

This was the original estimate provided with the Engineering Memo
 Airview

203 Customers 50,750 gpd

20181222

CONSTRUCTION ITEM	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Install flow equalization storage (20,000 gal)	1	Lump Sum	\$40,000	\$40,000
Influent Pumps from flow eq	1	Lump Sum	\$15,000	\$15,000
Convert existing 6500 gallon FE to aeration	1	Lump Sum	\$5,000	\$5,000
Sludge Holding tank	1	Lump Sum	\$25,000	\$25,000
Clarifier Repairs	1	Lump Sum	\$15,000	\$15,000
Install Mission Alarm and wiring with meter	1	Lump Sum	\$10,000	\$10,000
Replace diffusers in aeration tankage	1	Lump Sum	\$30,000	\$30,000
Replace RAS lines from clarifier	1	Lump Sum	\$15,000	\$15,000
Contractor O & P	1	Lump Sum	\$40,000	\$40,000
Replace blower	2	Lump Sum	\$10,000	\$20,000
New UV System	1	Lump Sum	\$40,000	\$40,000
Replace effluent pipe	1	Lump Sum	\$15,000	\$15,000
Remove contact chamber from creek	1	Lump Sum	\$5,000	\$5,000
Cleanup and clear lagoon berm	1	Lump Sum	\$30,000	\$30,000
Sludge removal from lagoon	1	Lump Sum	\$50,000	\$50,000
Cleanup sludge from creek	1	Lump Sum	\$30,000	\$30,000
Access road repair	1	Lump Sum	\$15,000	\$15,000
Smoke test system	1	Lump Sum	\$20,000	\$20,000
Collection system repair for I and I	1	Lump Sum	\$40,000	\$40,000
SUBTOTAL				\$460,000
Surveying Fees				\$30,000
Engineering (To be determined)				\$60,000
Contingency(10%)				\$46,000
TOTAL				\$596,000
Design will need to evaluate actual size of facility. The loading appears to be exceeding the aeration tank capacity.				

Arcadia Pines (Wastewater) – No discharge/No permit
Engineering Memorandum
Date: October 5, 2019

Wastewater Treatment Facility Understanding

The Arcadia wastewater treatment facility is located in West Paducah, KY. The plant services about 33 customers which is approximately 100 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. Conversations with the head of the Health department made me believe they have construction plans for this system in their files. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The single cell Lagoon has limited access. The perimeter fencing needs repairs at multiple locations. The berms have multiple varmint holes that are compromising the integrity of the lagoon berm. Varmint traps were located on the site and appears to be an ongoing problem. The lagoon itself has major erosion around the inner edge and has a minor leak on the south side of the lagoon discharging into the storm ditch. On the surface of the lagoon there is one overflow pipe. Due to vegetation in the area we could not locate the discharge point for the overflow. Lagoon grounds were mowed, and the area was clean. In the Neighborhood there is ongoing housing construction north of the lagoon. There appears to be an undeveloped portion of the subdivision that could be developed in the near future.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

Improvements: The perimeter fence needs repair. The berm is leaking and has various varmint holes that need to be repaired. The overflow discharge point needs to be located.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Arcadia neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. We recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.



Civil Engineering
 Land Surveying
 Potable Water
 Wastewater Treatment



Civil Site Design
 Construction Support
 GIS Mapping
 Wastewater Collection

Estimate of Construction
 Arcadia Pines WWTF
 No Permit for Non-Discharging Lagoon
 McCracken County, KY

Project: Construction Cost Estimate for WWTF Improvements

Description	Unit	Unit Price	Quantity	Total Cost
Chainlink fence repair	Lump Sum	\$5,000	1	\$5,000
Repair leaking berm/drain field	Lump Sum	\$20,000	1	\$20,000
Repair varment damage	Lump Sum	\$5,000	1	\$5,000
New access road	Lump Sum	\$5,000	1	\$5,000
Collection System repair	Lump Sum	\$10,000	1	\$10,000
Construction Cost Total				\$45,000
Smoke Testing	Lump Sum	\$3,500	1	\$3,500
Surveying	Lump Sum	\$7,500	1	\$7,500
GIS	Lump Sum	\$2,500	1	\$2,500
Engineering	Lump Sum	\$12,500	1	\$12,500
Construction Cost Total				\$81,000

Consider budgeting for Lagoon Sludge (Estimated)	\$50,000
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Brocklyn-Kentucky (Wastewater)
Engineering Memorandum
Date: December 26, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on May 31, 2018. The plant consists of an aeration tank, clarifier, polishing earthen cell, and chlorine disinfection. The aeration appeared to have a reasonable appearance for a mixed liquor however, the clarifier had a lot of floc and sludge at the surface. It is my understanding they are utilizing chlorine tablets for disinfection. This discharge from the clarifier is pumped to the polishing cell. After a period of storage in the polishing cell, the pond discharge gravity flows into the chlorine tablet feeder and contact chamber. The contact chamber is also acting like a re-aeration tank to meet dissolved oxygen requirements. (See Appendix 1 for overall picture)

