STORMWATER DETENTION- JUST HOW EFFECTIVE IS IT??

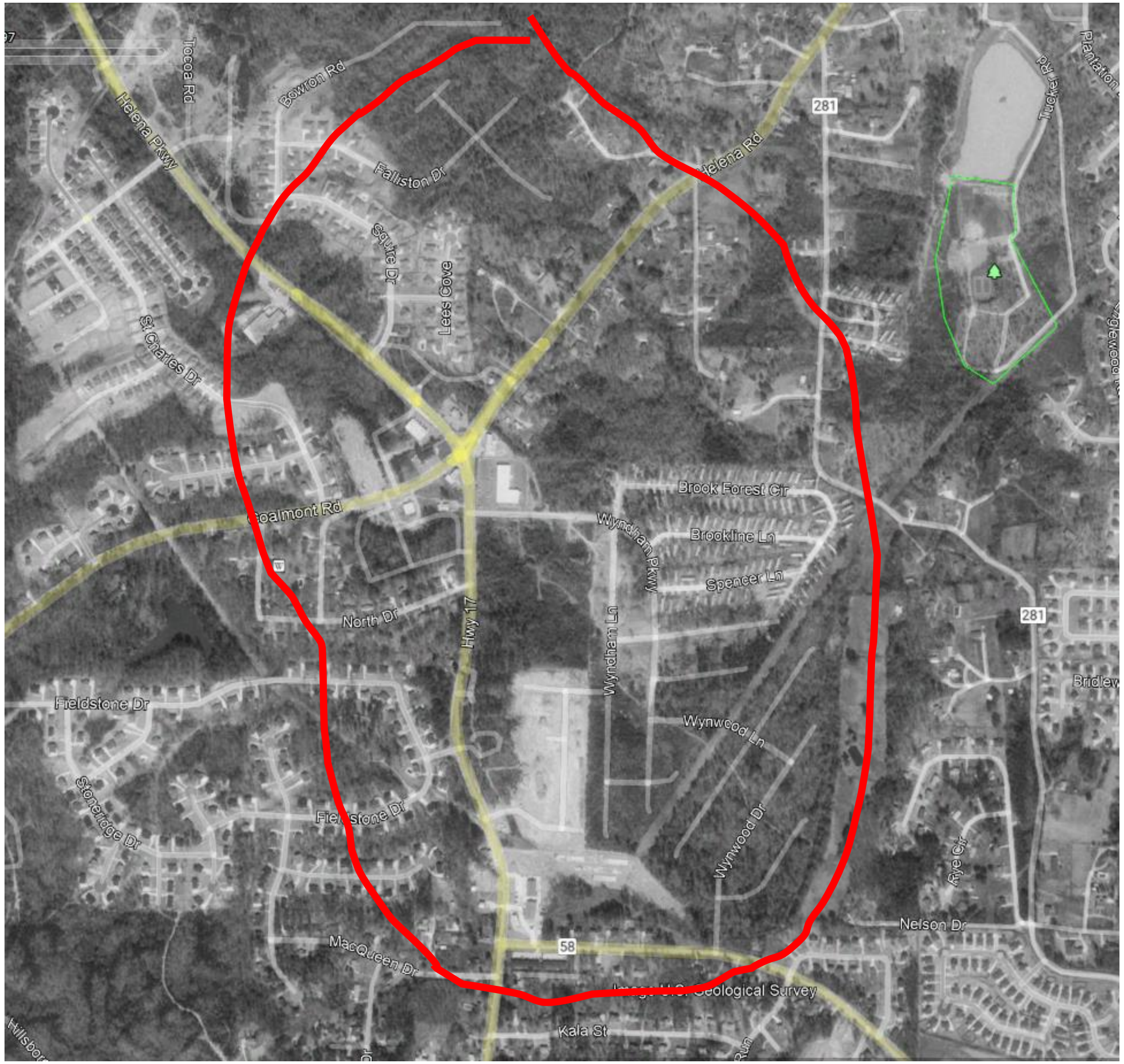
Presentation by: Jon E. Rasmussen, PE

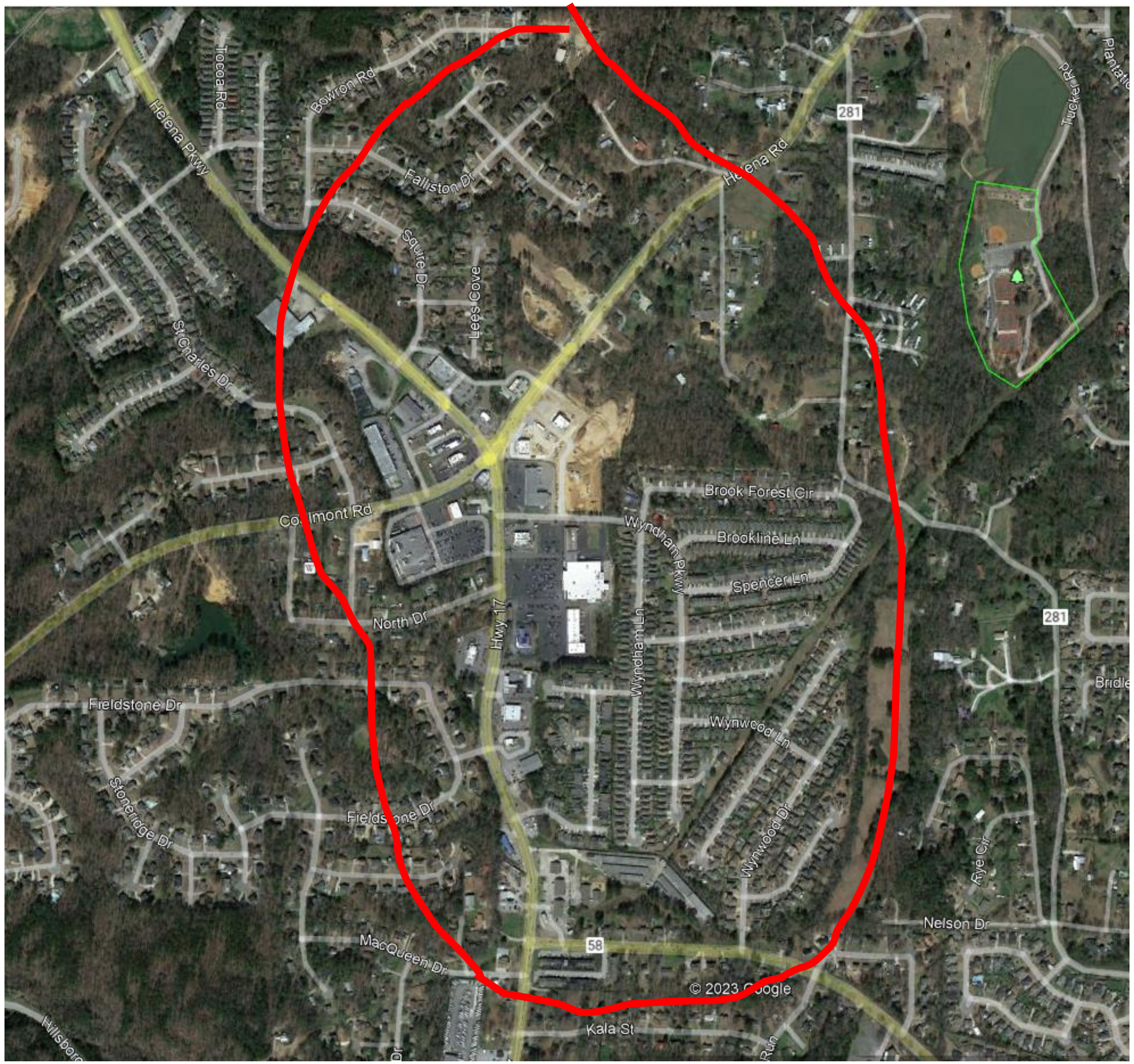
IS MEETING PRE- POST AT THE PROPERTY LINE ENOUGH??

- What are the downstream effects?
- Do we need to extend out study downstream?
- Do we have the information available to study downstream (lidar, plans, or aerial mapping)
- Are we checking SCS flows against other methods or sources (regression, rational method, stream gauges)?
- What are “Pre-development conditions”?
- Are Pre-dev flows at the property proportional to the Pre-dev flows of the regional watershed?

