Fort Dodge Stormwater Master Planning

Prepared By:

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CITY OF FORT DODGE Engineering

HRGreen

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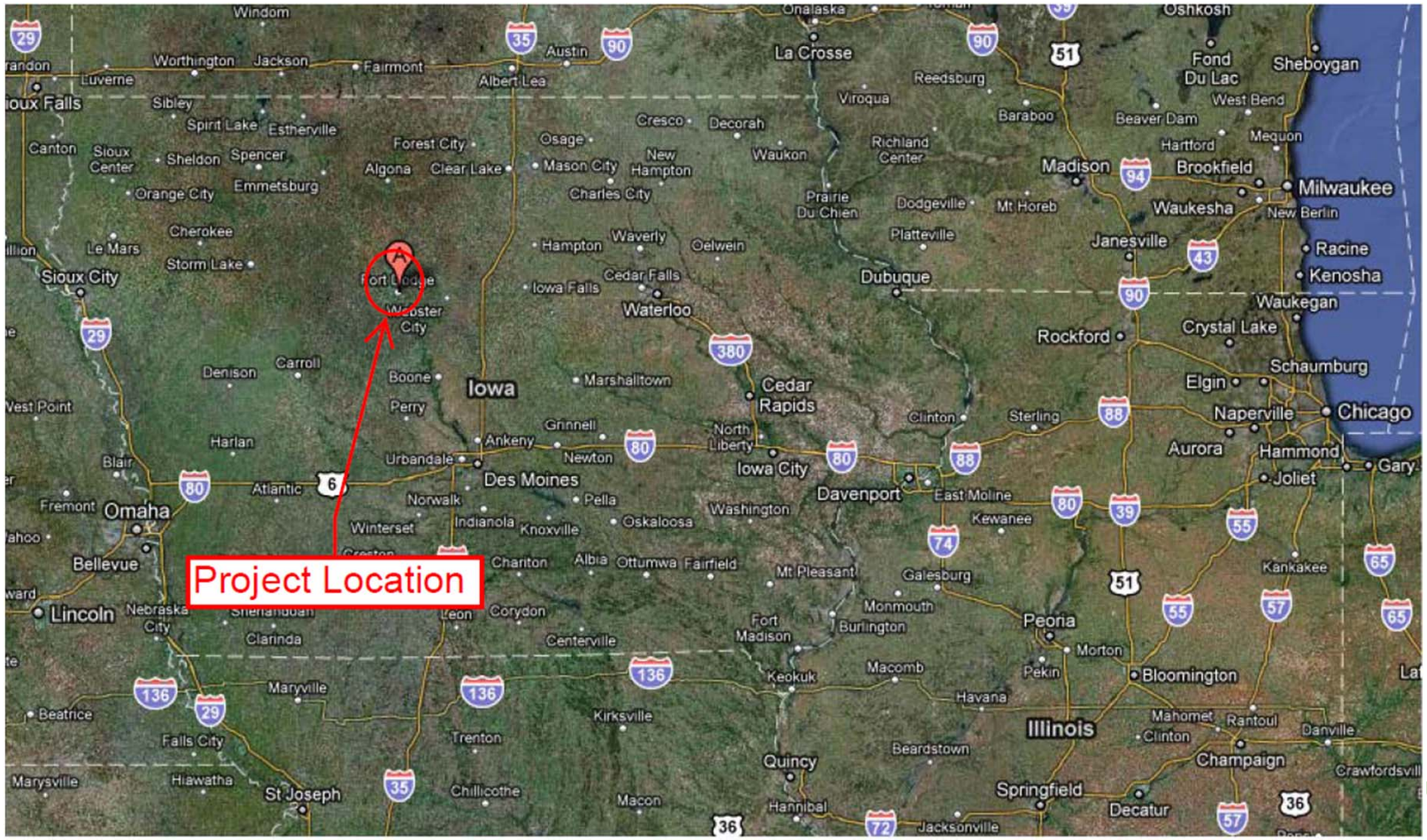
Project Location



Project Background

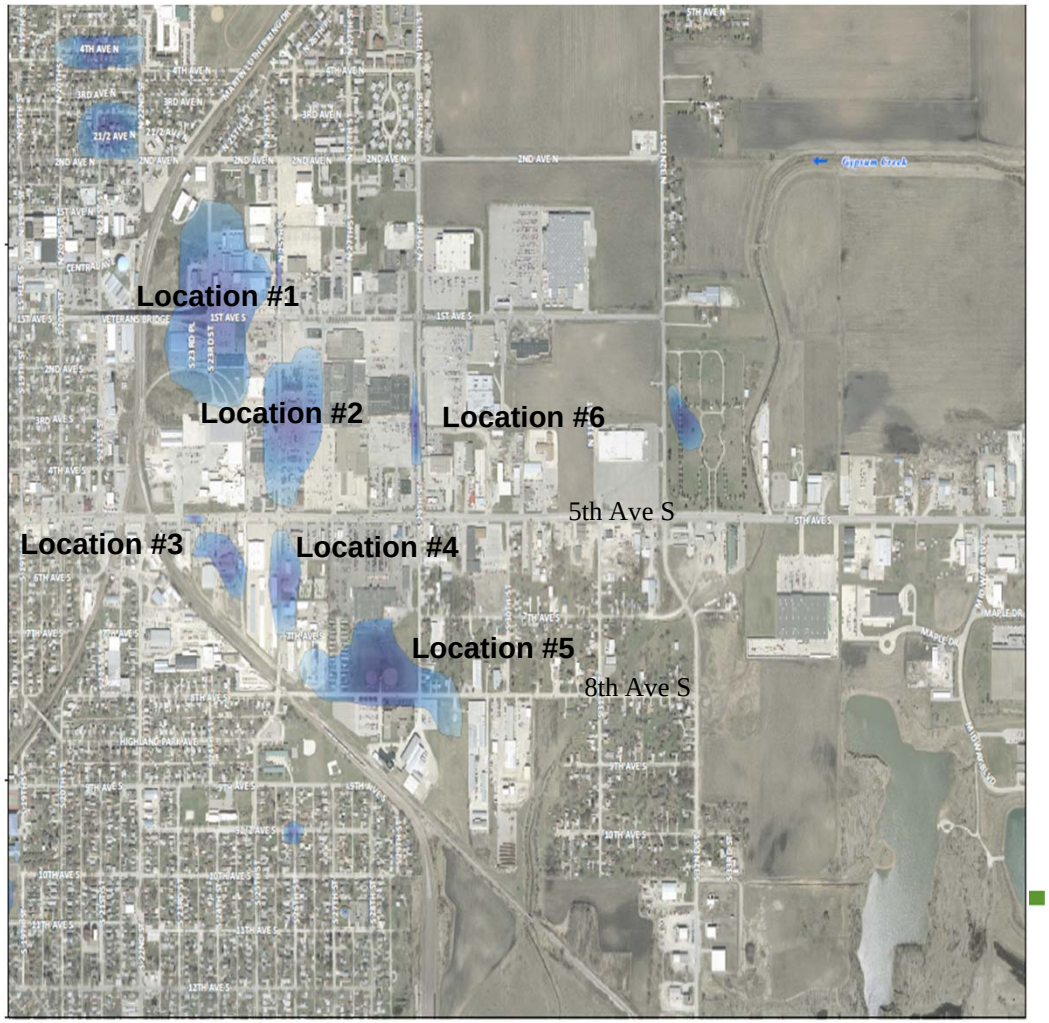
Flooding History

- Localized flooding and storm sewer pipe surcharging in the vicinity of the Crossroads Mall
  - The area consists of approx. 505 acres, which is comprised mainly of commercial and industrial land
  - Flooding problems attributed to large runoff volumes and high peak flows
  - Localized flooding and surcharged storm sewer are common within watershed and have occurred as recently as summers of 2007 and 2010

Project Background Cont'd

Locations of flooding are:

1) Vicinity of Veterans Bridge
2) West of Mall along S 25th St.
3) South of 5th Ave S and west of S 25th St
4) South of 5th Ave S and east of S 25th St
5) Along 8th Ave S between S 25th St and S 29th St
6) Along S 29th St just east of Mall

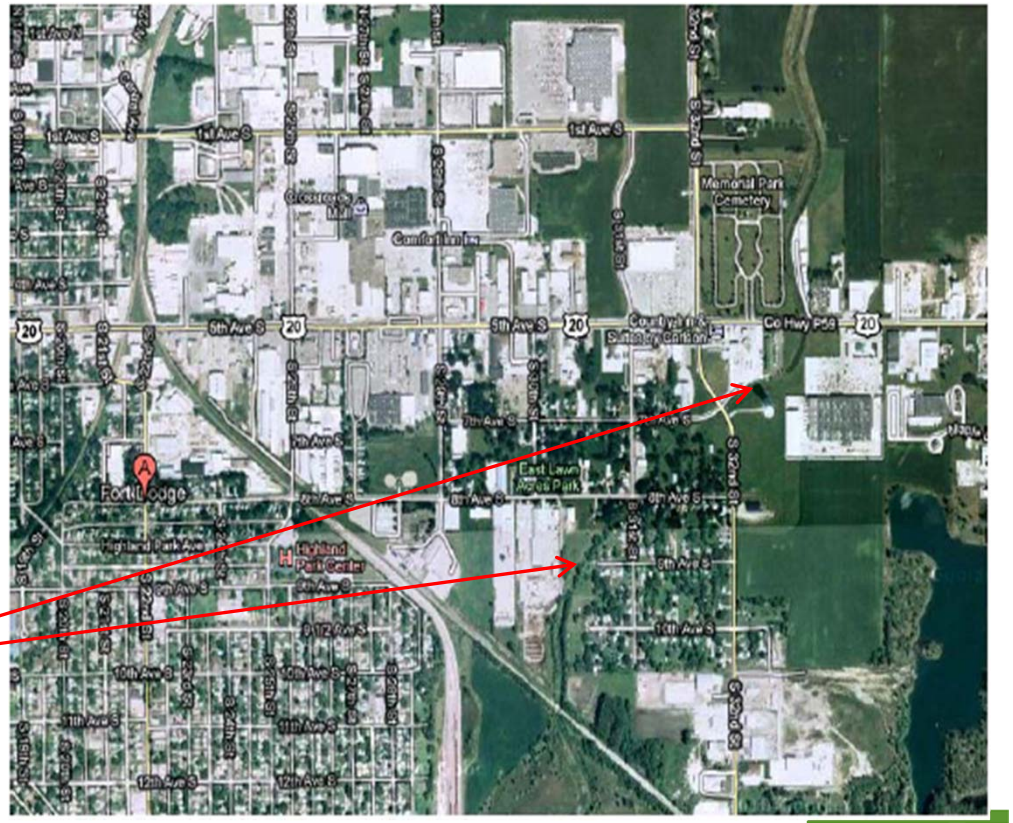


Project Background Cont'd

Flooding History

- In addition to flooding problems near the mall, much of total runoff volume is discharged to Gypsum Creek upstream of the existing 84" culvert just downstream of 5th Ave South
- City is concerned about capacity of the 84" culvert

84" culvert



Steps Taken to Alleviate Flooding

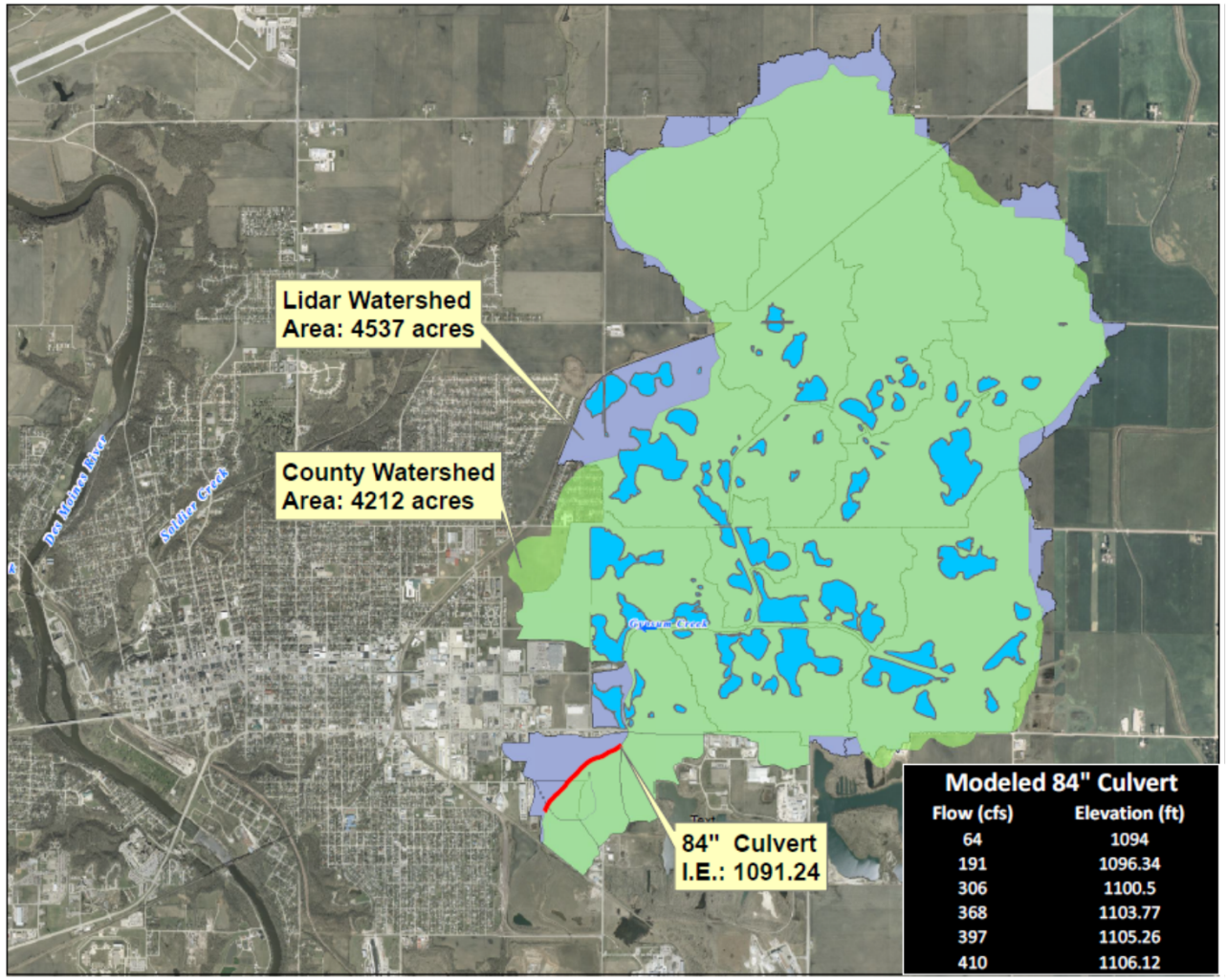
HR Green prepared a Watershed Analysis Report in August, 2010, based on Hydrocad (rational method) which documented the source of the flooding and potential solutions. Based on this report the city approved the preparation of a more detailed analysis based on the following:

- Infiltration practices or storage to reduce storm sewer conveyance needs
- XP-SWMM modeling recommended to:
  - Account for existing storage in pipes and on surface
  - Pressure flow in pipes
  - Division of flow between multiple interlinked systems

Existing Data and Proposed Modeling Approach

- City provided HR Green the latest GIS data
  - Contained roadway and storm sewer alignments, contours, aerial imagery, and other relevant spatial information
- ArcView GIS was used to organize and view the data
- XP-SWMM was used to analyze existing conditions of:
  - Gypsum Creek & 84” culvert
  - Sewer System
- Proposed conditions XP-SWMM model used to evaluate proposed storage and sewer improvement options

Gypsum Creek Watershed



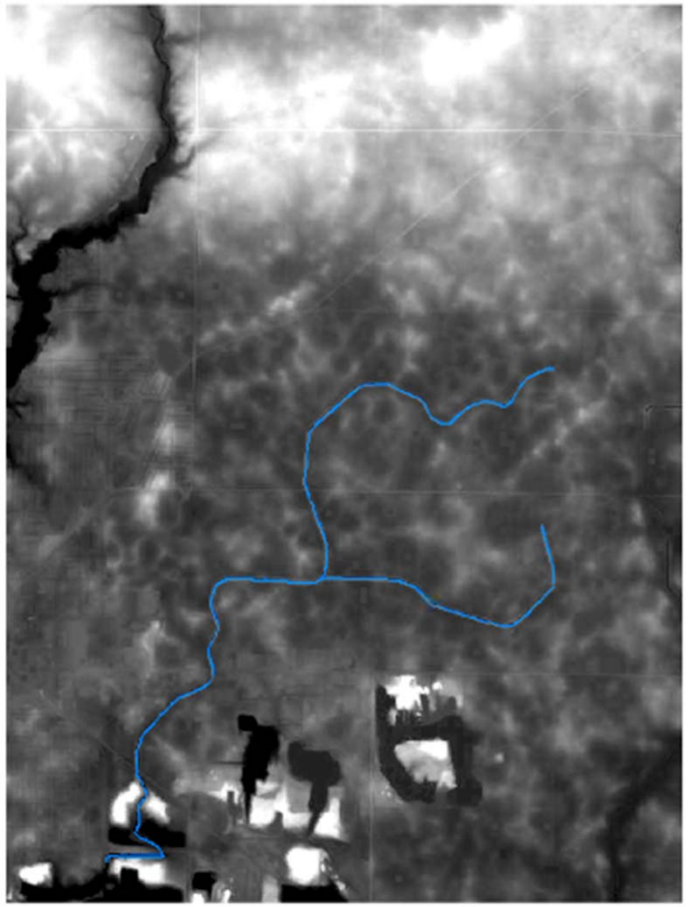
Gypsum Creek Modeling

- The Geospatial hydrology toolkit from HEC-GeoHMS was used to determine the discharges from the Gypsum Creek watershed
  - HEC-GeoHMS is a public-domain extension for ArcGIS 9.2/9.3 and one must have an ArcView license and Spatial Analyst Extension

