Lexington Club Sanitary

Sewer Evaluation

Performed for

Lexington Homes
1731 North Marcey Street, Suite 200
Chicago, IL 60614

&

The City of St. Charles
2 E. Main Street
St. Charles, IL 60174

Performed by
Wills Burke Kelsey Associates, Ltd.

December 17, 2010

Introduction

On behalf of Lexington Homes and the City of St. Charles, Wills Burke Kelsey Associates, Ltd. has evaluated the existing sanitary sewer system downstream of the proposed redevelopment project known as Lexington Club. The proposed land plan is currently considering mixed density residential homes for the redevelopment of the former Applied Composites property located north of the intersection of 9th Street and State Street. The proposed land plan consists of 102 2-story townhomes, 12 2-story row homes and 28 single family lots. This report considers existing conditions of the sanitary sewer, as well the ability of the sanitary sewer to facilitate flows from the proposed Lexington Club project.

Scope of Evaluation

The evaluation considers two different sanitary sewer pipe networks; the first network is the trunk sanitary sewer from the Lexington Club project to the Riverside Relief Siphon and the second network analyzed is the Riverside Relief Siphon. The trunk sanitary sewer from the Lexington Club to the Riverside Relief Siphon was evaluated using a manning's equation spreadsheet to estimate the flowing full capacity of each pipe in the network. The Riverside Relief Siphon was hydraulically modeled using PC-SWMM to analyze the entire network. The capacity analysis of the trunk sanitary sewer considered two flow regimes; dry weather flow (without inflow and infiltration) and wet weather flow (with inflow and infiltration). Based on input from the City of St. Charles Staff the hydraulic model for the Riverside Relief Siphon considered existing (prior to Lexington Club) and proposed (after Lexington Club build out) dry weather conditions; a wet weather condition was not evaluated.

Capacity Analysis

Our initial evaluation consisted of a capacity analysis of the sanitary sewers serving the project from just west of the intersection of 9th Street and State Street to the Riverside Relief Sewer Siphon. The Riverside Relief Siphon crosses under the Fox River from just south of the parking lot for Salerno's on the Fox on the west side to just north of the St. Charles Police Department Building on the east side was specifically excluded in the capacity analysis because it will be hydraulically modeled. Sanitary sewers studied ranged in size from 15 to 24 inches in diameter. We utilized the December 2009 RJN Group Report and the 1996 Black & Veatch Report as the best available information in determining system flows (sanitary and I&I) for our analysis. Consistent with the 1996 and 2009 studies we considered the design event to be the 10 year storm and evaluated the dry weather condition (no I&I) and the wet weather condition (with I&I). The pipe slopes, sizes, lengths, and invert elevations for our analysis were determined from the 1996 Black & Veatch Report, the City of St. Charles GIS Data and WBK field survey and investigation completed on December 10, 2010. It should be noted that there were some discrepancies between the data from the Black & Veatch Report and the City of St. Charles GIS Data.

In 2006 and 2009 the City of St. Charles hired RJN to perform flow monitoring at 14 locations throughout the west side of St. Charles to assess the impact of the sewer rehabilitation programs the City had implemented since the previous evaluation in 1996. Wills Burke Kelsey Associates, Ltd., evaluated the 2006 and 2009 flow data to determine the most accurate flow values to use in the capacity analysis. The 2006 RJN Sanitary Flow Metering Study monitored flow in manhole 5.3-127 and determined a peak sanitary flow of 0.325 cfs. The 2009 RJN Sanitary Flow Metering Study monitored flow in manhole 5.3-126, (which was identified as 5.3-128 in the RJN report but upon further field investigation and review of the City's GIS Data is actually 5.3-126) and determined a peak sanitary flow of 1.702 cfs. The sanitary network evaluated, the manhole numbers, and the location of the Lexington Club project are shown on the full size version of Exhibit D. Also, the 2006 and 2009 RJN studies estimated the wet weather flows (with I&I) at manholes 5.3-127 and 5.3-126 to be 7.00 cfs and 10.553 cfs, respectively. We input the existing conditions flows into the capacity analysis spreadsheets to evaluate the sanitary sewer system.

Wastewater flows from the Lexington Club project were added to the system based on proposed land uses defined in Exhibit A following this report. The IEPA wastewater average daily flow generation rate of 350 gallons/capita/day was utilized for the single family lots within the development. The IEPA wastewater average daily flow generation rate of 300 gallons/capita/day for 3 bedroom apartments was utilized for the 2-story townhomes and row homes within the development. The flows were calculated assuming all proposed residential dwellings were built and contributing to the system. However, the projected build out of the property is unknown at this time. Based on the average daily flow generation for the proposed Lexington Club, a peaking factor was a calculated and applied to the average daily flow. The peaking factor calculation is shown on Exhibit A following this report. Therefore, the peak additional sanitary flow for the proposed land plan is 0.272 cfs.

The results of the dry and wet weather conditions for the sanitary sewer from the proposed site to the Riverside Relief Siphon are shown on Exhibits B and C, respectively. Although, the proposed flow from the site will be connected at multiple locations to the existing sanitary network, we conservatively assumed all flows were input at the upstream location of the network along the south side of the Lexington Club property in the proposed conditions. Based on the results of the capacity analysis the system can convey the peak sanitary dry weather flow with the proposed project flows. Post project pipe capacities for dry weather flow range from approximately 4% to 17% flowing full. However, do to the significant amount of I & I the system is unable to convey either the existing or post project wet weather flows. Post project pipe capacities for wet weather flow range from approximately 60% to 250% flowing full. Also, during wet weather conditions half of the pipes (10 out of 20) analyzed from the Lexington Club project to the Riverside Relief Siphon are over capacity.

Design Flow Determination for the Siphon Analysis

Analysis of the Riverside Relief Siphon considers two flow regimes; existing conditions (prior to Lexington Club) and proposed conditions (after Lexington Club is built). Based on discussions with the City of St. Charles Staff we evaluated the 10 year event without I & I (dry weather condition) for each flow regime; a wet weather condition was not considered. The first flow value (existing conditions) is an estimation based on the 2006 and 2009 RJN West of the Fox River Metering Project Report. The proposed conditions flow value considers the addition of the proposed upstream redevelopment project known as Lexington Club.

Existing Conditions Flow:

As previously discussed in the evaluation of the sanitary sewer capacity the peak sanitary flow was metered in the 2006 and 2009 RJN Studies. The 2009 RJN Study monitored flows at manhole 5.3-126, (which was identified as 5.3-128 in the RJN report but upon further field investigation and review of the City's GIS Data is actually 5.3-126) and determined a peak sanitary flow of 1.702 cfs. This dry weather flow was utilized in the existing conditions analysis of the Riverside Relief Siphon.

Future Conditions Flow:

Future condition flow values are the result of the existing peak sanitary flow (1.702 cfs) plus the peak sanitary flow from the proposed development known as Lexington Club. As previously, discussed in the capacity analysis the peak sanitary flow generated by the proposed Lexington Club is 0.272 cfs. Therefore, the total future condition flow is 1.974 cfs, which is a 16% increase over the existing flows.

Existing Conditions Analysis

The subject sanitary sewer siphon includes 7 segments of pipe consisting of 1,855 feet in total length. Sanitary sewer flows from the west side of the Fox River cross the river through the siphon to the east side just north of the St. Charles Police Station. All flows are then directed south along 1st Avenue / Riverside Avenue to the Riverside Lift Station and pumped to the St. Charles Wastewater Treatment Plant (WWTP). The first two segments of pipe in our analysis are 24 inch gravity sewers from the east side of IL Route 31 to the siphon inlet chamber. The Riverside Relief Siphon consists of two ductile iron siphon pipes with diameters of 14 and 18 inches. The inverts of the two pipes in the siphon inlet chamber are at the same elevation per the original design engineering plans, entitled, “Riverside Relief Sewer,” dated September 21, 1981. The upstream invert of the two siphon pipes is 683.30.

The approximate length of the siphon is 522 feet. Both pipes discharge at different elevations within the outlet chamber. From the siphon outlet chamber sewage flows are directed east to 1st Avenue and then south along the east side of the Fox River through a 36 inch diameter interceptor pipe to the Riverside Lift Station.

PC-SWMM was utilized to evaluate the hydraulic condition of the siphon. PC-SWMM was utilized for its potential to benefit future analyses of the sanitary sewer. The roughness coefficient or Manning’s “n” value used for our analysis is 0.011 for the ductile iron siphon and 0.015 for the Reinforced Concrete Pipe (RCP) upstream and downstream of the siphon, which is reflective of a pipe in good condition. The condition of the pipe is assumed to be good since no investigation was performed. The existing 10 year design flow in dry weather, as noted above, is 1.702 cfs.

Based on the scope of the project and discussions with City Staff we ended the analysis at manhole 4.3-004. The tailwater condition at manhole 4.3-004 is based on the 1996 Black and Veatch Report the peak sanitary flow in that manhole was estimated at 1.889 cfs. Also, based on the Black and Veatch Report the capacity of the pipe downstream of this manhole is 10.67 cfs, therefore the pipe is flowing approximately 17.7% full. The invert elevation of the pipe in manhole 4.3-004 is 679.81 and based on the percent full we established the starting tailwater elevation at the downstream end of our model / analysis to be 680.21.

The analysis of the system utilizing the projected existing dry weather 10 year flow indicates that the system can convey the flow with no overflow. Based on discussions with City staff and through their observations, we believe this result to be accurate. A schematic of the pipe network and results of the analysis are found in Appendix A.

Future Conditions Analysis

The future conditions evaluation utilized the same pipe network conditions as the existing conditions noted above except flows were increased from 1.702 cfs to 1.974 cfs. Since, there was additional flow added to the system the percent flowing full of the last pipe was calculated using the existing condition flow of 1.889 cfs plus the Lexington Club flow of 0.272 cfs. Therefore, since the pipe has the same capacity (10.67 cfs) the pipe is flow approximately 20.2% full. Based on the new percent flowing full of the pipe the starting tailwater elevation at the downstream end should be 680.27. Under this condition the system can convey the additional flow, with no overflow predicted. The results of this analysis can be found in Appendix B.

Summary of the Siphon Analysis

Based on the results of the PC-SWMM analysis detailed above there is a 0.06 foot differential in the Hydraulic Grade Line (HGL) between the existing and future condition at the manhole upstream of the siphon inlet chamber (5.3-126). Therefore, the increase in flow caused by the Lexington Club project in the dry weather condition for the 10 year event has a negligible effect on the system and the flows can be conveyed. However, it should be noted that since the model does not consider the entire pipe network from the Riverside Relief Siphon to the Riverside Lift Station and it does not incorporate the effects of the Illinois Siphon and Park Shore Siphon, the HGLs are relative to the estimated tailwater elevations in each analysis. Further monitoring of the flow values on the east side of St. Charles and a model incorporating all three siphons (Riverside Relief Siphon, Illinois Street Siphon, and the Park Shore Siphon) is recommended to better understand how the entire network functions as a system.

Exhibit A

Lexington Club Sanitary Sewer Evaluation

IEPA Wastewater Average Daily Flow Generation Rate				
Building	**Use**	**Units**	**P.E.**	**Total Flow (GPD)**
Townhouses	Residential	102	3	30,600
Rowhouses	Residential	12	3	3,600
Single Family	Residential	28	3.5	9,800
Total Daily Flow for Residential				**44,000**

Peaking Factor Calculation	
PE	440
Peaking Factor	4.00
Peak Flow (Millions of Gallons per Day)	0.176
Peak Flow (Gallons per Day)	176095
Flow (Gallons per Minute)	122.3
Flow (CFS)	0.272

Exhibit B

Lexington Club Applied Composites Sanitary Trunk Sewer Study

Based on 10 Year Flow Event with no I/I (Dry Weather Flows)

XXX.XX	Required Sewer Improvements.

Upstream Manhole	Downstream Manhole	Upstream Elevation	Downstream Elevation	Pipe Length	Pipe Dia	Pipe Slope	Pipe Capacity (CFS)	Existing 2010 Flow Total w/o I&I (CFS)	Lexington Club Applied Composites Peak Hour Flow (CFS)	Proposed 2010 Flow Total w/ I&I (CFS)	2010 Existing Condition Pipe Capacity	2010 Proposed Condition Pipe Capacity
5.3-057	5.3-059	707.54	707.06	321	15	0.15%	2.505	0.095	0.272	0.367	3.79%	14.65%
5.3-059	5.3-061	707.06	706.65	255	15	0.16%	2.597	0.108	0.272	0.380	4.16%	14.63%
5.3-061	5.3-062	706.65	705.79	135	15	0.64%	5.170	0.122	0.272	0.394	2.36%	7.62%
5.3-062	5.3-063	705.79	704.35	53	15	2.72%	10.677	0.136	0.272	0.408	1.27%	3.82%
5.3-063	5.3-073	704.35	697.62	337	15	2.00%	9.153	0.149	0.272	0.421	1.63%	4.60%
5.3-073	5.3-072	697.62	693.55	221	15	1.84%	8.790	0.163	0.272	0.435	1.85%	4.95%
5.3-072	5.3-071	693.26	693.03	47	15	0.49%	4.531	0.176	0.272	0.448	3.88%	9.89%
5.3-071	5.3-237	693.03	691.32	301	18	0.57%	7.939	0.190	0.272	0.462	2.39%	5.82%
5.3-237	5.3-140	691.32	690.71	70	18	0.87%	9.832	0.203	0.272	0.475	2.06%	4.83%
5.3-140	5.3-139	690.71	688.98	172	18	1.01%	10.563	0.217	0.272	0.489	2.05%	4.63%
5.3-139	5.3-138	688.98	688.56	51	18	0.82%	9.558	0.230	0.272	0.502	2.41%	5.25%
5.3-138	5.3-136	688.56	687.51	105	18	1.00%	10.533	0.244	0.272	0.516	2.32%	4.90%
5.3-136	5.3-133	687.27	687.15	35	18	0.34%	6.167	0.257	0.272	0.529	4.17%	8.58%
5.3-133	5.3-132	687.15	686.48	177	18	0.38%	6.480	0.271	0.272	0.543	4.18%	8.38%
5.3-132	5.3-130	686.48	685.97	123	18	0.41%	6.782	0.284	0.272	0.556	4.19%	8.20%
5.3-130	5.3-129	685.97	685.74	207	18	0.11%	3.511	0.298	0.272	0.570	8.49%	16.24%
5.3-129	5.3-127	685.74	684.84	246	18	0.37%	6.371	0.311	0.272	0.583	4.88%	9.15%
5.3-127	5.3-126	684.64	683.87	162	18	0.48%	7.261	0.325	0.272	0.597	4.48%	8.22%
5.3-126	5.3-125	683.77	683.73	9	24	0.44%	15.122	1.702	0.272	1.974	11.25%	13.05%
5.3-125	5.3-221	683.73	683.30	88	24	0.49%	15.856	1.702	0.272	1.974	10.73%	12.45%

NOTES:

1. All pipe lengths are based on the City of St. Charles GIS Data.
2. All invert elevations and pipe sizes are based on the 1996 Black & Veatch Report, except for manholes 5.3-125, 5.3-126, and 5.3-127.
3. Invert elevations and pipe sizes for manholes 5.3-125, 5.3-126, and 5.3-127 are based on WBK field survey and investigation preformed on December 10, 2010.

Exhibit C

Lexington Club Applied Composites Sanitary Trunk Sewer Study

Based on 10 Year Flow Event with I/I (Wet Weather Flow)

XXX.XX	Required Sewer Improvements.