Various items of concern exist as this facility. There is no flow equalization at this facility. The incoming gravity flow enters directly into the aeration tank at the influent manual bar screen. (Appendix Picture 2)

While the aeration appeared to be reasonable operating, standard testing parameters were not performed when we were present to determine the quality of the mixed liquor. Due to the upkeep of the remaining portions of the facility, I do not believe the diffusers have been checked and/or cleaned in some time. Additionally, in review of the EPA's Echo violations listed, the facility is starting to violate limits more often and may be due to non-maintenance of the equipment. Additionally, the tank size appears to be borderline on having the aeration tank volume necessary to serve the 168 customers served. Further measurements will be necessary to determine if the current capacity is adequate or an expansion is necessary. (Appendix Picture 3)

The clarifier appears to be working properly. However, the supernatant water of the clarifier had a large amount of floc and/or sludge coming to the surface. While this might be an operational issue in regards to control of the mixed liquor and return sludge flow, the clarifier is not operating at an optimal level. The clarifier discharge is pumped to the polishing cell for final treatment. (Appendix Picture 4)

The polishing cell is a poorly designed treatment structure. A deteriorating concrete block wall (Appendix Picture 5) is partially surrounding the pond while the remaining pond surround is earthen. The earthen portion of the pond is allowing overland flow from yards to drain directly into the pond which will bring additional pollutants into the cell and contaminate the effluent. (Appendix Picture 6) Having overland flow will also increase the effluent flow during rain events and will increase chemical usage in the disinfection process. The pond has various issues of concern. To review the operational affects of this polishing cell, it also requires the review of the clarifier. The clarifier has a lot of sludge and floc in the supernatant water of the clarifier above the sludge blanket. This supernatant is pumped

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Potable Water
Wastewater Treatment



Civil Site Design
Construction Support
Transportation
Wastewater Collection

to the polishing cell. While this cell can protect sludge from discharging into the stream, the cell must be periodically cleaned to avoid sludge build up and recontamination of the effluent. I can't confirm sludge levels from this visit. Sludge judging of this cell should be completed. Additionally, I'm not aware of the depth of this cell. A shallow cell may have algae growth that will cause effluent problems. Since no aeration exists in the cell to improve mixing, I anticipate the cell turning over similar to a pond and may have contamination of the effluent from solid deposits on the cell bottom. (See polishing cell photo in Appendix Picture 7)

The contact chamber does not have typical baffling and may experience short circuiting. While it doesn't appear there are any violations for E. Coli, the contact chamber should be replaced or disinfection should be converted to Ultraviolet disinfection. (Appendix Picture 8)

Depending on further inspection of the contact chamber, it might be able to be salvaged if solely used for re-aeration to meet dissolved oxygen levels. This will be evaluated in the design and operational stage of the system transfer period.

The effluent quality looks clean as it was leaving the re-aeration tank. The effluent discharges into the existing stream that runs through the middle of the treatment facility yard.

Improvements: Install flow equalization, replace aeration system, replace sludge return lines, sludge judge polishing cell, evaluate the polishing cell to determine the benefit of this part of the treatment, regrade around perimeter of polishing cell with gutter system to redirect water if staying in use, install ultraviolet disinfection, and repair and repaint re-aeration tank to extend life of tankage.

In lieu of maintaining the polishing cell, the owner should evaluate the benefits of installing a cloth drum filter at the effluent and possibly converting the polishing cell to flow equalization.

Wastewater Collection System Understanding

Per records provided by the owner, the system has approximately 168 customers. These customers are served by a gravity sewer system. Per the operator, Inflow in infiltration is believed to be a problem on this facility. A flow meter should be installed to determine extend of the I and I problems. Funds should be invested into the collection system or the quality of the effluent will be an ongoing problem. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

APPENDIX



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Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection



This was the original estimate provided with the Engineering Memo
 Brocklyn Capital Estimate

20181226

CONSTRUCTION ITEM	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE
Install flow equalization storage (15,000 gal)	1	Lump Sum	\$30,000	\$30,000
Influent Pumps from flow eq	1	Lump Sum	\$15,000	\$15,000
Sludge Holding tank	1	Lump Sum	\$25,000	\$25,000
Install Mission Alarm and wiring with meter	1	Lump Sum	\$10,000	\$10,000
Replace diffusers in aeration tankage	1	Lump Sum	\$30,000	\$30,000
Replace RAS lines from clarifier	1	Lump Sum	\$15,000	\$15,000
Contractor O & P	1	Lump Sum	\$30,000	\$30,000
Replace blower	2	Lump Sum	\$10,000	\$20,000
New UV System	1	Lump Sum	\$35,000	\$35,000
Regrade around lagoon	1	Lump Sum	\$15,000	\$15,000
Sand blast and paint tankage	1	Lump Sum	\$15,000	\$15,000
Sludge judge lagoon cell	1	Lump Sum	\$2,500	\$2,500
Sludge removal from lagoon	1	Lump Sum	\$20,000	\$20,000
Cleanup sludge from creek	1	Lump Sum	\$10,000	\$10,000
Mini-MBBR on effluent cell	1	Lump Sum	\$30,000	\$30,000
Smoke test system	1	Lump Sum	\$17,500	\$17,500
Collection system repair for I and I	1	Lump Sum	\$35,000	\$35,000
SUBTOTAL				\$355,000
Surveying Fees				\$25,000
Engineering (To be determined)				\$45,000
Contingency(10%)				\$35,500
TOTAL				\$460,500

Design will need to evaluate actual size of facility. The aeration tank size appears to be borderline in regards to capacity to service this community.

