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1 EXECUTIVE SUMMARY

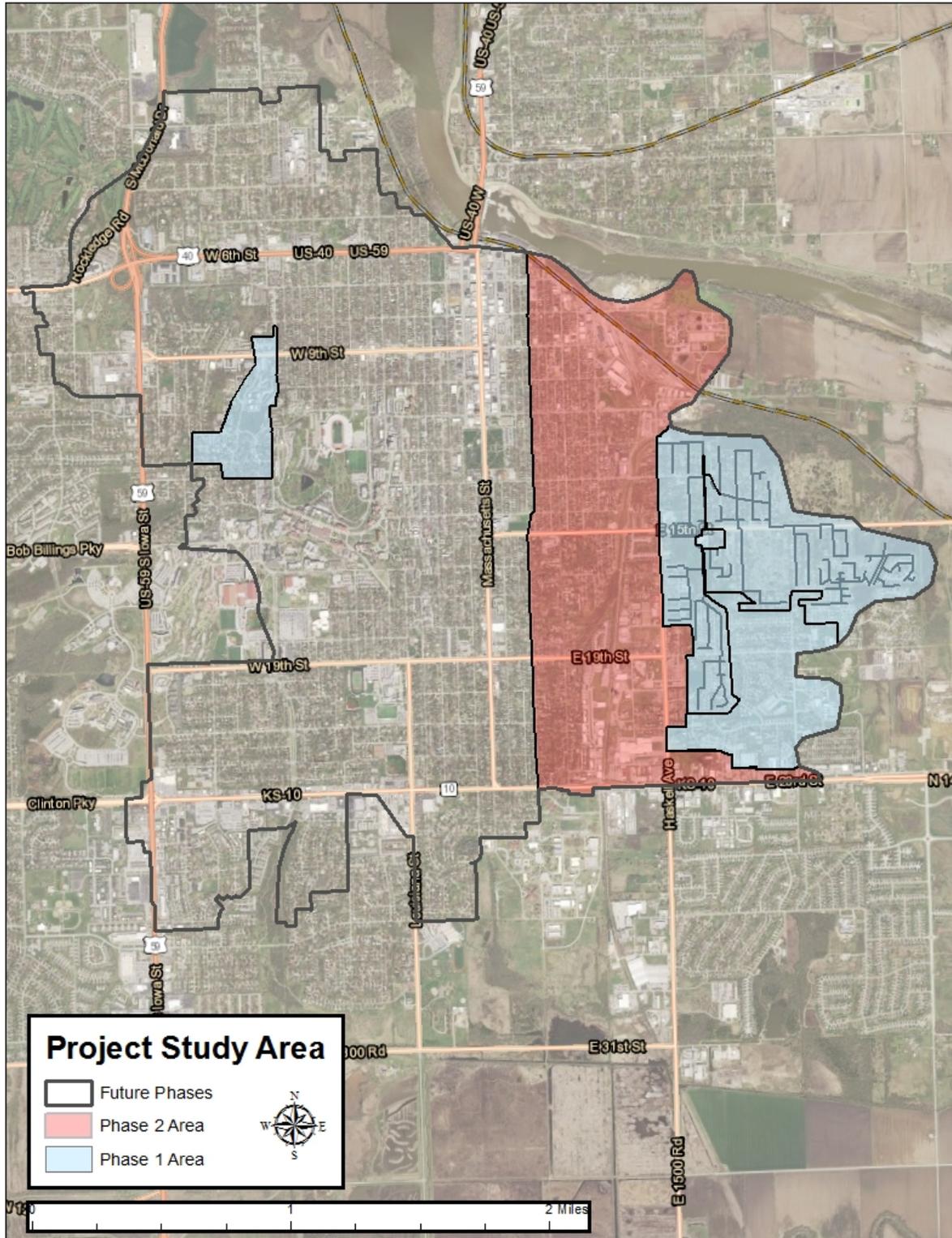
1.1 General Overview

The City of Lawrence, Kansas completed a Wastewater Facilities Master Plan in 2012. Included in the Master Plan is a capital improvement plan (CIP) and implementation of an 8 year Rapid Rainwater Reduction Program. The primary objective of the Rapid Rainwater Reduction Program (Ecoflow Program) is to reduce peak wet weather inflow and infiltration (I/I) rates by approximately 19 million gallons per day (MGD) or 35% within the oldest parts of the sanitary sewer system close to the Kansas River Wastewater Treatment Plant (KRWWTTP). Reducing I/I will be accomplished by inspecting and rehabilitating both public and private sector components of the sanitary sewer system. The reduction in flow will allow the City to achieve the following:

- Reduce sewer capacity restriction along the Burroughs Creek Interceptor
- Reduce the need for capacity expansion at the KRWWTTP
- Provide significant cost savings by reducing the need for capacity improvements

The Ecoflow Program will be implemented using a phased approach over the 8-year period. Each phase will include inspection/evaluation and rehabilitation of both private and public assets in a selected portion of the overall project area. Flows will be monitored throughout the project and an evaluation of flow reduction will be completed after each phase to gauge the success of the program. This executive summary provides a summary of the ongoing Phase 1 efforts and recommendations for Phase 2. The Phase 1 Area includes approximately 600 acres, and includes 1,300 parcels. The proposed Phase 2 Area covers approximately 750 acres and includes 1,300 parcels. Figure 1 shows an overall layout of the Phase 1 and Phase 2 basins.

Figure 1: Total Rapid I/I Reduction Project Areas



1.2 Phase 1 Field Investigation Findings

