

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



**CONSTRUCTION PERMIT**

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

Confluence Rivers Utility Operating Company, Inc.  
Freeman Hills WWTF  
0.2 mile northwest of CR 373 and CR 314 intersection  
Mexico, MO 65265

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 (Department).

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.

March 8, 2022  
Effective Date

March 7, 2024  
Expiration Date

A handwritten signature in black ink that reads "Chris Wieberg".  
Chris Wieberg, Director, Water Protection Program

## **CONSTRUCTION PERMIT**

### **I. CONSTRUCTION DESCRIPTION**

The Freeman Hills WWTF is located at 0.2 miles northwest of County Roads 373 and 314 in Audrain County, Missouri. The proposed construction is to get the facility into compliance and to meet final effluent limits for ammonia and *E. Coli*. Construction will include an aeration system in lagoon cell #1, installation of a MBBR unit after cell #3, clarifier, and UV disinfection with a V-notch weir. The aeration system for the lagoon will be partial mix. The MBBR system is approximately 5 ft diameter and 9 ft deep with a sidewater depth of 7 ft for a volume of approximately 1,028 gallons, providing a hydraulic retention time at design flow is 3.2 hours and 1.6 hours at the peak flow of 15,400 gpd. The MBBR reactor tank will be 65% filled with high surface area media, with a total media surface area of 1,695 m<sup>2</sup> (18,244 ft<sup>2</sup>), with medium bubble aeration. The hopper type clarifier will have a surface area of 28.3 square feet, with a capacity of 1406 gallons and a detention time of 4.38 hours. The UV disinfection system will be capable of treating a peak flow of 57,600 gpd. Sludge will still be retained in the lagoon. The design average flow remains at 7,700 gpd.

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 complete a cost analysis for compliance because the facility is not a combined or separate sanitary sewer system for a publically-owned treatment works.

### **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 consistent with plans and specifications signed and sealed by Ben Kuenzel, PE with 21 Design Group and as described in this permit.
3. The Department must be contacted in writing prior to making any changes to the 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).
4. 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 Northeast Regional Office per 10 CSR 20-7.015(9)(G).
5. The wastewater treatment facility shall be located at least two hundred feet (200') to residence and fifty feet (50') to property line per 10 CSR 20-8.140(C)(2)
6. The wastewater treatment facility shall be located above the twenty-five (25)-year flood level.
7. The wastewater facility structures, electrical equipment, and mechanical equipment shall be protected from physical damage by not less than the one hundred- (100-) year flood elevation per 10 CSR 20-8.140(2)(B). The minimum distance between wastewater treatment facilities and all potable water sources shall be at least three hundred feet (300') per 10 CSR 20-8.140(2)(C)1.
8. 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 <https://dnr.mo.gov/data-e-services/missouri-gateway-environmental-management-mogem>. See <https://dnr.mo.gov/data-e-services/water/electronic-permitting-epermitting> for more information.
9. A United States Army Corps of Engineers (USACE) Clean Water Act Section 404 Department of the Army permit and a Section 401 Water Quality Certification issued by the Department may be required for the activities described in this permit. This permit is not valid until these requirements are satisfied or notification is provided that no Section 404 permit is required by the USACE. You must contact your local USACE district since they determine what waters are jurisdictional and which permitting requirements may apply. You may call the Department's Water Protection Program, Operating Permits Section at 573-522-4502 for more information. See <https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/section-401-water-quality> for more information.