Carriage Park (Wastewater) – No discharge/No permit Engineering Memorandum

Date: October 5, 2019

Wastewater Treatment Facility Understanding

The Carriage Park wastewater treatment facility is located in West Paducah, KY. The plant services about 36 customers which is approximately 108 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. While we do have some plans on file, conversations with the head of the Health department made me believe they have construction plans for this system in their files as well. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The two cell Lagoon has limited access. The perimeter fencing needs repairs at multiple locations. The berms have multiple varmint holes that are compromising the integrity of the lagoon berm. The lagoon had an ongoing leak along the northeast berm that would be an illegal discharge. The lagoon itself has major erosion around the inner edge and has overgrown brush on the inner berms that needs removed. While we did not have construction plans with us during our site, visit, I recommend bringing plans and comparing them to the onsite features. The plans have a lateral bed at the southwest corner of the lagoon that was apparently sized to accept 19,000 gpd. I anticipate this customer base discharging around 7,000 gpd and therefore, may have access capacity to accept additional flow. Consideration should be given to accepting the flow from the Timberland-JoAnn Estates subdivision, that is also included in this acquisition. However, flow monitoring to confirm available capacity and permitting with the Health Department to achieve this connection.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

Improvements: The perimeter fence needs repair. The lagoon berm is leaking and should be repaired. Remove overgrowth from the inside of the lagoon berms.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Carriage Park neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. We recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.



Civil Engineering
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 Potable Water
 Wastewater Treatment



Civil Site Design
 Construction Support
 GIS Mapping
 Wastewater Collection

Estimate of Construction
 Carriage Park WWTF
 No Permit for Non-Discharging Lagoon
 McCracken County, KY

Project: Construction Cost Estimate for WWTF Improvements

Description	Unit	Unit Price	Quantity	Total Cost
Chainlink fence repair	Lump Sum	\$10,000	1	\$10,000
Repair leaking berm/drain field	Lump Sum	\$50,000	1	\$50,000
Repair varment damage	Lump Sum	\$5,000	1	\$5,000
New access road	Lump Sum	\$10,000	1	\$10,000
Collection System repair for I and I	Lump Sum	\$25,000	1	\$25,000
Construction Cost Total				\$100,000
Smoke Testing	Lump Sum	\$3,500	1	\$3,500
Surveying	Lump Sum	\$7,500	1	\$7,500
GIS	Lump Sum	\$2,500	1	\$2,500
Engineering	Lump Sum	\$17,500	1	\$17,500
Construction Cost Total				\$156,000

Consider budgeting for Lagoon Sludge (Estimated)	\$50,000
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The Delaplain Disposal – Delaplain WWTP KY0079049
Kentucky
Engineering Memorandum
Date: September 11, 2020

Introduction

The Delaplain wastewater treatment facility is located north of Georgetown, Kentucky approximately 19 miles north of Lexington, Kentucky. This facility services 290 residences and 33 commercial or industrial contributors. The system operates under Kentucky DEP Permit number KY0079049 and Agency ID number 3901.

Existing Flows and Loadings and Projections

The existing facility is authorized to treat up to 240,000 gpd.

According to the permit application submitted by Delaplain Disposal Co., the flow contribution is 55% commercial and 45% industrial. According to data available on EPA's Echo site and data submitted to 21 Design Group, Inc. by current ownership, the flows to the facility for 2020 are very roughly approximated below:

- Annual Average Daily Flow – 240,000 – 260,000 gpd
- **Maximum Monthly Average Daily Flow – 360,000 gpd**
- Maximum Weekly Average Daily Flow – 475,000 gpd
- Maximum Daily Average Daily Flow – 910,000 gpd
- Peak Hourly Flow – 1,200,000 gpd

The maximum monthly average daily flow and peak flows are concerning relative to the existing rated capacity and plant size. The plant has a clarifier that is ½-1/3 of the required size at this time. This is consistent with the current ownership's believe that I&I is a problem and flow equalization would be helpful, and it also makes some sense of the excursions in TSS (during wet weather).

