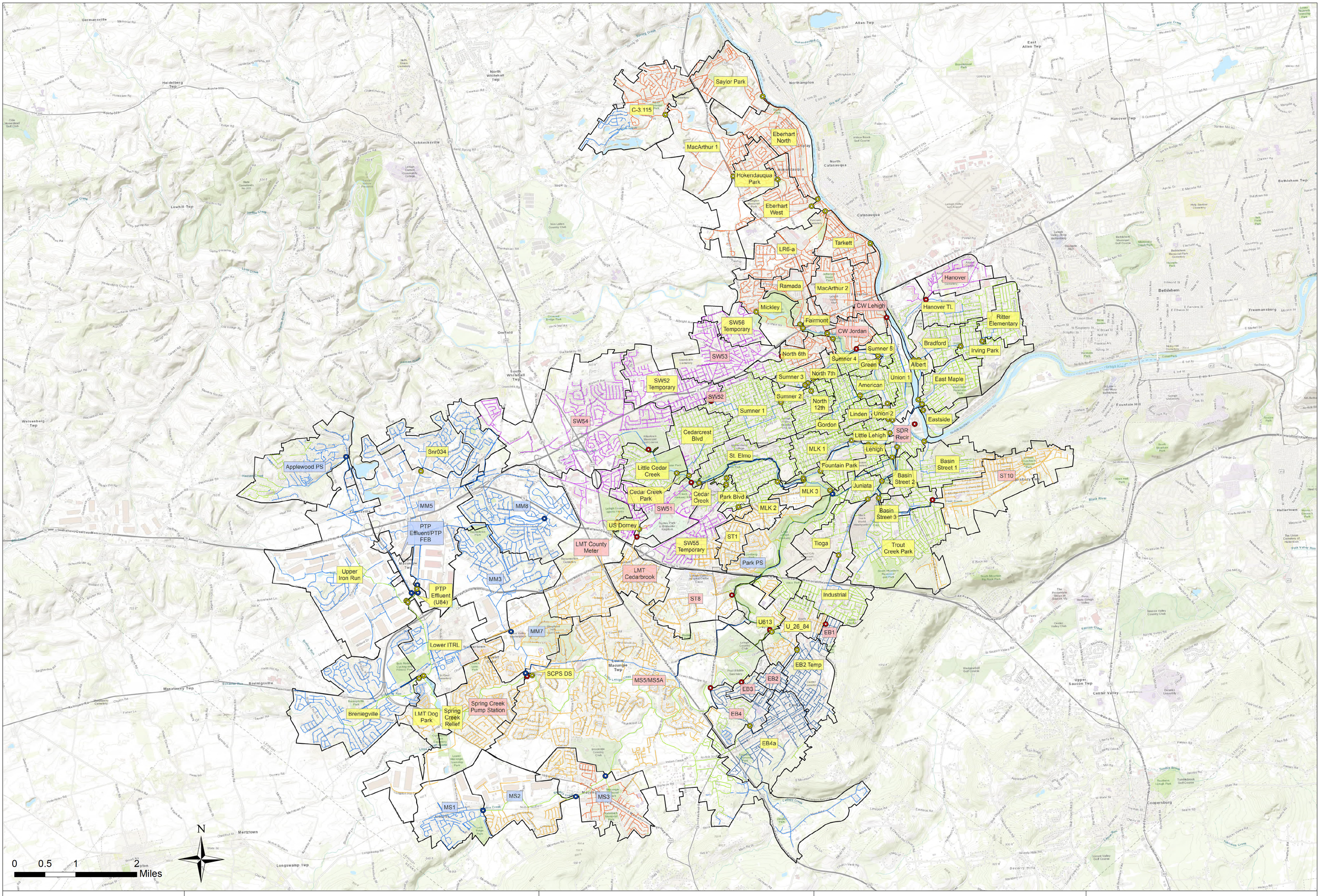
APPENDIX 7

Source Reduction Plans



Lehigh County Authority

KISS Sewer Meters (106 Total)

- Signatory Billing Meter (21)
- Signatory Non SBM (12)
- Temporary (73)

KISS Sewer Basins

KISS Basin Boundaries

LEHIGH COUNTY AUTHORITY

ACT 537 / KISS BASINS

LEHIGH COUNTY, PENNSYLVANIA

Remarks:

The differing colors for the KISS Sewer Basin layer are only used to help delineate the extent of each basin.

LEHIGH COUNTY AUTHORITY GIS

DATE: 11/20/2024 *SCALE: 1:28,500*

CREATED: AKW *CHECKED:*

Meter	Signatory	Sewershed	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)	*Baseline Infiltration % adjusted for data issues*	*BASELINE INFILTRATION RANK*	Baseline Infiltration (MGD)	*Average RDII (MGD)*	Length Normalized RDII (GPD/LF) adjusted for data issues	RDII Rank	BI and RDII Composite Rank	*Average Peaking Factor adjusted for data issues*	*INFLOW RANK*	*Modeled Peak Wet Weather Flow, WWF (MGD)*	Total Leakage Composite Rank
CEDAR CREEK RI_Net	SWT		-	15,526	70	0.07	100%	1	0.065		7	26	26	5.0	44	0.70	33
LITTLE CEDAR CREEK_Net	City	Cedar Creek	388	40,306	202	0.62	76%	2	0.471	0.391	10.1	10	10	6.0	31	2.09	16
ALBERT_Net	City	Eastside	263	9,059	45	0.12	65%	3	0.075	0.484	60	1	1	27.6	1	0.52	1
Irving Park_Net	City	Eastside	584	25,186	126	0.18	65%	4	0.114	0.133	8	21	21	6.0	29	1.05	18
Hanover TL_Net	City	Eastside	426	48,683	243	0.77	65%	5	0.502	0.208	6	32	32	5.0	41	2.11	36
North 12th	City	Sumner	1,935	48,091	240	0.34	61%	6	0.209	0.061	1.3	81	81	2.3	83	0.80	86
North 6th 2_Net	City	Sumner	443	12,585	63	0.22	60%	7	0.133	0.356	20	4	4	7.0	22	1.66	11
Trout Creek Park	City	Trout Creek	3,108	141,700	709	1.29	58%	8	0.750	0.665	4.7	47	47	4.0	59	8.37	57
SUMNER 4_Net	City	Sumner	752	19,914	100	0.13	57%	9	0.073	0.124	6.2	30	30	5.1	39	1.10	32
SUMNER 5_Net	City	Sumner	432	18,509	93	0.16	55%	10	0.090	0.341	18.4	6	6	7.7	18	0.77	8
Spring Creek PS + SCPS DS_Net	LMT		1,547	116,879	526	0.25	54%	11	0.134	1.120	9.6	12	12	4.5	55	1.85	30
BASIN STREET 2_Net	City	Trout Creek	849	39,222	196	0.68	53%	12	0.358	0.776	12	9	9	4.6	50	1.28	22
Industrial Blvd_Net	UMT		4,362	125,630	566	0.48	53%	13	0.257	0.425	3.4	56	56	2.4	82	4.51	72
EASTSIDE	City	Eastside	582	11,651	58	0.32	51%	14	0.163	0.082	9	13	13	3.0	73	1.38	47
JUNIATA_Net	City	Trout Creek	780	32,229	161	0.47	51%	15	0.240	0.273	8.5	16	16	3.4	69	1.52	46
ST10	ST		1,687	104,982	473	0.64	51%	16	0.325	1.001	8	20	20	10.0	9	8.32	12
US Dorney	SWT		1,302	55,608	250	0.28	50%	17	0.140	0.113	6	35	35	4.5	53	0.82	52
EB4	EB		367	45,240	204	0.09	48%	18	0.043	0.252	8	17	17	20.0	2	3.28	4
EB4a	EB		1,937	99,644	449	0.50	48%	19	0.240	0.428	4.3	50	50	5.4	36	7.50	48
MLK 2_Net	City+ST	Little Lehigh	462	35,573	178	0.14	47%	20	0.066	0.259	8	19	19	13.4	6	0.33	10
ST. ELMO_Net	City	Cedar Creek	1,241	83,039	415	0.42	47%	21	0.197	0.393	5	44	44	6.0	32	1.47	39
Park Blvd	City	Cedar Creek	287	15,894	79	0.14	47%	22	0.066		3	60	60	4.0	60	0.53	63
ST1 Surrogate	ST		566	32,860	148	0.15	47%	23	0.071	0.032	1	84	84	2.1	87	0.56	88
SW51	SWT		667	44,592	201	0.19	46%	24	0.087	0.300	7	25	25	8.0	16	0.44	17
BASIN STREET 1	City+ST	Trout Creek	1,365	63,689	318	0.42	46%	25	0.195	0.344	5.4	37	37	5.5	35	3.55	34
Mickley_Net	CSWA		647	29,896	135	0.19	46%	26	0.089	0.065	2.2	67	67	2.4	81	0.57	73
CW Jordan_Net	CSWA		633	49,937	225	0.14	45%	27	0.062	0.041	2.5	64	64	5.0	47	0.87	59
SW56	SWT		487	31,158	140	0.44	44%	28	0.194	0.225	7.2	24	24	5.2	38	0.87	26
Bradford	City	Eastside	627	36,318	182	0.72	44%	29	0.317	0.338	5	42	42	7.5	20	1.02	27
MacArthur 1_Net	CSWA		623	42,100	190	0.26	43%	30	0.113	0.093	2.2	68	68	2.2	86	0.75	77
Hokendauqua Park_Net	CSWA		831	56,778	256	0.28	41%	31	0.116	0.235	4.1	51	51	4.6	51	2.15	55
Eberhart West_Net	CSWA		672	46,901	211	0.13	41%	32	0.055	0.059	1.3	78	78	10.0	11	0.74	53
Tioga_Net	City	Trout Creek	227	26,815	134	0.88	40%	33	0.352	0.423	15.8	7	7	2.9	74	2.86	42
Fairmont_Net	CSWA		87	8,191	37	0.09	40%	34	0.035	0.094	8	22	22	5.0	46	0.24	31
SUMNER 2_Net	City	Sumner	329	14,633	73	0.11	40%	35	0.042	0.096	6.6	27	27	3.4	68	0.94	54
SUMNER 1_Net	City	Sumner	3,154	124,566	623	0.65	40%	36	0.259	0.329	2.6	63	63	4.1	58	2.72	64
MS2/MS2 Temp_Net	LMT		778	52,177	235	0.13	39%	37	0.050	0.247	6	31	31	12.0	8	0.71	15
GORDAN	City	Downtown	2,598	57,915	290	0.63	39%	38	0.246	0.091	1.6	74	74	2.4	80	1.92	78
SUMNER 3_Net	City	Sumner	412	23,509	118	0.26	38%	39	0.100	0.114	4.8	46	46	6.7	26	1.01	35
North 11th	City	Sumner	516	10,369	52	0.12	38%	40	0.046	0.020	1.9	73	73	2.3	84	0.23	80
Breinigsville	UMT		2,325	147,759	666	0.81	37%	41	0.298	0.293	2	72	72	2.1	88	3.27	82
Ritter Elementary	City	Eastside	1,223	59,725	299	0.33	36%	42	0.118	0.520	8.7	14	14	12.7	7	8.52	5
ST8	ST		390	40,862	184	0.25	36%	43	0.091	0.057	2	70	70	4.0	62	1.20	68
SnR034	UMT		521	52,256	235	0.12	36%	44	0.045	0.041	0.8	85	85	2.7	78	0.53	85
LITTLE LEHIGH_Net	City	Little Lehigh	251	20,278	101	0.42	35%	45	0.147	1.001	20	3	3	7.7	19	3.51	6
PPS+U613	City	Parkway	1,055	44,778	224		35%	46	-		6	33	33	5.0	43	**-3.19**	37
PPS+U613	ST		1,055	48,511	219		35%	47	-		6	34	34	5.0	45	**-3.19**	41
UNION 1_Net	City	Lehigh	832	41,990	210	0.20	35%	48	0.068	0.097	4	52	52	6.0	30	0.67	45
Eberhart North_Net	CWSA		1,535	73,780	332	0.23	35%	49	0.080	0.108	1.5	76	76	6.3	27	1.07	56
MM3 aka Phase 3_Net	UMT		945	87,238	393	0.20	34%	50	0.067	0.571	8	18	18	15.0	5	1.20	7
AMERICAN_Net	City	Downtown	1,876	49,094	245	0.24	33%	51	0.079	0.249	5.1	39	39	7.5	21	0.12	24
GREEN	City	Downtown	447	10,851	54	0.18	33%	52	0.061	0.017	1.6	75	75	2.2	85	0.48	83
U_26_84 (ST6)	ST		1,001	34,414	155	0.66	32%	53	0.212	0.352	4.5	48	48	10.0	10	1.28	21
UNION 2_Net	City	Downtown	204	11,428	57	0.08	31%	54	0.024	0.594	30	2	2	8.0	15	1.19	2
MLK 1	City	Little Lehigh	1,978	59,512	298	0.55	31%	55	0.171	0.225	3.8	54	54	3.4	70	2.39	67
LINDEN	City	Downtown	630	27,721	139	0.30	31%	56	0.094	0.068	2.5	65	65	3.2	72	1.04	71
Ramada	CSWA		646	32,089	145	0.15	31%	57	0.048	0.041	1.3	80	80	2.8	77	0.82	81
MLK 3_Net	City+ST	Little Lehigh	157	20,987	105	0.68	30%	58	0.205	0.755	20	5	5	5.8	34	**-7.52**	14
EAST MAPLE	City	Eastside	1,707	64,042	320	0.44	30%	59	0.133	0.333	5.2	38	38	6.8	25	5.87	28
MM8	UMT		1,751	150,953	680	0.37	30%	60	0.112	0.343	5	40	40	9.0	14	5.51	19
EB1	EB		253	11,444	52	0.07	30%	61	0.020	0.029	4	53	53	6.0	33	0.48	49
SW53	SWT		1,311	72,963	329	0.25	30%	62	0.074	0.135	3	61	61	4.0	61	1.57	66
MS5 Total_Net	LMT		5,070	457,785	2,062	1.17	30%	63	0.350	0.284	0.6	88	88	4.0	65	1.65	76
EB2_Net	EB		337	17,737	80	0.11	29%	64	0.031	0.284	8.5	15	15	15.1	4	2.45	3
SW52	SWT		1,025	65,448	295	0.17	29%	65	0.049	0.092	1.4	77	77	4.3	56	1.88	69
CW Lehigh_Net	CSWA		708	43,946	198	0.13	27%	66	0.034	0.426	10	11	11	9.0	13	0.15	9
Tarkett_Net	CSWA		757	47,775	215	0.10	27%	67	0.026	0.210	4.4	49	49	10.0	12	1.42	25
LR6-a	CSWA		745	53,472	241	0.24	27%	68	0.066	0.070	1.3	79	79	2.9	76	1.15	79
Saylor Park	CSWA		701	40,493	182	0.12	27%	69	0.032	0.051	1.2	83	83	3.8	67	0.72	75
SW55	SWT		800	71,764	323	0.27	26%	70	0.070	0.191	2.7	62	62	4.3	57	2.06	62
Upper Iron Run_Net	UMT		9,513	95,666	431	0.19	25%	71	0.047	0.625	6.5	28	28	4.5	54	3.18	44
SW54	SWT		2,418	168,942	761	0.72	25%	72	0.180	1.046	6.2	29	29	16.0	3	6.65	13
FOUNTAIN PARK_Net	City	Little Lehigh	426	30,066	150	0.60	25%	73	0.150		5	45	45	5.0	42	1.48	51
MS3_Net	Macungie		1,311	91,552	412	0.35	24%	74	0.084	0.138	3	57	57	7.0	24	3.14	43
MM7 aka Mill Creek_Net	UMT		1,375	61,397	277	0.31	24%	75	0.074	0.156	3	59	59	4.9	48	2.10	58
EB2a	EB		1,310	68,562	309	0.37	21%	76	0.077	0.246	3.6	55	55	4.0	63	2.17	61
EB3	EB		227	15,447	70	0.05	20%	77	0.010	0.051	5	41	41	8.0	17	0.61	20
LMT Dog Park + Spring Creek Relief	LMT		503	31,619	142		20%	78	-		2	71	71	4.0	64	0.32	70
INDUSTRIAL	City	Trout Creek	825	55,875	279	0.33	19%	79	0.062	0.312	5.6	36	36	5.1	40	3.71	38
LMT County	LMT		713	59,949	270	0.21	19%	80	0.040	0.185	3	58	58	6.2	28	3.74	50
North 6th_Net	CSWA		966	47,742	215	0.26	18%	81	0.048	0.746	15.6	8	8	3.4	71	0.80	40
MacArthur 2	CSWA		864	40,047	180	0.18	18%	82	0.032	0.087	2.2	66	66	4.7	49	1.55	60
Cedarcrest Blvd	City	Cedar Creek	1,095	75,410	377	0.22	18%	83	0.040	0.158	2.1	69	69	4.5	52	1.78	65
C-3.115	CSWA		1,454	83,665	377	0.19	18%	84	0.033	0.059	0.7	86	86	2.9	75	1.11	84
LMT Cedarbrook	LMT		663	48,183	217	0.11	18%	85	0.020	0.034	0.7	87	87	2.5	79	0.55	87
Hanover	HT		237	20,384	92	0.07	17%	86	0.011	0.025	1.2	82	82	3.8	66	0.24	74
LEHIGH	City	Little Lehigh	353	8,685	43	0.08	13%	87	0.010	0.069	7.9	23	23	5.2	37	0.30	23
MS1	Alburtis		995	48,046	216	0.17	13%	88	0.022	0.179	5	43	43	7.0	23	1.61	29

City Of Allentown

Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Sewershed	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)	*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
LITTLE CEDAR CREEK_Net	City	Cedar Creek	388	40,306	202	0.62	76%	6.0
ST. ELMO_Net	City	Cedar Creek	1,241	83,039	415	0.42	47%	6.0
Park Blvd	City	Cedar Creek	287	15,894	79	0.14	47%	4.0
Cedarcrest Blvd	City	Cedar Creek	1,095	75,410	377	0.22	18%	4.5
GORDAN	City	Downtown	2,598	57,915	290	0.63	39%	2.4
AMERICAN_Net	City	Downtown	1,876	49,094	245	0.24	33%	7.5
GREEN	City	Downtown	447	10,851	54	0.18	33%	2.2
UNION 2_Net	City	Downtown	204	11,428	57	0.08	31%	8.0
LINDEN	City	Downtown	630	27,721	139	0.30	31%	3.2
ALBERT_Net	City	Eastside	263	9,059	45	0.12	65%	27.6
Irving Park_Net	City	Eastside	584	25,186	126	0.18	65%	6.0
Hanover TL_Net	City	Eastside	426	48,683	243	0.77	65%	5.0
EASTSIDE	City	Eastside	582	11,651	58	0.32	51%	3.0
Bradford	City	Eastside	627	36,318	182	0.72	44%	7.5
Ritter Elementary	City	Eastside	1,223	59,725	299	0.33	36%	12.7
EAST MAPLE	City	Eastside	1,707	64,042	320	0.44	30%	6.8
UNION 1_Net	City	Lehigh	832	41,990	210	0.20	35%	6.0
MLK 2_Net	City+ST	Little Lehigh	462	35,573	178	0.14	47%	13.4
LITTLE LEHIGH_Net	City	Little Lehigh	251	20,278	101	0.42	35%	7.7
MLK 1	City	Little Lehigh	1,978	59,512	298	0.55	31%	3.4
MLK 3_Net	City+ST	Little Lehigh	157	20,987	105	0.68	30%	5.8
FOUNTAIN PARK_Net	City	Little Lehigh	426	30,066	150	0.60	25%	5.0
LEHIGH	City	Little Lehigh	353	8,685	43	0.08	13%	5.2
PPS+U613	City	Parkway	1,055	44,778	224		35%	5.0
North 12th	City	Sumner	1,935	48,091	240	0.34	61%	2.3
North 6th 2_Net	City	Sumner	443	12,585	63	0.22	60%	7.0
SUMNER 4_Net	City	Sumner	752	19,914	100	0.13	57%	5.1
SUMNER 5_Net	City	Sumner	432	18,509	93	0.16	55%	7.7
SUMNER 2_Net	City	Sumner	329	14,633	73	0.11	40%	3.4
SUMNER 1_Net	City	Sumner	3,154	124,566	623	0.65	40%	4.1
SUMNER 3_Net	City	Sumner	412	23,509	118	0.26	38%	6.7
North 11th	City	Sumner	516	10,369	52	0.12	38%	2.3
Trout Creek Park	City	Trout Creek	3,108	141,700	709	1.29	58%	4.0
BASIN STREET 2_Net	City	Trout Creek	849	39,222	196	0.68	53%	4.6
JUNIATA_Net	City	Trout Creek	780	32,229	161	0.47	51%	3.4
BASIN STREET 1	City+ST	Trout Creek	1,365	63,689	318	0.42	46%	5.5
Tioga_Net	City	Trout Creek	227	26,815	134	0.88	40%	2.9
INDUSTRIAL	City	Trout Creek	825	55,875	279	0.33	19%	5.1

1. System History and Overview

The City of Allentown's (City's) wastewater collection system (collection system) and its Kline's Island Wastewater Treatment Plant (KIWWTP) have been in operation since 1929 and originally served only residents of the City. Beginning in the late 1950's and continuing through the late 1960's, the City entered into service agreements with surrounding municipalities and authorities for conveyance of wastewater through City-owned trunk sewers and for treatment of wastewater at the KIWWTP. The first signatory agreement was executed with the Borough of Emmaus in 1959. Signatory agreements were subsequently executed with Coplay-Whitehall Sewer Authority, Salisbury Township and South Whitehall Township in 1965, and in 1969 a signatory agreement was executed with the Lehigh County Authority. Due to the need to treat flow from the signatories together with growth within the City, the KIWWTP was expanded to an average flow capacity of 28.5 mgd in 1968 and to 40 mgd in 1978, which is the current average flow capacity of the KIWWTP. The corresponding peak flow capacity of the KIWWTP is 87 mgd.

