Wastewater Department
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CORALVILLE

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Executive Summary

The City of Coralville Wastewater Department is responsible for operating and maintaining the wastewater treatment facility, the sanitary sewer system, eight sanitary sewer lift stations, ten storm water pump stations and six dewatering wells. The facility operated well despite heavy rain events throughout the year and working around a major facility upgrade.

This report will provide a summary on department operations and highlight wastewater treatment facility operations as well as facility performance. A brief introduction concerning key areas of the report are described below:

Wastewater Treatment - The City of Coralville Wastewater Treatment Facility is considered a major facility by the State of Iowa serving residential and commercial customers. Wastewater is collected and conveyed to the wastewater treatment facility by over 80 miles of sanitary sewer pipes. The facility uses a variety of processes to remove debris and pollutants from the water. The wastewater treatment facility performs at a high level despite aging equipment and loadings above the facility's design capacity.

Storm Water System - The City of Coralville Storm Water System protects the critical areas located along the Iowa River, Biscuit Creek and Clear Creek. These storm water pump stations are activated and placed into action when river and creeks flows reach action levels. These storm water pump stations are key components to the City of Coralville's Flood Management Plan.

I sincerely hope this report conveys all the information necessary to give an accurate overview of the day-to-day operations of the Coralville Wastewater Department.

Sincerely,

David Clark

David Clark
Wastewater Dept. Superintendent
City of Coralville

Wastewater Treatment Facility Performance

The wastewater treatment facility is an sequencing batch reactor (SBR) activated sludge process designed to treat 3.89 million gallons per day (MGD) average daily flow. The treatment facility is staffed 5 days per week, 8 hours per day and equipped with a Supervisory Control and Data Aquision (SCADA) system to monitor facility processes and to notify plant personnel of any emergencies during unstaffed hours.

The facility treated 1.217 billion gallons of water and removed on average 96% of the Biochemical Oxygen Demand (BOD) that entered the facility.

Exhibit 1- wastewater treatment facility effluent performance

Exhibit 1
Wastewater Treatment Facility Effluent Performance

National Pollutant Discharge Elimination System (NPDES) Parameters		
Parameter	**Average**	**Limit**
5-day carbonaceous biochemical oxygen demand (CBOD) (mg/l)	6.9	25
Total suspended solids (TSS) (mg/l)	14.8	30
Ammonia – N (mg/l)	8.7	11.4 (summer)
Toxicity (pass or fail)	Pass	Pass
pH (units)	7.6	6.4 – 9.0
E.coli (colonies/100 ml)	16	126

As shown in **Exhibit 1**, all parameters are within permitted limits.

The sludge retention time, hydraulic retention time, sludge volume index, and mixed liquor suspended solids concentration are monitored to optimize plant performance.

New standby generator and Headworks Building. Estimated startup date - summer 2020.

Exhibit 2 - annual wastewater treatment facility removal efficiencies

Exhibit 2
Annual Wastewater Treatment Facility Removal Efficiencies

2019 Annual Percent Removal Efficiencies		
Parameter	**Average**	**Efficiency Requirement**
5-day CBOD (mg/l)	96%	85%
TSS (mg/l)	92%	85%
Total Nitrogen (mg/l)	57%	No requirement
Total Phosphorus	79%	No requirement

Exhibit 3 – Influent flow rates

Exhibit 3
Influent Flow Rates

2019 Influent Flow Rates (MGD)		
Month	**Average Flow**	**Maximum Flow**
January	3.03	3.59
February	3.53	6.36
March	4.22	12.21
April	3.37	5.00
May	4.84	8.66
June	3.68	4.56
July	2.97	3.52
August	2.80	3.75
September	3.00	3.57
October	3.03	3.75
November	2.81	3.33
December	2.75	3.39

Rain events have a significant impact on flow rates. During high flow rain events, incoming flows can reach 19 MGD and disrupt the wastewater treatment facility's performance. To alleviate the problems associated with rain events, a portion of the incoming flow is automatically diverted to the storm water retention pond and returned to the treatment facility when incoming flows drop to design parameters.

Exhibit 4 - influent BOD5 concentrations

Exhibit 4
Influent BOD5 Concentrations

2019 Influent BOD5 Concentrations (mg/l)		
Month	**Average BOD5**	**Maximum BOD5**
January	191	249
February	172	232
March	134	177
April	176	222
May	139	189
June	151	184
July	183	245
August	199	278
September	197	264
October	163	203
November	202	287
December	213	265

Exhibit 5 - influent TSS concentrations

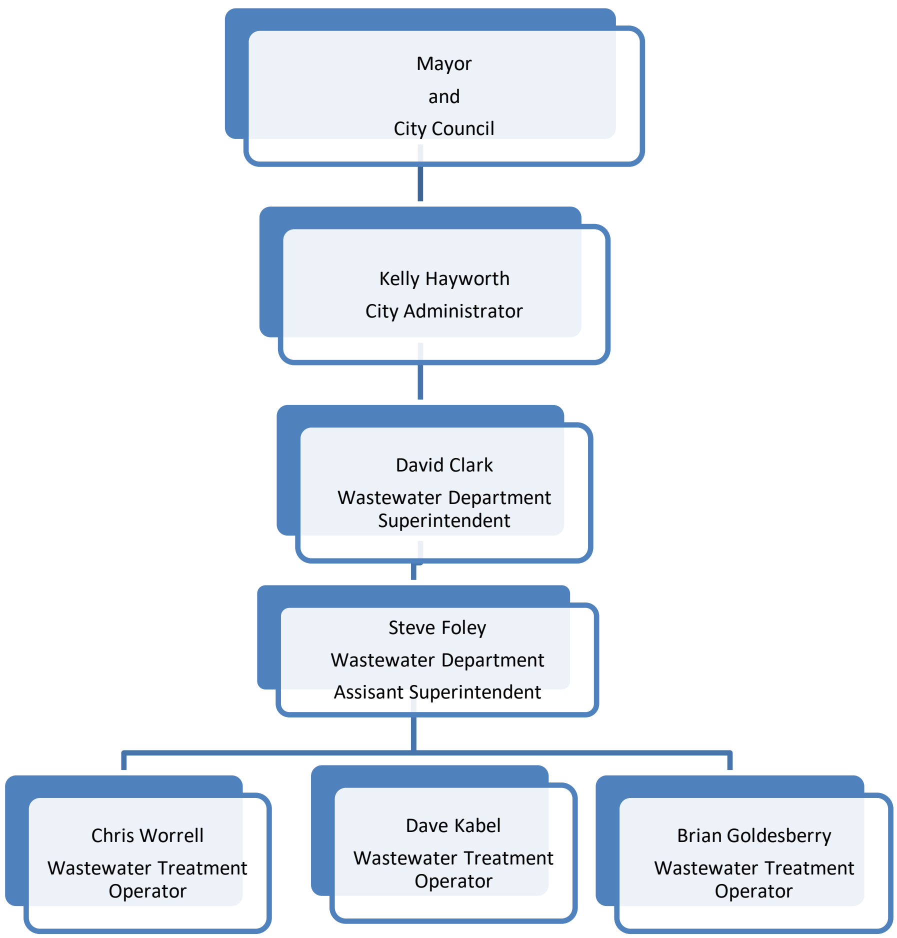
Exhibit 5
Influent TSS Concentrations

2019 Influent TSS Concentrations (mg/l)		
Month	**Average TSS**	**Maximum TSS**
January	154	217
February	183	297
March	268	899
April	192	316
May	131	201
June	130	173
July	153	277
August	197	364
September	215	456
October	151	264
November	207	370
December	209	270

Organizational Structure

The current Wastewater Department organizational structure is outlined below. Dave Kabel will be transferring to Storm Water in the spring of 2020. The recommended staffing level for a department of this size is six full time employees.

Exhibit 6
Organizational Chart



Wastewater Treatment Facility Processes

Preliminary Treatment

Wastewater enters the wastewater treatment facility through a 36" trunk sewer and flows through a course mechanical bar screen. This mechanical bar screen is automated and will begin to operate once the water level on the inlet side of the screen reaches a trip point. Once the trip point is triggered, the screen will begin a cleaning cycle and remove the debris collected on the screen. The screen has 1-inch openings and the peak design capacity is 14 MGD. There is a bypass channel around the mechanical bar screen should repairs be required. The bypass channel has a manually cleaned bar screen with 1.5-inch openings. The facility removed 272 cubic yards of screenings. All screening material is deposited at the local landfill.