The flow peaking factor for the facility is clearly significant, and because of the significant commercial contribution, it's very likely that there's significant variability and spikes in BOD, TSS and ammonia loadings. During excursions in the past, BOD levels were significantly higher than TSS levels, indicating incomplete treatment. We know that one of the original 50-hp centrifugal blowers was replaced recently (to maintain current capacity rating, not to increase aeration capacity), and it's likely that this improvement was made to address the high BOD events observed. It is unclear at this time if the improvement to blower capacity will meet demands from the flow and loading spikes, but it would seem likely that the blower capacity is inadequate based on current vs design flows.

Based on what we've seen and heard to date, the significant industrial contributor has not historically become an issue in operation or in permit compliance.

Based on discussions with current Ownership, the local region is growing rapidly, the area serviced is growing, and they anticipate growth in flows and loadings.

Permit Limitations and Historical Compliance Performance

The plant is authorized to discharge up to 240,000 gallons per day (gpd) by the KDEP per the operating permit. **As discussed above, the facility has discharged flows significantly in excess of this value a number of months this year and is likely to exceed this annual flow rate in 2020.**

A summary of the existing permit limits is described below:

- BOD5 – 10/15 mg/L (Monthly average/Maximum Weekly Average)
- TSS – 30/45 mg/L
- NH3-N – 2/3 mg/L
- NH3-N – 5/7.5 mg/L
- E-Coli – 130/240 mpn/100 ml
- Total Residual Chlorine – 0.011/0.019 mg/L
- Total Phosphorus – Report Only
- Total Nitrogen – Report Only
- Dissolved Oxygen – No limit



A review was performed of EPA's Echo compliance website which lists violations of wastewater treatment plants across the country. The Delaplain wastewater treatment plant has exceeded permit limitations several times in recent months and years for Total Suspended Solids, Ammonia Nitrogen, Total Residual Chlorine, E-Coli, and CBOD5.

Wastewater Treatment Facility Existing Conditions

The original facility included the following features:

- Two influent lines; one comes by gravity from the east side of the facility, and the other enters via forcemain from the west side of the facility.
- Comminutor to grind and remove influent solids
- Manually cleaned bar screen
- Aeration tank
- Two 50 hp centrifugal blowers used to aerate the aeration tank

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- Circular clarifier with scum collection and air lift of scum to digester
 - RAS/WAS box
 - Surge Chamber and transfer pump to convey stored wastewater into the aeration tank
 - Aerobic Digester
 - Chlorine feed point and chlorine contact tanks
 - Dechlorination feed point and dechlorination contact tanks
 - Control panels for various subcomponents in the system including the controls for the clarifier, blowers, and surge tank transfer pumps.
 - PD blower that appears to serve the aerobic

The existing facility has aged, showing the need for fresh coatings, protection from exposed wires, and spot welding repairs, but it is in relatively good working order.

The comminutor is no longer utilized, and the manual bar screen appears to result in overflows periodically from the uncleaned bar screen rack. The air pattern in the aeration tank indicates relatively turbulent mixing conditions using coarse bubble diffuser design that would likely not be improved significantly with diffuser replacement. It was unclear whether the surge tank is utilized or if the surge tank transfer pumps are in working condition. The existing gaseous chlorine and gaseous sulfur dioxide systems were in working condition according to the operators (however the chemical solution feed lines were not evident).

Functionality of the Existing System

The functionality of the existing plant is similar to other activated sludge systems. However, this system is challenged by:

- **The system is seeing flows (and most likely loadings) significantly in excess of original capacity.** This results in the need to carry very high mixed liquor concentrations and to maintain a very healthy sludge age in a limited range or face challenges during wet weather to retain biomass. (Based on effluent results, it appears this is a real problem here).
- The existing clarifier has a 10' depth and a 25' diameter. Because the 10-State Standards require 12' deep clarifiers, this tank is not acceptable as a secondary clarifier for activated sludge systems. At the maximum 10-State Standards surface overflow rate of 1,000 gpd/sf, the 25' diameter clarifier can only handle peak flows up to about 490,000 gpd. The peak daily flow and peak hourly flows to the plant significantly exceed this flow rate at this time, so the clarifier is very undersized for use in an activated sludge application.
- There is only 1-large zone of treatment, and it's difficult to make system repairs without multiple tanks to allow the system to be taken off line.
- There are no provisions evident for using the surge tank beyond overflowing the bar screen. It is currently not convenient to use the surge tank.
- There is only 1-operating blower for the aeration tank, and because it's centrifugal and there's no modulating inlet suction valve or VFD, it's either on or off.

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- It doesn't appear to include provisions for decanting supernatant from the digester (which is most likely undersized now).
 - The contact time for disinfection appears to be limited.
 - The current ownership believes the previous operator did not perform well; a new, effective operator has taken over recently.
 - The use of gaseous chlorine and gaseous sulfur dioxide poses addition risks to operators and the neighboring community, and it's somewhat uncommon to many operators.
 - Currently no remote monitoring is in place at the site. This makes it difficult for the operators to know when the facility is failing. Operational monitoring should be completed to monitor the quality of effluent, which should then be compared to the operating permit.

