STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

CONSTRUCTION PERMIT

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

City of Rosebud
Rosebud South Lagoon Wastewater Facility
South Terminus of S. Park Street
Rosebud, MO 63091

for the construction of (described facilities):

See attached.

Permit Conditions:

See attached.

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

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

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

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

November 13, 2025
Effective Date

Heather Peters, Director, Water Protection Program

November 12, 2027
Expiration Date

CONSTRUCTION PERMIT

I. CONSTRUCTION DESCRIPTION

This construction permit will require additions to the treatment process consisting of an influent bar screen, Triplepoint Nitrox TM (MBBR) system, polishing clarifier, and UV disinfection. The third existing lagoon will be decommissioned while the other two lagoon cells will have the addition of aerators. Sludge will be removed from the lagoons and berms will be regraded to reestablish 2 feet of freeboard. The project will increase the design average flow to 50,700 gallons per day (gpd) and serve a population equivalent of 507.

The Rosebud South Lagoon Wastewater Treatment Facility (WWTF) project is located at the South Terminus of South Park Street, Rosebud, Missouri, in Gasconade County. The current facility has a design average flow of 38,000 gpd and serves a population equivalent of approximately 380 people. The collection system has approximately 6 miles of sewer mains.

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

II. COST ANALYSIS FOR COMPLIANCE

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

The department is not required to determine cost analysis for compliance because the permit contains no new conditions or requirements that convey a new cost to the facility.

III. CONSTRUCTION PERMIT CONDITIONS

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

1. This construction permit does not authorize discharge.

2. All construction shall be in accordance with the plans and specifications and Change Order No. 1 submitted by Bartlett & West on April 14, 2023, and May 1, 2024 and signed and sealed by Matthew Vander Tuig, P.E. on April 14, 2023, and approved by the department on June 28, 2023.

3. Regulation 10 CSR 20-4.040(18)(B)1 requires that projects be publicly advertised, allowing sufficient time for bids to be prepared and submitted. Projects should be advertised at least 30 days prior to bid opening.

4. The department must be contacted in writing prior to making any changes to the approved plans and specifications that would directly or indirectly have an impact on the capacity, flow, system layout, or reliability of the proposed wastewater treatment facilities or any design parameter that is addressed by 10 CSR 20-8, in accordance with 10 CSR 20-8.110(11).

5. As per 10 CSR 20-4.040, all changes in contract price or time within the approved scope of work must be by change order in accordance with Section 19 of this rule.

6. State and federal law does not permit bypassing of raw wastewater; therefore, steps must be taken to ensure that raw wastewater does not discharge during construction. If a sanitary sewer overflow or bypass occurs, report the appropriate information to the department's electronic Sanitary Sewer Overflow/Bypass Reporting system at https://dnr.mo.gov/mogem/ or the St. Louis Regional Office per 10 CSR 20-7.015(9)(G).

7. In addition to the requirements for a construction permit, 10 CSR 20-6.200 requires land disturbance activities of 1 acre or more to obtain a Missouri state operating permit to discharge stormwater. The permit requires best management practices sufficient to control runoff and sedimentation to protect waters of the state. Land disturbance permits may only be obtained by means of the department's ePermitting system available online at https://dnr.mo.gov/data-e-services/missouri-gateway-environmental-management-mogem. See https://dnr.mo.gov/data-e-services/water/electronic-permitting-epermitting for more information.

8. A United States Army Corps of Engineers (USACE) Section 404 Department of Army permit (§404) along with the department's Section 401 Water Quality Certification or waiver (§401) may be required for the activities described in this permit. This permit is not valid until these requirements are satisfied. If construction activity will disturb any land below the ordinary high water mark of jurisdictional waters of the U.S., then a §404/§401 will likely be required. Since the USACE makes determinations on what is jurisdictional, you must contact the USACE to determine permitting requirements. See https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/section-401-water-quality for more information or you may contact the department's Water Protection Program at 573-522-4502 or wpsc401cert@dnr.mo.gov.

9. Upon completion of construction:

   A. The City of Rosebud will become the continuing authority for operation and maintenance of these facilities.

   B. Submit an electronic copy of the as-builts if the project was not constructed in accordance with previously submitted plans and specifications.

C. Submit the enclosed form Statement of Work Completed to the department in accordance with 10 CSR 20-6.010(5)(N) and request the operating permit modification be issued. When the facility applies for their next operating permit renewal, they will be expected to include an updated facility description on their application.

IV. REVIEW SUMMARY

1. CONSTRUCTION PURPOSE

The project includes modifications to the existing wastewater treatment system to better meet effluent limitations. The new NitrOx ™ system will allow for ammonia reduction while the UV disinfection system will help meet *E. coli* limits consistantly. Sludge removal will allow for better treatment and help meet new 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) limits as well as percent removal.

2. FACILITY DESCRIPTION

The exisiting facility has a three-cell lagoon, chlorination/dechlorination system, and sludge is retained in the cells. Additions to the wastewater treatment process include Triplepoint NitrOx ™ system, polishing clarifier, bar screen, and UV disinfection system. Sludge will be removed from the lagoons and berms will be regraded to reestablish 2 feet of freeboard. The project also involves the modification and rehabilitation of the collection system to reduce inflow and infiltration. The upgrades will help meet *E. coli*, ammonia, BOD_5, and TSS limits as well as percent removal. The third cell will be decommissioned and closed.

The Rosebud South Lagoon WWTF is located at the south terminus of South Park Street, Rosebud, Missouri, in Gasconade County. The existing facility has a design average flow of 38,000 gpd and serves a population equivalent of approximately 380 people.

3. COMPLIANCE PARAMETERS

The existing facility can meet BOD_5, TSS, and ammonia weekly and monthly averages. The proposed project is required to meet final effluent limits established in Missouri State Operating Permit No. MO-0091375 and established in the Antidegradation review dated April 29, 2022.

The following limits will be applicable to the facility after construction is completed:

Parameter	Units	Monthly Average Limit
Biochemical Oxygen Demand$_5$	mg/L	30
Total Suspended Solids	mg/L	30
Ammonia as N (Jan 1 – Mar 31)	mg/L	2.3
Ammonia as N (Apr 1 – Jun 31)	mg/L	1.4
Ammonia as N (Jul 1 – Sep 30)	mg/L	1.1
Ammonia as N (Oct 1 – Dec 31)	mg/L	2.1
BOD_5 Percent Removal	%	85
TSS Percent Removal	%	85

4. ANTIDEGRADATION

The department has reviewed the antidegradation report for this facility and issued the Water Quality and Antidegradation Review dated April 29, 2022, due to increasing design flow to 50,700 gallons per day (gpd). See **APPENDIX 1 – ANTIDEGRADATION**.

5. REVIEW OF MAJOR TREATMENT DESIGN CRITERIA

Existing Components: Lagoon Cell Nos. 1, 2, and 3 are non-aerated.

- Cell No. 1 has a wastewater volume of 2,134,300 gallons, 3 feet (ft) side water depth, and a sludge depth of 19.6 inches.
- Cell No. 2 has a wastewater volume of 573,540 gallons gallons, 3 ft side water depth, and a sludge depth of 21.8 inches.
- Cell No. 3 has a wastewater volume of 220,530 gallons, 3 ft side water depth, and a sludge depth of 14.1 inches.
- This provides approximately 57.76 days of total retention at the proposed design flow.

New Components:

- Bar Screen – The bar screen has a width of 2 ft, depth of 4.61 ft, and bar spacing is one and a half inch. The screen will be positioned at an angle of 45 degrees from the horizontal to allow for manual raking of the screen.

- Lagoon aerators and blowers – Two lagoons cell will have 12 Ares 750T aerators. Cell No. 1 will be supplied ten aerators and Cell No. 2 will have the remaining two. The aerators will supply 105.6 pounds per day of oxygen. Blowers shall be designed to supply a standard air flow of 171.85 standard cubic feet per minute (scfm) per blower. The discharge pressure shall be 3.0 pounds per square gauge (psig) and the minimum horsepower (HP) will be 5.0 HP for each blower. There shall be a minimum of two blower units, one for duty and one standby/backup.

- Airlift – airflow for the primary airlift will be 12.05 cubic feet per minute (cfm) and the secondary airlift will provide 6.89 cfm. The air lift will push recycled flow from the clarifier and Cell 2 to the NitrOx ™ unit. The secondary air lift will be accompanied with a 24-inch HDPE pipe.

- Triplepoint Water Technologies, LLC NitrOx™ – The lagoon-treated effluent will be pumped to the NitrOx™ system. The NitrOx™ system is capable of treating a design average flow of 50,700 gpd. The system is composed of two tanks with each approximately 8 ft x 8 ft x 18 ft with a sidewater depth of 15 ft. Total volume of the two tanks is 14,362 gallons. The average flow hydraulic retention time is 5.4 hours and the peak flow hydraulic retention time is 1.2 hours. A floating insulating cover shall be installed in each tank. An immersion tank heater will be installed to maintain a minimum wastewater temperature of 5°C. Each tank shall be filled with high surface area media. Aeration by means of tri-lobe or bi-lobe positive displacement blowers each capable of supplying 76 scfm with 5 HP motors. The effluent from the NitrOx™ basins will flow by gravity to the clarifier for polishing prior to disinfection and discharge.

- Polishing Clarifier – There will be one polishing clarifier following the NitrOx™ treatment. The basin will be 12 ft by 10 ft with approximately 14.95 ft of sidewater depth. The surface overflow rate at the average daily flow of 50,700 gpd equals 422.5 gpd per square foot.

- Ultraviolet Disinfection – Disinfection is the process of removal, deactivation, or killing of pathogenic microorganisms. A two bank UV disinfection system with low pressure mercury slimline lamps shall be provided and capable of treating a peak flow of 285,000 gpd while delivering a minimum UV intensity of 30.0 mJ/cm^2 with an expected ultraviolet transmissivity of 60 percent minimum.

- Flowmeters – Installation of an electro-magnetic flow measurement device will aid in wastewater service. An electromagnetic flow meter shall measure the flow from the UV disinfection to the outfall. A manhole will be constructed between the flowmeter and outfall.

6. OPERATING PERMIT

The Missouri State Operating Permit for Rosebud South Lagoon WWTF, MO-0091375, will require a modification to reflect the construction activities, and was successfully public noticed from March 17 to April 17, 2023, with no comments received. Submit the Statement of Work Completed to the department in accordance with 10 CSR 20-6.010(5)(N) and request the operating permit modification be issued.

Angie Garcia
Financial Assistance Center
angie.garcia@dnr.mo.gov

APPENDICES

1. Antidegradation
2. Process Flow Diagram
3. Summary of Design

APPENDIX 1 — ANTIDEGRADATION

Water Quality and Antidegradation Review

For the Protection of Water Quality
and Determination of Effluent Limits for Discharge to

Tributary to Soap Creek
by
City of Rosebud
South Lagoon WWTF

May 2022

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PURPOSE OF ANTIDEGRADATION REVIEW REPORT

The Rosebud South Lagoon WWTF is a three-cell lagoon with a design flow capacity of 38,000 gallons/day (gpd). The current facility cannot treat to the required effluent limits of its NPDES permit, which go into effect October 1, 2023. The City of Rosebud is proposing to increase the design flow to 50,700 to accommodate anticipated growth, add Triplepoint Nitrox for nitrification, and replace the chlorine tablet feeder with UV for disinfection.

Kyle J. Landwehr, of Bartlett & West, Inc., prepared the application. Matthew J. Vandertuig, P.E. of Bartlett & West, Inc., signed and sealed the Waste Water System Improvements Antidegradation Report for the City of Rosebud, dated February 2022.

The applicant elected to determine that all pollutants of concern (POC) are non-degrading in the receiving stream using current permit limits for 5-day Biological Oxygen Demand (BOD_5) and Total Suspended Solids (TSS). Because the applicant does not have a current ammonia limit, non-degrading was determined using Water Quality Based Effluent Limit formula (see Derivation of Limits). This analysis was conducted to fulfill the requirements of the AIP. Information that was provided by the applicant in the submitted report and summary forms in Appendix B was used to develop this review document.

FACILITY INFORMATION

Facility Name:	Rosebud South Lagoon WWTF
Address:	end of South Park Street, Rosebud, MO 63091
Permit #:	MO-0091375
County:	Gasconade
Facility Type:	POTW
Owner:	City of Rosebud
Continuing Authority:	City of Rosebud
UTM Coordinates (outfall):	X = 639146 ; Y = 4249122
Legal Description:	Section 18, T42N, R04W
Ecological Drainage Unit:	Ozark / Meramec

FACILITY HISTORY

The Rosebud South Lagoon WWTF's operating permit was renewed in May 2020 with a final effluent limit date of October 1, 2023. The facility determined the current three-lagoon system could not meet the new ammonia limits nor accommodate anticipated growth. It is meeting its current limits and is not under enforcement.

FACILITY PERFORMANCE HISTORY:

A review of the past 5 years of Discharge Monitoring Report data shows infrequent exceedances for BOD_5, TSS, Chlorine, and *Escherichia coli*.

RECEIVING WATERBODY INFORMATION

OUTFALL(S) TABLE:

OUTFALL	DESIGN FLOW (CFS)	TREATMENT LEVEL	EFFLUENT TYPE
#001	0.0507	Equivalent to Secondary	Domestic

RECEIVING STREAM(S) TABLE:

WATER-BODY NAME	CLASS	WBID	DESIGNATED USES*	12-DIGIT HUC	DISTANCE TO CLASSIFIED SEGMENT (MI)
Tributary to Soap Creek	NA	NA	General Criteria	07140103-0303	0.0
Soap Creek	C	3359	AQL-WWH, HHP, IRR, LWW, SCR, WBC-B	07140103-0303	0.42

* Protection of Warm Water Aquatic Life (AQL), Cold Water Fishery (CDF), Cool Water Fishery (CLF), Whole Body Contact Recreation – Category A (WBC-A), Whole Body Contact Recreation – Category B (WBC-B), Secondary Contact Recreation (SCR), Human Health Protection (HHP), Irrigation (IRR), Livestock & Wildlife Watering (LWW), Drinking Water Supply (DWS), Industrial (IND), Groundwater (GRW).

RECEIVING STREAM(S) LOW-FLOW VALUES:

RECEIVING STREAM	LOW-FLOW VALUES (CFS)		
	1Q10	7Q10	30Q10
Tributary to Soap Creek	0.0	0.0	0.0

Receiving Water Body Segment Outfall #1:		
Upper end segment* UTM coordinates:	X = 639146 ; Y = 4249122	outfall
Lower end segment* UTM coordinates:	X = 638679 ; Y = 4248764	downstream confluence (unnamed creek, not Soap Creek)

*Segment is the portion of the stream where discharge occurs. Segment is used to track changes in assimilative capacity and is bound at a minimum by existing sources and confluences with other significant water bodies.

A Geohydrologic Evaluation was not submitted with the request. Soap Creek is gaining for discharge purposes.

EXISTING WATER QUALITY

Existing permit limits were exceeded three times for BOD_5 in the past five years.

MIXING CONSIDERATIONS

MIXING CONSIDERATIONS
Mixing Zone: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)].
Zone of Initial Dilution: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

PERMIT LIMITS AND MONITORING INFORMATION
Proposed Monitoring Parameters and Effluent Limits

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average	Previous Permit Limit	Sampling Frequency	Reporting Frequency	Sample Type ****
Flow	MGD		*		*				

BOD_5	mg/L	NDEL		45	30	60	1/Q	1/Q	grab
TSS	mg/L	NDEL		45	30	110			
Ammonia as N (Jan 1 – Mar 31) (Apr 1 – Jun 30) (Jul 1 – Sep 30) (Oct 1 – Dec 31)	mg/L		 9.0 9.0 9.0 9.0		 2.3 1.4 1.1 2.1				

* - Monitoring requirement only
** - #/100mL; the Monthly Average for *E. coli* is a geometric mean.
*** - Parameter not previously established in previous state operating permit.

Basis for Limitations Codes:
MDEL – Minimally Degrading Effluent Limit
NDEL – Non-Degrading Effluent Limit
PEL – Preferred Effluent Limit
TBEL – Technology-Based Effluent Limit
WQBEL – Water Quality-Based Effluent Limit

RECEIVING WATER MONITORING REQUIREMENTS

No receiving water monitoring requirements recommended at this time.

ANTIDEGRADATION REVIEW 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 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 July 13, 2016, a facility is required to use Missouri's AIP for new and expanded wastewater discharges.

The AIP specifies 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 following is a review of the Waste Water System Improvements Antidegradation Report for the City of Rosebud, dated February 2022.

A. TIER DETERMINATION

Waterbodies are assigned Tier 1, 2, or 3 protection levels.

Tier 1 protection is applied to a waterbody on a pollutant by pollutant basis for pollutants may cause or contribute to the impairment of a beneficial use or violation of Water Quality Criteria (WQC); and prohibit further degradation of Existing Water Quality (EWQ) where additional pollutants of concern (POCs) would result in the water being included on the 303(d) List.

Tier 2 level protection is assigned to the waterbody on a pollutant by pollutant basis that prohibits the degradation of water quality of a surface water unless a review of reasonable alternatives and social and economic considerations justifies the degradation in accordance with the methods presented in the AIP.

Tier 3 protection prohibits any degradation of water quality of Outstanding National Resource Waters and Outstanding State Resource Waters as identified in Tables D and E of the Water Quality Standards (WQS). Temporary degradation of water receiving Tier 3 protection may be allowed by the department on a case-by-case basis as explained in Section VI of the AIP.

Below is a list of POCs reasonably expected and identified by the permittee in their application to be in the discharge. Pollutants of concern are defined as those pollutants "proposed for discharge that affect beneficial use(s) in waters of the state." They include pollutants that "create conditions unfavorable to beneficial uses in the water body receiving the discharge or proposed to receive the discharge" (AIP, Page 6).

All pollutants are assumed to be Tier 2 non-degrading, meaning the waste load will remain the same despite the increased flow. The other pollutant limits, e. coli and oil & grease, will not change. Chlorine will no longer be a pollutant because the tablet chlorinator is being replaced by UV disinfection.

Pollutants of Concern and Tier Determination

Pollutants of Concern	Tier	Degradation	Comment
Biological Oxygen Demand (BOD_5)/DO	2*	Non-degrading	
Total Suspended Solids (TSS)	2*	Non-degrading	
Ammonia as N	2*	Non-degrading	

* Tier assumed.

B. NECESSITY OF DEGRADATION

The AIP specifies that if the proposed activity does result in significant degradation then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required. Part of that analysis as shown below is the evaluation of non-degrading alternatives, such as regionalization or no discharge systems.

The applicant has the option of assuming discharge will be significant and proceeding directly to the alternatives analysis, thereby avoiding the determination of the assimilative capacity of the receiving water. The applicant has elected this option.

Regionalization
The Rosebud South Lagoon is the regional treatment facility.

No Discharge Evaluation
The facility is expanding its capacity, so any change to a no-discharge option would be prohibitively more expensive.

Alternatives to No discharge
The application did not include an alternatives analysis. Because the facility already has working lagoons for treatment, any other treatment technology, such as oxidation ditch or MBR, would be cost prohibitive. The applicant is upgrading the lagoons with a proven lagoon ammonia treatment technology, Nitrox MBBR, for ammonia removal.

C. SOCIAL AND ECONOMIC IMPORTANCE

The affected community consists of the residents of Rosebud, MO (population 390 in the 2020 census) and it's immediate surroundings. Proper and cost-effective operation of the facility serves the environmental and economic interests of both the State of Missouri and the local communities.

D. NATURAL HERITAGE REVIEW

A Missouri Department of Conservation Natural Heritage Review was obtained by the applicant. Two species of bats, Indiana and Northern Long-Eared, may be present in the project area. The following recommendations were made for construction activities:

- Manage construction to minimize sedimentation and run-off to nearby streams.
- At stream and drainage crossings, avoid erosion, silt introduction, petroleum or chemical pollution, and disruption or realignment of stream banks and beds.
- If any trees need to be removed for the project, contact the U.S. Fish and Wildlife Service for coordination under the Endangered Species Act.