Data Assembly

Create a terrain DEM of the project derived from LIDAR data

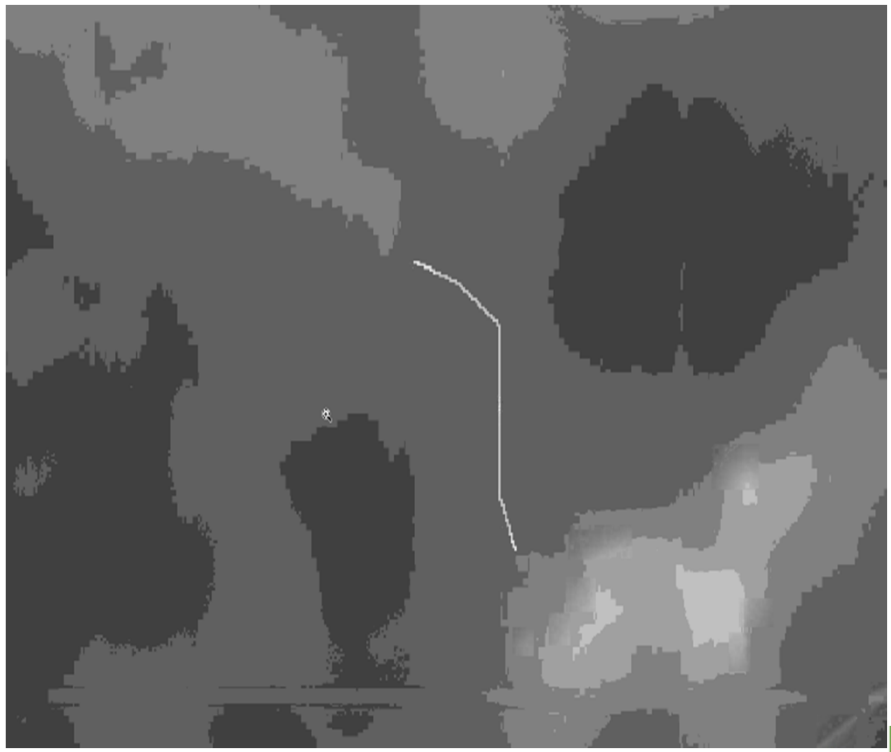
- Cut a channel through the terrain
- Blue lines depict channels
- Darker areas = lower elevations
- Lighter areas = higher elevations



Basin Processing

Build walls in order to correctly sub-divide watersheds and direct water to a certain outlet

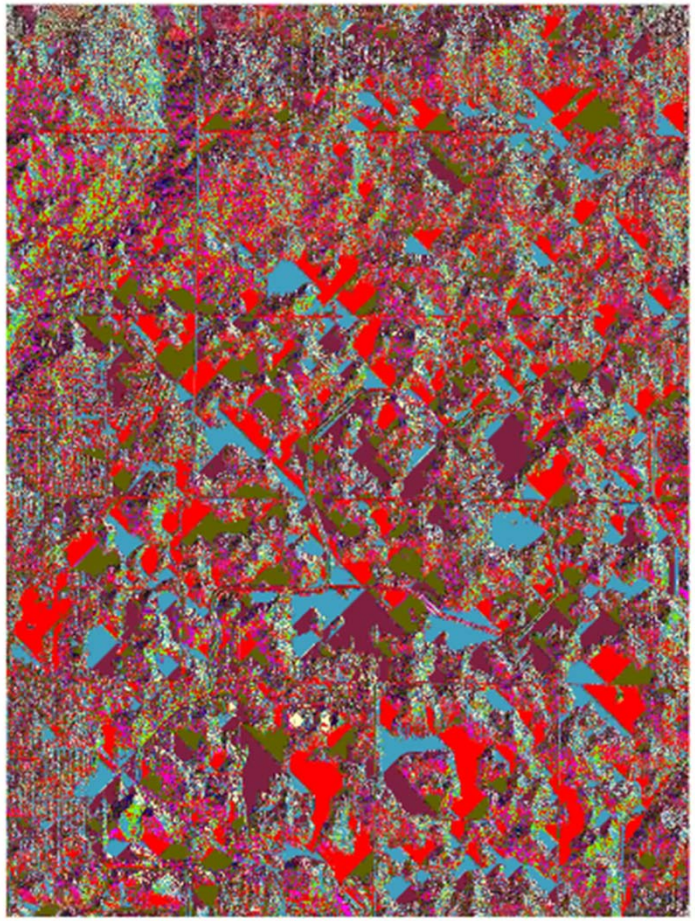
- Wall is shown by the white line
- Water does not flow across wall and the wall acts as a drainage divide
- Fill sinks
- Fill all depressions so that water flows through them and is not trapped



Stream and Watershed Characteristics

Flow Direction: Specify an outflow direction for each cell/sub-watershed

A color is assigned to each flow direction



Flow Accumulation: Program counts the number of cells tributary to each cell. Cells with large accumulated areas are shown in lighter grays or white (not shown).

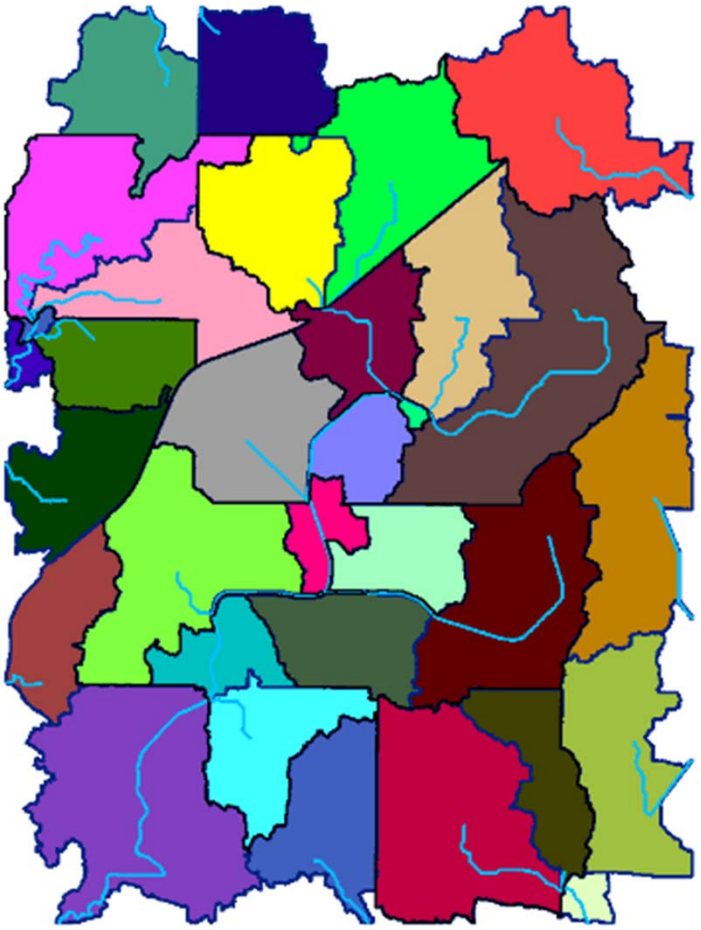
Stream and Watershed Characteristics Cont'd.

Define Watersheds: Define the locations of the streams based upon the specified watershed area

- One can define the watershed area for a stream, which may be set at 1 sq. mi. area

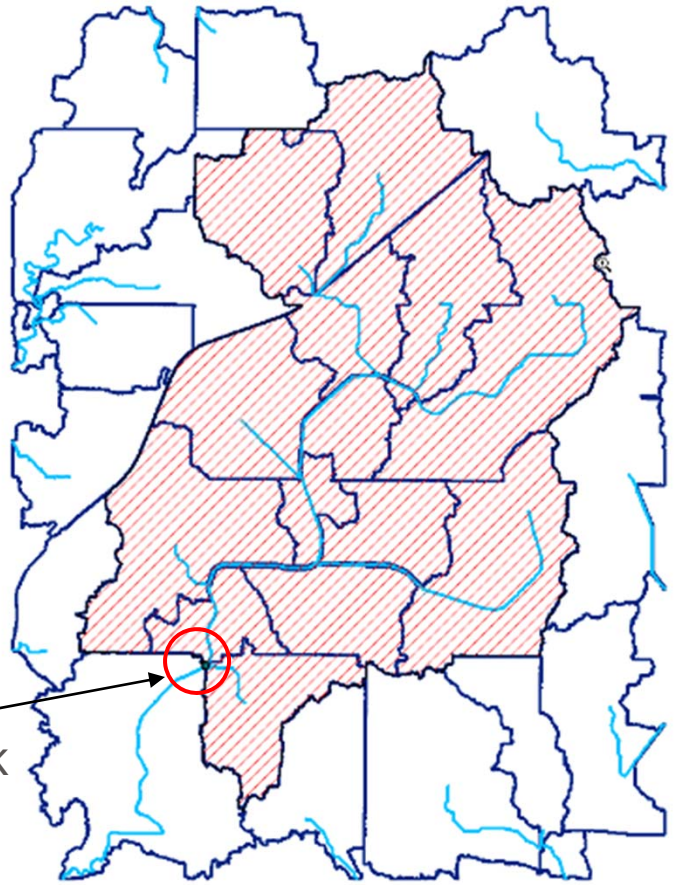
Result is a colored map showing all of the individual sub-basins

- Can have multiple outlets in the same project



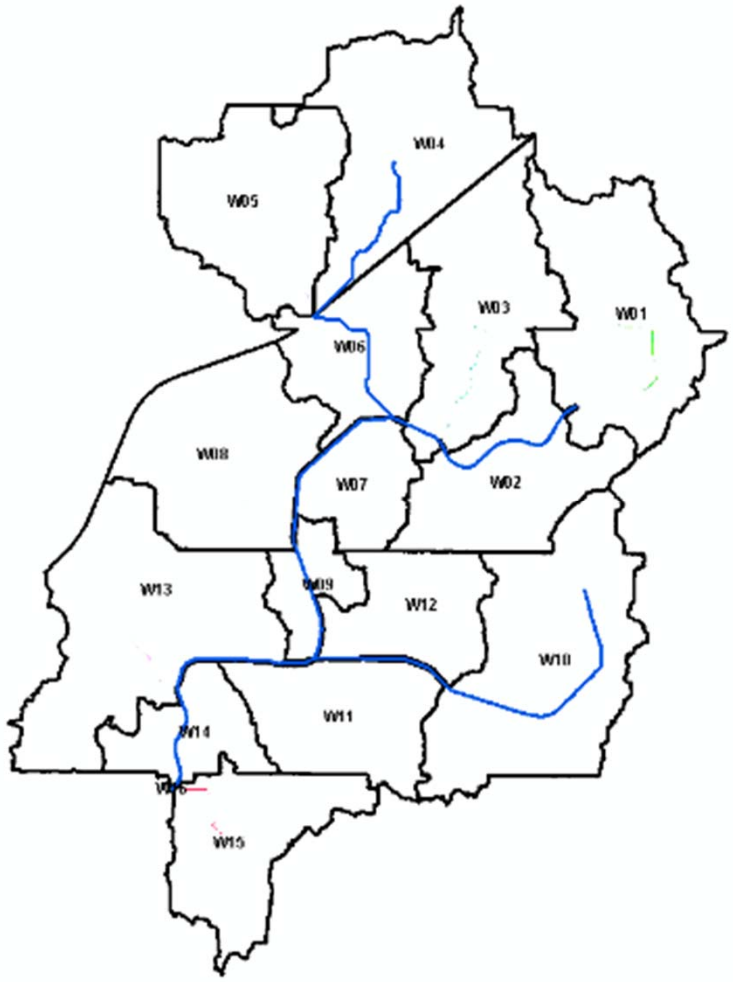
Watershed for Gypsum Creek

- Select the downstream outlet for Gypsum Creek, which is the upstream end of the 84” culvert
- The overall watershed for the 84” culvert is shown in the red cross-hatching, which includes all of the individual sub-basins

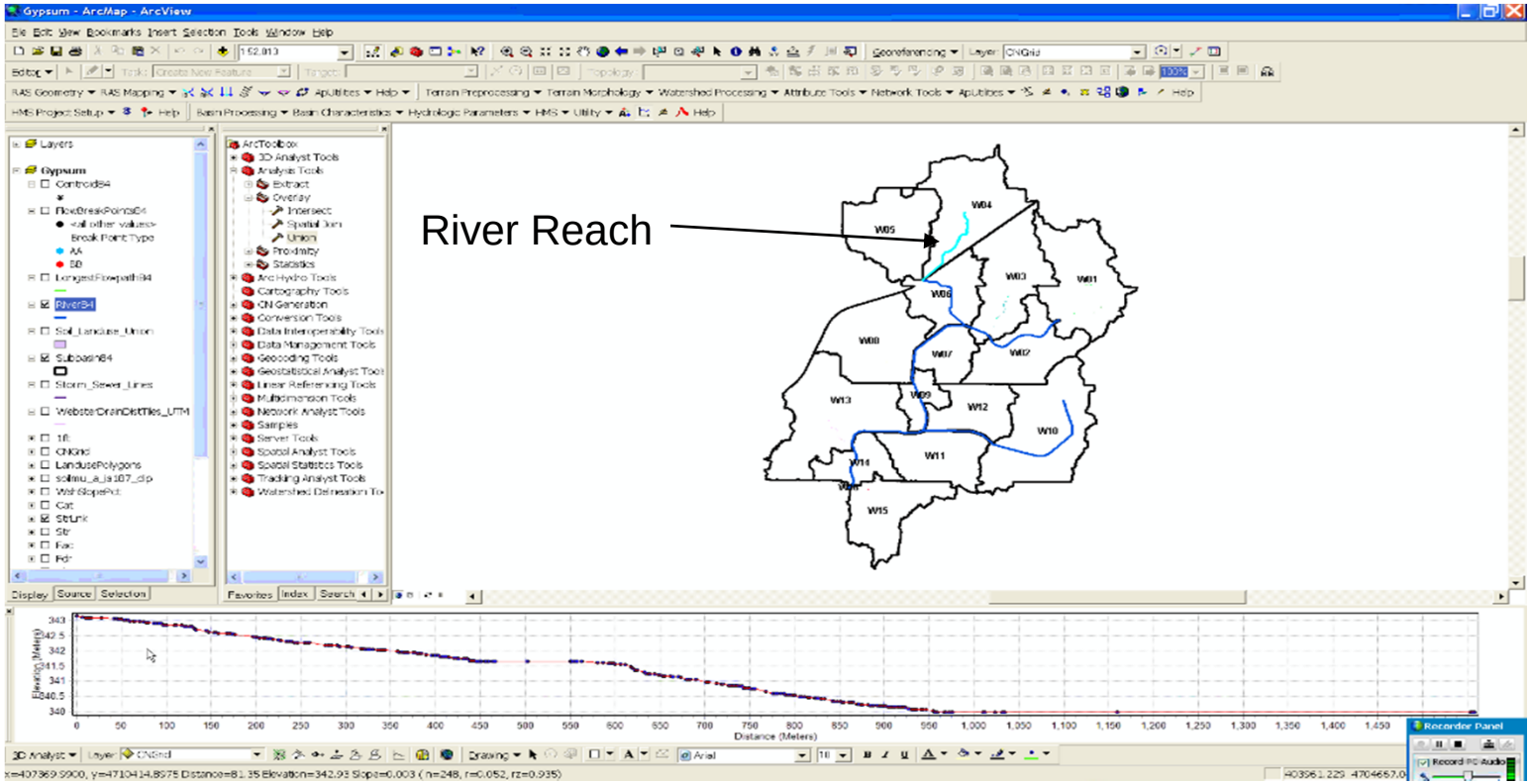


Sub-Basins comprising Gypsum Creek Watershed

- Each sub-basin is labeled and the flow path of each channel within the sub-basin is shown in blue



