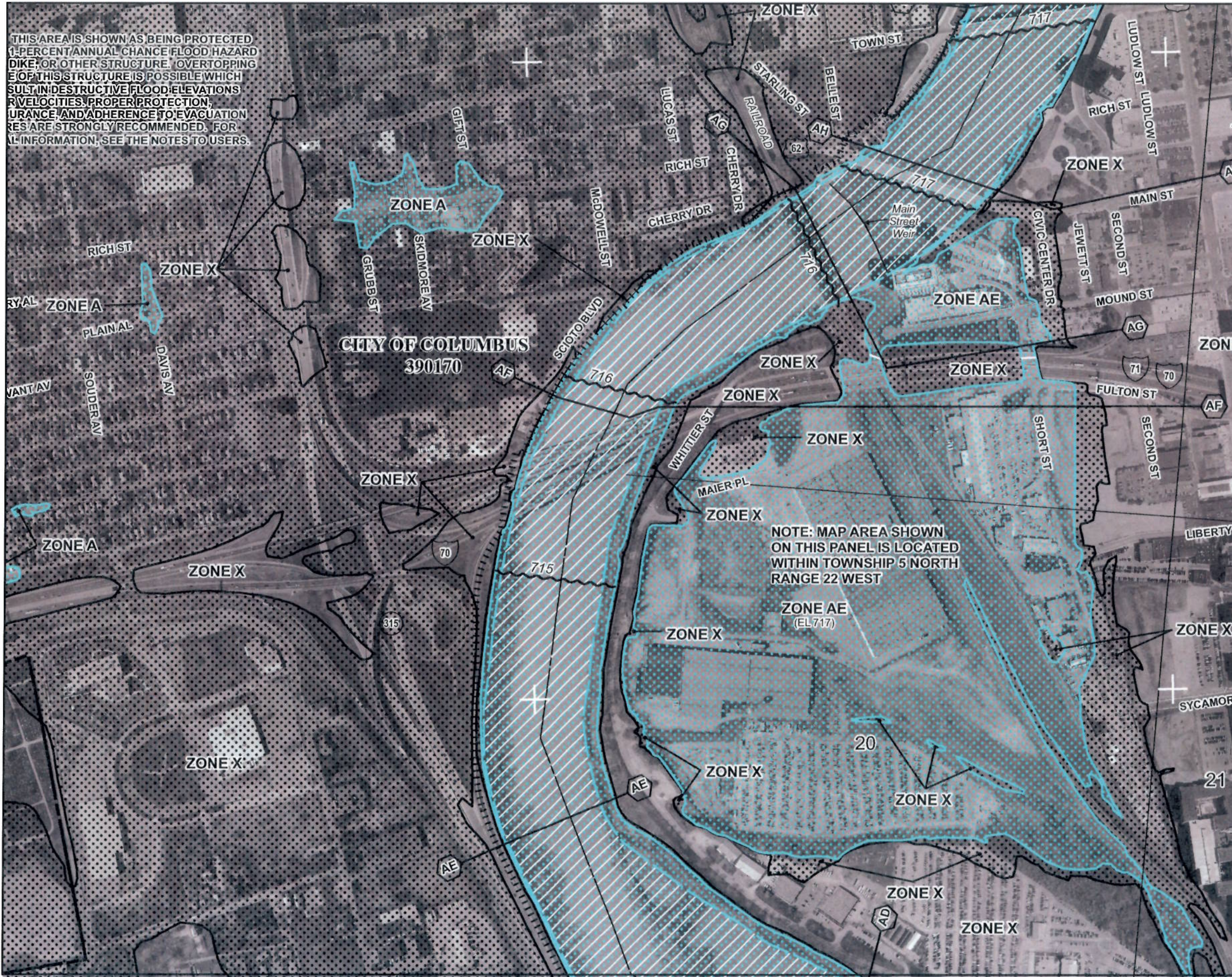
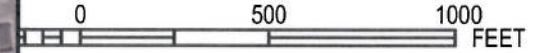
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

THIS AREA IS SHOWN AS BEING PROTECTED BY A 1-PERCENT ANNUAL CHANCE FLOOD HAZARD DIKE, OR OTHER STRUCTURE. OVERTOPPING OF THIS STRUCTURE IS POSSIBLE WHICH WILL RESULT IN DESTRUCTIVE FLOOD ELEVATIONS, FLOOD VELOCITIES, PROPER PROTECTION, PLANNING, AND ADHERENCE TO EVACUATION PROCEDURES ARE STRONGLY RECOMMENDED. FOR ADDITIONAL INFORMATION, SEE THE NOTES TO USERS.

National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 500'



### LEGEND

**SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100 year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard may include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

- ZONE X** Areas determined to be outside of the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 5 NORTH RANGE 22 WEST

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

---

## APPENDIX C – PROPOSED DRAINAGE AREAS

---



## DITCH DRAINAGE AREAS

**PID:** 105523  
**PROJECT:** FRA-70/71-12.68/14.86

**DATE:** 7/17/2018  
**CALC. BY:** TMT  
**GPD #:** 2012048

Drainage Area	Impervious Area		Pervious Area		Total Area		t <sub>c</sub> (Min.)	Notes
	Area (Acres)	C	Area (Acres)	C	Area (Acres)	Weighted C		
A5-1	0.26	0.90	0.50	0.70	0.76	0.77	15.00	5014+00 to 5011+50 (RT)
A5-2	0.08	0.90	0.13	0.70	0.21	0.78	15.00	5011+50 to 5010+00 (RT)
A5 SUMP (N)	0.31	0.90	0.26	0.75	0.57	0.83	15.00	
A5 SUMP	0.19	0.90	0.05	0.70	0.24	0.85	15.00	
A5-5	0.00	0.90	0.09	0.70	0.09	0.70	15.00	256+64 to 5005+00
A5-6	0.00	0.90	0.08	0.70	0.08	0.70	15.00	5007+32 to 5005+00
A5-7	0.85	0.90	0.05	0.70	0.90	0.89	15.00	5004+50 to 5006+50
A5-8	0.31	0.90	0.26	0.70	0.57	0.81	15.00	5009+50 to 5006+50 (RT)
NB71-1 RT	0.50	0.90	0.50	0.70	1.00	0.80	15.00	267+50 to 264+50
NB71-2 RT	0.04	0.90	0.06	0.70	0.10	0.78	15.00	264+50 to 264+05
NB71-3 RT	0.14	0.90	0.15	0.70	0.30	0.80	15.00	264+05 to 262+50
NB71-4 RT	0.15	0.90	0.07	0.50	0.22	0.77	15.00	262+50 to 261+00
NB71-1 LT	0.02	0.90	0.13	0.50	0.15	0.56	15.00	259+50 to 261+00
NB71-2 LT	0.01	0.90	0.19	0.60	0.21	0.62	15.00	261+00 to 262+50
NB71-3 LT	0.01	0.90	0.29	0.70	0.31	0.71	15.00	262+50 to 264+00
NB71-4 LT	0.01	0.90	0.12	0.60	0.13	0.62	15.00	264+00 to 264+50
NB71-5 LT	0.01	0.90	0.06	0.65	0.07	0.69	15.00	273+50 to 272+50
NB71-6 LT	0.02	0.90	0.37	0.55	0.39	0.57	15.00	272+50 to 270+50
NB71-7 LT	0.01	0.90	0.35	0.60	0.36	0.61	15.00	270+50 to 269+50
NB71-8 LT	0.26	0.90	0.58	0.60	0.84	0.69	15.00	269+50 to 268+50

## DITCH DRAINAGE AREAS

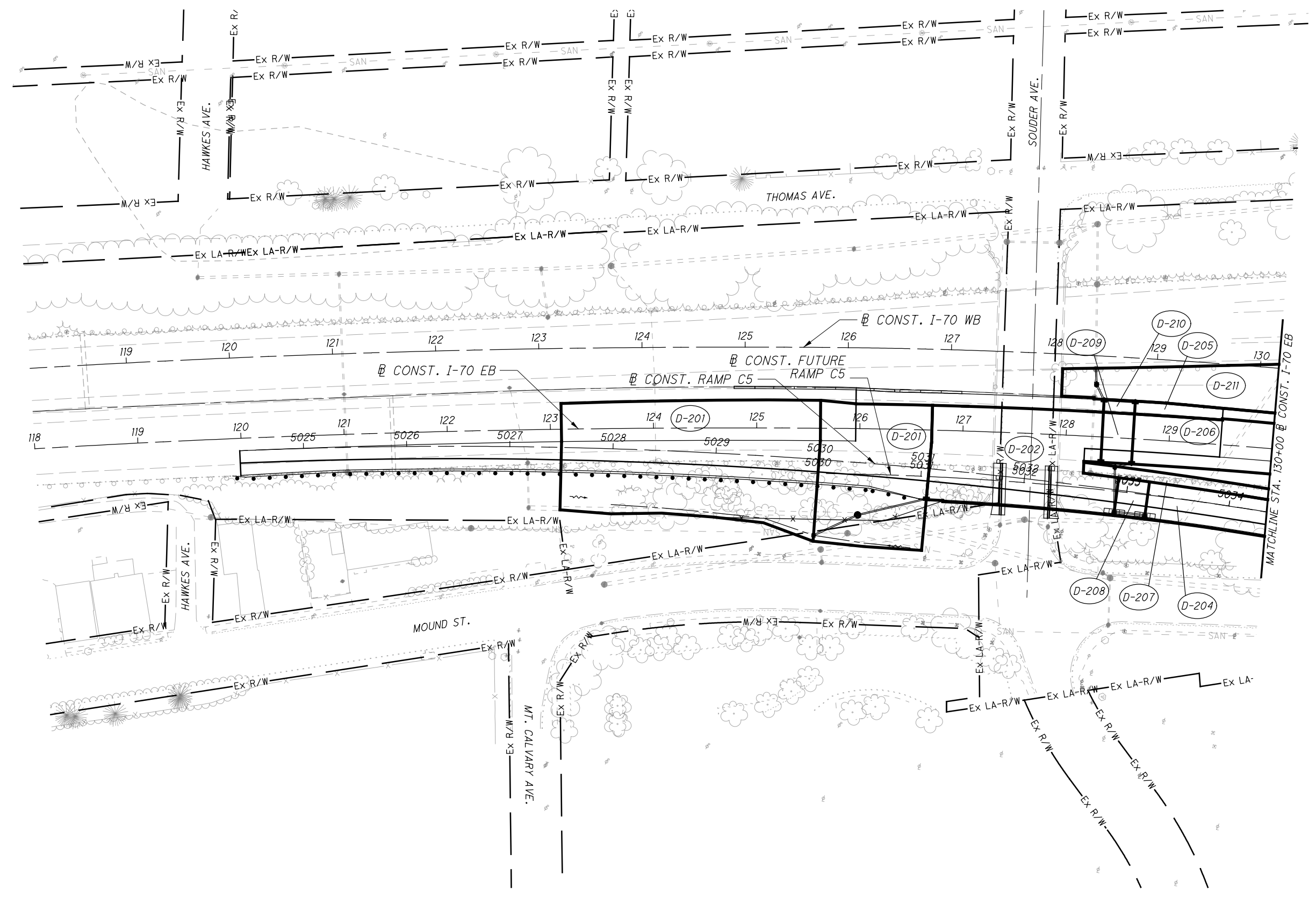
**PID:** 105523  
**PROJECT:** FRA-70/71-12.68/14.86

**DATE:** 7/17/2018  
**CALC. BY:** TMT  
**GPD #:** 2012048

Drainage Area	Impervious Area		Pervious Area		Total Area		t <sub>c</sub> (Min.)	Notes
	Area (Acres)	C	Area (Acres)	C	Area (Acres)	Weighted C		
EB70-1 LT			0.17	0.70	0.17	0.70	15.00	outside of north wall of squiggle bridge 186+00 to 184+00
EB70-2 LT			0.10	0.70	0.10	0.70	15.00	outside of north wall of squiggle bridge 183+10 to 184+00
EB70-10 RT	0.14	0.90	0.12	0.50	0.26	0.72	15.00	170+50 to 173+00
EB70-11 RT	0.25	0.90	0.11	0.50	0.36	0.78	15.00	173+00 to 175+15
EB70-12 RT	0.10	0.90	0.03	0.50	0.13	0.82	15.00	175+15 to 176+12
C5-1 RT	0.41	0.90	0.24	0.70	0.65	0.83	15.00	5028+00 to 5030+00
C5-2 RT	0.20	0.90	0.14	0.70	0.34	0.82	15.00	5031+00 to 5030+00
C5-3 RT	0.10	0.90	0.71	0.70	0.82	0.73	15.00	5039+50 to CB along 315
C5-1 LT	0.07	0.90	0.22	0.50	0.29	0.60	15.00	5041+50 to 5039+00
C5-2 LT	0.05	0.90	0.19	0.50	0.24	0.58	15.00	5039+00 to 5036+50
C5-4 LT	0.45	0.90	0.26	0.60	0.71	0.79	15.00	166+00 (EB-70) to 163+50 (EB-70)
C5-5 LT	0.39	0.90	0.29	0.60	0.67	0.77	15.00	161+01 (EB-70) to 163+50 (EB-70)
C5-6 LT	0.50	0.90	0.36	0.60	0.86	0.78	15.00	158+00 (EB-70) to 161+01 (EB-70)
C5-7 RT	0.16	0.90	0.26	0.70	0.42	0.78	15.00	5065+00 to 5068+00
C5-9 RT	0.07	0.90	0.11	0.70	0.17	0.78	15.00	5069+50 to 5068+90

Notes:  
 Minimum time of concentration of 10 minutes.

01\2012\2012048\FRA\105523\DRAINAGE\DRAINAGE DESIGN REPORT\04P001.DGN  
 1/30/2019  
 9:27:45 AM  
 CDDTV81STD\_USER



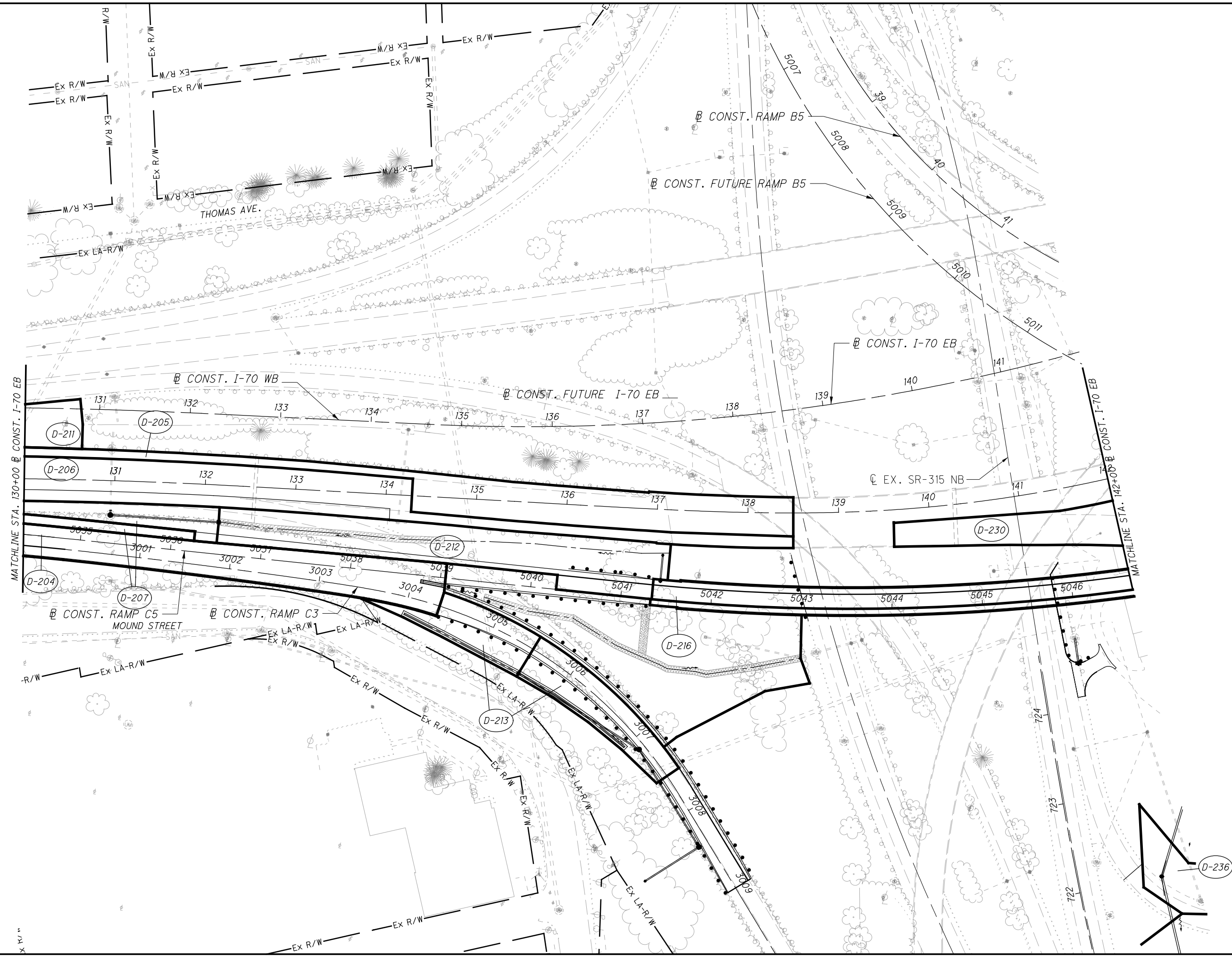
CALCULATED  
 MDG  
 CHECKED  
 CWL

0 25 50 100  
 HORIZONTAL  
 SCALE IN FEET

**DRAINAGE AREA PLAN**  
**I-70 EB STA. 118+00 TO STA. 130+00**

FRA-70/71-12.68 / 14.86

D:\2012\2012048\FRA\105523\DRAINAGE\DRAINAGE DESIGN REPORT\04P002.DGN  
1/30/2019  
9:29:01 AM  
CDDTV81STD\_USER



CALCULATED MDG CHECKED CWL

0 25 50 100

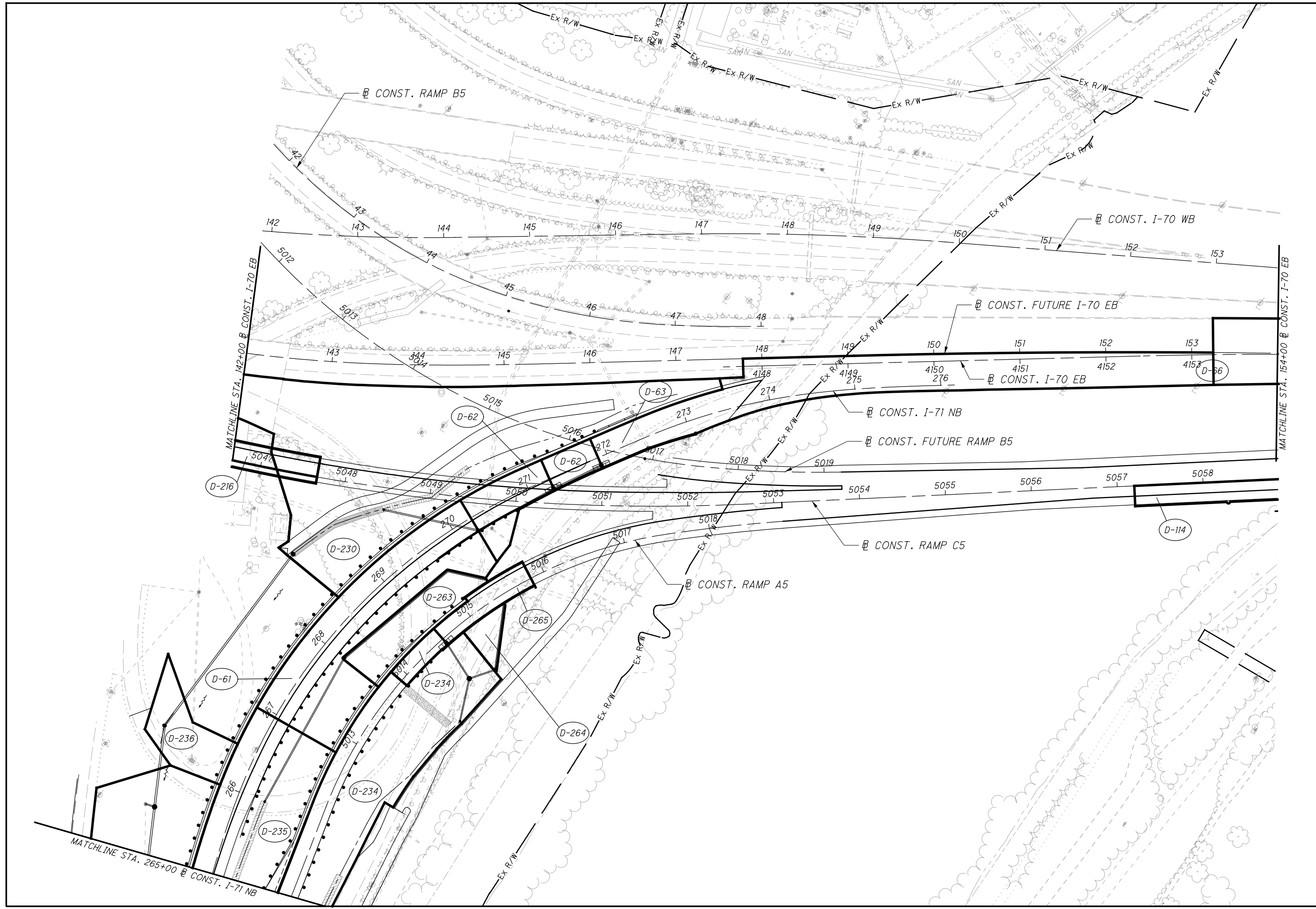
HORIZONTAL SCALE IN FEET

**DRAINAGE AREA PLAN**  
**I-70 EB STA. 130+00 TO STA. 142+00**

FRA-70/71-12.68/14.86

2/9

D:\2012\2012048\FRA\105523\DRAINAGE\DESIGN\DRAINAGE DESIGN REPORT\04P003.DGN  
1/30/2019  
9:36:55 AM  
CDDTV81STD\_USER



CALCULATED  
MDG  
CHECKED  
CWL

0 50 100  
HORIZONTAL  
SCALE IN FEET

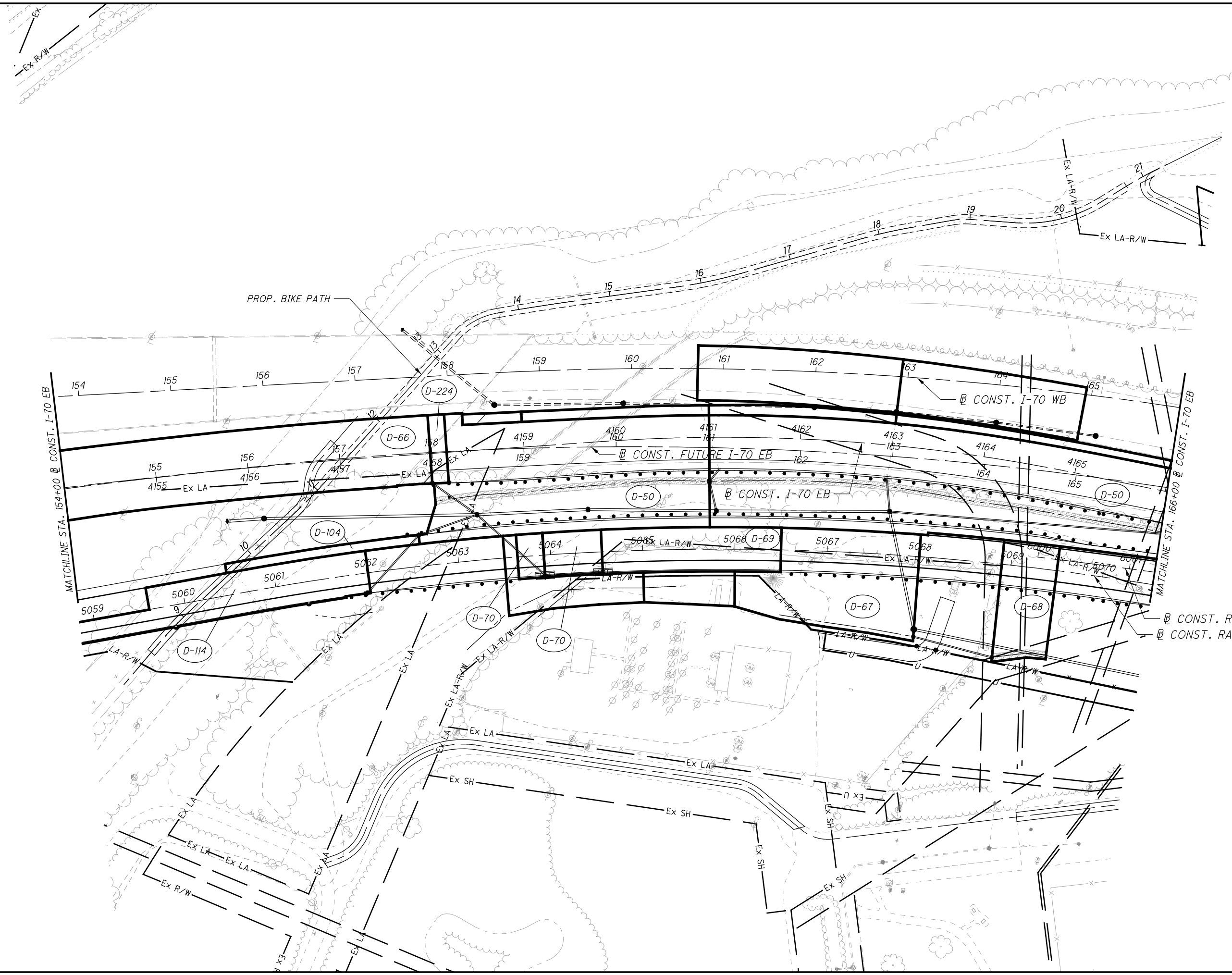
**DRAINAGE AREA PLAN**  
**I-70 EB STA. 142+00 TO STA. 154+00**