The timing of the peak flow is just as critical as the peak flow itself

1997 **WHICH IS PRE?** 2021



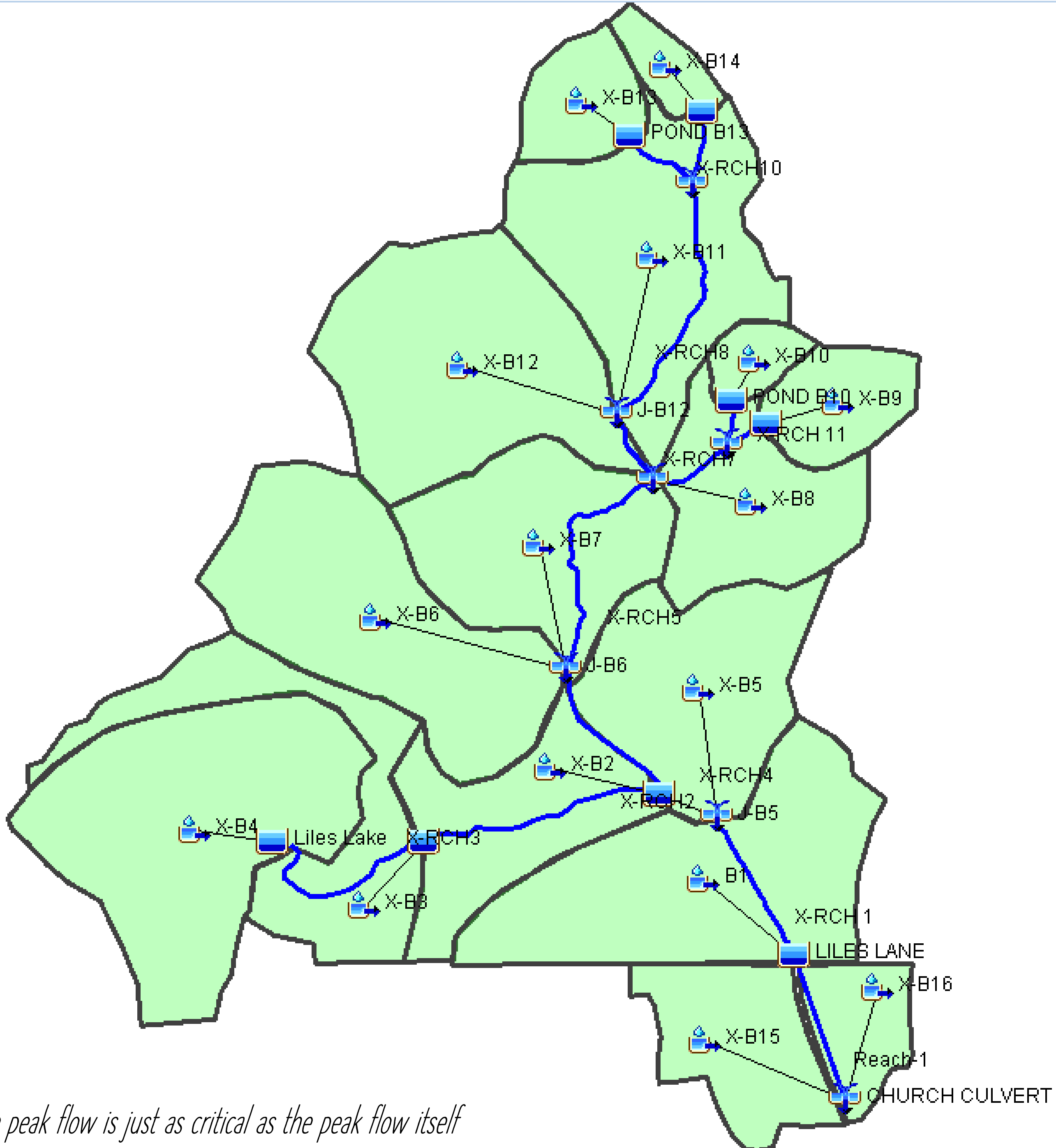


The timing of the peak flow is just as critical as the peak flow itself

Project Example

Liles Lane- Trussville, AL

- Basin area: 1.6 SM
- 14 sub-basins
- 6 water bodies
- Slopes range from 15-30%
- Rural watershed (3.7% impervious, 14% developed)
- Mixture of A and B soils
- CN's range from 43 to 65
- Tc range from 12 to 54 minutes



The timing of the peak flow is just as critical as the peak flow itself

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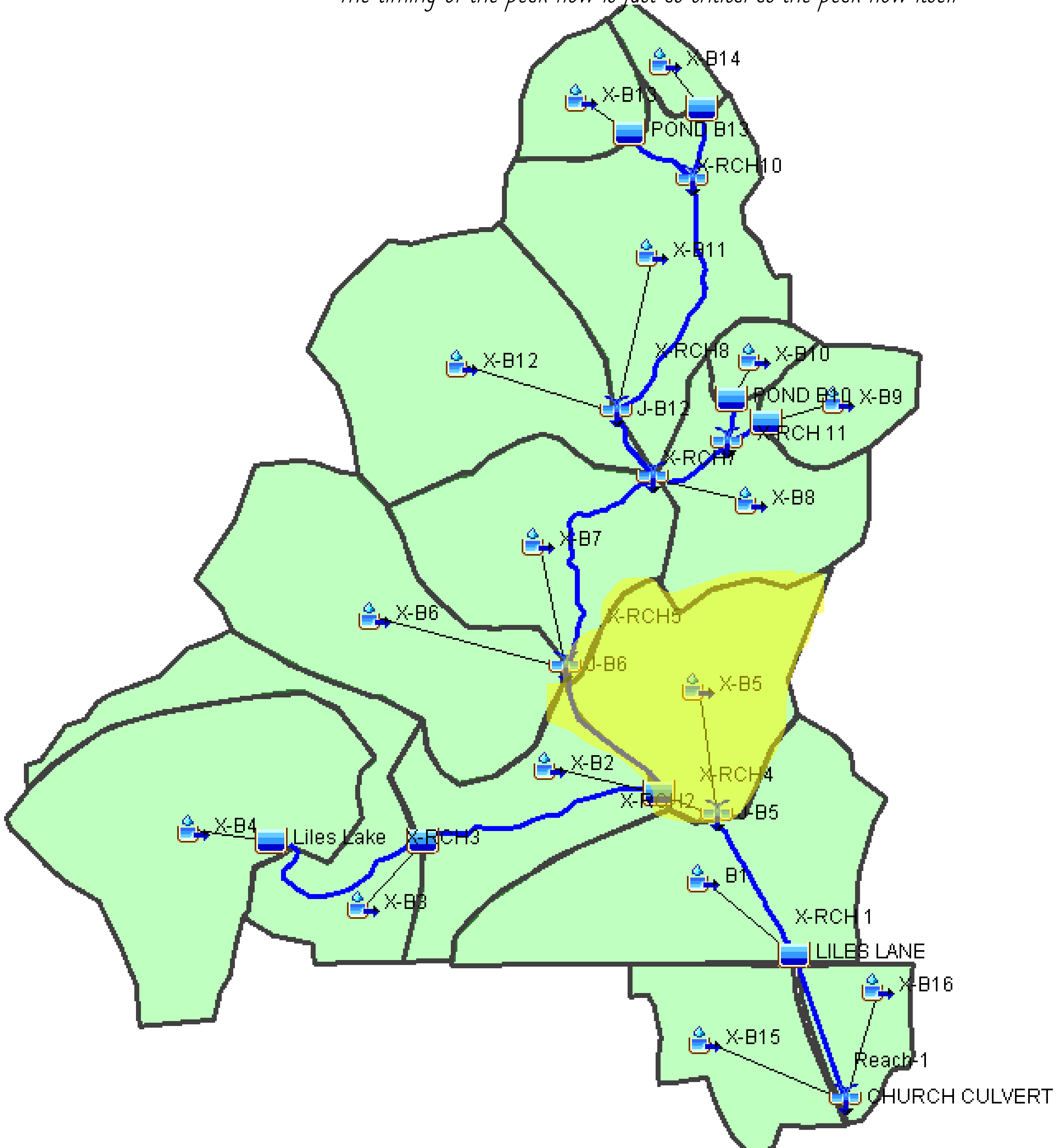
Project Example

Liles Lane- Trussville, AL

We are going to focus on sub-basin X-B5.



Aerial Photo

Existing Hydrologic Data

DA = 81.4 ac

Weighted CN= 62.10 unadjusted / 66.61 adj.

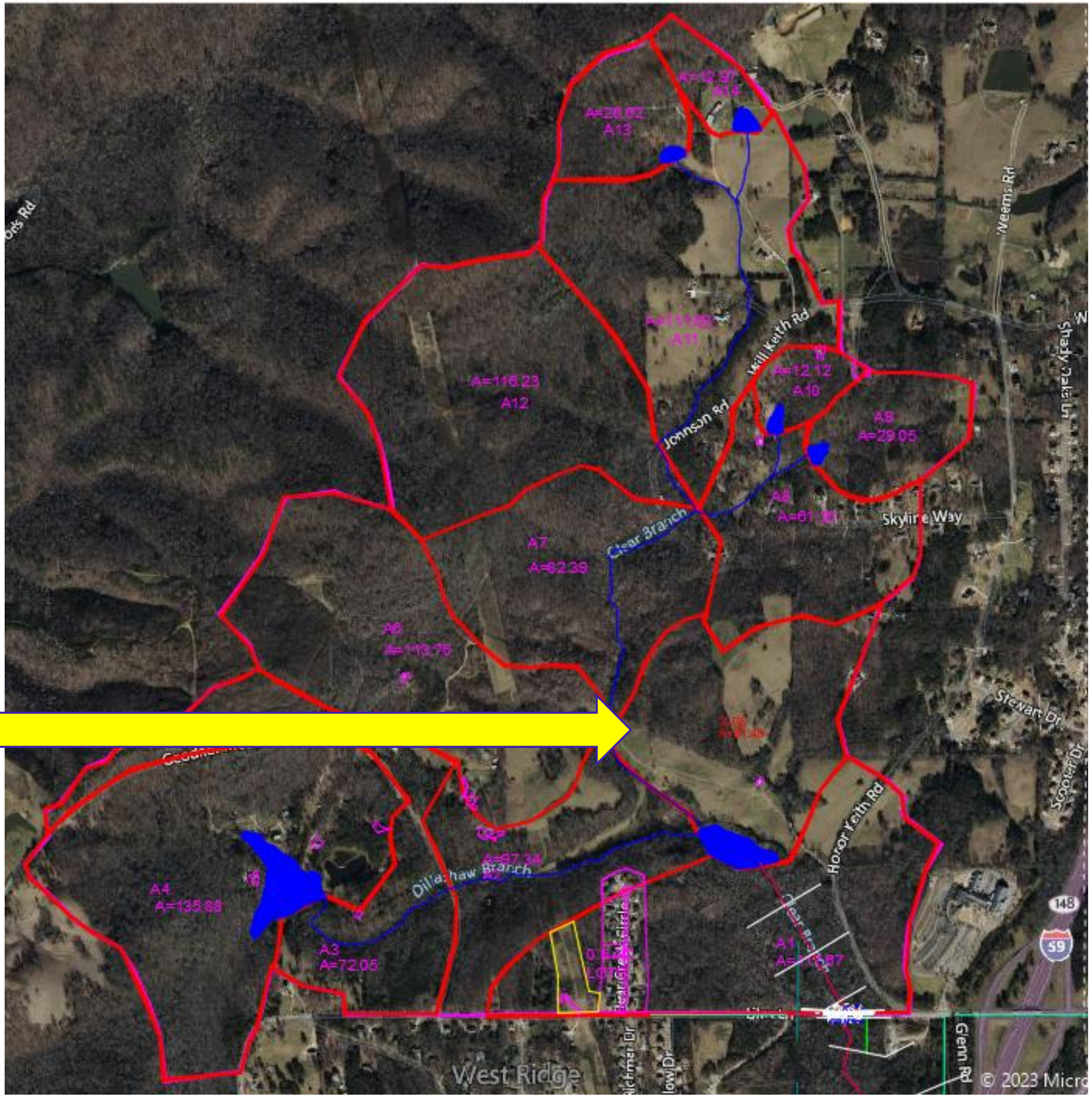
(40.6 ac fair woods, 3.45 ac impervious, pasture)

Tc = 23 minutes (scs lag method)

Slope= 16.6%

Flow length= 2426'