RECEIVING WATER MONITORING REQUIREMENTS

No receiving water monitoring requirements recommended at this time.

DERIVATION AND DISCUSSION OF PARAMETERS AND LIMITS

Wasteload allocations and limits were calculated using the following method:

A. **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) and stream volume of flow at the edge of the mixing zone (MZ). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration) and stream volume of flow at the edge of the zone of initial dilution (ZID).

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).

Outfall #001 **– Main Facility Outfall**

- **Flow.** Though not limited itself, the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations [40 CFR Part 122.44(i)(1)(ii)]. 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. Influent monitoring has been and will be required for this facility in its Missouri State Operating Permit.

- **Biochemical Oxygen Demand (BOD_5).** Effluent limits of 30 mg/L average monthly and 45 mg/L average daily maximum were established as a result of a mass loading maintenance or reduction demonstration by the applicant. At the existing design flow 38,000 gpd the mass loading to the waterbody is 14.3 lbs/day while the proposed loading was calculated to be 12.7 lbs/day at the proposed effluent concentration and increased design flow. These limits are at least as stringent as the minimum effluent regulations established in 10 CSR 20-7.015(8).

- **Total Suspended Solids (TSS).** Effluent limits of 30 mg/L average monthly and 45 mg/L average daily maximum were established as a result of a mass loading maintenance or reduction demonstration by the applicant. At the existing design flow 38,000 gpd the mass loading to the waterbody is 22.2 lbs/day while the proposed loading was calculated to be 12.7 lbs/day at the proposed effluent concentration and increased design flow. These limits are at least as stringent as the minimum effluent regulations established in 10 CSR 20-7.015(8).

- **Total Ammonia Nitrogen.** The applicant's current permit does not have ammonia limits. Therefore, to calculate non-degrading limits, "existing" ammonia loading was calculated as if the facility had WQBEL for ammonia. These calculations are presented below. New non-degrading limits are calculated in the table following the WQBEL calculations.

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

Quarter	Temp (°C)*	pH (SU)*	Total Ammonia Nitrogen CCC (mg/L)	Total Ammonia Nitrogen CMC (mg/L)
1st	11.0	7.8	3.1	12.1
2nd	21.2	7.8	2.0	12.1
3rd	26.0	7.8	1.5	12.1
4th	15.5	7.8	2.9	12.1

* Ecoregion Data (Ozark Highlands)

<u>1st Quarter</u>
Chronic WLA: Ce = ((0.038+ 0.0)3.1 – (0.0 * 0.01))/ 0.038= 3.1 mg/L
Acute WLA: Ce = ((0.038+ 0.0)12.1 – (0.0 * 0.01))/ 0.038= 12.1 mg/L
AML = 3.1 mg/L
MDL = 12.1 mg/L

<u>2nd Quarter</u>
Chronic WLA: Ce = ((0.038+ 0.0)2.0 – (0.0 * 0.01))/ 0.038= 2.0 mg/L
Acute WLA: Ce = ((0.038+ 0.0)12.1 – (0.0 * 0.01))/ 0.038= 12.1 mg/L
AML = 2.0 mg/L
MDL = 12.1 mg/L

<u>3rd Quarter</u>
Chronic WLA: Ce = ((0.038+ 0.0)1.5 – (0.0 * 0.01))/ 0.038= 1.5 mg/L
Acute WLA: Ce = ((0.038+ 0.0)12.1 – (0.0 * 0.01))/ 0.038= 12.1 mg/L
AML = 1.5 mg/L
MDL = 12.1 mg/L

<u>4th Quarter</u>
Chronic WLA: Ce = ((0.038+ 0.0)2.9 – (0.0 * 0.01))/ 0.038= 2.9 mg/L
Acute WLA: Ce = ((0.038+ 0.0)12.1 – (0.0 * 0.01))/ 0.038= 12.1 mg/L
AML = 2.9 mg/L
MDL = 12.1 mg/L

Net Change in Loadings Based upon Current and Proposed Permit Limits.

Pollutants of Concern	Current Weekly Average or Maximum Daily Limit (mg/L)	Proposed Maximum Daily Limit (mg/L)	Current Loading (lbs/day)	Proposed Loading (lbs/day)	Net Change (lbs/day)
BOD_5	60 (AWL)	45 (AWL)	19.0	18.6	- 0.4
TSS	110 (AWL)	45 (AWL)	34.9	19.0	- 15.9
Ammonia as N					
(Jan 1 – Mar 31)	12.1*/**	9.0	3.83	3.81	- 0.02
(Apr 1 – Jun 30)	12.1*/**	9.0	3.83	3.81	- 0.02
(Jul 1 – Sep 30)	12.1*/**	9.0	3.83	3.81	- 0.02
(Oct 1 – Dec 31)	12.1*/**	9.0	3.83	3.81	- 0.02

	CURRENT MONTHLY AVERAGE LIMIT (MG/L)	PROPOSED MONTHLY AVERAGE LIMIT (MG/L)	CURRENT LOADING (LBS/DAY)	PROPOSED LOADING (LBS/DAY)	NET CHANGE (LBS/DAY)
(Jan 1 – Mar 31)	3.1*/**	2.3	0.98	0.97	- 0.01
(Apr 1 – Jun 30)	2.0*/**	1.4	0.63	0.59	- 0.04
(Jul 1 – Sep 30)	1.5*/**	1.1	0.48	0.47	- 0.01
(Oct 1 – Dec 31)	2.9*/**	2.1	0.92	0.89	- 0.03

*WQBEL=water quality based effluent limit. **See Derivation and Discussion of Limits, Section 10. AWL = average weekly limit.

GENERAL ASSUMPTIONS OF THE WATER QUALITY AND ANTIDEGRADATION REVIEW

A. 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.
B. 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.
C. Changes to Federal and State Regulations (FSR) made after the drafting of this WQAR may alter Water Quality Based Effluent Limits (WQBEL).
D. Effluent limitations derived from FSR may be WQBEL or Effluent Limit Guidelines (ELG).
E. WQBEL supersede ELG only when they are more stringent. Mass limits derived from technology based limits are still appropriate.
F. A WQAR does not allow discharges to waters of the State, and shall not be construed as a National Pollution Discharge Elimination System (NPDES) or Missouri State Operating Permit to discharge or a permit to construct, modify, or upgrade.
G. Limitations and other requirements in a WQAR may change as Water Quality Standards (WQS), Methodology, and Implementation procedures change.
H. Nothing in this WQAR removes any obligations to comply with county or other local ordinances or restrictions.
I. 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.

ANTIDEGRADATION REVIEW PRELIMINARY DETERMINATION

The proposed facility upgrades are needed to reduce ammonia concentrations and account for future increases in usage. Because this project is an upgrade of an existing facility, alternatives analysis was not done. The combination of adding a Nitrox system for nitrification and UV disinfection should allow the facility to meet its permit limits, including a new limit for ammonia, for the foreseeable future.

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: Bern Johnson
Date: April 2022
Unit Chief: John Rustige, P.E.

Appendix A: Map of Discharge Location

FOR DEPARTMENT USE ONLY	
APP NO.	
FEE RECEIVED	CHECK NO.
DATE RECEIVED	

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

ANTIDEGRADATION REVIEW SUMMARY / REQUEST

1. FACILITY

NAME Rosebud South Lagoon Wastewater Treatment Facility		COUNTY Gasconade	
ADDRESS (PHYSICAL) South Terminus of South Park Street	CITY Rosebud	STATE MO	ZIP CODE 63091
PERMIT NUMBER MO-0091375	PROPOSED DESIGN FLOW 50,700 GPD	SIC / NAICS CODE 4952	

2. OWNER

NAME City of Rosebud, Missouri			
ADDRESS 307 Cedar Street	CITY Rosebud	STATE MO	ZIP CODE 63091
EMAIL ADDRESS cityofrosebud@gmail.com		TELEPHONE NUMBER WITH AREA CODE 573-505-1818	

3. CONTINUING AUTHORITY

The regulatory requirement regarding continuing authority is found in 10 CSR 20-6.010(2).

NAME City of Rosebud, Missouri	SECRETARY OF STATE CHARTER NUMBER N/A		
ADDRESS 307 Cedar Street	CITY Rosebud	STATE MO	ZIP CODE 63091
EMAIL ADDRESS cityofrosebud@gmail.com		TELEPHONE NUMBER WITH AREA CODE 573-505-1818	

4. CONSULTANT

PREPARER NAME Kyle J. Landwehr	COMPANY NAME Bartlett & West, Inc.		
ADDRESS 1719 Southridge Drive, Suite 100	CITY Jefferson City	STATE MO	ZIP CODE 65109
EMAIL ADDRESS kyle.landwehr@bartwest.com		TELEPHONE NUMBER WITH AREA CODE 573-659-6727	

5. RECEIVING WATER BODY SEGMENT #1

NAME
Tributary to Soap Creek

5.1 Upper end of segment – Location of discharge
UTM: X= ________, Y= ________ OR Lat 38°22'46.42"N, Long 91°24'24.77"W

5.2 Lower end of segment –
UTM: X= ________, Y= ________ OR Lat 38°22'34.26"N, Long 91°24'43.48"W

Per the Missouri Antidegradation Implementation Procedure (AIP), the definition of a segment, "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 (IF APPLICABLE, Use another form if a third segment is needed)

NAME

6.1 Upper end of segment – End of Segment #1
UTM: X= ________, Y= ________ OR Lat ________, Long ________

6.2 Lower end of segment –
UTM: X= ________, Y= ________ OR Lat ________, Long ________

7. DECHLORINATION

If chlorination and dechlorination is the existing or proposed method of disinfection treatment, will the effluent discharged be equal to or less than the Water Quality Standards for Total Residual Chlorine stated in Table A1 of 10 CSR 20-7.031?

☐ Yes ☑ No – What is the proposed method of disinfection? Ultraviolet Disinfection

Based on the disinfection treatment system being designed for total removal of Total Residual Chlorine, minimal degradation for Total Residual Chlorine is assumed and the facility will be required to meet the water quality based effluent limits. These compliance limits for Total Residual Chlorine are much less than the method detection limit of 0.13 mg/L.

8. SUMMARIZE THE FEASIBILITY OF CONSTRUCTING A NO-DISCHARGE TREATMENT WASTEWATER FACILITY

According to the Antidegradation Implementation Procedure Sections I.B. and II.B.1., the feasibility of no-discharge alternatives must be considered. No-discharge alternatives may include connection to a regional treatment facility, surface land application, subsurface land application, and recycle or reuse.

Multiple no-discharge alternatives were evaluated in the City's March 2021 Wastewater System Improvements Facility Plan. In summary, all no-discharge alternatives were not reasonably feasible from a capital cost perspective. See facility plan for full analysis.

9. ADDITIONAL REQUIREMENTS

Complete and submit the following with this submittal:

- ☐ Copy of the Geohydrologic Evaluation – Submit request through the Missouri Geological Survey website
- ☑ Copy of the Missouri Natural Heritage from the Missouri Department of Conservation website
- ☑ Attach your Antidegradation Review Report and all supporting documentation as these forms are only a summary.
- ☐ If applicable, submit a copy of any Existing Water Quality data used in this process. Include the date range of the data, source(s) of the data, and location of data collection relative to the outfall. If using your own collected water quality data, submit a copy of the Quality Assurance Project Plan (QAPP) approved by the department's Watershed Protection Section. For more detailed information, see the Missouri Antidegradation Implementation Procedure (AIP), Section II.A.1.

10. PATH / TIER REVIEW ATTACHMENTS ENCLOSED

Path A: Tier 2 – Non-Degradation Mass Balance	☑ **Yes**	☐ **No**
Path B: Tier 2 – Minimal Degradation	☐ **Yes**	☐ **No**
Path C: Tier 2 – Significant Degradation	☐ **Yes**	☐ **No**
Path D: Tier 1 – Preliminary Review Request	☐ **Yes**	☐ **No**
Path E: Temporary Degradation	☐ **Yes**	☐ **No**

11. APPLICANT PROPOSED ANTIDEGRADATION REVIEW EFFLUENT LIMITS

Preliminary effluent limits for the proposed project are dependent upon the path selected:

Applicable Pollutants of Concern	Concentration*		Path / Tier Review Attachment Used for POC Evaluation	Average Monthly Limit	Daily Maximum Limit or Average Weekly Limit
	mg/L	µg/L			
BOD_5	X		Tier 2: Non-Degrading	30	44
TSS	X		Tier 2: Non-Degrading	30	45
Ammonia (Summer)	X		Tier 2: Non-Degrading	1.1	9.0
Ammonia (Winter)	X		Tier 2: Non-Degrading	2.1	9.0
Total Phosphorus	X		N/A		

* Place an X in appropriate box for the concentration units for each Pollutant of Concern.

12. PROPOSED PROJECT SUMMARY

See anti-degradation report and facility plan report.

Applicants choosing to use a new wastewater technology that are considered an "unproven technology" in Missouri must comply with the requirements set forth in the *New Technology Definitions and Requirements fact sheet*.

13. CONTINUING AUTHORITY WAIVER (For New Discharges)

In accordance with 10 CSR 20-6.010(2)(C), applicants proposing use of a lower preference continuing authority, when the higher level authority is available, must submit a waiver from the existing higher authority one or other documentation for the department's review, provided it does not conflict with any area-wide management plan approved under section 208 of the Federal Clean Water Act or by the Missouri Clean Water Commission. Is the waiver necessary? ☐ Yes ☑ No

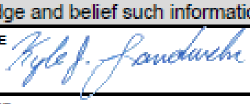
If yes, provide a copy.

14. APPLICATION FEE

☐ CHECK NUMBER ☑ JETPAY CONFIRMATION NUMBER 20030769

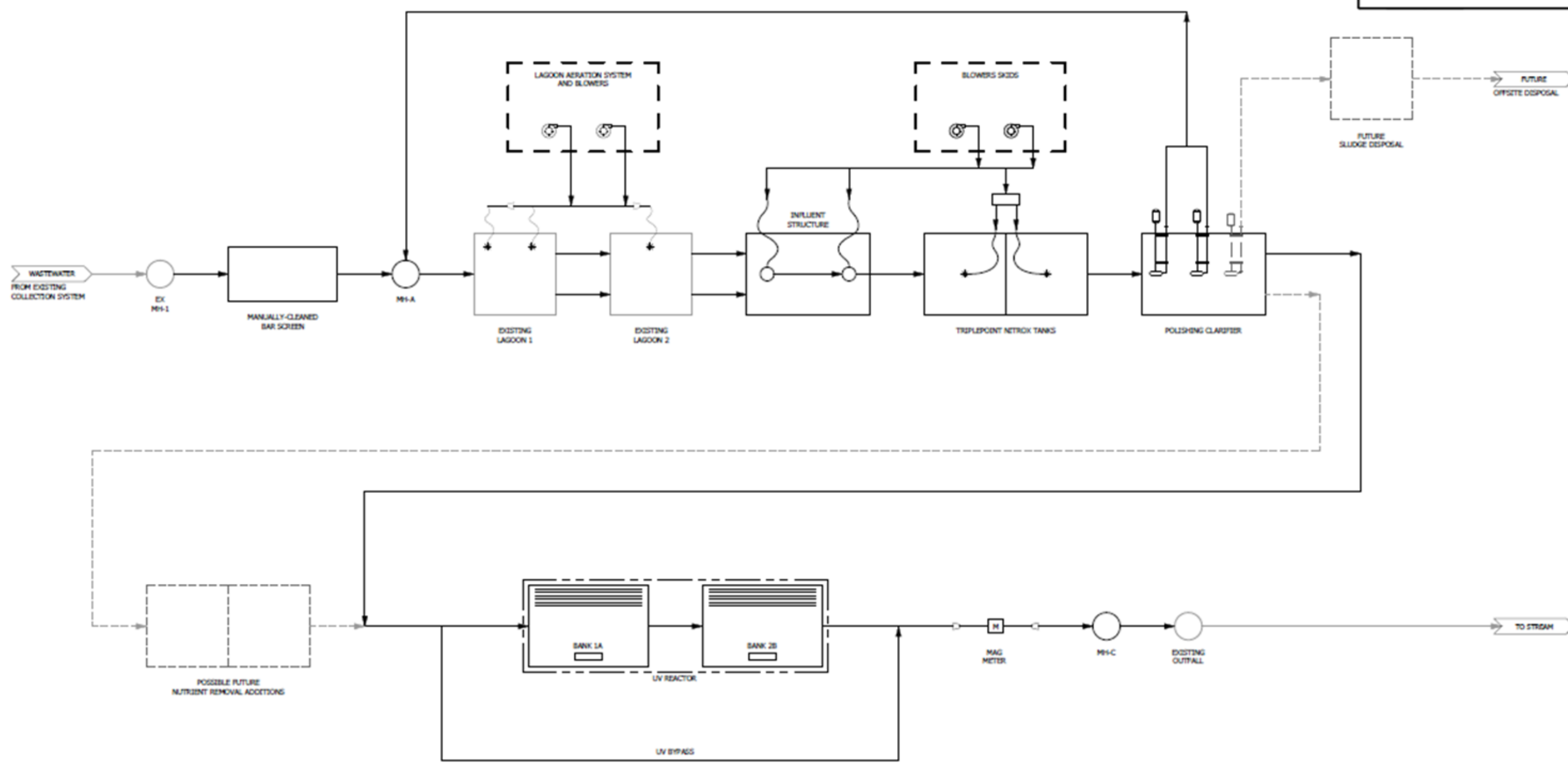
15. SIGNATURE

I am authorized and hereby certify that I am familiar with the information contained in this document and to the best of my knowledge and belief such information is true, complete and accurate.

SIGNATURE	DATE
	02/11/2022
PRINT NAME	TITLE
Kyle J. Landwehr	Lead Project Engineer

PLEASE IDENTIFY YOUR STATUS FOR THIS PROJECT: ☐ OWNER ☐ CONTINUING AUTHORITY ☑ CONSULTANT

APPENDIX 2 — PROCESS FLOW DIAGRAM



GENERAL NOTES:

1. PIPE, FITTINGS, VALVES, EQUIPMENT, ETC., TAGS AND LABELS ARE PROVIDED AS A COURTESY FOR THE CONTRACTOR. IT IS NOT THE INTENT OF THESE CALLOUTS, LABELS, AND TAGS TO BE A BILL OF MATERIALS LIST. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ITEMS EITHER CALLED OUT OR SHOWN IN THE DRAWINGS AND OR SPECIFICATIONS.
2. NOT ALL PIPE SUPPORTS AND HANGARS ARE SHOWN. CONTRACTOR SHALL ADEQUATELY SUPPORT ALL PIPING PER SPEC SECTION 400521.

