

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin
Director

May 21, 2024

Jon Holmes
City Manager
City of Aurora
2 West Pleasant
Aurora, MO 65605-1614

RE: C295873-01 City of Aurora, Missouri
Aurora Wastewater Treatment Facility Improvements, MO-0036757,
Construction Permit No. CP0002381, Lawrence County

Dear Jon Holmes:

The Missouri Department of Natural Resources' Financial Assistance Center has reviewed and approved the plans and specifications sealed on August 23, 2023, and submitted on August 25, 2023, by Allgeier, Martin & Associates, Inc. for the City of Aurora. Please find enclosed Construction Permit No. CP0002381. You must maintain these documents 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 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/.



Jon Holmes
May 21, 2024
Page 2

Please direct any technical questions regarding the construction permit, or plans and specifications to Angie Garcia, E.I., Technical Reviewer, at 573-751-1299 or angie.garcia@dnr.mo.gov. Please direct funding questions to Heather Rosenberg, Project Manager, at 573-526-0828 or heather.rosenberg@dnr.mo.gov. You may also submit questions or comments in writing to the Department of Natural Resources, Financial Assistance Center, P.O. Box 176, Jefferson City, MO 65102-0176 or fac@dnr.mo.gov. Thank you.

Sincerely,

FINANCIAL ASSISTANCE CENTER



Ginny Bretzke, P.E.
Clean Water Engineering Unit Chief

GB:agc

c: Robert D. Sell, P.E., Allgeier, Martin & Associates, Inc.
Southwest Regional Office
Angie Garcia, E.I., Department of Natural Resources, Financial Assistance Center
Heather Rosenberg, Department of Natural Resources, Financial Assistance Center

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION



CONSTRUCTION PERMIT

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

City of Aurora
2 West Pleasant
Aurora, MO 65605-1614

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 21, 2024
Effective Date

May 20, 2026
Expiration Date


John Hoke, Director, Water Protection Program

CONSTRUCTION PERMIT

I. CONSTRUCTION DESCRIPTION

The proposed upgrades include retrofitting the current filter system in the West Filter Building; replacing the existing traveling bridge sand filters with a new Aqua Diamond filtration system; increasing the sidewall depth of the existing sludge storage tanks by 4.5 feet and installing decanting/mixing equipment; constructing an additional 44-foot diameter sludge tank; modifying weir and channel structures at the west UV disinfection system; and various electrical improvements throughout the plant. A potential alternative construction item is the renovation of the existing building housing the east filter that is being taken out-of-service, so the building can be used for storage purposes. 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 required to determine a cost analysis for compliance because the permit requires compliance with new influent monitoring requirements for BOD₅, TSS, Total Kjeldahl Nitrogen, Nitrate + Nitrite, and Total Phosphorus. See Appendix 1.

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 & Associates, Inc. on August 25, 2023, and signed and sealed by Robert D. Sell, P.E. and Jared C. Nichols, P.E. on August 23, 2023, and approved by the department on May 21, 2024.

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 electronic Sanitary Sewer Overflow/Bypass Reporting system at <https://dnr.mo.gov/mogem/> or 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 <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.
8. A United States Army Corps of Engineers (USACE) Section 404 Department of Army permit (§404) along with the department's Section 401 Water Quality Certification or waiver (§401) 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 likely be required. Since the USACE makes determinations on what is jurisdictional, you must contact the USACE to determine permitting requirements. See <https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/section-401-water-quality> for more information or you may contact the department's Water Protection Program at 573-522-4502 or wpsc401cert@dnr.mo.gov.
9. Upon completion of construction:
 - A. The City of Aurora will become the continuing authority for operation and maintenance of these facilities;

- B. Submit an electronic copy of the as-builts if the project was not constructed in accordance with previously submitted plans and specifications;
- C. Submit the enclosed Statement of Work Completed form to the department in accordance with 10 CSR 20-6.010(5)(N) and request the operating permit modification be issued. 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

The project includes modifications to the wastewater treatment facility (WWTF) to help mitigate issues related to peak flows, loss of the sludge blanket in the clarifiers, and clogging of the filtration system.

2. FACILITY DESCRIPTION

The existing WWTF provides biological treatment using an oxidation ditch. The proposed upgrades include retrofitting the current filtration system, renovating the sludge storage tanks, constructing a new sludge tank, and modifications to the west UV channel and weir structures.

The Aurora WWTF is located 0.20 miles west of the MO-265 and S. Carnation Drive intersection, Aurora, Missouri, in Lawrence County. The facility has a design average flow of 2 million gallons per day (MGD) and serves a population equivalent of approximately 20,000 people.