At the time the original signatory agreements were executed, wastewater was conveyed to the KIWWTP by a total of seven (7) City-owned trunk sewers:

- Lehigh River Trunk Sewer
- Front Street-Union Street Trunk Sewer
- Jordon Creek Trunk Sewer
- Little Lehigh Creek Trunk Sewer
- Emmaus Trunk Sewer
- Trout Creek Trunk Sewer
- District No. 29 Trunk Sewer

As a condition of the construction grant obtained in the mid-1970's to expand the KIWWTP's capacity from 28.5 mgd to 40 mgd, the City and its signatories were required to perform Sewer System Evaluation Surveys (SSESs). As part of the City's SSES performed during that period, the hydraulic conveyance capacity of each trunk sewer was calculated and compared to the estimated capacity required for the year 2025. Based on this analysis, the sewer signatories subsequently constructed the following relief sewers which are owned and operated by the signatories:

- LCA Little Lehigh Creek Relief Sewer
- South Whitehall Relief Sewer
- Salisbury Relief Sewer
- Coplay-Whitehall Lehigh Sewer 1
- Coplay-Whitehall Jordan Sewer

The City's collection system currently consists of: (1) 285 miles of City-owned sewer pipe, of which 242 miles is 4 to 10-inches in diameter, 22 miles is 12 to 21-inches in diameter and 21 miles is 24-inches and larger in diameter; (2) 7,199 City-owned manholes and 382 privately-owned manholes; and (3) 33,359 connections to City-owned sewers and 18 connections to privately owned sanitary sewers. The table below presents a detailed breakdown of sanitary sewers by diameter and length.

Sewer Diameter (inches)	Sewer Length (feet)	Sewer Diameter (inches)	Sewer Length (feet)
4	10	21	11,566
6	1,745	24	53,805
8	1,155,844	27	10,026
10	117,748	30	9,891
12	34,165	33	2,017
14	1,517	36	28,613
15	31,579	39	1.922
16	703	42	4,977
18	34,613	54	245
20	2,577	60	936

Sewer pipe type includes reinforced concrete, vitrified clay, Polyvinyl Chloride (schedule 40, SDR 26 and SDR 35), cast iron, ductile iron, terra cotta, and reinforced poured in place concrete with tile floor.

2. Inflow and Infiltration - System, Characterization and Rehabilitation work to Date

Beginning in August 2018 and continuing through July 2019, Pennsylvania received the most annual rainfall since this data began collecting in 1895. The Lehigh Valley experienced 67 inches of precipitation in 2018 and 61 inches in 2019, well over the annual average of 45 inches. During the 12-month period of August 2018 through July 2019, the region received 80 inches of precipitation. This prolonged period of well-above-average precipitation saturated the ground surrounding the collection system piping of all service areas. The groundwater levels were 20-25 feet above normal during and after that annual period.

As would be expected, the precipitation and resulting saturated ground conditions dramatically increased rain derived inflow and infiltration (RDII) and base flow infiltration into the sewers. Flows to the Kline's Island Wastewater Treatment Plant (KIWWTP) increased from the normal 2017 flows of approximately 32 million gallons per day (MGD) to over 40 MGD during periods in 2019. The annual average daily flow for 2019 was 37.64 MGD. During this period, KIWWTP met all treatment-related permit requirements. However, KIWWTP's Hydraulic Design Capacity of 40 MGD was exceeded for three consecutive months in 2018/2019, triggering a Chapter 94 violation and subsequent requirements. Since that time, the Hydraulic Design Capacity of KIWWTP has increased to 44.6 MGD.

As part of the completed Flow Characterization Study (2021 FCS), data was collected from approximately 100 meters collected from March 2021 through November 2021. Approximately 30 rain gauges were also located strategically throughout the system to collect rainfall data. Four extensive rounds of quality assurance and quality control were performed on the data collected. Identified problems were corrected prior to loading data into the model software. The 2021 FCS yielded very high-quality data resulting from the data collection timespan capturing three significant rainfall events- Tropical Storms Fred, Henri, and Ida. This allowed for an accurate characterization of the baseline infiltration, rainfall derived infiltration, and inflow at the basin and subbasin level and also validated the digital model with flow meter data.

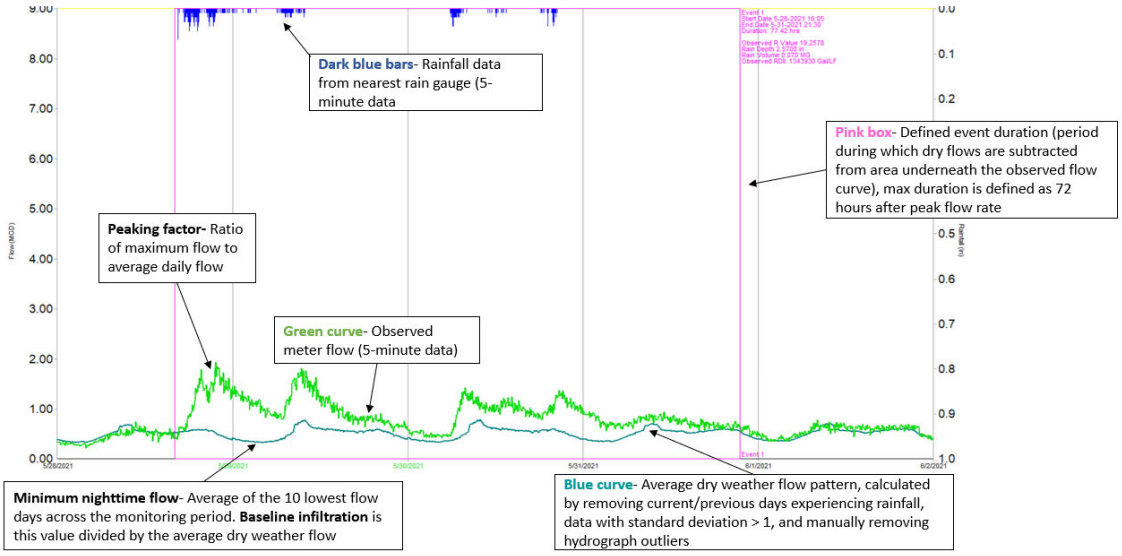
The 2021 FCS identified two key issues within the system:

Hydrograph analysis -> Inflow was primarily the result of leakage through public side manholes.

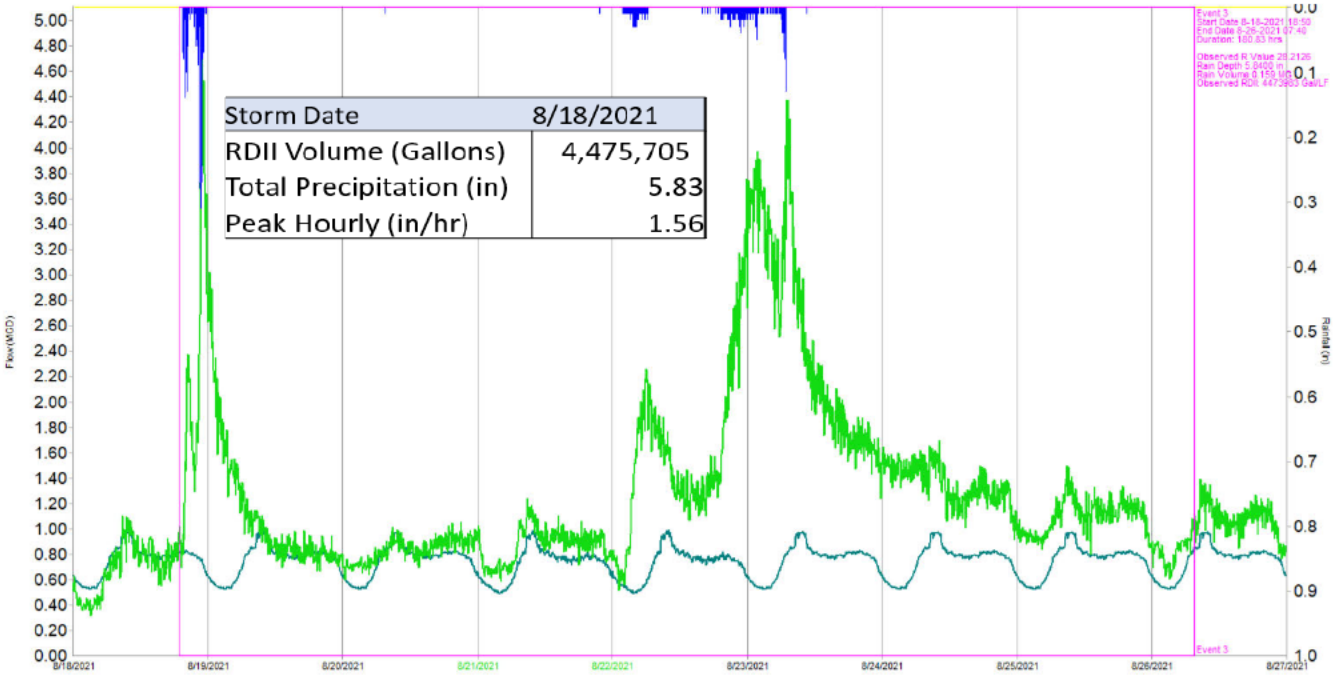
Statistical data analysis -> Baseline Infiltration was widespread throughout the system and the principal contributor of infiltration.

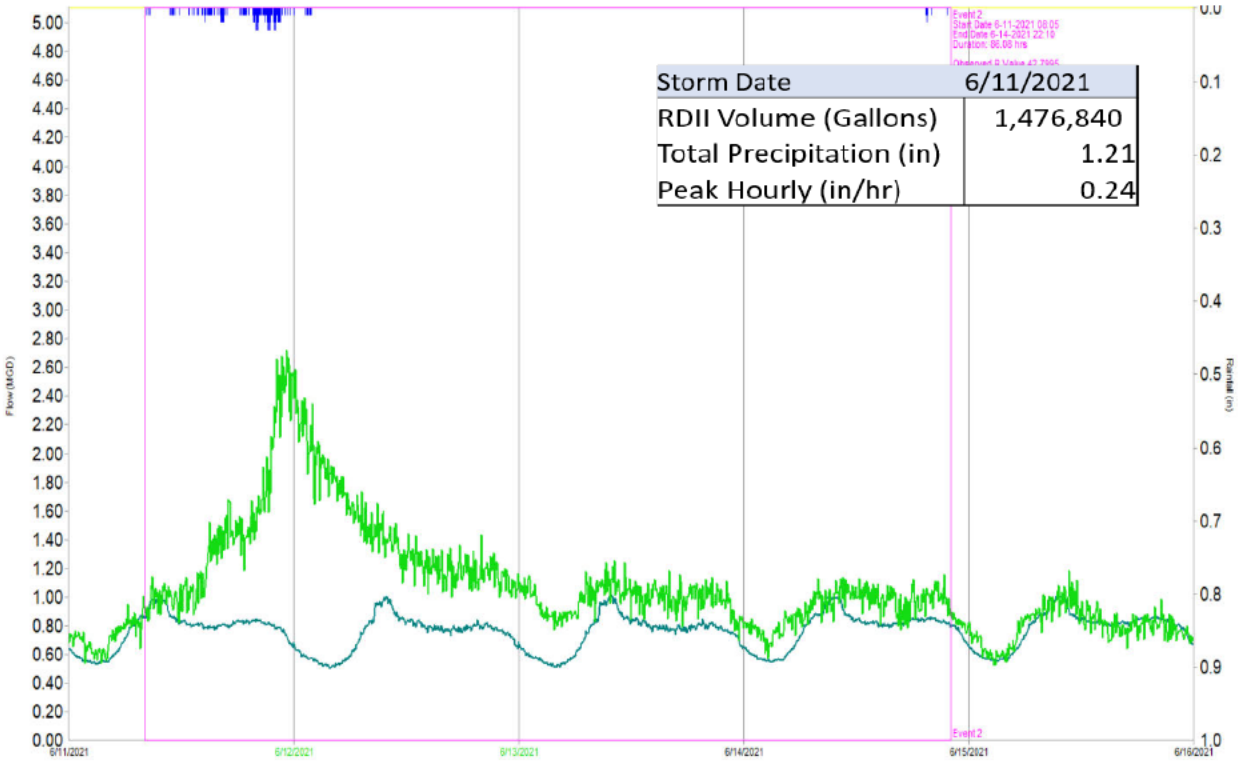
Explanation of hydrograph features

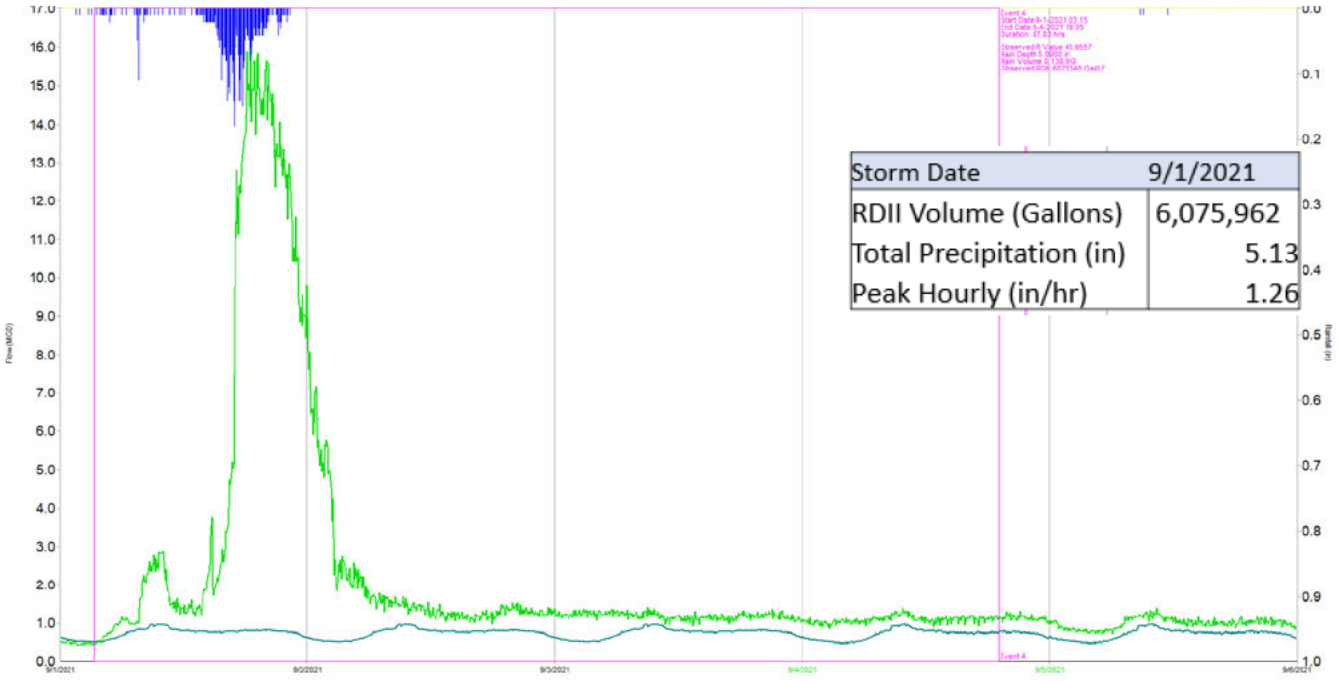
(Calculated using EPA SSOAP toolbox)



See below Typical Hydrographs from the 2022 RDII Analysis


Storm Date 8/18/2021
RDII Volume (Gallons) 4,475,705
Total Precipitation (in) 5.83
Peak Hourly (in/hr) 1.56
Flow(MGD)
Rainfall (in)
8/18/2021
8/19/2021
8/20/2021
8/21/2021
8/22/2021
8/23/2021
8/24/2021
8/25/2021
8/26/2021
8/27/2021


Storm Date 6/11/2021
RDII Volume (Gallons) 1,476,840
Total Precipitation (in) 1.21
Peak Hourly (in/hr) 0.24
Flow(MGD)
Rainfall (in)
6/11/2021
6/12/2021
6/13/2021
6/14/2021
6/15/2021
6/16/2021



In parallel with the model development and calibration, a RDII analysis was prepared and delivered to the City of Allentown. This RDII identified various issues within the City's eight sewer sheds, with Trout Creek and Eastside as the "top 2" areas of concern. Data from these two sewer sheds depict elevated levels of baseline infiltration with high peaking factors.

In 2019 The City of Allentown (COA) prepared a planned 5-year Infiltration and Inflow (I&I) source reduction plan (SRP). From 2020-2023, the City implemented the plan and completed the work listed below:

Project Year	Total Sewer Main Rehabilitated (LF)	Estimated I&I Reduction (MGD)
1	2,320	0.38
2	14,509	0.097
3	16,077	0.1075
4	6,936	0.46
Total	**39,842**	**0.63**

Based on the 2021 FCS and supplemental nighttime weiring analysis of targeted areas, the COA prepared a 10-year SRP in 2022, attached. The SRP Year 1 design was completed in 2023 and the program got underway in 2024. The work included rehabilitation of existing sewer main lines, including cleaning, inspecting, and cured-in-place pipe lining of approximately 22,000 linear feet of sewer mains. The 10-year SRP provides the basis for further Sanitary Sewer Evaluation Surveys (SSES) which will reduce costs and be more effective. This is discussed more thoroughly in the "Sewer Rehabilitation" section below.

Also in 2024, inspection of the City's interceptor sewer lines began. Four major interceptors on the east side of the City were inspected via multi-sensor inspection (MSI) unit; 1) Albert Street Trunkline, 2) Hanover Avenue Trunkline, 3) Hanover Trunkline, 4) Eastside Interceptor. The "siphon" under the Lehigh River was also inspected with the MSI unit. Approximately 7 miles of interceptors were inspected in 2024. Work planned for 2025 includes MSI unit inspections of the Lehigh Interceptor, totalling another approximately 1.3 miles of interceptor sewers.

3. Corrective Plan

Utilizing a comprehensive manhole inspection and piloting program and sanitary sewer evaluation studies, the City plans to create a defensible, cost effective and successful I&I program with data confirmed reductions. The City's specific approaches to both manhole and sewer rehabilitation are described further in this section. The initial inspections, assessments, and evaluations are intended to inform work in remaining manholes and basins.

Proposed Manhole Inspection/Repair Program

Lehigh County Authority (LCA) as the system operator under the Concession Lease with the City expects to address the most critical manholes (~3,532) in the first five years (2023-2027):

Stream Based MH	Peaking Factor >6 Basin MHs	Peaking Factor >5 Basin MHs	Peaking Factor <5 but >4 Sheet Flow MHs	Total
			56	56
535	1,596	599	802	3,532
		1		1
	17			17
	122	54		176

The remaining City manholes (~3700) will be addressed in the next six years (2028-2033). Year 1 of the program (2023) served as the first year for manhole inspections. Year 2 (2024) will serve as the second year for manhole inspections. Year 2 will also include repair work identified during Year 1. This pattern will repeat until the final years of the program as Year 10 inspections will occur in 2032 and Year 10 rehab work will occur in 2033.

