ALLGEIER, MARTIN and ASSOCIATES, INC.
Consulting Engineers

19 March 2019

Mr. Orvil Maples
Wastewater Superintendent
City of Aurora
P.O. Box 30
Aurora, MO 65605

Re: Wastewater Evaluation

Dear Mr. Maples:

The purpose of this letter is to provide the City with a recommendation and cost estimated for potential improvements to their wastewater collection and treatment systems. While this is not a comprehensive report, it touches upon the most pressing issues for the facilities currently and forward looking. Primarily, the following items will need to be addressed in the near future and should be included in upcoming budgets. The list broken down into an approximate phased approach:

2019
1. Inflow and Infiltration Reduction in the McNatt Basin
2. Replace the UV Disinfection at the Wastewater Treatment Plant

2020
1. Inflow and Infiltration Reduction in Basin 2
2. Replace the Filters at the Wastewater Treatment Plant
3. Install means for Monitoring the Sludge Blanket in Clarifiers at the Wastewater Treatment Plant
3. Renovate of the Locust Lift Station
4. Construct Additional Sludge Holding Capacity

Future Improvements
1. Additional of Phosphorus Removal to the Wastewater Treatment Plant
2. Continue Reduction of Inflow and Infiltration in the Collection System
3. Installation of a SCADA system

Each of these items will be more fully evaluated in the remainder of this report.

The improvements in 2019 are anticipated to be funded with City wastewater department funds. The 2020 project is significantly larger and is anticipated to be funded through a low interest low from the MDNR State Revolving Fund (SRF) loan program. This will require the City to utilize a portion of the bonding capacity previously passed, utilizing the wastewater department funds accrued through the rate increase to pay off the loan over a twenty (20) year period.

Replacement of UV Disinfection

The existing UV disinfection at the wastewater treatment plant serves to inactivate bacteria and viruses as the wastewater leaves the plant, as required by the NPDES permit. It was originally installed in 1985 with upgrades in 2001. The existing system has worked adequately, but has been modified to keep it functional and requires more maintenance and upkeep than some of the more modern systems that provide pneumatic wipers on the bulbs to keep them cleaner and more effective for disinfection. With the equipment nearing the end of its useful life, it is recommended that the equipment be replaced.

Based on a low pressure horizontal lamps system and assuming some room for growth (about 8MGD peak flow), it is believed that all of the UV could be installed in one channel. For the purposes of this report, it was assumed that the newest channel would be used. If the filters are also renovated, such that only one filter building is necessary (as discussed later in this report), this would work without any additional modifications. If both filters continue to be utilized, some additional piping would be required to divert the flow to one UV channel. Another option would be to utilize the existing UV channel in conjunction with the new one until the new filters are installed. For the purposes of this estimate, the additional piping will not be included and it will be assumed that the new filters will be installed in the near future allowing us to utilize the existing UV in the north channel in conjunction with the new UV installed.

It is estimated the cost to replace the UV system is as follows:

UV Renovation
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	LS	UV Equipment	$125,000.00	$ 125,000
2	1	LS	UV Equipment Installation	$ 50,000.00	$ 50,000
3	1	LS	Electrical Modifications	$ 40,000.00	$ 40,000
4	1	LS	Removal of Old Equipment	$ 8,000.00	$ 8,000
5	1	LS	Installation of Roof Structure over Channel	$ 25,000.00	$ 25,000
6	1	LS	Install Effluent Weir	$ 40,000.00	$ 40,000
7	1	LS	Misc Modifications	$ 15,000.00	$ 15,000
8	1	LS	Mobilization, Bonding, Etc.	$ 12,000.00	$ 12,000
			Construction Cost Estimate		$ 315,000
			Contingencies (10%)		$ 31,500
			Design & Construction Engineering		$ 48,000
			Part Time Resident Project Representative		$ 25,200
			TOTAL PROJECT COST		$ 419,700

Includes up to 21 days of Resident Project Representatives

The additional operation and maintenance cost associated with this improvement should be negligible or possibly even a savings on operation and maintenance. In addition to the elimination of the manual cleaning of the bulbs, the new system could provide some energy savings through the use of sensors to turn bulbs on and off as required to meet the required UV dosage, which is not available with the current system.