LEGEND

- PRIMARY LINE SEGMENT
- SECONDARY LINE SEGMENT
- PRIMARY LINE SEGMENT - FUTURE
- PRIMARY LINE SEGMENT - EXISTING
- EQUIPMENT
- EQUIPMENT BOUNDARY

APPENDIX 3 — SUMMARY OF DESIGN

WASTEWATER SYSTEM IMPROVEMENTS

SUMMARY OF DESIGN

FOR

CITY OF ROSEBUD, MISSOURI

BARTLETT & WEST PROJECT NO. 20358.005
DNR PROJECT NO. EPG-214-20

DATE PREPARED: NOVEMBER 2022

MATTHEW J. VANDERTUIG, P.E.
LICENSE NO. PE-2004026634

BARTLETT & WEST, INC.
MISSOURI CERTIFICATE OF AUTHORITY NO. 000167
601 MONROE STREET, SUITE 201
JEFFERSON CITY, MO 65101
573-634-3181

Runoff Calculations to Ditch South of Lagoons

Peak Runoff Calculations

Drainage Area = runoff to pond
MODOT District = 5
Drainage Area (ac) = 228.39
Drainage Length (ft) = 4,000
Change in Elev. (ft) = 123
Soil Type = D
Composite Runoff Coefficient (C) = 0.31

Kirpich Time of Concentration (min) = 17.70
Drainage Slope (ft/ft) = 0.031

Time of Concentration Checks:

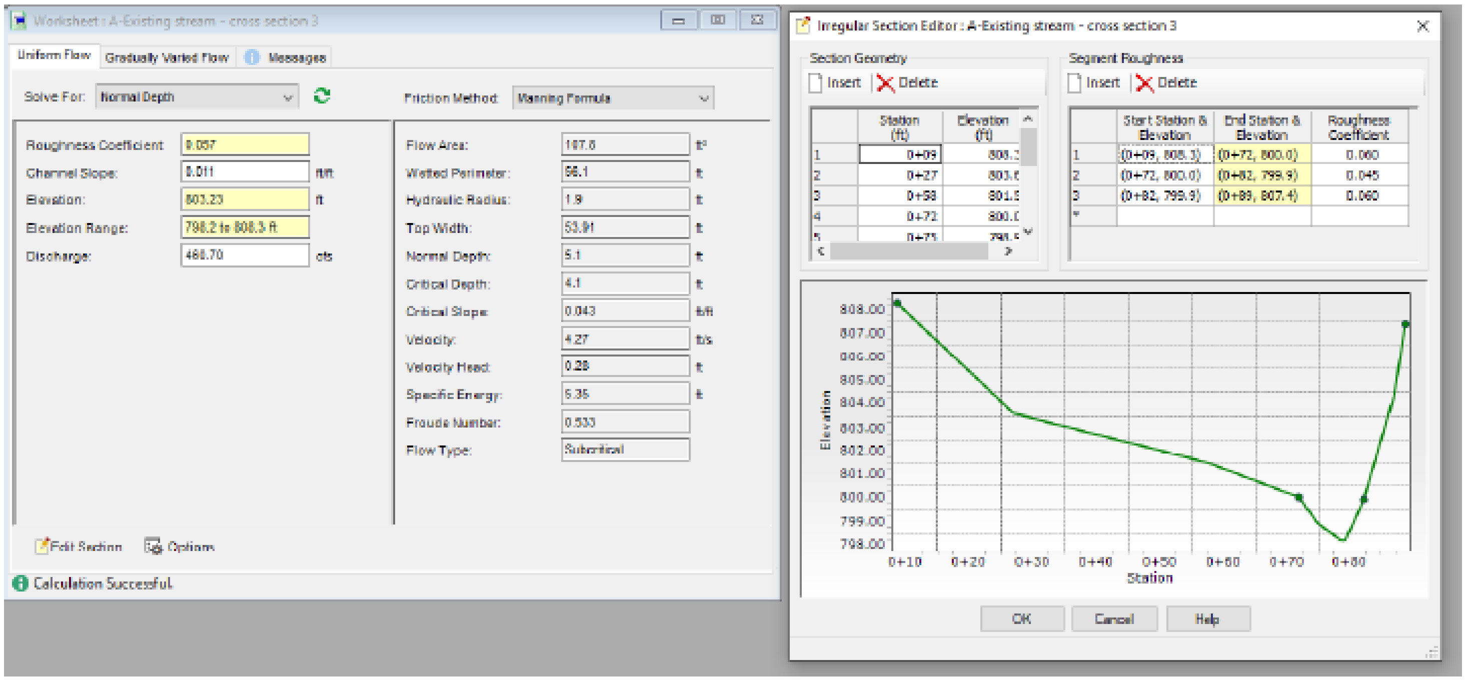
TR-55 Shallow Conc. Flow (unpaved): 23.56
TR-55 Shallow Conc. Flow (paved): 18.70

MODOT District Rainfall Intensity (in/hr)	Peak Flow (cfs)
i_{2yr} = 3.40	Q_{2yr} = 237.2
i_{5yr} = 4.11	Q_{5yr} = 286.6
i_{10yr} = 4.67	Q_{10yr} = 326.0
i_{25yr} = 5.49	Q_{25yr} = 383.1
i_{50yr} = 6.10	Q_{50yr} = 425.3
i_{100yr} = 6.61	Q_{100yr} = 460.7

Graph Data:

yr:	cfs:
2	237.2
5	286.6
10	326.0
25	383.1
50	425.3
100	460.7

BENTLEY FLOW MASTER CALCULATIONS FOR NORMAL DEPTH OF 100 YR STORM EVENT AT WWTF OUTFALL



BANK STABILIZATION APPLIED SHEAR STRESS CALCULATIONS

Location: Lagoon cell 1 south berm slope bank stabilization

Applied Shear Stress (mean boundary shear stress applied to the wetted perimeter):

$$\tau_o = \gamma R S_o$$

where,

τ_o = mean boundary shear stress, N/m² (lb/ft²)

γ = unit weight of water, 9810 N/m³ (62.4 lb/ft³)

R = hydraulic radius, m (ft)

S_o = average bottom slope (equal to energy slope for uniform flow), m/m (ft/ft)

γ (lb/ft³): **62.4**

Hydraulic Radius for Trapezodial Weir:

input:

Bottom Width (ft): 9

Left Side Slope (X:1): 1

Right Side Slope (X:1): 2

Depth (ft): 2.58 (based on trapezodial channel with n for rip rap)

output:

A (ft²): **33.20**

P (ft): **18.42**

R (ft): **1.80**

S_0 (ft/ft): **0.01**

τ_0 (lb/ft²): **1.12**

SF: **1.5**

Permissible shear stress for channel lining:

τ_p (lb/ft²): **1.69**

Applied Shear Stress (maximum shear stress on channel bottom):

$$\tau_d = \gamma d S_o$$

where,

τ_d = shear stress in channel at maximum depth, N/m² (lb/ft²)

d = maximum depth of flow in the channel for the design discharge, m (ft)

d (ft): **2.58** (based on trapezodial channel with n for rip rap)

S_0 (ft/ft): **0.01**

τ_d (lb/ft²): **1.61**

SF: **1.49**

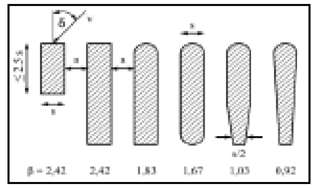
Permissible shear stress for channel lining:

τ_p (lb/ft²): **2.40** suggests d50 of 0.5 ft at FS of 1.49

MoDOT Type 2 rock ditch liner meets the requirement

BAR SCREEN CALCULATIONS

Flow Conditions		
Peak Hour Flow Per Screen	0.340	MGD
Channel Characteristics		
Width	2	ft
Depth	4.61	ft
Downstream Water Level	0.1	ft
Bar Rack Characteristics		
Screen Frame Type	Insert Type Frame	
Desired Bar Spacing	1 1/2	inch
(1/4, 3/8, 1/2, 3/4, 1, 2, & 3" Options)		
Resulting Bar Size (leading edge)	0.3750	inch
Resulting Free Space Between Bars	0.93	ft
Resulting Effective Channel Width	1.17	ft



Kirschmer's Constants	
Screen Angle	45
Bar Shape Factor	2.42

Clean Screen Condition Evaluation (Bernoulli's Equation)			Kirschmer's Comparison	
Clean Screen Condition	0%	blinded		
Downstream Channel Velocity	2.63	ft/sec	2.63	ft/sec
Velocity Through Bars	5.64	ft/sec	3.98	ft/sec
WEF MOP No. 8 suggests 2 to 4 ft/s at clean screen				
Headloss	0.55	ft	0.09	ft
Upstream Water Level	0.65	ft	0.19	ft
Upstream Channel Velocity	0.40	ft/sec	1.42	ft/sec
Channel Freeboard	3.96	ft	4.42	ft
Min. Recommended Channel Depth	2.15	ft	1.69	ft
Cell highlighted red if minimum recommended is less than Channel Characteristics				

Blinded Condition Evaluation (Bernoulli's Equation)			Blinded Conditions (Kirschmer)	
Alternative 1: Blinded Percent	25%	blinded	25%	blinded
Headloss	1.10	ft	0.12	ft
Upstream Water Level	1.20	ft	0.22	ft
Channel Freeboard	3.41	ft	4.39	ft
Min. Recommended Channel Depth	2.70	ft	1.72	ft
Cell highlighted red if minimum recommended is less than Channel Characteristics				
Alternative 2: Blinded Percent	50%	blinded	50%	blinded
Headloss	2.67	ft	0.21	ft
Upstream Water Level	2.77	ft	0.31	ft
Channel Freeboard	1.84	ft	4.30	ft
Min. Recommended Channel Depth	4.27	ft	1.81	ft
Cell highlighted red if minimum recommended is less than Channel Characteristics				

**Note that hydraulics calculations made above are based on Bernoulli's Principle and are considered to be conservative. Less conservative approaches include Kirschmer's Method and can be completed upon request

Kirschmer's hydraulic calculations provide more realistic results of what should be expected for bar screen hydraulics, however, there is little conservativism in this approach.

INFLUENT GRAVITY PIPE CAPACITY CALCULATIONS

Manning's Equation (for circular pipes, full pipe assumption)

Input:

Horizontal Storm Drain Length (ft):	230	HDPE
Storm Drain Slope (ft/ft):	0.0035	CMP
Storm Drain Diameter (in):	8	RCP
Storm Drain Material:	PVC	VCP
		PVC

output:

Storm Drain Length (ft):	230.40		
A (ft^2):	0.35		
P (ft):	2.09		
R (ft):	0.166666667		
n:	0.01		
Q (ft^3/s):	0.93	or	418.23 gal/min
V (ft/s):	2.67		
time in pipe (min):	1.44		

Partially Full Table:

depth (in)	y/D	V/V_{full}	Q/Q_{full}	V (ft/s)	Q(ft^3/s)	Q (gal/min)	Q (GPD)
0.00	0.00	0.0020	0.0000	0.01	0.00	0.00	0
0.08	0.01	0.0401	0.0000	0.11	0.00	0.02	23
0.16	0.02	0.0761	0.0001	0.20	0.00	0.03	46
0.24	0.03	0.1103	0.0001	0.29	0.00	0.05	70
0.32	0.04	0.1426	0.0002	0.38	0.00	0.06	93
0.40	0.05	0.1733	0.0002	0.46	0.00	0.08	116
0.48	0.06	0.2023	0.0002	0.54	0.00	0.10	139
0.56	0.07	0.2297	0.0003	0.61	0.00	0.11	162
0.64	0.08	0.2558	0.0021	0.68	0.00	0.89	1,283
0.72	0.09	0.2805	0.0044	0.75	0.00	1.86	2,677
0.80	0.10	0.3039	0.0072	0.81	0.01	3.01	4,337
0.88	0.11	0.3261	0.0104	0.87	0.01	4.34	6,253
0.96	0.12	0.3472	0.0140	0.93	0.01	5.85	8,418
1.04	0.13	0.3672	0.0180	0.98	0.02	7.52	10,825
1.12	0.14	0.3863	0.0224	1.03	0.02	9.35	13,468
1.20	0.15	0.4045	0.0271	1.08	0.03	11.35	16,340
1.28	0.16	0.4218	0.0323	1.13	0.03	13.50	19,435
1.36	0.17	0.4383	0.0378	1.17	0.04	15.80	22,750
1.44	0.18	0.4541	0.0436	1.21	0.04	18.25	26,277
1.52	0.19	0.4692	0.0498	1.25	0.05	20.84	30,014
1.60	0.20	0.4837	0.0564	1.29	0.05	23.58	33,956
1.68	0.21	0.4976	0.0633	1.33	0.06	26.46	38,099
1.76	0.22	0.5110	0.0705	1.36	0.07	29.47	42,441
1.84	0.23	0.5238	0.0780	1.40	0.07	32.62	46,977
1.92	0.24	0.5363	0.0859	1.43	0.08	35.91	51,705
2.00	0.25	0.5483	0.0940	1.46	0.09	39.32	56,622
2.08	0.26	0.5600	0.1025	1.50	0.10	42.87	61,727
2.16	0.27	0.5714	0.1113	1.53	0.10	46.54	67,016
2.24	0.28	0.5824	0.1204	1.55	0.11	50.34	72,488
2.32	0.29	0.5932	0.1297	1.58	0.12	54.26	78,141
2.40	0.30	0.6038	0.1394	1.61	0.13	58.31	83,973
2.48	0.31	0.6141	0.1494	1.64	0.14	62.49	89,983
2.56	0.32	0.6243	0.1597	1.67	0.15	66.78	96,169
2.64	0.33	0.6343	0.1702	1.69	0.16	71.20	102,529
2.72	0.34	0.6441	0.1811	1.72	0.17	75.74	109,063
2.80	0.35	0.6538	0.1922	1.75	0.18	80.39	115,768
2.88	0.36	0.6635	0.2036	1.77	0.19	85.17	122,644
2.96	0.37	0.6730	0.2153	1.80	0.20	90.06	129,688
3.04	0.38	0.6824	0.2273	1.82	0.21	95.07	136,900
3.12	0.39	0.6918	0.2396	1.85	0.22	100.19	144,278
3.20	0.40	0.7011	0.2521	1.87	0.23	105.43	151,819
3.28	0.41	0.7104	0.2649	1.90	0.25	110.78	159,523
3.36	0.42	0.7196	0.2779	1.92	0.26	116.24	167,387

INFLUENT GRAVITY PIPE CAPACITY CALCULATIONS

3.44	0.43	0.7288	0.2913	1.95	0.27	121.81	175,409
3.52	0.44	0.7379	0.3048	1.97	0.28	127.49	183,588
3.60	0.45	0.7471	0.3187	1.99	0.30	133.28	191,919
3.68	0.46	0.7561	0.3328	2.02	0.31	139.17	200,401
3.76	0.47	0.7652	0.3471	2.04	0.32	145.16	209,030
3.84	0.48	0.7743	0.3617	2.07	0.34	151.25	217,803
3.92	0.49	0.7833	0.3765	2.09	0.35	157.44	226,717
4.00	0.50	0.7923	0.3915	2.12	0.36	163.73	235,767
4.08	0.51	0.8012	0.4067	2.14	0.38	170.10	244,949
4.16	0.52	0.8101	0.4222	2.16	0.39	176.57	254,259
4.24	0.53	0.8190	0.4378	2.19	0.41	183.12	263,691
4.32	0.54	0.8278	0.4537	2.21	0.42	189.75	273,240
4.40	0.55	0.8365	0.4697	2.23	0.44	196.46	282,900
4.48	0.56	0.8452	0.4860	2.26	0.45	203.24	292,664
4.56	0.57	0.8538	0.5023	2.28	0.47	210.09	302,525
4.64	0.58	0.8623	0.5188	2.30	0.48	217.00	312,476
4.72	0.59	0.8707	0.5355	2.32	0.50	223.96	322,509
4.80	0.60	0.8790	0.5523	2.35	0.51	230.98	332,615
4.88	0.61	0.8872	0.5692	2.37	0.53	238.05	342,786
4.96	0.62	0.8953	0.5862	2.39	0.55	245.15	353,011
5.04	0.63	0.9032	0.6032	2.41	0.56	252.28	363,280
5.12	0.64	0.9110	0.6203	2.43	0.58	259.43	373,581
5.20	0.65	0.9186	0.6375	2.45	0.59	266.60	383,904
5.28	0.66	0.9261	0.6546	2.47	0.61	273.77	394,236
5.36	0.67	0.9333	0.6718	2.49	0.63	280.95	404,563
5.44	0.68	0.9404	0.6889	2.51	0.64	288.10	414,871
5.52	0.69	0.9472	0.7059	2.53	0.66	295.24	425,147
5.60	0.70	0.9538	0.7229	2.55	0.67	302.34	435,373
5.68	0.71	0.9602	0.7398	2.56	0.69	309.40	445,535
5.76	0.72	0.9663	0.7565	2.58	0.70	316.40	455,615
5.84	0.73	0.9722	0.7731	2.60	0.72	323.33	465,595
5.92	0.74	0.9778	0.7895	2.61	0.74	330.18	475,455
6.00	0.75	0.9831	0.8056	2.62	0.75	336.93	485,177
6.08	0.76	0.9881	0.8215	2.64	0.77	343.57	494,739
6.16	0.77	0.9928	0.8371	2.65	0.78	350.08	504,120
6.24	0.78	0.9972	0.8523	2.66	0.79	356.46	513,297
6.32	0.79	1.0013	0.8672	2.67	0.81	362.67	522,246
6.40	0.80	1.0050	0.8816	2.68	0.82	368.71	530,943
6.48	0.81	1.0083	0.8956	2.69	0.83	374.56	539,361
6.56	0.82	1.0114	0.9091	2.70	0.85	380.19	547,475
6.64	0.83	1.0140	0.9220	2.71	0.86	385.59	555,255
6.72	0.84	1.0163	0.9343	2.71	0.87	390.75	562,673
6.80	0.85	1.0182	0.9460	2.72	0.88	395.62	569,699
6.88	0.86	1.0198	0.9569	2.72	0.89	400.21	576,301
6.96	0.87	1.0209	0.9671	2.73	0.90	404.48	582,447
7.04	0.88	1.0217	0.9765	2.73	0.91	408.40	588,103
7.12	0.89	1.0221	0.9850	2.73	0.92	411.97	593,234
7.20	0.90	1.0221	0.9926	2.73	0.93	415.14	597,803
7.28	0.91	1.0217	0.9992	2.73	0.93	417.90	601,773
7.36	0.92	1.0209	1.0047	2.73	0.94	420.21	605,106
7.44	0.93	1.0198	1.0092	2.72	0.94	422.06	607,761
7.52	0.94	1.0182	1.0124	2.72	0.94	423.40	609,696
7.60	0.95	1.0163	1.0143	2.71	0.95	424.21	610,869
7.68	0.96	1.0140	1.0149	2.71	0.95	424.47	611,234
7.76	0.97	1.0114	1.0141	2.70	0.95	424.13	610,748
7.84	0.98	1.0084	1.0118	2.69	0.94	423.17	609,362
7.92	0.99	1.0051	1.0079	2.68	0.94	421.55	607,027
8.00	1.00	1.0015	1.0024	2.67	0.93	419.23	603,694

Project No. 20358.005
Project: Rosebud Wastewater System Improvements
Subject: Lagoon Storage and Flow Control Structures
Location: Rosebud, MO

Cell 1 Discharge Calculations

Orifice calcs:

Equations Used:

$$Q_o = C_o A_o \sqrt{2g(H - E_o)}$$

Q_o = orifice outflow
C_o = orifice discharge coefficient
g = acceleration due to gravity 32.2 ft/s²
A_o = net opening area = $\pi d^2/4$
H = water Elevation

C_o = 0.62

	#1:		#2:		#3:	
FL orifice =	809.53	ft	810.5	ft		ft
Number of orifices =	0		1			
Diameter of Orifice =	6	in	6	in		in