The basis for identifying the most critical manholes to address first is found in the Arcadis “Benchmark SRP” spreadsheets (Arcadis is the professional engineering consultant for LCA and the City). These spreadsheets were developed in the second half of 2022 during the Capacity Problem Definition phase of Act 537. A summary of the basis is shown in the chart above.

Approximately 2,000 manholes out of the 2,700 authorized have been inspected as of December 2024. This first planned cycle is a pilot project that will utilize and evaluate various manhole rehabilitation methods. The detailed design for a pilot program for the 2024 manhole rehabilitation was completed in September 2024. A total of 256 manholes have been identified for this cycle from the inspection program. Work will take place throughout the City to cover as many manhole situations as possible. The performance of the rehabilitation/repair technique work will be evaluated in the future to determine which methods perform the best in various situations. This will help identify methods for future rehabilitation and continually improve the process. Construction is underway. This work will serve as the basis for the remainder of the project:

- Standardize dish sealant method to be applied
- Develop inspection SOP
- Determine required external vs. internal resources

Arcadis will execute the Year 1 Inspection work and develop the scope of work for the Year 1 Rehab work. Thereafter, with the benefit of Year 1 experience, LCA will determine if inspection, rehab scoping, bidding, and construction phases of this program will be conducted by a consultant or internal staff.

Phasing & Budgeting

LCA will annually budget roughly $1M from 2024 through 2032 for this program. This assumes roughly $250K in inspection work and $750K for manhole repair work. Budgets for 2023 (Year 1 Inspection only) and 2033

(Year 10 Rehab only) will be adjusted accordingly.

The list below summarizes the proposed program schedule:

- 2023 = Year 1 Inspection
- 2024 = Year 1 Rehab + Year 2 Inspections
- 2025 = Year 2 Rehab + Year 3 Inspections
- 2026 = Year 3 Rehab + Year 4 Inspections
- 2027 = Year 4 Rehab + Year 5 Inspections
- 2028 = Year 5 Rehab + Year 6 Inspections
- 2029 = Year 6 Rehab + Year 7 Inspections
- 2030 = Year 7 Rehab + Year 8 Inspections
- 2031 = Year 8 Rehab + Year 9 Inspections
- 2032 = Year 9 Rehab + Year 10 Inspections
- 2033 = Year 10 Rehab = Manhole inspection/repair program completed

In 2034-2035 = any of the ~7,200 not sealed to date will be sealed (the concept of allowing the system to "breathe" will be taken into consideration as the program progresses)

Reporting

As required by PADEP and the Interim 537 Plan – beginning with the first quarter of 2023 and continuing through the fourth quarter of 2035 – LCA will provide a manhole inspection repair program report status update. This status update will be included in all quarterly submissions to PA DEP to document the work completed and other relevant issues. In addition, this manhole program is included in the Final Act 537 Plan to be submitted to PADEP. This manhole program is included as an appendix to the City's comprehensive I&I remediation plan.

Manhole Summary

Manhole Inspection and Rehabilitation Program

The Manhole Inspection and Rehabilitation Program is aimed at assessing the condition of the City's approximately 7,199 manholes. The primary focus of this program is to identify deficiencies that allow rain-derived inflow into the sewer system.

Objectives

1. **Comprehensive Inspection**: Conduct thorough inspections of all city manholes to assess their structural integrity and identify rehabilitation needs.
2. **Identify Inflow Sources**: Focus on deficiencies that contribute to rain-derived inflow, which can negatively impact the overall efficiency of the sewer system.

Inspection Process

All manholes will undergo a systematic inspection process, including:

- Visual assessments to identify physical damage or deterioration.
- Assessment of sealing effectiveness to prevent inflow.
- Documentation of conditions for each manhole.

Deficiency Investigation

The program will specifically investigate:

- Cracks or gaps in manhole structures and area surrounding manhole.
- Deterioration of seals and joints.
- Presence of debris that could facilitate inflow.

Findings

The inspection program is expected to reveal critical data regarding the condition of the manholes, particularly concerning their capacity to prevent rain-derived inflow. This information will be crucial for prioritizing rehabilitation efforts.

Program Fundamentals

Based on the inspection findings, the following actions are program fundamentals:

1. **Targeted Rehabilitation**: Focus on manholes identified with significant deficiencies that allow for inflow.
2. **Sealing and Repairs**: Implement sealing measures and structural repairs where necessary to prevent rainwater from entering the system.
3. **Ongoing Monitoring**: Establish a routine inspection schedule to ensure the long-term integrity of manholes and continued prevention of inflow.

Sewer Rehabilitation

As part of the development of a regional Act 537 Plan, Lehigh County Authority is supporting the effort to reduce infiltration and inflow (I&I) in the City of Allentown. The City/LCA hope the success of this, and related projects, will be an inspiration for surrounding communities to endorse similar work and make similar investments. The intent is for the program to pinpoint the specific areas in the City of Allentown's Trout Creek (359,530 ft) and Eastside (254,664 ft) sewer basins where private and public side rehabilitation projects (e.g., CIPP, grout, laterals, etc.) are needed to reduce infiltration. Private side work will be limited to clipped cleanouts connected downspouts and laterals up to the right of way (~15 feet) These projects are source reduction projects (SRPs) within the Act 537 Plan.

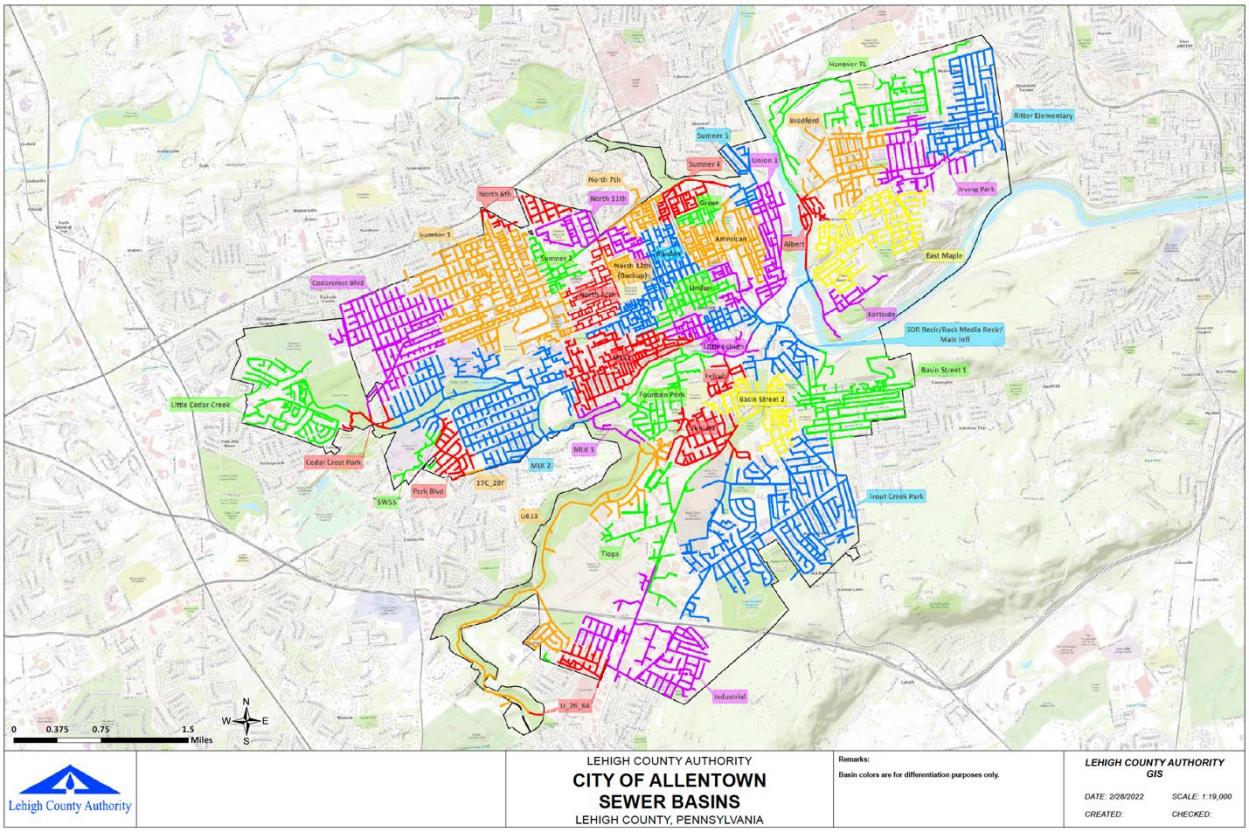
Reducing the baseline infiltration in the sewer system in Allentown is the major goal of a new Sanitary Sewer Evaluation Survey (SSES) effort which started in early 2025. The plan is to develop a program that will provide "post SRP data" to mathematically quantify infiltration and inflow reduction.

One primary goal is to reduce inflow and infiltration to below 120/275 gpcd (dry/wet gallon per capita per day, PADEP's current measure for success, based on EPA guidance documents) where it is cost effective to do so. Another important goal for the region is to identify and complete projects that reduce baseline infiltration and rain derived I&I, which will have the positive effect of recapturing system capacity that is being utilized today by the current levels of infiltration. The City and LCA would like to set up an SSES program that also enables an effective performance assessment of the projects after completion, including quantification of leakage removed, which will be a key component of the PADEP connection management plan contemplated in the draft Act 537 Plan.

The United States Environmental Protection Agency published (October 1991) a handbook titled "Sewer System Infrastructure Analysis and Rehabilitation." This document provides guidance on the evaluation and rehabilitation of existing sewers, with a strong focus on the reduction of excessive infiltration/inflow (I&I). Within this handbook, EPA recognizes that if wastewater flows do not exceed 120 gallons per day per capita (GPDC) during periods of seasonal high groundwater, then I/I flow is not considered excessive. Rainfall in 2018-2019 caused extremely high levels of ground water which would be outside the 120 GPDC. Furthermore, if the total daily flow during a storm event does not exceed 275 GPDC, and there are no operational problems, then I/I flow is not considered excessive.

Additionally, 40 CFR 352005 defines non-excessive infiltration as the quantity of flow which is less than 120 GPDC (domestic base flow and infiltration) or the quantity of infiltration which cannot be economically and effectively eliminated from a sewer system as determined in a cost-effectiveness analysis. It further defines non-excessive inflow as the maximum total flow rate during storm events which does not result in chronic operational problems related to hydraulic overloading of the treatment works or which does not result in a total daily flow of more than 275 GPDC.

With the new SSES program, The City and LCA are interested in knowing the sources of the inflow and infiltration. The work of this SSES will identify precisely where the problem areas are located including smaller catchments and specific lines.



Scope of SSES Program

The following key activities are planned as part of the SSES program:

- SSES Device Deployment, Data Collection, Maintenance.
- Level sensors will be deployed across each basin (100 total). After significant rain events and with satisfactory data collected from the first deployment, 25% - 50% of the level sensors will be redeployed to further identify I&I sources. Through this effort larger problem areas will cascade to smaller problem area locations.
- Flow isolation and nighttime weiring will be conducted to further narrow the locations of I&I sources.
- With level sensing and flow isolation / nighttime weiring having targeted the I&I sources at the 1,000 to 4,000 LF subbasin scale, further localized investigations such as CCTV and smoke and dye testing will be conducted to locate the actual sources of I&I.

- Through review and interpretation of results from the SSES field work, SRPs will be recommended for each basin. Where it makes sense, areas for immediate short-term fixes that can be implemented during the SSES work to demonstrate early effectiveness and improve adoption will be performed. Post-rehabilitation monitoring effectiveness strategies to be used after rehabilitation work is completed will be developed.
- Standards for SSES work, performance monitoring, and rehabilitation will be developed as well as recommendations for future SSES for the remaining basins based on work completed in this project.

Private Side Investigation and Rehabilitation

The major contribution of private side inflow and infiltration is well documented in communities across the US. The COA plan includes the following private side activities:

Investigation and identification of connected downspouts, clipped clean outs, via inspections or dye testing. City ordinance §455.73, §455.106, §455.110 directly states that rainwater conductors and downspouts shall be provided and maintained in good condition and the drainage shall not be directed into the sanitary sewer system or in a manner that creates a public nuisance. City ordinance §490-3.L. No person shall make connections of roof downspouts, exterior foundation drains, areaway drains or other sources of surface runoff or groundwater to a building sewer or building drain which in turn is connected directly or indirectly to a public sanitary sewer.

City's Building Standards and Safety uses the Property Rehabilitation and Maintenance Code as a guide for violations through its rental and pre-sale inspection program. Property Rehabilitation and Maintenance Code §455-29 "Basement Plumbing" directly states that sump pumps shall be directed to the exterior and not be directed into the sanitary sewer system or in a manner that creates a public nuisance or the accumulation of stagnant water. Identification of private side manhole and sewer I&I issues (apartment complexes). §490-3 Definitions: Building Drain: The sewer or sewers of a building used to convey sewage and/or industrial waste to building sewers or laterals, and in this article shall relate to the point of connection to the building sewer or laterals at the curb line or property line.§490-3.O. The owner of any improved property shall maintain and repair the building drain and lateral at his own expense and shall remove all trees, tree roots and other obstructions to the building drain and lateral. Where such maintenance or repairs are neglected by the owner, the City may, 10 days after mailing written notice to the owner, make or cause to be made such maintenance or repairs as may be necessary and charge the owner of such improved property for the cost thereof.

SRP includes lateral grouting and end seals within the right-of-way. The City has approved the end seals and a portion of the lateral within the right-of-way. Each program will need to be reviewed as the lateral grouting footage could be limited.

SSES And Sewer Rehabilitation Program Summary

Objectives

1. **Identify High Infiltration Areas**: Target areas with elevated infiltration rates for further investigation.
2. **Assess System Deficiencies**: Determine the specific deficiencies in smaller segments of the sewer system that require rehabilitation.
3. **Monitor Flow**: Conduct pre-rehabilitation and post-rehabilitation flow monitoring to evaluate the effectiveness of source reduction projects.

High Infiltration Rate Investigation

Areas identified in the Rehabilitation Priority Ranking will be subjected to SSES. Utilizing flow monitoring and visual assessments, this will pinpoint sections with significant infiltration issues.

Deficiency Assessment

Each identified section will undergo an evaluation to identify infiltration deficiencies such as:

- Cracked or damaged pipes
- Improper joint connections
- Infiltration from lateral connections

Flow Monitoring

Pre-rehabilitation flow monitoring will be conducted to establish baseline data. Post-rehabilitation monitoring will occur after implementation of recommended solutions to assess impact.

Program Fundamentals

Based on the findings of the SSES, the following rehabilitation example strategies will be considered:

1. **Pipe Lining**: Apply trenchless technology to rehabilitate damaged pipes, restoring structural integrity and reducing infiltration.
2. **Grouting**: Use chemical grouting to seal cracks and joints in the sewer system, effectively minimizing infiltration.
3. **Lateral Sealing**: Implement sealing measures for lateral connections to prevent external water from entering the system.

Sewershed	BI/RII	Inflow	MHI/SSES	Parcels	Length (LF)	Length (miles)	MHs	Years of SSES	Length per manhole
Trout Creek	1	1	1	7,154	359,530	68	1,806	25-26	199
Eastside	1	1	1	5,412	254,664	48	1,165	25-26	219
Cedar Creek	1	3	2	3,011	214,649	41	1,016	26-27	211
Sumner	3	3	2	7,973	272,176	52	1,279	26-27	213
Little Lehigh	3	3	3	4,682	219,879	42	922	27-28	238
Downtown	4	4	3	5,755	157,009	30	775	27-28	203
Lehigh	5	2	3	832	41,990	8	159	27-28	264
Parkway	5	5	3	183	11,252	2	65	27-28	173
TOTAL				**35,002**	**1,531,149**	**290**	**7,187**		213

City of Allentown

I&I Source Reduction 10-Year Priority Plan – Draft Technical Memorandum

To: Brian Chamberlain
Daniel Koplish
Jennifer McKenna

From: Felipe S. Contreras, P.E., CME, CFM
Erin Dovel, P.E.

Date: September 22, 2022

cc: Timothy D. Bradley, P.E.

Re: **City of Allentown I&I Source Reduction 10-Year Priority Plan**
Draft Technical Memorandum

1.0 Introduction

The City of Allentown (COA) has retained Kleinfelder to develop an infiltration and inflow (I&I) source reduction strategy for their sanitary sewer collection system, phased for the next 10 years. This planning strategy is in alignment with the U.S. Environmental Protection Agency's and Pennsylvania Department of Environmental Protection's required implementation of a connection management program and regional flow management strategies.

This Technical Memorandum presents an overview of the existing COA collection system, results of nighttime weiring efforts to characterize I&I, prioritization strategy, and rehabilitation costs. This information is organized in the following sections:

Section 1.0 – Introduction
Section 2.0 – Collection System Overview
Section 3.0 – Nighttime Weiring Analysis Review
Section 4.0 – Rehabilitation Priority Ranking
Section 5.0 – Rehabilitation Strategy, Costs, and 10-Year Plan
Section 6.0 – Summary and Next Steps

Appendix A – Sewershed Basin Summary
Appendix B – Sewershed Basin Map Book
Appendix C – Sewer Pipe Database

2.0 Collection System Overview

The COA's wastewater collection system and its Kline's Island Wastewater Treatment Plant (KIWWTP) have been in operation since 1929 and originally only served residents of Allentown. Beginning in the late 1950s and continuing through the late 1960s, COA entered into service

agreements with surrounding municipalities and authorities for conveyance of wastewater through COA-owned trunk sewers for treatment at the KIWWTP. Due to the need to treat flow from the various signatories together with growth within the City of Allentown, the KIWWTP was expanded to a permitted average flow capacity of 28.5 mgd in 1968 and to 40 mgd in 1978, which is the current permitted average flow capacity. The KIWWTP and COA sewer system are is currently operated and maintained by the Lehigh County Authority (LCA).

COA's collection system currently consists of:

- 285 miles of COA-owned sewer pipe, of which 242 miles is 4 to 10 inches in diameter, 22 miles is 12 to 21 inches in diameter, and 21 miles of 24-inch and larger diameter pipes.
- 7,199 COA-owned manholes and 382 privately-owned manholes.
- 33,359 connections to COA-owned sewers and 18 connections to privately-owned sanitary sewers.

The table below presents a detailed breakdown of sanitary sewers by diameter and length based on the comprehensive Geographic Information System (GIS) maintained by LCA:

Table 1: Sanitary Sewers by Diameter and Length

Sewer Diameter (in)	Sewer Length (ft)	Sewer Diameter (in)	Sewer Length (ft)
4	10	21	18,297
6	7,593	24	74,055
8	1,299,213	27	9,163
10	131,976	30	33,947
12	35,589	33	2,017
14	1,518	36	46,396
15	33,223	39	1,718
16	998	42	23,072
18	52,586	54	244
20	3,053	60	740

Sewer pipe type includes reinforced concrete, vitrified clay, polyvinyl chloride (schedule 40, SDR 26, and SDR 35), cast iron, ductile iron, terra cotta, and reinforced poured in place concrete with tile floor.

3.0 Nighttime Weiring Study Review

It is theorized that a base groundwater infiltration rate can be established in sewers during dry weather during the night (midnight to 6 am) where sewer usage is near zero. Arcadis performed a nighttime weiring study in selected manholes throughout the collection system between April and May of 2022 to quantify a base dry-weather infiltration rate. In total, 311 weirs were installed within 169 manholes across 21 sewershed basins. Flow was measured two to three times at each weired location. Nighttime base infiltration was calculated in gallons per day per linear foot (gpd/lf) of upstream pipe. Table 2 provides a summary of each sewershed basin and calculated base groundwater infiltration rate.

Table 2: Arcadis Nighttime Weiring Base Infiltration Summary

Basin Name	Quantity of Pipe Analyzed (lf)	Min. Base Infiltration (gpd/lf)	Max. Base Infiltration (gpd/lf)	Avg. Base Infiltration (gpd/lf)
Albert	6,482	0.05	3.92	1.38
Basin Street 2	34,093	0.05	25.92	5.15
Basin Street 1	53,975	0.06	17.27	4.75
Bradford	34,841	-0.27	11.78	4.01
East Maple	63,874	-0.29	10.06	2.73
Eastside	8,729	0.10	459.01	94.53
Gordan	52,621	-0.17	10.68	3.76
Hanover	39,890	0.02	11.49	1.89
Irving Park	23,938	0.35	51.33	6.95
Juniata	26,459	0.17	6.87	2.19
Little Cedar Creek	38,803	-9.72	11.88	0.32
North 12th	41,126	0.36	9.27	4.17
North 6th	12,855	-0.11	3.30	0.85
North 6th 2	7,442	0.15	6.08	1.77
North 6th 3	3,395	1.72	2.19	1.95
Ritter Elementary	56,662	-0.26	51.85	4.63
St. Elmo	77,805	0.04	21.53	3.52
Sumner 1	115,200	-0.25	13.66	2.94
Sumner 3	6,561	-2.93	5.39	1.23
Tioga	24,580	0.06	23.98	5.53
Trout Creek Park	121,538	-4.32	35.08	4.25

Note that negative but near zero base infiltration values likely indicate low base infiltration in the sewer segment. Higher negative values may indicate an incorrect flow direction assumption within the system. Appendix A provides a detailed breakdown of the weired basins along with pipe diameters and lengths. The total length of pipes analyzed in the weiring study comprises approximately 48% of the total length of pipe within the system.