Raw Wastewater Pumps

After initial screening, the raw wastewater enters a raw wastewater wet well and is a tributary to three raw wastewater pumps. These pumps are horizontal non-clog centrifugal pumps. The pumps are used to convey the flow from the wet well to the grit removal system. Each pump is equipped with a variable frequency drive (VFD) controller to assist in matching the pumping rate to the incoming raw wastewater flow rate. The rated capacity of each pump is 2.59 MGD (1,800 GPM).

Storm Water Pumps

The wastewater treatment facility also includes two storm water pumps. During high flow conditions when flow exceeds the capacity of the raw wastewater pumps, the raw wastewater wet well overflows into the storm water wet well. The storm water pumps will then convey the wastewater to the storm water retention basin. The rated capacity of each pump is 6.05 MGD (4,200 GPM) and both pumps are equipped with VFD's.

Grit Removal

The grit removal system consists of two vortex units using centrifugal force to remove inorganic material from the wastewater. The design capacity of the system is 6.38 MGD (4,400 GPM). The facility removed 108 cubic yards of grit. All grit material is deposited at the local landfill.

Rotary Fine Screens

After the grit removal process, the wastewater flow is conveyed to the rotary fine screens. The wastewater treatment facility has two fine screens with openings of 1/8" to capture fine material. Each screen is designed for 7.92 MGD (5,500 GPM). The screening material collected is sent to a screenings press and washer to clean the screenings and remove water. The end product is a dry fibrous material. This material is deposited at the local landfill.

Storm Water Retention Basin

The wastewater treatment facility has one storm water retention basin. Initially there were two basins but one was removed due the wastewater treatment facility upgrade. Flow is pumped to the retention basin by the storm water pumps. The stored flow in the pond is returned by gravity back to the raw wastewater pump wet well where the raw wastewater pumps convey the wastewater through the wastewater treatment facility. The storm water retention basin has a capacity of 5.03 MG. An overflow structure is present should the flow to the storm water retention basin exceed the basin's storage capacity.

SBR Secondary Treatment

After the wastewater has been through screenings and grit removal, the wastewater flows to the sequencing batch reactor (SBR) system. The system consists of four separate tanks with each tank having a capacity of .585 MG. Aeration to the SBR tanks is provided by four centrifugal blowers with fine bubble diffusers. The design capacity of the SBR system in the normal mode of operation (4 tank mode) is 5.131 MGD. If one of the four tanks is removed from service the effective capacity is reduced to 3.75 MGD. It is not uncommon to operate in three tank mode. The system is designed to reduce the organic loading to acceptable levels. The system works well but has difficulty in removing nutrients and achieving a high level of treatment. This is due to the growth of the Coralville area and loadings exceeding the design capacity of the system.

Disinfection and Effluent Pumping

Treated effluent from the SBR system passes through an ultraviolet disinfection (UV) system. Disinfection is required to meet permitted E.coli limits. The system is new and was installed in the fall of 2018 and has a capacity of 10.8 MGD. The system produces effluent quality well within permitted E.coli limits.

After disinfection, the flow is conveyed to the effluent pump wet well where three pumps discharge through a 24" force main extending downstream along Clear Creek to the Iowa River. Each pump has a rated capacity of 5.18 MGD (3,000 GPM). The capacity of the effluent pump station is 10.8 MGD with all three pumps in service.

Solids Processing

A portion of the solids produced in the SBR system are pumped to the "integrated surge anoxic mix" system (ISAM) for treatment and sludge conditioning. This system is an anaerobic process designed to reduce the volume of solids pumped to the aerobic digesters. The ISAM system has a holding capacity of .720 MG. The system is a batch process and pumps treated solids to the aerobic digesters twice daily.

The treated solids from the ISAM system are pumped to one of two aerobic digesters for further treatment and stabilization. Each aerobic digester has a positive displacement blower and a fixed nozzle jet aeration mixing system. The digesters have a combined holding capacity of 1.37 MG. One digester is typically in stand-by mode.

Solids Thickening

After solids conditioning through the ISAM process and aerobic digestion, the solids are ready for dewatering. Dewatering is accomplished with a one meter gravity belt thickener and the use of polymer. The dewatering process begins by mixing the raw polymer with water and injecting it into the solids from the aerobic digesters. The solids and the polymer are pumped through an inline static mixer to the gravity belt thickener where the water and the solids begin to separate. This slurry is deposited on the gravity belt's woven fabric where the water passes through the fabric and the solids remain. The remaining solids will be in the range of 4% to 6% solids as compared to the gravity belt feed solids concentration of 1% to 1.5% solids. The gravity belt thickener has a capacity of 250 GPM and is operated several days/week. Normal operations dictate an operating range of 140 GPM to 180 GPM. The thickened solids produced are then pumped to the solids storage tank.

Solids Storage

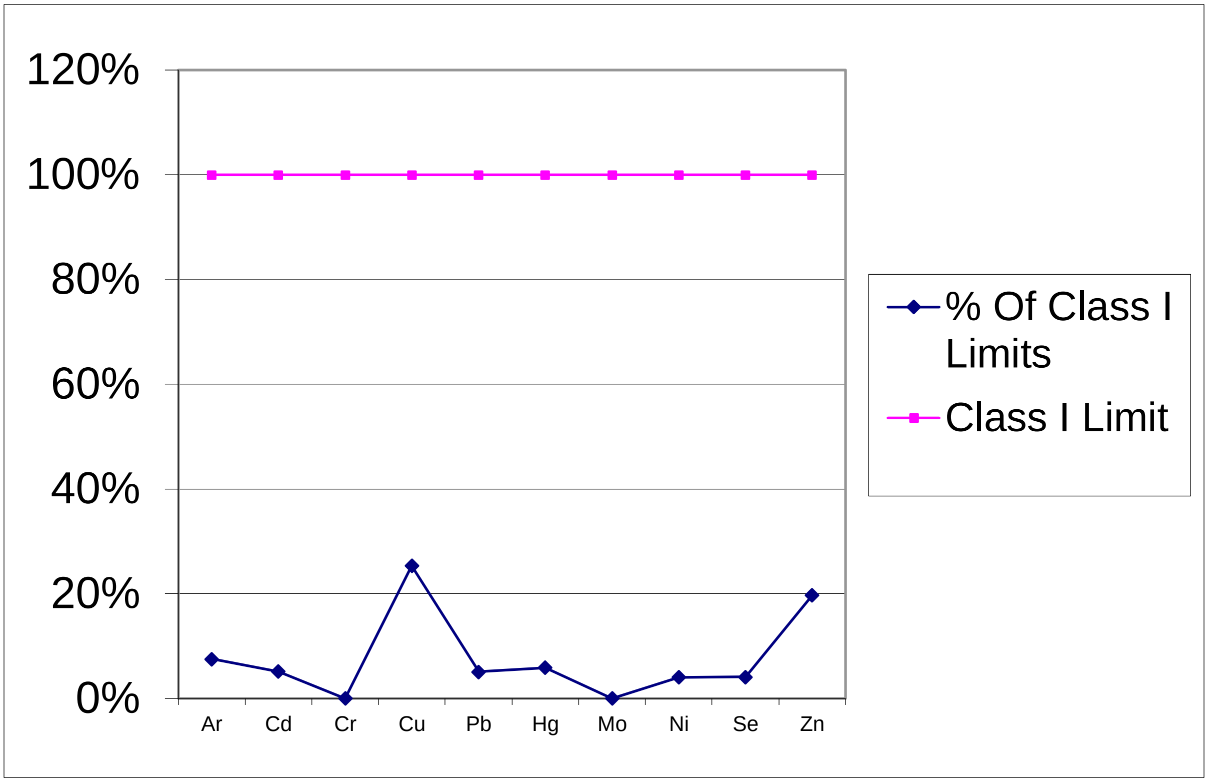
The solids storage tank has a capacity of 1.6 million gallons and was constructed in 2006. The tank has a ventilation system to minimize the accumulation of explosive gases and has a floor mounted jet mixing system with a 5,100 GPM mixing pump. This pump is located in the solids building lower level and is used to mix the tank contents as well as pump the solids to the load out station during land application. The tank was designed to store solids for up to eight months with land application occurring twice/year (spring and fall).

