

Missouri Department of dnr.mo.gov

# NATURAL RESOURCES

Michael L. Parson, Governor

Carol S. Comer, Director

May 31, 2019

Mr. Chuck Bryant, General Manager  
Carthage Water & Electric Plant  
P.O. Box 611  
Carthage, MO 64836-0611

RE: C295809-01 City of Carthage, Missouri–Wastewater Treatment Plant Improvements  
Wastewater Treatment Facility, MO-0039136, Construction Permit No. CP0002059,  
Jasper County

Dear Mr. Bryant:

The Missouri Department of Natural Resources' Water Protection Program has reviewed and approved the plans and specifications submitted by Allgeier, Martin & Associates, Inc. for the City of Carthage. Please find enclosed Construction Permit No. CP0002059 and 1 set of approved plans and specifications. You must maintain these with your official project file for a minimum of 4 years following completion of the project.

This permit will terminate 24 months from the date of issuance. In accordance with 10 CSR 20-6.010(5)(J), the Department may grant an extension. If you believe that an extension is necessary, you must submit a request and a justification in writing for the extension at least 30 days prior to the permit expiration date.

This construction permit does not supersede any requirements of the operating permit or enforcement actions. Nothing in this permit removes any obligations to comply with county or other local ordinances or restrictions.

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to 10 CSR 20-1.020 and Section 621.250, RSMo. To appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Contact information for the AHC is: Administrative Hearing Commission, United States Post Office Building, Third Floor, 131 West High Street, P.O. Box 1557, Jefferson City, MO 65102, Phone: 573-751-2422, Fax: 573-751-5018, and Website: [ahc.mo.gov/](http://ahc.mo.gov/).



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Mr. Chuck Bryant, General Manager  
May 31, 2019  
Page 2

If you have any questions concerning this matter, please contact Ms. Ginny Bretzke, P. E., Review Engineer, at 573-751-1302, [ginny.bretzke@dnr.mo.gov](mailto:ginny.bretzke@dnr.mo.gov), or Department of Natural Resources, Water Protection Program, P.O. Box 176, Jefferson City, MO 65102-0176.

Thank you for your efforts to help ensure clean water in Missouri.

Sincerely,

WATER PROTECTION PROGRAM



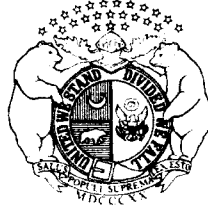
Conrad Blume, P.E., Clean Water Engineering Unit Chief  
Financial Assistance Center

CB:gbn

Enclosures

c: Mr. Dean Willis, P.E., Allgeier, Martin and Associates, Inc.  
Mr. Chuck Bryant, General Manager, Carthage Water & Electric Plant  
Ms. Courtney Zimmerman, Water Protection Program, Financial Assistance Center  
Ms. Ginny Bretzke, P.E., Water Protection Program, Financial Assistance Center  
Southwest Regional Office

**STATE OF MISSOURI**  
**DEPARTMENT OF NATURAL RESOURCES**  
**MISSOURI CLEAN WATER COMMISSION**



**CONSTRUCTION PERMIT**

The Missouri Department of Natural Resources hereby issues a permit to:

Carthage WWTP  
P.O. Box 611  
Carthage, MO 64836

for the construction of (described facilities):

See attached.

Permit Conditions:

See attached.

Construction of such proposed facilities shall be in accordance with the provisions of the Missouri Clean Water Law, Chapter 644, RSMo., and regulation promulgated thereunder, or this permit may be revoked by the Department of Natural Resources

As the Department does not examine structural features of design or the efficiency of mechanical equipment, the issuance of this permit does not include approval of these features.

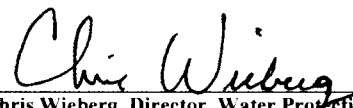
A representative of the Department may inspect the work covered by this permit during construction. Issuance of a permit to operate by the Department will be contingent on the work substantially adhering to the approved plans and specifications.

This permit applies only to the construction of water pollution control components, it does not apply to other environmentally regulated areas

May 31, 2019  
Effective Date

  
Edward B. Galbraith, Director, Division of Environmental Quality

May 30, 2021  
Expiration Date

  
Chris Wieberg, Director, Water Protection Program

## **CONSTRUCTION PERMIT**

### **I. CONSTRUCTION DESCRIPTION**

The work to be performed under this project includes the installation of additional aeration equipment in the existing activated sludge basins, replacement of ultraviolet disinfection equipment with new ultraviolet (UV) equipment, the retrofit of an existing sludge holding basin to an aerobic digester, installation of mechanical screening equipment, the addition of sludge mixers in two sludge holding tanks, Supervisory Control and Data Acquisition (SCADA) integration with proposed and existing equipment, and miscellaneous associated tasks such as yard piping, electrical, an electrical building, earthwork, fencing and other sitework.

This project will also include general site work appropriate to the scope and purpose of the project and all necessary appurtenances to make a complete and usable wastewater treatment facility.

### **II. COST ANALYSIS FOR COMPLIANCE**

Pursuant to Section 644.145, RSMo., when issuing permits under this chapter that incorporate a new requirement for discharges from publicly owned combined or separate sanitary or storm sewer systems or publicly owned treatment works, or when enforcing provisions of this chapter or the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., pertaining to any portion of a publicly owned combined or separate sanitary or storm sewer system or publicly owned treatment works, the Department of Natural Resources shall make a "finding of affordability" on the costs to be incurred and the impact of any rate changes on ratepayers upon which to base such permits and decisions, to the extent allowable under this chapter and the Federal Water Pollution Control Act. This process is completed through a cost analysis for compliance. Permits that do not include new requirements may be deemed affordable.