Water Elevation (ft)	H (ft)	Q (cfs)	Q (gpd)	H (ft)	Q (cfs)	Q (gpd)	H (ft)	Q (cfs)	Q (gpd)	Total Q (cfs)	Total Q (gpd)
807.50	-2.28	0.00	0	-3.25	0.00	0	807.50	0.00	0	0.00	0
807.60	-2.18	0.00	0	-3.15	0.00	0	807.60	0.00	0	0.00	0
807.70	-2.08	0.00	0	-3.05	0.00	0	807.70	0.00	0	0.00	0
807.80	-1.98	0.00	0	-2.95	0.00	0	807.80	0.00	0	0.00	0
807.90	-1.88	0.00	0	-2.85	0.00	0	807.90	0.00	0	0.00	0
808.00	-1.78	0.00	0	-2.75	0.00	0	808.00	0.00	0	0.00	0
808.10	-1.68	0.00	0	-2.65	0.00	0	808.10	0.00	0	0.00	0
808.20	-1.58	0.00	0	-2.55	0.00	0	808.20	0.00	0	0.00	0
808.30	-1.48	0.00	0	-2.45	0.00	0	808.30	0.00	0	0.00	0
808.40	-1.38	0.00	0	-2.35	0.00	0	808.40	0.00	0	0.00	0
808.50	-1.28	0.00	0	-2.25	0.00	0	808.50	0.00	0	0.00	0
808.60	-1.18	0.00	0	-2.15	0.00	0	808.60	0.00	0	0.00	0
808.70	-1.08	0.00	0	-2.05	0.00	0	808.70	0.00	0	0.00	0
808.80	-0.98	0.00	0	-1.95	0.00	0	808.80	0.00	0	0.00	0
808.90	-0.88	0.00	0	-1.85	0.00	0	808.90	0.00	0	0.00	0
809.00	-0.78	0.00	0	-1.75	0.00	0	809.00	0.00	0	0.00	0
809.10	-0.68	0.00	0	-1.65	0.00	0	809.10	0.00	0	0.00	0
809.20	-0.58	0.00	0	-1.55	0.00	0	809.20	0.00	0	0.00	0
809.30	-0.48	0.00	0	-1.45	0.00	0	809.30	0.00	0	0.00	0
809.40	-0.38	0.00	0	-1.35	0.00	0	809.40	0.00	0	0.00	0
809.50	-0.28	0.00	0	-1.25	0.00	0	809.50	0.00	0	0.00	0
809.60	-0.18	0.00	0	-1.15	0.00	0	809.60	0.00	0	0.00	0
809.70	-0.08	0.00	0	-1.05	0.00	0	809.70	0.00	0	0.00	0
809.80	0.02	0.00	0	-0.95	0.00	0	809.80	0.00	0	0.00	0
809.90	0.12	0.00	0	-0.85	0.00	0	809.90	0.00	0	0.00	0
810.00	0.22	0.00	0	-0.75	0.00	0	810.00	0.00	0	0.00	0
810.10	0.32	0.00	0	-0.65	0.00	0	810.10	0.00	0	0.00	0
810.20	0.42	0.00	0	-0.55	0.00	0	810.20	0.00	0	0.00	0
810.30	0.52	0.00	0	-0.45	0.00	0	810.30	0.00	0	0.00	0
810.40	0.62	0.00	0	-0.35	0.00	0	810.40	0.00	0	0.00	0
810.50	0.72	0.00	0	-0.25	0.00	0	810.50	0.00	0	0.00	0
810.60	0.82	0.00	0	-0.15	*0.07*	*47,059*	810.60	0.00	0	*0.07*	*47,059*
810.70	0.92	0.00	0	-0.05	*0.15*	*94,118*	810.70	0.00	0	*0.15*	*94,118*
810.80	1.02	0.00	0	0.05	0.22	141,177	810.80	0.00	0	0.22	141,177
810.85	1.07	0.00	0	0.10	0.31	199,655	810.85	0.00	0	0.31	199,655
810.90	1.12	0.00	0	0.15	0.38	244,526	810.90	*0.00*	0	*0.38*	*244,526*
811.00	1.22	0.00	0	0.25	0.49	315,682	811.00	*0.00*	0	*0.49*	*315,682*
811.10	1.32	0.00	0	0.35	0.58	373,520	811.10	*0.00*	*0*	*0.58*	*373,520*
811.20	1.42	0.00	0	0.45	0.66	423,532	811.20	0.00	0	0.66	423,532
811.30	1.52	0.00	0	0.55	0.72	468,232	811.30	0.00	0	0.72	468,232
811.35	1.57	0.00	0	0.60	0.76	489,052	811.35	0.00	0	0.76	489,052
811.40	1.62	0.00	0	0.65	0.79	509,022	811.40	0.00	0	0.79	509,022
811.50	1.72	0.00	0	0.75	0.85	546,777	811.50	0.00	0	0.85	546,777
811.60	1.82	0.00	0	0.85	0.90	582,089	811.60	0.00	0	0.90	582,089
811.70	1.92	0.00	0	0.95	0.95	615,378	811.70	0.00	0	0.95	615,378
811.80	2.02	0.00	0	1.05	1.00	646,956	811.80	0.00	0	1.00	646,956
811.90	2.12	0.00	0	1.15	1.05	677,063	811.90	0.00	0	1.05	677,063
812.00	2.22	0.00	0	1.25	1.09	705,886	812.00	0.00	0	1.09	705,886
812.10	2.32	0.00	0	1.35	1.14	733,579	812.10	0.00	0	1.14	733,579
812.20	2.42	0.00	0	1.45	1.18	760,263	812.20	0.00	0	1.18	760,263
812.30	2.52	0.00	0	1.55	1.22	786,042	812.30	0.00	0	1.22	786,042
812.40	2.62	0.00	0	1.65	1.25	811,002	812.40	0.00	0	1.25	811,002
812.50	2.72	0.00	0	1.75	1.29	835,216	812.50	0.00	0	1.29	835,216

italized print indicates cells calculated by linear interpolation for flows less than 1/2 full as the orifice calculation is based on the centroid of the orifice

Bartlett & West

Project No. 20358.005
Project: Rosebud Wastewater System Improvements
Subject: Lagoon Storage and Flow Control Structures
Location: Rosebud, MO

Cell 2 Discharge Calculations

Orifice calcs:

Equations Used:

$$Q_o = C_o A_o \sqrt{2g(H - E_o)}$$

Q_o = orifice outflow
C_o = orifice discharge coefficient
g = acceleration due to gravity 32.2 ft/s^2
A_o = net opening area = $\pi d^2/4$
H = water Elevation

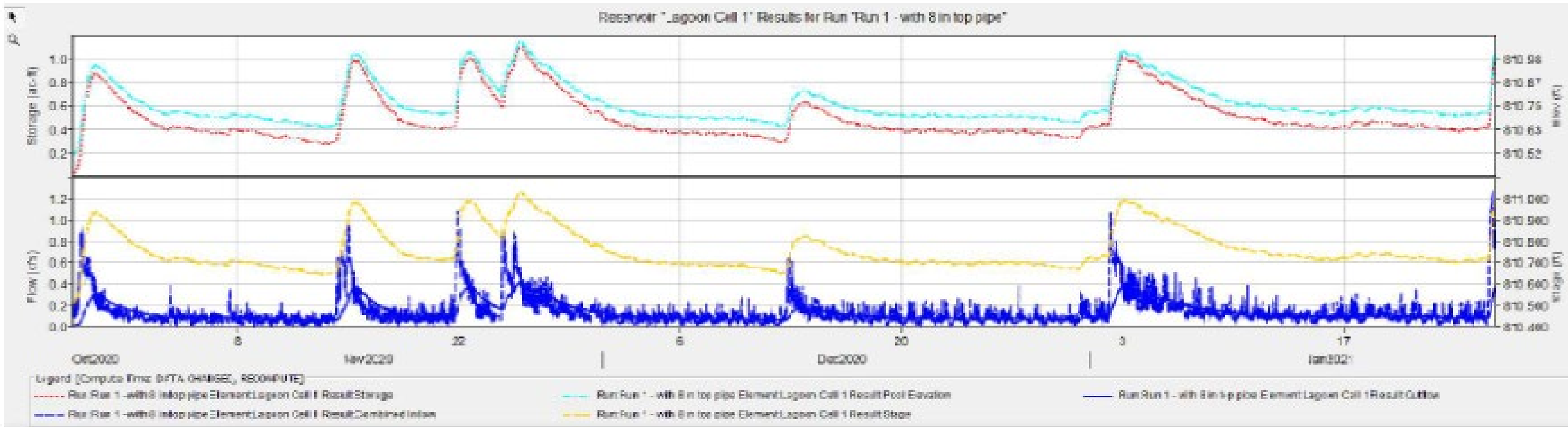
C_o = 0.62

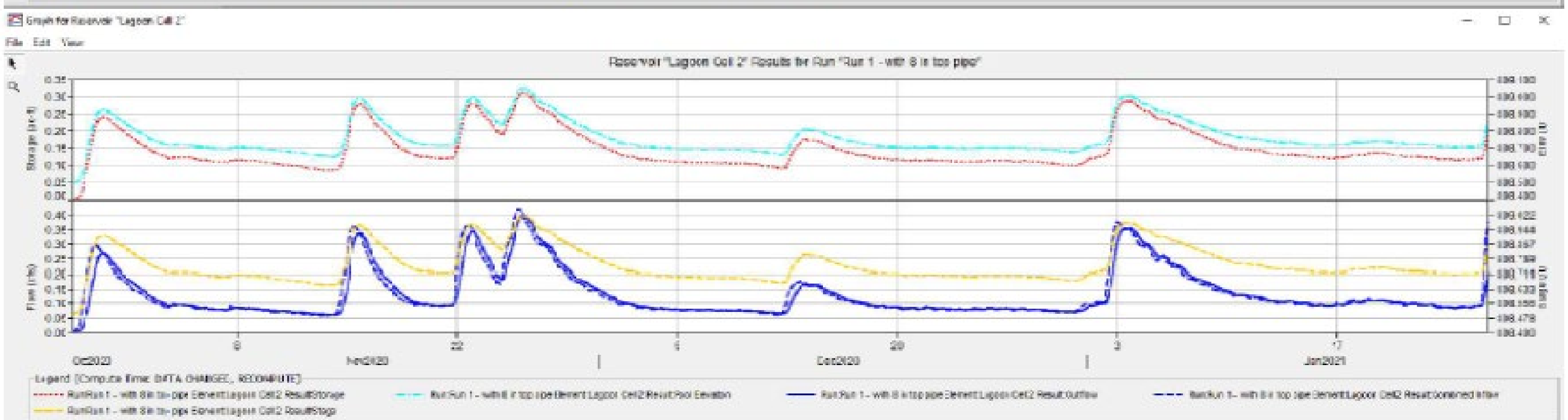
	#1:	#2:	#3:
FL orifice =	806.50 ft	808.5 ft	808.85 ft
Number of orifices =	0	1	1
Diameter of Orifice =	8 in	4 in	8 in

Water Elevation (ft)	H (ft)	Q (cfs)	Q (gpd)	H (ft)	Q (cfs)	Q (gpd)	H (ft)	Q (cfs)	Q (gpd)	Total Q (cfs)	Total Q (gpd)
805.50	-1.33	0.00	0	-3.17	0.00	0	-3.68	0.00	0	0.00	0
805.60	-1.23	0.00	0	-3.07	0.00	0	-3.58	0.00	0	0.00	0
805.70	-1.13	0.00	0	-2.97	0.00	0	-3.48	0.00	0	0.00	0
805.80	-1.03	0.00	0	-2.87	0.00	0	-3.38	0.00	0	0.00	0
805.90	-0.93	0.00	0	-2.77	0.00	0	-3.28	0.00	0	0.00	0
806.00	-0.83	0.00	0	-2.67	0.00	0	-3.18	0.00	0	0.00	0
806.10	-0.73	0.00	0	-2.57	0.00	0	-3.08	0.00	0	0.00	0
806.20	-0.63	0.00	0	-2.47	0.00	0	-2.98	0.00	0	0.00	0
806.30	-0.53	0.00	0	-2.37	0.00	0	-2.88	0.00	0	0.00	0
806.40	-0.43	0.00	0	-2.27	0.00	0	-2.78	0.00	0	0.00	0
806.50	-0.33	0.00	0	-2.17	0.00	0	-2.68	0.00	0	0.00	0
806.60	-0.23	0.00	0	-2.07	0.00	0	-2.58	0.00	0	0.00	0
806.70	-0.13	0.00	0	-1.97	0.00	0	-2.48	0.00	0	0.00	0
806.80	-0.03	0.00	0	-1.87	0.00	0	-2.38	0.00	0	0.00	0
806.90	0.07	0.00	0	-1.77	0.00	0	-2.28	0.00	0	0.00	0
807.00	0.17	0.00	0	-1.67	0.00	0	-2.18	0.00	0	0.00	0
807.10	0.27	0.00	0	-1.57	0.00	0	-2.08	0.00	0	0.00	0
807.20	0.37	0.00	0	-1.47	0.00	0	-1.98	0.00	0	0.00	0
807.30	0.47	0.00	0	-1.37	0.00	0	-1.88	0.00	0	0.00	0
807.40	0.57	0.00	0	-1.27	0.00	0	-1.78	0.00	0	0.00	0
807.50	0.67	0.00	0	-1.17	0.00	0	-1.68	0.00	0	0.00	0
807.60	0.77	0.00	0	-1.07	0.00	0	-1.58	0.00	0	0.00	0
807.70	0.87	0.00	0	-0.97	0.00	0	-1.48	0.00	0	0.00	0
807.80	0.97	0.00	0	-0.87	0.00	0	-1.38	0.00	0	0.00	0
807.90	1.07	0.00	0	-0.77	0.00	0	-1.28	0.00	0	0.00	0
808.00	1.17	0.00	0	-0.67	0.00	0	-1.18	0.00	0	0.00	0
808.10	1.27	0.00	0	-0.57	0.00	0	-1.08	0.00	0	0.00	0
808.20	1.37	0.00	0	-0.47	0.00	0	-0.98	0.00	0	0.00	0
808.30	1.47	0.00	0	-0.37	0.00	0	-0.88	0.00	0	0.00	0
808.40	1.57	0.00	0	-0.27	0.00	0	-0.78	0.00	0	0.00	0
808.50	1.67	0.00	0	-0.17	0.00	0	-0.68	0.00	0	0.00	0
808.60	1.77	0.00	0	-0.07	*0.04*	*23,333*	-0.58	0.00	0	*0.04*	*23,333*
808.70	1.87	0.00	0	0.03	0.08	50,457	-0.48	0.00	0	0.08	50,457
808.80	1.97	0.00	0	0.13	0.16	102,078	-0.38	0.00	0	0.16	102,078
808.85	2.02	0.00	0	0.18	0.19	120,148	-0.33	0.00	0	0.19	120,148
808.90	2.07	0.00	0	0.24	0.21	136,414	-0.28	*0.05*	*21,943*	*0.25*	*158,357*
809.00	2.17	0.00	0	0.34	0.25	162,735	-0.18	*0.10*	*63,344*	*0.35*	*226,079*
809.05	2.21	0.00	0	0.38	0.27	172,598	-0.14	*0.12*	*80,732*	*0.39*	*253,330*
809.10	2.27	0.00	0	0.43	0.29	184,718	-0.08	*0.16*	*103,503*	*0.45*	*288,221*
809.20	2.37	0.00	0	0.53	0.32	204,926	0.02	0.22	144,904	0.54	349,830
809.30	2.47	0.00	0	0.63	0.35	223,313	0.12	0.59	383,381	0.94	606,694
809.35	2.52	0.00	0	0.68	0.36	231,960	0.17	0.71	458,228	1.07	690,188
809.40	2.57	0.00	0	0.73	0.37	240,297	0.22	0.81	522,460	1.18	762,757
809.50	2.67	0.00	0	0.83	0.40	256,157	0.32	0.98	631,624	1.37	887,781
809.60	2.77	0.00	0	0.93	0.42	271,091	0.42	1.12	724,522	1.54	995,614
809.70	2.87	0.00	0	1.03	0.44	285,245	0.52	1.25	806,794	1.69	#######
809.80	2.97	0.00	0	1.13	0.46	298,728	0.62	1.36	881,419	1.83	#######
809.90	3.07	0.00	0	1.23	0.48	311,629	0.72	1.47	950,202	1.95	#######
810.00	3.17	0.00	0	1.33	0.50	324,016	0.82	1.57	#######	2.07	#######
810.10	3.27	0.00	0	1.43	0.52	335,947	0.92	1.66	#######	2.18	#######
810.20	3.37	0.00	0	1.53	0.54	347,469	1.02	1.75	#######	2.29	#######
810.30	3.47	0.00	0	1.63	0.55	358,620	1.12	1.84	#######	2.39	#######
810.40	3.57	0.00	0	1.73	0.57	369,435	1.22	1.92	#######	2.49	#######
810.50	3.67	0.00	0	1.83	0.59	379,943	1.32	1.99	#######	2.58	#######

Italized print indicates cells calculated by linear interpolation for flows less than 1/2 full as the orifice calculation is based on the centroid of the orifice

HEC-HMS STORAGE-DISCHARGE GRAPH RESULTS FROM FLOW MONITORING DATA OF FACILITY PLAN REPORT





Rosebud MO WWTF

HYDRAULIC CALCULATIONS FOR AVERAGE DAILY FLOW

DESCRIPTION:	WWTF outfall through mag meter, UV, future tanks, clarifier, Triplepoint, and Airlift
FLOW (GPD):	50,700 (ADF)
FLOW (GPM):	35.21
FLOW (MGD):	0.05

ELEMENT	MATERIAL	FLOW (GPM)	C FACTOR	PIPE CLASS	NOM. DIA (IN)	OUT. DIA (IN)	ID (IN)	VELOCITY (FPS)	LENGTH (FT)	PIPE LOSS	K FACTOR	FIT. LOSS (FT)	CUM. LOSS (FT)	HGL (FT)	COMMENTS
Upstream from effluent weir through UV through Triplepoint and Airlift Structures to Cell 2														**803.2300**	**Tailwater based on 100 year flood elevation - see "W:\Proj\20000\20358\20358.005\Documents\DesignCalcs\Hydraulic Calcs\Runoff to South Ditch\open channel 100 year depth calcs.fm8" and "A-Existing Stream - cross section 3" since we're planning on remove the weir plate in existing effluent channel**
SWING CHECK VALVE	DIP	35.21	120	CL 50	14.0	15.300	14.640	0.07			2.20	0.0002	0.0002	803.2302	(survey shows 15" steel, used 14" DI for calcs)
EXIT LOSS	DIP	35.21	120	CL 50	14.0	15.300	14.640	0.07			1.00	0.0001	0.0002	803.2302	(survey shows 15" steel, used 14" DI for calcs)
PIPE	DIP	35.21	120	CL 50	14.0	15.300	14.640	0.07	3.90	0.0000			0.0002	803.2302	(survey shows 15" steel, used 14" DI for calcs)
PIPE	PVC_AWWA	35.21	140	C900 (DR 25)	14.0	15.300	15.300	0.06	19.60	0.0000			0.0003	803.2303	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
SHARP-EDGE ENTRANCE	PVC_AWWA	35.21	140	C900 (DR 25)	14.0	15.300	15.300	0.06			0.50	0.0000	0.0003	803.2303	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
EXIT LOSS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			1.00	0.0023	0.0026	**803.2326**	**effluent manhole dowstream of mag meter**
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39	2.80	0.0003			0.0029	803.2329	
45° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.15	0.0003	0.0033	803.2333	bend down to lower depth at mag meter
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39	4.70	0.0006			0.0039	803.2339	
45° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.15	0.0003	0.0042	803.2342	bend DS of mag meter back to horizontal
REDUCER	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	4.0	4.500	4.160	0.83			0.20	0.0021	0.0063	803.2363	concentric reducer immediately DS of mag meter
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	4.0	4.500	4.160	0.83	8.10	0.0064			0.0127	**803.2427**	straight line run downstream of mag meter. **HGL at mag meter**
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	4.0	4.500	4.160	0.83	9.60	0.0076			0.0203	803.2503	straight line run upstream of mag meter
REDUCER	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	4.0	4.500	4.160	0.83			0.20	0.0021	0.0149	803.2449	concentric reducer immediately US of mag meter
45° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.15	0.0003	0.0152	803.2452	horizontal bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39	3.80	0.0005			0.0157	803.2457	
TEE - LINE FLOW	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.30	0.0007	0.0164	803.2464	tee downstream of UV
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39	4.80	0.0006			0.0170	803.2470	
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.30	0.0007	0.0177	803.2477	vertical 90 deg bend downstream of UV
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39	6.50	0.0008			0.0185	**803.2485**	vertical pipe up through UV slab. **HGL in vertical pipe below UV**
REDUCER	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	6.0	6.630	6.110	0.39			0.20	0.0005	0.0189	*803.2489*	reducer loss of reducing 90 deg bend
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.0192	*803.2492*	bend loss of reducing 90 deg bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	2.10	0.0001			0.0192	*803.2492*	**horizontal pipe to UV (HGL is in vertical pipe through slab and then follows horizontal pipe... assume 1/4 full**
														808.7700	**UV weir elevation**
												0.2742	0.2742	**809.0442**	headlosses per Trojan. **HGL at upstream end of UV**
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	1.30	0.0000			0.2742	809.0442	pipe upstream of UV
GATE VALVE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.2744	809.0444	
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.2747	809.0447	90 deg vertical bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	6.30	0.0002			0.2749	809.0449	vertical pipe through UV slab
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.2751	809.0451	90 deg vertical bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	4.20	0.0001			0.2753	809.0453	
TEE - LINE FLOW	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.2755	809.0455	
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	36.70	0.0012			0.2767	809.0467	
PROJECTING ENTRANCE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.80	0.0006	0.2774	809.0474	
					8.0							0.0208	0.2982	809.0682	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			2.00	0.0500	0.3482	809.1182	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	19.90	0.0007			0.3488	809.1188	assumed pipe length between future tanks
PROJECTING ENTRANCE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.80	0.0006	0.3495	809.1195	
					8.0							0.0208	0.3703	809.1403	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			2.00	0.0500	0.4203	809.1903	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	41.60	0.0014			0.4217	809.1917	assumed pipe length between future tank and clarifier
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.4219	809.1919	90 deg vertical bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23		0.0000			0.4219	**809.1919**	**HGL in pipe below clarifier weir trough**
PROJECTING ENTRANCE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.80			**810.2100**	**HGL in clarifer weir trough. update accordingly**
														810.7300	**Weir elevation in Clarifier is 810.70. See Weir calcs for HGL**
EXIT LOSS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			1.00	0.0008	0.0008	810.7308	
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	1.50	0.0001			0.0008	810.7308	pipe between clarifier and Nitrox #2
PROJECTING ENTRANCE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.80	0.0006	0.0015	810.7315	
												0.0208	0.0223	810.7523	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			2.00	0.0500	0.0723	810.8023	**HGL at Nitrox Tank #2.** 8" flapper.
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	1.70	0.0001			0.0723	810.8023	pipe between Nitrox #2 and Nitrox #1
PROJECTING ENTRANCE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.80	0.0006	0.0730	810.8030	
												0.0208	0.0938	810.8238	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			2.00	0.0500	0.1438	810.8738	**HGL at Nitrox Tank #1.** 8" flapper.
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	2.30	0.0001			0.1439	810.8739	pipe between Nitrox #1 and airlift
90° BEND	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23			0.30	0.0002	0.1441	810.8741	90 deg vertical bend
PIPE	PVC_ASTM	35.21	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.23	3.30	0.0001			0.1442	810.8742	**vertical pipe inside airlift. HGL below 811.62 by 0.75'**

