KISS PROBLEM DEFINITION & BACKGROUND ON SOLUTIONS

LCA Board of Directors

September 12, 2022

ARCADIS Design & Consultancy for natural and built assets

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1. Review storm impacts for 3, 5, and 10 year surrogate storms
2. Review selection of Hurricane Ida as our surrogate storm
3. Show the Problems
4. Define the 537 Plan Objectives
5. Review Overall Approach for Fixing Problems
6. Explain how we model I&I Reductions
7. Next steps

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Summary of Key Flows

Storm	Return Frequency	Event Rainfall (inches)	2021 Total SSO Volume (MG)	2050 Total SSO Volume (MG)*	2021 SSO Duration (days)	2050 SSO Duration (days)	2021 Number of Overflow Locations*	2050 Number of Overflow Locations*	2021 Peak Flow to KI (MGD)	2050 Peak Flow to KI (MGD)	2021 Bypass Volume (MG)	2050 Bypass Volume (MG)
Isaias	10-Year	5.0	35	59	1.1		94	136	212	256	4.0	5.6
Ivan	5-Year	4.3	31	52	1.0		60	83	175	212	3.7	5.2
Violet	5-Year	3.5	20	39	1.0		53	86	169	209	3.1	4.0
Ida	5-Year	4.2	21	38	1.0		47	79	166	202	2.6	3.8
Iris	3-Year	3.7	11	33	1.1		31	54	132	164	2.6	3.6
Kyle	3-Year	3.8	18	32	0.8		47	72	158	190	2.5	4.0

Top SSO Manholes

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Top Manholes	Isaias SSO Volume (MG)		Ivan SSO Volume (MG)		Violet SSO Volume (MG)		Ida SSO Volume (MG)		Iris SSO Volume (MG)		Kyle SSO Volume (MG)	
	2021	2050	2021	2050	2021	2050	2021	2050	2021	2050	2021	2050
X8	5.27	7.12	5.47	6.85	3.82	5.56	3.93	5.84	1.60	5.41	3.91	5.04
J_4_8	2.95	4.28	3.14	4.10	2.23	3.32	2.14	3.26	1.84	3.72	2.07	2.83
17_32C	2.71	4.11	2.95	3.59	2.34	3.17	2.41	3.41	1.27	3.61	2.01	2.57
U-58	0.54	4.84	0.44	4.07	0.13	4.63	0.25	2.86	0.15	4.01	0.31	2.17
199B	1.43	2.18	1.55	1.83	1.34	1.76	1.36	1.85	0.98	2.07	1.11	1.38
U_12_34	1.94	2.46	1.64	2.43	0.69	1.57	0.95	1.57	0.00	1.14	1.14	1.70
277E (D)	1.36	1.81	1.26	1.51	1.20	1.58	1.21	1.57	1.20	1.85	0.94	1.27
ATP001	0.00	2.06	0.00	2.35	0.00	2.79	0.00	1.69	0.00	2.51	0.00	0.87
R_1_2	1.63	2.40	1.08	1.88	0.44	0.87	0.69	1.27	0.03	0.24	0.36	0.85
C302K	0.94	1.22	0.93	1.39	0.58	0.88	0.56	0.92	0.09	0.30	0.23	0.51
X8A	0.97	1.26	0.82	1.23	0.30	0.57	0.48	0.76	0.06	0.40	0.52	0.86
4_27C	0.74	1.31	0.66	1.21	0.34	0.59	0.37	0.77	0.13	0.58	0.33	0.97
PLF174	0.84	1.07	0.78	0.98	0.39	0.54	0.52	0.70	0.13	0.27	0.54	0.75
25_1D	0.72	0.97	0.67	0.88	0.35	0.48	0.45	0.59	0.25	0.42	0.42	0.58
L-48	0.61	0.86	0.51	0.76	0.23	0.42	0.30	0.48	0.15	0.37	0.30	0.51
X_2_6	0.54	0.74	0.49	0.70	0.17	0.33	0.21	0.41	0.00	0.12	0.28	0.55
TC-9	0.38	0.49	0.43	0.55	0.27	0.37	0.28	0.35	0.20	0.26	0.25	0.37