The Department is not required to determine Cost Analysis for Compliance because the permit contains no new conditions or requirements that convey a new cost to the facility.

### **III. CONSTRUCTION PERMIT CONDITIONS**

The permittee is authorized to construct subject to the following conditions:

1. This construction permit does not authorize discharge.
2. All construction shall be in accordance with the plans and specifications submitted by Allgeier, Martin and Associates, Inc. on April 25, 2019, and signed and sealed by Mr. Dean A. Willis, P.E., and Mr. Jared C. Nichols, P.E., on April 10, 2019, and approved by the Department on May 31, 2019.

3. Regulation 10 CSR 20-4.040(18)(B)1 requires that projects be publicly advertised, allowing sufficient time for bids to be prepared and submitted. Projects should be advertised at least 30 days prior to bid opening.
4. The Department must be contacted in writing prior to making any changes to the approved plans and specifications that would directly or indirectly have an impact on the capacity, flow, system layout, or reliability of the proposed wastewater treatment facilities or any design parameter that is addressed by 10 CSR 20-8, in accordance with 10 CSR 20-8.110(11).
5. As per 10 CSR 20-4.040, all changes in contract price or time within the approved scope of work must be by change order in accordance with Section 19 of this rule.
6. State and federal law does not permit bypassing of raw wastewater, therefore steps must be taken to ensure that raw wastewater does not discharge during construction. If a sanitary sewer overflow or bypass occurs, report the appropriate information to the Department's Southwest Regional Office per 10 CSR 20-7.015(9)(G)
7. In addition to the requirements for a construction permit, 10 CSR 20-6.200 requires land disturbance activities of 1 acre or more to obtain a Missouri state operating permit to discharge stormwater. The permit requires best management practices sufficient to control runoff and sedimentation to protect waters of the state. Land disturbance permits will only be obtained by means of the Department's ePermitting system available online at [dnr.mo.gov/env/wpp/epermit/help.htm](http://dnr.mo.gov/env/wpp/epermit/help.htm). See [dnr.mo.gov/env/wpp/stormwater/sw-land-disturb-permits.htm](http://dnr.mo.gov/env/wpp/stormwater/sw-land-disturb-permits.htm) for more information.
8. A United States (U.S.) Army Corps of Engineers (COE) permit (404) and a Water Quality Certification (401) issued by the Department or permit waiver may be required for the activities described in this permit. This permit is not valid until these requirements are satisfied. If construction activity will disturb any land below the ordinary high water mark of jurisdictional waters of the U.S. then a 404/401 will be required. Since the COE makes determinations on what is jurisdictional, you must contact the COE to determine permitting requirements. You may call the Department's Water Protection Program at 573-751-1300 for more information. See [dnr.mo.gov/env/wpp/401/](http://dnr.mo.gov/env/wpp/401/) for more information.
9. Upon completion of construction:
  - A. The City of Carthage will become the continuing authority for operation and maintenance of these facilities;
  - B. Submit an electronic copy of the as built; and
  - C. Submit the form Statement of Work Completed to the Department in accordance with 10 CSR 20-6.010(5)(N). When the facility applies for their next operating

permit renewal, they will be expected to include an updated facility description on their application.

#### **IV. REVIEW SUMMARY**

##### **1. CONSTRUCTION PURPOSE**

Modifications are being made to the treatment system to improve the effectiveness and efficiency of treatment, including the following:

- A. New mechanical screening equipment installed ahead of the existing in-plant raw sewage pumps will protect the pumps and other equipment from damage caused by trash and rags in the sewer.
- B. Adding aeration equipment in existing activated sludge basins will increase the oxygen levels available for treatment.
- C. Replacing the existing 20-year old UV disinfection equipment with new equipment that uses low pressure, high intensity amalgam lamps will improve efficiency and lower operational costs.
- D. Retrofitting Sludge Holding Tank No. 1 to an aerobic digester will provide more complete sludge stabilization and will help minimize the generation of odors. Mixers will be added to the two remaining sludge holding tanks to help ensure full utilization of the tanks.
- E. SCADA integration with proposed and existing equipment will provide the operational controls needed for the system.

##### **2. FACILITY DESCRIPTION**

The City of Carthage Wastewater Treatment Plant (WWTP) was originally constructed in 1986 and had a major expansion in 1998/99. Wastewater treatment includes a flow equalization basin, influent lift station, grit removal, screening, two oxidation ditches, three final clarifiers, UV disinfection and re-aeration. Sludge handling includes sludge thickener basin, aerobic digester, two sludge holding tanks and land application of sludge.

The City of Carthage Wastewater Treatment Facility is located at 1701 West Mound Road, Carthage, Missouri, in Jasper County. The facility has a design average flow of 7.0 million gallons per day (mgd) and serves a hydraulic population equivalent of approximately 74,700 people.

##### **3. COMPLIANCE PARAMETERS**

The proposed WWTP Improvements project is required to meet effluent limits established in the existing Operating Permit MO-0039136.