X-B5



The timing of the peak flow is just as critical as the peak flow itself

X5-A (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>

DA = 8.08 ac

Weighted CN= 60.00 / <u>64.67</u> adj

Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>

DA = 8.08 ac

Weighted CN= 90

Tc = 5 minutes

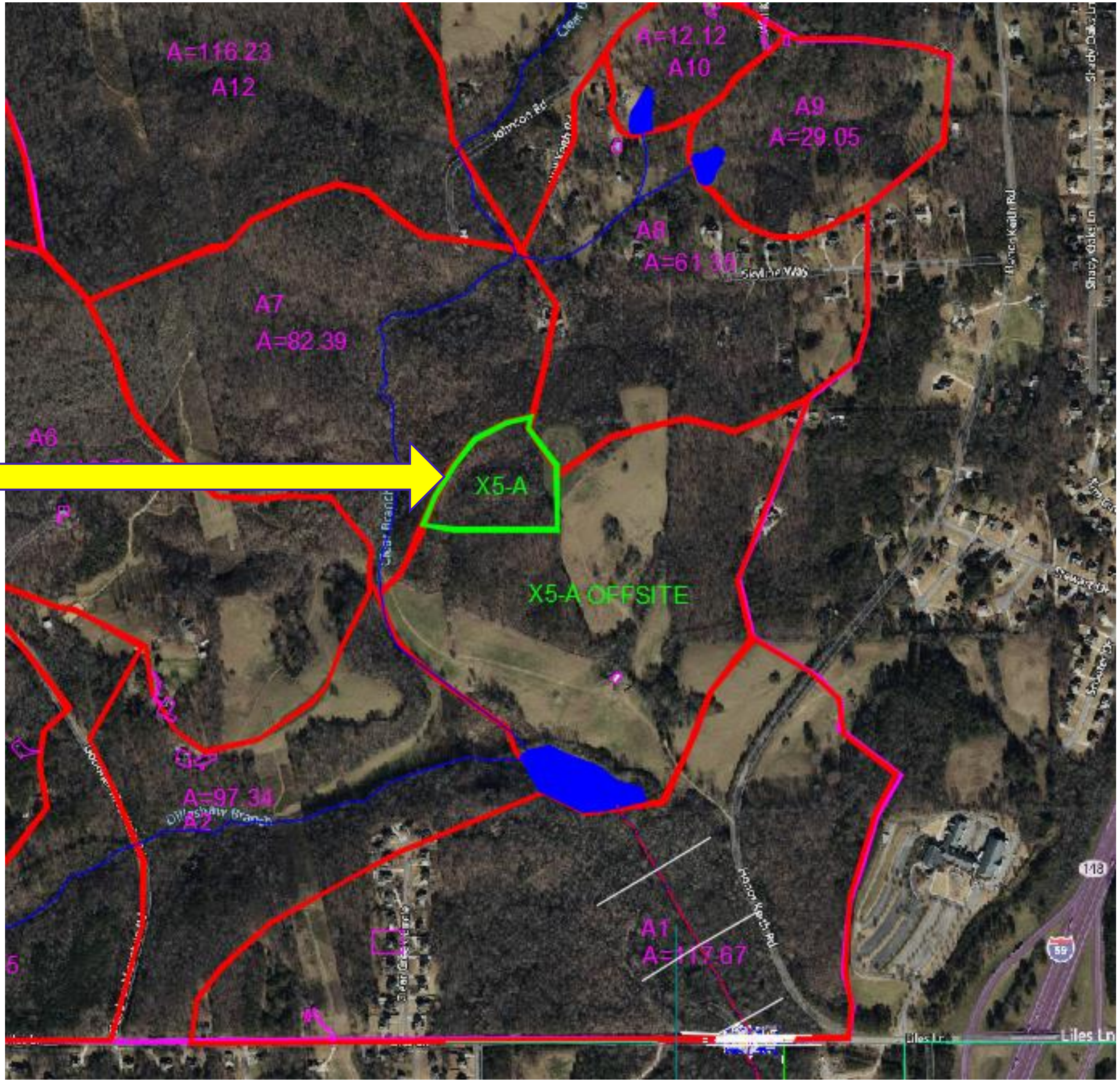
<u>X5-A OFFSITE</u>

DA= 73.32 AC

Weighted CN= 62.3 / <u>66.79</u> adj

Tc = 21.2 minutes

X5-A



The timing of the peak flow is just as critical as the peak flow itself

X5-B (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>

DA = 8.08 ac

Weighted CN= 60.00 / <u>64.67</u> adj

Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>

DA = 8.08 ac

Weighted CN= 90

Tc = 5 minutes

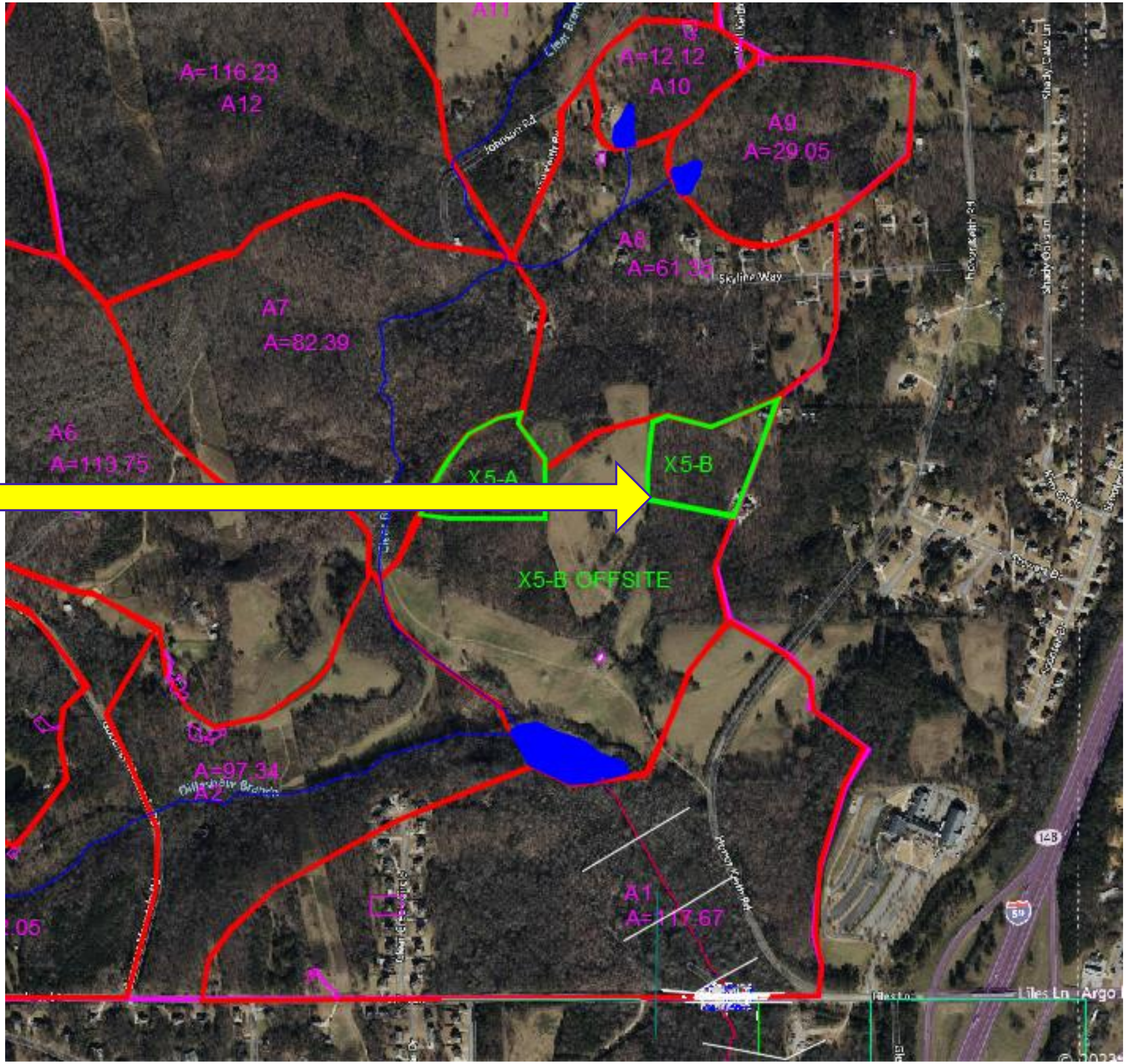
<u>X5-B OFFSITE</u>

DA= 65.24 AC

Weighted CN= 62.6 / <u>67.07</u> adj

Tc = 21.1 minutes

X5-B



The timing of the peak flow is just as critical as the peak flow itself

X5-C (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>

DA = 8.08 ac

Weighted CN= 60.00 / <u>64.67</u> adj

Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>