Land Application

The solids in the solids storage tank are land applied to local agricultural fields. The solids are analyzed quarterly to determine if they meet the Environmental Protection Agency (EPA) and the Iowa Department of Natural Resources (IDNR) regulations for land application. Once the analysis determines the regulations have been met, the solids are now classified as “Biosolids” an environmentally beneficial product and can be used to enhance the soils properties for growing a crop. Land application occurs twice/year (spring and fall) and is accomplished through an outside vendor. A total of 3.303 million gallons (461 dry metric tons) were recycled back into the environment over 159 acres.

Exhibit 7 – Biosolids sample analysis

Exhibit 7
Biosolids Sample Analysis



Maintenance

Cost control through effective preventive maintenance (PM) and corrective maintenance (CM) is very important to all wastewater treatment facilities.

A sound approach to maintenance involves three functions:

- PM
- CM
- Predictive maintenance (PdM)

A computerized maintenance management system (CMMS) concentrating and focusing on PM and PdM activities will increase equipment life spans and reduce life cycle costs.

Typical PdM activities may include:

- Infrared scanners
- Vibration analyzers
- Voltage and amperage meters
- Motor testing

This data is tracked to aid the prediction of possible equipment problems. By taking a proactive maintenance approach, we often are able to prevent breakdowns or the loss of major components. For example, infrared scanners allow us to detect hot spots in electrical equipment that can result from frayed wiring, loose connections, corroded connections, or failing parts. Detecting and repairing these problems, usually at a slight cost, can prevent the total failure of an expensive electrical device.

A CMMS is an integral part of any wastewater treatment facility. CMMS keeps the staff fully informed of maintenance and repair activities, and tracks performance of proper maintenance to protect the city's capital investment.

A new CMMS has been purchased and will be implemented with the startup of the new wastewater treatment facility. The existing Excel based maintenance spreadsheets is currently in use.

New Headworks Building upper level – fine screens

Exhibit 8 - work orders generated

Exhibit 8
Work Orders Generated

2019 Work Orders Generated		
Month	**Work Orders Generated**	**Work Orders Completed**
January	17	17
February	14	14
March	20	20
April	16	16
May	27	27
June	15	15
July	24	24
August	28	28
September	23	23
October	23	23
November	16	16
December	21	21

Exhibit 8 shows all the work orders generated for the Wastewater Department and includes; the wastewater treatment facility, sanitary sewer system, storm water pump stations and the Marriott Hotel dewatering wells.

NOTE: Utility locates through the Iowa One Call system are not classified as work orders. The Wastewater Department routinely performs over 750 locates per year.

New Aeration Basins

Laboratory

The primary objective of the laboratory is to determine compliance with the parameters established in the city's NPDES permit as issued by the State of Iowa. These permit required parameters include:

- Carbonaceous biochemical oxygen demand (CBOD5)
- Biochemical oxygen demand (BOD5)
- Total suspended solids (TSS)
- Ammonia nitrogen
- pH
- E.coli
- Temperature
- Dissolved oxygen
- Mixed liquor suspended solids (MLSS)
- 30-minute settleability
- Acute toxicity
- Total phosphorus
- Total nitrogen
- Total kjeldahl nitrogen

New grit removal system

In addition to permit required analysis, the Wastewater Department also performs analysis for process control. Process control analysis aids in troubleshooting performance issues and is an indicator of how well the process is performing.

Including process control analysis, more than 6,465 analyses were performed by the Wastewater Department. The department also achieved several other major laboratory accomplishments including:

- Completed U.S. EPA Discharge Monitoring Report-Quality Assurance (DMR-QA) Study
- Completed quarterly audit analysis
- Completed quarterly sludge analysis
- Completed annual toxicity analysis
- Completed quarterly E.coli analysis

Solids Processing

Solids processing is accomplished in three phases at the wastewater treatment facility:

- Phase I: Removing or wasting solids from the system
- Phase II: Treatment, conditioning and digestion of the solids wasted
- Phase III: Dewatering of the digested solids

Phase I is accomplished through clarification of the treated wastewater. Activated sludge in the sequencing batch reator (SBR) system is allowed to settle. The settled solids are thickened by gravity during the SBR system settle cycle and have a concentration in the range of 0.5 percent to 1 percent solids. The concentrated solids are removed from the SBR system during the decant cycle. Wasting is accomplished with submersible centrifugal pumps.

Phase II is accomplished through the ISAM process and by aerobic digestion. The ISAM process treats and conditions the solids under anaerobic and anoxic conditions. The digestion process provides further treatment and stabilization. Bacteria in the digesters are supplied oxygen and metabolize the organic matter yielding inert products. As the organic supply becomes low, the bacteria enter endogenous decay where internal organic material is used as a food source. In this manner, the bacteria self-destruct reducing the organic content of the solids. Digestion is complete when laboratory analysis indicates the volatile solids and bacteria have been reduced to an acceptable level. The state and federal environmental regulators determine this level.

Phase III is accomplished through chemical addition and dewatering the solids through a gravity belt thickener. Aerobically digested solids are pumped to the gravity belt thickener where two distinct processes occur. The first process is polymer conditioning where organic polyelectrolyte is mixed with the solids to neutralize the electrical charges between the solids and the water to form a floc via an inline vortex flocculant-mixing device. The second process is the gravity drainage where the flocculated solids are gently distributed onto a moving belt. The free water is allowed to separate from the flocculated solids employing the forces of gravity. The free flowing water (filtrate) is collected in a gravity drainage collection pan, which is located directly underneath the woven filtration belt and returned for further processing. The thickened solids leaving the gravity drainage zone will be discharged, aided by plastic plows, and directed to the outlet collection pan of the gravity belt. Typical feed solids concentrations range from 1% to 1.5% solids with thickened solids in the range of 4% to 6% solids. The thickened solids are then pumped to a storage tank before land applied to local agricultural land. The facility processed 32.085 MG of solids.

(Gravity belt on left. Solids flocculation on right)

Land Application Program

The Wastewater Department land application program relies on solids conditioning, digestion and facility management to optimize Biosolids land application efficiency.

The wastewater treatment facility is designed to store Biosolids for 8 months, which requires the Biosolids to be land applied twice/year (spring and fall). The processes are managed in the most effective manner to minimize unnecessary cost while providing effective treatment and storage prior to land application.

A representative sample is collected quarterly to determine compliance with environmental regulations and to determine agronomic application rates. Based on current sample results, the Biosolids were classified as Class II, which is considered environmentally beneficial.

The Wastewater Department land application program provides several benefits to the land owners that participate in our program. The facility's Biosolids make an excellent soil conditioner and are a source of nutrients. The benefits of our land application program are as follows:

- Recycling plant nutrients back into the soil: Primarily nitrogen, phosphorus, potassium, and minerals.
- Lowers commercial fertilizer requirements: Biosolids reduce commercial fertilizer requirements, which reduces the overall cost to land owners.
- Boosting crop yields: Biosolids act as a slow release fertilizer. Nitrogen and other nutrients are released slowly from the organic matter throughout the growing season.
- Improved soil condition: The organic matter in the Biosolids improves soil tilth and increases the soil's ability to absorb water and hold nutrients, which help reduce erosion and natural runoff.
- Stabilized soil structure: Resulting in benefits of soil physical properties; increased porousness, water movement, root penetration, and soil tilth.

Land application is performed through an outside vendor. The vendor provides a detailed report to all the land owners that participate in our program.

The Biosolids produced at the wastewater treatment facility provided an average nutrient value as follows:

- Nitrogen: 77 lbs/acre
- Phosphorus: 95 lbs/acre
- Potassium: 69 lbs/acre

Land application is accomplished with the use of semi-tractors with trailers and a flotation tire field applicator. The semi-tractor/trailers are used to transport the Biosolids out to the fields where the flotation tire applicator utilizes a pressurized discharge to inject the Biosolids into the soil.

