SUMMARY REPORT FOR THE CITY OF LAKE WAUKOMIS

SANITARY SEWER SYSTEM REPAIR PLAN

By: Jay Norco, P.E. – North Hills Engineering, Inc. November 24, 2021

This report has been prepared to share findings on the condition of the sanitary sewer system and to present a plan for system repair. These findings are based on visual inspections of system structures, review of available repair records, interviews with residents, and discussions with current and past City employees. Please note that the repair plan presented in this report is a draft, intended for review and discussion by the City Board and staff. This plan is intended to be dynamic, being adjusted annually to reflect actual costs and repair needs.

System Description:

The City's sewer collection system is about 60 years old. The City used to operate a treatment lagoon system below the dam, but currently the City system discharges to a KCMO sewer. Treatment is provided by Kansas City (KCMO) via an agreement. The City pays KCMO on a per-residence basis to accept and treat wastewater. It is noteworthy that KCMO is currently metering the wastewater flow rates and may in the future move the City to a volume-based fee. It is possible that the higher wet-weather flow rates could lead to an increase in the treatment rates.

The City system consists of about 33,000 feet of gravity sewers 159 manholes and clean-outs, and four pumping stations. The pumping stations are used to lift the wastewater to a higher elevation so that gravity flow can continue around the lake from the upper reaches of the bays towards the lake dam. Within the pipe network, the City has two inverted siphons that cross lake bays, and three forcemains that cross lake bays. Of the manholes, most have a round cross section and are made of concrete-block or pre-cast concrete. About 21 percent are made of concrete block with a rectangular section. Many of the sewer pipe segments lack means of access on the upstream end. About 50 manholes are needed to gain access to the pipes for inspection and repair.

Of the pipes, over 80 percent are made of vitrified clay pipe (VCP) and about 10 percent are PVC or iron. From several past lining efforts, about 9 percent of the system has been lined using the cured-in-place pipe (CIPP) process.

System Mapping:

Based on field inspections and available old maps, the author created an electronic GIS (geographic information system) model of the sanitary sewer system, using ESRI ArcMap software. In addition to creating accurate maps and locations of system assets, the GIS model is a valuable tool for storing information on system assets (pipes, manholes, pump stations, etc.) and for making decisions on repair priorities, tracking repair progress, and performing maintenance functions. Along with the City's new GPS locator unit, the GIS model will be used by City staff to manage the system in the future.

Findings on Conditions:

The author located and inspected the manholes and cleanouts in the City sewer system and created a database of structural properties and conditions. More limited data was available on the pipes, since only the ends could be seen. The pipe age, material, depth, and location were used along with repair records to make decisions on probable pipe conditions. Based on experience, the author used statistical trends on similar systems to draw conclusions on repair needs. (These conclusions will be refined and made more specific after all the pipes are explored using CCTV.)

Overall the system is in fair condition. The following general findings include:

1. About 80 percent of sewer manholes are deteriorated and need repair or replacement of some type. The good news is that only about 25 percent of the manholes require excavation and total replacement (these are the rectangular block manholes and are structurally unstable). The remainder of the manholes can be rehabilitated in place for (relatively) low cost.
2. About 12 percent of the manholes show damage from microbially induced concrete (MIC) corrosion that results from hydrogen sulfide gas. Most of these are in the lower sections of the system near the KCMO connection or just downstream of the LW City pump stations. These corroded manholes also can be repaired in place.
3. Many line segments lack access from the upper end. About 50 new manholes are needed to gain access for cleaning, CCTV access, and potential repair using trenchless methods.
4. The 900 Block pump station is in fair to poor condition and receives direct stormwater inflow in large rain events. This station should be replaced within 5 years, along with a Lake Association project to capture and re-direct the stormwater runoff.
5. The forcemain from the 900 block pump station is rusted cast iron and should be replaced within 5 years. Also, in heavy rain events the discharge from this station causes the receiving sewer manhole to overflow into the lake. This occurs 4-6 times each year. The recommended solution is to lay an extension of this forcemain further down the lake, reconfigure the discharge geometry, and improve the capacity of the receiving sanitary sewer.
6. The other three pump stations are in good condition and can continue to serve with modest repairs, including lining of the wetwells to address MIC corrosion.
7. The inverted siphon at the 800 Block has plugged repeatedly in recent years, giving evidence of heavy corrosion of the old iron pipe. This siphon cannot feasibly be repaired in place, and replacement with a new pipe is recommended. This also is a high priority project.
8. Overall the system of old VCP pipes appear to be in good condition, with the main defects being root intrusion, offset joints, and fractured pipe. But there are definite areas of heavy damage that will require repair right away. The author judges that half of the pipes need to be repaired by lining or by open-cut excavation and total replacement.
9. Much of the pipe alignments are in areas with extensive structures and features on the surface. Over the past 50 years the pipes have been covered with retaining walls, stars, patios, porches, decks, swimming pools, and even basements. This occurs mainly on the sewers below the lower tier of lots. This situation makes construction access and excavation difficult. In 2020 the City was required to excavate and repair the sewer below a basement and retaining in the 800 Block, demonstrating the