3. REVIEW OF MAJOR TREATMENT DESIGN CRITERIA

Existing Components:

The existing treatment plant includes influent pump station, mechanical screen, oxidation ditch, four clarifiers, two traveling bridge sand filters, peak flow basin, and UV disinfection. Solids handling includes two aerobic digesters, sludge holding basin with sludge retained in the holding basin until land applied.

New Components:

- Sludge Holding Basins
 - Construction of one sludge holding basin with a 45-ft diameter, 11.5-ft sidewater depth, and volume of 113,000 gallons. Installation of mixer will provide mixing of the sludge to prevent anaerobic conditions. The sludge will be received from the secondary clarifiers.

- Each of the two existing sludge holding basins have a 45-ft diameter and will be modified by raising the walls to make them 11.5 ft deep and add 4 mixers in each. This additional wall height would provide approximately 113,000 gallons of usable storage per tank.
- Aqua Diamond Filtration System – Each of the Aqua Diamond media retrofit filter units consists of eight 30-ft long diamond-shaped plenums of cloth media providing a total area of 960 ft² with a total area of 1,920 ft². Each filter is specified to treat an average flow rate of 1.5 MGD (3.0 MGD total) and a peak flow rate of 8 MGD (16 MGD total). The yielding flux rates will be 1.08 gpm/ft² and 5.79 gpm/ft² respectively. As is standard with this filter and the traveling bridge filter it replaces, each filter will be equipped with a single backwash pump. Backwash of the Aqua Diamond filter unit is based upon vacuum instead of pressure. Each basin unit will have one backwash filter. The flow from the Aqua Diamond filtration system then enters the west UV disinfection structure.
- Other additions to the treatment process consist of modifications to the west UV structure, various electrical improvements throughout the plant, and the renovation of the existing east filter building for storage purposes.

4. OPERATING PERMIT

Operating Permit No. MO-0036757 will require a modification to reflect the construction activities. The modified Aurora WWTF, MO-0036757, was successfully public noticed from March 1, 2024, to April 1, 2024, with no comments received. At construction completion, 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.

Angie Garcia, E.I.
Financial Assistance Center
Angie.Garcia@dnr.mo.gov

APPENDICES:

- 1. COST ANALYSIS FOR COMPLIANCE**
- 2. PROCESS FLOW DIAGRAM**
- 3. SUMMARY OF DESIGN**

APPENDIX 1
COST ANALYSIS FOR COMPLIANCE

**Missouri Department of Natural Resources
Water Protection Program
Cost Analysis for Compliance
(In accordance with § 644.145, RSMo.)**

**Aurora Wastewater Treatment Facility, Operating Permit Modification
City of Aurora
Missouri State Operating Permit No. MO-0036757**

Section 644.145, RSMo. requires the Department of Natural Resources (department) to make a “finding of affordability” when “issuing permits under” or “enforcing provisions of” state or federal clean water laws “pertaining to any portion of a combined or separate sanitary sewer system for publicly-owned treatment works.” This cost analysis does not dictate how the permittee will comply with new permit requirements.

New Permit Requirements

The permit requires compliance with new influent monitoring requirements for BOD₅, TSS, Total Kjeldahl Nitrogen, Nitrate + Nitrite, and Total Phosphorus.

Connections

The number of connections was reported by the permittee on the Financial Questionnaire.

Connection Type	Number
Residential	3207
Commercial	353
Industrial	1
Total	3,561

Data Collection for this Analysis

This cost analysis is based on data available to the department as provided by the permittee and data obtained from readily available sources. For the most accurate analysis, it is essential that the permittee provides the department with current information about their financial and socioeconomic situation. The financial questionnaire available on the department’s website (<https://dnr.mo.gov/document-search/financial-questionnaire-mo-780-2511>) is a required attachment to the permit renewal application. If the financial questionnaire is not submitted with the renewal application, the department sends a request to complete the form with the welcome correspondence. If certain data was not provided by the permittee to the department and the data is not obtainable through readily available sources, this analysis will state that the information is “unknown”.

Eight Criteria of §644.145, RSMo.

The department must consider the 8 criteria presented in Section 644.145, RSMo. to evaluate the cost associated with new permit requirements.

(1) A community’s financial capability and ability to raise or secure necessary funding

Criterion 1 Table. Current Financial Information for the City of Aurora	
Current Monthly User Rates per 5,000 gallons*	\$44.90
Median Household Income (MHI) ¹	\$42,274
Current Annual Operating Costs (excludes depreciation)	\$1,110,844

*User Rates were reported by the permittee on the Financial Questionnaire.

