Permit No. CP0001947

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

CONSTRUCTION PERMIT

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

Fox C-6 School District
745 Jeffco Boulevard
Arnold, MO 63010

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.

April 19, 2018
Effective Date

Edward B. Galbraith, Director, Division of Environmental Quality

April 18, 2020
Expiration Date

Chris Wieberg, Director, Water Protection Program

CONSTRUCTION PERMIT

I. CONSTRUCTION DESCRIPTION

Two existing manholes which receive wastewater from the school will be fitted with 6 inch and 8 inch PVC pipe and join the two flow sources in a new manhole. A single 8 inch PVC line will be constructed connecting 3 new manholes.

Raw wastewater will flow into a newly placed fiberglass septic tank. The septic tank will measure approximately 8 feet in diameter and 31.5 feet in length. The Septic tanks will be baffled into two distinct compartments with a total liquid capacity of 10,000 gallons. 13 feet 9 inches of 8 inch PVC will be placed from the primary treatment septic tank to a new manhole and 13 feet of 8 inch PVC will be constructed to the NEXOM™ SAGR™ system.

The SAGR™ unit will measure approximately 20.0 feet in width by 35.0 feet in length with a depth of 8.5 feet. Due to results of the geohydrologic evaluation the unit will have a concrete foundation and be encased in a 10 inch thick concrete support wall.

The top layer of the unit will be comprised of 1 foot of wood chips or mulch. Under the insulating layer will be a protective, non-woven, needle punched, polypropylene fabric. Protective fabric layer will be 7’6” of clean gravel. A series of 3 inch HDPE linear aeration manifolds will be placed at the bottom of the gravel layer. Two blowers will be placed and connected to 1 inch HDPE feed lines leading to the aeration manifolds. 4 inch SDR 35 PVC lines will be placed to distribute influent evenly over the surface of the gravel media.

A closed vessel, low-pressure, high intensity ultraviolet disinfection (UV) disinfection system will be installed. The disinfection chamber model will be ProLine GSA4 80VIK and contain 4 lamps horizontal and parallel to the flow.

A closure plan will need to be submitted to the St. Louis Regional Office for review and approval prior to closure activities associated with the existing treatment lagoon and all associated existing appurtenances.

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 "findings of affordability" because the permit applies to a **combined or separate sanitary sewer system for a publically-owned treatment works.**

Cost Analysis for Compliance - The Department has made a reasonable search for empirical data indicating the permit is affordable. The search consisted of a review of Department records that might contain economic data on the community, a review of information provided by the applicant as part of the application, and public comments received in response to public notices of this draft permit. If the empirical cost data was used by the permit writer, this data may consist of median household income, any other ongoing projects that the Department has knowledge, and other demographic financial information that the community provided as contemplated by Section 644. 145.3. See **APPENDIX – COST ANALYSIS FOR COMPLIANCE**.

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 Civil Design, Inc. on 10/30/17.

3. 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(8).

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 St. Louis Regional Office per 10 CSR 20-7.015(9)(E)2.

5. The wastewater treatment facility shall be located at least fifty feet (50') from any dwelling or establishment.

6. The wastewater treatment facility shall be located above the twenty-five (25)-year flood level.

7. Wastewater treatment facility shall not be located within one hundred feet (100'), and preferably three hundred feet (300') of any water well or water supply structure.

8. Upon completion of construction:

   A. The Jefferson County Public Sewer District will become the continuing authority for operation, maintenance, and modernization 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; and

   C. Submit the enclosed form Statement of Work Completed to the Department in accordance with 10 CSR 20-6.010(5)(D). and indicate on the form the request for the operating permit to be issued.

IV. REVIEW SUMMARY

1. CONSTRUCTION PURPOSE

The purpose of this construction is to provide permitted discharge and treatment of wastewater from Clyde Hamrick Elementary School. Previously the school had been serviced by the operation of a non-permitted single cell lagoon with two primary treatment septic tanks. The existing system will remain in use until the construction of the facility outlined in this permit is completed at which point the old system will be decommissioned.

2. FACILITY DESCRIPTION

The proposed wastewater treatment facility is located at the Clyde Hamrick Elementary School, 4525 E 4 Ridge Rd, in the City of Imperial in Jefferson County, Missouri. The facility has an average design flow of 2,700 gpd and serves a population equivalent of approximately 27. The actual population of the school was stated as 520; however, the applicant provided water use records in the submitted application for construction permit to justify using the proposed average design flow.

Due to the presence of a cafeteria, flows will be directed through an existing grease trap before entering the sewer lines and treatment train. Effluent from two distinct

sources on the school campus will be joined at a new manhole and enter the treatment process. Flows will move through PVC pipe by gravity to the primary treatment septic tank. Settled solids will be removed from the system as needed by a contract hauler. After exiting the septic tank the wastewater flow will be transported to the Nexom SAGR unit for secondary treatment.

Blowers providing aeration to the SAGR™ unit will be housed in a sound damping enclosure on a concrete pad. Flows will exit the SAGR™ and move to the UV disinfection. The UV system will be housed in a concrete vault with a sump. An existing backup generator will be connected to the system to provide power in case of grid failure. Finally the treated effluent will be transported to the discharge location.

3. COMPLIANCE PARAMETERS

The final effluent limits the project is required to meet are established in the Operating Permit MO-0138657 as developed through the Water Quality and Antidegradation Review.

4. ANTIDEGRADATION

The Department has reviewed the antidegradation report for this facility and issued the Water Quality and Antidegradation Review dated October 24th, 2017, due to the facility being a newly permitted discharge. See **APPENDIX – ANTIDEGRADATION**.

5. REVIEW of MAJOR TREATMENT DESIGN CRITERIA

- Septic Tank – A septic tank provides passive primary treatment as the settleable solids in raw wastewater settle onto the bottom of the tank. Raw wastewater will flow by gravity to the 10,000 gallon, two compartment septic tank. When the water level reaches a certain height, the wastewater flows into the second compartment through a minimum 1 ft gap in the baffling. The first compartment in the septic tank is 20 ft in length with the diameter being 8 ft while the second compartment is 11 feet 6 inches in length with 8 foot diameter. The septic tanks provide approximately 3.7 days of detention at average design flow. Effluent from the septic tank will flow by gravity to the SAGR unit. Settled solids in the septic tank shall be removed by a contract hauler.

- Nexom™ Submerged Aerated Growth Reactors (SAGR™) – Treated effluent from the septic tank will flow by gravity to a flow splitter structure which will separate the flow equally between the primary and influent flow control valve that feed two zones within the SAGR™ unit via distribution piping. The SAGR™ system is capable of treating an average design flow of 2,700 gpd and a peak flow of 4,000 gpd. The single unit will be constructed 35 ft x 20 ft x 8.5 ft with a 1.5 ft thick reinforced concrete foundation which will extend 1 ft horizontally beyond the reinforced concrete support walls. The support walls will be 10-in. thick and be 9 ft in height. The average retention time is 35 hours. The reactors are split by the influent piping into two zones. The cell is layered with 1 ft of top insulating mulch for heat retention, a protective non-woven geotextile fabric acting as a

barrier, and 7.5 ft of granular media. A total of two 4 in. cleanouts will be connected to the end of the 4-in distribution lines and is located in the mulch layer. The insulating mulch layer contains the 1-inch HDPE air distribution laterals. The granular media layer contains the two influent 4-inch PVC SDR-35 pipes with drilled orifices surrounded by a chamber to provide clear flow of wastewater. The distribution piping orifices will be ½-in diameter with 3 ft spacing between orifices for a total of 12 orifices per distribution line. The drop down 1-inch HDPE air feed line transports air from the blowers to 3-in HDPE air distribution manifolds and further to the SR90 aeration tubing. Aeration by means of rotary claw-type positive displacement blowers each capable of supplying 33 scfm with 5 HP motors. The effluent from the cell will be collected in a common effluent structure and will flow by gravity to the disinfection system.

- Disinfection –A closed vessel, gravity flow, low pressure high intensity UV disinfection system capable of treating a peak flow of 4,000 gpd while delivering a UV intensity of 60 $\mu W*s/cm^2$ with an expected ultraviolet transmissivity of 55% or greater. The closed vessel UV system consists of 4 lamps in a single disinfection chamber. The chamber will have a maximum length of 49 inches. The disinfected effluent will flow by gravity through a final manhole where flow measurements will be taken with a Greyline AVFM 5.0 Area-Velocity Flow Meter and then discharging to Outfall No. 001.

6. OPERATING PERMIT

Operating Permit MO-0138657 was public noticed from March 16, 2018 to April 16, 2018. No comments were received. Upon construction completion, submit the Statement of Work Completed to the Department in accordance with 10 CSR 20-6.010(5)(D).

Aaron Sawyer
Engineering Section
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APPENDIX – COST ANALYSIS FOR COMPLIANCE

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

Clyde Hamrick Elementary School, New Operating Permit
Fox C-6 School District
Missouri State Operating Permit #MO-0138657

Section 644.145 RSMo requires the Department of Natural Resources (DNR) 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 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 the school district's financial and socioeconomic situation. The financial questionnaire available to permittees on the DNR website (http://dnr.mo.gov/forms/780-2511-f.pdf) should have been submitted with the permit renewal application. If it was not received with the renewal application, the Department sent a request to complete it with the welcome letter.

The Department is required to issue a permit with final effluent limits in accordance with 644.051.1.(1) RSMo, 644.051.1.(2) RSMo, and the Clean Water Act. The practical result of this analysis is to incorporate a compliance schedule into the permit in order to mitigate adverse impact to distressed populations resulting from new costs for the wastewater treatment facility.

Flow evaluated: **2,700 gallons per day**

Total Connections for this facility: 1

New Permit Requirements:

The permit requires compliance with new final effluent limits for BOD_5, TSS, *E. coli*, Ammonia, and pH.

Anticipated Costs Associated with Complying with the New Requirements:

The following table outlines the estimated costs of the new permit requirements listed above:

New Requirement	Frequency	Estimated Cost	Estimated Annual Costs
BOD_5	Monthly	$41	$984
TSS	Monthly	$16	$384
E. coli	Monthly	$29	$348
Ammonia	Monthly	$20	$240
pH	Monthly	$8	$96
		TOTAL	**$2,052**

The Fox C-6 School District can accomplish capital improvements through the budget established for operation and maintenance of the wastewater treatment plant. Therefore, rates should not be impacted as a result of complying with the new requirements of this permit.

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

The Fox C-6 School District can accomplish capital improvements through the budget established for operation and maintenance of the wastewater treatment plant.

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

The Fox C-6 School District can accomplish capital improvements through the budget established for operation and maintenance of the wastewater treatment plant.

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

The investment in wastewater treatment will provide several social, environmental and economic benefits. 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 fulfill the goals of **restoring** and **maintaining** the chemical, physical and biological integrity of **the receiving stream**; and, where attainable, to 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 Fox C-6 School District can accomplish capital improvements through the budget established for operation and maintenance of the wastewater treatment plant. Therefore, rates should not be impacted as a result of complying with the new requirements of this permit.

(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.

School Districts accomplish capital improvements through established budgets that will not cause a financial hardship to the residents of the surrounding communities.

<u>Opportunity for cost savings or cost avoidance:</u>

- If available, connection to a larger centralized sewer system in the area may be more cost effective for the community.

- An opportunity may exist for the relocation of the point of discharge to a receiving stream capable of a greater mixing zone.

- The permittee may apply for State Revolving Fund (SRF) financial support in order to help fund a Capital Improvements Plan. Other loans and grants also exist for which the facility may be eligible. Contact information for the Department's Financial Assistance Center (FAC) and more information can be found on the Department's website at http://dnr.mo.gov/env/wpp/srf/wastewater-assistance.htm.

Opportunity for changes to implementation/compliance schedule, new technology, site specific criteria, use attainability analysis:

- The facility may propose changes to the schedule of compliance based on their own cost estimate or financial information.

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

The Fox C-6 School District did not report any other investments relating to environmental improvements.

(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;

This operating permit renewal requires new or expanded conditions; therefore new costs for the Fox C-6 School District are anticipated. The Fox C-6 School District accomplishes capital improvements through established budgets for the operation and maintenance of the wastewater treatment facility, therefore, the new costs will not cause a financial burden to the residents of the surrounding communities.

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

The Fox C-6 School District did not report any other relevant local economic conditions.

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 identified the actions for which cost analysis for compliance is required under Section 644.145 RSMo.

The Department estimates the cost for monthly BOD_5, TSS, E. coli, Ammonia, and pH sampling is $2,052 per year.

The Department considered the eight (8) criteria presented in subsection 644.145, RSMo when evaluating the cost associated with the relevant actions. Taking into consideration these criteria, this analysis examined whether the above referenced permit modifications affects 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. As a result of reviewing the above criteria, the Department hereby finds that the action described above 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.

Water Quality and Antidegradation Review

Department's Alternatives Analysis for Domestic Wastewater Facilities with Design Flow Less Than 10,000 Gallons per Day

For Protection of Water Quality
and Determination of Effluent Limits

October 24, 2017

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1. WATER QUALITY INFORMATION

In accordance with Missouri's Water Quality Standard [10 CSR 20-7.031(3)] and federal antidegradation policy at Title 40 Code of Federal Regulation (CFR) Section 131.12 (a), the Missouri Department of Natural Resources (Department) developed a statewide antidegradation policy and corresponding procedures to implement the policy. A proposed discharge to a water body will be required to undergo a level of Antidegradation Review which documents that the use of a water body's available assimilative capacity is justified. Effective August 30, 2008, and revised July13, 2016, a facility is required to use *Missouri's Antidegradation Implementation Procedure (AIP)* for new and expanded wastewater discharges.

2. APPLICABILITY

This Water Quality and Antidegradation Review is for facilities which produce primarily domestic wastewater and discharge less than 10,000 gallons per day. It is not applicable to facilities where the receiving waterbody, or downstream waterbodies, have a Total Maximum Daily Load (TMDL) or are 303(d) or 305(b) listed for the pollutants of concerns addressed in this alternatives analysis, with an exception for waterbodies that are listed for *E. coli* since disinfection will be required. Facilities that are currently under enforcement will need to coordinate with the Water Protection Program's compliance and enforcement section to determine applicability for the Department's Alternatives Analysis. No mixing will be included in this review for receiving waterbodies. If the applicant would like to have effluent limitation derivation include mixing considerations, a site specific alternatives analysis will need to be completed.

3. TIER DETERMINATION

Below is a list of pollutants of concern reasonably expected to be in the discharge for a domestic wastewater treatment facility. Pollutants of concern are defined as those pollutants "proposed for discharge that affects beneficial use(s) in waters of the state. POCs include pollutants that create conditions unfavorable to beneficial uses in the water body receiving the discharge or proposed to receive the discharge" (AIP, Page 7). No existing water quality data is required because all POCs were considered to be Tier 2 and significantly degrading in the absence of existing water quality. Assumed uses for the receiving waterbody are General Criteria, Protection of Warm Water Aquatic Life (AQL), Human Health Protection (HHP), Irrigation (IRR), and Livestock & Wildlife Protection (LWP). If any Tier 1 Pollutants of Concern not addressed in this alternatives analysis will be discharged, the applicant must submit *Attachment D: Tier 1 Review* (http://dnr.mo.gov/forms/780-2024-f.pdf) for those pollutants.

Table 1. Pollutants of Concern and Tier Determination

POLLUTANTS OF CONCERN	TIER*	DEGRADATION	COMMENT****
Biochemical Oxygen Demand (BOD_5)/DO	2	Significant	
Total Suspended Solids (TSS)	**	Significant	
Ammonia	2	Significant	
pH	***	Significant	Permit limits applied
Escherichia coli (*E. coli*)	2	Significant	

* Tier assumed.

** Tier determination not possible: No in-stream standard for this parameter.

*** The standard for this parameter is a range.

**** Permit limits for other parameters including Oil & Grease, Total Residual Chlorine, Nitrates, and Total Phosphorus will be applied based on water quality standards and criteria as applicable.

Total Residual Chlorine (TRC) effluent limits of 0.017 mg/L daily maximum, 0.008 mg/L monthly average are recommended if chlorine is used as a disinfectant. Standard compliance language for TRC, including the minimum level (ML), may be included in the operating permit.

4. DEMONSTRATION OF NECESSITY AND SOCIAL AND ECONOMIC IMPORTANCE

Missouri's Antidegradation Implementation Procedures (AIP) specify that if the proposed activity results in significant degradation then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required. The applicant must submit *Attachment E: Tier 2 – Significant Degradation Using Department's Alternatives Analysis for Domestic Wastewater Facilities with Design Flow Less Than 10,000 Gallons per Day* form. This analysis will serve as the applicant's alternatives analysis to fulfill the requirements of the AIP.

A Geohydrologic Evaluation must be submitted with the Antidegradation Review Request.

A Missouri Department of Conservation Natural Heritage Review Report must be obtained by the applicant. The applicant should review the Natural Heritage Review and contact the U.S. Fish and Wildlife Service and the Missouri Department of Conservation for further coordination if necessary.

4.1. NO DISCHARGE EVALUATION

According to 10 CSR 20-6.010(4)(D), reports for the purpose of constructing a wastewater treatment facility shall consider the feasibility of constructing and operating a no discharge facility. Per the Antidegradation Implementation Procedure Section II.B.1, for discharges likely to cause significant degradation, applicants must provide an analysis of non-degrading alternatives. No-discharge alternatives may include surface land application, subsurface land application, and connection to a regional treatment facility.

The applicant must submit a *No Discharge Evaluation* form to demonstrate that a no-discharge facility is not feasible for this site. If the information provided on the form is not sufficient to demonstrate that a no-discharge facility is not feasible, a more detailed evaluation of no discharge options will be required before the Department can complete its determination.