Field investigations were completed to identify structural and I/I defects in the sanitary sewer system. Field investigations included comprehensive manhole inspections, visual pipe inspections, smoke testing of sewer lines, main line closed circuit television (CCTV) inspection, and building plumbing evaluations. Results from the field inspection activities were utilized to generate cost effective recommendations for collection system improvements to reduce I/I within the Study Area. The following sections summarize the findings from the public and private sector investigations.

1.2.1 Public Sector Inflow/Infiltration Sources

Public sector field inspection activities were conducted to locate, quantify, and evaluate I/I entering the City's wastewater collection system. The following paragraphs briefly discuss the findings of TREKK's evaluation of the wastewater collection system within Phase 1.

- A total of 378 manholes were inspected in Phase 1. A total of 615 potential I/I sources were identified from manhole related defects. The majority of the defects found during manhole inspections include defective frame-chimney seals with 203 related defects (33%). In addition, poor wall, frame, and chimney conditions make up a large portion of defects.
- A total of 948 visual pipe inspections were performed identifying 154 potential I/I sources, structural defect or maintenance issues. The majority of the defects found during visual pipe inspections include roots, offset joints, cracks, fractures, or broken pipe.
- A total of 87,432 lineal feet of sanitary sewer was smoke tested, identifying 140 potential I/I source defects in the public sector. The majority of the public sector defects found during smoke testing included manhole defects.
- Based on the results of the smoke testing and visual pipe inspections, approximately 16,566 feet of sanitary sewer (83 individual lines segments) were identified for cleaning and internally CCTV inspection. TREKK cross referenced this recommended list with the City's existing CCTV database and determined that 23 line segments required CCTV. TREKK completed CCTV inspection on these 23 individual line segments, representing approximately 3,223 feet of sanitary sewer. The majority of the defects observed during CCTV inspection included root intrusion and cracked or broken clay pipe.