(2) Affordability of pollution control options for the individuals or households at or below the median household income level of the community

The following tables outline the estimated costs of the new permit requirements:

Criterion 2A Table. Estimated Cost Breakdown of New Permit Requirements			
New Requirement	Frequency	Estimated Cost	Estimated Annual Cost
Biochemical Oxygen Demands – Influent	Monthly	\$41	\$492
Total Suspended Solids – Influent	Monthly	\$16	\$192
Total Phosphorus – Influent	Monthly	\$24	\$288
Total Kjeldahl Nitrogen – Influent	Monthly	\$33	\$396
Nitrate + Nitrite – Influent	Monthly	\$40	\$480
Ammonia – Influent	Monthly	\$20	\$240
Total Estimated Annual Cost of New Permit Requirements			\$2,088

Criterion 2B Table. Estimated Costs for New Permit Requirements		
(1)	Estimated Annual Cost	\$2,088
(2)	Estimated Monthly User Cost for New Requirements ²	\$0.05
	Estimated Monthly User Cost for New Requirements as a Percent of MHI ³	0.0014%
(3)	Total Monthly User Cost*	\$44.95
	Total Monthly User Cost as a Percent of MHI ⁴	1.276%

* Current User Rate + Estimated Monthly Costs of New Sampling Requirements

(3) An evaluation of the overall costs and environmental benefits of the control technologies

This analysis is being conducted based on new requirements in the permit, which will not require the addition of new control technologies at the facility. However, the new sampling requirements are being established in order to provide data regarding the health of the receiving stream’s aquatic life and to ensure that the existing permit limits are providing adequate protection of aquatic life. Improved wastewater provides benefits such as avoided health costs due to water-related illness, enhanced environmental ecosystem quality, and improved natural resources. The preservation of natural resources has been proven to increase the economic value and sustainability of the surrounding communities. Maintaining Missouri’s water quality standards fulfills the goal of restoring and maintaining the chemical, physical, and biological integrity of the receiving stream; and, where attainable, it achieves a level of water quality that provides for the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water.

(4) Inclusion of ongoing costs of operating and maintaining the existing wastewater collection and treatment system, including payments on outstanding debts for wastewater collection and treatment systems when calculating projected rates

The community has reported that they have no outstanding debt for the current wastewater collection and treatment systems.

(5) An inclusion of ways to reduce economic impacts on distressed populations in the community, including but not limited to low and fixed income populations. This requirement includes but is not limited to

- (a) Allowing adequate time in implementation schedules to mitigate potential adverse impacts on distressed populations resulting from the costs of the improvements and taking into consideration local community economic considerations.**
- (b) Allowing for reasonable accommodations for regulated entities when inflexible standards and fines would impose a disproportionate financial hardship in light of the environmental benefits to be gained.**

The following table characterizes the current overall socioeconomic condition of the community as compared to the overall socioeconomic condition of Missouri. The following information was compiled using the latest U.S. Census data.

Criterion 5 Table. Socioeconomic Data ^{1, 5-9} for the City of Aurora

Administrative Unit	Aurora City	Missouri State	United States
Population (2021)	7,268	6,141,534	329,725,481
Percent Change in Population (2000-2021)	3.6%	9.8%	17.2%
2021 Per Capita Income (in 2022 Dollars)	\$23,289	\$36,473	\$40,650
2021 Median Household Income (in 2022 Dollars)	\$42,274	\$65,928	\$74,545
Percent Change in Median Household Income (2000-2021)	-4.2%	-1.1%	1.1%
Median Age (2021)	39.8	38.8	38.4
Change in Median Age in Years (2000-2021)	3.7	2.7	3.1
Unemployment Rate (2021)	12.3%	4.5%	5.5%
Unemployment Rate (2020-2021)	13.5%	4.5%	5.5%
Percent of Population Below Poverty Level (2021)	17.3%	12.8%	12.6%
Percent of Household Received Food Stamps (2021)	18.9%	10.1%	11.4%

(6) An assessment of other community investments and operating costs relating to environmental improvements and public health protection

There will be \$4,016,000 improvements going toward the wastewater treatment plant. Construction is estimated to start in spring 2024.

(7) An assessment of factors set forth in the United States Environmental Protection Agency's guidance, including but not limited to the "Combined Sewer Overflow Guidance for Financial Capability Assessment and Schedule Development" that may ease the cost burdens of implementing wet weather control plans, including but not limited to small system considerations, the attainability of water quality standards, and the development of wet weather standards

The new requirements associated with this permit will not impose a financial burden on the community, nor will they require the City of Aurora to seek funding from an outside source.

(8) An assessment of any other relevant local community economic conditions

The community did not report any other relevant local economic conditions.