4.2. DEMONSTRATION OF NECESSITY

The Department has used available data to complete an alternatives analysis of previously evaluated treatment technologies and expected performance. Data from forty-five Water Quality and Antidegradation Reviews (WQARs) completed between March 2011 and March 2016 was evaluated and results are presented in Figure 1, Figure 2, and Table 2 below.

The data include five facilities designed to provide a high level of treatment to meet the expected future ammonia as N effluent limits based on the 2013 EPA Ammonia criteria for the protection of mussels and gill-breathing snails (See Notice to Permittee in DERIVATION AND DISCUSSION OF LIMITS section). The data available to date indicates that the cost of facilities of this size range designed to meet 2013 EPA ammonia criteria is not substantively higher than other facilities designed to meet the current ammonia criteria.

The data include fourteen facilities designed to meet BOD and TSS effluent limits of 10 mg/L monthly average and 15 mg/L daily maximum or weekly average. The data available to date indicates that the cost of facilities designed to meet BOD and TSS effluent limits of 10 mg/L monthly average and 15 mg/L daily maximum or weekly average is not substantively higher than other facilities of this size range designed to meet less stringent BOD and TSS effluent limits.

Facilities which were designed to meet limits based on the 2013 EPA ammonia criteria included a membrane bioreactor, extended aeration package plant, recirculating sand filter with moving bed biofilm reactor, sequencing batch reactor, and an integrated fixed film activated sludge system.

Membrane bioreactor (MBR) systems combine a suspended growth biological reactor with solids removal via filtration across a membrane. The membranes can be designed for and operated in small spaces and with high removal efficiency of contaminants such as nitrogen, phosphorus, bacteria, biochemical oxygen demand, and total suspended solids. Membrane filtration allows a higher biomass concentration to be maintained in the treatment tank, thereby allowing smaller bioreactors to be used for a smaller footprint. MBR systems provide operational flexibility with respect to flow rates, as well as the ability to readily add or subtract units as needed, but that flexibility has limits. Membranes typically require that the water surface be maintained above a minimum elevation so that the membranes remain wet during operation. Throughput limitations are dictated by the physical properties of the membrane, and the result is that peak design flows generally should be no more than 1.5 to 2 times the average design flow. If peak flows exceed that limit, additional membranes may be needed to process the peak flow, or equalization may need to be included in the design. MBR systems typically have higher capital and operating costs than conventional systems.

The extended aeration process is a modification of the activated sludge process which provides biological treatment for the removal of biodegradable organic wastes under aerobic conditions. Wastewater in the aeration tank is mixed and oxygen is provided to the microorganisms. The mixed liquor then flows to a clarifier or settling chamber where most microorganisms settle to the bottom of the clarifier and a portion are pumped back to the beginning of the plant. The clarified wastewater flows over a weir and into a collection channel before being disinfected and discharged. Extended aeration is often used in smaller prefabricated package-type plants where lower operating efficiency is offset by mechanical simplicity and minimized design costs. In comparison to traditional activated sludge, longer mixing time with aged sludge and light loading (low F:M) offers a stable biological ecosystem better adapted for effectively treating waste load fluctuations from variable occupancy situations. Although the process is stable and easier to operate, extended aeration systems may discharge higher effluent suspended solids than found under conventional loadings.

Moving Bed Bioreactor (MBBR) systems may be a single aerated reactor, or several in series, with a buoyant free-moving plastic biofilm carrier media. MBBR systems can be designed to be capable of meeting more stringent total nitrogen limits. They produce a significantly reduced solids loading to the liquid-solids separation unit, the biofilm improves process stability, they offer flexibility to meet specific treatment objectives, and they are well suited for retrofit into existing treatment systems. MBBR systems require a smaller tank volume than a conventional activated sludge system and therefore have a smaller footprint. Adequate mixing must be provided to ensure that free floating media remains uniformly distributed and screens must be provided to retain the media within the reactors.

Integrated fixed film activated sludge (IFAS) systems add fixed or free floating media to an activated sludge basin. The process gets its name from combining a conventional activated sludge process with a fixed film system. This treatment system is similar to an MBBR; however MBBR systems do not recycle sludge. IFAS systems are often installed as a retrofit solution to conventional activated sludge systems. They require a smaller tank volume than a conventional activated sludge system and therefore have a smaller footprint. The biofilm combines aerobic, anaerobic, and anoxic zones promoting better nitrification compared to conventional activated sludge systems and the biofilm improves process stability. Adequate mixing must be provided to ensure that free floating media remains uniformly distributed and to slough biomass from the media. Higher dissolved oxygen concentrations may be required as compared to conventional activated sludge. Screens must be provided to retain the media within the reactors.

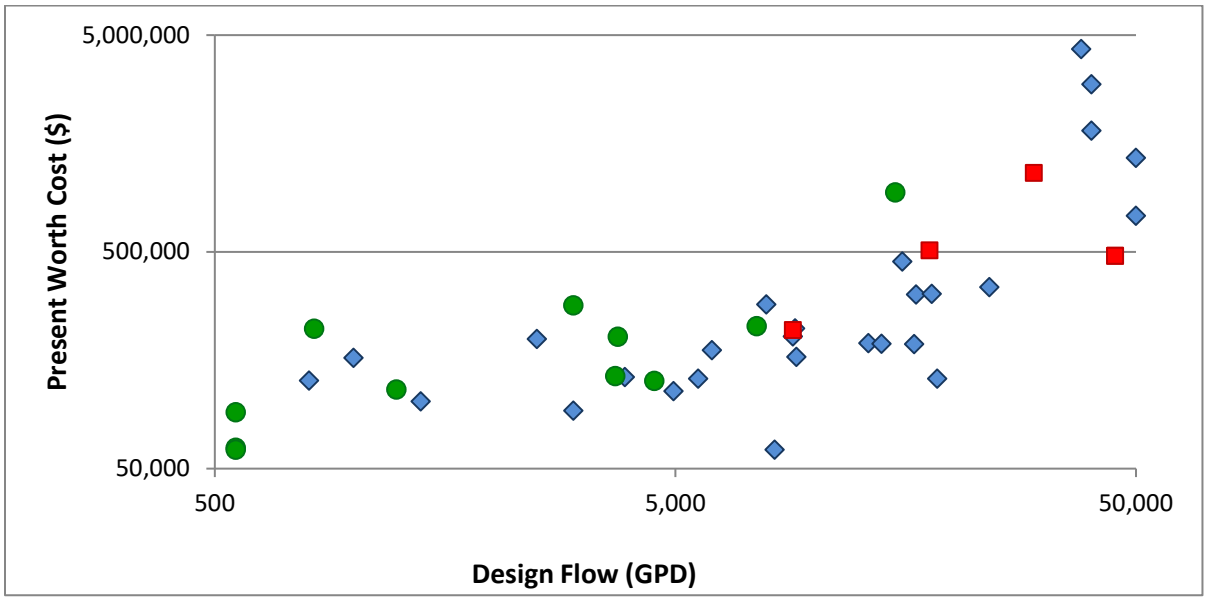
In addition to the treatment technologies listed above, all of which had previous WQARs that established advanced ammonia limits, there are other technology alternatives that can meet the advanced ammonia limits including recirculating sand filter, recirculating textile filter, conventional activated sludge, oxidation ditch, and lagoon retrofits. To obtain this level of performance, all technologies must be properly designed to accommodate nitrification and de-nitrification and they must be properly and actively operated.

Recirculating sand filters (RSF) remove contaminants in wastewater through physical, chemical, and, most importantly, biological processes. The three common components are a pretreatment unit (generally a septic tank), a recirculation tank, and a sand filter. In the recirculation tank, raw effluent from the septic tank and the sand filter filtrate are mixed and pumped back to the sand filter bed. RSFs are effective in applications with high levels of BOD and can provide a good effluent quality with 85 - 95% removal of BOD and TSS. They can be designed to provide nitrification, but this requires increased surface area. Treatment is affected by extremely cold weather. Treatment capacity can be expanded through modular design. RSFs require routine maintenance, although the complexity of maintenance is generally minimal.

Recirculating textile filters systems are configured similar to an RSF except the filter media is an engineered fabric textile. They can be configured to provide nitrification, but this may require additional treatment units. They have a small operating footprint, are more aesthetically pleasing than some other treatment options, produce minimal noise, have the ability to handle variable flows, and have simple maintenance.

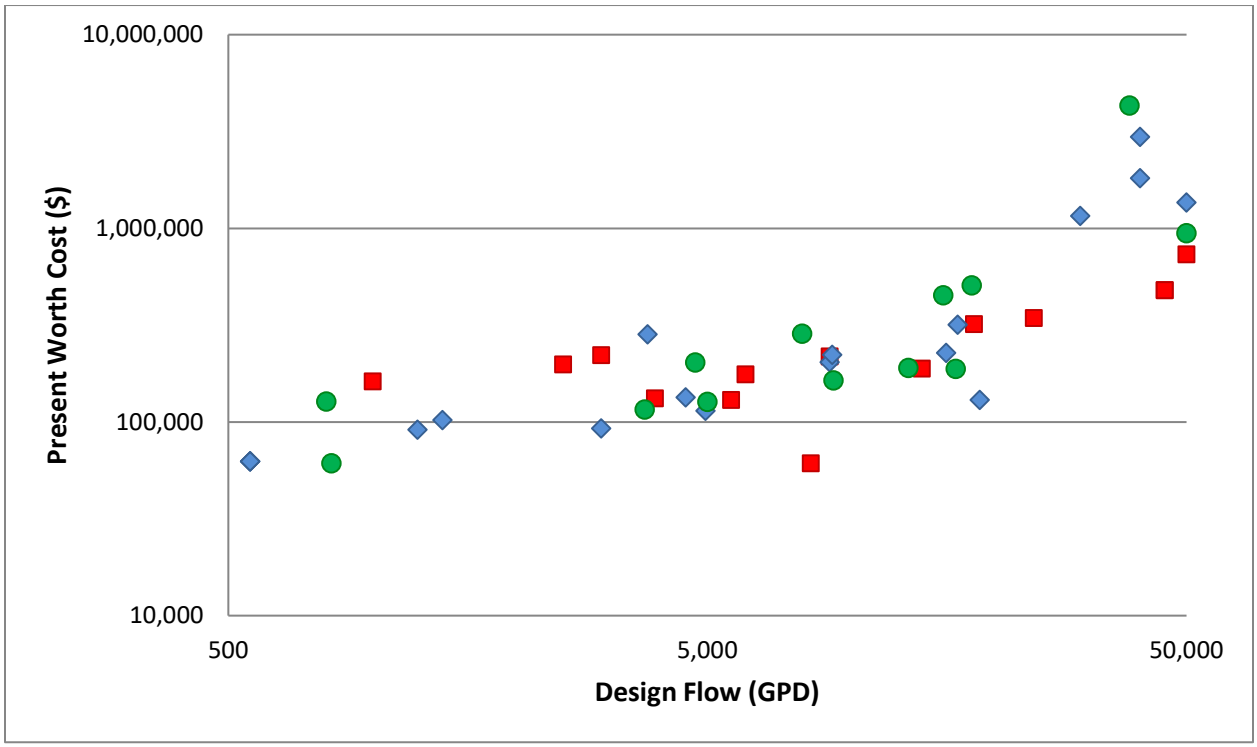
The above treatment system descriptions were adapted from EPA technology fact sheets and *Design of Municipal Wastewater Treatment Plants: WEF Manual of Practice No. 8 ASCE Manuals and Reports on Engineering Practice No. 76; Fifth Edition*, as well as other readily available sources and previous Water Quality and Antidegradation Reviews.

FIGURE 1. DESIGN FLOW VS. PRESENT WORTH COST VS. AMMONIA LIMITS



LEGEND		Summer Ammonia (mg/L)		Winter Ammonia (mg/L)	
		Daily Max	Monthly Avg.	Daily Max	Monthly Avg.
2013 EPA Criteria	■	≤1.7	≤0.6	≤5.6	≤2.1
Existing Aquatic Life Criteria (no mixing)	◆	approx. 3.7	approx. 1.4	approx. 7.5	approx. 2.9
Less Stringent (mixing)	●	>3.7	>1.4	>7.5	>2.9

FIGURE 2. DESIGN FLOW VS. PRESENT WORTH COST VS. BOD & TSS LIMITS



LEGEND	BOD (mg/L)		TSS (mg/L)	
	Daily Max	Monthly Avg.	Daily Max	Monthly Avg.
■	15	10	15	10
◆	15	10	>15	>10
●	>15	>10	>15	>10

TABLE 2. DESIGN FLOW VS. PRESENT WORTH COST

DATE	Design Flow (MGD)	Technology	BOD (mg/L)		TSS (mg/L)		Summer Ammonia (mg/L)		Winter Ammonia (mg/L)		Present Worth Cost ($)	$ PW/gpd
			Daily Max or Weekly Average	Monthly Average	Daily Max or Weekly Average	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average		
5/2/2012	0.000555	Recirculating Fabric Filter	15	10	20	15	12.1	4.6	12.1	4.6	62,506	113
4/2/2013	0.000555	Recirculating Fabric Filter	15	10	20	15	12.1	4.6	12.1	4.6	62,506	113
10/1/2014	0.000555	Extended Aeration Package Plant	15	10	22.5	15	7.8	3	7.8	3	62,506	113
4/4/2012	0.000800	Recirculating Fabric Filter	30	15	30	15	4	1.5	7.7	2.9	127,427	159
12/1/2013	0.000821	Membrane Bioreactor	30	20	30	20	12.1	4.6	12.1	4.6	61,240	75
9/2/2012	0.001000	Recirculating Fabric Filter	15	10	15	10	3.7	1.4	7.5	2.9	162,007	162
7/6/2011	0.001240	Recirculating Fabric Filter	15	10	22	15	6	3	6	3	91,000	73
1/1/2015	0.001400	Recirculating Fabric Filter	15	10	23	15	3.7	1.4	7.6	2.9	102,174	73
5/5/2011	0.002500	Extended Aeration	15	10	15	10	3.7	1.4	7.5	2.9	198,000	79
9/1/2011	0.003000	Recirculating Fabric Filter	15	10	15	10	12.1	4.6	12.1	4.6	220,915	74
3/1/2012	0.003000	Extended Aeration Package Plant	15	10	20	15	3.7	1.4	7.5	2.9	92,604	31
2/22/2016	0.003700	Recirculating Rock Filter	30	20	30	20	7.3	2.8	7.3	2.8	115,688	31
7/4/2011	0.003750	Recirculating Fabric Filter	15	10	20	15	12.1	4.6	12.1	4.6	283,000	75
4/1/2014	0.003885	Recirculating Sand Filter	15	10	15	10	3.7	1.4	7.5	2.9	132,185	34
12/1/2012	0.004500	Recirculating Sand Filter	15	10	23	15	12.1	4.6	12.1	4.6	133,676	30
6/3/2013	0.004718	Recirculating Sand Filter	30	20	30	20	12.1	4.6	12.1	4.6	203,060	43
11/2/2011	0.004950	Recirculating Sand Filter	15	10	20	15	3.5	1.4	7.5	2.9	114,058	23
6/4/2011	0.005000	Moving Bed Biofilm Reactor	45	30	45	30	5.7	2.2	8.2	3.2	127,000	25
9/6/2012	0.005600	Extended Aeration with Filtration and Aerated Holding Tanks	15	10	15	10	3.7	1.4	7.5	2.9	130,000	23
6/1/2011	0.006000	Recirculating Sand Filter	15	10	15	10	3.7	1.4	7.5	2.9	176,239	29
3/1/2011	0.007875	Modular Fixed Film Activated Sludge with Constructed Wetlands	30	20	30	20	3.7	1.4	7.5	2.9	285,780	36
4/3/2012	0.008210	Membrane Bioreactor	15	10	15	10	2.6	1	2.6	1	61,240	7
8/5/2014	0.009000	Recirculating Sand Filter	15	10	20	15	3.1	1.2	7.5	2.9	203,698	23
1/1/2014	0.009000	Membrane Bioreactor	15	10	15	10	1.6	0.6	5.5	2.1	217,739	24
4/6/2012	0.009100	Membrane Bioreactor	15	10	20	15	3.7	1.4	7.5	2.9	222,160	24
3/7/2012	0.009158	Recirculating Gravel filter	30	20	30	20	3.7	1.5	6.5	2.5	163,681	18
6/1/2014	0.013125	Recirculating Sand Filter	45	30	45	30	3	1.1	6	2.3	189,985	14
8/4/2012	0.014000	Extended Aeration	15	10	15	10	3.7	1.4	7.5	2.8	188,208	13
7/1/2014	0.015540	Recirculating Sand Filter	23	15	23	15	3.9	1.5	7.8	3	450,986	29
7/5/2011	0.015750	Recirculating Sand Filter	15	10	20	15	7.8	2.5	7.8	2.5	226,969	14
2/27/2015	0.016500	Extended Aeration Package Plant	45	30	45	30	3.7	1.4	7.5	2.9	187,957	11
7/1/2012	0.016650	Extended Aeration	15	10	20	15	3.7	1.4	7.5	2.9	317,750	19
9/3/2014	0.017800	Extended Aeration Package Plant	45	30	45	30	1.4	0.6	2.9	2.1	507,618	29
5/11/2015	0.018000	Recirculating Sand Filter, Polishing Reactor, Chemical Phosphorus Removal	15	10	15	10	3.7	1.4	6.5	2.1	320,318	18
7/3/2013	0.018500	Recirculating Fabric Filter with Chemical & Filter Phosphorus Removal	15	10	20	15	3.7	1.4	7.5	2.9	130,000	7

2/27/2015	0.024000	Recirculating Gravel Filter	**15**	**10**	**15**	**10**	**3.7**	**1.4**	**6.5**	**2.1**	343,816	14
9/1/2014	0.030000	Recirculating Sand Filter, Moving Bed Biofilm Reactor, Chemical Phosphorus removal	**15**	**10**	**20**	**15**	**1.7**	**0.6**	**5.6**	**2.1**	1,157,390	39
6/2/2012	0.038000	Aerated Lagoon with Recirculating Sand Filter	**45**	**30**	**45**	**30**	**3.7**	**1.4**	**7.5**	**2.9**	4,309,665	113
2/3/2013	0.040000	Moving Bed Biofilm Reactor (can be operated as IFAS)	**15**	**10**	**20**	**15**	**3.7**	**1.4**	**7.5**	**2.9**	2,963,181	74
8/20/2015	0.040000	Recirculating Sand Filter, Moving Bed Biofilm Reactor	**15**	**10**	**20**	**15**	**3.7**	**1**	**5.6**	**2.1**	1,812,000	45
6/4/2013	0.045000	Moving Bed Biofilm Reactor	**15**	**10**	**15**	**10**	**1.7**	**0.6**	**5.6**	**2.1**	479,344	11
3/9/2016	0.045000	Moving Bed Biofilm Reactor	**15**	**10**	**15**	**10**	**1.7**	**0.6**	**5.6**	**2.1**	479,344	11
6/4/2012	0.050000	New Technology Package Plant	**30**	**20**	**30**	**20**	**7.5**	**2.9**	**7.5**	**2.9**	942,050	19
7/3/2011	0.050000	Extended Aeration Package Plant	**15**	**10**	**20**	**15**	**3.7**	**1.4**	**7.5**	**2.9**	1,357,506	27
8/3/2014	0.050000	Recirculating Sand Filter	**15**	**10**	**15**	**10**	**3.7**	**1.4**	**7.5**	**2.9**	733,723	15

Additionally, the table of wastewater treatment technologies in the *Ammonia Criteria: New EPA Recommended Criteria* factsheet located at http://dnr.mo.gov/pubs/pub2481.htm includes several technologies which have demonstrated capability in meeting ammonia effluent limits of less than 0.7 mg/L when designed appropriately.