FRA-70/71-12.68/14.86

3  
9



D:\2012\2012048\FRA\105523\DRAINAGE\DESIGN\DRAINAGE DESIGN REPORT\04P004.DGN  
1/30/2019  
9:37:59 AM  
CDDTV81STD\_USER

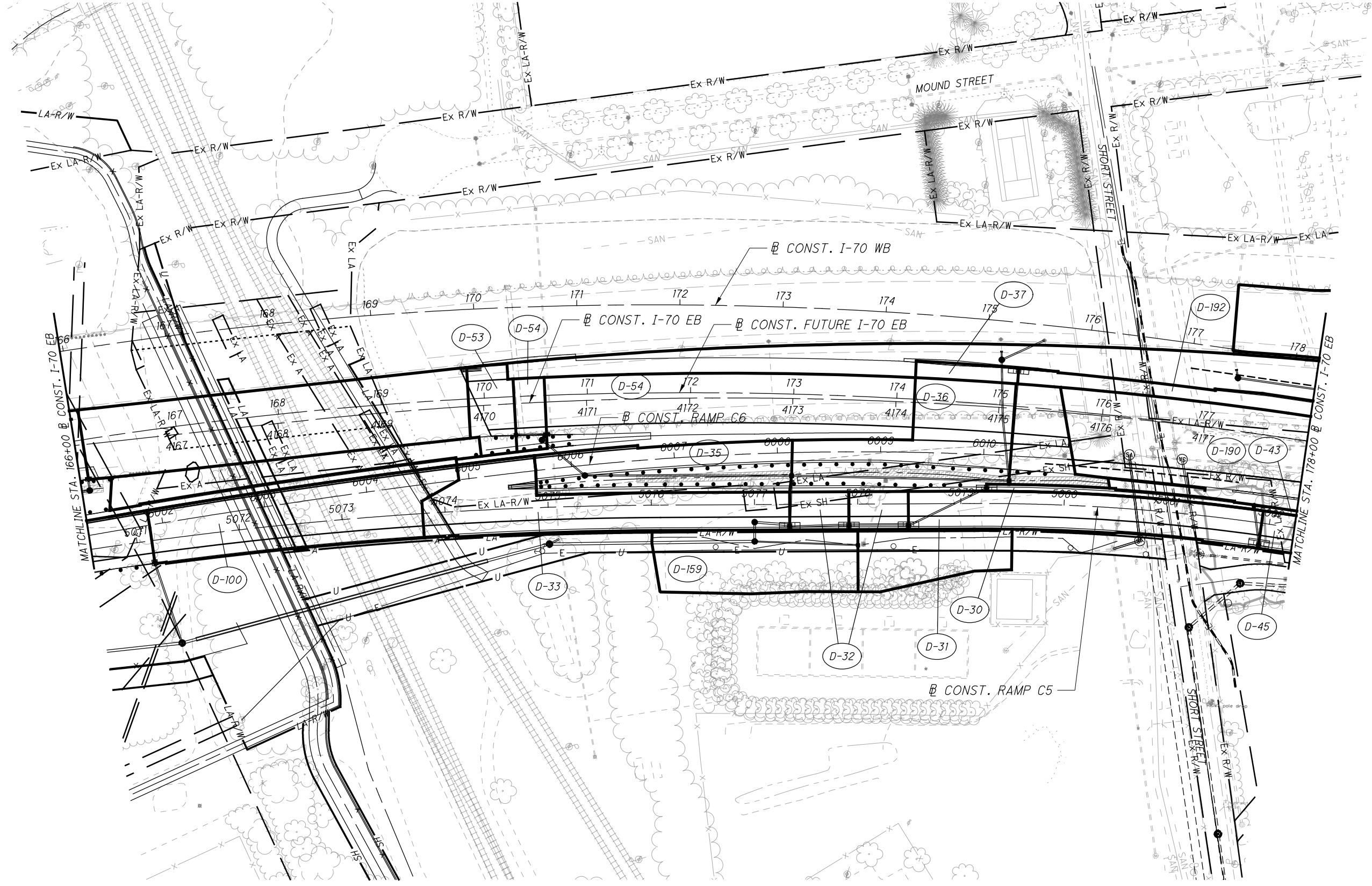


CALCULATED	MDG
CHECKED	CWL

0 50 100  
25  
HORIZONTAL  
SCALE IN FEET

**DRAINAGE AREA PLAN**  
**I-70 EB STA. 154+00 TO STA. 166+00**

FRA-70/71-12.68/14.86

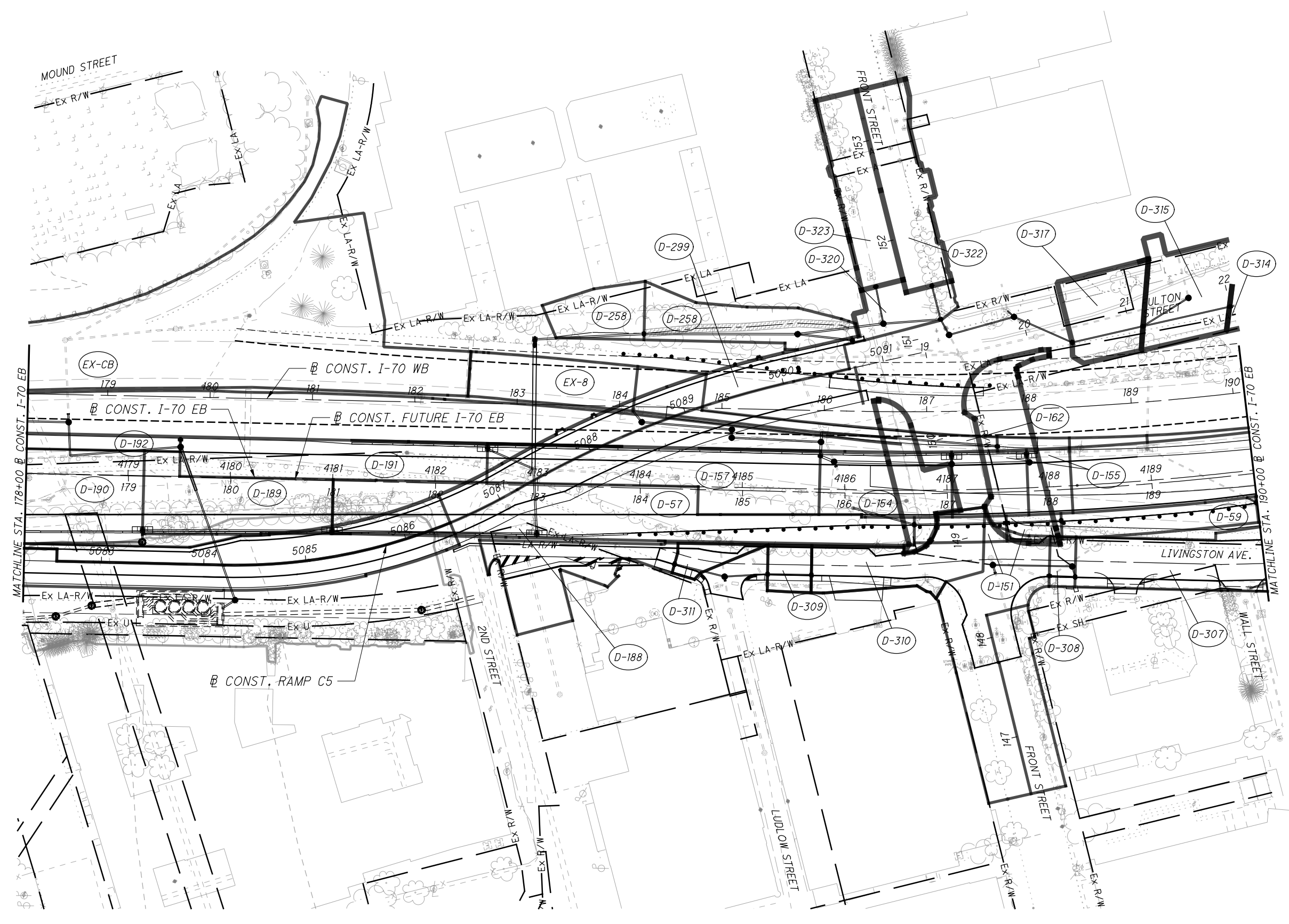


**DRAINAGE AREA PLAN**  
**I-70 EB STA. 166+00 TO STA. 178+00**

FRA-70/71-12.68/14.86

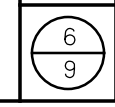
CALCULATED	
MDG	
CHECKED	
CWL	

D:\2012\2012048\FRA\105523\DRAINAGE\DESIGN\DRAINAGE DESIGN REPORT\04P006.DGN  
1/30/2019  
9:42:06 AM  
CDDTV81STD\_USER

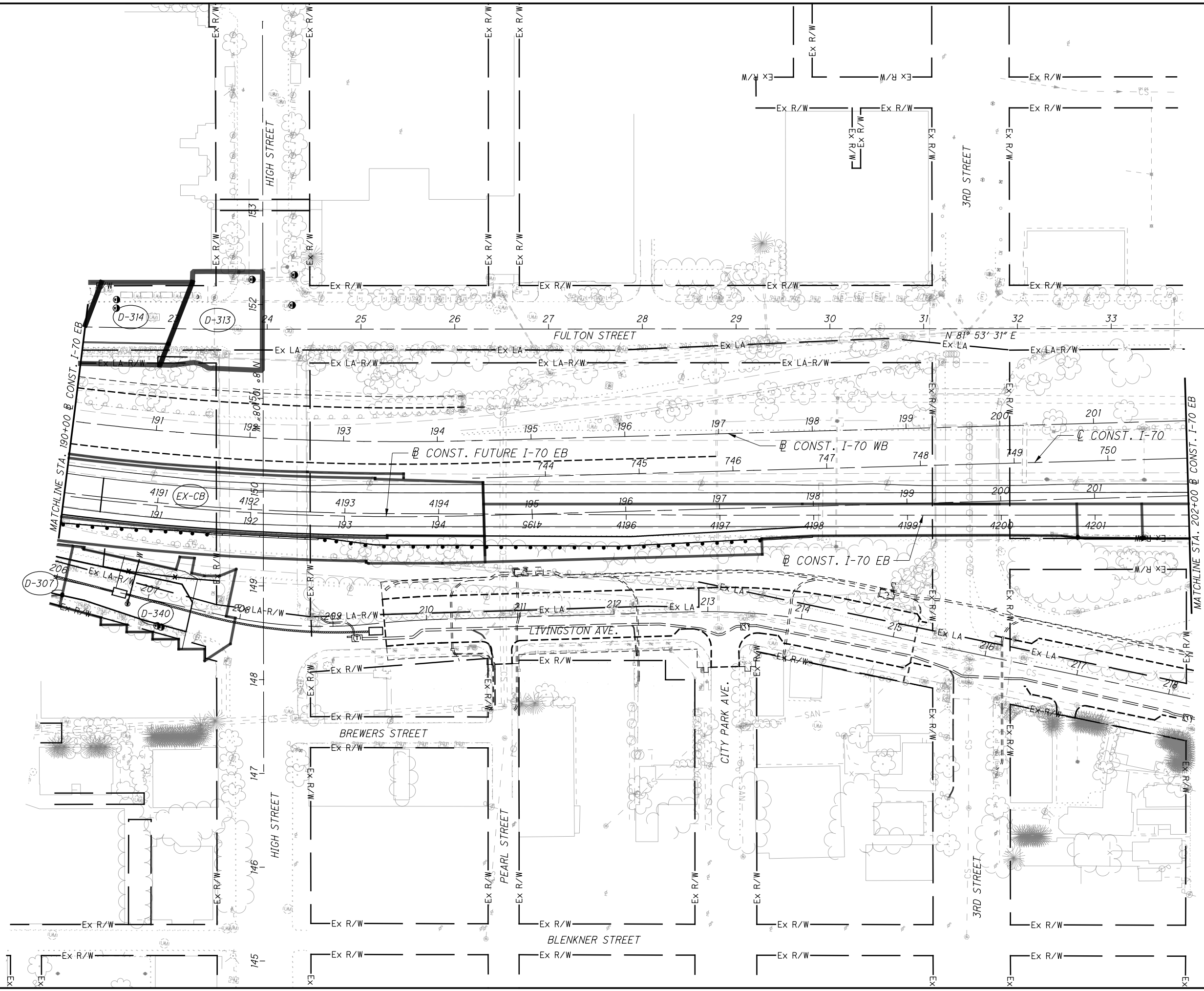


**DRAINAGE AREA PLAN**  
**I-70 EB STA. 178+00 TO STA. 190+00**

FRA-70/71-12.68/14.86



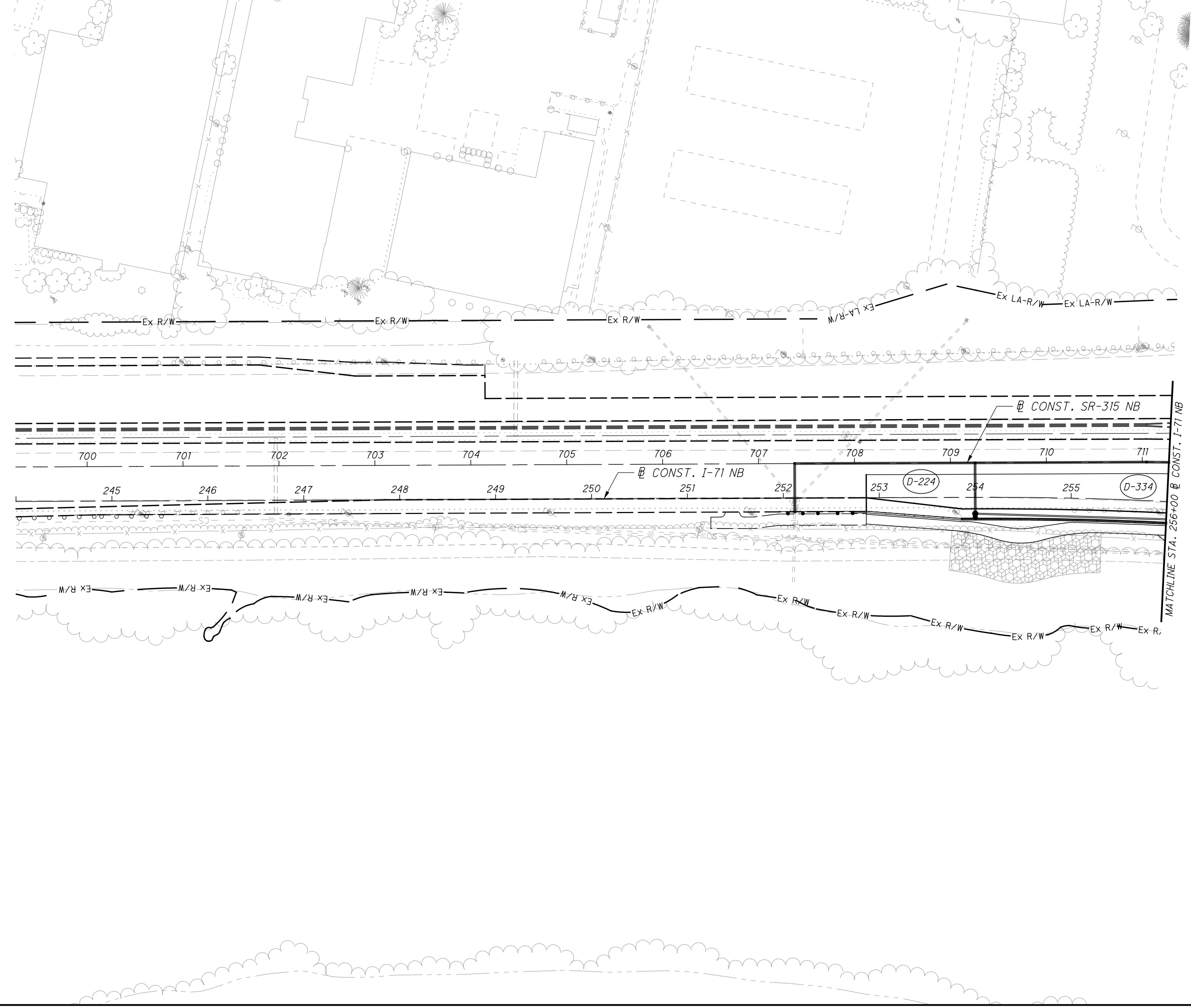
D:\2012\2012048\FRA\105523\DRAINAGE\DRAINAGE DESIGN REPORT\04P007.DGN  
 1/30/2019  
 9:43:44 AM  
 CDDTV81STD\_USER



**DRAINAGE AREA PLAN**  
**I-70 EB STA. 190+00 TO STA. 202+00**

FRA-70/71-12.68/14.86

D:\2012\2012048\FRA\105523\DRAINAGE\DESIGN\DRAINAGE DESIGN REPORT\04P008.DGN  
1/30/2019  
9:44:34 AM  
GDDTV81STD\_USER



CALCULATED	MDG
CHECKED	CWL

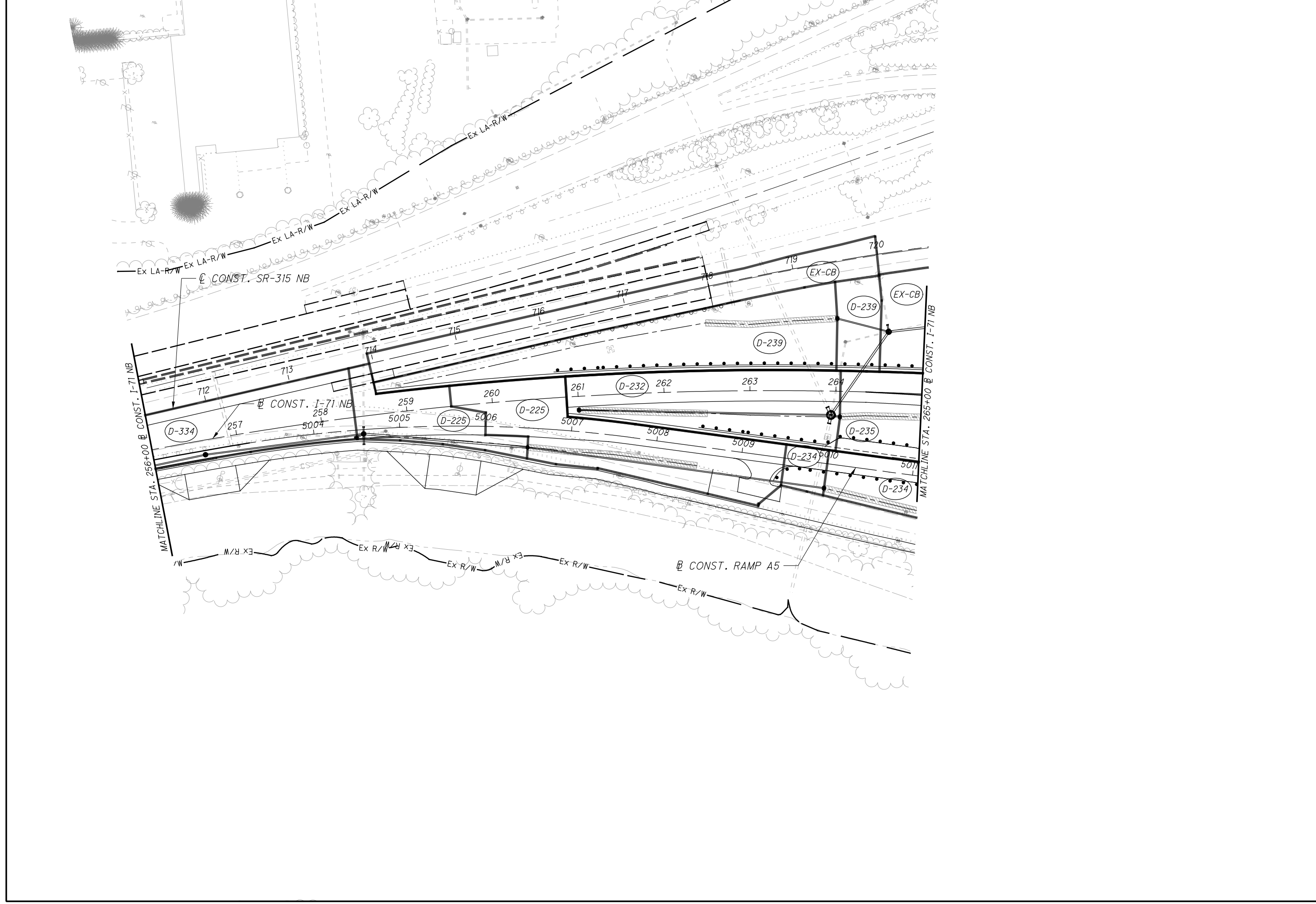
0 50 100  
HORIZONTAL SCALE IN FEET

**DRAINAGE AREA PLAN**  
**I-71 NB STA. 244+00 TO STA. 256+00**

**FRA-70/71-12.68/14.86**



01\2012\2012048\FRA\105523\DRAINAGE\DESIGN\DRAINAGE DESIGN REPORT\04P009.DGN  
1/30/2019  
9:21:52 AM  
CDDTV81STD\_USER



CALCULATED MDG	CHECKED CWL	FRA - 70 / 71-12.68 / 14.86	DRAINAGE AREA PLAN	I-71 NB STA. 256+00 TO STA. 265+84.16	N	0 50 100 HORIZONTAL SCALE IN FEET

---

## APPENDIX D – DITCH ANALYSIS

---



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/05/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch along EB70 RT 158+00 to 161+01

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
158+00	161+01	R	301.00	20.00			0.0073	0.86	0.86	0.78	0.67	Seed	3.62	5	0.030	18.17	1.54	0.15	2.43	0.33	7.22
												Seed	4.01	10	0.040	18.73	1.30	0.18	2.69	0.39	7.90





# DITCH ANALYSIS

**PID :** 105523    **Date :** 08/31/2013    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch along EB70 RT 166+00 to 161+01

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
166+00	163+50	R	250.00	20.00			0.0432	0.71	0.71	0.79	0.56	Seed	3.81	5	0.030	16.50	2.73	0.55	2.14	0.21	5.72
												Jute Mat	3.77	5	0.040	16.83	2.24	0.63	2.12	0.23	6.09
												Temp. Mat	3.77	5	0.040	16.83	2.24	0.63	2.12	0.23	6.09
												Temp. Mat	4.24	10	0.040	16.77	2.32	0.66	2.38	0.25	6.26
163+50	161+01	R	249.00	20.00			0.0229	0.67	1.38	0.77	1.08	Seed	3.60	5	0.030	18.38	2.63	0.45	3.88	0.31	7.06
												Jute Mat	3.56	5	0.040	18.73	2.16	0.51	3.84	0.36	7.52
												Temp. Mat	3.56	5	0.040	18.73	2.16	0.51	3.84	0.36	7.52
												Temp. Mat	4.02	10	0.040	18.60	2.23	0.54	4.33	0.38	7.73



# DITCH ANALYSIS

**PID :** 105523    **Date :** 01/12/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** I-70 EB 170+50 to 173+00 Right    **Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.      If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
170+50	173+00	R	250.00	20.00	4.00	3.00	0.0208	0.26	0.26	0.72	0.19	Seed	3.45	5	0.030	19.81	0.82	0.05	0.65	0.04	20.27
												Seed	3.82	10	0.040	20.46	0.71	0.06	0.72	0.05	20.35



# DITCH ANALYSIS

PID : 105523    Date : 09/09/2013    Project : FRA-70/71-12.68/14.86    Location : City of Columbus

Description : I-70 EB 173+00 to 175+00 Right

Designer : TMT

Rainfall Area : C

Allowable Shears

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
173+00	175+15	R	215.00	2.00	4.00	4.00	0.0051	0.36	0.36	0.78	0.28	Seed	3.65	5	0.030	17.88	1.21	0.09	1.03	0.27	4.19
												Seed	4.04	10	0.040	18.46	1.01	0.11	1.13	0.34	4.69



# DITCH ANALYSIS

**PID :** 105523    **Date :** 09/09/2013    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** I-70 EB 175+00 to 176+12 Right

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
175+94	175+15	R	79.00	0.00	12.50	25.00	0.0076	0.13	0.13	0.82	0.11	Seed	3.80	5	0.030	16.60	0.81	0.08	0.41	0.16	6.14
												Seed	4.22	10	0.040	16.94	0.68	0.09	0.45	0.19	7.05



# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/12/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch outside of north wall of the Squiggle Bridge    **Designer :** aje

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.      If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
183+10	184+00	L	90.00	2.00	2.00	2.00	0.0677	0.10	0.10	0.70	0.07	Seed	3.91	5	0.030	15.73	1.99	0.27	0.27	0.06	2.26
												Seed	4.36	10	0.040	15.86	1.75	0.34	0.30	0.08	2.32



# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/12/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch outside of north wall of the Squiggle Bridge

**Designer :** aje

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
186+00	184+00	L	200.00	2.00	2.00	2.00	0.0678	0.17	0.17	0.70	0.12	Seed	3.83	5	0.030	16.37	2.36	0.37	0.46	0.09	2.35
												Seed	4.26	10	0.040	16.57	2.08	0.47	0.51	0.11	2.44



# DITCH ANALYSIS

**PID :** 105523    **Date :** 06/29/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch along NB71 STA 259+00 to STA 264+00, Left

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
259+00	261+00	L	200.00	20.00			0.0160	0.15	0.15	0.56	0.08	Seed	3.64	5	0.030	18.05	1.07	0.10	0.31	0.10	4.09
												Seed	4.03	10	0.040	18.57	0.89	0.13	0.34	0.13	4.49
261+00	262+50	L	150.00	20.00			0.0290	0.21	0.36	0.62	0.21	Seed	3.49	5	0.030	19.48	1.72	0.25	0.75	0.14	4.70
												Seed	3.84	10	0.040	20.27	1.46	0.30	0.82	0.17	5.13
262+50	264+00	L	150.00	20.00			0.0287	0.31	0.67	0.71	0.43	Seed	3.37	5	0.030	20.65	2.11	0.34	1.47	0.19	5.50
												Seed	3.71	10	0.040	21.65	1.79	0.40	1.61	0.23	6.00



# DITCH ANALYSIS

**PID :** 105523    **Date :** 12/01/2014    **Project :** FRA-70-12.68

**Location :** City of Columbus

**Description :** Ditch along NB71 STA 264+05 to STA 261+00, Right

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
264+05	262+50	R	155.00	20.00			0.0232	0.30	0.30	0.80	0.24	Seed	3.81	5	0.030	16.50	1.70	0.23	0.92	0.16	5.05
												Seed	4.24	10	0.040	16.76	1.44	0.28	1.02	0.19	5.53
262+50	261+00	R	150.00	0.00	6.00	6.00	0.0093	0.22	0.52	0.77	0.41	Seed	3.64	5	0.030	18.04	1.60	0.23	1.49	0.39	4.72
												Seed	4.02	10	0.040	18.62	1.32	0.27	1.65	0.46	5.46





# DITCH ANALYSIS

**PID :** 105523    **Date :** 08/29/2013    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch along NB71 STA 266+00 to STA 264+05, Right    **Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\* ) Warning: Grade is steeper than allowable.      If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
266+00	Concent							0.17		0.82	0.14					15.53					
266+00	264+50	R	150.00	20.00			0.0104	0.58	0.75	0.78	0.59	Seed	3.76	5	0.030	16.98	1.69	0.19	2.22	0.29	6.80
												Seed	4.18	10	0.040	17.25	1.43	0.23	2.47	0.35	7.44
264+50	264+05	R	45.00	20.00			0.0276	0.10	0.85	0.79	0.67	Seed	3.72	5	0.030	17.29	2.45	0.42	2.49	0.24	6.24
												Jute Mat	3.71	5	0.040	17.35	2.02	0.48	2.49	0.28	6.65
												Temp. Mat	3.71	5	0.040	17.35	2.02	0.48	2.49	0.28	6.65
												Temp. Mat	4.14	10	0.040	17.61	2.08	0.50	2.77	0.29	6.83



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/01/2018    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ditch along NB71 STA 273+00 to STA 268+50, Left

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
273+00	272+46	L	54.00	0.00	6.00	4.00	0.0111	0.07	0.07	0.69	0.05	Seed	3.89	5	0.030	15.87	1.06	0.13	0.19	0.19	1.88
												Seed	4.34	10	0.040	16.01	0.91	0.15	0.21	0.21	2.15
272+46	270+50	L	196.00	20.00			0.0204	0.39	0.46	0.57	0.27	Seed	3.66	5	0.030	17.80	1.67	0.22	0.99	0.17	5.22
												Seed	4.06	10	0.040	18.28	1.41	0.26	1.10	0.20	5.71
270+50	269+50	L	100.00	2.00	2.00	6.00	0.0360	0.36	0.82	0.61	0.49	Seed	3.60	5	0.030	18.39	2.83	0.49	1.76	0.22	3.74
												Jute Mat	3.59	5	0.040	18.52	2.30	0.57	1.76	0.25	4.03
												Temp. Mat	3.59	5	0.040	18.52	2.30	0.57	1.76	0.25	4.03
												Temp. Mat	3.98	10	0.040	18.98	2.36	0.60	1.95	0.27	4.15
269+50	Concent							1.42		0.83	1.67					10.78					
269+50	268+50	L	100.00	2.00	2.00	2.00	0.0580	0.84	3.08	0.69	2.25	Seed	3.56	5	0.030	18.81	5.78	1.70	7.99	0.47	3.88
												Jute Mat	3.55	5	0.040	18.87	4.70	1.98	7.98	0.55	4.19
												Temp. Mat	3.55	5	0.040	18.87	4.70	1.98	7.98	0.55	4.19
												Perm, Type 1	3.55	5	0.040	18.87	4.70	1.98	7.98	0.55	4.19



# DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
											Perm, Type 1	3.94	10	0.040	19.32	4.84	2.10	8.86	0.58	4.32



# DITCH ANALYSIS

**PID :** 105523    **Date :** 12/03/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ditch along Ramp A5 STA 5014+00 to 5010+00, Right

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5014+00	5011+50	R	250.00	2.00	3.00	2.00	0.0040	0.76	0.76	0.77	0.59	Seed	3.62	5	0.030	18.20	1.47	0.11	2.12	0.46	4.29
												Seed	4.01	10	0.040	18.73	1.23	0.14	2.34	0.56	4.81
5011+50	5010+00	R	50.00	2.00	2.00	3.00	0.0080	0.21	0.97	0.78	0.75	Seed	3.58	5	0.030	18.61	2.01	0.22	2.68	0.43	4.16
												Seed	3.95	10	0.040	19.22	1.68	0.26	2.96	0.53	4.65



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/17/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ramp A5 Ditch in front of floodwall; Sta. 5004+50 to 5006+50

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5004+50	5006+50	R	200.00	20.00			0.0110	0.24	0.24	0.89	0.21	Seed	3.69	5	0.030	17.59	1.25	0.12	0.79	0.18	5.32
												Seed	4.08	10	0.040	18.06	1.06	0.15	0.87	0.21	5.82



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/17/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ramp A5 Ditch in front of floodwall; Sta. 5009+50 to 5006+50

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5008+75	5006+50	R	225.00	20.00			0.0253	0.57	0.57	0.81	0.46	Seed	3.79	5	0.030	16.72	2.13	0.33	1.75	0.21	5.81
												Seed	4.21	10	0.040	17.03	1.80	0.40	1.94	0.25	6.36



# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/27/2017    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ramp A5 left side to paved Gutter

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5015+38	5013+70	L	202.70	1.00	2.00	2.00	0.1420*	0.17	0.17	0.80	0.14	Seed	3.89	5	0.030	15.87	3.83	1.01	0.54	0.11	1.46
												Jute Mat	3.93	5	0.015	15.55	6.15	0.68	0.54	0.08	1.31
												Temp. Mat	3.93	5	0.015	15.55	6.15	0.68	0.54	0.08	1.31
												Temp. Mat	4.40	10	0.015	15.53	6.37	0.73	0.61	0.08	1.33



# DITCH ANALYSIS

**PID :** 105523    **Date :** 02/17/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ramp A5 right side to paved Gutter

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5015+40	5014+83	R	76.89	1.00	2.00	2.00	0.3700*	0.04	0.04	0.70	0.03	Seed	3.95	5	0.030	15.43	3.18	0.81	0.12	0.03	1.14
												Jute Mat	3.97	5	0.015	15.27	4.71	0.56	0.12	0.02	1.10
												Temp. Mat	3.97	5	0.015	15.27	4.71	0.56	0.12	0.02	1.10
												Temp. Mat	4.44	10	0.015	15.26	4.98	0.59	0.13	0.03	1.10





# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/27/2017    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ramp C3 right side to paved gutter 3004+00 to 3005+50

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
3004+00	3005+50	R	150.00	2.00	2.00	2.00	0.0487	0.21	0.21	0.80	0.17	Seed	3.92	5	0.015	15.65	3.85	0.24	0.66	0.08	2.32
												Seed	4.39	10	0.015	15.62	3.95	0.26	0.74	0.09	2.34



# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/27/2017    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ramp C3 right side to paved gutter 3007+00 to 3005+50

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
3007+00	3005+50	R	150.00	2.00	2.00	2.00	0.0200	0.27	0.27	0.80	0.22	Seed	3.90	5	0.015	15.79	3.15	0.15	0.84	0.12	2.48
												Seed	4.37	10	0.015	15.76	3.24	0.16	0.94	0.13	2.52



# DITCH ANALYSIS

**PID :** 105523    **Date :** 03/03/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5027+50 to STA 5030+00, RT

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5028+00	5030+00	R	200.00	2.00	2.00	2.00	0.0095	0.65	0.65	0.83	0.54	Seed	3.80	5	0.030	16.60	2.05	0.22	2.05	0.37	3.47
												Seed	4.22	10	0.040	16.91	1.73	0.27	2.28	0.45	3.82



# DITCH ANALYSIS

**PID :** 105523    **Date :** 03/03/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5031+00 to STA 5030+00, RT

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5031+00	5030+00	R	100.00	2.00	2.00	2.00	0.0180	0.34	0.34	0.82	0.28	Seed	3.90	5	0.030	15.79	2.08	0.24	1.09	0.21	2.86
												Seed	4.35	10	0.040	15.93	1.78	0.30	1.21	0.27	3.07



# DITCH ANALYSIS

**PID :** 105523    **Date :** 04/04/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ditch along Ramp C5 RT to SB315 basin

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5039+50	5040+00	R	51.00	20.00			0.0235	0.10	0.10	0.73	0.07	Seed	3.91	5	0.030	15.73	1.19	0.13	0.28	0.09	3.82
												Seed	4.36	10	0.040	15.86	1.00	0.16	0.31	0.11	4.19
5040+00	5040+50	R	50.00	2.00	2.00	3.00	0.0660	0.07	0.17	0.73	0.12	Seed	3.86	5	0.030	16.08	2.36	0.37	0.47	0.09	2.45
												Seed	4.30	10	0.040	16.26	2.05	0.46	0.53	0.11	2.56
5040+50	5041+00	R	56.00	2.00	2.00	2.00	0.1150*	0.10	0.26	0.73	0.19	Seed	3.83	5	0.030	16.36	3.37	0.71	0.74	0.10	2.40
												Jute Mat	3.82	5	0.040	16.41	2.78	0.85	0.73	0.12	2.47
												Temp. Mat	3.82	5	0.040	16.41	2.78	0.85	0.73	0.12	2.47
												Temp. Mat	4.26	10	0.040	16.58	2.88	0.91	0.82	0.13	2.50
5041+00	5041+50	R	54.00	2.00	2.00	3.00	0.1268*	0.12	0.39	0.73	0.28	Seed	3.80	5	0.030	16.64	3.91	0.95	1.07	0.12	2.60
												Jute Mat	3.79	5	0.040	16.69	3.23	1.12	1.07	0.14	2.70
												Temp. Mat	3.79	5	0.040	16.69	3.23	1.12	1.07	0.14	2.70
												Perm, Type 1	3.79	5	0.040	16.69	3.23	1.12	1.07	0.14	2.70
												Perm, Type 1	4.23	10	0.040	16.85	3.35	1.19	1.20	0.15	2.75



# DITCH ANALYSIS

STATION BEGIN	STATION END		SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5041+50	5043+00	R	158.00	2.00	2.00	2.00	0.1620 *	1.00	1.39	0.73	1.01	Seed	3.74	5	0.030	17.09	6.58	2.36	3.79	0.23	2.93
												Jute Mat	3.73	5	0.040	17.18	5.40	2.78	3.78	0.27	3.10
												Temp. Mat	3.73	5	0.040	17.18	5.40	2.78	3.78	0.27	3.10
												Perm, Type 1	3.73	5	0.040	17.18	5.40	2.78	3.78	0.27	3.10
												Perm, Type 2	3.73	5	0.040	17.18	5.40	2.78	3.78	0.27	3.10
												Perm, Type 2	4.17	10	0.040	17.32	5.58	2.96	4.22	0.29	3.17



# DITCH ANALYSIS

**PID :** 105523    **Date :** 03/03/2014    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5041+50 to STA 5036+50, LT

**Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5041+42	Concent						0.34		0.90	0.31						10.00					
5041+50	5039+00	L	250.00	20.00			0.0168	0.29	0.63	0.60	0.48	Seed	3.73	5	0.030	17.19	1.87	0.25	1.79	0.23	6.12
												Seed	4.14	10	0.040	17.57	1.58	0.30	1.99	0.28	6.70
5039+00	5036+50	L	250.00	20.00			0.0224	0.24	0.87	0.58	0.62	Seed	3.53	5	0.030	19.05	2.19	0.34	2.19	0.24	6.20
												Seed	3.89	10	0.040	19.78	1.85	0.40	2.41	0.29	6.77



# DITCH ANALYSIS

**PID :** 105523    **Date :** 03/03/2015    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5065+00 to 5063+50, RT    **Designer :** AJE

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5065+50	5063+50	R	200.00	2.00	2.00	2.00	0.0185	0.28	0.28	0.81	0.23	Seed	3.79	5	0.030	16.67	1.96	0.21	0.86	0.19	2.74
												Seed	4.21	10	0.040	16.97	1.66	0.27	0.96	0.23	2.93





# DITCH ANALYSIS

**PID :** 105523    **Date :** 03/03/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5066+00 to 5068+00, RT

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5066+50	5068+00	R	150.00	2.00	3.00	3.00	0.0180	0.42	0.42	0.78	0.33	Seed	3.85	5	0.030	16.19	2.09	0.25	1.26	0.23	3.35
												Seed	4.29	10	0.040	16.40	1.77	0.31	1.40	0.28	3.68



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/05/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** Ditch, Ramp C5 STA 5069+50 to 5068+90, RT

**Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5069+50	5068+90	R	60.00	2.00	3.00	3.00	0.0600	0.17	0.17	0.78	0.13	Seed	3.95	5	0.030	15.42	2.36	0.36	0.52	0.10	2.58
												Seed	4.41	10	0.040	15.49	2.02	0.46	0.58	0.12	2.73



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/05/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** C5 5076+00 to 5078+00 Right    **Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.      If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5076+00	5078+00	R	200.00	2.00	2.00	2.00	0.0113	0.27	0.27	0.55	0.15	Seed	3.72	5	0.030	17.27	1.44	0.12	0.56	0.17	2.67
												Seed	4.13	10	0.040	17.67	1.22	0.15	0.62	0.21	2.84



# DITCH ANALYSIS

**PID :** 105523    **Date :** 07/05/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** City of Columbus

**Description :** C5 5079+50 to 5078+00 Right    **Designer :** TMT

**Rainfall Area :** C

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.      If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
5079+50	5078+00	R	150.00	2.00	2.00	2.00	0.0224	0.17	0.17	0.55	0.09	Seed	3.80	5	0.030	16.59	1.54	0.15	0.36	0.10	2.42
												Seed	4.23	10	0.040	16.86	1.33	0.18	0.40	0.13	2.53

---

## APPENDIX E – INLET SPACING DESIGN

---



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
138+50	Begin																	
128+65	CB-3	985.00	0.90	0.55	2.38	4.90	10.00	0.0254	0.0400	0.0270	12.00	0.0267	5.32	1.96	0.67	2.63	0.220	5.51
128+35	CB-3	30.00	0.90	0.01	7.29	0.21	10.00	0.0254	0.0400	0.0270	12.00	0.0267	5.32	0.69	0.02	0.72	0.135	3.38



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
138+50	Begin																	
128+65	CB-3	985.00	0.90	0.74	2.20	4.53	10.00	0.0254	0.0400	0.0270	12.00	0.0267	5.32	2.44	1.10	3.54	0.246	6.16
128+35	CB-3	30.00	0.90	0.05	6.73	0.18	10.00	0.0254	0.0400	0.0270	12.00	0.0267	5.32	1.17	0.17	1.34	0.171	4.28



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/13/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70 EXISTING BRIDGE

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 8.60

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
153+25	Begin																	
157+98	CB-3	473.00	0.90	0.82	10.00	4.06	14.06	0.0084	0.0206	0.0206	8.60	0.0267	4.61	1.78	1.62	3.40	0.233	11.30
158+16	CB-3A	18.00	0.90	0.03	3.86	0.08	10.00	0.0840	0.0155	0.0155	9.20	0.0267	5.32	0.93	0.84	1.77	0.106	6.86





# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/13/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70 Lt Shoulder

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 4.75

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
158+35	Begin																		
159+10	I-3C	75.00	0.90	0.02	1.61	1.65	10.00	0.0045	0.0400	0.0400	11.00	0.1667	5.32	*****	*****	0.08	0.081	2.02	Sag
166+09	Begin																		
163+01	I-3C	308.00	0.90	0.06	1.55	4.71	10.00	0.0054	0.0400	0.0400	10.00	0.1667	5.32	0.29	0.00	0.29	0.128	3.21	
159+10	I-3C	391.00	0.90	0.10	1.11	6.97	10.00	0.0027	0.0400	0.0400	11.00	0.0417	5.32	*****	*****	0.48	0.177	4.42	End

## SUMP DATA

**Total Flow (cfs) :** 0.56

**Ponded Depth (ft.) :** 0.069

**Spread on Pavement (ft.) :** 1.57



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 02/01/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** I-70 EB right side (1358 R bridge)

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
169+86	Begin																	
166+12	CB-3	374.00	0.90	0.59	3.05	1.97	10.00	0.0194	0.0400	0.0370	10.00	0.0267	5.32	2.06	0.76	2.83	0.238	5.95



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 08/22/2013    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB 70 STA 169+84.48 to STA 194+48.56 Left

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
174+18	Begin																	
175+16	I-3C	98.00	0.90	0.04	1.63	1.19	10.00	0.0118	0.0400	0.0400	11.50	0.0560	5.32	0.19	0.00	0.19	0.095	2.38
179+50	CB-3A	434.00	0.90	0.15	6.48	4.08	10.56	0.0121	0.0400	0.0005	13.50	0.0417	5.21	0.62	0.08	0.70	0.154	3.86
182+50	I-3D	300.00	0.90	0.27	10.95	2.46	13.41	0.0120	0.0400	0.0160	10.50	0.0667	4.71	1.08	0.15	1.23	0.191	4.76
185+75	CB-3A	325.00	0.90	0.35	13.10	3.06	16.16	0.0073	0.0400	0.0223	12.00	0.0417	4.32	1.10	0.41	1.51	0.226	5.65
187+05	I-3D	130.00	0.90	0.19	15.35	1.28	16.63	0.0073	0.0440	0.0440	10.20	0.0667	4.26	1.09	0.04	1.14	0.211	4.79
187+79	I-3D	74.00	0.90	0.11	16.89	0.85	17.74	0.0073	0.0600	0.0600	9.50	0.0667	4.12	*****	*****	0.45	0.167	2.79 Sag
194+49	Begin																	
188+98	I-3C	551.00	0.90	0.68	2.67	2.74	10.00	0.0144	0.0700	0.0700	7.00	0.1667	5.32	2.75	0.51	3.26	0.327	4.68
188+21	I-3C	77.00	0.90	0.10	2.67	0.52	10.00	0.0144	0.0700	0.0700	7.00	0.1667	5.32	0.99	0.00	0.99	0.209	2.99
187+79	I-3D	42.00	0.90	0.06	7.40	0.41	10.00	0.0144	0.0600	0.0600	9.50	0.0667	5.32	*****	*****	0.29	0.124	2.07 End

## SUMP DATA

**Total Flow (cfs) :** 0.74

**Ponded Depth (ft.) :** 0.083

**Spread on Pavement (ft.) :** 1.24



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 02/01/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** 170+64.38 I-70 EB (1358 R Bridge)