Renovations of Filters

The existing filters are traveling bridge sand filters constructed in 1985 and 2001 with two separate treatment trains and effluent discharges. The filters from 1985 have a filter area of 576 ft^2 total (288 ft^2 per filter) and the 2001 filters have a filter area of 1,536 ft^2 total (768 ft^2 per filter). Based on the MDNR design guide, a maximum of 5 gpm per ft^2 is allowed, thus, the maximum loading rate for this facility is approximately 7.6 MGD with one filter in each train out of service.

During peak flow events, solids can accidently be washed through the clarifiers, resulting in a build up in the filters that must be manually removed. The process is time consuming and labor intensive. Operators do their best to mange these events and prevent the wash out from occurring, but complete elimination of these events is not feasible. In addition, one filter has issues with the backwash process. The track that the traveling bridge rides along during backwash is worn and causes the bridge to stall without completing the backwash. This is problematic, since the bridge moves the backwash pump and appurtenances methodically from one end to the other to complete a backwash cycle.

While the replacement of the filter media can help prolong the life of the filter, our experience is that as the filters age, the underdrain system begins to clog and reduce the filter capacity, thus, getting full capacity of the filter back may not be achieved by replacing the filter media. The fact that the filter has suffered from the clarifiers ahead of them having the sludge blow through lends to the likelihood that there may be more problems than a simple media replacement can solve. Although it will be less costly to replace the filter media, long term cost of maintaining the filters could be more costly than retrofitting the filters with an Aqua Diamond filtration system. The Aqua diamond system has much greater filter capacity than the existing filters due largely to the shape of the filter media system. Instead of being a flat surface, it has a diamond shape, providing an increased surface area. It is estimated that the new filter media building could have the same filter capacity as both buildings combined by utilizing just one of the filter beds retrofitted with the Aqua Diamond system. The second bed would need to be retrofit too, in order to provide redundancy in the system.

The Aqua Diamond is also very efficient at backwash. The backwash happens much quicker than that of the traveling bridge filters installed, thus reducing the amount of water used during the backwash cycle. Reducing the amount of water during the backwash cycle also reduces the volume of water returned to the head of the plant, which can increase peak flows.

The estimated cost to install the Aqua Diamond in the newer filter bay (both sides), providing capacity equal or greater to the total capacity of all of the existing filters in one bay with the second bay installed for redundancy is as follows:

Filter Renovation
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	LS	Filer Equipment	$ 1,180,000.00	$ 1,180,000
2	1	LS	Filter Installation	$ 290,000.00	$ 290,000
3	1	LS	Electrical Modifications	$ 175,000.00	$ 175,000
7	1	LS	Removal of Old Equipment	$ 50,000.00	$ 50,000
8	1	LS	Piping Modifications	$ 70,000.00	$ 70,000
9	1	LS	Repurposing/ Renovating of Older Filter Building	$ 95,000.00	$ 95,000
10	1	LS	Misc Modifications	$ 50,000.00	$ 50,000
11	1	LS	Mobilization, Bonding, Etc.	$ 35,000.00	$ 35,000
			Construction Cost Estimate		$ 1,945,000
			Contingencies (10%)		$ 194,500
			Design & Construction Engineering		$ 200,400
			Full Time Resident Project Representative		$ 85,000
			TOTAL PROJECT COST		$ 2,424,900

The additional operation and maintenance cost associated with this improvement should be negligible or possibly even a savings on operation and maintenance. If solids wash through to the Aqua Diamond, it will not clog the surface of the filters as they do with the existing sand filter. There may still be some manual effort to clean some of the sludge out of the basin, but it would likely result in a reduced shut down time, compared to the length of time it currently takes.

Phosphorus Removal

The City's operating permit does not currently have limits on phosphorus in the effluent discharge, but it does require the City to monitor the phosphorus that is discharged in the effluent. While it is uncertain at this time if phosphorus limits will be issued to the City in the near future, consideration to what it would take to remove phosphorus should be considered in future planning.

Phosphorus removal can be achieved by two methods; biological removal and chemical removal. Biological removal typically cannot remove a much of the phosphorus as chemical removal and requires very specific conditions be maintained. Further, once biologically captured, the sludge containing the removed phosphorus must be maintained with aerobic conditions or the phosphorus will be released and may be returned to the treatment process when supernatant off the sludge is returned to the treatment process. For the City of Aurora, modifications to oxidation ditch would be required to create an anoxic zone, if biological uptake of the phosphorus were to be achieved. A selector basin ahead of the ditch may also be required, which would be difficult to achieve, based upon space available.