Rosebud MO WWTF

HYDRAULIC CALCULATIONS FOR peak daily flow

DESCRIPTION:	**WWTF outfall through mag meter, UV, future tanks, clarifier, Triplepoint, and Airlift**	
FLOW (GPD):	158,500	(peak daily flow to Triplepoint)
FLOW (GPM):	110.07	
FLOW (MGD):	0.16	

ELEMENT	MATERIAL	FLOW (GPM)	C FACTOR	PIPE CLASS	NOM. DIA (IN)	OUT. DIA (IN)	ID (IN)	VELOCITY (FPS)	LENGTH (FT)	PIPE LOSS	K FACTOR	FIT. LOSS (FT)	CUM. LOSS (FT)	HGL (FT)	COMMENTS
Upstream from effluent weir through UV through Triplepoint and Airlift Structures to Cell 2														803.2300	**Tailwater based on 100 year flood elevation - see "W:\Proj\20000\20358\20358.005\Documents\DesignCalcs\Hydraulic Calcs\Runoff to South Ditch\open channel 100 year depth calcs.fm8" and "A-Existing Stream - cross section 3" since we're planning on remove the weir plate in existing effluent channel**
SWING CHECK VALVE	DIP	110.07	120	CL 50	14.0	15.300	14.640	0.21			2.20	0.0015	0.0015	803.2315	(survey shows 15" steel, used 14" DI for calcs)
EXIT LOSS	DIP	110.07	120	CL 50	14.0	15.300	14.640	0.21			1.00	0.0007	0.0022	803.2322	(survey shows 15" steel, used 14" DI for calcs)
PIPE	DIP	110.07	120	CL 50	14.0	15.300	14.640	0.21	3.90	0.0001			0.0023	803.2323	(survey shows 15" steel, used 14" DI for calcs)
PIPE	PVC_AWWA	110.07	140	C900 (DR 25)	14.0	15.300	15.300	0.19	19.60	0.0002			0.0025	803.2325	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
SHARP-EDGE ENTRANCE	PVC_AWWA	110.07	140	C900 (DR 25)	14.0	15.300	15.300	0.19			0.50	0.0003	0.0028	803.2328	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
EXIT LOSS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			1.00	0.0225	0.0253	**803.2553**	**effluent manhole dowstream of mag meter**
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20	2.80	0.0028			0.0281	803.2581	
45° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.15	0.0034	0.0315	803.2615	bend down to lower depth at mag meter
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20	4.70	0.0047			0.0362	803.2662	
45° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.15	0.0034	0.0396	803.2696	bend DS of mag meter back to horizontal
REDUCER	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	4.0	4.500	4.160	2.60			0.20	0.0210	0.0605	803.2905	concentric reducer immediately DS of mag meter
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	4.0	4.500	4.160	2.60	8.10	0.0527			0.1132	**803.3432**	straight line run downstream of mag meter. **HGL at mag meter**
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	4.0	4.500	4.160	2.60	9.60	0.0624			0.1757	803.4057	straight line run upstream of mag meter
REDUCER	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	4.0	4.500	4.160	2.60			0.20	0.0210	0.1342	803.3642	concentric reducer immediately US of mag meter
45° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.15	0.0034	0.1376	803.3676	horizontal bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20	3.80	0.0038			0.1414	803.3714	
TEE - LINE FLOW	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.30	0.0068	0.1481	803.3781	tee downstream of UV
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20	4.80	0.0048			0.1530	803.3830	
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.30	0.0068	0.1597	803.3897	vertical 90 deg bend downstream of UV
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20	6.50	0.0065			0.1662	**803.3962**	vertical pipe up through UV slab. **HGL in vertical pipe below UV**
REDUCER	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	6.0	6.630	6.110	1.20			0.20	0.0045	0.1707	803.4007	reducer loss of reducing 90 deg bend
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.1731	803.4031	bend loss of reducing 90 deg bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	2.10	0.0006			0.1736	803.4036	**horizontal pipe to UV (HGL is in vertical pipe through slab and then follows horizontal pipe... assume 1/3 full**
														808.7700	**UV weir elevation**
												0.3083	0.3083	**809.0783**	headlosses per Trojan. **HGL at upstream end of UV**
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	1.30	0.0004			0.3087	809.0787	pipe upstream of UV
GATE VALVE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.3110	809.0810	
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.3134	809.0834	90 deg vertical bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	6.30	0.0017			0.3151	809.0851	vertical pipe through UV slab
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.3174	809.0874	90 deg vertical bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	4.20	0.0012			0.3186	809.0886	
TEE - LINE FLOW	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.3209	809.0909	
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	36.70	0.0101			0.3310	809.1010	
PROJECTING ENTRANCE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.80	0.0062	0.3372	809.1072	
					8.0							0.0208	0.3580	809.1280	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			2.00	0.1450	0.5030	809.2730	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	19.90	0.0055			0.5085	809.2785	assumed pipe length between future tanks
PROJECTING ENTRANCE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.80	0.0062	0.5147	809.2847	
					8.0							0.0208	0.5355	809.3055	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			2.00	0.1450	0.6805	809.4505	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	41.60	0.0114			0.6920	809.4620	assumed pipe length between future tank and clarifier
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.6943	809.4643	90 deg vertical bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71		0.0000			0.6943	**809.4643**	**HGL in pipe below clarifier weir trough**
PROJECTING ENTRANCE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.80			**810.2200**	**HGL in clarifer weir trough. update accordingly**
														810.7400	**Weir elevation in Clarifier is 810.70. See Weir calcs for HGL**
EXIT LOSS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			1.00	0.0078	0.0078	810.7478	
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	1.50	0.0004			0.0082	810.7482	pipe between clarifier and Nitrox #2
PROJECTING ENTRANCE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.80	0.0062	0.0144	810.7544	
												0.0208	0.0352	810.7752	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			2.00	0.1450	0.1802	810.9202	**HGL at Nitrox Tank #2.** 8" flapper.
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	1.70	0.0005			0.1807	810.9207	pipe between Nitrox #2 and Nitrox #1
PROJECTING ENTRANCE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.80	0.0062	0.1869	810.9269	
												0.0208	0.2077	810.9477	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			2.00	0.1450	0.3527	811.0927	**HGL at Nitrox Tank #1.** 8" flapper.
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	2.30	0.0006			0.3533	811.0933	pipe between Nitrox #1 and airlift
90° BEND	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71			0.30	0.0023	0.3557	811.0957	90 deg vertical bend
PIPE	PVC_ASTM	110.07	140	SDR 26 (160 PSI)	8.0	8.630	7.970	0.71	3.30	0.0009			0.3566	811.0966	**vertical pipe inside airlift. HGL below 811.62 by 0.52'**

Rosebud MO WWTF

HYDRAULIC CALCULATIONS FOR peak hourly flow

DESCRIPTION: WWTF outfall through mag meter, UV, future tanks, clarifier, Triplepoint, and Airlift
FLOW (GPD): 271,434 (peak outflow from cell 2 per HEC-HMS)
FLOW (GPM): 188.50
FLOW (MGD): 0.27

ELEMENT	MATERIAL	FLOW (GPM)	C FACTOR	PIPE CLASS	NOM. DIA (IN)	OUT. DIA (IN)	ID (IN)	VELOCITY (FPS)	LENGTH (FT)	PIPE LOSS	K FACTOR	FIT. LOSS (FT)	CUM. LOSS (FT)	HGL (FT)	COMMENTS
Upstream from effluent weir through UV through Triplepoint and Airlift Structures to Cell 2														803.2300	Tailwater based on 100 year flood elevation - see "W:\Proj\20000\20358\20358.005\Documents\DesignCalcs\Hydraulic Calcs\Runoff to South Ditch\open channel 100 year depth calcs.fm8" and "A-Existing Stream - cross section 3" since we're planning on remove the weir plate in existing effluent channel
SWING CHECK VALVE	DIP	188.50	120	CL 50	14.0	15.300	14.640	0.36			2.20	0.0044	0.0044	803.2344	(survey shows 15" steel, used 14" DI for calcs)
EXIT LOSS	DIP	188.50	120	CL 50	14.0	15.300	14.640	0.36			1.00	0.0020	0.0064	803.2364	(survey shows 15" steel, used 14" DI for calcs)
PIPE	DIP	188.50	120	CL 50	14.0	15.300	14.640	0.36	3.90	0.0002			0.0066	803.2366	(survey shows 15" steel, used 14" DI for calcs)
PIPE	PVC_AWWA	188.50	140	C900 (DR 25)	14.0	15.300	15.300	0.33	19.60	0.0006			0.0072	803.2372	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
SHARP-EDGE ENTRANCE	PVC_AWWA	188.50	140	C900 (DR 25)	14.0	15.300	15.300	0.33			0.50	0.0008	0.0081	803.2381	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
EXIT LOSS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			1.00	0.0661	0.0741	**803.3041**	**effluent manhole dowstream of mag meter**
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06	2.80	0.0076			0.0817	803.3117	
45° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.15	0.0099	0.0916	803.3216	bend down to lower depth at mag meter
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06	4.70	0.0127			0.1044	803.3344	
45° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.15	0.0099	0.1143	803.3443	bend DS of mag meter back to horizontal
REDUCER	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.45			0.20	0.0615	0.1758	803.4058	concentric reducer immediately DS of mag meter
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.45	8.10	0.1425			0.3183	**803.5483**	straight line run downstream of mag meter. **HGL at mag meter**
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.45	9.60	0.1689			0.4873	803.7173	straight line run upstream of mag meter
REDUCER	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.45			0.20	0.0615	0.3798	803.6098	concentric reducer immediately US of mag meter
45° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.15	0.0099	0.3897	803.6197	horizontal bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06	3.80	0.0103			0.4000	803.6300	
TEE - LINE FLOW	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.30	0.0198	0.4199	803.6499	tee downstream of UV
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06	4.80	0.0130			0.4329	803.6629	
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.30	0.0198	0.4527	803.6827	vertical 90 deg bend downstream of UV
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06	6.50	0.0176			0.4703	**803.7003**	vertical pipe up through UV slab. **HGL in vertical pipe below UV**
REDUCER	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.06			0.20	0.0132	0.4835	*803.7135*	reducer loss of reducing 90 deg bend
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.4904	*803.7204*	bend loss of reducing 90 deg bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	2.10	0.0016			0.4919	*803.7219*	**horizontal pipe to UV (HGL is in vertical pipe through slab and then follows horizontal pipe... assume 1/2 full**
														808.7700	**UV weir elevation**
												0.3508	0.3508	**809.1208**	headlosses per Trojan. **HGL at upstream end of UV**
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	1.30	0.0010			0.3518	809.1218	pipe upstream of UV
GATE VALVE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.3586	809.1286	
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.3655	809.1355	90 deg vertical bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	6.30	0.0047			0.3702	809.1402	vertical pipe through UV slab
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.3770	809.1470	90 deg vertical bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	4.20	0.0031			0.3802	809.1502	
TEE - LINE FLOW	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.3870	809.1570	
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	36.70	0.0273			0.4143	809.1843	
PROJECTING ENTRANCE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.80	0.0183	0.4326	809.2026	
					8.0							0.0208	0.4534	809.2234	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			2.00	0.2470	0.7004	809.4704	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	19.90	0.0148			0.7152	809.4852	assumed pipe length between future tanks
PROJECTING ENTRANCE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.80	0.0183	0.7334	809.5034	
					8.0							0.0208	0.7542	809.5242	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			2.00	0.2470	1.0012	809.7712	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	41.60	0.0310			1.0322	809.8022	assumed pipe length between future tank and clarifier
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	1.0390	809.8090	90 deg vertical bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21		0.0000			1.0390	**809.8090**	**HGL in pipe below clarifier weir trough**
PROJECTING ENTRANCE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.80			**810.2600**	**HGL in clarifer weir trough. update accordingly**
														810.7500	**Weir elevation in Clarifier is 810.70. See Weir calcs for HGL**
EXIT LOSS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			1.00	0.0228	0.0228	810.7728	
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	1.50	0.0011			0.0239	810.7739	pipe between clarifier and Nitrox #2
PROJECTING ENTRANCE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.80	0.0183	0.0422	810.7922	
												0.0208	0.0630	810.8130	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			2.00	0.2470	0.3100	811.0600	**HGL at Nitrox Tank #2.** 8" flapper.
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	1.70	0.0013			0.3113	811.0613	pipe between Nitrox #2 and Nitrox #1
PROJECTING ENTRANCE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.80	0.0183	0.3295	811.0795	
												0.0208	0.3503	811.1003	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			2.00	0.2470	0.5973	811.3473	**HGL at Nitrox Tank #1.** 8" flapper.
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	2.30	0.0017			0.5990	811.3490	pipe between Nitrox #1 and airlift
90° BEND	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21			0.30	0.0068	0.6059	811.3559	90 deg vertical bend
PIPE	PVC_ASTM	188.50	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.21	3.30	0.0025			0.6083	811.3583	**vertical pipe inside airlift. HGL below 811.62 by 0.26'**

Rosebud MO WWTF

HYDRAULIC CALCULATIONS FOR peak hourly flow assumed by Triplepoint

DESCRIPTION: WWTF outfall through mag meter, UV, future tanks, clarifier, Triplepoint, and Airlift
FLOW (GPD): 285,188 (peak hourly flow assumed by Triplepoint)
FLOW (GPM): 198.05
FLOW (MGD): 0.29

ELEMENT	MATERIAL	FLOW (GPM)	C FACTOR	PIPE CLASS	NOM. DIA (IN)	OUT. DIA (IN)	ID (IN)	VELOCITY (FPS)	LENGTH (FT)	PIPE LOSS	K FACTOR	FIT. LOSS (FT)	CUM. LOSS (FT)	HGL (FT)	COMMENTS
Upstream from effluent weir through UV through Triplepoint and Airlift Structures to Cell 2														803.2300	Tailwater based on 100 year flood elevation - see "W:\Proj\20000\20358\20358.005\Documents\DesignCalcs\Hydraulic Calcs\Runoff to South Ditch\open channel 100 year depth calcs.fm8" and "A-Existing Stream - cross section 3" since we're planning on remove the weir plate in existing effluent channel
SWING CHECK VALVE	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38			2.20	0.0049	0.0049	803.2349	(survey shows 15" steel, used 14" DI for calcs)
EXIT LOSS	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38			1.00	0.0022	0.0071	803.2371	(survey shows 15" steel, used 14" DI for calcs)
PIPE	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38	3.90	0.0002			0.0073	803.2373	(survey shows 15" steel, used 14" DI for calcs)
PIPE	PVC_AWWA	198.05	140	C900 (DR 25)	14.0	15.300	15.300	0.35	19.60	0.0007			0.0080	803.2380	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
SHARP-EDGE ENTRANCE	PVC_AWWA	198.05	140	C900 (DR 25)	14.0	15.300	15.300	0.35			0.50	0.0009	0.0089	803.2389	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
EXIT LOSS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			1.00	0.0729	0.0818	803.3118	**effluent manhole dowstream of mag meter**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	2.80	0.0083			0.0901	803.3201	
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.1011	803.3311	bend down to lower depth at mag meter
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	4.70	0.0140			0.1151	803.3451	
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.1260	803.3560	bend DS of mag meter back to horizontal
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68			0.20	0.0679	0.1939	803.4239	concentric reducer immediately DS of mag meter
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68	8.10	0.1562			0.3501	803.5801	straight line run downstream of mag meter. **HGL at mag meter**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68	9.60	0.1851			0.5352	803.7652	straight line run upstream of mag meter
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68			0.20	0.0679	0.4180	803.6480	concentric reducer immediately US of mag meter
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.4289	803.6589	horizontal bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	3.80	0.0113			0.4402	803.6702	
TEE - LINE FLOW	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.30	0.0219	0.4621	803.6921	tee downstream of UV
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	4.80	0.0143			0.4763	803.7063	
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.30	0.0219	0.4982	803.7282	vertical 90 deg bend downstream of UV
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	6.50	0.0193			0.5175	803.7475	vertical pipe up through UV slab. **HGL in vertical pipe below UV**
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.20	0.0146	0.5321	803.7621	reducer loss of reducing 90 deg bend
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.5397	803.7697	bend loss of reducing 90 deg bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	2.10	0.0017			0.5414	803.7714	**horizontal pipe to UV (HGL is in vertical pipe through slab and then follows horizontal pipe... assume 1/2 full**
														808.7700	**UV weir elevation**
												0.3508	0.3508	809.1208	headlosses per Trojan. **HGL at upstream end of UV**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	1.30	0.0011			0.3519	809.1219	pipe upstream of UV
GATE VALVE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3595	809.1295	
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3670	809.1370	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	6.30	0.0051			0.3721	809.1421	vertical pipe through UV slab
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3797	809.1497	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	4.20	0.0034			0.3831	809.1531	
TEE - LINE FLOW	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3907	809.1607	
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	36.70	0.0299			0.4206	809.1906	
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.4408	809.2108	
					8.0							0.0208	0.4616	809.2316	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	0.7216	809.4916	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	19.90	0.0162			0.7378	809.5078	assumed pipe length between future tanks
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.7579	809.5279	
					8.0							0.0208	0.7787	809.5487	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	1.0387	809.8087	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	41.60	0.0339			1.0727	809.8427	assumed pipe length between future tank and clarifier
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	1.0802	809.8502	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27		0.0000			1.0802	809.8502	**HGL in pipe below clarifier weir trough**
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80			810.2700	**HGL in clarifer weir trough. update accordingly**
														810.7500	**Weir elevation in Clarifier is 810.70. See Weir calcs for HGL**
EXIT LOSS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			1.00	0.0252	0.0252	810.7752	
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	1.50	0.0012			0.0264	810.7764	pipe between clarifier and Nitrox #2
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.0466	810.7966	
												0.0208	0.0674	810.8174	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	0.3274	811.0774	**HGL at Nitrox Tank #2.** 8" flapper.
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	1.70	0.0014			0.3288	811.0788	pipe between Nitrox #2 and Nitrox #1
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.3489	811.0989	
												0.0208	0.3697	811.1197	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	0.6297	811.3797	**HGL at Nitrox Tank #1.** 8" flapper.
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	2.30	0.0019			0.6316	811.3816	pipe between Nitrox #1 and airlift
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.6391	811.3891	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	3.30	0.0027			0.6418	811.3918	**vertical pipe inside airlift. HGL below 811.62 by 0.23'**