The application rate averaged 2.9 dry metric tons/acre with annual totals as follows:

- 159 acres covered
- 3.303 million gallons applied
- 461 dry metric tons applied

An annual report was prepared and sent to the IDNR and U.S. EPA per regulatory requirements.

Sanitary Sewer System

The Wastewater Department operates and maintains the sanitary sewer system which serves a population of roughly 20,000. The system serves primarily residential and commercial customers. The main purpose of the sanitary sewer system is to convey wastewater to the wastewater treatment facility for treatment.

The sanitary sewer system consists of 439,584 feet (83 miles) of sanitary sewers ranging from 54" diameter pipe down to 4" diameter pipe. The majority of the system (68%) consists of 8" diameter pipe. The system also has several miles of force mains from the various wastewater lift stations through-out the city.

The sanitary sewer system does require regular cleaning to prevent blockages from forming. Blockages can occur when material is disposed in the sanitary sewer system when the system is not designed to convey the material. Commercial food service establishments can also contribute to the formation of blockages through improper maintenance of oil and grease traps. In an attempt to reduce the number of blockages in the system, the system is cleaned with the use of a vactor truck. This truck has a high pressure water and vacuum system to clean and remove debris. The Wastewater Department cleaned a total of 6,768 feet of pipe or 1.5% of the total system. Cleaning of the sanitary sewer system would occur more frequently if staffing levels were increased to the optimum level.
The system did experience seven sanitary sewer overflows (SSO) through-out the year.

The Wastewater Department operates and maintains eight wastewater lift stations. Lift stations are used to transport wastewater to a higher location when gravity flow systems will not work. A typical wastewater lift station will consist of pumps, controls, generator, wet well and some type of an alarm system. The lift stations located through-out the city are as follows:

3rd Avenue Lift Station

This is the city's largest lift station with an average daily flow of nearly 1.0 MGD. The lift station is a triplex station with two 12" pumps and one 8" pump. The large pumps have 130 hp motors and are designed to pump 2,300 GPM each. The small pump has a 50 hp motor and is designed to pump 900 GPM. These pumps are submersible type centrifugal pumps and are monitored through the wastewater treatment facility's SCADA system. The lift station also has an on-site standby generator that is shared with Storm Station # 9 should an electrical outage occur. Regular inspections and maintenance are performed through an outside vendor. The generator automatic transfer switch control panel has been replaced.

Iowa River Landing (IRL) Lift Station

This lift station is a duplex station with a standby generator and is located at the intersection of 7th Street and Quarry Road. The station has two submersible centrifugal pumps and an on-site standby generator. Each pump has a 15 hp motor with a design capacity of 950 GPM. The station has a telephone alarm dialer to alert Wastewater Department staff of alarm conditions. One pump was rebuilt and a new wet well level controller was installed. The force main for this station was rerouted to a new location as part of the 1st Avenue Road Construction Project.

Poot's Lift Station

This lift station is a duplex station and is located on Brown Deer Golf Course near Holiday Road and 1st Avenue. The station has a wet well and a dry well. The two pumps are horizontal centrifugal self-priming pumps with 20 hp motors. Each pump has a design capacity of 350 GPM. The station has a visual alarm light and buzzer. Alarm notifications are provided by the public. This is an older lift station dating back to 1991.

Brown Deer # 2 Lift Station

This lift station is a duplex station located on Brown Deer Circle. The station has two submersible centrifugal pumps with 5 hp motors. Each pump has a design capacity of 90 GPM. The station has a visual alarm light with buzzer and a telephone alarm dialer.

Brown Deer # 3 Lift Station

This lift station is a duplex station located on Brown Deer Ridge. The station has two submersible centrifugal grinder pumps with 3 hp motors. Each pump has a design capacity 47 GPM. The station has a visual alarm light with buzzer. Alarm notifications are provided by the public. The pump impeller and cutter assembles were replaced.

Brown Deer # 4 Lift Station

This is the city's second largest lift station with an average daily flow of nearly .2 MGD. The station has two submersible centrifugal pumps with 50 hp motors. Each pump has a design capacity 750 GPM. The station has an alarm dialer to notify Wastewater Department staff of alarm conditions and an emergency generator hook-up for extended power failures. The main switch gear was replaced as well as the control building.

Tall Pines Lift Station

This lift station is a duplex station located on Pine Ridge Court. The station has two submersible centrifugal grinder pumps with 5 hp motors. Each pump has a design capacity of 63 GPM. The station has a visual alarm light and buzzer. Alarm notifications are provided by the public. The pump impeller and cutter assembles were replaced. This lift station is subject to storm water intrusion during heavy rain events.

Kempf's Lift Station

This lift station is a duplex station located on Kelsey Lane. The station has a wet well with the pumps and controls mounted on top of the wet well. This type of setup requires the use of a vacuum priming system to ensure the pumps will operate when called for. Both pumps are vertical centrifugal pumps with 10 hp motors. Each pump has a design capacity 150 GPM. The station has an alarm dialer to notify Wastewater Department staff of alarm conditions and an on-site standby generator. This station is subject to storm water intrusion during heavy rain events. The pump rotating assemblies have been replaced and force main velocities increased.

Storm Water Pump Stations

The City of Coralville Storm Water System protects the critical areas located along the Iowa River, Biscuit Creek and Clear Creek. These storm water pump stations are activated and placed into action when river and creek flows reach action levels. These storm water pump stations are key components to the City of Coralville's Flood Management Plan. The storm water pump stations located through-out the city are as follows:

Storm Station # 1

This storm station is a duplex station located at 903 Quarry Road and is northeast of the Marriott Hotel parking ramp. The station has two submersible propeller pumps with 220 hp motors. Each pump has a design capacity of 39,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. The station also has two ground water dewatering wells to protect area infrastructure. The level control wiring for Dewatering Well #2 was replaced. The well was also cleaned.

Storm Station # 2

This storm station is a duplex station located at 118 E. 7th Street and is southwest of the Marriott Hotel parking lot. The station has two submersible propeller pumps with 270 hp motors. Each pump has a design capacity of 48,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. The station also has four ground water dewatering wells to protect area infrastructure. Dewatering Well #6 was cleaned and the pump/motor was replaced. Dewatering Well #4 was cleaned.

Storm Station # 3

This storm station is a duplex station located at 571 1st Avenue and is north of the Iowa River Power Resturant parking lot. The station has two submersible propeller pumps with 150 hp motors. Each pump has a design capacity of 24,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering.

Storm Station # 4

This storm station is a duplex station located at 225 1st Avenue and is northeast of the Clear Creek bridge. The station has two submersible propeller pumps with 135 hp motors. Each pump has a design capacity of 16,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering.

Storm Station # 5

This storm station is a duplex station located at 211 1st Avenue and is south of Panera Bread. The station has two submersible propeller pumps with 200 hp motors. Each pump has a design capacity of 22,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. The gate structure actuator was replaced and tied into the WWTP SCADA system. The gate is fully operational.

Storm Station # 6

This storm station is a duplex station located at 73 2nd Street and is north of Jiffy Lube. The station has two submersible propeller pumps with 110 hp motors. Each pump has a design capacity of 18,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. Pump #1 VFD drive was replaced and the wet well was cleaned.

Storm Station # 7

This storm station is a duplex station located at 324 2nd Street and is southwest of the Iowa Land Lodge. The station has two submersible propeller pumps with 200 hp motors. Each pump has a design capacity of 19,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator that is shared with Storm Station # 8 should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering.

Storm Station # 8

This storm station is a duplex station located at 322 2nd Street and is south of the McGrath car dealership. The station has two submersible propeller pumps with 110 hp motors. Each pump has a design capacity of 18,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator that is shared with Storm Station # 7 should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering.

Storm Station # 9

This storm station is a duplex station located at 300 3rd Avenue. The station has two submersible propeller pumps with 385 hp motors. Each pump has a design capacity of 43,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator that is shared with the 3rd Avenue Lift Station should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. The station also has three lift stations located along Biscuit Creek to protect area infrastructure. All subdrian pumps were pulled and inspected.