For chemical removal of phosphorus, the addition of alum or ferric chloride, followed by clarification and filtration can achieve very low phosphorus levels on a consistent basis through a fairly easy process. Once chemically bound, the phosphorus cannot be easily released back into the supernatant. Since the City of Aurora already has filters in place, the alternative to remove phosphorus chemically also has a lower capital cost than biological removal. The long-term maintenance costs for chemicals may be slightly higher, but the consistency and ease of operation for chemical removal makes it the recommended alternative.

It is estimated that the cost associated with the installation of facilities to removal phosphorus is as follows:

Phosphorus Removal
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	LS	Constuction of Checmical Feed Facilities and Injection Points	$ 75,000.00	$ 75,000
2	1	LS	Chemicla Injection Pumps and piping	$ 60,000.00	$ 60,000
3	1	LS	Misc Modifications	$ 30,000.00	$ 30,000
4	1	LS	Mobilization, Bonding, Etc.	$ 15,000.00	$ 15,000
			Construction Cost Estimate		$ 180,000
			Contingencies (10%)		$ 18,000
			Design & Construction Engineering		$ 37,200
			Full Time Resident Project Representative		$ 24,000
			TOTAL PROJECT COST		$ 259,200

The additional operation and maintenance cost associated with this improvement will be significant, primarily due to the additional chemicals required to remove phosphorus. Based on an estimated influent P concentration of 7mg/L (a typical value for domestic wastewater) and an effluent limit of 0.5 mg/L, the total P required to be removed is approximately 109 lbs/day for a flow of 2.0 MGD. To chemically remove the full 109 lbs/day, approximately 760 lbs of Alum are required. It is estimate that the annual Alum cost would be approximately $20 – 25 per day or $7,300 - $9,125 annually. The chemical cost is based on a number of assumption and could be fine tuned with data from the treatment plant, if this alternative is chosen to move forward with.

Sludge Storage

The Aurora wastewater treatment plant produces approximately 160 tons of dry sludge per year, or 877 lbs/day. Based on 1% solids when initially wasted, this equates to roughly 10,500 gallons per day of sludge produced. Currently sludge in handled by periodically wasting to the smaller sludge holding tanks, which were previously clarifiers. These tanks have a depth of approximately 9 feet and a diameter of 45 feet. Approximately 6-12 inches of the depth was lost during the conversion of the tanks from clarifiers to sludge holding basins. When accounting for 2' of freeboard and the volume lost in the conversion, each tank has about 75,000 gallons of storage. The two tanks combined have approximately 150,000 gallon or 14 days of sludge storage.

In addition to the converted clarifiers, the trickling filter tank was also converted to sludge storage. This basin varies in depth from 6'-8" to 7'-6" with a diameter of 150 feet. Based on an averaged depth of sludge 7.125 feet, the tank has a volume of approximately 675,000 gallons. This equates to a sludge storage of approximately 64 days, based on 1% solids. The way the facilities are operated, however, the City is able to get the sludge to 4-5% solids in the smaller sludge holding tanks. The 4-5% sludge is then transferred to the larger, trickling filter tank, allowing for this tank to have a sludge storage volume of nearly a year. There is some effort to dewater the sludge while in this tank too, getting the sludge in the 5-6% solids range, but it is not set up to easily dewater the sludge.

The City utilizes these tanks effectively and typically applies the sludge once a year on nearby fields, allowing them to essentially empty all their storage basins during one land application period. While this has worked well to this point, as the solids delivered to the plant continue to rise, additional storage would be beneficial to allow for flexibility in the solids handling operations. Additionally, more flexibility in decanting the sludge holding tanks is needed.

In order to provide more storage, the options to build an additional tank or to heighten the walls of the existing, smaller tanks can be explored. Based on the original drawings for the clarifiers that were later reconfigured into sludge holding tanks, and evaluating the ability to increase the wall height, it appears that a maximum of

approximately 4.5 feet can be added to the existing walls. This additional wall height would provide approximately 53,500 gallons of additional storage per tank or an additional 5 days of storage per tank at 1% solids. Increasing the wall height would allow the tanks to provide a total of 24 days sludge holding at 1 % solids in the two smaller sludge holding tanks. It is estimated the cost to increase the walls by this amount would be about $20,000 per tank or a total of approximately $40,000 for both tanks.