high cost and level of disruption. This situation will not prevent repair of the sewers, but it will increase the cost of repairs and likely will aggravate property owners. The author foresees future discussions over the level of restoration and the associated costs. This situation also places a greater emphasis on trenchless methods of repair.

Recent Repair Efforts:

The City has made some progress in repairing the system over the past decade. Three sections of the gravity sewer system have been lined using the CIPP process. The total footage is small, only about 9 percent of the system, but it shows what can be done with modern trenchless technology. CIPP is a proven technology, but it has limitations. It cannot repair pipe that is fractured and deformed, and it cannot address structural issues and infiltration at service connections, particularly break-in taps. Some of the areas that were lined prior may need point repairs to address defective service connections.

For the pump stations, the City is in the process of replacing motor control panels at the four wastewater pumping stations, and installing remote monitoring devices to notify City personnel of alarm situations. As part of routine maintenance, the City has been replacing pumps and valves at pump stations.

One area of admirable progress is the City's recent use of HDPE (high density polyethylene pipe) to replace and install new manholes using City labor and equipment. So far seven of these HDPE manholes have been installed. This innovative approach allows the City to quickly install a new manhole of corrosion resistant materials for about $1,100 in materials, which is a savings of at least $6,000 versus a pre-cast concrete manhole installed by a utility contractor.

City public works personnel are able to make basic sewer point repairs, replace short sections of pipe, and restore the surface, including concrete flatwork. To the extent that these capabilities can be used over a multi-year repair program, the City could significantly reduce the costs of repairing the sewer system.

Repair Cost Estimates:

As part of this Sewer Repair Plan, the author prepared cost estimates for comprehensive repair of the entire sewer system. The details are presented in the attachment: *System Statistics and Repair Cost Estimates*. Depending on the types of defects noted, the author assumed an appropriate method of repair and applied recent market costs. The cost estimates are categorized into three areas: manhole repairs, gravity sewer repairs, and pump station renewal costs.

The primary methods of pipe repair will be open-cut point repairs combined with CIPP lining. However, other methods may also be employed, including: pipe bursting, sectional pipe liners, lateral tee-liners, and fold-and-form PVC liners. The reader should note that we have not yet inspected all of the sewer pipes with CCTV, thus the pipe repair costs are based on experience with sewer systems of similar age and materials. The primary method of in-place manhole repair will be spray application of calcium aluminate high-strength mortar combined with 100% solids epoxy lining. Pressure injection of hydrophilic urethane grout may also be employed to halt groundwater leaks into manholes.

The total estimated repair cost totals $3.4 million. This cost roughly breaks down to 50 percent on pipe repairs, 25 percent on manhole repairs and new manholes, and 25 percent on pumping stations. This amount includes an allowance for engineering and project management. Overall the author believes the repair cost estimate to be conservative. One unknown at this point is the location of excavations required beneath costly surface features. The author included an allowance of $225k in addition to typical restoration costs.