10. All construction must adhere to applicable 10 CSR 20-8 (Chapter 8) requirements listed below.

- Flood protection shall apply to new construction and to existing facilities undergoing major modification. The wastewater facility structures, electrical equipment, and mechanical equipment shall be protected from physical damage by not less than the one hundred- (100-) year flood elevation. 10 CSR 20-8.140 (2) (B)
- Unless another distance is determined by the Missouri Geological Survey or by the department's Public Drinking Water Branch, the minimum distance between wastewater treatment facilities and all potable water sources shall be at least three hundred feet (300'). 10 CSR 20-8.140 (2) (C) 1.
- No treatment unit with a capacity of twenty-two thousand five hundred gallons per day (22,500 gpd) or less shall be located closer than the minimum distance of 200' to a neighboring residence and 50' to property line for lagoons; and 50' to a neighboring residence for all other discharging facilities. See 10 CSR 20-2.010(68) for the definition of a residence. 10 CSR 20-8.140 (2) (C) 2
- Facilities shall be readily accessible by authorized personnel from a public right-of-way at all times. 10 CSR 20-8.140 (2) (D)
- The outfall shall be so constructed and protected against the effects of flood water, ice, or other hazards as to reasonably ensure its structural stability and freedom from stoppage. 10 CSR 20-8.140 (6) (A)
- All sampling points shall be designed so that a representative and discrete twenty-four (24) hour automatic composite sample or grab sample of the effluent discharge can be obtained at a point after the final treatment process and before discharge to or mixing with the receiving waters. 10 CSR 20-8.140 (6) (B)
- All outfalls shall be posted with a permanent sign indicating the outfall number (i.e., Outfall #001). 10 CSR 20-8.140 (6) (C)
- All wastewater treatment facilities shall be provided with an alternate source of electric power or pumping capability to allow continuity of operation during power failures. 10 CSR 20-8.140 (7) (A) 1.
- Disinfection and dechlorination, when used, shall be provided during all power outages. 10 CSR 20-8.140 (7) (A) 2.
- Electrical systems and components in raw wastewater or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors that are normally present, shall comply with the NFPA 70 National Electric Code (NEC) (2017 Edition), as approved and published August 24, 2016, requirements for Class I, Division 1, Group D locations. 10 CSR 20-8.140 (7) (B)
- An audiovisual alarm or a more advanced alert system, with a self-contained power supply, capable of monitoring the condition of equipment whose failure could result in a violation of the operating permit, shall be provided for all wastewater treatment facilities. 10 CSR 20-8.140 (7) (C)
- No piping or other connections shall exist in any part of the wastewater treatment facility that might cause the contamination of a potable water supply. 10 CSR 20-8.140 (7) (D) 1.
- Hot water for any direct connections shall not be taken directly from a boiler used for supplying hot water to a digester heating unit or heat exchanger. 10 CSR 20-8.140 (7) (D) 2.