Wastewater Treatment Facility Recommended Improvements

- Because the facility receives flows and loadings in excess of current capacity (by roughly 40-50%), we believe there will be a need to upgrade the system BOD, TSS and NH₃-N reduction capacity. We also believe the facility faces excessive I&I, so flow equalization and an influent pump station will be helpful to reduce demands on the final clarifier.
- The failure of the original comminutor results in the need to collect significant screenings in multiple 5-gallon buckets. We recommend the addition of a mechanically cleaned screen for this application.
- The improvements proposed to integrate the above two recommendations includes the addition of a "roughing" MBBR (targeting 70% BOD reduction in a 40 minute hydraulic retention time or 10,000 gallons); the addition of equalization with 4-hours of hydraulic retention time or 60,000 gallons and an influent pump station with variable frequency drives with an influent flow meter; the addition of metal salt addition in the EQ and clarifier to improve solids capture during wet weather, and the addition of a tertiary auto-strainer for solids separation downstream of the existing clarifier.
 - Note that a variance will be required for acceptance of the secondary clarifier due to the 10' deep tank height and the high surface overflow rate.
 - This improvement is expected to reduce peak flows to the clarifier by up to 25%
 - This improvement is expected to reduce the required mixed liquor concentration by as much as 70% without requiring modifications to the existing aeration header or blowers.
 - This improvement is expected to minimize solids carry over into the clarifier during peak flow events relative to existing conditions.
- We recommend the addition of current density baffles to the side wall of the clarifier (in addition to the above described roughing MBBR and EQ tank improvements) to improve clarifier performance and to allow for regulatory acceptance of surface overflow rates in excess of the typically allowable surface overflow rates. The new roughing MBBR could be used in conjunction with the use of the new EQ tank for temporary clarification to achieve temporary treatment during installation of the current density baffles.

- The addition of a tertiary automatic straining system will add protection for the system from BOD and TSS excursions during wet weather events.
- The use of an in-line UV disinfection system will be used to achieve compliance with the disinfection requirements. (Note that the industrial contribution could impact UVT transmittance and this should be checked over a period of several samples prior to ordering equipment).
- While the above improvements should allow a good operator to significantly improve performance, the addition of an alum feed system to promote improved solids capture during wet weather events (in both the equalization tank and in the clarifier) will provide a margin of error to allow the system to achieve considerably improved permit compliance.
- There is a potential that a second clarifier will be required at some point in the future if I/I issues increase.

Wastewater Collection System Understanding

The collection system consists of gravity sewer as well as five separate lift stations. The plant has an hourly peak flow factor of almost 6:1, so I and I is considered a large issue for the collection system and should be dealt with sooner rather than later as it is negatively affecting the plants ability to meet the effluent discharge limits enforced by Kentucky. (Note however that while the 4:1 peak day: average day flow peaking factor and the 6:1 peak hour: average day ratios cause problems within this plant, they aren't large peaking factors relative to many plants. Some degree of I/I reduction can be expected, but we are not likely to achieve 2:1 or even 3:1 peaking factors with I/I reductions).

Industrial Pump Station 1 is located directly south of the wastewater facility along Interstate 75 and conveys all of the systems wastewater to the treatment plant. The wet well is outfitted with dual 20 hp non-clog pumps from Myers and has a discharge force main diameter of 6". Moonlake Pump Station 1 conveys wastewater through 4" force main across Interstate 75 directly to Industrial Park Pump Station 1 and is outfitted with dual 25 hp pumps from Myers. The station is poorly located in terms of ease of access, which will make maintenance and upgrades difficult to perform. A list of Pump Stations with specifications for each pump is located in the Appendix.

Wastewater Collection System Recommended Improvements

- GIS shapefiles should be developed for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.
- Install flow monitoring, perform smoke testing, perform video inspection at selected locations, evaluate systems and create GIS based maintenance priority list to help understand and reduce the effect of I and I on the system.
- A manual transfer switch should be installed at each lift station to allow for the use of a portable generator during emergencies.

REVISED CAPITAL ESTIMATE - NOV. 5, 2021

Delaplain (240,000 GPD AADF; 360,000 GPD MMADF)