River Profile Tool



- Shows a profile for a specific river reach, which is shown in cyan at the top

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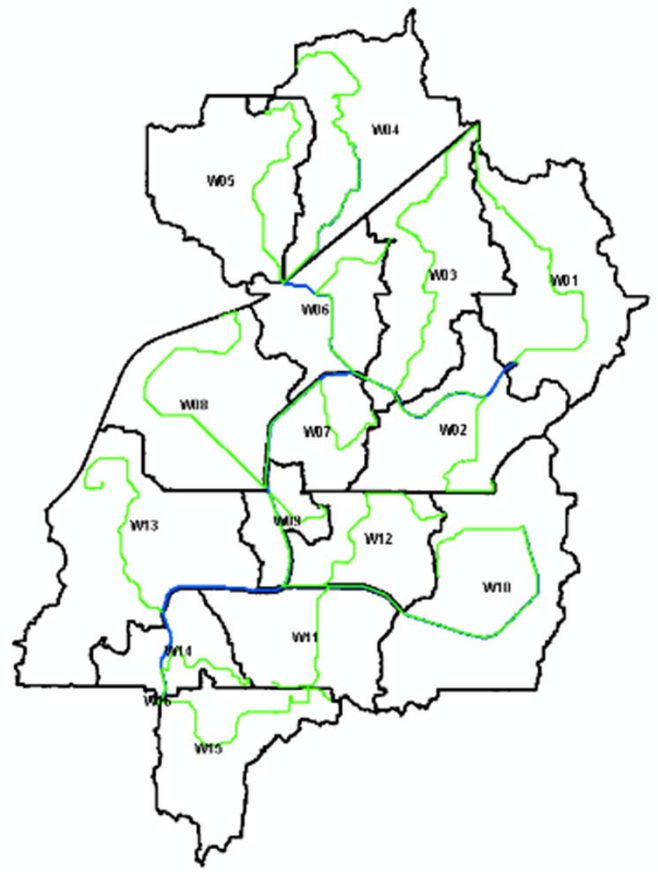
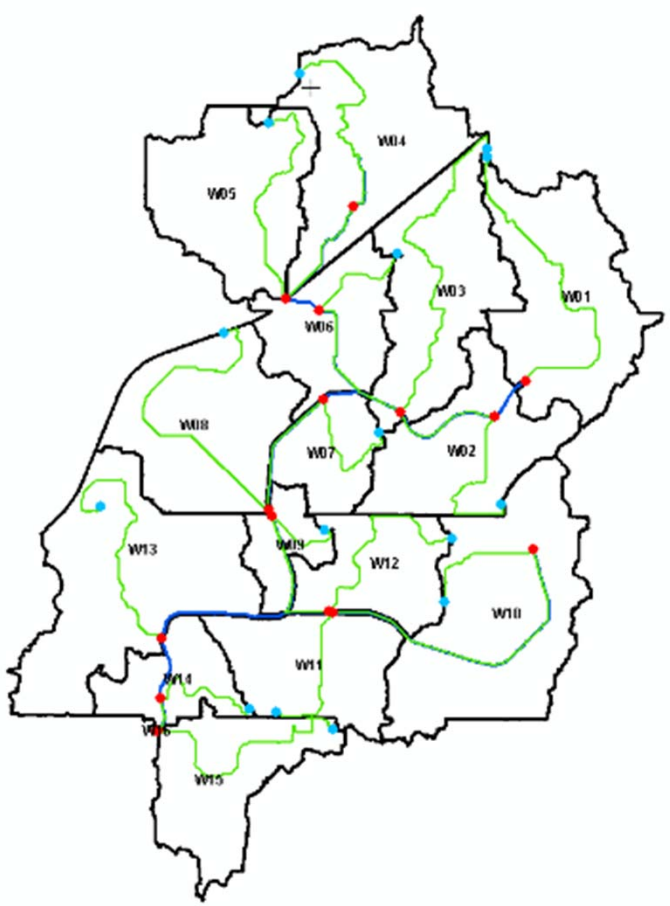
Longest Flow Path

- Program determines longest flow path within each sub-basin, which is shown by the green polylines
- To determine the cumulative flow path, add up the distances of the longest flow paths from all sub-basins so that you account for the most hydrologically remote point within the entire watershed



Segment Flow Path

- Program will divide the longest flow path within each sub-basin into 3 components, sheet flow, shallow concentrated flow, and channel flow
- Areas upstream of the blue dots consists of 100’ sheet flow
- Areas downstream of blue dots and upstream of red dots, consist of shallow concentrated flow
- Areas downstream of red dots are channel flow



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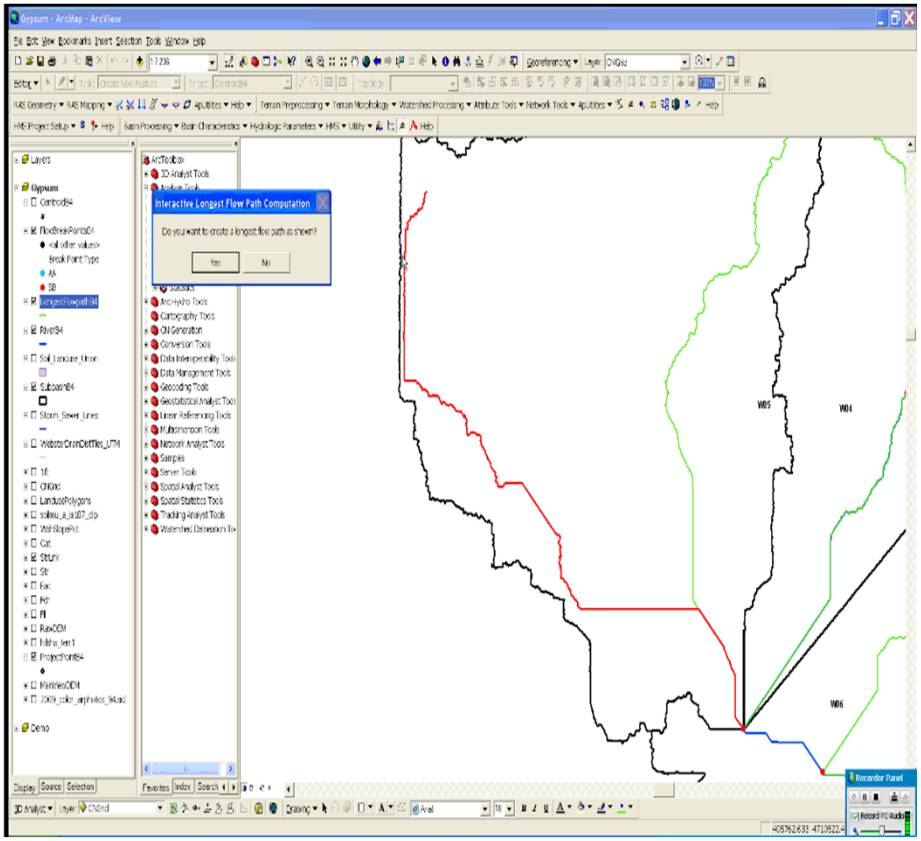
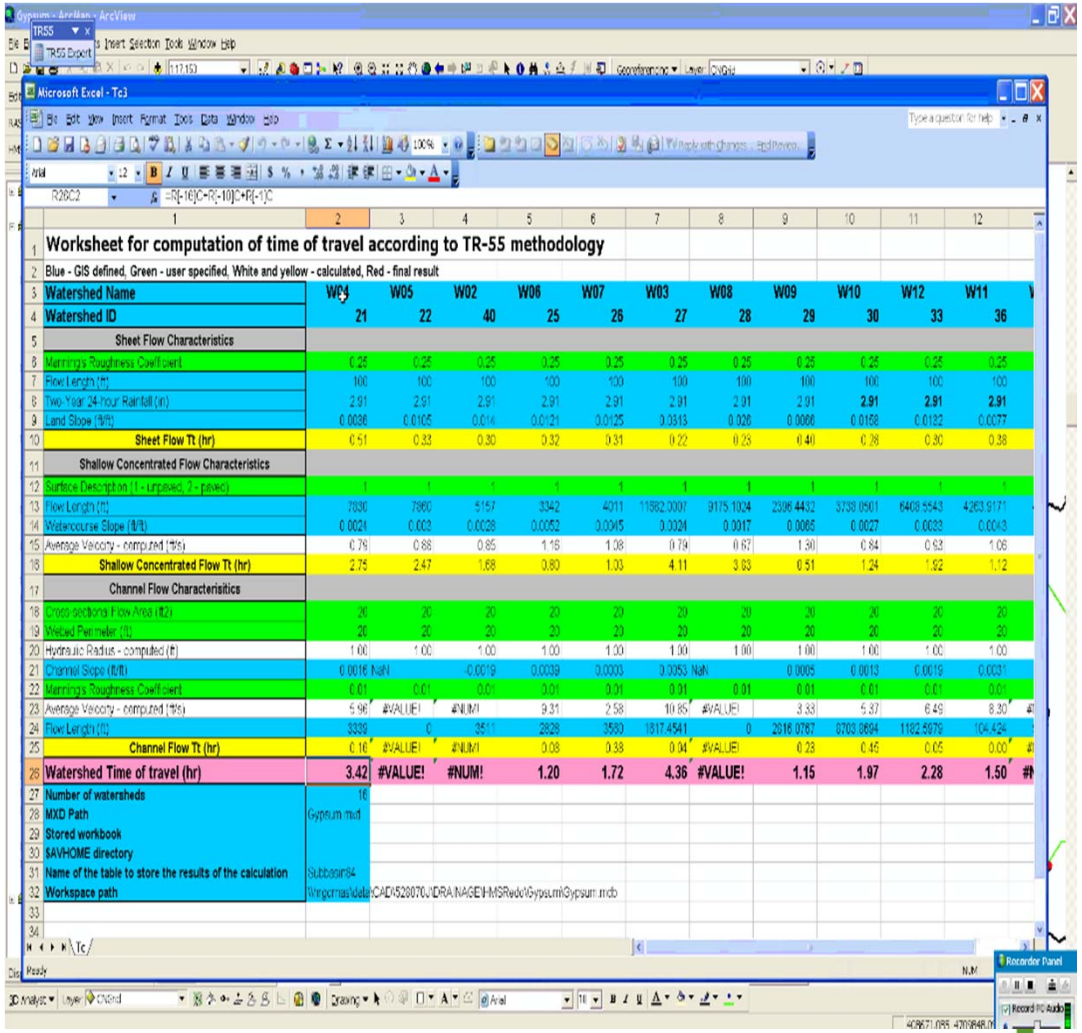
Interactive Longest Flow Path Tool

- If one does not like the way the program defines the longest flow path, you can modify it using the Interactive Longest Flow Path Tool
- The modified longest flow path is in red



Time of Concentration

- Tc calculations are done by utilizing the TR-55 Exporting Travel Time Parameters to Excel function in HEC-GeoHMS
- Blue = GIS provided data
- Green = User input
  - Mannings N
  - Paved/Unpaved
  - Channel Parameters
- Pink = Tc (hrs)



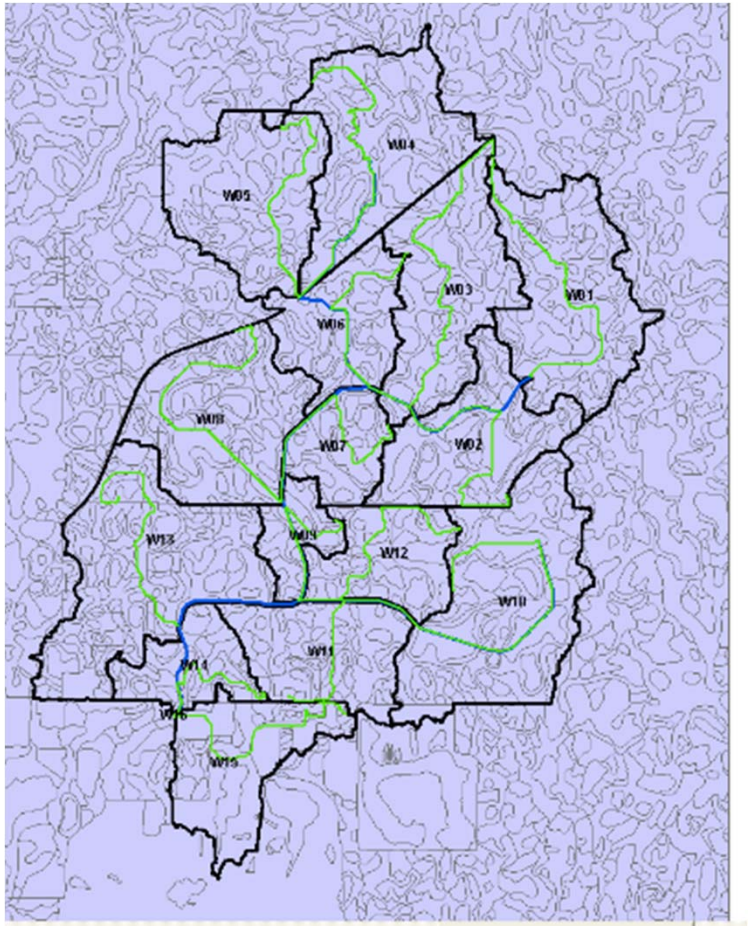
Worksheet for computation of time of travel according to TR-55 methodology

Blue - GIS defined, Green - user specified, White and yellow - calculated, Red - final result

Watershed Name	W04	W05	W02	W06	W07	W03	W08	W09	W10	W12	W11
Watershed ID	21	22	40	25	26	27	28	29	30	33	36
Sheet Flow Characteristics											
Manning's Roughness Coefficient	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flow Length (ft)	100	100	100	100	100	100	100	100	100	100	100
Two Year 24-hour Rainfall (in)	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91
Land Slope (ft/ft)	0.0036	0.0105	0.014	0.0121	0.0125	0.0313	0.026	0.0066	0.0168	0.0122	0.0077
Sheet Flow Tt (hr)	0.51	0.33	0.30	0.32	0.31	0.22	0.25	0.40	0.28	0.30	0.38
Shallow Concentrated Flow Characteristics											
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1	1	1	1
Flow Length (ft)	7030	7960	5157	3342	4011	11882.0007	9175.1024	2396.4432	3738.0501	6408.5543	4263.9171
Watercourse Slope (ft/ft)	0.0021	0.003	0.0028	0.0052	0.0045	0.0024	0.0017	0.0065	0.0027	0.0033	0.0043
Average Velocity - computed (ft/s)	0.79	0.88	0.85	1.16	1.08	0.79	0.67	1.30	0.84	0.93	1.06
Shallow Concentrated Flow Tt (hr)	2.75	2.47	1.68	0.80	1.03	4.11	3.83	0.51	1.24	1.92	1.12
Channel Flow Characterisitics											
Cross-sectional Flow Area (ft2)	20	20	20	20	20	20	20	20	20	20	20
Wetted Perimeter (ft)	20	20	20	20	20	20	20	20	20	20	20
Hydraulic Radius - computed (ft)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Channel Slope (ft/ft)	0.0016	NaN	-0.0019	0.0039	0.0003	0.0053	NaN	0.0005	0.0013	0.0019	0.0031
Manning's Roughness Coefficient	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Average Velocity - computed (ft/s)	5.98	#VALUE!	#NUM!	9.31	2.58	10.85	#VALUE!	3.33	5.37	6.49	8.30
Flow Length (ft)	3339	0	3511	2928	3580	1317.4541	0	2016.0767	0703.0694	1192.5079	104.424
Channel Flow Tt (hr)	0.16	#VALUE!	#NUM!	0.08	0.38	0.04	#VALUE!	0.23	0.46	0.05	0.00
Watershed Time of travel (hr)	3.42	#VALUE!	#NUM!	1.20	1.72	4.36	#VALUE!	1.15	1.97	2.28	1.50
Number of watersheds	10										
MXD Path	Gypsum.mxd										
Stored workbook											
$AVHOME directory											
Name of the table to store the results of the calculation	Subbasin84										
Workspace path	Wingermas\data\CAD\528070\DRAINAGE\HMSRedo\Gypsum\Gypsum.mdb										

Soils Data

- Used County soils data available in the GIS database and applied it to the watershed area
- The closed polylines correspond to a particular soils type