Upstream Manhole	Downstream Manhole	Upstream Elevation	Downstream Elevation	Pipe Length	Pipe Dia	Pipe Slope	Pipe Capacity (CFS)	Existing 2010 Flow Total w/ I&I (CFS)	Lexington Club Applied Composites Peak Hour Flow (CFS)	Proposed 2010 Flow Total w/ I&I (CFS)	2010 Existing Condition Pipe Capacity	2010 Proposed Condition Pipe Capacity
5.3-057	5.3-059	707.54	707.06	321	15	0.15%	2.505	5.979	0.272	6.251	238.71%	249.57%
5.3-059	5.3-061	707.06	706.65	255	15	0.16%	2.597	6.020	0.272	6.292	231.79%	242.26%
5.3-061	5.3-062	706.65	705.79	135	15	0.64%	5.170	6.068	0.272	6.340	117.38%	122.64%
5.3-062	5.3-063	705.79	704.35	53	15	2.72%	10.677	6.140	0.272	6.412	57.51%	60.06%
5.3-063	5.3-073	704.35	697.62	337	15	2.00%	9.153	6.216	0.272	6.488	67.91%	70.88%
5.3-073	5.3-072	697.62	693.55	221	15	1.84%	8.790	6.277	0.272	6.549	71.41%	74.51%
5.3-072	5.3-071	693.26	693.03	47	15	0.49%	4.531	6.343	0.272	6.615	139.99%	145.99%
5.3-071	5.3-143	693.03	691.32	301	18	0.57%	7.939	6.418	0.272	6.690	80.84%	84.27%
5.3-143	5.3-140	691.32	690.71	70	18	0.87%	9.832	6.468	0.272	6.740	65.78%	68.55%
5.3-140	5.3-139	690.71	688.98	172	18	1.01%	10.563	6.541	0.272	6.813	61.92%	64.50%
5.3-139	5.3-138	688.98	688.56	51	18	0.82%	9.558	6.600	0.272	6.872	69.05%	71.90%
5.3-138	5.3-136	688.56	687.51	105	18	1.00%	10.533	6.677	0.272	6.949	63.39%	65.98%
5.3-136	5.3-133	687.27	687.15	35	18	0.34%	6.167	6.714	0.272	6.986	108.87%	113.28%
5.3-133	5.3-132	687.15	686.48	177	18	0.38%	6.480	6.789	0.272	7.061	104.77%	108.96%
5.3-132	5.3-130	686.48	685.97	123	18	0.41%	6.782	6.847	0.272	7.119	100.96%	104.97%
5.3-130	5.3-129	685.97	685.74	207	18	0.11%	3.511	6.910	0.272	7.182	196.82%	204.56%
5.3-129	5.3-127	685.74	684.84	246	18	0.37%	6.371	6.946	0.272	7.218	109.03%	113.30%
5.3-127	5.3-126	684.64	683.87	162	18	0.48%	7.261	7.000	0.272	7.272	96.40%	100.15%
5.3-126	5.3-125	683.77	683.73	9	24	0.44%	15.122	10.553	0.272	10.825	69.78%	71.58%
5.3-125	5.3-221	683.73	683.30	88	24	0.49%	15.856	10.553	0.272	10.825	66.55%	68.27%

NOTES:

1. All pipe lengths are based on the City of St. Charles GIS Data.
2. All invert elevations and pipe sizes are based on the 1996 Black & Veatch Report, except for manholes 5.3-125, 5.3-126, and 5.3-127.
3. Invert elevations and pipe sizes for manholes 5.3-125, 5.3-126, and 5.3-127 are based on WBK field survey and investigation preformed on December 10, 2010.

WBK
WILLS BURKE KELSEY ASSOCIATES LTD.
116 West Main Street, Suite 201
St. Charles, Illinois 60174
(630) 443-7755

CLIENT :
LEXINGTON HOMES
1731 NORTH MARCEY STREET, SUITE 200
CHICAGO, IL 60614

NO.	DATE	NATURE OF REVISION	CHKD.

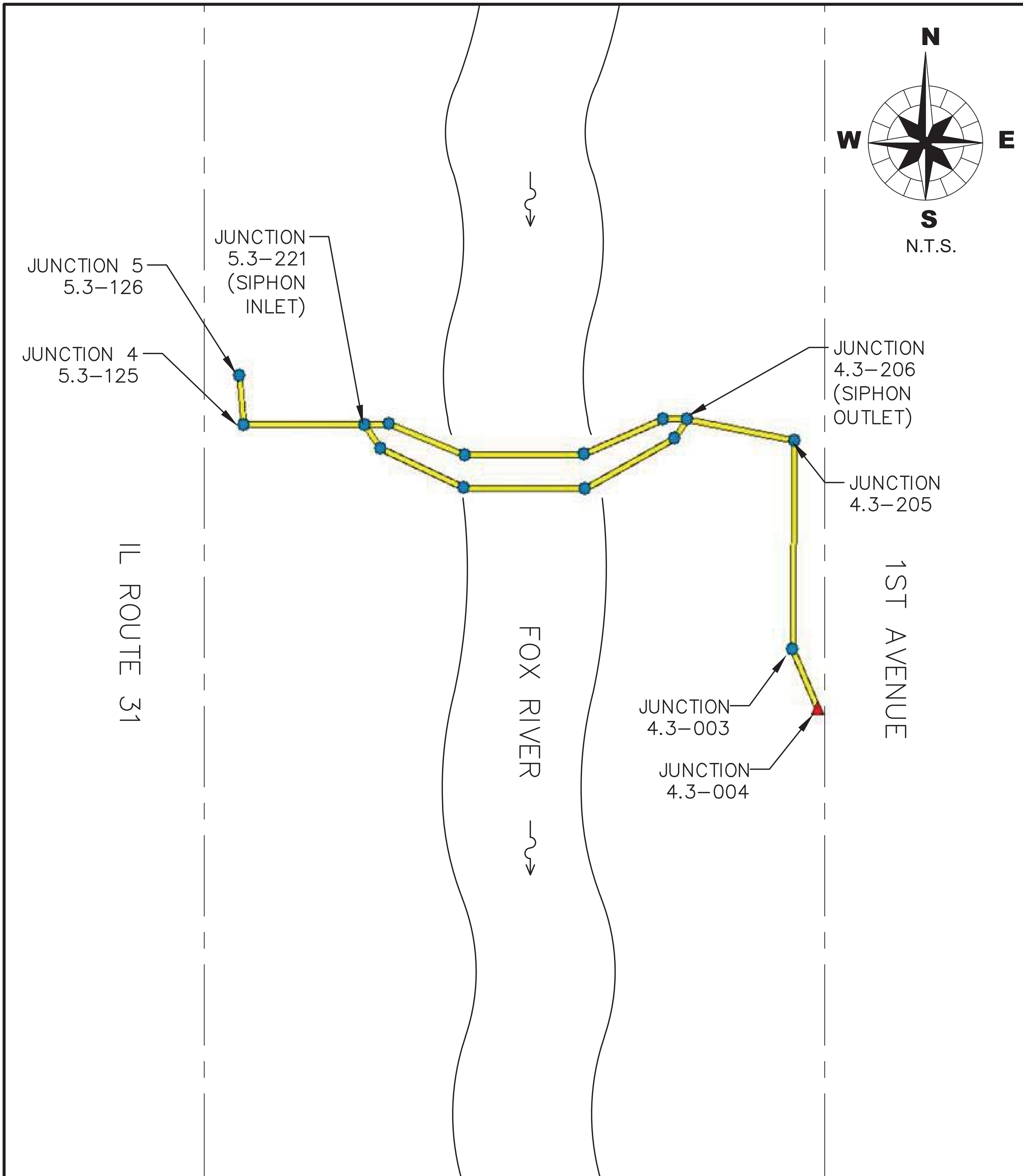
DSGN.	VRD
DWN.	EAM
CHKD.	GC
SCALE :	N.T.S.
FILE NAME:	EXD06941E.DWG

TITLE :
LEXINGTON CLUB APPLIED COMPOSITES
SYSTEM PLAN EXHIBIT

PROJECT NO. 06-941E
DATE : 12/17/2010
SHEET 1 OF 1
EX-D

N:\DWG\2006\06-941E\dwg\Exhibits\EXD06941E.dwg, EX-D-11x17, 12/14/2010 4:53:21 PM, emiller

APPENDIX A



WILLS BURKE KELSEY ASSOCIATES LTD.
116 West Main Street, Suite 201
St. Charles, Illinois 60174
(630) 443-7755

DSGN.	VRD		TITLE : SWMM SCHEMATIC	PROJECT NO. 06-941E
DWN.	EAM			DATE : 12/17/2010
CHKD.	GC			SHEET 1 OF 1
SCALE :	N.T.S.		RIVERSIDE SANITARY SIPHON	SS1
FILE NAME:	SSE06941E.DWG			

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.008)

Analysis Options

```
Flow Units ............... CFS
Flow Routing Method ...... DYNWAVE
Starting Date ............ JAN-31-2010 00:00:00
Ending Date .............. FEB-07-2010 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 5.00 sec
```

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	10.131	3.301
External Outflow	10.102	3.292
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.026	0.009
Continuity Error (%)	0.026	

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Total Flooding acre-in	Total Minutes Flooded
5.3-221	JUNCTION	0.73	0.87	684.17	2 21:05	0	0
5.3-125	JUNCTION	0.54	0.64	684.37	1 17:25	0	0
6	JUNCTION	4.01	5.38	683.38	0 03:21	0	0
4	JUNCTION	0.56	0.66	681.42	1 09:06	0	0
4.3-206	JUNCTION	0.59	0.70	681.36	1 21:45	0	0
4.3-003	JUNCTION	0.66	0.75	680.67	2 22:06	0	0
3	JUNCTION	3.37	5.36	683.36	0 02:48	0	0
1	JUNCTION	0.18	0.21	683.44	2 09:44	0	0
5.3-126	JUNCTION	0.60	0.71	684.48	2 10:43	0	0
2	JUNCTION	3.40	5.35	683.35	0 02:48	0	0
7	JUNCTION	4.01	5.39	683.39	0 03:20	0	0
8	JUNCTION	0.76	0.89	682.14	1 07:14	0	0
5	JUNCTION	0.18	0.21	683.44	1 00:59	0	0
4.3-205	JUNCTION	0.57	0.67	681.03	1 18:31	0	0
4.3-004	OUTFALL	0.43	0.44	680.25	1 00:14	0	0

Node Flow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
5.3-221	JUNCTION	0.00	1.70	2 21:05	0.00	
5.3-125	JUNCTION	0.00	1.70	2 19:53	0.00	

6	JUNCTION	0.00	0.90	1	00:01	0.00
4	JUNCTION	0.00	0.80	1	08:12	0.00
4.3-206	JUNCTION	0.00	1.70	2	15:18	0.00
4.3-003	JUNCTION	0.00	1.70	2	17:18	0.00
3	JUNCTION	0.00	0.80	2	19:49	0.00
1	JUNCTION	0.00	0.80	1	00:02	0.00
5.3-126	JUNCTION	1.70	1.70	1	00:00	0.00
2	JUNCTION	0.00	0.80	1	00:00	0.00
7	JUNCTION	0.00	0.90	1	06:47	0.00
8	JUNCTION	0.00	0.90	0	03:22	0.00
5	JUNCTION	0.00	0.90	1	00:04	0.00
4.3-205	JUNCTION	0.00	1.70	2	02:33	0.00
4.3-004	OUTFALL	0.00	1.70	1	00:14	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
4.3-004	91.19	1.51	1.70
System	91.19	1.51	1.70

****
Link Flow Summary
****

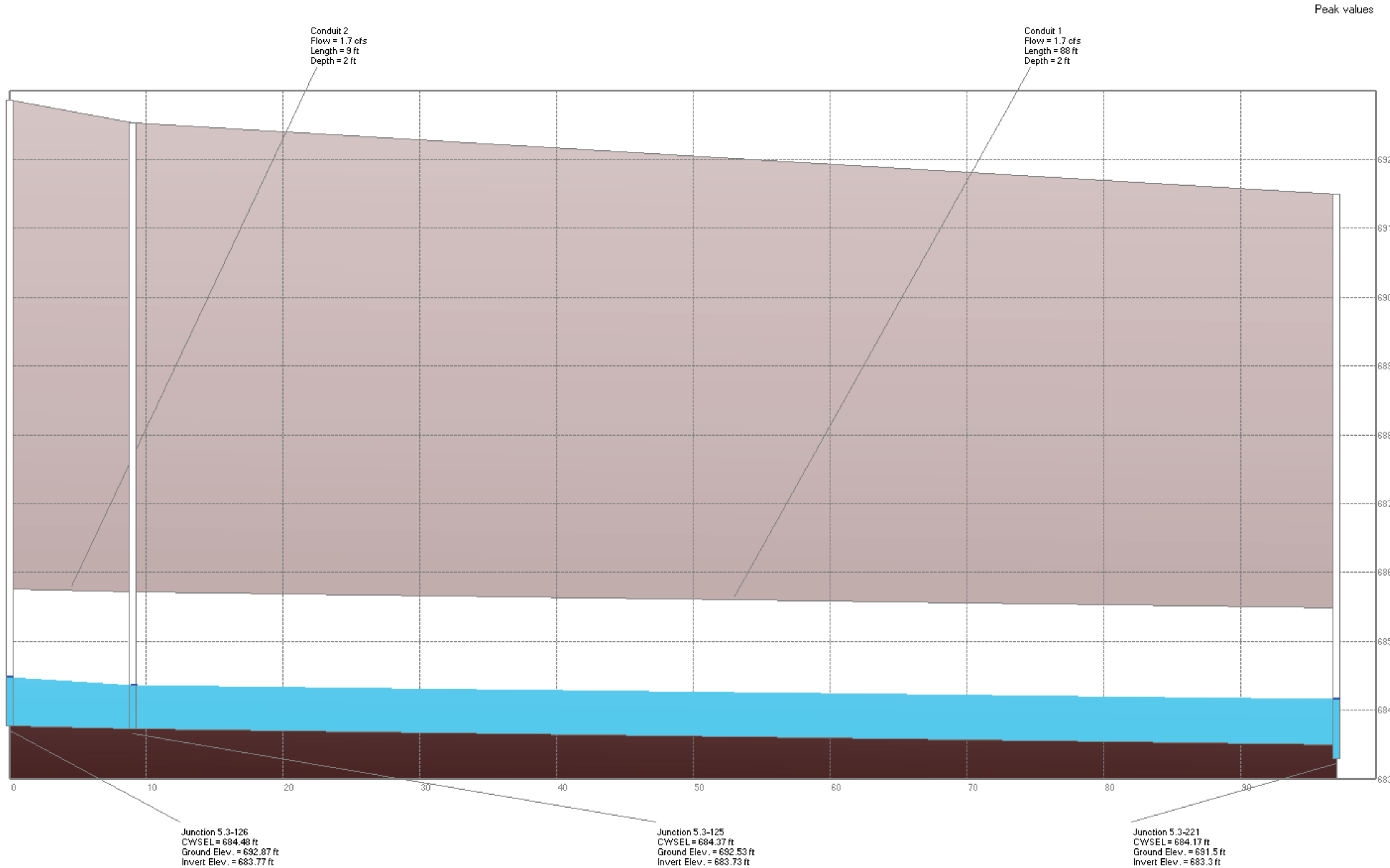
Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
1	CONDUIT	1.70	2 21:05	1.91	0.17	0.33	0
4	CONDUIT	0.80	2 19:49	0.74	5.86	1.00	9916
3	CONDUIT	0.80	1 00:02	1.66	0.07	0.46	0
8	CONDUIT	0.80	1 08:12	0.88	0.09	0.78	0
10	CONDUIT	0.90	1 06:47	0.56	3.42	1.00	9884
9	CONDUIT	0.80	2 15:18	2.48	0.09	0.52	0
5	CONDUIT	0.80	1 00:00	1.94	0.07	0.59	0
6	CONDUIT	1.70	2 17:18	1.58	0.18	0.32	0
7	CONDUIT	1.70	1 00:14	2.03	0.18	0.26	0
2	CONDUIT	1.70	2 19:53	1.83	0.13	0.34	0
11	CONDUIT	0.90	1 00:04	1.75	0.04	0.36	0
12	CONDUIT	0.90	1 00:01	1.97	0.04	0.57	0
13	CONDUIT	0.90	0 03:22	0.87	0.05	0.80	0
14	CONDUIT	0.90	1 05:01	3.27	0.05	0.37	0
23	CONDUIT	1.70	2 02:33	1.67	0.19	0.30	0