The final effluent limitations that are effective February 1, 2020, will be applicable to the facility following the completion of construction:

Parameter	Units	Daily Maximum	Weekly Average	Monthly average limit
Flow	MGD	*		*
Carbonaceous Biochemical Oxygen Demands	mg/L		15	15
Total Suspended Solids	mg/L		45	30
E. Coli	#/100mL		630	126
Ammonia as N-summer	mg/L	11.5		2.2
Ammonia as N-winter	mg/L	13.0		2.9
Oil & Grease	Mg/L	15		10
Cyanide, amenable to chlorination	µg/L	15.3		7.2
pH	SU	6.0-9.0		
*Monitoring requirement only				

#### 4. REVIEW of MAJOR TREATMENT DESIGN CRITERIA

**Existing major components which will remain in use include the following:**

- The entire existing system will continue to remain in use with the exception that the existing UV equipment will be removed/demolished and replaced with new UV units at the same location and the outer basin of Sludge Holding Tank No. 1 will be retrofitted for use as an aerobic digester.

**Construction will cover the following items:**

- Components are designed for a Population Equivalent of 74,700 based on hydraulic loading to the system.
- Details on the hydraulic and organic loadings used in preparing the design of components of the treatment system are provided in the “Revised Summary of Design” submitted by Allgeier, Martin & Associates, Inc., which is presented in Appendix A of this Construction Permit.
- Mechanical Bar Screen – Installation of screening devices removes nuisance inorganic materials from raw wastewater. A new screening system will include one mechanically cleaned screen with a front-cleaned, link-driven assembly with 3/8-inch clear opening, along with the associated structure. The screening device shall be capable of treating a design average flow of 7.0 mgd and a peak flow of 17.5 mgd. The mechanically cleaned screen will be installed in a 4.5-foot-wide channel and mounted at a 15 degree angle from vertical. A stainless steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and to ensure the raking mechanism reaches the bottom of the screen to prevent debris accumulation. The bar screen assembly shall be shipped in one piece and shall be of a drop-in design. Materials of construction shall be 304 stainless steel, except for components

specifically noted in the specifications. An insulated and heated full enclosure shall surround all parts of the mechanically cleaned bar screen that extend above the channel. Sluice gates in the concrete structure for the mechanical screen provide the ability to open/close the flow path as needed to bypass the mechanical screen.

- **Aeration Basins** – The existing plant uses two racetrack type 18-foot deep aeration basins with a jet aeration type system, plus two circular interior basins with slow speed turbine aerators. Additional aeration will be provided in the existing racetrack jet-aeration basins by adding fine bubble diffused aeration.

The dimensions of the portion of each basin where fine bubble diffused aeration will be added are 55-foot diameter for inner ring and 115-foot diameter for outer wall, creating a circular 30-foot wide racetrack-style basin with an 18 foot side water depth, for a volume of 1.08 MG per basin. The specified system performance criteria for each of the two aeration basins are that the following shall be met at a diffuser submergence of 17 feet:

- Actual Oxygen Requirement (AOR)—4,400 lb. O<sub>2</sub>/day/basin
- Standard Oxygen Requirement (SOR)—416 lbs. O<sub>2</sub>/hr./basin
- Standard Oxygen Treatment Efficiency (SOTE)—24.1 percent
- Standard Cubic Feet per Minute (SCFM)—1,500 scfm

A blower shall be provided for each of the two aeration basins for the fine bubble diffused aeration. The operating conditions for the aeration basin blowers are as follows:

- Discharge Pressure—8.5 pounds per square inch guage (psig)
- Maximum Rated Blower Pressure—20.0 psig
- Motor Horsepower (HP)—100 HP
- Maximum Brake Horsepower—71.7
- Motor RPM—1800 RPM
- Discharge Volume, SCFM—1000 to 1500 SCFM
- Elevation—14.3 pounds per square inch absolute (psia)
- Maximum Inlet Air Temperature—100°F
- Maximum Blower RPM—2600 RPM
- Motor Power supply—460-volt, 3 phase, 60 hertz compatible with the associated variable frequency drive.

For the existing jet aeration, the motive pumps will be replaced, providing two new pumps in each basin for a total of four new submersible “motive” pumps. The motive pumps are used for recirculating the contents of the existing activated sludge basins through the jet-aeration piping and nozzles. These submersible pumps shall be capable of pumping raw unscreened sewage and shall pass a minimum 3-inch diameter sphere. The pumps shall each deliver 2,600 gallons per minute (gpm) at a total dynamic head (TDH) of 25 feet, while operating over a range of 2,000 gpm at 30 feet TDH to 3,500 gpm at 18 feet TDH. Pump motor shall be 25 horsepower operating at 875 RPM and have a minimum hydraulic



efficiency of not less than 70 percent at design flow. The pump motor shall be 230/460 volt, three-phase, 60 Hz induction type with a squirrel cage rotor, shell type design, housed in an air-filled or oil-filled, watertight chamber, MEMA B type.