As a result of this alternatives analysis, the Department has determined that for a facility which discharges less than 10,000 gallons per day, depending on site specific conditions, there are technologies available which may be economically efficient and practicable that are capable of meeting the effluent limitations in Table 3. If the facility owners do not believe that there is a treatment technology that is both economically efficient and practicable for their facility to meet the limits in Table 3, a site specific alternatives analysis may be required.

4.3. DESIGN FLOW DETERMINATION

As part of the Department's alternatives analysis, facilities up to 50,000 gallons per day were evaluated. A design flow maximum of 10,000 gallons per day was chosen for applicability of this alternatives analysis for a variety of reasons. As facilities increase in size, site specific factors may require a more site specific alternatives analysis. For example, larger facilities are more likely to have wet weather flows that must be addressed and are more likely to need Whole Effluent Toxicity testing or nutrient monitoring. Larger facilities are also more likely to discharge a larger variety of pollutants of concern which may not be addressed in this review. Larger facilities also benefit from an economy of scale; smaller facilities tend to have a higher cost per gallon of wastewater treated, which is distributed over fewer paying customers. Finally, as we are working with a limited amount of data, limiting the design flow applicability for the Department's alternatives analysis ensures a factor of safety in our review.

4.4. REGIONALIZATION ALTERATIVE

Within Section II B 1. of the AIP, discussion of the potential for discharge to a regional wastewater collection system is mentioned. The applicant must provide justification for not pursuing regionalization on the *No Discharge Evaluation* form. If the information provided on the form is not sufficient to demonstrate that a regionalization alternative is not feasible, a more detailed evaluation will be required before the Department can complete its determination.

4.5. LOSING STREAM ALTERATIVE DISCHARGE LOCATION

Under 10 CSR 20-7.015(4)(A), *discharges to losing stream shall be permitted only after other alternatives including land application, discharge to gaining stream and connection to a regional facility have been evaluated and determined to be unacceptable for environmental and/or economic reasons*.

Information provided by the applicant on the *No Discharge Evaluation* form must include evaluation and justification for why the owner is not pursuing land application, or connection to a regional facility.

4.6. Social And Economic Importance Evaluation

Missouri's antidegradation implementation procedures specify that if the proposed activity results in significant degradation then a determination of social and economic importance is required.

Information provided by the applicant in the *Attachment E: Tier 2 – Significant Degradation Using Department's Alternatives Analysis for Domestic Wastewater Facilities with Design Flow Less Than 10,000 Gallons per Day* form must include a detailed social and economic importance evaluation. If the information provided on the form is not sufficient to demonstrate important social and economic importance, then a more detailed evaluation will be required before the Department can complete its determination.

6. General Assumptions of the Water Quality and Antidegradation Review

1. A Water Quality and Antidegradation Review (WQAR) assumes that [10 CSR 20-6.010(3) Continuing Authorities and 10 CSR 20-6.010(4) (D), consideration for no discharge] has been or will be addressed in a Missouri State Operating Permit or Construction Permit Application.

2. A WQAR does not indicate approval or disapproval of alternative analysis as per [10 CSR 20-7.015(4) Losing Streams], and/or any section of the effluent regulations.

3. Changes to Federal and State Regulations made after the drafting of this WQAR may alter Water Quality Based Effluent Limits (WQBEL).

4. Effluent limitations derived from Federal or Missouri State Regulations (FSR) may be WQBEL or Effluent Limit Guidelines (ELG).

5. WQBEL supersede ELG only when they are more stringent. Mass limits derived from technology based limits are still appropriate.

6. A WQAR does not allow discharges to waters of the state, and shall not be construed as a National Pollution Discharge Elimination System or Missouri State Operating Permit to discharge or a permit to construct, modify, or upgrade.

7. Limitations and other requirements in a WQAR may change as Water Quality Standards, Methodology, and Implementation procedures change.

8. Nothing in this WQAR removes any obligations to comply with county or other local ordinances or restrictions.

9. If the proposed treatment technology is not covered in 10 CSR 20-8 Design Guides, the treatment process may be considered a new technology. As a new technology, the permittee will need to work with the review engineer to ensure equipment is sized properly. The operating permit may contain additional requirements to evaluate the effectiveness of the technology once the facility is in operation. This Antidegradation Review is based on the information provided by the facility and is not a comprehensive review of the proposed treatment technology. If the review engineer determines the proposed technology will not consistently meet proposed effluent limits, the permittee will be required to revise their Antidegradation Report.

7. PERMIT LIMITS AND MONITORING INFORMATION

TABLE 3. EFFLUENT LIMITS – ALL OUTFALLS

PARAMETER		UNITS	DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	BASIS FOR LIMIT (NOTE 1)	MONITORING FREQUENCY
FLOW		MGD	*		*	FSR	ONCE/MONTH
BIOCHEMICAL OXYGEN DEMAND$_5$ **		MG/L		15	10	PEL	ONCE/MONTH
TOTAL SUSPENDED SOLIDS **		MG/L		15	10	PEL	ONCE/MONTH
PH		SU	6.5– 9.0		6.5 – 9.0	FSR	ONCE/MONTH
AMMONIA AS N (APR 1 – SEPT 30)		MG/L	1.7		0.6	PEL	ONCE/MONTH
AMMONIA AS N (OCT 1 – MAR 31)		MG/L	5.6		2.1	PEL	ONCE/MONTH
ESCHERICHIA COLIFORM (*E. COLI*)	WBC(A) (NOTE 2)	#/100ML	630***		126	FSR	ONCE/MONTH
	WBC(B) (NOTE 2)	#/100ML	1030***		206	FSR	ONCE/MONTH
	LOSING STREAM (NOTE 3)	#/100ML	126***		*	FSR	ONCE/MONTH

* Monitoring requirements only.

** Publicly owned treatment works will be required to meet a removal efficiency of 85% or more for BOD_5 and TSS. Influent BOD_5 and TSS data should be reported to ensure removal efficiency requirements are met.

*** Publicly owned treatment works will receive a weekly average *E. coli* limit and private facilities will receive a daily maximum *E. coli* limit.

NOTE 1 – PREFERRED ALTERNATIVE EFFLUENT LIMIT – PEL; OR FEDERAL/STATE REGULATION – FSR. ALSO, PLEASE SEE THE **GENERAL ASSUMPTIONS OF THE WQAR #4 & #5.**

NOTE 2 - Effluent limitations and monitoring requirements for *E. coli* for WBC(A) and WBC(B)are applicable only during the recreational season from April 1 through October 31. The Monthly Average Limit for *E. coli* is expressed as a geometric mean. The Weekly Average for *E. coli* will be expressed as a geometric mean if more than one (1) sample is collected during a calendar week (Sunday through Saturday).

NOTE 3 – Effluent limits and monitoring requirements for *E. coli* are applicable year round for designated losing streams. No more than 10% of samples over the course of a calendar year shall exceed the 126 #/100 mL daily maximum.

Permit limits for other applicable parameters, including Oil & Grease, Total Residual Chlorine, Nitrates, and Total Phosphorus, will be included in the operating permit based on water quality standards and criteria as applicable.

8. RECEIVING WATER MONITORING REQUIREMENTS

No receiving water monitoring requirements recommended at this time.

9. DERIVATION AND DISCUSSION OF LIMITS

Water quality-based – Using water quality criteria or water quality model results and the dilution equation below:

$$C = \frac{(C_s \times Q_s) + (C_e \times Q_e)}{(Q_e + Q_s)}$$ (EPA/505/2-90-001, Section 4.5.5)

Where C = downstream concentration
C_s = upstream concentration
Q_s = upstream flow
C_e = effluent concentration
Q_e = effluent flow

Chronic wasteload allocations were determined using applicable chronic water quality criteria (CCC: criteria continuous concentration). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration).

Water quality-based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's "Technical Support Document For Water Quality-based Toxics Control" (EPA/505/2-90-001).

Note: Under 40 CFR 133.105, permitting authorities shall require more stringent limitations than equivalent to secondary treatment limitations for 1) existing facilities if the permitting authority determines that the
30-day average and 7-day average BOD_5 and TSS effluent values that could be achievable through proper operation and maintenance of the treatment works, and 2) new facilities if the permitting authority determines that the 30-day average and 7-day average BOD_5 and TSS effluent values that could be achievable through proper operation and maintenance of the treatment works, considering the design capability of the treatment process.

9.1. LIMIT DERIVATION

- **Flow**. In accordance with [40 CFR Part 122.44(i)(1)(ii)] the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations. If the permittee is unable to obtain effluent flow, then it is the responsibility of the permittee to inform the Department, which may require the submittal of an operating permit modification.

- **Biochemical Oxygen Demand (BOD_5).** BOD_5 limits of 10 mg/L monthly average and 15 mg/L average weekly were determined by the Department to be achievable and protective of beneficial uses and existing water quality.

  As per the *DO Modeling & BOD Effluent Limit Development Administrative Guidance for the Purpose of Conducting Water Quality Assistance Reviews*, facilities less than 100,000 gallons per day, and proposing BOD treatment less than or equal to an average monthly of 10 mg/L and average weekly of
  15 mg/L as demonstrated by performance specifications from a manufacturer or effluent sampling of an existing facility with the same treatment facility are exempt from the DO modeling requirement. See http://dnr.mo.gov/env/wpp/permits/docs/DO_Modeling_Administrative_Guidance_Dec_09.pdf.

  Influent monitoring may be required for this facility in its Missouri State Operating Permit.

- **Total Suspended Solids (TSS).** TSS limits of 10 mg/L monthly average and 15 mg/L average weekly were determined by the Department to be achievable based and protective of beneficial uses and existing water quality. According to EPA, because TSS and BOD are closely correlated, we apply the same limits for TSS as BOD.

  Influent monitoring may be required for this facility in its Missouri State Operating Permit.

  - **pH**. – 6.5-9.0 SU. Technology based effluent limitations of 6.0-9.0 SU [10 CSR 20-7.015] are not protective of the Water Quality Standard, which states that water contaminants shall not cause pH

to be outside the range of 6.5-9.0 SU. No mixing zone is allowed when using the Department's Alternatives Analysis, therefore the water quality standard must be met at the outfall.

- **Total Ammonia Nitrogen**. The Department has determined that the alternatives analysis-based technology limits of 0.6 mg/L monthly average and
  1.7 mg/L daily maximum in summer, and 2.1 mg/L monthly average and 5.6 mg/L daily maximum in winter are achievable by some treatment technologies. Because these limits are more protective than the water quality-based limits calculated below for a stream with no mixing, the technology-based limits were used.

In choosing to use the Department's alternatives analysis, the facility is electing to build a treatment plant that provides a high level of treatment that meets the expected future limits based on the 2013 EPA Ammonia criteria and will potentially reduce the need to upgrade in the near future (See Notice to Permittee below). If the facility owners do not believe that there is a treatment technology that is both economically efficient and practicable for their facility to meet these limits, a site specific alternatives analysis may be required.

Water Quality-Based Effluent Limits (WQBEL):
Early Life Stages Present Total Ammonia Nitrogen criteria apply
[10 CSR 20-7.031(5)(B)7.C. & Table B3]. Background total ammonia nitrogen = 0.01 mg/L

Season	Temp (^oC)	pH (SU)	Total Ammonia Nitrogen CCC (mg N/L)	Total Ammonia Nitrogen CMC (mg N/L)
Summer	26	7.8	1.5	12.1
Winter	6	7.8	3.1	12.1

Summer: April 1 – September 30, Winter: October 1 – March 31.

Summer

$C_e = (((Q_e+Q_s)*C) - (Q_s*C_s))/Q_e$

Chronic WLA: $C_e = ((Q_e + 0.0)1.5 – (0.0 * 0.01))/Q_e = 1.5$ mg/L

Acute WLA: $C_e = ((Q_e + 0.0)12.1 – (0.0 * 0.01))/Q_e = 12.1$ mg/L

LTA_c = 1.5 mg/L (0.780) = **1.2 mg/L** [CV = 0.6, 99th Percentile, 30 day avg.]
LTA_a = 12.1 mg/L (0.321) = 3.88 mg/L [CV = 0.6, 99th Percentile]

MDL = 1.2 mg/L (3.11) = 3.7 mg/L [CV = 0.6, 99th Percentile]
AML = 1.2 mg/L (1.19) = 1.4 mg/L [CV = 0.6, 95th Percentile, n = 30]

Winter

Chronic WLA: $C_e = ((Q_e + 0.0)3.1 – (0.0 * 0.01))/Q_e = 3.1$ mg/L

Acute WLA: $C_e = ((Q_e + 0.0)12.1 – (0.0025 * 0.01))/Q_e = 12.1$ mg/L

LTA_c = 3.1 mg/L (0.780) = **2.4 mg/L** [CV = 0.6, 99th Percentile, 30 day avg.]
LTA_a = 12.1 mg/L (0.321) = 3.9 mg/L [CV = 0.6, 99th Percentile]

MDL = 2.4 mg/L (3.11) = 7.5 mg/L [CV = 0.6, 99th Percentile]
AML = 2.4 mg/L (1.19) = 2.9 mg/L [CV = 0.6, 95th Percentile, n = 30]

	Maximum Daily Limit (mg/l)		Average Monthly Limit (mg/l)	
	Summer	Winter	Summer	Winter
WQBEL	3.7	7.5	1.4	2.9
Alternatives Analysis Limits	1.7	5.6	0.6	2.1

- ***Escherichia coli (E. coli)***. Limits will be applied based on the receiving stream designated use.

  Whole Body Contact (A): Monthly average of 126 per 100 mL as a geometric mean and Daily Maximum or Weekly Average as a geometric mean of 630 per 100 mL during the recreational season (April 1 – October 31), to protect Whole Body Contact Recreation (A) designated use of the receiving water body, as per 10 CSR 20-7.031(5)(C) and 10 CSR 20-7.015 (9)(B)1. An effluent limit for both monthly average and daily maximum or weekly average is required by 40 CFR 122.45(d). Publicly owned treatment works will receive weekly average limits, while non-publicly owned treatment works will receive daily maximum limits.

  Whole Body Contact (B): Monthly average of 206 per 100 mL as a geometric mean and Daily Maximum or Weekly Average as a geometric mean of 1030 per 100 mL during the recreational season (April 1 – October 31), to protect Whole Body Contact Recreation (B) designated use of the receiving water body, as per 10 CSR 20-7.031(5)(C) and 10 CSR 20-7.015 (9)(B)1. An effluent limit for both monthly average and daily maximum or weekly average is required by 40 CFR 122.45(d). Publicly owned treatment works will receive weekly average limits, while non-publicly owned treatment works will receive daily maximum limits.

  Losing Stream: Discharges to losing streams shall not exceed 126 per 100 mL as a Daily Maximum at any time, as per 10 CSR 20-7.031(5)(C). Monitoring only for a monthly average. No more than 10% of samples over the course of the calendar year shall exceed 126 #/100 mL daily maximum as per 10 CSR 20-7.015(9)(B)1.G.

Per the effluent regulations, the *E. coli* sampling/monitoring frequency for facilities less than 100,000 gallons per day shall be set to match the monitoring frequency of wastewater and sludge sampling program for the receiving water category in 7.015(1)(B)3. during the recreational season (April 1 – October 31), with compliance to be determined by calculating the geometric mean of all samples collected during the reporting period (samples collected during the calendar week for the

weekly average, and samples collected during the calendar month for the monthly average). Please see GENERAL ASSUMPTIONS OF THE WQAR #7

- **Total Residual Chlorine (TRC)**. These limits will apply to facilities which chlorinate. Warm-water Protection of Aquatic Life CCC = 10 µg/L, CMC = 19 µg/L [10 CSR 20-7.031, Table A]. Background TRC = 0.0 µg/L.