Storm Station # 10

This storm station is a duplex station located at 209 2nd Street and is northeast of Monica's Resturant. The station has two submersible propeller pumps with 135 hp motors. Each pump has a design capacity of 16,000 GPM. The pumps are operated by a level sensor or by float switches. The station has an on-site standby generator should a power failure occur. The station is monitored by the wastewater treatment facility SCADA system along with weekly on-site inspections. The inlet to the wet well is equipped with a large trash rack to prevent large debris from entering. The station also has one lift station located along Clear Creek to protect area infrastructure. Subdrain pumps were inspected. One pump was repaired and the other pump was replaced.

Wastewater Treatment Facility Upgrade

Construction on the new $32 million dollar Wastewater Treatment Facility Upgrade Project began in July 2018. The project is roughly 85% complete. The upgrade will increase the facility's design capacity from 3.89 MGD to 8.0 MGD with a peak hourly flow rate of 21 MGD. The new facility will meet the requirements of the Iowa Nutrient Reduction Strategy and produce a high quality effluent that is similar in appearance to drinking water.

The project is in the later stages of construction with the majority of the work focused on the new headworks building, secondary treatment process and the final clarifiers.

Safety

The Wastewater Department is committed to safety and we are focused on our goal of Target Zero:

- Zero injuries and illnesses
- Zero Occupational Safety and Health Administration (OSHA) reportable incidents

The Wastewater Department places a high priority on safety and provides the necessary equipment and training to meet this objective. Focusing on safety protects department personnel from injury and the City of Coralville from liability.

The Wastewater Department performed the following as we strive to achieve Target Zero:

- Updated Hazard Communication Program
- Annual fire extinguisher inspections by an outside vendor
- Monthly fire extinguisher inspections

The Wastewater Department worked 365 days without an Occupational Safety and Health Administration (OSHA) reportable incident.

HSE TargetZero
Protecting People and the Environment

Conclusion

The Wastewater Department is committed to protecting the water environment by operating and maintaining the city's wastewater treatment facility in a manner to produce a high quality effluent. We appreciate the leadership that has been provided by the City Administrator, Mayor and City Council. The department could not perform in an effective, efficient and responsive manner without your support.

Exhibit 9 - influent loadings

Exhibit 9
Influent Loadings

Pounds **Influent loadings** **MGD**

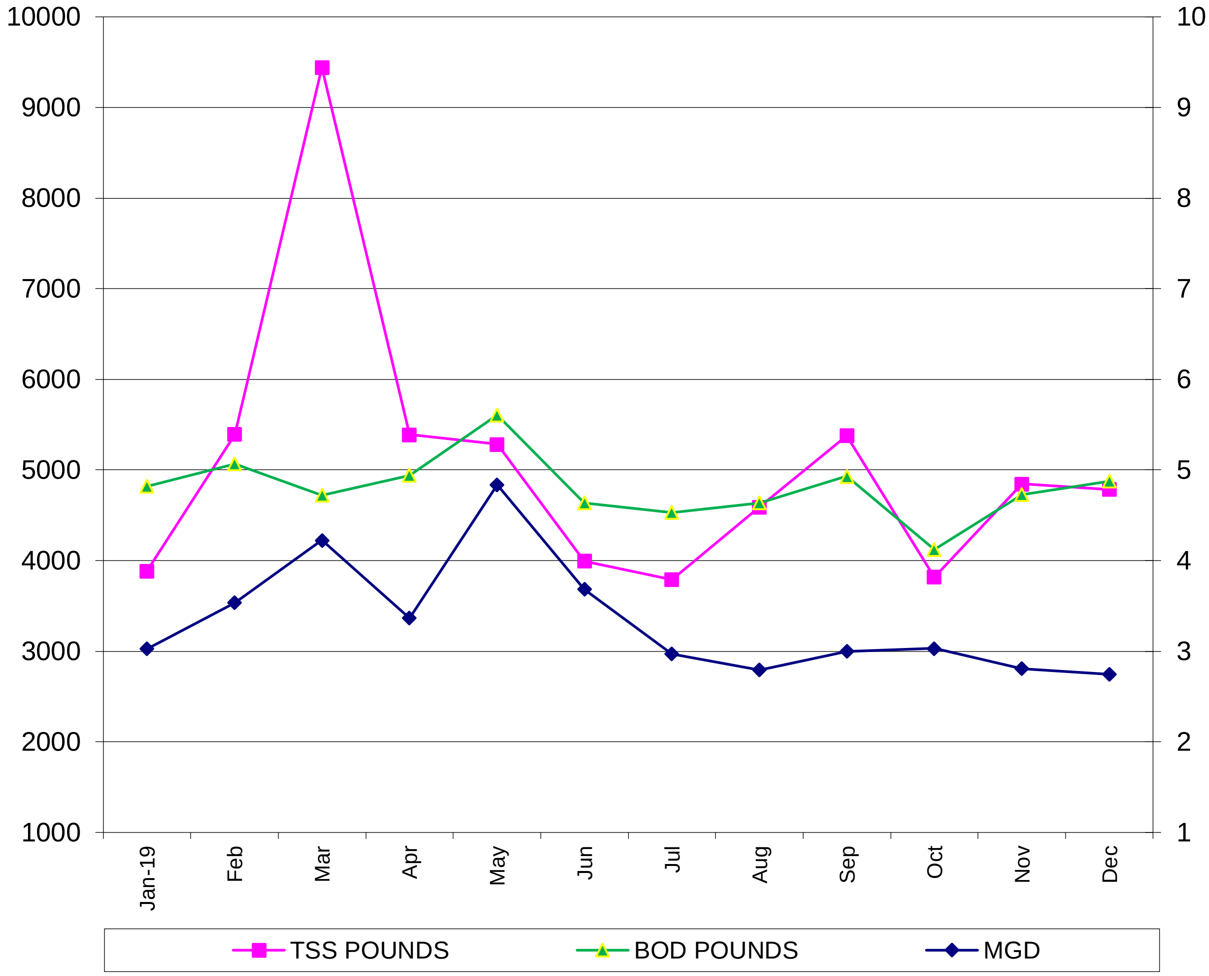
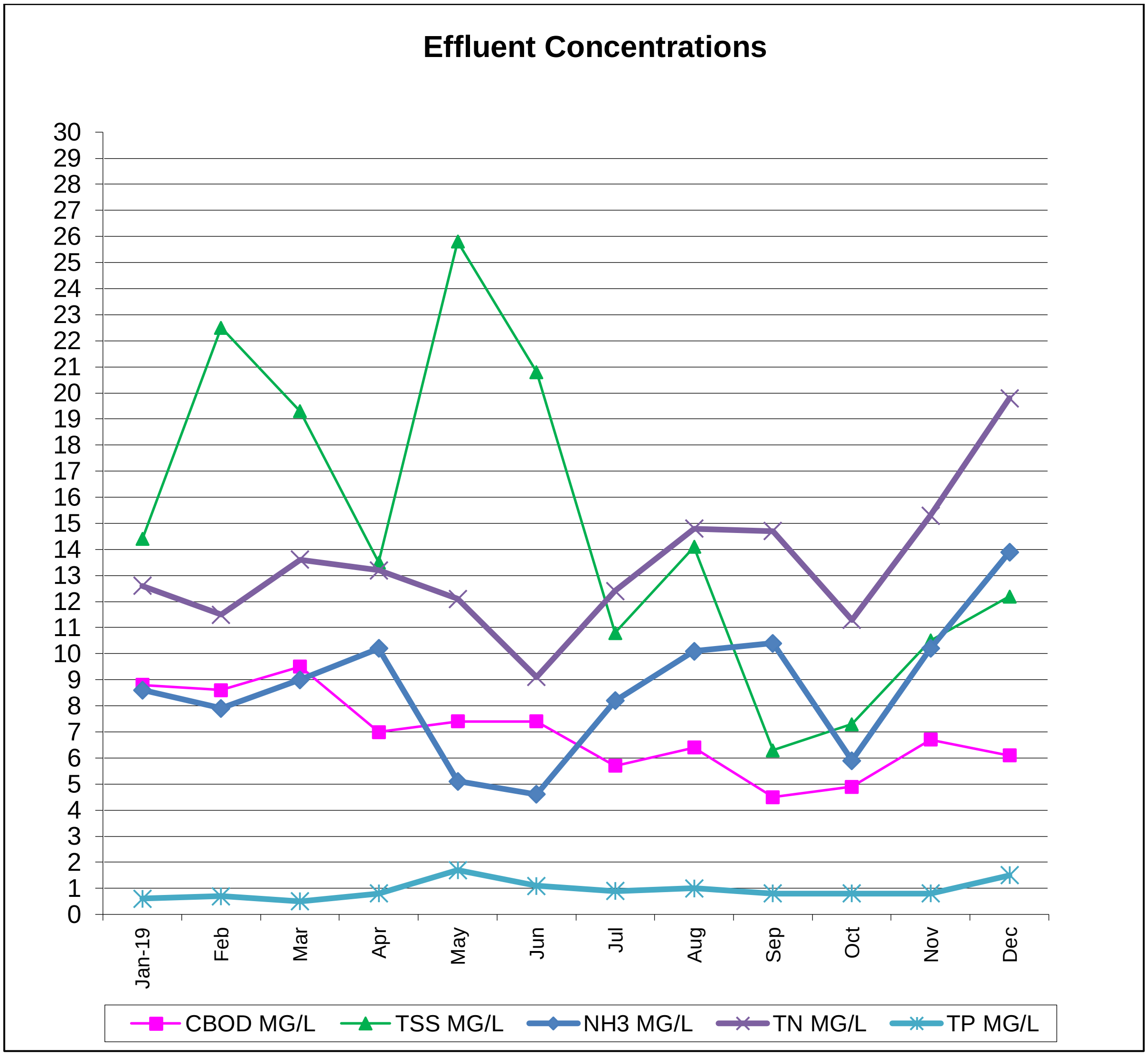