****
Flow Classification Summary
****

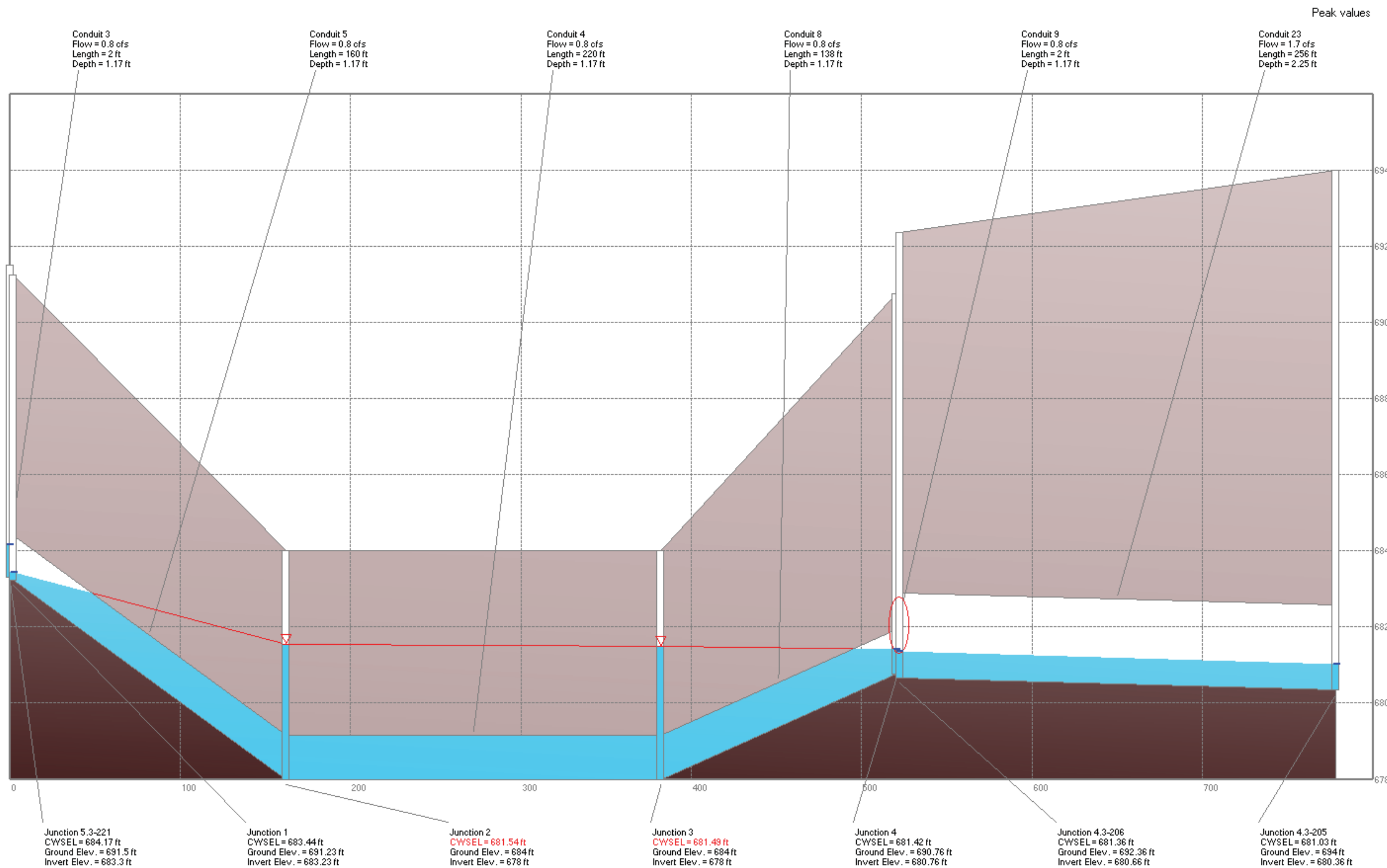
Conduit	Adjusted /Actual Length	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
1	1.00	0.00	0.00	0.00	0.89	0.00	0.00	0.11	0.40	0.0000
4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.10	0.0006
3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.37	0.0000
8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.0000
10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.06	0.0004
9	1.00	0.00	0.08	0.00	0.91	0.00	0.01	0.00	0.29	0.0000
5	1.00	0.00	0.09	0.00	0.91	0.00	0.00	0.00	0.21	0.0000

6	1.00	0.00	0.07	0.00	0.93	0.00	0.00	0.00	0.30	0.0000
7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.41	0.0000
2	1.00	0.00	0.09	0.00	0.91	0.00	0.00	0.00	0.36	0.0000
11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.36	0.0000
12	1.00	0.00	0.08	0.00	0.92	0.00	0.00	0.00	0.14	0.0000
13	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.08	0.0000
14	1.00	0.00	0.08	0.00	0.00	0.00	0.91	0.00	0.33	0.0000
23	1.00	0.02	0.01	0.00	0.97	0.00	0.00	0.00	0.33	0.0000

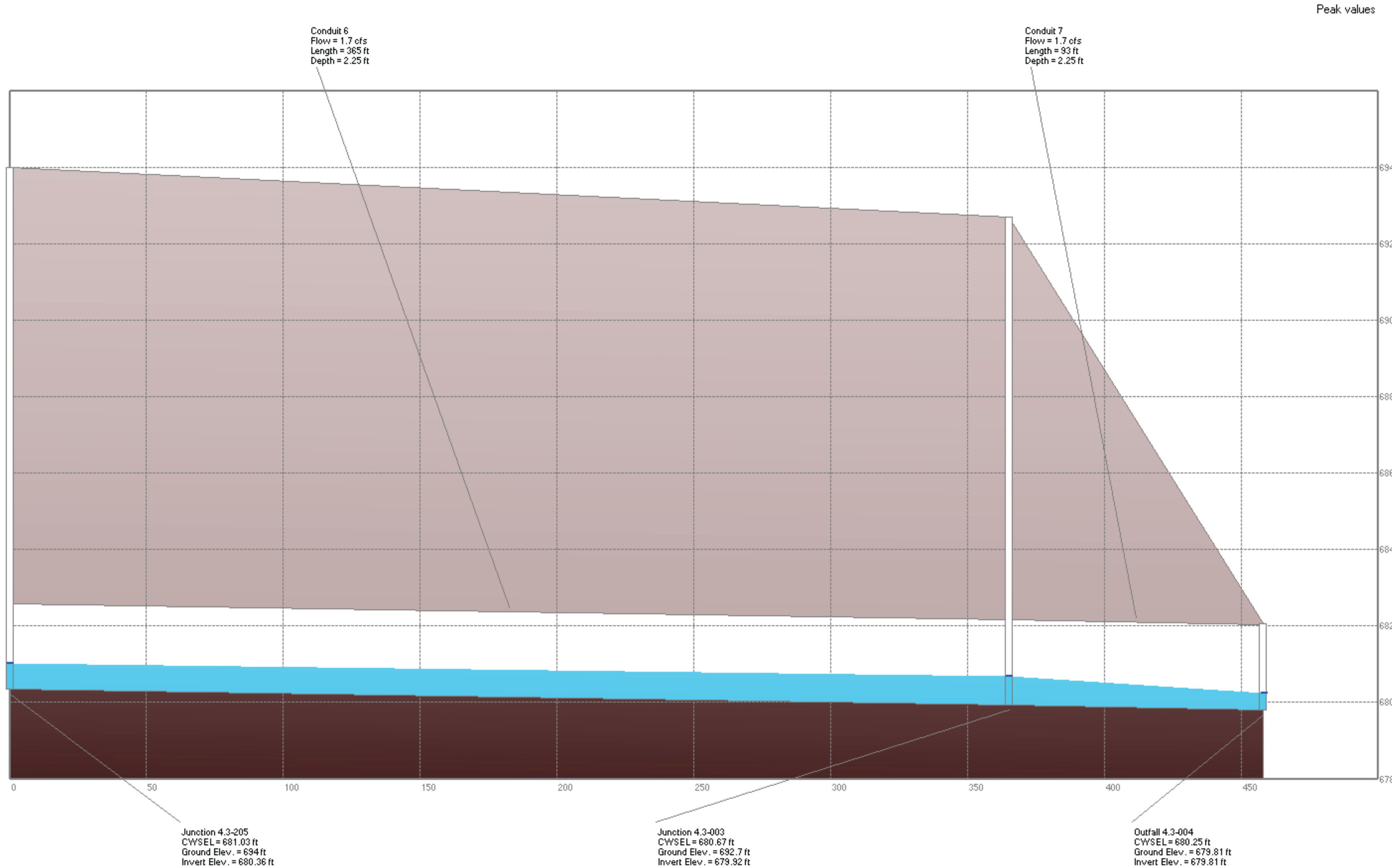
```
*************************
Highest Continuity Errors
*************************
Node 6 (0.16%)
Node 2 (0.11%)
Node 4.3-003 (0.02%)
Node 8 (0.00%)
Node 4.3-205 (0.00%)


***************************
Time-Step Critical Elements
***************************
Link 9 (84.62%)
Link 2 (4.26%)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.03 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00


Analysis begun on:  Mon Dec 13 16:26:06 2010
Total elapsed time: 00:00:32
```



Peak values
Conduit 2
Flow = 1.7 cfs
Length = 9 ft
Depth = 2 ft
Conduit 1
Flow = 1.7 cfs
Length = 88 ft
Depth = 2 ft
692
691
690
689
688
687
686
685
684
683
0
10
20
30
40
50
60
70
80
90
Junction 5.3-126
CWSEL = 684.48 ft
Ground Elev. = 692.87 ft
Invert Elev. = 683.77 ft
Junction 5.3-125
CWSEL = 684.37 ft
Ground Elev. = 692.53 ft
Invert Elev. = 683.73 ft
Junction 5.3-221
CWSEL = 684.17 ft
Ground Elev. = 691.5 ft
Invert Elev. = 683.3 ft



Peak values
Conduit 3
Flow = 0.8 cfs
Length = 2 ft
Depth = 1.17 ft
Conduit 5
Flow = 0.8 cfs
Length = 160 ft
Depth = 1.17 ft
Conduit 4
Flow = 0.8 cfs
Length = 220 ft
Depth = 1.17 ft
Conduit 8
Flow = 0.8 cfs
Length = 138 ft
Depth = 1.17 ft
Conduit 9
Flow = 0.8 cfs
Length = 2 ft
Depth = 1.17 ft
Conduit 23
Flow = 1.7 cfs
Length = 256 ft
Depth = 2.25 ft
694
692
690
688
686
684
682
680
678
0
100
200
300
400
500
600
700
Junction 5.3-221
CWSEL = 684.17 ft
Ground Elev. = 691.5 ft
Invert Elev. = 683.3 ft
Junction 1
CWSEL = 683.44 ft
Ground Elev. = 691.23 ft
Invert Elev. = 683.23 ft
Junction 2
CWSEL = 681.54 ft
Ground Elev. = 684 ft
Invert Elev. = 678 ft
Junction 3
CWSEL = 681.49 ft
Ground Elev. = 684 ft
Invert Elev. = 678 ft
Junction 4
CWSEL = 681.42 ft
Ground Elev. = 690.76 ft
Invert Elev. = 680.76 ft
Junction 4.3-206
CWSEL = 681.36 ft
Ground Elev. = 692.36 ft
Invert Elev. = 680.66 ft
Junction 4.3-205
CWSEL = 681.03 ft
Ground Elev. = 694 ft
Invert Elev. = 680.36 ft



Peak values
Conduit 6
Flow = 1.7 cfs
Length = 365 ft
Depth = 2.25 ft
Conduit 7
Flow = 1.7 cfs
Length = 93 ft
Depth = 2.25 ft
694
692
690
688
686
684
682
680
678
0
50
100
150
200
250
300
350
400
450
Junction 4.3-205
CWSEL = 681.03 ft
Ground Elev. = 694 ft
Invert Elev. = 680.36 ft
Junction 4.3-003
CWSEL = 680.67 ft
Ground Elev. = 692.7 ft
Invert Elev. = 679.92 ft
Outfall 4.3-004
CWSEL = 680.25 ft
Ground Elev. = 679.81 ft
Invert Elev. = 679.81 ft

APPENDIX B

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.008)

****
Analysis Options
****
Flow Units .... CFS
Flow Routing Method ...... DYNWAVE
Starting Date JAN-31-2010 00:00:00
Ending Date FEB-07-2010 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step .... 5.00 sec

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	11.750	3.829
External Outflow	11.721	3.820
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.027	0.009
Continuity Error (%)	0.022	

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	Time of Max Occurrence hr:min	Total Flooding acre-in	Total Minutes Flooded
5.3-221	JUNCTION	0.79	0.94	684.24	1	10:15	0	0
5.3-125	JUNCTION	0.59	0.70	684.43	2	00:03	0	0
6	JUNCTION	4.08	5.24	683.24	0	03:06	0	0
4	JUNCTION	0.61	0.72	681.48	2	05:20	0	0
4.3-206	JUNCTION	0.64	0.76	681.42	2	10:21	0	0
4.3-003	JUNCTION	0.71	0.81	680.73	2	01:31	0	0
3	JUNCTION	3.41	5.38	683.38	0	02:36	0	0
1	JUNCTION	0.19	0.22	683.45	1	00:39	0	0
5.3-126	JUNCTION	0.65	0.77	684.54	2	21:03	0	0
2	JUNCTION	3.47	5.36	683.36	0	02:36	0	0
7	JUNCTION	4.08	5.22	683.22	0	03:06	0	0
8	JUNCTION	0.82	0.96	682.21	1	01:58	0	0
5	JUNCTION	0.19	0.22	683.45	1	00:16	0	0
4.3-205	JUNCTION	0.61	0.73	681.09	1	00:59	0	0
4.3-004	OUTFALL	0.46	0.47	680.28	1	15:49	0	0

****
Node Flow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
5.3-221	JUNCTION	0.00	1.97	2	16:51	0.00	
5.3-125	JUNCTION	0.00	1.97	1	23:00	0.00	

6	JUNCTION	0.00	1.05	1	00:16	0.00
4	JUNCTION	0.00	0.93	2	12:50	0.00
4.3-206	JUNCTION	0.00	1.97	1	20:49	0.00
4.3-003	JUNCTION	0.00	1.97	2	23:49	0.00
3	JUNCTION	0.00	0.93	2	16:31	0.00
1	JUNCTION	0.00	0.93	1	09:42	0.00
5.3-126	JUNCTION	1.97	1.97	1	00:00	0.00
2	JUNCTION	0.00	0.93	1	00:01	0.00
7	JUNCTION	0.00	1.05	1	22:55	0.00
8	JUNCTION	0.00	1.05	1	04:25	0.00
5	JUNCTION	0.00	1.05	1	21:15	0.00
4.3-205	JUNCTION	0.00	1.97	2	06:55	0.00
4.3-004	OUTFALL	0.00	1.97	1	15:49	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
4.3-004	91.78	1.73	1.97
System	91.78	1.73	1.97

****
Link Flow Summary
****

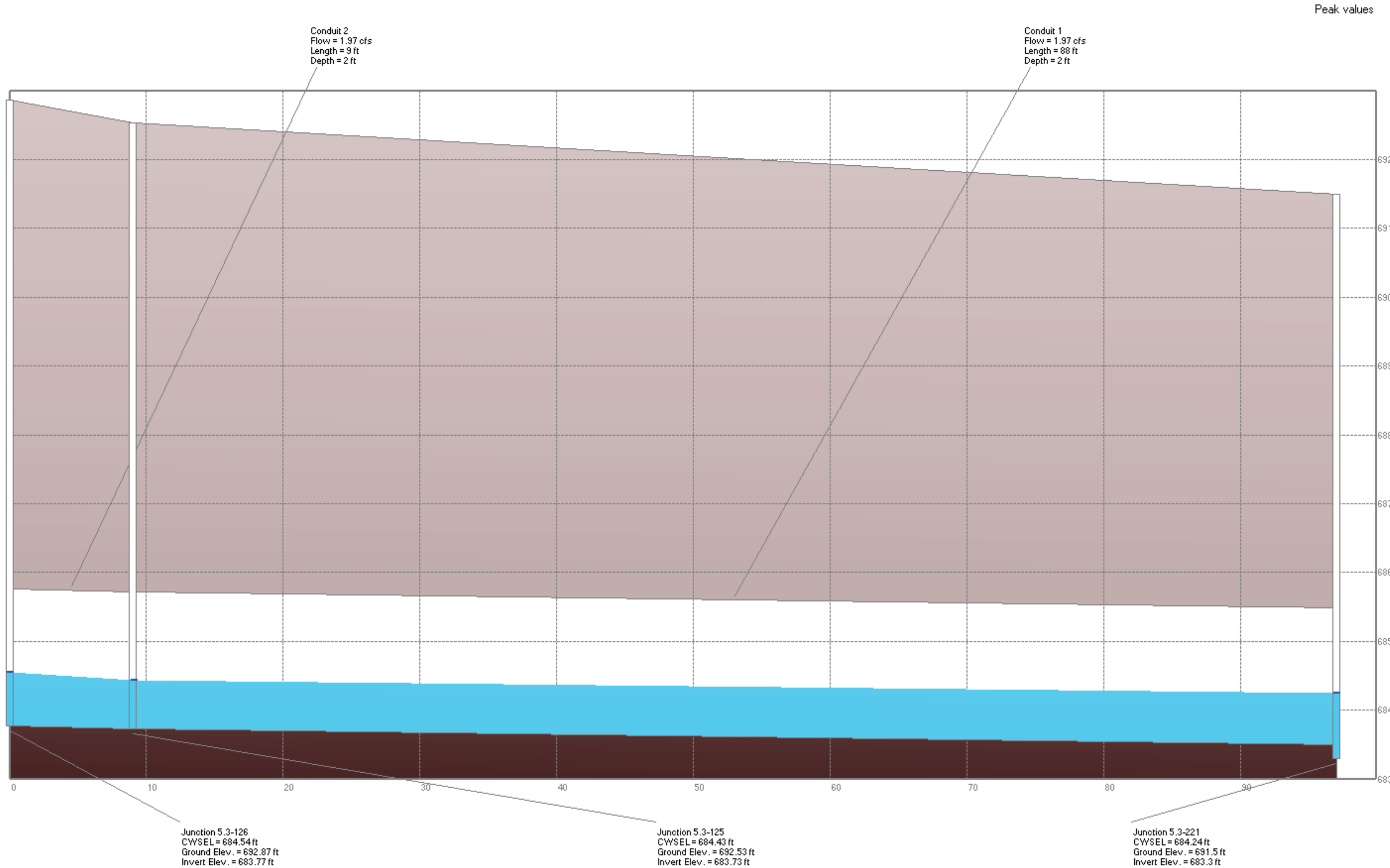
Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
1	CONDUIT	1.97	2 16:51	1.92	0.20	0.36	0
4	CONDUIT	0.93	2 16:31	0.86	6.80	1.00	9927
3	CONDUIT	0.93	1 09:42	1.73	0.08	0.50	0
8	CONDUIT	0.93	2 12:50	1.00	0.10	0.81	0
10	CONDUIT	1.05	1 22:55	0.59	3.96	1.00	9898
9	CONDUIT	0.93	1 23:08	2.86	0.10	0.57	0
5	CONDUIT	0.93	1 00:01	2.03	0.08	0.60	0
6	CONDUIT	1.97	2 23:49	1.64	0.21	0.34	0
7	CONDUIT	1.97	1 15:49	2.12	0.21	0.28	0
2	CONDUIT	1.97	1 23:00	1.87	0.15	0.37	0
11	CONDUIT	1.05	1 21:15	1.65	0.05	0.39	0
12	CONDUIT	1.05	1 00:16	2.05	0.05	0.57	0
13	CONDUIT	1.05	1 04:25	0.68	0.05	0.82	0
14	CONDUIT	1.05	1 12:23	3.83	0.05	0.40	0
23	CONDUIT	1.97	2 06:55	1.73	0.21	0.33	0