DA = 8.08 ac

Weighted CN= 90

Tc = 5 minutes

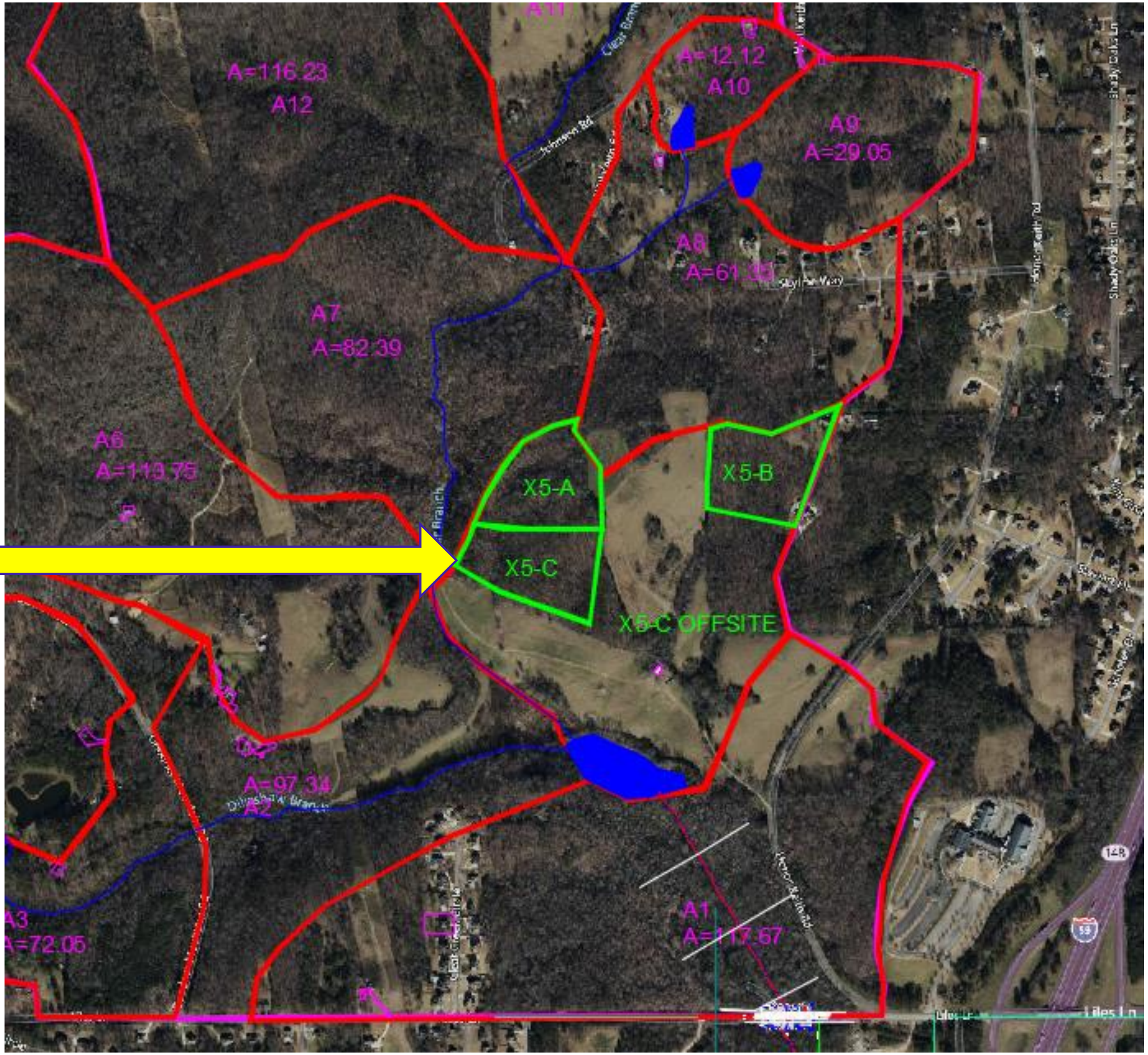
<u>X5-C OFFSITE</u>

DA= 57.16 AC

Weighted CN= 62.9 / <u>67.34</u> adj

Tc = 18.9 minutes

X5-C



The timing of the peak flow is just as critical as the peak flow itself

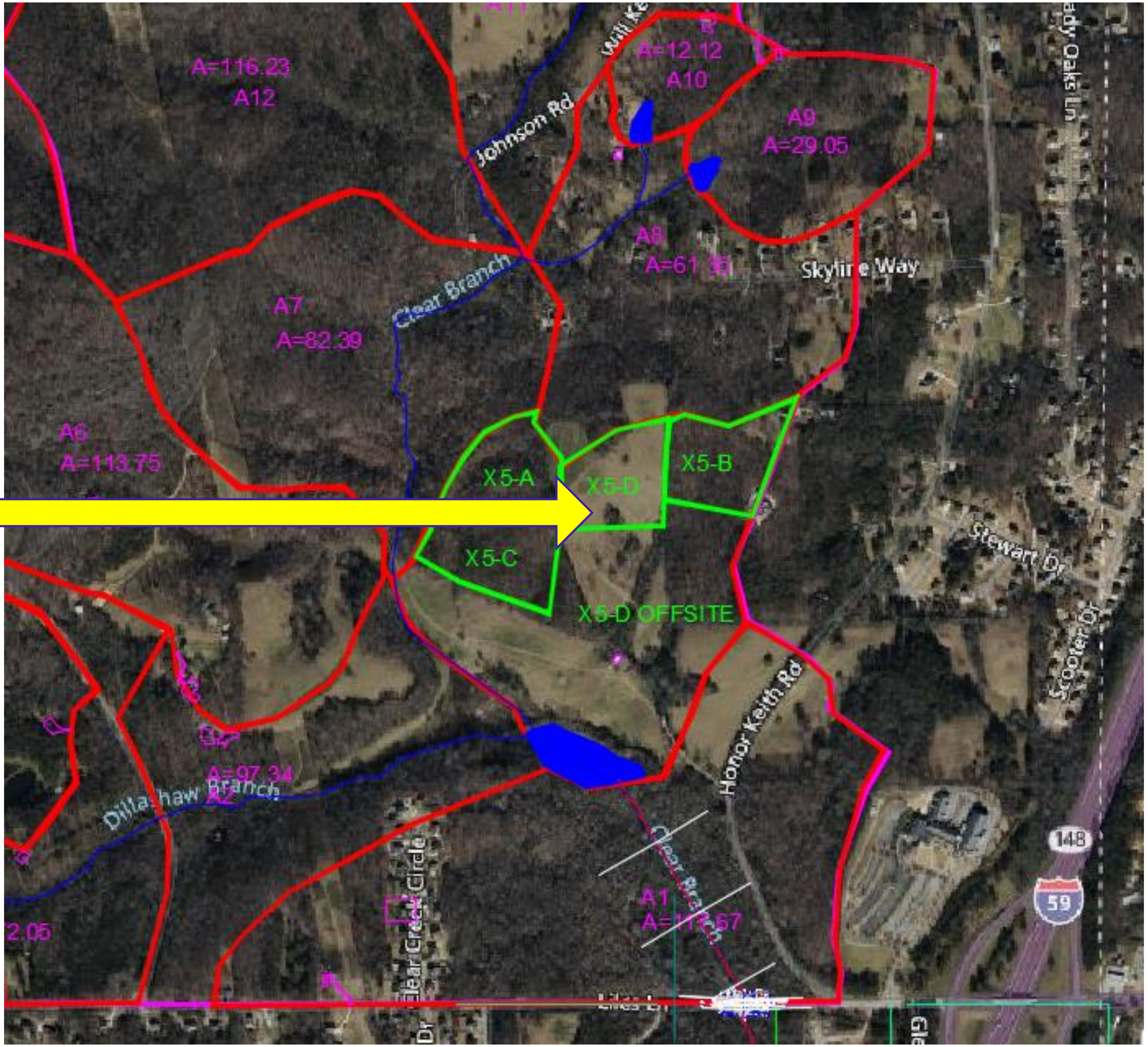
X5-D (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>
DA = 8.08 ac
Weighted CN= 60.00 / <u>64.67</u> adj
Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>
DA = 8.08 ac
Weighted CN= 90
Tc = 5 minutes

<u>X5-D OFFSITE</u>
DA= 49.08 AC
Weighted CN= 63.3 / <u>67.71</u> adj
Tc = 18.9 minutes

X5-D



The timing of the peak flow is just as critical as the peak flow itself

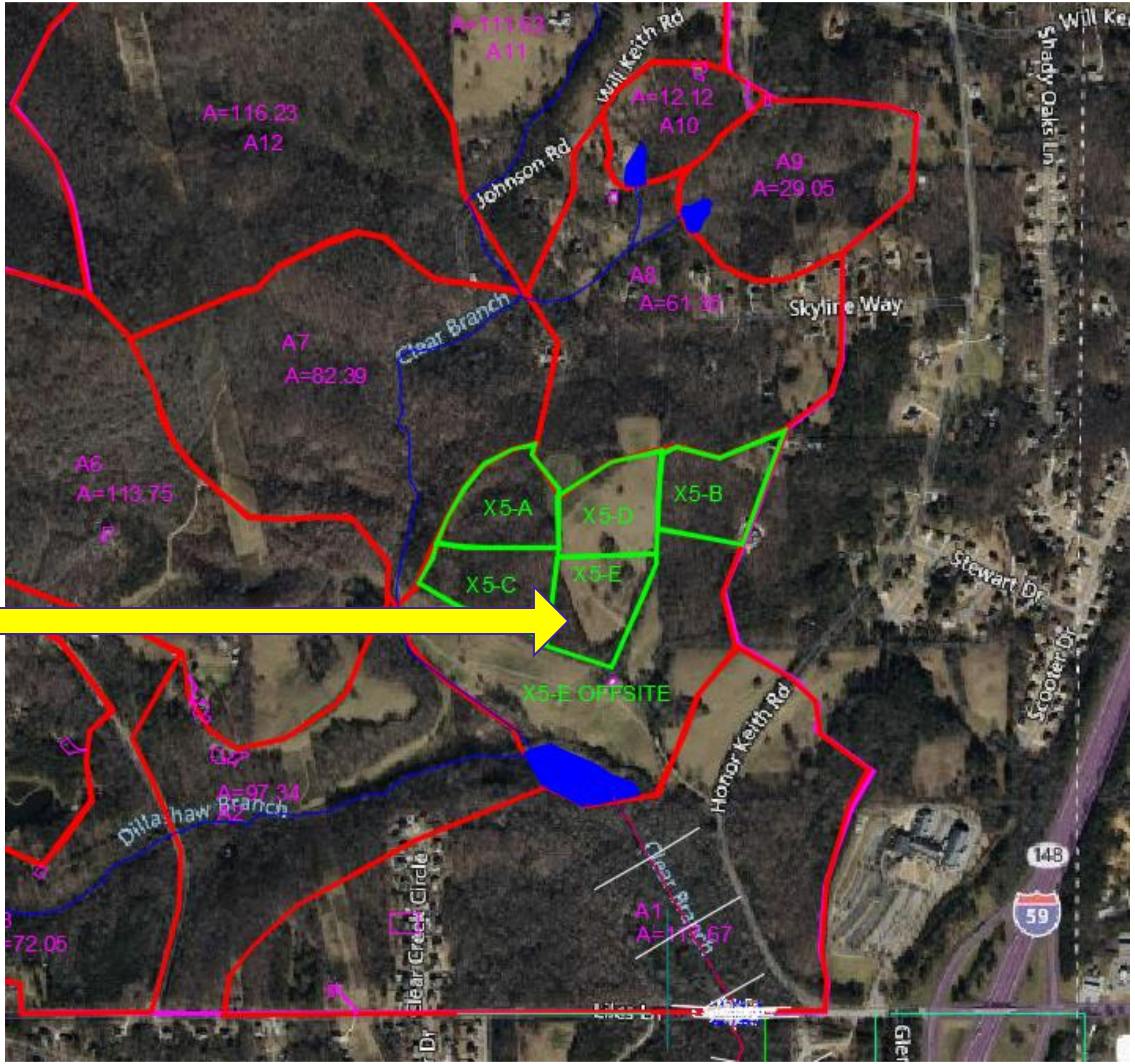
X5-E (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>
DA = 8.08 ac
Weighted CN= 60.00 / <u>64.67</u> adj
Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>
DA = 8.08 ac
Weighted CN= 90
Tc = 5 minutes

<u>X5-E OFFSITE</u>
DA= 41.0 AC
Weighted CN= 63.80 / <u>68.17</u> adj
Tc = 18.7 minutes

X5-E



The timing of the peak flow is just as critical as the peak flow itself

X5-F (New Commercial)