$C_e = (((Q_e+Q_s)*C) - (Q_s*C_s))/Q_e$

Chronic WLA: $C_e = ((Q_e + 0.0)10 – (0.0 * 0.0))/ Q_e = 10$ µg/L

Acute WLA: $C_e = ((Q_e + 0.0)19 – (0.0 * 0.0))/ Q_e = 19$ µg/L

LTA_c = 10 µg/L (0.527) = **5.3 µg/L** [CV = 0.6, 99th Percentile]
LTA_a = 19 µg/L (0.321) = 6.1 µg/L [CV = 0.6, 99th Percentile]

MDL = **5.3 µg/L** (3.11) = 16.5 µg/L [CV = 0.6, 99th Percentile]
AML = **5.3 µg/L** (1.55) = 8.2 µg/L [CV = 0.6, 95th Percentile, n = 4]

Total Residual Chlorine effluent limits of 0.017 mg/L daily maximum, 0.008 mg/L monthly average are recommended if chlorine is used as a disinfectant. Standard compliance language for TRC, including the minimum level (ML), should be included in the permit.

- **Oil & Grease**. These limits will apply to publicly owned treatment works and may apply to other facilities as appropriate. Conventional pollutant,
  [10 CSR 20-7.031, Table A]. Effluent limitation for protection of aquatic life; 10 mg/L monthly average, 15 mg/L daily maximum.

- **Total Phosphorus.** Discharges to Table Rock Lake and Lake Taneycomo watersheds shall meet 0.5 mg/L per 10 CSR 20-7.015(3). Discharges to the White River Basin and outside of the area designated above for phosphorus limitations shall have monitoring only for phosphorus at a frequency the same as BOD and TSS as per 10 CSR 20-7.015(3)(E).

Permit limits for any other applicable parameters may be included in the operating permit based on water quality standards and criteria as applicable.

10. ANTIDEGRADATION REVIEW PRELIMINARY DETERMINATION

The proposed new or expanded facility discharge is assumed to result in significant degradation of the receiving waterbody. The Department has used available data to complete a review of available treatment technologies and expected performance. As a result of this review, the Department has determined that, depending on site specific conditions, there may be technologies available which are economically efficient and practicable for a facility that are capable of meeting the effluent limits in Table 3. If the facility owners do not believe that there is a treatment technology that is both economically efficient and practicable for their facility to meet the limits in Table 3, a site specific WQAR may be requested.

Any treatment option designed to meet these effluent limits may be considered a reasonable alternative in moving forward with the appropriate facility plan, construction permit application, or other future submittals.

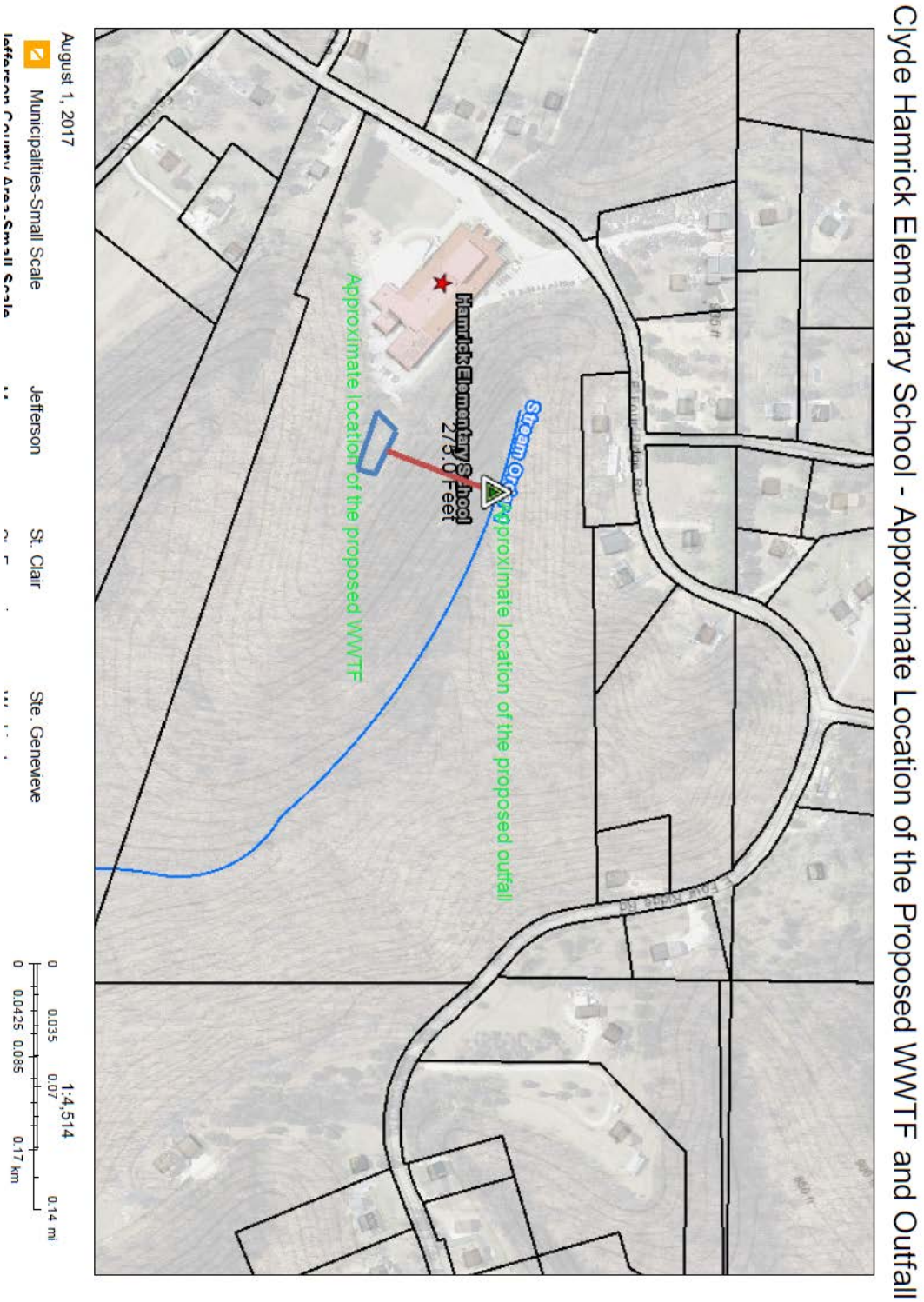
If the proposed treatment system is not covered in 10 CSR 20-8 Design Guides and is considered a new treatment technology, your construction permit application must address approvability of the technology in accordance with the *New Technology Definitions and Requirements* factsheet available at http://dnr.mo.gov/pubs/pub2453.htm. If you have any questions regarding the new technology factsheet, please contact Cindy LePage of the Water Protection Program. The permittee will need to work with the review engineer to ensure equipment is sized properly and that the technology will consistently achieve the proposed effluent limits. The operating permit may contain additional requirements to evaluate the effectiveness of the technology once the facility is in operation.

Per the requirements of the AIP, the effluent limits in this review were developed to be protective of beneficial uses and to attain the highest statutory and regulatory requirements. The Department has determined that the submitted review is sufficient and meets the requirements of the AIP. No further analysis is needed for this discharge.

Reviewer: Aaron Sawyer
Date: 10/24/2017
Unit Chief: John Rustige, P.E. JR

Appendix A: Map of Discharge Location

(*A USGS topographic map can be obtained on the web at http://www.dnr.mo.gov/internetmapviewer/.)*



Appendix B: Natural Heritage Review

(*Applicant must check for rare and endangered aquatic species that may be affected by the discharge by using the following web link: http://mdcgis.mdc.mo.gov/heritage/. The results of the survey must indicate whether there are known endangered species on the site.)*

Missouri Department of Conservation

Missouri Department of Conservation's Mission is to protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.

Natural Heritage Review Level One Report: No Known Records

Foreword: Thank you for accessing the Missouri Natural Heritage Review Website developed by the Missouri Department of Conservation with assistance from the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Missouri Department of Transportation and NatureServe. The purpose of this website is to provide information to federal, state and local agencies, organizations, municipalities, corporations and consultants regarding sensitive fish, wildlife, plants, natural communities and habitats to assist in planning, designing and permitting stages of projects.

PROJECT INFORMATION

Project Name and ID Number: Clyde Hamrick Elementary School #3020
Project Description: Jefferson County, Latitude: 38395566, Longitude: -90.491212, River/Stream Name: Unnamed tributary of Glaize Creek
Project Type: Waste Transfer, Treatment, and Disposal, Liquid waste/Effluent, Wastewater treatment plant, Construction or expansion
Contact Person: Jiaman Xu
Contact Information: jxu@civildesigninc.com or 3148804431

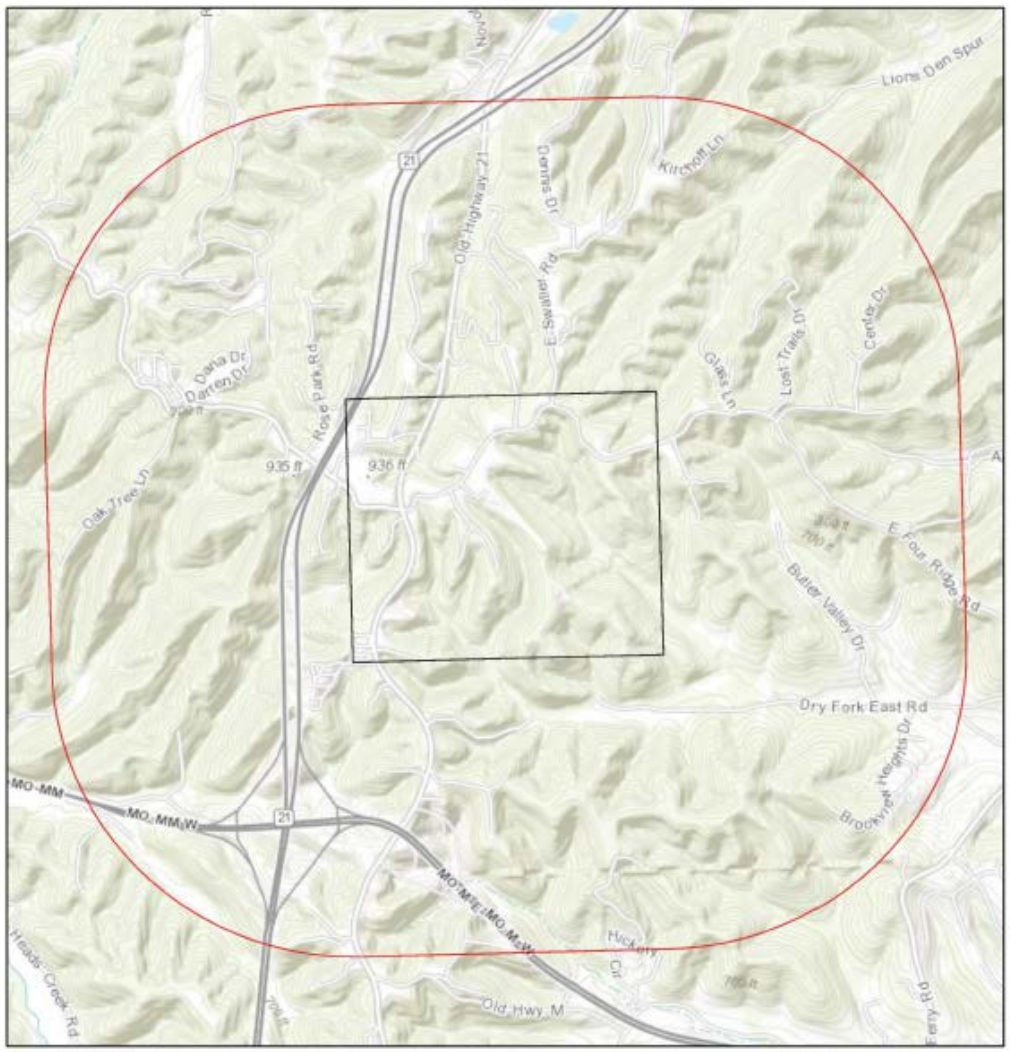
Disclaimer: The NATURAL HERITAGE REVIEW REPORT produced by this website identifies if a species tracked by the Natural Heritage Program is known to occur within or near the area submitted for your project, and shares suggested recommendations on ways to avoid or minimize project impacts to sensitive species or special habitats. If an occurrence record is present, or the proposed project might affect federally listed species, the user must contact the Department of Conservation or U,S, Fish and Wildlife Service for more information, The Natural Heritage Program tracks occurrences of sensitive species and natural communities where the species or natural community has been found. Lack of an occurrence record does not mean that a sensitive plant, animal or natural community is not present on or near the project area. Depending on the project, current habitat conditions, and geographic location in the state, surveys may be necessary, Additionally, because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present, Therefore, Reports include information about records near but not necessarily on the project site.

The Natural Heritage Report is not a site clearance letter for the project. It provides an indication of whether or not public lands and sensitive resources are known to be (or are likely to be) located close to the proposed project. Incorporating information from the Natural Heritage Program into project plans is an important step that can help reduce unnecessary impacts to Missouri's sensitive fish, forest and wildlife resources, However, the Natural Heritage Program is only one reference that should be used to evaluate potential adverse project impacts. Other types of information, such as wetland and soils maps and on-site inspections or surveys, should be considered. Reviewing current landscape and habitat information, and species' biological characteristics would additionally ensure that Missouri Species of Conservation Concern are appropriately identified and addressed in planning efforts.

U.S. Fish and Wildlife Service – Endangered Species Act (ESA) Coordination: Lack of a Natural Heritage Program occurrence record for federally listed species in your project area does not mean the species is not present, as the area may never have been surveyed. Presence of a Natural Heritage Program occurrence record does not mean the project will result in negative impacts, The information within this report is not intended to replace Endangered Species Act consultation with the U,S, Fish and Wildlife Service (USFWS) for listed species, Direct contact with the USFWS may be necessary to complete consultation and it is required for actions with a federal connection, such as federal funding or a federal permit; direct contact is also required if ESA concurrence is necessary. Visit the USFWS Information for Planning and Conservation (IPaC) website at https://ecos.fws.gov/ipac/ for further information. This site was developed to help streamline the USFWS environmental review process and is a first step in ESA coordination. The Columbia Missouri Ecological Field Services Office may be reached at 573-234-2132, or by mail at 101 Park Deville Drive, Suite A, Columbia, MO 65203,

Transportation Projects: If the project involves the use of Federal Highway Administration transportation funds, these recommendations may not fulfill all contract requirements. Please contact the Missouri Department of Transportation at 573-526-4778 or www,modot,mo,gov/ehp/index,htm for additional information on recommendations,

Clyde Hamrick Elementary School



June 27, 2017

1:27,925

0 0.225 0.45 0.9 mi

0 0.375 0.75 1.5 km

- Project Boundary
- Buffered Project Boundary

Species or Communities of Conservation Concern within the Area:

There are no known records for Species or Natural Communities of Conservation Concern within the defined Project Area.

Other Special Search Results:

No results have been identified for this project location.

Project Type Recommendations:
Waste Transfer, Treatment, and Disposal - Wastewater treatment plant: New or Maintenance. Recommendations to help avoid and minimize impacts to fish, forest and wildlife resources are under development.

Project Location and/or Species Recommendations:

Endangered Species Act Coordination – Indiana bats *(Myotis sodalis*, federal- and state-listed endangered) and **Northern long-eared bats** (*Myotis septentrionalis*, federal-listed threatened) may occur near the project area. Both of these species of bats hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in wooded areas, often riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats or Northern long-eared bats, especially from September to April. **If any trees need to be removed for your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.**

The project location submitted and evaluated is within the range of the Gray Myotis (i.e., Gray Bat) in Missouri. Depending on habitat conditions of your project's location, Gray Myotis (*Myotis grisescens*, federal and state-listed endangered) could occur within the project area, as they forage over streams, rivers, lakes, and reservoirs. Avoid entry or disturbance of any cave inhabited by Gray Myotis and when possible retain forest vegetation along the stream and from the cave opening to the stream. See http://mdc.mo.gov/104 for best management recommendations.

Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment. Please inspect and clean equipment thoroughly before moving between project sites. See http://mdc.mo.gov//9633 for more information.

- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs,
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (?140° F, typically available at do-it-yourself car wash sites), and dry in the hot sun before using again.

Streams and Wetlands – Clean Water Act Permits: Streams and wetlands in the project area should be protected from activities that degrade habitat conditions. For example, soil erosion, water pollution, placement of fill, dredging, in-stream activities, and riparian corridor removal, can modify or diminish aquatic habitats. Streams and wetlands may be protected under the Clean Water Act and require a permit for any activities that result in fill or other modifications to the site. Conditions provided within the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 permit (http://www.nwk.usace.army.mil/Missions/RegulatoryBranch.aspx) and the Missouri Department of Natural Resources (DNR) issued Clean Water Act Section 401 Water Quality Certification (http://dnr.mo.gov/env/wpp/401/index.html), if required, should help minimize impacts to the aquatic organisms and aquatic habitat within the area. Depending on your project type, additional permits may be required by the Missouri Department of Natural Resources, such as permits for stormwater, wastewater treatment facilities, and confined animal feeding operations. Visit http://dnr.mo.gov/env/wpp/permits/index.html for more information on DNR permits. Visit both the USACE and DNR for more information on Clean Water Act permitting.

For further coordination with the Missouri Department of Conservation and the U.S. Fish and Wildlife Services, please see the contact information below,

MDC Natural Heritage Review
Resource Science Division
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182
NaturalHeritageReview@mdc.mo.gov

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Miscellaneous Information

FEDERAL Concerns are species/habitats protected under the Federal Endangered Species Act and that have been known near enough to the project site to warrant consideration. For these, project managers must contact the U.S. Fish and Wildlife Service Ecological Services (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132; Fax 573-234-2181) for consultation.