By means of comparison, the total replacement (*e.g. traditional excavation and replacement*) of all pipes and manholes would exceed $6 million at current market prices. Mainly this is due to the difficult access and high cost of surface restoration. Thus, large savings can be achieved by use the CIPP lining process as the primary method of pipe repair. However, as time goes by and deterioration worsens, the opportunity for using CIPP on the damaged pipes will pass. Once a clay pipe sewer becomes collapsed or has badly offset joints, the CIPP process cannot be used. ***In other words, the longer the City waits to address the pipe repairs, the repair costs will increase.***

Comments on Infiltration and Inflow:

The intrusion of clean water into the gravity sewer collection system is a pervasive problem. Every sewer system experiences this problem to some degree. "Infiltration" refers to water that gradually seeps into pipes through cracks and joints. "Inflow" refers to higher volumes of water that flow into the system through vented manhole lids, area drains, and private sources. These private sources are typically the worst offenders, and include foundation drains and basement sump pumps. Together we call infiltration and inflow: " I & I". High levels of I & I lead to surcharged pipes, basement back-ups, and overworked pumping stations. A "high level" of I & I would be a daily flow rate exceeding four times the average dry weather flow rate.

The City does not have data on levels of I & I, or "I/I". Circumstantial evidence indicates that the levels are moderate, in that the gravity system does not overflow in heavy rain events (excepting the 900 Block Pump Station issue.) In the future, the author could install flow monitors in the north and south trunk lines to gather data. Or possibly KCMO would share flow data they have collected from their meter at the connection point.

In the process of lining pipes and manholes for structural reasons, the repairs will eliminate a small portion of I/I. To better address this issue the City might consider a future program of basement inspections, where a City inspector looks for basement sump pumps that are connected to the sanitary sewer. The resident would then be required to re-direct the pump discharge to a surface drainage course outside the house. The City could also employ smoke testing to locate some sources of inflow.

Draft Repair Plan:

The author's recommended repair philosophy is to address the repairs on a steady but gradual basis, beginning with the most critical repairs on the system. Although the sewer system has deteriorated and repairs are obviously needed, the reality is that the system is functioning for now. The deterioration did not happen all at once, and not in all sections of the system. Although clay pipe (VCP) sewers have issues, the basic material does not corrode and can last over 100 years, depending on trench conditions. In addition, the costs of sewer repair are very high and the rate impacts are heavy. These factors favor a modest and gradual approach. Refer to the attachment: *15-Year Sewer System Renewal Plan*.

When compared to performing all the repairs immediately via a bond issue, the 15-Year Plan has several advantages:

1. Repair Efficiency: A "fix it all at once" repair project tends to replace or repair system assets before they are needed. The multi-year plan is more flexible. If an unexpected failure of a critical asset occurs, the priorities can be shuffled and the repairs made.
2. Cost savings: For the repair program of about $3.3M, when compared to a bond issue the Plan would save about $1.8M in bond issuance and interest costs over the life of the loan.
3. Reduced disruption to the residents. The lake community has narrow roads, limited shoulder space, and the development is relatively dense. Making all the repairs in a few years would cause much disruption.
4. Opportunity for City Personnel to perform some of the repairs, such as manhole replacements and sewer point repairs. This could reduce the cost of the program by $300k-$600k. The City might even consider an additional employee with underground utility experience.
5. Smaller projects are easier for City personnel to manage and inspect.
6. A gradual approach would train City personnel to think in terms of asset management. Even after these initial repairs are made, the system will require ongoing evaluation and maintenance. A proactive management approach reduces costs over the long term.

As a draft, the author proposes a repair plan lasting 15 years, financed from annual sewer rate revenues. The plan foresees the most critical assets being repaired in the early years, followed by the lower priority repairs. An important first step is to inspect the entire system using CCTV. This will require installation of about 50 manholes to provide access to the pipes. The plan assumes that half of these manholes will be installed by City personnel.