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 8.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
169+84	Begin																	
170+30	CB-3A	46.00	0.90	0.08	3.00	0.51	10.00	0.0098	0.0400	0.0235	7.00	0.0267	5.32	0.37	0.01	0.38	0.128	3.20
170+60	CB-3	30.00	9.00	0.01	1.80	0.36	10.00	0.0098	0.0400	0.0292	8.00	0.0267	5.32	*****	*****	0.25	0.110	2.74 Sag
174+18	Begin																	
170+60	CB-3	358.00	0.90	0.56	2.95	1.90	10.00	0.0196	0.0400	0.0292	8.00	0.0267	5.32	*****	*****	2.68	0.233	5.82 End

## SUMP DATA

**Total Flow (cfs) :** 2.94

**Ponded Depth (ft.) :** 0.218

**Spread on Pavement (ft.) :** 6.19



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 08/22/2013    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB 70 STA 175+62 to STA 194+48.56 Right

**Designer :** CML

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
175+63	Begin																	
179+15	I-3D	352.00	0.90	0.67	3.44	2.34	10.00	0.0121	0.0294	0.0200	16.00	0.0667	5.32	1.88	1.33	3.21	0.243	8.26
181+00	I-3D	185.00	0.90	0.25	5.53	1.35	10.00	0.0121	0.0287	0.0200	17.00	0.0667	5.32	1.60	0.93	2.53	0.220	7.67
183+00	I-3D	200.00	0.90	0.23	6.89	1.34	10.00	0.0120	0.0518	0.0160	20.00	0.0667	5.32	1.68	0.35	2.03	0.253	4.89
186+68	CB-3A	368.00	0.90	0.33	8.06	3.28	11.34	0.0073	0.0400	0.0400	7.50	0.0267	5.06	1.27	0.59	1.86	0.244	6.11
187+57	CB-3	89.00	0.90	0.05	13.02	0.98	14.00	0.0073	0.0400	0.0400	7.50	0.0267	4.62	*****	*****	0.80	0.178	4.45 Sag
194+49	Begin																	
189+99	I-3D	450.00	0.90	0.26	1.52	3.25	10.00	0.0144	0.0400	0.0400	7.50	0.0667	5.32	1.07	0.18	1.25	0.185	4.63
188+10	CB-3A	189.00	0.90	0.11	10.00	1.68	11.68	0.0144	0.0400	0.0400	7.50	0.0267	5.00	0.59	0.08	0.67	0.147	3.67
187+57	I-3D	53.00	0.90	0.03	10.00	0.62	10.62	0.0144	0.0400	0.0400	7.50	0.0667	5.20	*****	*****	0.22	0.096	2.41 End

## SUMP DATA

**Total Flow (cfs) :** 1.02

**Ponded Depth (ft.) :** 0.103

**Spread on Pavement (ft.) :** 2.10



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 07/06/2016    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** I70 EB right shoulder reconstruction

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 9.50

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
4194+49	Begin																	
4200+82	CB-3A	633.00	0.90	0.44	2.58	6.68	10.00	0.0042	0.0400	0.0160	9.50	0.0267	5.32	1.38	0.73	2.11	0.284	7.10
4201+51	CB-3	69.00	0.90	0.06	2.58	1.08	10.00	0.0023	0.0400	0.0160	12.00	0.0267	5.32	*****	*****	1.02	0.243	6.06 Sag
4205+60	Begin																	
4202+54	CB-3A	306.00	0.90	0.26	2.58	2.79	10.00	0.0079	0.0400	0.0160	12.00	0.0267	5.32	0.95	0.30	1.25	0.207	5.18
4201+51	CB-3A	103.00	0.90	0.09	2.58	1.10	10.00	0.0074	0.0400	0.0160	9.50	0.0267	5.32	*****	*****	0.73	0.172	4.29 End

## SUMP DATA

**Total Flow (cfs) :** 1.75

**Ponded Depth (ft.) :** 0.182

**Spread on Pavement (ft.) :** 5.29



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 12/11/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** I-70 WB interim condition Sta. 539+00 to 550+25

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 5.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
539+00	Begin																	
540+62	I-3C	162.00	0.90	0.16	3.23	1.22	10.00	0.0175	0.0400	0.0160	8.00	0.0560	5.32	0.71	0.05	0.77	0.149	3.72
544+20	CB-3A	358.00	0.90	0.14	4.45	3.09	10.00	0.0140	0.0400	0.0160	8.00	0.0417	5.32	0.63	0.09	0.72	0.152	3.79
544+90	I-3C	70.00	0.90	0.01	7.60	1.44	10.00	0.0040	0.0400	0.0160	8.00	0.1667	5.32	*****	*****	0.16	0.108	2.70 Sag
550+25	Begin																	
545+66	I-3C	459.00	0.90	0.03	1.11	8.32	10.00	0.0061	0.0400	0.0160	4.00	0.1667	5.32	0.14	0.00	0.14	0.095	2.39
544+90	I-3C	76.00	0.90	0.01	9.44	2.15	11.59	0.0040	0.0400	0.0160	8.00	0.1667	5.02	*****	*****	0.05	0.068	1.70 End

## SUMP DATA

**Total Flow (cfs) :** 0.20

**Ponded Depth (ft.) :** 0.035

**Spread on Pavement (ft.) :** 0.57



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/13/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** NB I-71, EB I-70

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
266+96	Begin																	
270+25	CB-3A	329.00	0.90	0.57	2.43	1.65	10.00	0.0169	0.0600	0.0600	12.00	0.2670	5.32	2.19	0.54	2.73	0.281	4.68
271+27	I-3D	102.00	0.90	0.13	5.28	0.66	10.00	0.0169	0.0600	0.0600	12.00	0.6670	5.32	*****	*****	1.16	0.204	3.40 Sag
4152+65	Begin																	
271+27	I-3D	731.00	0.90	0.67	2.52	6.96	10.00	0.0032	0.0600	0.0600	12.00	0.0667	5.32	*****	*****	3.21	0.407	6.79 End

## SUMP DATA

**Total Flow (cfs) :** 4.37

**Ponded Depth (ft.) :** 0.272

**Spread on Pavement (ft.) :** 4.15





# INLET SPACING DESIGN

**PID :** 105523    **Date :** 05/11/2018    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** NB I-71 & RAMP A5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
252+12	Begin																	
254+00	CB-3A	700.00	0.90	0.39	3.67	6.97	10.64	0.0055	0.0400	0.0246	10.00	0.0417	5.19	1.25	0.57	1.82	0.256	6.39
5004+50	CB-3	439.00	0.90	0.67	4.99	4.69	10.00	0.0024	0.0500	0.0500	10.00	0.0417	5.32	2.94	0.84	3.78	0.427	8.54



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 03/02/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp A5 5014+58.61

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 8.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5015+83	Begin																	
5014+59	I-3D	124.00	0.90	0.08	1.97	0.72	10.00	0.0390	0.0600	0.0600	8.00	0.0667	5.32	0.40	0.00	0.40	0.117	1.95



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70, Ramp C3, Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
3004+36	Begin																	
5033+20	I-3D	579.00	0.90	0.54	2.90	2.87	10.00	0.0249	0.0400	0.0227	10.00	0.0667	5.32	1.60	0.98	2.59	0.220	5.49
5032+90	I-3D	30.00	0.90	0.03	5.90	0.19	10.00	0.0249	0.0400	0.0293	11.00	0.0667	5.32	0.92	0.20	1.13	0.161	4.02
5031+07	CB-3	183.00	0.90	0.37	6.09	1.01	10.00	0.0235	0.0400	0.0302	17.00	0.0267	5.32	1.58	0.40	1.98	0.201	5.02



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5036+25	Begin																	
5032+86	CB-3A	339.00	0.90	0.09	1.55	2.57	10.00	0.0249	0.0400	0.0293	10.00	0.0267	5.32	0.41	0.02	0.43	0.112	2.80



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 6.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5047+67	Begin																	
5041+42	CB-3A	625.00	0.90	0.34	2.07	3.42	10.00	0.0257	0.0400	0.0355	6.00	0.0267	5.32	1.21	0.42	1.63	0.184	4.59



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5057+20	Begin																	
5061+97	CB-3	477.00	0.90	0.39	10.00	5.26	15.26	0.0051	0.0350	0.0350	10.00	0.0267	4.44	1.28	0.28	1.56	0.233	6.65



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5061+60	Begin																	
5062+60	CB-3A	100.00	0.90	0.05	1.59	1.63	10.00	0.0051	0.0350	0.0350	10.00	0.0267	5.32	0.24	0.00	0.24	0.115	3.29



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70-12.68

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5 Sump @ 5063+93

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5063+64	Begin																	
5063+93	I-3D	29.00	0.90	0.03	2.84	0.54	10.00	0.0051	0.0350	0.0350	10.00	0.0667	5.32	0.14	0.00	0.14	0.095	2.72
5066+50	Begin																	
5064+56	I-3D	194.00	0.90	0.21	7.31	1.06	10.00	0.0427	0.0350	0.0350	10.00	0.0667	5.32	0.76	0.25	1.01	0.133	3.79
5063+93	I-3D	63.00	0.90	0.07	2.84	0.38	10.00	0.0427	0.0350	0.0350	10.00	0.0667	5.32	0.52	0.06	0.58	0.108	3.09





# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5, Ramp C6

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5073+78	Begin																	
5071+14	CB-3A	264.00	0.90	0.38	3.43	1.53	10.00	0.0201	0.0400	0.0280	10.00	0.0267	5.32	1.30	0.52	1.82	0.200	5.01



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5, Ramp C6

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5073+78	Begin																	
5077+34	I-3D	356.00	0.90	0.37	2.55	3.12	10.00	0.0070	0.0400	0.0160	10.00	0.0667	5.32	1.52	0.25	1.77	0.242	6.05
5077+91	I-3D	57.00	0.90	0.05	5.66	0.92	10.00	0.0035	0.0400	0.0160	10.00	0.0667	5.32	*****	*****	0.49	0.170	4.25 Sag
5086+46	Begin																	
5081+92	I-3D	454.00	0.90	0.27	2.25	2.21	10.00	0.0395	0.0400	0.0288	10.00	0.0667	5.32	0.94	0.35	1.29	0.155	3.88
5078+49	I-3D	343.00	0.90	0.29	4.46	3.10	10.00	0.0070	0.0400	0.0160	10.00	0.0667	5.32	1.50	0.24	1.74	0.240	6.00
5077+91	I-3D	58.00	0.90	0.05	7.54	0.95	10.00	0.0035	0.0400	0.0160	10.00	0.0667	5.32	*****	*****	0.48	0.169	4.22 End

## SUMP DATA

**Total Flow (cfs) :** 0.97

**Ponded Depth (ft.) :** 0.100

**Spread on Pavement (ft.) :** 2.13



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 4.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5086+46	Begin																	
5081+83	CB-3A	463.00	0.90	0.22	2.64	2.42	10.00	0.0404	0.0369	0.0331	4.00	0.0267	5.32	0.86	0.19	1.05	0.139	3.77
5079+25	I-3D	258.00	0.90	0.04	5.06	2.35	10.00	0.0190	0.0400	0.0400	3.00	0.0667	5.32	0.38	0.00	0.38	0.113	2.82



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 12/12/2018    **Project :** FRA-70/71-12.68/14.86    **Location :** Columbus Ohio

**Description :** Ramp C5 at Front Left

**Designer :** TMT

**Rainfall Area:** C

**Storm Frequency (yr.) :** 5

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5086+46	Begin																	
5090+66	CB-3A	420.00	0.90	0.29	10.00	3.15	13.15	0.0300	0.0160	0.0160	4.00	0.0417	4.27	0.64	0.48	1.11	0.110	6.86



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 07/02/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Front St. Left (North of Fulton)

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
153+02	Begin																	
151+60	CB-3A	142.00	0.90	0.18	5.00	1.67	10.00	0.0098	0.0160	0.0160	0.00	0.0000	5.32	0.49	0.38	0.86	0.123	7.68



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 07/02/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Front St. Right (North of Fulton)

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 11.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
153+02	Begin																	
151+36	CB-3A	166.00	0.90	0.21	5.00	1.88	10.00	0.0098	0.0160	0.0160	0.00	0.0000	5.32	0.54	0.46	1.01	0.130	8.14
151+14	CB-3A	22.00	0.90	0.09	5.00	0.26	10.00	0.0098	0.0160	0.0160	0.00	0.0000	5.32	0.50	0.40	0.90	0.125	7.79



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 01/28/2015    **Project :** FRA-70-12.68

**Location :** City of Columbus

**Description :** Front St. South of Livingston right side

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 6.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
148+22	Begin																	
146+40	CB-3A	182.00	0.90	0.09	2.16	1.06	10.00	0.0500	0.0378	0.0378	6.00	0.0000	5.32	0.42	0.02	0.44	0.097	2.58



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 01/05/2019    **Project :** FRA-70-12.68

**Location :** City of Columbus

**Description :** Fulton St.

**Designer :** TMT

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 12.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
23+96	Begin																	
22+95	CB-3A	101.00	0.90	0.21	5.00	0.67	10.00	0.0387	0.0160	0.0160	0.00	0.0000	5.32	0.58	0.42	1.01	0.101	6.29
22+00	CB-3A	95.00	0.90	0.19	5.00	0.62	10.00	0.0356	0.0160	0.0160	0.00	0.0000	5.32	0.71	0.63	1.33	0.114	7.10
21+13	CB-3A	87.00	0.90	0.18	5.00	0.56	10.00	0.0340	0.0160	0.0160	0.00	0.0000	5.32	0.76	0.73	1.49	0.119	7.47
20+42	CB-3A	71.00	0.90	0.15	5.00	0.43	10.00	0.0420	0.0160	0.0160	0.00	0.0000	5.32	0.76	0.69	1.45	0.114	7.10





# INLET SPACING DESIGN

**PID :** 105523    **Date :** 01/07/2019    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Livingston Ave. Access drive

**Designer :** TMT

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
203+22	Begin																	
201+54	I-2-6	168.00	0.90	0.19	2.56	1.33	10.00	0.0245	0.0160	0.0160	0.00	0.0000	5.32	0.32	0.59	0.91	0.106	6.60
201+12	I-2-6	42.00	0.90	0.05	2.06	0.42	10.00	0.0152	0.0160	0.0160	0.00	0.0000	5.32	0.34	0.49	0.83	0.112	6.98
200+23	CB-3A	89.00	0.90	0.04	2.00	0.95	10.00	0.0152	0.0160	0.0160	0.00	0.0000	5.32	0.42	0.26	0.68	0.104	6.49



# INLET SPACING DESIGN

**PID :** 105523     **Date :** 01/28/2015     **Project :** FRA-70/71-12.68/14.68

**Location :** City of Columbus

**Description :** Livingston Ave. right onto Fulton St (south - left side)

**Designer :** TMT

**Rainfall Area:** C

**Storm Frequency (yr.) :** 10

**Total Allow. Spread (ft.) :** 11.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
207+96	Begin																	
206+10	CB-3A	186.00	0.90	0.31	2.97	1.14	10.00	0.0354	0.0160	0.0160	11.00	0.0000	5.32	0.77	0.73	1.50	0.119	7.42
204+13	CB-3A	197.00	0.90	0.24	4.11	1.78	10.00	0.0120	0.0160	0.0160	11.00	0.0000	5.32	0.83	1.04	1.87	0.158	9.88
203+87	I-2-10	26.00	0.90	0.03	5.90	0.47	10.00	0.0020	0.0250	0.0230	11.00	0.0000	5.32	1.06	0.11	1.17	0.220	8.78
146+40	CB-3A	287.00	0.90	0.41	6.38	1.27	10.00	0.0500	0.0300	0.0300	11.00	0.0000	5.32	1.33	0.76	2.09	0.160	5.32

---

## APPENDIX F – STORM SEWER SYSTEM

---





# STORM SEWER SYSTEM

PID : 105523      Date : 10/16/2014      Project : FRA-70/71-12.68/14.86      Location : City of Columbus

Description : East of 1282R Bridge

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 722.19

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
	From To	(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'			
D204	D208	5033+16	0.54	0.49	10.00	5.32	5.09	2.6	2.5	15	29.9	0.0275	724.68	6.48	9.98	0.0020	725.47	728.21	2.74	2.28	13D
	begin	5032+86	0.54	0.49									723.86				725.41	727.38			0.015
D208	D207	5032+86	0.03	0.03	10.08	5.31	5.09	2.7	2.6	15	44.4	0.0070	723.86	3.96	5.03	0.0022	725.41	727.38	1.97	2.27	13D
		5032+86	0.57	0.51									723.55				725.31	727.98			0.015
D206	D207	128+65	0.74	0.67	10.00	5.32	5.09	3.5	3.4	15	16.4	0.0159	723.81	5.76	7.59	0.0037	725.37	729.06	3.69	4.00	CB 3
	begin	5032+86	1.31	1.18									723.55				725.31	727.98			0.015
D207	D209	5032+86	0.09	0.08	10.26	5.27	5.09	6.6	6.4	15	14.6	0.0123	723.55	5.41	6.68	0.0131	725.31	727.98	2.67	3.18	CB 3A
		128+35	1.40	1.26									723.37				725.12	728.30			0.015
D209	D210	128+35	0.03	0.03	10.31	5.26	5.09	6.8	6.6	15	60.0	0.0127	723.37	5.53	6.78	0.0137	725.12	728.30	3.18	3.68	CB 3
		128+35	1.43	1.29									722.61				724.30	729.27			0.015
								<b>Warning</b>													
D205	D210	128+65	0.55	0.50	10.00	5.32	5.09	2.6	2.5	15	30.2	0.0590	724.78	8.57	14.62	0.0020	725.14	730.03	4.89	4.00	CB 3
	begin	128+35	1.98	1.79									723.00				724.30	729.27			0.015
D210	D211	128+35	0.01	0.01	10.49	5.22	5.09	9.4	9.1	15	16.7	0.0204	722.61	7.64	8.60	0.0266	724.30	729.27	4.97	5.41	CB 3
		128+27	1.99	1.79									722.27				723.85	727.28			0.015
								<b>Warning</b>													
D211	EXCB	128+27	0.25	0.13	15.00	4.47	5.09	8.6	9.8	15	14.8	0.0054	722.27	7.00	4.43	0.0304	723.85	727.28	3.43	3.76	CB 8
	final	128+25	2.24	1.92									722.19				723.40	729.49			0.015
								<b>Warning</b>													



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 09/03/2013      **Project :** FRA-70-12.68

**Location :** City of Columbus

**Description :** Ramp C5 STA 5034+10, to EB70 STA 130+96 existing crossing

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 731.52

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
				(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
D212	D217	5036+50		0.87	0.62	15.00	4.47	4.97	2.8	3.1	15	120.0	0.0087	731.60	4.31	5.61	0.0030	732.29	734.85	2.56	2.00	CB 2-2B
	begin	130+96		0.87	0.62									730.56				731.74	735.06			0.015
D217	EXIN	130+96		0.00	0.00	15.46	4.41	4.97	2.7	3.1	15	73.0	0.0040	730.56	3.17	3.80	0.0030	731.74	735.06	3.32	3.25	MH 3
	final	130+95		0.87	0.62									730.27				731.52	736.37			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 03/23/2015      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** Exist. storm rerouting away for Franklin Main combined

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 0.00

JUNCTION From	STATION To	From To	ΔAREA	ΔCA	BEGIN TIME	RAINFALL		DISCHARGE		PIPE			F/L PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
			Σ AREA (acres)	Σ CA		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)									
D161	D165	177+25 begin	1.20 1.20	0.96 0.96	15.00	4.47	5.04	4.3	4.8	15	116.0	0.0100	727.00 725.84	5.03	6.02	0.0075	727.90 726.91	738.56 740.80	10.66	10.31	MH 3 0.015
D165	AB5	178+40 178+43	0.00 1.20	0.00 0.96	15.38	4.42	5.02	4.2	4.8	15	32.7	0.0101	725.25 724.92	5.04	6.05	0.0074	726.23 725.99	740.80 733.10	14.57	14.30	MH 3 0.015
AB5	D160	178+43 179+50	0.00 1.20	0.00 0.96	15.49	4.41	4.97	4.2	4.8	15	108.3	0.0100	724.92 723.84	5.01	6.02	0.0073	725.81 724.91	733.10 742.26	7.29	6.93	MH 3 0.015
D192	D160	179+50 begin	0.14 1.34	0.13 1.09	10.00	5.32	6.01	0.7	0.8	15	7.0	0.1114	736.53 735.75	7.20	20.10	0.0002	736.70 736.54	741.78 739.64	5.08	4.00	CB 6 0.015
D160	D332	179+51 180+07	0.00 1.34	0.00 1.09	15.85	4.36	4.90	4.7	5.3	15	159.0	0.0100	714.74 713.15	5.11	6.02	0.0090	715.71 714.24	739.64 728.32	23.93	23.65	MH 3 0.015
D332	BMP	180+07 final	0.00 1.34	0.00 1.09	16.37	4.29	4.89	4.7	5.3	15	15.0	0.0100	713.15 713.00	5.10	6.02	0.0090	714.23 714.09	728.32 730.93	14.09	13.92	MH 3 0.015



# STORM SEWER SYSTEM

PID : 105523 Date : 09/15/2014 Project : FRA-70/71-12.68/14.86

Location : City of Columbus

Description : EB 179+00 to 182+50

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 717.93

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
		(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
D45	D43	5081+92	0.28	0.25	10.00	5.32	5.98	1.3	1.5	15	37.0	0.0254	750.39	5.23	9.60	0.0007	750.74	755.65	4.91	4.01	13D
	begin	5081+83	0.28	0.25									749.45				750.32	756.24			0.015
D43	D44	5081+83	0.22	0.20	10.12	5.30	5.80	2.4	2.6	15	156.9	0.0037	749.45	3.00	3.66	0.0022	750.27	756.24	5.97	5.54	13D
		5083+24	0.50	0.45									748.87				749.82	761.48			0.015
D44	D190	5083+24	0.00	0.00	10.99	5.13	5.67	2.3	2.5	15	11.8	0.0101	736.64	4.36	6.07	0.0021	738.46	761.48	23.02	23.59	MH 2
		179+00	0.50	0.45									736.52				738.44	741.81			0.015
D190	D189	179+15	0.67	0.60	11.03	5.12	5.67	5.4	6.0	15	185.0	0.0084	736.77	4.73	5.51	0.0113	738.44	741.81	3.37	3.79	13D
		181+00	1.17	1.05									735.22				736.34	739.45			0.015
D189	D188	181+00	0.26	0.23	11.69	5.00	5.51	6.4	7.1	18	200.0	0.0100	734.97	5.59	9.79	0.0061	735.97	739.45	3.48	2.98	13D
		183+00	1.43	1.29									732.97				734.47	736.63			0.015
D188	DJ11	183+00	0.24	0.22	12.28	4.90	5.51	7.3	8.3	18	60.6	0.0066	732.97	4.77	7.96	0.0082	734.47	736.63	2.16	2.16	13D
		182+95	1.67	1.50									732.57				733.88	735.48			0.015
D191	DJ11	182+50	0.27	0.24	10.00	5.32	5.97	1.3	1.5	15	49.4	0.0180	732.16	4.58	8.09	0.0007	732.53	737.42	4.89	4.01	13D
	begin	182+95	1.94	1.74									731.27				732.13	735.48			0.015
DJ11	EX	182+95	0.00	0.00	12.49	4.86	5.38	8.5	9.4	96	161.7	0.0024	714.32	3.47	481.78	0.0000	718.30	735.48	17.18	13.16	MH 3
	final	182+48	1.94	1.74									713.93				718.30	742.42			0.013



# STORM SEWER SYSTEM

PID : 105523 Date : 09/12/2014 Project : FRA-70/71-12.68/14.86

Location : City of Columbus

Description : EB70 Sag at STA 187+81

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 718.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
		(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
D59	D58	188+10	0.12	0.11	10.00	5.32	5.95	0.6	0.6	15	54.0	0.0106	731.56	3.00	6.19	0.0001	731.84	735.96	4.12	3.15	CB 3A
	begin	187+57	0.12	0.11									730.99				731.77	735.85			0.015
D58	D57	187+57	0.08	0.07	10.30	5.26	5.77	1.0	1.1	15	90.0	0.0076	730.99	3.08	5.23	0.0004	731.38	735.85	4.47	3.61	CB 3
		186+68	0.20	0.18									730.31				731.19	736.01			0.015
D57	AB4	186+68	0.33	0.30	10.79	5.17	5.77	2.5	2.8	15	62.0	0.0037	730.31	3.03	3.67	0.0024	731.19	736.01	4.82	4.45	CB 3A
		186+09	0.53	0.48									730.08				731.04	733.58			0.015
AB4	D56	186+08	0.00	0.00	11.13	5.10	5.74	2.4	2.7	15	48.0	0.0108	730.08	4.54	6.27	0.0024	730.68	733.58	2.90	2.25	MH 3
		185+89	0.53	0.48									729.56				730.52	732.64			0.015
D155	D255	187+79	0.17	0.15	10.00	5.32	6.01	0.8	0.9	15	7.0	0.1714	724.02	8.84	24.93	0.0003	724.19	732.57	8.38	7.30	13D
	begin	187+81	0.70	0.63									722.82				723.63	725.07			0.015
D154	D254	187+05	0.20	0.18	10.00	5.32	6.01	1.0	1.1	15	7.0	0.1686	724.22	9.25	24.73	0.0004	724.40	728.40	4.00	2.93	13D
	begin	185+05	0.90	0.81									723.04				723.87	725.29			0.015
D255	D254	187+79	0.00	0.00	10.01	5.32	5.92	0.8	0.9	21	76.0	0.0089	722.32	3.02	13.97	0.0000	722.69	725.07	2.38	1.00	MH 3
		187+05	0.90	0.81									721.64				722.68	725.29			0.015
D254	D56	187+05	0.00	0.00	10.43	5.24	5.72	1.7	1.9	24	115.0	0.0050	721.39	3.01	14.85	0.0001	722.19	730.34	8.15	6.95	MH 3
		185+89	0.90	0.81									720.82				722.17	731.64			0.015





# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D56	D157	185+89 185+75	0.00 0.90	0.00 0.81	11.30	5.07	5.72	4.1	4.6	24	15.0	0.0047	720.82 720.75	3.75	14.41	0.0006	722.17 722.17	732.64 735.16	10.47	9.82	MH 3 0.015
D157	D302	185+75 184+76	0.48 1.38	0.43 1.24	11.37	5.06	5.72	6.3	7.1	24	10.0	0.0070	720.75 720.68	4.88	17.65	0.0013	722.17 722.15	735.16 735.29	12.99	12.41	13D 0.015
EX7	D300	540+62 begin 540+71	0.16 1.55	0.15 1.39	10.00	5.32	6.00	0.8	0.9	15	14.0	0.0357	736.06 735.56	5.04	11.38	0.0003	736.37 736.37	739.56 739.12	3.19	2.25	13C 0.015
D300	D301	184+00 185+09	0.00 1.55	0.00 1.39	10.05	5.31	5.94	0.8	0.9	15	88.0	0.0337	735.56 732.59	4.96	11.06	0.0002	735.81 733.40	739.12 737.17	3.31	2.31	MH 3 0.015
D301	D326	184+88 184+88	0.00 1.55	0.00 1.39	10.34	5.25	5.93	0.8	0.9	15	8.0	0.0100	732.17 732.09	3.22	6.02	0.0002	732.90 732.90	737.17 737.40	4.27	3.75	MH 3 0.015
D326	D302	184+88 185+75	0.00 1.55	0.00 1.39	10.38	5.24	5.83	0.8	0.9	15	87.4	0.0085	724.19 723.45	3.03	5.54	0.0002	724.54 724.26	737.40 735.29	12.86	11.96	MH 3 0.015
D162	EX2	187+51 begin 185+77	0.14 1.69	0.13 1.52	10.00	5.32	5.81	0.7	0.7	15	172.0	0.0100	728.78 727.06	3.07	6.02	0.0002	729.09 727.85	733.01 735.08	3.92	2.98	CB 6 0.015
D302	EX2	185+75 185+77	0.00 1.69	0.00 1.52	11.41	5.05	5.71	7.0	8.0	24	10.0	0.0050	720.68 720.63	4.43	14.91	0.0016	722.15 722.13	735.29 735.08	13.14	12.61	MH 3 0.015
EX2	EX	185+77 final 182+96	4.00 5.69	3.60 5.12	11.44	5.04	5.43	25.8	27.8	96	285.0	0.0007	714.52 714.32	3.13	259.91	0.0000	718.96 718.96	735.08 741.97	16.12	12.56	MH 3 0.013



# STORM SEWER SYSTEM

PID : 105523      Date : 07/05/2016      Project : FRA-70/71-12.68/14.86      Location : City of Columbus

Description : I70 EB shoulder reconstruction of MOT purposes

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	Δ AREA	Δ CA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D329	D330	2200+82	0.44	0.40	10.00	5.32	5.93	2.1	2.4	12	69.3	0.0048	726.06	3.09	2.29	0.0059	727.06	730.06	3.00	3.00	CB 3A
	begin	2201+51	0.44	0.40									725.73				726.56	729.92			0.015
D330	EX	2201+51	0.15	0.13	10.37	5.25	5.89	2.8	3.1	15	74.8	0.0216	725.48	6.07	8.86	0.0031	726.02	729.92	3.90	3.19	CB 3
		2202+25	0.59	0.53									723.86				724.84	728.10			0.015
D331	EX	2202+54	0.26	0.23	10.00	5.32	4.99	1.2	1.2	12	30.1	0.0249	724.67	5.15	5.24	0.0014	725.00	730.27	5.27	4.60	CB 3A
	begin	2202+25	0.85	0.76									723.92				724.69	728.10			0.015
EX	EX1	2202+25	1.00	0.90	15.00	4.47	4.99	7.4	8.3	24	138.0	0.0022	723.20	3.26	9.89	0.0018	724.69	728.10	3.41	2.90	CB 2-2B
	final	2202+24	1.85	1.66									722.90				724.41	725.04			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 07/03/2018      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** East of River Bridge to West of Short Street Bridge

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 700.00

JUNCTION From	STATION To	From To	ΔAREA Σ AREA (acres)	ΔCA Σ CA	BEGIN TIME (min.)	RAINFALL		DISCHARGE		PIPE			F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
						(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)									
D37	D36	175+15	0.04	0.04	10.00	5.32	5.90	0.2	0.2	15	106.0	0.0372	742.81	3.38	11.61	0.0000	742.93	747.91	4.98	3.85	I 3C
	begin	175+15	0.04	0.04									738.87				739.58	743.45			0.015
AB02	D36	175+59	0.50	0.45	10.00	5.32	4.48	2.4	2.0	15	61.0	0.0200	726.30	5.65	8.52	0.0013	726.73	731.63	4.90	4.08	MH 3
	begin	175+15	0.54	0.49									725.08				726.20	743.45			0.015
D36	D35	175+15	0.49	0.39	18.46	4.04	4.48	3.5	3.9	15	211.0	0.0046	725.08	3.53	4.10	0.0049	726.20	743.45	17.25	17.12	CB 8
		173+03	1.03	0.87									724.10				725.17	744.75			0.015
D53	D54	170+30	0.08	0.07	10.00	5.32	5.97	0.4	0.4	15	30.0	0.0147	739.12	3.03	7.29	0.0001	739.67	743.52	3.85	3.15	CB 3A
	begin	170+5991	1.11	0.95									738.68				739.67	743.28			0.015
D54	D55	170+30	0.61	0.55	10.17	5.29	5.97	3.3	3.7	15	7.0	0.0086	738.68	4.47	5.58	0.0044	739.67	743.28	3.61	3.35	CB 3
		170+60	1.72	1.50									738.62				739.63	744.15			0.015
D55	D261	170+55	0.00	0.00	10.19	5.28	5.93	3.3	3.7	15	54.0	0.0100	738.62	4.75	6.02	0.0044	739.36	744.15	4.79	4.28	MH 3
		6006+12	1.72	1.50									738.08				739.09	746.33			0.015
D261	D35	6005+84	0.00	0.00	10.38	5.25	5.82	3.3	3.6	15	200.3	0.0203	738.08	6.18	8.57	0.0042	738.67	746.33	7.66	7.00	MH
		173+00	1.72	1.50									734.02				735.03	744.72			0.015
D35	D33	173+00	0.26	0.19	19.46	3.93	4.48	6.6	7.5	21	48.0	0.0044	723.85	4.12	9.77	0.0030	725.17	744.72	19.55	19.12	CB 8
		5077+34	1.98	1.68									723.64				725.02	746.41			0.015



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D30	D31	5079+25	0.04	0.03	10.00	5.32	5.91	0.2	0.2	15	84.0	0.0296	743.64	3.00	10.37	0.0000	743.76	748.13	4.37	3.24	13D
	begin	5077+91	2.02	1.72									741.15				741.86	746.41			0.015
D31	D32	5078+49	0.29	0.26	10.47	5.23	5.85	1.5	1.7	15	58.0	0.0057	741.15	3.16	4.54	0.0009	741.76	746.41	4.65	4.01	13D
		5077+91	2.31	1.97									740.82				741.70	746.20			0.015
D32	D33	5077+91	0.10	0.09	10.77	5.17	5.79	2.0	2.2	15	56.0	0.0046	738.74	3.13	4.10	0.0015	739.49	746.20	6.71	6.21	13D
		5077+34	2.40	2.06									738.48				739.40	746.41			0.015
D33	D259	5077+34	0.37	0.33	19.65	3.91	4.47	9.3	10.7	21	34.0	0.0115	723.64	6.48	15.82	0.0060	724.94	746.41	21.47	21.02	13D
		5077+00	2.77	2.39									723.25				724.73	744.42			0.015
D259	D38	5077+00	0.00	0.00	19.74	3.90	4.46	9.3	10.7	21	18.7	0.0091	709.30	5.91	14.10	0.0060	710.73	744.42	33.69	33.37	MH 3
		5077+00	2.77	2.39									709.13				710.61	713.95			0.015
D159	D38	5078+00	0.44	0.29	10.00	5.32	5.89	1.5	1.7	12	100.0	0.0050	709.34	3.01	2.35	0.0030	710.00	710.84	0.84	0.50	CB 2-2B
	begin	5077+00	3.21	2.68									708.84				709.62	708.55			0.015
D38	D42	5077+00	0.00	0.00	19.79	3.89	3.81	10.4	10.2	27	199.0	0.0020	707.26	3.37	12.78	0.0014	709.40	713.95	4.55	4.44	MH 3
		5075+00	3.21	2.68									706.87				709.11	713.98			0.015
EX1	EX4	5075+40	0.91	0.46	15.00	4.47	4.89	2.0	2.2	12	214.6	0.0014	710.97	2.59	1.24	0.0052	712.60	714.12	1.52	2.15	CB 2-2B
	begin	5075+10	4.12	3.13									710.67				711.49	713.88			0.015
																					<b>Warning</b>
EX4	D42	5075+10	0.00	0.00	16.38	4.29	4.89	2.0	2.2	15	10.5	0.0048	710.42	3.15	4.15	0.0016	711.31	713.88	2.57	2.21	MH 1
		5075+00	4.12	3.13									710.37				711.29	714.31			0.015
D42	D41	5075+00	0.00	0.00	20.78	3.79	3.81	11.9	11.9	27	368.6	0.0020	706.87	3.44	12.91	0.0020	709.11	714.31	5.20	5.19	MH 3
		5071+31	4.12	3.13									706.13				708.38	711.50			0.015
D100	D41	5071+15	0.38	0.34	10.00	5.32	3.81	1.8	1.3	15	81.4	0.4289	742.15	15.49	39.44	0.0005	742.31	747.40	5.09	4.00	CB 3A
	begin	5071+31	4.50	3.48									707.25				708.38	711.50			0.015