The department contracted with Wichita State University to complete an assessment tool that would allow for predictions on rural Missouri community populations and future sustainability. The purpose of the study is to use a statistical modeling analysis in order to determine factors associated with each rural Missouri community that would predict the future population changes that could occur in each community. A stepwise regression model was applied to 19 factors which were determined as predictors of rural population change in Missouri. The model established a

hierarchy of the predicting factors which allowed the model to place a weighted value on each of the factors. A total of 745 rural towns and villages in Missouri received a weighted value for each of the predicting factors. The weighted values for each town/village were then added together to determine an overall decision score. The overall decision scores were then divided into five categories and each town was assigned to a different categorical group based on the overall decision score. The categorical groups were developed from the range of overall scores across all rural towns and villages within Missouri.

Based on the assessment tool, the City of Aurora has been determined to be a category 5 community. This means that the City of Aurora is predicted to be stable over time.

Conclusion and Finding

As a result of new regulations, the department is proposing modifications to the current operating permit that may require the permittee to increase monitoring. The department has considered the 8 criteria presented in Section 644.145, RSMo. To evaluate the cost associated with the new permit requirements. This analysis examined whether the new sampling requirements affect the ability of an individual customer or household to pay a utility bill without undue hardship or unreasonable sacrifice in the essential lifestyle or spending patterns of the individual or household.

After reviewing the above criteria, the department finds that the new sampling requirements may result in a low burden with regard to the community's overall financial capability and a low financial impact for most individual customers/households; therefore, the new permit requirements are affordable.

References

- (A) 2021 MHI in 2021 Dollar: United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, Table B19013: Median Household Income in the Past 12 Months (in 2021 Inflation-Adjusted Dollars). <https://data.census.gov/cedsci/table?q=B19013&tid=ACSDT5Y2021.B19013>.

(B) 2000 MHI in 1999 Dollar: (1) For United States, United States Census Bureau (2003) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-2-1 Part 1. United States Summary, Table 5. Work Status and Income in 1999: 2000, Washington, DC. <https://www.census.gov/content/dam/Census/library/publications/2003/dec/phc-2-1-pt1.pdf>.

(2) For Missouri State, United States Census Bureau (2003) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-2-27, Missouri, Table 10. Work Status and Income in 1999: 2000, Washington, DC. <https://www.census.gov/content/dam/Census/library/publications/2003/dec/phc-2-1-pt1.pdf>.

(C) 2022 CPI, 2021 CPI and 1999 CPI: U.S. Department of Labor Bureau of Labor Statistics (2022) Consumer Price Index - All Urban Consumers, U.S. City Average. All Items. 1982-84=100 (unadjusted) - CUUR0000SAO. <https://data.bls.gov/cgi-bin/surveymost?bls>.

(D) 2021 MHI in 2022 Dollar = 2021 MHI in 2021 Dollar x 2022 CPI / 2021 CPI; 2000 MHI in 2021 Dollar = 2000 MHI in 1999 Dollar x 2022 CPI / 1999 CPI.

(E) Percent Change in Median Household Income (2000-2021) = (2021 MHI in 2022 Dollar - 2000 MHI in 2022 Dollar) / (2000 MHI in 2022 Dollar).
2. $(\$2,088/3,561)/12 = \0.05 (Estimated Monthly User Cost for New Requirements)
3. $(\$0.05/(\$42,274/12))100\% = 0.0014\%$ (New Sampling Only)
4. $(\$44.95/(\$42,274/12))100\% = 1.276\%$ (Total User Cost)
- (A) Total Population in 2021: United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, Table B01003: Total Population - Universe: Total Population. <https://data.census.gov/cedsci/table?q=B01003&tid=ACSDT5Y2021.B01003>.

(B) For United States, United States Census Bureau (2002) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-1-1 Part 1. United States Summary, Table 1. Age and Sex: 2000, Washington, DC. <https://www.census.gov/content/dam/Census/library/publications/2003/dec/phc-2-1-pt1.pdf>.

(2) For Missouri State, United States Census Bureau (2002) 2000 Census of Population and Housing, Summary Population and Housing Characteristics, PHC-1-27, Missouri, Table 2. Age and Sex: 2000, Washington, DC. <https://www2.census.gov/library/publications/2003/dec/phc-2-1-pt2.pdf>.

(C) Percent Change in Population (2000-2021) = (Total Population in 2021 - Total Population in 2000) / (Total Population in 2000).
6. Median Age in 2021: United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, Table B01002: Median Age by Sex - Universe: Total population. <https://data.census.gov/cedsci/table?q=B01002&tid=ACSDT5Y2021.B01002>.

(B) For United States, United States Census Bureau (2002) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-1-1 Part 1. United States Summary, Table 1. Age and Sex: 2000, Washington, DC., Page 2. <https://www.census.gov/content/dam/Census/library/publications/2003/dec/phc-2-1-pt1.pdf>.