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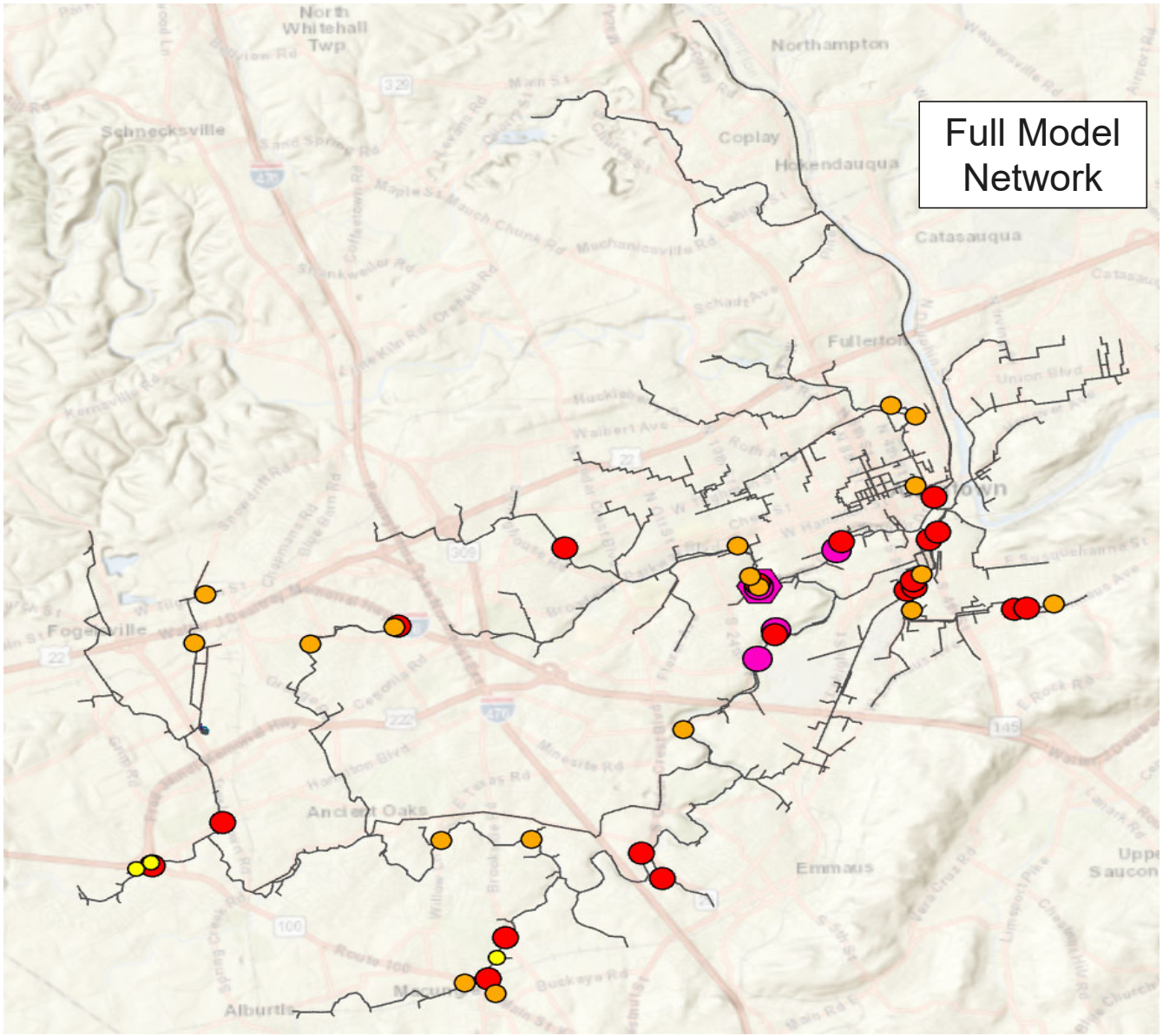
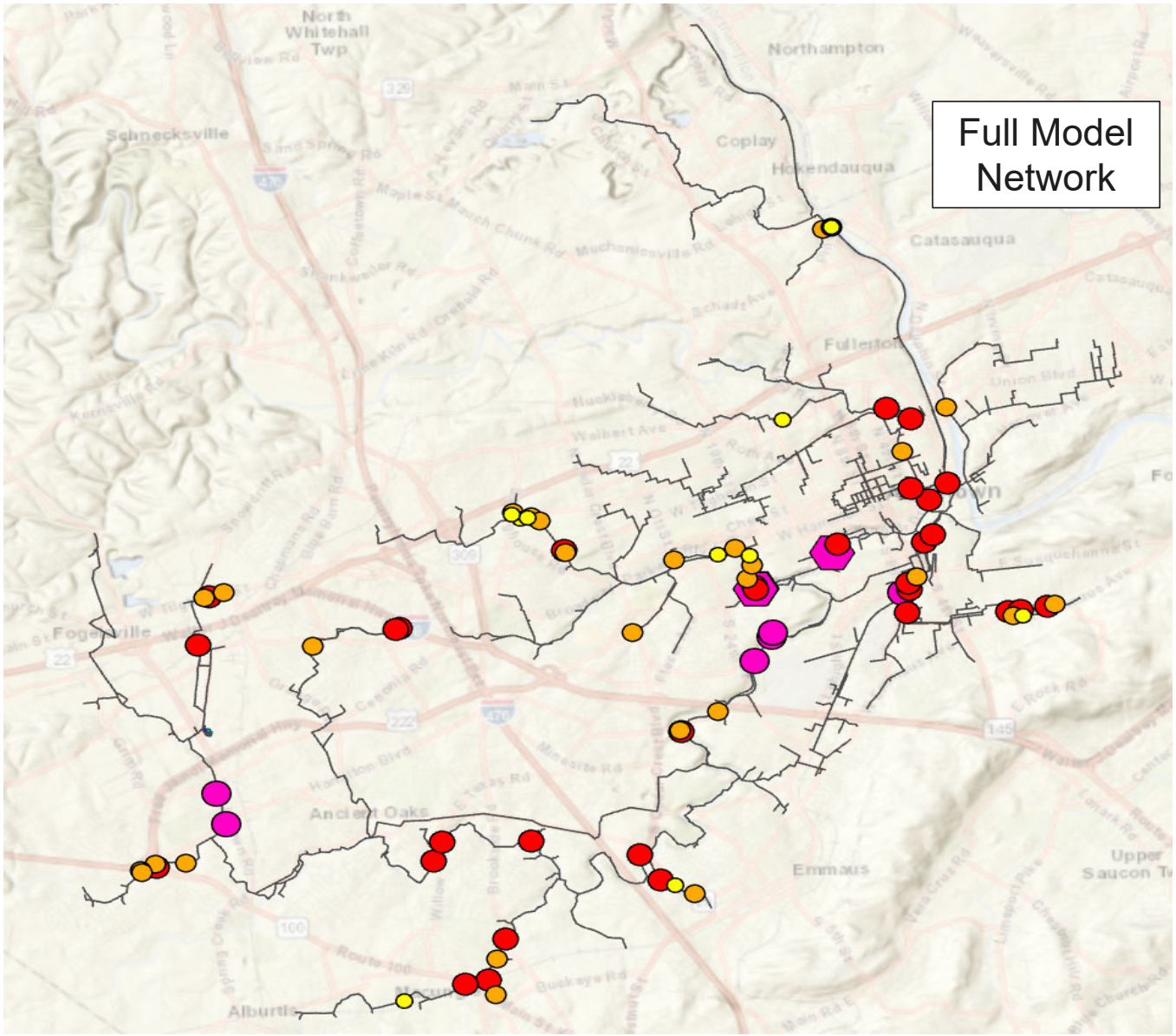
Ida