Each year, the work would be completed in series of projects. The project sizes would be set large enough to attract competitive bids and enjoy economies of scale, but small enough to be manageable and to work with the revenue cash flow.

The reader might wonder: "Why 15 years? Why not 10 or 20, or even 25?" A 10-year program would accomplish the repairs on an aggressive basis, but the rate impact could be too severe for a 10-year program. A period of 20 years is possible, but could allow more of the deteriorated components to require repairs on an emergency basis. A period of 25 years will allow too much additional deterioration to occur, thus driving up the repair costs.

Budget and Rate Impacts of Proposed Plan:

A basic rate impact calculation is presented in the attachment: *15-Year Sewer System Renewal Plan*, at the bottom of the document. The rate impact of such a large repair program on 440 customers is significant. The current sewer bill is about $75, of which $52 is the KCMO treatment charge. The author assumes that $20,000 of the sewer budget line item #54010 could be allocated to the proposed repair program. Thus, the draft 15-Year Plan would require a rate increase of $48 per month per customer. If the plan were structured as a 20-year program, the rate impact would be about $38 per month per customer. If the plan were structured as a 10-year program, the rate impact would be about $70 per month per customer.

Recommendations:

The proposed sewer repair program is a draft. The author recommends that the City Board of Aldermen consider this plan for the next month, then select an option for the repair plan. In a future meeting the Board could move to adopt the plan. The term "adopt" is likely a misnomer. The author's understanding is that the current Board cannot bind future Boards to make expenditures and there is no need to do so. The reader should remember that this plan is intended to be flexible. The actual costs could be higher or lower than the plan intends. The amount of repairs required will need to be adjusted. The key to getting started is the funding. The relevant action the current Board could take is to adopt a sewer rate increase and act to recognize the repair plan as a guide and a process. Each year the revenues and proposed costs would be reviewed and adjusted. As work progresses City personnel and the engineer would make reports on progress. As individual projects and work packages arise in future years, those Boards would need to act to approve each contract,

END OF DOCUMENT

Attachments:

Photos of General Findings

System Statistics and Repair Costs

Repair Plan Draft

PHOTOS OF GENERAL FINDINGS – Lake Waukomis Sanitary Sewer System

Typical rectangular block manhole. Mortar is gone and wall is heaved.

Typical round block manhole. Mortar is soft but wall is stable, can be rehabbed by lining.

Rect. block manhole. Mortar is gone, holes allowing soil and water to enter.

Rect. block manhole. Loose fitting lid, rusted through. Safety concern.

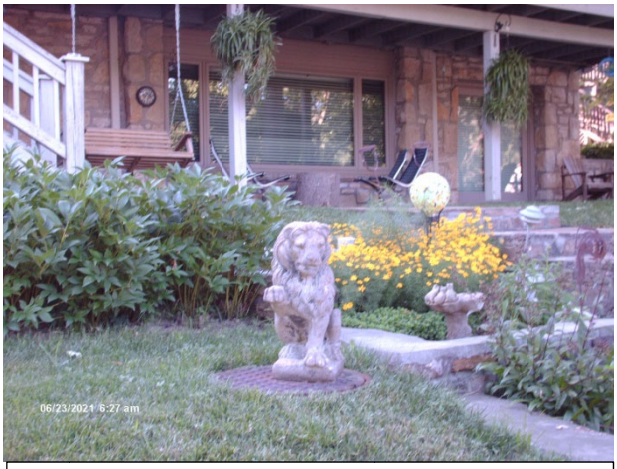
Newer pre-cast conc. Manhole, with MIC corrosion from H2S gas. About 1-inch gone.

Brick manhole has no bench (channel in bottom). Causes debris to clog, and odors.

Pipe geometry poor, no bench, reduces capacity, creates back-ups.

Manhole surrounded by walls, landscaping. Difficult access.

Masonry porch built over manhole. Nearly impossible to excavate here.



Manhole S09. Lid and statue are blown off from 900 Block Pump Station discharge, flows to lake.

Small PVC cleanout on main sewer line. Need to replace with manhole.