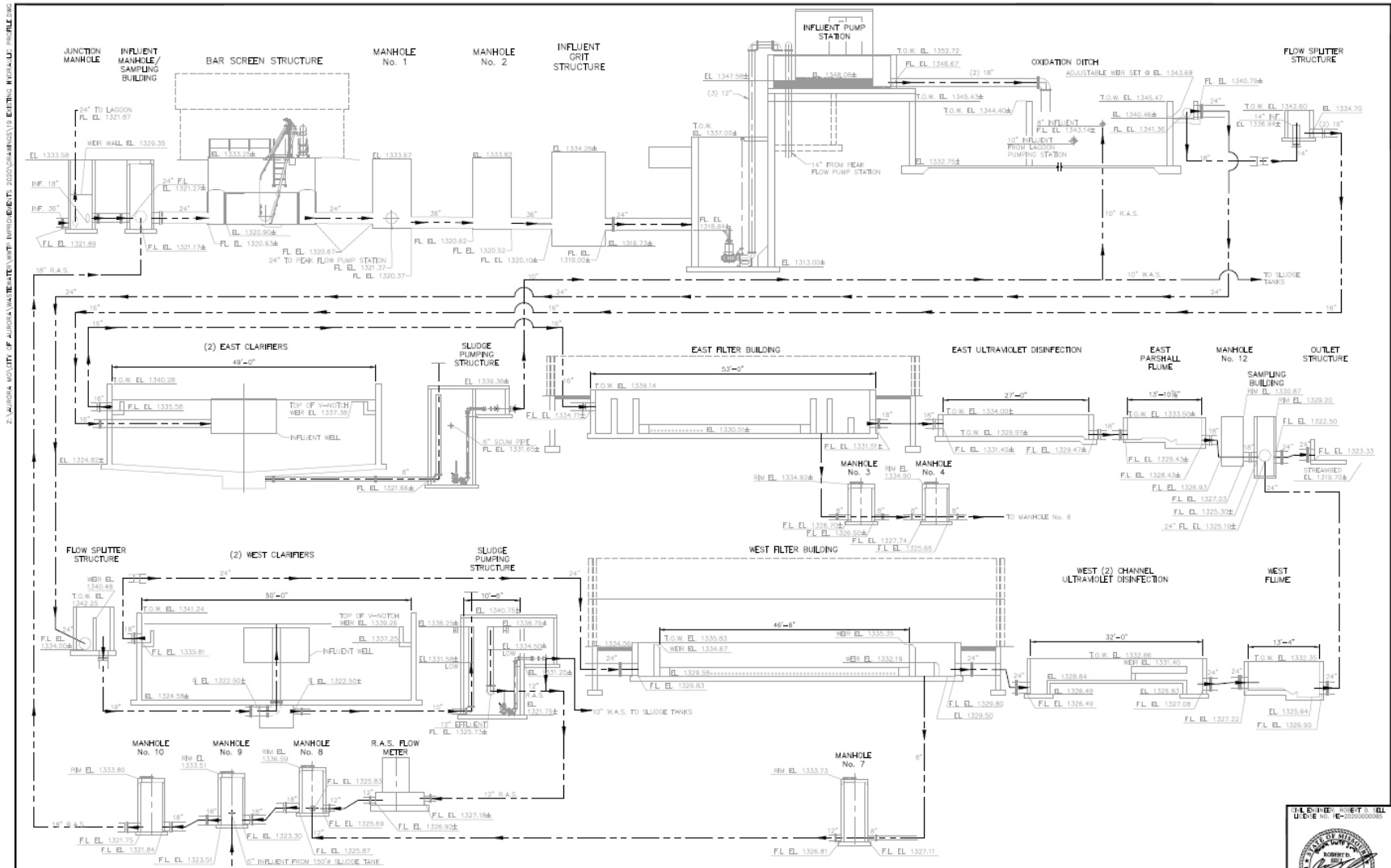
(2) For Missouri State, United States Census Bureau (2002) 2000 Census of Population and Housing, Summary Population and Housing Characteristics, PHC-1-27, Missouri, Table 2. Age and Sex: 2000, Washington, DC., Pages 64-92. <https://www2.census.gov/library/publications/2003/dec/phc-2-1-pt2.pdf>.

(C) Change in Median Age in Years (2000-2021) = (Median Age in 2021 - Median Age in 2000).

7. United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, S2301: Employment Status for the Population 16 Years and Over - Universe: Population 16 years and Over. <https://data.census.gov/cedsci/table?q=unemployment&tid=ACSST5Y2021.S2301>.
8. United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, Table S1701: Poverty Status in the Past 12 Months. <https://data.census.gov/cedsci/table?q=S1701&tid=ACSST5Y2021.S1701>.
9. United States Census Bureau. 2017-2021 American Community Survey 5-Year Estimates, Table S2201: Food Stamps/Supplemental Nutrition Assistance Program (SNAP) - Universe: Households. <https://data.census.gov/cedsci/table?q=S2201&tid=ACSST5Y2021.S2201>.