Our 5-year design event

Ida 2021


Full Model Network
North Whitehall Twp
Northampton
Schnecksville
Coplay
Catasauqua
Fullerton
Fogelsville
Ancient Oaks
Emmaus
Allurtis
Volume lost
0.000 - 0.001
0.001 - 0.010
0.010 - 0.100
0.100 - 1.000
1.000 - 3.000
3.000 - 15.000

Ida 2050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3.000 - 15.000

537 Plan Objectives

1. Eliminate all the blossoms through 2035
2. Sequence the work to build only when needed
3. Build non-modular infrastructure to 2050 flow conditions
4. Select the most life cycle cost-advantageous solution
5. Recognize long-term rehab needs for pipes and pumps and force mains
6. Minimize the number of independent Signatory projects constructed inside the City

Techniques for Fixing Problems

1. Reduce
2. Pipe
3. Pump
4. Store

In the Systems

1. Treat
2. Store

At the Plant

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“What Makes Sense” I&I Reductions

A starting point for evaluating cost and benefit of I&I removal

Meter Name	Manhole ID	Signatory	Net LF of Pipe	Net Parcel Count	Gross Parcel Count
	20_1I		64,042	1,707	1,707

Meter	
RDII Statistics Summary	
Dry Weather GPD/EDU	260
Average Dry Weather Flow, DWF (MGD)	0.443
Baseline Infiltration %	30%
Average Peaking Factor- Average Daily DWF	6.8
Average Peaking Factor- Actual Time of Day	6.5
Max Peaking Factor- Average Daily Flow	16.1
Max Peaking Factor- Actual Time of Day	13.3
Average RDII Flow Rate (MGD)	0.333
Length Normalized RDII Flow Rate (GPD/LF)	5.2

Hydrograph Conclusions:

- Clear markers of manhole F&C leakage but only during significant events
- Significant RDII with 1-2 day recovery period

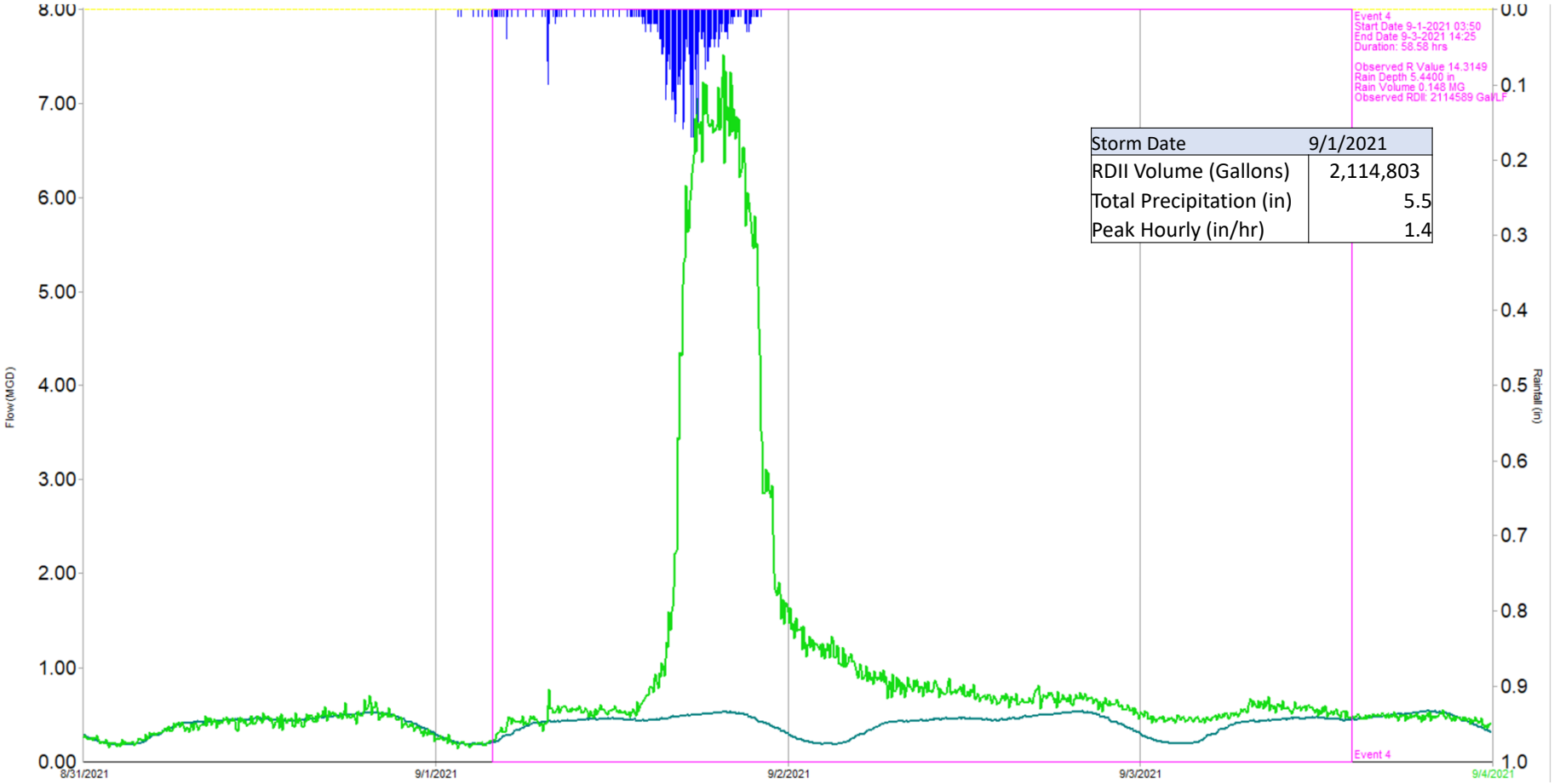
Statistics Conclusions:

- Average GPD/EDU
- Moderate Baseline Infiltration
- Very Very High Peaking Factor (Even with Peaking factor suppressed because of high BI)
- High RDII/LF

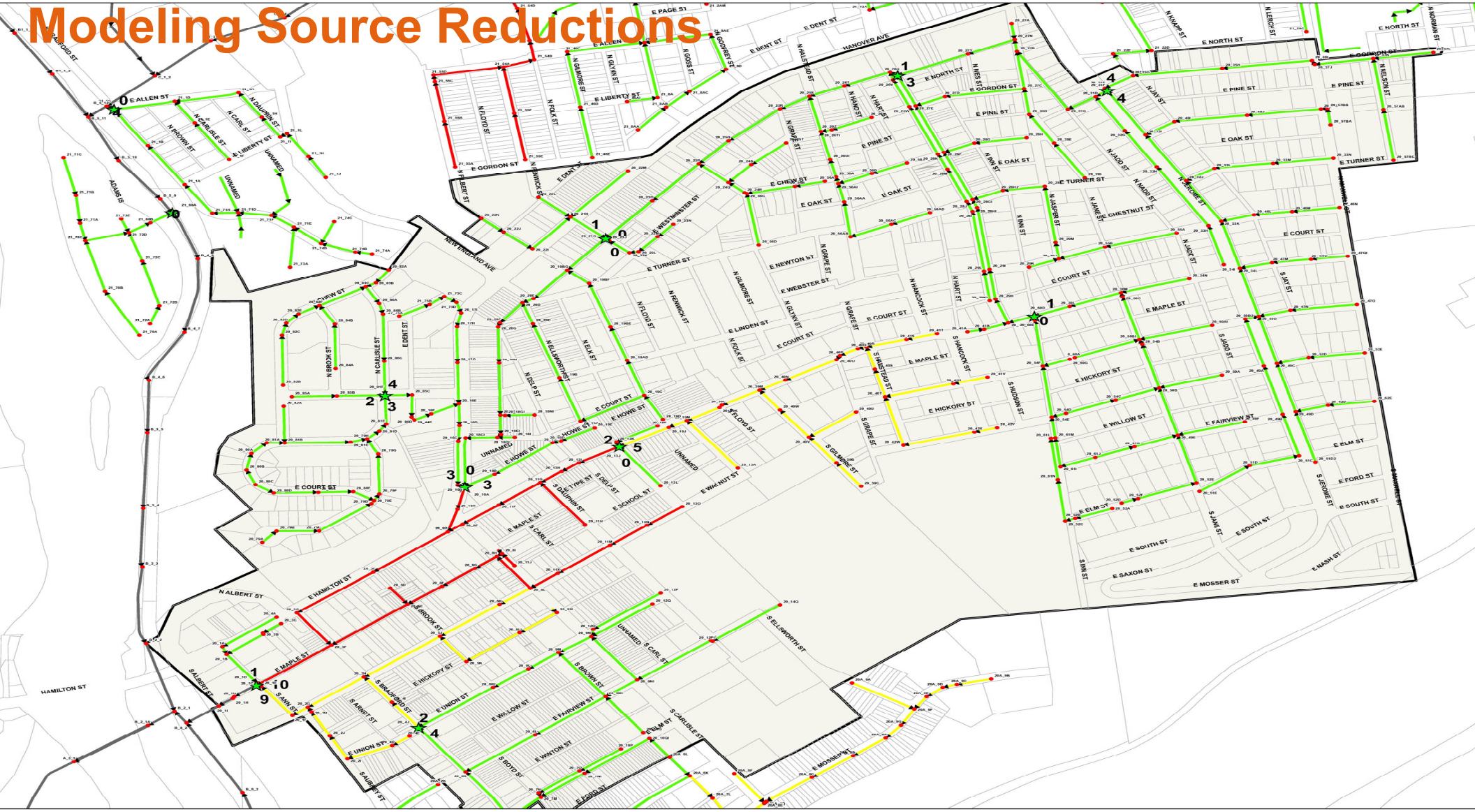
SSES Recommendations:

- Nighttime weiring – Priority 1
- Manhole frame and cover and clipped CO inspection/puddling investigation - Priority 1

Hydrograph – RG10, 9/1/21 Storm



Modeling Source Reductions



Modeling I&I Source Reductions

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	Rehab Description	Inflow - Fast Dial	RII - Medium Dial	RII and BI - Slow Dial	BI - Very Slow Dial	Notes
1	Mainline lining without tap seals or end seals	0%	5%	5%	5%	Old school CIPP
2	Mainline lining with end seals but without tap seals	0%	10%	10%	10%	Mainline alone
3	Mainline lining with end seals and grouted tap seals	5%	20%	20%	20%	CIPPL + LTC stub
4	Mainline lining with end seals and tophat tap seals	5%	15%	15%	15%	CIPPL + Tophats
5	Mainline lining with end seals and full wrap tap seals	5%	25%	25%	25%	CIPPL + Stubby
6	Mainline lining with end seals and grouted tap and riser seals	10%	35%	40%	40%	CIPPL + LTC Shorti
7	LTC Grouting on mains already lined or grouted	10%	25%	30%	30%	LTC on previously lined/grouted main
8	Shorti Liner on mains already lined	10%	40%	40%	40%	Shorti on previously lined main
9	T Liner to property line cleanout on mains already lined	20%	45%	60%	60%	Tliner on previously lined main
10	LACO and LTC on previously lined/grouted main	20%	45%	60%	60%	
11	Mainline lining with end seals and full wrap tap and riser seals	10%	50%	50%	50%	CIPPL + Shorti
12	Mainline lining with end seals and T liner to property line cleanout	20%	55%	70%	70%	CIPPL + Tliner
13	Mainline line with end seals, tap grouting, and LACO grouting	20%	55%	70%	70%	CIPPL + LTC + LACO
14	Mainline lining with end seals and T liner to property line and 4x6 replacement	25%	65%	75%	75%	CIPP + Tliner through transition
15	Mainline lining with end seals and LACO to property line and 4x6 replacement	25%	65%	75%	75%	CIPP + LTC + LACO through Transition
16	Mainline grouting	0%	10%	10%	10%	MLJ
17	Mainline grouting with LTCs	10%	35%	40%	40%	MLJ and LTC
18	Mainline, LTC, and LACO grouting	20%	65%	65%	65%	MLJ, LTC, and LACO
19	Full Mainline Replacement - No manholes, no laterals	10%	50%	60%	60%	Replace main and riser
20	Full Mainline Replacement - includes manholes but no laterals	70%	70%	60%	60%	Replace main, manholes, and riser
21	Full Mainline Replacement - Manholes, laterals to curb	70%	75%	75%	75%	Replace main, manholes, and lateral to curb
22	Full Mainline Replacement - Manholes, laterals through transition	70%	75%	80%	80%	Replace main, manholes, and lateral to transition
23	Frame, Cover, and Chimney Sealing	50%	50%	10%	0%	F&C
24	Chimney sealing alone	10%	10%	10%	0%	Chimney
25	Manhole lining	5%	5%	5%	5%	FRCL
26	Manhole grouting	5%	5%	5%	5%	Injection Grout
27	Clipped Cleanout Sealing	10%	10%	5%	0%	Cap Clean out
28	Sump pump disconnect					Sump Disconnect
29	Roof Drain disconnect					Roof Drain disconnect
30	Storm/area drain disconnect					Area Drain disconnect