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D41	D101	5071+31 5068+00	0.00 4.50	0.00 3.48	22.56	3.62	3.81	12.6	13.2	27	322.0	0.0020	706.13 705.49	3.41	12.87	0.0024	708.38 707.58	711.50 715.32	3.12	3.12	MH 3 0.015
D68	D67	5068+90 begin	0.17 4.67	0.13 3.61	15.00	4.47	5.03	0.6	0.7	15	88.0	0.0114	710.00 709.00	3.10	6.42	0.0001	710.28 709.78	712.53 712.87	2.25	1.28	CB 2-2B 0.015
D67	D101	5068+00 5068+00	0.42 5.09	0.33 3.94	15.47	4.41	5.02	2.0	2.3	15	8.0	0.0200	709.00 708.84	5.40	8.52	0.0017	709.78 709.77	712.87 715.32	3.09	2.62	CB 2-2B 0.015
D101	D111	5068+00 5067+65	0.00 5.09	0.00 3.94	24.14	3.49	3.81	13.7	15.0	27	130.4	0.0060	705.49 704.71	5.58	22.33	0.0031	707.58 707.17	715.32 729.50	7.74	7.58	MH 3 0.015
D51	D52	166+12 begin	0.59 5.68	0.53 4.47	10.00	5.32	6.00	2.8	3.2	15	11.0	0.0100	734.50 734.39	4.58	6.02	0.0032	735.41 735.37	739.65 738.44	4.24	3.90	CB 3 0.015
D52	D111	166+49 163+01	0.00 5.68	0.00 4.47	10.04	5.31	5.83	2.8	3.1	15	302.0	0.0236	734.39 727.25	6.28	9.26	0.0031	734.91 728.23	738.44 730.50	3.53	2.80	CB 3 0.015
EX	AB3	163+00 begin	0.26 5.94	0.24 4.70	10.00	5.32	5.97	1.3	1.4	15	74.4	0.0500	726.54 722.82	6.53	13.47	0.0006	726.83 723.68	730.88 726.96	4.05	3.09	13C 0.015
AB3	D111	162+96 163+01	0.00 5.94	0.00 4.70	10.19	5.28	5.95	1.3	1.4	15	34.0	0.0385	722.49 721.18	5.94	11.82	0.0006	722.79 722.04	727.29 730.50	4.50	3.55	MH 3 0.015
D111	D262	163+00 161+10	0.00 5.94	0.00 4.70	24.53	3.46	3.81	16.3	17.9	27	188.0	0.0055	704.71 703.68	5.57	21.37	0.0045	707.17 706.33	730.50 727.25	23.33	23.54	CB 8 0.015
EX3	AB27	160+87 begin	0.30 6.24	0.27 4.97	10.00	5.32	5.96	1.4	1.6	15	80.0	0.0323	722.39 719.81	5.79	10.82	0.0008	722.73 720.69	726.39 723.02	3.66	2.75	13C 0.015
AB27	D50	161+12 161+01	0.00 6.24	0.00 4.97	10.23	5.28	5.96	1.4	1.6	15	16.4	0.2502	719.81 715.72	11.91	30.12	0.0008	720.01 716.59	723.02 721.03	3.01	1.96	MH 3 0.015



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D50	D262	161+01 5065+80	2.24 8.48	1.80 6.77	18.51	4.03	4.61	8.3	9.5	15	33.0	0.0800	713.30 710.66	13.07	17.03	0.0289	714.00 711.87	721.03 727.25	7.03	6.48	CB 8 0.015
D262	D110	161+09 159+64	0.00 8.48	0.00 6.77	25.09	3.41	3.81	23.1	25.8	30	139.0	0.0045	703.43 702.80	5.55	25.74	0.0053	706.33 705.60	727.25 726.43	20.92	21.32	CB 8 0.015
D224	D66	4158+16 begin 4157+98	0.03 8.52	0.03 6.80	10.00	5.32	5.95	0.2	0.2	15	18.0	0.0300	721.12 720.58	3.00	10.43	0.0000	721.56 721.56	725.39 725.48	3.83	3.02	CB 3A 0.015
D66	D113	157+98 5063+25	0.92 9.44	0.83 7.63	10.10	5.30	5.95	4.6	5.1	15	59.0	0.0100	720.58 719.99	5.08	6.02	0.0083	721.56 721.07	725.48 725.28	3.92	3.65	CB 3A 0.015
D110	D113	159+69 158+46	0.00 9.44	0.00 7.63	25.50	3.38	3.81	22.9	25.8	30	120.0	0.0050	702.80 702.20	5.80	27.04	0.0053	705.60 704.97	726.46 725.28	20.86	21.16	CB 8 0.015
D114	D104	5061+97 begin 5062+60	0.39 9.83	0.35 7.98	10.00	5.32	5.91	1.9	2.1	15	84.0	0.0043	725.03 724.67	3.00	3.94	0.0014	725.70 725.58	730.28 730.90	4.58	4.00	CB 3A 0.015
D104	D113	5062+60 157+79	0.05 9.88	0.05 8.03	10.47	5.23	5.88	2.1	2.3	15	67.0	0.0645	724.67 720.35	8.24	15.29	0.0017	725.01 721.28	730.90 725.28	5.89	4.98	CB 3A 0.015
D113	D108	5063+25 5061+00	0.00 9.88	0.00 8.03	25.85	3.35	3.81	27.9	31.7	30	231.0	0.0055	702.20 700.93	6.07	28.35	0.0079	704.97 703.14	725.28 705.75	20.31	20.58	CB 8 0.015
D69	D70	5064+56 begin 5063+93	0.21 10.09	0.19 8.22	10.00	5.32	5.91	1.0	1.1	15	63.0	0.0032	724.45 724.25	2.29	3.39	0.0004	725.11 725.09	729.05 728.85	3.94	3.35	I 3D 0.015
D70	D113	5063+93 5063+25	0.10 10.19	0.09 8.31	10.46	5.23	5.85	1.5	1.7	15	100.0	0.0225	724.25 722.00	5.15	9.03	0.0009	724.63 722.88	728.85 725.28	4.22	3.35	I 3D 0.015
D108	OUT	5061+00 final 5060+60	0.00 10.19	0.00 8.31	26.48	3.30	3.80	27.5	31.6	30	41.0	0.0080	700.93 700.60	7.30	34.31	0.0079	703.13 702.81	705.75 703.10	2.62	2.32	MH 3 0.015



# STORM SEWER SYSTEM

PID : 105523 Date : 05/06/2018 Project : FRA-70-12.68

Location : City of Columbus

Description :NB-71 STA 254+16 to Gatewell #6

Designer : TMT

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 696.30

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE				PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
	From To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D333	D220	0.39	0.35	10.00	5.32	6.01	1.9	2.1	15	3.8	0.0053	714.04	3.25	4.40	0.0014	714.94	719.31	4.37	4.02	CB 6		
	begin	0.39	0.35									714.02				714.93	717.01				0.015	
D220	D222	0.00	0.00	10.02	5.32	5.73	1.9	2.0	15	259.2	0.0050	714.02	3.18	4.27	0.0013	714.65	717.01	2.36	1.74	MH 3		
	256+60	0.39	0.35									712.72				713.63	715.32				0.015	
D222	D223	0.00	0.00	17.04	4.21	4.69	1.5	1.6	15	183.1	0.0078	712.72	3.50	5.30	0.0009	713.22	715.32	2.10	1.35	MH 3		
	5004+57	0.39	0.35									711.30				712.18	713.95				0.015	
EXMH	D223	0.50	0.45	10.00	5.32	4.28	2.4	1.9	15	117.0	0.0035	706.21	2.94	3.57	0.0012	708.12	718.20	10.08	10.74	MH 3		
	begin	0.89	0.80									705.80				707.98	713.95				0.015	
D223	EXGT	0.00	0.00	21.25	3.75	4.28	10.7	12.3	18	72.0	0.0044	705.58	6.08	6.53	0.0181	707.98	713.95	5.97	6.87	MH 3		
	final	0.89	0.80									705.26				706.67	706.76				0.015	
									<b>Warning</b>													
D234	D225	1.01	0.79	19.22	3.95	4.40	3.1	3.5	15	348.1	0.0138	713.94	5.29	7.09	0.0038	714.58	719.19	4.61	4.00	CB 8		
	begin	1.90	1.59									709.12				710.12	713.78				0.015	
D225	D223	0.81	0.68	20.32	3.84	4.30	5.6	6.3	21	191.3	0.0030	708.03	3.42	8.06	0.0021	709.26	713.78	4.52	4.00	CB 2-2B		
	5004+58	2.71	2.26									707.46				708.80	712.90				0.015	
D334	D223	0.67	0.60	10.00	5.32	6.00	3.2	3.6	15	9.4	0.0149	709.69	5.48	7.34	0.0042	710.60	716.22	5.62	5.28	CB 6		
	begin	3.38	2.87									709.55				710.56	712.90				0.015	



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 09/11/2013      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** NB71 STA 268+50 to Gatewell #5

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 698.83

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
	From To	(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D235	D229	0.85	0.67	17.61	4.14	4.72	2.8	3.2	15	11.0	0.0200	716.93	5.89	8.52	0.0032	717.73	721.99	4.26	3.81	CB 8
	begin	0.85	0.67									716.71				717.69	722.00			0.015
D232	D229	0.52	0.40	18.62	4.02	4.41	1.6	1.8	15	293.0	0.0050	711.48	3.06	4.25	0.0010	712.07	716.73	4.66	4.00	CB 8
	begin	1.37	1.07									710.02				710.91	722.00			0.015
D230	D236	3.08	2.13	19.32	3.94	4.13	8.4	8.8	21	249.0	0.0101	701.12	6.02	14.86	0.0041	702.13	706.87	4.74	4.00	CB 8
	begin	4.45	3.20									698.60				700.88	701.92			0.015
D236	D64	0.16	0.11	20.01	3.87	4.13	8.7	9.2	24	95.0	0.0051	698.35	4.68	14.99	0.0022	700.88	701.92	1.04	1.57	CB 2-2B
		4.61	3.31									697.87				700.67	707.09			0.015
D64	D237	0.00	0.00	20.35	3.83	4.13	9.6	10.3	24	99.0	0.0051	697.87	4.79	14.99	0.0028	700.67	707.09	6.42	7.22	MH 3
		4.61	3.31									697.37				700.39	708.54			0.015
D237	D229	0.00	0.00	21.90	3.68	4.13	12.9	14.5	24	118.0	0.0074	697.37	5.91	18.11	0.0054	700.39	708.54	8.15	9.17	MH 3
		4.61	3.31									696.50				699.75	722.00			0.015
EX	D64	0.42	0.26	10.00	5.32	4.13	1.4	1.1	15	11.0	0.0045	697.92	2.84	4.06	0.0004	700.67	706.89	6.22	7.72	CB 8
	begin	5.03	3.57									697.87				700.67	707.09			0.015
EX	D237	0.50	0.45	10.00	5.32	4.13	2.4	1.9	15	64.0	0.0844	703.54	9.48	17.49	0.0011	703.83	707.91	4.08	3.12	12A
	begin	5.53	4.02									698.14				700.39	706.87			0.015





# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	INTENSITY (25 yrs.)	(cfs.) (10 yrs.)	(cfs.) (25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D239	D237	264+00 begin 264+59	0.80 6.33	0.56 4.58	21.65	3.71	4.23	2.1	2.4	15	62.0	0.0100	700.18 699.56	4.21	6.02	0.0018	700.75 700.49	705.43 708.54	4.68	4.00	CB 8 0.015
EX	D229	262+65 begin 263+95	7.60 13.93	4.69 9.26	15.12	4.46	4.13	20.9	19.3	36	318.0	0.0014	696.98 696.55	3.43	22.87	0.0011	700.11 699.75	704.94 722.00	4.83	4.96	CB 8 0.015
D229	EXGT	263+94 final 5009+78	0.00 13.93	0.00 9.26	22.23	3.65	4.13	33.8	38.2	36	211.0	0.0012	696.09 695.83	4.79	21.83	0.0044	699.75 698.83	722.00 698.83	22.25	22.91	MH 3 0.015

**Warning**



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 07/01/2018      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** NB71 STA 266+95 to EB STA 152+65

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 718.20

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MINUS	MANNING'S
				(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
D63	D62	152+65		0.67	0.60	10.00	5.32	5.85	3.2	3.5	15	62.0	0.0045	719.79	3.44	4.05	0.0039	721.00	724.19	3.19	3.15	13D
	begin	271+89		0.67	0.60									719.51				720.76	723.98			0.015
D62	D61	271+27		0.18	0.15	10.30	5.26	5.85	4.0	4.4	15	100.0	0.0045	719.51	3.46	4.04	0.0061	720.76	723.98	3.22	3.22	13D
		270+25		0.85	0.75									719.06				720.11	724.17			0.015
D61	HW61	270+25		0.57	0.43	10.78	5.17	5.76	6.1	6.8	18	113.0	0.0054	718.81	4.29	7.20	0.0055	720.08	724.17	4.09	3.86	CB 3A
	final	269+50		1.42	1.18									718.20				719.45	719.70			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 04/29/2018      **Project :** FRA-70-12.68/14.86

**Location :** City of Columbus

**Description :** Ramp A5 5013+50 left Paved Gutter

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
				(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D263	HW26	5013+70		0.17	0.14	15.53	4.40	4.86	0.6	0.7	15	192.0	0.0087	726.51	2.82	5.62	0.0001	726.81	729.01	2.20	1.25	CB 7
	begin	5011+98		0.17	0.14									724.84				725.62	726.09			0.015



# STORM SEWER SYSTEM

PID : 105523      Date : 03/24/2015      Project : FRA-70-12.68

Location : City of Columbus

Description : Ramp A 5015+00 right Paved Gutter

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
	From To	(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
D264	D266	5014+85	0.04	0.03	15.26	4.44	5.03	0.1	0.2	15	32.8	0.0399	723.78	3.09	12.04	0.0000	723.88	727.78	3.90	2.75	CB 7
	begin	5014+50	0.04	0.03									722.47				723.17	732.42			0.015
D265	D266	5014+59	0.08	0.08	10.00	5.32	5.99	0.4	0.5	15	49.3	0.4247	749.36	9.87	39.25	0.0001	749.46	754.61	5.15	4.00	I 3D
	begin	5014+50	0.13	0.11									728.42				729.18	732.42			0.015
D266	HW26	5014+50	0.00	0.00	15.44	4.41	4.97	0.5	0.5	15	51.1	0.0039	721.85	1.98	3.77	0.0001	722.42	732.42	10.00	9.32	MH 3
	final	5014+00	0.13	0.11									721.65				722.42	0.00			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 09/03/2014      **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ramp C3 STA 3005+50 to STA 3008+41

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 705.35

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
D213	D214	3005+50	0.48	0.36	15.79	4.37	4.85	1.6	1.8	15	157.6	0.0042	727.79	2.85	3.90	0.0010	728.41	731.26	2.85	2.22	CB 2-2B
	begin	3007+00	0.48	0.36									727.13				728.02	737.65			0.015
D214	D215	3007+00	0.00	0.00	16.71	4.25	4.78	1.5	1.7	15	126.3	0.0108	727.31	4.00	6.25	0.0010	727.78	737.65	9.87	9.09	MH 3
		3008+40	0.48	0.36									725.95				726.84	733.84			0.015
D215	HW50	3008+40	0.00	0.00	17.24	4.18	4.77	1.5	1.7	15	71.0	0.3077	725.95	13.10	33.41	0.0010	726.15	733.84	7.69	6.64	MH 3
	final	3008+41	0.48	0.36									704.10				705.35	705.35			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 09/03/2013      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** Ramp C5 STA 5031+36.75 Right

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 685.25

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
				(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
D201	DJ6	5030+00		0.99	0.82	15.00	4.47	5.06	3.7	4.1	15	47.0	0.0047	699.00	3.55	4.12	0.0055	700.25	701.75	1.50	1.50	CB 2-2B
	begin	5030+42		0.99	0.82									698.78				699.82	709.45			0.015
D202	DJ6	5031+07		0.37	0.33	10.00	5.32	5.99	1.8	2.0	15	68.4	0.1925	717.76	11.65	26.42	0.0013	718.00	722.75	4.75	3.74	CB 3
	begin	5030+42		1.36	1.15									704.59				705.50	709.45			0.015
DJ6	EX50	5031+36		0.00	0.00	15.22	4.44	4.87	5.1	5.6	48	252.3	0.0029	686.12	3.13	71.53	0.0000	687.75	709.84	22.09	19.72	MH 3
	final	5030+08		1.36	1.15									685.40				687.74	705.49			0.015



# STORM SEWER SYSTEM

**PID :** 105523    **Date :** 07/09/2018    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Ramp C5 STA 5041+42 Left

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 685.25

JUNCTION		STATION		Δ AREA	Δ CA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
				(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
D216	HW21	5041+42		0.34	0.31	10.00	5.32	5.98	1.6	1.8	15	28.0	0.0096	743.52	3.91	5.91	0.0011	744.17	748.77	4.60	4.00	CB 3A
	begin	5041+42		0.34	0.31									743.25				744.14	744.50			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 07/10/2018      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** Fulton & Front system running to 96"

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 25

**Hydraulic Gradient Frequency (yrs.) :** 10

**Minimum Pipe Size :** 12.00

**Tailwater Elevation (ft.):** 718.32

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE				PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D313	D314	0.21	0.19	10.00	6.01	5.27	1.1	1.0	12	95.0	0.0351	764.11	5.74	6.22	0.0010	764.39	768.36	3.97	3.25		CB 6	
	begin	0.21	0.19									760.78				761.49	765.15				0.015	
D314	D315	0.19	0.17	10.28	5.95	5.22	2.1	1.9	12	87.0	0.0351	760.78	6.82	6.22	0.0037	761.17	765.15	3.98	3.37		CB 6	
	21+13	0.40	0.36									757.73				758.52	762.19				0.015	
D315	D317	0.18	0.16	10.49	5.91	5.19	3.1	2.7	12	71.0	0.0189	755.93	5.89	4.56	0.0077	756.51	762.19	5.68	5.26		CB 3A	
	20+42	0.58	0.52									754.59				755.44	759.58				0.015	
D317	D318	0.15	0.14	10.69	5.86	5.15	3.9	3.4	12	62.0	0.0190	754.59	6.14	4.58	0.0120	755.26	759.58	4.32	3.99		CB 3A	
	19+92	0.73	0.66									753.41				754.30	758.23				0.015	
D318	D319	0.00	0.00	10.86	5.83	5.13	3.8	3.4	12	66.0	0.0555	753.41	9.36	7.82	0.0119	753.89	758.23	4.34	3.82		MH 3	
	19+26	0.73	0.66									749.75				750.64	756.82				0.015	
D319	D320	0.00	0.00	10.98	5.81	5.12	3.8	3.4	12	17.0	0.0229	746.50	6.64	5.03	0.0119	747.20	756.82	9.62	9.32		MH 3	
	151+14	0.73	0.66									746.11				747.00	756.70				0.015	
D322	D320	0.21	0.19	10.00	6.01	5.30	1.1	1.0	12	34.0	0.0306	751.40	5.44	5.81	0.0011	751.69	756.97	5.28	4.57		CB 6	
	begin	0.94	0.85									750.36				751.07	756.70				0.015	
D320	D321	0.09	0.08	11.02	5.80	5.10	5.4	4.7	15	56.0	0.0250	744.40	7.57	9.52	0.0071	745.05	756.70	11.65	11.05		CB 3A	
	151+23	1.03	0.93									743.00				744.07	757.51				0.015	





# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (25 yrs.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D323	D321	151+50 begin	0.80 1.83	0.72 1.65	10.00	6.01	5.30	4.3	3.8	12	37.0	0.0197	750.36 749.63	6.30	4.67	0.0153	751.11 750.55	757.34 757.51	6.23	5.98	CB 3A 0.015
D321	D268	151+23 185+72	0.00 1.83	0.00 1.65	11.14	5.77	5.06	9.5	8.3	18	84.0	0.0131	742.75 741.65	6.68	11.21	0.0084	743.76 742.96	757.51 755.43	13.75	13.26	MH 3 0.015
D268	D258	185+72 184+22	0.00 1.83	0.00 1.65	11.35	5.73	5.01	10.9	9.6	18	150.0	0.0241	741.65 738.04	8.83	15.19	0.0110	742.55 739.39	755.43 743.54	12.88	12.28	MH 3 0.015
D299	D268	5090+75 begin	0.29 2.12	0.26 1.91	10.00	6.01	5.29	1.6	1.4	15	54.0	0.0283	753.71 752.18	5.69	10.14	0.0006	754.03 753.04	757.96 755.43	3.93	3.00	CB 6 0.015
D258	D257	184+22 183+16	0.28 2.40	0.17 2.08	15.00	5.10	4.45	10.6	9.2	18	107.0	0.0354	738.04 734.25	10.19	18.43	0.0103	738.82 735.59	743.54 741.25	4.72	4.00	CB 2-2B 0.015
D327	D257	183+16 begin	0.20 2.60	0.18 2.26	10.00	6.01	5.32	1.1	1.0	15	6.0	0.0083	737.25 737.20	3.31	5.50	0.0003	738.02 738.02	741.00 741.25	2.98	2.50	CB 3A 0.015
D257	DJ11	183+16 final	5.43 8.03	4.53 6.79	16.60	4.86	4.22	33.0	28.6	36	126.0	0.0056	724.61 723.90	6.76	46.68	0.0025	726.58 726.27	741.25 741.97	14.67	13.64	CB 2-3 0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 02/27/2015      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** Livingston Ave 206+10

**Designer :** AJE

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 12.00

**Tailwater Elevation (ft.):** 743.81

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D340	EX	206+10	0.31	0.28	10.00	5.32	6.00	1.5	1.7	12	28.9	0.0643	753.80	7.64	8.42	0.0029	754.11	757.29	3.18	2.49	CB 3A
	begin	205+82	0.31	0.28									751.94				752.71	756.32			0.015



# STORM SEWER SYSTEM

PID : 105523 Date : 03/02/2015 Project : FRA-70/71-12.68/14.86

Location : City of Columbus

Description : Livingston 204+42 to Front (South)

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 0.00

Tailwater Elevation (ft.): 737.46

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MINUS	MANNING'S
				(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN		'n'
D308	D307	203+87		0.03	0.03	10.00	5.32	5.96	0.1	0.2	12	25.4	0.0162	749.05	2.40	4.22	0.0000	749.32	753.05	3.73	3.00	CB 6
	begin	204+13		0.03	0.03									748.64				749.32	753.14			0.015
D307	D305	204+13		0.24	0.22	10.18	5.29	5.96	1.3	1.4	12	10.6	0.0094	748.64	3.66	3.23	0.0022	749.32	753.14	3.82	3.50	CB 3A
		204+10		0.27	0.24									748.54				749.29	753.55			0.015
D305	D312	204+10		0.00	0.00	10.22	5.28	5.92	2.2	2.5	12	77.5	0.0237	748.54	5.97	5.12	0.0066	749.05	753.55	4.50	4.01	MH 3
		148+22		0.27	0.24									746.70				747.54	753.64			0.015
D312	EX	148+42		0.00	0.00	10.44	5.23	5.81	2.8	3.1	15	226.7	0.0424	746.45	7.74	12.41	0.0031	746.89	753.33	6.44	5.63	MH 3
	final	146+40		0.27	0.24									736.83				737.81	742.22			0.015
CAPE	D305	148+90		0.20	0.18	10.00	5.32	5.99	1.0	1.1	6	48.6	0.0745	752.66	7.34	1.43	0.0490	753.00	754.83	1.83	1.67	CB 7
	begin	204+12		0.47	0.42									749.04				749.53	753.55			0.015
CAP	D312	149+14		0.13	0.11	10.00	5.32	5.96	0.6	0.7	6	92.0	0.0705	753.69	6.50	1.39	0.0193	753.95	755.86	1.91	1.67	CB 7
	begin	148+68		0.60	0.54									747.20				747.66	753.33			0.015



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 01/14/2019      **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** Livingston onto Ludlow

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 12.00

**Tailwater Elevation (ft.):** 737.46

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D310	D309	201+55 begin 201+12	0.19 0.19	0.17 0.17	10.00	5.32	5.97	0.9	1.0	12	43.0	0.0195	745.98 745.14	4.36	4.64	0.0011	746.31 745.85	749.48 748.64	3.17	2.50	CB 3A 0.015
D309	D306	201+12 200+71	0.05 0.24	0.05 0.22	10.16	5.29	5.94	1.1	1.3	12	42.0	0.0200	745.14 744.30	4.69	4.70	0.0017	745.51 745.04	748.64 748.18	3.13	2.50	CB 3A 0.015
D311	D306	200+22 begin 200+71	0.08 0.32	0.07 0.29	10.00	5.32	5.93	0.4	0.4	12	50.4	0.0204	743.58 742.55	3.47	4.75	0.0002	743.79 743.31	747.28 748.18	3.49	2.70	CB 3A 0.015
D306	EX	200+61 final 200+81	0.00 0.32	0.00 0.29	10.31	5.26	5.93	1.5	1.7	12	8.0	0.0050	742.55 742.51	3.00	2.35	0.0031	743.31 743.29	748.49 746.42	5.18	4.94	MH 3 0.015

---

## APPENDIX G – MOT DRAINAGE CALCULATIONS

---

FRA-70-11.28

PID 77372

City of Columbus, Franklin Co.

PHASE 1A MOT Drainage Calculations

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co. PID 77372  
 Location: Sta. 182+00 to 183+00 Lt PhIA  
 Slotted Drain Rt. Temporary Pavement

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.87	%	C
<b>Drainage Area =</b>	0.13 acres	0%	0.25 Field
		15%	0.70 Maintained Grass
		85%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.43** cfs

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft.in)	1.00	12		Sta. 182+00 to 183+00	Lt PhIA	
Slope	0.01600	ft/ft		Slotted Drain Rt. Temporary Pavement		
Manning's N	0.015					
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	3.91	cfs	1751.337	gpm		
V	4.97	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.02	1.28
0.10	1.29	0.04	0.64	0.60	0.08	1.99
0.15	1.59	0.07	0.80	0.71	0.19	2.57
0.20	1.85	0.11	0.93	0.80	0.34	3.06
0.25	2.09	0.15	1.05	0.87	0.54	3.48
0.30	2.32	0.20	1.16	0.92	0.76	3.86
0.35	2.53	0.24	1.27	0.95	1.03	4.19
0.40	2.74	0.29	1.37	0.98	1.32	4.49
0.45	2.94	0.34	1.47	0.99	1.63	4.75
0.50	3.14	0.39	1.57	1.00	1.95	4.97
0.55	3.34	0.44	1.67	0.99	2.29	5.17
0.60	3.54	0.49	1.77	0.98	2.62	5.33
0.65	3.75	0.54	1.88	0.95	2.95	5.47
0.70	3.96	0.59	1.98	0.92	3.27	5.57
0.75	4.19	0.63	2.09	0.87	3.56	5.64
0.80	4.43	0.67	2.21	0.80	3.82	5.67
0.85	4.69	0.71	2.35	0.71	4.02	5.66
0.90	5.00	0.74	2.50	0.60	4.16	5.59
0.95	5.38	0.77	2.69	0.44	4.20	5.45
1.00	6.28	0.79	3.14	0.00	3.91	4.97
						Full



## Worksheet for Trapezoidal Channel - Ph1A Sta. 183+00 to 186+00

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00400	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	1.00	ft
Discharge	1.30	ft <sup>3</sup> /s

### Results

Normal Depth	0.51	ft
Flow Area	1.04	ft <sup>2</sup>
Wetted Perimeter	3.30	ft
Hydraulic Radius	0.32	ft
Top Width	3.06	ft
Critical Depth	0.30	ft
Critical Slope	0.03213	ft/ft
Velocity	1.25	ft/s
Velocity Head	0.02	ft
Specific Energy	0.54	ft
Froude Number	0.38	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.51	ft
Critical Depth	0.30	ft
Channel Slope	0.00400	ft/ft

---

## Worksheet for Trapezoidal Channel - Ph1A Sta. 183+00 to 186+00

---

### GVF Output Data

Critical Slope

0.03213 ft/ft

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Sta. 183+00 to 186+00 Lt PhIA  
Right FB Ditch Temporary Pavement MOT drainage

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

**Runoff Coeff. =** 0.77  
**Drainage Area =** 0.56 acres

% C  
0% 0.25 Field  
64% 0.70 Maintained Grass  
36% 0.90 Pavement

Tc = 15 min.

R I :	2 years		
I (in/hr)	3.00		

**Q2 = 1.30** cfs

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft.in)	1.00	12				
Slope	0.00080	ft/ft			Sta. 184+50 to 186+00 Lt PhIA	
Manning's N	0.015				Slotted Drain	
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	0.87	cfs	391.6108	gpm		
V	1.11	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.00	0.29
0.10	1.29	0.04	0.64	0.60	0.02	0.45
0.15	1.59	0.07	0.80	0.71	0.04	0.57
0.20	1.85	0.11	0.93	0.80	0.08	0.68
0.25	2.09	0.15	1.05	0.87	0.12	0.78
0.30	2.32	0.20	1.16	0.92	0.17	0.86
0.35	2.53	0.24	1.27	0.95	0.23	0.94
0.40	2.74	0.29	1.37	0.98	0.29	1.00
0.45	2.94	0.34	1.47	0.99	0.36	1.06
0.50	3.14	0.39	1.57	1.00	0.44	1.11
0.55	3.34	0.44	1.67	0.99	0.51	1.16
0.60	3.54	0.49	1.77	0.98	0.59	1.19
0.65	3.75	0.54	1.88	0.95	0.66	1.22
0.70	3.96	0.59	1.98	0.92	0.73	1.25
0.75	4.19	0.63	2.09	0.87	0.80	1.26
0.80	4.43	0.67	2.21	0.80	0.85	1.27
0.85	4.69	0.71	2.35	0.71	0.90	1.26
0.90	5.00	0.74	2.50	0.60	0.93	1.25
0.95	5.38	0.77	2.69	0.44	0.94	1.22
1.00	6.28	0.79	3.14	0.00	0.87	1.11 Full

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Sta. 184+50 to 186+00 Lt PhIA  
 Slotted Drain to CB-6 Lt EOP Temp Pavement

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.90	%	C
<b>Drainage Area =</b>	0.15 acres	0%	0.25 Field
		0%	0.50 Maintained Grass
		100%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.51 cfs**

Note: Area includes additional Pavment from Phase 3

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft.in)	1.00	12				
Slope	0.00100	ft/ft			Sta. 186+00 to 187+75 Temp PhIA	
Manning's N	0.015				Slotted Drain Lt Temporary Pavement	
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	0.98	cfs	437.8342	gpm		
V	1.24	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.00	0.32
0.10	1.29	0.04	0.64	0.60	0.02	0.50
0.15	1.59	0.07	0.80	0.71	0.05	0.64
0.20	1.85	0.11	0.93	0.80	0.09	0.76
0.25	2.09	0.15	1.05	0.87	0.13	0.87
0.30	2.32	0.20	1.16	0.92	0.19	0.96
0.35	2.53	0.24	1.27	0.95	0.26	1.05
0.40	2.74	0.29	1.37	0.98	0.33	1.12
0.45	2.94	0.34	1.47	0.99	0.41	1.19
0.50	3.14	0.39	1.57	1.00	0.49	1.24
0.55	3.34	0.44	1.67	0.99	0.57	1.29
0.60	3.54	0.49	1.77	0.98	0.66	1.33
0.65	3.75	0.54	1.88	0.95	0.74	1.37
0.70	3.96	0.59	1.98	0.92	0.82	1.39
0.75	4.19	0.63	2.09	0.87	0.89	1.41
0.80	4.43	0.67	2.21	0.80	0.95	1.42
0.85	4.69	0.71	2.35	0.71	1.01	1.41
0.90	5.00	0.74	2.50	0.60	1.04	1.40
0.95	5.38	0.77	2.69	0.44	1.05	1.36
1.00	6.28	0.79	3.14	0.00	0.98	1.24 Full

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co. PID 77372  
 Location: Sta. 186+00 to 187+75 Temp PhIA  
 Slotted Drain at Lt. of Temporary Pavement

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.90		%	C
<b>Drainage Area =</b>	0.29	acres	0%	0.25 Field
			0%	0.35 Maintained Grass
			100%	0.90 Pavement

Note: drainage area includes temporary pavement from Phase 3

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.99** cfs

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Sta. 184+50 to 187+75 Lt PhIA  
Slotted Drain adjacent to existing median barrier

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.88	%	C
<b>Drainage Area =</b>	0.40 acres	0%	0.25 Field
		10%	0.70 Maintained Grass
		90%	0.90 Pavement

Tc = 10 min.

RI:	2 years		
I (in/hr)	3.80		

**Q2 = 1.34 cfs**



<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft..in)	1.00	12				
Slope	0.00980	ft/ft		Sta. 189+00 to 194+00 Lt PhIA		
Manning's N	0.015		Slotted Drain adjacent to existing median barrier			
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	3.06	cfs	1370.638	gpm		
V	3.89	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.01	1.00
0.10	1.29	0.04	0.64	0.60	0.06	1.56
0.15	1.59	0.07	0.80	0.71	0.15	2.01
0.20	1.85	0.11	0.93	0.80	0.27	2.39
0.25	2.09	0.15	1.05	0.87	0.42	2.73
0.30	2.32	0.20	1.16	0.92	0.60	3.02
0.35	2.53	0.24	1.27	0.95	0.80	3.28
0.40	2.74	0.29	1.37	0.98	1.03	3.51
0.45	2.94	0.34	1.47	0.99	1.27	3.71
0.50	3.14	0.39	1.57	1.00	1.53	3.89
0.55	3.34	0.44	1.67	0.99	1.79	4.04
0.60	3.54	0.49	1.77	0.98	2.05	4.17
0.65	3.75	0.54	1.88	0.95	2.31	4.28
0.70	3.96	0.59	1.98	0.92	2.56	4.36
0.75	4.19	0.63	2.09	0.87	2.79	4.41
0.80	4.43	0.67	2.21	0.80	2.99	4.44
0.85	4.69	0.71	2.35	0.71	3.15	4.43
0.90	5.00	0.74	2.50	0.60	3.26	4.38
0.95	5.38	0.77	2.69	0.44	3.28	4.26
1.00	6.28	0.79	3.14	0.00	3.06	3.89 Full

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Sta. 189+00 to 194+00 Lt PhIA  
 Slotted Drain adjacent to existing median barrier

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.87		%	C
<b>Drainage Area =</b>	0.79	acres	0%	0.25 Field
			13%	0.70 Maintained Grass
			87%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 2.63 cfs**

## Worksheet for Rectangular Channel - Ph1A 190+25 to 192+30 Rt

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00800	ft/ft
Bottom Width	1.00	ft
Discharge	0.63	ft <sup>3</sup> /s

### Results

Normal Depth	0.44	ft
Flow Area	0.44	ft <sup>2</sup>
Wetted Perimeter	1.88	ft
Hydraulic Radius	0.23	ft
Top Width	1.00	ft
Critical Depth	0.23	ft
Critical Slope	0.04827	ft/ft
Velocity	1.44	ft/s
Velocity Head	0.03	ft
Specific Energy	0.47	ft
Froude Number	0.38	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.23	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.04827	ft/ft

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Sta. 190+25 to Sta. 192+30 PhIA Ditch Rt

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.84	%	C
<b>Drainage Area =</b>	0.25 acres	0%	0.25 Field
		32%	0.70 Maintained Grass
		68%	0.90 Pavement

Tc = 15 min.