APPENDIX 2

PROCESS FLOW DIAGRAM

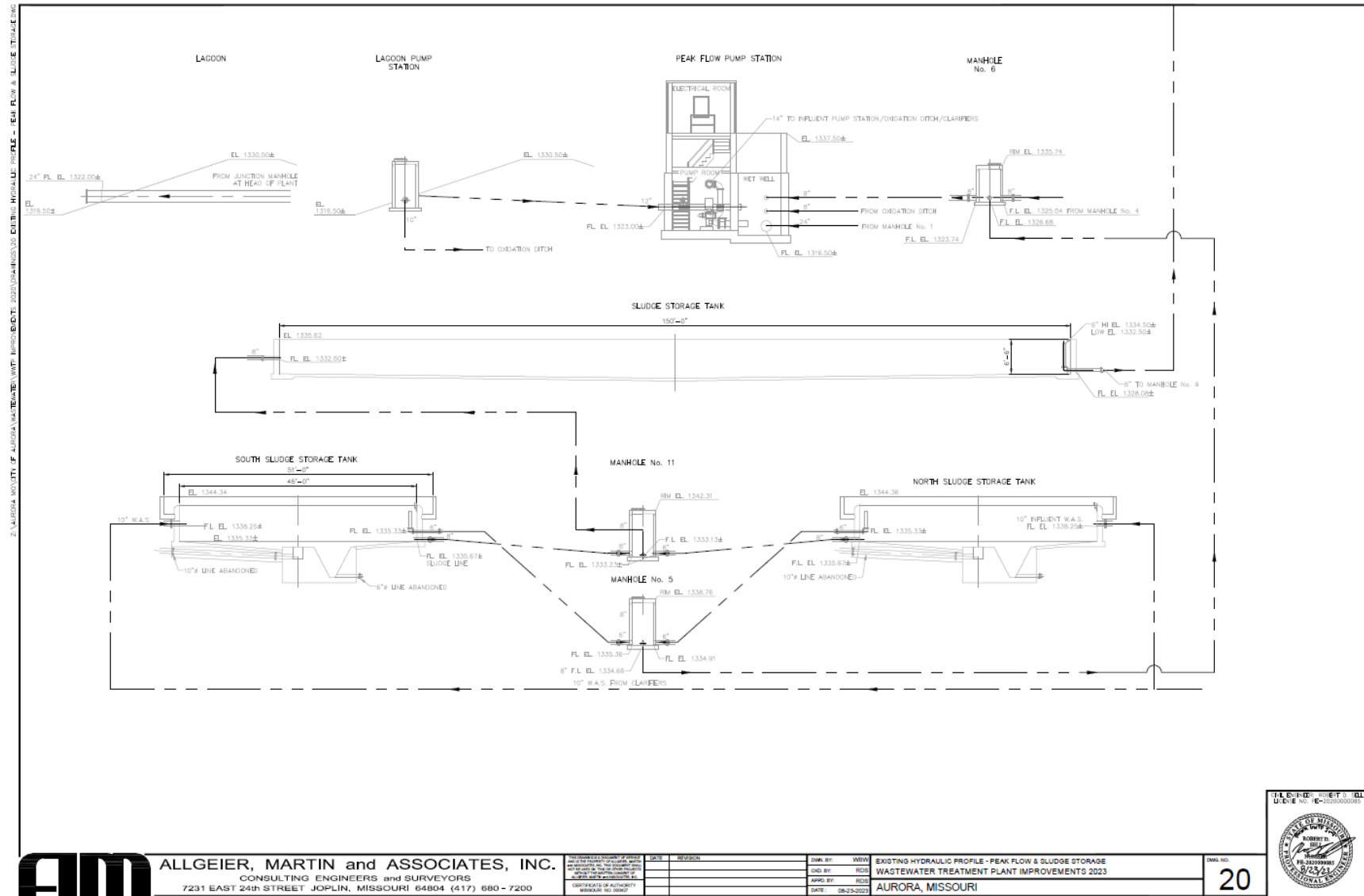


AM ALLGEIER, MARTIN and ASSOCIATES, INC.
 CONSULTING ENGINEERS and SURVEYORS
 7231 EAST 24th STREET JOPLIN, MISSOURI 64804 (417) 680 - 7200

DATE	REVISION

DWG. NO. 19
 DATE: 08-23-2021
 EXISTING HYDRAULIC PROFILE
 WASTEWATER TREATMENT PLANT IMPROVEMENTS 2023
 AURORA, MISSOURI