- **Open Channel UV Disinfection** – Disinfection is the process of removal, deactivation, or killing of pathogenic microorganisms. The existing UV equipment will be removed and new equipment will be installed. The new open channel, gravity flow UV disinfection system with low pressure, high intensity amalgam lamps will be capable of treating a peak flow of 17.5 mgd while delivering a minimum UV intensity of 30 mJ/cm<sup>2</sup> with an expected ultraviolet transmissivity of 65 percent or greater. The open channel UV system consists of three independent channels (or banks) with the configuration of the lamps dependent on whether a vertical or horizontal system is selected. For a vertical system (such as Glasco UV or approved equal), there will be 2 modules per bank and 40 lamps per module, for a total of at least 240 lamps; lamps shall be capable of producing a minimum new lamp output of 110 watts of UV-C energy at a wavelength of 253.7nm. For a horizontal system (such as Calgon Carbon or approved equal), there will be 6 modules per bank and 8 lamps per module, for a total of at least 144 lamps; lamps shall be capable of producing a minimum new lamp output of 205 watts of UV-C energy at a wavelength of 253.7nm. The disinfected effluent will flow by gravity through existing flow measurement equipment and to Outfall No. 001.
- **Aerobic Digester** – Aerobic digestion helps stabilize primary sludge in a tank designed to provide effective air mixing, reduction of the organic matter, supernatant separation and sludge concentration under controlled conditions. The existing Sludge Holding Tank No. 1 is being retrofitted to provide additional aerobic digestion. The tank is divided into two basins, with a racetrack-style basin around the outside and a circular basin in the middle. The inside circular basin is 55-foot diameter with a sidewater depth of 16 feet, providing a storage volume of approximately 284,000 gallons. This inner basin has an existing aeration system that will continue to be used, consisting of one 75 HP mechanical surface aerator that can deliver an estimated 2.0 lbs. of oxygen per HP/hr.

The outside racetrack-style basin has a diameter of 57 feet 4 inches on the inside and 107 feet 4 inches on the outside, for a 24-foot wide channel after adjusting for wall thickness. With a sidewater depth of 14 feet 9 inches, the outer basin can store approximately 656,000 gallons. Medium-bubble diffused aeration equipment, with drop pipes and shear tubes, is being added to this outside racetrack-style basin. The design airflow is 3000 SCFM with two blowers operating and the air supply is to be 7.5 psig at the blower. Three blowers are to be provided and each blower shall be the horizontal, rotary, positive displacement type, with rugged construction and with the following operating conditions:

- Discharge Pressure—7.5 psig

- Maximum Rated Blower Pressure—20.0 psig
- Motor Horsepower—75 HP
- Max. Brake Horsepower (BHP)—61.5 BHP
- Motor rotations per minute (RPM)—1800 RPM
- Discharge Volume, SCFM—1500 SCFM
- Elevation—14.3 psia
- Maximum Inlet Air Temperature—100°F
- Maximum Blower RPM—2600 RPM
- Motor Power supply—460-volt, 3 phase, 60 hertz compatible with the associated variable frequency drive.

The aerobic digester follows the gravity-type thickener, but is prior to the sludge holding basins. The aerobic digester (both basins) will receive 12,350 lb. TSS/day at peak month conditions. Because of the large proportion of inert solids received from the water treatment plant, the volatile portion of the total solids is estimated to be approximately 60 percent (7,500 lb VSS/day). To meet the 503(b) requirements for vector reduction, a 38 percent VSS reduction is required; for peak month conditions, there will be approximately 2,960 lb VSS destroyed per day, which is 39 percent of the incoming 7,500 lb VSS/d.

- Sludge Mixing Equipment—Two submersible mixers will be installed in each of the two existing sludge holding tanks. Sludge Holding Tank No. 2 has a 105-foot diameter with a sidewater depth of approximately 16 feet for a storage volume of 1.04 MG. Sludge Holding Tank No. 3 has a 100-foot diameter with a sidewater depth of 16 feet for a storage volume of 0.94 MG. The mixers should be designed to operate in a thickened sludge with typical suspended solids concentrations of 4 to 7 percent. The mixer propeller is to have a three blade design providing approximately a 31-inch diameter rotation. The motor for each mixer should be 20 HP, 1745 rpm, three-phase, 480 volt, 60 hertz and should drive a sturdy planetary gear drive with output speed of approximately 300 rpm. The unit is to include an electrical soft start to reduce the impact on the propeller and drive system.

## **5. OPERATING PERMIT**

These construction activities do not require a modification to the operating permit. It is expected that the facility owner will include a new facility description in their next operating permit renewal application to reflect the addition of the mechanical bar screen ahead of the raw sewage pumps and modifications to other equipment, as needed.

## **APPENDICES**

- Appendix A—“Revised Summary of Design” submitted by Allgeier, Martin & Associates, Inc.

Revised Summary of Design  
Carthage, MO Wastewater Treatment Plant  
Attachment to Form MO 780-2189; Item 1.7

The planned 2019 improvements to the Carthage WWTP do not alter the existing hydraulic or organic capacity of the facility. The design capacity of the WWTP is as follows:

	<u>Design Capacity</u>
Average Flow	7.0 mgd.
Peak Flow	17.5 mgd.
Average BOD5	12,750 lb./d.
Average TSS	19,120 lb./d.
Average TKN	2,300 lb./d.

Raw Sewage Pumping – The Levee District lift station utilizes two 1800 gpm and three 4000 gpm pumps, delivering flow directly to the WWTP, and yielding a firm capacity of approximately 5600 gpm (8.1 mgd). The Southwest lift station also delivers flow directly to the treatment plant, utilizing three 1700 gpm pumps that provide a firm capacity of about 2000 gpm (3.2 mgd). The raw sewage pumping at the WWTP includes four submersible non-clog sewage pumps, each capable of delivering 2600 gpm, when operating alone. The firm capacity of the plant's raw sewage pumps is approximately 6400 gpm (9.2 mgd). The raw sewage pumping capacity of the combined lift stations and WWTP pumps is approximately 20.5 mgd which is somewhat in excess of the 17.5 MGD peak design flow of the treatment plant.