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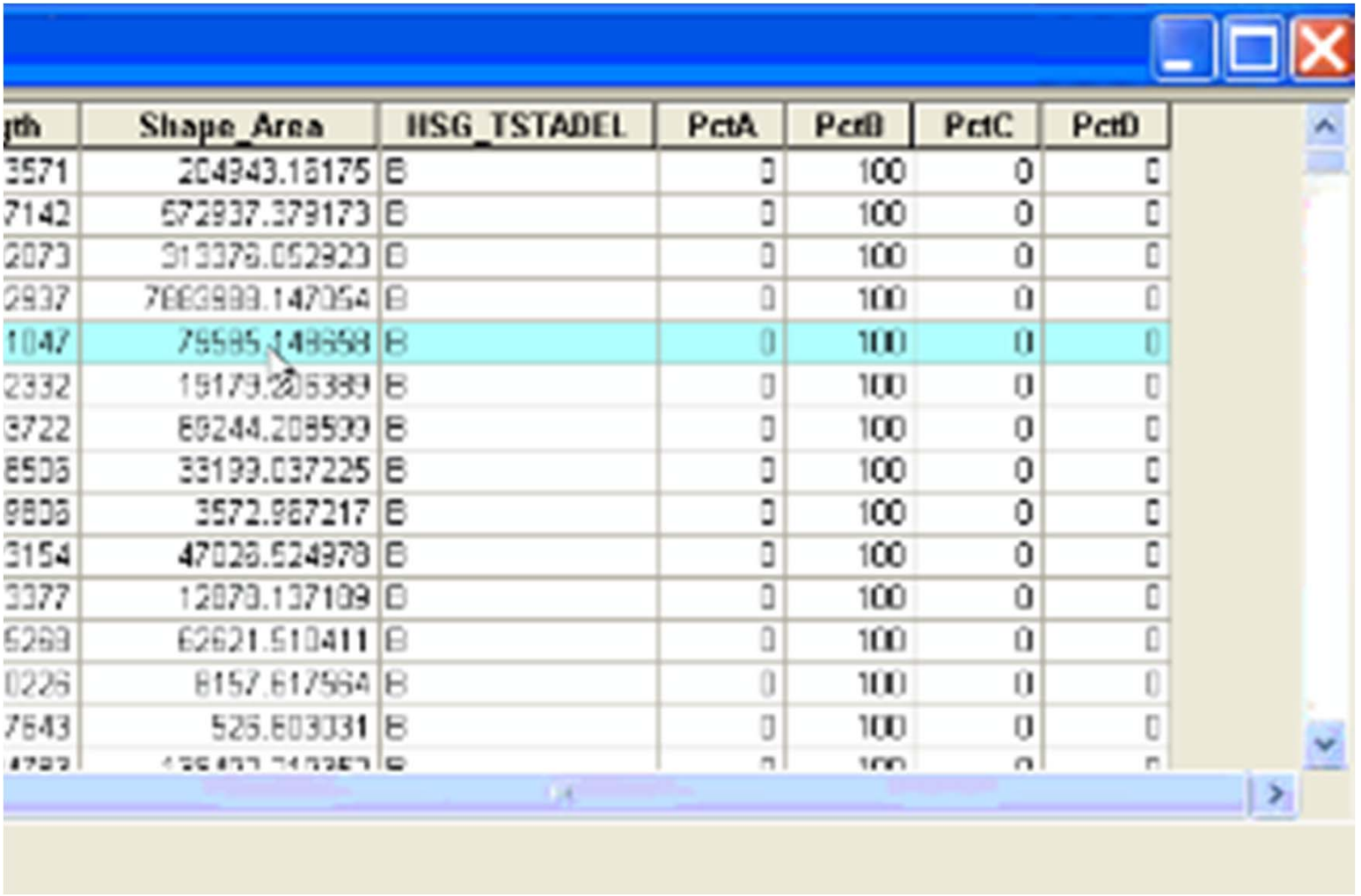
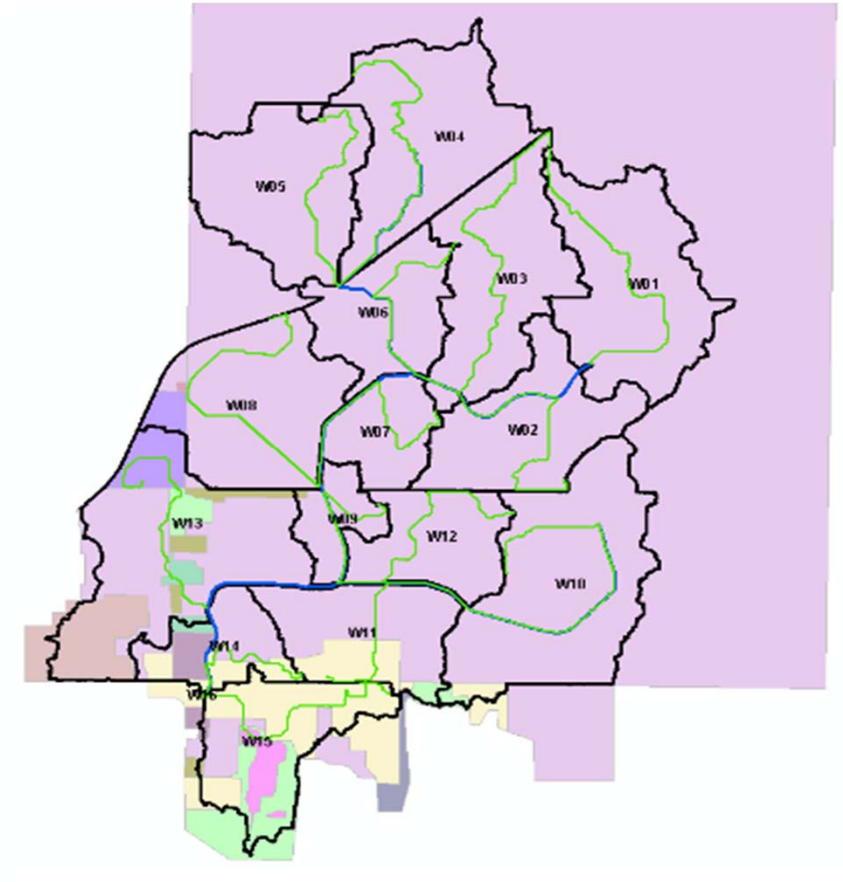
Soils Attributes Table



gth	Shape_Area	HSG_TSTADEL	PctA	PctB	PctC	PctD
3571	204943.18175	B	0	100	0	0
7142	572937.379173	B	0	100	0	0
2073	913378.052923	B	0	100	0	0
2937	7883983.147054	B	0	100	0	0
1047	79585.148658	B	0	100	0	0
2332	19173.205383	B	0	100	0	0
3722	69244.208503	B	0	100	0	0
8503	33193.037225	B	0	100	0	0
9803	3572.967217	B	0	100	0	0
3154	47028.524978	B	0	100	0	0
3377	12878.137109	B	0	100	0	0
5283	62621.510411	B	0	100	0	0
0226	8157.617564	B	0	100	0	0
7643	525.603331	B	0	100	0	0

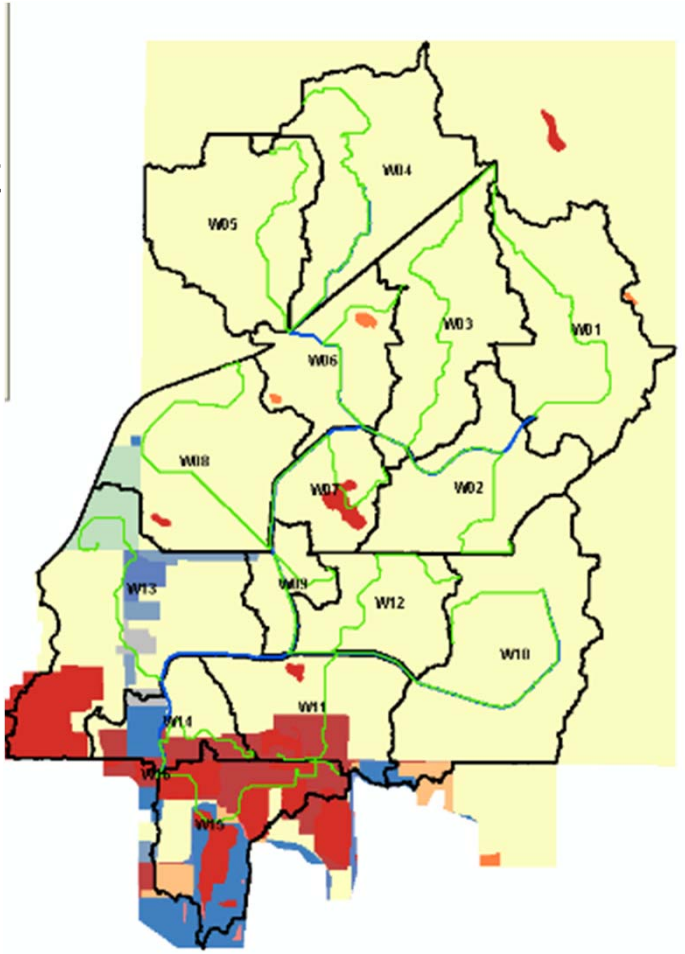
Land Use

- Various land uses are depicted with different colors of shading



Runoff Curve Number Tables

- Soils and Land Use GIS data is combined to create a RCN layer. Each color represents a different RCN value.



Sub-Basin Summary Spreadsheet

Coralville - I Jobs II
Date: 02/23/11

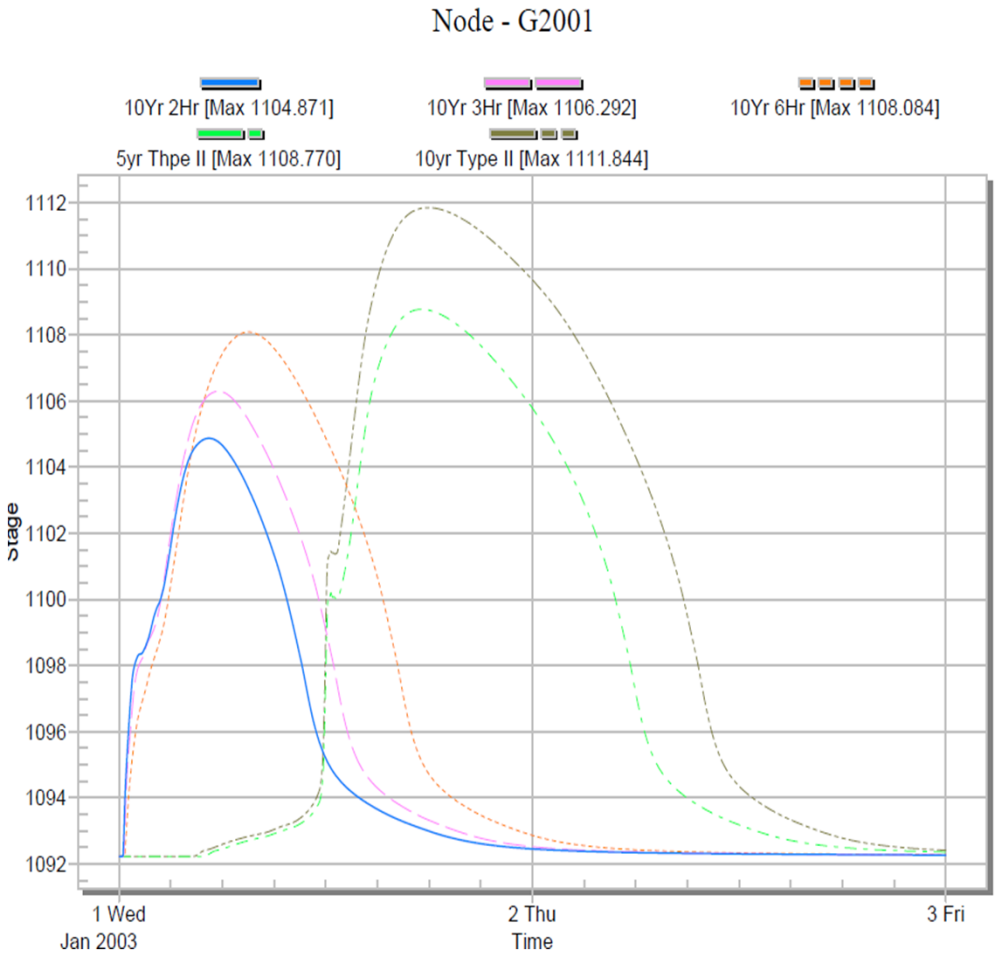
Sub-Basin Data

OBJECTID	GRIDCODE	Shape_Area_m2	HydroID	DrainID	NAME	Description	LossMet	TransMet	BasinSlope	BasinCN	Rain2Yr	LagMethod	BasinLag	Area_sqmiles	Tc	Acres
20	0	1746452	41	41	**W01**		SCS	SCS	2.12	78.0	2.91	CNLag	1.53	0.674	**3.37**	**431.6**
3	3	1278624	40	40	**W02**		SCS	SCS	2.92	78.0	2.91	CNLag	1.12	0.494	**2.09**	**316.0**
7	7	1549904	27	27	**W03**		SCS	SCS	2.32	78.0	2.91	CNLag	1.77	0.598	**4.35**	**383.0**
1	1	1707096	21	21	**W04**		SCS	SCS	2.24	78.0	2.91	CNLag	1.57	0.659	**3.31**	**421.8**
2	2	1489480	22	22	**W05**		SCS	SCS	1.96	78.0	2.91	CNLag	1.27	0.575	**2.72**	**368.1**
5	5	966020	25	25	**W06**		SCS	SCS	2.42	78.1	2.91	CNLag	0.94	0.373	**1.19**	**238.7**
6	6	614532	26	26	**W07**		SCS	SCS	3.84	79.1	2.91	CNLag	0.85	0.237	**1.46**	**151.9**
8	8	1596868	28	28	**W08**		SCS	SCS	2.60	77.8	2.91	CNLag	1.25	0.617	**4.00**	**394.6**
9	9	423052	29	29	**W09**		SCS	SCS	4.58	77.9	2.91	CNLag	0.60	0.163	**0.96**	**104.5**
10	10	2183484	30	30	**W10**		SCS	SCS	3.60	77.8	2.91	CNLag	1.36	0.843	**1.93**	**539.6**
16	16	1092352	36	36	**W11**		SCS	SCS	2.74	79.8	2.91	CNLag	0.64	0.422	**1.40**	**269.9**
13	13	865756	33	33	**W12**		SCS	SCS	2.69	78.0	2.91	CNLag	1.05	0.334	**2.21**	**213.9**
21	0	2165284	46	46	**W13**		SCS	SCS	3.64	79.4	2.91	CNLag	0.88	0.836	**1.47**	**535.1**
17	17	638784	37	37	**W14**		SCS	SCS	4.19	77.9	2.91	CNLag	0.61	0.247	**1.26**	**157.8**
19	19	1131060	39	39	**W15**		SCS	SCS	5.60	80.8	2.91	CNLag	0.68	0.437	**3.27**	**279.5**
18	18	212	38	38	**W16**		SCS	SCS	6.36	89.3	2.91	CNLag	0.01	0.0001	**0.19**	**0.1**

- Table is exported out of GIS
- Columns of importance are the watershed names, Tc, and areas
    - These 3 columns of data are then input into XP-SWMM for further analysis of the Gypsum Creek watershed and it's impact on the storm sewer system in the main business district of Fort Dodge, IA

XP-SWMM Analysis

- Once we imported the hydrologic data from GIS into XP-SWMM, we found that the peak water surface elevation upstream of the existing 84” culvert was surcharging the pipe and overtopping 5th Avenue South
- 10-yr peak water surface elevation is approx. 1108 using the Huff rainfall distribution



XP-SWMM Analysis

- Based upon previous coordination with City staff, there were no reported incidents of overtopping associated with the existing 84” culvert
  - HR Green decided to add existing storage in the upstream watershed so as to reduce the peak flows
    - Existing storage below elevation 1108 was modeled
    - 10-year peak water surface elevation was found to be approximately 1105, about 3 ft lower than previously modeled without any storage
    - City will need to ensure that the existing storage is preserved if watershed is developed in the future

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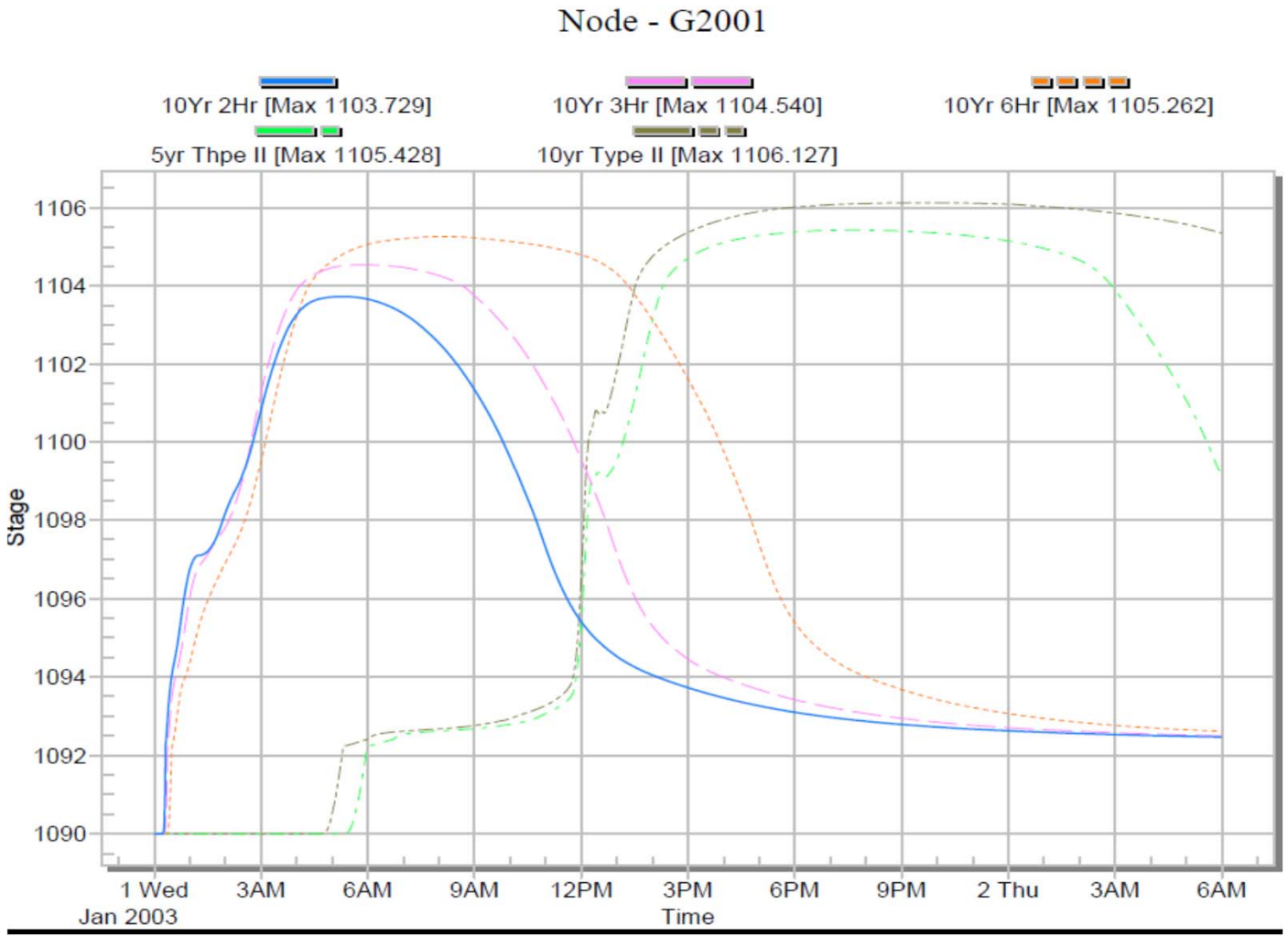
XP-SWMM Analysis



XP-SWMM Sewer Model Development

- Preparation of GIS data
- Import of Data into XP-SWMM
- Evaluation of Existing Conditions
- Evaluation of Alternatives