<u>Hydrologic Data (Pre-Dev)</u>

DA = 8.08 ac

Weighted CN= 60.00 / <u>64.67</u> adj

Tc = 10 minutes

<u>Hydrologic Data (Commercial)</u>

DA = 8.08 ac

Weighted CN= 90

Tc = 5 minutes

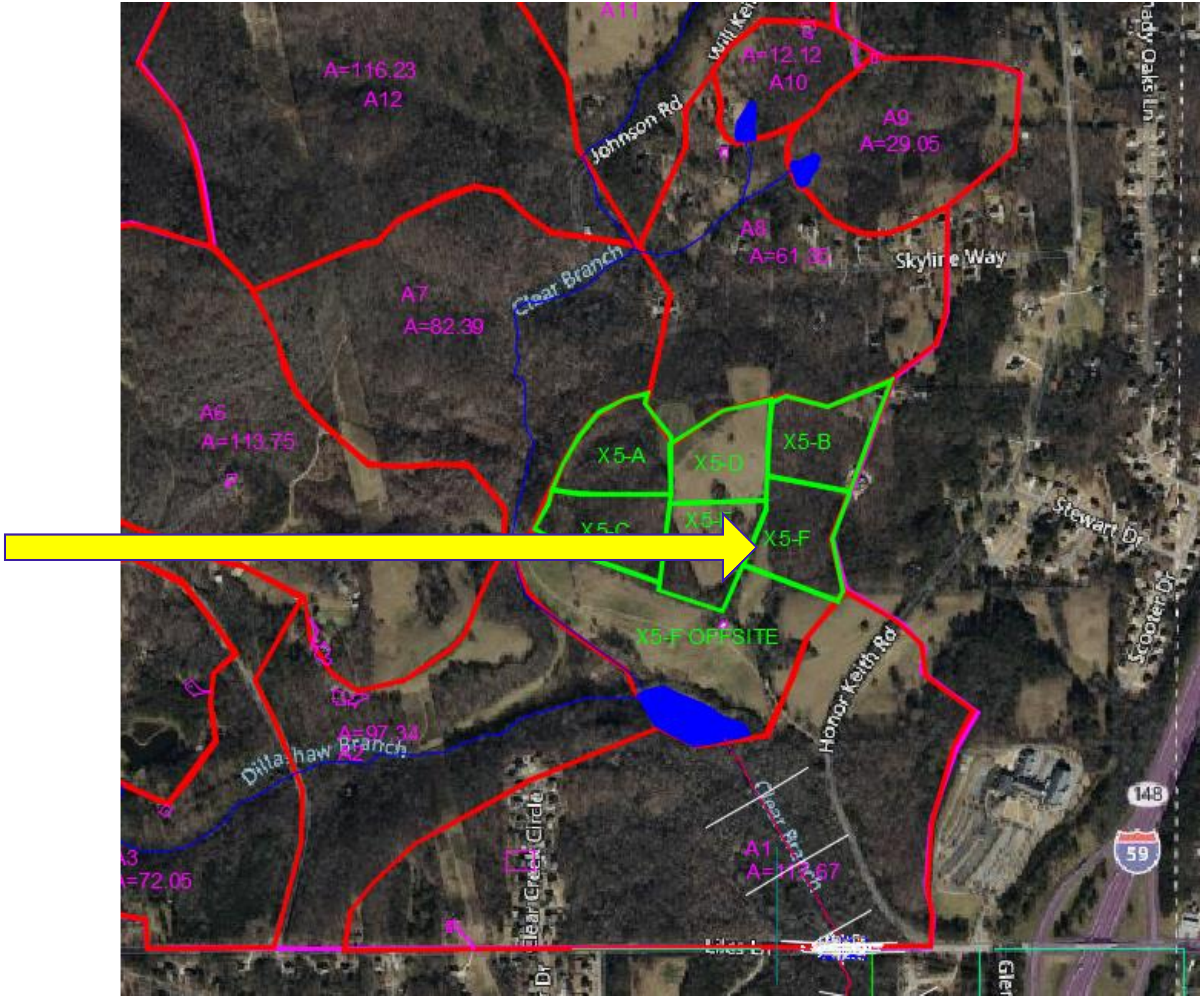
<u>X5-F OFFSITE</u>

DA= 32.92 AC

Weighted CN= 64.70 / <u>68.99</u> adj

Tc = 13.8 minutes

X5-F



The timing of the peak flow is just as critical as the peak flow itself

X5-F (New Commercial)

Pond Data

Conventional OS pond routing

Detention for 1-100yr

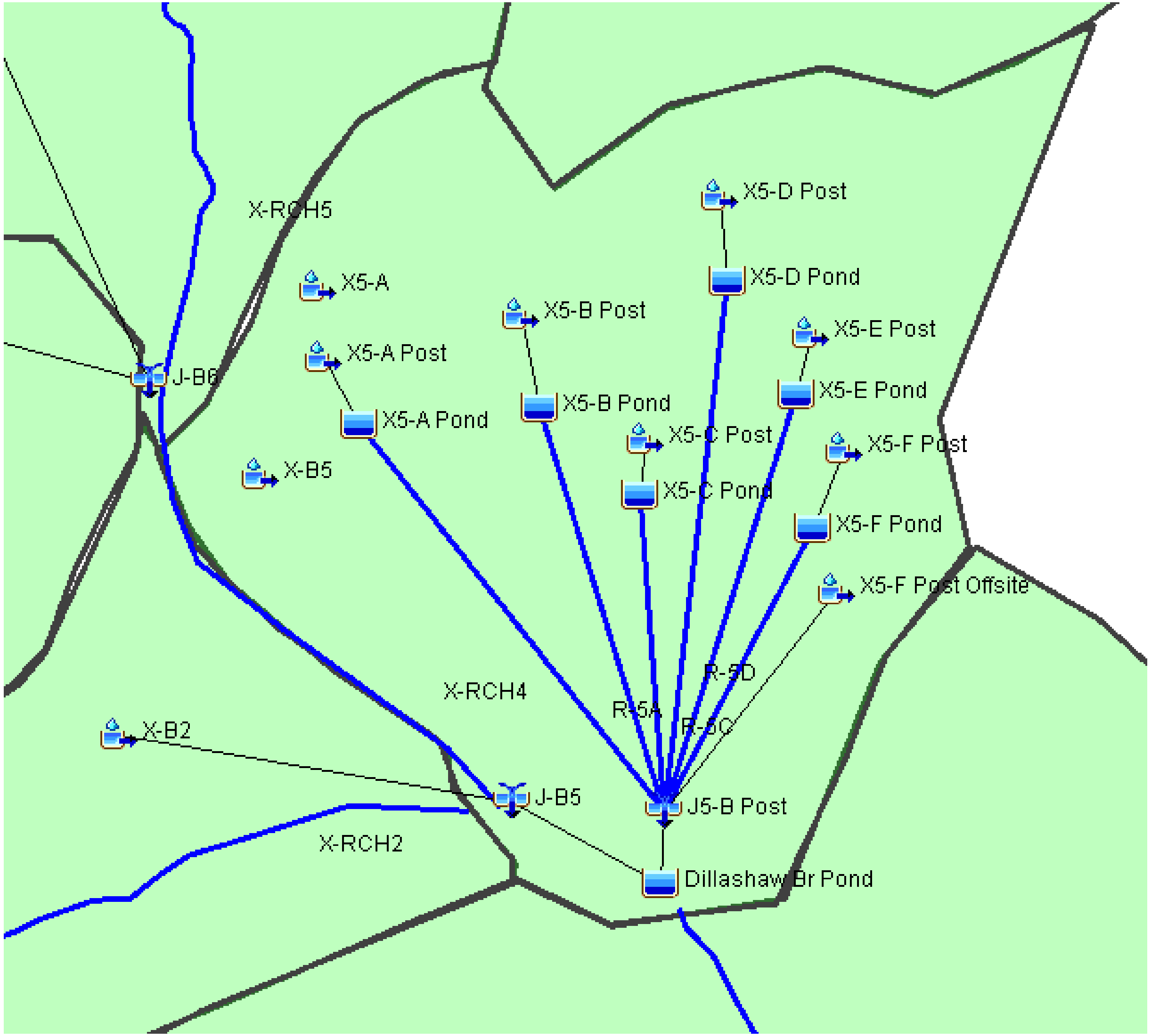
Reach R-5F

L= 1012 '

S= 10%

Mannings n = 0.03

3' wide x 3' deep open channel



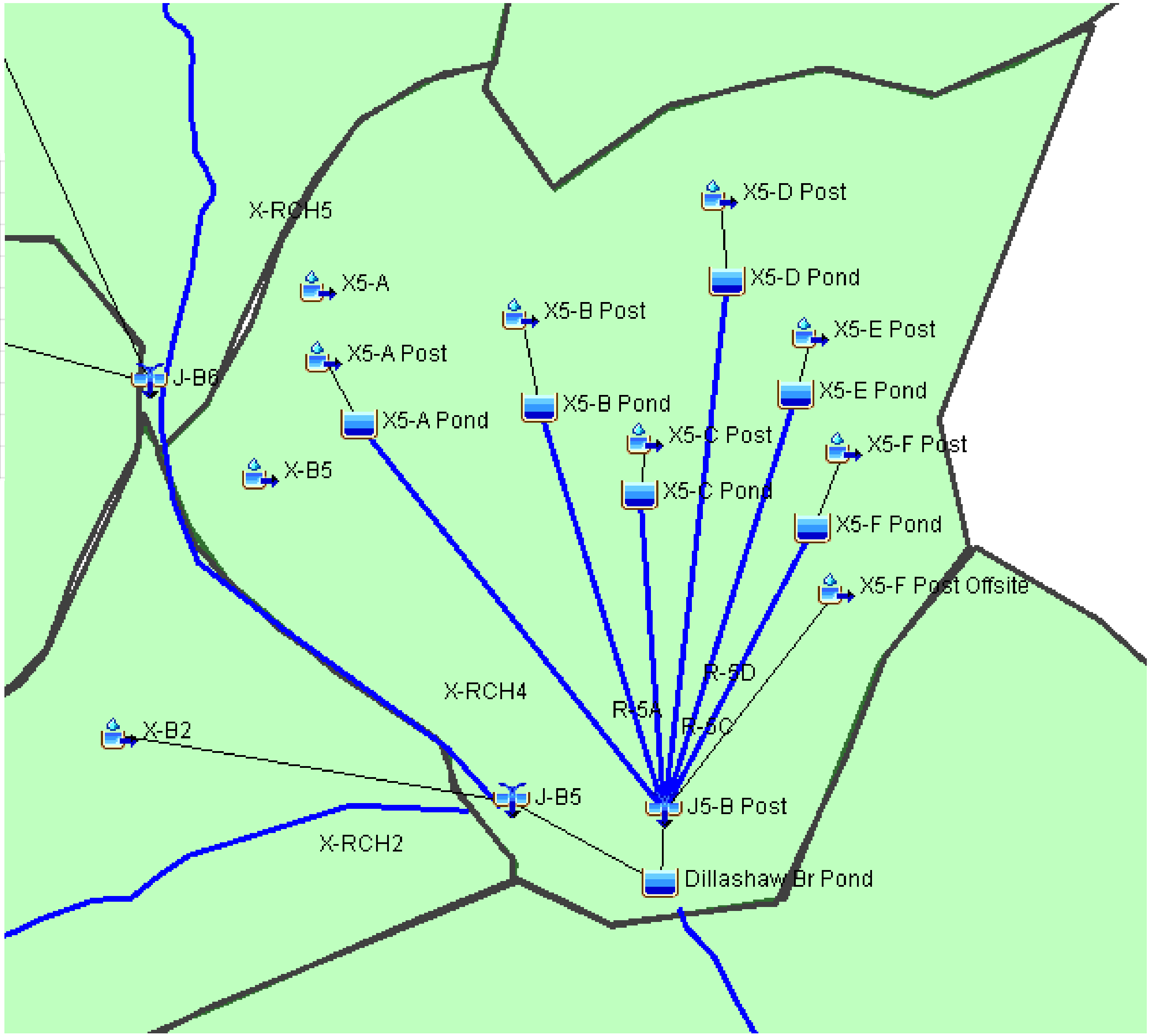
The timing of the peak flow is just as critical as the peak flow itself