Item	NARUC Category	EXPENSES	FIXED ASSETS	TOTAL
Blowers and Blower Controls for New MBBR Blowers (2, 15 HP)	Sewer - Treatment and Disposal	\$0	\$65,000	\$65,000
Installation of Blowers	Sewer - Treatment and Disposal	\$0	\$22,800	\$22,800
Blower Pad	Sewer - Treatment and Disposal	\$0	\$1,500	\$1,500
Blower Discharge Header Piping, Valves, Etc. (Installed)	Sewer - Treatment and Disposal	\$0	\$12,000	\$12,000
Cages w/Diffusers (72) and MBBR Media (25 Cubic Mtrs)(3, 8'x8'x15')	Sewer - Treatment and Disposal	\$0	\$0	\$0
Cage Materials (w/Shipping, Tax)	Sewer - Treatment and Disposal	\$0	\$33,000	\$33,000
Cage Fabrication	Sewer - Treatment and Disposal	\$0	\$40,000	\$40,000
Painting for Carbon Steel	Sewer - Treatment and Disposal	\$0	\$11,300	\$11,300
Media	Sewer - Treatment and Disposal	\$0	\$31,500	\$31,500
Diffusers & Diffuser Piping	Sewer - Treatment and Disposal	\$0	\$16,000	\$16,000
Installation of Cages	Sewer - Treatment and Disposal	\$0	\$55,400	\$55,400
Filter Building Foundation	Sewer - Treatment and Disposal	\$0	\$25,000	\$25,000
Filter Building	Sewer - Treatment and Disposal	\$0	\$33,000	\$33,000
Filter Equipment (w/Shipping, Taxes, Minor Additions)	Sewer - Treatment and Disposal	\$0	\$163,500	\$163,500
Filter Touchup Painting	Sewer - Treatment and Disposal	\$0	\$1,700	\$1,700
Filter Backwash Piping (from Filter Building to Package Plant)	Sewer - Treatment and Disposal	\$0	\$10,000	\$10,000
Sump Pump in Filter Building Sump	Sewer - Treatment and Disposal	\$0	\$2,500	\$2,500
Chlorine Contact Tank Level Control Modifications in Exist. Pack. Plant	Sewer - Treatment and Disposal	\$0	\$7,500	\$7,500
Sodium Bisulfite Piping (Re-Locate Feed Point to Filter Building)	Sewer - Treatment and Disposal	\$0	\$2,500	\$2,500
Polymer Feed System	Sewer - Treatment and Disposal	\$0	\$20,000	\$20,000
Add/Upgrade Mission Monitoring System	Sewer - General Plant	\$0	\$12,500	\$12,500
Electrical Distribution for Blowers	Sewer - General Plant	\$0	\$23,000	\$23,000
Electrical Distribution in Filter Building	Sewer - General Plant	\$0	\$25,000	\$25,000
Gravel Access Road to Filter (Approximately 200 feet)	Sewer - General Plant	\$0	\$6,000	\$6,000
Fence Addition Around (Approximatey 200 feet Chain Link)	Sewer - General Plant	\$0	\$9,200	\$9,200
TOTAL		\$0	\$629,900	\$629,900

APPENDIX



Aeration Tank



Circular Clarifier



Bar Screen



Gaseous Chlorine Storage

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment



Civil Site Design
Construction Support
Transportation
Wastewater Collection

Industrial Pump Station 1 (INPS1)

#1 Pump - 9/11/13: Myers 4" non-clog pump, 20 hp, 230 volt, 3 phase, 10" impeller Model #4VC200M4-23, SN 10013516

#2 Pump – 5/29/18: Myers 4" non-clog pump, 20 hp, 230volt, 3phase, w/50' cord, upper & lower T.C. seals and 10" oversized impeller SN 10554284

Industrial Pump Station #2 (INPS2)

#1 Pump – 12/14/12: Meyers 4VH75M4-23, 7.5 hp, 230 volt, 26 amps, 60 hertz, 3 phase, SN 00165030.
11/2018 – extensive rebuild – Clark Electric.

#2 Pump 12/28/2018: Meyers MY 4VH75M4-23, 7.5 hp, 230 volt, 3 phase, 35' cord, 8" oversize impeller. SN 10582019.

Moon Lake Pump Station #1 (ML1)

#1 pump - 2/18/15: 4RCX250M2-43-35, 25 hp 3/460 volt with 35' cable. Lower TX seal, 5.88" oversized impeller. SN 10080201

#2 pump - 5/19/14: 4RCX250M2-43-35 25HP 3/460 volt with 35' cable. SN 10246932

Moon Lake Pump Station #2 (ML2)

#1 Pump - 10/2016: Myers 4V75M4-23-35 4" sewage pump 7.5 hp, 230 volt 3 phase w/standard seals and 35'cord serial 7.5" std impeller, SN10365415.

2 Pump - 8/2017 Myers 4V75M4-23 7 ½ hp, 3 ph, 230 volt, SN 10519205

Riffon Meadows Pump Station (RM)

#1 Pump – 2007: WGX30H-21-25, 3 hp, 3450 RPM, 230 volt, 1 phase, Impeller 5" SN GX304-4-25

#2 Pump - 2007: WGX30H-21-25, 3 hp, 3450 RPM, 230 volt, 1 phase, Impeller 5"

Fox Run Utilities (Wastewater)
Engineering Memorandum
Date: December 31, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on June 30, 2018. The plant consists of an influent pump station, aeration tank, clarifier, polishing filter, and chlorine disinfection. The aeration appeared to have a reasonable appearance for a mixed liquor however, the clarifier had a high volume of sludge with it appearing to have the sludge blanket at the surface of the water. Typically the sludge blanket would be below around 4' of supernatant clear water on the top of the clarifier. After the clarifier, the water travels to what used to be a polishing sand filter. This filter is no longer treating as originally designed but does have some filter media in the bottom per the operator. Additionally, this tankage is now acting as a contact chamber for the liquid chlorine being injected prior to discharging to the stream. (See Appendix 1 for overall picture)

Various items of concern exist at this facility. There is minimal flow equalization at this facility from the influent pump station. There is no sludge holding to waste sludge when needed.