4.0 Rehabilitation Priority Ranking

Utilizing the GIS information managed by LCA and the extents of the nighttime weiring results, Kleinfelder developed a quantitative ranking system for each pipe in order to prioritize rehabilitation activities within the basins included in the nighttime weiring study. Priority is based on calculated infiltration, proximity to flood plains, and consideration of recently rehabilitated pipe sections or pipe sections currently planned to be rehabilitated. Table 3 provides the quantitative ranking system, comprising eight distinct categories with one (1) being the highest priority and eight (8) being the lowest priority.

Table 3: Individual Pipe Priority Rank

Priority Rank	Base Infiltration (gpd/lf)	Within Flood Hazard Area	With Recent/Planned Repairs
1	>=10	Yes	No
2	>=10	No	No
3	>=10	Yes	Yes

Priority Rank	Base Infiltration (gpd/lf)	Within Flood Hazard Area	With Recent/Planned Repairs
4	>=10	No	Yes
5	<10	Yes	No
6	<10	Yes	Yes
7	<10	No	No
8	<10	No	Yes

As shown, pipes with high base infiltration rates (>= 10 gpd/lf) within flood hazard areas with no recent or planned repairs are ranked as the highest priority. Pipes with low infiltration rates (<10 gpd/lf) have been generally assigned as a lower priority. Pipes that have been recently rehabilitated or pipes that have plans to be rehabilitated have been given overall lower priority than pipes without any recent or planned work.

Once a rehabilitation priority ranking was established for each pipe, an aggregated priority ranking was calculated for each sewershed basin. Table 4 presents a breakdown of the priority ranking percentages per basin. As shown, the percentage of pipes ranked one to two range from 0% to 14.1%. The percentage of pipes ranked three to four range from 0% to 3.9%. Overall, the majority of the pipes in each basin are considered low priority (ranks seven through eight), primarily because these pipes have infiltration less than 10 gpd/lf and are not within flood hazard areas.

Table 4: Percent Priority Rank per Basin

Basin	% Ranks in 1-2	% Ranks in 3-4	% Ranks in 5-6	% Ranks in 7-8
Albert	0.0%	0.0%	28.7%	71.3%
Basin Street 1	5.1%	0.0%	0.0%	94.9%
Basin Street 2	4.3%	0.0%	0.0%	95.7%
Bradford	3.4%	0.4%	0.0%	96.2%
East Maple	2.2%	0.2%	0.0%	97.6%
Eastside	0.3%	3.9%	0.0%	95.7%
Gordan	2.2%	0.0%	0.0%	97.8%
Hanover	7.6%	0.0%	1.4%	91.1%
Irving Park	0.2%	0.0%	0.0%	99.8%
Junianta	0.0%	0.0%	1.0%	99.0%
Little Cedar Creek	2.2%	0.0%	0.7%	97.1%
North 12th	0.0%	0.0%	0.0%	100.0%
North 6th	0.0%	0.0%	0.0%	100.0%
North 6th 2	0.0%	0.0%	0.0%	100.0%
North 6th 3	0.0%	0.0%	0.0%	100.0%
Ritter Elementary	1.3%	0.2%	0.0%	98.5%
St. Elmo	5.8%	0.3%	2.1%	91.9%
Sumner 1	1.1%	0.1%	0.0%	98.8%
Sumner 3	6.5%	0.0%	0.0%	93.5%
Tioga	14.1%	0.5%	0.0%	85.4%
Trout Creek Park	4.1%	0.1%	6.8%	89.1%

Another method utilized for assessing basin rehabilitation priority is to calculate a weighted average priority ranking based on pipe length using the following equation:

$$Weighted\ Average = \frac{\sum_{i=1}^{n}(Pipe\ Priority\ Ranking_i * Pipe\ Length_i)}{\sum_{i=1}^{n} Pipe\ Length_i}$$

Table 5 provides the resulting weighted average priority ranking for each basin. Note that the lower the ranking, the higher the rehabilitation priority. Upon comparing Tables 4 and 5, it can be observed that basins with lower weighted averages (i.e., Tioga and Sumner 3) contain the highest percentage of individual pipes with priority rankings 1 and 2 (14.1% and 6.5%, respectively).

Table 5: Priority Rank Weighted Averaged per Basin

Basin	Weighted Average Rank
Albert	6.36
Basin Street 1	6.37
Basin Street 2	6.40
Bradford	6.48
East Maple	6.66
Eastside	6.97
Gordan	6.63
Hanover	6.08
Irving Park	7.19
Junianta	7.03
Little Cedar Creek	6.59
North 12th	7.00
North 6th	7.03
North 6th 2	7.00
North 6th 3	7.14
Ritter Elementary	7.05
St. Elmo	6.19
Sumner 1	6.86
Sumner 3	5.89
Tioga	4.87
Trout Creek Park	6.21

Table 6 presents a composite priority rank for each basin considering both the weighted average rank method and the percent pipe priority method (as described and shown in Tables 4 and 5 above). Table 6 is sorted by highest to lowest rehabilitation priority, which will be used to plan associated rehabilitation work over the next 10 years.

Table 6: Composite Priority Rank per Basin

Basin	Priority Rank Based on Percentage	Priority Rank Based on Weighted Average	Composite Priority Rank
Tioga	1	1	1
Hanover	2	3	2.5
Sumner 3	3	2	2.5
St. Elmo	4	4	4

Basin	Priority Rank Based on Percentage	Priority Rank Based on Weighted Average	Composite Priority Rank
Basin Street 1	5	7	6
Trout Creek Park	7	5	6
Basin Street 2	6	8	7
Bradford	8	9	8.5
Gordan	9	11	10
Little Cedar Creek	10	10	10
Albert	16	6	11
East Maple	11	12	11.5
Sumner 1	13	13	13
Eastside	14	14	14
Ritter Elementary	12	19	15.5
Junianta	17	17	17
North 12th	18	16	17
North 6th 2	20	15	17.5
Irving Park	15	21	18
North 6th	19	18	18.5
North 6th 3	21	20	20.5

5.0 Rehabilitation Strategy, Costs, and 10-Year Plan

After establishing a rehabilitation priority ranking for each basin, costs of rehabilitation and schedule over the next 10 years were established. Given the nature of the infiltration into the existing system, and the relative costs and level of effort for different rehabilitation options, grouting of leaky pipe joints was considered as the primary method of repair. Table 7 presents the estimated construction costs of pipe grouting for the range of pipe diameters found across the basins in this study. Joint sealing and testing have been considered in the development of the total unit price, and unit pricing has been based on recent construction costs and industry accepted construction cost estimation sources.

Table 7: Pipe Grout Cost Basis

Pipe Diameter (Inch)	Unit	Grout Repair: Testing	Grout Repair: Joint Sealing	Total Unit Price
6	EA	$35.00	$35.00	$70.00
8	EA	$38.00	$38.00	$76.00
10	EA	$42.50	$42.50	$85.00
12	EA	$50.00	$50.00	$100.00
14	EA	$65.00	$65.00	$130.00
15	EA	$70.00	$70.00	$140.00
16	EA	$80.00	$80.00	$160.00
24	EA	$130.00	$130.00	$260.00

Existing lateral joints within sewers are also planned to be rehabilitated via joint sealing. An estimate of the number of laterals in each basin of the study was approximated using available GIS information. Sewer lateral grouting cost is estimated to be $1,000 per lateral.

In addition to the sewer grout rehabilitation, manhole rehabilitation is also proposed for manholes within flood hazard areas and manholes found to frequently surcharge during wet-weather conditions. Approximately 190 manholes within the flood hazard area are proposed to be rehabilitated by installing watertight frames and covers. This rehabilitation cost is estimated to be $2,000 per manhole. Thirty-one manholes have been observed to frequently surcharge, and therefore, a pressure-tight system is proposed. This rehabilitation cost is estimated to be $10,000 per manhole.

Table 8 presents a summary of the rehabilitation costs for grouting of sewers and laterals as well as manhole repairs per basin. The total rehabilitation cost assumes a 15% contingency, rounded to the nearest hundred, and does not include design or construction observation services. Table 9 presents the planned rehabilitation year and total rehabilitation cost per year, rounded to the nearest hundred.

Table 8: Rehabilitation Costs per Basin

Basin	Sewer Joint Grout Cost ($)	Lateral Joint Grout Cost ($)	Water-Tight Manhole Cost ($)	Pressure Seal Manhole Cost ($)	Total Rehabilitation Cost ($)
Tioga	694,304	102,000		10,000	927,200
Sumner 3	398,609	211,000			701,000
Hanover	1,075,151	350,000	60,000	10,000	1,719,400
St. Elmo	1,914,015	964,000	84,000	80,000	3,498,300
Trout Creek Park	3,166,100	2,025,000	126,000	30,000	6,149,200
Basin Street 1	1,446,746	908,000		10,000	2,719,500
Basin Street 2	876,679	743,000	16,000	10,000	1,892,500
Bradford	917,281	329,000		10,000	1,444,700
Little Cedar Creek	983,692	519,000	22,000	30,000	1,787,900
Gordan	1,414,422	2,620,000			4,639,600
Albert	164,224	76,000	50,000		333,800
East Maple	1,748,888	1,435,000		50,000	3,719,000
Sumner 1	2,752,335	2,194,000			5,688,300
Eastside	226,883	277,000	14,000		595,600
Ritter Elementary	1,434,114	570,000		40,000	2,350,700
North 12th	1,276,185	1,914,000			3,668,700
Junianta	674,857	558,000	8,000	30,000	1,461,500
North 6th 2	193,262	272,000			535,100
Irving Park	644,925	300,000			1,086,700
North 6th	328,618	180,000	2,000		587,200
North 6th 3	85,992	165,000		10,000	288,600

Table 9: Planned Rehabilitation Year and Costs

Basin	Planned Rehabilitation Year	Rehabilitation Cost Per Year ($)
Tioga	1	3,347,600
Sumner 3		
Hanover		
St. Elmo	2	3,498,300
Trout Creek Park	3	6,149,200
Basin Street 1	4	4,612,000
Basin Street 2		
Bradford	5	3,232,600
Little Cedar Creek		
Gordan	6	4,639,600
Albert	7	4,052,800
East Maple		
Sumner 1	8	5,688,300
Eastside	9	6,615,000
Ritter Elementary		
North 12th		
Junianta	10	3,959,100
North 6th 2		
Irving Park		
North 6th		
North 6th 3		

Appendix B provides a map book showing all basin areas, flood hazard areas, individual sewer pipe priority ranking and associated weir flow, and manholes of interest identified in flood plains and/or found to frequently surcharge.

6.0 Summary and Next Steps

The data and analyses presented in this memorandum summarize the prioritization of collection system rehabilitation. To accomplish this, a quantitative ranking system was developed based on nighttime weiring results, proximity to flood plains, recently completed or planned repairs, and manhole locations within the flood plain and frequency of surcharging. We recommend that a meeting be held between Kleinfelder and COA to build a consensus on the ranking system, general priority of rehabilitation, and construction cost breakdown projections over the next 10 years.

Appendix A

Sewershed Basin Summary

Basin	Pipe Diameter (Inch)	Number of Pipe Segments (#)	Pipe length (ft)	% of Pipe Length in Total System
Albert	8	39	6,483	0.37%
	Total	39	6,483	0.37%
Basin Street 1	8	240	47,265	2.66%
	10	11	1,320	0.07%
	12	10	3,067	0.17%
	15	12	2,352	0.13%
	Total	273	54,003	3.04%
Basin Street 2	6	2	518	0.03%
	8	140	27,726	1.56%
	10	26	5,725	0.32%
	Total	168	33,969	1.91%
Bradford	6	1	328	0.02%
	8	140	30,809	1.74%
	10	15	2,489	0.14%
	15	7	1,256	0.07%
	Total	163	34,882	1.96%
East Maple	8	290	54,086	3.05%
	10	22	3,426	0.19%
	12	6	1,187	0.07%
	15	24	5,188	0.29%
	Total	342	63,886	3.60%
Eastside	8	40	8,009	0.45%
	12	4	719	0.04%
	Total	44	8,729	0.49%
Gordan	6	1	142	0.01%
	8	275	43,268	2.44%
	10	25	5,100	0.29%
	12	3	385	0.02%
	15	20	3,378	0.19%
	Total	324	52,273	2.94%
Hanover	6	2	244	0.01%
	8	158	34,532	1.95%
	10	5	938	0.05%
	12	9	2,042	0.11%
	15	10	2,070	0.12%
	16	1	64	0.00%
	Total	185	39,890	2.25%
Irving Park	8	109	21,220	1.20%
	10	15	2,705	0.15%
	24	1	354	0.02%
	Total	125	24,279	1.37%

Basin	Pipe Diameter (Inch)	Number of Pipe Segments (#)	Pipe length (ft)	% of Pipe Length in Total System
Junianta	8	135	24,927	1.40%
	10	8	1,531	0.09%
	Total	143	26,458	1.49%
Little Cedar Creek	6	4	437	0.02%
	8	215	38,428	2.16%
	Total	219	38,864	2.19%
North 12th	6	1	72	0.00%
	8	247	42,316	2.38%
	10	5	924	0.05%
	12	10	2,022	0.11%
	15	9	2,334	0.13%
	Total	272	47,668	2.68%
North 6th	8	56	11,643	0.66%
	10	7	1,188	0.07%
	Total	63	12,831	0.72%
North 6th 2	6	1	230	0.01%
	8	44	6,153	0.35%
	10	5	656	0.04%
	12	4	403	0.02%
	Total	54	7,442	0.42%
North 6th 3	8	22	3,394	0.19%
	Total	22	3,394	0.19%
Ritter Elementary	6	3	54	0.00%
	8	210	43,035	2.42%
	10	25	4,997	0.28%
	12	25	4,386	0.25%
	14	6	1,050	0.06%
	15	1	200	0.01%
	Total	270	53,722	3.03%
St. Elmo	8	354	70,991	4.00%
	10	16	3,529	0.20%
	12	2	468	0.03%
	Total	372	74,987	4.22%
Sumner 1	6	10	1,271	0.07%
	8	452	87,975	4.96%
	10	62	12,493	0.70%
	12	7	1,692	0.10%
	15	12	1,792	0.10%
	Total	543	105,222	5.93%
Sumner 3	8	73	12,964	0.73%
	10	1	151	0.01%
	12	1	88	0.00%
	15	7	1,349	0.08%
	Total	82	14,553	0.82%

Basin	Pipe Diameter (Inch)	Number of Pipe Segments (#)	Pipe length (ft)	% of Pipe Length in Total System
Tioga	6	3	538	0.03%
	8	111	17,323	0.98%
	10	13	3,705	0.21%
	12	1	210	0.01%
	15	15	2,805	0.16%
	Total	143	24,582	1.38%
Trout Creek Park	6	1	417	0.02%
	8	551	105,421	5.94%
	10	49	10,849	0.61%
	12	17	3,861	0.22%
	15	5	1,063	0.06%
	Total	623	121,611	6.85%
		Grand Total	849,729	47.86%

Appendix B

Sewershed Basin Map Book

Maps redcated for security purposes

Lehigh County Authority

Sewer System Source Reduction Plan (SRP)

Years 2026 to 2030

1. System History and Overview

Lehigh County Authority

In 1972, Lehigh County and Lehigh County Authority placed into service a sanitary sewer interceptor system in western Lehigh County to convey wastewater from the Boroughs of Alburtis and Macungie and the Townships of Upper and Lower Macungie to Allentown's Allentown/Emmaus Interceptor. Today, the system additionally serves portions of the Townships of Weisenberg, Upper Milford, and Lowhill, and portions of the Borough of Emmaus. The interceptor system, known as the Western Lehigh Interceptor (WLI) System, consists of 18 miles of gravity sewers ranging in size from 8 inch to 36 inch diameter pipe, one relief pumping station and force main (Spring Creek Road Pump Station), and five meter stations. Wastewater from the WLI discharges into the Allentown/Emmaus Interceptor at Keck's Bridge. The Allentown/Emmaus Interceptor flows from Keck's Bridge to its downstream confluence with the Cedar Creek Interceptor and Little Lehigh Interceptor. The Little Lehigh Interceptor begins at this confluence and serves as the final conveyance step in the transport of wastewater to Allentown's Kline's Island Wastewater Treatment Plant.

In 1981, Allentown compelled LCA to remove a portion of LCA's peak wet weather flows from Allentown's Little Lehigh Interceptor. LCA built and now operates and maintains relief facilities along the Little Lehigh Creek to address intermittent hydraulic overloading of the Little Lehigh Interceptor: Park Pumping Station and Force Main, and the Keck's Bridge Relief Interceptor between Keck's Bridge and Park Pumping Station. The Park Pumping Station and Force Main were placed in operation in the fall of 1983 to supplement capacity in the Little Lehigh Interceptor and pump it through a force main to a location approximately 1000 lf upstream of the KIWWTP. In August 1986, LCA completed construction of the Keck's Bridge Relief Interceptor to relieve overflows during storm events in existing interceptors in the Keck's Bridge area and to allow for future development in LCA service areas. The capacity of Park Pumping Station was increased in 1986 to accommodate additional flows from the Keck's Bridge Relief Interceptor.

In 1998, the Spring Creek Pump Station (SCPS) began operation. This relief pumping system includes 2,500 feet of 20-inch diameter force main and 11,900 feet of 24-inch diameter force main which bypass approximately 24,000 linear feet of the WLI in Lower Macungie Township. The pump station is designed to pump up to 7 MGD during peak flow periods typically associated with severe rain events.

In 2005, the 10,250 LF 24-inch SCPS force main extension from Millrace Road to the 42-inch Little Lehigh Relief Interceptor near the interception of Devonshire Road and Keystone Avenue (approximately 2,000 feet downstream of Kecks Bridge) was completed. This extension relieved hydraulic loading on that section of the WLI between manholes L-66 and L-1.

LCA also owns a pretreatment plant (PTP) in Upper Macungie Township that treats the industrial wastewaters from the Fogelsville industrial corridor in the upper quarter of the LCA service area as well as the residential wastewaters from the areas upstream of the pretreatment plant.

In 2009, LCA built a 3 MG Flow Equalization Basin (FEB) immediately upstream of the PTP to capture and hold increased flows during significant rain events. This concrete above ground tank has been responsible for most of the improvement in wet weather performance in LCA's WLI, in Allentown's Little Lehigh and Jordan Creek Interceptors, and the reduction in use of the KIWWTP Outfall 003 bypass.

Upper Milford Township

Upper Milford Township (UMiT) is located in southern Lehigh County, adjoining Emmaus Borough, Lower

Macungie Township and the Borough of Macungie. The sanitary sewer system in UMiT is owned and operated by the Lehigh County Authority pursuant to a sewer service agreement dated January 1, 1982. UMiT designates the areas of the UMiT where sewer service will be provided and approves the allocation granted. Currently, there are over 800 customers being served in the UMiT sewer system consisting of over 70,000 feet of pipe, including 29,000 lf of low pressure pipe installed to serve the Vera Cruz area of the Township. Over 55% of the system is 8-inch pipe, 45% is either 2-inch force main, low pressure force main, or 10-inch. The system is 95% PVC and the remainder is DIP. The majority of the system was constructed in the 1980s with the low pressure system constructed in 2012 and 2013. The system consists of collection systems discharging into the Emmaus Borough system, into the Lower Macungie Township system and into the LCA WLI Interceptor system.

Weisenberg Township

Weisenberg Township is located in the northwestern section of Lehigh County, adjoining Lowhill and Upper Macungie Township. The sanitary sewer system in Weisenberg Township is owned and operated by the Lehigh County Authority. In an agreement dated April 19, 1990, Weisenberg Township designated LCA as the operating agent for the Pointe West and Pennsylvania State University wastewater systems in the Township. Also in an agreement with Upper Macungie Township dated April 19, 1990, Upper Macungie Township agreed to accept the wastewater from the Pointe West Development. The agreement provided for repair and/or elimination of I/I by Weisenberg Township.