Screening – The mechanically cleaned screen that is located ahead of the raw sewage pumps at the WWTP will be installed in a 4.5-foot-wide channel and operates with a depth up to approximately 4 feet. The screen is a front-cleaned, link-driven assembly with 3/8-inch clear opening. The maximum head loss through the unit is approximately 8-inches at 12 mgd.

A second screen is installed downstream of the grit chamber to remove material from the sewage that is pumped directly to the grit chambers from system lift stations. This screen is a climber type bar screen, which has 3/8-inch clear openings. The screen fits in a 4-foot wide channel and operates with a maximum upstream water depth of about 3.4 feet. The approach velocity of the wastewater at peak design flow is approximately 2 fps. The maximum head loss through the unit is 8 inches.

Grit Removal – The raw sewage is sent to two parallel detritus type grit removal chambers. Each chamber is 20 feet square, with a normal water depth of approximately 22 inches, providing an average velocity of 0.4 fps at peak design flow. Grit is scraped to a peripheral hopper, from which it is augered into a receptacle. The units are designed to remove 95 percent of the 100-mesh grit particles at peak flow.

Aeration Basins - The plant uses two racetrack type 18-foot deep aeration basins with a combination of fine bubble diffusers and a jet aeration type system; plus two circular interior basins with slow speed turbine aerators.

The two racetrack type basins provide a total volume of 2.16 MG (1.08 MG each). Aeration is provided to the jet-aeration equipment in those basins by up to three blowers, each of which can provide approximately 1500 scfm. A fourth blower is provided for standby, with replacement of a defective blower being accomplished in a matter of hours, if required. The jet-aeration blowers and aeration system are capable of transferring an estimated 11,850 pounds oxygen per day based on an evaluation of past performance. The new fine bubble diffused air systems in each racetrack type basin includes two 1,500 scfm blowers, and can deliver a total of 8,800 pounds oxygen per day to the basins.

The two circular activated sludge basins provide an additional 0.54 MG of aeration volume (0.27 MG each). Aeration of these basins is accomplished with one 75 hp mechanical surface aerator in each converted clarifier. Each aerator

provides an estimated 1.8 lbs. oxygen per hp-hr, and provides complete-mix conditions. Total oxygen transfer from the two aerators is approximately 6,050 pounds of oxygen per day.

The total oxygenation provided by the three different types of aeration equipment equals approximately 26,700 pounds of oxygen per day at standard conditions. This is in excess of the daily design requirement of 25,880 lbs. oxygen/day at design conditions (12,750 lbs. BOD/d. x 1.2 lbs. oxygen/lb. BOD + 2,300 lbs. TKN/d. x 4.6 lbs oxygen/lb. TKN). The preceding assumes full time utilization of the aeration equipment. The aeration capacity will allow marginal cycling of the blowers for limited nitrification/denitrification.

Piping facilities allow the flow and organic load to the various aeration basins to be balanced relative to oxygen transfer capabilities and detention times. The average organic loading to the aeration basins at design conditions equals 12,750 lbs. BOD/2.7 MG, or 36 lbs. BOD/1000 cu.ft.-day. Assuming a mixed liquor volatile suspended solids concentration of 2,800 mg/l, the food to microorganism ratio equals 0.33 lb. BOD/lb. MLVSS-day. These loading are typical of a conventional activated sludge process. At design conditions, the hydraulic detention time equals 2.7 MG/7 MGD, or 9.3 hours, which is slightly longer than a conventional activated sludge system, but shorter than an extended aeration system.

Intermediate Pumping – Four intermediate screw pumps are utilized to lift mixed liquor to the final clarifiers. Return activated sludge (RAS) flows by gravity from these elevated clarifiers back to the aeration basins. The intermediate pumps are capable of pumping the 17.5 MGD peak sewage flow plus return activated sludge (RAS) flow. Assuming a maximum RAS flow equal to 1.5 times the average design flow, the RAS component is estimated at 10.5 MGD. The intermediate pumps are designed to yield a firm capacity of 28 MGD, therefore four are provided, with each capable of delivering 9.33 MGD.

Final Clarifiers – Three 86-foot-diameter clarifiers with 15-foot sidewater depths are provided. At 17.5 MGD, the surface overflow rate equals 1000 gpd/sq.ft. Assuming a 4000 mg/l MLSS level, an RAS flow of 7 MGD, and a peak flow of 17.5 MGD, the peak solids loading rate to each clarifier equals 47 lbs. solids/sq.ft.-day. Sludge removal from the clarifiers is via 12-inch diameter telescopic sludge valves located on the perimeter of the tanks.

Disinfection Facilities – Disinfection is provided by ultraviolet lamps immersed in the effluent flow. Ultraviolet lamps are installed in three independent channels, each of which will hold two modules of low-pressure, high-intensity amalgam lamps. A total lamp output in excess of 1,400 watts per million gallons of capacity is provided. The lamps are designed to disinfect the peak flow (17.5 MGD) to a monthly average of less than 126 E. coli colonies per 100 ml.