STATE Concerns are species/habitats known to exist near enough to the project site to warrant concern and that are protected under the Wildlife Code of Missouri (RSMo 3 CSR 1 0). "State Endangered Status" is determined by the Missouri Conservation Commission under constitutional authority, with requirements expressed in the Missouri Wildlife Code, rule 3CSR 1 0-4.111. Species tracked by the Natural Heritage Program have a "State Rank" which is a numeric rank of relative rarity. Species tracked by this program and all native Missouri wildlife are protected under rule 3CSR 10-4.110 General Provisions of the Wildlife Code.

Additional information on Missouri's sensitive species may be found at http://mdc.mo.gov/discover-nature/field-guide/endangered-species . Detailed information about the animals and some plants mentioned may be accessed at http://mdc4.mdc.mo.gov/applications/mofwis/mofwis_search1.aspx . If you would like printed copies of best management practices cited as internet URLs, please contact the Missouri Department of Conservation.

Appendix C: Antidegradation Review Summary Attachments

The attachments that follow contain summary information provided by the applicant.

Department staff determined that the following changes must be made to the information contained within these attachments:

1) Water Quality Review Assistance/Antidegradation Review Request form:

    a. No changes needed.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM

WATER QUALITY REVIEW ASSISTANCE/ ANTIDEGRADATION REVIEW REQUEST

PRE-CONSTRUCTION REVIEW FOR PROTECTION OF BENEFICIAL USES AND DEVELOPING EFFLUENT LIMITS

For Office Use Only	
CHECK NUMBER	
DATE RECEIVED	FEE SUBMITTED

TYPE OF PROJECT ☐ Grant ☐ SRF Loan ☑ All Other Projects

REQUESTER	TELEPHONE NUMBER WITH AREA CODE
John Brazeal	(636) 296-8000
PERMITTEE / FACILITY NAME: Clyde Hamrick Elementary School	MSOP NUMBER (IF APPLICABLE)
COUNTY: Jefferson County	SIC / NAICS CODE

REASON FOR REQUEST

☑ New Discharge (See Instruction #9) ☐ Upgrade (No expansion) (See AIP) ☐ Expansion ☐ QAPP or Study Review

DESCRIPTION OF PROPOSED ACTIVITY

The proposed WWTF will composite a primary tank and an advanced treatment technology. The treated wastewater will then flow through a UV disinfection system prior to discharging into the tributary of Glaize Creek.

FACILITY INFORMATION

METHOD OF BACTERIA COMPLIANCE

☐ Chlorine Disinfection ☑ Ultraviolet Disinfection ☐ Ozone ☐ Not Applicable

WATER QUALITY ISSUES*

*Water quality issues include: effluent limit compliance issues, notices of violation, water body beneficial uses not attained or supported, etc.

OUTFALL	LOCATION (UTM OR LAT/LONG OR LEGAL DESCRIPTION)	MAPPED[1] (CHECK)	RECEIVING WATER BODY[2]
1	38.396010, -90.489675	☑	Tributary of Glaize Creek

[1] Please attach topographic map (See: www.dnr.mo.gov/internetmapviewer/) with outfall locations clearly marked. For additional outfalls, attach a separate form.

[2] Please see general instructions for discharges to streams.

OUTFALL	NEW DESIGN FLOW ** (MGD)	TREATMENT TYPE	EFFLUENT TYPES*
1	0.0027	Package Treatment System	Domestic Wastewater

* Describe predominating character of effluent. Example: Domestic Wastewater, Municipal Wastewater, Industrial Wastewater, Storm water, Mining Leachate, etc.

** If expansion, indicate new design flow.

See General Instructions. Additional information may be needed to complete your request. Your request may be returned if items are missing. The water quality review assistance is a process to determine effluent limits for new facilities or existing facilities seeking to increase loading into the receiving stream.

SIGNATURE	DATE
	8-24-2017
PRINT NAME: John Brazeal	EMAIL ADDRESS: brazealj@foxc6.org
	TELEPHONE NUMBER WITH AREA CODE: (636) 296-8000

Applicant supplied (check all that apply):

- ☑ Fee. See Instructions
- ☐ Attachment A – Significant Degradation
- ☐ Attachment B – Minimal Degradation
- ☐ Attachment C – Temporary degradation
- ☐ Attachment D – Tier 1 Review
- ☐ No Degradation Evaluation
- ☑ Heritage Review Determination. See Instruction #8.
- ☑ Geohydrologic Evaluation. See Instruction #9.
- ☐ Tier Analysis for minimal degradation (see Page 3, Tier 2 Reviews).
- ☐ Quality Assurance Project Plan.
- ☐ Time of travel study (see Instruction #3) or model (see Instruction #2).

Submit request to:
Missouri Department of Natural Resources,
Water Protection Program,
ATTN: WPCB Engineering Section
P.O. Box 176
Jefferson City, MO 65102-0176
Telephone: 573-751-1300
Fax: 573-522-9920

2) Attachment E: Tier 2 – Significant Degradation Using Department's Alternatives Analysis for Domestic Wastewater Facilities with Design Flow Less Than 10,000 Gallons Per Day form:

   a. No changes needed.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM, WATER POLLUTION CONTROL BRANCH

ANTIDEGRADATION REVIEW SUBMITTAL

ATTACHMENT E: TIER 2 – SIGNIFICANT DEGRADATION USING DEPARTMENT'S ALTERNATIVES ANALYSIS FOR DOMESTIC WASTEWATER FACILITIES WITH DESIGN FLOW LESS THAN 10,000 GALLONS PER DAY

1. APPLICABILITY

If you answer "Yes" to any of the below questions, a site specific alternatives analysis may be required.

The department's alternatives analysis is *not* applicable to facilities that have a Total Maximum Daily Load (TMDL) or are 303(d) or 305(b) listed for the pollutants of concerns addressed in this alternatives analysis, with an exception for *E. coli* since disinfection will be required.

Facilities currently under enforcement will need to coordinate with the Water Protection Program's compliance and enforcement section to determine applicability for the department's alternatives analysis.

1.1 Does the receiving waterbody or downstream waterbody have a Total Maximum Daily Load (TMDL)? ☐ Yes ☑ No
(This can be checked at: http://dnr.mo.gov/env/wpp/tmdl/)

1.2 Is the receiving waterbody or downstream waterbody 303(d) or 305(b) listed as impaired or potentially impaired? (This can be checked at: dnr.mo.gov/env/wpp/waterquality/303d/303d.htm) ☐ Yes ☑ No

1.3 Is the facility currently under enforcement with the department or the U.S. Environmental Protection Agency? ☐ Yes ☑ No

1.4 Is the design flow 10,000 gallons per day or more? ☐ Yes ☑ No

1.5 Is a nondischarging system a viable option ☐ Yes ☑ No

The following forms must also be submitted with this form:

☑ No Discharge Evaluation Form (dnr.mo.gov/env/forms/780-2805-f.pdf)

☑ Water Quality Review Assistance/Antidegradation Review Request Form (http://dnr.mo.gov/forms/780-1893-f.pdf)

2. FACILITY

NAME			TELEPHONE NUMBER WITH AREA CODE
Clyde Hamrick Elementary School			(636) 282-6930
ADDRESS (PHYSICAL)	CITY	STATE	ZIP CODE
4525 E 4 Ridge Rd.	Imperial	MO	63052

3. OWNER

NAME AND OFFICIAL TITLES			
Fox C - 6 School District			
ADDRESS	CITY	STATE	ZIP CODE
745 Jeffco Blvd.	Arnold	MO	63010
TELEPHONE NUMBER WITH AREA CODE	EMAIL ADDRESS		
(636) 296-8000			

4. CONTINUING AUTHORITY The regulatory requirement regarding continuing authority is found in 10 CSR 20-6.010(3) available at www.sos.mo.gov/adrules/csr/current/10csr/10c20-6a.pdf

NAME AND OFFICIAL TITLES			
Jefferson County Public Sewer District			
ADDRESS	CITY	STATE	ZIP CODE
4632 Yeager Rd.	Hillsboro	MO	63050
TELEPHONE NUMBER WITH AREA CODE	EMAIL ADDRESS		
636-797-9900			

MO 780-2804 (05-17)

5. RECEIVING WATER BODY SEGMENT #1

NAME

Unnamed tributary of Glaize Creek - Stream Order 1

5.1 UPPER END OF SEGMENT (Location of discharge)
UTM X=_____ Y=_____ OR Lat 38.39601 Long -90.489675

5.2 LOWER END OF SEGMENT
UTM X=_____ Y=_____ OR Lat 38.38846 Long -90.481639

Per the Missouri Antidegradation Implementation Procedure, or AIP, the definition of a segment is: "A section of water that is bound, at a minimum, by significant existing sources and confluences with other significant water bodies."

6. WATER BODY SEGMENT #2

NAME

Unnamed tributary of Glaize Creek - Stream Order 2

6.1 UPPER END OF SEGMENT
UTM X=_____ Y=_____ OR Lat 38.388465 Long -90.481639

6.2 LOWER END OF SEGMENT
UTM X=_____ Y=_____ OR Lat 38.384935 Long -90.477627

7. SOCIAL AND ECONOMIC IMPORTANCE OF THE PREFERRED ALTERNATIVE

This section must be completed with adequate and thorough descriptions of the social and economic importance associated with the proposed project in accordance with the Antidegradation Implementation Procedure Section II.E. for discharge to be allowed.

Social and economic importance is defined as the social and economic benefits to the community that will occur from any activity involving a new or expanding discharge.

7.1 Identify the affected community:

(The affected community is defined in 10 CSR 20-7.031(2)(B) as the community "in the geographical area in which the waters are located: Per the Antidegradation Implementation Procedure Section II.E.1, "the affected community should include those living near the site of the proposed project as well as those in the community that are expected to directly or indirectly benefit from the project.")

The affected community, Clyde Hamrick Elementary School, is a public school in Fox C-6 School District and located at 4525 E 4 Ridge Road in Imperial, Missouri. The School has a total number of 520 students and staff. As the only elementary school in the designated school attendance zone, it offers grades from Kindergarten to Fifth Grade.

7.2 Identify the important social and economic development associated with the project:

Will the proposed discharging activity:

Create or expand employment?	☑ Yes	☐ No	☐ Don't know	☐ N/A
Increase median family income?	☑ Yes	☐ No	☐ Don't know	☐ N/A
Reduce the number of households below the poverty line?	☑ Yes	☐ No	☐ Don't know	☐ N/A
Increase the community tax base?	☐ Yes	☐ No	☑ Don't know	☐ N/A
Increase needed housing supply?	☐ Yes	☐ No	☑ Don't know	☐ N/A
Provide necessary public services (e.g., school, infrastructure, fire department, etc.)?	☑ Yes	☐ No	☐ Don't know	☐ N/A
Correct a public health, safety, or environmental problem?	☑ Yes	☐ No	☐ Don't know	☐ N/A

Other:

7.3 Describe the important social and economic development associated with the project:

The applicant must describe the expected changes in the factors identified in question 7.2 that are associated with the project and provide information on any additional items demonstrating important social and economic development. The applicant should first describe the existing condition of the affected community. This base condition should then be compared to the predicted change (benefit) in social and economic condition after the discharge is allowed. The social and economic measures identified above do not constitute a comprehensive list. Each situation and community is different and will require an analysis of unique social and economic factors in accordance with the Antidegradation Implementation Procedure Section II.E.1.

When the Department issued a Letter of Warning to the lagoons at Meramec Heights, the School took the initiative to upgrade all their sanitary systems including the one at Clyde Hamrick. Civil Design, Inc has helped the School District to bring sanitary systems at Meramec Heights and Ridgewood into compliance and Clyde Hamrick is the next in line.

Sanitary treatment for Clyde Hamrick is currently provided by an unpermitted single-cell sewage lagoon, located behind the school approximately 120 feet from the building, and 50 from the parking lot. Prior to entering the lagoon, wastewater flows through two septic tanks, one for the original building and one for the school addition, which provide initial separation of solids. Historical plans also indicate that effluent from the septic tanks flow through sand filters before entering the sewage lagoon, which allows solids to settle to the bottom of the pond and the remaining wastewater is treated naturally with the use of wind, sunlight, bacteria, and algae. There was no indication that the sand filters still exist during inspection. The lagoon is approximately 140 feet in length and 60 feet wide and currently contains a total sludge volume of around 385,770 gallons. At the time of inspection, when school was not in session, the lagoon was dry and the pipe from the school and septic tanks into the lagoon could not be located. The cell is dry and overgrown with tall weeds and brush. Historical aerial photography indicates that the lagoon cell is wet in the spring, when school is in session and wet weather exists. The area surrounding the lagoon including the fence and berm were heavily wooded and air flow across the basin was limited. The overflow structure was surrounded by tall weeds and no flow appears to reach the structure, except maybe during extreme conditions. The lagoon was not functioning properly to adequately treat the wastewater from the school.

The proposed solution for Clyde Hamrick is a primary underground tank and an advanced treatment technology combined with a UV disinfection system. The new system reduces potential for overflows from the existing lagoon and bank failure that would cause contamination of the receiving stream as well as ground water contamination. Jefferson County Public Sewer will take over the proposed facility as continuing authority. Combined together, the proposed WWTF will not only provide an adequate treatment but also a safe environment for the school. With the new sanitary system, the school is able to run more smoothly in providing necessary public education. Being the only elementary school in the designated school attendance zone, equipped with this sanitary system, the school is able to offer employment opportunities which can increase the family income and reduce the number of household under poverty line. In addition, a safe and health environment will help kids from low income family get a chance to improve their life quality in the future.

7.4 Is any other written correspondence or documentation included with this application to provide further evidence of social and economic importance:

☑ No

☐ Yes

- ☐ Letter(s) from the mayor or community in support of the proposed project
- ☐ Rezoning approval
- ☐ Other:

8. NO DISCHARGE ALTERNATIVES EVALUATION

According to 10 CSR 20-6.010(4)(D), reports for the purpose of constructing a wastewater treatment facility shall consider the feasibility of constructing and operating a no discharge facility. Per the Antidegradation Implementation Procedure Section II.B.1, for discharges likely to cause significant degradation, applicants must provide an analysis of non-degrading alternatives. No-discharge alternatives may include surface land application, subsurface land application, and connection to a regional treatment facility.

You must submit the *No-Discharge Evaluation Form* available at dnr.mo.gov/env/forms/780-2805-f.pdf to demonstrate that a nondischarging alternative is not feasible. If sufficient information is not provided on the *No-Discharge Evaluation Form* to demonstrate that a nondischarging facility is not feasible, a more detailed evaluation of no discharge options must be submitted.

9. IDENTIFY PREFERRED TREATMENT ALTERNATIVE

Describe your preferred treatment alternative that has been recommended or approved by a registered professional engineer licensed to practice in Missouri. The preferred treatment alternative must be capable of meeting the effluent limits in the table under item 10 of this form.

Applicants choosing to use a new wastewater technology considered an "unproven technology" in Missouri must comply with the requirements set forth in the Innovative Technology factsheet found at: dnr.mo.gov/pubs/pub2453.htm

The proposed WWTF will composite a primary tank and an advanced treatment technology. The treated wastewater will then flow through a UV disinfection system prior to discharging into the tributary of Glaize Creek. The advanced treatment technologies that are currently under reviewing include AdvanTex and Nexom. Both are capable of meeting the effluent limits in the table below.

ENGINEERING CONSULTANT NAME	COMPANY NAME
Laura M. Rightler	Civil Design, Inc.

10. SUMMARY OF THE POLLUTANTS OF CONCERN AND EFFLUENT LIMITS

Pollutants of concern to be considered include those pollutants reasonably expected to be present in the discharge per the Antidegradation Implementation Procedure Section II.A. and assumed or demonstrated to cause significant degradation.
The tier protection levels are specified and defined in rule at 10 CSR 20-7.031 (2).
All POCs in this alternatives analysis were considered to be Tier 2 and significantly degrading in the absence of existing water quality.

As a result of this alternatives analysis review, the department has determined, depending on site specific conditions, there are treatment technologies available that may be economically efficient and practicable, which are capable of meeting the effluent limitations below. If the facility owners do not believe there is a treatment technology that is economically efficient, affordable, or practicable for their facility to meet these limits, a site specific alternatives analysis will be required.

The chosen alternative must be capable of meeting the following effluent limitations:

Pollutant of Concern*		Units	Daily Maximum	Weekly Average	Monthly Average
BOD_5		mg/L		15	10
TSS		mg/L		15	10
Ammonia as N Summer		mg/L	1.7		0.6
Ammonia as N Winter		mg/L	5.6		2.1
pH		SU	6.5–9.0		6.5–9.0
Escherichia coli (*E. coli*)	WBC(A)	#/100 mL	630***		126
	WBC(B)	#/100 mL	1030***		206
	Losing Stream**	#/100 mL	126***		Monitoring only

* Permit limits for other parameters, including oil and grease, total residual chlorine, nitrates, and total phosphorus, will be included in the operating permit based on applicable water quality standards and criteria as applicable.

Total residual chlorine (TRC) effluent limits of 0.017 mg/L daily maximum, 0.008 mg/L monthly average are recommended if chlorine is used as a disinfectant. Standard compliance language for TRC, including the minimum level (ML), may be included in the operating permit.

** For any facility that will discharge to a waterbody designated as a losing stream or within two miles flow distance upstream of a losing stream.

*** Publicly owned treatment works will receive a weekly average limit and private facilities will receive a daily maximum limit.

If any Tier 1 Pollutants of Concern not addressed in this alternatives analysis will be discharged, the applicant must submit *Attachment D: Tier 1 Review* (dnr.mo.gov/forms/780-2024-f.pdf) for those pollutants.

OWNER: I have read and reviewed the prepared documents and agree with this submittal.