Rosebud MO WWTF

HYDRAULIC CALCULATIONS FOR peak hourly flow assumed by Triplepoint plus 1 X design Q RAS back through Airlift, TP Nitrox Tanks, and Clarifier (future condition)

DESCRIPTION:	**WWTF outfall through mag meter, UV, future tanks, clarifier, Triplepoint, and Airlift**	
FLOW (GPD):	285,188	(peak hourly flow assumed by Triplepoint)
FLOW (GPM):	198.05	
FLOW (MGD):	0.29	

ELEMENT	MATERIAL	FLOW (GPM)	C FACTOR	PIPE CLASS	NOM. DIA (IN)	OUT. DIA (IN)	ID (IN)	VELOCITY (FPS)	LENGTH (FT)	PIPE LOSS	K FACTOR	FIT. LOSS (FT)	CUM. LOSS (FT)	HGL (FT)	COMMENTS
Upstream from effluent weir through UV through Triplepoint and Airlift Structures to Cell 2														803.2300	**Tailwater based on 100 year flood elevation - see "W:\Proj\20000\20358\20358.005\Documents\DesignCalcs\Hydraulic Calcs\Runoff to South Ditch\open channel 100 year depth calcs.fm8" and "A-Existing Stream - cross section 3" since we're planning on remove the weir plate in existing effluent channel**
SWING CHECK VALVE	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38			2.20	0.0049	0.0049	803.2349	(survey shows 15" steel, used 14" DI for calcs)
EXIT LOSS	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38			1.00	0.0022	0.0071	803.2371	(survey shows 15" steel, used 14" DI for calcs)
PIPE	DIP	198.05	120	CL 50	14.0	15.300	14.640	0.38	3.90	0.0002			0.0073	803.2373	(survey shows 15" steel, used 14" DI for calcs)
PIPE	PVC_AWWA	198.05	140	C900 (DR 25)	14.0	15.300	15.300	0.35	19.60	0.0007			0.0080	803.2380	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
SHARP-EDGE ENTRANCE	PVC_AWWA	198.05	140	C900 (DR 25)	14.0	15.300	15.300	0.35			0.50	0.0009	0.0089	803.2389	proposed 15" ASTM D3034 (used 14 PVC for headloss calcs here) (still need to confirm downstream "steel" pipe dimension for proper pipe selection here)
EXIT LOSS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			1.00	0.0729	0.0818	**803.3118**	**effluent manhole dowstream of mag meter**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	2.80	0.0083			0.0901	803.3201	
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.1011	803.3311	bend down to lower depth at mag meter
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	4.70	0.0140			0.1151	803.3451	
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.1260	803.3560	bend DS of mag meter back to horizontal
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68			0.20	0.0679	0.1939	803.4239	concentric reducer immediately DS of mag meter
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68	8.10	0.1562			0.3501	**803.5801**	straight line run downstream of mag meter. **HGL at mag meter**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68	9.60	0.1851			0.5352	803.7652	straight line run upstream of mag meter
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	4.0	4.500	4.160	4.68			0.20	0.0679	0.4180	803.6480	concentric reducer immediately US of mag meter
45° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.15	0.0109	0.4289	803.6589	horizontal bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	3.80	0.0113			0.4402	803.6702	
TEE - LINE FLOW	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.30	0.0219	0.4621	803.6921	tee downstream of UV
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	4.80	0.0143			0.4763	803.7063	
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.30	0.0219	0.4982	803.7282	vertical 90 deg bend downstream of UV
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17	6.50	0.0193			0.5175	**803.7475**	vertical pipe up through UV slab. **HGL in vertical pipe below UV**
REDUCER	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	6.0	6.630	6.110	2.17			0.20	0.0146	0.5321	*803.7621*	reducer loss of reducing 90 deg bend
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.5397	*803.7697*	bend loss of reducing 90 deg bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	2.10	0.0017			0.5414	*803.7714*	**horizontal pipe to UV (HGL is in vertical pipe through slab and then follows horizontal pipe... assume 1/2 full**
														808.7700	**UV weir elevation**
												0.3508	0.3508	**809.1208**	headlosses per Trojan. **HGL at upstream end of UV**
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	1.30	0.0011			0.3519	809.1219	pipe upstream of UV
GATE VALVE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3595	809.1295	
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3670	809.1370	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	6.30	0.0051			0.3721	809.1421	vertical pipe through UV slab
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3797	809.1497	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	4.20	0.0034			0.3831	809.1531	
TEE - LINE FLOW	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	0.3907	809.1607	
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	36.70	0.0299			0.4206	809.1906	
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.4408	809.2108	
					8.0							0.0208	0.4616	809.2316	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	0.7216	809.4916	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	19.90	0.0162			0.7378	809.5078	assumed pipe length between future tanks
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80	0.0202	0.7579	809.5279	
					8.0							0.0208	0.7787	809.5487	assumed headlosses for media retention sieve per Triplepoint for worst case flow
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			2.00	0.2600	1.0387	809.8087	**HGL at future tank.** Assumed 8" duckbill flapper check
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27	41.60	0.0339			1.0727	809.8427	assumed pipe length between future tank and clarifier
90° BEND	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.30	0.0076	1.0802	809.8502	90 deg vertical bend
PIPE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27		0.0000			1.0802	**809.8502**	**HGL in pipe below clarifier weir trough**
PROJECTING ENTRANCE	PVC_ASTM	198.05	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.27			0.80			**810.2700**	**HGL in clarifer weir trough. update accordingly**
														810.7500	**Weir elevation in Clarifier is 810.70. See Weir calcs for HGL**
EXIT LOSS	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			1.00	0.0349	0.0349	810.7849	
PIPE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50	1.50	0.0017			0.0366	810.7866	pipe between clarifier and Nitrox #2
PROJECTING ENTRANCE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			0.80	0.0280	0.0646	810.8146	
		233.26										0.0208	0.0854	810.8354	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			2.00	0.3027	0.3881	811.1381	**HGL at Nitrox Tank #2.** 8" flapper.
PIPE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50	1.70	0.0019			0.3899	811.1399	pipe between Nitrox #2 and Nitrox #1
PROJECTING ENTRANCE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			0.80	0.0280	0.4179	811.1679	
		233.26										0.0208	0.4387	811.1887	media retention seive
RUBBER FLAPPER CHECK: V < 6 FPS	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			2.00	0.3027	0.7414	811.4914	**HGL at Nitrox Tank #1.** 8" flapper.
PIPE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50	2.30	0.0025			0.7439	811.4939	pipe between Nitrox #1 and airlift
90° BEND	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50			0.30	0.0105	0.7544	811.5044	90 deg vertical bend
PIPE	PVC_ASTM	233.26	140	SDR 26 (160 PSI)	8.0	8.630	7.970	1.50	3.30	0.0036			0.7581	811.5081	**vertical pipe inside airlift. HGL below 811.62 by 0.11'**

Rosebud Primary Air Lift Calculations (285,200 GPD)

Enter data in green cells only

Pumping rate	285,200	gallon/day
Pipe diameter	4.03	inch
submergence	12.45	ft
lift	2.47	ft
% submergence	83%	

Input data

cross-sectional area of pipe		0.088	ft2
Pipe volume		1.10	ft3
Pipe volume/cu.ft.		7.48	gallon
Vl (Flow rate)		198.06	GPM
A (Pipe area)		0.088	ft2
L (Lift)		2.5	ft
D (Pipe diameter)		4.026	inch
Lf (density of fluid)		62.4	lb/ft3
S (submergence)		12.45	ft
Lg (Gas density)		0.0765	lb/ft3
Value of Ordinate		89,704	8.97E+04
Value of Abscissa	100<Y<10,225		10.85
	10,225<Y<73,637		10.13
	73,637<Y<117,690		10.50
	117,690<Y<123.645		1.98
	123,645<Y<128,308		0.01
	128,308<Y<99,018		14.81
Graph reading		10.50	

Don't change anything

Vg (Gas flow)	12.05	ft3/min
Pressure	5.39	psi

Answer

Calculations for an air lift assembly

Results from left	
gal/day	285,200
gal/hr	11883.33
gal/min	198.06

Calculate needed gals/day	
4166.667	gal/hr
100,000	gal/day

Calculation of maximum air lift pump capacity								
total length	10.83	feet	330.0984	cm		feet of water	7.2561	
submergence	67	%	0.67			feet of rise	3.5739	
pipe diameter	4.03	inches	10.2362	cm				
water flow	472.148	liter/min	124.742	gal/min		179,627.85	gal/day	

optimal air flow range for these parameters				
8%	437.17	liter/min	15.43	cfm
9%	433.16	liter/min	15.29	cfm
pressure	3.14	PSI		

Rosebud Secondary Air Lift Calculations (285,200 GPD)

Enter data in green cells only

Pumping rate	285,200	gallon/day
Pipe diameter	4.03	inch
submergence	14.25	ft
lift	1.67	ft
% submergence	90%	

Input data

cross-sectional area of pipe	0.088	ft2
Pipe volume	1.26	ft3
Pipe volume/cu.ft.	7.48	gallon
Vl (Flow rate)	198.06	GPM
A (Pipe area)	0.088	ft2
L (Lift)	1.7	ft
D (Pipe diameter)	4.026	inch
Lf (density of fluid)	62.4	lb/ft3
S (submergence)	14.25	ft
Lg (Gas density)	0.0765	lb/ft3
Value of Ordinate	65,727	6.57E+04
Value of Abscissa	100<Y<10,225	7.75
	10,225<Y<73,637	7.30
	73,637<Y<117,690	7.23
	117,690<Y<123.645	0.15
	123,645<Y<128,308	0.00
	128,308<Y<99,018	9.09
Graph reading	7.30	

Don't change anything

Vg (Gas flow)	6.89	ft3/min
Pressure	6.17	psi

Answer

Calculations for an air lift assembly

Results from left	
gal/day	285,200
gal/hr	11883.33
gal/min	198.06

Calculate needed gals/day	
4166.667	gal/hr
100,000	gal/day

Calculation of maximum air lift pump capacity						
total length	10.83	feet	330.0984	cm	feet of water	7.2561
submergence	67	%	0.67		feet of rise	3.5739
pipe diameter	4.03	inches	10.2362	cm		
water flow	472.148	liter/min	124.742	gal/min	179,627.85	gal/day

optimal air flow range for these parameters				
8%	437.17	liter/min	15.43	cfm
9%	433.16	liter/min	15.29	cfm
pressure	3.14	PSI		

Ares Aeration® & NitrOx® Basis of Design

Date: 07-20-22
Project Name: Rosebud, MO
Project Number: 6245

The Aeration Process

Biological Oxygen (BOD) Calculations

Removal of BOD (and CBOD) takes place naturally in an aerated lagoon. The Characteristic Equation for treatment efficiency of 5-Day Biological Oxygen Demand is given in Equations 1 through 3, at the bottom of this report. These calculations are used to size the lagoons. They are independent of the aeration calculations and assume that sufficient dissolved oxygen levels are maintained in the water. The equation is dependent on time and temperature. For lagoons operated in series, the equation is applied separately to each cell and the results are combined.

Aeration Requirement Calculations

Aeration calculations are more complicated than biological calculations as they depend on several factors. These include:

- Site conditions, such as treatment depth, elevation, and temperature.
- Design parameters, such as minimum dissolved oxygen (DO) level and oxygen supply rate.
- Actual Oxygen Requirement (AOR), which is based on the nutrient loading rates (these can include BOD/CBOD and TKN/NH_3-N and are based on the product of nutrient concentrations and the wastewater flowrate).
- Type of aerator.
- Oxygen transfer efficiency (OTE) of the aerator, which should be measured by an independent lab.
- Field condition adjustments (see Equation 2, below).
- Mixing requirements, such as complete or partial mix. The former is generally only required for activated sludge basins (ASB) or other high strength processes with short detention times.

Aerated Lagoons—Long Treatment Times

Aerated lagoons are typified by their comparatively large size and long treatment times (usually greater than 10 days). Influent concentrations are low to moderate (usually less than 300 mg/L of BOD). The bulk of the treatment takes place aerobically with additional anaerobic respiration taking place on the lagoon floor. Aerated lagoons do not generally have a mixed liquor suspended solids (MLSS) or return activated sludge (RAS) component. Partial mixing is required to prevent stratification and eliminate dead zones; however, complete mix is not necessary.

Aerated lagoons are typically designed to operate at a minimum DO level of 2 mg/L. Oxygen is usually supplied at a rate of 1.5 times the BOD demand. If nitrification/denitrification takes place, the oxygen supply rate is designed for 4.6 times the nitrogenous oxygen demand (NBOD).

Activated Sludge Basins (ASB)

6586 S. Kenton Street
Centennial, CO 80111
312.428.4634 | lagoons.com

Activated sludge basins (ASB) and other related wastewater tanks and lagoons are characterized by short treatment times (usually from 1 to 5 days), high wastewater strengths, and an active biomass that must be maintained in suspension to prevent rapid sludge accumulation. A high strength (greater than 2,000 mg/L) return activated sludge (RAS) component is usually fed back into the basin from a downstream clarifier. Biological nutrient removal is much faster in these basins.

ASBs are typically designed to operate at a minimum DO level of 1 to 2 mg/L. Oxygen is supplied at a rate of 1.0 to 1.5 times the BOD demand. If nitrification/denitrification takes place, the oxygen supply rate is designed for 4.0 to 4.6 times the nitrogenous oxygen demand (NBOD). An aeration system is based on both oxygenation requirements and complete mix requirements, whichever is greater.

TRIPLEPOINT ENVIRONMENTAL
Detailed Design Calculations: Aerated Lagoons

SUMMARY - General Design Parameters				
v4.1	*B*	**Design Scenario Name**		**ADW**
	1	Influent Flowrate	MGD	0.051
	2	Influent Concentration	mg/L	165.0
	3	Effluent Conc. (Summer)	mg/L	4.2
	4	Effluent Conc. (Winter)	mg/L	12.1
	5	Actual Oxygen Supplied	lb/day	105.6
	6	Air included for nitrification?		No
	7	Number of Aerators		12
	8	Estimated Tubing Length	ft	1700
	9	Standard Airflow	SCFM	171.85
	10	Inlet Airflow	ICFM	201.00
	11	Design Presure (w/cushion)	psig	3.01
	12	Projected Brake Hp	bhp	2.25
	13	Estimated Design Hp	hp	5.0

1. $FTE = \alpha (SOTE) \theta^{(T-20)} (\beta C^*_{\infty T} - DO) \div C^*_{\infty 20}$ *field transfer efficiency*

   Where,

α	contaminant factor {contaminants, depth, bubble size} (range: 0.40–0.70)
β	TDS factor {total dissolved solids} (range: 0.90–1.00)
$\theta = 1.024$	temperature factor
DO	target dissolved oxygen level (mg/L)
$C^*_{\infty T}$	saturation oxygen concentration at site—adjusted for water depth
$C^*_{\infty 20}$	sat. oxygen concentration at STP conditions—adjusted for water depth
T	water temperature (Celsius)

2. $Airflow = AOR / (25.056 * FTE)$
3. $E = 2.3 * k * t / (1 + 2.3 * k * t)$ *biological treatment efficiency*

   Where,

k = varies	kinetic coefficient {related to temperature} (range: 0.06 to 0.12)
t = time	treatment time in days

SUMMARY - Biological Treatment Calculations				
	Item	**Description**	**Units**	**ADW**
	1	Number of Treatment Cells		3
	2	Flow Regime		Series
	3	Site Elevation - HWL	ft	809
Cell 1				
	4	Wastewater Flowrate	MGD	0.1
	5	Treatment Volume	M-Gal	1.7
	6	Treatment Time	days	34.2
	7	Treatment Type	-	Partial Mix
	8	Std Reaction Rate, k_{20}	$days^{-1}$	0.28
Summer	9	Design Water Temp	°C	20
	10	Design Reaction Rate, k_T	$days^{-1}$	0.122
	11	Biological Treatment Eff.	%	90.5%
	12	Influent BOD Loading	lb/day	70
	13	Influent BOD Concentration	mg/L	165.0
	14	BOD Removed	lb/day	63
	15	Effluent BOD Loading	lb/day	7
	16	Effluent BOD Concentration	mg/L	15.6
Winter	17	Design Water Temp	°C	0.5
	18	Biological Treatment Eff.	%	82.8%
	19	BOD Removed	lb/day	58.0
	20	Effluent BOD Concentration	mg/L	28.5
	N1	Influent NBOD Loading	lb/day	19
	N2	Influent NBOD Conc.	mg/L	43.9
	N3	Assumed NBOD Removed	lb/day	-
	N4	Effluent NBOD Loading*	lb/day	19
	N5	Assumed Eff. NBOD Conc.	mg/L	44
Cell 2				
	21	Wastewater Flowrate	MGD	0.1
	22	Treatment Volume	M-Gal	0.5
	23	Treatment Time	days	9.7
	24	Treatment Type	-	Partial Mix
	25	Std Reaction Rate, k_{20}	$days^{-1}$	0.28
Summer	26	Design Water Temp	°C	20
	27	Design Reaction Rate, k_T	$days^{-1}$	0.122
	28	Biological Treatment Eff.	%	73.0%
	29	Influent BOD Loading	lb/day	7
	30	Influent BOD Concentration	mg/L	15.6
	31	BOD Removed	lb/day	5
	32	Effluent BOD Loading	lb/day	2
	33	Effluent BOD Concentration	mg/L	4.2
Winter	34	Design Water Temp	°C	0.5
	35	Biological Treatment Eff.	%	57.6%
	36	BOD Removed	lb/day	7.0
	37	Effluent BOD Concentration	mg/L	12.1
	N6	Influent NBOD Loading	lb/day	19
	N7	Influent NBOD Conc.	mg/L	43.9
	N8	Assumed NBOD Removed	lb/day	-
	N9	Effluent NBOD Loading*	lb/day	19
	N10	Assumed Eff. NBOD Conc.	mg/L	44

SUMMARY - Aeration Calculations				
	Item	**Description**	**Units**	**ADW**
	1	Site Elevation	ft	809
	2	O_2 Loading Factor (BOD_5)	O2/BOD	1.5
	3	Alpha-value, α		0.60
	4	Beta-value, β		0.95
	5	Theta-value, θ		1.02
Cell 1				
	6	Lagoon Side Water Depth	ft	3.00
	7	Air Release Depth	ft	2.25
	8	AOR - Total	lb/day	95
	9	SOTE/ft	%/ft	2.67%
	10	SOTE	%	6.01%
	11	Design DO Concentration	mg/L	2.0
	12	FTE		2.43%
	13	Air requirement	scfm	156
	14	Airflow per aeration unit	scfm	15.6
	15	Aerator Type		750T
	16	Number of aeration units	units	10
	17	Water Pressure	psig	0.97
	18	Aerator Pressure Loss	psig	0.50
	19	Header/Feeder P Loss	psig	0.54
	20	Total Operating Pressure	psig	2.01
	21	Design Motor Pressure	psig	3.01
Cell 2				
	22	Lagoon Side Water Depth	ft	3.00
	23	Air Release Depth	ft	2.25
	24	AOR - Total	lb/day	10
	25	SOTE/ft	%/ft	2.92%
	26	SOTE	%	6.57%
	27	Design DO Concentration	mg/L	2.0
	28	FTE		2.66%
	29	Air requirement	scfm	16
	30	Airflow per aeration unit	scfm	7.8
	31	Aerator Type		750T
	32	Number of aeration units	units	2
	33	Water Pressure	psig	0.97
	34	Aerator Pressure Loss	psig	0.48
	35	Header/Feeder P Loss	psig	0.43
	36	Total Operating Pressure	psig	1.88
	37	Design Motor Pressure	psig	2.88

The NitrOx® Process

The patented NitrOx Process was developed based on the principle that nitrification will reliably occur when the proper conditions are created. For wastewater lagoon systems that receive primarily domestic waste, the critical conditions required for nitrification include:

- CBOD of 20–30 mg/L
- Dissolved Oxygen of 4.6 lb/O_2 per pound of NH_3-N (Metcalf & Eddy)
- Sufficient population of Nitrifying bacteria
- Given sufficient Nitrifying bacteria, a water temperature of 4–5° C

The NitrOx Process utilizes the existing lagoon infrastructure for 90% BOD removal, after which nitrifying bacteria begin to nitrify. The effluent from the lagoons then flows hydraulically or is pumped into a two-stage nitrification reactor. In colder climates where the winter water temperature drops below 4° C, a thermal regulation heat exchanger is added in order to increase the water temperature; typically, only a few degrees during the coldest months of the year. In the two NitrOx Reactor cells, there are millions of individual biofilm carriers that provide a habitat for nitrifying bacteria, ensuring that there are sufficient nitrifying bacteria even in the coldest water conditions. Each NitrOx Reactor cell has aeration to provide the necessary oxygen, as well as to create a complete mix environment to keep the biofilm carriers in constant motion. The two cells are covered with floating insulated covers to mitigate heat loss and the media is kept in the tanks with stainless steel sieves. Finally, the effluent from the second NitrOx Reactor is discharged into a final polishing/clarification lagoon prior to the ultimate discharge from the lagoon system.