Sludge Thickening – Wasting of sludge to a gravity type sludge thickener is controlled with a weir gate at the top of the intermediate pump structure. Mixed liquor is sent to the thickener as required for proper sludge wastage. At peak monthly design conditions, an estimated 12,350 lbs. solids will be sent daily to the thickener. The corresponding flow rate equates to 0.57 MGD at a MLSS concentration of 2,830 mg/l. A 40-foot-diameter thickener is utilized, with the resulting solids loading rate of 11 lb. TSS/sq.ft.-day. At 0.57 MGD flow, the surface overflow rate equals 454 gpd/sq.ft.

Aerobic Digestion – Thickened sludge is pumped to an aerobic digester and/or sludge holding tank prior to ultimate disposal by land application. The aerobic digester will receive 12,350 lb. TSS/day at peak month conditions. Because of the large proportion of inert solids that are received from the water treatment plant, the volatile portion of the total solids is estimated to be approximately 60%, or 7,500 lb. VSS/day.

The digester is comprised of two cells within a common circular tank. The inner cell is 55 ft diameter, with a sidewater depth of 16 feet, yielding a storage volume of 38,000 cubic feet. The outer racetrack portion of the aerobic digester is 24 feet wide with a sidewater depth of 15 feet, providing a storage volume of 97,000 cubic feet. The combination of the two aerobic digesters cells provides a total volume of 135,000 cubic feet (1,000,000 gallons), and a hydraulic detention time of approximately 30-days at an anticipated waste sludge flow rate of 34,000 gpd.

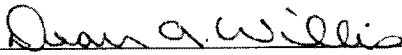
The inner (38,000 cu.ft.) aerobic digester cell is aerated and mixed with one 75 hp mechanical surface aerator which can deliver an estimated 2.0 lbs. of oxygen per hp/hr. Total oxygen transfer capability is, therefore, 3,600 lbs. oxygen per day. The 75 hp aerator provides a mixing input of 2 hp per 1,000 cu.ft. of digester volume. Approximately 2.3 lbs. of oxygen is required per pound of VSS destroyed, therefore the existing aerator is capable of destroying about 1,565 lbs. VSS per day.

The outer 97,000 cu.ft. cell is aerated and mixed with a fixed medium bubble diffuser system and three 1500 scfm positive displacement blowers. With two blowers in operation the aeration system for this cell will transfer approximately 6900 lbs. of oxygen to the mixed liquor in the aerobic digester, resulting in the degradation of about 3,000 lbs. of volatile suspended solids. Overall the two aerobic digester cells provide adequate capacity to reduce volatile solids in the waste sludge as required by EPA 503 regulations for land application.

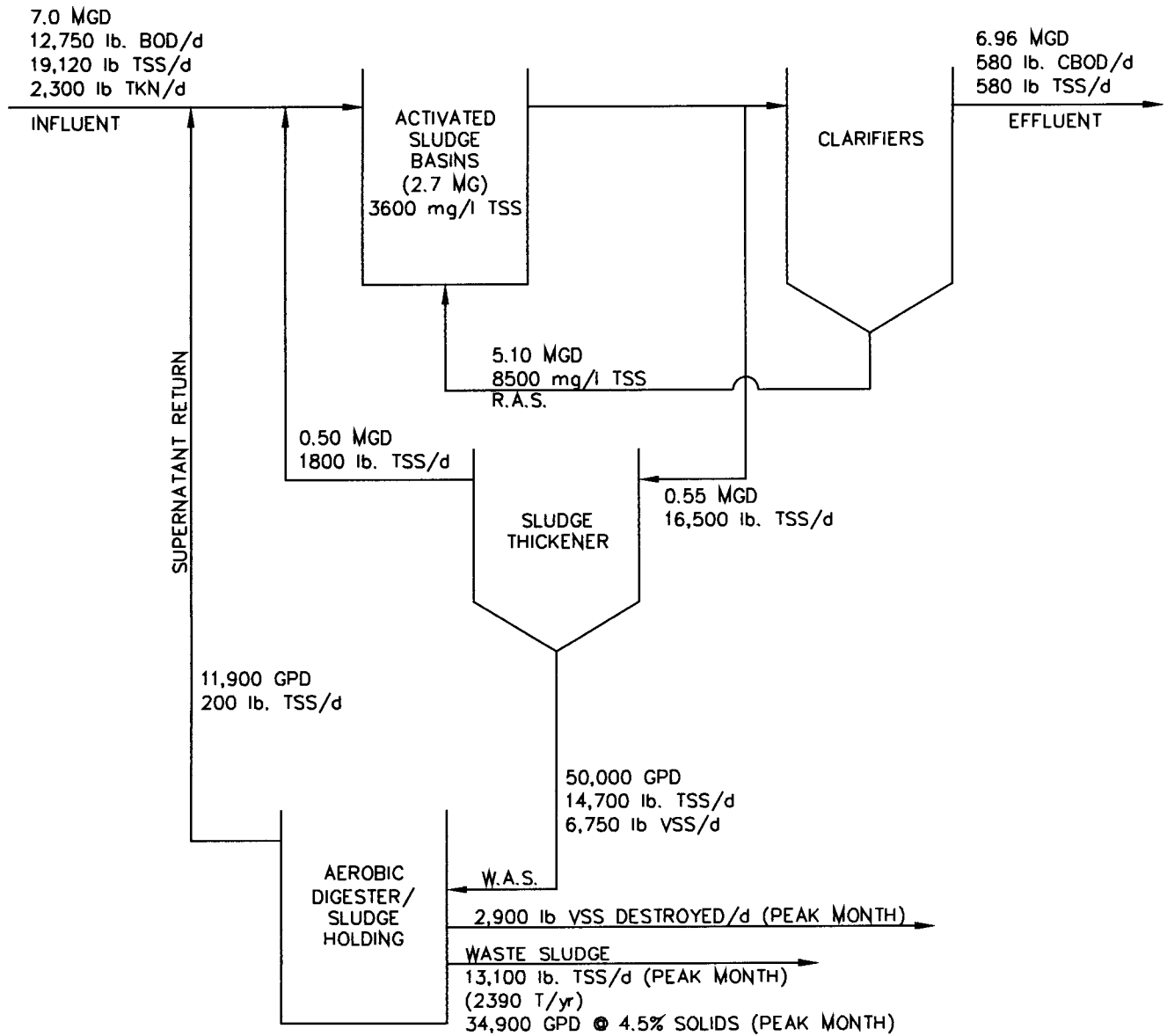
Sludge Storage - An estimated 12,350 lb. TSS will be wasted daily to the aerobic digester at peak month design conditions. An estimated 2,960 lb. TSS will be destroyed daily in the digester, and 9,390 lbs. TSS will be sent daily to the sludge holding tanks. The sludge holding tanks are provided with facilities for decanting supernatant, thereby allowing a relatively high solids concentration to be maintained in the tanks. Historically, because of the nature of the sludge, a 4 to 6 percent solids level has been maintained. The disposal of 9,390 lbs. TSS/d. at 4.5 percent solids requires an average of 25,000 gpd to be hauled from the facility for land applications or otherwise stored on site.