Reviewing literature on sludge thickening, a significantly thicker sludge can be obtained by increasing the thickening duration from 9-10 days up to 30 days. After 30 days, it appears the amount of additional thickening begins to diminish. The additional storage to allow the volume to be increased to 24 days will certainly help with the flexibility of the operation, but may not give as much flexibility in operation as adding an additional tank. Further, 24 days storage is based on current sludge production at the plant. As time goes on, the production of higher sludge volumes will diminish the number storage days available in the tanks.

There is not a large amount of space available at the site, but there is space to add an additional tank, if desired. It is anticipated that the new tank would provide enough volume to provide a full 30 days detention, in conjunction with the existing, small sludge holding tanks and provide for 25% future growth, as a minimum (however, there is not a downside to providing even more sludge storage). If a tank were built without doing anything to increase the wall height on the existing tank, in order to provide 30 days storage with room for 25% growth, a tank 60' in diameter and 12 feet of water depth (14' side wall depth) would be required. It is estimated that the tank costs would be approximately $260,000. If an extension to the existing, small sludge holding tank walls of 4.5' is added, the additional storage that will be needed to provide the specified volume will require a tank that is 44 feet in diameter and 12 feet of water depth (14' side wall depth). It is estimated that the tank cost for the 44' diameter tank would be approximately $167,000.

Based on providing 30 days sludge holding plus 25% room for growth for thickening ahead of the larger, renovated trickling filter sludge holding tank, it is recommended that the existing tanks be renovated to have an increase in the wall height and a new 44' diameter tank be installed. This has a slightly reduced cost compared to adding all of the storage into one, new 60' diameter tank.

In order to provide more flexibility in decanting the sludge, there are several options. None of these options are perfect to allow for decanting, but a combination of the existing sludge valve and an additional pipe on the exterior of the wall to allow for supernatant to be drawn off could help to allow for the sludge to be dewatered more effectively. It is recommended that the wall be core drilled to allow a draw off pipe at various levels of the wall to be installed. The various levels of draw off could be controlled through a series of gates on the exterior of the tank, with all of the draw off points being directed to a pipe leading to the existing decant pipe.

The estimated cost associated with providing additional storage and additional decanting equipment is as follows:

Sludge Holding
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	2	LS	Increase Wall Height on Sludge Thickening Tank	$ 20,000.00	$ 40,000
2	1	LS	Install a New 44' Diameter Tank	$167,000.00	$ 167,000
3	1	LS	Piping Interconnect of New Tank and Revisions to Existing Piping	$ 65,000.00	$ 65,000
4	1	LS	Site Grading	$ 20,000.00	$ 20,000
5	3	LS	Install Sludge Dewatering Equipment	$ 35,000.00	$ 105,000
6	1	LS	Misc Modifications/ Railing	$ 35,000.00	$ 35,000
7	1	LS	Mobilization, Bonding, Etc.	$ 25,000.00	$ 25,000
			Construction Cost Estimate		$ 457,000
			Contingencies (10%)		$ 45,700
			Design & Construction Engineering		$ 64,800
			Part Time Resident Project Representative		$ 25,200
			TOTAL PROJECT COST		$ 592,700

Includes up to 21 days of Resident Project Representatives

The additional operation and maintenance cost associated with this improvement should be negligible.

Another option would be to change the process to an aerobic digestion process. This may allow for a shorter time required to meet the SOUR test requirements. At this time the City utilizes a 38% reduction test to insure the sludge has been properly treated, which may take more time. The sludge being delivered to the tanks has already been significantly treated through the regular aerated treatment process, thus, reducing the volatile portion of the sludge by an additional 38% may be more difficult. An aerobic digestion system would require additional tank capacity or a reduction in the amount the sludge is thickened. As such, since the City is already comfortable with the methods of sludge handling currently employed, this option will not be considered further and the recommendations will allow the City to operate in the current manner, with enhancements to that process through provision for additional sludge storage.

Sludge Blanket Monitoring

On occasion, regionalized rain events have caused the plant operation to be upset unexpectedly. One of the biggest problems is the potential for the sludge blanket in the clarifiers to be washed out and pushed into the filters. Some equipment is available that can assist with monitoring the sludge blanket, but it is largely thought to unreliable and by the time the operator is notified with this type of instrumentation it is often too late to prevent the sludge from overtopping the clarifiers. As an alternative to providing a sludge blanket monitor, it may be more beneficial to provide additional flow monitoring equipment at the head of the plant and telemetry to notify the operators in advance of the high flows actually getting to the clarifier so the operator can make a decision to bring additional clarifiers on line or other measures to prevent the sludge blank from rising. It appears there would be room to add a Parshall flume at the head of the plant where the abandoned headworks screening currently sits between the influent pumps and the oxidation ditch. With the demolition of the screening that is no longer used, the channels could be used to install a Parshall flume and measure the influent flow.