SIGNATURE	DATE
	8-24-2017

CONTINUING AUTHORITY: I have read and reviewed the prepared documents and agree with this submittal.

SIGNATURE	DATE
	8-25-2017

MO 780-2024 (05-17)

3) No Discharge Evaluation Form:

a. No changes needed.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM, WATER POLLUTION CONTROL BRANCH

NO DISCHARGE EVALUATION

NO DISCHARGE EVALUATION

According to 10 CSR 20-6.010(4)(D), reports for the purpose of constructing a wastewater treatment facility shall consider the feasibility of constructing and operating a no-discharge facility. Per the Antidegradation Implementation Procedure Section II.B.1, for discharges likely to cause significant degradation, applicants must provide an analysis of nondegrading alternatives. No-discharge alternatives may include surface land application, subsurface land application, and connection to a regional treatment facility.

Please refer to the *No-Discharge Evaluation Memo and Matrix* available at dnr.mo.gov/env/wpp/permits/docs/20160217-no-discharge-memo.pdf for examples of information and documentation to provide to justify common reasons for not pursuing no-discharge land application. If sufficient information is not provided on this form to demonstrate that a no-discharge facility is not feasible, a more detailed evaluation of no-discharge options may have to be submitted.

Additional pages may be attached if more room is needed.

1. FACILITY

NAME	COUNTY
Clyde Hamrick Elementary School	Jefferson County

2. EVALUATION OF NO-DISCHARGE LAND APPLICATION

Check all applicable reasons why no-discharge land application was not pursued:

☐ **2.1 Land Availability and Cost:**

A. How many acres are required for land application of the effluent?

B. What is the cost to purchase any necessary additional land within 1.5 miles of the facility?

C. Were costs evaluated for transporting and land applying at a location farther from the site? ☐ Yes ☐ No

D. What is the capital cost estimate for piping and pumps to transport effluent to a suitable land application site?

E. Did you evaluate entering a long-term lease with a farmer or other land owner: ☐ Yes ☐ No

How many land owners were contacted and what restrictions were presented?

Could controls be built into the contract, such as requiring the owner to use a certain percentage of the water annually?

F. Were increased application rates evaluated in order to use less land? ☐ Yes ☐ No

G. Was using multiple application sites evaluated to optimize application rate per site? ☐ Yes ☐ No

H. Can the facility do seasonal discharge or seasonal application? ☐ Yes ☐ No

I. Was land applying to public use areas, such as golf courses or parks, evaluated? ☐ Yes ☐ No

J. Were long-term costs evaluated and compared for upgrading to a mechanical plant with future Water Quality Standards changes (i.e. mussel ammonia, bacteria, TP, TN) versus cost for a land application system? ☐ Yes ☐ No

☐ **2.2 Easements**

A. Were land owners contacted for rights to an easement? ☐ Yes ☐ No

B. What is the cost of easement acquisition?

☐ **2.3 Zoning or Suitability of Site in Proximity to Neighboring Sites or Waterbodies:**

A.	Can buffer distances be increased to reduce neighbor complaints?	☐ Yes	☐ No
B.	Was drip or subsurface irrigation evaluated as opposed to surface application?	☐ Yes	☐ No
C.	Does the county ordinance specifically restrict land application, surface and subsurface?	☐ Yes	☐ No
D.	Can a vegetated buffer be installed to reduce necessary buffer distances?	☐ Yes	☐ No
E.	Can higher application rates requiring less land be used?	☐ Yes	☐ No
F.	Are there other steps or considerations that can be made (see 2.1)?	☐ Yes	☐ No
G.	What is the distance to a neighboring county without zoning restrictions?		

☑ **2.4 Unsuitability of Geology or Soils**

A.	Is a geohydrologic evaluation, county soils survey map, or other resource showing suitability and application rates included with this application?	☑ Yes	☐ No
B.	Is it cost-effective to bring in additional soils?	☐ Yes	☑ No
C.	Can the application rate be decreased to a suitable rate?	☐ Yes	☑ No
D.	Were subsurface application alternatives (e.g. low pressure pipe, drip) considered?	☑ Yes	☐ No
E.	If collapse potential is a concern, was using a liner or alternative site (see 2.1) evaluated?	☑ Yes	☐ No

2.5 Summarize why no-discharge land application was not a practicable or economically efficient alternative

A no-discharge lagoon was evaluated with on-site land application. Soil information acquired from Natural Resources Conservation Service and Geohydrologic Evaluation conducted by the Department show that the site receives a moderate overall geologic limitations rating and a moderate collapse potential rating. The complete soil information is attached for review. The work necessary to provide an area suitable for land application is evaluated to cost $735,000. For off-site land application, the lagoon will need to be pumped and hauled at least four times a year with an estimated annual operation cost of $140,000. Therefore, no-discharge land application is not practicable and economically efficient.

3. EVALUATION OF REGIONALIZATION

3.1 Regionalization Feasibility:

A. What is the distance to connect to the closest municipality's line or other facility's line? About 3 miles (15,840 feet)

B. Is there any planning or zoning in the area regarding development and services? No

C. What is the estimated capital cost for piping and pumps to regionalize?

D. Does a regional facility have the capacity to treat the additional effluent from this project, and if not, what would it cost to upgrade the regional facility?

3.2 Summarize why regionalization was not a practicable or economically efficient alternative

Properties around the school are mostly residential houses and widely distributed on the satellite image. The hilly area is also a challenge in designing a regional wastewater treatment facility(WWTF). The School is within the Jefferson County Public Sewer District service area but outside service limits of both Rock Creek and Glaize Creek Sewer Districts. There are no centralized WWTF within 3 miles of the school. Research indicated no planned new development that would benefit from a new regional facility at this time. There are also no identified potential customers that a new system network would provide for opportunity to connect. Therefore, it's not economically efficient to connect all the sewers together.

4. DOCUMENTATION

4.1 Is any other written correspondence or documentation included with this application to provide further justification for not pursuing a no-discharge option or regionalization?

☐ No

☑ Yes:

- ☐ Correspondence with land owners regarding land for sale or lease or easement rights.
- ☐ Letters from the community or a consulting engineer regarding availability, proximity, and location of suitable land and the reasonable cost of such land.
- ☐ Documentation of recent land sales or appraisals.
- ☐ Calculations for sizing a land application system.
- ☐ Detailed cost estimates for a land application system or regionalization including lift stations, piping, easements, liners, and/or connection costs.
- ☑ Geohydrologic evaluation or other soils report.
- ☐ Copy of a county or city ordinance.
- ☐ Council meeting minutes.
- ☐ A letter from an existing higher preference continuing authority waiving preferential status where service is not available in accordance with 10 CSR 20-6.0 10 (3) or if capacity is not available.
- ☐ A letter from the existing higher preference continuing authority stating that the regional facility has no interest in taking flow from the new or expanded facility.
- ☐ A letter from the regional municipality stating that the project area is outside city limits and annexation would be required.
- ☐ Verification of funding from State Revolving Fund, which does not fund projects outside city limits.
- ☑ Other:

Comment letter on no-discharge lagoon construction permit application from the Department of Natural Resources

OWNER: I have read and reviewed the prepared documents and agree with this submittal.

NAME AND OFFICIAL TITLES

John Brazeal, Chief Financial Officer

SIGNATURE

DATE 8-24-2017

CONTINUING AUTHORITY: I have read and reviewed the prepared documents and agree with this submittal. The regulatory requirement regarding continuing authority is found in 10CSR 20-6.010(3) available at: sos.mo.gov/cmsimages/adrules/csr/current/10csr/10c20-6.pdf

NAME AND OFFICIAL TITLES

Jefferson County Public Sewer District

SIGNATURE

DATE 8-25-2017

Sewage Disposal

This table shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (Ksat) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Sewage Disposal

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

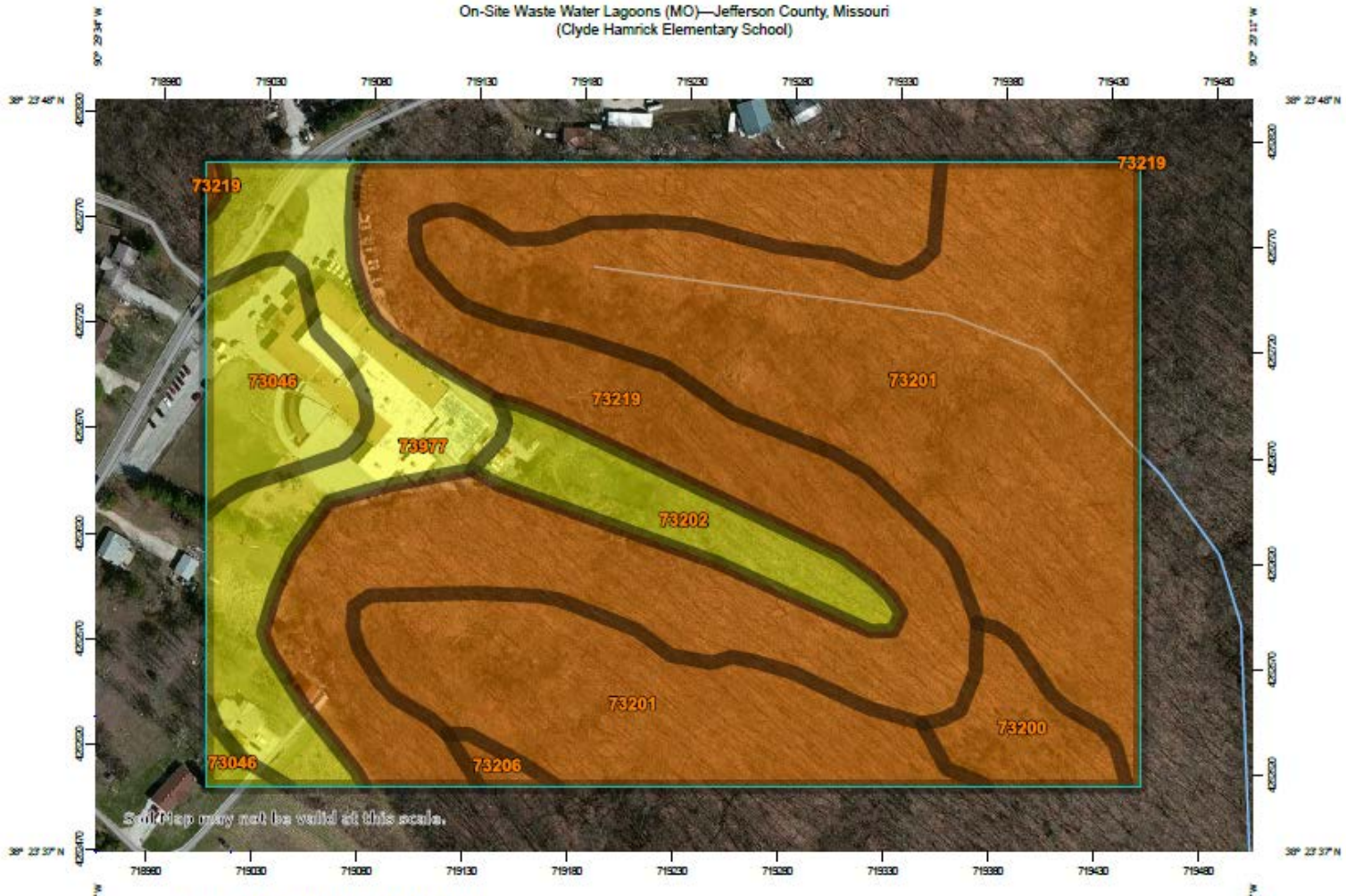
Sewage Disposal–Jefferson County, Missouri					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
73046—Wrengart silt loam, 3 to 8 percent slopes, eroded					
Wrengart	90	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Slope	0.92
		Slow water movement	1.00	Depth to saturated zone	0.04

Sewage Disposal–Jefferson County, Missouri					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
73200—Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony					
Sonsac	85	Very limited		Very limited	
		Slow water movement	1.00	Depth to hard bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
73201—Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony					
Sonsac	85	Very limited		Very limited	
		Slow water movement	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
		Depth to bedrock	1.00		
73202—Rueter gravelly silt loam, 3 to 15 percent slopes, very stony					
Rueter	90	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.04	Seepage	0.50
73206—Useful silt loam, 15 to 40 percent slopes					
Useful	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to hard bedrock	0.18
		Slope	1.00	Depth to saturated zone	0.04
		Depth to bedrock	0.62		
73219—Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony					
Rueter	90	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	1.00	Seepage	1.00
73977—Wrengart silt loam, 8 to 15 percent slopes, eroded					
Wrengart	90	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Seepage	0.50
		Slope	0.63	Depth to saturated zone	0.04

Data Source Information

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

On-Site Waste Water Lagoons (MO)—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



Map Scale: 1:2,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Soil Rating Lines
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Soil Rating Points
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

On-Site Waste Water Lagoons (MO)

On-Site Waste Water Lagoons (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Provisionally Suitable - Low	Wrengart (90%)	Provisionally Suitable - Fragments 36-60% (0.64)	1.7	5.1%
				Provisionally Suitable - Fragic Layer 20-40" (0.67)		
				Provisionally Suitable - Weighted clay 20-30 (0.69)		
				Provisionally Suitable - Slope 3-8% (0.83)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Unsuitable	Sonsac (85%)	Unsuitable - Bedrock 20-40" (0.40)	1.0	3.1%
				Provisionally Suitable - Fragments 36-60% (0.63)		
				Provisionally Suitable - Slope 3-8% (0.75)		
				Provisionally Suitable - Moderate Permeability (0.97)		
			Gatewood (10%)	Unsuitable - Bedrock 20-40" (0.45)		
				Provisionally Suitable - Slope 3-8% (0.75)		
			Gasconade (5%)	Unsuitable - Bedrock 0-20" (0.16)		
				Provisionally Suitable - Fragments 36-60% (0.73)		

On-Site Waste Water Lagoons (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Provisionally Suitable - Slope 3-8% (0.75)		
				Suitable - Weighted clay >45% (0.90)		
				Provisionally Suitable - Moderate Permeability (0.96)		
			Rock outcrop (0%)	Unsuitable - Bedrock 0-20" (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Provisionally Suitable - Slope 3-8% (0.75)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Unsuitable	Sonsac (85%)	Unsuitable - Bedrock 20-40" (0.40)	14.2	43.7%
				Unsuitable - Slope >15% (0.41)		
				Provisionally Suitable - Fragments 36-60% (0.63)		
				Provisionally Suitable - Moderate Permeability (0.97)		
			Gatewood (8%)	Unsuitable - Slope >15% (0.41)		
				Unsuitable - Bedrock 20-40" (0.45)		

On-Site Waste Water Lagoons (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Gasconade (5%)	Unsuitable - Bedrock 0-20" (0.16)		
				Unsuitable - Slope >15% (0.41)		
				Provisionally Suitable - Fragments 36-60% (0.73)		
				Suitable - Weighted clay >45% (0.90)		
				Provisionally Suitable - Moderate Permeability (0.96)		
			Alred (2%)	Unsuitable - Slope >15% (0.41)		
				Provisionally Suitable - Fragments 36-60% (0.65)		
				Provisionally Suitable - Moderate Permeability (0.83)		
				Suitable - Weighted clay >45% (0.91)		
			Rock outcrop (0%)	Unsuitable - Bedrock 0-20" (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Unsuitable - Slope >15% (0.41)		

On-Site Waste Water Lagoons (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Provisionally Suitable - Low	Rueter (90%)	Provisionally Suitable - Fragments 36-60% (0.70)	1.6	4.9%
				Provisionally Suitable - Slope 9-15% (0.71)		
				Suitable - Weighted clay >45% (0.87)		
				Provisionally Suitable - Moderate Permeability (0.88)		
73206	Useful silt loam, 15 to 40 percent slopes	Unsuitable	Useful (85%)	Unsuitable - Slope >15% (0.41)	0.2	0.5%
				Provisionally Suitable - Bedrock 40-60" (0.66)		
				Provisionally Suitable - Fragments 36-60% (0.69)		
				Suitable - Weighted clay >45% (0.92)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Unsuitable	Rueter (90%)	Unsuitable - Slope >15% (0.38)	10.4	31.8%
				Unsuitable - Fragments 61-100% (0.48)		
				Unsuitable - Weighted clay 0-20 (0.49)		
				Provisionally Suitable - Moderate Permeability (0.50)		
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Provisionally Suitable - Low	Wrengart (90%)	Provisionally Suitable - Slope 9-15% (0.61)	3.6	11.0%

On-Site Waste Water Lagoons (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Provisionally Suitable - Fragic Layer 20-40" (0.68)		
				Provisionally Suitable - Weighted clay 30-35 (0.73)		
				Provisionally Suitable - Fragments 16-35% (0.85)		
				Provisionally Suitable - Moderate Permeability (0.98)		
Totals for Area of Interest					**32.6**	**100.0%**

On-Site Waste Water Lagoons (MO)— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Unsuitable	25.7	79.1%
Provisionally Suitable - Low	6.8	20.9%
Totals for Area of Interest	**32.6**	**100.0%**

Description

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

This interpretation is currently serving the Truman Lake Area (comprising most of Henry, St. Clair, Benton, and Hickory Counties, Missouri), but will soon be expanded to apply to the entire state of Missouri. The interpretation is a soil suitability index created to assist landowners and developers with on-site waste management system decisions. Each soil is rated for its suitability for installation of sewage lagoons. The closely follows the soil properties considered suitable in the 1995 Missouri State Regulations for On-site Disposal Systems but is not intended to replace on-site investigations.

The best suited soils for standard sewage lagoon systems are very deep, have moderately slow to extremely slow permeability, are fine textured, have less than 15% rock fragments, are on less than 2% slope, have no fragipan within 60 inches, are not in depressional or karst areas, and are not subject to flooding or ponding. Soils that are unsuited have a shallow effective rooting depth, moderately rapid to very rapid permeability, are coarse textured, have more than 15% rock fragments, are on greater than 15% slope, are in a depressional or karst area, or are subject to flooding or ponding.