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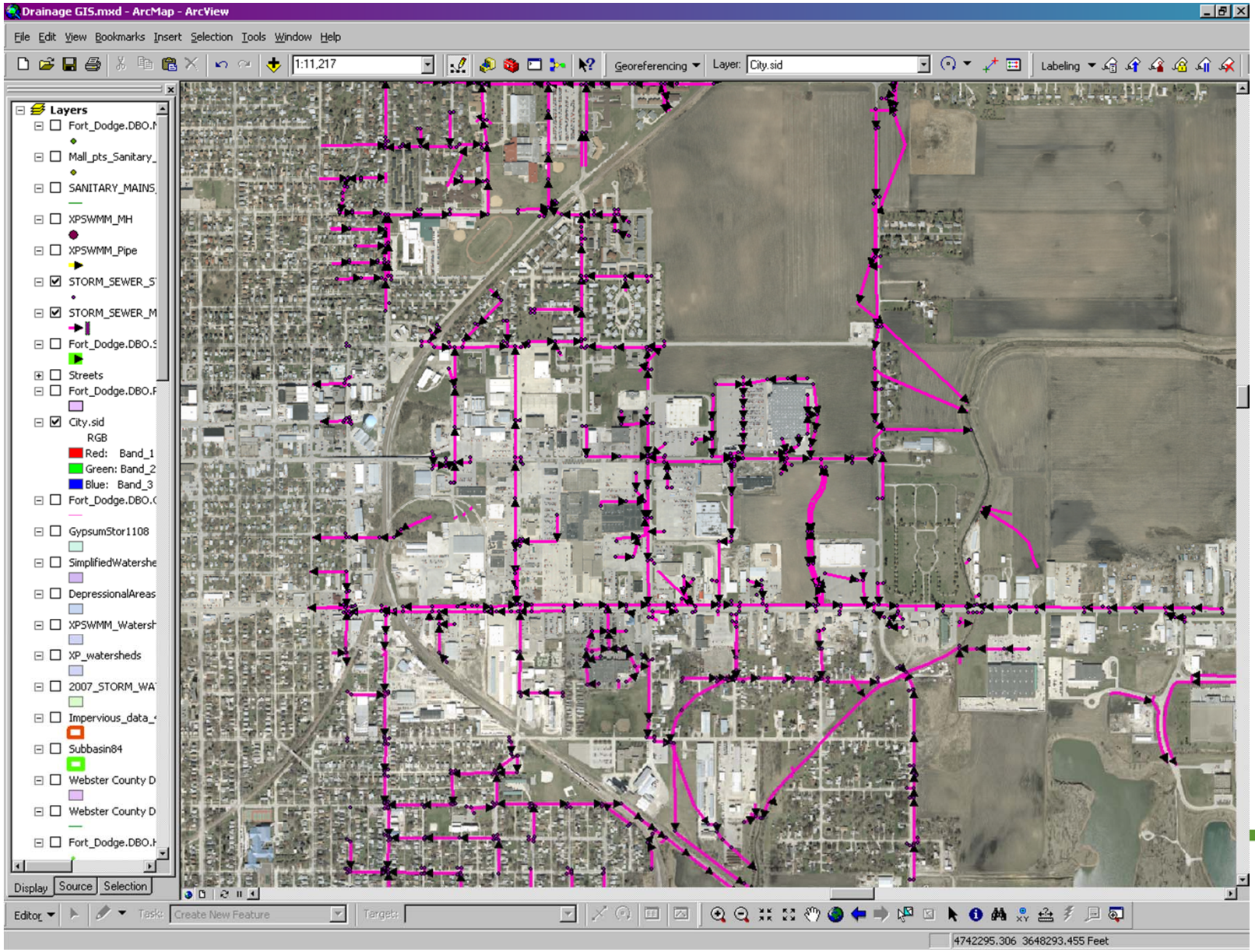
Drainage GIS.mxd - ArcMap - ArcView
File Edit View Bookmarks Insert Selection Tools Window Help
1:11,217
Georeferencing
Layer: City.sid
Labeling
Layers
Fort_Dodge.DBO.M
Mall_pts_Sanitary_
SANITARY_MAINS_
XPSWMM_MH
XPSWMM_Pipe
STORM_SEWER_S
STORM_SEWER_M
Fort_Dodge.DBO.S
Streets
Fort_Dodge.DBO.F
City.sid
RGB
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Green: Band_2
Blue: Band_3
Fort_Dodge.DBO.C
GypsumStor1108
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DepressionalAreas
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XP_watersheds
2007_STORM_WA
Impervious_data_
Subbasin84
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Display Source Selection
Editor
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Target:
4742295.306 3648293.455 Feet