The following photos illustrate some of the defects identified during public sector inspections:

MH NW051320-197 Root Intrusion/Wall Damage



MH SW051320-153 Infiltration



MH NW361219-124 Corrosion



MH SW051320-091 Broken Pipe



MH SW321220-023 Root Intrusion



MH NW361219-102 Root Intrusion



1.2.2 Private Sector Inflow/Infiltration Sources

Private sector field inspection activities were conducted to locate, quantify, and evaluate I/I entering the City's wastewater collection system. Private sector I/I sources were identified through smoke testing and building plumbing evaluations. The Phase 1 area was divided into three smaller sub-areas (A, B, and C) to better manage the scheduling of the plumbing evaluations and defect disconnects. Overall, the plumbing evaluations are approximately 35% complete for all of Phase 1. Additional I/I sources will be identified as the project progresses. It is estimated that evaluations for Phase 1 will be fully complete by the end of the year. The following paragraphs briefly discuss the findings.

- A total of 587 building plumbing evaluations have been completed in Phase 1. The participation rate of property owners requesting plumbing evaluations has exceeded 90% in the initial Phase 1A Area. The Phase 1B Area is 54% complete and the final Phase 1C area will begin September 17th. A total of 25 property owners have refused plumbing evaluations.
- A total of 184 I/I defects were identified from the building plumbing evaluations. The majority of the defects found during the plumbing evaluations include defective cleanouts, foundation drains, sump pumps, and stairwell drains.
- Out of the 587 properties evaluated, 27 percent of them contain an I/I defect contributing flow to the sanitary sewer system.

A summary of private sector I/I defects are presented in Table 1.

Table 1: Summary of Private Sector I/I Defects

Inflow/Infiltration Source	Number of Defects
Area Drain	4
Cleanout	76
Downspout	2
Driveway Drain	1
Foundation Drain	44
Stairwell Drain	22
Sump Pump	32
Other	4
Total Private-Sector I/I:	185

The following photos illustrate some of the defects identified during private sector inspections and some of the repairs completed:

Foundation Drain Defect



Sump Pump Defect



Foundation Drain Defect



Repaired Foundation Drain



Cleanout Defect



Repaired Cleanout



1.3 Phase 1 Improvements

The following sections discuss the recommended Phase 1 improvements to both the public and private sectors. Phase 1 improvements should be completed by April 2015 to allow for post-construction flow monitoring during the wet season. Post construction flow monitoring and an evaluation of the I/I flow reduction in Phase 1 will help gauge the success of the program and provide useful insight for approaching future phases.

1.3.1 Public Sector Improvements

Public sector improvements include rehabilitating sewer mains and manholes to address the identified defects found during field investigations. The City is currently in negotiations with SAK construction to complete the work. It is anticipated that work will commence by October 1. Table 2 and Table 3 provide a summary of the recommended public improvements for the Phase 1 area. The improvements summarized in Table 4 include the repairs within the Rapid I/I area but outside the Phase 1 area. Table 5 summarizes the sewers to be repaired as part of the City's annual CIPP Pipeline Repair Program that are located outside the Rapid I/I area.

Table 2: Phase 1 Manhole Rehabilitation Summary

Type of Rehabilitation	Quantity	Unit	Unit Cost (\$)	Total Cost (\$)
Replace Frame / Cover / Frame Seal				
Paved	15	EA	3,275	49,125
Un-paved	5	EA	1,775	8,875
Strong Seal Chimney Liner (14")	32	EA	385	12,320
Replace Frame Seal / External Wrap	13	EA	1,150	14,950
Cementitious Wall Liner	373	VF	137.50	51,288
Total Cost*:				136,557

Table 3: Pipeline Rehabilitation Program (In Rapid I/I Phase 1 Area)

Repair	Number of Lines	Total Linear Ft	Unit	Unit Cost (\$)	Total Cost (\$)
Pipe Lining/CIPP	90	18,963			428,255
8-inch	88	18,528	FT	22.50	416,880
10-inch	1	87	FT	22.75	1,979
12-inch	1	348	FT	27.00	9,396
New Manhole	2	-	EA	10,000	20,000*
Replacement/Spot Repairs	12	660	LS	188,000	188,000*
Total:					636,255
*Estimated					

Table 4: Pipeline Rehabilitation Program (In Rapid I/I Area - Outside Phase 1)