In an agreement dated April 22, 2002, the Township conveyed ownership of the wastewater systems to the LCA.

There are 149 customers being served in Weisenberg Township with a system consisting of almost 21,000 feet of pipeline which discharge flows through Upper Macungie Township and the WLI Interceptor system. Over 97% of the system is 8-inch pipe and 3% is 2-inch force main. The system is 99% PVC and 1% DIP. No new connections are expected within Weisenberg Township.

Lowhill Township

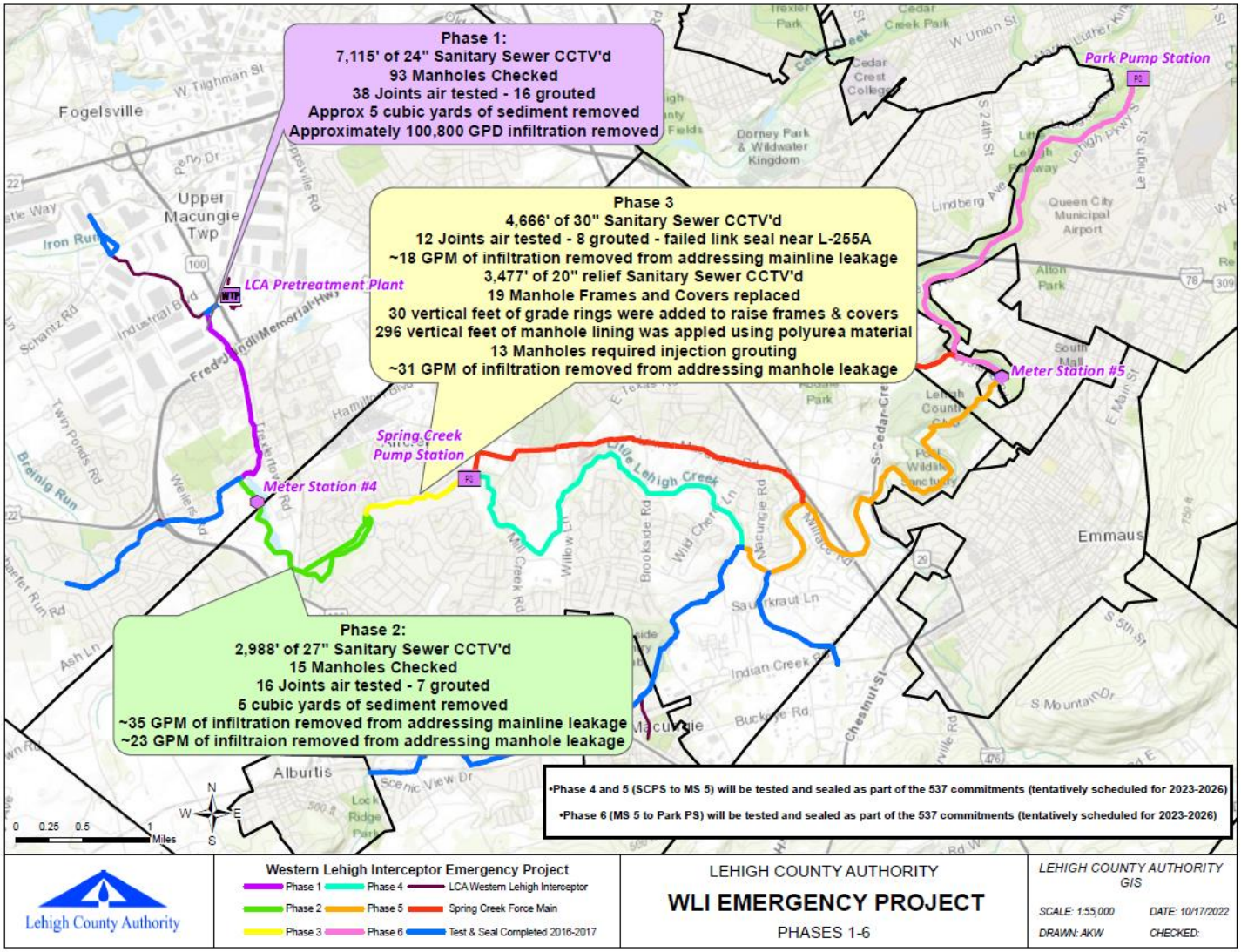
Lowhill Township is located in the northwestern section of Lehigh County, adjoining Weisenberg and Upper Macungie Townships. In June of 2016, the sanitary sewer system in Lowhill Township was acquired by LCA which now owns and operates the system. A service agreement has been executed with Upper Macungie Township Authority to allow the flow of wastewater through their system to the WLI. The Lowhill Township system consists of 3,052 feet of 8-inch PVC gravity pipeline and 587 feet of 2-inch PVC force main through which 43 connections discharge into the Upper Macungie Township collector system and ultimately into the LCA WLI system.

2. Inflow and Infiltration – Rehabilitation Efforts Conducted to Date

Western Lehigh Interceptor and Little Lehigh Relief Interceptor Test and Seal Rehabilitation

All of LCA's trunk lines and interceptors lay in bottom lands, often within 40 feet of stream and crossing the stream regularly. As such, these pipes are subject to more elevated groundwater conditions than the majority of the collection sewers they serve; if they infiltrate, they will do so at a high rate and at a rate impacted by stream levels.

Every joint on the Breinigsville, Alburtis Macungie, and Upper Milford Trunk Lines was tested and if needed, grout sealed in 2015. In 2018-2019, extraordinarily high groundwater conditions allowed LCA to drain the Western Lehigh Interceptor (WLI) from U108 (Schantz Road) to L256 (Spring Creek Pump Station (SCPS)) by using either the FEB to hold flows or with bypass pumping and determine exactly which joints were leaking and grout seal those.



Note that Phases 4, 5, and 6 as shown in the Figure will not be performed as part of the LCA SRP 2026-2030; the remainder of the WLI (from L255 (Spring Creek Pump Station) to L1(Kecks Bridge Meter Station 5) and all of the Little Lehigh Relief Interceptor from A17 (Kecks Bridge) to B1 (Park Pump Station). These segments will require considerable access preparation and will require use of FEB, SCPS, and likely bypass pumping to complete the 46,000 lf of 30", 36", 42", and 48" rehabilitation work on PCCP and RCP pipe.

Trunkline and Interceptor Manhole Frame, Cover, and Chimney Sealing

All of LCA's trunk lines and interceptors lay in bottom lands, usually well within the floodplain of the streams they parallel, and crossing the streams regularly. As such, when streams flood, which happens regularly, many of the trunkline and interceptor manholes are inundated. The original bolt down covers and gaskets, where installed, are not working. This project's objective was to ensure inflow through the frame, cover, and chimney of the 550 manholes on the Breinigsville, Alburtis Macungie, and Upper Milford Trunk Lines and the WLI and LLRI is reduced dramatically by making them reliably watertight.

A comprehensive inspection of these 550 manholes was conducted Fall 2022 – Winter 2023 to evaluate what improvements were needed for each manhole to render them watertight when stream flooding occurs. These inspections also identified any improvements needed to the body and bench of the manhole as well. Of the 550 manholes, manhole frame, cover, and chimney rehabilitation work on 500 manholes has been completed through 2024. As noted in the "Corrective Plans 2026-2030" section of this document, the remaining 50 manholes will be addressed in years 2026-2030.

The manhole rehabilitation work eliminated the majority of inflow through manhole covers, frames, and chimney for the foreseeable future.

Upper Milford Sewer Rehab

A number of sewers in the Upper Milford Township portion of LCA's system were determined to contribute excessive inflow and infiltration. This project aimed to reduce this leakage.

Every joint on these 7600 lf of sewer, including taps, lower laterals, and laterals connected to manholes were tested and sealed using chemical grout capital grouting technologies.

On the basis of the 2022 nighttime weiring results, 20 segments were attributed to areas with elevated infiltration leakage and were selected by LCA for mainline joint (MLJ) grouting and lateral tap connection (LTC) grouting in Upper Milford Township.

For MLJ work, all 20 of these were tested and grouted. It was found that:

- 19 of the segments are PVC and 1 is ductile iron.
- As expected in PVC and DIP, failure rates are expected to be only 2%. For many segments, failure rates were 0%, again as expected. However, in the end, the segment that contributed to the high leakage was isolated and successfully sealed.
- 317 MLJs were tested. 16 failed the air test (5% failure rate) and were grouted. 12 of these failed joints were found on a single, off-road line.
- An average of 3 gallons of grout per failed MLJ was used to make these joints watertight and stabilize the pipe, indicated long term sealing was achieved for these main line joints.

For LTC work, these segments contained 23 tap connections, of which 5 failed the air test and were grouted (22% failure rate). The average grout used per LTC was 5 gallons, indicated long term sealing was achieved.

For LCM work, there was only 1 LCM. Constructed of PVC, there were only 2 joints to be tested between the property line and the manhole. 1 of these failed (50% failure rate). This was sealed using 1 gallon of grout, indicating moderate sealing was achieved.

This project reduced baseline infiltration and rainfall induced infiltration into these pipes to an acceptable level.

3. Corrective Plans 2026-2030

Lehigh County Authority

Reducing inflow and infiltration is being addressed via:

1. an ongoing manhole inspection and rehabilitation program,
2. an SSES and sewer rehabilitation program.

Manhole Inspection and Rehabilitation Program

The Manhole Inspection and Rehabilitation Program is aimed at assessing the condition of, and rehabilitating, the 50 remaining manholes on LCA's interceptors (i.e. 500 of the 550 total have been previously inspected and rehabilitated through 2024). The primary focus of this program is to identify and correct deficiencies that allow rain-derived and stream flood condition inflows into the sewer system.

Objectives

1. **Comprehensive Inspection**: Conduct thorough inspections of the remaining 50 manholes to assess their structural integrity and identify rehabilitation needs.
2. **Identify Inflow Sources**: Focus on deficiencies that contribute to rain-derived and stream flood condition inflows, which can negatively impact the overall efficiency of the sewer system.

Inspection Process
All manholes will undergo a systematic inspection process, including:

- Visual assessments to identify physical damage or deterioration.
- Assessment of sealing effectiveness to prevent inflow.
- Documentation of conditions for each manhole.

Deficiency Investigation
The program will specifically investigate:

- Cracks or gaps in manhole structures and area surrounding manhole.
- Deterioration of seals and joints.
- Presence of debris that could facilitate inflow.

Findings
The inspection program is expected to reveal critical data regarding the condition of the manholes, particularly concerning their capacity to prevent rain-derived inflow. This information will be crucial for prioritizing rehabilitation efforts.

Rehabilitation Recommendations
Based on the inspection findings, the following actions are recommended:

1. **Targeted Rehabilitation**: Focus on manholes identified with significant deficiencies that allow for inflow.
2. **Sealing and Repairs**: Implement sealing measures and structural repairs where necessary to prevent rainwater from entering the system.
3. **Ongoing Monitoring**: Establish a routine inspection schedule to ensure the long-term integrity of manholes and continued prevention of inflow.

Reporting
As required by PA DEP and the Interim 537 Plan, LCA will provide a manhole inspection repair program report status update. This status update will be included in all quarterly submissions to PA DEP to document the work completed and other relevant issues. In addition, this manhole program will be included in the Final Act 537 Plan to be submitted to PA DEP. This manhole program will be included as an appendix to the City's comprehensive I&I remediation plan.

<u>SSES And Sewer Rehabilitation Program Summary</u>
The SSES and Sewer Rehabilitation Program will focus on inspections of the LCA interceptors and relief interceptors from Spring Creek Pump Station to Park Pump Station. This includes the Lower Western Lehigh Interceptor and the Little Lehigh Relief Interceptor. Rehabilitation efforts will be conducted as needed pending inspection results.

Objectives

1. **Identify High Infiltration Areas**: Target areas with elevated infiltration rates for further investigation.
2. **Assess System Deficiencies**: Determine the specific deficiencies in smaller segments of the sewer system that require rehabilitation.
3. **Monitor Flow**: Conduct pre-rehabilitation and post-rehabilitation flow monitoring to evaluate the effectiveness of source reduction projects.

High Infiltration Rate Investigation
Areas identified in the Rehabilitation Priority Ranking will be subjected to SSES. Utilizing flow monitoring and visual assessments, this will pinpoint sections with significant infiltration issues.

Deficiency Assessment
Each identified section will undergo an evaluation to identify infiltration deficiencies such as:

- Cracked or damaged pipes
- Improper joint connections
- Infiltration at connector pipes

Flow Monitoring

Pre-rehabilitation flow monitoring will be conducted to establish baseline data. Post-rehabilitation monitoring will occur after implementation of recommended solutions to assess impact.

Recommendations
Based on the findings of the SSES, the following rehabilitation example strategies are proposed:

1. **Pipe Lining**: Apply trenchless technology to rehabilitate damaged pipes, restoring structural integrity and reducing infiltration.
2. **Grouting**: Use chemical grouting to seal cracks and joints in the sewer system, effectively minimizing infiltration.
3. **Connector Pipe Sealing**: Implement sealing measures for pipe connections to prevent external water from entering the system.

Upper Milford Township, Weisenberg Township, Lowhill Township

Manhole Inspection Program
The Manhole Inspection Program is aimed at assessing the condition of the Township manholes. The primary focus of this program is to identify deficiencies that allow rain-derived inflows into the sewer system.

Objectives

1. **Comprehensive Inspection**: Conduct thorough inspections of manholes to assess their structural integrity and identify rehabilitation needs.
2. **Identify Inflow Sources**: Focus on deficiencies that contribute to rain-derived inflows, which can negatively impact the overall efficiency of the sewer system.

Inspection Process
All manholes will undergo a systematic inspection process, including:

- Visual assessments to identify physical damage or deterioration.
- Assessment of sealing effectiveness to prevent inflow.
- Documentation of conditions for each manhole.

Deficiency Investigation
The program will specifically investigate:

- Cracks or gaps in manhole structures and area surrounding manhole.
- Deterioration of seals and joints.
- Presence of debris that could facilitate inflow.

Findings
The inspection program is expected to reveal critical data regarding the condition of the manholes, particularly concerning their capacity to prevent rain-derived inflow. This information will be crucial for prioritizing rehabilitation efforts.

Recommendations
Based on the inspection findings, the following actions are recommended:

1. **Targeted Rehabilitation**: Focus on manholes identified with significant deficiencies that allow for inflow.
2. **Sealing and Repairs**: Implement sealing measures and structural repairs where necessary to prevent rainwater from entering the system.
3. **Ongoing Monitoring**: Establish a routine inspection schedule to ensure the long-term integrity of manholes and continued prevention of inflow.

Reporting
As required by PA DEP and the Interim 537 Plan, LCA will provide a manhole inspection repair program report status update. This status update will be included in all quarterly submissions to PA DEP to document the work completed and other relevant issues. In addition, this manhole program will be included in the Final Act 537 Plan to be submitted to PA DEP. This manhole program will be included as an appendix to the City's comprehensive I&I remediation plan.

SSES And Sewer Rehabilitation Program Summary
The SSES and Sewer Rehabilitation Program will focus on inspections of the sewer mains and laterals in the Township system. Rehabilitation efforts will be conducted as needed pending inspection results.

Objectives

1. **Identify High Infiltration Areas**: Target areas with elevated infiltration rates for further investigation.
2. **Assess System Deficiencies**: Determine the specific deficiencies in smaller segments of the sewer system that require rehabilitation.
3. **Monitor Flow**: Conduct pre-rehabilitation and post-rehabilitation flow monitoring to evaluate the effectiveness of source reduction projects.

High Infiltration Rate Investigation
Areas identified in the Rehabilitation Priority Ranking will be subjected to SSES. Utilizing flow monitoring and visual assessments, this will pinpoint sections with significant infiltration issues.

Deficiency Assessment
Each identified section will undergo an evaluation to identify infiltration deficiencies such as:

- Cracked or damaged pipes
- Improper joint connections
- Infiltration at connector pipes

Flow Monitoring

Pre-rehabilitation flow monitoring will be conducted to establish baseline data. Post-rehabilitation monitoring will occur after implementation of recommended solutions to assess impact.

Recommendations
Based on the findings of the SSES, the following rehabilitation example strategies are proposed:

1. **Pipe Lining**: Apply trenchless technology to rehabilitate damaged pipes, restoring structural integrity and reducing infiltration.
2. **Grouting**: Use chemical grouting to seal cracks and joints in the sewer system, effectively minimizing infiltration.

3. **Connector Pipe Sealing**: Implement sealing measures for pipe connections to prevent external water from entering the system.

4. Phasing & Budgeting

LCA has budgeted approximately $7.23M from 2026 through 2030 for this program. It is planned that the bulk of the I&I reduction and rehabilitation projects will take place in years 2027 and 2028.

Program	Total Budget	2026 Budget	2027 Budget	2028 Budget	2029 Budget	2030 Budget
LCA SRP 2026-2030	$7,230,000	$250,000	$3,000,000	$3,000,000	$300,000	$680,000

Upper Macungie Township

Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approx. MHs	Average Dry Weather Flow, DWF (MGD)		*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
Breinigsville (U-8)	UMT	2,325	147,759	666	0.81		37%	2.1
Industrial Blvd. Net (U84-6)	UMT	4,362	125,630	566	0.48		53%	2.4
Snowdrift Road (SnR034)	UMT	521	52,256	235	0.12		36%	2.7
MM3 (Phase 3 Net) (PH3-7L)	UMT	945	87,238	393	0.20		34%	15.0
MM8 (Rabenold PS) (RPS-1)	UMT	1,751	150,953	680	0.37		30%	9.0
Upper Iron Run Net (U-85)	UMT	9,513	95,666	431	0.19		25%	4.5
MM7 (Mill Creek Net) (PH3-A)	UMT	1,375	61,397	277	0.31		24%	4.9

SRP:

Upper Macungie Township's SRP will consist of the following:

1. The majority of the rehabilitation work proposed by Upper Macungie Township to address the system-wide I/I problems during the 2025-2035 planning period will focus on the elimination of infiltration and inflow contributions through laterals and private-side connections. The Township has a long-standing policy of aggressive maintenance and rehabilitation efforts. At this point, almost 100% of the Township's approximately 25-miles of vitrified clay pipe (VCP) sanitary sewer mains have either been replaced with PVC, or lined with either a CIPP liner or HDPE slip-liner. Most of the Township's sewer manholes have been through several rounds of inspections and repairs.

2. Much of the maintenance-type work proposed for Upper Macungie Township for years 2025 through 2035 involves the continuation of the ongoing manhole inspection and sanitary sewer CCTV inspection programs. The manhole inspection program will be based upon a 10-year cycle, with approximately 10% of the Township's sewer manholes to be inspected each year. The sanitary sewer CCTV inspection program will continue to run on a 15-year cycle, with approximately 5% to 10% over the Township's sewer mains to be inspected each year. Any problematic defects identified during the manhole and/or sanitary sewer inspection programs will be rehabilitated promptly during the inspection year or the year after.

3. Additionally, the Township intends to aggressively pursue solutions to more effectively halt the inflow of stormwater through manhole lids and inflow dishes. The Township will review all sanitary sewer manhole locations within high-priority subareas to determine which manholes may be subject to

stormwater inundation and/or over-topping sheet flow and will address these manholes with either a gasketed inflow dish and/or a caulk/sealant product. Going forward, all sealed manholes will be properly resealed upon disturbance, either during the inspection programs noted above or during routine maintenance activities.