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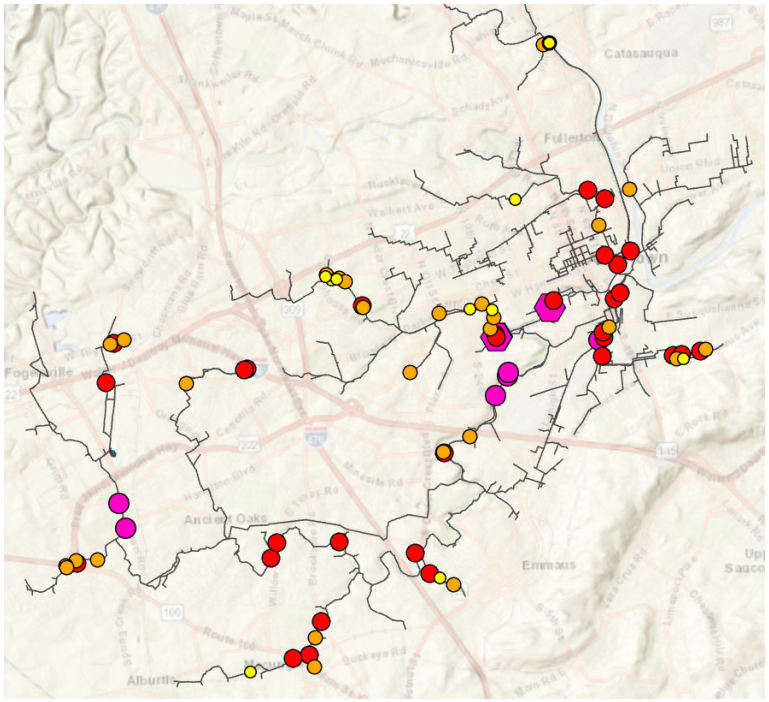
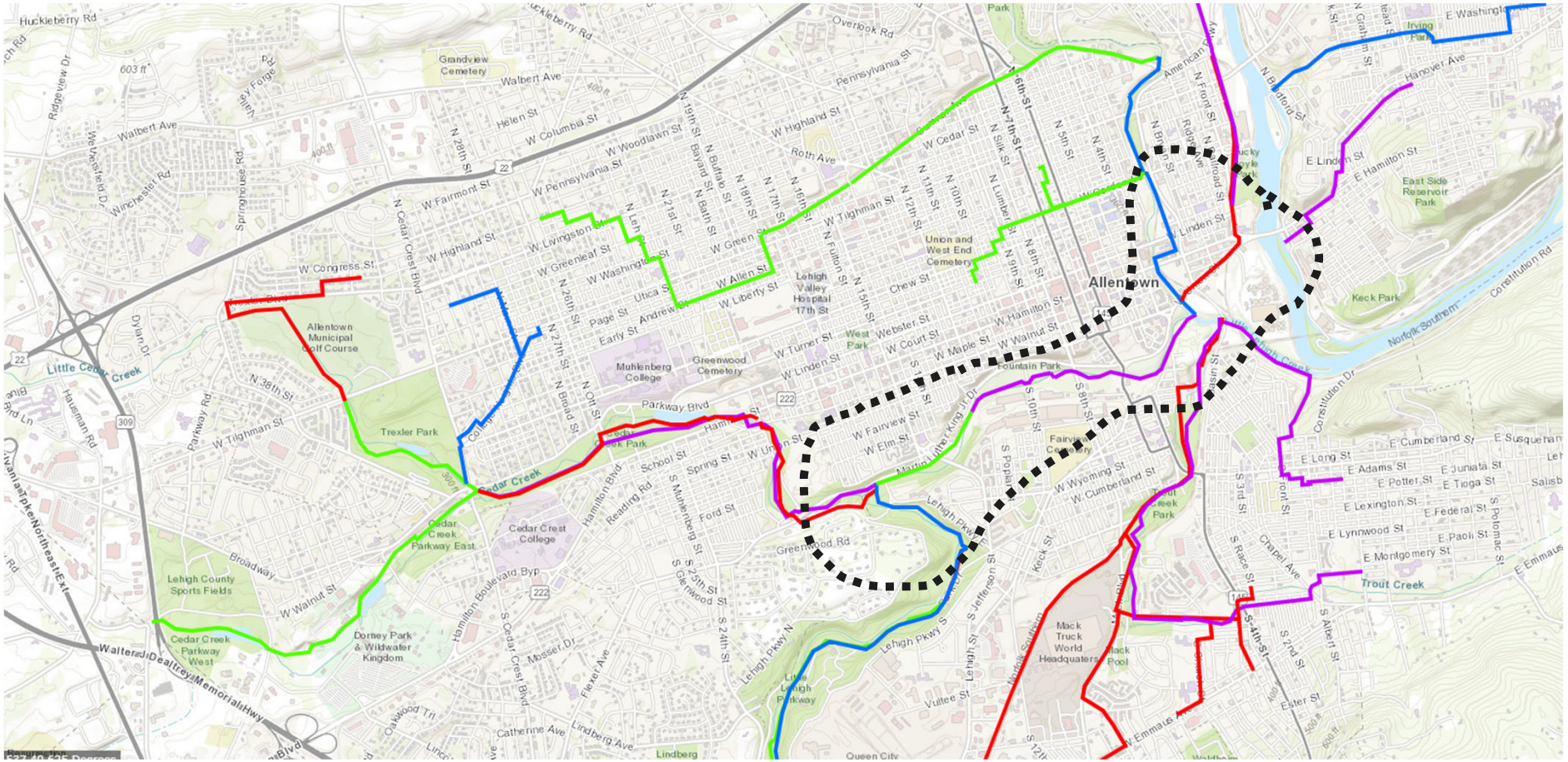
Next Steps