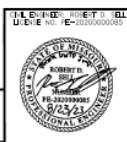


ALLGEIER, MARTIN and ASSOCIATES, INC.
 CONSULTING ENGINEERS and SURVEYORS
 7231 EAST 24th STREET JOPLIN, MISSOURI 64804 (417) 680-7200

DATE	REVISION

DESIGNED BY: WDW
 CHECKED BY: RDS
 APPROVED BY: RDS
 DATE: 08-25-2023

PROJECT NO. 20



FILED IN: SHEET 3 OF 3
 DATE: 8/23/23
 PROJECT NO. 20

APPENDIX 3

SUMMARY OF DESIGN

DESIGN SUMMARY WASTEWATER TREATMENT PLANT IMPROVEMENTS AURORA, MISSOURI

DESIGN FLOWS AND LOADS

Current (2023) Average Daily Flow	2.21 MGD
Current (2023) Peak Day Flow	10.45 MGD
Current (2023) Average BOD ₅	1,384 lbs/day
Current (2023) Average Total Suspended Solids	2,185 lbs/day
Current (2023) Average Total N	760 lbs/day
Current (2023) Average Ammonia-Nitrogen	463 lbs/day
Current (2023) Population Persons	7,432

Projected (2043) Average Daily Flow	3.05 MGD
Projected (2043) Peak Day Flow	14.41 MGD
Projected (2043) Average BOD ₅	1,739 lbs/day
Projected (2043) Average Total Suspended Solids	2,668 lbs/day
Projected (2043) Average Total N	880 lbs/day
Projected (2043) Average Ammonia-Nitrogen	536 lbs/day
Projected (2043) Population Persons	8,370

SLUDGE HANDLING IMPROVEMENTS

The proposed improvements to the sludge handling facilities involve increasing the overall available storage capacity. The existing 45' diameter tanks will have the walls raised to increase capacity. Additionally, a new tank of the same dimensions as the newly modified tanks will also be constructed. In addition to increasing capacity, new submersible mixers will be installed in all tanks to homogenize the sludge more effectively. This includes installing one mixer in each of the 45' diameter tanks and four mixers in the 150' diameter tank. The submersible mixers were sized per the manufacturer's recommendations. The proposed mixers can operate with only two feet of water depth which is ideal for the large tank considering how shallow it is. New decanting equipment will also be installed in the two 45' diameter tanks being modified that will match the equipment going in the new 45' diameter tank.

Current (2023) Sludge Production	880 lbs/day (10,500 gpd wasted at 1% solids initially)
Current (2023) Sludge Production	880 lbs/day (2,110 gpd dewatered to 5% solids)
Projected (2043) Sludge Production	1,020 lbs/day (12,200 gpd wasted at 1% solids initially)
Projected (2043) Sludge Production	1,020 lbs/day (2,450 gpd dewatered to 5% solids)

Current Sludge Storage:

- Two 45' Dia. x 7' Deep Tanks
 - 59,500 gallons usable storage each (119,000 gallons usable storage total)
 - Days Storage at Current Rates (At 5% Solids)— 28 Days each (56 Days Total)
 - Day Storage at Projected Rates (At 5% Solids)— 24 Days each (48 Days Total)
- One 150' Dia. x 7.125' Deep Tank

- 675,000 gallons of usable storage
- Days Storage at Current Rates (At 5% Solids)– 320 Days
- Days Storage at Projected Rates (At 5% Solids)– 276
- Days Total Sludge Storage
 - 794,000 gallons of usable storage
 - Days Storage at Current Rates (At 5% Solids)– 376 Days
 - Days Storage at Projected Rates (At 5% Solids)– 324 Days

Proposed Sludge Storage:

- Raise Walls on Two Existing 45' Dia. Tanks to Make them 11.5' Deep
 - 113,000 gallons usable storage each (226,000 gallons usable storage total)
 - Days Storage at Current Rates (At 5% Solids)– 53 Days each (106 Days Total)
 - Day Storage at Projected Rates (At 5% Solids)– 46 Days each (92 Days Total)
- Build One New 45' Dia. x 11.5' Deep Tank
 - 113,000 gallons of usable storage each
 - Days Storage at Current Rates (At 5% Solids)– 53 Days
 - Day Storage at Projected Rates (At 5% Solids)– 46 Days
- One 150' Dia. x 7.125' Deep Tank –Capacity Remains Unchanged
- Total Sludge Storage
 - 1,014,000 gallons of usable storage
 - Days Storage at Current Rates (At 5% Solids)– 480 Days
 - Days Storage at Projected Rates (At 5% Solids)– 414 Days

FILTER IMPROVEMENTS

The existing filtration facilities include four independent traveling bridge-type granular media filters separated into two different buildings (the East Filter Building and the West Filter Building) that operate in parallel. The East Filter Building contains two of the granular media filter units that are 9' wide by 35' long, providing a total of 630 square feet of filter bed surface area. The West Filter Building contains two of the granular media filter units that are 16' wide by 48' long, providing a total of 1,536 square feet of filter bed surface area.