NitrOx® LAGOON AMMONIA REMOVAL

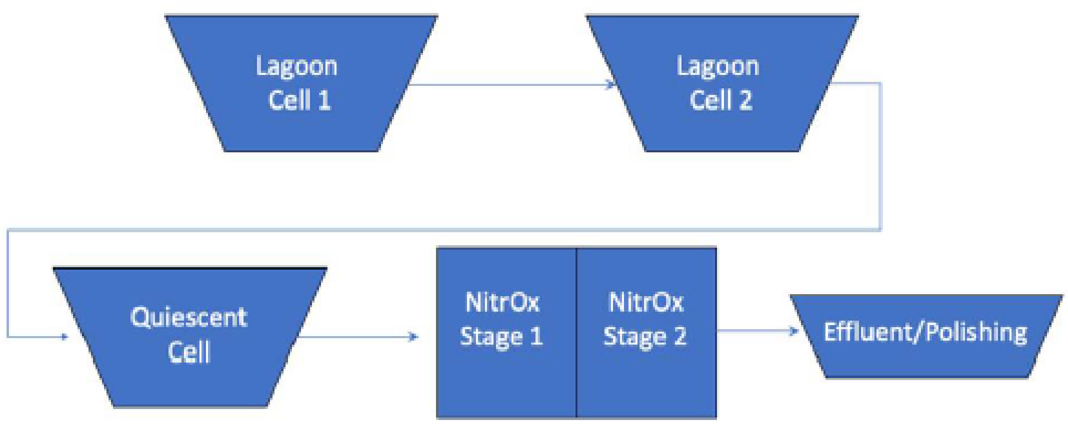


Figure 1: Typical flow process of the NitrOx Lagoon Ammonia Removal Process.
*Note that other configurations are possible.

TRIPLEPOINT ENVIRONMENTAL
Detailed Design Calculations: NitrOx

SUMMARY - Design Input Values			
	Plant Influent Characteristics	**Units**	**Values**
1	Annual Average Daily Flow	gpd	50,700
2	Maximum Monthly Average Daily Flow	gpd	63,375
3	Peak Daily Flow	gpd	253,500
4	Peak Hourly Flow	gpd	507,000
5	Influent BOD	mg/L	165
6	Influent BOD	lbs/day	87.2
7	Influent TSS	mg/L	100
8	Influent TSS	lbs/day	52.9
9	Influent NH3-N	mg/L	16.0
10	Influent NH3-N	lbs/day	8.5
11	Influent TKN	mg/L	33.0
12	Influent TKN	lbs/day	17.4
13	Influent pH		7
14	Water Temperature	deg-C	12
	NitrOx Influent Characteristics	**Units**	**Values**
15	Annual Average Daily Flow	gpd	50,700
16	Maximum Monthly Average Daily Flow	gpd	63,375
17	Peak Daily Flow	gpd	158,438
18	Peak Hourly Flow	gpd	285,188
19	Influent BOD	mg/L	30
20	Influent TSS	mg/L	45
21	Influent NH3-N	mg/L	27.6
22	Influent TKN	mg/L	27.6
23	Design Influent TKN	mg/L	27.6
A4	Alkalinity Required as CaCO3 (Minumum)	mg/L	242
24	Influent pH		7
25	NitrOx Water Temperature	deg-C	5
SUMMARY - General Design Parameters			
	NitrOx Tank Sizing Summary	**Units**	**Values**
26	Number of Treatment Trains Proposed		1
27	Number of Tanks Per Train		2
28	Total Number of Tanks		2
29	Length of Each	ft	8.0
30	Width of Each	ft	8.0
31	Side Water Depth of Each	ft	15
32	Tank Height of Each	ft	18
33	Volume of Each	gallons	7,181
34	Volume Total	gallons	14,362
35	Hydraulic Retention Time at Max Month Flow	hours	5.4
36	Hydraulic Retention Time at Peak Hourly Flow	hours	1.2
40	Number of Ares Units per Tank		1
41	Total Number of Ares Units		2

	NitrOx Air Requirement (Per Treatment Train)	Stage 1	Stage 2
42	AOR (lbs/day)	49	39
43	Assumed Diffuser Subm. at AWL (ft.)	14.25	14.25
44	Elevation (ft.)	809	809
45	Alpha	0.60	0.60
46	Beta	0.9	0.9
47	Target DO Residual (MBBR Process) (mg/L)	5.0	6.0
48	SOR (lbs/day)	193	193
49	Target Diffuser Efficiency/ft. Submergence	2.0	2.0
50	**Airflow (scfm)**	**26**	**26**
	NitrOx Blower Requirement Summary	**Units**	**Values**
51	No. of Blowers		2
52	Airflow Requirement per Blower	scfm	76
53	Airflow per 1,000 scfm	scfm/1,000 cf	28
54	Water Pressure at Air Release Depth	psig	6.17
55	Piping and Diffuser Losses	psig	0.50
56	Cushion	psig	1.00
57	**Maximum Design Discharge Pressure**	**psig**	**7.67**
58	Assumed Overall Efficiency		0.62
59	Approximate BHP Requirement/Blower	bhp	3.9
60	Approximate BHP Requirement Total	bhp	3.9
61	Estimated Nameplate HP / Blower	hp	5
62	Blower Type		Tri-Lobe PD
SUMMARY - Calculated Output Values			
	NitrOx Effluent Parameters	**Units**	**Values**
63	Effluent SCBOD	mg/L	7.5
64	Effluent SCBOD	lbs/day	4.0
65	Effluent NH3-N in Winter (Monthly Average)	mg/L	2.1
66	Effluent NH3-N in Winter (Monthly Average)	lbs/day	1.1
67	Effluent NH3-N in Summer (Monthly Average)	mg/L	1.1
68	Effluent NH3-N in Summer (Monthly Average)	lbs/day	0.6

4. $FTE = \alpha\ (SOTE)\ \theta^{(T-20)}\ (\beta\ C^*_{\infty T} - DO) \div C^*_{\infty 20}$ *field transfer efficiency*

Where,

α	contaminant factor {contaminants, depth, bubble size} (range: 0.40–0.70)
β	TDS factor {total dissolved solids} (range: 0.90–1.00)
$\theta = 1.024$	temperature factor
DO	target dissolved oxygen level (mg/L)
$C^*_{\infty T}$	saturation oxygen concentration at site—adjusted for water depth
$C^*_{\infty 20}$	sat. oxygen concentration at STP conditions—adjusted for water depth
T	water temperature (Celsius)

Rosebud WWTF Clarifier Design Summary			
Design Parameter	**Value**	**Reference**	**Clarifier 1 Actual**
Sidewater Depth (ft)	10	WWGSD 7.1.1	14.95
Surface Overflow Rate (GPD/ft^2) - Design Flow	1,000	WWGSD 7.1.2	422.5
Surface Overflow Rate (GPD/ft^2) - Peak Flow	3,000	WWGSD 7.1.2	2,800.00
Solids Loading Rate (lb/day/ft^2) - Peak Flow with 1Q Return	35	WWGSD 7.1.2	1.05
Weir Loading Rate (GPD/LF)	20,000	WWGSD 7.1.4	16,794

WEIR TROUGH DESIGN

Project No. 20358.005
Project: Rosebud Wastewater System Improvements
Subject: Weir Trough Design
Location: Rosebud, MO

Weir Trough Orifice Discharge Calculations

Orifice calcs:

Equations Used:

$$Q_o = C_o A_o \sqrt{2g(H - E_o)}$$

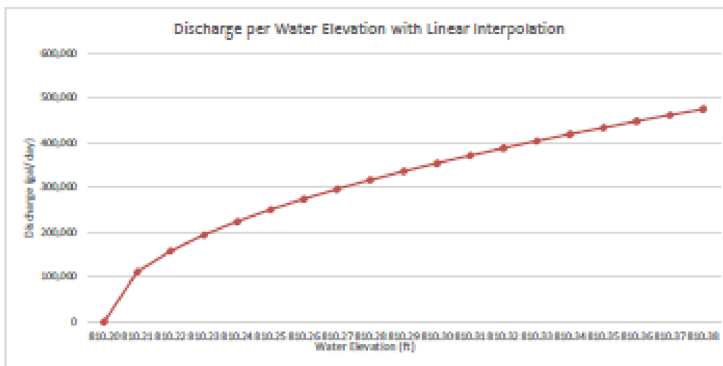
Q_o = orifice outflow
C_o = orifice discharge coefficient
g = acceleration due to gravity 32.2 ft/s^2
A_o = net opening area = πd²/4
H = water Elevation
E_o = elevation of orifice

C_o = 0.62

Weir Saw Tooth Elevation: 810.7 peak flow plus IQ: 335,900
dimension to bottom of trough (in): 6

#1:
FL orifice = 810.20 ft (assuming hole in bottom of weir trough)
Number of orifices = 1
Diameter of Orifice = 8 in

Water Elevation (ft)	H (ft)	Q (cfs)	Q (gpd)	H (in)	
810.20	0.00	0.00	0	0.00	
810.21	0.01	0.17	112,242	0.12	
810.22	0.02	0.25	158,735	0.24	
810.23	0.03	0.30	194,410	0.36	
810.24	0.04	0.35	224,485	0.48	
810.25	0.05	0.39	250,982	0.60	
810.26	0.06	0.43	274,937	0.72	
810.27	0.07	0.46	296,966	0.84	
810.28	0.08	0.49	317,470	0.96	
810.29	0.09	0.52	336,727	1.08	
810.30	0.10	0.55	354,942	1.20	
810.31	0.11	0.58	372,266	1.32	
810.32	0.12	0.60	388,819	1.44	
810.33	0.13	0.63	404,696	1.56	
810.34	0.14	0.65	419,973	1.68	
810.35	0.15	0.67	434,713	1.80	
810.36	0.16	0.69	448,970	1.92	
810.37	0.17	0.72	462,788	2.04	
810.38	0.18	0.74	476,205	2.16	
810.39	0.19	0.76	489,254	2.28	
810.40	0.20	0.78	501,964	2.40	
810.41	0.21	0.80	514,360	2.52	
810.42	0.22	0.81	526,464	2.64	
810.43	0.23	0.83	538,296	2.76	
810.44	0.24	0.85	549,874	2.88	
810.45	0.25	0.87	561,212	3.00	
810.46	0.26	0.89	572,327	3.12	
810.47	0.27	0.90	583,229	3.24	
810.48	0.28	0.92	593,931	3.36	
810.49	0.29	0.94	604,444	3.48	340,000 gpd for 6" so ponded to 810.32 in weir trough if 6" pipe is used (i.e. 8" is required)
810.50	0.30	0.95	614,777	3.60	
810.51	0.31	0.97	624,940	3.72	
810.52	0.32	0.98	634,939	3.84	
810.53	0.33	1.00	644,784	3.96	
810.54	0.34	1.01	654,481	4.08	
810.55	0.35	1.03	664,036	4.20	
810.56	0.36	1.04	673,455	4.32	
810.57	0.37	1.06	682,744	4.44	
810.58	0.38	1.07	691,909	4.56	
810.59	0.39	1.08	700,954	4.68	
810.60	0.40	1.10	709,884	4.80	
810.61	0.41	1.11	718,703	4.92	
810.62	0.42	1.13	727,415	5.04	
810.63	0.43	1.14	736,023	5.16	
810.64	0.44	1.15	744,533	5.28	
810.65	0.45	1.17	752,946	5.40	
810.66	0.46	1.18	761,266	5.52	
810.67	0.47	1.19	769,496	5.64	
810.68	0.48	1.20	777,639	5.76	
810.69	0.49	1.22	785,697	5.88	
810.70	0.50	1.23	793,674	6.00	(2" below weir elevation)
810.71	0.51	1.24	801,572	6.12	
810.72	0.52	1.25	809,392	6.24	
810.73	0.53	1.26	817,138	6.36	
810.74	0.54	1.28	824,811	6.48	
810.75	0.55	1.29	832,413	6.60	
810.76	0.56	1.30	839,946	6.72	
810.77	0.57	1.31	847,412	6.84	
810.78	0.58	1.32	854,813	6.96	
810.79	0.59	1.33	862,151	7.08	
810.80	0.60	1.35	869,427	7.20	
810.81	0.61	1.36	876,642	7.32	
810.82	0.62	1.37	883,798	7.44	
810.83	0.63	1.38	890,897	7.56	
810.84	0.64	1.39	897,940	7.68	
810.85	0.65	1.40	904,928	7.80	
810.86	0.66	1.41	911,862	7.92	
810.87	0.67	1.42	918,744	8.04	



WEIR TROUGH DESIGN

Bartlett & West

Project No. 20358.005
Project: Rosebud Wastewater System Improvements
Subject: Weir Trough Design
Location: Rosebud, MO

Clarifier Weir using the Kindsvater-Shen equation

CLARIFIER WEIR:

Inputs:

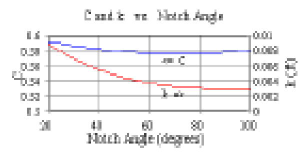
Q_{min} (MGD):	0
Q_{max} (MGD):	0.3359
θ (degrees):	90
spacing between v notch weirs (in):	6
length of weir (ft):	20

Outputs:

C:	0.5779049
k (ft):	0.0029025
Number of v notch weirs:	251

$$Q = 4.28\, C \tan\left(\frac{\theta}{2}\right)(h+k)^{5/2}$$

where Q = Discharge (cfs)
C = Discharge Coefficient
θ = Notch Angle
h = Head (ft)
k=Head Correction Factor (ft)



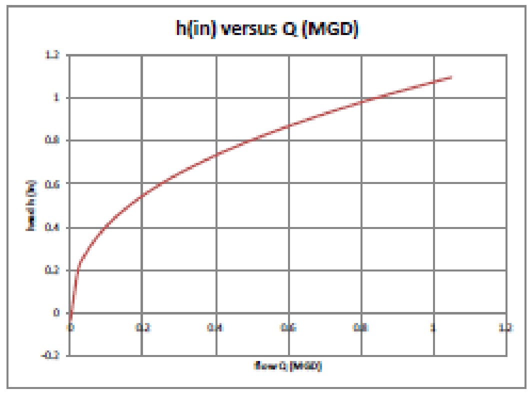
$C = 0.607165052 - 0.000874466963\,Ø + 6.10393334x10^{-6}\,Ø^2$

$k\ (ft.) = 0.0144902648 - 0.00033955535\,Ø + 3.29819003x10^{-6}\,Ø^2 - 1.06215442x10^{-8}\,Ø^3$

where Ø is the notch angle in degrees

Q vs h table:

Q (MGD)	Q (gpm)	h (ft)	h(in)	
0.000	0.00	-0.0029	-0.03	
0.007	4.67	0.0094	0.11	
0.013	9.33	0.0133	0.16	
0.020	14.00	0.0162	0.19	
0.027	18.66	0.0185	0.22	
0.034	23.33	0.0205	0.25	
0.040	27.99	0.0223	0.27	
0.047	32.66	0.0239	0.29	
0.054	37.32	0.0253	0.30	(design flow)
0.060	41.99	0.0267	0.32	
0.067	46.65	0.0280	0.34	
0.074	51.32	0.0292	0.35	
0.081	55.98	0.0303	0.36	
0.087	60.65	0.0314	0.38	
0.094	65.31	0.0324	0.39	
0.101	69.98	0.0334	0.40	
0.107	74.64	0.0344	0.41	
0.114	79.31	0.0353	0.42	
0.121	83.98	0.0361	0.43	
0.128	88.64	0.0370	0.44	
0.134	93.31	0.0378	0.45	
0.141	97.97	0.0386	0.46	
0.148	102.64	0.0394	0.47	
0.155	107.30	0.0402	0.48	
0.161	111.97	0.0409	0.49	
0.168	116.63	0.0416	0.50	
0.175	121.30	0.0423	0.51	
0.181	125.96	0.0430	0.52	
0.188	130.63	0.0437	0.52	
0.195	135.29	0.0444	0.53	
0.202	139.96	0.0450	0.54	
0.208	144.62	0.0456	0.55	
0.215	149.29	0.0463	0.56	
0.222	153.95	0.0469	0.56	
0.228	158.62	0.0475	0.57	
0.235	163.28	0.0480	0.58	
0.242	167.95	0.0486	0.58	
0.249	172.62	0.0492	0.59	
0.255	177.28	0.0498	0.60	
0.262	181.95	0.0503	0.60	
0.269	186.61	0.0508	0.61	
0.275	191.28	0.0514	0.62	
0.282	195.94	0.0519	0.62	
0.289	200.61	0.0524	0.63	
0.296	205.27	0.0529	0.64	
0.302	209.94	0.0534	0.64	
0.309	214.60	0.0539	0.65	
0.316	219.27	0.0544	0.65	
0.322	223.93	0.0549	0.66	
0.329	228.60	0.0554	0.66	
0.336	233.26	0.0559	0.67	(peak flow with future condition 1Q return)
0.343	237.93	0.0563	0.68	
0.349	242.59	0.0568	0.68	
0.356	247.26	0.0572	0.69	
0.363	251.93	0.0577	0.69	
0.369	256.59	0.0581	0.70	
0.376	261.26	0.0586	0.70	
0.383	265.92	0.0590	0.71	
0.390	270.59	0.0595	0.71	
0.396	275.25	0.0599	0.72	
0.403	279.92	0.0603	0.72	
0.410	284.58	0.0607	0.73	
0.417	289.25	0.0611	0.73	
0.423	293.91	0.0616	0.74	
0.430	298.58	0.0620	0.74	
0.437	303.24	0.0624	0.75	
0.443	307.91	0.0628	0.75	
0.450	312.57	0.0632	0.76	
0.457	317.24	0.0636	0.76	
0.464	321.90	0.0639	0.77	
0.470	326.57	0.0643	0.77	
0.477	331.23	0.0647	0.78	
0.484	335.90	0.0651	0.78	
0.490	340.57	0.0655	0.79	
0.497	345.23	0.0658	0.79	



WEIR TROUGH DESIGN

Manning's Equation (for open channels)