Exhibit 10 - effluent concentrations

Exhibit 10
Effluent Concentrations


Effluent Concentrations
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12
11
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Jan-19
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
CBOD MG/L
TSS MG/L
NH3 MG/L
TN MG/L
TP MG/L

Exhibit 11 - gravity belt performance

Exhibit 11
Gravity Belt Performance

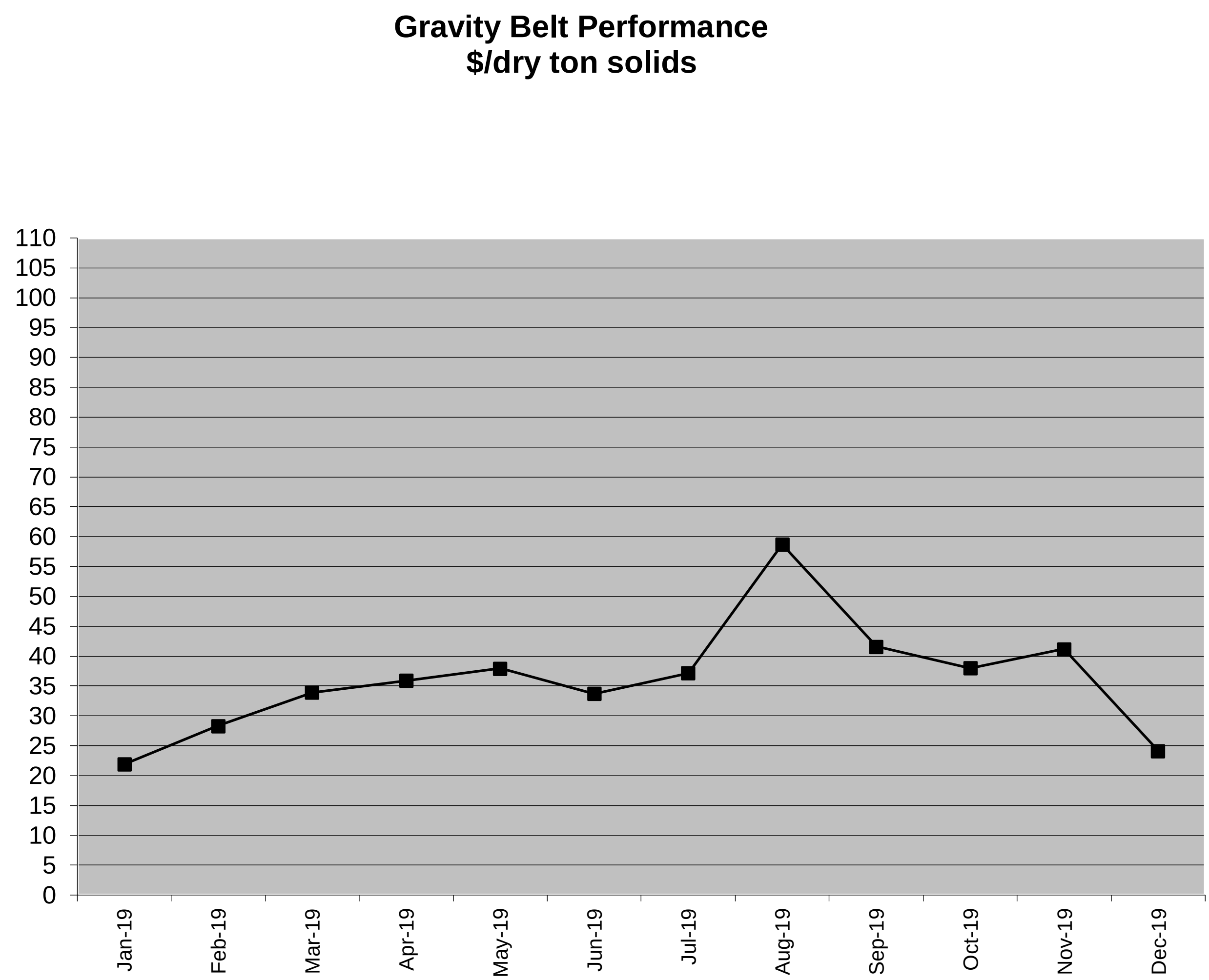

Exhibit 12 – electrical consumption

Exhibit 12
Electrical Consumption

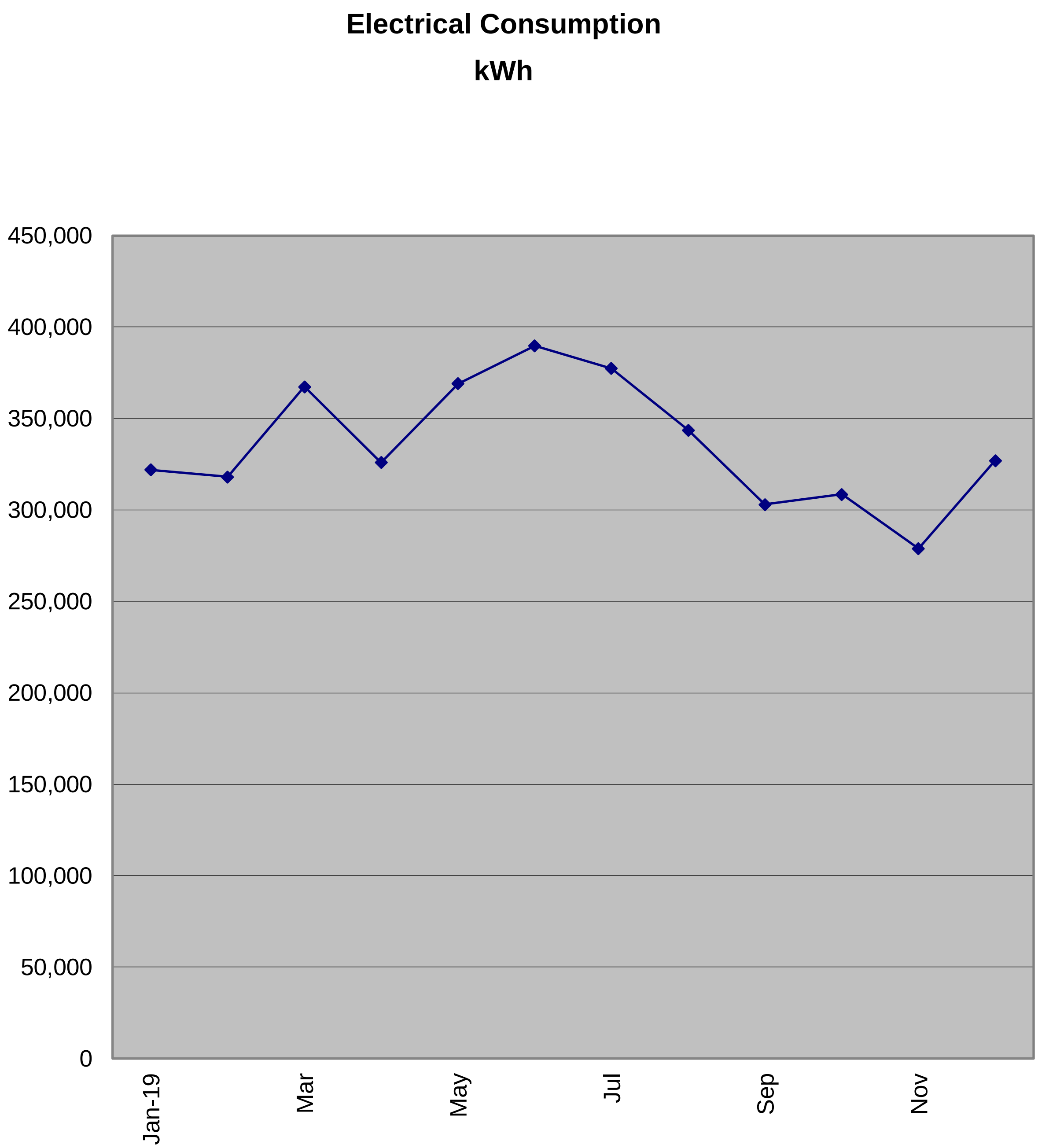

Exhibit 13 – wastewater treatment terms, glossary and abbreviations

Exhibit 13
Wastewater Treatment Terms, Glossary and Abbreviations

Wastewater Terms and Glossary

Activated Sludge:

The term "activated sludge" refers to a brownish flocculent culture of organisms developed in aeration tanks under controlled conditions. It is also Sludge floc produced in raw or settled waste water by the growth of zoological bacteria and other organisms in the presence of dissolved oxygen. Activated sludge is normally brown in color.

Activated Sludge Process:

A common method of disposing of pollution in wastewaters. In the process, large quantities of air are bubbled through wastewaters that contain dissolved organic substances in open aeration tanks. Bacteria and other types of micro-organisms present in the system need oxygen to live, grow, and multiply in order to consume the dissolved organic "food" or pollutants in the waste. After several hours in a large holding tank, the water is separated from the sludge of bacteria and discharged from the system. Most of the activated sludge is returned to the treatment process, while the remainder is disposed of by one of several acceptable methods.

Aeration:

The process or method of bringing about intimate contact between air and a liquid.

Aeration Tank:

A chamber for injecting air into water.

Aerobic Bacteria:

Bacteria that requires free (elementary) oxygen for growth.

Alkalinity:

The capacity of water to neutralize acids, a property imparted by the water's content of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates, and phosphates. Alkaline fluids have a pH value over 7.

Anaerobic:

A biological environment that is deficient in all forms of oxygen, especially molecular oxygen, nitrates and nitrites. The decomposition by microorganisms of waste organic matter in wastewater in the absence of dissolved oxygen is classed as anaerobic.

Anaerobic Bacteria:

Bacteria that grows in the absence of free oxygen and derive oxygen from breaking down complex substances.

Anoxic:

A biological environment that is deficient in molecular oxygen, but may contain chemically bound oxygen, such as nitrates and nitrites.

Bacteria:

Bacteria are microscopic living organisms. They are a group of universally distributed, rigid, essentially unicellular, microscopic organisms lacking chlorophyll. They are characterized as spheroids, rod-like, or curved entities, but occasionally appearing as sheets, chains, or branched filaments.

Biological Oxidation:

The process by which bacteria and other types of micro-organisms consume dissolved oxygen and organic substances in wastewater, using the energy released to convert organic carbon into carbon dioxide and cellular material.

Biochemical Oxygen Demand (BOD):

A quantitative measure of the oxygen needed by bacteria and micro-organisms for the biological oxidation of organic wastes in a unit volume of waste water. BOD is generally measured in milligrams per liter (mg/l) of oxygen consumed over a five day period. Although complete biological decomposition of organic waste requires about 20 days, the five day BOD is about two-thirds of the total oxygen required and, therefore, is a practical measure of waste concentration. In waste treatment language, BOD is most frequently stated as the percentage removed during treatment, or remaining after treatment.

Bulking Sludge:

A phenomenon that occurs in activated sludge plants whereby the sludge occupies excessive volumes and will not concentrate readily. This condition refers to a decrease in the ability of the sludge to settle and consequent loss over the settling tank weir. Bulking in activated sludge aeration tanks is caused mainly by excess suspended solids (SS) content. Sludge bulking in the final settling tank of an activated sludge plant may be caused by improper balance of the BOD load, SS concentration in the mixed liquor, or the amount of air used in aeration.

Chemical Oxygen Demand (COD):

A quantitative measure of the amount of oxygen required to oxidize all organic compounds in a unit volume on waste water – non-biodegradable as well as the BOD. The COD level can be determined more readily than BOD, but this measurement does not indicate how much of the waste can be decomposed by biological oxidation.

Chlorination:

The application of chlorine to water, sewage, or industrial wastes, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.

Coagulation:

The agglomeration of colloidal or suspended matter brought about by the addition of some chemical to the liquid, by contact, or by other means.

Coliform Organisms:

A group of bacteria recognized as indicators of fecal pollution (see also escherichia coliform).

Combined Sewer:

Carries both sanitary sewage and storm water run-off.

Composite Sample:

To have significant meaning, samples for laboratory tests on wastewater should be representative of the wastewater. The best method of sampling is proportional composite sampling over several hours during the day. Composite samples are collected because the flow and characteristics of the wastewater are continually changing. A composite sample will give a representative analysis of the wastewater conditions.

Denitrification:

A biological process by which nitrate is converted to nitrogen gas.

Diffused Air:

Method of aeration.

Digestion:

The biochemical decomposition of organic matter that results in the formation of mineral and simpler organic compounds.

Dissolved Air Flotation:

Method of removing oil and suspended solids.

Dissolved Oxygen (DO):

The oxygen dissolved in water, wastewater, or other liquid. DO is measured in milligrams per liter. If the DO of a sample of water is 2 mg/L, it means that there are 2lbs of oxygen in 1 mil lb of water.

Dissolved Solids:

Solids physically suspended in sewage that cannot be removed by proper laboratory filtering.

Effluent:

The liquid that comes out of a treatment plant after completion of any treatment process.

Escherichia Coliform:

A species of bacteria found in large numbers in the intestinal tract of warm-blooded animals.

Extended Aeration:

A modification of the activated sludge process which provides for aerobic sludge digestion within the aeration system.

Floc:

The agglomeration of smaller particles in gelatinous mass that can be more easily removed from the liquid than the individual small particles.

Flocculation:

The coming together of coalescing and minute particles in a liquid.

Grease:

In wastewater, a group of substances, including fats, waxes, free fatty acids, calcium and magnesium soaps, mineral oils, and certain other non-fatty materials.

Grit:

Heavy, inorganic matter, such as sand or pebbles.

Inorganic Material:

Material that will not respond to biological action (sand, cinders, stone). Non-volatile fraction of solids.

Infection:

Introduction of presence of pathogenic organisms in potable water supply.

Micro-Organisms:

Microscopic plants and animals such as bacteria, molds, protozoa, algae, and small metazoa.

Mixed Liquor:

The combination of primary effluent and active biological solids (return sludge) in the activated sludge process that is fed into the aeration tank.

Mixed Liquor Suspended Solids (MLSS):

The milligrams of suspended solids per liter of mixed liquor that are combustible at 550 degrees Centigrade. An estimate of the quantity of MLSS to be wasted from the aeration tank of an extended aeration plant may be determined by the rate of settling and centrifuge tests on the sludge solids.

Mixed Media Gravity Filter:

A filter using more than one filtering media (such as coal and sand.)

Nitrification:

The conversion of nitrogen matter into nitrates by bacteria.

Nitrogen:

Nitrogen is present in wastewater in many forms: total Kjeldahl nitrogen, ammonia nitrogen, organic nitrogen.