Repair	Number of Lines	Total Linear Ft	Unit	Unit Cost (\$)	Total Cost (\$)
Pipe Lining/CIPP	59	12,936			314,980
8-inch Sanitary	49	11,851	FT	22.50	266,648
18-inch Storm	7	714	FT	43.50	31,059
21-inch Storm	2	331	FT	45.75	15,143
24-inch Storm	1	40	FT	53.25	2,130
Total:					314,980

Table 5: Pipeline Rehabilitation Program (Outside Rapid I/I Area)

Repair	Number of Lines	Total Linear Ft	Unit	Unit Cost (\$)	Total Cost (\$)
Pipe Lining/CIPP	23	6,525			161,152
8-inch	18	4,292	FT	22.50	96,570
10-inch	2	658	FT	22.75	14,970
15-inch	3	1,575	FT	31.50	49,612
Total:					161,152

1.3.2 Private-Sector I&I Abatement Program Improvements

Private sector improvements include rehabilitating the following plumbing defects in situations where significant rainwater is entering the system:

- Basement Entry and Area Drains
- Cleanouts
- Downspouts
- Driveway Drains
- Foundation Drains
- Sump Pumps

A group of seven (7) prequalified plumbers are currently under contract with the City to complete the private sector improvements. A process has been established that releases work to these plumbers immediately after defects are found during the building plumbing evaluations. This expedites the repair process and streamlines the coordination efforts with the property owner. In addition to the outside plumbers under contract with the City, Department Staff has been assigned and completed 14 simple cleanout cover repairs. Work has already commenced on the private sector improvements and it is anticipated that a majority of the work will be completed by January

1, 2015. Table 6 and the following bullet points provide a summary of the private sector improvements that have already been repaired or are currently under contract:

- Includes 91 defects at a total of 78 properties.
- The average repair cost for these properties is approximately \$1,700.
- A total of 11 property owners have refused repair.
- City staff has determined that it is not cost effective to repair defects identified at 5 properties.

Table 6: Phase 1 Private Sector I/I Abatement Summary

Type of Rehabilitation	Quantity	Standard Unit Cost (\$)	Average Additional Unit Cost (\$)	Total Average Unit Cost (\$)	Total Cost (\$)
Basement Entry and Area Drains	3	\$3,500	-\$14	\$3,486	\$10,458
Cleanout (Fixed By Plumbers)	39	\$700	-\$41	\$659	\$27,300
Cleanout (Fixed By City)	14	\$700	-\$600	\$100	\$1,400
Downspout	2	\$575	\$0	\$575	\$1,150
Driveway Drain	1	\$3,900	\$400	\$4,300	\$4,300
Foundation Drain	18	\$2,420	\$504	\$2,924	\$52,632
Sump Pump (Use Existing Pit)	2	\$1,460	-\$600	\$860	\$1,720
Sump Pump (Modify Existing Pit)	9	\$2,420	\$203	\$2,623	\$23,607
Sump Pump Dispersion System	2	\$2,950	\$295	\$3,245	\$6,490
Other	2	-	-	\$1,875	\$3,750
Totals	91				\$132,807

1.4 Proposed Phase 2 Summary

Maintaining momentum and continuity is key to successfully implementing the Ecoflow program. The private I/I component of the Ecoflow program is highly visible among the public and it is important to keep everyone engaged and eager to participate in program as it moves forward. As Phase 1 moves toward completion, it is important to have Phase 2 planning activities complete and ready for implementation. The Phase 2 area shown in Figure 1 is similar in size to Phase 1 and contains the quantities shown in Table 7.

Table 7: Phase 2 Quantities

Task	Quantity
Manhole Inspections	479
Smoke Testing	118,300
CCTV Inspections	30,000
Dye Testing (Public)	15
Building Plumbing Evaluations	1,600
Dye Testing (Private)	150

A fee proposal for TREKK Design Group to continue with the Phase 2 efforts has been prepared and is attached to this document. The total proposed fees for Phase 2 come to \$783,000.