Manhole located, buried 18” deep in yard. City staff can raise to grade.

Ingenious camo'd cover by homeowner, rocks glued to board… But new MH needed, raised to grade.

Some lids have vent holes, allow water inflow, this one in ponding area of intersection. Replace.

Sewer line under pool. Manhole under deck and wall. Repairs will be interesting…

Sewer runs below patios and decks. Hopefully excavation not required….

Rectangular block manhole badly heaved by adjacent retaining wall.

View of heaved MH, picture at left. Costly to replace due to wall and landscaping.

STATISTICS & REPAIR COST ESTIMATES

CITY OF LAKE WAUKOMIS - 2021 SEWER SYSTEM PLAN

11/24/2021

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MANHOLE STATISTICS FROM 2021 MH INSPECTION PROJECT:

159	structures (manholes, cleanouts) were documented and logged.

Open Status, of the total number:

12	7.5%	are CNL (Could not locate). Generally these are buried deep and must be located and raised.
4	2.5%	have stuck lid. Generally these rusted shut and the casting must be replaced.
2	1.3%	are found but are buried.
141	88.7%	were opened, inspected, and evaluated.

Material:

32	20.1%	Manholes are of pre-cast concrete.
3	1.9%	Manoles are of brick and mortar.
52	32.7%	Manholes are of concrete block, ROUND X-sect.
33	20.8%	Manholes are of concrete block, RECT X-sect.
5	3.1%	Manholes are of cast concrete.
8	5.0%	Manholes are of HDPE pipe.
9	5.7%	Are clean-outs (PVC or Clay)
17	10.7%	Unknown (are Buried, STL, or CNL)



Defects:

33	20.8%	Manholes are in good shape and require no work of any kind at this time.
41	25.8%	Manholes/ Cleanouts require **complete** replacement. ***(most of these are rectangular concrete block….)***
		Note: This does not include NEW manholes that are needed for pipe access…
21	13.2%	Manholes shows signs of hydrogen sulfide induced corrosion.
85	53.5%	Manholes have derteriorated, but can be saved by in-situ repairs (e.g. lining, bench repair, etc.)
10	6.3%	Manholes need to be raised up to grade (were found, opened and grade adjustment measured)
14	8.8%	Manholes need to be opened and raised up to grade (Buried and CNL)
9	5.7%	Manholes need the casting replaced, is deteriorated or stuck.
1	0.6%	Manholes have a damaged chimney, taking in water or dirt.
35	22.0%	Manholes need the bench (e.g. invert) replaced or added.
6	3.8%	Manholes need other custom modifications: hatch, lid, alteration of old pump station structure, etc.




PIPE STATISTICS FROM 2021 MAPPING PROJECT:

201	Total number of Lake Waukomis Line segments
32420	Total footage of Lake Waukomis Line segments
161	Estimated average length per line segment.

Statistics, of the total number:

LF	%			
3029	9.3%	Segments are CIPP lined VCP, consisting of:	16	segments
1243	3.8%	Segments are IRON pipe, consisting of:	7	segments (These are mainly the inverted siphon crossings, a few others.)

1825	5.6%	Segments are PVC pipe, consisting of:	17	segments	(Some of these may be partly of PVC, partly of VCP)
134	0.4%	Segments are RCP pipe, consisting of:	1	segments	
26180	80.8%	Segments are VCP pipe, consisting of:	160	segments	

Additional Forcemain Pipes (under pressure, from pump stations..)