X5-F (New Commercial)

Summary Results

X-5A + X-5B + X-5C + X-5D + X-5E + X-5F (60% Developed, 51% Imp)											
Return Period Yr	X-B5 pre	X5-F pre	X5-F post	X5-F offsite	X5-A post	X5-B post	X5-C post	X5-D post	X5-E post	X5-A+B+C+D+E+F	% Exceeded
1	54	7	7	33	7	7	7	7	7	62	15%
2	76	10	8	45	8	8	8	8	8	85	12%
5	118	16	10	68	10	10	10	10	10	120	2%
10	158	21	16	89	16	16	16	16	16	168	6%
25	218	30	28	121	28	28	28	28	28	281	29%
50	269	38	35	147	35	35	35	35	35	354	32%
100	323	41	41	175	41	41	41	41	41	420	30%

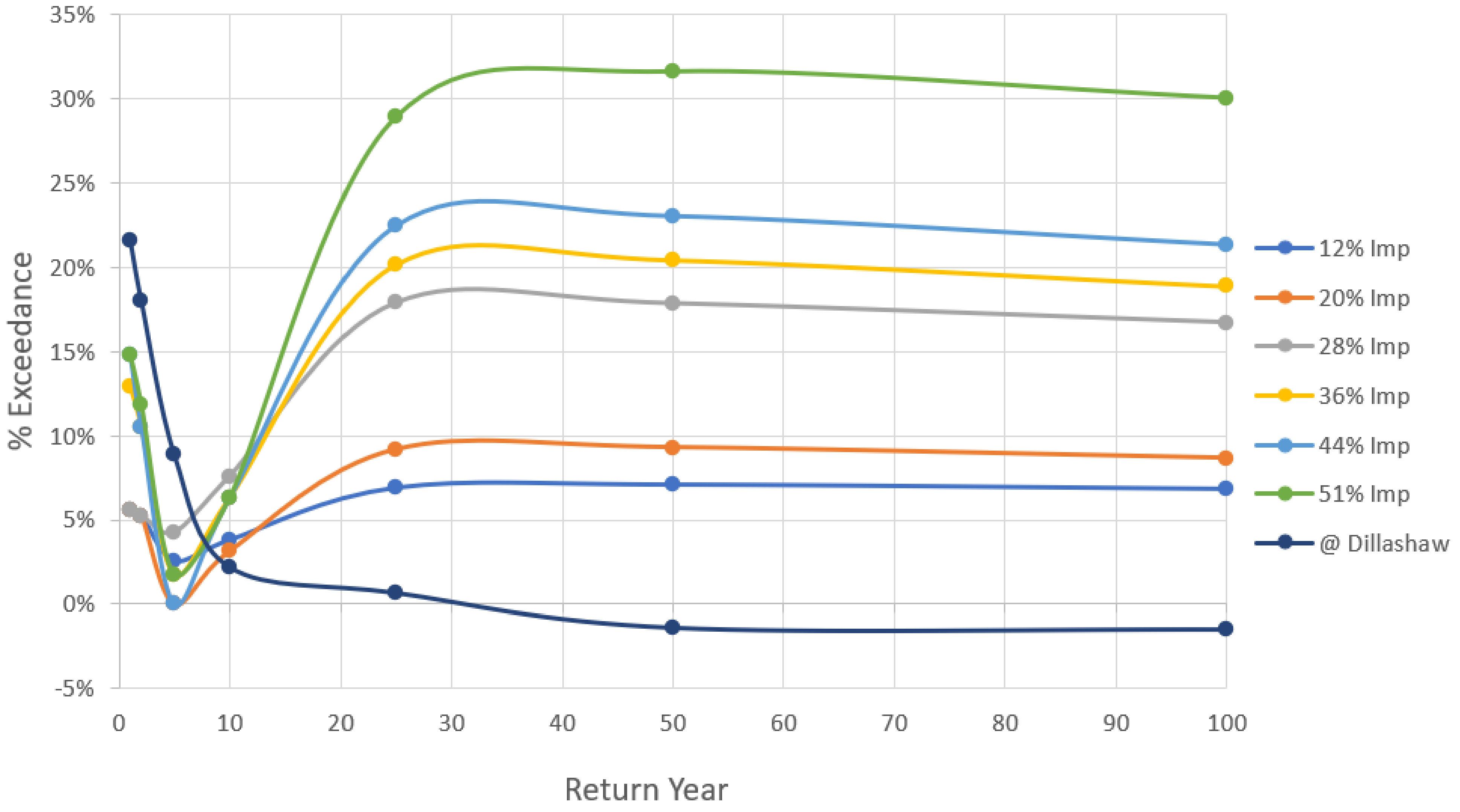
(60% Developed, 51% Imp) @ Dillashaw					
Return Period Yr	Pre	Peak time	Post	Peak time	% Exceed
1	74	12:38	90	12:38	22%
2	111	12:41	131	12:43	18%
5	237	12:40	258	12:42	9%
10	407	12:37	416	12:38	2%
25	726	12:34	731	12:34	1%
50	1028	12:32	1014	12:33	-1%
100	1367	12:30	1347	12:29	-1%



The timing of the peak flow is just as critical as the peak flow itself

X5-(A-F)