Nitrogen Cycle:

The cycle of life, death, and decay involving organic nitrogenous matter is known as the nitrogen cycle. In the nitrogen cycle ammonia is produced from proteins.

Nutrient:

Any substance assimilated by organisms that promotes growth and replacement of cellular constituents.

Organic Matter:

The waste from homes or industry of plant or animal origin. Volatile fraction of solids.

Organic Material:

Material that can be broken down by bacteria (fats, meats, plant life).

Orthophosphate:

A simple compound of phosphorous and oxygen that is soluble in water.

Oxic:

A biological environment which is aerobic.

Oxidation:

The conversion of organic material to a more stable form using bacteria, chemicals, or oxygen.

Oxidation Ponds or Lagoons:

Holding ponds designed to allow the decomposition of organic wastes by aerobic or anaerobic means.

pH Value:

A convenient method of expressing small differences in the acidity or alkalinity of solutions. Neutrality = pH 7.0; lower values indicate increasing acidity, higher values indicate increasing alkalinity.

Potable Water:

Water fit for human consumption.

Polyelectrolytes:

Synthetic chemicals used as a coagulant aid (polymer).

Polyphosphate:

A large compound formed of several orthophosphate molecules connected by phosphate-storing microorganisms.

Primary Waste Treatment:

Mechanical separation of solids, grease, and scum from waste-water. With the aid of flocculating agents, primary treatment can eliminate 50% to 65% of the suspended solids. Solids removed by the primary treatment may comprise as much as 30% to 40% of the original BOD of the water.

Raw Wastewater:

Wastewater before it receives any treatment.

Reactor:

A tank where a wastewater stream is mixed with bacterial sludge and biochemical reactions occur.

Receiving Waters:

Rivers, lakes, or other water sources that receive treated or untreated waters.

Return Sludge:

Settled activated sludge returned to mix with incoming raw or primary settled wastewater. When the return sludge rate in the activated sludge process is too low, there will be insufficient organisms to meet the waste load entering the aerator.

Return Activated Sludge:

Activated return sludge is normally returned continuously to the aeration tank. Recycling of activated sludge back to the aeration tank provides bacteria for incoming wastewater. It should be brown in color with no obnoxious odor and is often also returned in small portions to the primary settling tanks to aid sedimentation. Settled activated sludge is generally thinner than raw sludge. Some activated sludge will be wasted to prevent excessive solids build up.

Secondary Waste Treatment:

Secondary treatment is part of the primary treatment in that the wastewater continues from the equalization tank and sludge holding zone where it loses the most solids. From the primary stages it passes to the aeration zone where it continues to be broken down and separated from any solids. After aeration the wastewater will pass to the clarifier and disinfection zones. Some plants will include a tertiary treatment that typically involves chlorination or UV treatment.

Sedimentation Tanks:

Provide a period of quiescence during which suspended waste material settles to the bottom of the tank and is scraped into a hopper and pumped out for disposal. During this period, floatable solids (fats, oils) rise to the surface of te tank and are skimmed off into scum pipes for disposal.

Sewage:

Largely the water supply of a community after it has been fouled by various uses. From the standpoint of course, it may be a combination of the liquid or water-carried wastes from residences, business buildings, and institutions, together with those from industrial establishments, and with such ground water, surface water, and storm water as may be present.

Sewers:

A system of pipes used for collecting domestic and industrial waste, as well as storm water run-off. Lateral sewers connect homes and industries to trunk sewers, which channel waste into interceptor sewers carry only domestic and industrial wastewater. Storm sewers carry only storm water run-off. Combined sewers carry both.

Sludge:

The accumulated suspended solids of sewage deposited in tanks or basins.

Sludge Age:

In the activated sludge process, a measure of the length of time a particle of suspended solids has been undergoing aeration, expressed in day. It is usually computed by dividing the weight of the suspended solids in the aeration tank by the weight of excess activated sludge discharged from the system per day.

Sludge Digestion:

The purpose of sludge digestion is to separate the liquid from the solids to facilitate drying. The proper pH range for digested sludge is 6.8 – 7.2.

Sludge Index:

Properly called sludge volume index (SVI). It is the volume in millimeters occupied by 1 g of activated sludge after settling of the aerated liquid for 30 minutes.

Sludge Reaeration:

The continuous aeration of sludge after initial aeration for the purpose of improving or maintaining its condition.

Splitter Box:

A division box that splits the incoming flow into two or more streams. A device for splitting and directing discharge from the head box to two separate points of application.

Suspended Solids:

Solids physically suspended in sewage that can be removed by proper laboratory filtering.

Tertiary Waste Treatment:

Following secondary treatment, the clarified effluent may require additional aeration and/or other chemical treatment to destroy bacteria remaining from the secondary treating stage, and to increase the content of dissolved oxygen needed for oxidation of the residual BOD. Tertiary treatment can also be used to remove nitrogen and phosphorous. This is done with chlorination and often times UV treatment.

Total Solids:

The total amount of solids in solution and suspension.

Trickling Filter:

An aerobic biological process used as secondary treatment of sewage. Effluent from the primary clarifier is distributed over a bed of rocks. As the liquid trickles over the rocks, a biological growth on the rocks breaks down the organic matter in the sewage. The effluent is then taken to a clarifier to remove biological matter coming from the filter.

Turbidity:

Any finely divided, insoluble impurities that mark the clarity of the water.

Waste Activated Sludge:

That portion of sludge from the secondary clarifier in the activated sludge process that is wasted to avoid a buildup of solids in the system.

Waste Treatment Sludge:

A series of tanks, screens, filters, and other processes by which most pollutants are removed from water.

Wastewater:

Domestic wastewater is 99.9% water and 0.1% solids. Fresh wastewater is usually slightly alkaline. If the pH of the raw wastewater is 8.0, it indicates that the sample is alkaline. If wastewater has a pH value of 6.5, it means that it is acid. Wastewater is said to be septic when it is undergoing decomposition.

Water Pollution:

A general term signifying the introduction into water of micro-organisms, chemicals, wastes, or sewage which renders the water unfit for its intended use.

Abbreviations

The following is not a list of all the abbreviations used in the field of wastewater treatment. It is however a list of some the more common abbreviations that may be encountered.

- AOR -Actual Oxygen Requirement
- BOD – Biochemical Oxygen Demand
- BTU – British Thermal Units
- COD – Chemical Oxygen Demand
- CRT – Cathode Ray Tube
- DAF – Dissolved Air Flotation
- DO – Dissolved Oxygen
- F/M – Food to Microorganism ratio
- HTH – High Test Hypochlorite
- LPG – Liquefied Petroleum Gas
- MCC – Motor Control Center
- MCRT – Mean Cell Retention Time
- MGD – Million Gallons per Day
- MLSS – Mixed Liquor Suspended Solids
- MLVSS – Mixed Liquor Volatile Suspended Solids
- MPN – Most Probable Number (of coliform organisms)
- NEC – National Electric Code
- NPSH – Net positive Suction Head
- ORP- Oxidation Reduction Potential
- OSHA – Occupational Safety and Health Act
- PCB's – Polychlorinated Biphenyls
- PSA – Pressure Swing Adsorption (oxygen generation)
- RAS – Return Activated Sludge
- RBC's – Rotating Biological Contactors
- SCR – Silicon Control Rectifier
- SOR – Standard Oxygen Requirement

- SOUR – Specific Oxygen Uptake Rate
- SVI – Sludge Volume Index
- SRT – Solids Retention Time (same as MCRT)
- SS – Suspended Solids (same as TSS)
- TKN – Total Kjeldhal Nitrogen
- TOC – Total Organic Carbon
- TS – Total Solids
- TSS – Total Suspended Solids (same as SS)
- USEPA – United States Environmental Protection Agency
- VS – Volatile Solids
- VSS – Volatile Suspended Solids
- WAS – Waste Activated Sludge
- WPCF – Water Pollution Control Federation
- cu ft – cubic feet
- deg – degrees
- gal – gallon
- gpd – gallons per day
- hp – horsepower
- lbs – pounds
- kw – kilowatt
- kwH – kilowatt-hour
- mg/l – milligrams per liter
- ppm – parts per million
- psi – pounds per square inch
- rpm – revolutions per minute