The influent pump station will need to be overhauled in order to ensure reliability. The size of the influent pumps are unknown. The pumps will need to be pulled, inspected, and evaluated for capacity. The facility is using a flexible black hose instead of a metal and or buried pipe that will help avoid freezing and break down from sun exposure. This pipe should be replaced. Additionally, the operator believes there is inflow and infiltration issues in the system. Additional capacity should be added to the influent pump station to provide more consistent flow to the plant if additional analysis confirms this need. (Appendix Picture 2)

While the aeration appeared to be reasonable operating, standard testing parameters were not performed when we were present to determine the quality of the mixed liquor. Due to the upkeep of the remaining portions of the facility, I do not believe the diffusers have been checked and/or cleaned in some time. Additionally, in review of the EPA's Echo violations listed, the facility is starting to violate limits more often. It appears monitoring reports were not submitted for the first 3 quarters of 2018. Seeing this, it is difficult to determine the actual improvements necessary for repairs. However, I estimate the aeration tank being approximately 25'x 12'x8' deep. This would provide around 18,000 gpd capacity which is close to the 20,000 gpd capacity listed on the permit. Understanding that there are only 34 customers, I anticipate this producing a normal flow rate of around 6,800 gpd. Therefore, the aeration tank appears to be sufficient from a sewage flow rate. (Appendix Picture 3)

The clarifier is currently poorly maintained. Sludge was to the surface and the was actually had a solid appearance. As poor of a condition this facility was in during the site visit, it is difficult to determine what is salvageable. The condition of the clarifier might be an operational issue in regards to control of

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Wastewater Treatment



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Construction Support
Transportation
Wastewater Collection

the mixed liquor and return sludge flow, the clarifier is not operating at an optimal level. Some repairs recommended will consist of replacing the returns with new steel piping and installing surface skimmers. (Appendix Picture 4 & 5)

The polishing chamber receives flow from the clarifier and is currently acting like a contact chamber for disinfection. It is difficult to determine if this portion of the treatment process is performing as designed and consistent with the current operating permit.

The effluent quality looks clean as it was leaving facility and discharging into the creek.

Outside the addition of sludge holding and the addition of flow equalization to the influent pump station, we feel the capacity will be sufficient for the customers connected to the system. I do feel that the main issue with this facility will be simply operation and maintenance of the plant.

Improvements: Install flow equalization, install sludge holding, replace aeration system, replace sludge return lines and install a surface skimmer, and repair and repaint tankage to extend life of tankage.

[Wastewater Collection System Understanding](#)

Per records provided by the owner, the system has approximately 34 customers. These customers are served by a gravity sewer system. Per the operator, Inflow in infiltration is believed to be a problem on this facility. A flow meter should be installed to determine extent of the I and I problems. Funds should be invested into the collection system or the quality of the effluent will be an ongoing problem. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

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Wastewater Collection

APPENDIX

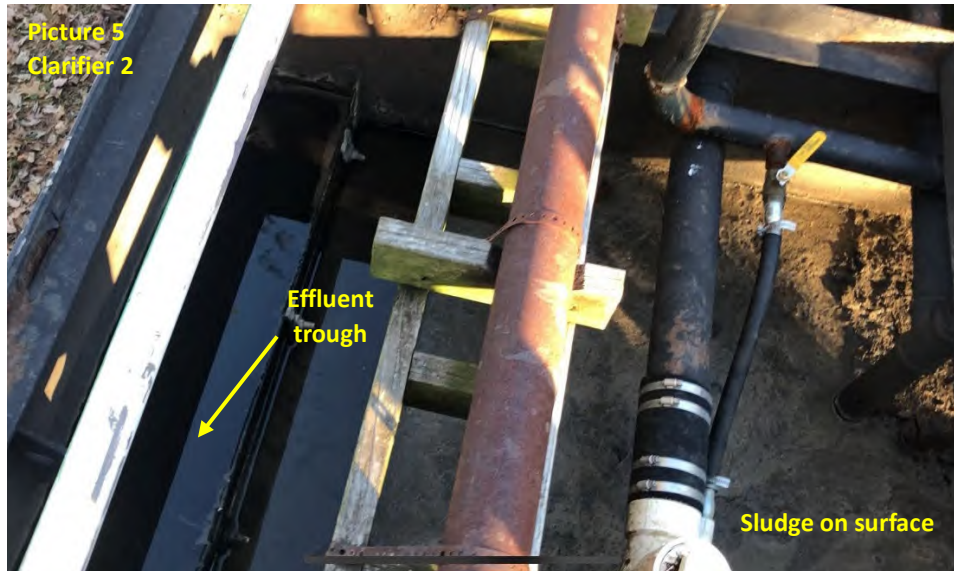


Picture 1
Overall Plant



Picture 2
Influent Pump Station





Golden Acres-Kentucky (Wastewater, KY0044164)