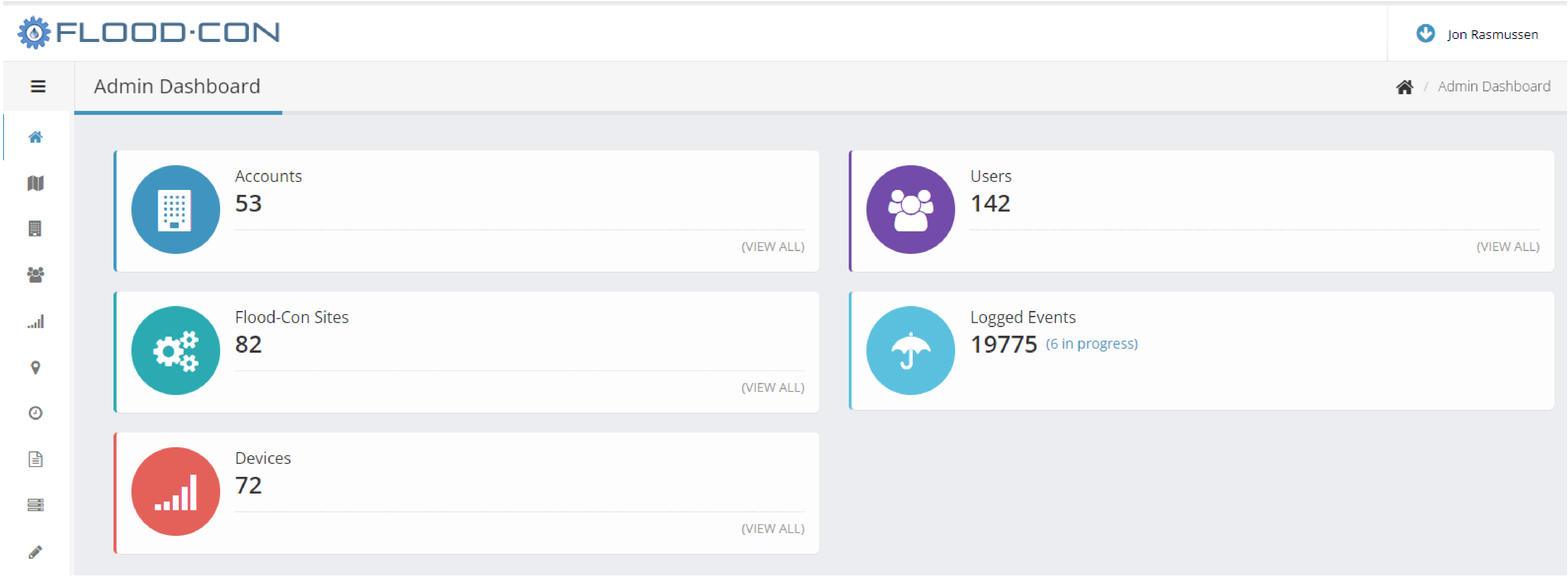
Summary Results



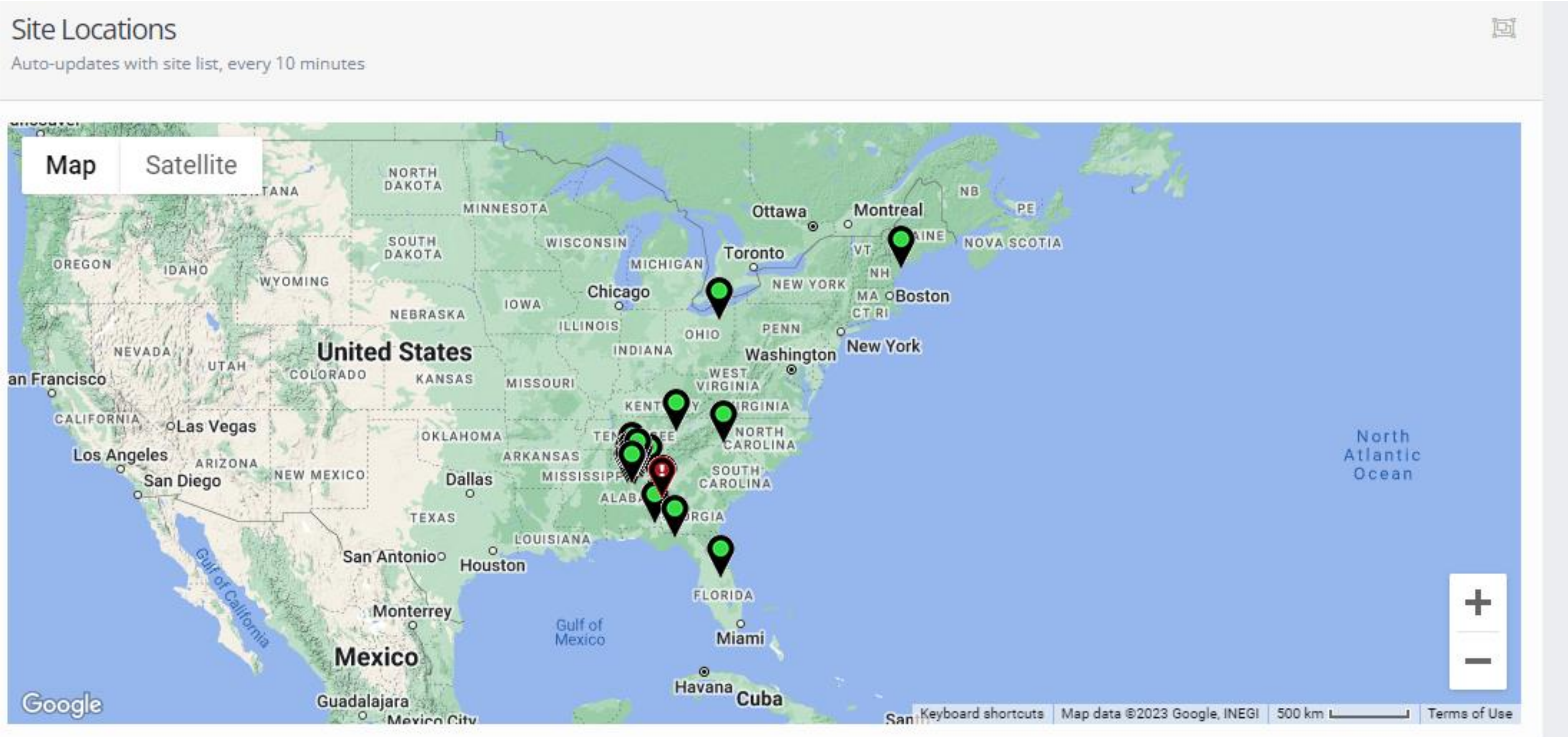
The timing of the peak flow is just as critical as the peak flow itself

THE AUTOMATED OUTLET STRUCTURE

WEBSITE CONSOLE- TOTAL LOGGED EVENTS



DEPLOYMENTS

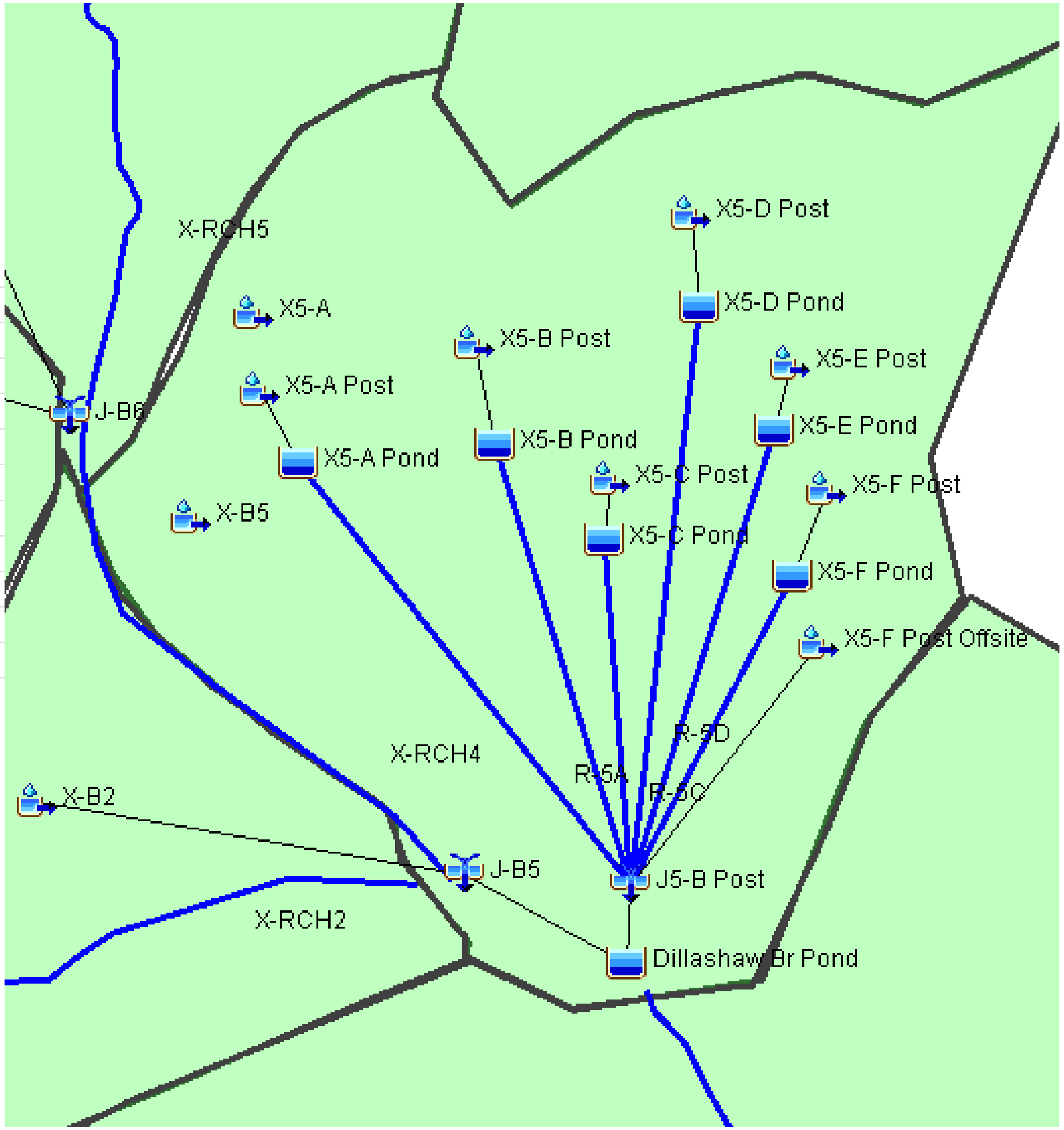


X5-F WITH AOS (New Commercial)

Summary Results

X-5A + X-5B + X-5C + X-5D + X-5E + X-5F AOS (60% Developed, 51% Imp)											
Return Period Yr	X-B5 pre	X5-F pre	X5-F post	X5-F offsite	X5-A post	X5-B post	X5-C post	X5-D post	X5-E post	X5-A+B+C+D+E+F	% Exceeded
1	54	7	7	33	5	4	7	7	3	54	0%
2	76	10	8	45	6	5	8	8	4	76	0%
5	118	16	10	68	8	7	10	10	6	118	0%
10	158	21	16	89	14	12	16	16	12	158	0%
25	218	30	28	121	26	25	28	28	24	218	0%
50	269	38	35	147	33	32	35	35	32	269	0%
100	323	41	41	175	39	38	41	41	35	323	0%
Pond Vol= 67,600 cf 33"X24" AOS MODEL # 33-24-18H											

(60% Developed, 51% Imp) @ Dillashaw					
Return Period	Pre	Peak time	Post	Peak time	% Exceede
1	74	12:38	74	12:38	0%
2	111	12:41	111	12:43	0%
5	237	12:40	237	12:41	0%
10	407	12:37	406	12:38	0%
25	726	12:34	725	12:34	0%
50	1028	12:32	1025	12:32	0%
100	1367	12:30	1362	12:31	0%

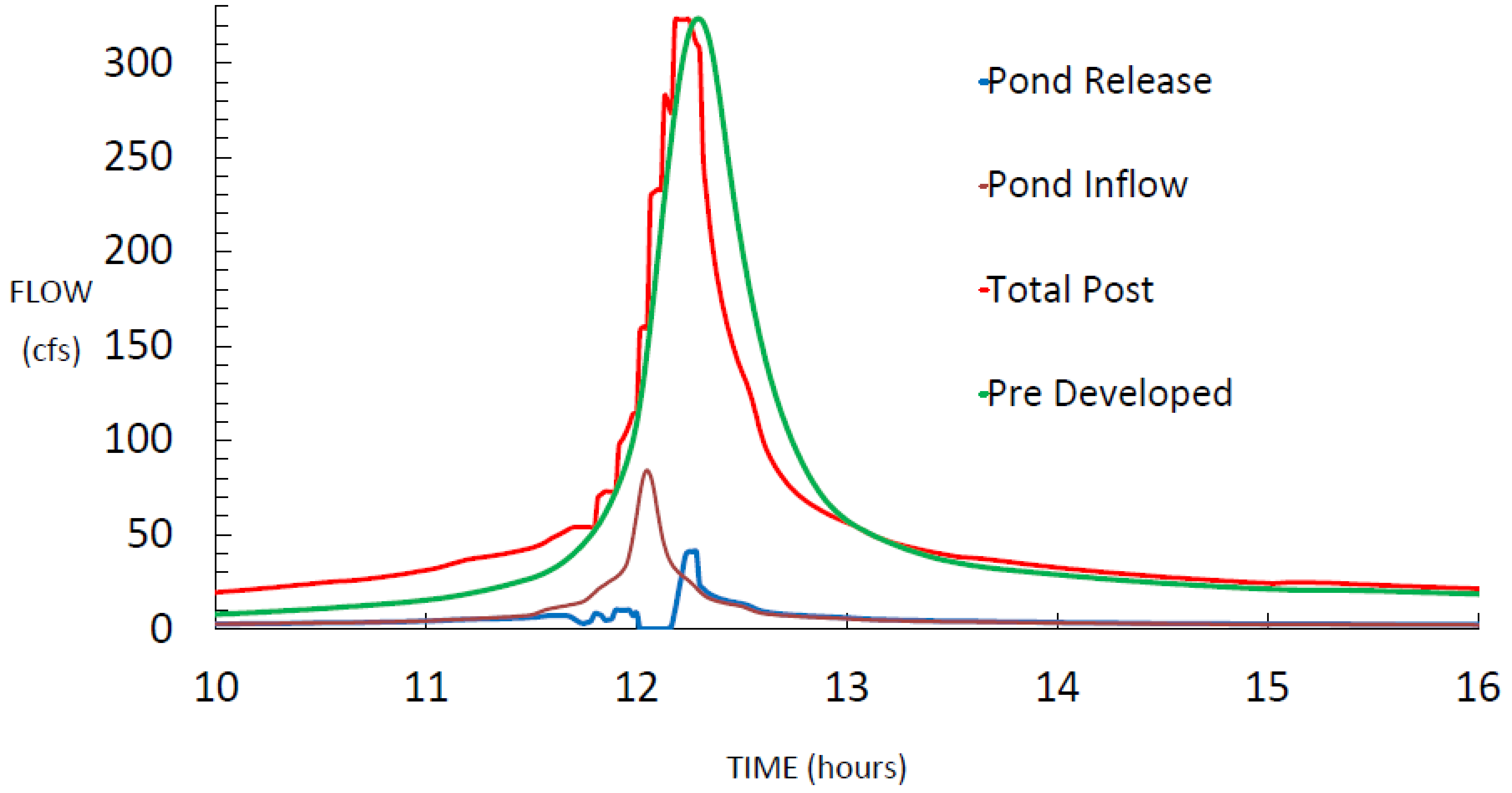


The timing of the peak flow is just as critical as the peak flow itself

X5-F WITH AOS
(New Commercial)