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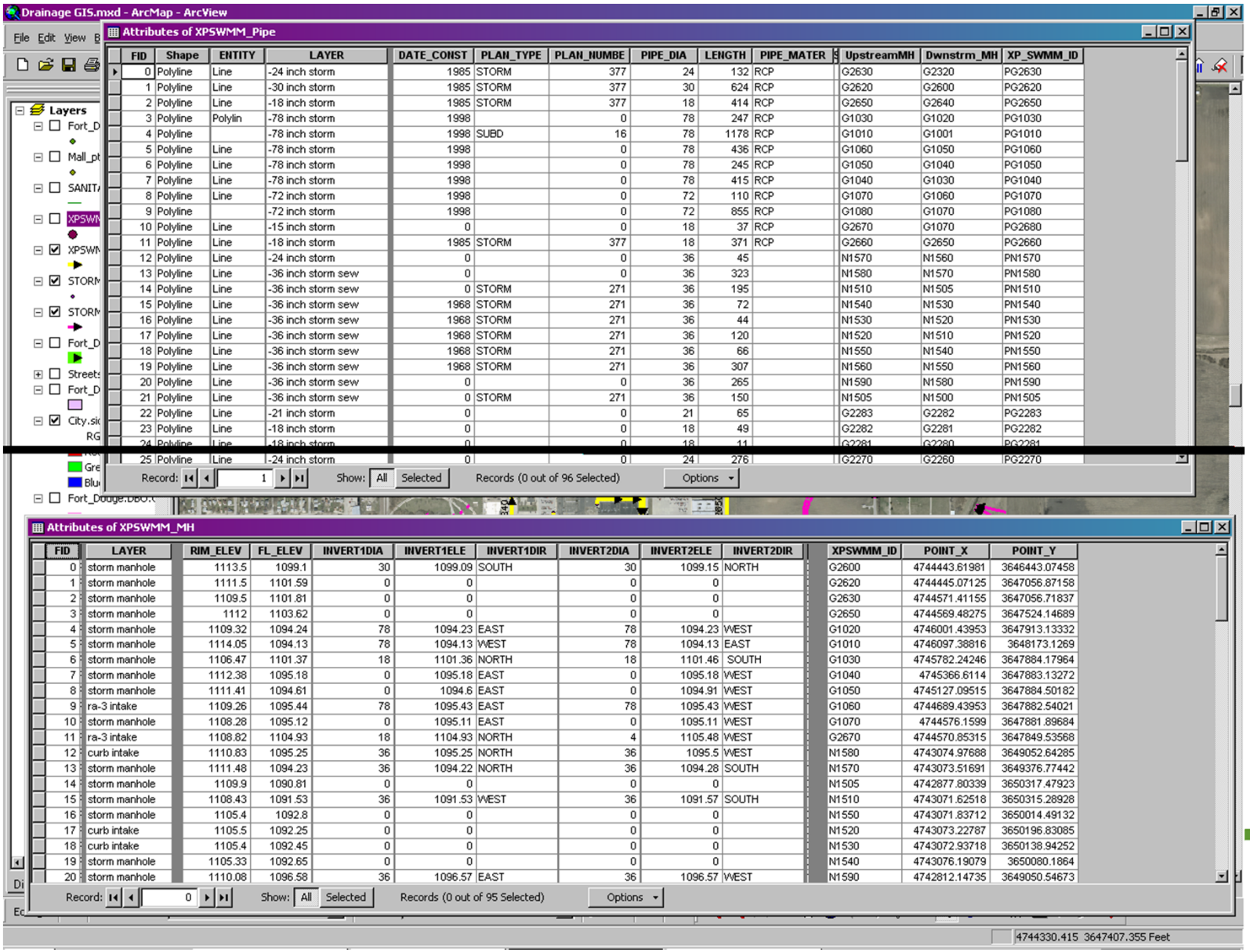
Drainage GIS.mxd - ArcMap - ArcView
File Edit View B
Layers
Fort_D
Mall_pt
SANITA
XPSWM
XPSWM
STORM
STORM
Fort_D
Streets
Fort_D
City.sh
RG
Gre
Blu
Fort_Dodge.DBO.
Attributes of XPSWMM_Pipe
FID Shape ENTITY LAYER DATE_CONST PLAN_TYPE PLAN_NUMBE PIPE_DIA LENGTH PIPE_MATER UpstreamMH Dwnstrm_MH XP_SWMM_ID
0 Polyline Line -24 inch storm 1985 STORM 377 24 132 RCP G2630 G2320 PG2630
1 Polyline Line -30 inch storm 1985 STORM 377 30 624 RCP G2620 G2600 PG2620
2 Polyline Line -18 inch storm 1985 STORM 377 18 414 RCP G2650 G2640 PG2650
3 Polyline Polylin -78 inch storm 1998 0 78 247 RCP G1030 G1020 PG1030
4 Polyline -78 inch storm 1998 SUBD 16 78 1178 RCP G1010 G1001 PG1010
5 Polyline Line -78 inch storm 1998 0 78 436 RCP G1060 G1050 PG1060
6 Polyline Line -78 inch storm 1998 0 78 245 RCP G1050 G1040 PG1050
7 Polyline Line -78 inch storm 1998 0 78 415 RCP G1040 G1030 PG1040
8 Polyline Line -72 inch storm 1998 0 72 110 RCP G1070 G1060 PG1070
9 Polyline -72 inch storm 1998 0 72 855 RCP G1080 G1070 PG1080
10 Polyline Line -15 inch storm 0 0 18 37 RCP G2670 G1070 PG2680
11 Polyline Line -18 inch storm 1985 STORM 377 18 371 RCP G2660 G2650 PG2660
12 Polyline Line -24 inch storm 0 0 36 45 N1570 N1560 PN1570
13 Polyline Line -36 inch storm sew 0 0 36 323 N1580 N1570 PN1580
14 Polyline Line -36 inch storm sew 0 STORM 271 36 195 N1510 N1505 PN1510
15 Polyline Line -36 inch storm sew 1968 STORM 271 36 72 N1540 N1530 PN1540
16 Polyline Line -36 inch storm sew 1968 STORM 271 36 44 N1530 N1520 PN1530
17 Polyline Line -36 inch storm sew 1968 STORM 271 36 120 N1520 N1510 PN1520
18 Polyline Line -36 inch storm sew 1968 STORM 271 36 66 N1550 N1540 PN1550
19 Polyline Line -36 inch storm sew 1968 STORM 271 36 307 N1560 N1550 PN1560
20 Polyline Line -36 inch storm sew 0 0 36 265 N1590 N1580 PN1590
21 Polyline Line -36 inch storm sew 0 STORM 271 36 150 N1505 N1500 PN1505
22 Polyline Line -21 inch storm 0 0 21 65 G2283 G2282 PG2283
23 Polyline Line -18 inch storm 0 0 18 49 G2282 G2281 PG2282
24 Polyline Line -18 inch storm 0 0 18 11 G2281 G2280 PG2281
25 Polyline Line -24 inch storm 0 0 24 276 G2270 G2260 PG2270
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1 storm manhole 1111.5 1101.59 0 0 0 0 G2620 4744445.07125 3647056.87158
2 storm manhole 1109.5 1101.81 0 0 0 0 G2630 4744571.41155 3647056.71837
3 storm manhole 1112 1103.62 0 0 0 0 G2650 4744569.48275 3647524.14689
4 storm manhole 1109.32 1094.24 78 1094.23 EAST 78 1094.23 WEST G1020 4746001.43953 3647913.13332
5 storm manhole 1114.05 1094.13 78 1094.13 WEST 78 1094.13 EAST G1010 4746097.38816 3648173.1269
6 storm manhole 1106.47 1101.37 18 1101.36 NORTH 18 1101.46 SOUTH G1030 4745782.24246 3647884.17964
7 storm manhole 1112.38 1095.18 0 1095.18 EAST 0 1095.18 WEST G1040 4745366.6114 3647883.13272
8 storm manhole 1111.41 1094.61 0 1094.6 EAST 0 1094.91 WEST G1050 4745127.09515 3647884.50182
9 ra-3 intake 1109.26 1095.44 78 1095.43 EAST 78 1095.43 WEST G1060 4744689.43953 3647882.54021
10 storm manhole 1108.28 1095.12 0 1095.11 EAST 0 1095.11 WEST G1070 4744576.1599 3647881.89684
11 ra-3 intake 1108.82 1104.93 18 1104.93 NORTH 4 1105.48 WEST G2670 4744570.85315 3647849.53568
12 curb intake 1110.83 1095.25 36 1095.25 NORTH 36 1095.5 WEST N1580 4743074.97688 3649052.64285
13 storm manhole 1111.48 1094.23 36 1094.22 NORTH 36 1094.28 SOUTH N1570 4743073.51691 3649376.77442
14 storm manhole 1109.9 1090.81 0 0 0 0 N1505 4742877.80339 3650317.47923
15 storm manhole 1108.43 1091.53 36 1091.53 WEST 36 1091.57 SOUTH N1510 4743071.62518 3650315.28928
16 storm manhole 1105.4 1092.8 0 0 0 0 N1550 4743071.83712 3650014.49132
17 curb intake 1105.5 1092.25 0 0 0 0 N1520 4743073.22787 3650196.83085
18 curb intake 1105.4 1092.45 0 0 0 0 N1530 4743072.93718 3650138.94252
19 storm manhole 1105.33 1092.65 0 0 0 0 N1540 4743076.19079 3650080.1864
20 storm manhole 1110.08 1096.58 36 1096.57 EAST 36 1096.57 WEST N1590 4742812.14735 3649050.54673
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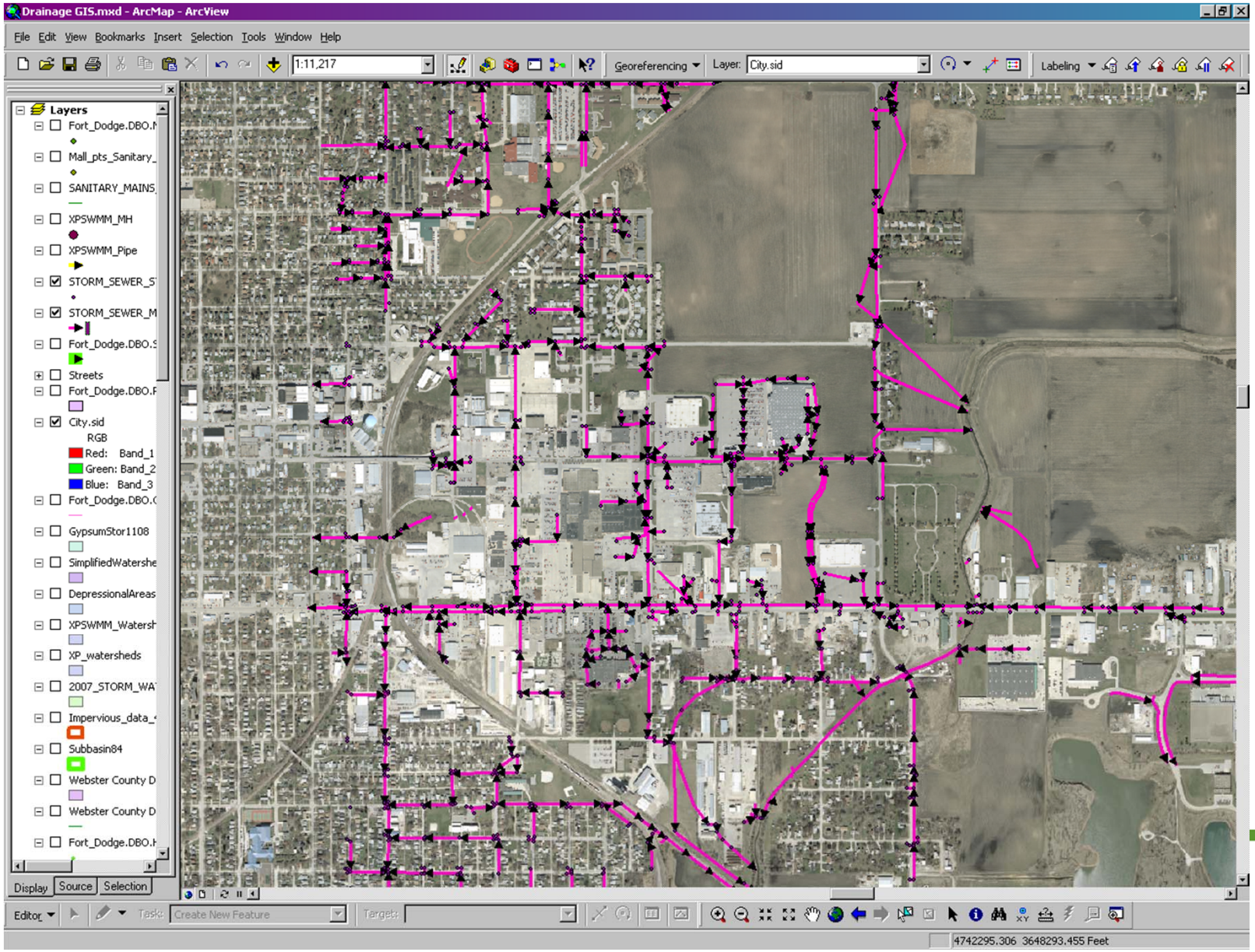
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STORM_SEWER_M
Fort_Dodge.DBO.S
Streets
Fort_Dodge.DBO.F
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RGB
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Green: Band_2
Blue: Band_3
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SimplifiedWatershe
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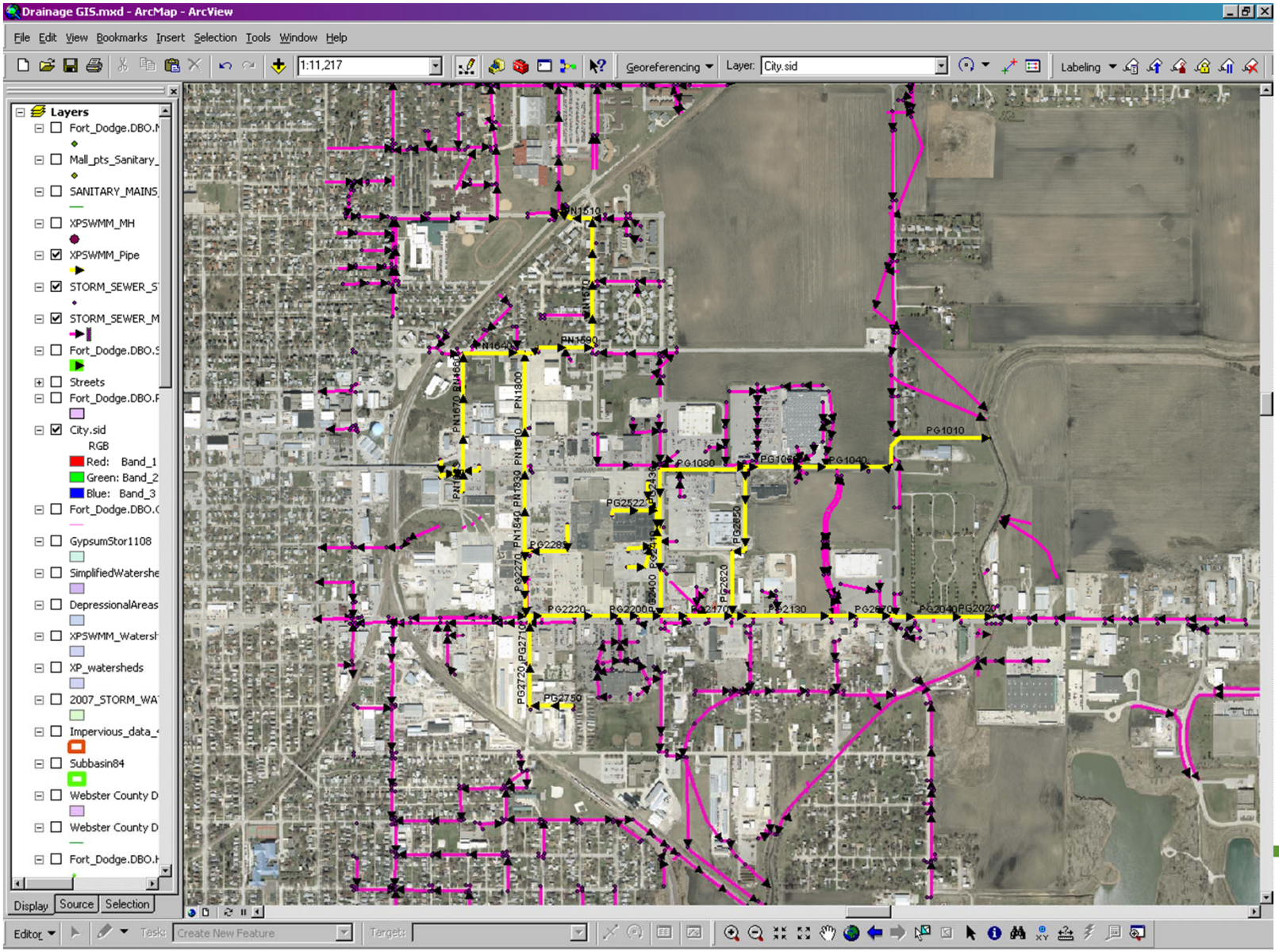
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STORM_SEWER_S
STORM_SEWER_M
Fort_Dodge.DBO.S
Streets
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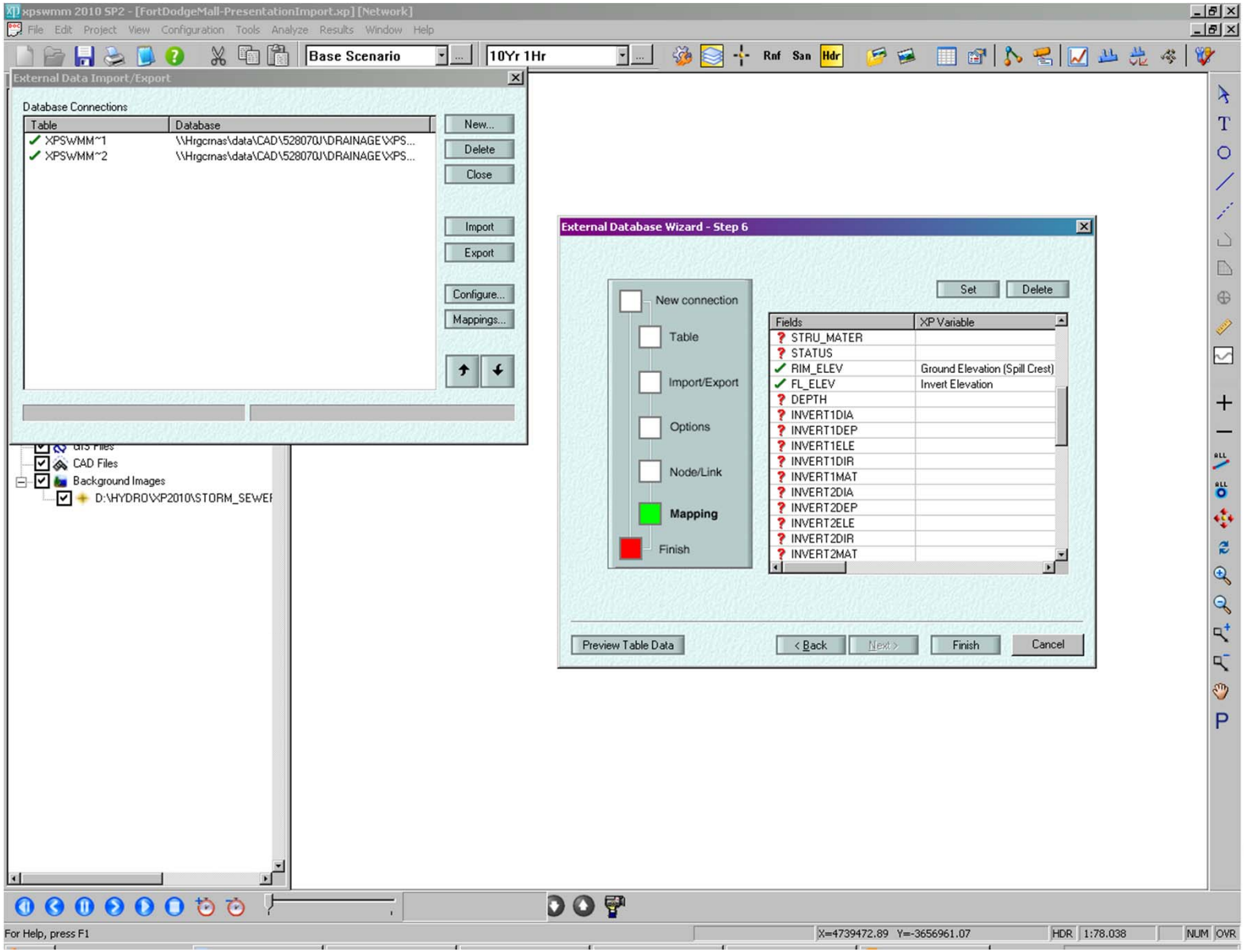
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Rnf San Hdr
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Mappings...
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Background Images
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Mapping
Finish
Set
Delete
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Ground Elevation (Spill Crest)
FL_ELEV
Invert Elevation
DEPTH
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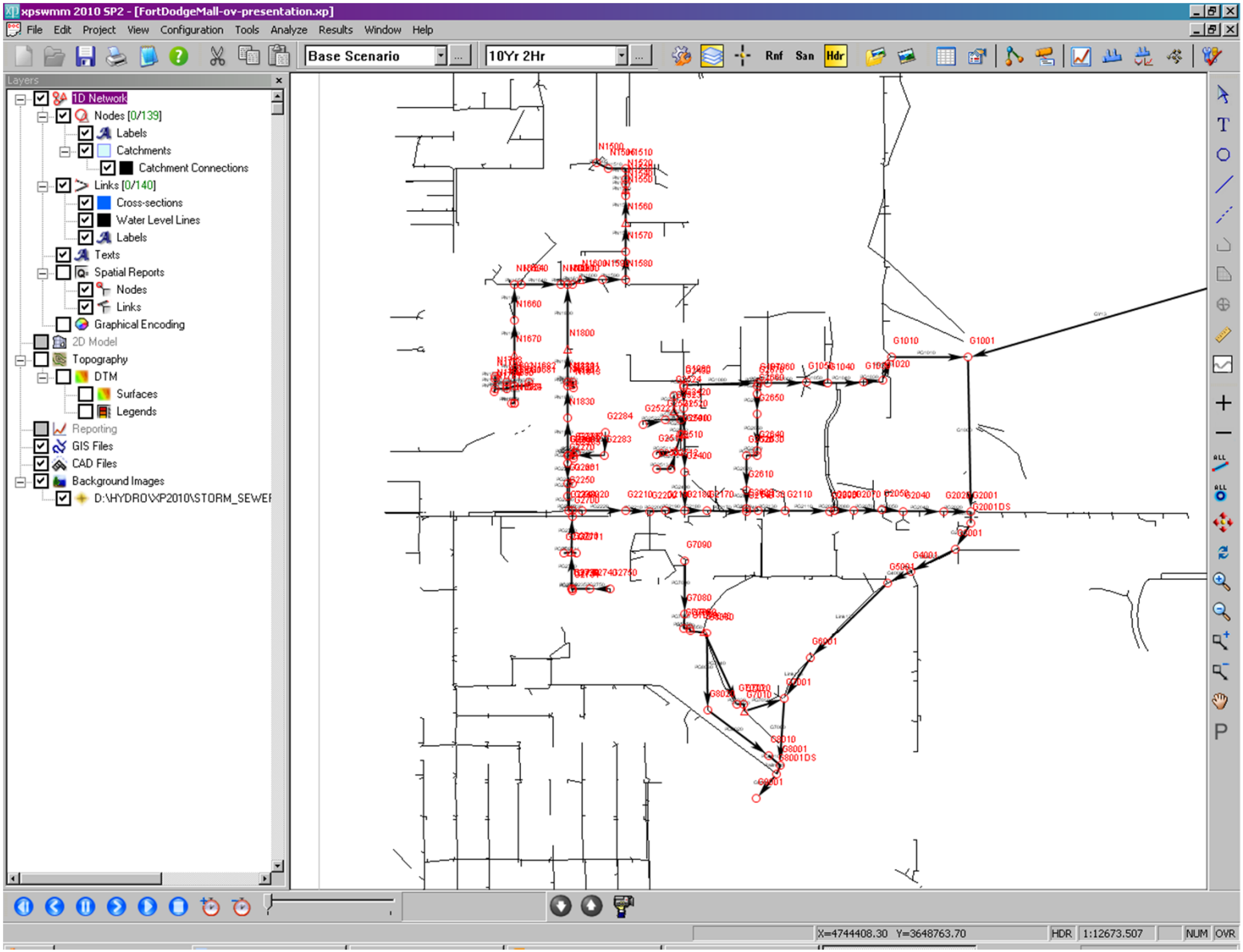
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Labels
Catchments
Catchment Connections
Links [0/140]
Cross-sections
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Labels
Texts
Spatial Reports
Nodes
Links
Graphical Encoding
2D Model
Topography
DTM
Surfaces
Legends
Reporting
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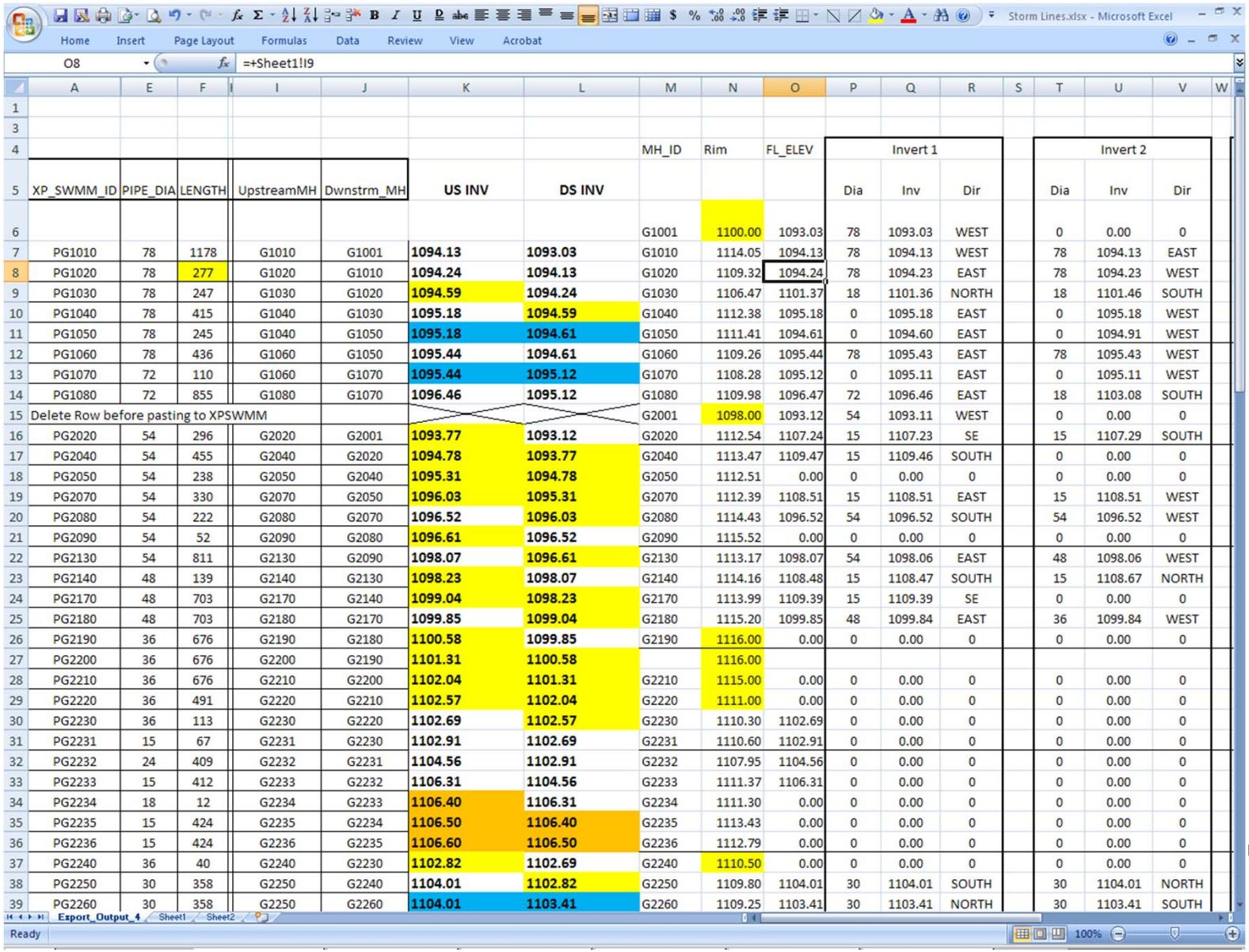