- Where a potable water supply is to be used for any purpose in a wastewater treatment facility other than direct connections, a break tank, pressure pump, and pressure tank or a reduced pressure backflow preventer consistent with the department's Public Drinking Water Branch shall be provided. 10 CSR 20-8.140 (7) (D) 3. A.
- For indirect connections, a sign shall be permanently posted at every hose bib, faucet, hydrant, or sill cock located on the water system beyond the break tank or backflow preventer to indicate that the water is not safe for drinking. 10 CSR 20-8.140 (7) (D) 3. B.
- Where a separate non-potable water supply is to be provided, a break tank will not be necessary, but all system outlets shall be posted with a permanent sign indicating the water is not safe for drinking. 10 CSR 20-8.140 (7) (D) 4.
- A means of flow measurement shall be provided at all wastewater treatment facilities. 10 CSR 20-8.140 (7) (E)
- Effluent twenty-four (24) hour composite automatic sampling equipment shall be provided at all mechanical wastewater treatment facilities and at other facilities where necessary under provisions of the operating permit. 10 CSR 20-8.140 (7) (F)
- Adequate provisions shall be made to effectively protect facility personnel and visitors from hazards. The following shall be provided to fulfill the particular needs of each wastewater treatment facility:
  - Fencing. Enclose the facility site with a fence designed to discourage the entrance of unauthorized persons and animals; 10 CSR 20-8.140 (8) (A)
  - Gratings over appropriate areas of treatment units where access for maintenance is necessary; 10 CSR 20-8.140 (8) (B)
  - First aid equipment; 10 CSR 20-8.140 (8) (C)
  - Posted "No Smoking" signs in hazardous areas; 10 CSR 20-8.140 (8) (D)
  - Appropriate personal protective equipment (PPE); 10 CSR 20-8.140 (8) (E)
  - Portable blower and hose sufficient to ventilate accessed confined spaces; 10 CSR 20-8.140 (8) (F)
  - 10 CSR 20-8.140 (8) (G) Portable lighting equipment complying with NEC requirements. See subsection (7)(B) of this rule;
  - 10 CSR 20-8.140 (8) (H) Gas detectors listed and labeled for use in NEC Class I, Division 1, Group D locations. See subsection (7)(B) of this rule;
  - Appropriately-placed warning signs for slippery areas, non-potable water fixtures (see subparagraph (7)(D)3.B. of this rule), low head clearance areas, open service manholes, hazardous chemical storage areas, flammable fuel storage areas, high noise areas, etc.; 10 CSR 20-8.140 (8) (I)
  - Explosion-proof electrical equipment, non-sparking tools, gas detectors, and similar devices, in work areas where hazardous conditions may exist, such as digester vaults and other locations where potentially explosive atmospheres of flammable gas or vapor with air may accumulate. 10 CSR 20-8.140 (8) (K)
  - Provisions for local lockout/tagout on stop motor controls and other devices; 10 CSR 20-8.140 (8) (L)
  - Provisions for an arc flash hazard analysis and determination of the flash protection boundary distance and type of PPE to reduce exposure to major electrical hazards shall be in accordance with NFPA 70E Standard for Electrical Safety in the Workplace (2018 Edition), as approved and published August 21, 2017. 10 CSR 20-8.140 (8) (M)

- Effective flow splitting devices and control appurtenances (e.g. gates and splitter boxes) shall be provided to permit proper proportioning of flow and solids loading to each settling unit, throughout the expected range of flows. 10 CSR 20-8.160 (2) (B)
- Overflow weirs shall be readily adjustable over the life of the structure to correct for differential settlement of the tank. 10 CSR 20-8.160 (3) (C) 1.
- Walls of settling tanks shall extend at least six inches (6") above the surrounding ground surface and shall provide not less than twelve inches (12") of freeboard. 10 CSR 20-8.160 (3) (E)
- Safety features shall appropriately include machinery covers, life lines, handrails on all stairways and walkways, and slip resistant surfaces. For additional safety follow the provisions listed in 10 CSR 20-8.140(8). 10 CSR 20-8.160 (5) (A)
- The design shall provide for convenient and safe access to routine maintenance items such as gear boxes, scum removal mechanism, baffles, weirs, inlet stilling baffle areas, and effluent channels. 10 CSR 20-8.160 (5) (B)
- For electrical equipment, fixtures, and controls in enclosed settling basins and scum tanks, where hazardous concentrations of flammable gases or vapors may accumulate, follow the provisions in 10 CSR 20-8.140(7)(B). The fixtures and controls shall be conveniently located and safely accessible for operation and maintenance. 10 CSR 20-8.160 (5) (C)
- Emergency Power. Disinfection and dechlorination processes, when used, shall be provided during all power outages. 10 CSR 20-8.190 (2) (A)
- The UV dosage shall be based on the design peak hourly flow, maximum rate of pumpage, or peak batch flow. 10 CSR 20-8.190 (5) (A) 1.
- If no flow equalization is provided for a batch discharger, the UV dosage shall be based on the peak batch flow. 10 CSR 20-8.190 (5) (A) 2.
- The UV system shall deliver the target dosage based on equipment derating factors and, if needed, have the UV equipment manufacturer verify that the scale up or scale down factor utilized in the design is appropriate for the specific application under consideration. 10 CSR 20-8.190 (5) (A) 3.
- The UV system shall deliver a minimum UV dosage of thirty thousand microwatt seconds per centimeters squared ( $30,000 \mu\text{W} \cdot \text{s}/\text{cm}^2$ ). 10 CSR 20-8.190 (5) (A) 4.
- The UV system must continuously monitor and display at the UV system control panel the following minimum conditions:
  - The relative intensity of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.A.
  - The operational status and condition of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.B.
  - The ON/OFF status of each lamp in the system; 10 CSR 20-8.190(5)(C)1.C. and
  - The total number of operating hours of each bank or each closed vessel system. 10 CSR 20-8.190(5)(C)1.D.
- The UV system shall include an alarm system. Alarm systems shall comply with 10 CSR 20-8.140(7)(C). 10 CSR 20-8.190 (5) (C) 2.