RI:	2 years		
I (in/hr)	3.00		

**Q2 = 0.63 cfs**

<b>Circular Pipe Flow</b>							FRA-70-11.28 City of Columbus, Franklin Co. PID 77372	
Diameter (ft..in)	1.00	12						
Slope	0.03450	ft/ft			Ph1A Sta. 187+75 sag Outlet			
Manning's N	0.015				Pipe from CB-6 to existing median			
Percent full	100%			1.81	cfs from slotted drains 2yr			
Depth	1.00	ft						
theta	6.28							
Area	0.79	sf						
Wetted Perimeter	3.14	ft						
Surface Width	0.000	ft						
Q	5.74	cfs	2571.694	gpm				
V	7.30	fps						
Depth	theta	A		T	Q	V		
0.05	0.90	0.01	0.45	0.44	0.03	1.88		
0.10	1.29	0.04	0.64	0.60	0.12	2.93		
0.15	1.59	0.07	0.80	0.71	0.28	3.77		
0.20	1.85	0.11	0.93	0.80	0.50	4.49		
0.25	2.09	0.15	1.05	0.87	0.79	5.12		
0.30	2.32	0.20	1.16	0.92	1.12	5.67		
0.35	2.53	0.24	1.27	0.95	1.51	6.16		
0.40	2.74	0.29	1.37	0.98	1.93	6.59		
0.45	2.94	0.34	1.47	0.99	2.39	6.97		
0.50	3.14	0.39	1.57	1.00	2.87	7.30		
0.55	3.34	0.44	1.67	0.99	3.36	7.59		
0.60	3.54	0.49	1.77	0.98	3.85	7.83		
0.65	3.75	0.54	1.88	0.95	4.34	8.03		
0.70	3.96	0.59	1.98	0.92	4.80	8.18		
0.75	4.19	0.63	2.09	0.87	5.23	8.28		
0.80	4.43	0.67	2.21	0.80	5.61	8.32		
0.85	4.69	0.71	2.35	0.71	5.91	8.31		
0.90	5.00	0.74	2.50	0.60	6.11	8.21		
0.95	5.38	0.77	2.69	0.44	6.16	8.00		
1.00	6.28	0.79	3.14	0.00	5.74	7.30	Full	

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft..in)	1.00	12				
Slope	0.00150	ft/ft			Sta. 187+75 to 189+50 Temp PhIA	
Manning's N	0.015				Slotted Drain Lt Temporary Pavement	
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	1.20	cfs	536.2352	gpm		
V	1.52	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.01	0.39
0.10	1.29	0.04	0.64	0.60	0.02	0.61
0.15	1.59	0.07	0.80	0.71	0.06	0.79
0.20	1.85	0.11	0.93	0.80	0.10	0.94
0.25	2.09	0.15	1.05	0.87	0.16	1.07
0.30	2.32	0.20	1.16	0.92	0.23	1.18
0.35	2.53	0.24	1.27	0.95	0.31	1.28
0.40	2.74	0.29	1.37	0.98	0.40	1.37
0.45	2.94	0.34	1.47	0.99	0.50	1.45
0.50	3.14	0.39	1.57	1.00	0.60	1.52
0.55	3.34	0.44	1.67	0.99	0.70	1.58
0.60	3.54	0.49	1.77	0.98	0.80	1.63
0.65	3.75	0.54	1.88	0.95	0.90	1.67
0.70	3.96	0.59	1.98	0.92	1.00	1.71
0.75	4.19	0.63	2.09	0.87	1.09	1.73
0.80	4.43	0.67	2.21	0.80	1.17	1.74
0.85	4.69	0.71	2.35	0.71	1.23	1.73
0.90	5.00	0.74	2.50	0.60	1.27	1.71
0.95	5.38	0.77	2.69	0.44	1.28	1.67
1.00	6.28	0.79	3.14	0.00	1.20	1.52
						Full



## INLET SPACING DESIGN

**PID :** 77372      **Date :** 03/17/2015      **Project :** FRA-70-11.28

**Location :** City of Columbus, Franklin Co.

**Description :** I70EB Phase 1A 188+25 Lt Ex Sag Inlet

**Designer :** JLB

**Rainfall Area:** C

**Storm Frequency (yr.) :** 2

**Total Allow. Spread (ft.) :** 2.00

**Allowable Depth (ft.)** 0.00

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
188+25	I-3B	10.00	0.85	0.24	10.00	0.16	10.16	0.0030	0.0400	0.0400	2.00	0.0417	3.67	*****	*****	0.75	0.205	5.13

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co. PID 77372  
 Location: Sta. 187+75 to 189+50 Temp PhIA  
 Slotted Drain Lt of Temporary Pavement

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.90		%	C
<b>Drainage Area =</b>	0.24	acres	0%	0.25 Field
			0%	0.50 Maintained Grass
			100%	0.90 Pavement

Note: drainage area includes temporary pavement from Phase 3

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.82** cfs



<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft..in)	1.00	12				
Slope	0.00100	ft/ft		Ph1A Sta. 189+50 to 192+30 Temp		
Manning's N	0.015			Slotted Drain Lt Temporary Pavement		
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	0.98	cfs	437.8342	gpm		
V	1.24	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.00	0.32
0.10	1.29	0.04	0.64	0.60	0.02	0.50
0.15	1.59	0.07	0.80	0.71	0.05	0.64
0.20	1.85	0.11	0.93	0.80	0.09	0.76
0.25	2.09	0.15	1.05	0.87	0.13	0.87
0.30	2.32	0.20	1.16	0.92	0.19	0.96
0.35	2.53	0.24	1.27	0.95	0.26	1.05
0.40	2.74	0.29	1.37	0.98	0.33	1.12
0.45	2.94	0.34	1.47	0.99	0.41	1.19
0.50	3.14	0.39	1.57	1.00	0.49	1.24
0.55	3.34	0.44	1.67	0.99	0.57	1.29
0.60	3.54	0.49	1.77	0.98	0.66	1.33
0.65	3.75	0.54	1.88	0.95	0.74	1.37
0.70	3.96	0.59	1.98	0.92	0.82	1.39
0.75	4.19	0.63	2.09	0.87	0.89	1.41
0.80	4.43	0.67	2.21	0.80	0.95	1.42
0.85	4.69	0.71	2.35	0.71	1.01	1.41
0.90	5.00	0.74	2.50	0.60	1.04	1.40
0.95	5.38	0.77	2.69	0.44	1.05	1.36
1.00	6.28	0.79	3.14	0.00	0.98	1.24 Full

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Ph1A Sta. 189+50 to 192+30 Temp  
 Slotted Drain Lt of Temporary Pavement

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.89	%	C
<b>Drainage Area =</b>	0.23 acres	0%	0.25 Field
		4%	0.70 Maintained Grass
		96%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.78 cfs**

## Worksheet for Rectangular Channel - Ph1A Ramp Ditch Rt

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.035	
Channel Slope	0.02100	ft/ft
Bottom Width	1.00	ft
Discharge	1.05	ft <sup>3</sup> /s

### Results

Normal Depth	0.45	ft
Flow Area	0.45	ft <sup>2</sup>
Wetted Perimeter	1.89	ft
Hydraulic Radius	0.24	ft
Top Width	1.00	ft
Critical Depth	0.32	ft
Critical Slope	0.05062	ft/ft
Velocity	2.35	ft/s
Velocity Head	0.09	ft
Specific Energy	0.53	ft
Froude Number	0.62	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.32	ft
Channel Slope	0.02100	ft/ft
Critical Slope	0.05062	ft/ft

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28  
Location:

City of Columbus, Franklin Co.  
PhIA Exit Ramp Ditch Rt

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

Runoff Coeff. = 0.78  
Drainage Area = 0.45 acres

% C  
0% 0.25 Field  
62% 0.70 Maintained Grass  
38% 0.90 Pavement

Tc = 15 min.

RI :	2 years		
I (in/hr)	3.00		

Q2 = 1.05 cfs

Circular Pipe Flow							FRA-70-11.28 City of Columbus, Franklin Co. PID 77372		
Diameter (ft..in)	1.00	12							
Slope	0.05400	ft/ft			Phase1A 189+50 Lt. Ex 12 Outlet				
Manning's N	0.015								
Percent full	100%								
Depth	1.00	ft							
theta	6.28								
Area	0.79	sf							
Wetted Perimeter	3.14	ft							
Surface Width	0.000	ft							
Q	7.18	cfs	3217.411	gpm					
V	9.14	fps							
Depth	theta	A		T	Q	V			
0.05	0.90	0.01	0.45	0.44	0.03	2.35			
0.10	1.29	0.04	0.64	0.60	0.15	3.66			
0.15	1.59	0.07	0.80	0.71	0.35	4.72			
0.20	1.85	0.11	0.93	0.80	0.63	5.62			
0.25	2.09	0.15	1.05	0.87	0.98	6.40			
0.30	2.32	0.20	1.16	0.92	1.41	7.09			
0.35	2.53	0.24	1.27	0.95	1.89	7.70			
0.40	2.74	0.29	1.37	0.98	2.42	8.24			
0.45	2.94	0.34	1.47	0.99	2.99	8.72			
0.50	3.14	0.39	1.57	1.00	3.59	9.14			
0.55	3.34	0.44	1.67	0.99	4.20	9.50			
0.60	3.54	0.49	1.77	0.98	4.82	9.80			
0.65	3.75	0.54	1.88	0.95	5.43	10.04			
0.70	3.96	0.59	1.98	0.92	6.01	10.23			
0.75	4.19	0.63	2.09	0.87	6.54	10.36			
0.80	4.43	0.67	2.21	0.80	7.01	10.41			
0.85	4.69	0.71	2.35	0.71	7.39	10.39			
0.90	5.00	0.74	2.50	0.60	7.65	10.27			
0.95	5.38	0.77	2.69	0.44	7.71	10.00			
1.00	6.28	0.79	3.14	0.00	7.18	9.14	Full		

FRA-70-11.28

PID 77372

City of Columbus, Franklin Co.

PHASE 1B MOT Drainage Calculations

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Ph 1B Sta. 183+50 to Sta. 186+70 Lt Trench Check

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

**Runoff Coeff. =** 0.90  
**Drainage Area =** 0.19 acres

% C  
0% 0.25 Field  
0% 0.70 Maintained Grass  
100% 0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.65** cfs

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Ph 1B Sta. 183+50 to Sta. 187+50 trench outlet

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.90		%	C
<b>Drainage Area =</b>	0.24	acres	0%	0.25 Field
			0%	0.70 Maintained Grass
			100%	0.90 Pavement

Tc = 10 min.

RI:	2 years		
I (in/hr)	3.80		

**Q2 = 0.82** cfs



**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Ph 1B Sta. 188+25 trench outlet  
 Sta. 187+50 to Sta. 189+00 Lt.

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.90	%	C
<b>Drainage Area =</b>	0.11 acres	0%	0.25 Field
		0%	0.70 Maintained Grass
		100%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.38** cfs

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft.in)	0.67	8				
Slope	0.03000	ft/ft				
Manning's N	0.015				Ph1B Sta. Outlet Pipe Capacity	
Percent full	100%				Sta. 187+50 and Sta. 188+25	
Depth	0.67	ft			tie into existing median inlet	
theta	6.28					
Area	0.35	sf				
Wetted Perimeter	2.09	ft				
Surface Width	0.000	ft				
Q	1.81	cfs	813.3803	gpm		
V	5.20	fps				
Depth	theta	A		T	Q	V
0.03	0.90	0.01	0.30	0.29	0.01	1.33
0.07	1.29	0.02	0.43	0.40	0.04	2.08
0.10	1.59	0.03	0.53	0.48	0.09	2.69
0.13	1.85	0.05	0.62	0.53	0.16	3.20
0.17	2.09	0.07	0.70	0.58	0.25	3.64
0.20	2.32	0.09	0.77	0.61	0.36	4.03
0.23	2.53	0.11	0.84	0.64	0.48	4.38
0.27	2.74	0.13	0.91	0.65	0.61	4.69
0.30	2.94	0.15	0.98	0.66	0.76	4.96
0.33	3.14	0.17	1.05	0.67	0.91	5.20
0.37	3.34	0.20	1.11	0.66	1.06	5.40
0.40	3.54	0.22	1.18	0.65	1.22	5.57
0.43	3.75	0.24	1.25	0.64	1.37	5.71
0.47	3.96	0.26	1.32	0.61	1.52	5.82
0.50	4.19	0.28	1.40	0.58	1.65	5.89
0.53	4.43	0.30	1.48	0.53	1.77	5.92
0.57	4.69	0.32	1.56	0.48	1.87	5.91
0.60	5.00	0.33	1.67	0.40	1.93	5.84
0.63	5.38	0.34	1.79	0.29	1.95	5.69
0.67	6.28	0.35	2.09	0.00	1.81	5.20 Full

## Worksheet for Rectangular Channel - Ph1B Sta 186+00 Lt.

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.041	
Channel Slope	0.00080	ft/ft
Bottom Width	1.50	ft
Discharge	0.65	ft <sup>3</sup> /s

*Trench Flow Depth  
Check @ flattest slope.*

### Results

Normal Depth	<u>0.80</u>	ft
Flow Area	1.20	ft <sup>2</sup>
Wetted Perimeter	3.09	ft
Hydraulic Radius	0.39	ft
Top Width	1.50	ft
Critical Depth	0.18	ft
Critical Slope	0.05780	ft/ft
Velocity	0.54	ft/s
Velocity Head	0.00	ft
Specific Energy	0.80	ft
Froude Number	0.11	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.80	ft
Critical Depth	0.18	ft
Channel Slope	0.00080	ft/ft
Critical Slope	0.05780	ft/ft

## Worksheet for Rectangular Channel - Ph1B Sta 187+50 Lt.

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.041
Channel Slope	0.00100 ft/ft
Bottom Width	1.50 ft
Discharge	0.82 ft <sup>3</sup> /s

### Results

Normal Depth	0.87 ft
Flow Area	1.31 ft <sup>2</sup>
Wetted Perimeter	3.25 ft
Hydraulic Radius	0.40 ft
Top Width	1.50 ft
Critical Depth	0.21 ft
Critical Slope	0.05727 ft/ft
Velocity	0.63 ft/s
Velocity Head	0.01 ft
Specific Energy	0.88 ft
Froude Number	0.12
Flow Type	Subcritical

*Trench flow depth  
check @ flattest slope*

### GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

### GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.87 ft
Critical Depth	0.21 ft
Channel Slope	0.00100 ft/ft
Critical Slope	0.05727 ft/ft

## Worksheet for Rectangular Channel - Ph1B Sta 188+25 Lt.

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.041	
Channel Slope	0.00150	ft/ft
Bottom Width	1.50	ft
Discharge	0.38	ft <sup>3</sup> /s

### Results

Normal Depth	0.43	ft
Flow Area	0.64	ft <sup>2</sup>
Wetted Perimeter	2.36	ft
Hydraulic Radius	0.27	ft
Top Width	1.50	ft
Critical Depth	0.13	ft
Critical Slope	0.06011	ft/ft
Velocity	0.59	ft/s
Velocity Head	0.01	ft
Specific Energy	0.43	ft
Froude Number	0.16	
Flow Type	Subcritical	

*Trench flow depth  
check*

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.13	ft
Channel Slope	0.00150	ft/ft
Critical Slope	0.06011	ft/ft

FRA-70-11.28

PID 77372

City of Columbus, Franklin Co.

PHASE 2 MOT Drainage Calculations

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Sta. 169+80 to Sta. 172+80  
Phase 2

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

**Runoff Coeff. =** 0.82  
**Drainage Area =** 0.55 acres

% C  
0% 0.25 Field  
40% 0.70 Maintained Grass  
60% 0.90 Pavement

Tc = 15 min.

R I :	2 years		
I (in/hr)	3.00		

**Q2 = 1.35 cfs**

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372					
Diameter (ft.in)	0.67	8					
Slope	0.02500	ft/ft			Sta 174+50 Ph2 trench drain outlet		
Manning's N	0.015				Sta. 172+80 to Sta. 174+50		
Percent full	100%						
Depth	0.67	ft					
theta	6.28						
Area	0.35	sf					
Wetted Perimeter	2.09	ft					
Surface Width	0.000	ft					
Q	1.66	cfs	742.5112	gpm			
V	4.74	fps					
Depth	theta	A		T	Q	V	
0.03	0.90	0.01	0.30	0.29	0.01	1.22	
0.07	1.29	0.02	0.43	0.40	0.03	1.90	
0.10	1.59	0.03	0.53	0.48	0.08	2.45	
0.13	1.85	0.05	0.62	0.53	0.15	2.92	
0.17	2.09	0.07	0.70	0.58	0.23	3.32	
0.20	2.32	0.09	0.77	0.61	0.32	3.68	
0.23	2.53	0.11	0.84	0.64	0.44	4.00	
0.27	2.74	0.13	0.91	0.65	0.56	4.28	
0.30	2.94	0.15	0.98	0.66	0.69	4.53	
0.33	3.14	0.17	1.05	0.67	0.83	4.74	
0.37	3.34	0.20	1.11	0.66	0.97	4.93	
0.40	3.54	0.22	1.18	0.65	1.11	5.09	
0.43	3.75	0.24	1.25	0.64	1.25	5.21	
0.47	3.96	0.26	1.32	0.61	1.39	5.31	
0.50	4.19	0.28	1.40	0.58	1.51	5.38	
0.53	4.43	0.30	1.48	0.53	1.62	5.41	
0.57	4.69	0.32	1.56	0.48	1.71	5.40	
0.60	5.00	0.33	1.67	0.40	1.76	5.33	
0.63	5.38	0.34	1.79	0.29	1.78	5.19	
0.67	6.28	0.35	2.09	0.00	1.66	4.74	Full



**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
Location: Sta. 172+80 to Sta. 174+50  
Phase 2

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.83		%	C
<b>Drainage Area =</b>	0.28	acres	0%	0.25 Field
			36%	0.70 Maintained Grass
			64%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.88** cfs

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372					
Diameter (ft.in)	0.67	8					
Slope	0.01850	ft/ft					
Manning's N	0.015						Sta 175+75 Ph2 trench drain outlet
Percent full	100%						Ph2 Sta. 174+50 to Sta. 175+75
Depth	0.67	ft					
theta	6.28						
Area	0.35	sf					
Wetted Perimeter	2.09	ft					
Surface Width	0.000	ft					
Q	1.42	cfs	638.7323	gpm			
V	4.08	fps					
Depth	theta	A		T	Q	V	
0.03	0.90	0.01	0.30	0.29	0.01	1.05	
0.07	1.29	0.02	0.43	0.40	0.03	1.64	
0.10	1.59	0.03	0.53	0.48	0.07	2.11	
0.13	1.85	0.05	0.62	0.53	0.12	2.51	
0.17	2.09	0.07	0.70	0.58	0.20	2.86	
0.20	2.32	0.09	0.77	0.61	0.28	3.17	
0.23	2.53	0.11	0.84	0.64	0.37	3.44	
0.27	2.74	0.13	0.91	0.65	0.48	3.68	
0.30	2.94	0.15	0.98	0.66	0.59	3.89	
0.33	3.14	0.17	1.05	0.67	0.71	4.08	
0.37	3.34	0.20	1.11	0.66	0.83	4.24	
0.40	3.54	0.22	1.18	0.65	0.96	4.38	
0.43	3.75	0.24	1.25	0.64	1.08	4.49	
0.47	3.96	0.26	1.32	0.61	1.19	4.57	
0.50	4.19	0.28	1.40	0.58	1.30	4.63	
0.53	4.43	0.30	1.48	0.53	1.39	4.65	
0.57	4.69	0.32	1.56	0.48	1.47	4.64	
0.60	5.00	0.33	1.67	0.40	1.52	4.59	
0.63	5.38	0.34	1.79	0.29	1.53	4.47	
0.67	6.28	0.35	2.09	0.00	1.42	4.08	Full

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co.  
 Location: Sta. 174+50 to Sta. 175+75  
 Phase 2

PID 77372

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.82		%	C
<b>Drainage Area =</b>	0.22	acres	0%	0.25 Field
			41%	0.70 Maintained Grass
			59%	0.90 Pavement

Tc = 10 min.

R I :	2 years		
I (in/hr)	3.80		

**Q2 = 0.68** cfs

FRA-70-11.28

PID 77372

City of Columbus, Franklin Co.

PHASE 3 MOT Drainage Calculations

**DISCHARGE CALCULATIONS**

Project: FRA-70-11.28 City of Columbus, Franklin Co. PID 77372  
 Location: Ph 3 Sta. 184+50 Rt. MOT Drainage Phase 3

Checked \_\_\_\_\_

**RUNOFF**

<b>Runoff Coeff. =</b>	0.89		%	C
<b>Drainage Area =</b>	0.42	acres	0%	0.25 Field
			5%	0.70 Maintained Grass
			95%	0.90 Pavement

Tc = 15 min.

R I :	2 years		
I (in/hr)	3.00		

**Q2 = 1.12 cfs**

<b>Circular Pipe Flow</b>		FRA-70-11.28 City of Columbus, Franklin Co. PID 77372				
Diameter (ft.in)	1.00	12		Ph 3 Sta. 184+50 Rt.		
Slope	0.00840	ft/ft				
Manning's N	0.015					
Percent full	100%					
Depth	1.00	ft				
theta	6.28					
Area	0.79	sf				
Wetted Perimeter	3.14	ft				
Surface Width	0.000	ft				
Q	2.83	cfs	1268.964	gpm		
V	3.60	fps				
Depth	theta	A		T	Q	V
0.05	0.90	0.01	0.45	0.44	0.01	0.93
0.10	1.29	0.04	0.64	0.60	0.06	1.45
0.15	1.59	0.07	0.80	0.71	0.14	1.86
0.20	1.85	0.11	0.93	0.80	0.25	2.22
0.25	2.09	0.15	1.05	0.87	0.39	2.52
0.30	2.32	0.20	1.16	0.92	0.55	2.80
0.35	2.53	0.24	1.27	0.95	0.74	3.04
0.40	2.74	0.29	1.37	0.98	0.95	3.25
0.45	2.94	0.34	1.47	0.99	1.18	3.44
0.50	3.14	0.39	1.57	1.00	1.41	3.60
0.55	3.34	0.44	1.67	0.99	1.66	3.74
0.60	3.54	0.49	1.77	0.98	1.90	3.86
0.65	3.75	0.54	1.88	0.95	2.14	3.96
0.70	3.96	0.59	1.98	0.92	2.37	4.03
0.75	4.19	0.63	2.09	0.87	2.58	4.08
0.80	4.43	0.67	2.21	0.80	2.77	4.11
0.85	4.69	0.71	2.35	0.71	2.92	4.10
0.90	5.00	0.74	2.50	0.60	3.02	4.05
0.95	5.38	0.77	2.69	0.44	3.04	3.95
1.00	6.28	0.79	3.14	0.00	2.83	3.60 Full

## Worksheet for Rectangular Channel - Ph3 Sta. 184+50 Rt.

### Project Description

Friction Method	Manning Formula	
Solve For	Normal Depth	

### Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01700	ft/ft
Bottom Width	1.00	ft
Discharge	1.12	ft <sup>3</sup> /s

### Results

Normal Depth	0.51	ft
Flow Area	0.51	ft <sup>2</sup>
Wetted Perimeter	2.01	ft
Hydraulic Radius	0.25	ft
Top Width	1.00	ft
Critical Depth	0.34	ft
Critical Slope	0.05106	ft/ft
Velocity	2.21	ft/s
Velocity Head	0.08	ft
Specific Energy	0.58	ft
Froude Number	0.55	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.51	ft
Critical Depth	0.34	ft
Channel Slope	0.01700	ft/ft
Critical Slope	0.05106	ft/ft

---

## APPENDIX H – 50 YEAR SAG CHECK

---







# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/13/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB I-70 Lt Shoulder

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 10.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
158+35	Begin																		
159+10	I-3C	75.00	0.90	0.02	1.61	1.58	10.00	0.0045	0.0400	0.0400	11.00	0.1667	6.50	*****	*****	0.09	0.087	2.18	Sag
166+09	Begin																		
163+01	I-3C	308.00	0.90	0.06	1.55	4.49	10.00	0.0054	0.0400	0.0400	10.00	0.1667	6.50	0.35	0.00	0.35	0.138	3.46	
159+10	I-3C	391.00	0.90	0.10	1.11	6.62	10.00	0.0027	0.0400	0.0400	11.00	0.0417	6.50	*****	*****	0.58	0.191	4.77	End

## SUMP DATA

**Total Flow (cfs) :** 0.68

**Ponded Depth (ft.) :** 0.078

**Spread on Pavement (ft.) :** 1.79



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 08/22/2013    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB 70 STA 169+84.48 to STA 194+48.56 Left

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 45.00

**Allowable Depth (ft.) :** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
174+18	Begin																	
175+16	I-3C	98.00	0.90	0.04	1.63	1.14	10.00	0.0118	0.0400	0.0400	11.50	0.0560	6.50	0.23	0.00	0.23	0.103	2.57
179+50	CB-3A	434.00	0.90	0.15	6.48	3.87	10.35	0.0121	0.0400	0.0005	13.50	0.0417	6.42	0.73	0.14	0.87	0.167	4.17
182+50	I-3D	300.00	0.90	0.27	10.95	2.32	13.27	0.0120	0.0400	0.0160	10.50	0.0667	5.83	1.28	0.27	1.55	0.208	5.20
185+75	CB-3A	325.00	0.90	0.35	13.10	2.86	15.96	0.0073	0.0400	0.0223	12.00	0.0417	5.38	1.33	0.64	1.96	0.250	6.24
187+05	I-3D	130.00	0.90	0.19	15.35	1.19	16.54	0.0073	0.0440	0.0440	10.20	0.0667	5.29	1.39	0.15	1.54	0.236	5.37
187+79	I-3D	74.00	0.90	0.11	16.89	0.77	17.66	0.0073	0.0600	0.0600	9.50	0.0667	5.13	*****	*****	0.66	0.193	3.21 Sag
194+49	Begin																	
188+98	I-3C	551.00	0.90	0.68	2.67	2.61	10.00	0.0144	0.0700	0.0700	7.00	0.1667	6.50	3.15	0.83	3.98	0.353	5.04
188+21	I-3C	77.00	0.90	0.10	2.67	0.48	10.00	0.0144	0.0700	0.0700	7.00	0.1667	6.50	1.41	0.00	1.41	0.239	3.42
187+79	I-3D	42.00	0.90	0.06	7.40	0.39	10.00	0.0144	0.0600	0.0600	9.50	0.0667	6.50	*****	*****	0.35	0.134	2.23 End

## SUMP DATA

**Total Flow (cfs) :** 1.01

**Ponded Depth (ft.) :** 0.102

**Spread on Pavement (ft.) :** 1.52



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 02/01/2015    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** 170+64.38 I-70 EB (1358 R Bridge)

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 43.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
169+84	Begin																	
170+30	CB-3A	46.00	0.90	0.08	3.00	0.48	10.00	0.0098	0.0400	0.0235	7.00	0.0267	6.50	0.44	0.03	0.47	0.138	3.44
170+60	CB-3	30.00	9.00	0.01	1.80	0.34	10.00	0.0098	0.0400	0.0292	8.00	0.0267	6.50	*****	*****	0.32	0.120	3.00 Sag
174+18	Begin																	
170+60	CB-3	358.00	0.90	0.56	2.95	1.82	10.00	0.0196	0.0400	0.0292	8.00	0.0267	6.50	*****	*****	3.27	0.251	6.27 End

## SUMP DATA

**Total Flow (cfs) :** 3.60

**Ponded Depth (ft.) :** 0.255

**Spread on Pavement (ft.) :** 7.11



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 08/22/2013    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** EB 70 STA 175+62 to STA 194+48.56 Right

**Designer :** CML

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 36.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
175+63	Begin																	
179+15	I-3D	352.00	0.90	0.67	3.44	2.23	10.00	0.0121	0.0294	0.0200	16.00	0.0667	6.50	2.13	1.79	3.92	0.262	8.90
181+00	I-3D	185.00	0.90	0.25	5.53	1.27	10.00	0.0121	0.0287	0.0200	17.00	0.0667	6.50	1.88	1.37	3.25	0.242	8.43
183+00	I-3D	200.00	0.90	0.23	6.89	1.25	10.00	0.0120	0.0518	0.0160	20.00	0.0667	6.50	2.06	0.65	2.72	0.283	5.46
186+68	CB-3A	368.00	0.90	0.33	8.06	3.04	11.10	0.0073	0.0400	0.0400	7.50	0.0267	6.25	1.57	0.94	2.51	0.273	6.83
187+57	CB-3	89.00	0.90	0.05	13.02	0.89	13.91	0.0073	0.0400	0.0400	7.50	0.0267	5.71	*****	*****	1.20	0.207	5.18 Sag
194+49	Begin																	
189+99	I-3D	450.00	0.90	0.26	1.52	3.10	10.00	0.0144	0.0400	0.0400	7.50	0.0667	6.50	1.23	0.29	1.52	0.199	4.99
188+10	CB-3A	189.00	0.90	0.11	10.00	1.57	11.57	0.0144	0.0400	0.0400	7.50	0.0267	6.16	0.75	0.15	0.90	0.164	4.09
187+57	I-3D	53.00	0.90	0.03	10.00	0.57	10.57	0.0144	0.0400	0.0400	7.50	0.0667	6.37	*****	*****	0.32	0.111	2.79 End

## SUMP DATA

**Total Flow (cfs) :** 1.52

**Ponded Depth (ft.) :** 0.134

**Spread on Pavement (ft.) :** 2.75



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 07/06/2016    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus

**Description :** I70 EB right shoulder reconstruction

**Designer :** AJE

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 19.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
4194+49	Begin																	
4200+82	CB-3A	633.00	0.90	0.44	2.58	6.34	10.00	0.0042	0.0400	0.0160	9.50	0.0267	6.50	1.58	0.99	2.57	0.306	7.65
4201+51	CB-3	69.00	0.90	0.06	2.58	1.01	10.00	0.0023	0.0400	0.0160	12.00	0.0267	6.50	*****	*****	1.34	0.269	6.72 Sag
4205+60	Begin																	
4202+54	CB-3A	306.00	0.90	0.26	2.58	2.66	10.00	0.0079	0.0400	0.0160	12.00	0.0267	6.50	1.10	0.42	1.52	0.223	5.58
4201+51	CB-3A	103.00	0.90	0.09	2.58	1.04	10.00	0.0074	0.0400	0.0160	9.50	0.0267	6.50	*****	*****	0.95	0.189	4.73 End

## SUMP DATA

**Total Flow (cfs) :** 2.29

**Ponded Depth (ft.) :** 0.228

**Spread on Pavement (ft.) :** 6.43



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/13/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** NB I-71, EB I-70

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 24.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
266+96	Begin																	
270+25	CB-3A	329.00	0.90	0.57	2.43	1.57	10.00	0.0169	0.0600	0.0600	12.00	0.2670	6.50	2.53	0.80	3.33	0.302	5.04
271+27	I-3D	102.00	0.90	0.13	5.28	0.61	10.00	0.0169	0.0600	0.0600	12.00	0.6670	6.50	*****	*****	1.56	0.228	3.80 Sag
4152+65	Begin																	
271+27	I-3D	731.00	0.90	0.67	2.52	6.61	10.00	0.0032	0.0600	0.0600	12.00	0.0667	6.50	*****	*****	3.92	0.439	7.32 End

## SUMP DATA

**Total Flow (cfs) :** 5.48

**Ponded Depth (ft.) :** 0.316

**Spread on Pavement (ft.) :** 4.82



# INLET SPACING DESIGN

**PID :** 105523    **Date :** 10/16/2014    **Project :** FRA-70/71-12.68/14.86

**Location :** City of Columbus, Franklin Co.

**Description :** Ramp C5, Ramp C6

**Designer :** MDG

**Rainfall Area:** C

**Storm Frequency (yr.) :** 50

**Total Allow. Spread (ft.) :** 22.00

**Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
5073+78	Begin																	
5077+34	I-3D	356.00	0.90	0.37	2.55	2.97	10.00	0.0070	0.0400	0.0160	10.00	0.0667	6.50	1.76	0.40	2.16	0.261	6.51
5077+91	I-3D	57.00	0.90	0.05	5.66	0.84	10.00	0.0035	0.0400	0.0160	10.00	0.0667	6.50	*****	*****	0.69	0.194	4.85 Sag
5086+46	Begin																	
5081+92	I-3D	454.00	0.90	0.27	2.25	2.11	10.00	0.0395	0.0400	0.0288	10.00	0.0667	6.50	1.07	0.50	1.58	0.167	4.18
5078+49	I-3D	343.00	0.90	0.29	4.46	2.92	10.00	0.0070	0.0400	0.0160	10.00	0.0667	6.50	1.78	0.42	2.20	0.262	6.56
5077+91	I-3D	58.00	0.90	0.05	7.54	0.86	10.00	0.0035	0.0400	0.0160	10.00	0.0667	6.50	*****	*****	0.71	0.195	4.88 End

## SUMP DATA

**Total Flow (cfs) :** 1.40

**Ponded Depth (ft.) :** 0.127

**Spread on Pavement (ft.) :** 2.73



# STORM SEWER SYSTEM

PID : 105523      Date : 09/12/2014      Project : FRA-70/71-12.68/14.86      Location : City of Columbus

Description : EB70 Sag at STA 187+81

Designer : AJE

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 50

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 718.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
	From To	(acres)		(min.)	(10 yrs.) (50 yrs.)	(10 yrs.) (50 yrs.)	(10 yrs.) (50 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D59	D58	0.12	0.11	10.00	5.32	6.43	0.6	0.7	15	54.0	0.0106	731.56	3.00	6.19	0.0002	731.85	735.96	4.11	3.15	CB 3A
	begin	0.12	0.11									730.99				731.78	735.85			0.015
D58	D57	0.08	0.07	10.30	5.26	6.25	1.0	1.1	15	90.0	0.0076	730.99	3.08	5.23	0.0004	731.40	735.85	4.45	3.61	CB 3
	186+68	0.20	0.18									730.31				731.23	736.01			0.015
D57	AB4	0.33	0.30	10.79	5.17	6.25	2.5	3.0	15	62.0	0.0037	730.31	3.03	3.67	0.0029	731.23	736.01	4.78	4.45	CB 3A
	186+09	0.53	0.48									730.08				731.05	733.58			0.015
AB4	D56	0.00	0.00	11.13	5.10	6.21	2.4	3.0	15	48.0	0.0108	730.08	4.54	6.27	0.0028	730.71	733.58	2.87	2.25	MH 3
	185+89	0.53	0.48									729.56				730.53	732.64			0.015
D155	D255	0.17	0.15	10.00	5.32	6.49	0.8	1.0	15	7.0	0.1714	724.02	8.84	24.93	0.0003	724.20	732.57	8.37	7.30	13D
	begin	0.70	0.63									722.82				723.64	725.07			0.015
D154	D254	0.20	0.18	10.00	5.32	6.49	1.0	1.2	15	7.0	0.1686	724.22	9.25	24.73	0.0004	724.41	728.40	3.99	2.93	13D
	begin	0.90	0.81									723.04				723.88	725.29			0.015
D255	D254	0.00	0.00	10.01	5.32	6.40	0.8	1.0	21	76.0	0.0089	722.32	3.02	13.97	0.0001	722.70	725.07	2.37	1.00	MH 3
	187+05	0.90	0.81									721.64				722.69	725.29			0.015
D254	D56	0.00	0.00	10.43	5.24	6.19	1.7	2.1	24	115.0	0.0050	721.39	3.01	14.85	0.0001	722.21	730.34	8.13	6.95	MH 3
	185+89	0.90	0.81									720.82				722.20	731.64			0.015





# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D56	D157	185+89 185+75	0.00 0.90	0.00 0.81	11.30	5.07	6.19	4.1	5.0	24	15.0	0.0047	720.82 720.75	3.75	14.41	0.0007	722.20 722.19	732.64 735.16	10.44	9.82	MH 3 0.015
D157	D302	185+75 184+76	0.48 1.38	0.43 1.24	11.37	5.06	6.19	6.3	7.7	24	10.0	0.0070	720.75 720.68	4.88	17.65	0.0015	722.19 722.17	735.16 735.29	12.97	12.41	13D 0.015
EX7	D300	540+62 begin 540+71	0.16 1.55	0.15 1.39	10.00	5.32	6.48	0.8	1.0	15	14.0	0.0357	736.06 735.56	5.04	11.38	0.0003	736.38 736.38	739.56 739.12	3.18	2.25	13C 0.015
D300	D301	184+00 185+09	0.00 1.55	0.00 1.39	10.05	5.31	6.42	0.8	1.0	15	88.0	0.0337	735.56 732.59	4.96	11.06	0.0003	735.82 733.41	739.12 737.17	3.30	2.31	MH 3 0.015
D301	D326	184+88 184+88	0.00 1.55	0.00 1.39	10.34	5.25	6.41	0.8	0.9	15	8.0	0.0100	732.17 732.09	3.22	6.02	0.0003	732.91 732.91	737.17 737.40	4.26	3.75	MH 3 0.015
D326	D302	184+88 185+75	0.00 1.55	0.00 1.39	10.38	5.24	6.30	0.8	0.9	15	87.4	0.0085	724.19 723.45	3.03	5.54	0.0003	724.55 724.26	737.40 735.29	12.85	11.96	MH 3 0.015
D162	EX2	187+51 begin 185+77	0.14 1.69	0.13 1.52	10.00	5.32	6.29	0.7	0.8	15	172.0	0.0100	728.78 727.06	3.07	6.02	0.0002	729.10 727.86	733.01 735.08	3.91	2.98	CB 6 0.015
D302	EX2	185+75 185+77	0.00 1.69	0.00 1.52	11.41	5.05	6.18	7.0	8.6	24	10.0	0.0050	720.68 720.63	4.43	14.91	0.0019	722.17 722.15	735.29 735.08	13.12	12.61	MH 3 0.015
EX2	EX	185+77 final 182+96	4.00 5.69	3.60 5.12	11.44	5.04	5.88	25.8	30.1	96	285.0	0.0007	714.52 714.32	3.13	259.91	0.0000	718.99 718.99	735.08 741.97	16.09	12.56	MH 3 0.013



# STORM SEWER SYSTEM

PID : 105523 Date : 05/06/2018 Project : FRA-70-12.68

Location : City of Columbus

Description :NB-71 STA 254+16 to Gatewell #6

Designer : TMT

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 50

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 696.30

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE				PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
	From To	(acres)		(min.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D333	D220	0.39	0.35	10.00	5.32	6.49	1.9	2.3	15	3.8	0.0053	714.04	3.25	4.40	0.0016	714.95	719.31	4.36	4.02	CB 6		
	begin	0.39	0.35									714.02				714.95	717.01				0.015	
D220	D222	0.00	0.00	10.02	5.32	6.19	1.9	2.2	15	259.2	0.0050	714.02	3.18	4.27	0.0015	714.68	717.01	2.33	1.74	MH 3		
	256+60	0.39	0.35									712.72				713.64	715.32				0.015	
D222	D223	0.00	0.00	17.04	4.21	5.10	1.5	1.8	15	183.1	0.0078	712.72	3.50	5.30	0.0010	713.24	715.32	2.08	1.35	MH 3		
	5004+57	0.39	0.35									711.30				712.19	713.95				0.015	
EXMH	D223	0.50	0.45	10.00	5.32	4.66	2.4	2.1	15	117.0	0.0035	706.21	2.94	3.57	0.0014	708.41	718.20	9.79	10.74	MH 3		
	begin	0.89	0.80									705.80				708.24	713.95				0.015	
D223	EXGT	0.00	0.00	21.25	3.75	4.66	10.7	13.4	18	72.0	0.0044	705.58	6.08	6.53	0.0215	708.24	713.95	5.71	6.87	MH 3		
	final	0.89	0.80									705.26				706.69	706.76				0.015	
									<b>Warning</b>													
D234	D225	1.01	0.79	19.22	3.95	4.79	3.1	3.8	15	348.1	0.0138	713.94	5.29	7.09	0.0045	714.62	719.19	4.57	4.00	CB 8		
	begin	1.90	1.59									709.12				710.14	713.78				0.015	
D225	D223	0.81	0.68	20.32	3.84	4.69	5.6	6.9	21	191.3	0.0030	708.03	3.42	8.06	0.0025	709.35	713.78	4.43	4.00	CB 2-2B		
	5004+58	2.71	2.26									707.46				708.82	712.90				0.015	
D334	D223	0.67	0.60	10.00	5.32	6.49	3.2	3.9	15	9.4	0.0149	709.69	5.48	7.34	0.0049	710.62	716.22	5.60	5.28	CB 6		
	begin	3.38	2.87									709.55				710.58	712.90				0.015	



# STORM SEWER SYSTEM

PID : 105523      Date : 07/01/2018      Project : FRA-70/71-12.68/14.86      Location : City of Columbus

Description : NB71 STA 266+95 to EB STA 152+65

Designer : TMT

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 50

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 718.20

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE			PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
D63	D62	0.67	0.60	10.00	5.32	6.23	3.2	3.7	15	62.0	0.0045	719.79	3.44	4.05	0.0045	721.28	724.19	2.91	3.15	13D		
	begin	0.67	0.60									719.51				721.01	723.98				0.015	
D62	D61	0.18	0.15	10.30	5.26	6.23	4.0	4.7	15	100.0	0.0045	719.51	3.46	4.04	0.0070	721.01	723.98	2.97	3.22	13D		
		0.85	0.75									719.06				720.31	724.17				0.015	
D61	HW61	0.57	0.43	10.78	5.17	6.23	6.1	7.3	18	113.0	0.0054	718.81	4.29	7.20	0.0065	720.31	724.17	3.86	3.86	CB 3A		
	final	1.42	1.18									718.20				719.47	719.70				0.015	



# STORM SEWER SYSTEM

**PID :** 105523      **Date :** 07/03/2018      **Project :** FRA-70/71-12.68/14.86      **Location :** City of Columbus

**Description :** East of River Bridge to West of Short Street Bridge

**Designer :** TMT

**Rainfall Area:** C

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 50

**Minimum Pipe Size :** 15.00

**Tailwater Elevation (ft.):** 700.00

JUNCTION From	STATION To	From To	ΔAREA Σ AREA (acres)	ΔCA Σ CA	BEGIN TIME (min.)	RAINFALL INTENSITY				DISCHARGE (cfs.)			PIPE			F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
						(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	(in.)	(ft.)	(ft./ft.)										
D37	D36	175+15	0.04	0.04	10.00	5.32	6.38	0.2	0.2	15	106.0	0.0372	742.81	3.38	11.61	0.0000	742.94	747.91	4.97	3.85	13C			
	begin	175+15	0.04	0.04									738.87				739.59	743.45			0.015			
AB02	D36	175+59	0.50	0.45	10.00	5.32	4.87	2.4	2.2	15	61.0	0.0200	726.30	5.65	8.52	0.0015	726.75	731.63	4.88	4.08	MH 3			
	begin	175+15	0.54	0.49									725.08				726.44	743.45			0.015			
D36	D35	175+15	0.49	0.39	18.46	4.04	4.87	3.5	4.3	15	211.0	0.0046	725.08	3.53	4.10	0.0058	726.44	743.45	17.01	17.12	CB 8			
		173+03	1.03	0.87									724.10				725.22	744.75			0.015			
D53	D54	170+30	0.08	0.07	10.00	5.32	6.45	0.4	0.5	15	30.0	0.0147	739.12	3.03	7.29	0.0001	739.69	743.52	3.83	3.15	CB 3A			
	begin	170+5991	1.11	0.95									738.68				739.69	743.28			0.015			
D54	D55	170+30	0.61	0.55	10.17	5.29	6.45	3.3	4.0	15	7.0	0.0086	738.68	4.47	5.58	0.0052	739.69	743.28	3.59	3.35	CB 3			
		170+60	1.72	1.50									738.62				739.65	744.15			0.015			
D55	D261	170+55	0.00	0.00	10.19	5.28	6.41	3.3	4.0	15	54.0	0.0100	738.62	4.75	6.02	0.0051	739.40	744.15	4.75	4.28	MH 3			
		6006+12	1.72	1.50									738.08				739.11	746.33			0.015			
D261	D35	6005+84	0.00	0.00	10.38	5.25	6.29	3.3	3.9	15	200.3	0.0203	738.08	6.18	8.57	0.0049	738.70	746.33	7.63	7.00	MH			
		173+00	1.72	1.50									734.02				735.05	744.72			0.015			
D35	D33	173+00	0.26	0.19	19.46	3.93	4.87	6.6	8.2	21	48.0	0.0044	723.85	4.12	9.77	0.0036	725.22	744.72	19.50	19.12	CB 8			
		5077+34	1.98	1.68									723.64				725.05	746.41			0.015			



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D30	D31	5079+25	0.04	0.03	10.00	5.32	6.39	0.2	0.2	15	84.0	0.0296	743.64	3.00	10.37	0.0000	743.77	748.13	4.36	3.24	13D
	begin	5077+91	2.02	1.72									741.15				741.86	746.41			0.015
D31	D32	5078+49	0.29	0.26	10.47	5.23	6.32	1.5	1.8	15	58.0	0.0057	741.15	3.16	4.54	0.0011	741.78	746.41	4.63	4.01	13D
		5077+91	2.31	1.97									740.82				741.71	746.20			0.015
D32	D33	5077+91	0.10	0.09	10.77	5.17	6.26	2.0	2.4	15	56.0	0.0046	738.74	3.13	4.10	0.0018	739.51	746.20	6.69	6.21	13D
		5077+34	2.40	2.06									738.48				739.41	746.41			0.015
D33	D259	5077+34	0.37	0.33	19.65	3.91	4.86	9.3	11.6	21	34.0	0.0115	723.64	6.48	15.82	0.0072	725.00	746.41	21.41	21.02	13D
		5077+00	2.77	2.39									723.25				724.76	744.42			0.015
D259	D38	5077+00	0.00	0.00	19.74	3.90	4.16	9.3	9.9	21	18.7	0.0091	709.30	5.91	14.10	0.0052	710.95	744.42	33.47	33.37	MH 3
		5077+00	2.77	2.39									709.13				710.85	713.95			0.015
D159	D38	5078+00	0.44	0.29	10.00	5.32	4.16	1.5	1.2	12	100.0	0.0050	708.34	3.01	2.35	0.0015	711.00	710.84	-0.16	1.50	CB 2-2B
	begin	5077+00	3.21	2.68									707.84				710.85	708.55			0.015
D38	D42	5077+00	0.00	0.00	19.79	3.89	4.16	10.4	11.1	27	199.0	0.0020	707.26	3.37	12.78	0.0017	710.85	713.95	3.10	4.44	MH 3
		5075+00	3.21	2.68									706.87				710.51	713.98			0.015
EX1	EX4	5075+40	0.91	0.46	15.00	4.47	5.32	2.0	2.4	12	214.6	0.0014	710.97	2.59	1.24	0.0061	712.82	714.12	1.30	2.15	CB 2-2B
	begin	5075+10	4.12	3.13									710.67				711.50	713.88			0.015
																					<b>Warning</b>
EX4	D42	5075+10	0.00	0.00	16.38	4.29	5.31	2.0	2.4	15	10.5	0.0048	710.42	3.15	4.15	0.0019	711.33	713.88	2.55	2.21	MH 1
		5075+00	4.12	3.13									710.37				711.31	714.31			0.015
D42	D41	5075+00	0.00	0.00	20.78	3.79	4.16	11.9	13.0	27	368.6	0.0020	706.87	3.44	12.91	0.0024	710.51	714.31	3.80	5.19	MH 3
		5071+31	4.12	3.13									706.13				709.64	711.50			0.015
D100	D41	5071+15	0.38	0.34	10.00	5.32	4.16	1.8	1.4	15	81.4	0.4289	742.15	15.49	39.44	0.0006	742.32	747.40	5.08	4.00	CB 3A
	begin	5071+31	4.50	3.48									707.25				709.64	711.50			0.015



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D41	D101	5071+31 5068+00	0.00 4.50	0.00 3.48	22.56	3.62	4.16	12.6	14.4	27	322.0	0.0020	706.13 705.49	3.41	12.87	0.0029	709.64 708.71	711.50 715.32	1.86	3.12	MH 3 0.015
D68	D67	5068+90 begin	0.17 4.67	0.13 3.61	15.00	4.47	5.45	0.6	0.7	15	88.0	0.0114	710.00 709.00	3.10	6.42	0.0002	710.29 709.80	712.53 712.87	2.24	1.28	CB 2-2B 0.015
D67	D101	5068+00 5068+00	0.42 5.09	0.33 3.94	15.47	4.41	5.45	2.0	2.5	15	8.0	0.0200	709.00 708.84	5.40	8.52	0.0020	709.80 709.78	712.87 715.32	3.07	2.62	CB 2-2B 0.015
D101	D111	5068+00 5067+65	0.00 5.09	0.00 3.94	24.14	3.49	4.16	13.7	16.4	27	130.4	0.0060	705.49 704.71	5.58	22.33	0.0037	708.71 708.23	715.32 729.50	6.61	7.58	MH 3 0.015
D51	D52	166+12 begin	0.59 5.68	0.53 4.47	10.00	5.32	6.49	2.8	3.4	15	11.0	0.0100	734.50 734.39	4.58	6.02	0.0038	735.43 735.39	739.65 738.44	4.22	3.90	CB 3 0.015
D52	D111	166+49 163+01	0.00 5.68	0.00 4.47	10.04	5.31	6.31	2.8	3.3	15	302.0	0.0236	734.39 727.25	6.28	9.26	0.0036	734.93 728.24	738.44 730.50	3.51	2.80	CB 3 0.015
EX	AB3	163+00 begin	0.26 5.94	0.24 4.70	10.00	5.32	6.45	1.3	1.5	15	74.4	0.0500	726.54 722.82	6.53	13.47	0.0008	726.84 723.69	730.88 726.96	4.04	3.09	13C 0.015
AB3	D111	162+96 163+01	0.00 5.94	0.00 4.70	10.19	5.28	6.43	1.3	1.5	15	34.0	0.0385	722.49 721.18	5.94	11.82	0.0007	722.81 722.05	727.29 730.50	4.48	3.55	MH 3 0.015
D111	D262	163+00 161+10	0.00 5.94	0.00 4.70	24.53	3.46	4.16	16.3	19.6	27	188.0	0.0055	704.71 703.68	5.57	21.37	0.0053	708.23 707.23	730.50 727.25	22.27	23.54	CB 8 0.015
EX3	AB27	160+87 begin	0.30 6.24	0.27 4.97	10.00	5.32	6.44	1.4	1.7	15	80.0	0.0323	722.39 719.81	5.79	10.82	0.0009	722.74 720.70	726.39 723.02	3.65	2.75	13C 0.015
AB27	D50	161+12 161+01	0.00 6.24	0.00 4.97	10.23	5.28	6.44	1.4	1.7	15	16.4	0.2502	719.81 715.72	11.91	30.12	0.0009	720.02 716.61	723.02 721.03	3.00	1.96	MH 3 0.015



# STORM SEWER SYSTEM

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	(10 yrs.)	(50 yrs.)	(10 yrs.)	(50 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
D50	D262	161+01 5065+80	2.24 8.48	1.80 6.77	18.51	4.03	5.01	8.3	10.4	15	33.0	0.0800	713.30 710.66	13.07	17.03	0.0342	714.04 711.88	721.03 727.25	6.99	6.48	CB 8 0.015
D262	D110	161+09 159+64	0.00 8.48	0.00 6.77	25.09	3.41	4.16	23.1	28.1	30	139.0	0.0045	703.43 702.80	5.55	25.74	0.0063	707.23 706.36	727.25 726.43	20.02	21.32	CB 8 0.015
D224	D66	4158+16 begin 4157+98	0.03 8.52	0.03 6.80	10.00	5.32	6.43	0.2	0.2	15	18.0	0.0300	721.12 720.58	3.00	10.43	0.0000	721.66 721.66	725.39 725.48	3.73	3.02	CB 3A 0.015
D66	D113	157+98 5063+25	0.92 9.44	0.83 7.63	10.10	5.30	6.43	4.6	5.5	15	59.0	0.0100	720.58 719.99	5.08	6.02	0.0097	721.66 721.09	725.48 725.28	3.82	3.65	CB 3A 0.015
D110	D113	159+69 158+46	0.00 9.44	0.00 7.63	25.50	3.38	4.16	22.9	28.1	30	120.0	0.0050	702.80 702.20	5.80	27.04	0.0063	706.36 705.61	726.46 725.28	20.10	21.16	CB 8 0.015
D114	D104	5061+97 begin 5062+60	0.39 9.83	0.35 7.98	10.00	5.32	6.39	1.9	2.2	15	84.0	0.0043	725.03 724.67	3.00	3.94	0.0016	725.74 725.59	730.28 730.90	4.54	4.00	CB 3A 0.015
D104	D113	5062+60 157+79	0.05 9.88	0.05 8.03	10.47	5.23	6.36	2.1	2.5	15	67.0	0.0645	724.67 720.35	8.24	15.29	0.0020	725.03 721.29	730.90 725.28	5.87	4.98	CB 3A 0.015
D113	D108	5063+25 5061+00	0.00 9.88	0.00 8.03	25.85	3.35	4.16	27.9	34.5	30	231.0	0.0055	702.20 700.93	6.07	28.35	0.0094	705.61 703.43	725.28 705.75	19.67	20.58	CB 8 0.015
D69	D70	5064+56 begin 5063+93	0.21 10.09	0.19 8.22	10.00	5.32	6.39	1.0	1.2	15	63.0	0.0032	724.45 724.25	2.29	3.39	0.0005	725.12 725.09	729.05 728.85	3.93	3.35	I 3D 0.015
D70	D113	5063+93 5063+25	0.10 10.19	0.09 8.31	10.46	5.23	6.32	1.5	1.8	15	100.0	0.0225	724.25 722.00	5.15	9.03	0.0010	724.64 722.89	728.85 725.28	4.21	3.35	I 3D 0.015
D108	OUT	5061+00 final 5060+60	0.00 10.19	0.00 8.31	26.48	3.30	4.16	27.5	34.5	30	41.0	0.0080	700.93 700.60	7.30	34.31	0.0094	703.43 702.85	705.75 703.10	2.32	2.32	MH 3 0.015

---

# APPENDIX I – GRATE CAPACITY CHECK

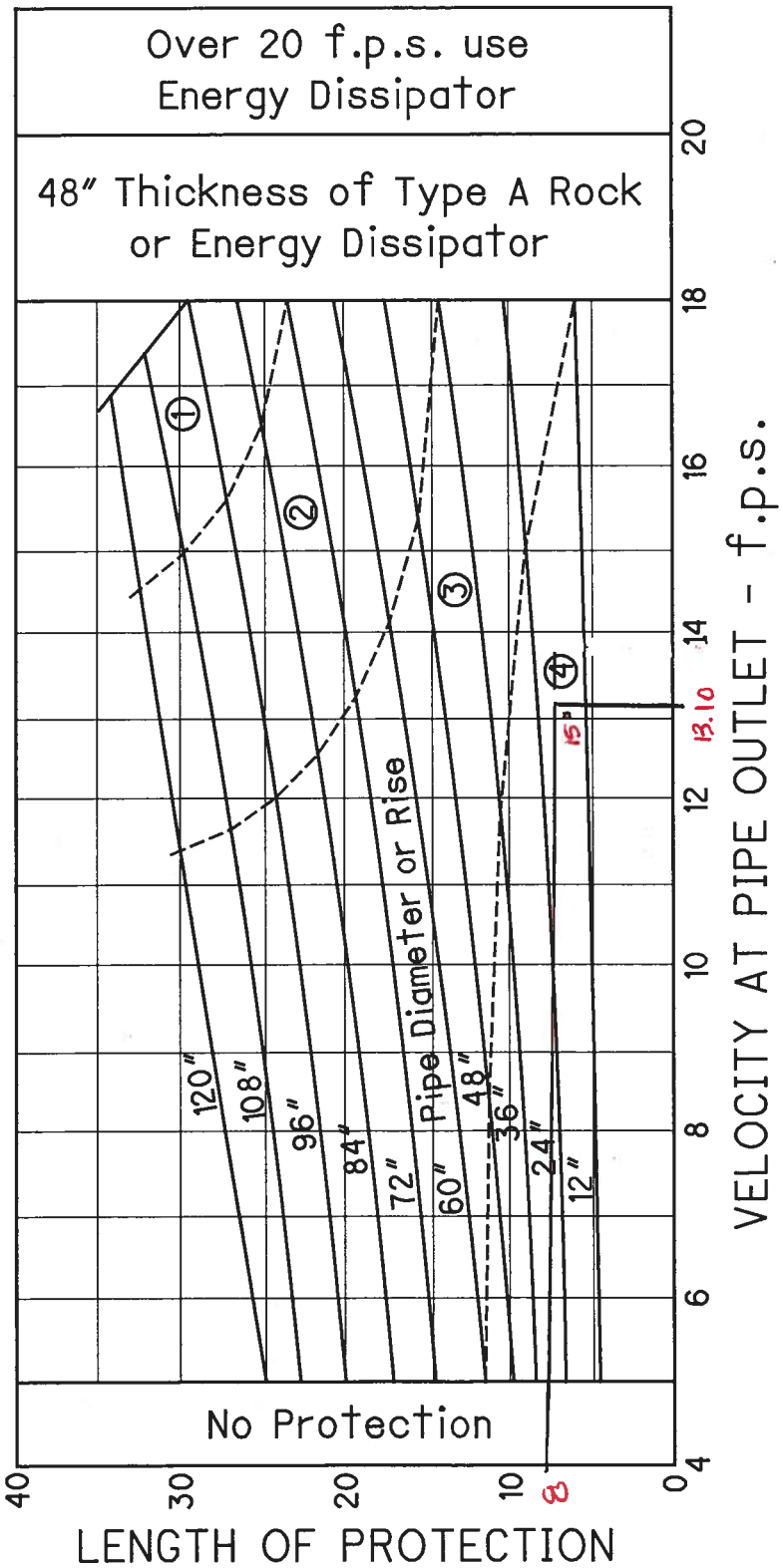
---





ROCK CHANNEL PROTECTION  
AT CULVERT AND STORM  
SEWER OUTLETS

1107-1  
REFERENCE SECTION  
1107.2



LEGEND	ROCK TYPE
① 48" of 18" rock	A
② 36" of 18" rock	A
③ 30" of 12" rock	B
④ 18" of 6" rock	C

8' x 4'

NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

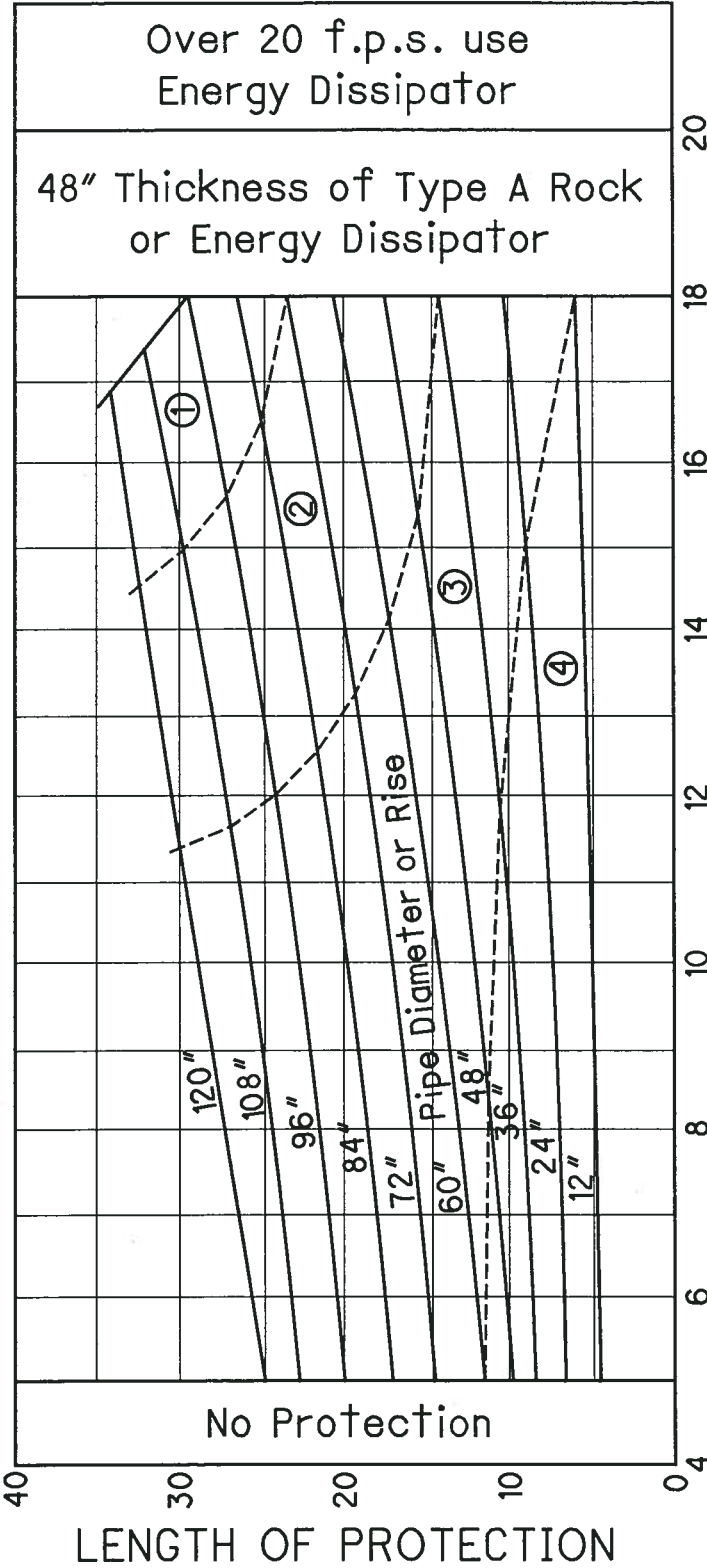
(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

HW-4 (C5@ 5041+42 LT)

# ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1107-1

REFERENCE SECTION  
1107.2



VELOCITY AT PIPE OUTLET - f.p.s.

3.91 FPS = no protection

LEGEND	ROCK TYPE
① 48" of 18" rock	A
② 36" of 18" rock	A
③ 30" of 12" rock	B
④ 18" of 6" rock	C

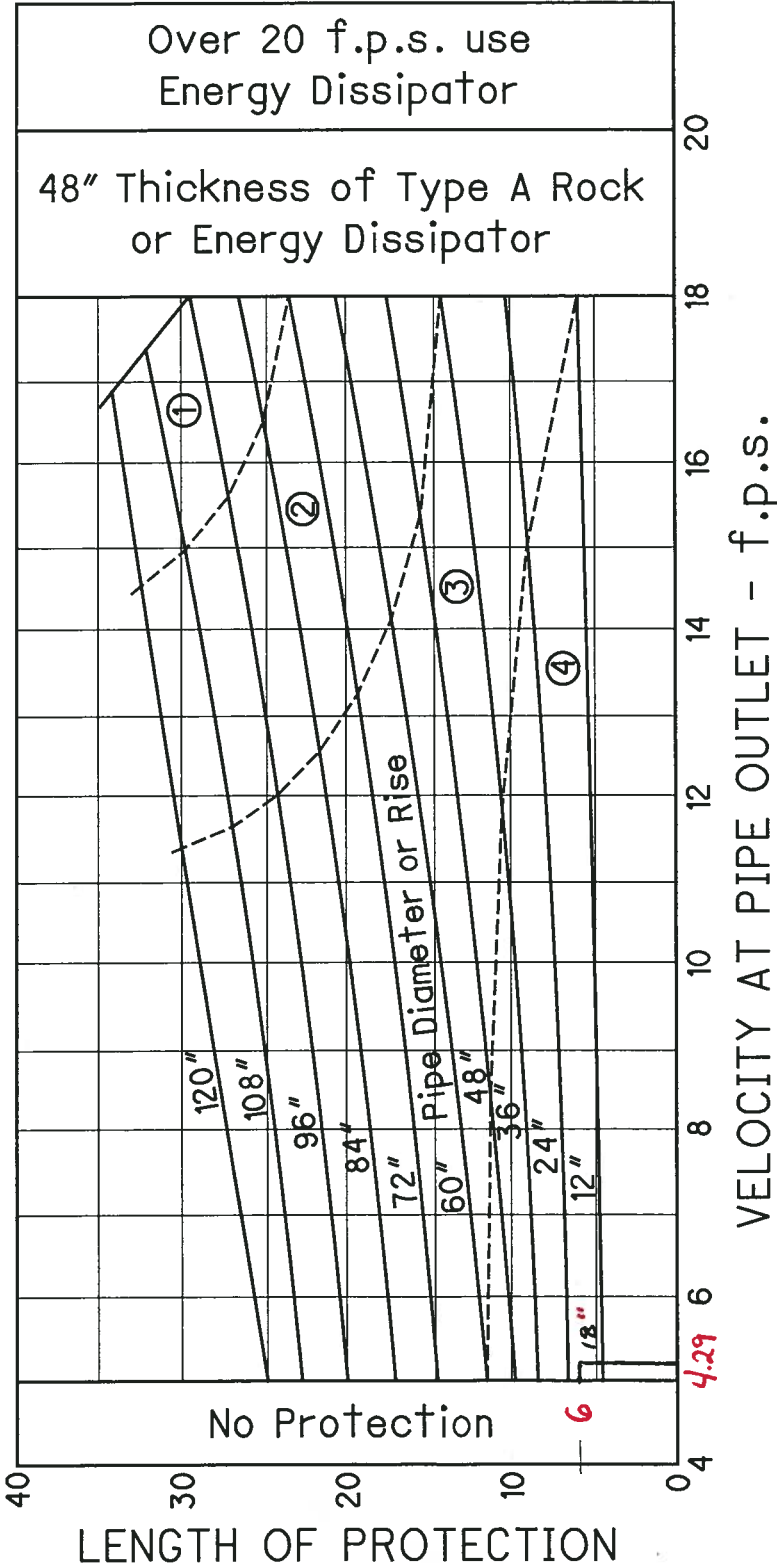
### NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS	1107-1 <hr/> REFERENCE SECTION 1107.2
--	---



LEGEND	ROCK TYPE
① 48" of 18" rock	A
② 36" of 18" rock	A
③ 30" of 12" rock	B
④ 18" of 6" rock	C

*4'x6'*

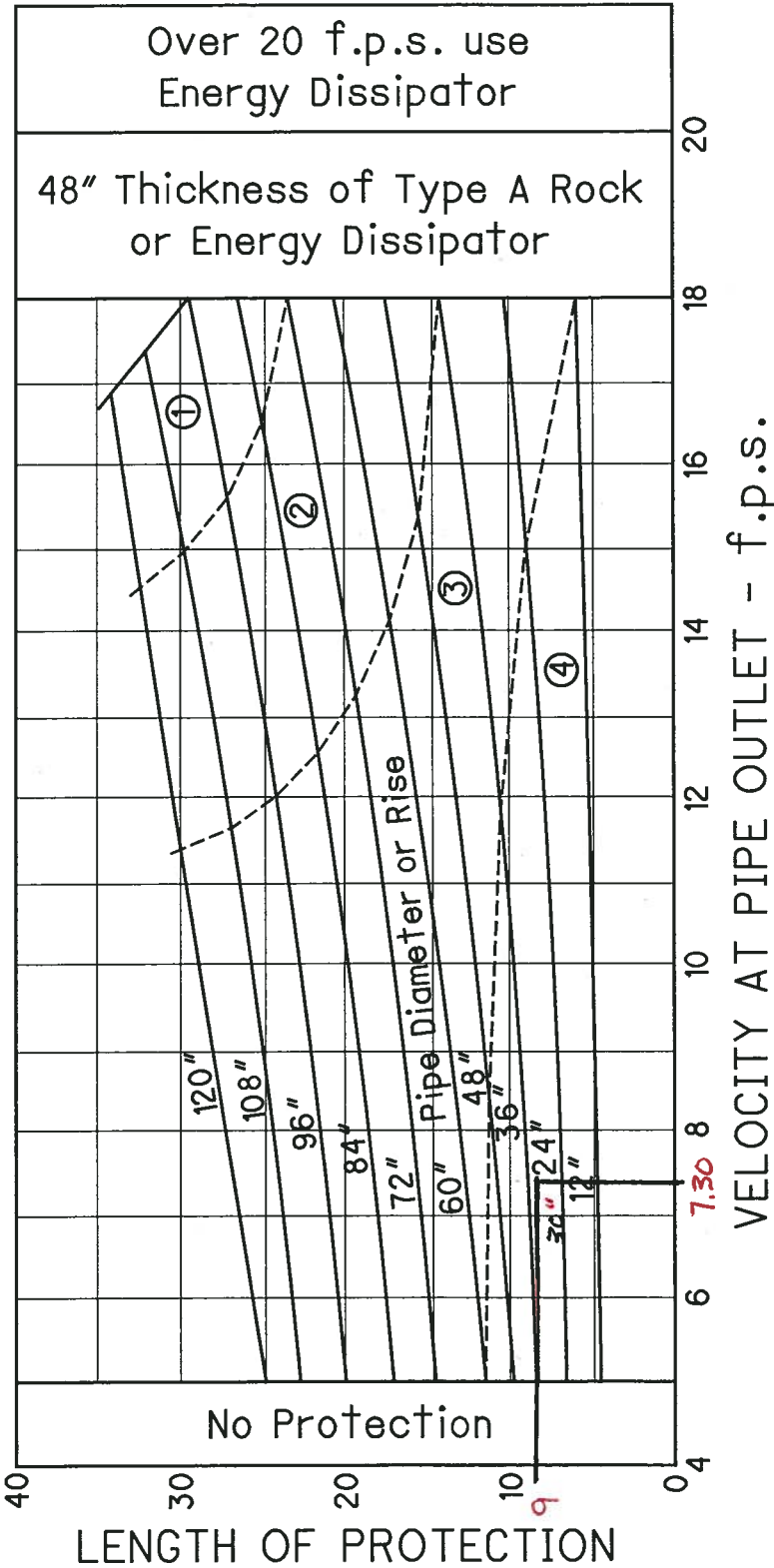
NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS	1107-1
	REFERENCE SECTION 1107.2



- ROCK TYPE**
- LEGEND**
- ① 48" of 18" rock
  - ② 36" of 18" rock
  - ③ 30" of 12" rock
  - ④ 18" of 6" rock
- 9'x5'

**NOTES**

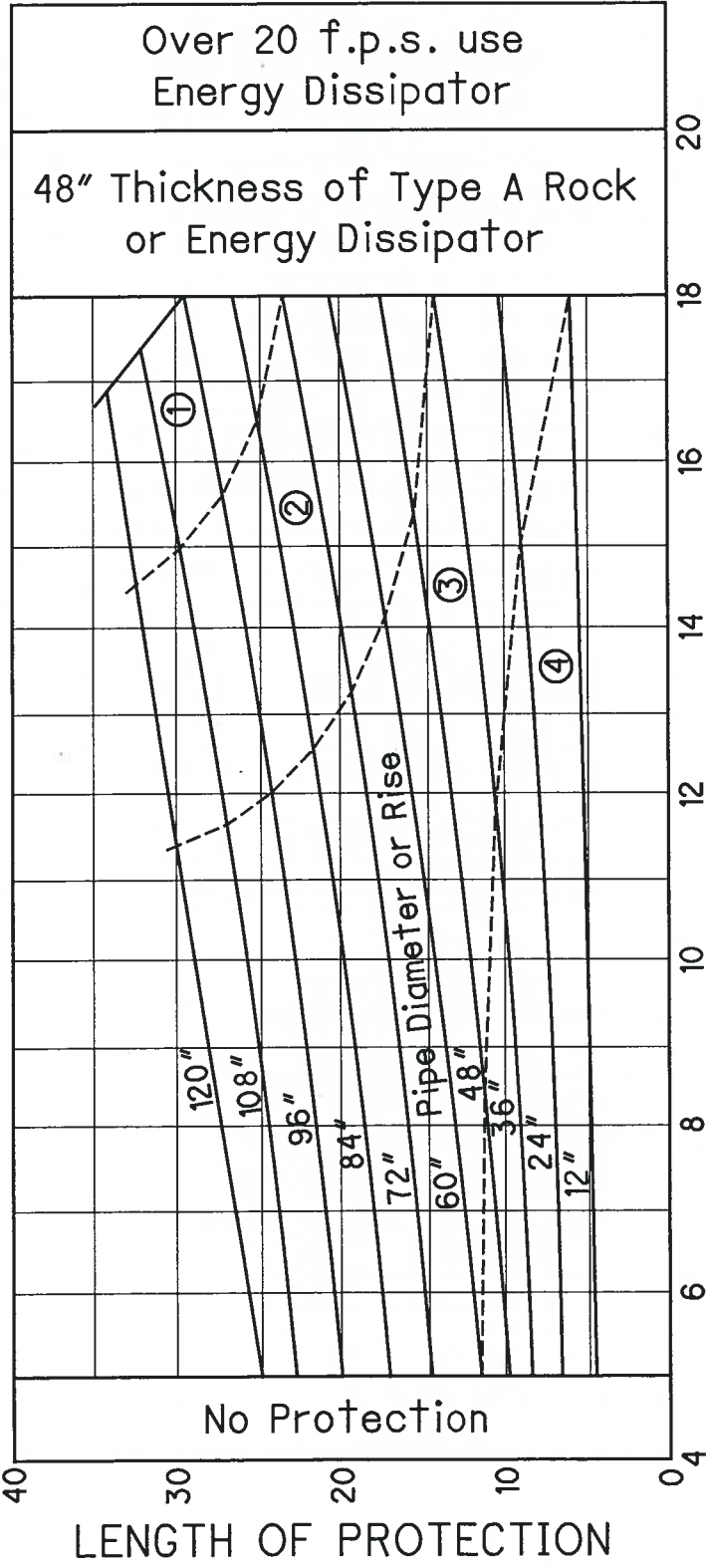
Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

HW-263 (A5@ 5011+98 LT)

ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS	1107-1
	REFERENCE SECTION 1107.2



VELOCITY AT PIPE OUTLET - f.p.s.