906 LF, consisting of : 4 segments, all cast iron.

BUDGET SYSTEM REPAIR COSTS:

PART 1 MANHOLE REPAIRS:		QTY	UNIT	COST	EXTEN $
MH Repairs by Utility Contractor & City:					
Complete manhole replacement:		41	EA	11000	$ 451,000
Avg, 4.6 feet, asssume moderate difficult access, incl. demo old structures, utility locates, potholing.					
Assume 3' or 3.5' HDPE, iron lid, poured concrete invert.					
Restoration in areas requiring costly work:(pool decks, patios, retaining walls, stairs, etc.)	Assume:	10	EA	5000	$ 50,000
Install new manholes needed for access, by Utility Contractor		24	EA	8500	$ 204,000
Avg, 4.6 feet, asssume moderate difficult access, incl. demo old structures:					
Assume 3' or 3.5' HDPE, iron lid, poured concrete invert.					
Install new manholes needed for access, by City Crew		24	EA	1200	$ 28,800
Casting replacement		9	EA	900	$ 8,100
Grade adjustment		25	EA	700	$ 17,500
Custom MH modifications		4	EA	4000	$ 16,000
MH Repairs by Manhole Specialty Contractor:					
Manholes need to be repaired by lining, Calcium Alum mortar:		290	VFT	220	$ 63,800
Manholes need to be repaired by Epoxy coating. 100-150 DFT.		99	VFT	260	$ 25,740
Manhole bench reconstruction:		35	EA	600	$ 21,000
Other mods: hydrophilic grout injection, chimmey patching, root removal, etc.		10	EA	500	$ 5,000
TOTAL ESTIMATED BUDGET COST FOR ALL MANHOLE REPAIRS:					$ 890,940

PART 2 GRAVITY SEWER REPAIRS:		QTY	UNIT	COST	EXTEN $
Pipe Repair Assumptions:					
Total system pipe footage of VCP & RCP (not PVC, and CIPP) = 26,314 LF					
Assume:					
Percentage of VCP in good shape requiring no immediate repairs in 10 years.	**40%** = 10525.6 LF				
Percentage of VCP to be rpaired with CIPP,(after point repairs) :	**50%** = 13,157 LF				
Percentage of VCP that requires open cut replacement:	**10%** = 2,631 LF				
Number of point repairs required:	100%				
201 line segments x **33%** requiring a repair x 1 repair per segment = 66 point repairs					
CCTV Investigation					
Work to be done by specialty CCTV sewer contractor, electronic data format, includes allowance for heavy cleaning.		32,420	LF	3	$ 97,260
CCTV data review by Enigneer, includes creation of prioritzed line repair database, categorization into projects		32,420	LF	0.75	$ 24,315
Pipe Repair Work by Utility Contractor (Open-Cut Work):					
Point Repairs:(most are shallow, half or so have difficult access)		66	EA	7500	$ 497,475
Adder for costly restoration (difficult to predict), assume no recorded easements….		15	EA	15000	$ 225,000
Open cut replacment (for segments too badly deteriorated to line):, in locations allowing access with moderate restoration.		2,631	LF	100	$ 263,140
Replace Inverted Siphon Lines:					

800 Block: Replace 310 LF of existing cast iron pipe, using HDPE.	1	LS	110000	$	110,000
200 Block: Replace 390 LF of existing cast iron pipe, using HDPE.	1	LS	130000	$	130,000
Pipe Work by CIPP Contractor					
CIPP lining work, mainly 8-inch, assuming short segments, standard class, difficult access.	13,157	LF	32	$	421,024

For comparison, open cut replacement of all segments: 26,314 LF x $ 130.00 per LF = $ 3,420,820

Note: These are preliminary costs and include a modest contingency, but may not include location-specific costs for access, restoration, or additional defects found.
These preliminary construction costs do not include soft costs such as engineering, project management, legal costs, and easement costs.