11. Upon completion of construction:

- A. Confluence Rivers Utility Operating Company will become the continuing authority for operation and maintenance of these facilities;

- B. Submit an electronic copy of the as built if the project was not constructed in accordance with previously submitted plans and specifications; and
- C. Submit the enclosed form Statement of Work Completed to the Department in accordance with 10 CSR 20-6.010(5)(N), with a request to issue the operating permit modification. The facility has paid for their modification

**IV. REVIEW SUMMARY**

**1. CONSTRUCTION PURPOSE**

Construction is to get the facility back into compliance and to meet final effluent limits for ammonia and *E. Coli*.

**2. FACILITY DESCRIPTION**

The Freeman Hills WWTF is located at 0.2 miles northwest of County Roads 373 and 314, outside Mexico, in Audrain County, Missouri. The facility has a design average flow of 7,700 gpd and serves a hydraulic population equivalent of approximately 77 people. The existing system is a 3 cell lagoon system with sludge retained in the lagoon. Construction will add a MBBR after Cell #3, a clarifier, and UV disinfection.

**3. COMPLIANCE PARAMETERS**

The proposed project is required to meet final effluent limits listed below, including the ammonia and *E. Coli* effluent limits established in Operating Permit MO-0033901. The limits following the completion of construction will be applicable to the facility:

EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS		
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE
Flow	MGD	*		*
Biochemical Oxygen Demand <sub>5</sub>	mg/L		45	30
Total Suspended Solids	mg/L		45	30
<i>E. coli</i> (Note 1)	#/100mL	1,030		206
Ammonia as N (Jan 1 – Mar 31)	mg/L	10.1		2.7
Ammonia as N (Apr 1 – Jun 30)	mg/L	12.1		1.8
Ammonia as N (Jul 1 – Sep 30)	mg/L	12.1		1.3
Ammonia as N (Oct 1 – Dec 31)	mg/L	12.1		3.1
<i>EFFLUENT PARAMETER(S)</i>	<b>UNITS</b>	<b>MINIMUM</b>		<b>MAXIMUM</b>
pH – Units***	SU	6.5		9.0

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

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

- The 3 cell lagoon has approximately 24 days of detention time at design average flow of 7,700 gpd. Flow is transferred between cells through 8 inch pipes.
  - Lagoon Cell No. 1 – The influent flows by gravity into Lagoon Cell No.1. Lagoon Cell No. 1 has a surface area of 0.39 acres with 2 ft of freeboard and a clay liner. Cell No. 1 has approximately 16 days of detention time.
  - Lagoon Cell No. 2 –Lagoon Cell No. 2 is non-aerated and has a surface area of 0.11 acres with a clay liner.
  - Lagoon Cell No. 3 –Lagoon Cell No. 3 is non-aerated and has a surface area of 0.07 acres, with 2 feet of freeboard and a clay liner.
  - Sludge will be retained in the lagoon.