Engineering Memorandum

Date: February 17, 2019

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on February 1, 2015. The plant consists of an aeration tank, clarifier, and chlorine. (Appendix Picture 1) The facility appears to be in reasonable shape. Structure, air piping, and sludge returns appear they are still capable of functioning. However, the plant was not operating in the pictures and video provided. You will also notice that the aeration and the clarifier liquid coloration and makeup appear to be the same. The facility looks like it hasn't been operating as of lately. I performed a quick estimate of capacity. The facility's operating permit states it has capacity of 25,000 gpd. I believe the actual capacity is closer to around 18,000 gpd. It does appear that there are only about 31 houses that would be serviced by the facility. If this is the case, the facility does appear to have the capacity to treat for normal flows (without I and I problems) from the houses that are connected.

A review was performed of EPA's Echo compliance website which lists violations. Prior to the first quarter of 2018, the facility exceeded only ammonia on two quarters and E. coli on one quarter over 10 quarters of testing. After the first quarter of 2018, the plant started to exceed limits on Ammonia, DO, E. Coli, and CBOD. Observing these results and if violations occurred in this manner, I would tend to believe an equipment failure occurred at the facility or the facility has been abandoned. Keep in mind the previous note that the liquid makeup in aeration and clarifier were very similar, which would make me believe one of these two ideas is true. (See Picture 2)

While the plant appears adequate, there are a few items of concern for the facility. The facility looks to be a reasonable facility that can be salvaged. However, the facility is not operating and you can see the rock discoloration where the water level of the plant has reached. (Appendix Picture 3)

The system does have a substantial amount of rock discoloration around the plant. (Appendix Picture 3) Additionally, this appears to be a designed in approach with the facility. I and I must be exorbitant for the facility to back wastewater up approximately 2' above the tank. This design approach also causes problems with increased I and I due to its nature of sitting in a bowl. The facility's grading is built up around the facility and appears to be designed to shed overland rainwater directly into the facility. This will cause issues of overloading the plant, washing leaves into the plant and disrupting the process, and will be a liability for electrocution and potential for equipment failure. At a minimum, I would recommend to modify grades at least down to the ponding water level, but also provide flow equalization up at the front of the treatment process. I and I must be evaluated and for a facility of this size, will be detrimental for treatment as well as expense to repair.

The aeration process of the treatment facility appears to be in reasonable shape. From the coloration of the aeration liquid, I do not see a benefit in running any samples to trouble shoot the facility. However,

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Wastewater Treatment



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Transportation
Wastewater Collection

the facility needs to have a startup in order to provide a true evaluation. It is recommended that the diffusers be pulled and checked. Most likely they will need replaced. If sludge were to enter the piping or diffuser holes, this would cause fouling and the diffusers would need to be replaced. This is not a real expensive item to replace and can be done as a maintenance project for a reasonable cost. Blowers should be evaluated as well to determine if they have the capacity to provide the aeration needed. Again, seeing the facility meet limits for 2.5 years prior to these last couple of quarters, I would believe the blowers have the capacity if they will function. (Appendix Picture 3)

I am unable to evaluate the clarifier's functionality in the state it is in. This facility appears to not be functioning and it is not possible to evaluate. However, in estimating the capacity, it appears the volume should be sufficient to operate efficiently to meet limits for serving the estimate 31 homes. I also believe the clarifier can provide treatment for around 18,000 gpd. Again, see note above in regards to meeting limits for 2.5 years. The clarifier should be cleaned, put into operation, and further evaluated for size after actual dimensions and/or as-built drawings are provided. (Appendix Picture 4)

Minimal pictures were provided of the chlorination system that would aid in 21DG providing an opinion of its state. However, the system has violated E. coli in the past and it should be evaluated. The facility does not have a TRC limit which tends me to believe the system does not have dechlorination. You should plan for dechlorination, which is minimal cost to add to the facility. Again, this system did violate E. coli in the last few quarters but appeared to meet limits in the same 2.5 year period stated above, with the exception of one single event.

No pictures were provided of the stream or effluent but in review of the clarifier, I do not believe the facility was meeting limits during your visit.

It did not appear any monitoring was in place for this facility. I recommend Mission monitoring be installed for improvement control and access.

Improvements: Provide flow equalization, replace diffusers, regrade around the treatment plant, install new fencing due to grading, install mission monitoring, install dechlorination.

[Wastewater Collection System Understanding](#)

No information in regards to the collection system was provided to the Engineer for review to drafting this memo. It is recommended to obtain actual DMRS and/or flow data for the facility from the current owner to evaluate how bad I and I is a problem. It appears I and I is a problem due to the perimeter pictures around the wastewater facility. However, a pipe could have clogged to cause the discoloration. Additional research should be completed to determine the quality of the collection system.

No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The Engineer was not informed if this system was all gravity, pressure, or had any pump stations. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.