The values for soil factors in the index are listed by soil property and ranked from 0 to 1. Those soils ranked 1 have properties considered "suitable" while those ranked from 0 to 0.5 are considered "unsuitable." Soils ranked between 0.5 and 1 are considered provisionally suitable. Provisionally suitable soils are generally well suited to conventional design but may have one or more slight limitations that and may need more design considerations. The provisionally suitable class is split into 2 classes, low potential and high potential. The "provisionally suitable - high" class is generally better suited and has fewer limitations to overcome than the "provisionally suitable - low" class.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen, which is displayed on the report. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the Selected Soil Interpretations report with this interpretation included from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

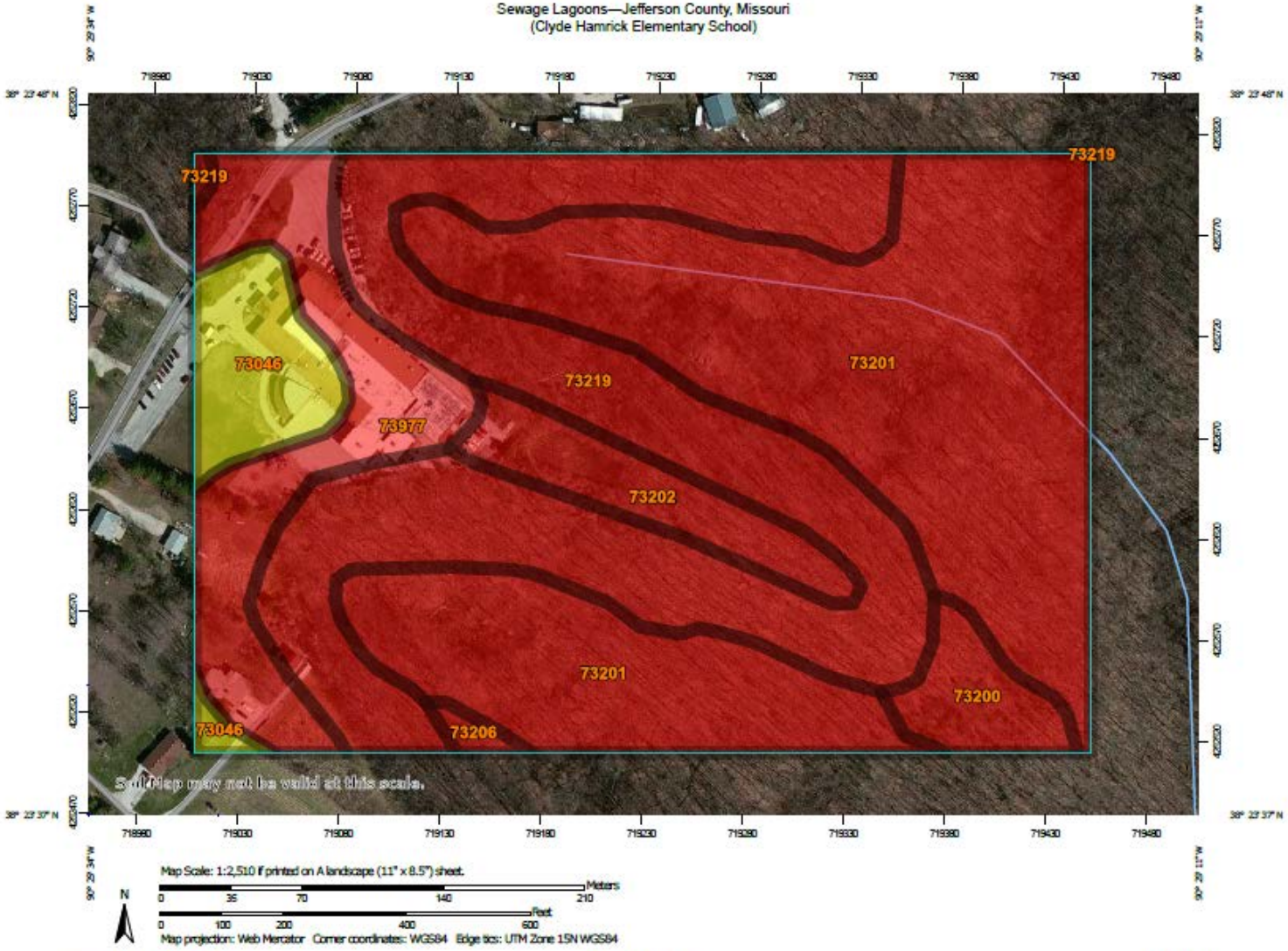
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Sewage Lagoons—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Background
- Aerial Photography

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Sewage Lagoons

Sewage Lagoons— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Somewhat limited	Wrengart (90%)	Slope (0.92)	1.7	5.1%
				Depth to saturated zone (0.04)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Sonsac (85%)	Depth to hard bedrock (1.00)	1.0	3.1%
				Slope (1.00)		
			Gatewood (10%)	Depth to hard bedrock (1.00)		
				Depth to saturated zone (1.00)		
				Slope (1.00)		
			Gasconade (5%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Very limited	Sonsac (85%)	Depth to hard bedrock (1.00)	14.2	43.7%
				Slope (1.00)		
			Gatewood (8%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
				Depth to saturated zone (1.00)		
			Gasconade (5%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
			Alred (2%)	Slope (1.00)		
				Seepage (0.50)		
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Rueter (90%)	Slope (1.00)	1.6	4.9%
				Seepage (0.50)		
73206	Useful silt loam, 15 to 40 percent slopes	Very limited	Useful (85%)	Slope (1.00)	0.2	0.5%
				Depth to hard bedrock (0.18)		

Sewage Lagoons— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Depth to saturated zone (0.04)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Very limited	Rueter (90%)	Slope (1.00)	10.4	31.8%
				Seepage (1.00)		
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Very limited	Wrengart (90%)	Slope (1.00)	3.6	11.0%
				Seepage (0.50)		
				Depth to saturated zone (0.04)		
			Goss (7%)	Slope (1.00)		
				Seepage (0.50)		
			Gatewood (3%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
				Depth to saturated zone (0.88)		
Totals for Area of Interest					**32.6**	**100.0%**

Sewage Lagoons— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	30.9	94.9%
Somewhat limited	1.7	5.1%
Totals for Area of Interest	**32.6**	**100.0%**

Description

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Ksat is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The

percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

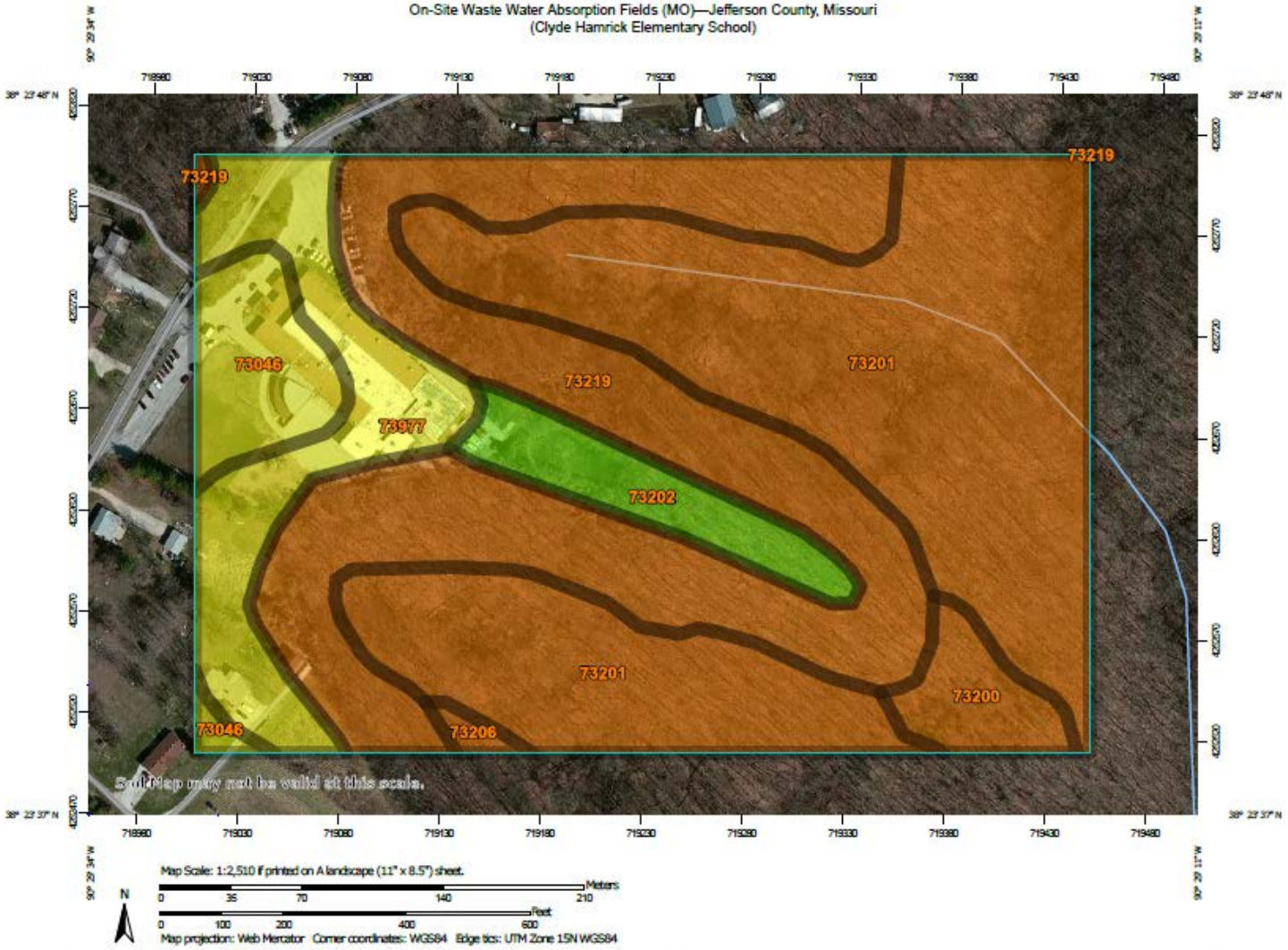
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

On-Site Waste Water Absorption Fields (MO)—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Soil Rating Lines
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Soil Rating Points
- Not rated: miscellaneous area
- Unsuitable
- Provisionally suitable - low
- Provisionally suitable - high
- Suitable
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

On-Site Waste Water Absorption Fields (MO)

On-Site Waste Water Absorption Fields (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Provisionally Suitable - Low	Wrengart (90%)	Provisionally Suitable - Fragic 24-30" (0.53)	1.7	5.1%
				Provisionally Suitable - Water Table: 30-48" (0.65)		
				Pro Suitable - Group V: Rock 51-70%, Bedrock >60" (0.70)		
				Suitable - Slope 0-15% (0.99)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Unsuitable	Sonsac (85%)	Unsuitable - Bedrock 0-36" (0.44)	1.0	3.1%
				Unsuitable - Group V: Rock 51-70%, Bedrock <60" (0.45)		
				Suitable - Slope 0-15% (0.98)		
			Gatewood (10%)	Unsuitable - Group IVb: <24" (0.20)		
				Unsuitable - Bedrock 0-36" (0.50)		
				Provisionally Suitable - Water Table: 24-30" (0.55)		
				Suitable - Slope 0-15% (0.98)		
			Gasconade (5%)	Unsuitable - Bedrock 0-36" (0.18)		
				Pro Suitable - Group IVa (0.60)		
				Suitable - Slope 0-15% (0.98)		

On-Site Waste Water Absorption Fields (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Rock outcrop (0%)	Unsuitable - Bedrock 0-36" (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Not rated (0.00)		
				Suitable - Slope 0-15% (0.98)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Unsuitable	Sonsac (85%)	Unsuitable - Bedrock 0-36" (0.44)	14.2	43.7%
				Unsuitable - Group V: Rock 51-70%, Bedrock <60" (0.45)		
				Provisionally Suitable - Slope 23-30% (0.50)		
			Gatewood (8%)	Unsuitable - Group IVb: <24" (0.20)		
				Unsuitable - Bedrock 0-36" (0.50)		
				Provisionally Suitable - Slope 23-30% (0.50)		
				Provisionally Suitable - Water Table: 24-30" (0.55)		
			Gasconade (5%)	Unsuitable - Bedrock 0-36" (0.18)		
				Provisionally Suitable - Slope 23-30% (0.50)		
				Pro Suitable - Group IVa (0.60)		
			Alred (2%)	Provisionally Suitable - Slope 23-30% (0.50)		

On-Site Waste Water Absorption Fields (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Pro Suitable - Group IVa (0.60)		
			Rock outcrop (0%)	Unsuitable - Bedrock 0-36" (0.00)		
				Unsuitable - Miscellaneous Area (0.00)		
				Not rated (0.00)		
				Provisionally Suitable - Slope 23-30% (0.50)		
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Provisionally Suitable - High	Rueter (90%)	Pro Suitable - Group III (0.90)	1.6	4.9%
				Suitable - Slope 0-15% (0.98)		
73206	Useful silt loam, 15 to 40 percent slopes	Unsuitable	Useful (85%)	Provisionally Suitable - Slope 23-30% (0.50)	0.2	0.5%
				Pro Suitable - Group IVa (0.60)		
				Provisionally Suitable - Water Table: 30-48" (0.65)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Unsuitable	Rueter (90%)	Unsuitable - Slope >30% (0.34)	10.4	31.8%
				Pro Suitable - Group V: Rock 51-70%, Bedrock >60" (0.70)		
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Provisionally Suitable - Low	Wrengart (90%)	Provisionally Suitable - Fragic 24-30" (0.58)	3.6	11.0%
				Provisionally Suitable - Water Table: 30-48" (0.65)		
				Pro Suitable - Group III (0.90)		

On-Site Waste Water Absorption Fields (MO)— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Suitable - Slope 0-15% (0.96)		
Totals for Area of Interest					32.6	100.0%

On-Site Waste Water Absorption Fields (MO)— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Unsuitable	25.7	79.1%
Provisionally Suitable - Low	5.2	16.1%
Provisionally Suitable - High	1.6	4.9%
Totals for Area of Interest	32.6	100.0%

Description

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 0 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health.

This interpretation is currently serving the Truman Lake Area (comprising most of Henry, St. Clair, Benton, and Hickory Counties, Missouri), but will soon be expanded to apply to the entire state of Missouri. The interpretation is a soil suitability index created to assist landowners and developers with on-site waste management system decisions. Each soil is rated for its suitability for installation of septic tank absorption fields. The index closely follows the soil properties considered suitable in the 1995 Missouri State Regulations for On-site Disposal Systems but is not intended to replace on-site investigations.

The best suited soils for absorption fields are very deep, are medium textured, have less than 50% rocks, have no platy or massive structure, have no high shrink-swell clays, have a water table deeper than 48 inches, have no fragipan within 60 inches, are not in depressional or karst areas, are on less than 15% slopes, and are not subject to flooding or ponding. Soils that are unsuited are shallow, are too high or too low in clay, have more than 50% rocks, have platy or massive structure, have high shrink-swell clays, have a water table shallower than 24 inches, have a fragipan within 24 inches, are in depressional or karst areas, are on greater than 15% slopes, or are subject to flooding or ponding. Permeability is also taken into consideration within the soil texture groups.