Year	Meter Basin	# MH/LF Pipe	Work
2025	RPS-1	102 Laterals	CIPP Lateral Connection Liner Seals Rehab Project
2025	All	495 Laterals	Lateral Tap Connection (LTC) Grouting
2025	RPS-1	All	Micro-metering to identify high-priority sub-areas of significant inflow
2025 - 2026	RPS-1	All	Dye-testing potential defects identified during smoke testing
2026	RPS-1	High-priority subareas	Manhole Lids and Infiltration Dishes Evaluation and Rehabilitation
2025 - 2035	RPS-1	All previous LTC grouted laterals	Full lateral replacement (main to public easement/right-of-way) with lateral cleanouts
2027 - 2033	U-8, U84-6, Snr034, PH3-7L	All	Micro-metering to identify high-priority sub-areas of significant inflow
2028 - 2029	U-8, SnR034	High-priority subareas	Cleanout investigations for clipped cleanouts
2030 - 2032	U-8, U84-6, SnR034, PH3-7L	High-priority subareas	Manhole Lids and Infiltration Dishes Evaluation and Rehabilitation
2025 - 2035	All	All previous LTC grouted laterals within high-priority subareas	Full lateral replacement (main to public easement/right-of-way) with lateral cleanouts
2025 - 2035	All	All Sanitary Sewer Laterals	Private lateral inspections required of all properties prior to re-sale

2025 - 2035	All	All Sanitary Sewer Mains	Township CCTV inspection of all sewer mains (15-year rolling program)
2025 - 2035	All	All Sanitary Sewer Manholes	Manhole inspections and repairs (10-year rolling program)

LOWER MACUNGIE TOWNSHIP
SANITARY SEWER SYSTEM
SOURCE REDUCTION PLAN
UPDATE FEBRUARY 2025

INTRODUCTION

Lower Macungie Township (Township) prepared a Source Reduction Plan (SRP) to identify the Infiltration/ Inflow (I/I) work to be undertaken by the Township to reduce extraneous flows in their sanitary sewer system. The SRP is dated December 2022 and revised January 2023. The work proposed in the SRP to reduce I/I will be used by the Lehigh County Authority (LCA) in the modeling of the LCA's collection and conveyance system as part of the Act 537 Planning process currently underway by LCA. The SRP covered the years 2022 to 2031 and provides detailed information on the I/I work to be performed by the township during each year. A summary of the work proposed in the plan is provided in Exhibit 1, attached.

SUMMARY UPDATE

The Township has been following the SRP and, in fact, had performed significant I/I removal work on the system several years prior to 2022. Table 1 Below summarizes the I/I work the township has completed from 2020 to 2024.

TABLE 1
LOWER MACUNGIE TOWNSHIP
SRP WORK COMPLETED 2020-2024

Year	Mainline Work		Lateral Work		Manhole Work	
	CIPPL (LF)	Taps Sealed	Replaced	CIPPL	Fully Lined	Dishes Installed
2020	13,729	150	38			
2021	13,890	164		51	31	31
2022				55		
2023	11,763	297				
2024	21,977	288				
Totals	61,360	899	38	106	31	31

The township has already awarded a contract for 2025 which will line 23,285 LF of VCP pipe using CIPP. Also 252 laterals will be re-instated, and the taps will be sealed. The contract will also install 31 Vac-a Tees on sewer laterals for use in lining the laterals as part of a 2026 contract. The township will continue with their yearly I/I work as proposed in the SRP through 2031.

EXHIBIT 1

LOWER MACUNGIE TOWNSHIP
SANITARY SEWER SYSTEM
SOURCE REDUCTION PLAN

SUMMARY OF SRP

Year	Lateral Lining	Grout Laterals	Lateral Replacement	Manhole Sealing	Main Line Lining	Lateral Reinstatement	Manhole Inserts	Manholes Watertight
2022	55							
2023		175		3	11,771	120	148	
2024			15		11,401	136	64	
2025					10,426	152	59	
2026					13,254	170	57	
2027					12,093	121	62	
2028		320						
2029		275						
2030		300						215
2031		300						222
Total	**55**	**1,370**	**15**	**3**	**58,945**	**699**	**390**	**437**

BARRY ISETT & associates INC
MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

SRP Program Summary

FOR

Borough of Macungie

Macungie Borough
21 Locust Street
Macungie, PA 18062

January 28, 2025

5420 Crackersport Road, Allentown, PA 18104	**610.398.0904**	**610.481.9098**
2325 Heritage Center Drive, Suite 315, Furlong, PA 18925	267.454.2260	610.481.9098
1003 Egypt Road, Phoenixville, PA 19460	610.935.2175	610.481.9098
420 N. Park Road, Suite 202, Wyomissing, PA 19610	484.346.7640	484.346.7639
2 Market Plaza Way, Suite 7, Mechanicsburg, PA 17055	717.795.8575	717.795.9110
8 W. Broad Street, Suite 1100, Hazleton, PA 18201	570.455.2999	570.454.9979
1170 Highway 315, Suite 3, Wilkes-Barre, PA 18702	570.285.8200	570.285.8201
1444 E. Lackawanna Avenue, Suite 214, Olyphant, PA 18447	570.497.8360	610.481.9098
525 Main Street, Suite 200, Stroudsburg, PA 18360	272.200.2050	272.200.2051

Borough of Macungie
Sanitary Sewer System
Inflow and Infiltration Source
Reduction Program

1.0 General

The United States Environmental Protection Agency issued a Compliance Order to all municipal dischargers to the City of Allentown's Kline's Island wastewater treatment plant (KIWWTP) due to the excessive number of Sewer System Overflows (SSO) which had occurred.

Peak flow issues in the Lehigh County Authority (LCA) sewer conveyance systems contributed to these SSOs. The Borough of Macungie, as a member of the Western Lehigh Sewer Partners (WLSP), contributes to these peak sanitary sewer flows in LCA's Sewer System as well as at Allentown's wastewater treatment plant.

The Borough of Macungie, along with the other partners in the WLSP, have elected to prepare and implement a corrective action plan to collectively address the problems within each of these sanitary sewer systems. The following projects are actions taken or to be taken by the Borough of Macungie in its efforts to reduce the amount of extraneous flows entering into the LCA sanitary sewer system and the Allentown wastewater treatment plant.

Attached is the cover sheet from the WLSP Rehabilitation Prioritization for the Borough of Macungie, prepared by Arcadis. This prioritization was based on flow weirs, smoke tests, and basement inspections which were conducted throughout the Macungie Sanitary Sewer System.

Between the years of 2013 and 2023 the Borough of Macungie has undertaken a comprehensive program to rehabilitate their sewer system to remediate the I&I issues. This program included the lining of sewer mains, rehabilitation of Manholes, and the lining of sewer laterals. As of 2025 the Borough's project list for sewer rehabilitation is down to one project that is scheduled for 2025 and is funded through CDBG funds. Additionally, Borough ordinances require the completion of a sewer lateral video and necessary repairs as part of any property transfer.

2.0 Main Line Sewer Lining

Between 2013 and 2018 the Borough lined 151 main line sewer runs for a total lined length of 31,067 feet. Exhibit B shows the breakdown of the projects and has a map showing all of the lined piped runs.

3.0 Manhole Rehabilitation

The Borough undertook manhole rehabilitation is 2019. The project included the investigation of all manholes in the Borough followed by the rehabilitation of the manholes. The project included the chimney lining of X manholes and full depth lining of X manholes. Exhibit C shows the location and description of the repairs for each of the manholes.

4.0 Lateral Lining and Cleanout Installation

The final phase of the I&I remediation work was the lining of problematic sewer laterals and the installation/repair of lateral cleanouts. This was completed in 2022 for a total construction cost of $1,905,100. The work included lining of 408 lateral connections and over 3,300 LF of lateral line, the installation of 80 new cleanouts, and the video investigation of 10,000 LF of sewer laterals.

5.0 Remaining Sewer Rehabilitation Project

The Borough will be looking to seal manhole covers of certain manholes that tend to get flooded during heavy rainfall to reduce inflow into the sewer system. The first stage of the work on the manhole lid project has been completed with the identification of twelve manholes for sealing, the first round of the sealing has been completed. The Borough has applied and received preliminary approval for CDBG funding to complete manhole rehabilitation (2), lining of mains (365 LF), and lining of laterals (16) in the locust street area, this project is expected to be undertaken in 2025.

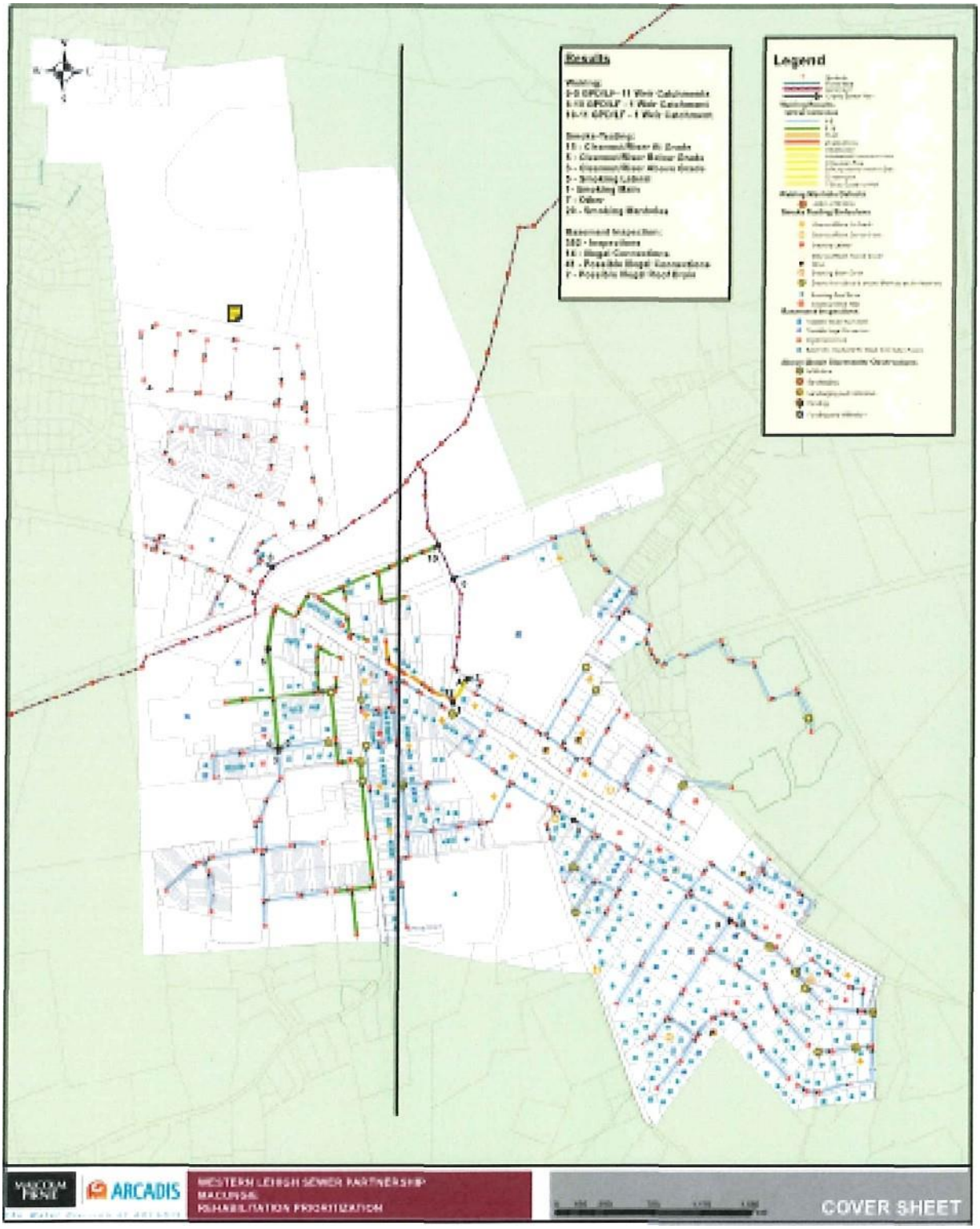
BARRY ISETT & associates INC

MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

Exhibit A

Assessment Map

Exhibit A
Cover Sheet
Western Lehigh Sewer Partnership
Macungie Rehabilitation Prioritization



BARRY ISETT & associates INC

MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

Exhibit B

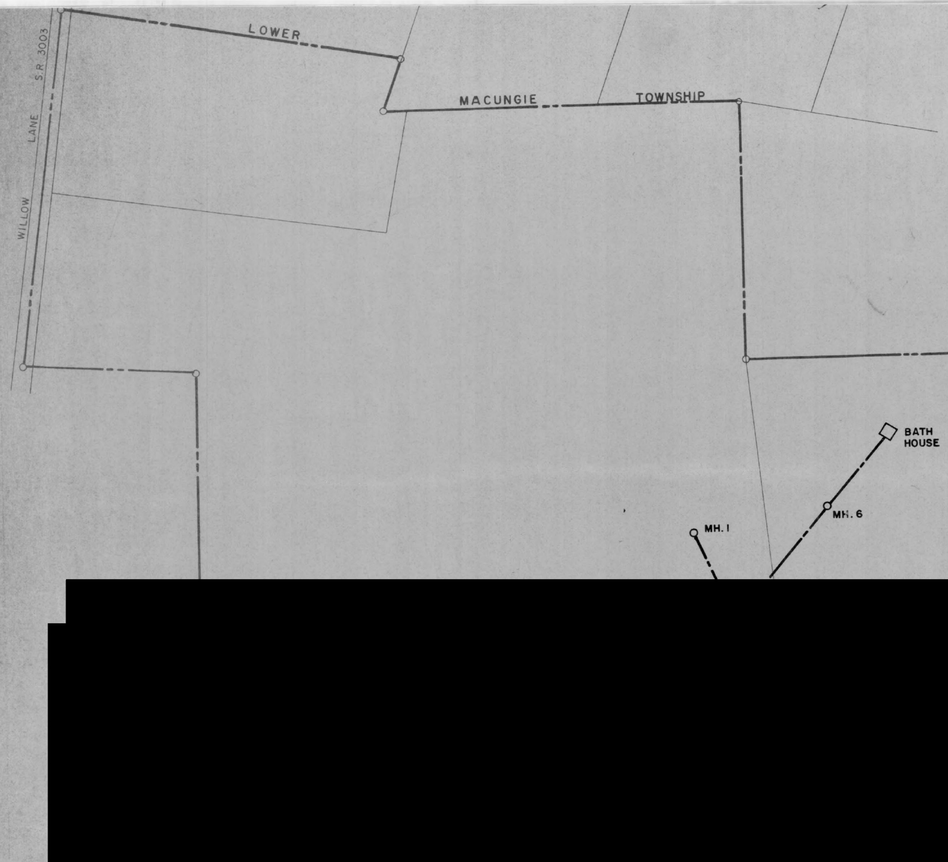
Sewer Main Lining

OFFICIAL BOROUGH MAP

BOROUGH OF MACUNGIE

LEHIGH COUNTY PENNSYLVANIA

0 200 400 1000
100



[redacted]

REDACTED FOR SECURITY PURPOSES

Completed Work - CIPP Sanitary Sewer Lining

Borough of Macungie

April 9, 2018 (Updated: November 2, 2022)

	No. of MH Runs	Length
Upstream of MH 94A		
2013 CIPP – Completed in 2013	2	430'
2017 CIPP – Completed March, 2018	35	7,706'
2018 CIPP – Completed in November 2018	1	202'
Upstream of MH 38 (Also US of MH 94A)		
2017 CIPP – Completed March, 2018	9	1,753'
2018 CIPP – Completed November 2018	27	6,347'
Upstream of MH 19		
2013 CIPP - Completed in 2013	21	4,210'
2016 CIPP – Completed April 2017	18	3,873'
2017 CIPP – Completed March, 2018	13	2,823
2017 CIPP – Completed April, 2018	3	535'
2018 CIPP - Completed November 2018	16	2,318'
Upstream of IMH 131		
2013 CIPP – Completed in 2013	6	870'
Total Completed	151	31,067'

Borough of Macungie

Summary of Sanitary Sewer Lateral Lining

Completed in 2022

Catchment Basin	Stubby < 3'	Shorty: <6'	Add'l Lining >6'
122 A	0	2	0'
68	22	10	0'
94A	51	82	88.9'
38	3	115	1,231'
63-2	81	1	0'
19-1	23	18	93'
Total	180	228	1,413'

Note: The Add'l Lining is in addition to a Shorty. For example if a lateral was lined at its full length (from the sewer main to the property line) and the total length was 25', it would be included as one shorty plus 19' add'l lining.

BARRY ISETT & associates INC

MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

Exhibit C

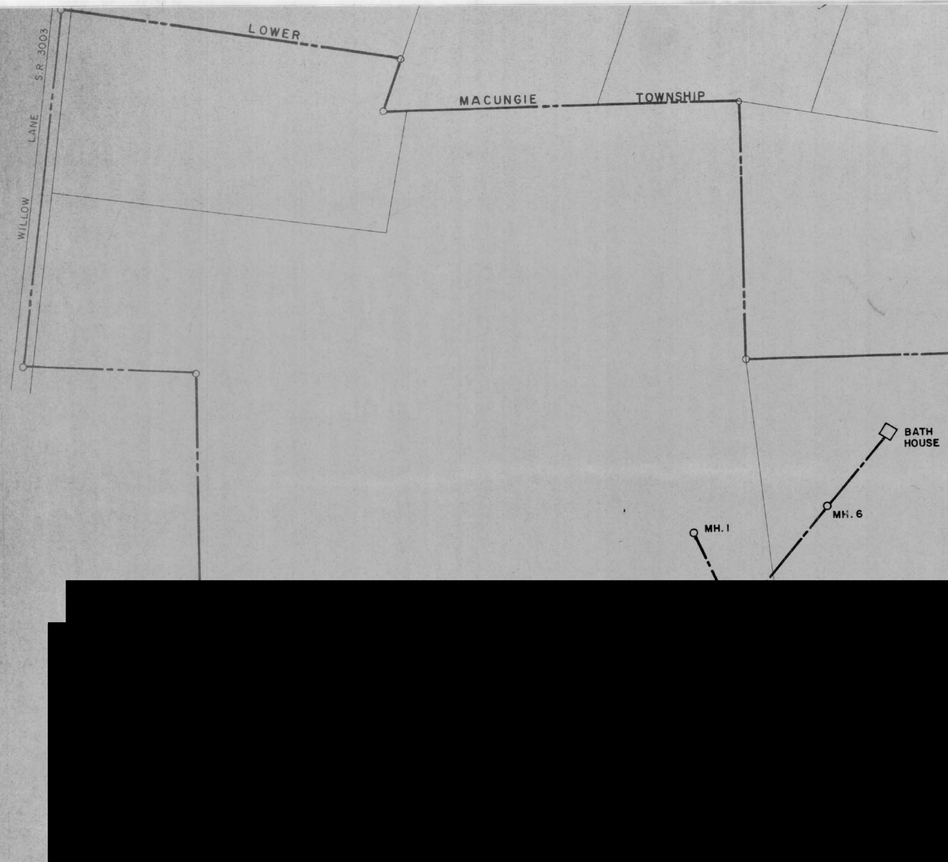
Manhole Rehabilitation

OFFICIAL BOROUGH MAP

BOROUGH OF MACUNGIE

LEHIGH COUNTY PENNSYLVANIA

0 200 400 1000
100



[redacted]

REDCATED FOR SECURITY PURPOSES

Summary of Rehabilitated Manholes
2019 Manhole Rehabilitation Project
Borough of Macungie, Lehigh County, Pennsylvania

MH #	LOCATION		
		Chimney Lining	Full Depth Lining
46-13	Glenwood & Hilcrest	X	
46-13A	Hillcrest	X	
46-13B	Hillcrest	X	
46-13C	Hillcrest	X	
46-13D	Hillcrest	X	
112-19	Hillcrest	X	
112-18	Hillcrest	X	
112-17	Hillcrest	X	
112-16	Hillcrest	X	
112-15	Hillcrest	X	
112-14	Hillcrest	X	
112-11	Hillcrest	X	
112- 12	Hillcrest	X	
112-13	Hillcrest	X	
112-10	Fairview	X	X
112-9	Fairview	X	
112-8	Hill & Fairview	X	
112-7	Fairview	X	
112	Fairview	X	
112-1	Fairview & Vine	X	
46-1	Hickory & Fairview	X	
46	Hickory & Fairview	X	
114	Fairview & Main	X	
116	Fairview & Fern	X	
117	East of Fern on Fairview	X	
118	Fern	X	
118-A	Fern & Buss	X	
118-B	Buss	X	
46-9	Hickory (Rear Esmt)	X	X
46-8	Hickory (Rear Esmt)	X	X
46-7	Hickory (Rear Esmt)	X	X
46-6	Hickory (Rear Esmt)	X	X
47	Hickory (821)	X	
46-2	Hickory (Rear of 821)	X	
113-1	Main & Maple	X	
113	Main & Maple	X	
45	Hickory & Maple	X	

