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The Honorable Mayor Karnes and
Members of the City Council

Current Status and Improvement Options for the Water System for the City of Lincoln Park

October 7, 2022

Introduction

The City of Lincoln Park is an older community. Established as a village out of Ecorse Township in 1921 and later incorporated as a city in 1925. The city was largely developed between 1925 and 1971, with most of the water system infrastructure being installed before 1950.

The last major upgrade in the system took place between 1987 and 1990. During this period, two main areas received upgrades. One was the area north of Southfield between Dix and the city limit. The other area was between east of Fort St and west of Electric between Moran and Champaign. This project upgraded old pipes with new polyvinyl chloride pipes.

Based on currently available data, the water mains in the city have an average age of over eighty years old. While the city has used different materials for water mains, including concrete and high-density polyethylene (HDPE), most of the mains were constructed with cast iron.

Whether the water main was installed in the 1920's (approximately 100-year life expectancy) or post World War 2 (approximately 75-year life expectancy); the water main in the city of Lincoln Park, is reaching the end of its expected useful service life.

The Problem of Aged Pipes

Maintaining aged pipes beyond their useful service life is extremely difficult. Cast-iron pipes corrode. This makes them more brittle and susceptible to breaks. Breaks in pipes can occur for a variety of reasons. The most common reasons are the shifting of ground during the normal freeze/thaw cycle and a hydraulic phenomenon known as hammering. Hammering occurs during changes in pressure which can cause vibrations in the pipes. These vibrations can cause old pipes to break at their most vulnerable spots.

Looking at just the last three years, the number of watermain breaks in the city continues to grow. Table 1 shows the number of watermain breaks in the city over the past few years.

Year	Number of Breaks
2020	80
2021	120
2022 (to date)	141

Table 1: Watermain Breaks

Whether through slow leaks that go undetected or through water mains that rupture, failing pipes result in water loss that is extremely costly. Water loss is the difference between water purchased (or produced) by a water system and water that is billed to water customers. Water loss is particularly a problem for communities who purchase water from other sources, like Lincoln Park. When water is purchase from GLWA but is unable to be sold to customers, it represents an expense in the system. Current estimates show that for every ten percent of water that is purchased but not sold to customers, the city spends approximately $251,000.

Over the past six fiscal years, the city has had an average water loss of twenty-seven percent. However, that water loss continues to increase. Table 2 shows the annual water loss per fiscal year since FY 2016. The lowest recorded water loss in this period was in FY 2017 when the city had a water loss of under fifteen percent. Since that time, the water loss has continued to grow and now is consistently above thirty-five percent. At thirty percent water loss, the estimated cost to the city's water system is $750,000. This helps to create financial strain on the system, making it difficult to afford improvements.

Fiscal Year	Water Loss (percent)
FY 2016	19.49%
FY 2017	14.75%
FY 2018	26.78%
FY 2019	28.51%
FY 2020	36.94%
FY 2021	35.59%

Table 2: Percentage of Water Loss FY 2016 - FY2021

Apart from the cost of the water loss attributable to water main breaks, there are other significant costs related to these breaks. Other costs attributed to watermain breaks include the cost to physically repair the break and the restoration for the break area once the work is completed.

According to estimates, the total average cost for an individual watermain break repair is approximately $4,480. Considering the past three years have had an average of 114 watermain breaks per year, the average annual cost of watermain breaks is approximately $510,720. It could reasonably be assumed that the aged system is costing the city, and the rate payers, over $1M annually. For perspective, that money represents enough funds to pay for nearly an entire mile of watermain replacement, ten new DPS workers, or water rate decreases.

Watermain breaks not only present a financial problem to the city. They also present real public safety concerns. When watermain breaks occur, it results in significant water leaving the system. This can lead to significant pressure drops or even total loss of pressure which can allow bacteria to enter the system mandating residents and businesses boil water before use.

Pressure drops in the system also can create issues for fire suppression. Commercial buildings are required to have fire suppression systems (i.e., indoor sprinkler systems). These systems require a significant amount of pressure to operate. If the pressure drops because of a watermain break, there might not be enough water pressure for a commercial building's fire suppression system to operate as designed.