2.82 FPS  
no protection

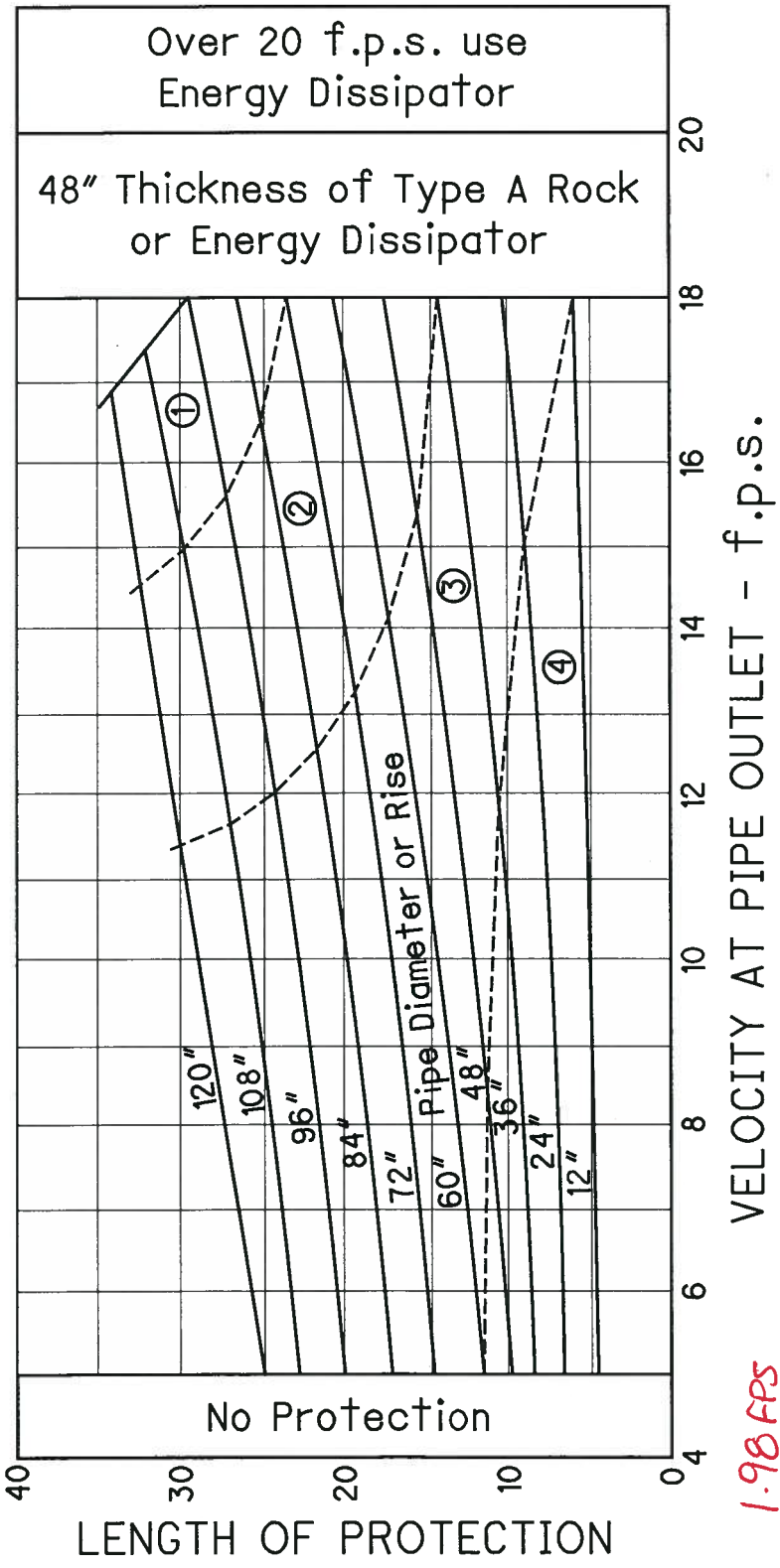
LEGEND	ROCK TYPE
① 48" of 18" rock	A
② 36" of 18" rock	A
③ 30" of 12" rock	B
④ 18" of 6" rock	C

NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.  
 The width of protection shall be the width of the headwall, with 4' being the minimum.  
 (Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

HW-266 (A5 @ 5014+00RT)

<h1 style="margin: 0;">ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS</h1>	<h2 style="margin: 0;">1107-1</h2>
	<b>REFERENCE SECTION</b> 1107.2



**LEGEND**

<ul style="list-style-type: none"> <li>① 48" of 18" rock</li> <li>② 36" of 18" rock</li> <li>③ 30" of 12" rock</li> <li>④ 18" of 6" rock</li> </ul>	<p><b>ROCK TYPE</b></p> <p>A A B C</p>
---	--

**NOTES**

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

---

# APPENDIX J – ROCK CHANNEL PROTECTION

---



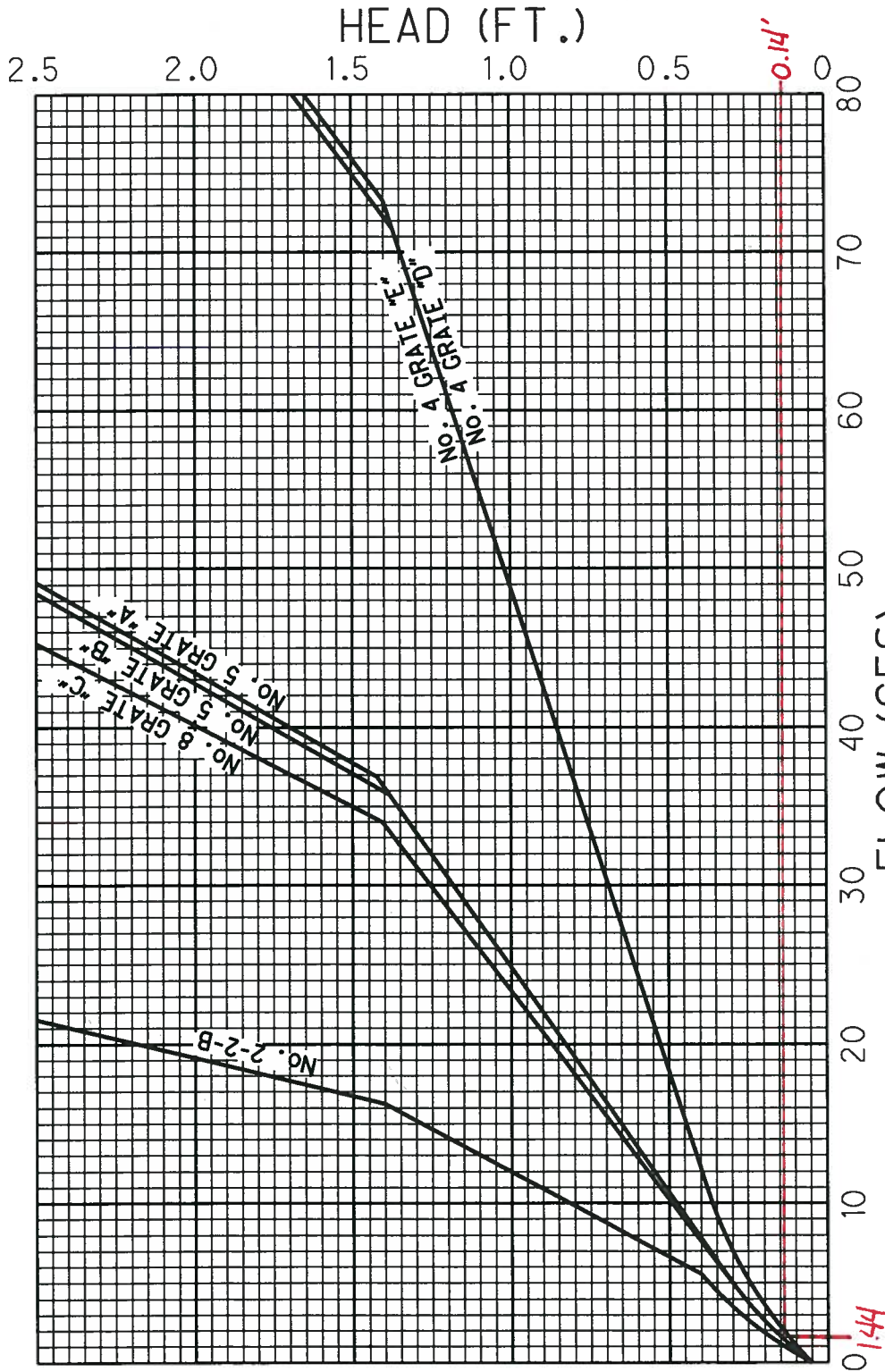
D-35

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



FLOW (CFS)

10 year = 0.72 x 2 = 1.44 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)



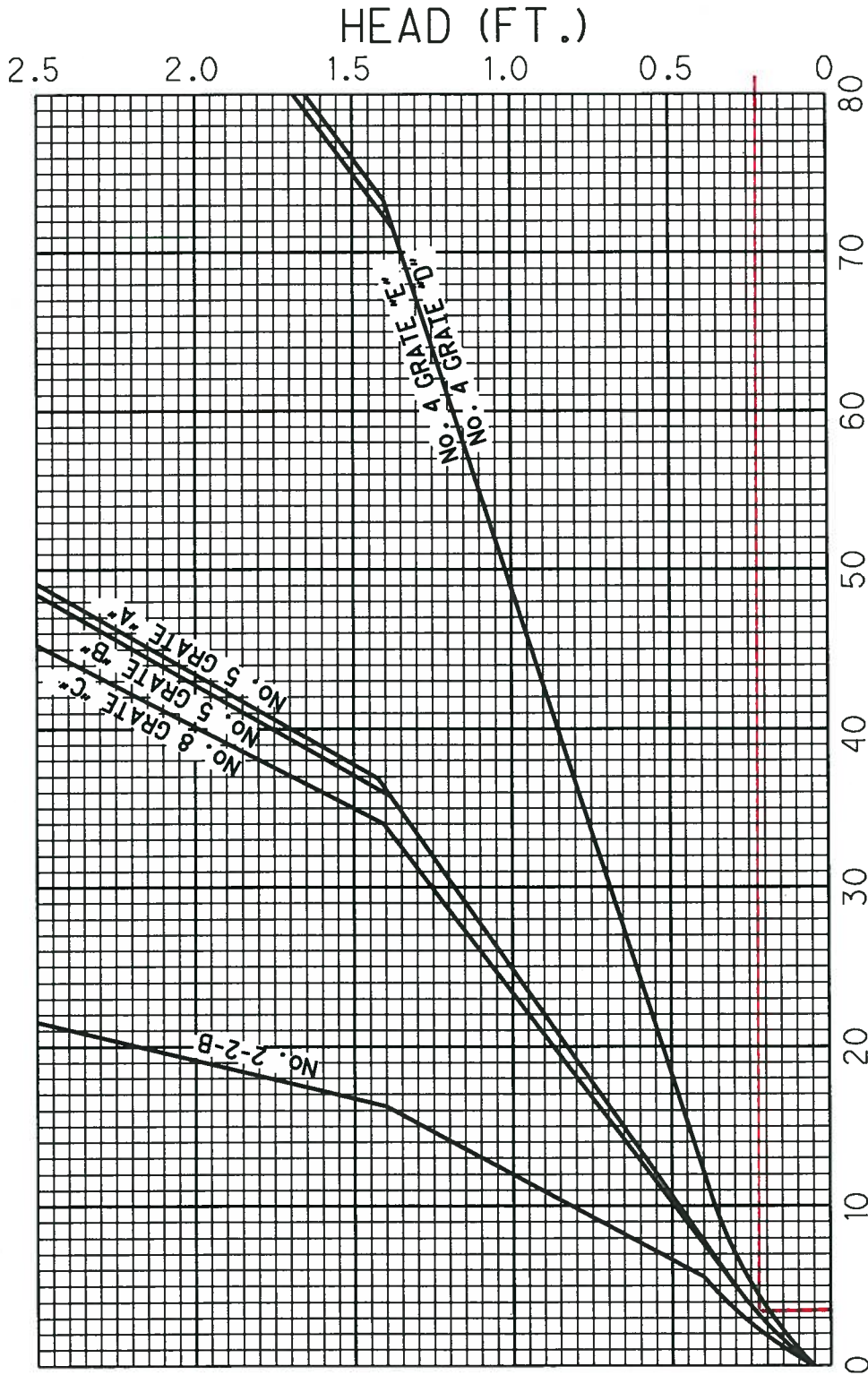
D-36

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



FLOW (CFS)

10 year = 1.58 x 2 = 3.16 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

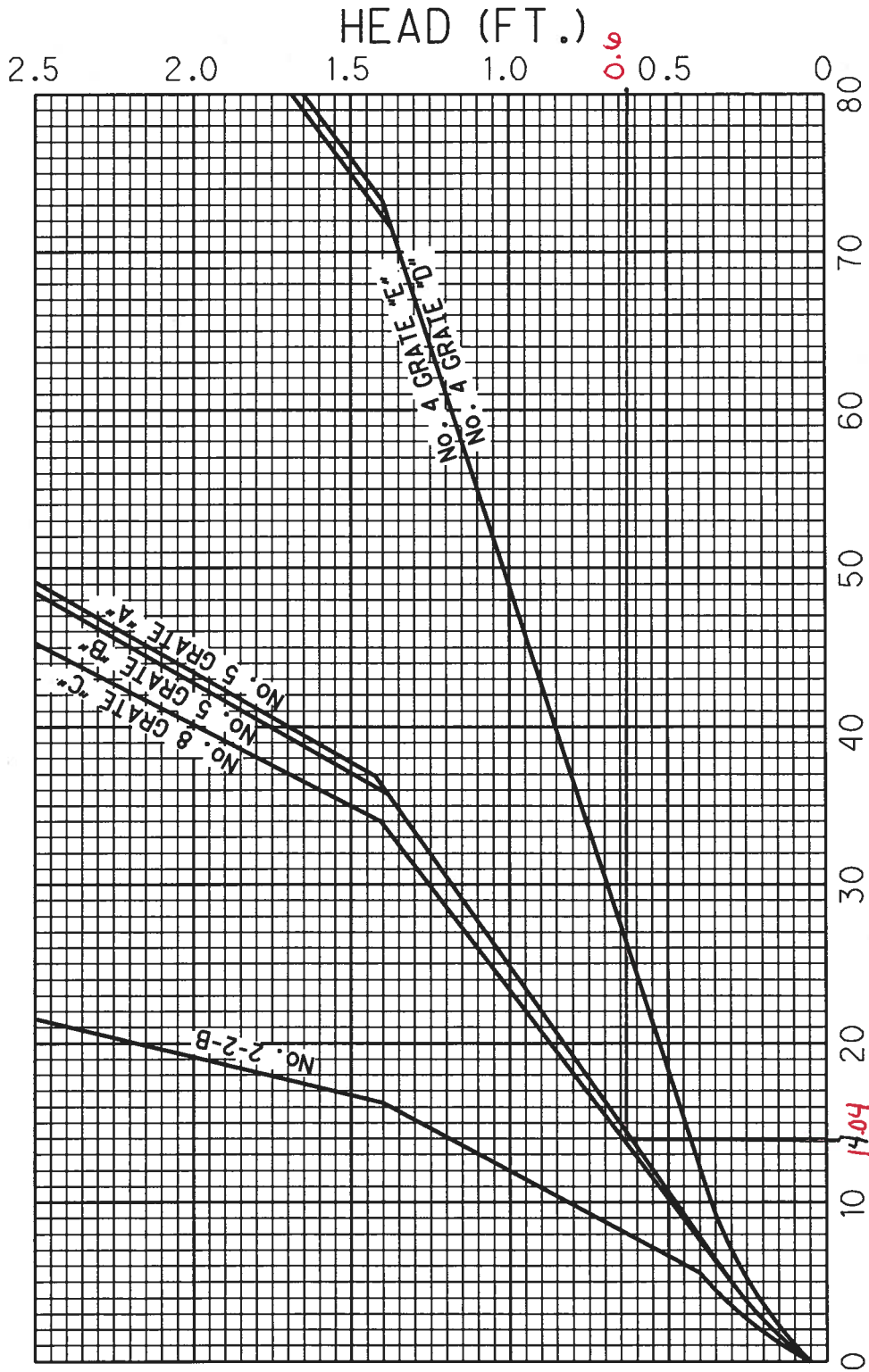
D-50

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



FLOW (CFS)

10 year = 7.02 x 2 = 14.04 CFS

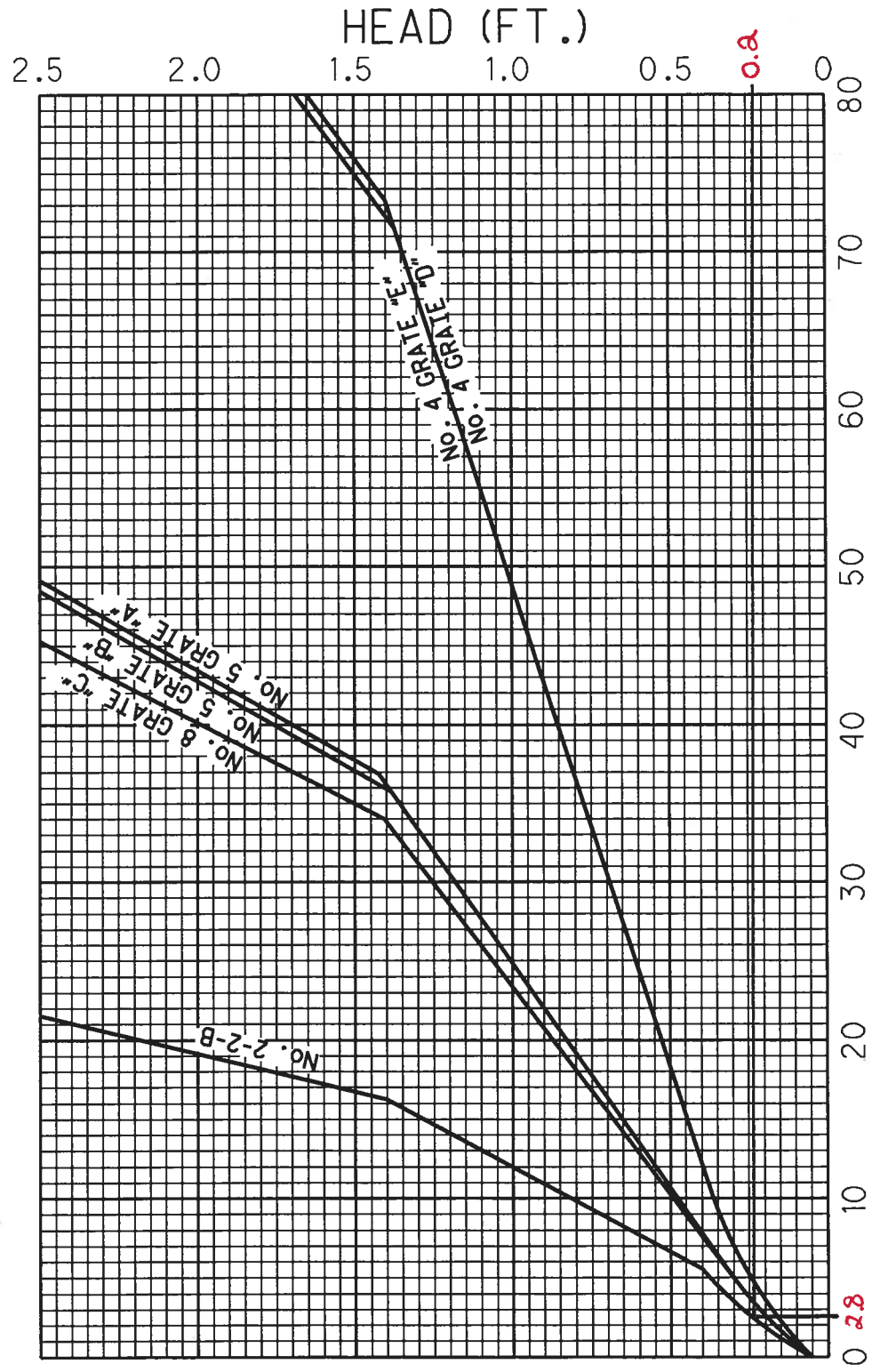
CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

D-67

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION  
1102.3.5



FLOW (CFS)

10 year = 1.40 x 2 = 2.8 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

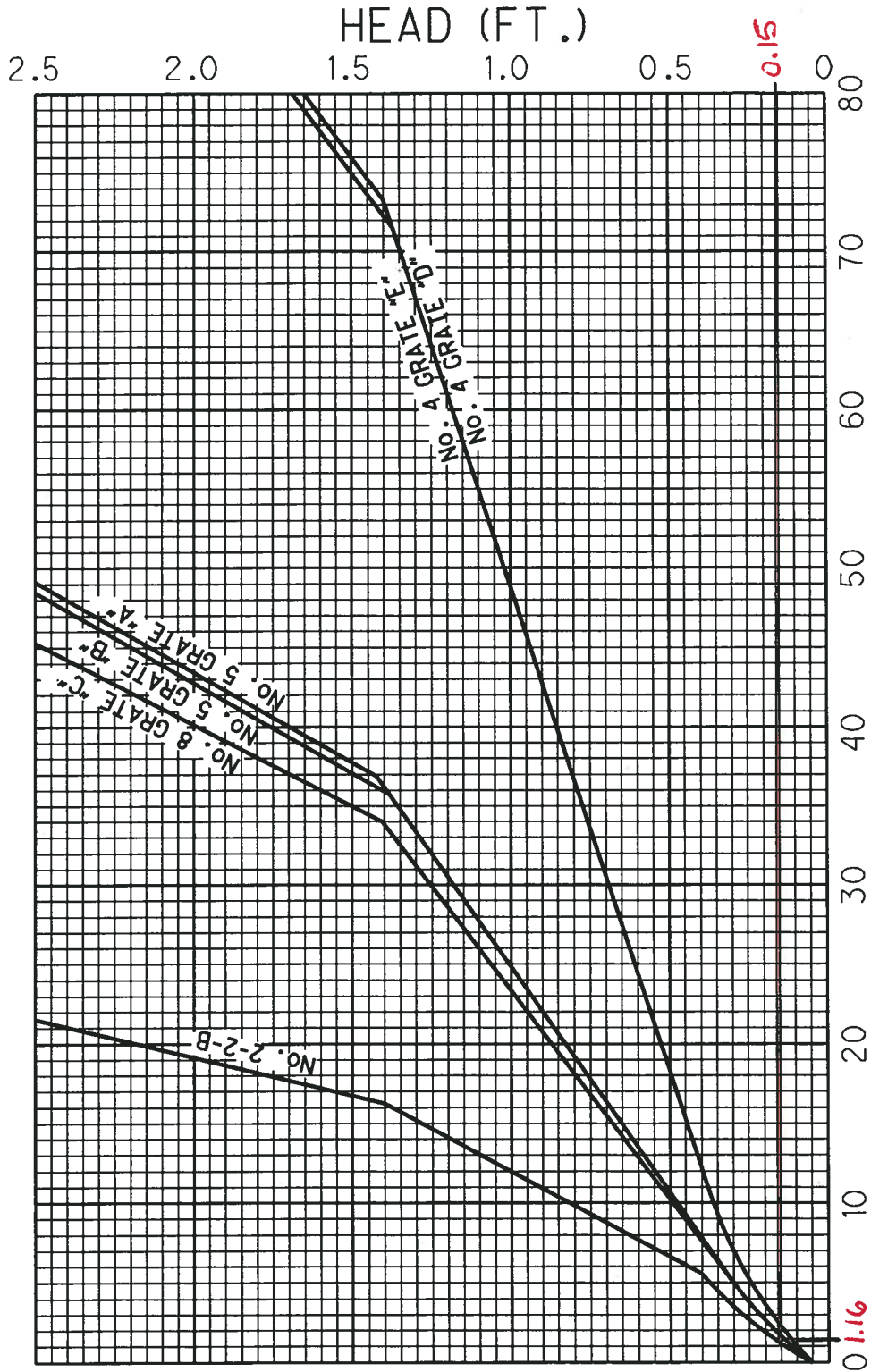
D-68

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



FLOW (CFS)

10 year = 0.58 x 2 = 1.16 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

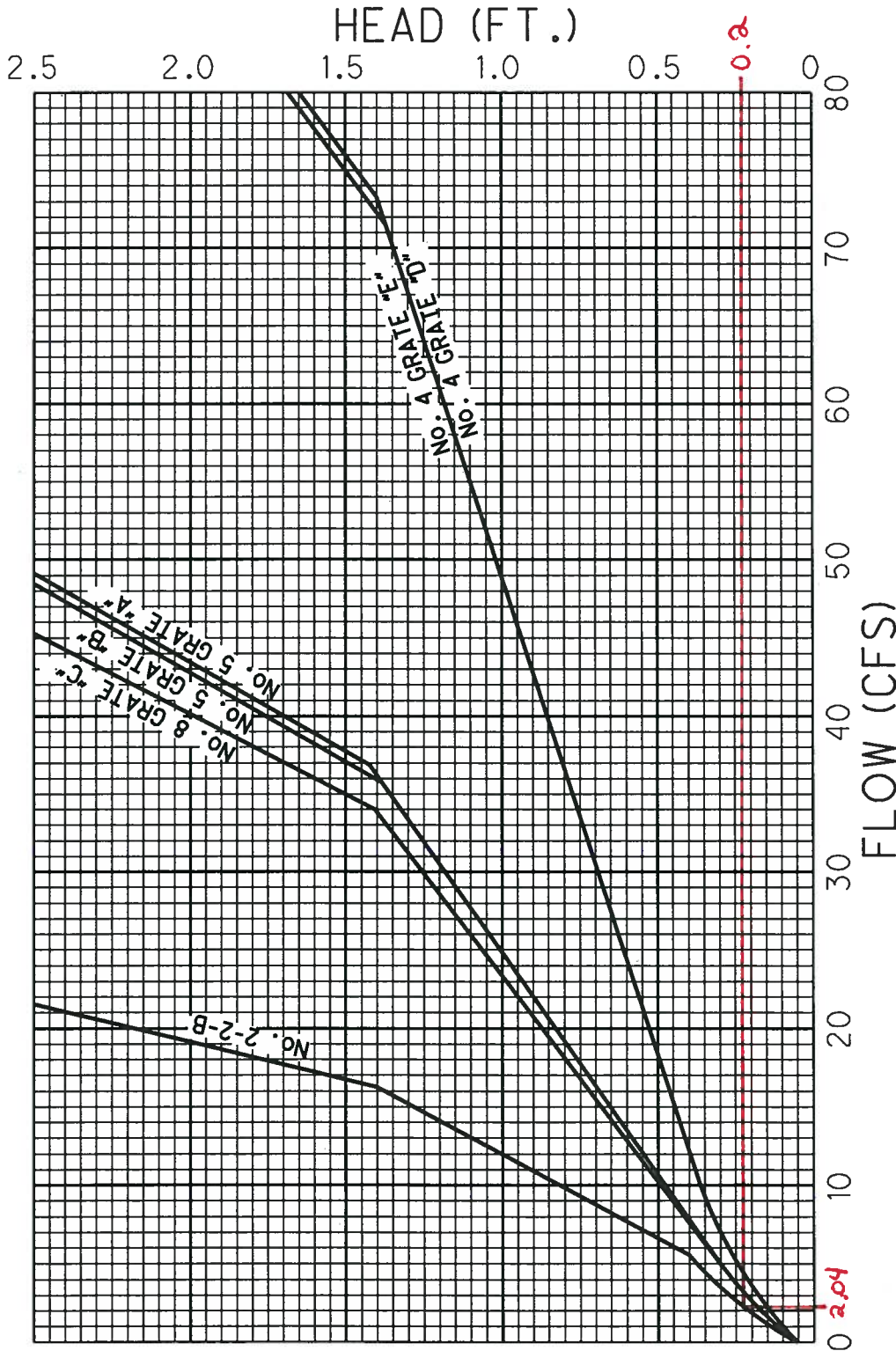
D-159

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



FLOW (CFS)

10 year = 1.02 x 2 = 2.04 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

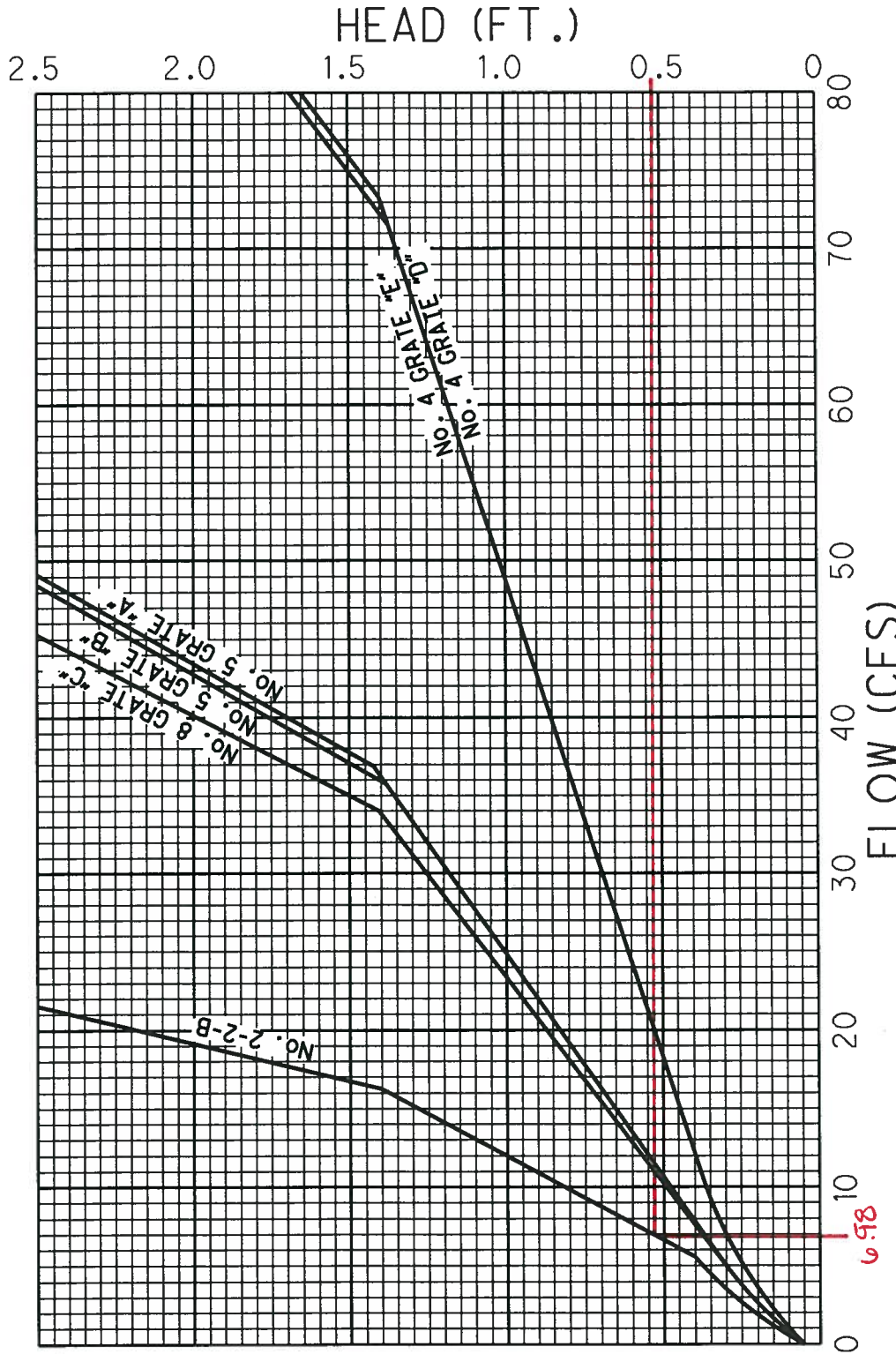
D-201

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



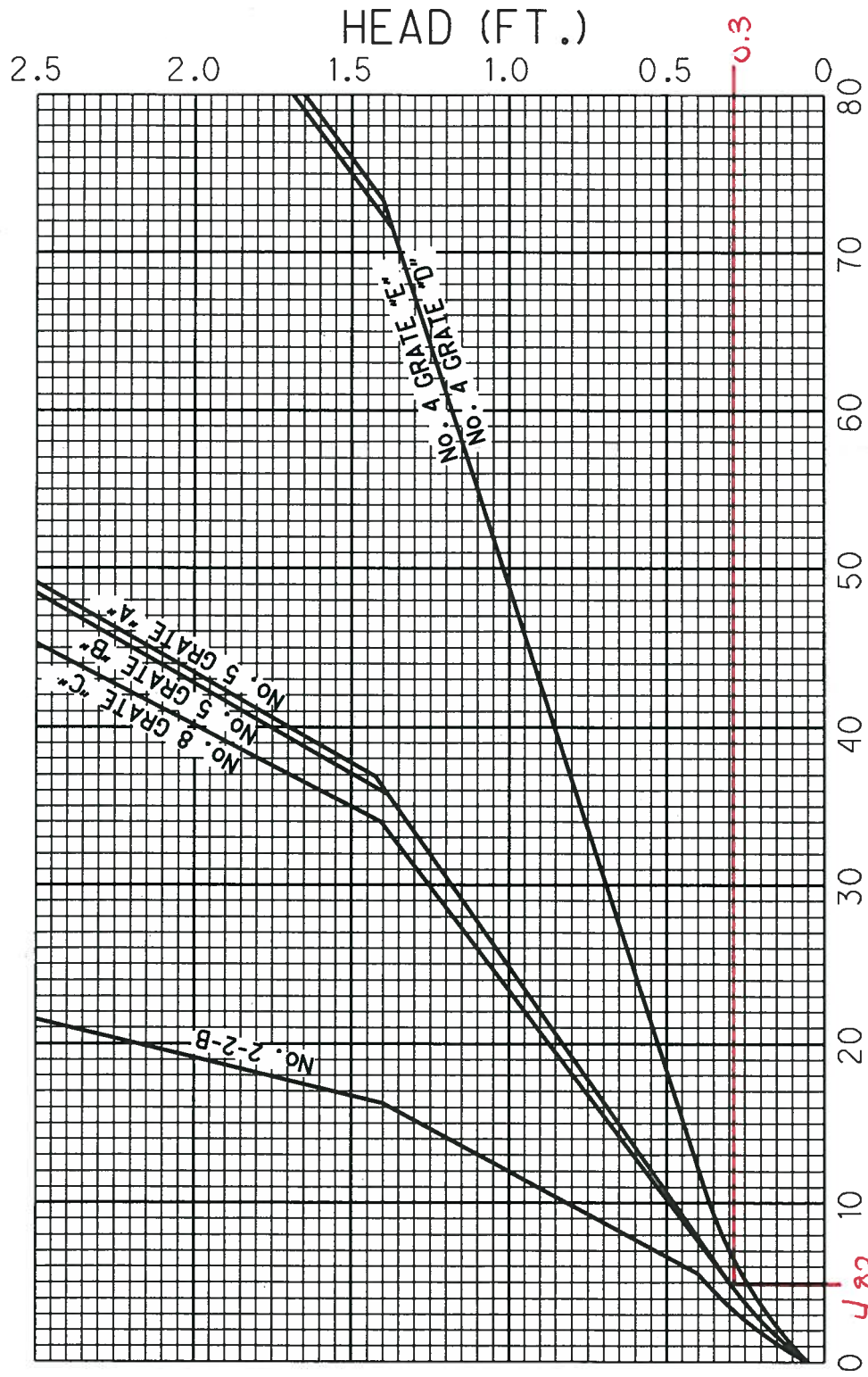
FLOW (CFS)