The estimated cost associated with providing additional flow monitoring equipment is as follows:

Flow Metering
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	LS	Demolition of Screening Structure	$ 30,000.00	$ 30,000
2	1	LS	Installation of Parshall Flume	$ 30,000.00	$ 30,000
3	1	LS	Misc Modifications/ Telemetry	$ 40,000.00	$ 40,000
4	1	LS	Mobilization, Bonding, Etc.	$ 20,000.00	$ 20,000
			Construction Cost Estimate		$ 120,000
			Contingencies (10%)		$ 12,000
			Design & Construction Engineering		$ 27,600
			Part Time Resident Project Representative (3 days)		$ 3,600
			TOTAL PROJECT COST		$ 163,200

The additional operation and maintenance cost associated with this improvement should be negligible.

Renovation of Locust Lift Station

The Locust Lift Station is located on the north side of the intersection of East Locust Street and South Oak Ave. The lift station is small and very similar to the McNatt Lift Station that was just renovated on the north end of the City. Both these lift stations were built at approximately the same time. While the lift station is still functional and performs well, the 2 HP pumps that are installed are obsolete and a replacement that would fit on the existing guide rail system cannot be found. Additionally, the lid for the station has a broken hinge and should be replace, and the valves should be replaced as a part of routine maintenance. The existing 4" discharge piping is thought to be in good condition and conveys the flow to a manhole that is only about 20 feet from the lift station.

It is estimated that the cost associated with the renovation of the Locust Lift Station is as follows:

Locust Lift Station Renovation
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	LS	Piping Modification to accommodate new pumps	$ 28,000.00	$ 28,000
2	2	EA	New pumps	$ 9,500.00	$ 19,000
3	1	LS	New Control Panel & Electrical Modifications	$ 40,000.00	$ 40,000
7	1	LS	Clean & Paint or Replace Valve Pit Piping, Fittings, Valves	$ 18,000.00	$ 18,000
8	1	LS	Bypass pumping	$ 4,500.00	$ 4,500
9	1	LS	Mobilization, Bonding, Etc.	$ 10,000.00	$ 10,000
			Construction Cost Estimate		$ 119,500
			Contingencies (10%)		$ 12,000
			Design & Construction Engineering		$ 19,000
			Part Time Resident Project Representative		$ 8,400
			TOTAL PROJECT COST		$ 158,900

Includes up to 7 days of Resident Project Representatives

The additional operation and maintenance cost associated with this improvement should be negligible or possibly even a savings on operation and maintenance.

Reduction of Inflow and Infiltration in the Collection System

While positive steps towards removal of inflow and infiltration (I&I) have been taken in recent years there is still much to be completed. The portions of the systems that have been evaluated still have many repairs to be completed and much of the system has not yet been fully evaluated. The goal for 2019 is to complete the rehabilitation of the McNatt basin system. The lift station was recently renovated to allow the pumps to keep up with the usually high flows seen in the system, which are largely attributed to I&I. The next step is to reduce the flow to the station through collection system repair in the public and private systems as identified in the 2017/ 2018 studies of that portion of the system. There is also a need to increase the capacity of the line receiving the flow from the McNatt station. Following are the planned improvements for 2019 and the associated costs.