Storm Lines.xlsx - Microsoft Excel

Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

O8 | =+Sheet1!I9

	A	E	F	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1																		
3																		
4								MH_ID	Rim	FL_ELEV	Invert 1				Invert 2			
5	XP_SWMM_ID	PIPE_DIA	LENGTH	UpstreamMH	Dwnstrm_MH	US INV	DS INV				Dia	Inv	Dir		Dia	Inv	Dir	
6								G1001	1100.00	1093.03	78	1093.03	WEST		0	0.00	0	
7	PG1010	78	1178	G1010	G1001	1094.13	1093.03	G1010	1114.05	1094.13	78	1094.13	WEST		78	1094.13	EAST	
8	PG1020	78	277	G1020	G1010	1094.24	1094.13	G1020	1109.32	1094.24	78	1094.23	EAST		78	1094.23	WEST	
9	PG1030	78	247	G1030	G1020	1094.59	1094.24	G1030	1106.47	1101.37	18	1101.36	NORTH		18	1101.46	SOUTH	
10	PG1040	78	415	G1040	G1030	1095.18	1094.59	G1040	1112.38	1095.18	0	1095.18	EAST		0	1095.18	WEST	
11	PG1050	78	245	G1040	G1050	1095.18	1094.61	G1050	1111.41	1094.61	0	1094.60	EAST		0	1094.91	WEST	
12	PG1060	78	436	G1060	G1050	1095.44	1094.61	G1060	1109.26	1095.44	78	1095.43	EAST		78	1095.43	WEST	
13	PG1070	72	110	G1060	G1070	1095.44	1095.12	G1070	1108.28	1095.12	0	1095.11	EAST		0	1095.11	WEST	
14	PG1080	72	855	G1080	G1070	1096.46	1095.12	G1080	1109.98	1096.47	72	1096.46	EAST		18	1103.08	SOUTH	
15	Delete Row before pasting to XPSWMM							G2001	1098.00	1093.12	54	1093.11	WEST		0	0.00	0	
16	PG2020	54	296	G2020	G2001	1093.77	1093.12	G2020	1112.54	1107.24	15	1107.23	SE		15	1107.29	SOUTH	
17	PG2040	54	455	G2040	G2020	1094.78	1093.77	G2040	1113.47	1109.47	15	1109.46	SOUTH		0	0.00	0	
18	PG2050	54	238	G2050	G2040	1095.31	1094.78	G2050	1112.51	0.00	0	0.00	0		0	0.00	0	
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20	PG2080	54	222	G2080	G2070	1096.52	1096.03	G2080	1114.43	1096.52	54	1096.52	SOUTH		54	1096.52	WEST	
21	PG2090	54	52	G2090	G2080	1096.61	1096.52	G2090	1115.52	0.00	0	0.00	0		0	0.00	0	
22	PG2130	54	811	G2130	G2090	1098.07	1096.61	G2130	1113.17	1098.07	54	1098.06	EAST		48	1098.06	WEST	
23	PG2140	48	139	G2140	G2130	1098.23	1098.07	G2140	1114.16	1108.48	15	1108.47	SOUTH		15	1108.67	NORTH	
24	PG2170	48	703	G2170	G2140	1099.04	1098.23	G2170	1113.99	1109.39	15	1109.39	SE		0	0.00	0	
25	PG2180	48	703	G2180	G2170	1099.85	1099.04	G2180	1115.20	1099.85	48	1099.84	EAST		36	1099.84	WEST	
26	PG2190	36	676	G2190	G2180	1100.58	1099.85	G2190	1116.00	0.00	0	0.00	0		0	0.00	0	
27	PG2200	36	676	G2200	G2190	1101.31	1100.58		1116.00									
28	PG2210	36	676	G2210	G2200	1102.04	1101.31	G2210	1115.00	0.00	0	0.00	0		0	0.00	0	
29	PG2220	36	491	G2220	G2210	1102.57	1102.04	G2220	1111.00	0.00	0	0.00	0		0	0.00	0	
30	PG2230	36	113	G2230	G2220	1102.69	1102.57	G2230	1110.30	1102.69	0	0.00	0		0	0.00	0	
31	PG2231	15	67	G2231	G2230	1102.91	1102.69	G2231	1110.60	1102.91	0	0.00	0		0	0.00	0	
32	PG2232	24	409	G2232	G2231	1104.56	1102.91	G2232	1107.95	1104.56	0	0.00	0		0	0.00	0	
33	PG2233	15	412	G2233	G2232	1106.31	1104.56	G2233	1111.37	1106.31	0	0.00	0		0	0.00	0	
34	PG2234	18	12	G2234	G2233	1106.40	1106.31	G2234	1111.30	0.00	0	0.00	0		0	0.00	0	
35	PG2235	15	424	G2235	G2234	1106.50	1106.40	G2235	1113.43	0.00	0	0.00	0		0	0.00	0	
36	PG2236	15	424	G2236	G2235	1106.60	1106.50	G2236	1112.79	0.00	0	0.00	0		0	0.00	0	
37	PG2240	36	40	G2240	G2230	1102.82	1102.69	G2240	1110.50	0.00	0	0.00	0		0	0.00	0	
38	PG2250	30	358	G2250	G2240	1104.01	1102.82	G2250	1109.80	1104.01	30	1104.01	SOUTH		30	1104.01	NORTH	
39	PG2260	30	358	G2250	G2260	1104.01	1103.41	G2260	1109.25	1103.41	30	1103.41	NORTH		30	1103.41	SOUTH	

Export_Output_4 | Sheet1 | Sheet2

Ready

100%

HRGreen

xpswmm 2010 SP2 - [Untitled] [XP Tables]

File Edit View Options Format Window Help

Base Scenario | 10Yr 2Hr | Active Subcatchments | All Objects in Current Net | Close

Name	Storm	Length	Diameter (Hei	Upstream Inve	Downstream I	Max Flow	Roughness	Shape	Upstream Nod	Downstream	Conduit Slope
PG1010	10Yr 2Hr	869.000	6.500	1094.130	1093.030	235.756	0.0130	Circular	G1010	G1001	0.13000
PG1020.1	10Yr 2Hr	283.000	6.500	1094.240	1094.130	184.378	0.0130	Circular	G1020	G1010	0.03887
PG1030.1	10Yr 2Hr	247.000	6.500	1094.590	1094.240	184.399	0.0130	Circular	G1030	G1020	0.14170
PG1040.1	10Yr 2Hr	415.000	6.500	1095.180	1094.590	184.904	0.0130	Circular	G1040	G1030	0.14217
PG1050.1	10Yr 2Hr	245.000	6.500	1095.180	1094.610	-137.270	0.0130	Circular	G1040	G1050	0.23265
PG1060.1	10Yr 2Hr	436.000	6.500	1095.440	1094.610	125.103	0.0130	Circular	G1060	G1050	0.19037
PG1062.1	10Yr 2Hr	180.000	3.000	1100.560	1095.440	-0.775	0.0130	Circular	G1062	G1060	2.84444
PG1067.1	10Yr 2Hr	565.000	2.500	1104.990	1100.560	0.000	0.0130	Circular	G1067	G1062	0.00000
PG1070.1	10Yr 2Hr	110.000	6.000	1095.440	1095.120	-125.487	0.0130	Circular	G1060	G1070	0.29091
PG1080	10Yr 2Hr	855.000	6.000	1096.460	1095.120	87.101	0.0130	Circular	G1080	G1070	0.16000
PG2020.1	10Yr 2Hr	296.000	4.500	1093.770	1092.230	50.556	0.0130	Circular	G2020	G2001	0.52027
PG2040.1	10Yr 2Hr	455.000	4.500	1094.780	1093.770	50.570	0.0130	Circular	G2040	G2020	0.22198
PG2050.1	10Yr 2Hr	238.000	4.500	1095.310	1094.780	50.545	0.0130	Circular	G2050	G2040	0.22269
PG2070.1	10Yr 2Hr	330.000	1.000	1096.030	1095.310	8.625	0.0130	Circular	G2070	G2050	0.21818
PG2080.1	10Yr 2Hr	222.000	4.500	1096.520	1096.030	81.776	0.0130	Circular	G2080	G2070	0.22072
PG2090	10Yr 2Hr	52.000	4.500	1096.610	1096.520	-36.863	0.0130	Circular	G2090	G2080	0.17000
PG2110	10Yr 2Hr	498.000	4.500	1097.510	1096.610	-18.884	0.0130	Circular	G2110	G2090	0.18000
PG2130.1	10Yr 2Hr	313.000	1.000	1098.070	1097.510	6.947	0.0130	Circular	G2130	G2110	0.17891
PG2140.1	10Yr 2Hr	139.000	4.000	1098.230	1098.070	10.998	0.0130	Circular	G2140	G2130	0.11511
PG2170.1	10Yr 2Hr	553.000	4.000	1099.040	1098.230	-26.413	0.0130	Circular	G2170	G2140	0.14647
PG2180.1	10Yr 2Hr	250.000	4.000	1099.850	1099.040	-34.512	0.0130	Circular	G2180	G2170	0.32400
PG2190.1	10Yr 2Hr	253.000	3.000	1100.580	1099.850	-31.868	0.0130	Circular	G2190	G2180	0.28854
PG2200.1	10Yr 2Hr	190.000	3.000	1101.310	1100.580	-45.357	0.0130	Circular	G2200	G2190	0.38421
PG2201	10Yr 2Hr	267.000	1.750	1101.440	1101.310	29.757	0.0130	Circular	G2201	G2200	0.04869
PG2210.1	10Yr 2Hr	262.000	3.000	1102.040	1101.310	-55.484	0.0130	Circular	G2210	G2200	0.27863
PG2220.1	10Yr 2Hr	491.000	3.000	1102.570	1102.040	-41.118	0.0130	Circular	G2220	G2210	0.10794
PG2230.1	10Yr 2Hr	113.000	3.000	1102.690	1102.570	-46.573	0.0130	Circular	G2230	G2220	0.10619
PG2240.1	10Yr 2Hr	40.000	3.000	1102.820	1102.690	-52.190	0.0130	Circular	G2240	G2230	0.32500
PG2241.1	10Yr 2Hr	258.000	2.250	1103.594	1102.820	-38.363	0.0130	Circular	G2241	G2240	0.30000
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PG2250.1	10Yr 2Hr	172.000	2.500	1104.010	1102.820	21.767	0.0130	Circular	G2250	G2240	0.69186
PG2260.1	10Yr 2Hr	145.000	2.500	1104.010	1103.410	-20.310	0.0130	Circular	G2250	G2260	0.41379
PG2261.1	10Yr 2Hr	10.000	1.000	1104.020	1103.410	-1.922	0.0130	Circular	G2261	G2260	6.10000
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PG2281	10Yr 2Hr	11.000	1.500	1102.700	1102.640	-6.913	0.0130	Circular	G2281	G2280	0.55000
PG2282	10Yr 2Hr	49.000	1.500	1103.000	1102.700	-8.634	0.0130	Circular	G2282	G2281	0.61000
PG2283	10Yr 2Hr	65.000	1.750	1103.010	1103.000	-7.300	0.0130	Circular	G2283	G2282	0.02000
PG2284	10Yr 2Hr	65.000	1.000	1103.020	1103.010	-1.421	0.0130	Circular	G2284	G2283	0.02000
PG2285	10Yr 2Hr	10.000	1.000	1103.050	1103.040	-3.228	0.0130	Circular	G2285	G2282	0.10000
PG2286	10Yr 2Hr	10.000	1.000	1103.060	1103.050	5.711	0.0130	Circular	G2286	G2282	0.10000
PG2287.1	10Yr 2Hr	10.000	1.000	1103.070	1103.060	6.538	0.0130	Circular	G2287	G2286	0.10000
PG2400	10Yr 2Hr	434.000	2.500	1103.070	1101.650	-24.471	0.0130	Circular	G2400	G2180	0.33000
PG2410.1	10Yr 2Hr	422.000	2.500	1104.500	1103.070	33.108	0.0130	Circular	G2410	G2400	0.33886
PG2420.1	10Yr 2Hr	308.000	2.250	1104.810	1104.500	-10.626	0.0130	Circular	G2420	G2410	0.10065
PG2430.1	10Yr 2Hr	237.000	1.500	1105.040	1104.810	-13.729	0.0130	Circular	G2430	G2420	0.09705
PG2440.1	10Yr 2Hr	14.000	1.500	1105.040	1103.080	44.925	0.0130	Circular	G2430	G1080	14.00000
PG2500	10Yr 2Hr	36.000	1.750	1104.780	1104.570	25.736	0.0130	Circular	G2500	G2410	0.58000
PG2510	10Yr 2Hr	192.000	1.750	1105.000	1104.820	14.321	0.0130	Circular	G2510	G2500	0.09000
PG2511	10Yr 2Hr	221.000	1.000	1105.010	1105.000	8.296	0.0130	Circular	G2511	G2510	0.00000
PG2512	10Yr 2Hr	214.000	1.500	1105.020	1105.010	9.191	0.0130	Circular	G2512	G2510	0.00000
PG2513	10Yr 2Hr	170.000	1.250	1105.030	1105.020	5.702	0.0130	Circular	G2513	G2512	0.01000
PG2520	10Yr 2Hr	165.000	1.750	1104.930	1104.820	14.422	0.0130	Circular	G2520	G2500	0.07000

Watersheds | Pipes | ControlStructures | Weir

NUM OVR

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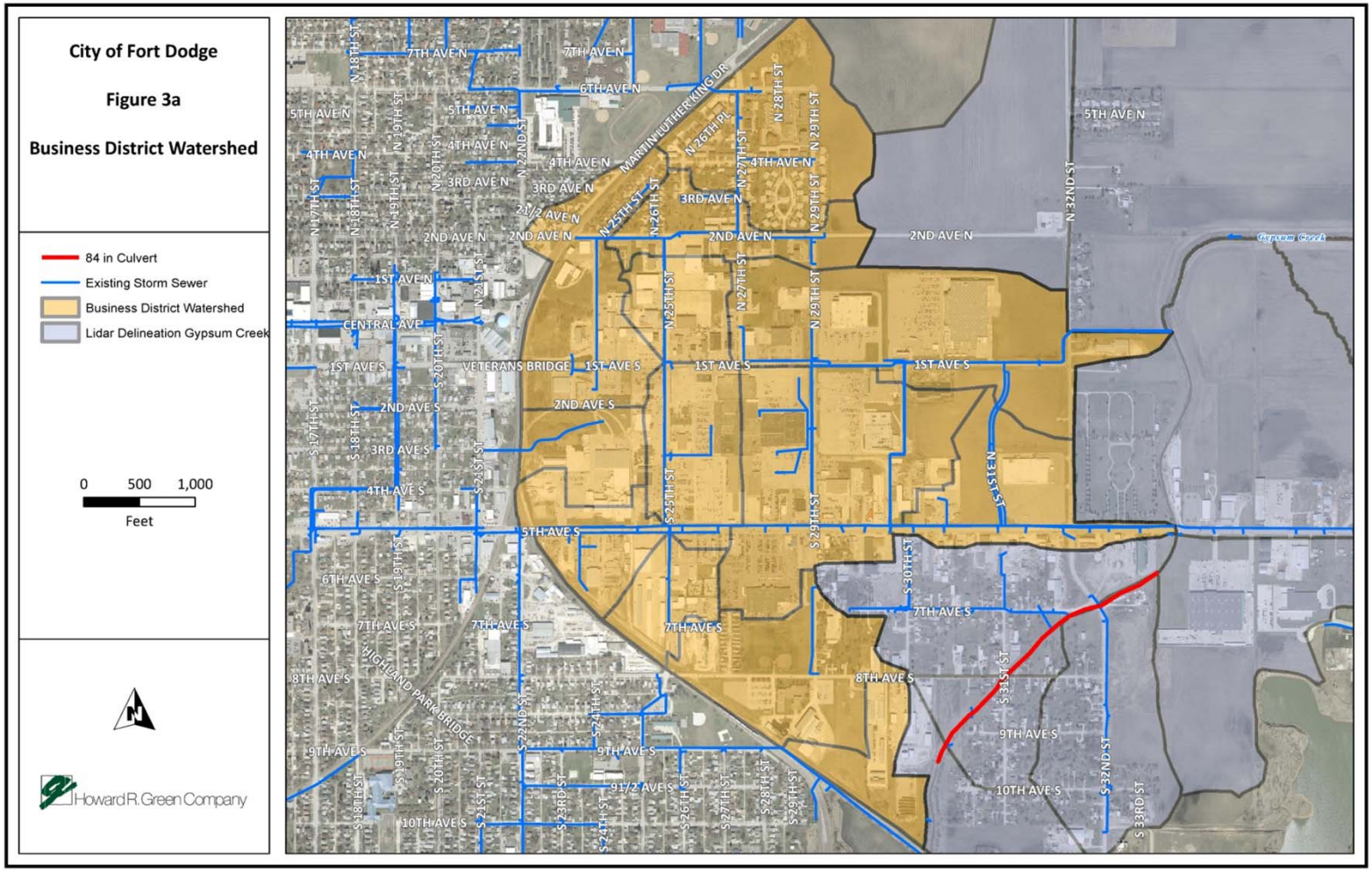
XP-SWMM Analysis