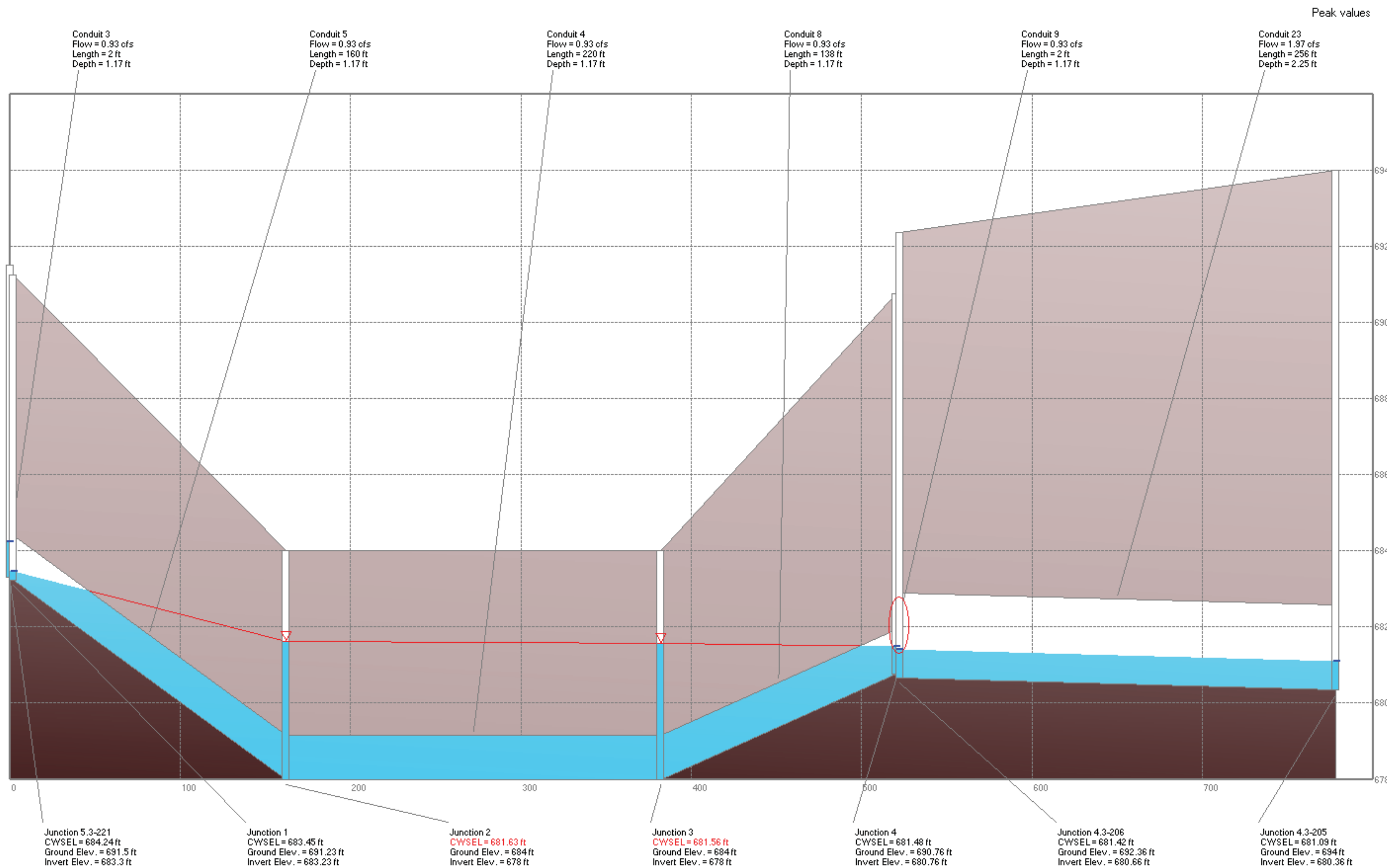
****
Flow Classification Summary
****

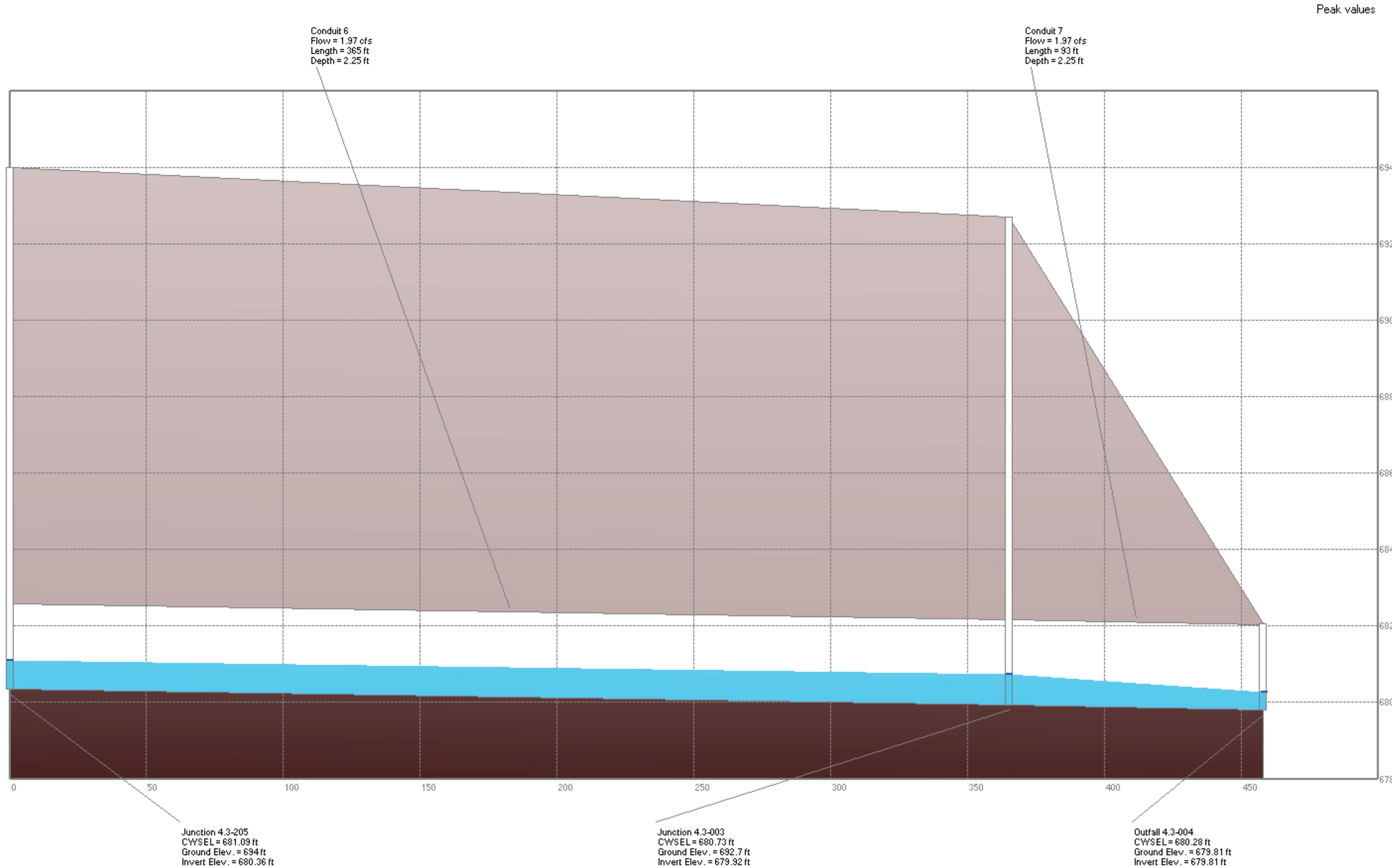
Conduit	Adjusted /Actual Length	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
1	1.00	0.00	0.00	0.00	0.90	0.00	0.00	0.10	0.38	0.0000
4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.11	0.0007
3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.37	0.0000
8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.15	0.0000
10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.07	0.0002
9	1.00	0.00	0.08	0.00	0.91	0.00	0.01	0.00	0.29	0.0000
5	1.00	0.00	0.08	0.00	0.92	0.00	0.00	0.00	0.24	0.0000

6	1.00	0.00	0.07	0.00	0.93	0.00	0.00	0.00	0.30	0.0000
7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.41	0.0000
2	1.00	0.00	0.08	0.00	0.92	0.00	0.00	0.00	0.36	0.0000
11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.36	0.0000
12	1.00	0.00	0.08	0.00	0.92	0.00	0.00	0.00	0.15	0.0000
13	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.09	0.0000
14	1.00	0.00	0.08	0.00	0.00	0.00	0.92	0.00	0.33	0.0000
23	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.32	0.0000

```
*************************
Highest Continuity Errors
*************************
Node 6 (0.14%)
Node 2 (0.09%)
Node 4.3-003 (0.02%)
Node 8 (0.00%)
Node 4.3-205 (0.00%)


***************************
Time-Step Critical Elements
***************************
Link 9 (86.04%)
Link 2 (3.53%)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00


Analysis begun on:  Thu Dec 16 08:18:00 2010
Total elapsed time: 00:00:34
```


Peak values
Conduit 2
Flow = 1.97 cfs
Length = 9 ft
Depth = 2 ft
Conduit 1
Flow = 1.97 cfs
Length = 88 ft
Depth = 2 ft
692
691
690
689
688
687
686
685
684
683
0
10
20
30
40
50
60
70
80
90
Junction 5.3-126
CWSEL = 684.54 ft
Ground Elev. = 692.87 ft
Invert Elev. = 683.77 ft
Junction 5.3-125
CWSEL = 684.43 ft
Ground Elev. = 692.53 ft
Invert Elev. = 683.73 ft
Junction 5.3-221
CWSEL = 684.24 ft
Ground Elev. = 691.5 ft
Invert Elev. = 683.3 ft


Peak values
Conduit 3
Flow = 0.93 cfs
Length = 2 ft
Depth = 1.17 ft
Conduit 5
Flow = 0.93 cfs
Length = 160 ft
Depth = 1.17 ft
Conduit 4
Flow = 0.93 cfs
Length = 220 ft
Depth = 1.17 ft
Conduit 8
Flow = 0.93 cfs
Length = 138 ft
Depth = 1.17 ft
Conduit 9
Flow = 0.93 cfs
Length = 2 ft
Depth = 1.17 ft
Conduit 23
Flow = 1.97 cfs
Length = 256 ft
Depth = 2.25 ft
694
692
690
688
686
684
682
680
678
0
100
200
300
400
500
600
700
Junction 5.3-221
CWSEL = 684.24 ft
Ground Elev. = 691.5 ft
Invert Elev. = 683.3 ft
Junction 1
CWSEL = 683.45 ft
Ground Elev. = 691.23 ft
Invert Elev. = 683.23 ft
Junction 2
CWSEL = 681.63 ft
Ground Elev. = 684 ft
Invert Elev. = 678 ft
Junction 3
CWSEL = 681.56 ft
Ground Elev. = 684 ft
Invert Elev. = 678 ft
Junction 4
CWSEL = 681.48 ft
Ground Elev. = 690.76 ft
Invert Elev. = 680.76 ft
Junction 4.3-206
CWSEL = 681.42 ft
Ground Elev. = 692.36 ft
Invert Elev. = 680.66 ft
Junction 4.3-205
CWSEL = 681.09 ft
Ground Elev. = 694 ft
Invert Elev. = 680.36 ft



Peak values
Conduit 6
Flow = 1.97 cfs
Length = 365 ft
Depth = 2.25 ft
Conduit 7
Flow = 1.97 cfs
Length = 93 ft
Depth = 2.25 ft
694
692
690
688
686
684
682
680
678
0
50
100
150
200
250
300
350
400
450
Junction 4.3-205
CWSEL = 681.09 ft
Ground Elev. = 694 ft
Invert Elev. = 680.36 ft
Junction 4.3-003
CWSEL = 680.73 ft
Ground Elev. = 692.7 ft
Invert Elev. = 679.92 ft
Outfall 4.3-004
CWSEL = 680.28 ft
Ground Elev. = 679.81 ft
Invert Elev. = 679.81 ft

TROTTER and ASSOCIATES, INC.
ENGINEERS AND SURVEYORS

Memorandum

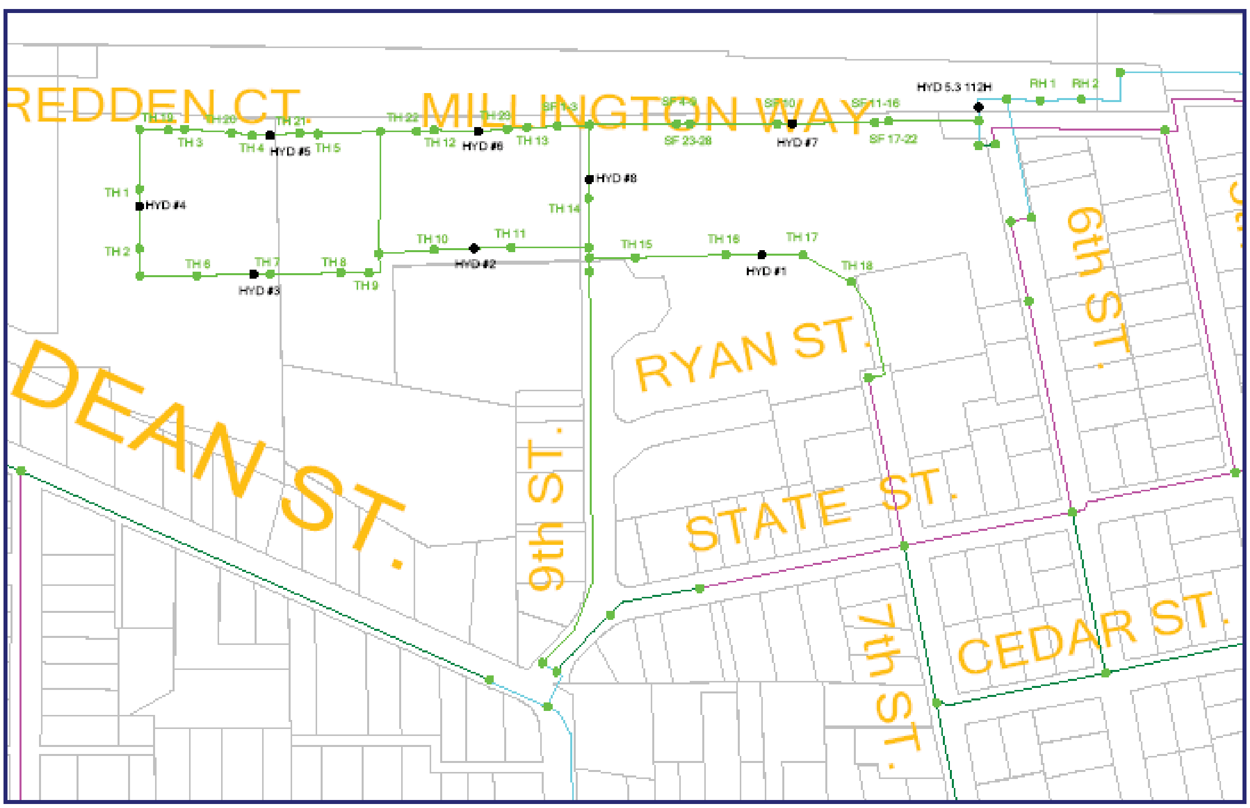
Date: December 27, 2010

To: Chris Tiedt, City of St. Charles Engineering

From: Mike Holland, Trotter and Associates, Inc.