Common Sense I&I Reduction Blossom Impacts

- Late September
- Will show overflow locations/volumes without upsizing the system
- Will have an open system run to identify peak flow to KI WWTP if conveyance is upsized to eliminate impediments



What's not Removed must be Conveyed…….. and Treated



Operating Guidelines

- Interceptor pressurization / hydraulic grade line limits
- Pump station operation rules
- Basement protection rules
- Interceptor Parallel vs. Enlargements
- Acceptable use of City interceptors

June 2022 – August 2022

Techniques for Fixing Problems

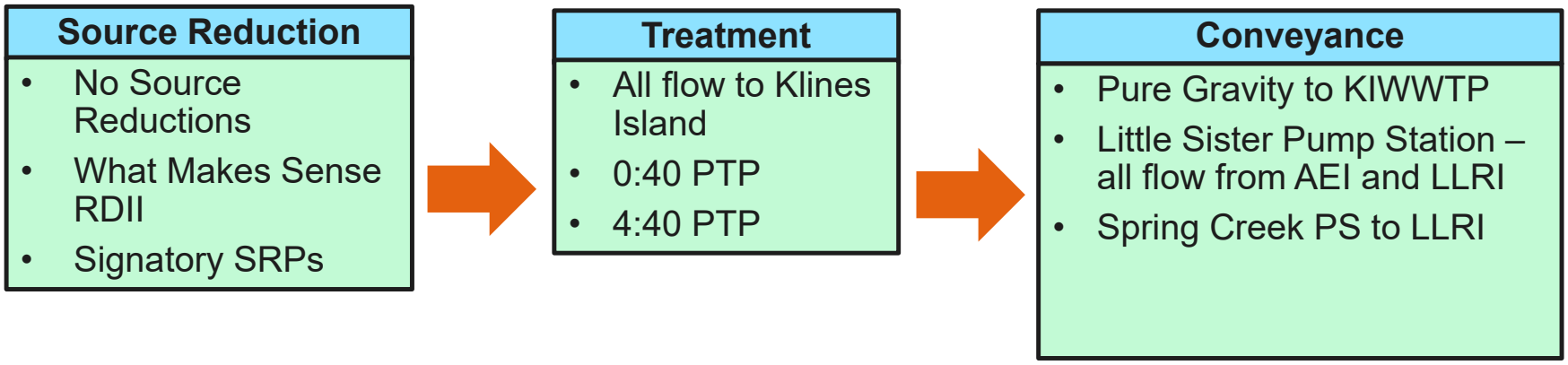
1. Reduce
2. Pipe
3. Pump
4. Store

In the Systems

1. Treat
2. Store

At the Plant

Preliminary Screening of Alternatives (PSOA)



September 2022 – April 2023

Final Alternative Analyses

- Revised/Finalized Source Reduction Plan(s)
- Revisions to operating guidelines
- Capital, O&M, Energy (carbon footprint), and Net Present Worth
- Design storm sensitivity
- Climate change considerations
- Sequence of construction

April 2023 – February 2024

Selection of Solution

- Short list of options
- Final proof of performance via 24-year simulation
- Project sequence and schedule
- Bond and finance strategy
- Institutional approaches / inter-municipal agreements
- Decision-making
- Stakeholder involvement
- Approval & submission

March 2024 – June 2025

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Discussion