**Construction will cover the following items:**

- Lagoon Cell No. 1 Aeration Unit- A partial mix aeration will be provided. Aeration by means of one tri-lobe or bi-lobe positive displacement type blowers capable of supplying 33 scfm.
- 6 inch PVC pipe from Lagoon Cell No. 3 to the MBBR.
- Moving Bed Biofilm Reactor (MBBR) –The lagoon treated effluent will flow by gravity to the MBBR capable of treating a design average flow of 7,700 gpd and a peak flow of 15,400 gpd.
  - The MBBR is approximately 5 ft diameter and 9 ft deep with a sidewater depth of 7 ft for a volume of approximately 1,028 gallons.
  - The hydraulic retention time at design flow is 3.2 hours and 1.6 hours at the peak flow of 15,400 gpd.
  - The MBBR will be filled with high surface area media. The proposal is to place 1,695 m<sup>2</sup> (18,244 ft<sup>2</sup>) of media, which exceeds the calculated 1,672 m<sup>2</sup> (17,997 ft<sup>2</sup>) required for treatment
    - Each media piece shall be 0.80” diameter, 0.25”-1” long and total surface area of 152 ft<sup>2</sup>/ft<sup>3</sup>.
    - The media shall have a specific gravity of 0.93 to 1.05 to allow it to float freely in the water column where the bacteria can gain access to food and oxygen.
    - The reactor tank shall be filled with 65% media.
  - Aeration by means of one tri-lobe or bi-lobe positive displacement type blower capable of supplying 33 scfm, which is more than the 29 scfm required for the MBBR tank’s aeration grid with medium bubble aeration grid.
  - The effluent from the MBBR will flow by gravity to the clarifier system through a screened 6 inch ductile iron pipe.
  - A portion of flows will be recycled back to lagoon cell #1 through a screened 6 inch ductile iron pipe.
- Secondary Hopper Style Clarifier- The hopper type clarifier will have a surface area of 28.3 square feet.
  - The clarifier has the dimensions of 6 ft diameter by 12 ft with a sidewater depth of 10 feet.
    - The detention capacity of the hopper, using only the top third (by height) is 1406 gallons.



- The hydraulic retention time at design average flow is 4.38 hours and at peak flow is 2.19 hours.
- The overflow rate at peak flow is 544 gpd/ft<sup>2</sup>, meeting the requirements of 10 CSR 20-8.160(3)(B)2, which is 1,200 gpd/ ft<sup>2</sup>. At design average flow, the surface overflow rate is 272 gpd/ft<sup>2</sup>.
- The weir is 4 ft with a loading rate of 962 gpd at peak hourly flow (3850 gph) which meets the requirements of 10 CSR 20-8.160(3)(C)2 of being less than 10,000 gpd/ft<sup>2</sup>.
- Scum is returned back to lagoon cell #1 through a 2 inch return line.
- Disinfection – Disinfection is the process of removal, deactivation, or killing of pathogenic microorganisms.
  - The gravity flow, Sanitron Model S2400C or engineer approved equal UV disinfection system, capable of treating a peak flow of 57,600 gpd while delivering a minimum UV intensity of 30 mJ/cm<sup>2</sup>
  - The single channel UV system consists of a minum of 1 lamp. The disinfected effluent will flow by gravity through flow measurement equipment and to Outfall No. 001.
- Flow Measurement – Installation of accurate flow measurement devices will give the treatment facility a means of improved data analysis.
  - V-notch Weir –A v-notch weir with a 45degree notch. This measurement device does not include flow totalizing or recording.

## **5. OPERATING PERMIT**

Operating permit MO-0033901 will require a modification to reflect the construction activities. The modified Freeman Hills WWTF was successfully public noticed from December 17, 2021 to January 18, 2022 with no comments received. Submit the Statement of Work Completed to the Department in accordance with 10 CSR 20-6.010(5)(N) and request the operating permit modification be issued. The facility needs to pay \$75 for their operating permit modification.

## **V. NOTICE OF RIGHT TO APPEAL**

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to 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. Any appeal should be directed to:

Administrative Hearing Commission  
U.S. Post Office Building, Third Floor  
131 West High Street, P.O. Box 1557  
Jefferson City, MO 65102-1557  
Phone: 573-751-2422  
Fax: 573-751-5018  
Website: <https://ahc.mo.gov>

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**APPENDIX -PROCESS FLOW DIAGRAM**