Fire hydrants also rely on the water pressure in the system. When a fire occurs in the city, the city's fire department utilizes fire hydrants as a water source for fighting fires. Without adequate water pressure in the system, the risk of not being able to adequately fight fires is concerning.

Current Program

The city does currently have a program in place to replace watermains. Currently, the program replaces approximately one mile of watermain each year. This comes at a cost of approximately $1.2 million per year.

Unfortunately, the city has approximately 130 miles of watermain. Considering that each repair performed during a watermain break only addresses a small portion of the system, and the city is currently only able to replace approximately one mile a year, it will take the city too long to replace the entire system.

For the next two years, the city will increase the amount of watermain replaced without any additional impact to the systems finances. This is possible as a result of the city allocating funding

from the American Rescue Plan Act (ARPA) to fund the next two years of more aggressive watermain replacement. The total amount allocated for this project was $5 million. This funding represents approximately 2.5 miles of watermain replacement over the next two years, more than double what has been done recently.

To identify the areas that might have the highest impact, the city's engineering firm has analyzed city data of watermain breaks to identify the section of the city with the highest number of breaks. Over the past three years, this section accounted for twenty-eight watermain breaks in the city. During the next two years, the watermain replacements will take place in this section. Table 3 shows the planned watermain projects over the next two years.

This program will help the water loss problem in the city and slightly decrease the city's costs attributed to watermain breaks. However, this will only address 5.1 miles out of the city's 130 miles of watermain (approximately four percent). More work will be needed if the city's water system is to ever operate properly. Clearly, the city's water system is at a crisis point.

Year	Street	Location
2023	Gregory	Dix to Fort St
2023	Buckingham	Dix to Fort St
2023	Pagel	Dix to Fort St
2024	London	Dix to Fort St
2024	Richmond	Dix to Fort St
2024	Merrell	Dix to Fort St
2024	Stewart	Dix to Fort St

Table 3: Planned Watermain Replacements 2023 and 2024

Options Moving Forward

While the next two years are certainly going to have a large impact on the water loss and the number of watermain breaks the city experiences, it will not replace the entire system. The city is left two major options. One is to continue along the same path of a slow replacement schedule. The other option is to move forward with a more aggressive schedule, and there are also some other options for a more aggressive schedule.

Option 1: Do Nothing Differently

The first option is to stay the current course. With this option, the city would continue to replace the watermains at an approximately rate of one mile per year. Considering, that due to age, the city needs to replace at least half of the watermain in the city (approximately sixty-five miles) it will take nearly sixty-five years to accomplish this task. Unfortunately, by the time the project would be completed it would be time to begin replacing the pipes that were replaced at the beginning.

This option also is likely unfeasible. This is because, as the current pipes continue to age, they become even more problematic. The increased frequency of watermain breaks results in growing operational costs. These growing operational costs take funding away from capital improvements. This results in a situation where the cost to maintain the system makes it impossible to upgrade the system.

The continued aging and deterioration of the system will be detrimental to the city's ability to replace watermains. It is estimated that the number of watermain breaks will increase each year by twenty-eight if no serious action is taken. Using this estimate, by the year 2029 we can anticipate at least 307 watermain breaks per year.

This increase in watermain breaks will cost the city multiple millions of dollars over the next seven years. Using the estimated $4,480 per main break, the cost to the city to repair main break will

more than double to an estimated $1.375 million by the year 2029. Over this time, the city is estimated to spend $6.993 million on repair watermain breaks.

As previously mentioned, water loss is one of the issues associated with watermain breaks. The estimated twenty-eight additional watermain breaks per year are associated with an additional 0.4 percent water loss annually. Over a seven-year period, water loss will increase by at least 2.8 percent.

Water loss comes at a cost. Over the course of the next seven years the city can be reasonably estimated to spend $1.351 million on water loss attributed to watermain breaks. Combined with the total cost of repairing watermain breaks, the city will spend an estimated $8.2 million over the next seven years because of the aged system. These costs will unfortunately have to be passed on to rate payers.