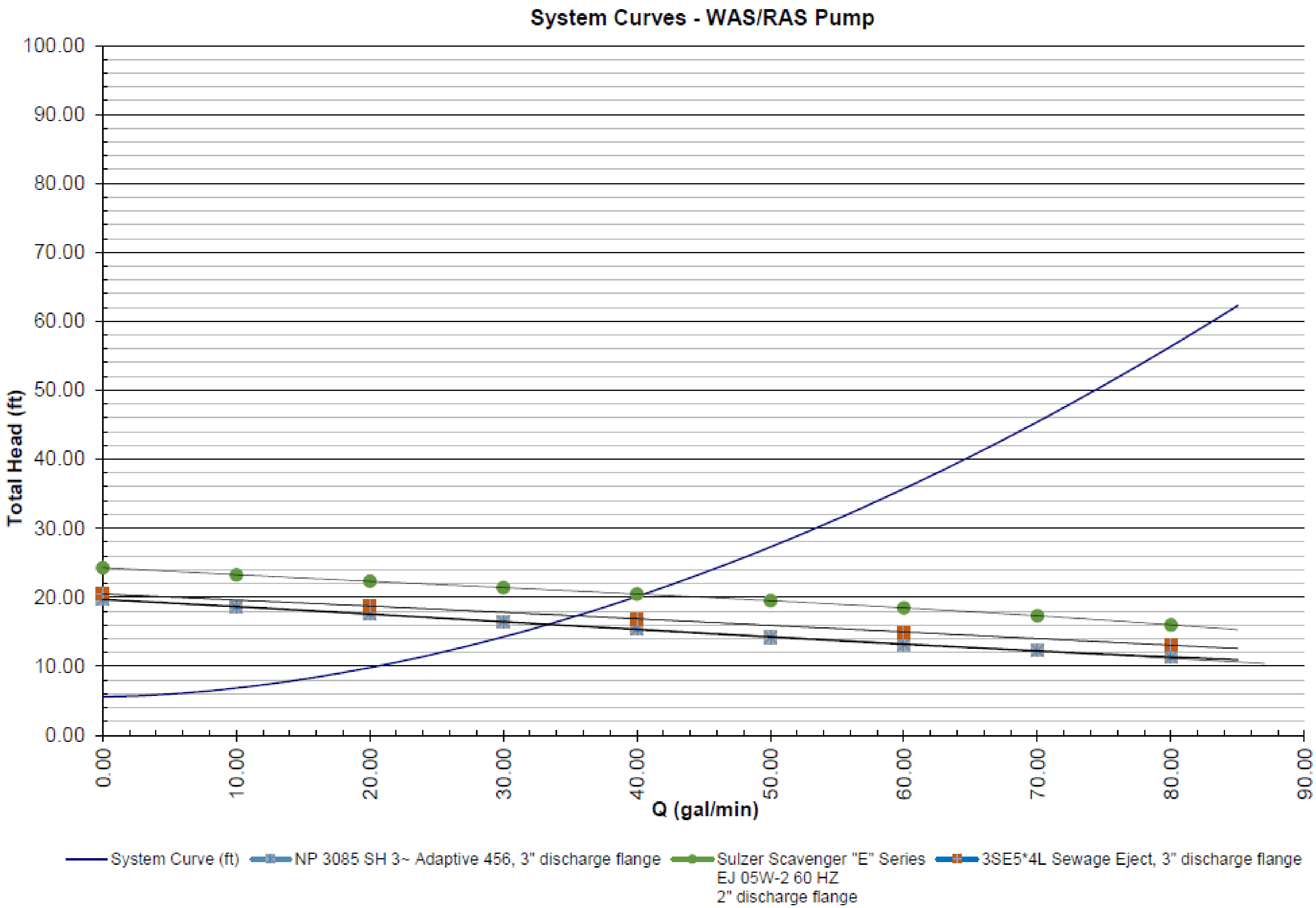
Location: Circle Drive Upstream to ES-1

input:

Channel Length (ft):	5	Smooth Earth
Channel Slope (ft/ft):	0.0010	Firm Gravel
Bottom Width (ft):	1	Natural Channels, Good Condition
Left Side Slope (X:1):	vertical walls	Rip Rap
Right Side Slope (X:1):	vertical walls	Natural Channels With Stones and Weeds
Depth (ft):	0.23	Concrete
Ditch Conditions:	Steel	Very Poor Natural Channels
		Steel

output:

Storm Drain Length (ft):	5.00	
A (ft^2):	0.23	
P (ft):	1.46	
R (ft):	0.157534247	
n:	0.012	
Q (ft^3/s):	0.26	
Q (gpm):	118.22	
Q (GPD):	170,241	half of peak future flow condition (each half of 10' length of weir) is 335,900/2 = 167,950 GPD
Depth (in):	2.76	
V (ft/s):	1.15	
time in ditch (min):	0.07	


System Curves - WAS/RAS Pump
Total Head (ft)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
Q (gal/min)
System Curve (ft)
NP 3085 SH 3~ Adaptive 456, 3" discharge flange
Sulzer Scavenger "E" Series EJ 05W-2 60 HZ 2" discharge flange
3SE5*4L Sewage Eject, 3" discharge flange

PERFORMANCE GUARANTEE

Trojan Technologies certifies to Rosebud, MO that the TROJANUV3000PTP™ Disinfection Equipment supplied will disinfect to the limits of ≤ 200 Fecal Coliform/100mL based upon a 30 day Geometric Mean, provided the following criteria is upheld.

Peak Flow: 0.285 MGD

Suspended Solids: ≤ 30 mg/L Based on a 30 Day Average

UV Transmittance @ 253.7 nm: 60% Minimum

Trojan Lamp Hours: ≤ 12,000

This performance guarantee is also contingent upon proper care and maintenance of the unit, as detailed within the Operation and Maintenance Manual, and the use of Trojan approved parts. The performance guarantee is specific to the plant treatment process and water quality reviewed at the time of bid and conditioned on the absence of water and operating conditions which may adversely affect the equipment provided, including water conditions falling outside of the parameters listed above.

This performance guarantee is also contingent upon proper care and maintenance of the unit, as detailed within the Operation and Maintenance Manual, and the use of Trojan approved parts. The performance guarantee is specific to the plant treatment process and water quality reviewed at the time of bid.

FOR DEPARTMENT USE ONLY	
APP NO.	CP NO.
FEE RECEIVED	CHECK NO.
DATE RECEIVED	

MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM

APPLICATION FOR CONSTRUCTION PERMIT – WASTEWATER TREATMENT FACILITY

APPLICATION OVERVIEW

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

PART A – BASIC INFORMATION

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

1.1 Is this a Federal/State funded project? ☑ YES ☐ N/A Funding Agency: SRF Project #: C295083-01

1.2 Has the Missouri Department of Natural Resources approved the proposed project's antidegradation review?
☑ YES Date of Approval: 04/2022 ☐ N/A

1.3 Has the department approved the proposed project's facility plan*****?
☑ YES Date of Approval: 08/2021 ☐ NO (If No, complete No. 1.4.)

1.4 [Complete only if answered No on No. 1.3.] Is a copy of the facility plan***** for wastewater treatment facilities included with this application?
☐ YES ☐ NO ☐ Exempt because ______

1.5 Is a copy of the appropriate plans***** and specifications***** included with this application?
☑ YES Denote which form is submitted: ☐ Hard copy ☑ Electronic copy (See instructions.) ☐ NO

1.6 Is a summary of design***** included with this application? ☑ YES ☐ NO

1.7 Has the appropriate operating permit application (A, B, or B2) been submitted to the department?
☑ YES Date of submittal: 11/29/2022
☐ Enclosed is the appropriate operating permit application and fee submittal. Denote which form: ☐ A ☑ B ☐ B2
☐ N/A: However, In the event the department believes that my operating permit requires revision to permit limitation such as changing equivalent to secondary limits to secondary limits or adding total residual chlorine limits, please share a draft copy prior to public notice? ☐ YES ☐ NO

1.8 Is the facility currently under enforcement with the department or the Environmental Protection Agency? ☐ YES ☑ NO

1.9 Is the appropriate fee or JetPay confirmation included with this application? ☐ YES ☑ NO
See Section 7.0

***** Must be affixed with a Missouri registered professional engineer's seal, signature and date.

2.0 PROJECT INFORMATION

2.1 NAME OF PROJECT	2.2 ESTIMATED PROJECT CONSTRUCTION COST
Wastewater System Improvements - City of Rosebud	$ 2,994,974

2.3 PROJECT DESCRIPTION

Addition of manually cleaned bar screen, sludge removal from lagoon cells 1 & 2, lagoon cell 3 closure, lagoon aeration, influent air lift pumping, Triplepoint NitrOx MBBR ammonia removal system, polishing clarifier, Ultraviolet disinfection, and misc. site work

2.4 SLUDGE HANDLING, USE AND DISPOSAL DESCRIPTION

Sludge will be removed from existing lagoon cells 1, 2, and 3 and disposed of following regulations. See plans and specifications for additional information.

2.5 DESIGN INFORMATION

A. Current population: 390 ; Design population: 507

B. Actual Flow: 17.5K gpd; Design Average Flow: 50.7K gpd;
Actual Peak Daily Flow: 63.4K gpd; Design Maximum Daily Flow: 254K gpd; Design Wet Weather Event: 507K

2.6 ADDITIONAL INFORMATION

A. Is a topographic map attached? ☐ YES ☑ NO See accepted facility plan.

B. Is a process flow diagram attached? ☑ YES ☐ NO See attached plans.

3.0 WASTEWATER TREATMENT FACILITY				
NAME Rosebud South Lagoon WWTF		TELEPHONE NUMBER WITH AREA CODE 573-505-1818	E-MAIL ADDRESS cityofrosebud@gmail.com	
ADDRESS (PHYSICAL) South Terminus of South Park Street	CITY Rosebud	STATE MO	ZIP CODE 63091	COUNTY Gasconade

Wastewater Treatment Facility: Mo- 0091375 (Outfall 1 Of 1)

3.1 Legal Description: _____ ¼, _____ ¼, _____ ¼, Sec. 18, T 42N, R 04W
(Use additional pages if construction of more than one outfall is proposed.)

3.2 UTM Coordinates Easting (X): 639146 Northing (Y): 4249123
For Universal Transverse Mercator (UTM), Zone 15 North referenced to North American Datum 1983 (NAD83)

3.3 Name of receiving streams: Tributary to Soap Creek

4.0 PROJECT OWNER			
NAME City of Rosebud, Missouri		TELEPHONE NUMBER WITH AREA CODE 573-505-1818	E-MAIL ADDRESS cityofrosebud@gmail.com
ADDRESS 307 Cedar St.	CITY Rosebud	STATE MO	ZIP CODE 63091

5.0 CONTINUING AUTHORITY: A continuing authority is a company, business, entity or person(s) that will be operating the facility and/or ensuring compliance with the permit requirements.

NAME City of Rosebud, Missouri		TELEPHONE NUMBER WITH AREA CODE 573-505-1818	E-MAIL ADDRESS cityofrosebud@gmail.com
ADDRESS 307 Cedar St.	CITY Rosebud	STATE MO	ZIP CODE 63091

5.1 A letter from the continuing authority, if different than the owner, is included with this application. ☐ YES ☐ NO ☑ N/A

5.2 COMPLETE THE FOLLOWING IF THE CONTINUING AUTHORITY IS A MISSOURI PUBLIC SERVICE COMMISSION REGULATED ENTITY.

A. Is a copy of the certificate of convenience and necessity included with this application? ☐ YES ☐ NO

5.3 COMPLETE THE FOLLOWING IF THE CONTINUING AUTHORITY IS A PROPERTY OWNERS ASSOCIATION.

A. Is a copy of the as-filed restrictions and covenants included with this application? ☐ YES ☐ NO

B. Is a copy of the as-filed warranty deed, quitclaim deed or other legal instrument which transfers ownership of the land for the wastewater treatment facility to the association included with this application? ☐ YES ☐ NO

C. Is a copy of the as-filed legal instrument (typically the plat) that provides the association with valid easements for all sewers included with this application? ☐ YES ☐ NO

D. Is a copy of the Missouri Secretary of State's nonprofit corporation certificate included with this application? ☐ YES ☐ NO

6.0 ENGINEER			
ENGINEER NAME / COMPANY NAME Kyle J. Landwehr		TELEPHONE NUMBER WITH AREA CODE (573) 659-6727	E-MAIL ADDRESS kyle.landwehr@bartwest.com
ADDRESS 601 Monroe St., Ste. 201	CITY Jefferson City	STATE MO	ZIP CODE 65101

7.0 APPLICATION FEE

☐ CHECK NUMBER ☑ JETPAY CONFIRMATION NUMBER 20038834

8.0 PROJECT OWNER: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

PROJECT OWNER SIGNATURE [signature]		
PRINTED NAME Shannon Grus		DATE 7-29-25
TITLE OR CORPORATE POSITION Mayor	TELEPHONE NUMBER WITH AREA CODE 573-505-1818	E-MAIL ADDRESS shannon.grus@gmail.com

Mail completed copy to:
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
P.O. BOX 176
JEFFERSON CITY, MO 65102-0176

END OF PART A.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHETHER PART B NEEDS TO BE COMPLETE.

PART B – LAND APPLICATION ONLY
(Submit only if the proposed construction project includes land application of wastewater.)

8.0 FACILITY INFORMATION

8.1 Type of wastewater to be irrigated: ☐ Domestic ☐ State/National Park ☐ Seasonal business
☐ Municipal ☐ Municipal with a pretreatment program or significant industrial users
☐ Other (explain) ______

8.2 Months when the business or enterprise will operate or generate wastewater:
☐ 12 months per year ☐ Part of the year (list months): ______

8.3 This system is designed for:
☐ No-discharge.
☐ Partial irrigation when feasible and discharge rest of time.
☐ Irrigation during recreational season, April – October, and discharge during November – March.
☐ Other (explain) ______.

9.0 STORAGE BASINS

9.1 Number of storage basins: ______ (Use additional pages if greater than three basins.)

9.2 Type of basins: ☐ Steel ☐ Concrete ☐ Fiberglass ☐ Earthen ☐ Earthen with membrane liner

9.3 Storage basin dimensions at inside top of berm (feet). Report freeboard as feet from top of berm to emergency spillway or overflow pipe.
Basin #1: Length ______ Width ______ Depth ______ Freeboard ______ Depth ______ Safety ______ % Slope ______
Basin #2: Length ______ Width ______ Depth ______ Freeboard ______ Depth ______ Safety ______ % Slope ______
Basin #3: Length ______ Width ______ Depth ______ Freeboard ______ Depth ______ Safety ______ % Slope ______

9.4 Storage Basin operating levels (report as feet below emergency overflow level).
Basin #1: Maximum operating water level ______ ft Minimum operating water level ______ ft
Basin #2: Maximum operating water level ______ ft Minimum operating water level ______ ft
Basin #3: Maximum operating water level ______ ft Minimum operating water level ______ ft

9.5 Design depth of sludge in storage basins.
Basin #1: ______ ft Basin #2: ______ ft Basin #3: ______ ft

9.6 Existing sludge depth, if the basins are currently in operation.
Basin #1: ______ ft Basin #2: ______ ft Basin #3: ______ ft

9.7 Total design sludge storage: ______ dry tons and ______ cubic feet

10.0 LAND APPLICATION SYSTEM

10.1 Number of irrigation sites ______ Total Acres ______ Maximum % field slopes ______
Location: ______ ¼, ______ ¼, ______ ¼, ______ Sec. ______ T ______ R ______ County ______ Acres
Location: ______ ¼, ______ ¼, ______ ¼, ______ Sec. ______ T ______ R ______ County ______ Acres
Location: ______ ¼, ______ ¼, ______ ¼, ______ Sec. ______ T ______ R ______ County ______ Acres
(Use additional pages if greater than three irrigation sites.)

10.2 Type of vegetation: ☐ Grass hay ☐ Pasture ☐ Timber ☐ Row crops
☐ Other (describe) ______

10.3 Wastewater flow (dry weather) gallons per day: Average annual ______ Seasonal ______ Off-season ______

10.4 Land application rate (design flow including 1-in-10 year storm water flows):
Design: ______ inches/year ______ inches/hour ______ inches/day ______ inches/week
Actual: ______ inches/year ______ inches/hour ______ inches/day ______ inches/week

10.5 Total irrigation per year (gallons): Design: ______ gal Actual: ______ gal

10.6 Actual months used for irrigation (check all that apply):
☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec

10.7 Land application rate is based on:
☐ Hydraulic Loading ☐ Other (describe) ______
☐ Nutrient Management Plan (N&P) If N&P is selected, is the plan included? ☐ YES ☐ NO

Schulte, Cari

From:	Bax, Stacia
Sent:	Friday, August 1, 2025 10:34 AM
To:	Schulte, Cari
Cc:	Rosenberg, Heather; Garcia, Angie; Bretzke, Ginny
Subject:	RE: C295083-01 Rosebud Construction Permit - Fee Waiver Form

Hi All,
I approve of the fee waiver. While it is not our responsibility or even obligation to remind folks when their permits are about to expire, I believe in this case we should grant this waiver due to this project being so close to completion. As always in our desire for providing the best customer service, if/when we were to remind folks of deadlines like this it provides a positive experience that is appreciated, it is still the responsibility of the continuing authority (i.e., city) to meet their obligations and follow regulations.

Cari, this should be ready for you. If you need anything else, please let us know.

Thanks,
Stacia
573-526-0147 (Office)
stacia.bax@dnr.mo.gov

From: Garcia, Angie <Angie.Garcia@dnr.mo.gov>
Sent: Wednesday, July 30, 2025 4:52 PM
To: Bretzke, Ginny <Ginny.Bretzke@dnr.mo.gov>; Bax, Stacia <stacia.bax@dnr.mo.gov>
Cc: Rosenberg, Heather <Heather.Rosenberg@dnr.mo.gov>
Subject: RE: C295083-01 Rosebud Construction Permit - Fee Waiver Form

Hello,

I spoke with Cari. She can assign a CP number before the fee is paid or waived. She has it on her to- do list 😊

Thanks,

Angie Garcia, E.I. (she/her)
Environmental Engineer Associate
Financial Assistance Center
(573) 751-1299

From: Bretzke, Ginny <Ginny.Bretzke@dnr.mo.gov>
Sent: Wednesday, July 30, 2025 4:45 PM
To: Bax, Stacia <stacia.bax@dnr.mo.gov>
Cc: Garcia, Angie <Angie.Garcia@dnr.mo.gov>; Rosenberg, Heather <Heather.Rosenberg@dnr.mo.gov>
Subject: FW: C295083-01 Rosebud Construction Permit - Fee Waiver Form

Stacia,
For the Rosebud construction permit, links to the fee waiver form and the justification information from the engineer are listed in Angie's email below. In addition, the new construction permit application (for re-issuing the same permit) is here:

\\n-nr64f.state.mo.us\nwpsc\wpcp\permits_SLRO\Gasconade\MO0091375 - Rosebud South Lagoon\Construction Permits\CPXXXXXXX - SRF 2025\cpXXXXXXX-mo0091375-c295083-01-rosebud-wwtf-20250729-cp-application-gasconade-cw.pdf

There is a place on the form for the Section Chief to approve the fee waiver.

I am assuming that Cari cannot get a CP number assigned until after the fee waiver is approved.

Angie can help answer any questions.

Thanks,

Ginny Bretzke, P.E.
Clean Water Engineering Unit Chief
Financial Assistance Center
(573) 751-1302
ginny.bretzke@dnr.mo.gov

From: Garcia, Angie <Angie.Garcia@dnr.mo.gov>
Sent: Wednesday, July 30, 2025 8:28 AM
To: Bretzke, Ginny <Ginny.Bretzke@dnr.mo.gov>
Cc: Rosenberg, Heather <Heather.Rosenberg@dnr.mo.gov>
Subject: C295083-01 Rosebud Construction Permit - Fee Waiver Form

Hi Ginny,

Please see below the Fee Waiver Form for Rosebud. I based the required comment on the justification provided by the consultant. Feel free to make revisions as needed.

Fee Waiver Form: T:_SLRO\Gasconade\MO0091375 - Rosebud South Lagoon\Construction Permits\CPXXXXXXX - SRF 2025\cpXXXXXXX-mo0091375-c295083-01-rosebud-wwtf-2025XXXX-fee-waiver-form-gasconade-cw.docx

Justification: T:_SLRO\Gasconade\MO0091375 - Rosebud South Lagoon\Construction Permits\CPXXXXXXX - SRF 2025\cpXXXXXXX-mo0091375-c295083-01-rosebud-wwtf-20250729-fee-waiver-justification-gasconade-cw.docx

Let me know if you have any questions.

Thanks,

Angie Garcia, E.I. (she/her)
Environmental Engineer Associate
Financial Assistance Center
(573) 751-1299