McNatt Lift Station Basin Public I&I Repairs
City of Aurora, Missouri
January 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	4,058	LF	8-Inch CIPP (6.0 mm)	$ 23.25	$ 94,349
2	1	LS	Mobilization for CIPP	$ 8,000.00	$ 8,000
3	6	EA	Setup for Lateral Repairs (Manhole to Manhole)	$ 500.00	$ 3,000
4	27	EA	Trenchless Lateral Connection Repairs (LCRs)	$ 1,300.00	$ 35,100
5	1	LS	Mobilization for LCRs	$ 2,500.00	$ 2,500
6	3	EA	6'-12' Deep Point Repair Under Pavement for 8" Dia. Pipe	$ 4,400.00	$ 13,200
7	4	EA	6'-12' Deep Point Repair Under Turf for 8" Dia. Pipe	$ 2,000.00	$ 8,000
8	20	LF	Additional Footage for 6'-12' Deep Point Repair Under Pvmt for 8" Dia. Pipe	$ 250.00	$ 5,000
9	1	LS	Mobilization for Point Repairs	$ 1,100.00	$ 1,100
10	1	EA	Open Trench Lateral Repair 6'-12' Deep Under Alleyway	$ 3,700.00	$ 3,700
11	1	LS	Mobilization for Open Trench Lateral Repairs	$ 1,100.00	$ 1,100
12	1	LS	Mobilization for Manhole Curtain Grouting*	$ 1,800.00	$ 1,800
13	3	EA	Manhole Curtain Grouting*	$ 1,500.00	$ 4,500
14	1	LS	Mobilization for Frame and Cover Repairs	$ 1,100.00	$ 1,100
15	3	EA	Replace Manhole Frame*	$ 1,400.00	$ 4,200
16	1	EA	Replace Manhole Cover*	$ 650.00	$ 650
			Purchase Order Estimated Costs		$ 187,299
			Contingencies (10%)		$ 18,700
			Design & Construction Engineering**		$ 19,500
			Resident Project Representative***		$ 15,500
			TOTAL PROJECT COST		$ 240,999

* Denotes bid item is not fully covered in Tool Box; Unit Price is estimated

** Includes coordinating a purchase order under the existing cooperative procurement contract in place for Joplin and bidding any additional work not covered in the cooperative procurement contract.

*** Includes up to 10 days of Resident Project Representative and review of post rehab videos to ensure work conforms to specifications

In addition to these public repairs, significant contributions to the inflow and infiltration have been identified on the public side of the system. Following is estimate of the cost to perform the private repairs.

Private I&I Abatement
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	1	EA	Mobilization for Clean Out Replacement	$ 650.00	$ 650
2	27	LS	Clean Out Replacement	$ 726.00	$ 19,602
3	1	EA	Foundation Drain Repair*	$ 3,600.00	$ 3,600
4	1	EA	Stairwell Drain*	$ 3,600.00	$ 3,600
5	2	EA	Sump Pump Repiping*	$ 2,250.00	$ 4,500
6	1	LS	Mobilization for Lateral Line CCTV	$ 750.00	$ 750
7	20	EA	Set-up per Mahole to Manhole Segment	$ 50.00	$ 1,000
8	21	EA	CCTV Lateral Line Inspection	$ 225.00	$ 4,725
9	1	LS	Mobilization for Lateral Line Repair	$ 1,100.00	$ 1,100
10	50	LF	Additional Lateral Line	$ 250.00	$ 12,500
11	12	EA	Lateral Line Repair**	$ 3,800.00	$ 46,360
			Construction Cost Estimate		$ 98,387
			Contingencies (20%)		$ 19,700
			Design & Construction Engineering***		$ 10,500
			TREKK Subconsultant Services****		$ 25,900
			Resident Project Representative ***		$ 4,500
			TOTAL PROJECT COST		$ 158,987

* Denotes bid item is not fully covered in Tool Box; Unit Price is estimated

** Assumes 10' per repair in alleyway, less than 6' deep and assume that 40% of CCTV inspections yield problems

*** Assumes coordination/ providing information to contractor or City on location to correct defects. Does not include bidding this project as a stand alone project. Includes up to 4 days of on-site Resident Project Representative from AMA

**** TREKK will provide services to coordinate getting the home owners approval to perform the repair, coordiante the repairs with the owner and plumber and provide a final inspection of the work performed. They will also provide prequalification of plumbers for bidding the project.

In addition to reducing the inflow and infiltration issues, the discharge of the McNatt Lift Station is problematic. At least a small section of the discharge gravity sewer is only 6-inch diameter and may not be capable of handling the flow from the lift station. In order to increase the capacity of the gravity collection system, it is recommended that the gravity line be increased to 8" or 10" gravity sewer. An estimate of the cost is provided below.