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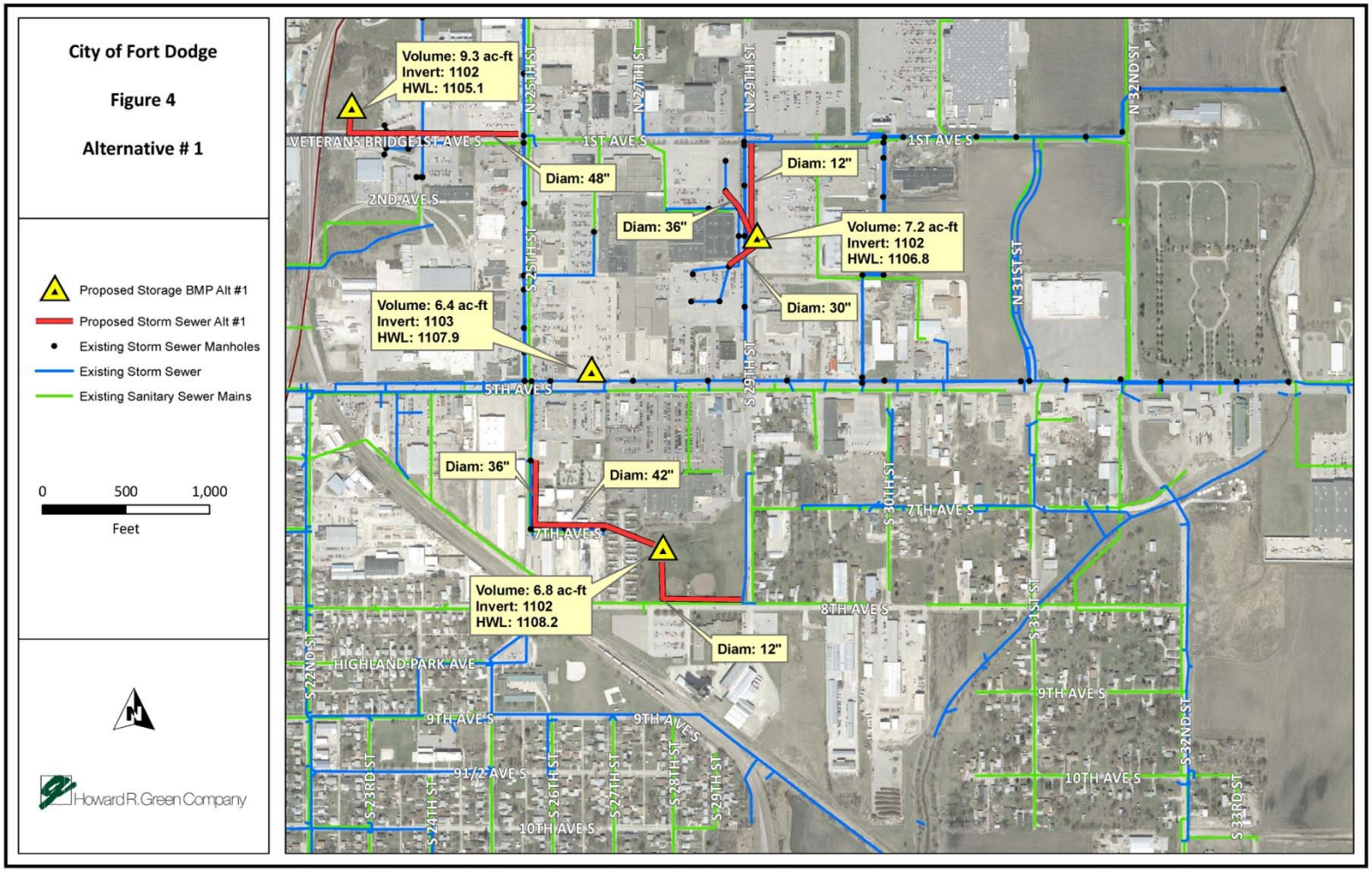
Storage Alternative



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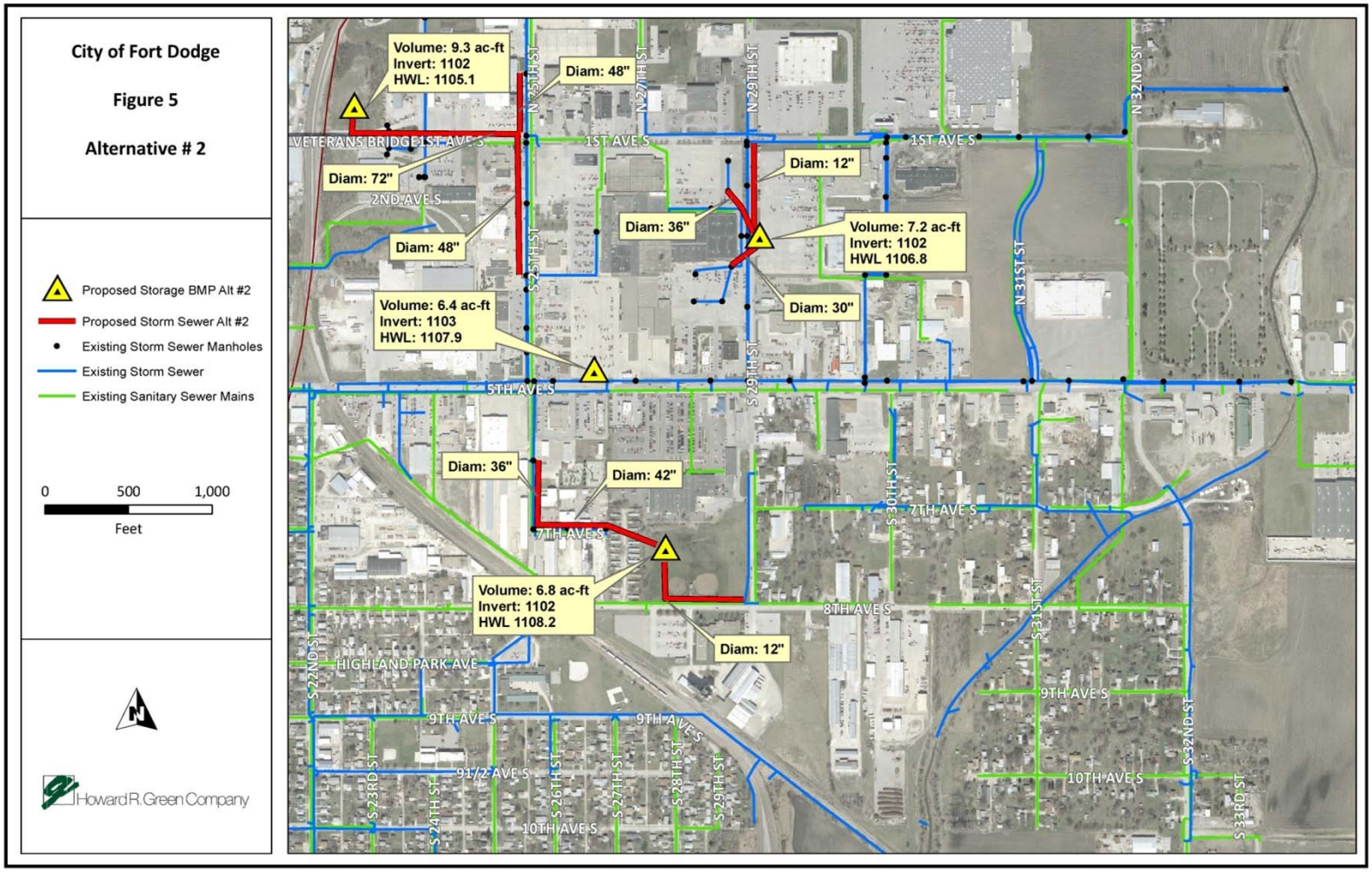
Sewer Extended to Mall



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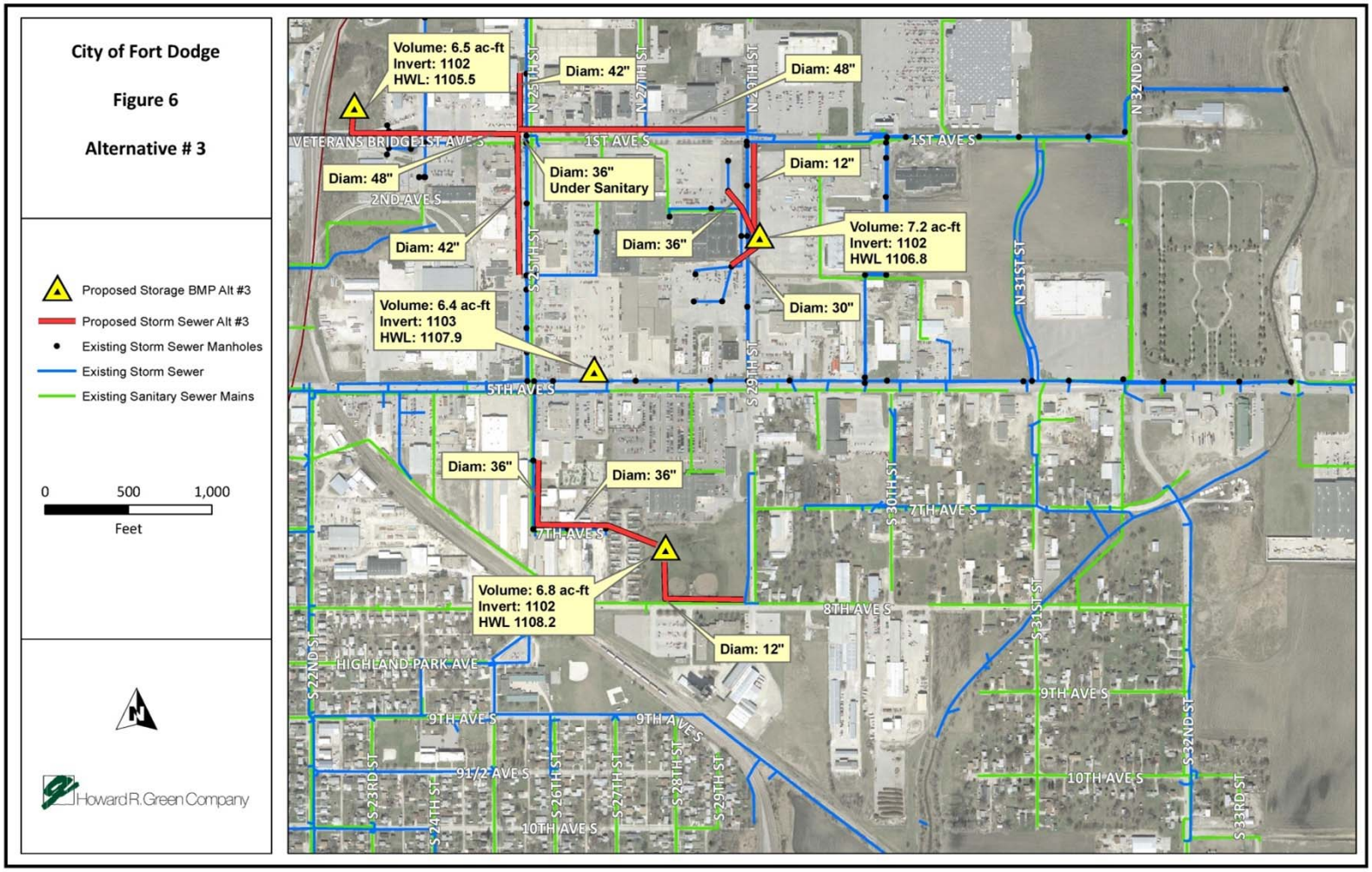
Connection to 72” Outlet



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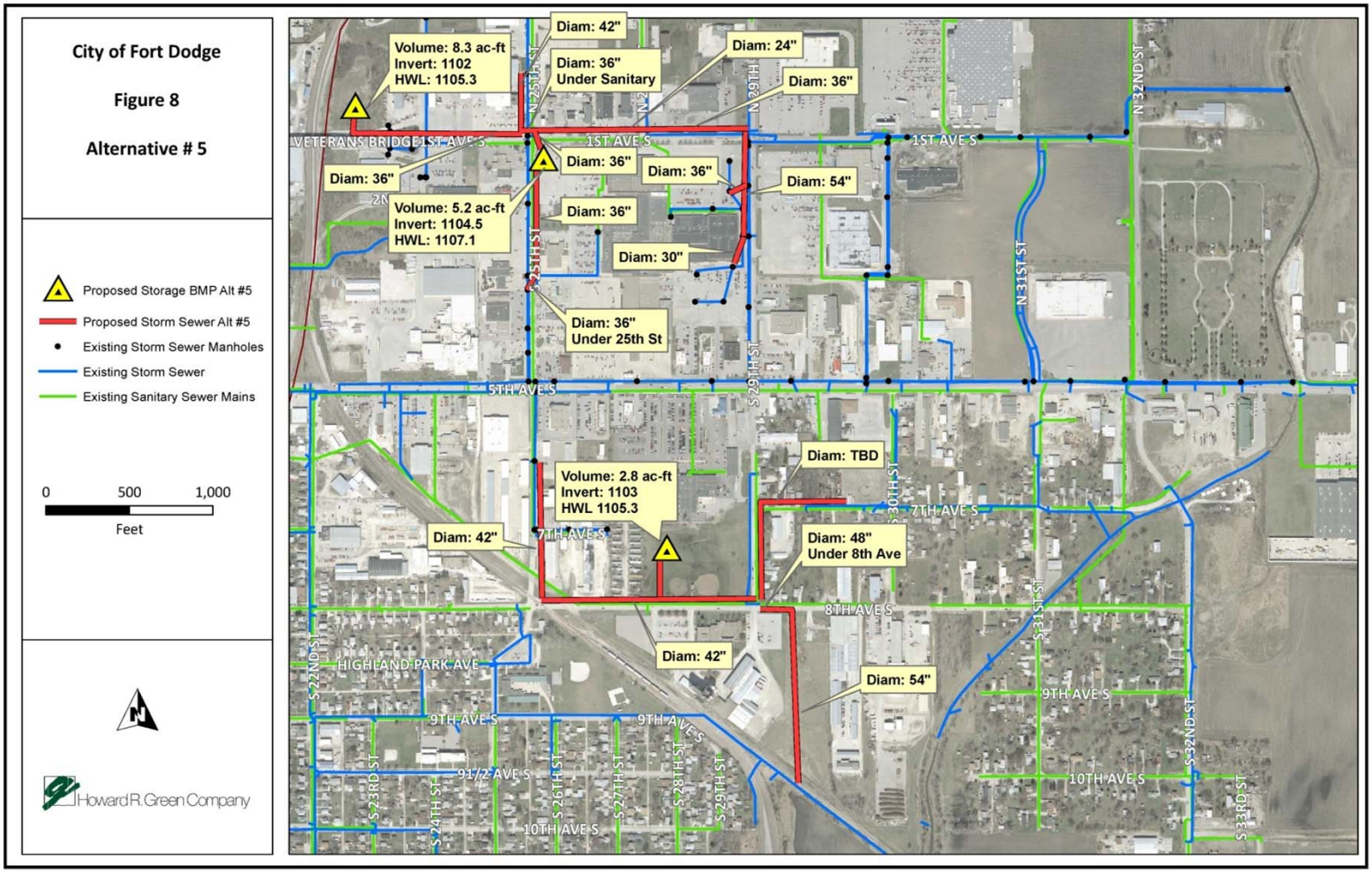
Chosen Alternate



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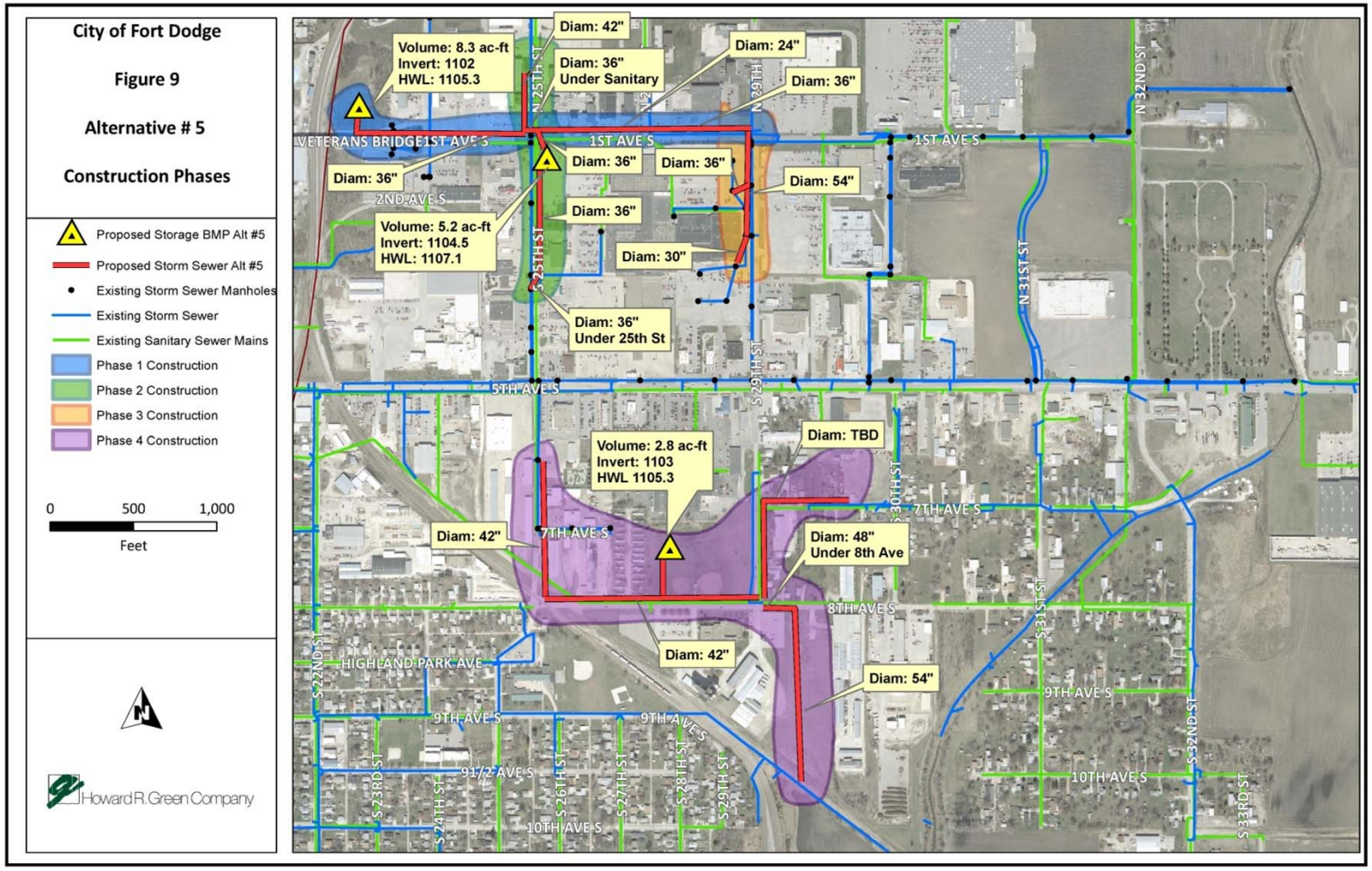
Phasing



Questions?

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