X5-F AOS- Pond Summary

100 Yr 24 Hr Storm					
9.15 " Precip	323.34	cfs Pre Peak	84.2	cfs Pond Inflow	
41.00 cfs Qp Pond	321.18	cfs Bypass Peak	323.00	cfs Post Total	
67662 cu. ft Pond Storage Volume					
761.94 Max Pond Elev	AOS Inv Elev =	758.38			



The timing of the peak flow is just as critical as the peak flow itself

FLOOD·CON

Jon Rasmussen

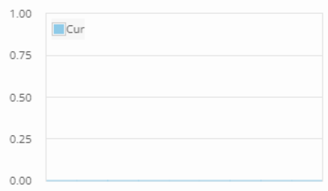
HPD Training Facility AOS

Sites / HPD Training Facility AOS Profile

Site Profile

HPD Training Facility AOS - Beast- surface pond skimmer on

Rainfall



Current:
Cumulative:

Sensors

Depth

Site Characteristics

Drainage area: 5.5 acres
Latitude: 33.38876898
Longitude: -86.79909706

Particle ID:
Status: ✔ OK
Override:
Gate 1 Set

Generate Auth Key

Event History

11/11/2021	12:48 PM	2 hours, 26 minutes	0.62 in.	1.81 ft.	Rain
11/4/2021	1:09 AM	5 hours, 29 minutes	0.1 in.	0.07 ft.	Rain
10/30/2021	2:35 PM	1 hour, 30 minutes	0.02 in.	0.02 ft.	Rain
10/29/2021	12:20 PM	8 hours, 43 minutes	0.1 in.	0.11 ft.	Rain
10/29/2021	12:20 AM	3 hours, 54 minutes	0.04 in.	0.02 ft.	Rain
10/28/2021	4:21 PM	0 minutes	0.01 in.	0 ft.	Rain
10/27/2021	11:21 PM	8 hours, 38 minutes	0.37 in.	0.32 ft.	Rain
10/21/2021	5:13 AM	4 hours, 9 minutes	1.04 in.	2.14 ft.	Rain
10/16/2021	2:02 AM	4 hours, 6 minutes	0.23 in.	0.72 ft.	Rain
10/6/2021	3:00 PM	9 hours, 55 minutes	6.69 in.	6.62 ft.	Rain
10/6/2021	7:41 AM	2 hours, 19 minutes	1.34 in.	0.1 ft.	Rain
10/5/2021	5:39 AM	16 hours, 41 minutes	2.58 in.	1.57 ft.	Rain
10/4/2021	3:02 AM	1 day, 1 hour	1.31 in.	0.39 ft.	Rain
10/3/2021	1:22 AM	7 hours	0.29 in.	0 ft.	Rain

NOAA ATLAS 14 RESULTS

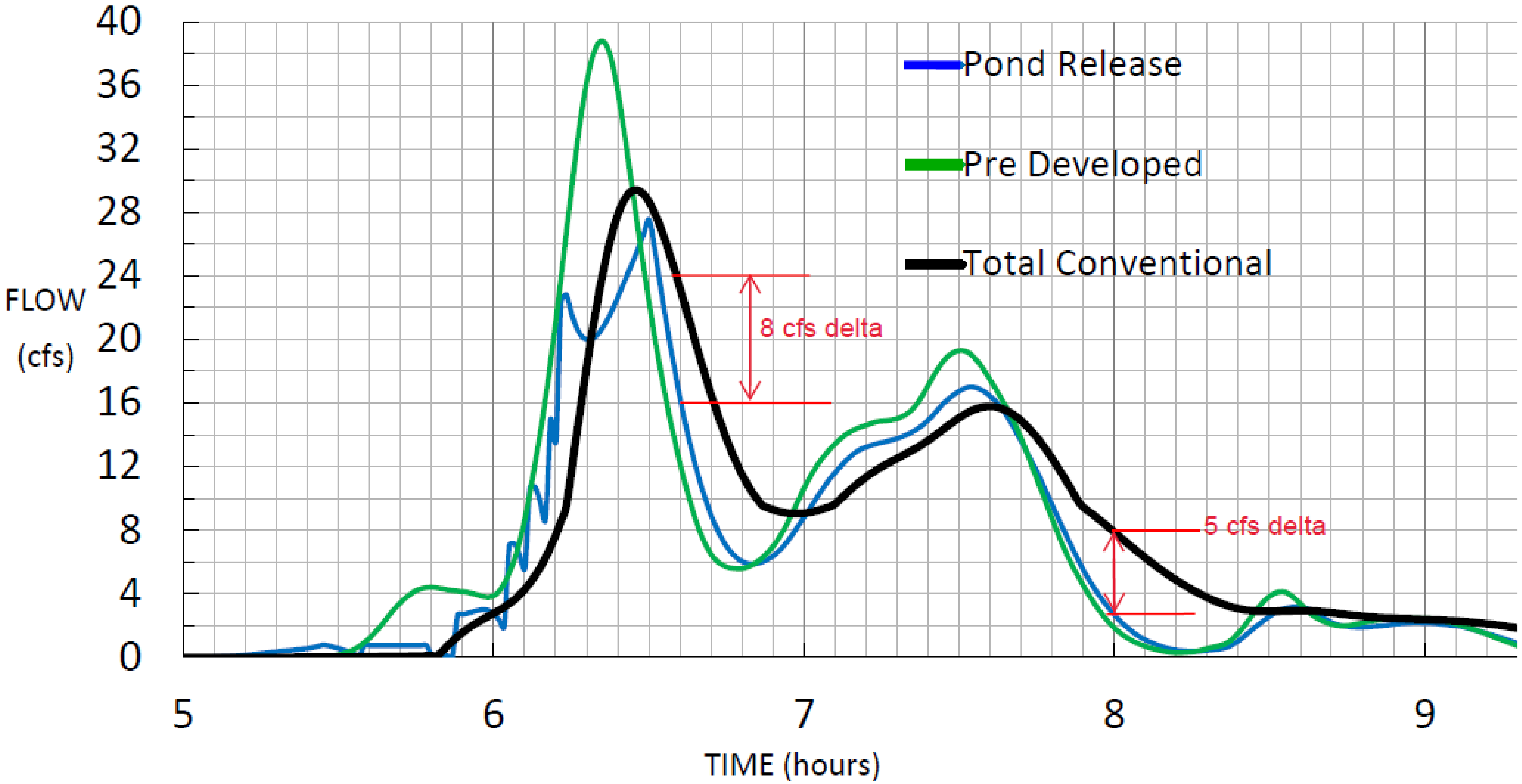
Hoover Police, Hoover, AL
10-6-21
1 Min Intervals
Flood-Con, LLC

	1yr	Y/N	2yr	Y/N	5yr	Y/N	10yr	Y/N	25yr	Y/N	50yr	Y/N	100yr	Y/N	200yr	Y/N
5	0.434	Y	0.497	Y	0.602	Y	0.691	Y	0.816	-	0.914	-	1.01	-	1.12	-
10	0.635	Y	0.728	Y	0.882	Y	1.01	Y	1.19	Y	1.34	-	1.48	-	1.63	-
15	0.775	Y	0.888	Y	1.08	Y	1.23	Y	1.46	Y	1.63	Y	1.81	-	1.99	-
30	1.14	Y	1.3	Y	1.58	Y	1.82	Y	2.15	Y	2.42	-	2.69	-	2.97	-
60	1.49	Y	1.71	Y	2.08	Y	2.4	Y	2.85	Y	3.21	Y	3.59	-	3.98	-
2	1.85	Y	2.12	Y	2.58	Y	2.97	Y	3.55	Y	4.01	Y	4.49	Y	4.99	-
3	2.08	Y	2.37	Y	2.88	Y	3.33	Y	3.99	Y	4.54	Y	5.09	Y	5.7	Y
6	2.52	Y	2.86	Y	3.46	Y	4.01	Y	4.84	Y	5.55	Y	6.3	Y	7.12	-
12	3.06	Y	3.45	Y	4.16	Y	4.84	Y	5.9	Y	6.81	-	7.81	-	8.91	-
24	3.63	Y	4.11	Y	5.02	Y	5.88	Y	7.22	-	8.38	-	9.64	-	11	-

Time		RF, in	∑ RF, in	Interval	1 min RF	5 min	10 min	15 min	30 min	60 min	2 hours	3 hours	6 hours	12 hours	24 hours
10/6/2021 14:59	0.00			0											
10/6/2021 15:00	1.00	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:01	2.00	0	0.01	2.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:02	3.00	0	0.01	3.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:03	4.00	0	0.01	4.00	0.00	0.010	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:04	5.00	0	0.01	5.00	0.00	0.010	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:05	6.00	0	0.01	6.00	0.00	0.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:06	7.00	0	0.01	7.00	0.00	0.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:07	8.00	0	0.01	8.00	0.00	0.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:08	9.00	0	0.01	9.00	0.00	0.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:09	10.00	0	0.01	10.00	0.00	0.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10/6/2021 15:10	11.00	0.01	0.02	11.00	0.01	0.010	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Conventional vs AOS

10621	Storm Event				
6.69	" Precip	38.78	cfs Pre Peak	38.3	cfs Pond Inflow
27.55	cfs Qp Pond	18.01	cfs Bypass Peak	38.00	cfs Post Total
26743	cu. ft Pond Storage Volume				
1088.57	Max Pond Elev	AOS Inv Elev =		1082.00	



CONCLUSION

TAKEAWAYS & STEPS TO "PRESERVE" OUR WATERSHEDS

A higher level of watershed management should be adopted. It could look something like this:

1. Mapping the locations of future development (just like a zoning map).
2. Map the watershed(s) to an outfall point.
3. Develop a basin model for the watershed that would represent the existing conditions.
4. Proposed developments would be inserted into the watershed model and checked for downstream pre-post flows and conveyance capacity. The regulatory would receive a copy of the plans in CAD on state plane coordinates and the project hydrology calculations. The information would be inserted into the existing model to assure the pre-development conditions are preserved.

The timing of the peak flow is just as critical as the peak flow itself

WEBINAR LINK

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FLOOD·CON