Subject: Lexington Club WaterCAD Modeling

Per your request, Trotter and Associates, Inc. has completed the WaterCAD Modeling of the proposed Lexington Club development project. The model was produced to analyze the proposed water distribution system to determine if sufficient fire flow capacity can be provided for the proposed development with or without requiring the proposed residences to be sprinkled. Additionally it has been requested that the proposed water distribution system be analyzed to determine the effect of increasing portions of the existing and proposed 8” diameter watermain to 10” diameter watermain.



40W201 Wasco Road, Suite D - St. Charles, Illinois 60175 - 630/587-0470 - Fax. 630/587-0475

Based on preliminary engineering plans developed by the Wills Burke Kelsey Associates and a project layout map provided by Lexington Homes, the proposed distribution system was added to the City's current WaterCAD model. The proposed development consists of an 8-inch diameter water distribution system intended to serve 102 2-story townhouses, 12 2-story rowhouses and 28 single family homes.

In order to set-up the WaterCAD model, water usages were estimated and assigned to each of the proposed buildings. These water usages, or demands, were estimated using the IEPA's design criteria for population equivalents (P.E.) of residential buildings. For a townhouse or rowhouse the design criteria is 3.0 P.E. and for a single family home it is 3.5 P.E. One P.E. is equal to 100 gallons per day, so for a townhouse or rowhouse this equates to a total of 300 gallons per day (0.21 gal/min) of water usage and for a single family home this equates to 350 gallons per day (0.24 gal/min) of water usage. Nodes with these demands were then placed on the distribution system in the WaterCAD model at the locations of the various residences. A spreadsheet of these demands are provided in the appendix of this memo.

It was also requested by the City of St. Charles that the WaterCAD model provide an analysis of the effect of changing the proposed 8-inch diameter main that connects Mark St. and runs west to 9th St. and then continues south, to a 10-inch main. Therefore two separate scenarios were created in the WaterCAD Model, one with all 8-inch mains per the engineering plans and one changing the watermain that connects the existing main on Mark St. to the existing main on 9th St. to 10-inch diameter. Once the scenarios were developed a fire flow analysis was run for each scenario to determine what the maximum flow available at each location is while maintaining a minimum of 20 psi residual pressure in the system. It should be noted that the fire flow analysis was run under a Max Day usage which represents the City's system during summer months when water usage is at its highest. Based on historical usage the City has seen water usages of twice what they normally are, therefore under Max Day usage the model's demands are multiplied by 2.0. The results of the fire flow analysis are as follows:

	8" Main	10" Main
	Fire Flow (gal/min)	Fire Flow (gal/min)
RH 1	2,239.19	1,996.19
RH 2	2,304.08	2,056.04
SF 1-3	1,723.10	1,731.33
SF 4-9	1,797.64	1,766.30
SF 10	1,882.86	1,799.78
SF 11-16	1,985.31	1,839.44
SF 17-22	2,002.50	1,845.46
SF 23-28	1,807.38	1,770.44
TH 1	1,606.21	1,728.21
TH 2	1,607.11	1,728.20
TH 3	1,619.65	1,727.89
TH 4	1,640.82	1,728.01
TH 5	1,674.53	1,728.21
TH 6	1,618.73	1,727.68
TH 7	1,641.05	1,727.52
TH 8	1,676.83	1,727.24
TH 9	1,697.91	1,727.46
TH 10	1,709.73	1,724.60
TH 11	1,702.08	1,720.15
TH 12	1,718.89	1,729.60
TH 13	1,720.84	1,730.45
TH 14	1,707.87	1,721.39
TH 15	1,687.44	1,714.68
TH 16	1,652.86	1,728.76
TH 17	1,581.03	1,738.69
TH 18	1,536.36	1,680.39
TH 19	1,616.69	1,728.28
TH 20	1,633.74	1,728.39
TH 21	1,664.11	1,728.56
TH 22	1,718.35	1,729.29
TH 23	1,720.44	1,730.58

Per the 2009 International Fire Code, the fire flow requirement for one and two-family dwellings under 3,600 square feet is 1,000 gallons per minute. However, if a building is equipped with an automatic sprinkler system the fire flow requirement may be reduced by 50% equating to 500 gallons per minute. Based on the above table all of the proposed buildings have a fire flow capacity well above the minimum required fire flow whether it is sprinkled or not.

In comparing the effects of increasing the main size to 10-inch diameter it was noticed that the fire flow capacity increased for all of the townhomes but decreased at the single family homes and rowhouses. This is because the fire flow was limited in the 10-inch scenario at these locations because the residual pressure in the system reached the minimum 20 psi at a location outside of the development. So for example, Rowhouse 1 (RH 1) has a fire flow capacity of 1,996.19 gpm when the residual pressure in the system reached 20 psi. If the pressure in the system was allowed to go below 20 psi then the fire flow would have increased at this location to get to the minimum 20 psi. This will be further clarified in the following analysis.

The City of St. Charles has stated that hydrants would still be used in the proposed development even if sprinkler systems are provided. Therefore hydrants were placed in the WaterCAD model to analyze the fire flow capacity of the proposed development with a hydrant running at each location. To do this a 1,000 gallon per minute demand was placed on a hydrant and a fire flow analysis was then done to determine the fire flow capacity at the residences within 500 ft of that hydrant while the hydrant is producing 1,000 gpm. The results of this are as follows:

Single Family #1 - #3 (SF 1-3)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
6	1000.0	720.99	22.52	730.23	27.57

Single Family #4 - #9 (SF 4-9)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
7	1000	874.38	23.1	798.39	28.61
8	1000.0	766.82	24.21	752.59	29.02

Single Family #10 (SF 10)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
7	1000.0	893.61	23.38	803.95	29.29

Single Family #11 - #16 (SF 11-16)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
7	1000.0	961.84	25.01	830.4	30.68
5.3 112H	1000.0	1093.76	24.32	886.06	30.42

Single Family #17 - #22 (SF 17-22)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
7	1000.0	974.56	25.08	834.66	30.7
5.3 112H	1000.0	1098.79	24.25	887.49	30.4

Single Family #23 - #28 (SF 23-28)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
7	1000	876.92	23.46	799.33	29.02
8	1000.0	773.22	24.70	755.39	29.47

Townhouse #1 (TH 1)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
4	1000.0	609.37	20.00	727.97	21.35

Townhouse #2 (TH 2)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
4	1000.0	614.51	20.00	727.9	21.53

Townhouse #3 (TH 3)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	652.5	20.01	728.04	22.87

Townhouse #4 (TH 4)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	649.52	20.00	728.08	22.77

Townhouse #5 (TH 5)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	671.39	20.21	727.71	23.73

Townhouse #6 (TH 6)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
3	1000.0	638.74	20.00	727.62	22.41

Townhouse #7 (TH 7)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
3	1000.0	642.76	20.00	727.56	22.56

Townhouse #8 (TH 8)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
3	1000.0	670.65	20.39	726.87	23.92

Townhouse #9 (TH 9)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
3	1000.0	684.16	20.62	727	24.6

Townhouse #10 (TH 10)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
2	1000.0	707.13	21.23	722.72	26.11

Townhouse #11 (TH 11)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
2	1000.0	703.21	21.80	720.92	26.67
8	1000.0	705.45	23.22	721.54	29.16

Townhouse #12 (TH 12)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
6	1000.0	719.37	21.06	729.51	26.05

Townhouse #13 (TH 13)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
6	1000.0	720.16	21.85	730.06	26.86
8	1000.0	717.22	23.21	727.92	28.18

Townhouse #14 (TH 14)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
8	1000.0	711.86	22.96	724.08	28.36

Townhouse #15 (TH 15)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
1	1000.0	692.32	21.92	720.87	26.71
8	1000.0	701.03	23.36	720.14	28.26

Townhouse #16 (TH 16)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
1	1000.0	640.37	20.60	730.47	23.26

Townhouse #17 (TH 17)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
1	1000.0	613.13	20.24	734.08	21.67

Townhouse #18 (TH 18)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
1	1000.0	607.46	20.30	735.84	21.38

Townhouse #19 (TH 19)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	653.82	20.01	728.45	22.9

Townhouse #20 (TH 20)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	650.81	20.00	728.49	22.8

Townhouse #21 (TH 21)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5	1000.0	664	20.08	727.78	23.35

Townhouse #22 (TH 22)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
6	1000.0	719.3	21.11	729.45	26.09

Townhouse #23 (TH 23)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
6	1000.0	719.91	21.47	729.98	26.47

Rowhouse #1 (RH 1)

		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5.3 112H	1000.0	1212.48	26.07	966.74	32.48

Rowhouse #2 (RH 2)

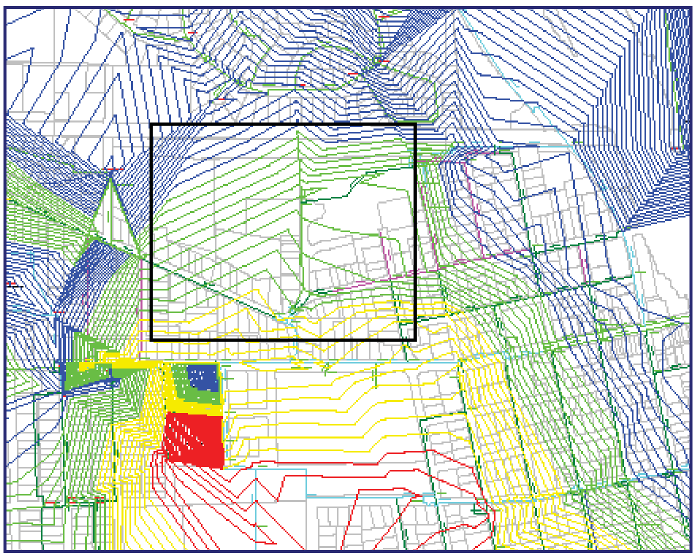
		8" Main		10" Main	
Hydrant #	Flow (gpm)	Fire Flow (gpm)	Pressure (psi)	Fire Flow (gpm)	Pressure (psi)
5.3 112H	1000.0	1259.2	27.91	1007.2	34.3

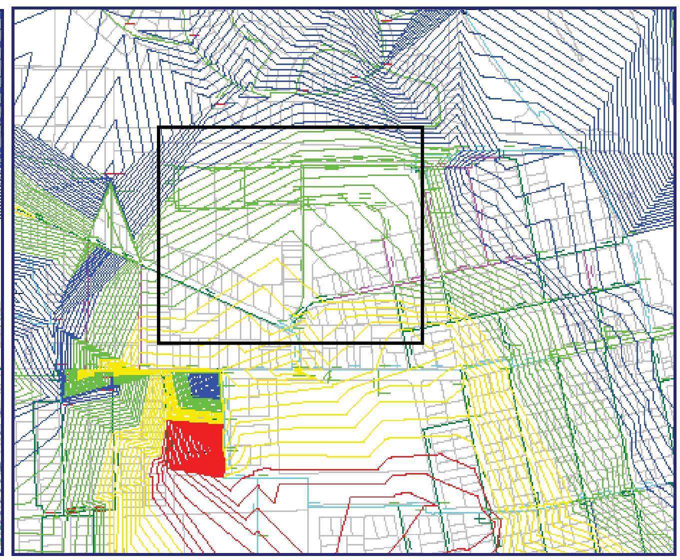
From this analysis it can be seen that with a hydrant running at 1,000 gal/min each of the proposed residences still has well above the required 500 gal/min of capacity required for a sprinkled home. Under the 10” Main scenario the capacity does increase for all of the townhomes but appears to decrease for the single family homes and rowhouses. As stated previously, this is due to the system pressure outside of the development being at the minimum 20 psi. Using Rowhouse #1 (RH 1) above as an example, when Hydrant 5.3 112H is running at 1,000 gpm the fire flow for the 8” Main scenario is 1,212.48 gpm at 26.07 psi while the fire flow for the 10” Main scenario is 966.74 gpm at 32.48 psi. These results are showing that during a fire event these would be the expected fire flows if limited by the lowest pressure in the distribution system. If the distribution system was allowed to be lower than 20 psi then that would allow the fire flows at this specific location to be increased. However, since all of the fire flow results exceed the minimum required fire flow no further analysis was performed.

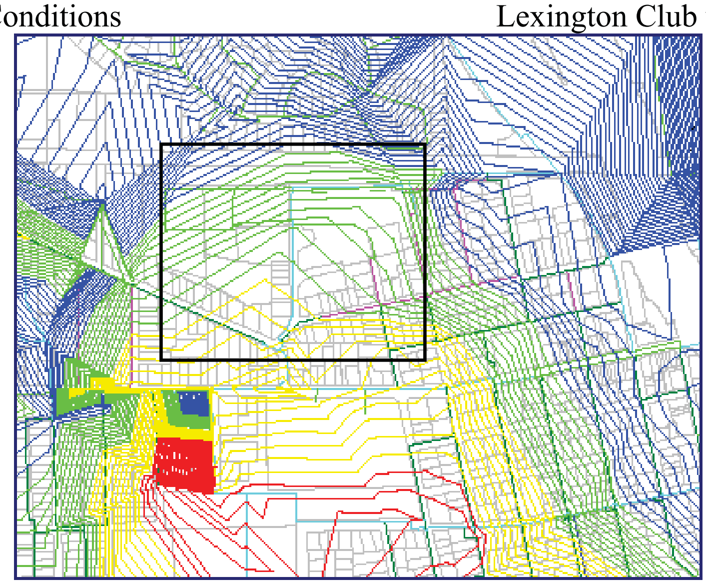
Distribution System Effects:

As part of the WaterCAD analysis for the proposed Lexington Club development, the City of St. Charles also requested that the WaterCAD model be used to investigate what impact the development would have on the system pressure and fire flow in the surrounding area. To do this, the existing model, the 8" main scenario and the 10" main scenario were each run under Max Day demands and contour maps were generated showing system pressure and fire flow capacity.

Contour maps showing the system pressure are shown below and also attached in the appendix. The red contours indicate areas of the system below 40 psi of pressure, the yellow contours indicated areas between 40 psi and 50 psi, the green contours indicate areas between 50 psi and 60 psi and the blue contours indicated areas above 60 psi. For clarity a box has been placed around the development area.