TOTAL ESTIMATED BUDGET COST FOR ALL LINE REPAIRS:				$	1,768,214

PART 3 PUMP STATION RENEWAL COSTS:	QTY	UNIT	COST		EXTEN $
PS #3, 900 Block Pump Station & Capacity Issues:					
Replace 900 Block Pump Station, rebuild wetwell: Covers FRP well, conc. valve pit, storage MH, pipe, valves, panel, electrical	1	LS	170000	$	170,000
Extend electrical service, lighting arresting provisions, low profile service rack.	1	LS	25000	$	25,000
900 Block Forcemain & Capacity Issues					
Replace 8" iron forcemain across lake, using 8" HDPE, about 300 LF	1	LS	80000	$	80,000
Replace 900 Block Forcemain, re-align to move discharge point further east: 8-inch PVC or HDPE, open cut bury.	760	LF	80	$	60,800
Reconfigure MH S06A and pipe intersection, at #1087 S. Shore Dr.	1	LS	25000	$	25,000
Rebuild Pump Stations #1 (300 Block) and #2 (400 Block):					
PS#1: Line wetwell, bypass pumping.	1	LS	25000	$	25,000
PS#2: Line wetwell, bypass pumping.	1	LS	25000	$	25,000
Replace PS#1 forcemain 8-inch CIP with new HDPE, crossing lake bay.	330	LF	200	$	66,000
Replace PS#2 forcemain 8-inch CIP with new HDPE, crossing lake bay.	220	LF	200	$	44,000
TOTAL ESTIMATED BUDGET COST FOR ALL PUMP STATION REPAIRS:				$	476,800

TOTAL ESTIMATED REPAIR COSTS (TOTAL PRESENT WORTH):		$	3,135,954
Associated soft cost: Engineering, Project Administration, Contstruction Observation	8.0%	$	250,876
		$	3,386,830

If accomplished over a period of : **15** years, at a rate I = 2.5% , then the annual uniform cost = ($273,542.28)
If accomplished over a period of : **20** years, at a rate I = 2.5% , then the annual uniform cost = ($217,255.44)
If accomplished over a period of : **10** years, at a rate I = 2.5% , then the annual uniform cost = ($386,975.04)

PUMP STATION Service Data:

PS1	300 Block =	66	EDU, is duplex sefl-primer drypit pumps.	Existing capacity =	350 gpm 1 pump, 450 gpm 2 pumps
PS2	400 Block:=	49	EDU, is ***simplex*** sefl-primer drypit pumps.	Existing capacity =	350 gpm 1 pump
PS3	700 Block:=	22	EDU, is ***simplex*** sefl-primer drypit pumps.	Existing capacity =	350 gpm 1 pump
PS4	900 Block:=	151	EDU, is duplex sefl-primer drypit pumps.	Existing capacity =	350 gpm 1 pump, 450 gpm 2 pumps
		288			

PLAN SUMMARY
CITY OF LAKE WAUKOMIS, MO
15-YEAR SEWER SYSTEM RENEWAL PLAN (DRAFT)

J.Norco, P.E.
11/24/2021

SUMMARY: This plan begins with the worst areas of known damage, and addresses defect on a prioritized basis over a period of 15 years.
Only 10 years are shown, the final 5 years will follow the same pattern as Year 10, which is after the large repair items are resolved.
This plan includes inspection of the entire system by CCTV at the outset, to prioritize and catalog repairs needed.
This plan is based on the premise that the system is working now, and the City can gradually address the deterioration.

NOTES:

1 This plan tries to minimize up-front costs for analysis and engineering. Thus, we can expect revisions as work progresses.
2 The plan will be updated every year or two to reflect actual costs, system findings, and updated priorities.
3 Unit costs below are estimates/opinions based on engineer's experience and market history. Actual costs will vary.
4 The plan below shows only minor work to be performed by City forces - In Phase 1, including installing 24 manholes for pipe access.
If the City elected to perform sewer point repairs and manhole replacments the total cost could be reduced, by a range of $300k - $500k.