Two sludge storage tanks are provided. One tank is 100 ft. diameter with a 16 ft. sidewater depth, and the other tank is 105 feet in diameter with a 16 ft. sidewater depth. A total volume of 1,980,000 gallons of storage is provided for waste sludge, equating to 79-days at peak month design conditions. The storage tanks provide about 103-days of waste sludge storage at average monthly design conditions, and significantly more than that at current conditions.

Flow Equalization – Flow equalization for the treatment facility is provided by use of an earthen holding basin located east of the facility. Under peak flow conditions, wastewater is delivered to the lagoons by peak flow sewage pumps located north of the railroad tracks, and/or directly from the Levee District lift system pumps. Flow is returned to the WWTP by gravity flow via operation of a control valve.

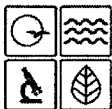
  
Dean A. Willis, P.E. Allgeier, Martin and Associates, Inc.





YEAR 2038 DESIGN FLOW & LOADS  
CARTHAGE WWTP

MAR 9 2019



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 WATER PROTECTION PROGRAM  
**APPLICATION FOR CONSTRUCTION PERMIT -**  
**WASTEWATER FACILITY**

FOR DEPARTMENT USE ONLY	
APP NO. <u>AP31930</u>	CP NO. <u>CP0002059</u>
FEE RECEIVED <u>3,000</u> <u>3/27/18</u>	CHECK NO.
DATE RECEIVED <u>3/6/19</u>	

**APPLICATION OVERVIEW**

The Application for Construction Permit – Wastewater Facility form is for construction pertaining to domestic wastewater treatment facilities, agrichemical facilities, and components thereof. This form has been developed in a modular format and consists of Part A and B. **All applicants must complete Part A.** Part B should be completed for applicants who currently land-apply wastewater or propose land application for wastewater treatment. **Please read the accompanying instructions before completing this form. Submittal of an incomplete application may result in the application being returned.**

**PART A – BASIC INFORMATION**

**1.0 APPLICATION INFORMATION** (Note – If any of the questions in this section are answered NO, this application may be considered incomplete and returned.)

- 1.1 Is this a Federal/State funded project?  YES  N/A Funding Agency: MDNR-SRF Project #: C295809-01
  - 1.2 Is this an application for an agrichemical?  YES (See instructions.)  N/A
  - 1.3 Has the Missouri Department of Natural Resources approved the proposed project's antidegradation review?  
 YES Date of Approval: 3/13/2018
  - 1.4 Has the department approved the proposed project's facility plan\*?  
 YES Date of Approval: 11/20/2018  NO  N/A (If Not Applicable, complete No. 1.5.)
  - 1.5 [Complete only if answered Not Applicable on No. 1.4] Is a copy of the engineering report\* for wastewater treatment facilities with a design flow less than 22,500 gpd included with this application?  
 YES  NO
  - 1.6 Is a copy of the appropriate plans\* and specifications\* included with this application?  
 YES Denote which form is submitted:  Hard copy  Electronic copy (See instructions.)  NO
  - 1.7 Is a summary of design\* included with this application?  YES  NO
  - 1.8 Is a general operating permit applicable?  
 YES Submit the appropriate operating permit application to the Regional Office at least 60 days prior to operation.  
 NO Enclose the appropriate operating permit application and fee submittal. Denote which form:  B  B2
  - 1.9 Is the facility currently under enforcement with the department or the Environmental Protection Agency?  YES  NO
  - 1.10 Is the appropriate fee included with this application?  YES  NO (See instructions for appropriate fee.) *Fee was subm. Her under previous application*
- \* Must be affixed with a Missouri registered professional engineer's seal, signature and date.