Option 2: Increase the Amount of Watermain Replaced Every Year

The second option is to increase the amount of watermain being replaced every year. In this option, the city will need to increase the amount spent annually on replacements. There are variations on this option that will be discussed further. These variations are the quantity of replacements and the funding mechanisms to pay for the work.

To properly address the problem, the city needs to find a way to improve the system more aggressively beyond the current one-time, two-year program. Beyond 2024's planned projects, the current program will require an additional $1.5M – $1.7M in additional funding annually. This will likely need to be addressed through rate increases.

While more than doubling the amount of watermains replaced annually is a good start, it will still take over fifty years to replace half of the system. This timeframe is not accelerated enough to be able to properly address the issues experienced in the system. There are also issues with the funding of this program through increased water rates.

The city is currently already on a significantly aggressive schedule to increase water rates. Any additional increases will have a significantly negative impact on the affordability of service to the rate payers. A second issue with funding it directly through rate increases is that it leaves zero ability for the city to address the state mandate to replace lead service lines in the city or any other capital improvements in the system.

Even More Aggressive Replacement

The only real option to improve the water system is to replace the watermains more aggressively in the city. For the city to realize any potential savings related to watermain breaks and water loss, the city will need an immediate jumpstart on replacing the system. Unfortunately, funding levels and current costs make the water/sewer fund inadequate to do so, even with the recently increased rates.

Not only is attempting to aggressively increase the replacement of the system costly, but there are also capacity issues at hand. There is only so much watermain that the city could physically replace in one year, even if it had enough funding. The upper limit of what could be expected, according to our engineers and experts, would be around six miles of watermain per year.

If the city were to take an aggressive five-year approach (after the current two-year program) and replace approximately six miles per year, the city could replace thirty miles of watermain by the

end of the five-year program which could result in just under a quarter of the system being replaced in that time.

If the city utilized this approach the city would be able to replace thirty-five miles of watermain in seven years. It could be reasonably assumed that the city would realize such a large savings between water loss and operation costs due to the decrease in water main breaks that the city would then be able to maintain a two-mile to two and a half mile per year replacement program. This means that in approximately twenty-six years, half of the city's watermains could be replaced.

Unfortunately, this approach would require a large infusion of cash immediately. The only ways in which the city could raise the capital required to complete the project are either by increasing rates (to a dramatic amount), locating various grants (however the amount needed is very unlikely to be raised through grants), or through financing (i.e., bonding).

Bonding the project allows the city to spread the cost out over a determined number of years. This is the largest benefit to bonding over increasing rates. Due to the extended payback period, bonding would reduce the city's annual revenue requirements to pay for the project, instead of needing to increase water rates to an untenable height over a short period.

Because the annual revenue requirements are lower, the only viable option to fund the water upgrades is to issue bonds. The city's water system has two options for issuing bonds. The first would be to issue revenue bonds. With revenue bonds, the bonds are secured by a pledge of the water system revenues. The city would need to raise rates to provide sufficient funds to cover operation, maintenance and administration, debt service on the bonds, and likely fund a bond reserve account (equal to one year's debt service to provide additional security for the bond holder). However, this requires the city to raise rates at time when the rates are already being raised to cover other costs.

The other type of bond to consider is a voter approved general obligation unlimited tax bond. With voter approved bonds, the city is authorized to levy a special debt millage to cover the cost of the bond payments over the life of the bonds. This allows the city to pledge its taxing authority to cover the bond payments. This was the option taken during the 1987 – 1990 water project. This is the same approach the city used to secure funding for road improvements.

For the 1987-1990 water improvement project, the city sought voter approval to issue $8M in bonds. This took place during the November 1986 election and the voters approved the program with about a seventeen percent margin. The project was very successful. To this day, the areas that were improved continue to operate effectively and are among those with the fewest watermain breaks annually. Unfortunately, after this project, the city did not continue to aggressively improve the system resulting in the system continuing to age and depreciate.