TASK DESCRIPTION	Item Cost	ESTIMATED COST PER BUDGET YEAR, DOLLARS									
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
PHASE 1 - INITIAL INVESTIGATION & ACCESS											
CCTV Investigation, with basic jetter cleaning, focus on problem areas, trunks.											
Contractor: 32420 LF @ $ 3.00 / LF =	98,000	98,000									
Spec, Bid, Review, analysis of CCTV data, prioritize, recommendations. (Engr.)	25,000	25,000									
Work by City: Install new manholes for access:	28,000	28,000									
Work by Contrator: Install new manholes for access:											
Unit Cost 24 EA. X $ 8,500 / EA =	204,000	50,000	154,000								
Engineering, Mapping, Bid Documents, and Plan Administration:	13,000	5,000	8,000								
PHASE 2 - FOCUS ON CRITICAL ASSETS											
800 Block Inverted Siphon - replace with HDPE.	110,000		110,000								
900 Block Forcemain & Capacity Repairs	166,000			166,000							
900 Block Pump Station Replacement	195,000				195,000						
(Combine with LWA project to re-direct storm water drainage)											
Critical open cut point repairs, on main line & laterals.	115,000			75,000	40,000						
Repairs to Pump Stations: #1 & #2	50,000						50,000				
Engineering, Mapping, Bid Documents, and Plan Administration:	52,000		9,000	22,000	21,000						
PHASE 3 - PRIORITIZED SYSTEM REPAIRS											
Open cut replacement, 100 Block sewer	263,000					263,000					
Open cut point repairs and CIPP pipe lining	545,000							80,000	120,000	165,000	180,000
Manhole replacements	275,000						50,000	50,000	50,000	50,000	75,000
Manhole re-hab (in-place, by specialty contractor)	120,000							60,000	60,000		
Manhole repairs (grade adjust, castings, other mods…)	42,000									42,000	
200 Block inverted siphon replacement	130,000						130,000				
Replace forcemains across bays: for Pump Stations #1 and #2	110,000								110,000		
Engineering, Mapping, Bid Documents, and Plan Administration:	125,000					21,000	17,000	17,000	30,000	20,000	20,000

TASK DESCRIPTION	Item Cost	ESTIMATED COST PER BUDGET YEAR, DOLLARS									
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
TOTAL PRESENT WORTH COST FOR 10-YEAR PROGRAM	2,666,000										
TOTAL COST FOR EACH YEAR	Budget:	$206,000	$ 281,000	$ 263,000	$ 256,000	$284,000	$ 247,000	$ 207,000	$ 370,000	$277,000	$275,000
	Year:	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Assume annual revenue = **$ 273,440**	BEGINNING BALANCE:	**$100,000**	$ 167,440	$ 159,880	$ 170,320	$ 187,760	$ 177,200	$ 203,640	$ 270,080	$ 173,520	$ 169,960
	ANNUAL REVENUE:	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440	$ 273,440
	ENDING BALANCE:	$ 167,440	$ 159,880	$ 170,320	$ 187,760	$ 177,200	$ 203,640	$ 270,080	$ 173,520	$ 169,960	$ 168,400

This cash flow analysis assumes the repair fund is primed with : **$100,000** from reserves, to allow work to be finished & paid in the year scheduled. If not available, the improvments would be deferred 6 - 12 mo's.

REVENUE ASSUMPTIONS FOR ABOVE REPAIR PROGRAM:

Compare revenue available for sewer repairs:

Assume with the current budget annual amount available for repairs out of Line Item "54010 Maint/Sewer Repair" = $ 20,000 / yr

Revenue from sewer rate increase: 440 cust. X **$ 48.00** / mo x 12 mo/yr = $ 253,440 / yr

$ 273,440 / yr

Note: A 20-year repair program would reduce the rate impact to about $38/mo.
*A 10-year repair program would **increase** the rate impact to about $70/mo.*

COMPARE THE OPTION OF A BOND ISSUANCE TO ACCOMPLISH ALL WORK:

Assume:
- Construction Fund Amount = $ 3,386,000
- Interest rate = **1.75%** per period
- Assume: **20** year note, and: **2** loan payments per year
- Term of note = **40** periods
- Approx annual interest pmt: **$ (59,255)**

- Present worth of interst pmts: $ 1,694,351
- Issuance costs = 3.0% $ 101,580 (as a percentage of the construction fund)

Estimated total present worth of bond issue costs: $ 1,795,931

THUS, DOING A BOND ISSUE TO PERFORM THE REPAIRS "ALL AT ONCE" WILL ADD ABOUIT $1.5 - $2M TO THE TOTAL COST OF THE PROGRAM.