109	Vine & Maple	X	
110	Maple	X	
111	Maple	X	
105	Buttonwood	X	
107	Buttonwood	X	
108	Vine & Buttonwood	X	
108A	Buttonwood	X	
106	Vine & Cypress	X	
102	Cypress & Chestnut	X	
44	Hickory	X	
43	Hickory & Buttonwood	X	
42	Hickory & Cypress	X	
41	Hickory & Sycamore	X	
8	Sycamore & Fern	X	
17	Sycamore	X	
17-1	Sycamore	X	
17-2	So. Of Sycamore (45,43)	X	
9	Fern	X	
10	Buttonwood & Fern	X	
11	Fern (So of Buttonwood)	X	
18	Buttonwood (near school)	X	
142-7	Chestnut (near Eyer)	X	
142-8	Chestnut (near Eyer)	X	
142-6	Chestnut	X	X
142-5	Chestnut	X	
142-4	Between Chestnut & Walnut	X	X
142-3	Between Chestnut & Walnut	X	X
142-2	Between Chestnut & Walnut	X	
144	Walnut	X	X
141-A	Walnut	X	
143	Walnut	X	
142	Walnut	X	
141	Walnut	X	
139	Park (entrance to pool)	X	
138	Between Lehigh and Walnut	X	
120	Lehigh	X	
94	Main	X	
51	Main	X	
50A	Lumber & Main	X	
50	Main	X	
94A	Park (off Main)	X	
1	Park (off Main)	X	

2	Fern (near Park)	X	
3	Fern	X	
4	Fern	X	
4-1	Fern & Walnut	X	
13	Walnut	X	
12	Walnut	X	
6	Fern	X	
14	Chestnut	X	
7	Fern & Chestnut	X	
6C	Fern & Chestnut	X	
15		X	
89	Poplar	X	
31A	Arch & Poplar	X	
31B	Arch & Dock	X	
122A	Main	X	X
122	Main & Thorn	X	
122-1	Thorn	X	
122-2	Thorn	X	
123	Main	X	
129A	Main (Front of Turkey Hill)	X	
129	Main (Shoppes of Macungie)	X	
128	Main	X	
127	Main	X	
126	Main	X	
125	Main	X	
124	Main	X	
B1C	Brookfield	X	
B1B	Brookfield	X	
B1A	Brookfield	X	
B2	Brookfield	X	
B3	Brookfield	X	
B4	Brookfield	X	
B5	Brookfield	X	
B6	Brookfield	X	
B7	Brookfield	X	
B8	Brookfield	X	
B9	Brookfield	X	
B10	Brookfield	X	
B15	Brookfield	X	
B14	Brookfield	X	
B13	Brookfield	X	
B12	Brookfield	X	
B11	Brookfield	X	
2.00	Lindfield & Ridings	X	
2.02.2	Lindfield	X	

2.02	Lindfield	X	
2.04	Lindfield	X	
2.06	Lindfield	X	
3.0	Ridings	X	
4.0	Ridings	X	
4.01	Ridings	X	
2.01.02	Windsor	X	
2.01	Ridings & Windsor	X	
2.03	Ridings	X	
2.03.02	Slurry	X	
4.03	Ridings	X	
2.05.04	Oxford	X	
2.05.02	Oxford	X	
2.05	Ridings & Oxford	X	
2.07	Ridings	X	
2.09	Ridings	X	
2.11	Ridings	X	
4.05	Ridings	X	
63-3.6	Willow	X	
63-5	Willow	X	
63-7	Race & Chestnut	X	
63-2	Race	X	
63-1	Race	X	
80	Church & Chestnut	X	
79	Church	X	
85	Church	X	
77	Cherry & Church	X	
71B	Cherry & Hay	X	
71	Locust & Hay	X	
68	Locust & Pine	X	
71D	Locust	X	
70A	Pine	X	
70B	Pine	X	
70	Pine	X	
69	pine	X	
87	Spruce & Bird	X	
86	Bird & Chestnut	X	
83	Church & Hickory	X	
88A	Church & Coach	X	
28	Lea & Main	X	
28A	Lea	X	
29	Lea & Coach	X	
30	Lea & Hickory	X	
83A	Hickory & Mountain	X	X
88	Mountain & Coach	X	
32	Lea & Walnut	X	

32A	Cotton & Lea	X	
32B	Cotton & Bird	X	
33	Walnut & Arch	X	
34	Walnut	X	
35	Walnut	X	
35A	Walnut	X	
96B	Lea & Main	X	
96A	Main	X	
96	Main	X	
97	main	X	
90	Main	X	
91	Poplar & Main	X	
92	Poplar & Hickory	X	
93	Hickory	X	
37	Walnut & Hickory	X	
36	Walnut	X	
38	Hickory & Chestnut	X	
39	Hickory & Chestnut	X	
39-A	Chestnut & Cotton	X	
39-B	Chestnut & Cotton	X	
40	Hickory	X	
100	Vine & Sycamore	X	
101	Sycamore & Chestnut	X	
67	Locust	X	
67A	Locust	X	
62	Locust & Race	X	
59	Race & Main	X	
58	Main	X	
57	Main	X	
56	Mill	X	
55	Mill	X	
54	Miller	X	
23	Mill	X	
24	Church & Lehigh	X	
52	Church & Miller	X	
53-2	Church	X	
53	Main & Church	X	
53-1	Lehigh	X	
25	Lehigh & Creek	X	
119	Lehigh	X	
25A	Lehigh & Creek	X	
48	Lehigh & Lumber	X	
27	Creek & Main	X	
22	Creek	X	
21	Along RR	X	
19	Along RR	X	

46-10	Hickory	X	
46-10A	Hickory	X	
46-4	Hickory	X	
112-4	Vine	X	
112-5	Vine	X	
112-6	Vine	X	
46-12	Vine & Glenwood	X	

BARRY ISETT & associates INC

MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

Exhibit D

Lateral Lining

Borough of Macungie

Summary of Sanitary Sewer Lateral Lining

Completed in 2022

Catchment Basin	Stubby < 3’	Shorty: <6’	Add’l Lining >6’
122 A	0	2	0’
68	22	10	0’
94A	51	82	88.9’
38	3	115	1,231’
63-2	81	1	0’
19-1	23	18	93’
Total	180	228	1,413’

Note: The Add’l Lining is in addition to a Shorty. For example if a lateral was lined at its full length (from the sewer main to the property line) and the total length was 25’, it would be included as one shorty plus 19’ add’l lining.

OTT CONSULTING INC.

CIVIL ENGINEERS · SURVEYORS · LANDSCAPE ARCHITECTS

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LEHIGH VALLEY OFFICE
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EMMAUS, PA 18049

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WEBSITE: WWW.OTTENG.COM
EMAIL: INFO@OTTENG.COM

ALBS 1501.02

January 28, 2025

Arcadis U.S., Inc.
316 Covered Bridge Road
King of Prussia, PA 19406
Attn: Mr. James W. Shelton PE
Vice President – National Technical Director - Buried Infrastructure (via email)

Re: Planned Source Reduction Protocol (01/28/2025)
Alburtis Borough, Lehigh County, Pennsylvania

Dear Mr. Shelton:

The Borough of Alburtis (population 2,569 as of 2022) owns and operates its own sanitary sewer system, which is tributary to the Western Lehigh Interceptor and ultimately to the Kline's Island Waste Water Treatment Plant. In keeping with the main goal of reducing inflow and infiltration, as part of the Western Lehigh Sewerage Partnership Sewer Capacity Assurance and Rehabilitation Program (SCARP), the Borough has installed CIPP Lining, conducted main line dig and repair, performed main line lining (including manhole to manhole lining) and sectional repairs, and a Borough wide lateral CCTV inspection and lining/repair program; as well as performed CCTV inspection and basement inspections from 2010 to present, in order to reduce overall inflow and infiltration (I/I) within the Borough's sanitary sewer system.

The Borough is currently in the process of concluding a lateral inspection program for approximately 950 sanitary sewer laterals within the Borough and select repair work is in progress for the remaining three (3) laterals in need of lining; however, a majority of the laterals did not appear to contain structural defects.

Additionally, night-time weiring performed by Arcadis in May of 2022, shows that a majority of the Borough's sanitary sewer system now experiences less than 5 GPD/LF of infiltration. The remaining areas of the Borough (> 5 GPD/LF) were represented by a single weir (L-182), with likely sources of I/I contribution coming from inflow via manhole frames and covers, especially those located in low-lying areas which may experience ponding, typically found within floodplains and/or near retention ponds. The results of this evaluation are further supported by Arcadis' 2021 Rainfall-Derived Infiltration and Inflow (RDII) Analysis.

As such, the Borough will continue to pursue reduction of inflow and infiltration within the sanitary sewer system, concentrating efforts on raising and/or sealing manholes located within the floodplain of the Swabia Creek, to prevent water intrusion through these manholes, as well as through the manhole frames and covers (the manholes to be sealed include TLA-1, TLA-2, TLA-3, TLA-4, TLA-5, TLB-1 & TLB-2). The Borough is currently receiving budgetary quotes for two options: raise the manhole lid elevations to a point above the 100-year floodplain elevation or remove the existing frames and covers and replace with a water-tight version. The Borough is also pursuing quotes to seal the interior of the manholes.

Planned Source Reduction Protocol (01/28/2025)
Alburtis Borough, Lehigh County, Pennsylvania

Additionally, the Borough will also pursue inspection and sealing of manhole lids/frames/dishes, when an acceptable standard is determined (caulk, EPDM seal, pan, etc.). Lastly, the Borough will continue to perform basement inspections and consider grant application opportunities for overall system improvement (likely targeting sewer lateral and tap connections within lined mains).

Thank you for your assistance in this matter. Please feel free to contact the undersigned with any questions or comments.

Sincerely,

OTT CONSULTING INC.

Jeffrey L. Ott, Pres.

Jeffrey L. Ott, P.E., M.B.A., S.E.O., President
Alburtis Borough Engineer

Cc: Stephen Nemeth, Alburtis Borough Manager
File

Encl: S-1.1 Sanitary Sewer Site Plan
Alburtis Township, Night Time Weiring Weir Results (Arcadis)
Alburtis 2021 RDII Analysis (Arcadis)

Alburtis Borough

Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)	*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*	*Length Normalized RDII (GPD/LF)*
MS1	ALBURTIS	995	48,046	216	.17	13%	7.0	3.7

SRP:

Alburtis Borough's SRP will consist of the following:

1. Manholes: During 2016, the Borough performed manhole inspections of the entire system and ranked manholes by condition. Most of the work proposed for Alburtis Borough during years 2025 through 2035 is manhole rehabilitation. The Borough will update the inspection summary and will prepare bid documents for rehabilitation. During the next 10-year period, at least 22 manholes per year should be inspected and rehabilitated as needed. In 2025, the Borough plans to rehabilitate and seal manholes TLA-1, TLA-2, TLA-3, TLA-4, TLA-5, TLB-1 and TLB-2 which are all located in the floodplain of the Swabia Creek.

2. Main line: During 2018, the Borough performed a CCTV inspection of approximately 29,000 LF of their mainlines (not including approximately 20,000 LF inspected by LCA) and then addressed the high priority repairs and replacements in 2020. The Borough should revisit any higher priority repairs and replacement which may remain, and then seek grant funding to effectuate the necessary rehabilitative work.

3. Laterals: In 2021, the Borough performed CCTV inspections of all of the laterals in the system. Once the CCTV inspections were completed, lateral rehabilitation then occurred. The Borough should consider a program from 2025 through 2035 to seal taps and risers on lined clay pipes.

4. Smoke Testing: The Borough will be pursuing a Smoke Testing Program during 2025 in the sewershed to the pump station. Identified I/I areas will be addressed. The Borough should consider a smoke testing program to be performed on a regular basis throughout its gravity system.

Salisbury Township

Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)		*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
ST10	ST	1,687	104,982	473	0.64		51%	10.0
PPS+U613	ST	1,055	48,511	219			35%	5.0
U_26_84 (ST6)	ST	1,001	34,414	155	0.66		32%	10.0
ST8	ST	390	40,862	184	0.25		36%	4.0
ST1 Surrogate	ST	566	32,860	148	0.15		47%	2.1

SRP:

Salisbury Township's SRP will consist of the following:

1. The bulk of the work proposed for Salisbury Township for years 2022 through 2035 is manhole inspection and repair. The intent is to inspect an average of about 330 manholes per year, beginning in 2022, and after determining the status of the repairs required, bid the repair for about 100 manholes per year the following year. Manholes will be repaired based on the inspection quality of the manhole. The manholes needing the most work will be repaired first. All manholes will be cover sealed after the inspection process.

2. Salisbury Township will continue to maintain the underground pipe collection system. The intent is to have Township personnel video tape the undocumented portion of the existing system between 2023 and 2026 and repair the system as necessary during years 2023 through 2035.

Year	Meter Basin	# MH/LF Pipe	Work
2023	1, 8, 10	322 MHs	Manhole Inspections - Completed
2023 - 2024	1, 8,10	227 MHs	Manhole Repairs – 86 MB#10, 121 MB#1, 20 MB#8 - Completed
2023 - 2024	10	1,200 LF	Sewer Main Lining - Completed
2023 - 2035	All	SSES – Video & Investigations	Township video of sewer lines and manholes
2025 - 2035	All	Manhole Frame & Covers	Frame, Cover and Riser ring rehabilitation and replacement as part of street paving projects
2025 - 2035	All	Lateral Videos	Lateral videos of private laterals as properties are sold
2024	12, 10	100	Manhole Lining Completed, 64 MB#12, 36 MB#10
2024	2	Main Line Breaks	24 Repaired
2025 - 2027	10	100 per year	Manholes Lined
2025 - 2035	10	1,100 LF per year (CDBG)	Main Line Lined
2027 - 2028	6	100 MH/year	Manholes Lined
2029 - 2031	8	100 MH/year	Manholes Lined
2032 - 2033	4	100 MH/year	Manholes Lined
2034 - 2035	System	100 MH/year	Manholes Lined (those identified by investigations)

South Whitehall Township
Sewer System Source Reduction Plan (SRP)
Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)		*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
US Dorney	SWT	1,687	104,982	473	0.64		51%	4.5
SW51	SWT	667	44,592	201	0.19		46%	8.0
SW56	SWT	487	31,158	140	0.44		44%	5.2
CEDAR CREEK RI_NET	SWT	0	15,526	70	0.07		100%	5.0

SSM's December 20, 2022, memo targeted Basins 51, 54 & 56 for priority I&I work. South Whitehall has committed to sealing and raising 100% of the manholes in the entire system by 2033. S. Whitehall will continue to prioritize I&I work in each of the 3 targeted basins (51,54 & 56) These three basins were identified as having flow peaking factors greater than five from the KISS model prepared by ARCADIS. Proposed work to be performed through 2033.

We have attached a summary spreadsheet with the Township's estimated costs for the work. The proposed manhole raising and sealing work will be conducted in low lying areas near or adjacent to creeks. The remainder of the manholes in the system will be sealed. Sealing manholes consist of epoxy sealing the chimneys and sealing the lid with sealing material. This work would be for manholes in streets or grade adjustment could not be applied. Raising and sealing will consist of raising manhole tops approx. 12-18 inches as the topography allows, epoxy seal the chimneys and seal the lid.

In order to help reduce the base line infiltration in all basins, S. Whitehall will perform night reconnaissance work to locate clear flows and develop a plan to eliminate or reduce. Main line lining or full replacement may be considered. Lining would include main end seals and lateral connections. Since the lateral connections are not owned by the Township, no work is scheduled to be performed by the Township on lateral connections. All lining or replacement work would be reported to LCA on an annual basis or sooner at the preference of LCA.

South Whitehall will continue to flow monitor large private systems including Dorney Park, office parks and shopping malls in order to reduce I&I.

Year	Meter Basin	# MH/LF Pipe	Work
2023	51, 54	401 MHs	Manhole Inspections - Completed
2023 - 2024	54, 52	473 MHs	Manhole Inspections - Completed

2024	52, 54	65 Manholes	Lined all manholes along the trunk line
2025 2035	All	SSES – Video & Investigations	Township video of sewer lines and manholes
2025 - 2030	54	Manhole Frame & Covers	Raise all manholes up out of the swale.
2024	54	Manhole Inserts/seal lids	completed
2025	52	Manhole Inserts/seal lids	Entire basin
2025	56	Manhole lining	50 manholes
2024	56	Manhole Inserts	Entire Basin
2025	56	Seal lids	Entire Basin
2026	54	Manhole inserts	Entire Basin
2026	51	60 Manholes	Manhole Lining
2026	51	Manhole Inserts/seal lids	Entire Basin
2026- 2035	System	60 Manholes	Manholes Lined (those identified by investigations)
2026- 2035	System	CIP lining	CIP Lining as need on bad pipes as identified
2023 - infinity	System	Monitoring	Continue to keep up inspections and repairs

Hanover Township, Lehigh County

Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)		*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
Hanover SBM	HT	65	24,662	134	0.07		17%	3.8

SRP:

Hanover Township Lehigh County's SRP will consist of the following:

1. Despite being one of the smallest contributors to the Klines Island Wastewater Treatment Plant, the Township remains committed to reduce peak flows during heavy rainfall events and implement source removal, flow monitoring, CCTV inspection, and manhole inspection activities upon their sanitary sewer system on a regular basis. Since 2010, the Township has televised the entire sanitary sewer collection system within the City of Allentown service area. Additionally, in 2023 the Township inspected all of the sanitary sewer manholes tributary to the KIWWTP, and in 2024 all defects identified during these inspections were appropriately rehabilitated.

2. The bulk of the work proposed for Hanover Township for years 2025 through 2035 involves the continuation of the ongoing manhole inspection and sanitary sewer CCTV inspection programs. The manhole inspection program will be based upon a 5-year cycle, so that each manhole will be inspected at least once every 5-years. Given the limited number of manholes in the Hanover Township system, all manholes are anticipated to be inspected during the same year. The sanitary sewer CCTV inspection program will be based upon a 10-year cycle, with each sanitary sewer main scheduled for CCTV inspection at least once every 10-years. Any problematic defects identified during the manhole and/or sanitary sewer inspection programs will be rehabilitated promptly during the inspection year or the year after.

3. Additionally, the Township intends to aggressively pursue solutions to more effectively halt the inflow of stormwater through manhole lids and inflow dishes. The Township will review all sanitary sewer manhole locations to determine which manholes may be subject to stormwater inundation and/or over-topping sheet flow and will address these manholes with either a gasketed inflow dish and/or a caulk/sealant product. Going forward, all sealed manholes will be properly re-sealed upon disturbance, either during the inspection programs noted above or during routine maintenance activities.

Year	Meter Basin	# MH/LF Pipe	Work
2023	Hanover SBM	123 MHs	Manhole Inspections – Completed
2024	Hanover SBM	70 MHs	Manhole Repairs – Completed
2026	Hanover SBM	All MHs	Manhole Lids and Infiltration Dishes Evaluation and Rehabilitation
2026 – 2035	Hanover SBM	All sanitary sewer mains	Township CCTV inspection of sewer mains
2028	Hanover SBM	All MHs	Manhole Inspections and Repairs
2033	Hanover SBM	All MHs	Manhole Inspections and Repairs

Borough of Emmaus

Sanitary Sewer System Source Reduction Plan (SRP)

Years 2025 to 2035

Problem Basins based on Analysis:

Meter	Signatory	Parcels	Basin Length (LF)	Approximate MHs	Average Dry Weather Flow, DWF (MGD)		*Baseline Infiltration % adjusted for data issues*	*Average Peaking Factor adjusted for data issues*
EB4	EB	367	45,240	204	0.09		48%	20.0
EB4a	EB	1,937	99,644	449	0.50		48%	5.4
EB1	EB	253	11,444	52	0.07		30%	6.0
EB2	EB	337	17,737	80	0.11		29%	15.1
EB2a	EB	1,310	68,562	309	0.37		21%	4.0
EB3	EB	227	15,447	70	0.05		20%	8.0

Emmaus Borough's SRP consists of the following:

1. Emmaus Borough will continue to maintain its collector sewer system. The Borough Sewer Department personnel plan to perform inspection and categorization of the undocumented portion of the existing sewer system between 2025 and 2030 and repair the system as necessary during years 2027 through 2035.
2. The intent is to video inspect an average of about 6 to 7 miles of pipe and visually inspect about 100 to 150 manholes per year. After determining the status of the repairs required, the Borough would bid the repair work after an appropriate project scope is identified and funding is secured for cost-effective public bidding. It is expected that this will involve multiple public bid projects over the upcoming 10-year period.
3. Some rehabilitation, especially manhole riser rehab, may need to be performed out of basin-priority sequence due to Borough or PennDOT road paving and reconstruction schedules.
4. If severe defects are encountered, Borough staff and their engineering consultant will evaluate to determine if imminent or emergency-priority repair should be scheduled.
5. Borough Ordinance #1185, adopted in 2019, requires service laterals to be inspected at the time of property ownership transfers. Most inspections are performed by Borough Sewer Department staff and property owners are notified of defects requiring repair. The Borough's inspection activity is ongoing, performed upon receipt of applications from property owners. Application fees are charged, so this work is not dependent on annual Borough budget line-item approvals.
6. The Borough applied for ARPA funding assistance through the Commonwealth Financing Authority and will be bidding for reconstruction of 125 manhole tops (including new riser rings, frames, covers, and exterior waterproofing membrane wraps). To be bid in 2025.
7. The Borough has identified a significant scope of sewer main relining, lateral reinstatements, and manhole rehabilitation, to be incorporated into a PennVest funding request. It is expected that this will be bid as two projects (pipe work and manhole work) with the funding application to be submitted in late-2025 or 2026.