10 year = 3.49 x 2 = 6.98 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

D-212

CAPACITY OF A GRATE CATCH BASIN IN A SUMP	1102-1
	REFERENCE SECTION 1102.3.5



FLOW (CFS)

10 year =  $2.41 \times 2 = 4.82$  CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

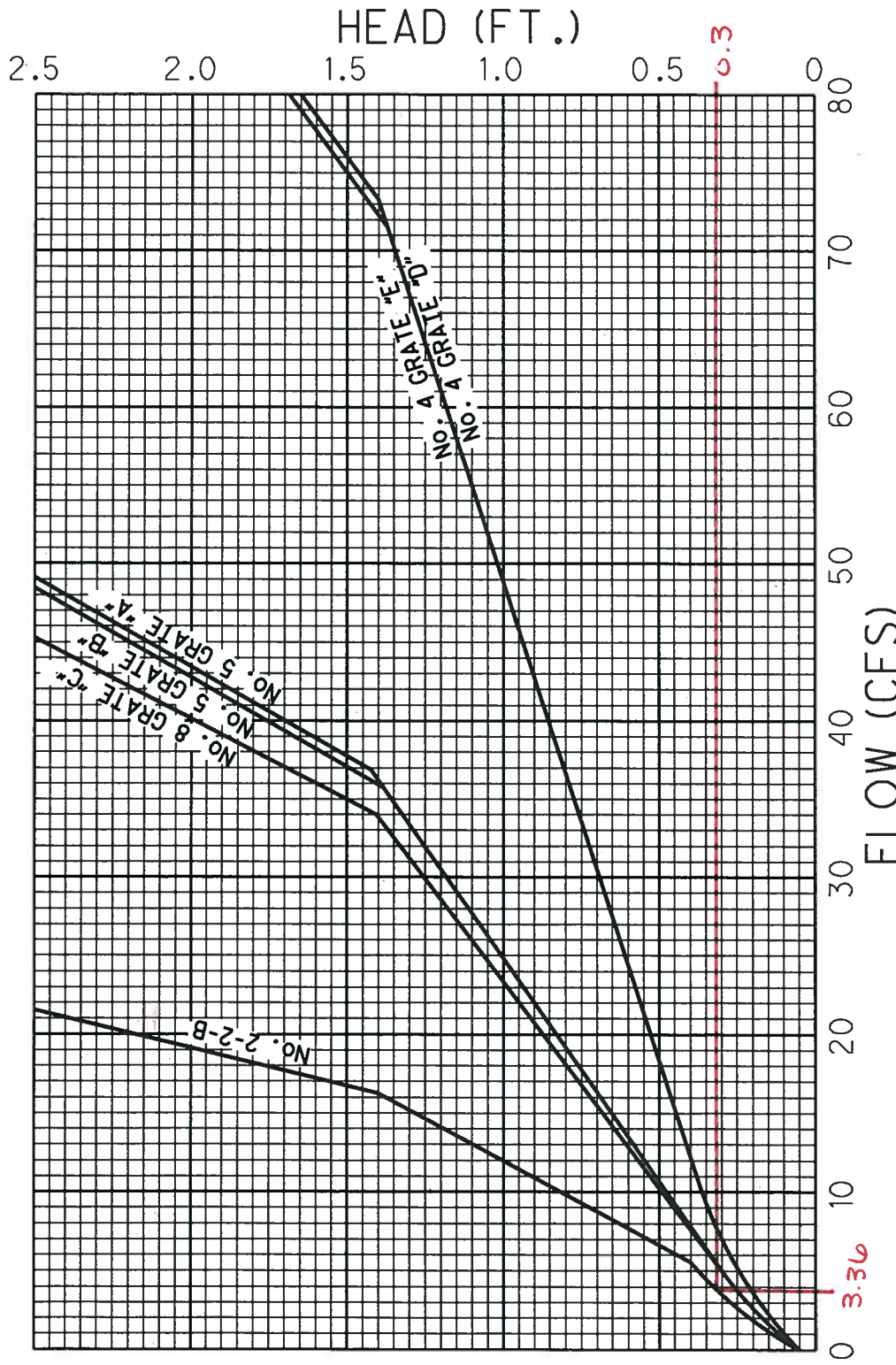
D-213

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



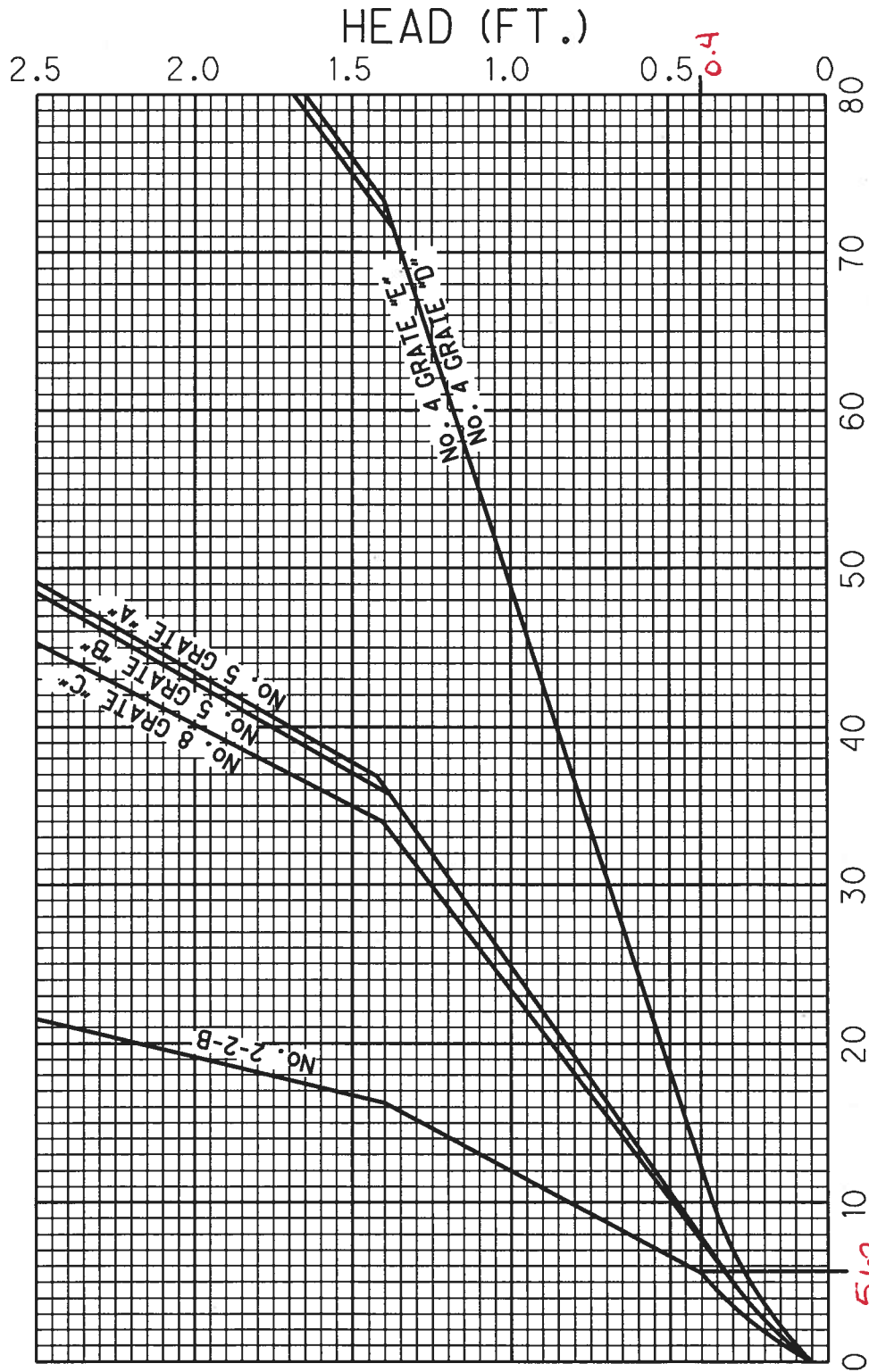
10 year =  $1.68 \times 2 = 3.36$  CFS  
CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)



D-225

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1  
REFERENCE SECTION  
1102.3.5



FLOW (CFS)

10 year = 2.81 x 2 = 5.62

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

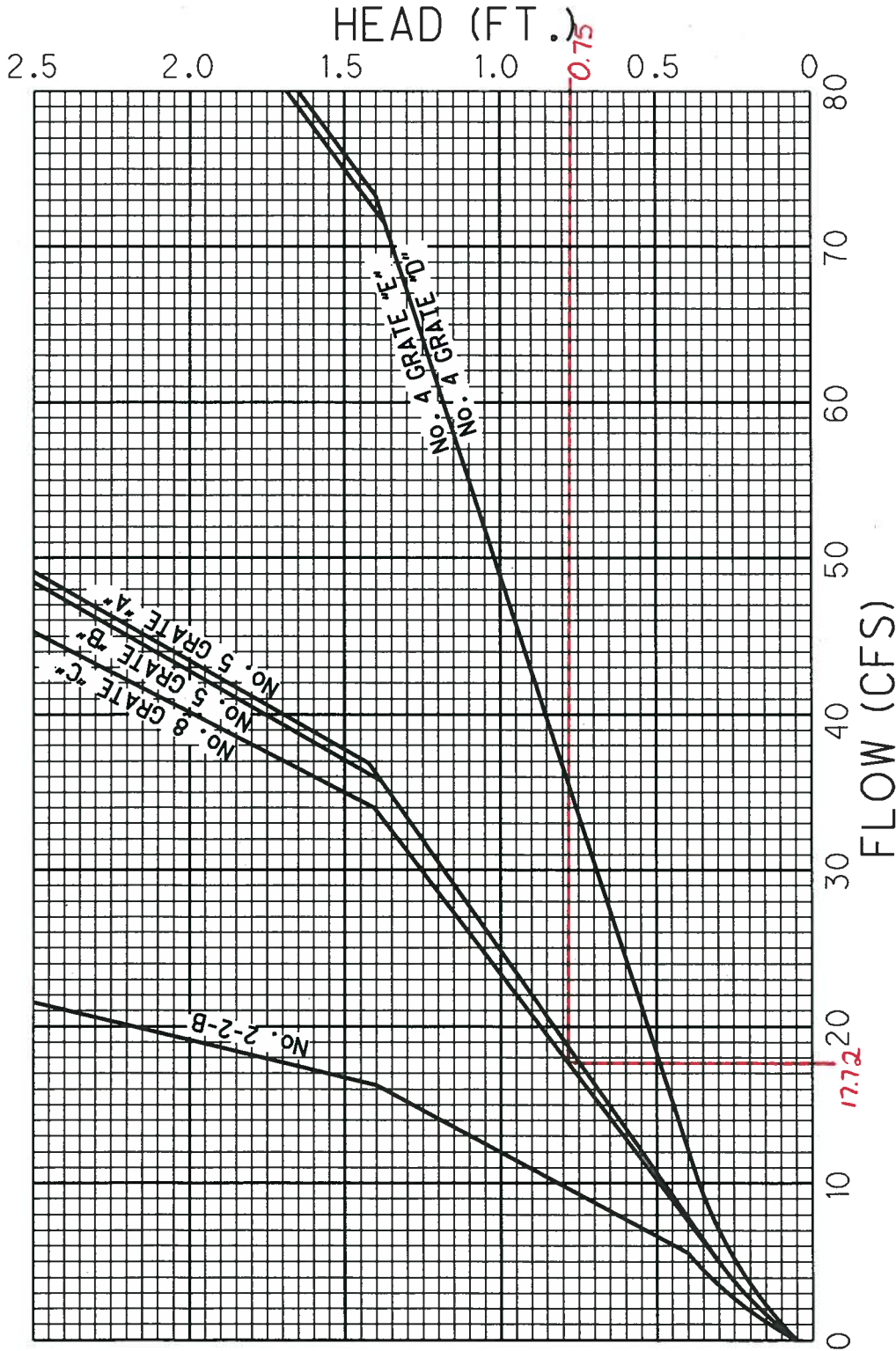
D-230

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



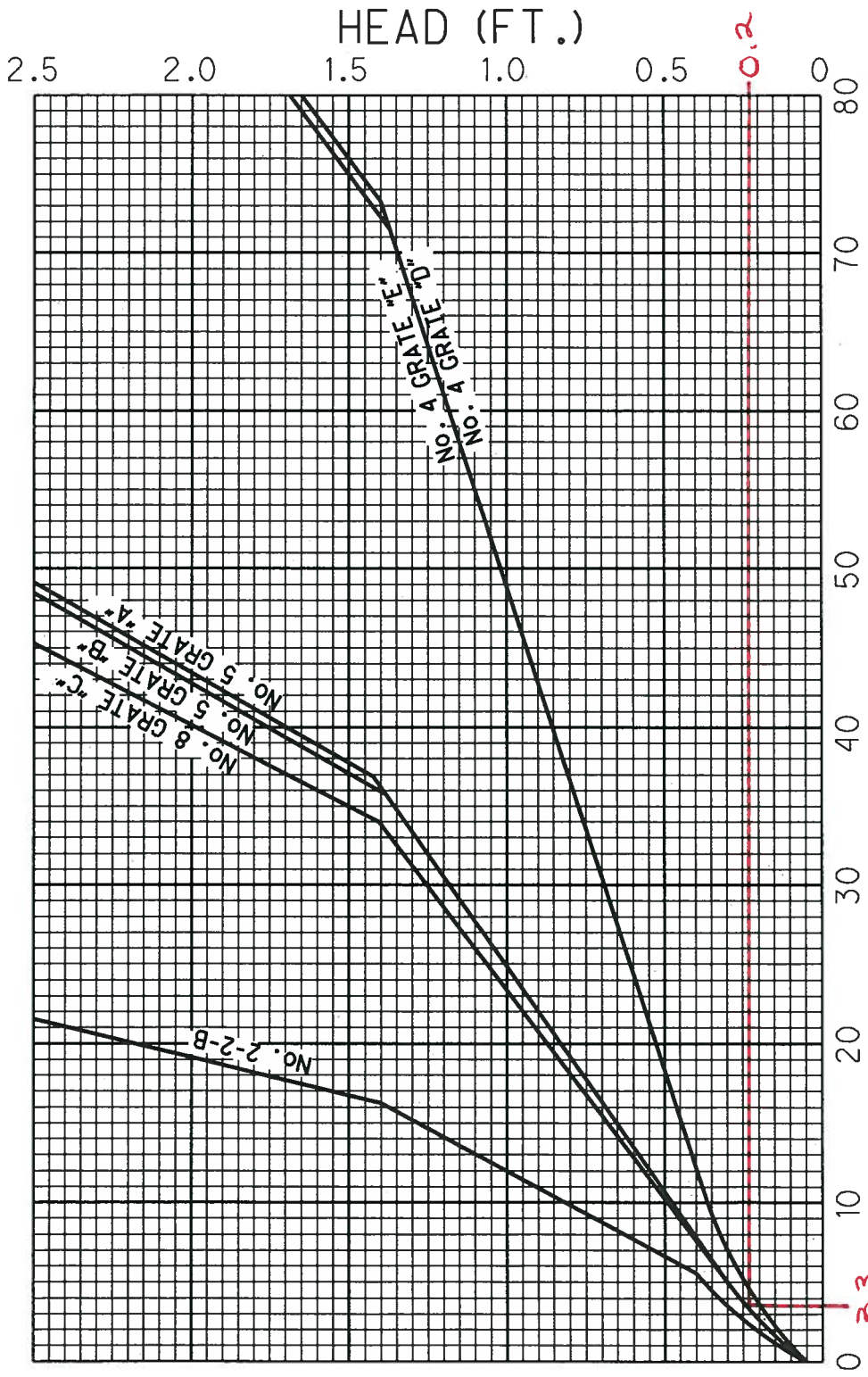
FLOW (CFS)

10 year =  $8.86 \times 2 = 17.72$

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

D-232

CAPACITY OF A GRATE CATCH BASIN IN A SUMP	1102-1
	REFERENCE SECTION 1102.3.5



FLOW (CFS)

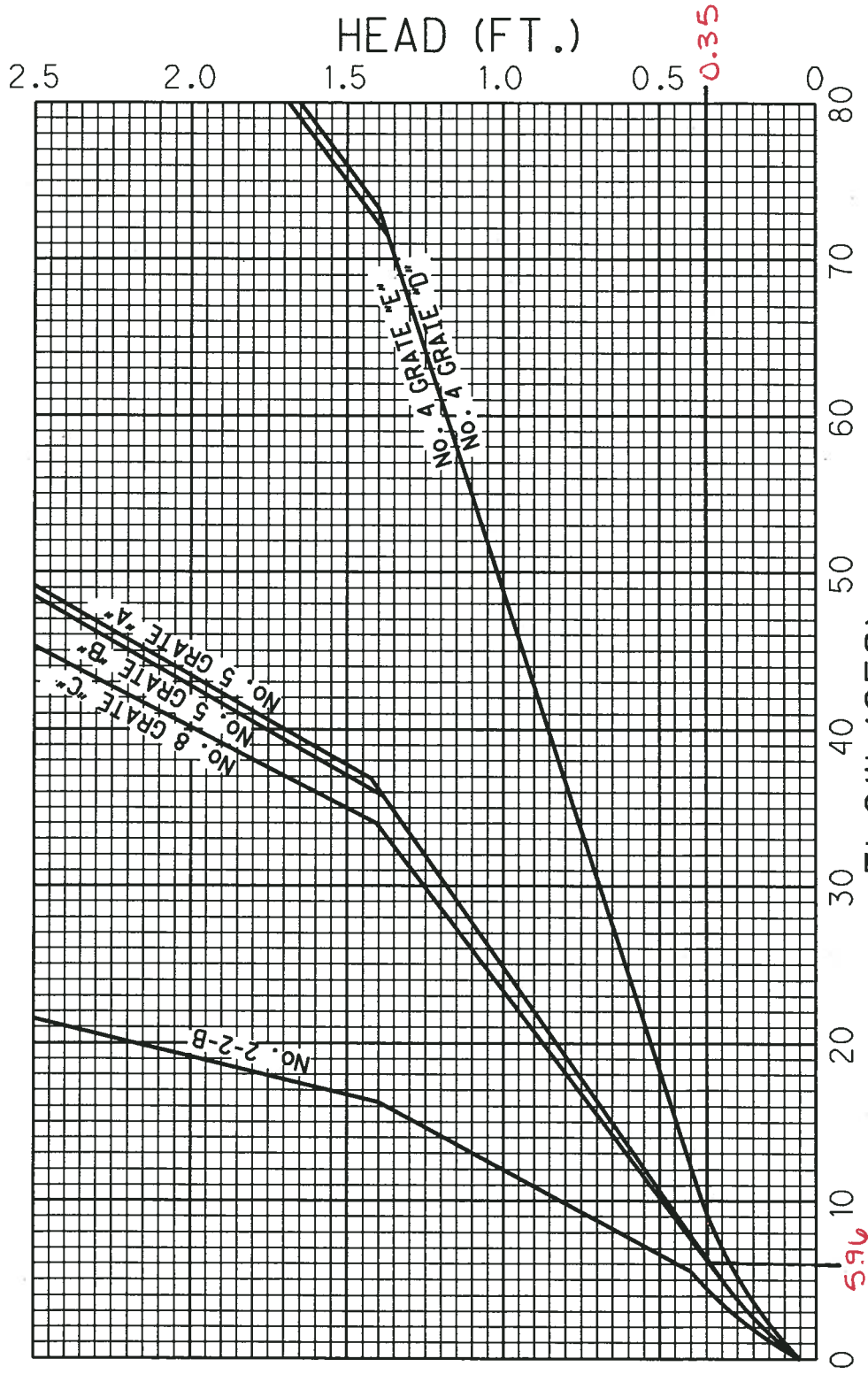
$10 \text{ year} = 1.65 \times 2 = 3.3 \text{ CFS}$

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

D-234

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1  
REFERENCE SECTION  
1102.3.5



FLOW (CFS)

10 year =  $2.96 \times 2 = 5.92$  CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

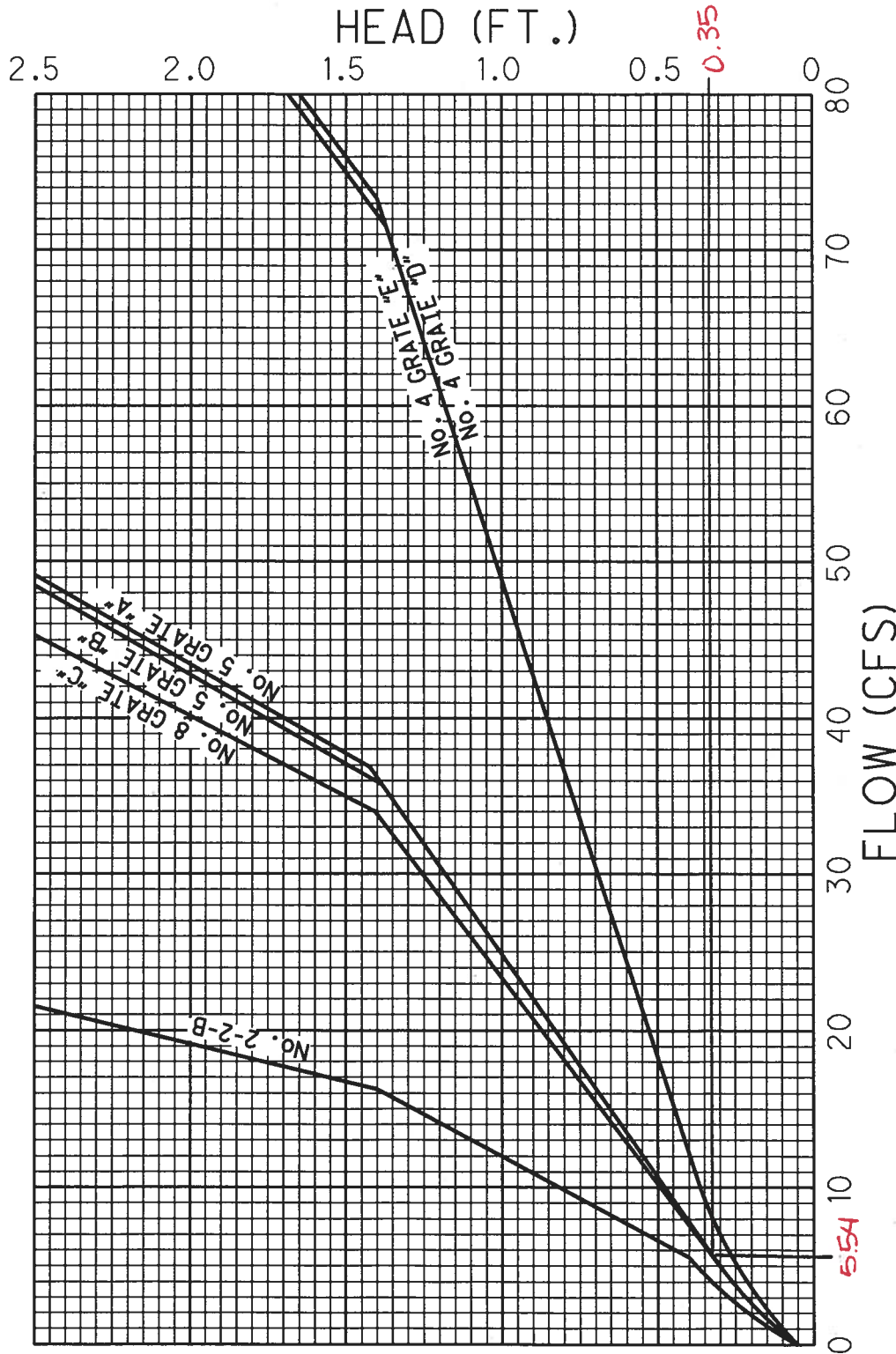
D-235

# CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION

1102.3.5



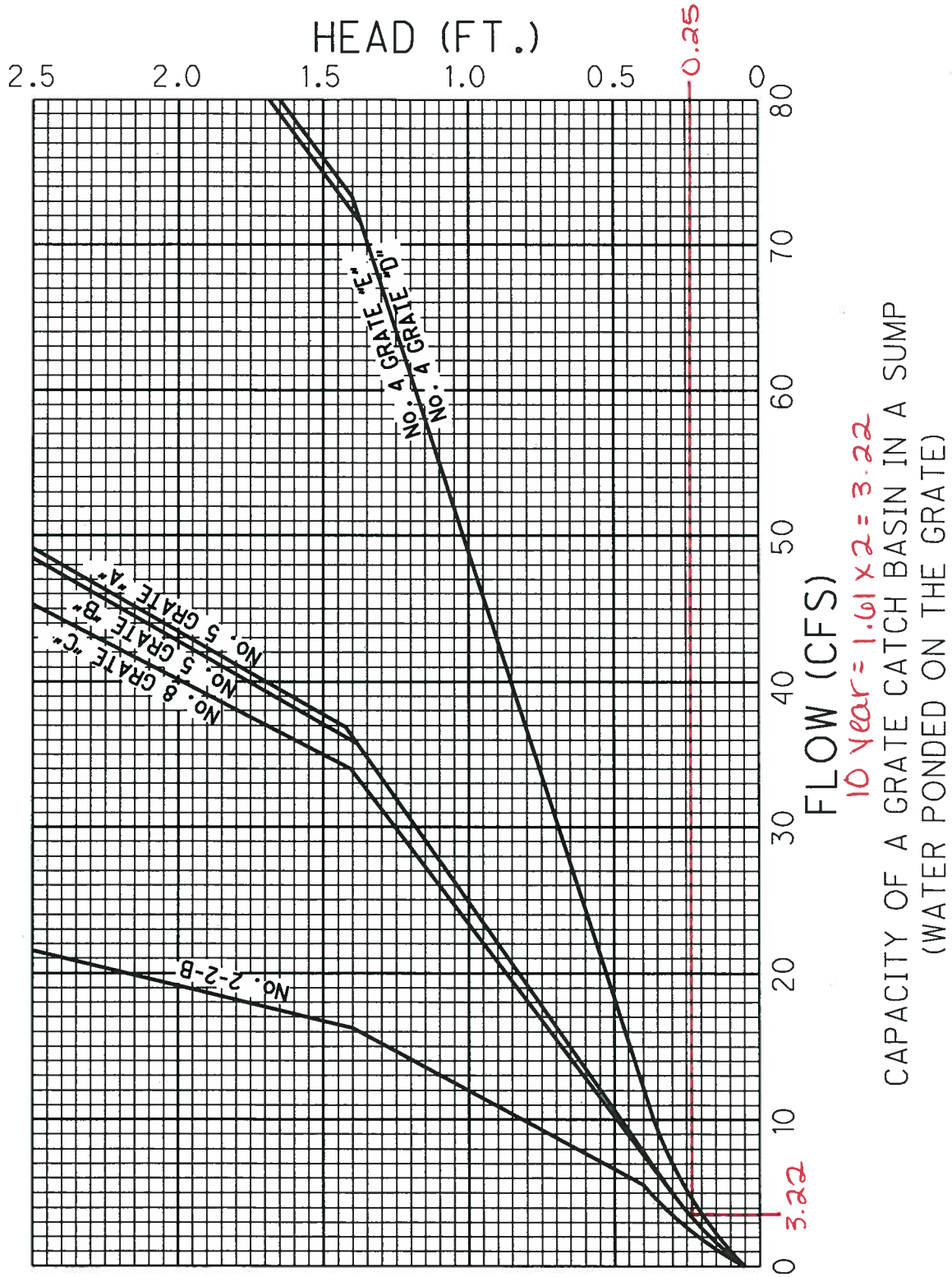
FLOW (CFS)

10 year = 2.77 x 2 = 5.54

CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

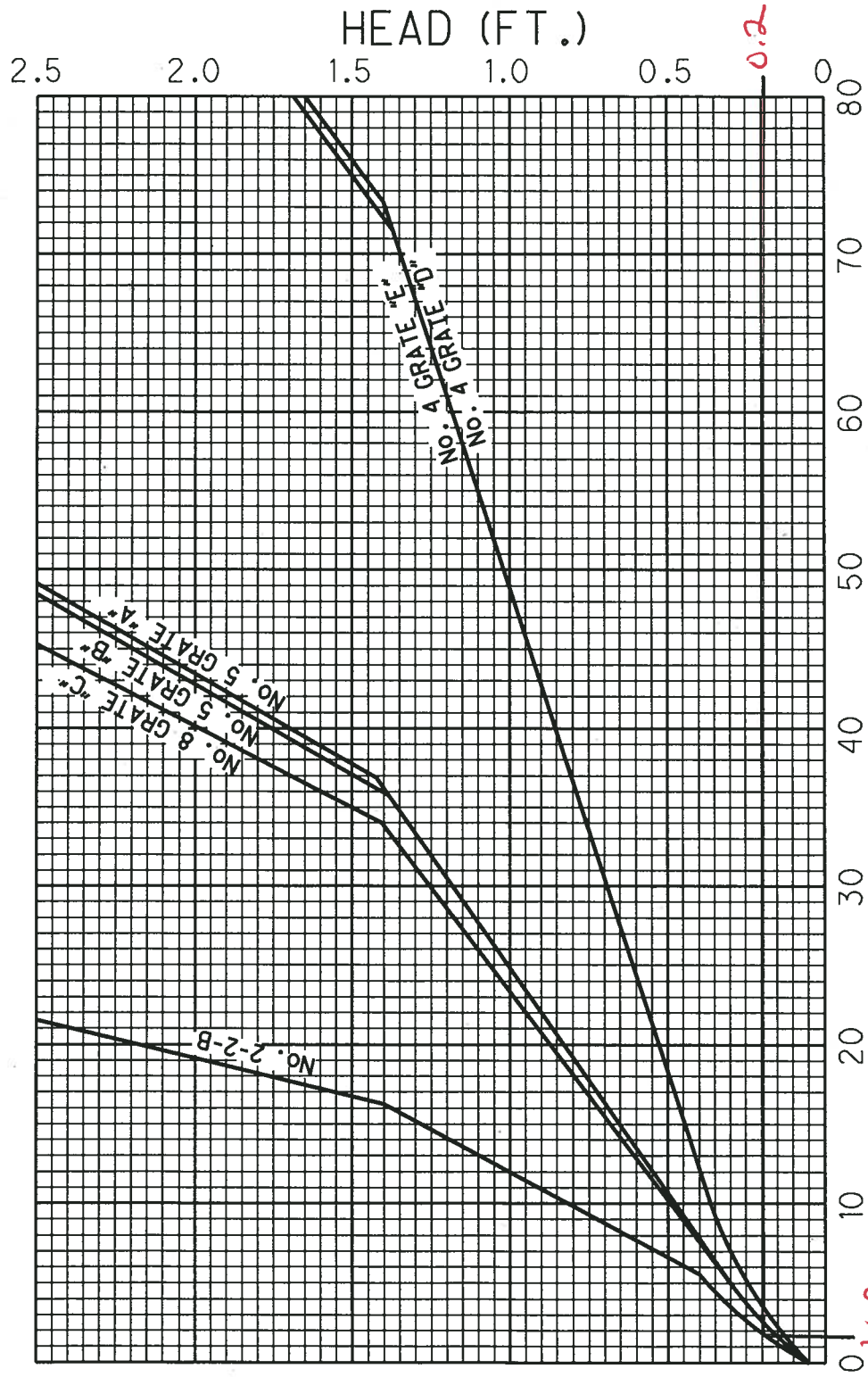
D-239

CAPACITY OF A GRATE CATCH BASIN IN A SUMP	1102-1
	REFERENCE SECTION 1102.3.5



D-258

CAPACITY OF A GRATE CATCH BASIN IN A SUMP	1102-1
	REFERENCE SECTION 1102.3.5



10 year =  $0.81 \times 2 = 1.62$  CFS  
CAPACITY OF A GRATE CATCH BASIN IN A SUMP  
(WATER PONDED ON THE GRATE)

1.62

0.2