Recommendations – How to Update the System

As previously stated, the system needs massive upgrades. Though the system is at a crisis point, swift action over the next seven years will make it possible to achieve a better operating and safer system.

For the current two-year program, the city has identified the sections of the city that experienced the highest frequencies of watermain breaks. Using this data allows the city to find areas that improvements will make the most impact on maintenance costs and water loss, thereby maximizing the return on investment.

Utilizing the same approach as the city is for the current two-year program to create a second, five-year program, the city can realistically decrease both watermain breaks and water loss in a significant way. The city's engineering firm has identified the watermain sections to replace to make the most impact. The plan can be found in Appendix A.

With the current crisis point the city's water system faces and the need to make improvements immediately, it is recommended that the city moves forward with the seven-year plan.

Recommendations – Financing Options

The recommended plan would require an estimated $35M over the seven years. Currently, only the first two years are funded. This funding is from the ARPA. Other options are needed to fund replacement in years three through seven.

As discussed earlier there are only three different options to fund this kind of a program. The first is through rates (i.e., pay as you go). This, unfortunately, is not a viable option due to the immediate impact on the rate payers. This leaves the other two options such as revenue bonds or unlimited tax general obligation bonds.

It is recommended that the city pursue an unlimited tax general obligation bond in the approximate amount of $30M. Table 4, below, shows some millage estimates based on the following assumptions from our financial advisor:

- Twenty-year bond – interest rate of 4.5%
- Twenty-five-year bond – interest rate of 4.75%
- Thirty-year bond – interest rate of 5.0%

Millage Needed	**Twenty-Year (4.5%)**	**Twenty-Five-Year (4.75%)**	**Thirty-Year (5.0%)**
First Year	1.344	1.4187	1.4934
Peak Rate	2.8485	2.4795	2.2329
Final Year	0.9136	0.8061	0.7107
Average Rate	2.5182	2.2494	2.0187

Table 4: Millage Rates Required

A few points to remember regarding bonding and interest rates. The first is that the longer-term bonds (i.e., thirty year) will always have a higher interest rate. The next, is that due to this higher interest rate and the sheer fact they are longer than the others they will accumulate more interest. To summarize, longer-term bonds will cost more in the long run but will carry lower annual payments and thus a lower required millage rate.

The city very well might want to pursue the shorter, twenty-year, bond term due to the overall cost savings in interest. Another reason for pursuing a shorter-term is that the city must recognize that in twenty years the needs of the city might be completely different. There might be a need for

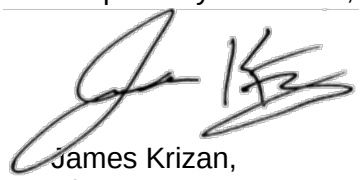
financing projects in other areas, including city buildings or other infrastructure needs. The twenty-year bond will likely provide better future flexibility than the other options.

Conclusion

The water system is at a crisis point. The city needs to act swiftly and decisively over the next few years. Continued inadequate investment will result in future failures that might even hinge on catastrophic.

It is unfortunate that the city is in the position it is. However, the actions and plans presented in this document provide a way forward. It is recommended that the city moves forward with these plans.