The values for soil factors in the index are listed by soil property and ranked from 0 to 1. Those soils ranked from 0.95 to 1 have properties considered "suitable" while those ranked from 0 to 0.5 are considered "unsuitable." Soils ranked between 0.5 to 0.95 are considered provisionally suitable. Provisionally suitable soils are generally well suited to conventional design but may have one or more slight limitations that and may need more design considerations. The provisionally suitable class is split into 2 classes, low potential and high potential. The "provisionally suitable - high" class is generally better suited and has fewer limitations to overcome than the "provisionally suitable - low" class.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen, which is displayed on the report. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the Selected Soil Interpretations report with this interpretation included from the Soil Reports tab in Web Soil Survey or from the

Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

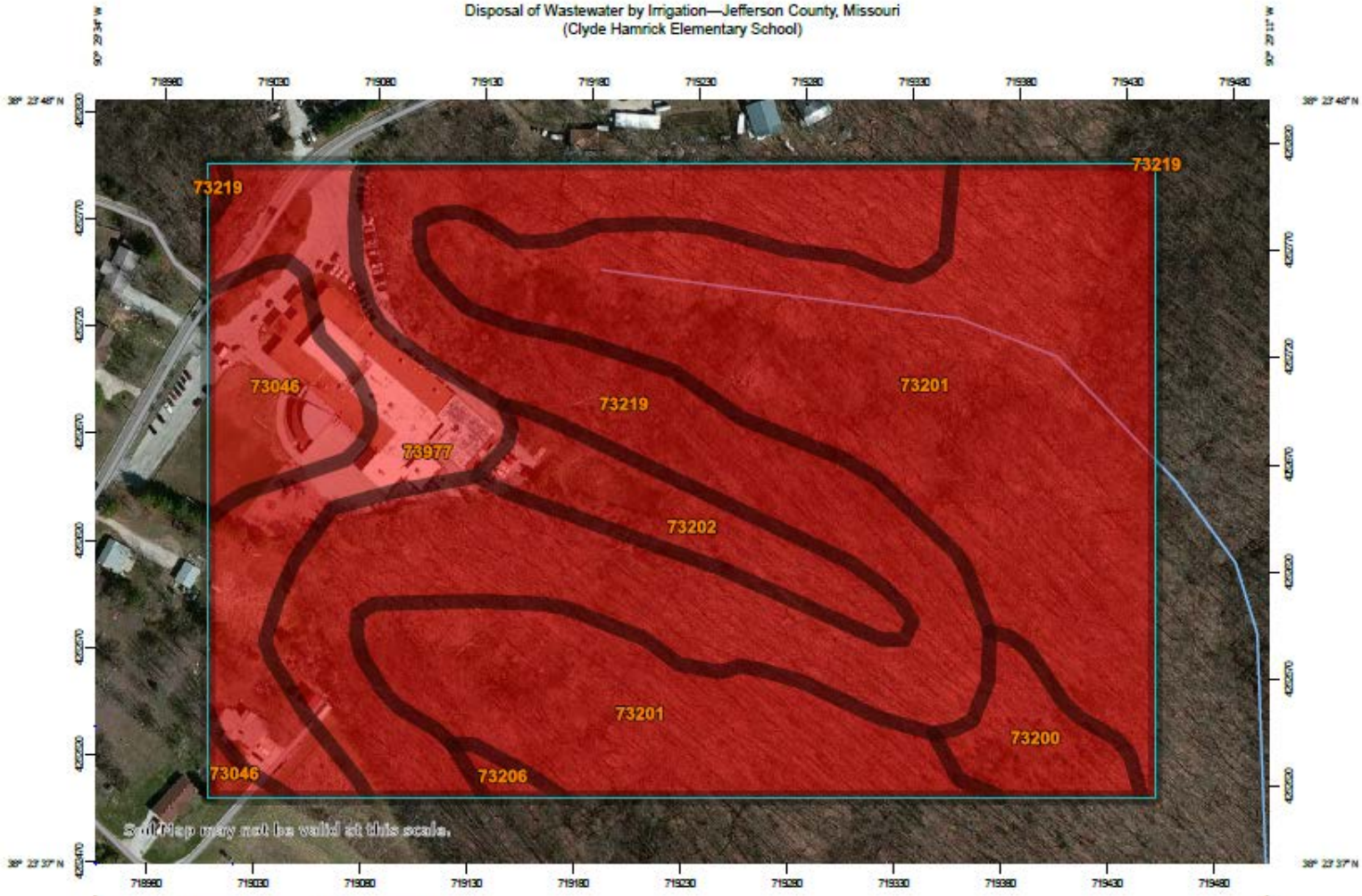
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Disposal of Wastewater by Irrigation—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



Map Scale: 1:2,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Disposal of Wastewater by Irrigation

Disposal of Wastewater by Irrigation— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Very limited	Wrengart (90%)	Slow water movement (1.00)	1.7	5.1%
				Too steep for surface application (0.68)		
				Depth to saturated zone (0.68)		
				Too acid (0.03)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	1.0	3.1%
				Too acid (1.00)		
				Droughty (1.00)		
				Too steep for surface application (1.00)		
				Seepage, porous bedrock (0.50)		
			Gatewood (10%)	Slow water movement (1.00)		
				Too steep for surface application (1.00)		
				Depth to saturated zone (0.95)		
				Too acid (0.85)		
				Droughty (0.62)		
			Gasconade (5%)	Slow water movement (1.00)		
				Droughty (1.00)		
				Depth to bedrock (1.00)		

Disposal of Wastewater by Irrigation— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (0.10)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	14.2	43.7%
				Too acid (1.00)		
				Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
			Gatewood (8%)	Slow water movement (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to saturated zone (0.95)		
				Too acid (0.85)		
			Gasconade (5%)	Slow water movement (1.00)		
				Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		

Disposal of Wastewater by Irrigation— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Alred (2%)	Too acid (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Slow water movement (1.00)		
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Rueter (90%)	Too acid (1.00)	1.6	4.9%
				Too steep for surface application (1.00)		
				Slow water movement (0.37)		
				Too steep for sprinkler application (0.22)		
				Seepage, porous bedrock (0.10)		
73206	Useful silt loam, 15 to 40 percent slopes	Very limited	Useful (85%)	Slow water movement (1.00)	0.2	0.5%
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to saturated zone (0.68)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Very limited	Rueter (90%)	Slow water movement (1.00)	10.4	31.8%
				Too steep for surface application (1.00)		

Disposal of Wastewater by Irrigation— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Too steep for sprinkler application (1.00)		
				Too acid (0.99)		
				Seepage, porous bedrock (0.10)		
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Very limited	Wrengart (90%)	Slow water movement (1.00)	3.6	11.0%
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (0.78)		
				Depth to saturated zone (0.68)		
				Too acid (0.67)		
			Goss (7%)	Slow water movement (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Too acid (0.21)		
			Gatewood (3%)	Slow water movement (1.00)		
				Depth to saturated zone (1.00)		
				Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		

Description

Wastewater includes municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. The effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, saturated hydraulic conductivity (Ksat), slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations

Disposal of Wastewater by Irrigation— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Totals for Area of Interest					32.6	100.0%

Disposal of Wastewater by Irrigation— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	32.6	100.0%
Totals for Area of Interest	32.6	100.0%

between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

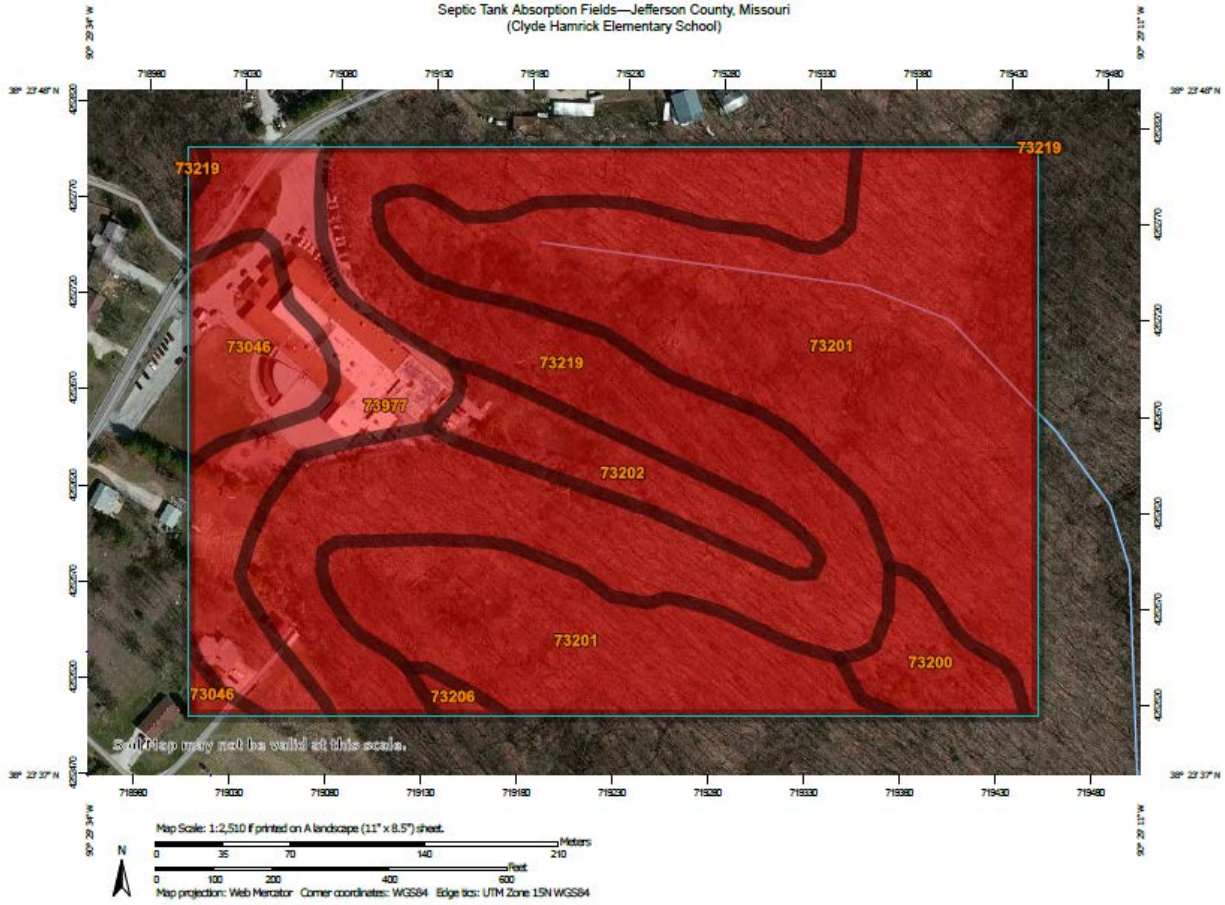
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Septic Tank Absorption Fields—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



Map Scale: 1:2,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Septic Tank Absorption Fields

Septic Tank Absorption Fields— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Very limited	Wrengart (90%)	Depth to saturated zone (1.00)	1.7	5.1%
				Slow water movement (1.00)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	1.0	3.1%
				Depth to bedrock (1.00)		
			Gatewood (10%)	Depth to saturated zone (1.00)		
				Slow water movement (1.00)		
				Depth to bedrock (1.00)		
			Gasconade (5%)	Depth to bedrock (1.00)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	14.2	43.7%
				Slope (1.00)		
				Depth to bedrock (1.00)		
			Gatewood (8%)	Depth to saturated zone (1.00)		
				Slow water movement (1.00)		
				Slope (1.00)		
				Depth to bedrock (1.00)		
			Gasconade (5%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Alred (2%)	Slow water movement (1.00)		

Septic Tank Absorption Fields— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Slope (1.00)		
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Rueter (90%)	Slow water movement (1.00)	1.6	4.9%
				Slope (0.04)		
73206	Useful silt loam, 15 to 40 percent slopes	Very limited	Useful (85%)	Depth to saturated zone (1.00)	0.2	0.5%
				Slow water movement (1.00)		
				Slope (1.00)		
				Depth to bedrock (0.62)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Very limited	Rueter (90%)	Slow water movement (1.00)	10.4	31.8%
				Slope (1.00)		
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Very limited	Wrengart (90%)	Depth to saturated zone (1.00)	3.6	11.0%
				Slow water movement (1.00)		
				Slope (0.63)		
			Goss (7%)	Slow water movement (1.00)		
				Slope (1.00)		
			Gatewood (3%)	Depth to bedrock (1.00)		
				Depth to saturated zone (1.00)		
				Slow water movement (1.00)		
				Slope (1.00)		
Totals for Area of Interest					**32.6**	**100.0%**

Septic Tank Absorption Fields— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	32.6	100.0%
Totals for Area of Interest	**32.6**	**100.0%**

Description

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

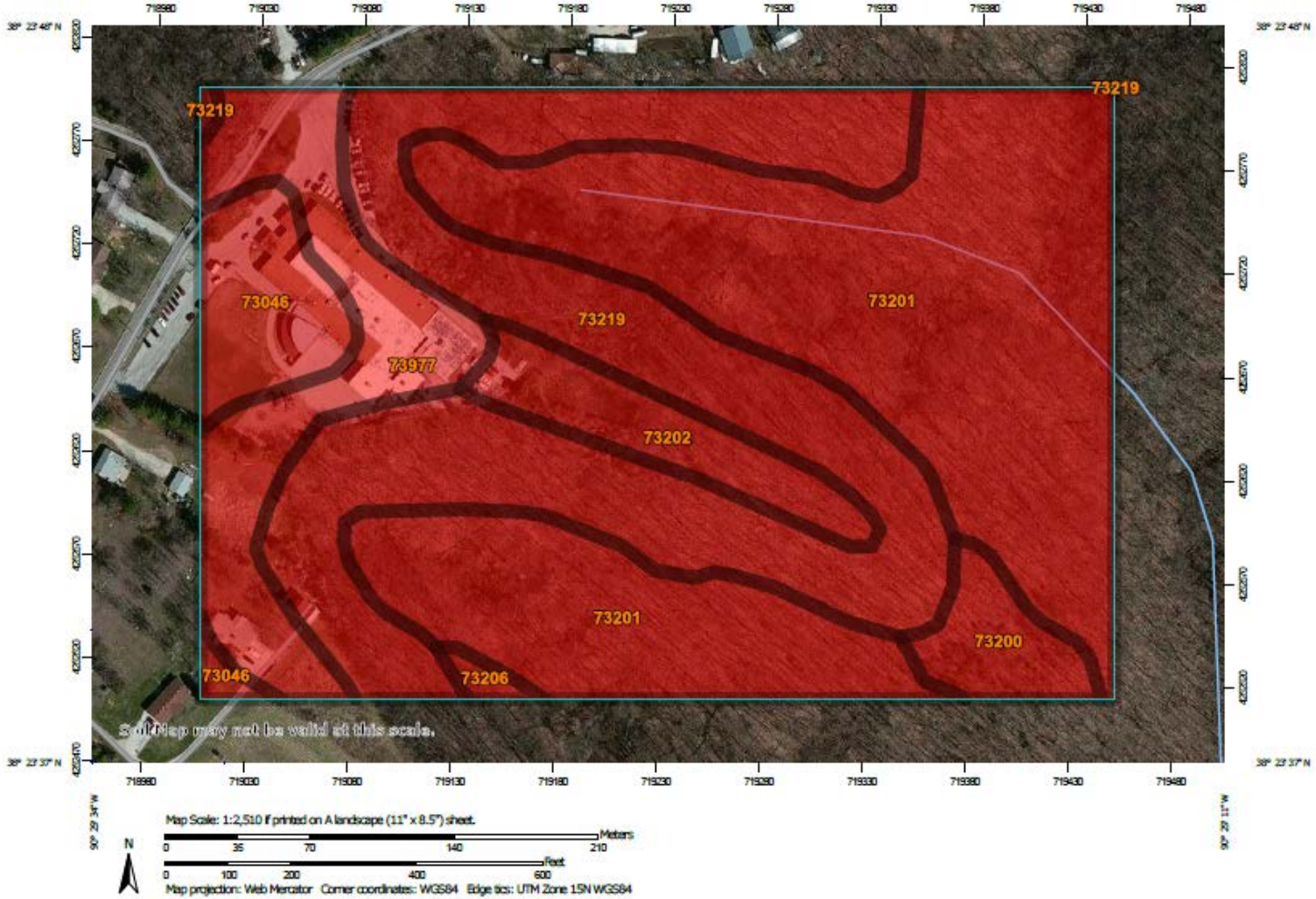
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Land Application of Municipal Sewage Sludge—Jefferson County, Missouri
(Clyde Hamrick Elementary School)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Background
- Aerial Photography

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jefferson County, Missouri
Survey Area Data: Version 19, Sep 28, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 2, 2012—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Land Application of Municipal Sewage Sludge

Land Application of Municipal Sewage Sludge— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73046	Wrengart silt loam, 3 to 8 percent slopes, eroded	Very limited	Wrengart (90%)	Slow water movement (1.00)	1.7	5.1%
				Depth to saturated zone (0.68)		
				Too acid (0.03)		
73200	Sonsac gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	1.0	3.1%
				Too acid (1.00)		
				Droughty (1.00)		
				Depth to bedrock (0.29)		
			Gatewood (10%)	Slow water movement (1.00)		
				Depth to saturated zone (0.95)		
				Too acid (0.85)		
				Droughty (0.62)		
				Depth to bedrock (0.07)		
			Gasconade (5%)	Slow water movement (1.00)		
				Droughty (1.00)		
				Depth to bedrock (1.00)		
				Large stones on the surface (0.06)		
73201	Sonsac gravelly silt loam, 15 to 40 percent slopes, very stony	Very limited	Sonsac (85%)	Slow water movement (1.00)	14.2	43.7%
				Too acid (1.00)		
				Droughty (1.00)		
				Slope (1.00)		
				Depth to bedrock (0.29)		

Land Application of Municipal Sewage Sludge— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Gatewood (8%)	Slow water movement (1.00)		
				Slope (1.00)		
				Depth to saturated zone (0.95)		
				Too acid (0.85)		
				Droughty (0.62)		
			Gasconade (5%)	Slow water movement (1.00)		
				Droughty (1.00)		
				Slope (1.00)		
				Depth to bedrock (1.00)		
				Large stones on the surface (0.06)		
			Alred (2%)	Too acid (1.00)		
				Slope (1.00)		
				Slow water movement (1.00)		
				Strongly contrasting textural stratification (0.38)		
73202	Rueter gravelly silt loam, 3 to 15 percent slopes, very stony	Very limited	Rueter (90%)	Too acid (1.00)	1.6	4.9%
				Slow water movement (0.37)		
				Slope (0.04)		
73206	Useful silt loam, 15 to 40 percent slopes	Very limited	Useful (85%)	Slow water movement (1.00)	0.2	0.5%
				Slope (1.00)		
				Depth to saturated zone (0.68)		
73219	Rueter gravelly silt loam, 15 to 55 percent slopes, extremely stony	Very limited	Rueter (90%)	Slow water movement (1.00)	10.4	31.8%
				Slope (1.00)		
				Too acid (0.99)		

Land Application of Municipal Sewage Sludge— Summary by Map Unit — Jefferson County, Missouri (MO099)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
73977	Wrengart silt loam, 8 to 15 percent slopes, eroded	Very limited	Wrengart (90%)	Slow water movement (1.00)	3.6	11.0%
				Depth to saturated zone (0.68)		
				Too acid (0.67)		
				Slope (0.63)		
			Goss (7%)	Slow water movement (1.00)		
				Slope (1.00)		
				Too acid (0.21)		
			Gatewood (3%)	Slow water movement (1.00)		
				Depth to saturated zone (1.00)		
				Droughty (1.00)		
				Slope (1.00)		
				Depth to bedrock (0.71)		
Totals for Area of Interest					**32.6**	**100.0%**

Land Application of Municipal Sewage Sludge— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	32.6	100.0%
Totals for Area of Interest	**32.6**	**100.0%**

Description

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include saturated hydraulic conductivity (Ksat), depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated

rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher