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 Dixon
Dixon Wastewater Treatment Plant
10171 Cottonwood Rd
Dixon, MO 65459

for the construction of (described facilities):

See attached.

Permit Conditions:

See attached.

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

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

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

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

October 24, 2024
Effective Date

October 23, 2026
Expiration Date

John Hoke, Director, Water Protection Program

CONSTRUCTION PERMIT

I. CONSTRUCTION DESCRIPTION

The proposed phase 1 improvements for the Dixon Wastewater Treatment Plant (WWTP) include a new open-channel ultraviolet (UV) disinfection system, new triplex intermediate pump station to convey secondary clarifier effluent to the disinfection system, a new Parshall flume to measure flows following disinfection, and modification of the sludge handling process by construction of a new aerobic digester. The design flow of the facility will remain unchanged at 362,400 gallons per day (gpd).

Per the submitted existing and proposed facility flow diagrams, the peak flow storage basins will no longer be in use following construction of the phase 1 improvements. A closure plan will need to be submitted to the Central Field Operations Office for review and approval prior to any closure activities. For additional guidance on closure plans, please refer to the department's treatment plant closure guidance webpage at the following link: Wastewater Treatment Plant Closure - PUB2568 | Missouri Department of Natural Resources (mo.gov)

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 consistent with plans and specifications signed and sealed by Kenneth Campbell, P.E. and Steven Stack, P.E. with Archer-Elgin Surveying and Engineering, LLC and as described in this permit.

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

4. In accordance with 10 CSR 20-6.010(12), a full closure plan shall be submitted to the department's Central Field Operations Office for review and approval of any permitted wastewater treatment system being replaced. The closure plan must meet the requirements outlined in Standard Conditions Part III of the Missouri State Operating Permit No. MO-0100129.

5. 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 Central Field Operations Office per 10 CSR 20-7.015(9)(G).

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

7. A United States Army Corps of Engineers (USACE) Clean Water Act Section 404 Department of the Army permit and a Section 401 Water Quality Certification issued by the department may be required for the activities described in this permit. This permit is not valid until these requirements are satisfied or notification is provided that no Section 404 permit is required by the USACE. You must contact your local USACE district since they determine what waters are jurisdictional and which permitting requirements may apply. You may call the department's Water Protection Program, Operating Permits Section at 573-522-4502 for more information. See https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/section-401-water-quality for more information.

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

- Flood protection shall apply to new construction and to existing facilities undergoing major modification. The wastewater facility structures, electrical equipment, and

mechanical equipment shall be protected from physical damage by not less than the 100-year flood elevation. 10 CSR 20-8.140(2)(B)

- Unless another distance is determined by the Missouri Geological Survey or by the department's Public Drinking Water Branch, the minimum distance between wastewater treatment facilities and all potable water sources shall be at least 300 feet. 10 CSR 20-8.140(2)(C)1.
- Facilities shall be readily accessible by authorized personnel from a public right–of-way at all times. 10 CSR 20-8.140(2)(D)
- The outfall shall be so constructed and protected against the effects of flood water, ice, or other hazards as to reasonably ensure its structural stability and freedom from stoppage. 10 CSR 20-8.140(6)(A)
- All sampling points shall be designed so that a representative and discrete 24-hour automatic composite sample or grab sample of the effluent discharge can be obtained at a point after the final treatment process and before discharge to or mixing with the receiving waters. 10 CSR 20-8.140(6)(B)
- All outfalls shall be posted with a permanent sign indicating the outfall number (i.e., Outfall #001). 10 CSR 20-8.140(6)(C)
- All wastewater treatment facilities shall be provided with an alternate source of electric power or pumping capability to allow continuity of operation during power failures. 10 CSR 20-8.140(7)(A)1.
- Disinfection and dechlorination, when used, shall be provided during all power outages. 10 CSR 20-8.140(7)(A)2.
- Electrical systems and components in raw wastewater or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors that are normally present, shall comply with the NFPA 70 National Electric Code (NEC) (2017 Edition), as approved and published August 24, 2016, requirements for Class I, Division 1, Group D locations. 10 CSR 20-8.140(7)(B)
- An audiovisual alarm or a more advanced alert system, with a self-contained power supply, capable of monitoring the condition of equipment whose failure could result in a violation of the operating permit, shall be provided for all wastewater treatment facilities. 10 CSR 20-8.140(7)(C)
- No piping or other connections shall exist in any part of the wastewater treatment facility that might cause the contamination of a potable water supply. 10 CSR 20-8.140(7)(D)1.
- A means of flow measurement shall be provided at all wastewater treatment facilities. 10 CSR 20-8.140(7)(E)
- Effluent 24-hour composite automatic sampling equipment shall be provided at all mechanical wastewater treatment facilities and at other facilities where necessary under provisions of the operating permit. 10 CSR 20-8.140(7)(F)
- Adequate provisions shall be made to effectively protect facility personnel and visitors from hazards. The following shall be provided to fulfill the particular needs of each wastewater treatment facility:
    - Fencing. Enclose the facility site with a fence designed to discourage the entrance of unauthorized persons and animals; 10 CSR 20-8.140 (8) (A)
    - Gratings over appropriate areas of treatment units where access for maintenance is necessary; 10 CSR 20-8.140(8)(B)
    - First aid equipment; 10 CSR 20-8.140(8)(C)

  - Posted “No Smoking” signs in hazardous areas; 10 CSR 20-8.140(8)(D)
  - Appropriate personal protective equipment (PPE); 10 CSR 20-8.140(8)(E)
  - Portable blower and hose sufficient to ventilate accessed confined spaces; 10 CSR 20-8.140(8)(F)
  - 10 CSR 20-8.140(8)(G) Portable lighting equipment complying with NEC requirements. See subsection (7)(B) of this rule;
  - Appropriately-placed warning signs for slippery areas, non-potable water fixtures (see subparagraph (7)(D)3.B. of this rule), low head clearance areas, open service manholes, hazardous chemical storage areas, flammable fuel storage areas, high noise areas, etc.; 10 CSR 20-8.140(8)(I)
  - Provisions for local lockout/tagout on stop motor controls and other devices; 10 CSR 20-8.140(8)(L)
- For solids pumping systems, audio-visual alarms shall be provided in accordance with 10 CSR 20-8.140(7)(C) for:
  - Pump failure; 10 CSR 20-8.170(6)(A) and
  - High pressure. 10 CSR 20-8.170(6)(C)
- Emergency Power. Disinfection and dechlorination processes, when used, shall be provided during all power outages. 10 CSR 20-8.190(2)(A)
- The UV dosage shall be based on the design peak hourly flow, maximum rate of pumpage, or peak batch flow. 10 CSR 20-8.190(5)(A)1.
- If no flow equalization is provided for a batch discharger, the UV dosage shall be based on the peak batch flow. 10 CSR 20-8.190(5)(A)2.
- The UV system shall deliver the target dosage based on equipment derating factors and, if needed, have the UV equipment manufacturer verify that the scale up or scale down factor utilized in the design is appropriate for the specific application under consideration. 10 CSR 20-8.190(5)(A)3.
- The UV system shall deliver a minimum UV dosage of 30,000 microwatt seconds per centimeters squared ($\mu W \bullet s/cm^2$). 10 CSR 20-8.190(5)(A)4.
- Open channel UV systems. The combination of the total number of banks shall be capable of treating the design peak hourly flow, maximum rate of pumpage, or peak batch flow. 10 CSR 20-8.190(5)(B)1.
- The UV system must continuously monitor and display at the UV system control panel the following minimum conditions:
  - The relative intensity of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.A.
  - The operational status and condition of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.B.
  - The ON/OFF status of each lamp in the system; 10 CSR 20-8.190(5)(C)1.C. and
  - The total number of operating hours of each bank or each closed vessel system. 10 CSR 20-8.190(5)(C)1.D.
- The UV system shall include an alarm system. Alarm systems shall comply with 10 CSR 20-8.140(7)(C). 10 CSR 20-8.190(5)(C)2.

9. Upon completion of construction:

   A. The city of Dixon 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 Statement of Work Completed form to the department in accordance with 10 CSR 20-6.010(5)(N) (https://dnr.mo.gov/document-search/wastewater-construction-statement-work-completed-mo-780-2155). The operating permit facility description will be modified to reflect the construction activities following the department's receipt of the Statement of Work Completed form.

IV. REVIEW SUMMARY

1. CONSTRUCTION PURPOSE

The Dixon WWTP operating permit MO-0100129 includes a schedule of compliance for *E. coli* limits, which become effective April 1, 2025. The focus of the construction is to implement improvements necessary to meet the schedule of compliance for disinfection while making maximum utilization of available American Recover Plan Act (ARPA) grant monies. Phase 1 improvements will also include improvements to sludge handling with the goal of ameliorating violations identified by the United States Environmental Protection Agency (EPA) in 2022 and 2023.

2. FACILITY DESCRIPTION

The current Dixon WWTP includes equalization basins, bar screen, influent Parshall flume, comminution, grit removal, oxidation ditch, two secondary clarifiers, and sludge holding basins. The proposed construction will add an open-channel UV disinfection system, triplex intermediate pump station to convey secondary clarifier effluent to the disinfection system, a new Parshall flume to measure flows following disinfection, and modification of the sludge handling process by construction of a new aerobic digester.

The Dixon WWTP is located at 10171 Cottonwood Rd, Dixon, in Pulaski County, Missouri. The facility has a design average flow of 362,400 gpd and serves a hydraulic population equivalent of 3624 people.

3. COMPLIANCE PARAMETERS

The proposed project is required to meet final effluent limits as established in Operating Permit MO-0100129.

The limits following the completion of construction will be applicable to the facility:

Parameter	Units	Monthly average limit
Biochemical Oxygen Demand$_5$ (BOD_5)	mg/L	30
Total Suspended Solids	mg/L	30
*E. coli**	#/100mL	206*
Ammonia as N-January	mg/L	3.1
Ammonia as N-February	mg/L	2.7
Ammonia as N-March	mg/L	3.1
Ammonia as N-April	mg/L	2.7
Ammonia as N-May	mg/L	2.2
Ammonia as N-June	mg/L	1.7
Ammonia as N-July	mg/L	1.5
Ammonia as N-August	mg/L	1.3
Ammonia as N-September	mg/L	1.8
Ammonia as N-October	mg/L	2.5
Ammonia as N-November	mg/L	3.1
Ammonia as N-December	mg/L	3.1
pH	SU	6.5-9.0
BOD_5 Percent Removal	%	85
TSS Percent Removal	%	85
Oil & Grease	mg/L	10

**E. coli limits will become effective April 1, 2025 based on the schedule of compliance provided with MO-0100129 issued April 1, 2021. This timeline is not dependent on the status of construction activities covered by this permit.*

4. REVIEW of MAJOR TREATMENT DESIGN CRITERIA

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

- Screening – Influent screening to remove nuisance inorganic materials from raw wastewater. Screening is designed for an average daily flow of 0.362 MGD and a peak flow of 7.0 MGD. Following screening influent flows to influent Parshall flume.
- Flow Measurement – Installation of accurate flow measurement devices will give the treatment facility a means of improved data analysis.
  - Parshall Flume – A 6-inch throat influent Parshall flume
- Grit Removal – Installation of grit removal facilities removes grit and inert inorganics from raw wastewater. Grit removal prevents downstream abrasion and wear on mechanical components and accumulation at the bottom of basins or channels. Facility is provided with grit chamber following screening and influent flow measurement. The grit removal system is designed for an average daily flow of 0.362 MGD and a peak flow of 1.087 MGD.
- Oxidation Ditch – Existing oxidation ditch with aeration provided by two blowers. Design MLSS of 3,000 mg/L. The hydraulic retention time is about 20.3 hrs at design flow of 362,400 gpd. The side water depth of the treatment train is 10 ft. The F/M ratio in the anoxic zone was designed to be 0.096.

- Secondary Clarifiers – Two existing secondary clarifiers with diameter of 26 ft designed to accommodate an average flow of 0.362 MGD and peak flow of 1.08 MGD.
- Sludge Holding Basins – Four existing sludge storage basins. Each are approximately 24 feet long by 24 feet wide and about 6 feet deep.

Construction will cover the following items:

- Flow Measurement – Installation of accurate flow measurement devices will give the treatment facility a means of improved data analysis.
  - Parshall Flume – A 6-inch throat effluent Parshall flume with ultrasonic flow sensor shall measure the secondary treated and disinfected wastewater prior to discharge at Outfall No. 001. Designed for an average flow rate of 0.362 MGD and peak flow of 1.08 MGD.
- Intermediate Pump Station – Construction of a triplex intermediate pump station to convey secondary clarifier effluent to the UV disinfection process. Capable of pumping 495 gpm at 12 ft of TDH with a single pump in operation and 750 gpm (1.08 MGD) at 18.5 ft of TDH with two pumps operating in parallel.
- Disinfection – Disinfection is the process of removal, deactivation, or killing of pathogenic microorganisms.
  - Open Channel Ultraviolet (UV) – An open channel, gravity flow, low pressure high intensity UV disinfection system capable of treating a peak flow of 1.09 MGD while delivering a minimum UV intensity of 35 mJ/cm^2 with an expected ultraviolet transmissivity of 60 percent or greater. The single open channel UV system consists of two banks in series with 3 modules per bank and 4 lamps per module for a total of 24 lamps. The disinfected effluent will flow by gravity through flow measurement equipment and to Outfall No. 001.
- Relocated Outfall – A new, larger diameter outfall line will be constructed to accommodate future phases of development. The new outfall pipe will be routed to a new outfall structure located immediately next to the current outfall location.
- Aerobic Digester – Construction of one aerobic digester basin with a 35 ft diameter, a 15 ft sidewater depth, and a volume of approximately 107,959 gallons. The design basis of the digester is an influent solids concentration of 0.5 percent. Installation of floating aerators will provide aeration and mixing of the sludge to prevent anaerobic conditions. Designed to treat a daily waste volume of 477.9 lbs/day based on the maximum design BOD_5 loading of 569 lbs/day and sludge yield coefficient of 0.84. Aerators to provide a design operating dissolved oxygen concentration of 2.0 mg/L. Design actual oxygen transfer rate (AOTR) of 1,318 lbs O_2/day and 1,567 lbs O_2/day for winter and summer months, respectively. The aerobic digester receives pumped flows from the WAS pump station. There will be one 5-HP pump with capacity of 495 gpm at 12 ft TDH normal operations.
- Emergency Power – A 400 kW standby diesel generator and automatic transfer switch will provide redundant power for the intermediate pump station and UV disinfection.

5. OPERATING PERMIT

These construction activities do not change the effluent limits or conditions of the current operating permit. The department will conduct an internal modification to reflect the current facility description upon receipt of the Statement of Work Completed form.

Operating permit MO-0100129 will be expiring on March 31, 2026. A renewal application must be filed before October 2, 2025, regardless of the status of these construction activities. If you have questions on completing the renewal application, please contact the NPDES permitting section at 573-522-4502 or cleanwaterpermits@dnr.mo.gov.

V. NOTICE OF RIGHT TO APPEAL

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to Section 621.250 RSMo. To appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

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

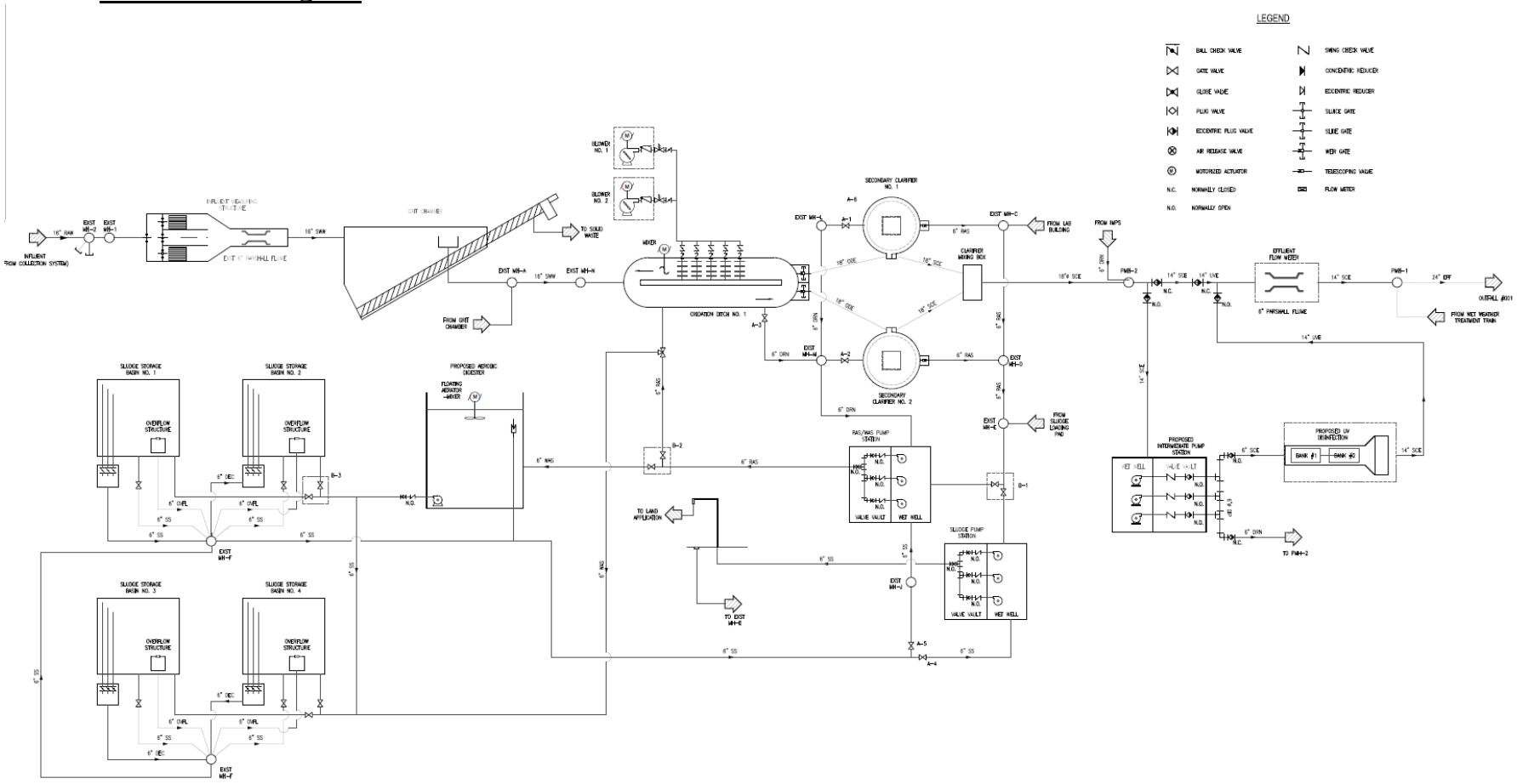
Thomas Silkwood
Engineering Section
thomas.silkwood@dnr.mo.gov

Chia-Wei Young, P.E.
Engineering Section
chia-wei.young@dnr.mo.gov

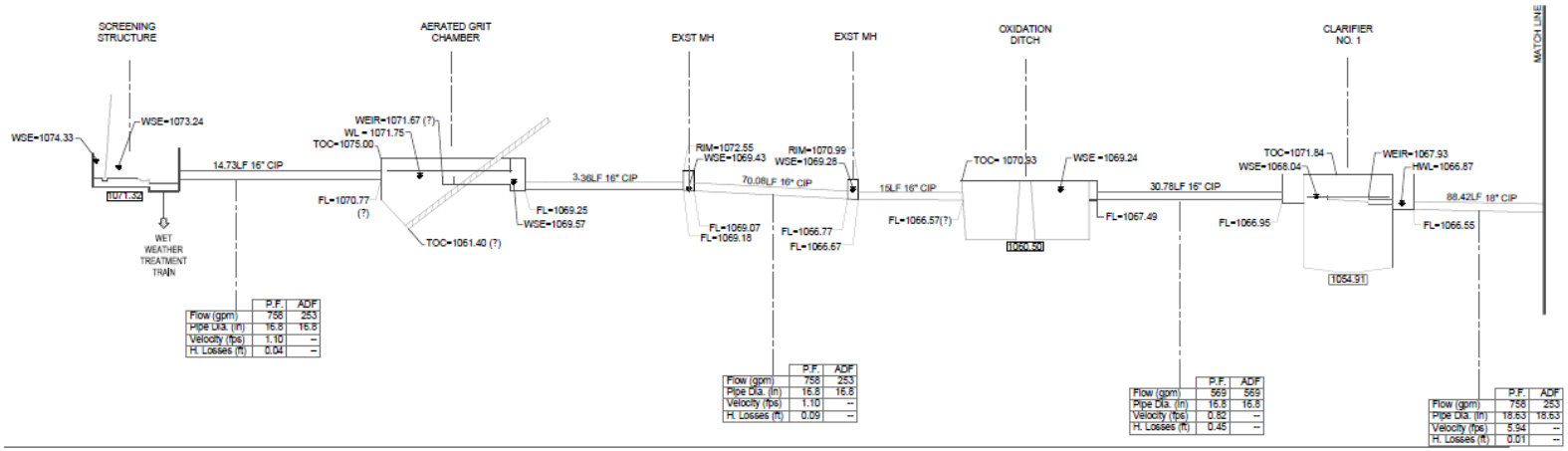
APPENDICES

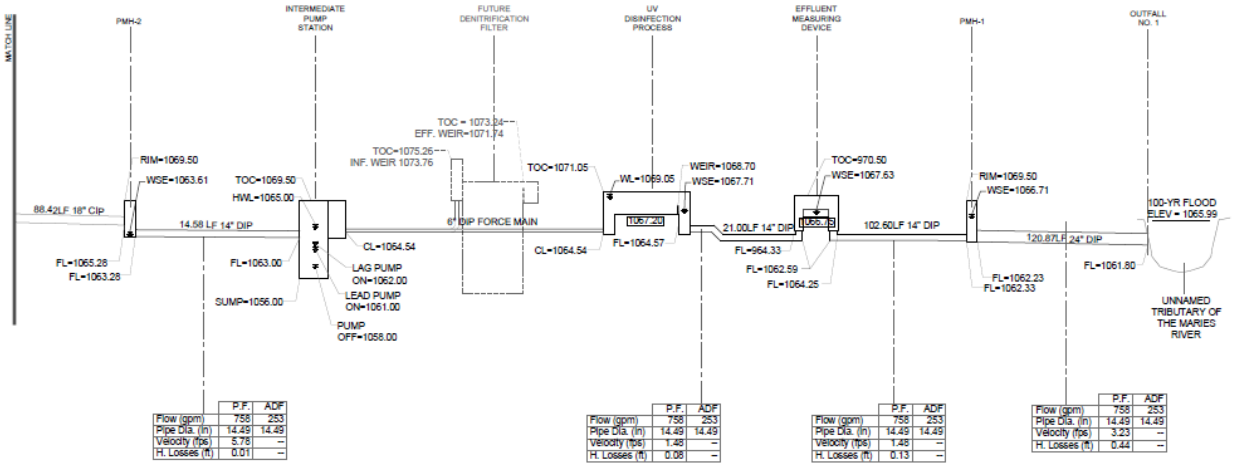
- **Process Flow Diagram**
- **Hydraulic Profile**
- **Aerobic Digester Pump Curve**
- **Summary of Design**

- **Process Flow Diagram**

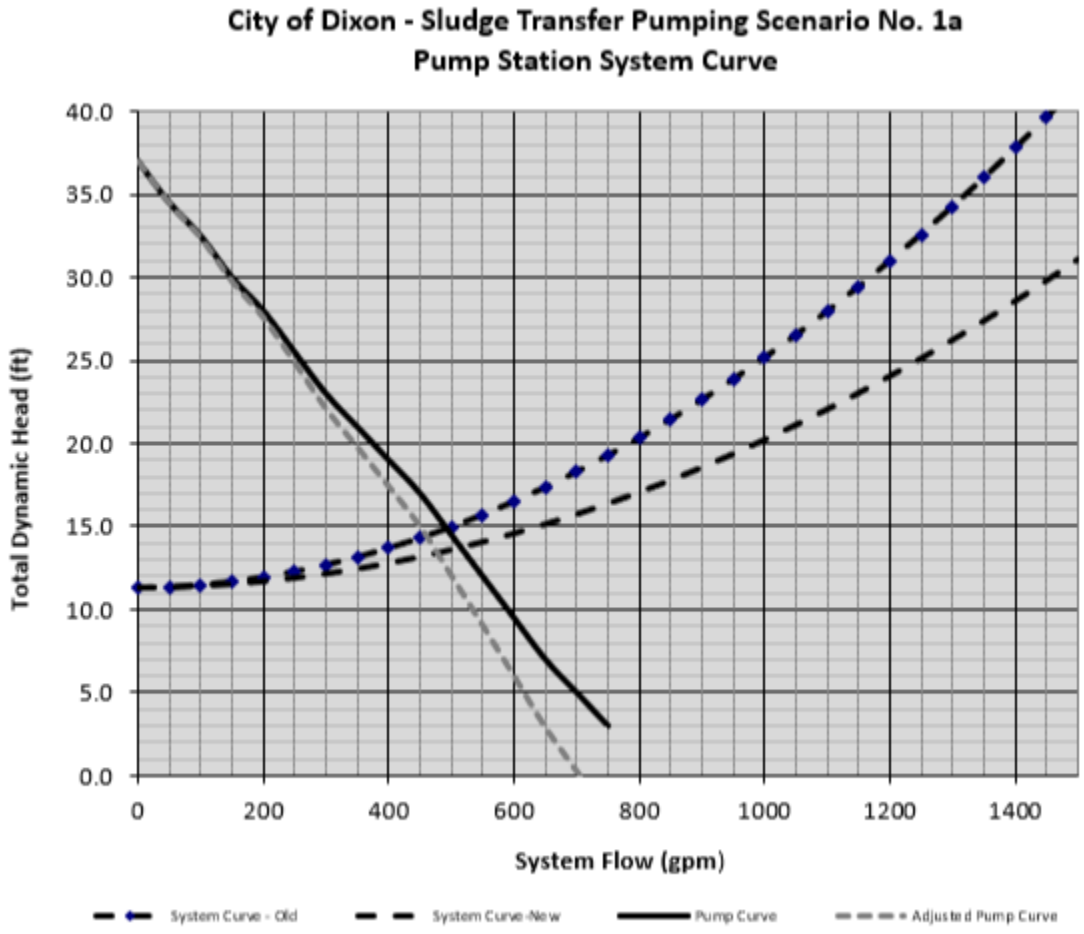


- **Hydraulic Profile**





- **Aerobic Digester Pump Curve**



- **Summary of Design**

City of Dixon

Wastewater Treatment Plant Phase 1 Improvements

Summary of Design

August 30, 2024

ARCHER-ELGIN
engineering • surveying • architecture

STATE OF MISSOURI
KENNETH CAMPBELL
NUMBER PE-2006002797
PROFESSIONAL ENGINEER
09-03-24

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1 Introduction

1.1 Purpose

The purpose of this report is to summarize the design of the Dixon WWTP Phase 1 improvements required to meet numerous criteria established in the Dixon WWTP Improvements Facility Plan issued on July 12, 2022, by Archer-Elgin Engineering and Surveying and revised on March 2, 2023. The focus of this development phase is to implement improvements necessary to meet the schedule of compliance for disinfection while maximizing utilization of available American Recovery Plan Act of 2021 grant monies. Phase 1 improvements shall also address solids handling at the facility with an eye towards amelioration of EPA violations identified in 2022 and 2023.

2 Design Flow and Loadings

Flow and loading projections over the 20-year planning period, 2022 – 2042, were completed in the Facility Plan. The 2042 projections are shown in the table below.

Table 2-1. 2042 Projected Flow and Loading

	Average Day	Max Month	Max Day	Peak Hour
Flow:	0.325	0.587	2.215	7.0
BOD (mg/L):	125	210	310	
BOD (lb./d):	339	569	840	
TSS (mg/L):	100	250	275	
TSS (lb./d):	271	678	745	
NH3-N (mg/L):	15	25	30	
NH3-N (lb/d):	41	68	81	

Maximum day and peak hour flows for the facility are indicative of the total projected flow arriving at the facility based on 10% annual exceedance probability (AEP) storm event occurring in the collection system sewershed over a 3 hour duration. Based on an evaluation of the facility, it was determined that the maximum capacity of the secondary treatment train was 1.08 MGD, affording an approximate peaking factor of 3.0. Flows in excess of the secondary treatment train capacity are diverted to one of two peak flow storage basins where it is attenuated and later drained back to the secondary treatment train during dry weather.

Treatment needs were established based upon the effluent limitations listed in the currently effective Missouri State Operating Permit (MO-0100129). A copy of the operating permit is located in Appendix A.

Table 2-2. Final Effluent Requirements – Effective through 03-31-2034

Effluent Requirements	
BOD_5 Concentration †	
Monthly Avg (mg/L)	30
Weekly Avg (mg/L)	45
TSS Concentration †	
Monthly Avg (mg/L)	30
Weekly Avg (mg/L)	45
Ammonia Concentration	
Monthly Avg (mg/L) – Summer *	1.3
Daily Max (mg/L) – Summer *	10.1

Monthly Avg (mg/L) – Winter ‡	2.5
Daily Max (mg/L) - Winter ‡	12.1
E. coli	
Monthly Avg (CFU/100 ml) **	206
Weekly Avg (CFU/100 ml) **	1,030
Oil and Grease (mg/L)	
Monthly Avg (mg/L)	10
Daily Max (mg/L)	15

(†) The facility must meet a removal efficiency of 85% or greater.

(*) Daily maximum and monthly average ammonia nitrogen effluent concentrations limits occurring annually between April 1 and September 30

(‡) Daily maximum and monthly average ammonia nitrogen effluent concentrations limits occurring annually between (October 1 and March 31).

(**) E. coli testing expressed as a geometric mean.

Quarterly sampling for influent and effluent total phosphorus and total nitrogen shall be performed during the term of the currently effective operating permit.

The operating permit contains a schedule of compliance for disinfection of plant effluent. A complete and functional disinfection process must be constructed and started -up by April 1, 2025 to afford compliance with effluent limitations established in the operating permit.

3 Process Flow Diagram

The purpose of the Process Flow Diagram is to display the various WWTP liquid and solid treatment train unit processes improvements necessary to remove contaminants and to meet NPDES permit discharge requirements. The proposed liquid and solids handling process schematics are shown in G-series drawings. A summary of all unit processes is listed below. Design details of the proposed improvements are presented in subsequent sections.

Table 3-1. Unit Processes – Phase 1 Improvements & Modifications

Unit Process Description	Existing	Modification/ Improvement	New
Influent Flow Measurement	X		
Headworks – Screen	X		
Oxidation Ditch	X		
Secondary Clarifier(s)	X		
Effluent Flow Measurement			X
Intermediate Pump Station			X
UV Disinfection – Dry Weather			X
Aerobic Digester / Sludge Storage		X	
Miscellaneous Site Improvements			X

4 Hydraulic Profiles

The purpose of the Hydraulic Profile is to depict the selected design control elevations for each of the WWTP's unit processes commencing at the headworks structure and ceasing at the plant outfall structure. Design calculations are based upon applicable average and peak flow design capacities of each unit process and reflect accepted practices for water surface freeboard levels. The dry weather hydraulic profile is shown in Appendix B.

5 Wastewater Treatment Plant Improvements

5.1 Intermediate Pump Station

The 1% annual exceedance probability (AEP) flood plain for the receiving stream was evaluated to determine the tail water conditions for the plat outfall. Based on the tailwater conditions, the effluent weir for the UV disinfection process was set to afford a minimum of 1 FT freeboard above 1% AEP event. Due to the necessary height of the weir, an intermediate pump station process must be implemented to convey all secondary clarifier effluent (SCE) flow up to the UV disinfection process.

The Intermediate Pump Station (IMPS) shall consist of submersible, non-clog, centrifugal pump s installed within a wetwell. The IMPS shall have a triplex configuration with two (2) duty and one (1) standby pump. The IMPS shall operate in an operator adjustable lead-lag-standby configuration based on feedback from discrete float switches. The pumps shall operate at constant speed.

One (1) new davit crane shall be installed at the wetwell lid for removal of pump equipment from the wetwell for inspecition and maintenance activities.

The FSPS is presented in FSPS-series drawings. Design parameters are provided in the table below.

Table 5-1. Intermediate Pump Station Design Parameters

Flow	
Required Pumping Capacity @ ADF (MGD)	0.362
Required Pumping Capacity @ PHF (MGD)	1.08
Proposed Equipment Summary	
Pumps in Service	2 Duty 1 Standby
Single Pump Capacity @ 12.0 FT TDH (GPM)	495
Two Pumps Operating in Parallel @ 18.5 FT TDH (GPM)	750
Pump Size, Max (HP)	5.0
Possible Pump Selections	
- Xylem Flygt NP3102 MT 3~ Adaptive 465, 5.0 Hp, 240VAC, 3-ph, 60 Hz, 1720 RPM - Sulzer-ABS XFP150E CB1 with PE35/6-E-60Hz, 4.69 Hp, 230VAC, 3-ph, 60 Hz, 1170 RPM	

City of Dixon
Summary of Design

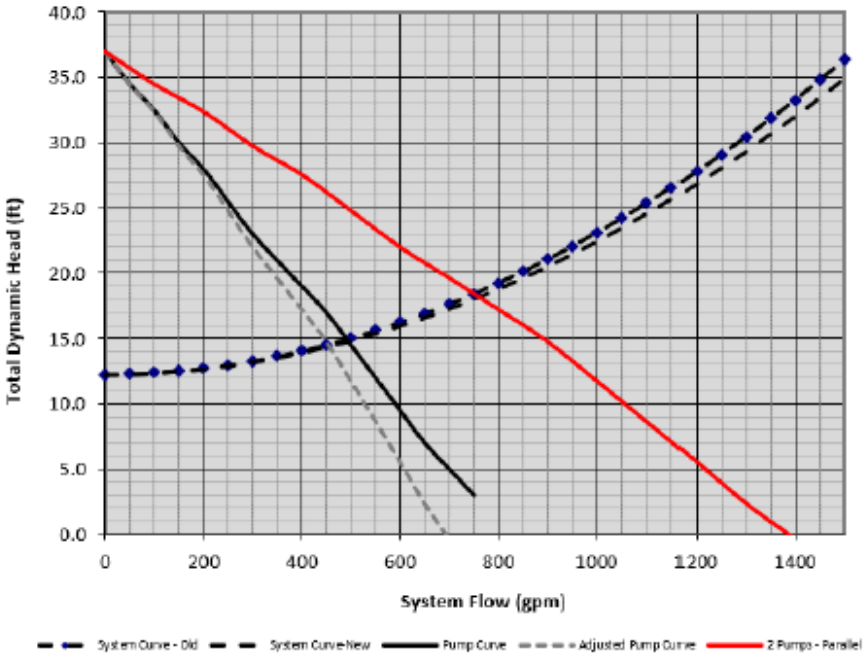

Figure 5.1-1 IMPS System Curve at WSE = Pump OFF Control Elevation, C_h = 120 (Old) and C_h = 140 (New)

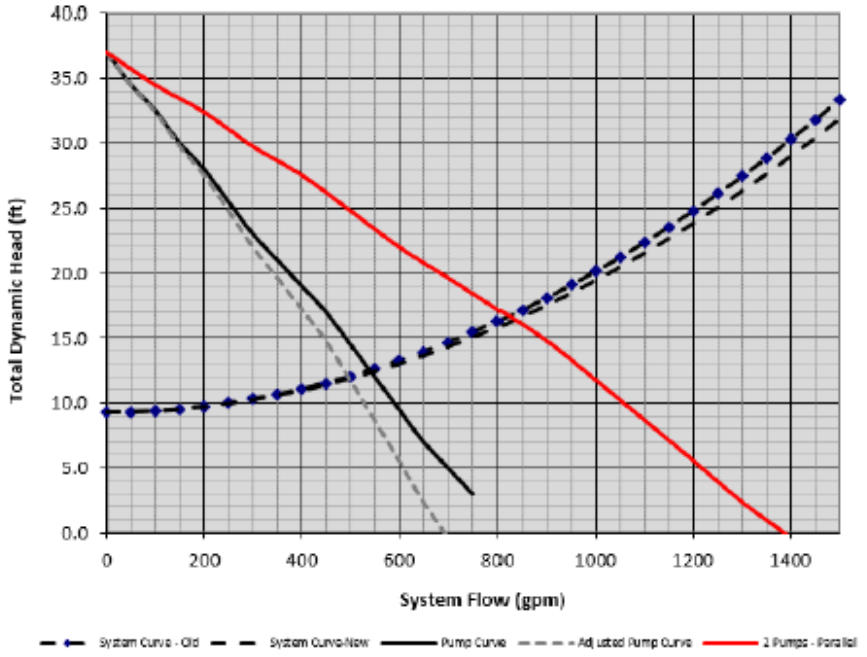

Figure 5.1-2 IMPS System Curve at WSE = Lead Pump ON Control Elevation, C_h = 120 (Old) and C_h = 140 (New)

5.1.1 Calculations

Process calculations are provided below.

Volume for Pump Start

Volume (gal) = Area* x (Pump On – Pump Off) x 7.4805

Volume (gal) = 66 SF x (1061.00 – 1058.00) x 7.4805 = 1,481

Cycle Time

Cycle Time (min) = (4 x Volume for Pump Start) / (Ave Pump Capacity)

Cycle Time (min) = (4 x 1,481 gal) / 475 gpm = 12.47

Pump Starts per Hour

Pump Starts per Hour = 60 min / Cycle Time

Pump Starts per Hour = 60 min / 12.47 min = 4.81

Pump Starts per Hour per Pump = 3.75 / 3 pumps = 1.60

5.2 Disinfection

A UV Disinfection process shall be constructed for the secondary treatment train within the scope of the Phase 1 Improvements project. The UV disinfection process shall be sized to accommodate 2 log inactivation of the target indicator organism, e. Coli., as well as other pathogenic organism. An open concrete flow channel shall be constructed. Within the new flow channel, two banks of submerged UV lamps shall be installed in a horizontal configuration. A fixed serpentine level control weir shall be installed at the downstream end of the flow channel to assure adequate water over the UV lamps. An automatic cleaning system having a hydraulic or pneumatic primary driver shall be installed. A programmable logic controller (PLC) based system controller shall be utilized to vary the applied ultraviolet radiation dose based on the volumetric flow passing through the flow channel. The liquid transmittance value shall be operator adjustable via periodic testing with a handheld UV transmittance meter. Two banks of lamps will be installed in parallel within the flow channel: one firm bank and one standby bank. The process equipment shall meet disinfection requirements at the design average daily flow with one bank out of service. The process equipment shall operate all banks at full power to provide the requisite dose for peak flow conditions. Design parameters are provided in the table below.

Table 5-2. UV Disinfection Process Design Parameters

	Design Criteria
PDF (MGD)	1.08
Disinfection Limit	206 E. Coli monthly geomean, 1,030 E. Coli weekly geomean
Peak Dose	20,000 µW-sec/cm² based on T1 35,000 µW-sec/cm² based on MS2
UV Transmittance	60%

Design Criteria	
Proposed Equipment Summary	
No. of Channels	1
No. of Banks (Duty)	1 (at average daily design flow)
No. of Banks (Redundant)	1 (at average daily design flow)
No. of Modules/Bank	3
No. of Lamps/Module	4
Total No. of Lamps	24
Channel Depth (FT)	4'-8""
Channel Length, not including weir (FT)	28.83
Channel Width (FT)	1'-8"
Level Control	Fixed Serpentine Weir

5.2.1 Calculations

This process was designed in order to achieve the required disinfection limit.

5.3 Effluent Flow Measurement

The purpose of this flow measurement is to determine the daily total as well as instantaneous volumetric flowrate of treated effluent leaving the the WWTP at Outfall #001. Effluent flow measurement shall be performed via a 6-in electromagnetic flow meter. The flow meter shall be installed immediately downstream of the UV Disinfection process and provide instantaneous volumetric flow data to the UV disinfection process for dose pacing.

Table 5-3. Effluent Flow Measurement Design Parameters

Design Criteria	
Min Day Flow, MGD*	0.033
ADF, MGD	0.362
PF, MGD	1.08
Parshall Flume Summary	
Throat Width, IN	6.0
Min Volumetric Flowrate, GPM	200.0
Maximum Volumetric Flowrate, GPM	1,754

* Estimated minimum day flow, no flow project applied.

5.3.1 Calculations

Process calculations are provided below.

H_{PDF} = (PDF / 1.331)$^{0.6329}$ = (1.08 MGD / 1.331)$^{0.6329}$ = 0.876 FT

H_{ADF} = (ADF / 1.331)$^{0.6329}$ = (0.362 MGD / 1.331)$^{0.6329}$ = 0.439 FT

H_{MInDay} = (Min Day Flow / 1.331)$^{0.6329}$ = (0.03 MGD / 1.331)$^{0.6329}$ = 0.096 FT

5.4 Aerobic Digestion

The purpose of aerobic digestion is to stabilize and reduce the volume of the sludge prior to land application. WAS is pumped to the aerobic digester. Volatile solids in the sludge are reduced prior to thickening and transfer of the sludge to the sludge storage basin for holding.

Table 5-4. Aerobic Digestion Design Parameters

Flow and Loading	
Max Month BOD_5 Loading (lbs BOD_5/day)	569
Average Day BOD_5 Loading (lbs BOD_5/day)	339
Sludge Yield Coefficient	0.84
VSS Reduction in Digester, %	39.0% (Winter) 46% (Summer)
WAS % Solids, %	0.5
Digested Sludge % Solids after decant.	2.0
Sludge Production, lbs d-1	478
WAS Volume, gpd	11,383
Aerobic Digester Criteria	
Digester volume, cu. FT.	14,432
Digester Dia, FT	35
Digester SWD, FT	15
VSS Reduction, lbs d^{-1}	149 (Max Month, Winter)
SRT, d	40 (Max Month, Winter)

5.4.1 Calculations

Process calculations are provided below.

Daily Waste Volume

WAS (lbs d^{-1}) = Max Month BOD_5 Loading (lb d^{-1}) * Sludge Yield Coefficient
WAS (lbs d^{-1}) = 569 lbs BOD_5 d^{-1} * 0.84
WAS (lbs d^{-1}) = 477.9

Volatile Solids Destruction

$VSS_{destruction}$ (lbs d^{-1}) = Volatile fraction * WAS (lbs d^{-1})* %VSSreduction
$VSS_{destruction}$ (lbs d^{-1}) = 0.80 * 477.9 lbs d^{-1}* 0.39 (39% VSS reduction for 480 DEG C days)
$VSS_{destruction}$ (lbs d^{-1}) = 149.1

Required Digester Volume

Target SRT for Sludge Basin = 75 days

Total Mass Wasted (lbs) = SRT (days) * WAS (lbs/day)
Total Mass Wasted (lbs) = 40 days * 478 lbs d^{-1}= 19,120

Total Mass Destroyed (lbs) = SRT (days) * $VSS_{destruction}$
Total Mass Destroyed (lbs) = 40 days * 478 lbs d^{-1} = 5,964

Net Storage Required, Ms (lbs) = 19,120 lbs – 5,964 lbs = 13,156

Volume Required (gallons) = Ms / (ρ * S.G. * ps)
Volume Required (gallons) = 13,156 lbs / (8.34 lbs FT^{-3} * 1.007 * 0.020) = 78,324

6 Instrumentation

Instrumentation selection will be based on reliability and maintenance considerations. Analog instruments will communicate via 4-20mA signals and digital signals to provide the operator local indication of process status.

The following is a representative list of the type of instruments proposed for specific applications:

- Wetwell / Liquid Level:
  - sealed PVC coated mercury-free weighted float level switches will also be utilized. Float switches are a proven industry standard reliable backup technology. Float switches also enable hardwire interlocks with motor control circuits for failsafe operation.
- Open channel flow meter: multi-path acoustic transit time meter. Technology enables accurate measurement of open channels of any geometry with variable level with built in redundancy. Device is suitable for use on wastewater with low inorganic particulates and minimal entrained air.
- In-Line Pressure Indication: standard pressure gauge. For pressure gauges in liquid sludge applications, a diaphragm will be placed between the liquid and the gauge.