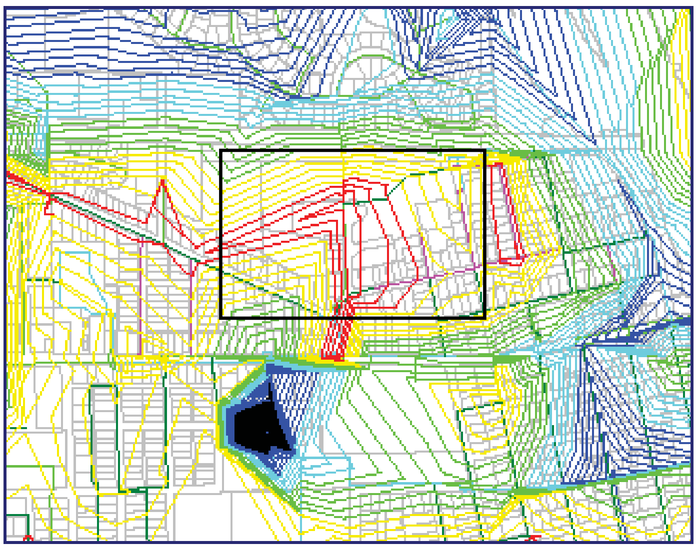

Current Conditions

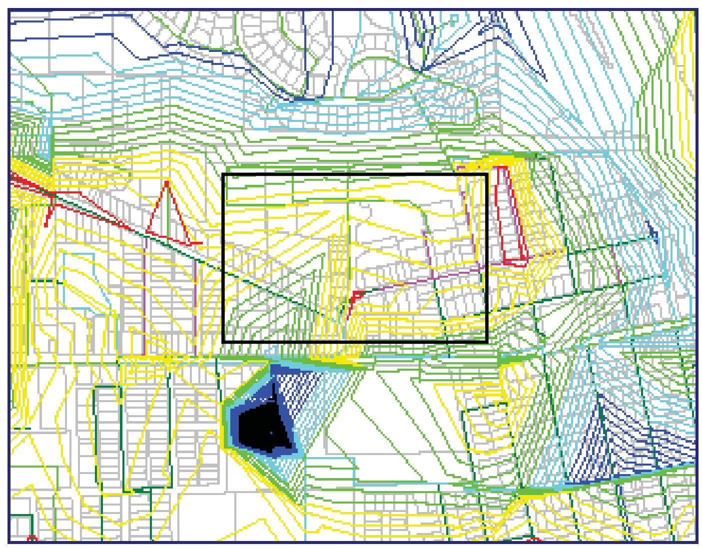

Lexington Club with 8" Main

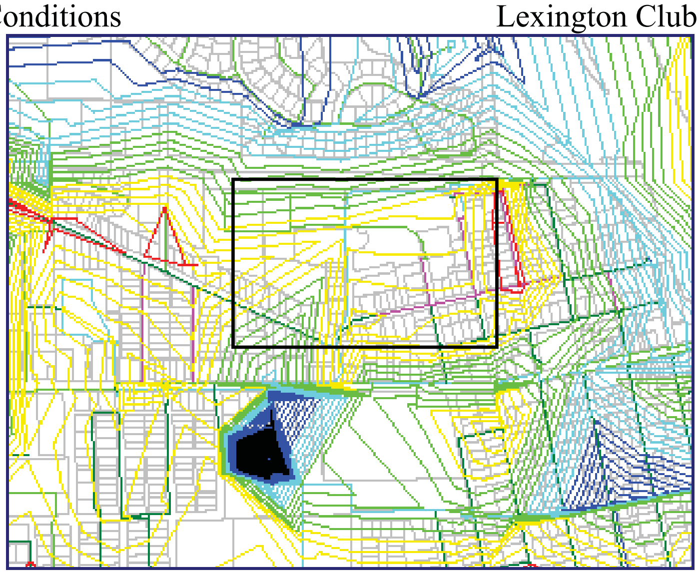

Lexington Club with 10" Main

From the system pressure contour maps the system pressure surrounding the development area is expected to have 50-60 psi of system pressure, which is typically an acceptable amount. A slight decrease (approximately 1 – 2 psi) can be seen between the current conditions and proposed development conditions, however since the City's system controls automatically maintain system pressure through monitoring of the level in the water towers, the expected effect on system pressure is minimal. There was not a noticeable effect on the system pressure in changing from the 8" main to the 10" main.

Contour maps showing the system fire flow capacity are also shown below and attached in the appendix. The red contours indicate areas of the system below 1,000 gpm of fire flow capacity, the yellow contours indicated areas between 1,000 and 2,000 gpm, the green contours indicate areas between 2,000 and 3,000 gpm, the light blue contours indicate areas between 3,000 and 4,000 gpm and the dark blue contours indicated areas above 4,000 gpm. For clarity a box has been placed around the development area.


Current Conditions


Lexington Club with 8" Main


Lexington Club with 10" Main

From the fire flow capacity contour maps it can be seen that the area in red on the current conditions contour map indicating a fire flow capacity below 1,000 gpm is greatly reduced in the area immediately surrounding the proposed development for both the 8” main and 10” main scenarios. This is expected due to the upsizing of the existing 6” Main from Mark St. to 9th St. However it does not appear that increasing the 8” Main to a 10” Main significantly affects the fire flow capacity in the surrounding area.

<u>Conclusions:</u>

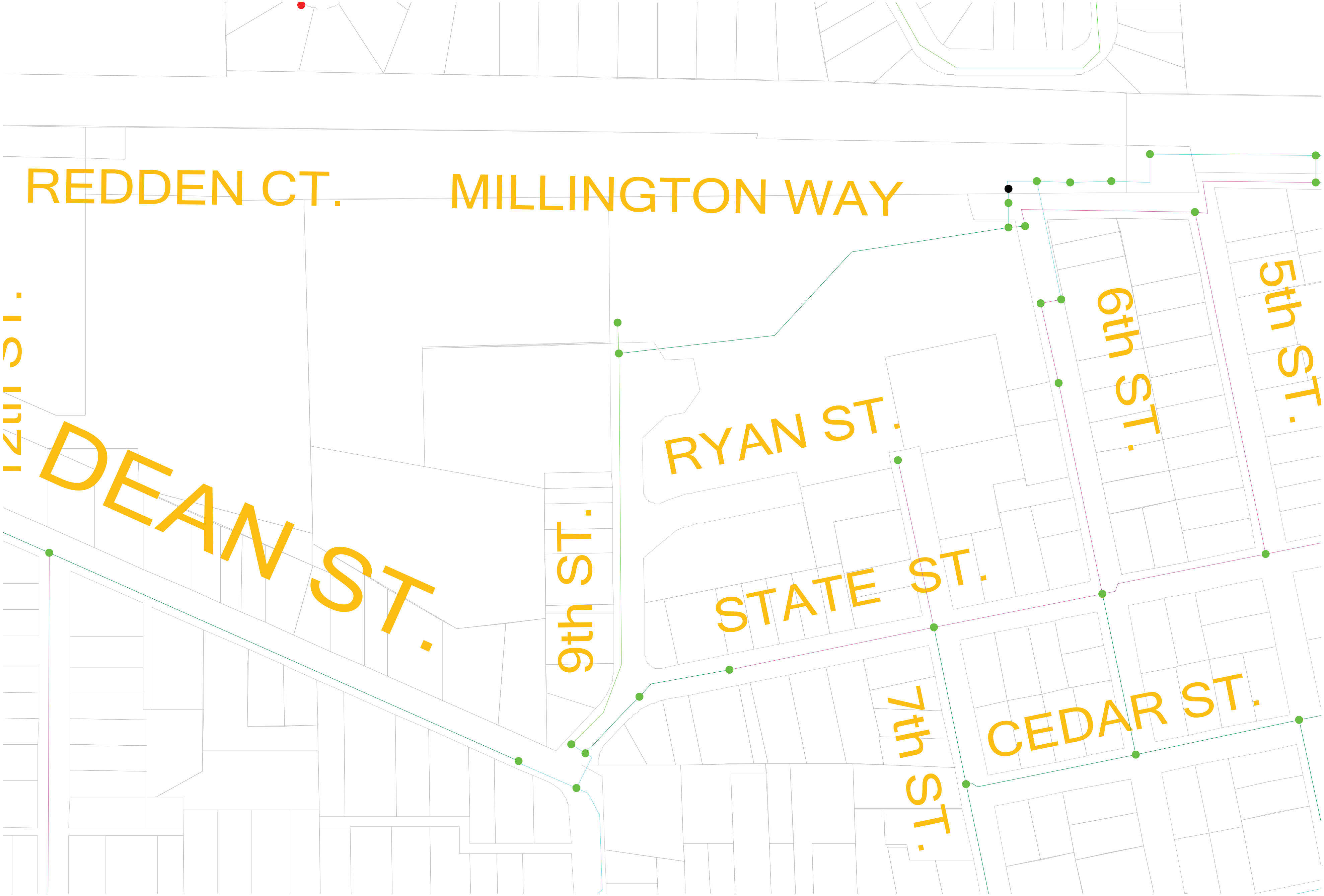
Based on the WaterCAD modeling for the proposed Lexington Club development the results indicate that the proposed development will have adequate fire flow capacity to meet the minimum fire flow requirements of the 2009 International Fire Code. The WaterCAD model indicates that the proposed development will exceed the required fire flow capacity of 500 gallons per minute for sprinkled homes even with a nearby hydrant running at 1,000 gallons per minute. The model also indicated that if the homes were not sprinkled the proposed distribution system would exceed the required fire flow capacity of 1,000 gallons per minute. The results of the WaterCAD model also show that the proposed development is not expected to have a negative impact on the water pressure in the surrounding system but that the fire flow capacity of the surrounding area would be improved as a result.

The WaterCAD model did indicate that the fire flow capacity of the proposed development would be improved by increasing the proposed 8-inch diameter main from Mark Street to 9Th Street to a 10-inch diameter main but that this was not necessary in order to meet the minimum fire flow requirements. However, the model also indicated that the distribution system pressure and fire flow capacity in the surrounding areas were not significantly impacted by this increase in watermain size.

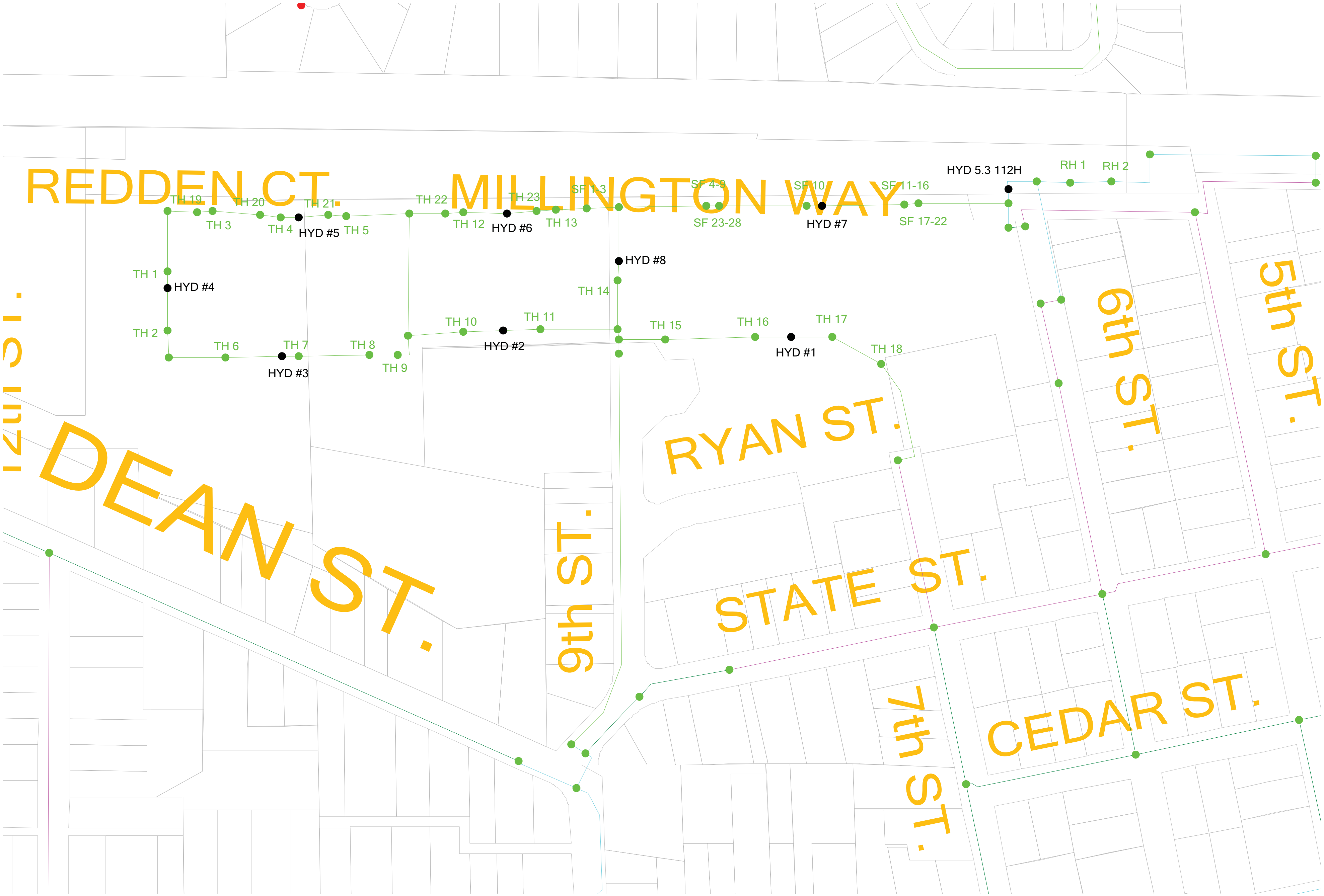
Appendix

Scenario: 2006	**Current Conditions WaterCAD Model Layout**
Scenario: Lexington PUD	**Proposed Lexington Club WaterCAD Layout**
Scenario: Lexington 10" Main	**Proposed Lexington Club WaterCAD Layout w/ 10" Main**
Contour Plot – Pressure	**Scenario: 2006 Max Day**
Contour Plot – Pressure	**Scenario: Lexington PUD Max Day**
Contour Plot – Pressure	**Scenario: Lexington 10" Main Max Day**
Contour Plot – Available Fire Flow	**Scenario: 2006 Max Day Fire Flow Analysis**
Contour Plot – Available Fire Flow	**Scenario: Lexington Max Day Fire Flow**
Contour Plot – Available Fire Flow	**Scenario: Lexington 10" Max Day Fire Flow**
Precision GIS	**Existing Water System From City of St.Charles**
Lexington Club – Utility Plan	**Preliminary Engineering Drawing**
Lexington Club – Concept Plan	
Lexington Club Base Demands	

Scenario: 2006 Base



Scenario: Lexington PUD

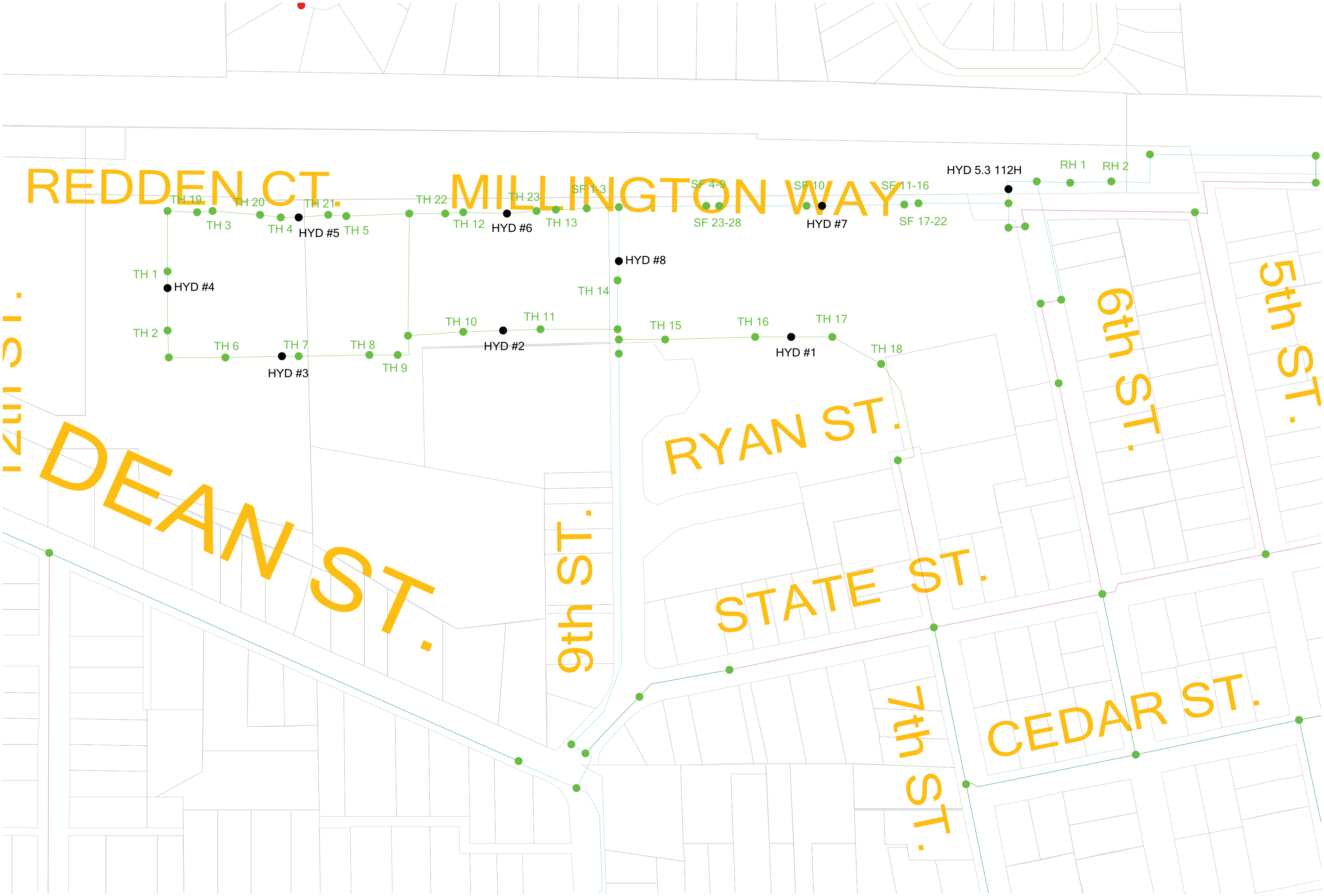


Title:
h:\...\lexington pud water model.wcd
12/22/10 09:35:38 AM

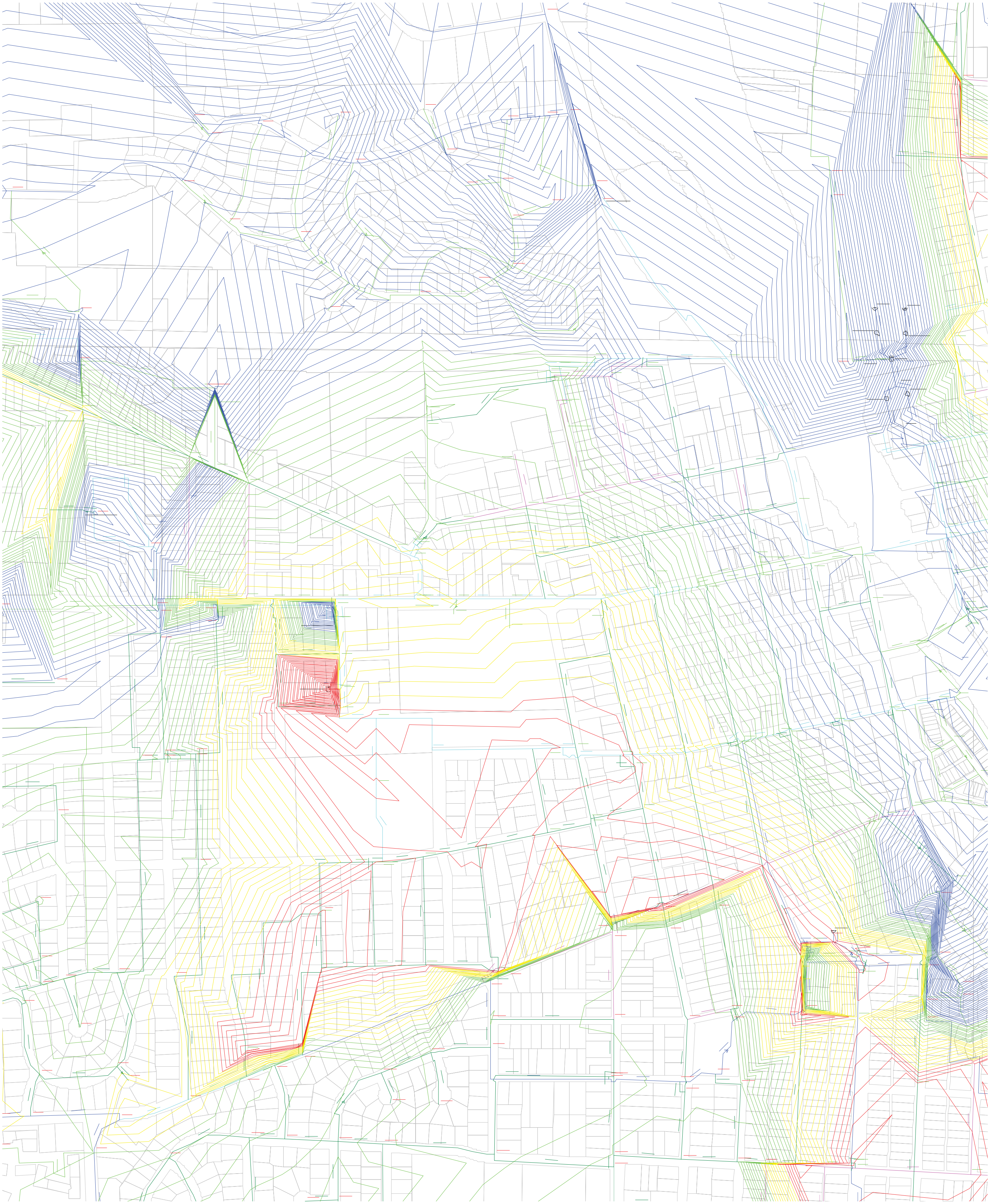
Trotter and Associates

Project Engineer: Mike Holland
WaterCAD v7.0 [07.00.061.00]

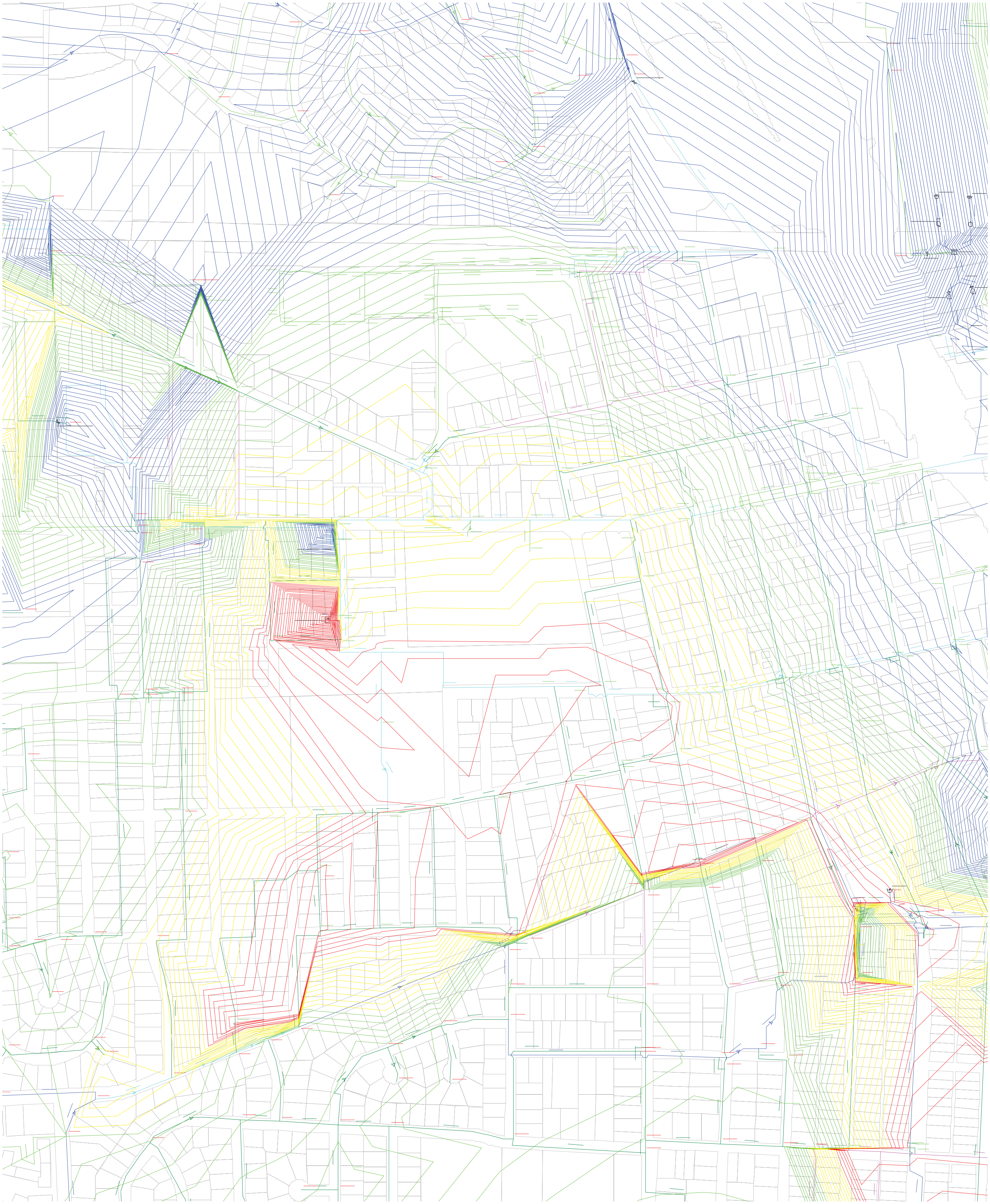
Scenario: Lexington 10" Main



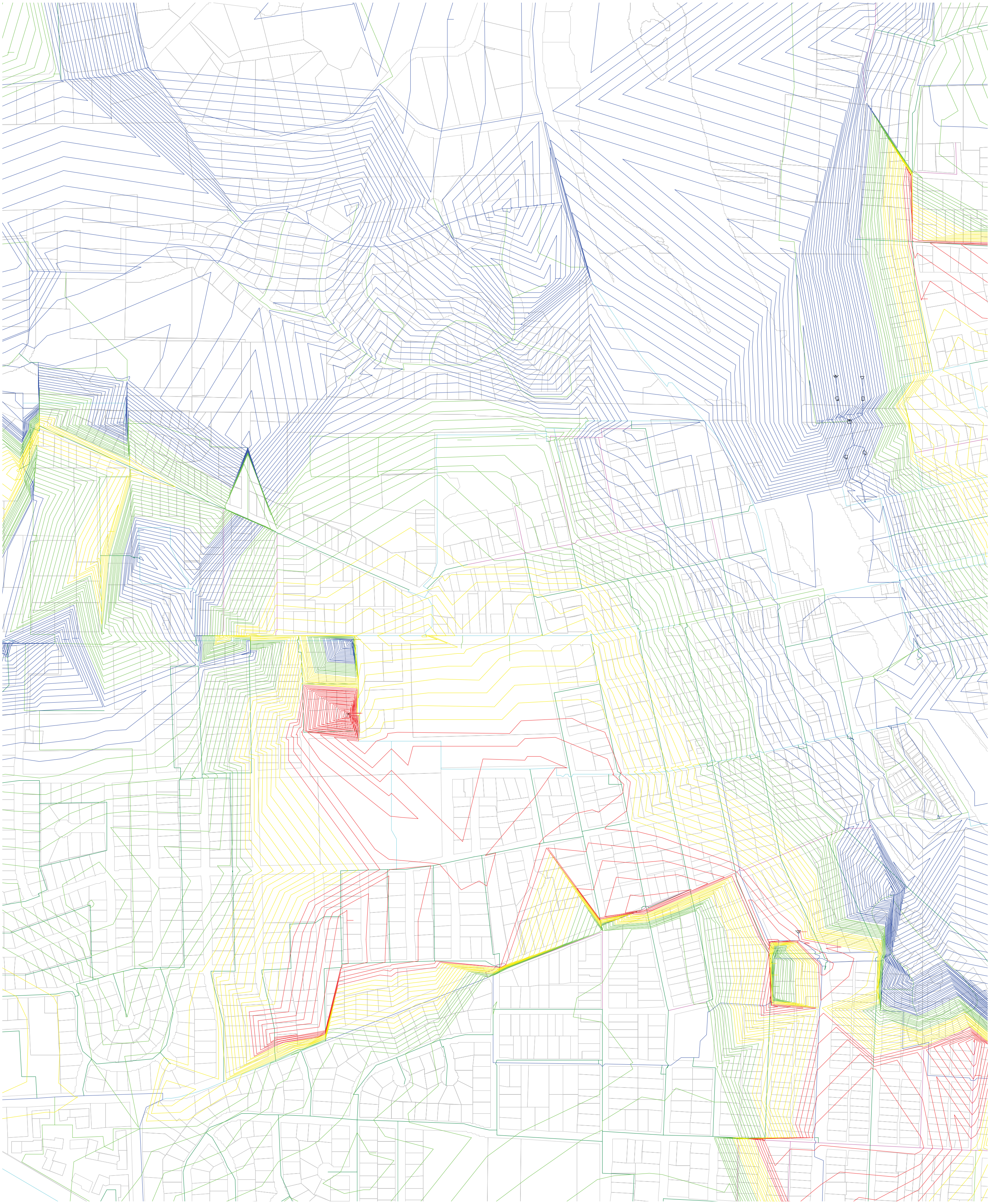
Contour Plot - Pressure
Scenario: 2006 Max Day



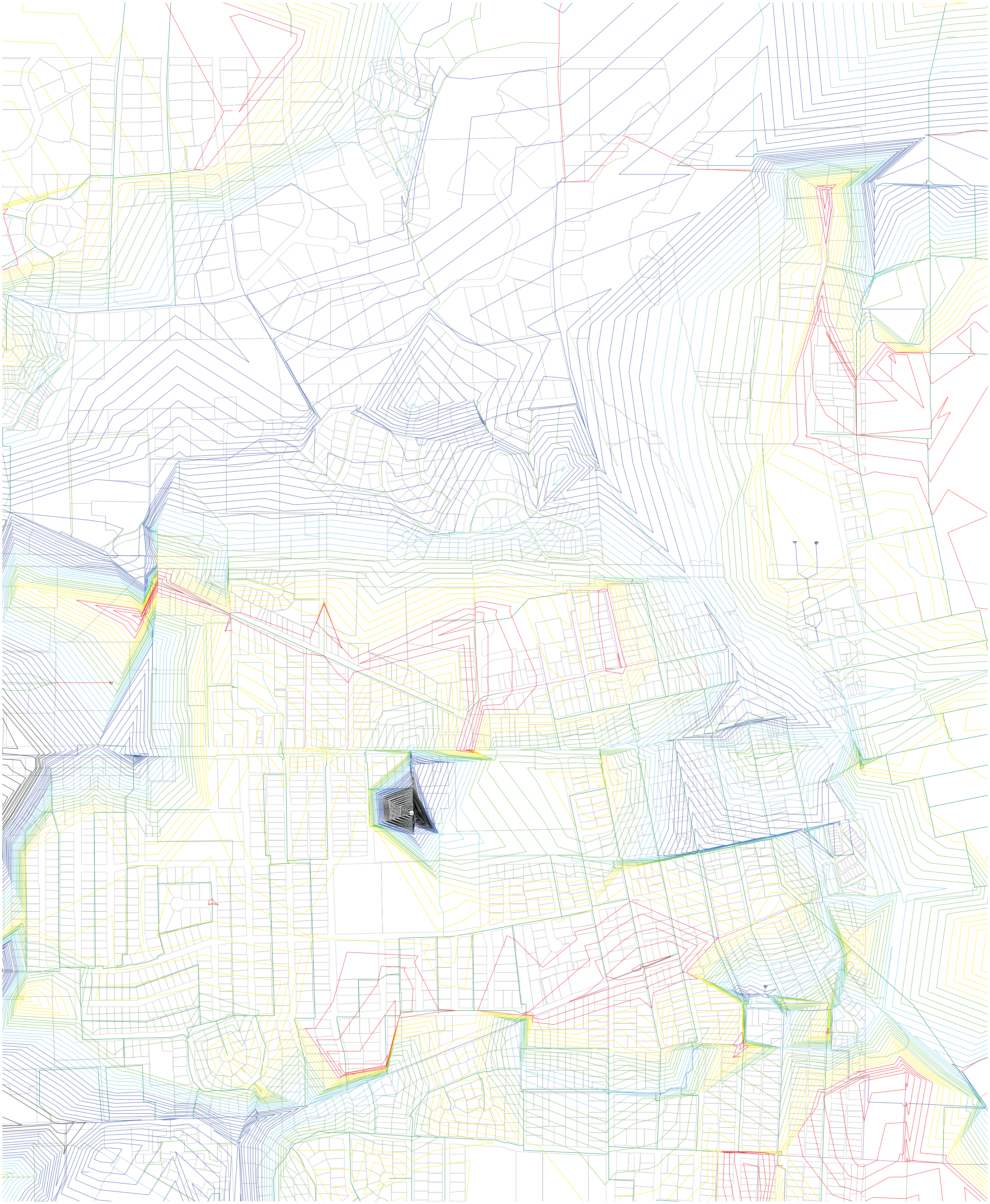
Contour Plot - Pressure
Scenario: Lexington PUD Max Day



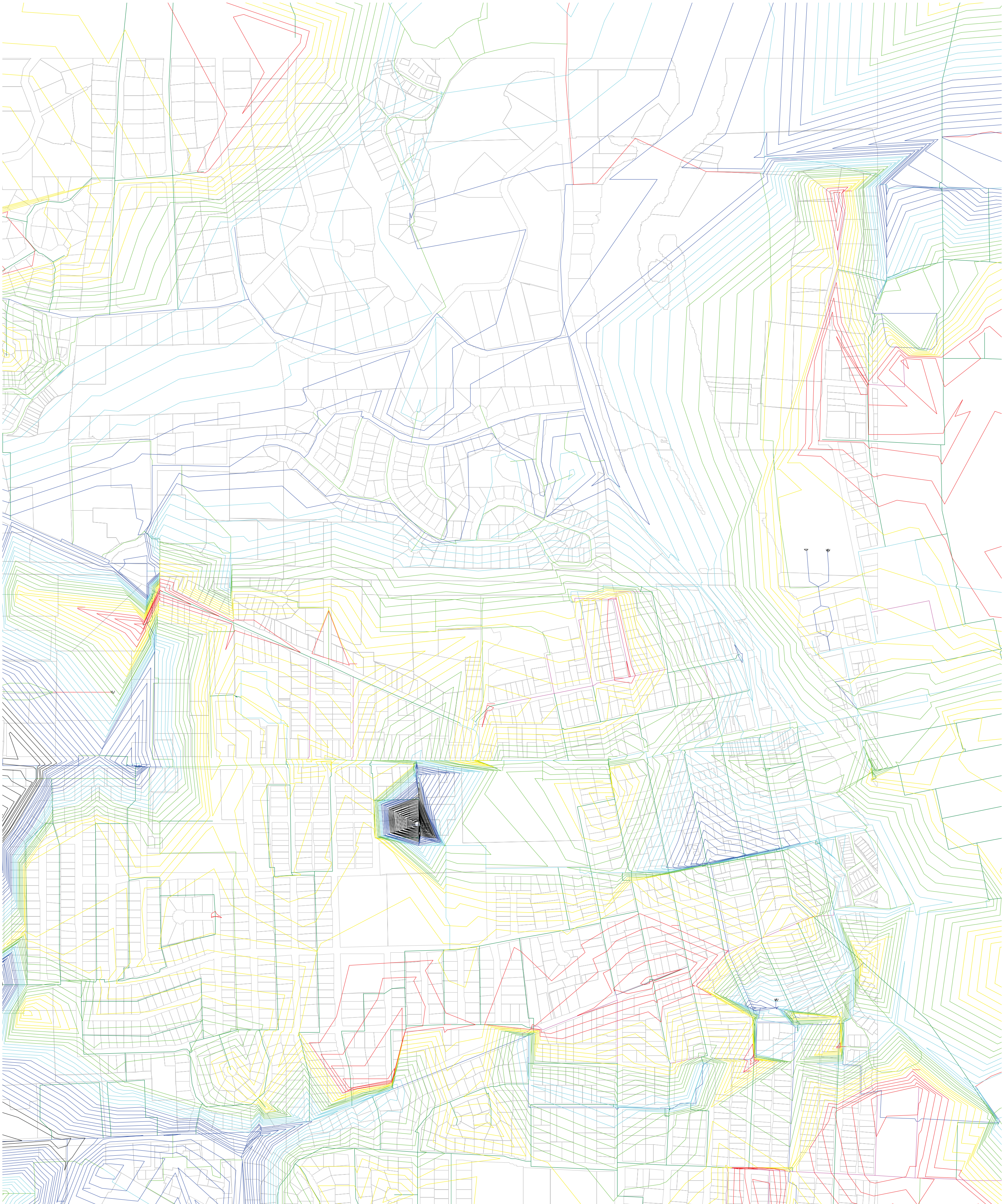
Contour Plot - Pressure
Scenario: Lexington 10" Main Max Day



Contour Plot - Available Fire Flow
Scenario: 2006 Max Day Fire Flow Analysis



Contour Plot - Available Fire Flow
Scenario: Lexington Max Day Fire Flow

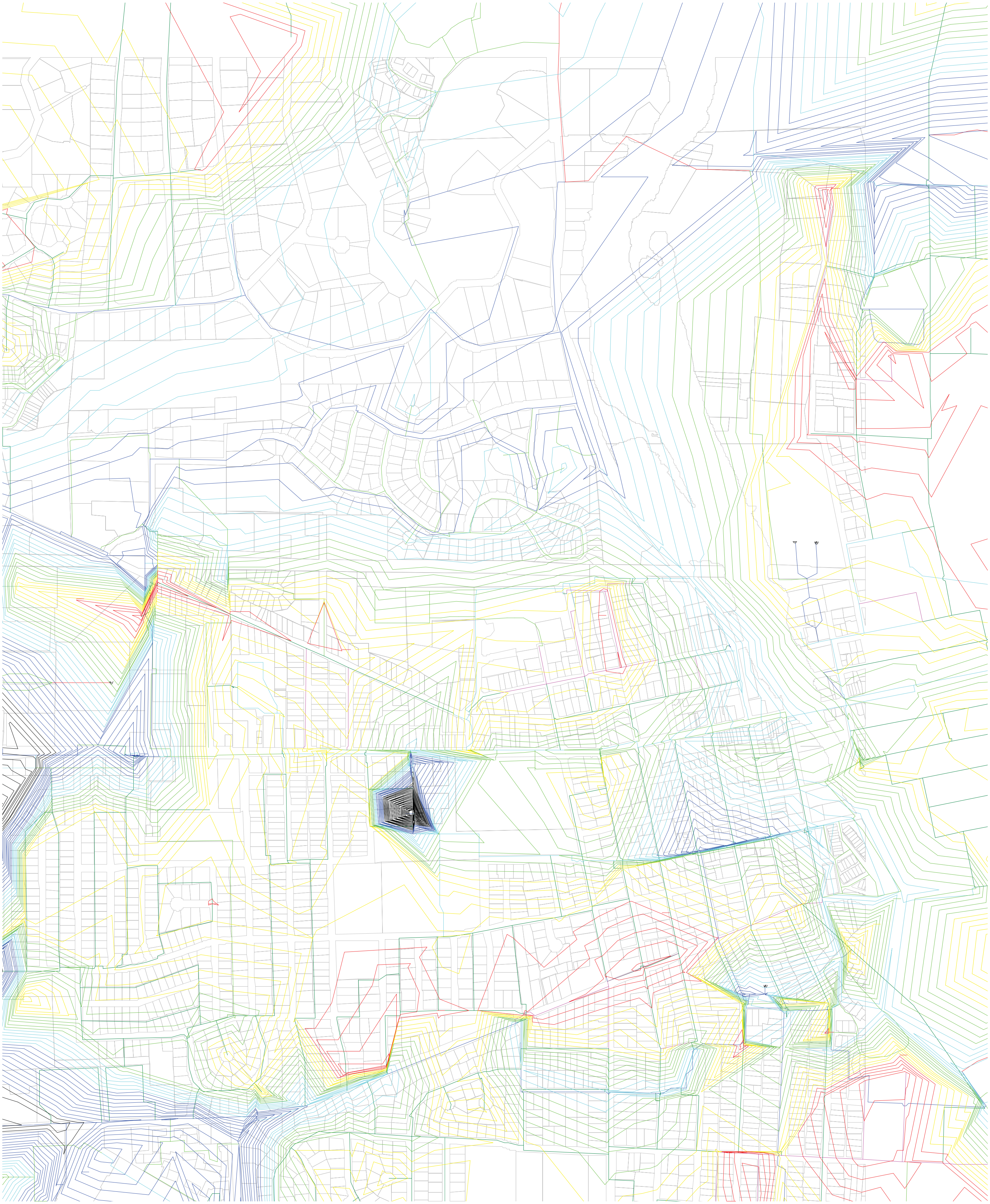


Title:
h:\...\lexington pud water model.wcd
12/27/10 12:10:03 PM © Bentley Systems, Inc. Haestad Methods Solution Center Watertown, CT 06795 USA +1-203-755-1666

Trotter and Associates

Project Engineer: Mike Holland
WaterCAD v7.0 [07.00.061.00]

Contour Plot - Available Fire Flow
Scenario: Lexington 10" Max Day Fire Flow



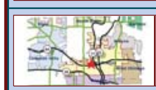
Title:
h:\...\lexington pud water model.wcd

Project Engineer: Mike Holland
Trotter and Associates
WaterCAD v7.0 [07.00.061.00]

City of St. Charles, Illinois

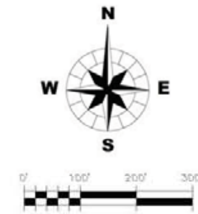
Precision GIS

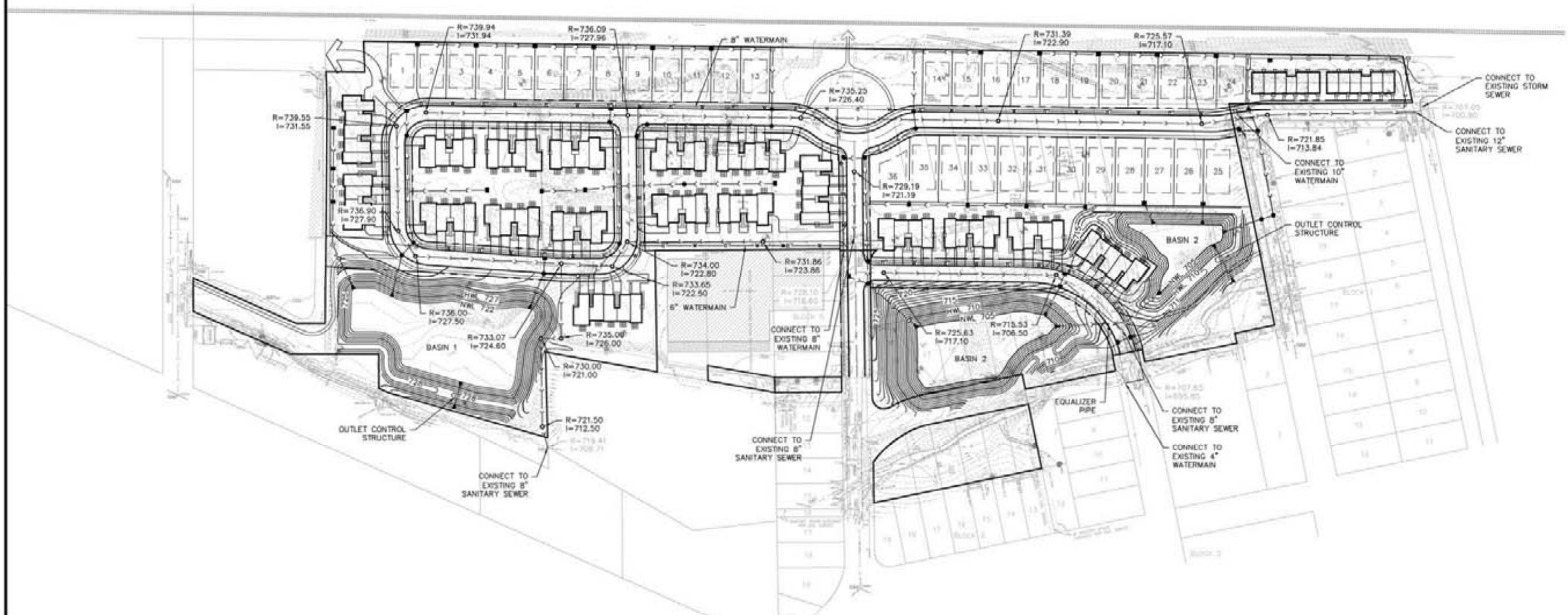
DONALD P. DEWITTE *Mayor*
BRIAN TOWNSEND *City Administrator*



This map was created using Precision GIS.
Print Date: December 8, 2010 4:29:50 PM CST
By: CI\ctiedt

0 130 260 ft.





NOTE:

- ALL SANITARY SEWER TO BE 8" PVC SDR26.

TITLE: LEXINGTON CLUB

UTILITY PLAN

CLIENT: LEXINGTON HOMES
1731 N. MARCEY ST., SUITE 200
CHICAGO, IL 60614
(773) 360-0300

WILLS BURKE KELSEY ASSOCIATES LTD.
116 West Main Street, Suite 201
St. Charles, Illinois 60174
(630) 443-7755

DSGN	JWK
DWN	EJN/EAM
CHKD	JCL
SCALE	1" = 100'
	06-941C-UT.DWG

NO. | DATE | NATURE OF REVISION

PROJECT NO. 06-941C

DATE: 11/17/2009

SHEET 4 OF 5

DRAWING NO.

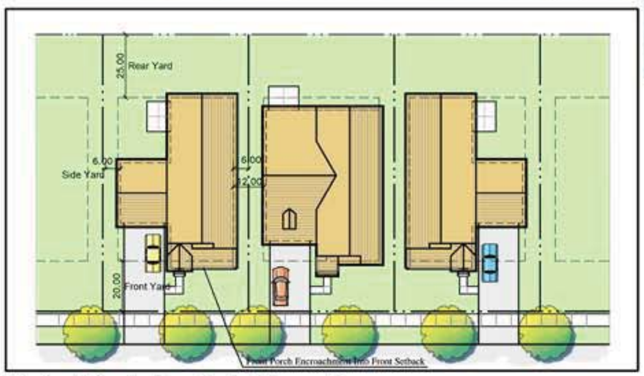
UT1

102 2-STORY TOWNHOUSES

12 2-STORY ROWHOUSES

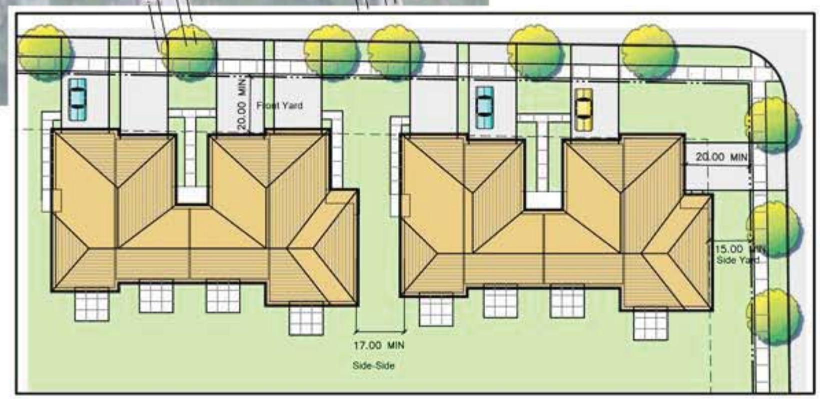
28 SINGLE FAMILY LOTS

142 TOTAL UNITS



Typical Single Family Lot Layout

Scale: 1"=20'



Typical Townhome Layout

Scale: 1"=20'

North

Scale: 1" = 80'

0 40 80 160 320

CONCEPT ONE

April 29, 2010

The Lexington Club

St. Charles, Illinois

Lexington Homes
1731 North Marcey Suite 200
Chicago, IL 60614
312-280-0980

April 29, 2010

BSB DESIGN

Lexington Club Base Demands

Single Family #1 - #3 (SF 1-3)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
3	3.5	10.5	1050	0.73

Single Family #4 - #9 (SF 4-9)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
6	3.5	21.0	2100	1.46

Single Family #10 (SF 10)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
1	3.5	3.5	350	0.24

Single Family #11 - #16 (SF 11-16)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
6	3.5	21.0	2100	1.46

Single Family #17 - #22 (SF 17-22)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
6	3.5	21.0	2100	1.46

Single Family #23 - #28 (SF 23-28)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
6	3.5	21.0	2100	1.46

Townhouse #1 (TH 1)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #2 (TH 2)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #3 (TH 3)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #4 (TH 4)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #5 (TH 5)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #6 (TH 6)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #7 (TH 7)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #8 (TH 8)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #9 (TH 9)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #10 (TH 10)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #11 (TH 11)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #12 (TH 12)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #13 (TH 13)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #14 (TH 14)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #15 (TH 15)				
No. Units	PE/Unit	Total PE	Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #16 (TH 16)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #17 (TH 17)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #18 (TH 18)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #19 (TH 19)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #20 (TH 20)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #21 (TH 21)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Townhouse #22 (TH 22)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
4	3.0	12.0	1200	0.83

Townhouse #23 (TH 23)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
5	3.0	15.0	1500	1.04

Rowhouse #1 (RH 1)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
6	3.0	18.0	1800	1.25

Rowhouse #2 (RH 2)				
No. Units	PE/Unit		Demand (gpd)	Demand (gpm)
6	3.0	18.0	1800	1.25