McNatt Discharge Sewer Capacity Increase
City of Aurora, Missouri
March 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	325	LF	10" Dia. PVC Gravity Sewer Line	$ 60.00	$ 19,500
2	1	EA	Manholes	$ 4,500.00	$ 4,500
3	30	LF	Pavement Repair	$ 60.00	$ 1,800
4	295	LF	Type A Surface Restoration	$ 4.00	$ 1,180
5	1	LS	Connection to Existing Manholes	$ 3,500.00	$ 3,500
6	1	LS	Mobalization	$ 8,500.00	$ 8,500
			Construction Cost Estimate		$ 38,980
			Contingencies (10%)		$ 3,900
			Design & Construction Engineering		$ 8,500
			Resident Project Representative		$ 7,200
			Easement Verification/ Acquisition		$ 7,500
			TOTAL PROJECT COST		$ 66,080

SCADA System

The City's wastewater collection and treatment plant do not have any remote monitoring system aside from auto dialers that are able to notify personnel when an alarm is activated. Many communities find it beneficial to have a supervisory control and data acquisition (SCADA) system to allow various aspects of their system to be monitored and controlled. This can be solely at the wastewater treatment plan to monitor operate the plant centrally from the office building or can be expanded to allow for monitoring of all the lift station site. Some of the items in the plant that can monitored are:

1. Pumps Running/ Stopped
2. Water Level (with a transducer installed)
3. High/ Low Water Level Alarms
4. Power Outage
5. Generator On/Off (if generator installed)
6. Three-Phase Power Monitoring
7. Alarms and Call-Out for Pre-determined Conditions

The system can be monitoring only or allow the operator to control these features remotely. In the plant each of the unit processes can be monitored for various parameters, such as DO in the oxidation ditch, flow through the effluent channel, etc.

An estimated cost for providing a SCADA system is as follows:

SCADA
City of Aurora, Missouri
January 2019

ITEM NO.	NO. OF UNITS	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED
1	5	EA	Remote Terminal Unit (RTU) Site at Location in Collection System	$ 20,000.00	$ 100,000
2	1	EA	Master Terminal Unit (MTU) Site	$ 28,000.00	$ 28,000
3	3	LS	Remote Transmitting Units at the Treatment Plant	$ 25,000.00	$ 75,000
4	1	LS	Misc., Mobilization, Bonding, Etc.	$ 20,000.00	$ 20,000
			Construction Cost Estimate		$ 223,000
			Contingencies (10%)		$ 22,300
			Design & Construction Engineering		$ 39,600
			Part Time Resident Project Representative (5 days)		$ 7,500
			TOTAL PROJECT COST		$ 292,400

It is estimated that the additional operation and maintenance of the additional equipment would include a monthly fee of approximately $40-$45 per site per month to provide cell service to all the sites. There are alternatives to using cell service that would not require a monthly fee, such as radios, but they tend to be less reliable. While radios are still widely used, their cost for replacement is much higher than that of cellular based systems. The life cycle cost should be considered when choosing a system.

The City would also have to plan for some regular maintenance of the equipment, which should not be a significant cost, but due to the nature of electrical components, it's likely their life expectancy is only about 10-15 years at which time much of it will need to be updated. The bigger cost over maintenance would likely be replacement cost.

SUMMARY OF POTENTIEL IMPROVMENTS

A total cost of all the potential improvements totals approximately $4.7 Million. In addition to the improvements listed, each year new improvements will need to be made to reduce I&I. The previous report we performed on a small sub basin of the collection system (about 5% of the system) estimated nearly $1.4 Million in improvements were required to correct that small section, which are not included in this report. System wide, correction of the I&I will cost several million dollars over the year to come to take steps toward upkeep of the collection system.

In addition to the I&I work, development within the community will eventually require upgrades to both the collection system to increases capacity and upgrades to the treatment facilities to accommodate the higher flow and loads. The first step to increase collection system capacity was completed a few years back, but as development continues, additional increases in collection capacity will be required.

The rate study performed in 2016 recommended a gradual increase in the sewer rates to accommodate additional operating expense caused by inflation, to allow for funding to correct inflow and infiltration problems, and to allow for funding to make improvements in the collection and treatment system to meet growth and permitting requirements. After review of the potential improvements, above, you will find that continuing on the path to increase rates as previously stated is necessary to maintain and improve the City's wastewater system. Within the next year or two, it would also be prudent to re-evaluate the rates in light of the current circumstances and to determine if the increases have been adequate to keep up with system needs.

I hope the report has adequately addressed the question at hand.

If you have any questions or need additional information, please don't hesitate to contact me.

Sincerely,

ALLGEIER, MARTIN and ASSOCIATES, INC.

J. Eric DeGruson, P.E.
Vice President/ Civil Engineer

Enclosures