The existing filters operated satisfactorily for a number of years, however, the original granular filter bed peak filtering capacity has declined over the years despite efforts to restore the lost capacity. In order to restore additional capacity the two granular, traveling bridge filters in the West Filter Building are being replaced within the existing concrete basins with two new AquaDiamond filters manufactured by Aqua-Aerobic Systems, Inc. Once the new filters are installed, the East Filter Building will be taken out of service.

Each of the AquaDiamond media retrofit filter units consist of eight, 30' long diamond-shaped plenums of cloth media design providing a total of 960 sq. ft. of filter bed surface area per filter or a total of 1,920 ft². This filtering area does not include areas impacted by structural supports. Each filter is specified to treat an average flow rate of 1.5 MGD (3.0 MGD total) and a peak flow rate of 8 MGD (16 MGD total), yielding flux rates of 1.08 gpm/sq.ft. and 5.79 gpm/sq.ft. respectively. With one of the filters out of service the other unit, which is designed to operate at a maximum loading rate of 5.79 gpm/sq.ft., provides for a peak design flow of 8

MGD. At the average design flow of 3 MGD, with one unit in service, the loading rate is 2.17 gpm/sq.ft. Assuming that one of the filters is out of service and using MDNR's 5.0 gpm/sq. ft. flux rate, *firm* capacity of one AquaDiamond unit will be approximately 6.9 MGD.

The fiber pile filter fabric used with the AquaDiamond type filters is the same material used on Aqua-Aerobic disk filters. The material has proven its effectiveness and durability in over a thousand installations over the last twenty years and has seen several improvements over that time. There are a number of disk-type filters with the fiber pile fabric that have been approved and are in use in the State of Missouri, and a few newer AquaDiamond-style units are also in service in Missouri at this time.

The AquaDiamond filters are back washed by a pump that creates a vacuum on the fabric, pulling filtered water back through the fabric and at the same time scouring the surface by the movement of the backwash shoe. The backwash volume and pressure are designed to assure the maintenance of the fabric's cleanliness and flow capacity. The bridge-mounted backwash pump draws 450 gpm through four backwash shoes at a time, equating to a flow of about 28 gpm per lineal foot of fabric length within the shoes. The rate of return of backwash water to the treatment plant is expected to average less than 3% of the filter throughput. As is standard with this filter and the traveling bridge filter it replaces, each filter is equipped with a single backwash pump. Adequate spare parts will be retained to ensure timely attention to the pumps when maintenance is required.

The replacement of the existing filters in the West Filter Building with new, higher capacity, more reliable equipment coupled with taking the East Filter Building out of service does not result in any changes to the overall design capacity of the plant due to existing upstream and downstream restrictions. The improvements are intended to restore capacity to the filter portion of the plant, while also significantly improving the efficiency of the filtration by minimizing the amount of recycled backwash waste that is generated. Improvements are contained within the existing filter structure and include flow control modifications that allow delivery of the higher flows to the new filters.

UV DISINFECTION STRUCTURE IMPROVEMENTS

A hydraulic analysis of the existing West UV Structure indicated that the current configuration of the finger weirs at the facility creates a restriction that reduces the available hydraulic capacity. With the new filter improvements, all flow through the plant will be passing through the West Filters and subsequently through the West UV Structure.

Currently, flow entering either of the two channels in the UV structure reaches a wall that forces flow through the end of the weirs (two weirs in each channel). Flow fills the finger weirs and spills over the weir edge to fill the below portion of the channel. From there, water exits the facility through a pipe. The point at which flow reaches the wall and is forced into the weirs through the openings on the end is what is causing the hydraulic restriction. At higher flows after the new filters are installed, this restriction could cause the water level in the UV channels to back up such that it affects the operation of the upstream filters. In its current configuration, the West UV Structure has a maximum capacity of 5.3 MGD before the water surface elevation gets high enough to create an issue for the operation of the filters.

In order to address this issue, it is proposed that the existing wall upstream of the weirs is removed and relocated to the downstream end of the weirs. This will allow for water to fill up the channel first before spilling over into the finger weirs and flowing out through the end of the weirs to discharge from the facility. The proposed discharge ends out of the weirs shall be approximately 6" by 22" as opposed to the previous 6" by 12" openings, allowing for decreased headloss through the weirs and therefore greater hydraulic capacity. In the new configuration, the UV structure has a capacity of 10 MGD before water levels rise to impact the function of the upstream filters.