Major activities in Emmaus Borough's SRP pre-2025 history:

1. The Borough completed a multi-year program to gain entry, inspect the interior and exterior of private properties, and proactively assist property owners in eliminating illegal sump pump, roof drain, and area drainage connections from the sanitary sewer system. 3,899 properties were successfully inspected, out of a total of 3,904. Completed over the period of 2006-2014.
2. The Borough purchased a Pearpoint portable camera system for sewer main TV inspection in 2017. The Borough upgraded to a Cues truck-mounted inspection studio system in 2022. A team of Borough Public Works Department personnel assigned to the sanitary sewer system O&M received training for operation of the equipment. As of 2024, three of the four crew members dedicated to sewer system O&M were NASSCO certified, and the fourth member of the team is scheduled to obtain certification in 2025.
3. The Borough inspected a significant number of manholes, applied for funding assistance, and contracted for reconstruction of 145 manhole tops (including new grade riser rings, frames, covers, and exterior waterproofing membrane wraps). Completed in September 2019.
4. The Borough contracted for replacement of 530' OF sewer mains and 10 service laterals, and reconstruction of 3 manhole tops in Franklin Street. Completed in July 2024.

Year	Meter Basin	# MH / LF Pipe	Work Description
Completed SRP Activities			
2006 - 2014	ALL Basins	3,899 Individual Property Inspections	Inspected site exterior and building interior for identification & removal of illegal points of I&I entry (roof drains, sump pumps, etc.).
2019	1	15 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	2a	31 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	3	9 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	4	34 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	4a	54 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	Trib. direct to WLI MH #34	2 Manholes	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap (CFA funding)
2019	ALL Basins	Defects found & repaired in 8 of 134 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.

Year	Meter Basin	# MH / LF Pipe	Work Description
2020	ALL Basins	Defects found & repaired in 7 of 206 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.
2020	Location not confirmed	2 Pipe-to-MH connections	Borough staff identified and repaired two gushers at pipe connections to manholes
2021	ALL Basins	Defects found & repaired in 8 of 121 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.
2022	ALL Basins	Defects found & repaired in 17 of 178 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.
2023	ALL Basins	Defects found & repaired in 17 of 112 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.
2024	ALL Basins	Defects found & repaired in 24 of 107 laterals inspected	Video inspected private sewer laterals as properties were scheduled for sale. Identified defects for repair by property owners' contractors.
2024	4a	Franklin Street – Mains, Laterals, and MH's	Replaced 530' of 8" mains and 10 services; reconstructed risers, frame & lid, and install exterior waterproofing wrap on 3 MH's
2024	3	MH E-221 & C-91	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap
2024	4a	MH C-30 & C-271	Reconstructed risers, frame, & lid; installed exterior waterproofing wrap
Scheduled SRP Activities			
2025	4a	125 Manholes	Reconstruct risers, frame, & lid; install exterior waterproofing wrap (ARPA / CFA funding has been approved)

Year	Meter Basin	# MH / LF Pipe	Work Description
2025	2a	MH B-214 & 20' of 8" sewer	Remove and rebuild top section of precast barrel; Reconstruct influent drop pipe and replace 20' of influent sewer pipe; replace risers, frame, & lid; install exterior waterproofing wrap
2026-2028	4 and 4a	115 to 150 Manholes *	Reconstruct risers, frame, & lid; install exterior waterproofing wrap (PennVest funding to be requested) (* The number of manholes to be re-built depends upon final evaluation of cost of pavement lane overlay requirements to be imposed by PennDOT)
2026-2028	4 and 4a	34,600' Mains, 750 Laterals	Reline 8" VCP sewer main lines, and reinstate /seal sewer lateral penetrations (PennVest funding to be requested)
Ongoing and Planned SRP Activities			
2026	4	MH C-302G	Install exterior waterproofing wrap (part of PennDOT bridge rebuild project along Indian Creek Road)
2025 - 2030	ALL Basins in turn	Video Inspect Mains	Borough video inspect sewer mains, identify defects; average of about 6 miles/year
2025 - 2030	ALL Basins in turn	Visual Inspect Manholes	Borough visual inspect manholes, identify defects; average of about 100-150 per year
2025 - 2035	ALL Basins	Laterals	Video inspect private sewer laterals as properties are sold. Identify & repair defects
2025 - 2035	ALL Basins	Main Line Breaks	Identify and repair on prioritized basis, following discovery
2027 - 2035	ALL Basins	Rehab of sewer mains and lateral connections	Establish manageable scope of sewer main and lateral rehab work based on results of annual inspections, secure funding, and bid for contractor projects to perform pipe lining and other applicable repairs.
2027 - 2035	ALL Basins	Rehab of manholes	Establish manageable scope of manhole rehab work based on results of annual inspections, secure funding, and bid for contractor projects to perform manhole repairs and rehabilitation.

COPLAY WHITEHALL SEWER AUTHORITY

SOURCE REDUCTION PLAN 2023-2032

ACCEPTED BY CWSA BOARD 12/15/2022

Introduction

As a signatory of the Klines Island Wastewater Treatment Plant (KIWWTP), the Coplay-Whitehall Sewer Authority (CWSA) has been asked to develop a Source Reduction Plan (SRP). The purpose of the SRP is to plan Infiltration and Inflow reduction work that can be hydraulically modeled as part of the planning process for future upgrades and expansion at KIWWTP. The CWSA intends for the SRP to be in addition to the regular infiltration and inflow reduction work it performs on a daily basis.

Source Identification and Selection of Rehabilitation Areas

The CWSA was a participant in a region wide sewerage flow study performed by ARCADIS, Inc in 2021. The multi-month flow study monitored and recorded flow data at 12 locations in the CWSA sanitary sewer system. After the data was analyzed the CWSA elected to perform further investigation after the initial flow study. The CWSA chose 6 drainage basin areas totaling ~35 miles of sanitary sewer main and commissioned a night-time weiring study to be performed on these six basins. The night-time weiring study identified ~3.5 miles of sanitary sewer main where rehabilitation work would be beneficial.

Source Reduction Plan

The CWSA intends to rehabilitate the ~3.5 miles of sanitary sewer main previously identified via pressure testing and grouting. This work will be completed during the 2023-2032 planning period. The CWSA intends to divide this work into annual, bi-annual or tri-annual SRP project schedules during this period. The exact locations of the planned rehabilitation and an estimated cost of completion are attached to this plan summary.

The CWSA also intends to identify manholes in the CWSA system which encounter inflow due to ponding water during rain events. The regional flow study indicated this type of inflow may be present at some locations. The CWSA will continue to investigate suspect areas during rain events and seal manhole lids as necessary. The CWSA anticipates locating and sealing 1-20 manhole lids per year during the 2023-2032 planning period.

2022 Coplay-Whitehall Sewer Authority Weiring Study Summary	
TOTAL WEIRED LENGTH	
Total Distance (LF)	189,082
Number of Joints (estimated)	37,816
Total Number of Pipe Runs	1,036
RED ZONES	
Total Distance (LF)	13,741
% Total Weired Length	7.27%
Number of Joints (estimated)	2,748
Total Number of Pipe Runs	93
YELLOW ZONES	
Total Distance (LF)	4,513
% Total Weired Length	2.39%
Number of Joints (estimated)	902
Total Number of Pipe Runs	27
RED + YELLOW ZONES	
Total Distance (LF)	18,254
% Total Weired Length	9.65%
Number of Joints (estimated)	3,650
Total Number of Pipe Runs	120
ESTIMATED COST OF REPAIR VIA PRESSURE TESTING AND GROUTING ESTIMATED UNIT COST $35.00 PER JOINT	
RED ZONES	$96,180.00
YELLOW ZONES	$31,570.00
15% Engineering/Inspection	$19,162.50
10% Contingency	$12,775.00
TOTAL	$159,687.50

RED ZONES			
Run Name	Location	Location 2	Length(LF)
OF-1 to OF-7	S 5th Avenue	Stiles	195.0
OF-1 to OF-2	Cobblestone Lane	Stiles	120.0
BV-4 to OF-1	S 5th Avenue	Stiles	44.7
OF-2 to OF-3	Cobblestone Lane	Stiles	57.4
OF-3 to OF-4	Cobblestone Lane	Stiles	99.1
OF-4 to OF-5	Cobblestone Lane	Stiles	158.1
OF-5 to OF-6	S 2nd Avenue	Stiles	79.0
OF-7 to OF-8	S 2nd Avenue	Stiles	58.0
OF-8 to OF-9	S 2nd Avenue	Stiles	81.9
OF-10 to OF-9	S 5th Ave	Stiles	155.9
OF-11 to OF-10	S 2nd Ave	Stiles	199.4
OF-12 to OF-10	S 2nd Ave	Stiles	287.7
BV-1 to BV-2	Barkley Village	Stiles	45.4
BV-2 to BV-3	S 5th Avenue	Stiles	142.0
BV-3 to BV-4	S 5th Avenue	Stiles	137.0
		Sub Total	1,861
PTV-16 to PTV-15	Georgia Dr	Fullerton	138.3
PTV-17 to PTV-15	Redwood Dr	Fullerton	128.7
PTV-18 to PTV-17	Redwood Dr	Fullerton	296.4
J-4.70 to PTV-1	Sunset Dr R/W	Fullerton	71.6
PTV-19 to PTV-20	Brooke CRT. R/W	Fullerton	157.3
PTV-20 to PTV-21	Brooke CRT. R/W	Fullerton	198.2
PTV-23 to PTV-24	Alberta Dr	Fullerton	186.3
PTV-24 to PTV-25	Alberta Dr	Fullerton	235.0
PTV-25 to PTV-26	Alberta Dr	Fullerton	149.0
PTV-26 to PTV-27	Alberta Dr	Fullerton	100.1
PTV-28 to PTV-27	Alberta Dr	Fullerton	102.6
PTV-28 to PTV-30	Georgia Dr	Fullerton	297.0
PTV-28 to PTV-29	Georgia Dr	Fullerton	160.0
PTV-31 to PTV-32	Sunset Dr	Fullerton	104.0
J-4.69 to J-4.70		Fullerton	64.0
J-4.70 to J-4.71		Fullerton	231.0
J-4.71 to J-4.72		Fullerton	215.0
J-4.77 to J-4.78	Sunset Dr	Fullerton	99.2
J-4.78 to J-4.79	Sunset Dr	Fullerton	97.0
J-4.79 to J-4.80	Sunset Dr	Fullerton	118.3
J-4.80 to J-4.81	Sunset Dr	Fullerton	45.5
J-4.81 to PTV-23	Alberta Dr	Fullerton	117.4
J-4.81 to J-4.82	Sunset Dr	Fullerton	59.9
J-4.82 to J-4.83	Sunset Dr	Fullerton	162.2
J-4.83 to J-4.84	Sunset Dr	Fullerton	91.3
J-4.85 to J-4.84	Sunset Dr	Fullerton	78.5
J-4.85 to J-4.86	Van Buren Dr	Fullerton	97.8

J-4.86 to J-4.87	Van Buren Dr	Fullerton	81.1
J-4.87 to J-4.88	Van Buren R/W	Fullerton	60.6
J-4.88 to J-4.89	Van Buren R/W	Fullerton	156.7
LDS-1 to LDS-2	Van Buren Dr	Fullerton	137.8
J-4.72 to J-4.73	Sunset Dr R/W	Fullerton	119.1
J-4.73 to PTV-31	Sunset Dr	Fullerton	200.0
J-4.73 to J-4.74	Sunset Dr R/W	Fullerton	112.6
J-4.74 to PTV-19	Brooke CRT. R/W	Fullerton	65.5
J-4.75 to J-4.76	Sunset Dr R/W	Fullerton	202.9
J-4.77 to J-4.76	Sunset Dr R/W	Fullerton	76.2
J-4.79 to PTV-22	Presidential Dr	Fullerton	275.1
J-4.90 to J-4.91	Mauch Chunk	Fullerton	352.0
		Sub Total	5,641
JV-1 to JV-2	Kay Drive	Fullerton	81.8
JV-2 to JV-3	Kay Drive	Fullerton	67.2
JV-3 to JV-4	Kay Drive	Fullerton	204.3
JV-4 to JV-5	Fernhill Lane	Fullerton	173.9
JV-5 to JV-6	Fernhill Lane	Fullerton	204.9
JV-5 to JV-13	Kansas Avenue	Fullerton	337.8
JV-6 to JV-7	Fernhill Lane	Fullerton	232.1
JV-6 to JV-8	Carolina Avenue	Fullerton	196.4
JV-8 to JV-9	Carolina Avenue	Fullerton	143.0
JV-9 to JV-10	Carolina Avenue	Fullerton	77.1
JV-11 to JV-10	Carolina Avenue	Fullerton	138.6
JV-11 to JV-12	Carolina Avenue	Fullerton	97.2
JV-13 to JV-11	Kansas Avenue	Fullerton	85.9
JH-56 to JH-55	Fairmont Avenue	Fullerton	177.0
JH-57 to JH-56	Fairmont Avenue	Fullerton	205.3
JH-58 to JH-57	Fairmont Avenue	Fullerton	23.3
JH-58 to JV-1	Kay Drive	Fullerton	40.0
JH-59 to JH-58	Fairmont Avenue	Fullerton	138.9
JH-60 to JH-59	Fairmont Avenue	Fullerton	182.7
JH-61 to JH-60	Fairmont Avenue	Fullerton	182.9
JH-62 to JH-61	Jordan Drive	Fullerton	152.8
JH-62 to JH0-63	Jordan Drive	Fullerton	73
JH-64 to JH-63	Jordan Drive	Fullerton	95.3
		Sub Total	3,311
A6-287 to OG-1	Olympic Drive	Fullerton	57.8
OG-1 to OG-2	Olympic Drive	Fullerton	94.3
OG-2 to OG-3	Olympic Drive	Fullerton	85.6
OG-3 to OG-4	Olympic Drive	Fullerton	158.8
OG-4 to OG-5	Olympic Circle N	Fullerton	140.2
OG-4 to OG-9	Olympic Circle	Fullerton	172.7
OG-5 to OG-6	Olympic Circle East	Fullerton	262.7
OG-6 to OG-7	Olympic Circle East	Fullerton	246.9
OG-7 to OG-8	Olympic Circle East	Fullerton	228.5

OG-9 to OG-10	Olympic Circle	Fullerton	190.6
OG-10 to OG-11	Corinth Road	Fullerton	213.3
OG-10 to OG-14	Olympic Circle N	Fullerton	255.3
OG-11 to OG-12	Corinth Road	Fullerton	104.8
OG-12 to OG-13	Corinth Road	Fullerton	344.9
OG-14 to OG-15	Olympic Circle N	Fullerton	236.1
OG-15 to OG-16	Olympic Circle N	Fullerton	135.3
		Sub Total	2,928

Red Zone Total	**13,741**

YELLOW ZONES			
Run Name	**Location**	**Location 2**	**Length(LF)**
PTV-1 to PTV-2	Sunset Dr R/W	Fullerton	156.5
PTV-2 to PTV-3	Sunset Dr	Fullerton	175.9
PTV-2 to PTV-4	Sunset Dr	Fullerton	155.3
PTV-4 to PTV-5	Sunset Dr	Fullerton	234.7
PTV-5 to PTV-6	Sunset Dr	Fullerton	112.3
PTV-6 to PTV-7	Sunset Dr R/W	Fullerton	144.2
PTV-7 to PTV-8	Sunset Dr R/W	Fullerton	103.6
PTV-9 to PTV-8	Peachtree R/W	Fullerton	263.6
PTV-10 to PTV-9	Peachtree R/W	Fullerton	154.4
PTV-11 to PTV-9	Peachtree R/W	Fullerton	98.0
PTV-12 to PTV-11	Peachtree R/W	Fullerton	160.3
PTV-13 to PTV-12	Georgia Dr	Fullerton	201.1
PTV-14 to PTV-13	Georgia Dr	Fullerton	178.6
PTV-15 to PTV-14	Georgia Dr	Fullerton	143.7
		Sub Total	2,282
CR-1 to CR-2	Columbia St r/w	Stiles	396.9
CR-2 to CR-3	Columbia St r/w	Stiles	111.3
CR-3 to CR-4	Portland Drive R/W	Stiles	132.7
CR-4 to CR-5	Portland Drive	Stiles	134.4
CR-4 to CR-9	Portland Drive	Stiles	90.7
CR-5 to CR-6	Portland Drive	Stiles	124.8
CR-5 to CR-7	Carl Drive	Stiles	324.7
CR-7 to CR-8	Portland Drive	Stiles	91.4
CR-9 to CR-10	Portland Drive	Stiles	80.3
CR-10 to CR-11	Portland Drive	Stiles	156.4
CR-11 to CR-12	Limestone Drive	Stiles	208.3
CR-12 to CR-13	Limestone Drive	Stiles	217.4
CR-13 to CR-14	Limestone Drive	Stiles	163.0
		Sub Total	2,232

Yellow Zone Total	**4,515**

Red + Yellow Zone Grand Total	**18,256**

NORTH WHITEHALL TOWNSHIP

LEHIGH COUNTY

3256 LEVANS ROAD

COPLAY, PA 18037

I/I SOURCE REDUCTION PLAN

FEBRUARY 2025

PREPARED BY:

KEYSTONE CONSULTING ENGINEERS, INC.

PO BOX 639

KRESGEVILLE, PA 18333

(610) 681-5233

1. GENERAL

North Whitehall Township has an existing sanitary sewer allocation of 140,000 GPD, which is conveyed through the Coplay-Whitehall Sewer Authority (CWSA) system, with ultimate treatment and disposal at the Kline's Island Sewer Treatment Plant. With average daily flows of approximately 50,000 GPD, North Whitehall Township is well within its allocated amount.

North Whitehall Township Public Works employees monitor and visually inspect the sanitary sewer system throughout the year. The Township maintains a GIS data base and maps to assist in the identification of areas for Infiltration/Inflow (I/I) reduction or rehabilitation of the sanitary infrastructure.

2. PROJECTS COMPLETED

The Township performs periodic inspections for potential I/I issues. Also, in 2011, a substantial portion of North Whitehall's sanitary sewer mains were videoed and evaluated. As a result of these inspections and the closed circuit tv evaluation, the Township has completed the following source removal and rehabilitation projects:

a. Repairs to three (3) sanitary sewer laterals in the Village of Ormrod, to eliminate infiltration.
b. Repairs to three (3) sanitary sewer manholes to eliminate infiltration.
c. Installation of 150 manhole inserts to alleviate surface inflow.

In addition to the above source removal projects, in 2022, the Township participated in a joint Sanitary Sewer Manhole Rehabilitation Project with Upper Macungie Township (UMT) and Coplay-Whitehall Sewer Authority (CWSA). As part of that project, a number of sanitary sewer manholes in North Whitehall's system received maintenance and repairs aimed at increasing system longevity and further reducing infiltration through and around the manhole structures. Moving forward, the Township plans to continue participating in this joint project with UMT and CWSA.

3. COSTS

Within the next few years, the Township anticipates spending approximately $50,000.00 to camera their entire sanitary sewer system and to flush and vacuum sanitary sewer mainlines. Based on the results of the cctv work, the Township will budget for future projects accordingly.

4. SOURCE REDUCTION BENEFIT

Based on comparable projects elsewhere, the Township anticipates reducing I/I within their system by approximately 15%.

5. FUTURE SOURCE REDUCTION PROJECTS

Future projects will be dependent on the results and evaluation of the cctv work described above. Future projects could include the following:

a. Repair and/or replacement of sanitary sewer pipes which are allowing I/I into the system.
b. Repair and/or replacement of sanitary sewer manholes which are allowing I/I into the system.
c. Removal of any identified inflow connections.
d. Continue with the Township's CCTV inspection program as necessary.
e. Continue with yearly inspections of all manholes within the system. The condition of each manhole will be recorded in the GIS data base with repair or replacement as necessary.

The Township anticipates budgeting $100,000.00 to $250,000.00 for these future improvements to the sanitary sewer system. The Township hopes continued source reduction will result in a 15% decrease of infiltration/inflow into the system.