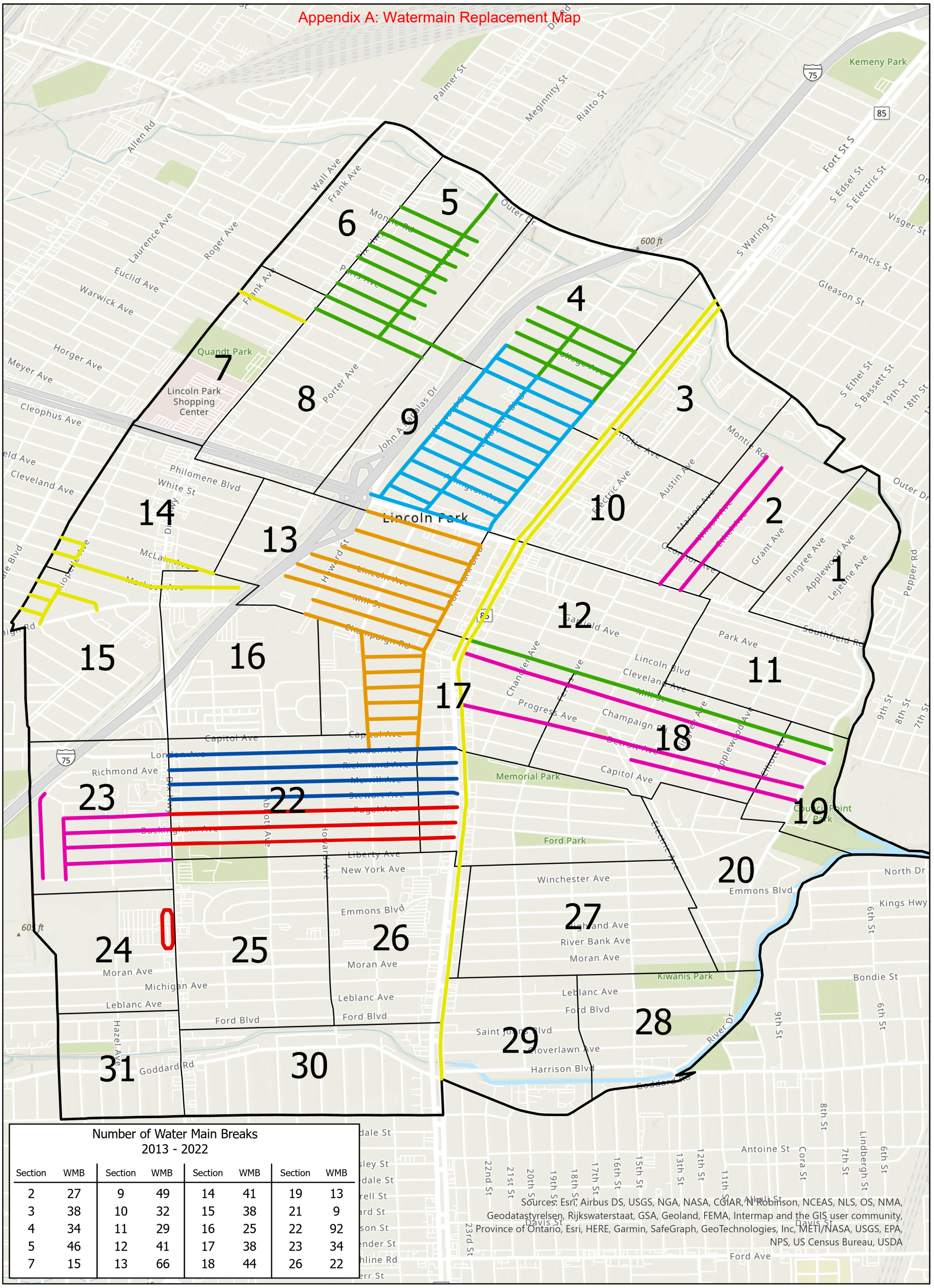
Respectfully submitted,



James Krizan,
City Manager

APPENDIX A: WATERMAIN REPLACEMENT MAP

Appendix A: Watermain Replacement Map



Number of Water Main Breaks
2013 - 2022

Section	WMB	Section	WMB	Section	WMB	Section	WMB
2	27	9	49	14	41	19	13
3	38	10	32	15	38	21	9
4	34	11	29	16	25	22	92
5	46	12	41	17	38	23	34
7	15	13	66	18	44	26	22

Legend

- 2023 WM Replacement
- 2024 WM Replacement
- 2025 WM Replacement
- 2026 WM Replacement
- 2027 WM Replacement
- 2028 WM Replacement
- 2029 WM Replacement

City of Lincoln Park

2023 - 2029 Water Main Replacement

0 500 1,000 2,000 Feet

HENNESSEY ENGINEERS, INC

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