**2.0 PROJECT INFORMATION**

2.1 NAME OF PROJECT

WWTP Improvements, Project C295809-01, Carthage, Missouri

2.2 PROJECT DESCRIPTION

Upgrade of Carthage WWTP including the addition of aeration capability to existing aeration basins, installation of mechanical screening equipment, improvements to aerobic digesters and sludge handling equipment, and replacement of ultraviolet disinfection equipment. (Categorical Exclusion Project that does not alter NPDES Permit conditions)

2.3 SLUDGE HANDLING, USE AND DISPOSAL DESCRIPTION

Aerobic digestion, sludge storage, and land application.

2.4 DESIGN INFORMATION

- A. Current population: 14,378; Design population: 17,900
- B. Actual Flow: 4,450,000 gpd; Design Average Flow: 7,000,000 gpd;  
 Actual Peak Daily Flow: 16,300,000 gpd; Design Maximum Daily Flow: 17,500,000 gpd;  
 Design Wet Weather Event: 17,500,000 gpd

2.5 ADDITIONAL INFORMATION

- A. Is a topographic map attached?  YES  NO
- B. Is a process flow diagram attached?  YES  NO

2.6 ESTIMATED PROJECT CONSTRUCTION COST

\$ 3,509,000.00

<b>3.0 WASTEWATER TREATMENT FACILITY</b>				
NAME Carthage WWTP		TELEPHONE NUMBER WITH AREA CODE (417) 237-7301		EMAIL ADDRESS mkienzle@cwepnet.com
ADDRESS (PHYSICAL) 1701 West Mound Road		CITY Carthage	STATE MO	ZIP CODE 64836
COUNTY Jasper				
Wastewater Treatment Facility: Mo- 0039136 (Outfall 001 Of 1 )				
3.1 Legal Description: SW ¼, NW ¼, NE ¼, Sec. 05 , T 28N , R 31W (Use additional pages if construction of more than one outfall is proposed.)				
3.2 UTM Coordinates Easting (X): 381524 Northing (Y): 4115804 For Universal Transverse Mercator (UTM), Zone 15 North referenced to North American Datum 1983 (NAD83)				
3.3 Name of receiving streams: Spring River				
<b>4.0 PROJECT OWNER</b>				
NAME City of Carthage		TELEPHONE NUMBER WITH AREA CODE (417) 237-7003		EMAIL ADDRESS staff@carthagemo.gov
ADDRESS 326 Grant Street		CITY Carthage	STATE MO	ZIP CODE 64836
<b>5.0 CONTINUING AUTHORITY:</b> Permanent organization that will serve as the continuing authority for the operation, maintenance and modernization of the wastewater collection system.				
NAME Carthage Water & Electric Plant		TELEPHONE NUMBER WITH AREA CODE (417) 237-7300		EMAIL ADDRESS cbryant@cwepnet.com
ADDRESS P.O. Box 611		CITY Carthage	STATE MO	ZIP CODE 64836
5.1 A letter from the continuing authority, if different than the owner, is included with this application. <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A				
5.2 COMPLETE THE FOLLOWING IF THE CONTINUING AUTHORITY IS A MISSOURI PUBLIC SERVICE COMMISSION REGULATED ENTITY.				
A. Is a copy of the certificate of convenience and necessity included with this application? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
5.3 COMPLETE THE FOLLOWING IF THE CONTINUING AUTHORITY IS A PROPERTY OWNERS ASSOCIATION.				
A. Is a copy of the as-filed restrictions and covenants included with this application? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
B. Is a copy of the as-filed warranty deed, quitclaim deed or other legal instrument which transfers ownership of the land for the wastewater treatment facility to the association included with this application? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
C. Is a copy of the as-filed legal instrument (typically the plat) that provides the association with valid easements for all sewers included with this application? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
D. Is a copy of the Missouri Secretary of State's nonprofit corporation certificate included with this application? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
<b>6.0 ENGINEER</b>				
ENGINEER NAME / COMPANY NAME Dean A. Willis, Allgeier, Martin and Associates, Inc.		TELEPHONE NUMBER WITH AREA CODE (417) 680-7200		EMAIL ADDRESS dean.willis@amce.com
ADDRESS 7231 East 24th Street		CITY Joplin	STATE MO	ZIP CODE 64804
<b>7.0 PROJECT OWNER:</b> I hereby certify that I am familiar with the information contained in this application and to the best of my knowledge and belief such information is true, complete, and accurate, and if granted this permit, I agree to abide by the Missouri Clean Water Law and all rules, regulations, orders, and decisions, subject to any legitimate appeal available to applicant under Missouri Clean Water Law. I also understand the issuance of the construction permit does not guarantee the proposed wastewater treatment will meet the required effluent limitations of the issued Missouri State Operating Permit for this facility.				
PROJECT OWNER SIGNATURE				
PRINTED NAME Chuck Bryant				DATE 3/1/19
TITLE OR CORPORATE POSITION General Manager, Carthage Water & Electric Plant		TELEPHONE NUMBER WITH AREA CODE (417) 237-7300		EMAIL ADDRESS cbryant@cwepnet.com
Mail completed copy to: MISSOURI DEPARTMENT OF NATURAL RESOURCES WATER PROTECTION PROGRAM P.O. BOX 176 JEFFERSON CITY, MO 65102-0176				
<b>END OF PART A</b>				
<b>REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHETHER PART B NEEDS TO BE COMPLETE.</b>				