INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.
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Eric J. Holcomb
Governor

Brian C. Rockensuess
Commissioner

March 22, 2023

VIA ELECTRONIC MAIL

Mr. R. Daniel Stevens, Director of Administration
Hamilton County Building Corporation
1 Hamilton County Square, Suite 157
Noblesville, Indiana 46060

Dear Mr. Stevens:

Re: 327 IAC 3 Construction
Permit Application
Bakers Corner WWTP
Permit Approval No. 24943
Bakers Corner, Indiana
Hamilton County

The application, plans and specifications, and supporting documents for the above-referenced project have been reviewed and processed in accordance with rules adopted under 327 IAC 3. Enclosed is the Construction Permit (Approval No. 24943), which applies to the construction of the above-referenced proposed water pollution treatment/control facility to be located approximately 750 feet south and 600 feet west of the intersection of East 241st Street and U.S. Route 31 near the unincorporated community of Bakers Corner.

Please review the enclosed permit carefully and become familiar with its terms and conditions. In addition, it is imperative that the applicant, consulting architect/engineer (A/E), inspector, and contractor are aware of these terms and conditions.

It should be noted that any person affected or aggrieved by the agency's decision in authorizing the construction of the above-referenced facility may, within fifteen (15) days from date of mailing, appeal by filing a request with the Office of Environmental Adjudication for an adjudicatory hearing in accordance with IC 4-21.5-3-7 and IC 13-15-6. The procedure for appeal is outlined in more detail in Part III of the attached construction permit.

Plans and specifications were prepared by Wessler Engineering, and certified by Ms. Kathleen M. Ziino, P.E., and submitted for review on December 9, 2022, with additional information submitted on February 1, 17, 28, and March 3, and 8.

Any technical/engineering questions concerning this permit may be addressed to Ms. Alissa O'Donnell, of our staff, at 317/232-8646.

Sincerely,

Kevin D. Czerniakowski

Kevin D. Czerniakowski, P.E.
Section Chief
Facility Construction and
Engineering Support Section
Office of Water Quality

Project No. P-25686
Enclosures
cc: Hamilton County Health Department
Wessler Engineering

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
AUTHORIZATION FOR CONSTRUCTION OF WATER POLLUTION TREATMENT/CONTROL FACILITY
UNDER 327 IAC 3

DECISION OF APPROVAL

The Hamilton County Building Corporation, in accordance with the provisions of IC 13-15 and 327 IAC 3 is hereby issued a permit to construct the water pollution treatment/control facility to be located approximately 750 feet south and 600 feet west of the intersection of East 241st Street and U.S. Route 31 near the unincorporated community of Bakers Corner. The permittee is required to comply with requirements set forth in Parts I, II and III hereof. The permit is effective pursuant to IC 4-21.5-3-4(d). If a petition for review and a petition for stay of effectiveness are filed pursuant to IC 13-15-6, an Environmental Law Judge may be appointed for an adjudicatory hearing. The force and effect of any contested permit provision may be stayed at that time.

NOTICE OF EXPIRATION DATE

Authorization to initiate construction of this pollution treatment/control facility shall expire at midnight one year from the date of issuance of this permit. In order to receive authorization to initiate construction beyond this date, the permittee shall submit such information and forms as required by the Indiana Department of Environmental Management. It is requested that this information be submitted sixty (60) days prior to the expiration date to initiate construction. This permit shall be valid for a period of five (5) years from the date below for full construction completion.

Issued on March 22, 2023, for the Indiana Department of Environmental Management.

Kevin D. Czerniakowski

Kevin D. Czerniakowski, P.E.
Section Chief
Facility Construction and
Engineering Support Section
Office of Water Quality

WATER POLLUTION TREATMENT/CONTROL FACILITY DESCRIPTION

Bakers Corner is currently an unsewered community in Hamilton County. The Indiana Department of Transportation (INDOT) is converting the intersections of 236th and 276th Streets with US-31 to interchanges. The INDOT US-31 project is anticipated to increase access to and encourage commercial and residential development in the Bakers Corner community and surrounding areas. To accommodate this growth, sanitary infrastructure will need to be built, and the Hamilton County Building Corporation intends to construct a new wastewater treatment plant (WWTP). The proposed WWTP average and peak hourly flow capacities will be 0.5 MGD and 2.25 MGD, respectively. The proposed project will include but is not limited to the following:

- Construction of a new outdoor screening structure with a mechanical in-channel fine screen and removable manually cleaned coarse bar bypass screen
- Construction of a new 8 ft x 8 ft x 11 ft RAS feed structure
- Construction of two (2) single channel oxidation ditches with fine bubble membrane diffusers, two (2) 6.2-HP submersible mixers, and three (3) positive displacement blowers capable of 164 cfm, each
- Construction of a new control building which houses the laboratory, office, bathroom, electrical room, and chemical phosphorus removal facilities
- Installation of two (2) 250 gallon chemical totes, 535 gallon spill containment unit, two (2) 0-31 GPH chemical metering pumps, 3/4-inch PVC chemical feed tubing inside 6-inch PVC carrier piping, and combination safety shower/eyewash unit.
- Construction of two (2) 40 ft diameter secondary clarifiers
- Construction of a new RAS/WAS pump station and installation of three (3) submersible pumps (2 duty, 1 standby) each capable of 175 gpm
- Construction of a new RAS/WAS metering structure and installation of two (2) 4-inch electromagnetic flow meters (one on each line to either the RAS feed structure or the polymer dewatering building)
- Construction of a new ultraviolet (UV) light disinfection and cascade post-aeration structure and installation of a new parshall flume effluent flow meter
- Construction of a new polymer dewatering building and installation of a 55 gallon polymer drum, 66 gallon spill containment unit, chemical pump, and static mixer
- Construction of a new 30 ft x 31 ft concrete dewatering pad with trench draining and installation of two (2) roll-off dumpsters w/ geotextile bags
- Construction of a new plant drain pump station and installation of two (2) submersible pumps each capable of 200 gpm
- Installation of a standby 200 kW diesel generator

CONDITIONS AND LIMITATIONS TO THE AUTHORIZATION FOR CONSTRUCTION OF WATER POLLUTION TREATMENT/CONTROL FACILITY

During the period beginning on the effective date of this permit and extending until the expiration date, the permittee is authorized to construct the above described water pollution treatment/control facility. Such construction shall conform to all provisions of State Rule 327 IAC 3 and the following specific provisions:

PART I

SPECIFIC CONDITIONS AND LIMITATIONS TO THE CONSTRUCTION PERMIT

Unless specific authorization is otherwise provided under the permit, the permittee shall comply with the following conditions:

1. Additional treatment facilities shall be installed if the proposed facilities prove to be inadequate or cannot meet applicable federal or state standards.

2. Any local permits required for this project, along with zoning or easement acquisition, shall be obtained before construction is initiated.

3. If pollution or nuisance conditions are created, immediate corrective action will be taken by the permittee.

4. If construction is located within a floodway, a permit may also be required from The Department of Natural Resources prior to the start of construction. It is the permittee's responsibility to coordinate with that agency and obtain any required approvals if applicable. Questions may be directed to the Technical Services Section, Division of Water at 317/232-4160.

5. Plans for the outfall structure shall be submitted to the Department of Natural Resources for consideration of approval prior to the start of construction.

Failure to meet guidelines as set forth in the above conditions could be subject to enforcement proceedings as provided by 327 IAC 3-5-3.

PART II

GENERAL CONDITIONS

1. No significant or material changes in the scope of the plans or construction of this project shall be made unless the following provisions are met:
   a. Request for permit modification is made 60 days in advance of the proposed significant or material changes in the scope of the plans or construction;
   b. Submit a detailed statement of such proposed changes;
   c. Submit revised plans and specifications including a revised design summary; and
   d. Obtain a revised construction permit from this agency.
2. This permit may be modified, suspended, or revoked for cause including, but not limited to the following:
   a. Violation of any term or conditions of this permit:
   b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.
3. Nothing herein shall be construed as guaranteeing that the proposed water pollution treatment/control facility shall meet standards, limitations or requirements of this or any other agency of state or federal government, as this agency has no direct control over the actual construction and/or operation of the proposed project.

PART III

NOTICE OF RIGHT TO ADMINISTRATIVE REVIEW

Anyone wishing to challenge this construction permit must do so by filing a Petition for Administrative Review with the Office of Environmental Adjudication (OEA), and serving a copy of the petition upon IDEM. The requirements for filing a Petition for Administrative Review are found in IC 4-21.5-3-7, IC 13-15-6-1 and 315 IAC 1-3-2. A summary of the requirements of these laws is provided below.

A Petition for Administrative Review must be filed with the Office of Environmental Adjudication (OEA) within fifteen (15) days of the issuance of this notice (eighteen (18) days if notice was received by U.S. Mail), and a copy must be served upon IDEM. Addresses are:

Director
Office of Environmental Adjudication
Indiana Government Center North
Room 103
100 North Senate Avenue
Indianapolis, Indiana 46204

Commissioner
Indiana Department of Environmental Management
Indiana Government Center North
Room 1301
100 North Senate Avenue
Indianapolis, Indiana 46204

The petition must contain the following information:

1. The name, address and telephone number of each petitioner.
2. A description of each petitioner's interest in the permit.
3. A statement of facts demonstrating that each petitioner is:
    a. a person to whom the order is directed;
    b. aggrieved or adversely affected by the permit; or
    c. entitled to administrative review under any law.
4. The reasons for the request for administrative review.
5. The particular legal issues proposed for review.
6. The alleged environmental concerns or technical deficiencies of the permit.
7. The permit terms and conditions that the petitioner believes would be appropriate and would comply with the law.
8. The identity of any persons represented by the petitioner.
9. The identity of the person against whom administrative review is sought.
10. A copy of the permit that is the basis of the petition.
11. A statement identifying petitioner's attorney or other representative, if any.

Failure to meet the requirements of the law with respect to a Petition for Administrative Review may result in a waiver of the Petitioner's right to seek administrative review of the permit. Examples are:

1. Failure to file a Petition by the applicable deadline;
2. Failure to serve a copy of the Petition upon IDEM when it is filed; or
3. Failure to include the information required by law.

If Petitioner seeks to have a permit stayed during the administrative review, he or she may need to file a Petition for a Stay of Effectiveness. The specific requirements for such a Petition can be found in 315 IAC 1-3-2 and 315 IAC 1-3-2.1.

Pursuant to IC 4-21.5-3-17, OEA will provide all parties with notice of any pre-hearing conferences, preliminary hearings, hearings, stays, or orders disposing of the review of this action. Those who are entitled to notice under IC 4-21.5-3-5(b) and would like to obtain notices of any pre-hearing conferences, preliminary hearings, hearings, stays, or orders disposing of the review of this action without intervening in the proceeding must submit a written request to OEA at the address above.

More information on the review process is available at the website for the Office of Environmental Adjudication at http://www.in.gov/oea.

Wastewater Treatment Facility Design Summary

I. GENERAL

1. Applicant: Hamilton County Building Corporation
2. Facility Name: Bakers Corner Wastewater Treatment Plant
3. Project Type: New facility
4. Project Title: Bakers Corner WWTP
5. Project Location: Approximately 750 feet south and 600 feet west of the intersection of East 241st Street and U.S. Route 31
6. Construction Permit Number: 24943
7. Design Engineer: Ms. Kathleen M. Ziino, P.E.
8. Engineering Company: Wessler Engineering
9. NPDES Permit Number: Pending
10. Preliminary Effluent Limitations: March 4, 2022
11. Project Scope
    A. Description of existing treatment facilities: Bakers Corner is currently an unsewered community in Hamilton County.

    B. Description of project needs: The Indiana Department of Transportation (INDOT) is converting the intersections of 236th and 276th Streets with US-31 to interchanges. The INDOT US-31 project is anticipated to increase access to and encourage commercial and residential development in the Bakers Corner community and surrounding areas. To accommodate this growth, sanitary infrastructure will need to be built, and the Hamilton County Building Corporation intends to construct a new wastewater treatment plant (WWTP).

    C. The proposed project will include but is not limited to the following:

        - Construction of a new outdoor screening structure with a mechanical in-channel fine screen and removable manually cleaned coarse bar bypass screen
        - Construction of a new 8 ft x 8 ft x 11 ft RAS feed structure
        - Construction of two (2) single channel oxidation ditches with fine bubble membrane diffusers, two (2) 6.2-HP submersible mixers, and three (3) positive displacement blowers capable of 164 cfm, each
        - Construction of a new control building which houses the laboratory, office, bathroom, electrical room, and chemical phosphorus removal facilities
        - Installation of two (2) 250 gallon chemical totes, 535 gallon spill containment unit, two (2) 0-31 GPH chemical metering pumps, 3/4-inch PVC chemical feed tubing inside 6-inch PVC carrier piping, and combination safety shower/eyewash unit.

- Construction of two (2) 40 ft diameter secondary clarifiers
- Construction of a new RAS/WAS pump station and installation of three (3) submersible pumps (2 duty, 1 standby) each capable of 175 gpm
- Construction of a new RAS/WAS metering structure and installation of two (2) 4-inch electromagnetic flow meters (one on each line to either the RAS feed structure or the polymer dewatering building)
- Construction of a new ultraviolet (UV) light disinfection and cascade post-aeration structure and installation of a new parshall flume effluent flow meter
- Construction of a new polymer dewatering building and installation of a 55 gallon polymer drum, 66 gallon spill containment unit, chemical pump, and static mixer
- Construction of a new 30 ft x 31 ft concrete dewatering pad with trench draining and installation of two (2) roll-off dumpsters w/ geotextile bags
- Construction of a new plant drain pump station and installation of two (2) submersible pumps each capable of 200 gpm
- Installation of a standby 200 kW diesel generator

D. Is project part of an Agreed Order?: No

E. How facility will maintain treatment during construction: Private septic systems will be maintained until the new plant is operational

12. Source of Funding: Indiana Finance Authority State Water Infrastructure Fund (via American Rescue Plan Act) and Local Funds

13. Estimated Total Project Cost: $16,000,000

II. DESIGN DATA

The facility is anticipating flows as low as 0.08 MGD during the initial start-up and near term conditions before significant development can occur in the area.

1. Design Average Flow: 0.5 MGD
   A. Domestic: 0.18 MGD
   B. Industrial/Commercial: 0.32 MGD
   C. Infiltration/Inflow: Minimal

2. Design Peak Hourly Flow: 2.25 MGD

3. Design Waste Strength
   A. CBOD: 200 mg/L
   B. TSS: 200 mg/L
   C. NH_3-N: 25 mg/L
   D. P: 6 mg/L

4. Design Population Equivalent: 4,906 (based on 0.17 lb CBOD/PE influent loading)

5. NPDES Permit Limitation on Effluent Quality
   - A. $CBOD_5$: 10 mg/L (monthly average)
   - B. TSS: 12 mg/L (monthly average)
   - C. NH_3-N: 1.1 mg/L summer and 1.6 mg/L winter (monthly average)
   - D. P: 1.0 mg/L
   - E. pH: 6.0 s.u. (daily min) and 9.0 s.u. (daily max)
   - F. DO: 6.0 mg/L (daily min)
   - G. *E. coli*: 125 count/100 mL (monthly average), 235 count/100 mL (daily max)
6. Sampling Method (Grab or Automatic Sampler) and Location
   - A. Influent: Automatic, screening structure
   - B. Effluent: Automatic, UV disinfection and cascade structure
7. Receiving Stream
   - A. Name: Baker Ditch (tributary to Hinkle Creek)
   - B. Stream Uses: Full body contact recreational use and shall be capable of supporting a well-balanced warm water aquatic community
   - C. 7-day, 1-in-10 year low flow: 0.0 CFS

III. PLANT DETAILS

1. Laboratory type (e.g., on site, third-party testing): On-site
2. Plant site fence provided: Yes, chain-link fence
3. Handrail/grating provided where necessary: Yes, where applicable
4. Flood hazard elevation at 100 year flood: 897.74 ft (estimated)
5. Provisions for mechanical/electrical protection at 100 year flood: Yes, typical structure floor elevation is more than 7 ft above the 100-year flood elevation
6. Type and rating of standby power equipment: 200 kW diesel generator
7. Provisions for removing heavy equipment: Yes, davit cranes (screening, oxidation ditches, RAS/WAS pump station, UV disinfection, and plant drain pump station)
8. Septage/leachate receiving facilities: None

IV. TREATMENT UNITS

Influent Flow Meter (Proposed)
1. Type and size: 9-inch electromagnetic
2. Location description: On the 10-inch effluent line from Lift Station 1
3. Indicating, recording, and totalizing: Yes, SCADA

Screening (Proposed)
1. Type of screening: Mechanical fine screen (in-channel screw)
2. Location description: New screening structure
3. Bypass bar screen provision: Yes, manual bar screen

4. Number and rated capacity: One (1) @ 2.25 MGD
5. Clear opening sizes, bar or perforations: 0.25-inch
6. Slope of unit: 35°
7. Method of unit cleaning: Automated wash-water rinse
8. Method of screening disposal: Dumpster to landfill
9. Method of unit isolation: None, single unit (screen can pivot out of channel)
10. Method of flow split control: None, single unit
11. Additional information: When not in use, the bypass screen is completely removed from the channel (same channel as mechanical). The intention for future plant expansion is to abandon this structure in favor of a larger capacity headworks structure that includes separate screening channels.

RAS Feed Structure (Proposed)

1. Dimensions: 8 ft x 8 ft x 11 ft (5,260 gallons)
2. Additional information: Incoming screened raw influent flows will be mixed with RAS (from the RAS/WAS pump station) and plant drain pump station flows.

Oxidation Ditch (Proposed)

1. Number and dimensions of unit: Two (2)
   - A. Ditch Type: Single channel, non-concentric, no center island
   - B. Ditch Dimensions: 60 ft L x 11 ft W (straight) and 11.5 ft (outer radius)
   - C. Concrete Wall Thickness: 1.16 ft W
   - D. Side water depth and freeboard: 16 ft SWD and 2 ft FB
   - E. Volume: 0.208 MGD, each (0.415 MGD total)
2. Process: Sanitaire Bioloop; Simultaneous Nitrification and Denitrification (SNDN)
3. Hydraulic detention time: 19.9 hrs
4. Organic loading: 15 lb CBOD/1000 ft^3
5. Design MLSS concentration: 2,900 mg/L
6. Design solids retention time: 12.9 days
7. Design F/M ratio: 0.111 lb CBOD/day/lb MLVSS
8. Aeration equipment
   - A. Fine bubble diffusers with efficiency of 2.9 lb O_2/HP-hr (~2.2 scfm/diffuser)
   - B. Three (3) PD rotary lobe blowers @ 164 cfm, each (2 duty, 1 standby)
9. Oxygen requirement
   - A. CBOD removal: 917 lb O_2/day
   - B. NH3-N removal: 480 lb O_2/day
10. Total air demand: 1,397 lb O_2/day (AOR) || 2,328 lb O_2/day (SOR)
11. Flow velocity in ditch: 1.17 ft/sec
12. Number and capacity of return sludge pumps: Three (3) @ 175 gpm, each
13. Method of return sludge rate control: Telescopic values control the rate of RAS removal from clarifiers. Submersible RAS pumps draw from RAS wet well and pump it to the RAS/WAS metering structure (controls where it goes).
14. Return sludge rate as % of design average flow: 50 – 150 %

15. Provisions for return rate metering
    A. Type and size: 4-inch electromagnetic
    B. Location: RAS/WAS meter structure
16. Return sludge discharge location: RAS feed structure (after screening)
17. Method of unit isolation: Plug valves on each oxidation ditch influent piping
18. Method of flow split control: N/A; operated in series
19. Additional information: Until the time when flows necessitate having both oxidation ditches operate in series, only one ditch will be in operation and the pass-through gate will be closed. The oxidation ditch influent pipes are designed such that the ditches can be operated with one tank out of service.

Secondary Clarification (Proposed)

1. Type of clarifier: Circular, center feed
2. Number and dimensions of unit: Two (2) @ 40 ft dia.
3. Side water depth and freeboard of unit: 12 ft SWD and 2 ft FB
4. Surface overflow rate
    A. at design average flow: 398 gpd/ft^2 (one clarifier operating)
    B. at design peak hourly flow: 895 gpd/ft^2 (both clarifiers operating)
5. Hydraulic detention time
    A. at design average flow: 5.4 hrs (one clarifier operating)
    B. at design peak hourly flow: 2.4 hrs (both clarifiers operating)
6. Weir loading rate at design peak hourly flow: 9,766 gpd/lin·ft
7. Location of overflow weir: Circular weir, 1 ft 8 in from edge of tank
8. Method of scum collection: Skimmer with beach
9. Method of scum disposal: Drained to RAS/WAS pump station
10. Type of sludge removal mechanism: Scraper with telescoping valves
11. Method of unit isolation: Slide gates (influent splitter box)
12. Method of flow split control: Fixed weirs (influent splitter box)

Chemical Phosphorus Removal (Proposed)

1. Chemical properties
    A. Chemical name: Alum (Aluminum Sulfate)
    B. Weight concentration in solution: 48.5
    C. Specific gravity: 1.335
2. Chemical storage container
    A. Type: Polyethylene tank
    B. Volume: 2,000 gal
    C. Expected storage supply: 46 days
3. Secondary containment
    A. Type: Walled concrete containment pad
    B. Dimensions or volume: 12 ft L x 12 ft W x 2 ft H (2,150 gallons)
4. Number and capacity of chemical feed pumps: Two (2) @ 31.7 gph, each
5. Design chemical feed rate: 2.4 GPH
6. Location(s) of chemical injection: RAS feed structure and oxidation ditch effluent
7. Provisions for adequate mixing at injection point: Added in turbulent conditions

8. Chemical building
   A. Method of ventilation control: Power vented
   B. Method of temperature control: Electric Heater
   C. Safety shower/eyewash equipment: Yes
9. Additional information: Near term flows are anticipated to be very low which would create an excessive storage period if the 2,000 gallon storage tank was installed. As a result, two (2) 250 gallon chemical totes will be installed on top of polyethylene spill containment pallets for near term needs. As the influent flow increases, a new 2,000 gallon storage tank inside a new walled concrete containment pad will be installed.

Ultraviolet Disinfection (Proposed)

1. Open channel or closed-vessel: Open channel
2. Vertical, horizontal, or diagonal lamp orientation: Horizontal
3. Lamp type: Low pressure, high intensity
4. Number of banks: Two (2)
5. Number of modules per bank: Three (3)
6. Number of lamps per module: Four (4)
7. Dosage: 30,000 $\mu Ws/cm^2$
8. Transmittance: 65% minimum
9. Provisions for intensity monitoring: Yes, sensor
10. Type of level control provisions: Serpentine weir
11. Type of bypass provisions: None, banks can be pulled out of channel
12. Type of safety equipment: Yes, face shield, goggles, gloves
13. Automatic or manual cleaning equipment: Automatic

Effluent Flow Meter (Proposed)

1. Type and size: 6-inch throat Parshall flume
2. Location description: In the structure for UV disinfection and post-aeration
3. Indicating, recording, and totalizing: Yes, SCADA

Cascade Post-Aeration (Proposed)

1. Number of steps: Seven (7)
2. Dimensions of steps: 1 ft tall x 1 ft deep x 4 ft wide
3. Total fall: 7 ft

Aerobic Digester (Proposed)

1. Number and dimensions of unit: One (1) @ 36 ft diameter x 24 ft H
2. Side water depth and freeboard of unit: 20.4 ft SWD and minimum 1 ft FB
3. Volume: 155,330 gal (operating at SWD); 182,700 gal (total)
4. Total design sludge loading: 483 lbs/day (includes +15% chemical sludge)
5. Volatile solids percentage: 70% VSS/TSS
6. Design solids retention time: 43 days
7. Type and efficiency of diffusers: Coarse bubble and 0.75 % SOTE
8. Dedicated or shared plant blowers: Dedicated

9. Type and rated capacity of blowers: Two (2) PD rotary lobe @ 623, each
10. Decanting method: Telescoping valve
11. Discharge location of supernatant: Plant drain pump station
12. Additional information: Near term sludge production is anticipated to be very low which would create an excessive retention time if the digester was installed. As a result, only the sludge dewatering bag system will be utilized for near term needs. As the influent flow increases, this digester will be installed to assist in sludge management.

Sludge Dewatering Bag System (Proposed)

1. Number and volume of unit: Two (2) 20 yd^3 roll-off dumpster w/ geotextile bag
2. Type of chemicals added: Polymer
3. Expected solids content of dewatered sludge: 12-14 %
4. Drainage containment provisions: Sloped concrete pad with trench drain
5. Discharge location of drainage: Plant drain lift station (to RAS feed structure)

Final Sludge Disposal (Proposed)

1. Ultimate disposal method of sludge: Landfill
2. Expected solids content of sludge (by the principal method of disposal): 12-14 %
3. Location of disposal site: Licensed third-party hauler
4. Ownership of the disposal site: Licensed third-party hauler
5. Availability of sludge transport equipment: Licensed third-party hauler

Plant Drain Pump Station (Proposed)

1. Location description: WWTP, south of screening structure
2. Type of pump: Submersible, non-clog, centrifugal pumps
3. Number of pumps: Two (2)
4. Constant or variable speed: Constant
5. Design operating capacity and TDH: 200 gpm @ 31 ft (single pump)
6. Operating volume of the wet well: 6,027 gal
7. Detention time in the wet well: 30 min
8. Shutoff valve and check valve in the discharge line: Yes
9. Shutoff valve on suction line: N/A
10. Type of ventilation: Free standing air vent
11. Type of standby power: Plant generator
12. Type of alarm: SCADA
13. Type of bypass or overflow provisions: None
14. Additional information: Discharges enter the RAS feed structure

PROJECT NO.
P-25686

INTRA-OFFICE MEMO

FROM: 327 IAC Construction Permit Coordinator
Engineering Plan Review Section
Office of Water Quality

TO: AJO

permit 24943

SUBJECT: **Project:** Bakers Corner WWTP
Location: Bakers Corner, Hamilton County
 # Units: New WWTP – Influent screening, return activated sludge feed structure, oxidation ditches, secondary clarifiers, RAS/WAS pump station and meter, UV disinfection, cascade aeration, parshall flume, biosolids dewatering, polymer feed system, chemical feed system, laboratory, office, plant drain pump, process and yard piping, valves, emergency power generator, HVAC, electrical, instrumentation, controls mechanical, SCADA system, paving, and landscaping
Received On: 12/9/2022
Wastewater Treatment By: Bakers Corner WWTP

Maintenance Provided By: Hamilton County Building Corporation

WWTP Design Summary ------------ ☑	Should be completely filled out, And match the Preliminary Limits
$ Check---------------------------------- ☑	Not required for State or Federal projects
Signed Application -------------------- ☑	Signed by applicant for SRF projects
Plans and Specifications ------------ ☑	Each page must be signed or sealed by an Indiana P.E.
Potentially Affected Person List ---- ☑	Names and addresses on signed and dated form, mailing list and mailing labels (Code 65-42FC) **- 11**
Preliminary Limits from NPDES---- ☑	New one needed if more than 1 year old - it may need to include information regarding BADCT and Phosphorus Limits
Anti-degradation Assessment------- ☑	Verification from NPDES Section that a preliminary approval is complete

P-25686

APPLICATION FOR WASTEWATER TREATMENT PLANT CONSTRUCTION PERMIT PER 327 IAC 3

State Form 53160 (R8 / 6-22)
Approved by State Board of Accounts, 2022

Indiana Department of Environmental Management
Office of Water Quality
Facility Construction & Engineering Support Section,
Mail Code 65-42FC
100 North Senate Avenue, Room N1255
Indianapolis, IN 46204-2251

APPLICANT	APPLICANT'S ENGINEER
Name ☒ Mr. or ☐ Ms. R. Daniel Stevens	Name ☒ Mr. or ☐ Ms. Kathleen M. Ziino
Name of Organization Hamilton County Building Corporation	Name of Company Wessler Engineering
Address *(number and street, city, state, and ZIP)* 1 Hamilton County Square, Suite 157, Noblesville, IN 46060	Address *(number and street, city, state, and ZIP)* 1130 AAA Way, Carmel, IN 46032
Telephone Number (317) 776-9719	Telephone Number (317) 788-4551
E-Mail Address Dan.Stevens@hamiltoncounty.in.gov	E-Mail Address katez@wesslerengineering.com

NAME AND LOCATION OF PROPOSED FACILITY

Name
Bakers Corner Wastewater Treatment Plant

Location or Project Boundaries
Northwest corner of US31 highway and 236th Street, 0.1 miles West of US31 Highway and 0.4 miles North of 236th street

City or Town
Bakers Corner, Adams Township

County
Hamilton County

PROJECT DESCRIPTION

Describe the scope and/or purpose of this project
The project can be described as construction of a new wastewater treatment plant to provide a more efficient means of wastewater treatment for the citizens of Hamilton County. Major components of the WWTP construction include influent screening structure, return-activated sludge (RAS) feed structure, oxidation ditches, secondary clarifiers, RAS/WAS pump station, UV disinfection and cascade aeration, parshall flume, RAS/WAS meter structure, biosolids dewatering, polymer feed system, chemical feed system, laboratory, office, plant drain pump station, process and yard piping, valves; emergency power generator; HVAC; electrical; instrumentation and controls; mechanical; SCADA system; paving; and landscaping.

FACILITY TYPE

☒ Municipal wastewater treatment facility
☐ Semipublic wastewater treatment facility

PROJECT TYPE

☒ New facility
☐ Expansion or modification of existing facility
☐ LTCP improvements

SOURCE OF FUNDING

☐ IFA's Wastewater State Revolving Fund Loan Program
☐ OCRA's Community Development Block Grant
☐ USDA's Rural Development Loan and Grant Assistance
☒ Local Funds
☐ Private Funds
☒ Other: ARPA Funding

CERTIFICATION AND SIGNATURE

I swear or affirm, under penalty of perjury as specified by IC 35-44.1-2-1 and other penalties specified by IC 13-30-10 and IC 13-15-7-1(3), that the statements and representations in this application are true, accurate, and complete.

Printed Name of Person Signing
R. DANIEL STEVENS

Title
Director of Administration

Check No. 48713
$1,350.00 / 12-8-22
Wessler Eng. Inc.

12-9-22

Signature of Applicant	Date Signed *(month / day / year)* 12 / 7 / 2022

(Please refer to IC 13-30-10 for penalties of submission of false information.)

12-9-22

WASTEWATER TREATMENT PLANT CONSTRUCTION PERMIT FEES

I. The applicants listed below must remit a fee of one hundred dollars ($100) as required by 327 IAC 3-5-5. These applications must be signed by an official of the entity. (*Check all that apply.*)		
☐	County, Municipality, or Township which is defined as a unit under IC 36-1-2-23	
☐	A Nonprofit Organization	
☐	A Conservancy District	
☐	A School Corporation that operates a sewage treatment facility	
☒	A Regional Water or Sewage District	
II. All other applications (including semi-public) will pay the following fees per project type as required by 327 IAC 3-5-5:		
New Wastewater Treatment Plant (not including industrial)		
☒	A. Up to 500,000 gallons per day	$1,250.00
☐	B. Greater than 500,000 gallons per day	$2,500.00
Wastewater Treatment Plant Expansion*		
☐	A. Up to fifty percent (50%) design capacity:	
☐	1. Greater than 500,000 gallons per day	$1,250.00
☐	2. Up to 500,000 gallons per day	$625.00
☐	B. Greater than fifty percent (50%) design capacity	
☐	1. Greater than 500,000 gallons per day	$2,500.00
☐	2. Up to 500,000 gallons per day	$1,250.00
*** NOTE: Modifications of existing facilities which do not include an increase in design capacity (or for reductions of design capacity) are considered to be expansions of 0% design capacity and should remit the appropriate fee per the above fee schedule.**		
Only one (1) of the fees will apply. Checks for the applicable fee shall be made payable to the **Indiana Department of Environmental Management**. Fees shall not be refundable once staff review and processing of the Permit Application has commenced.		

12-9-22

WASTEWATER TREATMENT PLANT DESIGN SUMMARY

I. General

1. Applicant: Hamilton County Building Corporation
2. Facility Name: Bakers Corner Wastewater Treatment Plant
3. Project Title: US31 Corridor Infrastructure Investment Project Phase 1A and 1B, Division 1 - Wastewater Treatment Plant
4. Project Location: Northwest corner of US31 highway and 236th Street, 0.1 miles West of US31 Highway and 0.4 miles North of 236th street
5. Design Engineer: Wessler Engineering
6. Engineering Company: Wessler Engineering
7. NPDES Permit Number: New Facility
   A. Effective date (*month / day / year*): TBD / TBD / TBD
   B. Expiration date (*month / day / year*): TBD / TBD / TBD
8. Project Scope
   A. Description of existing treatment facilities:
   Privately owned septic systems are currently responsible for the wastewater treatment of customers to be served by the new WWTP in Hamilton County, Indiana

   B. Description of project needs:
   The Bakers Corner community is currently unsewered, with each home and business having an individual groundwater well and a septic system. The intersection of US31 and 236th Street is in the process of being upgraded by Indiana Department of Transportation (INDOT) to an interchange, and the supporting frontage roads that will be created are likely to spur growth in the Bakers Corner area. To facilitate this growth, as well as the expected growth at the intersection of US 31 and 276th Street, supporting sanitary and water infrastructure will need to be developed. The proposed WWTP is Division 1 of a project to provide wastewater and water utility services to the area that encompasses the United States Highway 31 (US31) corridor from 216th Street to the Hamilton/Tipton County line in northern Hamilton County. The Division 2 project (separate) will include water and sewer systems.

   C. Description of proposed facilities:
   Major components of the WWTP construction include influent screening structure, return-activated sludge (RAS) feed structure, oxidation ditches, secondary clarifiers, RAS/WAS pump station, UV disinfection and cascade aeration, parshall flume, RAS/WAS meter structure, biosolids dewatering, polymer feed system, chemical feed system, laboratory, office, plant drain pump station, process and yard piping, valves; emergency power generator; HVAC; electrical; instrumentation and controls; mechanical; SCADA system; paving; and landscaping.

   D. Is project part of an Agreed Order?: ☐ Yes ☒ No

   E. How facility will maintain treatment during construction:
   Private septic systems will be maintained until startup of the new plant.
9. Source of Funding: ARPA and Local Funds
10. Estimated Total Project Cost: 16,000,000

read
3/8/23

Certification Seal, Signature, and Date

Printed Name of Engineer
Kathleen M. Ziino, P.E.

Signature Kathleen M Ziino

Date Signed *(month / day / year)*
03 / 07 / 2023

KATHLEEN MARY ZIINO
REGISTERED
No. PE11100108
STATE OF INDIANA
PROFESSIONAL ENGINEER

II. Design Data

1. Design Average Flow (MGD): 0.5 MGD
   - A. Domestic: 0.18 MGD (36%)
   - B. Industrial/Commercial: 0.32 MGD (64%)
   - C. Infiltration/Inflow: Minimal
2. Design Peak Hourly Flow (MGD): 2.25 MGD
3. Maximum Flow Capacity (MGD): 2.25 MGD
   - A. Combination of treatment plant + EQ volume: 2.25 MGD
   - B. Other explanation: N/A
4. Design Waste Strength
   - A. CBOD: 200 mg/L
   - B. TSS: 200 mg/L
   - C. NH_3-N: 25 mg/L
   - D. P: 6 mg/L
   - E. Other: N/A
5. Design Population Equivalent (PE): 4,906 (based on 0.17 lb CBOD/PE influent loading)
6. NPDES Permit Limitation on Effluent Quality
   - A. $CBOD_5$: Monthly: 10 mg/L; Weekly: 15 mg/L
   - B. TSS: Monthly: 12 mg/L; Weekly: 18 mg/L
   - C. NH_3-N: Summer Monthly: 1.1 mg/L; Winter Monthly: 1.6 mg/L
   - D. P: 1 mg/L
   - E. pH: Daily minimum 6.0 s.u.; Daily Maximum: 9.0 s.u.
   - F. DO: Daily minimum: 6.0 mg/L
   - G. Total Residual Chlorine: N/A (UV Disinfection utilized at this facility) mg/L
   - H. *E.coli*: Monthly Average:125 count/100mL
   - I. Other: N/A
7. Sampling Method (Grab or Automatic Sampler) and Location
   - A. Influent: Automatic Sampler; Screening Structure
   - B. Effluent: Automatic Sampler; UV Disinfection and Cascade Structure
8. Receiving Stream
   - A. Name: Baker Ditch tributary to Hinkle Creek
   - B. Stream Uses: Full body contact recreational use and shall be capable of supporting a well-balanced warm water aquatic community
     ☐ and designated as salmonid water and shall be capable of supporting a salmonid fishery

☐ and designated as an impaired water
☐ and classified as an outstanding state resource water (OSRW)
☐ and classified as an outstanding national resource water (ONRW)

C. 7-day, 1-in-10 year low flow: 0 CFS (0 MGD)

III. PLANT DETAILS

1. Laboratory type (e.g., on site, third-party testing): On site
2. Plant site fence provided: Yes, chain-link fence
3. Handrail/grating provided where necessary: Yes where applicable
4. Flood hazard elevation (ft) at 100 year flood: 897.74'
5. Provisions for mechanical/electrical component protection at 100 year flood: Typical structure floor elevation is set at 908.00, more than 7 ft above the 100-year flood elevation
6. Type and rating (kW) of standby power equipment: 200 kW emergency generator
7. Provisions for removing heavy equipment: Yes, davit crane at the screenings structure (fine screen), oxidation ditch (mixers), RAS/WAS pump station, plant drain pump station, and UV disinfection (bulbs)
8. Septage/leachate receiving facilities
   A. Type of preliminary treatment: N/A
   B. Storage and controlled feed provisions: N/A
   C. Location of discharge to treatment process: N/A

IV. Treatment Units

Plant Site Lift Station ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Location description: Plant Drain Lift Station
2. Type of pump: Submersible non-clog centrifugal pumps
3. Number of pumps: 2 Pumps
4. Constant or variable speed: Constant Speed
5. Design operating capacity (gpm) and TDH (ft): 200 gpm at 31' TDH (Single pump running)
6. Operating volume of the wet well (gal): 845.96 gal (Total Wet Well Volume: 6027.75 gal)
7. Detention time in the wet well (min): N/A
8. Shutoff valve and check valve in the discharge line: Yes
9. Shutoff valve on suction line: N/A
10. Type of ventilation: Free standing air vent
11. Type of standby power: Generator
12. Type of alarm: Plant SCADA system shall monitor and display the following alarms: Pump (1,2) Fail, High Level, and Low Level
13. Type of bypass or overflow provisions: N/A
14. Additional Information:

Flow Equalization ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of structure:
2. Number and dimensions (ft) of unit:
3. Side water depth and freeboard (ft) of unit:
4. Volume (gal):
5. Type and size (HP) of mixing equipment:
6. Type of aeration provisions (if applicable):
7. Description of flow return methods and controls:
8. Type of sludge removal provisions:

9. Type and thickness of lagoon liner (if applicable):
10. Additional information:

Influent Flow Meter ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Type and size (in): 8-inch Magnetic Flow Meter
2. Location description: 10-inch effluent line of Lift Station 1 - see Additional Information
3. Indicating, recording and totalizing: Yes, using Plant SCADA System
4. Additional information: Flow meter is part of Division 2 - Water and Sewer of this project

Fat, Oil, and Grease Separation ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type:
2. Location description:
3. Additional information:

Grit Removal ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of grit removal system:
2. Location description:
3. Number and dimensions (ft) of unit:
4. Side water depth and freeboard (ft) of unit:
5. Rated capacity (gpd):
6. Type of bypass provisions:
7. Type of aeration provisions (if applicable):
8. Method of unit isolation:
9. Method of flow split control:
10. Additional information:

Comminutor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of comminutor:
2. Location description:
3. Rated capacity (gpd):
4. Bypass bar screen provision:
5. Additional information:

Screening ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Type of screening: In-channel Screw Fine Screen
2. Location description: Screenings Structure
3. Bypass bar screen provision: Yes, manual bar screen with 1.75-inch O.C. bar spacing
4. Number and rated capacity (gpd): One (1) at 2.25 MGD
5. Clear opening sizes, bar or perforations (in): 0.25-inch openings
6. Slope of unit (°):35 degrees
7. Method of unit cleaning: Spiral screw unit removes debris from channel with automated wash-water to rinse debris prior to compaction
8. Method of screening disposal: Landfill
9. Method of unit isolation: Screen can be pivoted out of channel for maintenance
10. Method of flow split control: N/A
11. Additional information: N/A

Primary Clarification ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of clarifier:
2. Number and dimensions (ft) of unit:
3. Side water depth and freeboard (ft) of unit:
4. Surface overflow rate (gpd/ft^2)
   A. At design average flow:
   B. At design peak hourly flow:
5. Hydraulic detention time (hrs)
   A. At design average flow:
   B. At design peak hourly flow:
6. Weir loading rate at design peak hourly flow (gpd/lin·ft):
7. Location of overflow weir:
8. Method of scum collection:
9. Method of scum disposal:
10. Type of sludge removal mechanism:
11. Method of unit isolation:
12. Method of flow split control:
13. Additional information:

Anoxic Component of Biological Nutrient Removal or Selector Tank ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of anoxic unit/zone:
2. Side water depth and freeboard (ft) of anoxic unit/zone:
3. Hydraulic detention time (hrs):
4. Number and capacity of mixed liquor recycle pumps (gpm):
5. Method of mixed liquor recycle rate control:
6. Mixed liquor recycle rate as % of design average flow:
7. Provisions for mixed liquor recycle rate metering
   A. Type and size:
   B. Location:
8. Mixed liquor recycle discharge location:
9. Method of unit isolation:
10. Method of flow split control:
11. Additional information:

Anaerobic Component of Biological Nutrient Removal or Selector Tank ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of anaerobic unit/zone:
2. Side water depth and freeboard (ft) of anaerobic unit/zone:
3. Hydraulic detention time (hrs):
4. CBOD/TP Ratio:
5. Readily Biodegradable BOD/TP Ratio:
6. Type and size (HP) of mixing equipment:
7. Method of unit isolation:
8. Method of flow split control:

9. Additional information:

Activated Sludge ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Conventional or extended aeration:
2. Number and dimensions (ft) of unit:
3. Side water depth and freeboard (ft) of unit:
4. Hydraulic detention time (hrs):
5. Organic loading at design average flow (lb CBOD/1000 ft^3):
6. Design MLSS concentration (mg/L):
7. Design solids retention time (days):
8. Design F/M ratio (lb CBOD/day/lb MLVSS):
9. Type and efficiency of diffusers (% per ft submergence):
10. Dedicated or shared plant blowers:
11. Type and rated capacity of blowers (cfm):
12. Constant or variable speed blowers:
13. Oxygen requirement (lb O_2/day)
    A. CBOD removal:
    B. NH_3-N removal:
14. Total air demand (cfm):
15. Firm blower capacity (cfm):
16. Type of ventilation in blower room:
17. Number and capacity of return sludge pumps (gpm):
18. Method of return sludge rate control:
19. Return sludge rate as % of design average flow:
20. Provisions for return rate metering
    A. Type and size:
    B. Location:
21. Return sludge discharge location:
22. Method of unit isolation:
23. Method of flow split control:
24. Additional information:

Oxidation Ditch ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Number and dimensions (ft) of unit: Two (2) in series Oxidation Ditches, 11-ft channel width by 60-ft straight wall length (208,000 gallons each)
2. Side water depth and freeboard (ft) of unit: 16-ft SWD; 2-ft freeboard
3. Hydraulic detention time (hrs): 20 hours at ADF; 4.4 hours at PHF (both basins in operation)
4. Organic loading (design average flow, lb CBOD/1000 ft^3): 15 lb BOD/1000 ft3
5. Design MLSS concentration (mg/L): 2,900 mg/L
6. Design solids retention time (days): 12.9 days
7. Design F/M ratio (lb CBOD/day/lb MLVSS): 0.111 lb CBOD/day/lb MLVSS
8. Aeration equipment
    A. Type and number: Three (3) positive displacement rotary lobe blowers (2 duty + 1 standby) @ 164 scfm each
    B. Efficiency (lb O_2/HP-hr): 2.9 lb O2/HP-hr
9. Oxygen requirement (lb O_2/day)
    A. CBOD removal: 917 lb O2/day

B. NH_3-N removal: 476 lb O2/day

10. Oxygen provided (lb O_2/day): 1394 lb O2/day

11. Flow velocity in ditch (ft/sec): 1.17 ft/sec

12. Number and capacity of return sludge pumps (gpm): Three (3) Pumps total; two pumps running in parallel to do 350 GPM at 31.8-ft TDH

13. Method of return sludge rate control: Telescopic Valves control rate of RAS removal from Clarifiers, submersible RAS pumps operate off of the level of the RAS wet well and pump RAS to the RAS/WAS meter structure where manual valves are used to direct RAS/WAS based upon WAS flow calculations.

14. Return sludge rate as % of design average flow: 50 - 100%

15. Provisions for return rate metering
    - A. Type and size: 4" Magnetic Flow Meter
    - B. Location: RAS/WAS Meter Structure

16. Return sludge discharge location: RAS Feed Structure

17. Method of unit isolation: Plug valves on each Oxidation Ditch influent piping

18. Method of flow split control: The influent plug valves upstream of the ditches, the pass through gate, and the oxidation ditch effluent slide gates will be used as the method for flow split control.

19. Additional information: The ditches are designed to operate in series during flows equal to and greater than the average design flow of 0.5 MGD. The facility is anticipating flows as low as 0.08 MGD during the initial start-up of the plant before significant development can occur in the area. The influent pipes are designed such that the ditches can be operated in parallel, or with one tank out of service during the initial start-up phase.

Trickling Filter ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Freeboard (ft) of unit:
3. Type of media:
4. Media specific surface area (ft^2/ft^3):
5. Hydraulic loading (gpm/ft^2):
6. Organic loading (design average flow, lb CBOD/1000 ft^3):
7. Type of recirculation system:
8. Type of ventilation system:
9. Additional information:

Rotating Biological Contactor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Freeboard (ft) of unit:
3. Type of media:
4. Hydraulic detention time (min):
5. Hydraulic loading (gpm/ft^2):
6. Organic loading (design average flow, lb CBOD/1000 ft^2):
7. Method of shaft drive:
8. Supplemental air:
9. Method of unit isolation:
10. Method of flow split control:
11. Additional information:

Sequential Batch Reactor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of SBR process:
2. Number and dimensions (ft) of unit:
3. Side water depth and freeboard (ft) and volume (gal) of unit
    A. At low water level:
    B. At avg water level:
    C. At high water level:
4. Cycle Time (min)
    A. Fill:
    B. React:
    C. Settle:
    D. Decant and idle:
5. Hydraulic detention time (hrs)
    A. At low water level:
    B. At avg water level:
    C. At high water level:
6. Organic loading (lb CBOD/1000 ft^3)
    A. At low water level:
    B. At avg water level:
    C. At high water level:
7. Peak decant rate (gpm):
8. Design MLSS concentration (mg/L):
9. Design solids retention time (days):
10. Design F/M ratio (lb CBOD/day/lb MLVSS):
11. Type and efficiency of diffusers (% per ft submergence):
12. Provisions for retrievable diffusers (when applicable):
13. Number and rating of mixers (HP):
14. Oxygen requirement (lb O_2/day)
    A. CBOD removal:
    B. NH_3-N removal:
15. Total air demand (cfm):
16. Dedicated or shared plant blowers:
17. Type and rated capacity of blowers (cfm):
18. Constant or variable speed blowers:
19. Firm blower capacity (cfm):
20. Type of ventilation in blower room:
21. Method of sludge transfer between tanks:
22. Number and capacity of waste sludge pumps (gpm):
23. Post-equalization or disinfection at peak decanter rate:
24. Method of unit isolation:
25. Method of flow split control:
26. Additional information:

Rotating Algal Reactor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Process Description:
2. Number and dimensions (ft) of tanks:
3. Wheel and media characteristics

A. Wheel diameter (ft):	
B. Wheel surface area (ft^2/wheel):	
C. Internal wheel volume (ft^3):	
D. Percent fill of wheel (%):	
E. Media specific surface area (ft^2/ft^3):	
F. Internal media surface area (ft^2/wheel):	
4. First stage BOD removal	
A. Number of wheels:	
B. Total effective surface area (ft^2):	
C. CBOD loading (lbs CBOD/1,000 ft^2):	
5. Second stage NH_3-N removal	
A. Number of wheels:	
B. Total effective surface area (ft^2):	
C. NH_3-N loading (lbs NH_3-N/1,000 ft^2):	
6. Hydraulic detention time (hrs):	
7. Hydraulic loading (gpd/ft^2):	
8. Type and efficiency of diffusers (SOTE %):	
9. Operational blowers	
A. Air required to move wheel (cfm):	
B. Number of blowers:	
C. Type and rated capacity (cfm):	
D. Constant or variable speed:	
E. Firm blower capacity (cfm):	
10. Scouring blower	
A. Air required to scour (cfm):	
B. Type and rated capacity (cfm):	
C. Constant or variable speed:	
11. Process building	
A. Method of ventilation:	
B. Method of temperature control:	
12. Method of unit isolation:	
13. Method of flow split control:	
14. Additional information:	
Facultative Lagoon	☐ Proposed ☐ Existing ☐ Modification ☒ N/A
1. Continuous or controlled discharge:	
2. Treatment cells	
A. Number:	
B. Dimensions (ft):	
C. Maximum water depth (ft):	
D. Freeboard at maximum water depth (ft):	
E. Volume (gal):	
F. Hydraulic detention time (days):	
G. Organic loading (lbs CBOD/acre/day):	
3. Storage cell (controlled discharge only)	
A. Dimensions (ft):	

B. Maximum water depth (ft):
C. Freeboard at maximum water depth (ft):
D. Volume (gal):
E. Hydraulic storage time (days):
4. Influent pipe location:
5. Effluent pipe location:
6. Slope ratio of embankment (H:V) and top width (ft):
7. Type and thickness of lagoon liner:
8. Method of effluent flow control:
9. Method of stream flow measurement:
10. Type of facilities for multi-level lagoon discharge:
11. Type of mixing equipment (if applicable):
12. Additional information:

Aerated Lagoon ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Treatment cell
A. Number:
B. Dimensions (ft):
C. Maximum water depth (ft):
D. Freeboard at maximum water depth (ft):
E. Volume (gal):
F. Hydraulic detention time (day):
G. Organic loading (lbs CBOD/day):
H. Complete or partial mix:
I. Uncovered or covered/insulated:
2. Settling cell or settling zone within aeration cell
A. Dimensions (ft):
B. Maximum water depth (ft):
C. Freeboard at maximum water depth (ft):
D. Volume (gal):
E. Hydraulic detention time (day):
F. Uncovered or covered/insulated:
3. Aeration equipment
A. Type and number:
B. Rated capacity:
4. Oxygen demand:
5. Influent pipe location:
6. Effluent pipe location:
7. Slope ratio of embankment (H:V) and top width (ft):
8. Type and thickness of lagoon liner:
9. Type of facilities for multi-level lagoon discharge:
10. Additional information:

Secondary Clarification ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Type of clarifier: Circular Mechanical Clarifier
2. Number and dimensions (ft) of unit: Two (2) 40-ft diameter clarifiers

3. Side water depth and freeboard (ft) of unit: 12-ft SWD; 2-ft freeboard
4. Surface overflow rate (gpd/ft^2)
   - A. at design average flow: 199 gpd/ft2
   - B. at design peak hourly flow: 895 gpd/ft2
5. Hydraulic detention time (hrs)
   - A. at design average flow: 5.41 hours with one unit offline
   - B. at design peak hourly flow: 1.97 hrs hours with one unit offline
6. Weir loading rate at design peak hourly flow (gpd/lin·ft): 9,766 gpd/ft
7. Location of overflow weir: 90 degree V-Notches (quantity: 230) in circular weir, 1' from the edge of the tank.
8. Method of scum collection: Collected in scum trough by surface skimmer assembly
9. Method of scum disposal: Drained to RAS/WAS Pump Station
10. Type of sludge removal mechanism: Siphon header with telescoping valve
11. Method of unit isolation: Slide gates in influent splitter box
12. Method of flow split control: Influent splitter box with fixed weirs
13. Additional information:

Submerged Biological Rock Bed Reactor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Process description and seasonal operational procedure:
2. Design unit influent quality (at highest monthly loading from lagoon)
   - A. CBOD (mg/L):
   - B. NH_3-N (mg/L):
   - C. TSS (mg/L):
3. Number and dimensions (ft) of units:
4. Side water depth (ft):
5. Media type, depth (ft), and size distribution (in):
6. Media porosity (%):
7. Insulation layer material and thickness (in):
8. Liner type and thickness (mil):
9. Effective wastewater (media pore) volume in reactor (ft^3):
10. Hydraulic detention time (hrs):
11. CBOD flux rate (lbs CBOD/100 ft^2 media cross-section):
12. NH_3-N loading rate (lbs NH_3-N/1,000 ft^3 media):
13. Type and efficiency of diffusers (SOTE %):
14. Oxygen requirement (lb O_2/day)
   - A. CBOD removal:
   - B. NH_3-N removal:
15. Total air demand (cfm):
16. Type and rated capacity of blowers (cfm):
17. Constant or variable speed blowers:
18. Firm blower capacity (cfm):
19. Type of ventilation in blower room:
20. Method of unit isolation:
21. Method of flow split control:
22. Additional information:

Fixed Media Polishing Reactor ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Process description and seasonal operational procedure:
2. Design unit influent quality (at highest monthly loading from upstream treatment unit)
    - A. CBOD (mg/L):
    - B. NH_3-N (mg/L):
    - C. TSS (mg/L):
3. Number and dimensions (ft) of tanks:
4. Side water depth (ft):
5. Insulation layer material and thickness (in):
6. Media specific surface area for BOD (ft^2/ft^3):
7. BOD loading rate (lbs CBOD/100 ft^2 media):
8. Number of BOD media modules:
9. Media specific surface area for NH_3-N (ft^2/ft^3):
10. NH_3-N loading rate (lbs NH_3-N/100 ft^2 media):
11. Number of NH_3-N media modules:
12. Type and efficiency of diffusers (SOTE %):
13. Oxygen requirement (lb O_2/day)
    - A. CBOD removal:
    - B. NH_3-N removal:
14. Total air demand (cfm):
15. Type and rated capacity of blowers (cfm):
16. Constant or variable speed blowers:
17. Firm blower capacity (cfm):
18. Type of ventilation in blower room:
19. Method of unit isolation:
20. Method of flow split control:
21. Additional information:

Rapid Sand Filtration ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Freeboard (ft) of unit:
3. Filtration rate (gpm/ft^2)
    - A. at design average flow:
    - B. at design peak hourly flow:
4. Type, depth (inch), and size distribution (mm) of filter media:
5. Backwash
    - A. Type of backwash mechanism:
    - B. Number and rated capacity of pumps (gpm):
    - C. Constant or variable speed:
    - D. Source of backwash water:
    - E. Discharge location of backwash water:
6. Air scour (cfm):
7. Capability to chlorinate ahead of the filter:
8. Method and provisions for solids removal:

9. Method of unit isolation:
10. Method of flow split control:
11. Additional information:

Rotating Disc Filter ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Process Description:
2. Number and dimensions (ft) of cells:
3. Outside-in or inside-out flow:
4. Number of discs:
5. Effective submerged filter area (ft^2) per disc:
6. Total submerged filter area (ft^2):
7. Type and filter media pore size (μm):
8. Filtration rate (gpm/ft^2)
   A. at design average flow:
   B. at design peak hourly flow:
9. Solids loading rate ($lbs\ TSS/ft^2$)
   A. at design average flow:
   B. at design peak hourly flow:
10. Backwash
   A. Type of backwash mechanism:
   B. Number and rated capacity of pumps (gpm):
   C. Constant or variable speed:
   D. Source of backwash water:
   E. Discharge location of backwash water:
11. Air scour (cfm):
12. Method and provisions for cell bottom solids removal:
13. Method of unit isolation:
14. Method of flow split control:
15. Additional information:

Chemical Phosphorus Removal ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Chemical properties
   A. Chemical name: Aluminum Sulfate (Alum)
   B. Weight concentration in solution (%):48.5%
   C. Specific gravity: 1.335
2. Chemical storage container
   A. Type: Design: 2000 gal tank; Near-term: HDPE Totes - 2-250 gal
   B. Volume (gal): Design: 2000 gal, Near-term: 250 gallons each, 500 gal total
   C. Expected storage supply (days): 30 days - see Additional information
3. Secondary containment
   A. Type: Design: walled concrete containment pad; Near-term: Polyethylene spill containment pallet
   B. Dimensions (ft) or volume (gal): Design: 12-ft L x 12-ft W x 2-ft H, 2150 gal capacity; Near-term: 5.17-ft L x 5.17-ft W x 2.34-ft H, 535 gal
4. Number and capacity of chemical feed pumps (gpm): Two (2) (1 duty + 1 standby), each with a maximum flow rate of 31.7 gph
5. Design chemical feed rate: 2.4 gph, with no Biological Phosphorous removal at ADF

6. Location(s) of chemical injection: RAS Feed Structure and Oxidation Ditch Effluent
7. Provisions for adequate mixing at injection point: Chemical injection will occur under turbulent conditions at the application site
8. Chemical building
    - A. Method of ventilation control: Powered Vent
    - B. Method of temperature control: Electric Heater
    - C. Safety shower/eyewash equipment: Yes
9. Additional information: Near term flows are anticipated to be very low which would create an excessive storage period if the 2000 gal tank was installed in the near term (almost 220 days). Therefore, totes are being installed in the near term to provide a storage supply anticipated to be just under 30 days. As influent flow increase, increasing chemical usage and decreasing the storage period of the totes, intent is to replace totes with the 2000 gal storage tank outside of the Chemical Room in a walled concrete containment pad. Calculations indicate that the totes will reach 10 days of storage around 0.37 MGD (75% of design capacity) - this is when the 2000 gal tank is intended to be installed.

Two-Day Polishing Pond ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of ponds:
2. Hydraulic detention time (days):
3. Type and thickness of pond liner:
4. Type of scum control:
5. Additional information:

Chlorine Disinfection ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Chemical properties
    - A. Gas, Liquid, or Tablet:
    - B. Compound name:
    - C. Weight concentration in solution (%):
    - D. Specific gravity:
2. Contact Tank
    - A. Dimensions (ft):
    - B. Freeboard (ft):
    - C. Volume (gal):
    - D. Contact time at design peak hourly flow (min):
    - E. Type of scum control:
    - F. Type of bypass provisions:
3. Method of chemical feed
    - A. Type:
    - B. Location:
    - C. Design rate capacity (gpm):
    - D. Dosage (mg/L):
4. Source of the disinfectant feed water:
5. Breakwater tank for the feed water:
6. Chemical storage container
    - A. Type:
    - B. Volume (gal):
    - C. Expected storage supply (days):
7. Secondary containment (if applicable)

  - A. Type:
  - B. Dimensions (ft) or volume (gal):

8. Chemical building
  - A. Method of ventilation control:
  - B. Method of temperature control:
  - C. Safety shower/eyewash equipment:

9. Other safety equipment
  - A. Type:
  - B. Location:

10. Additional information:

Dechlorination ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Chemical properties
  - A. Gas, Liquid, or Tablet:
  - B. Compound name:
  - C. Weight concentration in solution (%):
  - D. Specific gravity:

2. Method of chemical feed
  - A. Type:
  - B. Location:
  - C. Design rate capacity (gpm):
  - D. Dosage (mg/L):

3. Chemical storage container
  - A. Type:
  - B. Volume (gal):
  - C. Expected storage supply (days):

4. Secondary containment (if applicable)
  - A. Type:
  - B. Dimensions (ft) or volume (gal):

5. Chemical building
  - A. Method of ventilation control:
  - B. Method of temperature control:
  - C. Safety shower/eyewash equipment:

6. Other safety equipment
  - A. Type:
  - B. Location:

7. Additional information:

Ultraviolet Disinfection ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Open channel or closed-vessel: Open Channel
2. Vertical, horizontal, or diagonal lamp orientation: Horizontal
3. Lamp type: High Intensity Low Pressure Lamps
4. Number of banks: Two (2)
5. Number of modules per bank: Three (3)
6. Number of lamps per module: Four (4)
7. Dosage (μWs/cm2): 30,000 uWs/cm2

8. Transmittance (%):65 % minimum
9. Provisions for intensity monitoring: Yes, with low UV intensity alarm
10. Type of level control provisions: 336-in Serpentine Weir
11. Type of bypass provisions: UV banks can be pulled out of channel for maintenance
12. Type of safety equipment: Covered channel grating, operator PPE, and warning signs
13. Automatic or manual cleaning equipment: Automatic self-cleaning system
14. Additional information: N/A

Cascade Post-Aeration ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Number of steps: Seven (7)
2. Dimensions of steps (ft): 1-ft tall x 1-ft deep x 4-ft wide
3. Total fall (ft): 7-ft
4. Additional information: N/A

Diffused Air Post-Aeration ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Side water depth and freeboard (ft) of unit:
3. Type and efficiency of diffusers (SOTE %):
4. Dedicated or shared plant blowers:
5. Type and rated capacity of blowers (cfm):
6. Additional information:

Effluent Flow Meter ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Type and size (in): 6" Parshall Flume
2. Location description: UV Disinfection Structure - Upstream of Cascade Aeration System
3. Indicating, recording and totalizing: Yes, via Plant SCADA System
4. Additional information: N/A

Sludge Thickening ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of sludge thickeners:
2. Number and dimensions (ft) of unit:
3. Hydraulic capacity (gpm):
4. Solids capacity (lb/hr):
5. Type of chemicals added:
6. Expected solids content of sludge (%):
7. Additional information:

Anaerobic Digester ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Side water depth and freeboard (ft) of unit:
3. Volume (gal):
4. Total design sludge loading (lbs/day):
5. Volatile solids percentage (%):
6. Design solids retention time (days):
7. Type and size (HP) of mixing equipment:

8. Internal or external heating:
9. Decanting method:
10. Discharge location of supernatant:
11. Additional information:

Aerobic Digester ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Number and dimensions (ft) of unit: 1 above ground tank, 36 ft in diameter, 24 ft high
2. Side water depth and freeboard (ft) of unit: 20.4 ft side water depth, at least 1 foot freeboard
3. Volume (gal): Storage capacity - 182,800 gal, Operating volume - 155,400 gal
4. Total design sludge loading (lbs/day): 900 lb/d
5. Volatile solids percentage (%):39
6. Design solids retention time (days): 30
7. Type and efficiency of diffusers (SOTE %):Coarse bubble, 15.7% SOTE
8. Dedicated or shared plant blowers: Dedicated
9. Type and rated capacity of blowers (cfm): Two (2) positive displacement rotary lobe blowers (1 duty + 1 standby) @ 623 cfm each
10. Decanting method: Telescoping valve within tank
11. Discharge location of supernatant: Plant drain system
12. Additional information: The future aerobic digester will not be installed under near-term conditions. The future aerobic digester will be installed as influent flows reach plant capacity to assist in sludge management.

Aerated Sludge Holding Tank ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Side water depth and freeboard (ft) of unit:
3. Volume (gal):
4. Total design sludge loading (lbs/day):
5. Sludge storage retention time (days):
6. Type and efficiency of diffusers (SOTE %):
7. Dedicated or shared plant blowers:
8. Type and rated capacity of blowers (cfm):
9. Decanting method:
10. Discharge location of supernatant:
11. Additional information:

Sludge Drying Bed ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number and dimensions (ft) of unit:
2. Method of unit isolation:
3. Concrete ramp and runway provisions:
4. Discharge location of drainage:
5. Additional information:

Mechanical Dewatering ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Type of dewatering unit:
2. Number and dimensions (ft) of unit:
3. Hydraulic capacity (gpm):
4. Solids capacity (lb/hr):
5. Type of chemicals added:

6. Expected solids content of dewatered sludge (%):
7. Discharge location of drainage:
8. Additional information:

Sludge Dewatering Bag System ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Number and volume (yd^3) of unit: Two (2) Parallel Geobag Units, 20 yd3 each
2. Type of chemicals added: Polymer
3. Expected solids content of dewatered sludge (%):12-14%
4. Drainage containment provisions: Dumpster on a concrete pad sloped to trench drain, which drains to the Plant Drain Pump Station
5. Discharge location of drainage: From dumpsters to trench to plant drain lift station to RAS feed structure upstream of oxidation ditches
6. Additional information: N/A

Final Sludge Disposal ☒ Proposed ☐ Existing ☐ Modification ☐ N/A

1. Ultimate disposal method of sludge: Haul Off
2. Expected solids content of sludge (by the principal method of disposal): 12-14%
3. Location of disposal site: Landfill
4. Ownership of the disposal site: Contract Basis
5. Availability of sludge transport equipment: Yes
6. Additional information: N/A

V. SEWER COLLECTION SYSTEM

Lift Station ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Location:
2. Type of pump (example: submersible, dry pit):
3. Number of pumps:
4. Constant or variable speed:
5. Design pump rate (gpm) and TDH (ft):
6. Operating volume of the wet well (gal):
7. Average detention time in the wet well (min):
8. Type of standby power/pump provisions:
9. Type of alarm:
10. Additional information:

Low Pressure Sewer Grinder Pump Station ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Number of stations:
2. Number of residential connections per simplex station (two maximum):
3. Design pump rate (gpm) at maximum TDH (ft):
4. Type of alarm:
5. Privately or utility owned and maintained:
6. Additional information:

Vacuum Pump Station ☐ Proposed ☐ Existing ☐ Modification ☒ N/A

1. Location:
2. Total volume of vacuum tank (gal):
3. Operating volume of the vacuum tank (gal):
4. Number and size (HP) of vacuum pumps:

5. Number and type of sewage pumps:	
6. Constant or variable speed:	
7. Design pump rate (gpm) and TDH (ft):	
8. Type of standby power/pump provisions:	
9. Type of alarm:	
10. Additional information:	
Sewer	☐ Proposed ☐ Existing ☐ Modification ☒ N/A
1. Gravity or vacuum sewer:	
2. Type of pipe material:	
3. ASTM/AWWA Standard and SDR/DR:	
4. Diameter and length of sewer (indicate length for each size):	
5. Number of manholes:	
6. Number of vacuum valve pits (if applicable):	
7. Additional information:	
Force Main and Low Pressure Sewer	☐ Proposed ☐ Existing ☐ Modification ☒ N/A
1. Type of pipe material:	
2. ASTM/AWWA Standard:	
3. SDR/DR and pressure class (psi):	
4. Diameter and length of sewer (indicate length for each size):	
5. Additional information:	

IDENTIFICATION OF POTENTIALLY AFFECTED PERSONS

Please list any and all persons whom you have reason to believe have a substantial or proprietary interest in this matter, or could otherwise be considered to be potentially affected under law. Failure to notify a person who is later determined to be potentially affected could result in voiding IDEM's decision on procedural grounds. To ensure conformance with Administrative Orders and Procedures Act (AOPA) and to avoid reversal of a decision, please list all such parties. The letter on the opposite side of this form will further explain the requirements under the AOPA. Attach additional names and addresses on a separate sheet of paper, as needed.

Name
See attached in the end
Address (*number and street)*
City
State
ZIP Code

Name
Address (*number and street)*
City
State
ZIP Code

Name
Address (*number and street)*
City
State
ZIP Code

Name
Address (*number and street)*
City
State
ZIP Code

Name
Address (*number and street)*
City
State
ZIP Code

Name
Address (*number and street)*
City
State
ZIP Code

CERTIFICATION

I certify that to the best of my knowledge I have listed all potentially affected parties, as defined by IC 4-21.5-3-5.

Proposed Facility Name
Bakers Corner Wastewater Treatment Plant

City
Bakers Corner, Adams Township

Printed Name of Person Signing
Kathleen Ziino

County
Hamilton

Signature Kathleen M Ziino

Date Signed (*month / day / year*)
12 / 07 / 2022

12-9-22

Identification of Potentially Affected Persons Instructions

The Administrative Orders and Procedures Act (AOPA), IC 4-21.5-3-5, requires that the Indiana Department of Environmental Management (IDEM) give notice of its decision on your application to the following persons:

- Each person to whom the decision is specifically directed
- Each person to whom a law requires notice be given

The following are the minimum recommendations made as to who should be included in this list:

- All adjoining landowners to the property where the proposed construction is to occur
- All persons or entities with a substantial and direct proprietary interest in the issuance of this permit
- Anyone who is known to have expressed concern or an interest in this particular project or projects in this specific area
- Anyone else whom the applicant may feel that might be potentially affected by the issuance of this permit

IC 13-15-3-1 requires IDEM to provide notice of receipt of a permit application to the following:

- The county executive of a county affected by a permit application
- The executive of a city affected by a permit application
- The executive of a town council of a town affected by a permit application

Under IC 13-15-3-1 (b) IDEM is requesting information necessary to provide such notice to the appropriate officials.

Mailing labels are required to be submitted with your project. These mailing labels need to have the names and addresses of the affected parties along with our mailing code (which is 65-42FC) listed above each affected party listing.

For Example:
65-42FC
JOHN DEERE
111 CIRCLE DR
YOUR CITY IN 44444

65-42FC
Robert W. Holden
1130 AAA Way,
Carmel, IN 46032

65-42FC
Carolyn H Gerth
Trustee of Carolyn H Gerth Rev Trust
1806 S 200 W
Tipton, IN 46072

65-42FC
Gemini Property Group LLC
1318 E 236th Street
Arcadia, IN 46030

65-42FC
Godby Properties LP
14550 Mundy Drive
Noblesville, IN 46030

65-42FC
Michael A & Joni S Summe
1558 E 236th St
Arcadia, IN 46030

65-42FC
Nader & Claire Rezkalla Family Rev Trust
12143 Admirals Landing Blvd
Arcadia, IN 46236

65-42FC
Daniel & Janie Spearman
1556 E 236th St
Arcadia, IN 46030

65-42FC
Judith A Boyd
1552 E 236th St
Arcadia, IN 46030

65-42FC
Estefany M Burgos, Lesly Bibiana Burgos, & Jorge Omar Zaleta JTRS
1554 E 236th St
Arcadia, IN 46030

65-42FC
Hamilton County Board of Commissioners
1 Hamilton County Square Suite 157
Noblesville, IN 46060

65-42FC
State of Indiana
100 N Senate Avenue Room N642
Indianapolis, IN 46204

WESSLER
ENGINEERING

LETTER OF TRANSMITTAL

		DATE: 12/8/22	**JOB NO:** 244721
TO:	Indiana Department of Environmental Management	**FROM:**	Kathleen M. Ziino
	Office of Water Quality, Facility Construction and Engineering Support Section, Mail Code 65-42FC		Wessler Engineering
	100 North Senate Avenue, Rm. N1255		1130 AAA Way
	Indianapolis, Indiana 46204		Carmel, IN 46032
		PHONE:	(317) 788-4551
		E-MAIL:	katez@wesslerengineering.com
RE:	Bakers Corner Wastewater Treatment Plant		

WE ARE SENDING YOU THE FOLLOWING ITEMS: ☒ Attached ☐ Under Separate Cover via

COPIES	DATE	NO.	DESCRIPTION
1	12/8/22	1	Construction Permit Application for the Bakers Corner WWTP
1	12/8/22	2	Project Manual for the Bakers Corner WWTP
1	12/8/22	3	Design plans for the Bakers Corner WWTP
1	12/8/22	4	Check in the amount of $1,350 for the application fee
1	12/8/22	5	List of Potentially Affected Persons and mailing labels
		.	

THESE ARE TRANSMITTED as checked below:

- ☒ For approval
- ☐ For your use
- ☐ As requested
- ☐ For review and comment
- ☐ For Bids due
- ☐ Approved as submitted
- ☐ Approved as noted
- ☐ Returned for corrections
- ☐ Resubmit copies for approval
- ☐ Submit copies for distribution
- ☐ Return corrected prints

REMARKS:

Please accept this Application for Wastewater Treatment Plant Construction Permit on behalf of Hamilton County Building Corporation.

This project includes: influent screening structure, return activated sludge (RAS) feed structure, oxidation ditches, secondary clarifiers, RAS/WAS pump station, UV disinfection and cascade aeration, Parshall flume, RAS/WAS meter structure, biosolids dewatering, polymer feed system, chemical feed system, laboratory, office, plant drain pump station, process and yard piping, valves, emergency power generator, HVAC, electrical; instrumentation and controls, mechanical,; SCADA system, paving, and landscaping.

Please contact Kathleen M. Ziino for any questions on the submittal at (463) 777-8086 or katez@wesslerengineering.com

Received by:	Kathleen M Ziino

COPY TO:	File, Client	**NAME:**	Kathleen M. Ziino
		TITLE:	Project Manager

IDEM- WATER QUALITY

DEC 08 2022

RECEIVED

12-9-22

IDEM

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We Protect Hoosiers and Our Environment.

100 N. Senate Avenue • Indianapolis, IN 46204
(800) 451-6027 • (317) 232-8603 • www.idem.IN.gov

Eric J. Holcomb
Governor

Brian C. Rockensuess
Commissioner

March 4, 2022

VIA ELECTRONIC MAIL

Ms. Kate Ziino
Wessler Engineering
1130 AAA Way
Carmel, IN 46032

Dear Ms. Ziino:

Re: Preliminary Effluent Limitations
Proposed Bakers Corner WWTP
Hamilton County

This letter is in response to your request for preliminary effluent limitations for a proposed Bakers Corner Wastewater Treatment Plant (WWTP). As indicated in your request, the average design flow of the WWTP will be 0.5 MGD. The proposed discharge location will be to Baker Ditch. The $Q_{7,10}$ low-flow of the receiving stream at the point of discharge is considered to be zero cfs.

This letter also serves as notification that supplemental information is required to fully evaluate the proposed discharge. Construction and NPDES permitting may not proceed until the supplemental information specified herein has been submitted to, and been preliminarily approved by, this Office.

Preliminary effluent limitations are impacted by numeric and narrative water quality criteria as well as antidegradation requirements. Current Indiana Antidegradation Standards at 327 IAC 2-1.3-3 contain a provision for all surface waters of the State. The existing uses and the level of water quality necessary to protect existing uses shall be maintained and protected. The antidegradation rules for Indiana are found in 327 IAC 2-1.3.

Before approving a new discharge of treated wastewater, alternatives to the proposed discharge must be evaluated to satisfy antidegradation requirements. If this office makes a preliminary determination that the new discharge is necessary on the basis of economic or social factors, the effluent limitations contained herein (developed to minimize the potential lowering of water quality) may be utilized for construction and NPDES permitting. If this office determines the discharge is not necessary on the basis of economic or social factors, the proposed new discharge will not be allowed, and construction and NPDES permits will not be issued.

ANTIDEGRADATION DEMONSTRATION REQUIREMENTS FOR AMMONIA-NITROGEN

327 IAC 2-1.3-5(a) requires every antidegradation demonstration shall include the following basic information:

(1) The regulated pollutants known or believed to be present in the wastewater and proposed to be discharged.
(2) The estimated concentration and mass loading of all regulated pollutants proposed to be discharged.
(3) The location of the proposed discharge and a map of the area of the proposed discharge that shows the receiving water or waters that would be affected by the new or increased loading, including the area downstream of the proposed discharge.

Every antidegradation demonstration shall include the following necessary information:

(1) The availability, reliability, cost-effectiveness, and technical feasibility of the following:
    (A) No degradation.
    (B) Minimal degradation.
    (C) Degradation mitigation techniques or alternatives.
(2) An analysis of the effluent reduction benefits and water quality benefits associated with the degradation mitigation techniques or alternatives required to be assessed under subdivision (1)(C), including the following:
    (A) A review of pollution prevention alternatives and techniques that includes the following:
        (i) A listing of alternatives and techniques, including new and innovative technologies.
        (ii) A description of how the alternatives and techniques available to the applicant would minimize or prevent the proposed significant lowering of water quality.
        (iii) The effluent concentrations attainable by employing the alternatives and techniques.
        (iv) The costs associated with employing the alternatives and techniques.
        (v) An identification of the pollution prevention alternatives and techniques selected to be employed and an explanation of why those selections were made.
    (B) An evaluation of the feasibility and costs of connecting to an existing POTW or privately owned treatment works, within the vicinity of the proposed new or increased loading, that:
        (i) will effectively treat the proposed discharge; and
        (ii) is willing to accept wastewater from other entities.
    (C) For POTWs, if the proposed significant lowering of water quality is a result of a proposed new or increased loading from one (1) or more indirect dischargers, the analysis shall also include the following:
        (i) The requirements of clause (A) shall be completed for the

indirect discharger or dischargers as well as for the POTW. The POTW may require the indirect dischargers to prepare this information.
(ii) If one (1) or more of the indirect dischargers proposes or does discharge to a combined sewer or sanitary sewer that is connected to a combined sewer, all combined sewer overflows (CSOs) between the point of discharge to the sewer and the POTW shall be identified.

(3) The availability, cost-effectiveness, and technical feasibility of central or regional sewage collection and treatment facilities, including long-range plans for discharges outlined in:
    (A) state or local water quality management planning documents; and
    (B) applicable facility planning documents.
(4) The availability, cost-effectiveness, and technical feasibility of discharging to another waterbody that:
    (A) is not an OSRW; or
    (B) has a higher assimilative capacity for the regulated pollutant.

327 IAC 2-1.3-5(g) requires the antidegradation demonstration include the following social and economic analysis information:(g) For each regulated pollutant in the proposed new or increased loading associated with activities in subsection (f), each antidegradation demonstration shall include the following social and economic analysis information:

(1) The anticipated impact on aquatic life and wildlife, considering the following:
    (A) Endangered or threatened species.
    (B) Important commercial or recreational sport fish species.
    (C) Other individual species.
    (D) The overall aquatic community structure and function.
(2) The anticipated impact on human health.
(3) The degree to which water quality may be lowered in waters located within the following:
    (A) National, state, or local parks.
    (B) Preserves or wildlife areas.
    (C) OSRWs or ONRWs.
(4) The extent to which the resources or characteristics adversely impacted by the lowered water quality are unique or rare within the locality or state.
(5) Where relevant, the anticipated impact on economic and social factors, including the following:
    (A) Creation, expansion, or maintenance of employment.
    (B) The unemployment rate.
    (C) The median household income.
    (D) The number of households below the poverty level.
    (E) Community housing needs.
    (F) Change in population.
    (G) The impact on the community tax base.
    (H) Provision of fire departments, schools, infrastructure, and other necessary public services.
    (I) Correction of a public health, safety, or environmental problem.

(J) Production of goods and services that protect, enhance, or improve the overall quality of life and related research and development.
(K) The impact on the quality of life for residents in the area.
(L) The impact on the fishing, recreation, and tourism industries.
(M) The impact on endangered or threatened species.
(N) The impact on economic competitiveness.
(O) Demonstration by the applicant that the factors identified and reviewed under clauses (A) through (N) are necessary to accommodate important social or economic development despite the proposed significant lowering of water quality.
(P) Inclusion by the applicant of additional factors that may enhance the social or economic importance associated with the proposed discharge, such as an approval that recognizes social or economic importance and is given to the applicant by:
  (i) a legislative body; or
  (ii) other government officials.

In determining whether a proposed discharge is necessary to accommodate important economic or social development in the area in which the waters are located under antidegradation standards and implementation procedures, the commissioner will give substantial weight to any applicable determinations by governmental entities.

Once an antidegradation demonstration has been received by this Office and determined complete, the antidegradation demonstration will be public noticed for a thirty day period requesting comment in accordance with 327 IAC 5-2-11.2. If this office makes a tentative determination to approve the submitted antidegradation demonstration, then construction and NPDES permitting may proceed with the understanding that a final determination will not be made until public input on the tentative decision has been considered. This office will seek public input on the tentative decision during the public participation process for the issuance of the NPDES permit. **It should be noted that the public participation process and/or permit appeal process included in the rules for the issuance of NPDES permits could alter (and possibly make more stringent) the limits that are established in the final NPDES permit or result in the denial of the request.** Should the tentative decision be to deny the antidegradation demonstration, the tentative decision for denial will be public noticed for a thirty day period requesting comment in accordance with 327 IAC 5-2-11.2. The public process for an antidegration demonstration can be found at 327 IAC 2-1.3-6.

Preliminary Effluent Limitations for Sanitary-Type Wastewater

Table 1

	Summer		Winter		
Parameter	Monthly Average	Weekly Average	Monthly Average	Weekly Average	Units
CBOD5	10	15	10	15	mg/l
TSS	12	18	12	18	mg/l
Ammonia-N	1.1	1.6	1.6	2.4	mg/l
Phosphorus	1.0	----	1.0	----	mg/l

Table 2

Parameter	Daily Minimum	Monthly Average	Daily Maximum	Units
pH	6.0	----	9.0	s.u
Dissolved Oxygen	6.0	----	----	mg/l
E. coli	----	125	235	count/100mL

The effluent flow must be measured. The mass limits for $CBOD_5$, NH_3-N, and TSS are calculated by multiplying the average design flow (in MGD) by the concentration value and by 8.345. Summer effluent limits apply from May 1 through November 30 of each year. Winter effluent limits apply December 1 through April 30 of each year.

*The effluent limitations for *E. coli* are 125 colonies/100 ml as a monthly average calculated as a geometric mean and 235 colonies/100 ml as a daily maximum. **Ultraviolet light disinfection or disinfection by other non-halogen compounds is required as a consideration in antidegradation. Disinfection by chlorination or other halogen compounds will require the applicant to demonstrate that disinfection by ultraviolet light is either not technically feasible or that it is not affordable.**

If the preliminary effluent limitations specified above are not acceptable to the discharger, then alternate limitations may be pursued. To pursue alternate limitations, an assessment of alternative feasible treatment technologies comparing the expected effluent concentrations with the expected capital and maintenance costs for each alternative, and the corresponding expected new or increased loading above the level generated by the effluent limits specified above must be submitted for review. The assessment must also include an affordability analysis and justification for selecting the most cost-effective treatment plant design that is affordable. In no case will limitations be approved which will result in exceedances of State water quality standards.

In addition, Indiana Code 13-18-26 requires the permit applicant to certify that the following documents have been prepared and completed for new facilities and/or facility expansions with a design capacity above 0.10 MGD:

- A Life Cycle Cost-Benefit Analysis, as described in IC 13-18-26-3;
- A Capital Asset Management Plan, as described in IC 13-18-26-4; and
- A Cybersecurity Plan, as described in IC 13-18-26-5.

The certification of completion must be submitted to IDEM along with the permit application and must be notarized. IDEM will not issue a permit to an applicant that is subject to IC 13-18-26 if the required certification is not included with the application packet, as required by IC 13-18-26-1(b).

The plans and analyses must be reviewed and revised (as necessary) at least once every five years. A new certification must be submitted to IDEM (with the NPDES renewal application) if any plan or analysis is revised during the five-year review.

If there are any questions regarding design requirements of the construction permit, please contact Ms. Missy Nunnery at 317/232-5579. The NPDES permit will not be issued until the construction permit is finalized.

If there are any questions regarding the antidegradation requirements or NPDES permit requirements, please feel free to contact Jay Hanko at Jhanko@idem.IN.gov or 317/233-0704.

Sincerely,

Leigh Voss

Leigh Voss, Chief
Municipal NPDES Permits Section
Office of Water Quality

Enclosures

EXAMPLE

IC 13-18-26 Certification of Completion
Wastewater

Indiana Code 13-18-26 requires the permit applicant to certify that the following documents have been prepared and completed:

- A Life Cycle Cost-Benefit Analysis, as described in IC 13-18-26-3;
- A Capital Asset Management Plan, as described in IC 13-18-26-4; and
- A Cybersecurity Plan, as described in IC 13-18-26-5.

The certification of completion must be submitted to IDEM along with the permit application, and must be notarized. The plans and analyses must be reviewed and revised (as necessary) at least once every five years. A new certification must be submitted to IDEM (with the NPDES renewal application) if any plan or analysis is revised during the five-year review.

I hereby certify that I am an authorized representative for the permit applicant and pursuant to IC 13-18-26, the permit applicant has developed and completed a life cycle cost-benefit analysis; a capital asset management plan; and a cybersecurity plan that meet the requirements of IC 13-18-26-3, IC 13-18-26-4, and IC 13-18-26-5. To the extent required under IC 13-18-26-6, the plans and analyses are available for public inspection.

____________________	____________________	____________
Permit Applicant (Printed)	Signature	Date
____________________	____________________	____________
Authorized Representative (Printed)	Signature	Date
____________________	____________________	
Notary (Printed)	Signature	

My Commission Expires: ______________

(seal)

WESSLER
ENGINEERING

LETTER OF TRANSMITTAL

DATE: 3/8/23 **JOB NO:** 244721

TO: Indiana Department of Environmental Management
Office of Water Quality, Facility Construction and Engineering Support Section, Mail Code 65-42FC
100 North Senate Avenue, Rm. N1255
Indianapolis, Indiana 46204

FROM: Kathleen M. Ziino
Wessler Engineering
1130 AAA Way
Carmel, IN 46032
PHONE: (317) 788-4551
E-MAIL: katez@wesslerengineering.com

RE: Bakers Corner Wastewater Treatment Plant

WE ARE SENDING YOU THE FOLLOWING ITEMS: ☒ Attached ☐ Under Separate Cover via

COPIES	DATE	NO.	DESCRIPTION
1	3/8/23	1	Response to IDEM Comments on 12/8/22 Application
1	3/8/23	2	Attachments associated with individual responses to comments
1	3/8/23	3	Attachment A – Revised Construction Permit Application
1	3/8/23	4	Attachment B – Updated and New Specification for Project Manual
1	3/8/23	5	Attachment C – Updated and New plan sheets for the design plans

THESE ARE TRANSMITTED as checked below:

☒ For approval
☐ For your use
☐ As requested
☐ For review and comment
☐ For Bids due

☐ Approved as submitted
☐ Approved as noted
☐ Returned for corrections

☒ Resubmit copies for approval
☐ Submit copies for distribution
☐ Return corrected prints

REMARKS:

Please accept this response to the comments associated with the Deficiency Notice received January 18, 2022. Included in this package is our response letter and accompanying attachments along with separate attachments that include the revised construction permit application, along with updated and new specifications and plan sheets for inclusion/replacement in the Project Manual and Design Plans originally submitted on December 8, 2022.

Please contact Kathleen M. Ziino for any questions on the submittal at (463) 777-8086 or katez@wesslerengineering.com

Received by:

IDEM- WATER QUALITY
MAR 08 2023
RECEIVED

Kathleen M Ziino

COPY TO: File, Client

NAME: Kathleen M. Ziino
TITLE: Project Manager

WESSLER
ENGINEERING

More than a Project™

February 1, 2023
Updated March 8, 2023

Ms. Alissa O'Donnell
Indiana Department of Environmental Management
100 N. Senate Avenue, Suite 1200
Indianapolis, IN 46204

IDEM- WATER QUALITY
MAR 08 2023
RECEIVED

Re: Hamilton County US 31 WWTP
IDEM Construction Permit Review

Dear Ms. O'Donnell:

This letter is in response to the technical comments provided in the Deficiency Notice for the Construction Permit Application, Bakers Corner WWTP, Bakers Corner, Indiana, Hamilton County, Project No. P-25686, dated January 18, 2023. This response incorporates updates based on the additional information requested in the February 13, 2023, email from you to Kate Ziino, and as discussed at the meeting held February 20, 2023. Each of the individual items noted in your letter are addressed below. Some responses include updates to the IDEM Construction Permit Application, the Project Manual, and the Design Plans originally submitted on December 8, 2022. For ease in replacing individual sections of these documents, the updated information has been grouped together in the following attachments:

Attachment A: Revised IDEM Construction Permit Application
Attachment B: Updated and New Project Manual Specifications
Attachment C: Updated and New Design Plan Sheets

1. *Please revise the design summary sheet as it appears to contain incorrect or incomplete information. Please send a revised design summary and ensure that it is signed, dated, and stamped. Otherwise provide justification for the following:*
    a. *Plant Details. Please describe the plant's mechanical/electrical protection against a 100-year flood (e.g., proposed levee or buildings constructed 3 feet above floodplain elevation). This information is needed to confirm that the proposed design includes protection against a 100-year flood.*

   Based on information available, the majority of the Bakers Corner WWTP site is outside the floodplain (see Attachment 1A-1, FEMA National Flood Hazard Layer FIRMette map for the floodplain boundary). However, at the time of the submittal of the IDEM Construction Permit Application for the Bakers Corner WWTP, flood elevations were not available on the Indiana Department of Natural Resources (DNR) or Indiana Floodplain Mapping websites.

   Thus, Wessler estimated the 100-year flood elevation shown in the project documents (897.74') utilizing the base flood elevations found in the "IDNR Construction in a Floodway Assessment" Report associated with approved IDNR permit #FW-30671. The IDNR assessment is included in Attachment 1A-2 and the calculations are included in Attachment 1A-3. The 100-year flood elevations for the Bakers Ditch floodway found in the IDNR report were at points downstream of the plant's proposed discharge location, therefore, the 100-year flood elevation was estimated at the desired discharge point. At this 100-year flood elevation (897.74'), the WWTP structures/equipment closest to the floodplain, such as the UV power distribution centers, the UV modules, and the UV storage building, will all be located above this elevation. Typical structure floor elevation is set at 908.00, more than 7 ft above the 100-year flood elevation. Attachment 1A-4 notes the comparison of the 100-year flood elevation to structure elevations as shown on Sheets 6C2 and 10A1 of the complete drawing set. All other WWTP structures, electrical, and mechanical equipment will also be protected from physical damage by the historical 100-year flood.

Attachment 1A-1: FEMA Floodway Report for Hamilton County
Attachment 1A-2: IDNR Construction in a Floodway Assessment
Attachment 1A-3: 100-year Flood Elevation Calculation
Attachment 1A-4: Reference Sheets 6C2 and 10A1

> b. *Treatment Unit, Plant Site Lift Station. IDEM is looking for a different type of alarm to be listed in this section (e.g., visual/audio, telemetry, SCADA).*

The plant SCADA system shall monitor and display the following alarms for the Plant Site Lift Station (Plant Drain Lift Station) as per specification section 13400 2.12 D. 2. And 4.:

a. Pump (1,2) Fail
b. Low Level Alarm
c. High Level Alarm

Additional information has been included in the Plant Site Lift Station section of the design summary. Please see Attachment A, Revised IDEM Construction Permit Application.

The operating volume of the wet well has also been updated to 845.96 gallons from 6027.75 gallons (which represented the total wet well volume).

> c. *Treatment Unit, Influent Flow Meter. Please list what is used for indicating, recording, and totalizing (e.g., circular chart).*

The Bakers Corner WWTP is not designed to accept gravity flow into the plant and will only receive flow from Lift Station No. 1 in the collection system, located on 236th Street, west of the WWTP. The collection system project is Division 2, Water and Sewer, submitted separately from the Bakers Corner WWTP project. Lift Station No. 1 is designed to include a flow meter. The flow meter data shall be indicated, recorded, and totalized at the WWTP using SCADA as per specification section 13400 2.01.

Details of Lift Station No. 1, including location in the collection system, site plan, and pump data sheet from Specification 11200 of the Division 2, Water and Sewer, Project Manual are included in Attachment 1C-1 for reference. Please note that the collection system will also include Lift Station No. 2, however, Lift Station No. 2 will direct flow to Lift Station No. 1, which will pump the combined flow from the two stations to the WWTP.

Attachment 1C-1: Division 2 Lift Station No. 1 details (FOR REFERENCE ONLY)

> d. *Treatment Unit, Effluent Flow Meter. This section was left blank and should be filled out because a Parshall flume appears to be part of the design.*

The design summary has been updated in the revised IDEM Construction Permit Application (Attachment A) to include the same.

2. *Please provide all treatment process design calculations as this is a new wastewater treatment plant. This includes, but is not limited to, aeration, chemical phosphorus removal, and sludge calculations. Please note that there may be approximately 15 to 20% additional chemical sludge (by weight) generated due to phosphorous removal by chemical precipitation.*

   The following design calculations are provided with this response letter:
   - Hydraulic Calculations: see response to Comment 3
   - Pump Curves and Backup Calculations: see response to Comment 4
   - Attachment 2-1: Air Demand Calculations
   - Attachment 2-2: Bioloop System Calculations
   - Attachment 2-3: Clarifier Design Calculations
   - Attachment 2-4: Chemical Phosphorus – Dose and Storage Calculations
   - Attachment 2-5: Cascade Aeration Calculations
   - Attachment 2-6: Sludge Calculations

3. *Please provide the hydraulic calculations to support the water surface elevations as shown on the hydraulic profile sheet 1G6.*

   Hydraulic Calculations are attached for your use in Attachment 3-1.

4. *Please provide pump performance curves as well as superimposed TDH curves for the proposed lift station pumps. Please also send representative system TDH calculations using a design C factor of 120. The expected pump capacity will be located at the point where the TDH system curve intersects the pump performance curve. This information is necessary to verify the lift station pump capacities.*

   Please find the pump curves and backup calculations for the Plant Drain Pump Station in Attachment 4-1 and for the RAS/WAS Pump Station in Attachment 4-2. Regarding the RAS/WAS Pump Station curves: The RAS wet well should normally run closer to the HWL since the wet well is connected to the clarifiers and the clarifiers each have a t-valve that will discharge into the wet well close to that height. The only times that the RAS/WAS pumps will be at the LWL (the traditional level associated with sizing pumps) is when the clarifiers or the wet well is being drained and is nearly complete in that process. Under that draining scenario, the pump will move back on its curve and will pump at a reduced rate, which is acceptable, just reduced from the peak RAS rate.

   Attachment 4-1: Plant Drain Pump Station Curves and Backup Calculation
   Attachment 4-2: RAS/WAS Pump Station Curves and Backup Calculations

5. *The proposed new screening structure raises a number of concerns. Please see the criteria listed below that IDEM utilizes when reviewing treatment plant designs. Please provide sufficient justification for the following questions as to why the guidelines cannot be met and/or revise the design to address any concerns.*
   a. *Ten State Standards 61.123 states that dual channels shall be provided and equipped with the necessary gates to isolate flow from any screening unit. For both the proposed fine screen and coarse screen, the design only provides one channel. The coarse bar screen bypass should be kept separate from the fine screen. Please explain how the plant will continue to operate if the coarse screen become blinded because it is located in the same channel.*

Our understanding of the intent behind the need for two channels is to allow for continued screening even while screening equipment is out of operation. The design of the screw press screen allows for it to be rotated out of the channel flow for maintenance, with no disruption to flow. The manual maintenance bar screen meets the intent of Ten State Standards 61.124, which states that "Where a single mechanically cleaned screen is used, an auxiliary manually cleaned screen shall be provided." Normally the manual maintenance bar screen will be stored on site. The maintenance bar screen will need regular monitoring and cleaning as needed to prevent it from blinding while the screw press screen is rotated out of the channel being serviced.

Also note that for future plant expansion, the intent is to abandon the Screenings Structure and construct a larger capacity headworks structure in the location identified on Sheet 2Y2 as "Future Headworks" west of the Screenings Structure. The future headworks structure would have at least two screens in separate channels and may also include a grit removal system.

b. *According to Sheet 3G1, the manual coarse screen will be used only when the mechanical screen is removed. It's unclear whether the coarse bypass screen is a permanent fixture in the channel or if it'll be removed when not in use. If it's detachable, how will the operator get it into the channel with the Davit crane located over the mechanical fine screen? IDEM has only approved permanent bypass structures in a separate channel, as far as I am aware.*

The bar screen is removed from the channel entirely when not in use. Drawing Sheets 3G1, 3C1, and 3C2, included in Attachment C, Updated and New Design Plan Sheets, have been updated as follows: 1) the name of the screen as been changed to "MAINTENANCE BAR SCREEN", 2) more details have been added to clarify what is permanent and what is removable, and 3) an additional davit crane base will be installed and the davit crane will be portable. In addition, a temporary drainage plate has been added so that when the maintenance bar screen is being cleaned, the screenings are captured.

c. *Ten State Standards 61.125 states that the screen channel invert should be 3 to 6 inches below the invert of the incoming sewer. This is not possible with the proposed design, which has the incoming sewer coming up through the screening channel's ground. Is there any concern that screenings will not be pushed along (swirling near the piping) and will instead accumulate and block the incoming flows?*

The flow from the plant is being pumped into the screenings structure, which is anticipated to keep the screenings in solution. In addition, the expectation is that flow will hydraulically follow the path of least resistance through the screen towards the screening structure effluent drop pipe. In case of any blockage in the piping ahead of the discharge point due to screenings or solids buildup, a cleanout is provided on the force main just upstream of the screenings structure as shown on updated Sheet 3C1 (see Attachment C, Updated and New Design Plan Sheets).

d. *Ten State Standards 61.128 states that screening devices and screening storage areas shall be protected from freezing. The design is located outside rather than inside a building, and specification 11331 (cylindrical fine screen) does not appear to mention any freeze protection.*

The description of the components of the fine screen included in Part 1.01.B of specification 11331 notes that a weather protection package is being provided. A "weather protection package" is not explicitly called out, but is represented by the individual components described in Section 2.02.H on page 11331-5:

The transport tube, press zone, discharge section, and drain tube shall be fitted with 10 watt per foot, self-regulating heating cable, ¾" to 1-1/2" thick closed cell foam insulation, and a 20-gauge type 304 stainless steel jacket. Provide heat trace, insulation, and SS cladding for the screen.

e. *Ten State Standards 61.22 states that two fine screens shall be provided and their capacity shall treat design peak instantaneous flow with one unit out of service. The design includes only one screen, with no explanation as to why a redundant screen is not included for a plant with peak flows of up to 2.25 MGD. Please explain how the plant will operate if this mechanical fine screen is out of service for an extended period of time.*

When the mechanical fine screen is out of service, it will be rotated out of the influent flow and the manual maintenance bar screen will be installed. The maintenance bar screen will need regular monitoring and cleaning as needed to prevent it from blinding while the screw press screen is being serviced. The temporary drainage plate will prevent screenings from falling back into the flow when the maintenance bar screen is being cleaned.

6. *Ten State Standards 65.1 states that the use of flow equalization should be considered where significant variations in organic and hydraulic loadings are expected. When the average design flow to peak hourly design flow ratio is greater than or equal to 3.0, IDEM looks for flow equalization. The proposed design ratio is 4.5. Please adequately justify why no equalization is included.*

The primary driver for the peak/average ratio is the incorporation of a proposed Indiana National Guard armory in the flow projections. Due to the nature of their proposed operations, the facility will have large numbers of visitors at the facility over the course of abbreviated periods of time. This skews the peak/average ratio. However, the equipment for each of the WWTP liquid treatment processes was selected specifically to provide treatment through the anticipated range of design flows and loads (minimum 0.08 MGD through the peak 2.25 MGD). Therefore, flow equalization is not required.

7. *The proposed biological nutrient removal system resembles a previous Sanitaire design that I reviewed (Bioloop oxidation ditch). While I recognize the importance of aerobic and anoxic zones, the proposed new oxidation ditches raise several concerns. Please provide sufficient justification for the following questions and/or revise the design to address any concerns.*

   a. *The design summary states that there are "two (2) in series oxidation ditches," but the process flow diagram (sheet 1G5) and oxidation ditch plan (sheet 4C1) show the oxidation ditches in parallel. Furthermore, the design summary indicates that there is no method for flow split control.*

The ditches are designed to operate in series during flows equal to and greater than the average design flow of 0.5 MGD. A pass-through slide gate (OD-SG01) is provided between the two ditches (shown on Sheet 4C2) to allow for series operation of the oxidation ditches. Please see Attachment 7A-1 for a diagram that shows which valves or gates will be normally open (N.O.) or normally closed (N.C.) during the series operation of the ditches.

The facility is anticipating flows as low as 0.08 MGD during the initial start-up of the plant before significant development can occur in the area. The oxidation ditch influent pipes are designed such that the ditches can be operated in parallel, or with one tank out of service. Until the time when flows necessitate having both oxidation ditches operate in series, only one ditch will be in operation and the pass-through gate will be closed. The influent plug valves (OD-PV01 and OD-PV02) upstream of the ditches and the oxidation ditch effluent slide gates (OD-SG02 and OD-SG03) will be used as the method for flow split control. RAS will be fed upstream to the RAS Feed Structure to allow the operational flexibility when one or both oxidation ditches are in service since the RAS will be fed to a location that is independent of the oxidation ditch flow split control. The piping immediately upstream of the oxidation ditches is arranged to further extend this flexibility, with the intent that one of the influent plug valves will be open and the other one closed to direct flow to either of the oxidation ditches for the low flow conditions or for maintenance. Once the plant receives consistent high flows to necessitate the oxidation ditches running in series, one of the influent valves will be closed. Please see Attachment 7A-2 for a diagram that shows which valves or gates will be normally open (N.O.) or normally closed (N.O.) during the parallel (or one tank out of service) operation of the ditches.

Additional information including method for flow split control, has been added to the design summary (see Attachment A, Revised IDEM Construction Permit Application).

b. *According to the design summary, the F/M ratio is 0.0581 lb CBOD/day/lb MLVSS. However, IDEM calculates an F/M ratio of 0.111 based on the provided information that the design MLSS concentration will be 2,900 mg/L and IDEM's assumption that MLVSS is approximately 75% of MLSS. The F/M ratio should be between 0.05 and 0.10 for an extended aeration design.*

The design summary has been corrected to indicate an F/M ratio of 0.111 lb CBOD/day/lb MLVSS at design conditions. Based on information provided in Attachment 2-2, Bioloop System Calculations, the F/M ratio is 0.103 lb CBOD/day/lb MLVSS at near-term conditions.

Ten State Standards recommend an F/M of 0.05-0.1 for single-stage extended aeration processes and an F/M of 0.2-0.5 for conventional activated sludge. The Bioloop system F/M ratio falls somewhere between the two processes because it is operated as a 2-stage nitrification process (operating the 2 ditches in series). This has been proven at other installations, specifically the Muncie Water Pollution Control Facility WPCF) and Fond du Lac, WI. See Attachment 7B-1 for details on these two facilities. The Muncie WPCF system is similar to the proposed Bakers Corner WWTP as it does not have anaerobic basins upstream of the Bioloop oxidation ditches. See the summary of 2017 Monthly Reports of Operation for the Muncie WPCF and estimated F/M calculations in Attachment 7B-2. In reviewing the 2017 average primary effluent CBOD and MLSS, the F/M ratio calculates to 0.138 lb CBOD/lb MLVSS/day while achieving low effluent CBOD and TSS values (3 mg/L and 5 mg/L, respectively). The F/M ratio at the Bakers Corner WWTP at near-term and design conditions is also included in Attachment 7B-2 for reference.

Attachment 7B-1: Bioloop Reference Plants
Attachment 7B-2: Reference Plant F/M Ratio Review

c. *According to the design summary, the oxygen requirement for CBOD removal is listed as 872 lb O2/day. Ten States Standards 92.331 specifies the oxygen requirements for activated sludge as*

1.1 lb O2/lb BOD, with the exception of 1.5 lb O2/lb BOD for extended aeration. Neither of these is equal to the oxygen requirement stated in the design summary. The oxygen requirement for CBOD in an extended aeration plant is calculated by IDEM to be 1,251 lbs/O2.

The Bioloop system is not a typical extended aeration system – it is an aerobic/anoxic system. Therefore, the oxygen requirements for activated sludge of 1.1 lb O2/lb BOD is the appropriate value to use under design conditions. The initial calculations assumed some BOD would remain in the effluent. We have corrected this assumption to provide enough air to remove all BOD and NH3-N. Based on this correction, the oxygen requirement for CBOD removal is 917 lbs O2/lb BOD. The corrected air demand is presented in Attachment 2-1, Air Demand Calculations. As shown in Attachment 2-1, the corrected air demand under design conditions required a minor correction in the aeration blowers capacity as well. Updated values have been provided in the revised IDEM Construction Permit Application (see Attachment A), as well as the Design Summary on Sheet 1G5 (see Attachment C).

At the near-term flows, this system may be operated as an extended aeration system, rather than the Bioloop aerobic/anoxic system. Therefore, air demand calculations have been developed at oxygen requirements of 1.1 (activated sludge system) and 1.5 lb O2/lb BOD (extended aeration system). Attachment 2-1, Air Demand Calculations, includes the calculated air demand under near-term conditions at both oxygen requirement assumptions. In addition, the blower curve has been provided in Attachment 2-1, which confirms the specified blowers will be able to meet the air demand for both near-term and design conditions. The blowers have VFDs to adjust air supply across the anticipated range of design flows.

Note that the air demand calculations presented in Attachment 2-1 are higher than those included in Attachment 2-2, Bioloop Calculations, for design conditions and a little less for near-term conditions. Under design conditions, Sanitaire included a credit for denitrification that reduced their calculated air demand. The air demand calculations in Attachment 2-1, which are the calculations that sized the blowers, did not include this credit and, therefore, are more conservative under design conditions. Under near-term conditions, the assumptions used are slightly different; however, the calculated air demands are within 10% of each other.

d. The design on sheet 4C1 proposes a limited number of diffusers. The diffusers are shown to occupy roughly one-third of one straight side of the oxidation ditches, accounting for about 14% of the total oxidation ditch volume. There are concerns that there will not be enough diffusers to provide the necessary aeration for treatment without having design calculations to examine.

Per the Bioloop Sanitaire calculations provided during design (Attachment 2-2), seventy-five (75) fine bubble diffusers will be provided per oxidation ditch (total of 150 diffusers). Sanitaire indicated that each diffuser is designed to provide up to 4 scfm. As part of the air demand calculations included in Attachment 2-1, the capacity of the diffusers was compared against the demand of the system and the number of diffusers was confirmed to be sufficient (air supplied is an average of 2.2 scfm/diffuser).

e. Aside from concerns about adequate treatment, there is a large portion of the oxidation ditches where solids could settle. The submersible mixer is placed diagonally on the opposite side, about one-third of the way in on the opposite straight side of the oxidation ditch. There are reservations that the ditch will be unable to keep solids suspended between the diffusers and the submersible mixer, particularly as it travels around the curved wall. According to the design summary, the flow velocity in the ditch is listed as 0.009 ft/sec. According to Ten States Standards 92.333, all *mechanical aeration systems should have an average velocity of 1 ft/s in order to keep all biological solids suspended. Please clarify the discrepancies.*

The original information included in the design summary is velocity through the ditch if the flow was left to its own devices, i.e. Q=V/A. However, the mixers impart a velocity on the flow by mechanically increasing the speed of the flow through the ditch, so the calculated low value is incorrect for the system. Sanitaire has provided velocity data for the mixers as part of the Bioloop design calculations, which are included in Attachment 2-2. The correct velocity, 1.17 ft/s for each oxidation ditch, has been updated in the design summary in the revised IDEM Construction Permit Application (Attachment A).

8. *The proposed chemical phosphorus removal design raises some concerns. The additional information under the chemical phosphorus removal states that "near- term flows are anticipated to be very low with storage supply anticipated to be just under 30 days with toes. As influent flow reaches design ADF, increasing chemical usage, intent is to replace totes with storage tank." The proposed chemical phosphorus building's design does not include any final buildout design details.*
    a. *Rather than explaining that there will be a future capacity increase, the construction permit application is for the full average design flow, and thus the chemical removal facilities must reflect the full flow.*
        i. *Final building information such as storage tank volume and secondary containment, as well as design chemical feed rate and expected storage days, are not included in the design summary and construction drawings.*

The design summary has been updated in Attachment A, Revised IDEM Construction Permit Application to note the needed storage volume at design flow and the anticipated location for the additional storage and containment, which is anticipated to be located outside east of the Chemical Room of the Plant Control Building. Sheets 2Y2, 2Y3, and 9C1 have been updated to show location of additional chemical storage, presented in Attachment C, Updated and New Design Plan Sheets.

Backup calculations for the information provided in Attachment A, Revised IDEM Construction Permit Application and shown on the updated drawings are included in Attachment 2-4.

b. *Because the design essentially calls for both an initial and final buildout, IDEM must see the temporary and permanent chemical removal facilities. This is because IDEM must approve the plant's final design because, even with assurances, it cannot be guaranteed that another construction permit will be submitted in the future when these final buildout changes are needed.*

Attachment C includes updated Sheets 2Y2, 2Y3, and 9C1, which show the planned location for additional chemical storage east of the Chemical Room of the Plant Control Building.

c. *Please demonstrate how a chemical dose and chemical feed pumping rate were established and that it will be adequate to bring the effluent phosphorus concentration to under 1.0 mg/L. Stoichiometric calculations will need to be included as part of the design basis.*

Backup calculation for the information requested is included in Attachment 2-4.

d. Because the storage tank volume is not provided, please provide assurance of a regional supplier and the expected chemical delivery schedule if the total storage volume is less than 10 days.

The backup calculations included in Appendix 2-4 show that the intent is to provide at least 10 days storage at all times. The two 250 gal totes will provide 30 days storage under near term conditions. As the storage time reduces to 10 days (calculated to be when plant reaches approximately 75% capacity), a 2,000-gal tank will be installed in the approximate location shown on updated Sheets 2Y2, 2Y3, and 9C1 in Attachment C, Updated and New Design Plan Sheets.

9. *The RAS/WAS pump station (sheet 5G1) is shown in the design going directly into the polymer feed building (sheet 8C1), which then directs wasted sludge to the geobags for dewatering (sheet 10C1). Please explain why an aerated sludge holding tank was not included as part of the sludge treatment train. How would the plant function if the biosolids dewatering structure and/or geobags were out of commission for an extended period of time? The volume of the RAS/WAS pump station is the only "backup" storage.*

The solids handling system is generally a passive system with polymer injected into the flow as sludge is pumped to the geotextile bags. Two geotextile bags are provided so that one can be filled while the other is under maintenance. The plug valves BDS-PV01 and BDS-PV02 will be used to feed and isolate the geotextile bags as needed. The polymer injection system can be bypassed in the event that the system is out of commission, by opening plug valve PLM-PV03 and closing plug valve PLM-PV02 in the Polymer Feed Building. Additionally, the RAS/WAS wet well has also been sized for average (0.5 MGD) and peak design (2.25 MGD) flows and could help to store sludge during low flow conditions if needed.

The proposed Bakers Corner WWTP is expected to see flow as low as 0.08 MGD during the initial start-up and near-term conditions. Sludge production is anticipated to be very low during this period (less than 3,000 gallons per day). The geotextile bags are designed to receive sludge flow of approximately 100 gpm, which equates to wasting 3.5 hours per 7-day week, with each geotextile bag anticipated to take a month to fill under near-term conditions. Based on these design calculations, the sludge dewatering geotextile bags will be sufficient to handle the sludge wasting directly from the RAS/WAS pump station under near-term conditions.

Under design conditions of 0.5 MGD, the anticipated wasting schedule is 21.7 hours per 7-day week without an aerobic digester for sludge storage. Each geotextile bag is anticipated to be filled in 5 days with WAS pumped 7-8 hours per day for 3 days per 7-day week. As flows increase to the WWTP, the Hamilton County Regional Utility District will need to perform a cost analysis to determine when adding aerobic digester(s) upstream of the polymer feed building and downstream of the RAS/WAS meter structure is more cost effective than hauling geotextile bags to the landfill. With an aerobic digester storage tank sized for 30 days of storage, wasting is calculated to occur less than 5 hours per 7-day week, with each geotextile bag anticipated to take 23 days to fill under design conditions.

The plans and specifications have been updated as follows to include information regarding the future aerobic digester: The process flow diagram and design summary have been updated on Sheet 1G5, included in Appendix C, Updated and New Design Plan Sheets. The overall site plan (Sheet 2Y2, also included in Appendix C) and the Site Piping Plan (Sheet 2Y3) have been updated to indicate the proposed location of the future digester, along with future sludge piping and associated pump station, to be installed when sludge management warrants the need. In addition, both sheets indicate the space reserved for the future sludge storage area over and above the future digester for additional sludge management. Sheets have been added to Area 8 for the future digester (8G2, 8C3, and 8C4).

Specifications 11335 - Glass-lined Wastewater Treatment Tank, and 11374 - Coarse Bubble Aeration Equipment, have been added to the Project Manual, the blower associated with the aerobic digester has been added to the data sheet in Specification 11370 - Positive Displacement Blowers and Accessories, and the Table of Contents has been updated. The design summary has been updated in the revised IDEM Construction Permit Application in Appendix A to include information on the future aerobic digester.

The calculations to develop the design are included in Attachment 2-6. Updates to the design summary are included in Attachment A, Revised IDEM Construction Permit Application. The new specifications and updated table of contents are included in Attachment B, Updated and New Project Manual Specifications. Updated Sheets 1G5, 2Y2, 2Y3, and the new future digester sheets are included in Attachment C, Updated and New Design Plan Sheets.

10. *According to the process flow diagram (sheet 1G5), the RAS feed structure has a volume of 1,088 ft3. The internal dimensions of the RAS feed structure plan (sheet 10C1) are 8 ft x 8 ft x 11 ft (704 ft3) and the external dimensions are 9.25 ft x 9.25 ft x 11 ft (941 ft3). The dimensions shown on the plans do not match the volume stated on sheet 1G5. Please clarify the discrepancies.*

    The volume shown on the process flow diagram on Sheet 1G5 was a calculation error and has been corrected to match the internal RAS Feed Structure dimensions and a volume of 704 ft3. This value has also been updated on Sheet 1G5 in Attachment C, Updated and New Design Plan Sheets.

11. *The 100-year flood water elevation is marked on the hydraulic profile (sheet 1G6) as 897.74 ft. At this elevation, it appears that half of the cascade post-aeration steps, the effluent piping, and the outfall are all submerged. How would the wastewater treatment plant function in these circumstances? Please also revise the design to include backflow prevention on the effluent line to prevent the Baker Ditch tributary from flooding the effluent piping.*

    The receiving water body is a ditch, not a pond or lake. Therefore, the hydraulics were calculated based on the expectation that the water in Baker Ditch is flowing, even under flood conditions. Since the 100-year flood elevation is lower than the elevations of the UV structure and Parshall flume, as discussed in the response to Comment 1A, flow will continue to flow out of the WWTP. The effluent hydraulics and piping have been designed to account for any back pressure associated with a flooded ditch condition, which will allow plant effluent to flow to the ditch during a 100-year flood condition. The effluent will continue to receive some aeration across the unflooded steps.

    Since the system is designed to allow the effluent flow to always flow away from the WWTP, we do not feel a backflow preventer to the effluent line is necessary. In addition, a backflow preventor would create additional headloss that would make effluent hydraulics worse. Other WWTPs around the state have submerged effluent pipes under 100-year flood conditions without backflow prevention. Examples of this configuration include Newton County Regional Water and Sewer District WWTP and Town of Whiteland WWTP.

12. *Specification 11200 (submersible non-clog centrifugal pumps) was not included. Please provide this missing specification as the project manual progresses from 10523 (fire extinguishers) to 11260 (UV disinfection equipment).*

    Please see Attachment B, Updated and New Project Manual Specifications, for Specification 11200 missing from the project manual submitted with the original IDEM Construction Permit Application.

Sincerely,

WESSLER ENGINEERING

Kathleen M Ziino

Kathleen Ziino, P.E.
Senior Project Manager

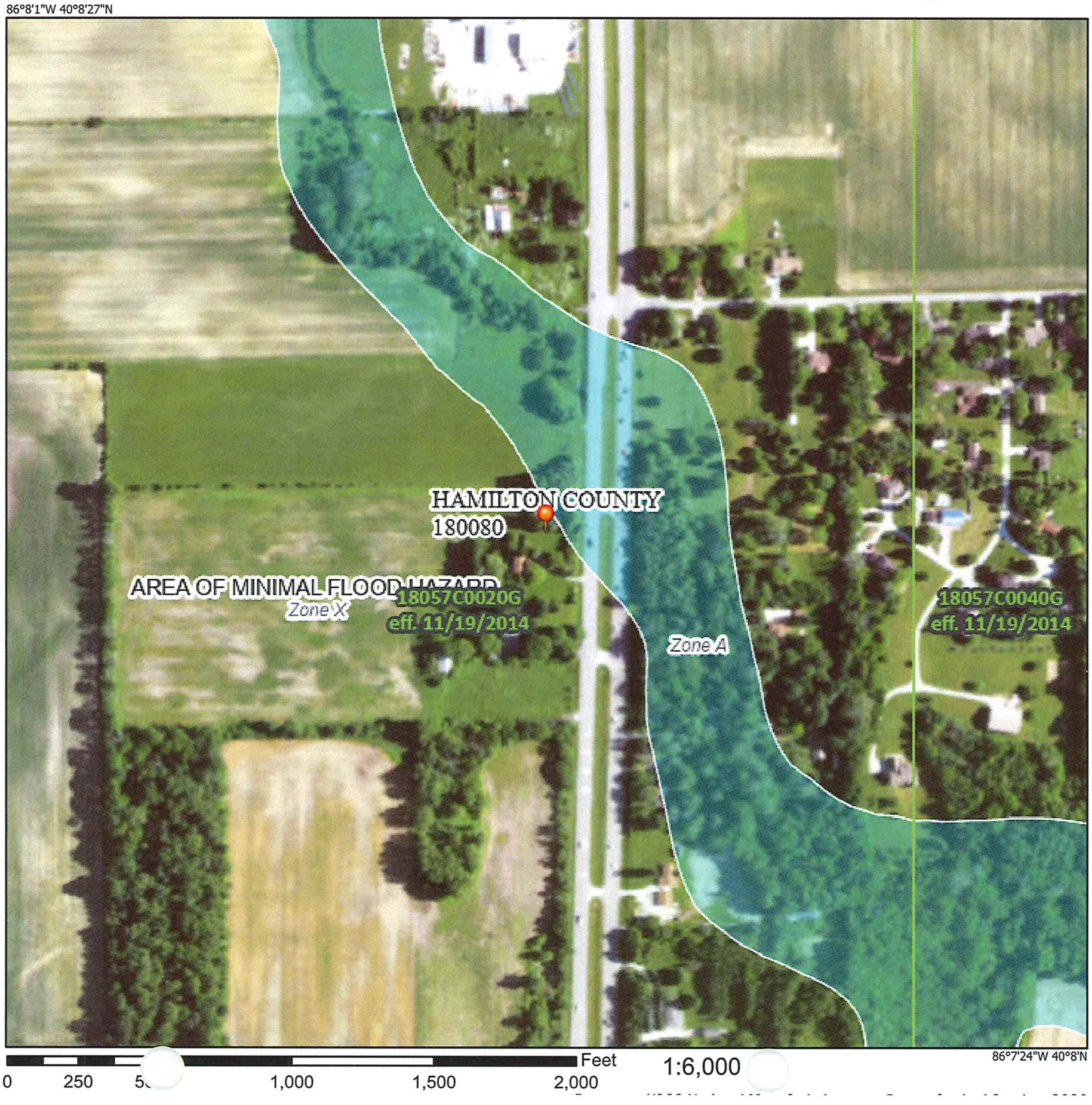
SG/ALT/KMZ:\\mdwa.local\wessler\Clients\Hamilton County\Projects\244721 Hamilton Co Bakers Corner\04-001 Design\L Permits\IDEM WWTP Construction Permit\IDEM Response of Letter 01_18_23\IDEM Response 03-08-23.docx
cc: File, Client

Question 1 Attachments

Attachment 1A-1

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile *Zone*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- ☐ Digital Data Available
- ☐ No Digital Data Available
- ☒ Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/30/2022 at 9:49 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas c be used for regulatory purposes.

Attachment 1A-2

Indiana Department of Natural Resources
Division of Water

Construction in a Floodway Assessment

As mandated by the regulations of the Flood Control Act, IC 14-28-1 and the Floodplain Management rules, 312 IAC 10, a construction project in a floodway requires a permit application review that includes a hydrologic and hydraulic evaluation to determine the effect a project may have on the base flood elevation and an environmental review to determine the impact a construction project may have on fish, wildlife, and botanical resources.

Hydrologic and Hydraulic Evaluation

The Division of Water assesses the change to the effective cross sectional flow area resulting from proposed construction projects in order to minimize cumulative effects on the base flood elevation. Construction projects located in a floodway can result in varying degrees of loss to the effective cross sectional flow area. The Division of Water developed non-modeling hydraulic assessment worksheets to assess specific construction projects that result in negligible loss of the effective cross sectional flow area. If negligible loss cannot be demonstrated through a non-modeling assessment approach or if a cumulative loss of the effective cross sectional flow area exists from other construction projects, computer modeling will be required to be submitted to evaluate the effects the proposed project will have on the base flood elevation. For more information on computer modeling, refer to General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana at www.in.gov/dnr/water/3483.htm .

Non-Modeling Hydraulic Assessment Worksheets

Specific to each non-modeling assessment approach, examples of typical project types are provided on each worksheet to assist you in selecting the appropriate worksheet for your specific project. For more information about what project types are used in each non-modeling assessment approach, refer to the Construction in a Floodway Assessment User Guide.

1) No Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet (State Form 55238)
2) Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet (State Form 55236)
    a) Companion Worksheet A (State Form 55237)
3) Ineffective Area of the Contraction or Expansion Reach of a Stream Crossing Non-Modeling Worksheet (State Form 55235)
4) Bridge Replacement in Kind Non-Modeling Worksheet (State Form 55233) *and* associated Companion worksheets
    a) Bridge Replacement-in-Kind Companion Worksheet B (State Form 55234), or
    b) INDOT Bridge Replacement in Kind Assessment Worksheet (INDOT bridge work only)
5) Bridge Resurfacing Checklist

Fish, Wildlife, and Botanical Impact Assessment

In the permit application review process, the Divisions of Fish and Wildlife, Nature Preserves, and Outdoor Recreation assess the cumulative impacts that construction projects in the floodway may have on fish, wildlife, and botanical resources. Each Non-Modeling Hydraulic Assessment Worksheet includes the minimum plan requirements and computations necessary to assess impacts on flora and fauna and the potential for required mitigation.

These worksheets serve to communicate the framework used to evaluate a project's cumulative impacts to the effective cross sectional flow area and fish, wildlife, and botanical resources in the floodway. These worksheets are meant to relay the information needed to evaluate the vast majority of projects but cannot describe the information needed for all scenarios and all potential projects. The purpose of the worksheet is to balance the need for transparency of the evaluation methods and information needed for a particular project; the preparer's discernment is still needed when preparing an application and supporting documents for review to meet the statutory requirements.

or more information, Non-Modeling Hydraulic Assessment Worksheets, Companion Worksheets, Construction in a Floodway Assessment User Guide, Worksheet Examples, General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana, Mitigation Guidelines, the permit Application Manual and training videos are available on our webpage at www.in.gov/dnr/water.

NO CHANGE IN EFFECTIVE CROSS SECTIONAL FLOW AREA NON-MODELING WORKSHEET

State Form 55238 (4-13)

For Division of Water use: Application # FW-______

An assessment using the No Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet is appropriate to use to assess non-bridge projects that will result in no discernable loss of the effective cross sectional flow area. Project examples include bank stabilization, restoration projects, excavation, or fill of 6" or less when comparing pre-construction to post-construction conditions such as a trail, parking lot, access drive, or sidewalk.

The minimum documentation and computations specified below in this document must be submitted to the Division of Water along with a completed, signed, and dated application form (State Form 42946) and the appropriate application fee.

Unless the instructions in this document direct you otherwise, all plan details, questions and computations in this worksheet must be addressed to adequately evaluate a project under a non-modeling assessment approach.

Minimum Plan Details and Computation Requirements:

1) **Plan Details and Supporting Documentation**

For each of the minimum plan details described in the following chart, complete Column 1 and Column 2. The required plan view items can be combined into one or more plan drawings if the information is clearly defined.

Column 1 Indicate with √ if item is included in application submittal	Column 2 Indicate page or sheet # for each required item	Column 3 Minimum Plans Required	Column 4 For Division of Water use only
☒	pg 8: project site map	A map that clearly identifies the location of the proposed project site in relationship to the waterway and surrounding roadways	☐ Accepted ☐ Item Not Clear
☒	pg 12 disturbed area drawing	An aerial plan view that illustrates disturbed area of the project site	☐ Accepted ☐ Item Not Clear
☒	pg 19-30: plan sheets	A plan view that illustrates the proposed project's construction components. Indicate permanent and temporary components throughout the project site	☐ Accepted ☐ Item Not Clear
☒	pg 112: cross section view of Baker Ditch floodplain	A cross section view(s) showing an overlay comparison of the pre-construction and post-construction conditions of the effective cross sectional flow area at the most restrictive segment(s) of the encroachment. Typical cross sections should be extended perpendicularly to the limits of the project. Cross sections should be stationed left to right, looking downstream, and oriented perpendicular to flow. Additional cross sections if requested in question # 4 in this worksheet. *Note: Assumed elevations can be used for the cross section(s)*	☐ Accepted ☐ Item Not Clear

Plan Details and Supporting Documentation continued

☒	pg 111: cross section view	A plan view that clearly marks the location(s) and label of the cross section(s)	☐ Accepted ☐ Item Not Clear
☒	pg 13-18: photo orientation map and photo log	Photos that illustrate the natural and manmade surroundings, e.g.: 1) from the project site, a downstream view of the channel 2) from the project site, an upstream view of the channel 3) from a downstream streambank, a view of the project site 4) from an upstream streambank, a view of the project site Label orientation of each photo	☐ Accepted ☐ Item Not Clear
☒	pg 20-23: plan sheets	Plans require horizontal and vertical scale, north arrow, labels, stations, and date	☐ Accepted ☐ Item Not Clear

Computation Requirements

2) Is all proposed construction work above top of bank?

● Yes. No further computations are needed to assess the loss to the cross sectional flow area. Skip questions #3 and #4. Proceed to question #5 and #6.

○ No. Proceed to question #3.

3) Compute and record the post-construction and pre-construction cross sectional areas **at the most restrictive segment(s) of the project** by completing Columns 1 and 2 in this chart. Use a separate sheet to record multiple restrictive cross sections of the project.

Cross sectional area at the most restricted segment of the project	Column 1 Area (square feet)	Column 2 Indicate the Cross Section letter and plan sheet #
Pre-construction condition	______sq ft	
Post-construction condition	______sq ft	
If the post-construction area is equal to or greater than the pre-construction area, skip question #4 and proceed to questions #5 and #6.		

Computation Requirements continued

4) When the post-construction cross sectional area condition is smaller than the pre-construction cross section area condition, the restriction to the cross sectional area at the site could result in an increase to the upstream or downstream base flood elevation. To determine whether the proposed project will not have an adverse effect on the upstream or downstream base flood elevation, provide:

- An upstream and downstream typical cross section, and
- Compute and record the upstream and downstream cross sectional areas in this chart. Use a separate sheet to record additional upstream and downstream cross sectional areas if there is more than one restrictive segment of the project.

Cross Section	Column 1 Area (square feet)	Column 2 Indicate the Cross Section letter and plan sheet #
Upstream of project	_____sq ft	
Downstream of project	_____sq ft	

If the post-construction cross sectional area at the most restrictive segment(s) of the project as computed in question #3 is smaller than the upstream and downstream cross sectional areas computed in question #4, the potential for a change to the base flood elevation could result; therefore, the No Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet cannot be used to evaluate the project.

We suggest that you review the Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet, State Form 55236, and Companion Worksheet A, State Form 55237, to determine if another non-modeling assessment approach can be utilized for this project to demonstrate that computer modeling is not required.

5) **Additional Justification/ Comments, if needed: (Use a separate sheet if needed)**

Flow of Baker Ditch crosses US 31 north of the project area and flows south and parallel to US 31 improvements and the roadway profile of the floodway. There will be no grade raise from the existing road grade. The base flood elevation is within 3.0-8.0 ft. of the roadway elevation, so the flow in this portion of the floodway is insignificant although the low lying ground on the northeast side of the existing/proposed roadway embankment would be flooded. The floodway of Baker Ditch is approximately 225 ft. wide, with this impact being on the fringe of the floodway, with no over the road conveyance capacity. The minor amount of fill added to the floodplain is less than the volume cut, creating a permanent impact of -53 cys of proposed fill in the Baker Ditch floodplain over 0.25 acres. Two critical cross-sectional areas of the Baker Ditch floodplain were evaluated. The upstream analysis of the existing floodplain shows its area to be 385 sq. ft. The total fill to the existing floodplain cross section will impact 3 sq. ft, and cut will impact 15 sq. ft. The total net floodplain impact of the fill in this upstream cross section will be less than 5%. The downstream cross-sectional analysis of the existing floodplain shows its area to be 479 sq. ft. The total fill to the existing floodplain cross section will impact 44.5 sq. ft. and the total cut will impact 27 sq. ft. The total net floodplain impact of the fill associated with the 236th intersection improvements of US 31 on the Baker Ditch floodplain will be less than 5%.

6) **Fish, Wildlife, and Botanical Impact Assessment**

If a delineated floodway exists at the project site, compute the disturbance values in the following charts. For sources of delineated floodways, refer to the Indiana Floodplain Information Portal at www.INFIP.dnr.in.gov or FEMA Map Service Center at https://msc.fema.gov/.

If a floodway delineation is not available at the project site, skip Question #6.

If the proposed construction exceeds the disturbance thresholds outlined in the Floodway Habitat Mitigation, a mitigation plan is likely to be required. During the permit application review process, a Division of Fish and Wildlife biologist will contact you if a mitigation plan is required. For information concerning mitigation requirements, refer to the Natural Resources Commission Bulletin # 17, http://www.in.gov/legislative/iac/20120801-IR-312120434NRA.xml.pdf.

Total number acres in floodway disturbed by project construction = 0.26 acres

Riparian habitat disturbance computation:

Type of Riparian Habitat	Number acres in floodway disturbed by project construction
A) Non wetland tree removal in rural area	0.70
B) Non wetland tree removal in urban area	0
C) Early successional habitat	0
Total A, B, & C	0.70

In-stream disturbance computation:

Total number of linear feet of in-stream disturbed by project construction = 0 linear feet

Wetlands disturbance computation:

Type of Riparian Habitat	Number acres in floodway disturbed by project construction
A) Palustrine Forested wetlands	0.042
B) Palustrine Scrub-shrub wetlands	0
C) Palustrine Emergent wetlands	0.012
Total A, B, & C	0.054

Be aware that after reviewing the submitted plans and computations in the worksheet, the IDNR staff may request additional documentation if sufficient evidence has not been provided that clearly demonstrates the effect that the project may have on the base flood elevation or impacts to fish, wildlife, and botanical resources in the floodway.

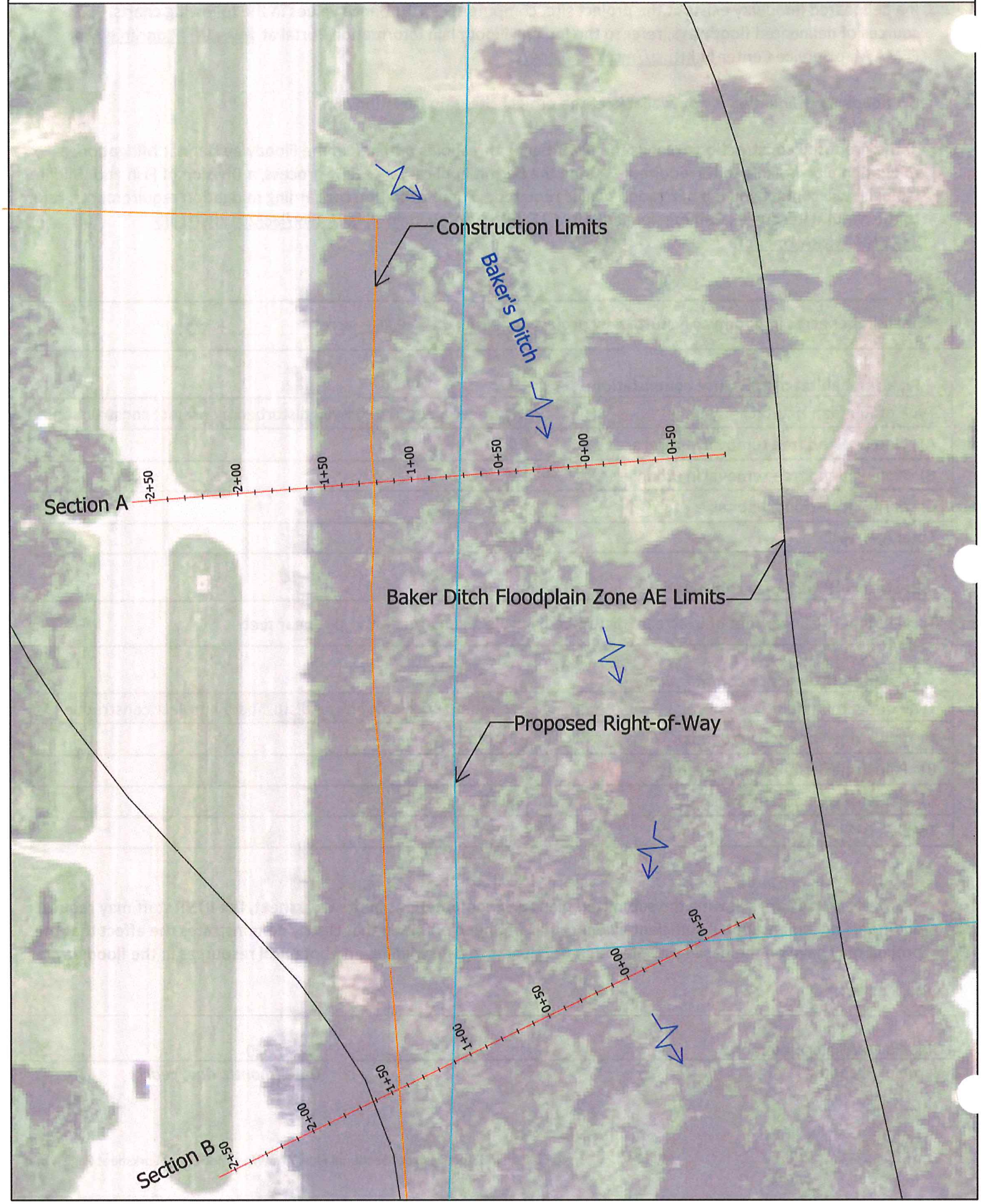
Claudia McAllister-Peterson
Name of Preparer

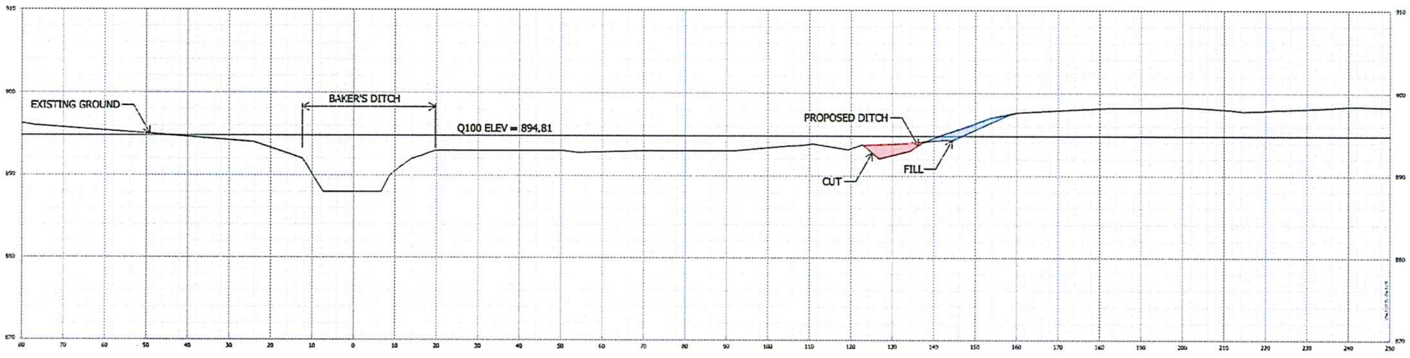
3/25/2020
Date *(month, day, year)*

BAKER DITCH FLOODPLAIN CROSS SECTIONAL ANALYSIS LOCATION LAYOUT

US 31 & 236th Interchange
Des. No. 1702149

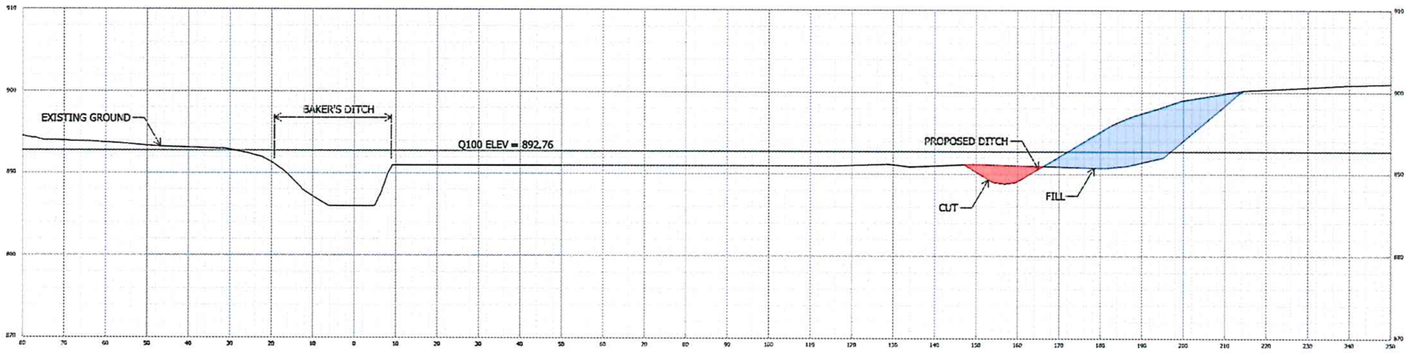
scale: 1" = 100'





FLOODWAY CROSS SECTION A

CROSS SECTIONAL ANALYIS
CROSS-SECTIONAL EXIST. FLOODPLAIN AREA = 385 SFT
CROSS-SECTIONAL CUT = 15 SFT
CROSS-SECTIONAL FILL = 3 SFT
NET FLOODPLAIN IMPACT = -3.12%



FLOODWAY CROSS SECTION B

CROSS SECTIONAL ANALYIS
CROSS-SECTIONAL EXIST. FLOODPLAIN AREA = 479 SFT
CROSS-SECTIONAL CUT = 27 SFT
CROSS-SECTIONAL FILL = 44.5 SFT
NET FLOODPLAIN IMPACT = 3.65%

Plot: 3/20/2020 9:44:38 AM

File: L:\INDOT\17709-03-01\Draw\Models\CMP_Floodplain_XS.dgn

NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL	DESIGN ENGINEER		06/15/2019 DATE
DESIGNED: MLM	06/06/2019	DRAWN: MLM	06/14/2019
CHECKED: GTB	06/14/2019	CHECKED: GTB	06/14/2019

INDIANA DEPARTMENT
OF TRANSPORTATION

US 31 AND 236TH ST
INTERSECTION IMPROVEMENTS

SCALE 1"=30'	BRIDGE FILE
	DESIGNATION 1702149
SURVEY BOOK	SHEETS
ELECTRONIC	of
CONTRACT	PROJECT 17709-03-01

Attachment 1A-3

US 31 WWTP Design
Estimate Q100 elevation using Data Provided in IDNR Construction in a Floodway Assessment, dated 3/25/2020

a) Length between sections A and B:

Hamilton County GIS estimated length – 387 ft
Nancy's PDF estimated length between sections A and B – 400 ft
Google Earth (screenshot below) length – 382 ft

Measure the distance between multiple points on the ground

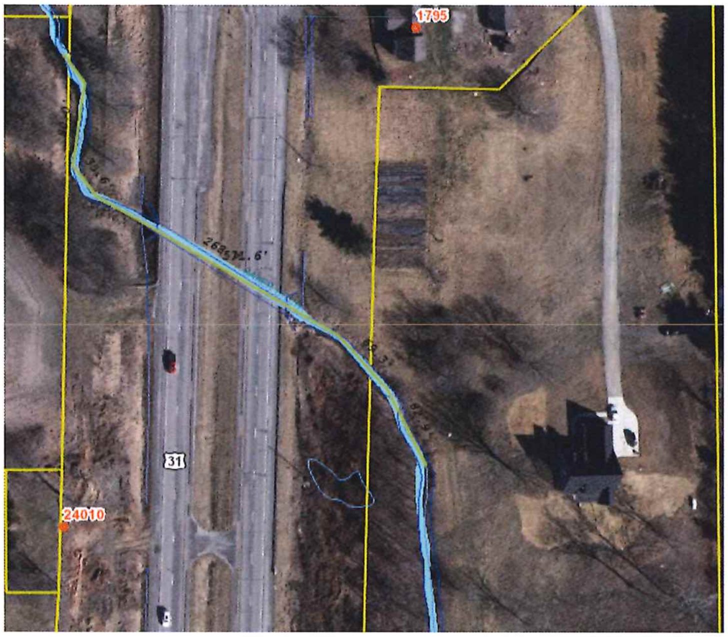
Length: 381.62 Feet

☐ Show Elevation Profile

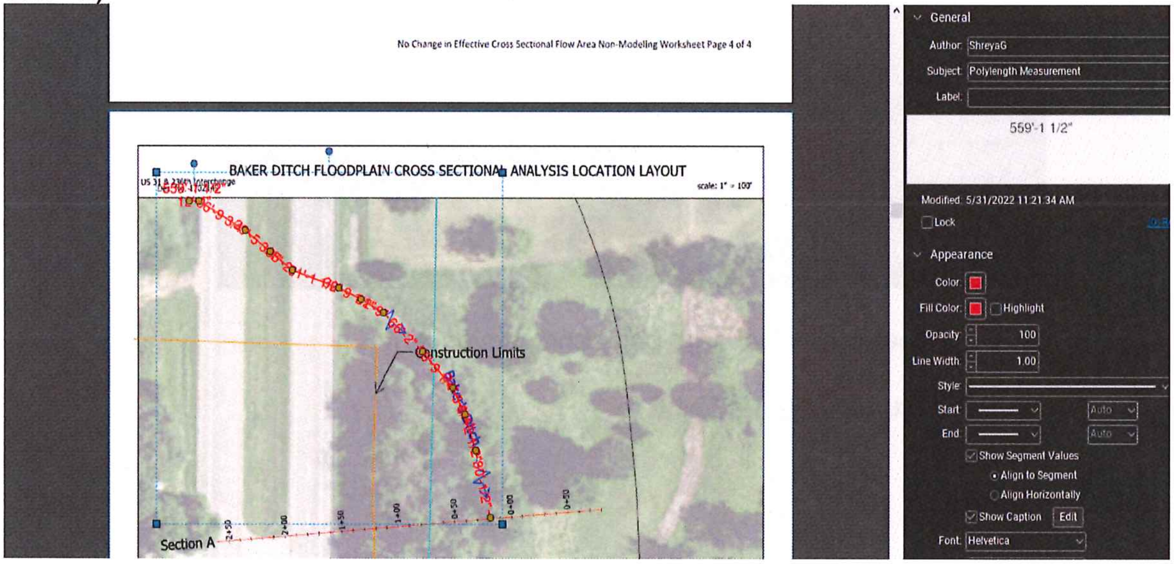
☑ Mouse Navigation

b) Length between discharge point and section A:

GIS measured length – 571.6 ft



Nancy's PDF length – 560+ ft (Does not show till that point but it should be higher than 560+ ft)


No Change in Effective Cross Sectional Flow Area Non-Modeling Worksheet Page 4 of 4

BAKER DITCH FLOODPLAIN CROSS SECTIONAL ANALYSIS LOCATION LAYOUT

General

Author: ShreyaG

Subject: Polylength Measurement

Label:

559'-1 1/2"

Modified: 5/31/2022 11:21:34 AM

☐ Lock

Appearance

Color: 🟥

Fill Color: 🟥 ☐ Highlight

Opacity: 100

Line Width: 1.00

Style:

Start: Auto

End: Auto

☑ Show Segment Values

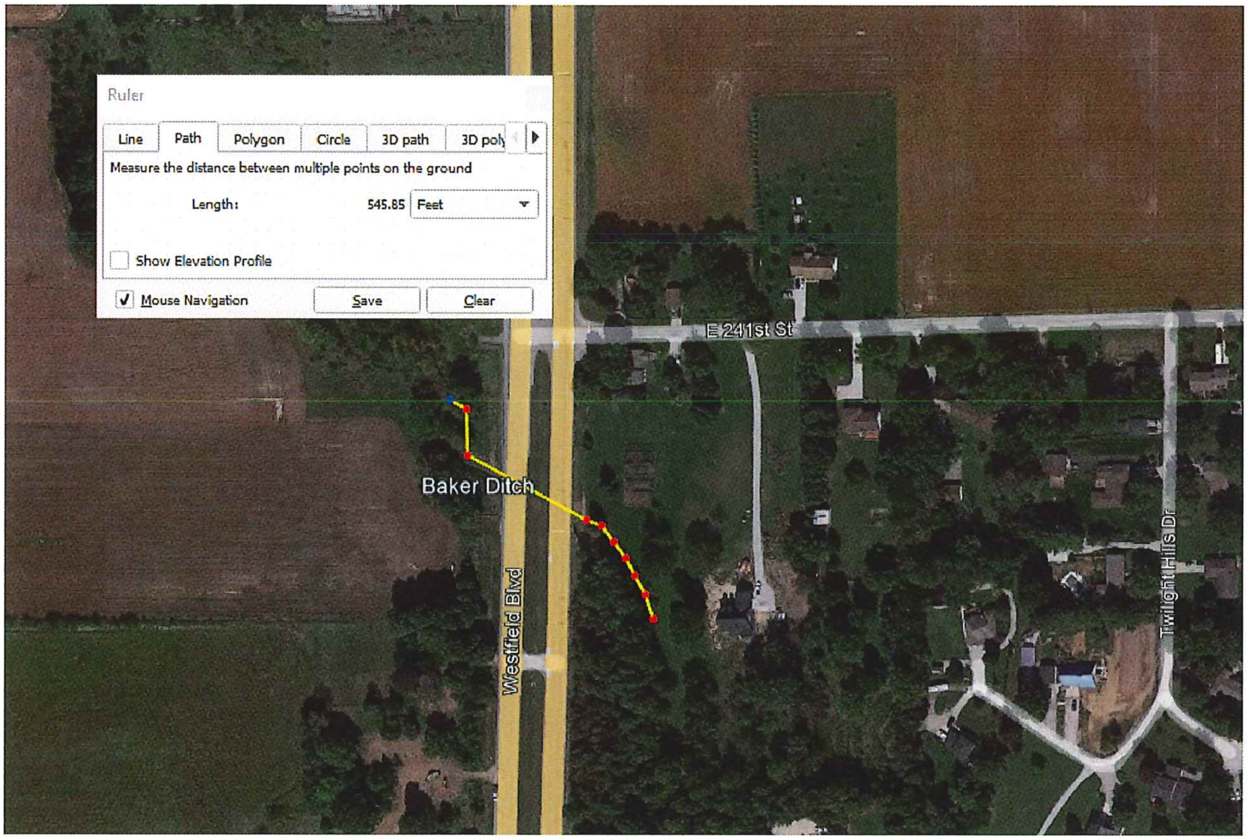
● Align to Segment

○ Align Horizontally

☑ Show Caption Edit

Font: Helvetica

Google Earth pro length btw discharge location and section A – 546 ft



Measure the distance between multiple points on the ground

Length: 545.85 Feet

☐ Show Elevation Profile

☑ Mouse Navigation

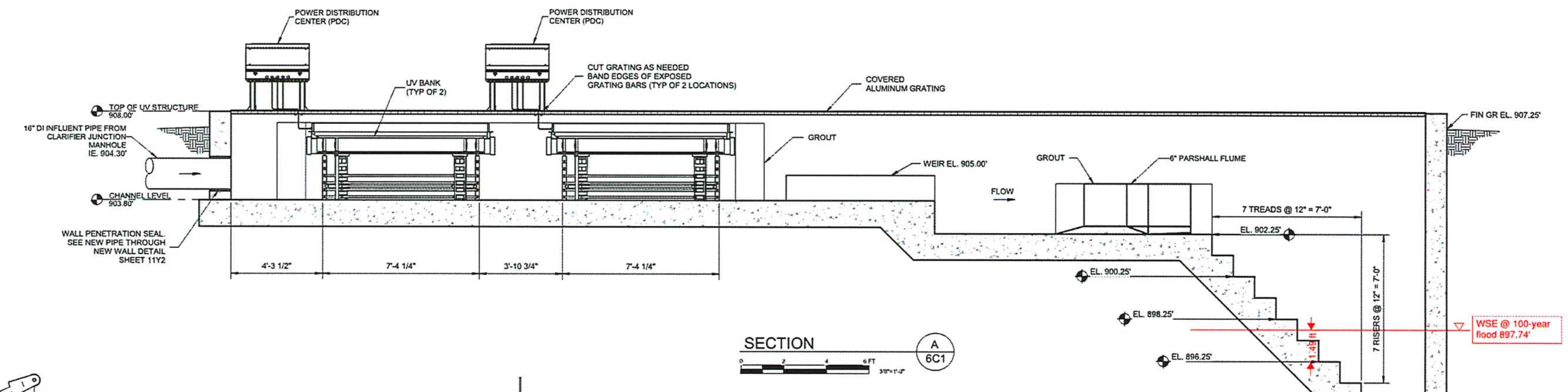
Used Google Earth lengths for calculations

Base flood elevation at Section A: 894.81’ (Ref Nancy’s file)
Base flood elevation at Section B: 892.76’ (Ref Nancy’s file)

Base flood changing (ft) per feet = (894.81-892.76)/382 = 0.005366 ft/ft

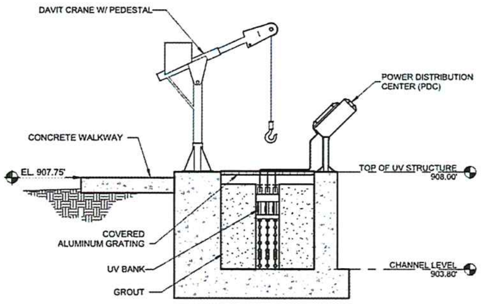
Estimated base flood elevation at discharge point:
Assume x is the base flood elevation at the anticipated discharge point
(x-894.81)/546 = 0.005366
x = 897.74 ft UPDATED HYDRAULICS TO USE THIS ELEVATION
Previously estimated base flood elevation during hydraulics calculations was: 888 ft

Attachment 1A-4



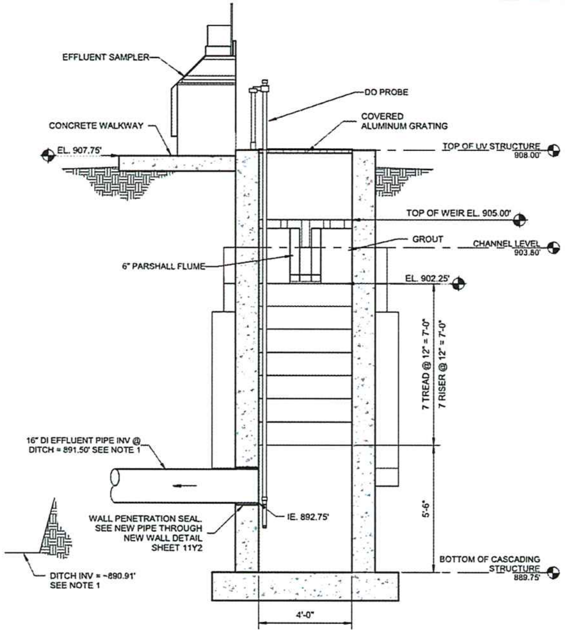
SECTION A 6C1

0 2 4 6 FT 3/8"=1'-0"



SECTION B 6C1

0 2 4 6 FT 3/8"=1'-0"



SECTION C 6C1

0 2 4 6 FT 3/8"=1'-0"

NOTE:
1. CONTRACTOR TO FIELD VERIFY INVERT OF DITCH. ADJUSTMENT OF 16" EFFLUENT PIPE INVERT MAY BE REQUIRED AT DITCH CONNECTION.

Plotted: 11/23/2022 3:03:07 PM C:\Users\MikeN\Documents\244721-UV-CENTRAL-R23_MikenXJJWH.rvt

SCALE VERIFICATION
BAR IS ONE INCH LONG ON ORIGINAL DRAWING

DRAWN BY JL
CHECKED BY KMZ
APPROVED BY RWH
ISSUE DATE
NOVEMBER 2022
PROJECT NUMBER
244721-04-001

NO.	DATE	INITIALS	REVISION DESCRIPTION

ROBERT W. HOLDEN, II No. 10000096 11/23/2022

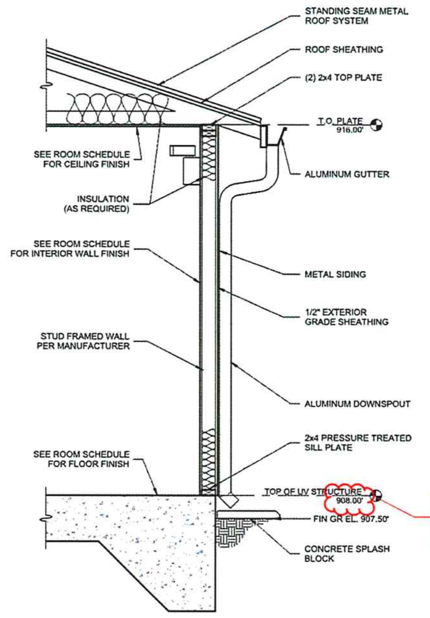
WESSLER
ENGINEERING
More than a Project™

US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT
PHASE 1A AND 1B
DIVISION 1 - WASTEWATER TREATMENT PLANT

UV DISINFECTION AND CASCADE AERATION STRUCTURE - SECTIONS

SHEET NO.
6C2
PAGE NUMBER
48

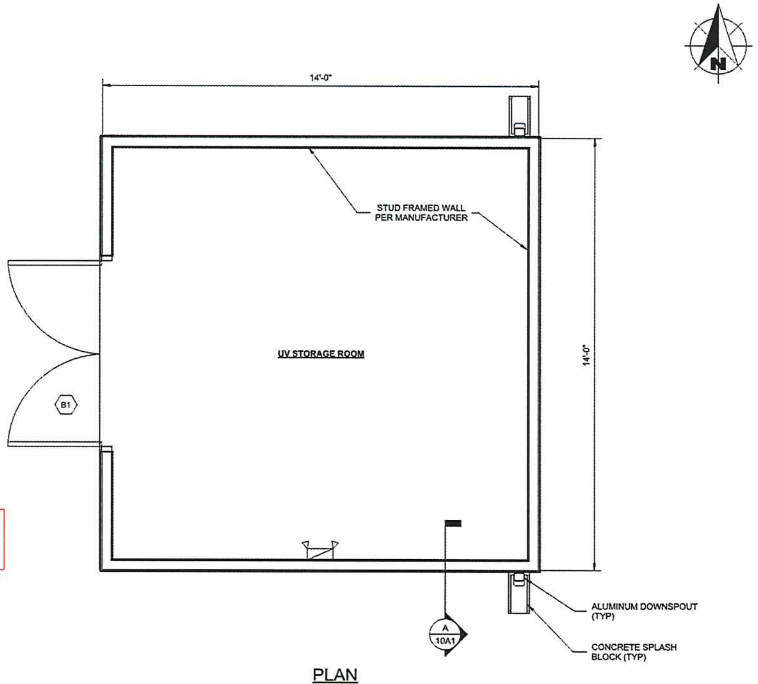
Plotted: 11/17/2022 11:14:58 AM C:\Users\JonathanL\OneDrive - Wessler Engineering\Documents\244721-MS-CENTRAL-R23_JonathanL_WE.rvt



This is higher than 100-year flood elevation of 897.74'

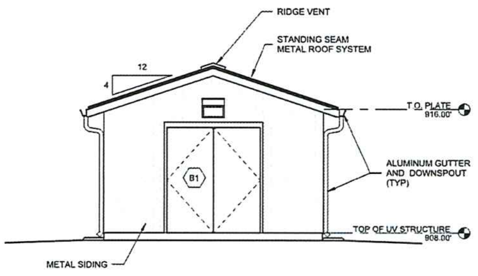
SECTION A 10A1

0 1 2 3 FT 3/4"=1'-0"



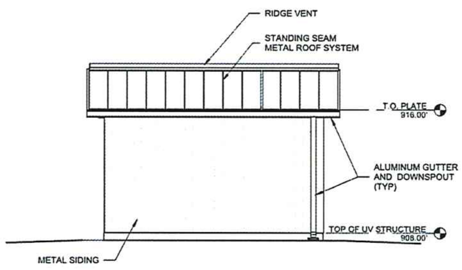
PLAN

0 1 2 4 FT 1/2"=1'-0"



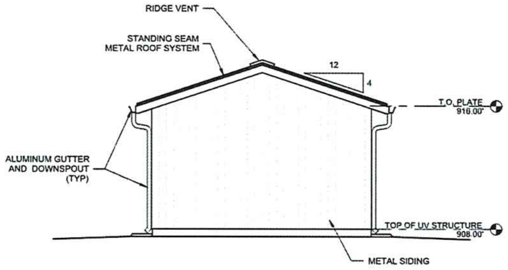
WEST ELEVATION

0 2 4 8 FT 1/4"=1'-0"



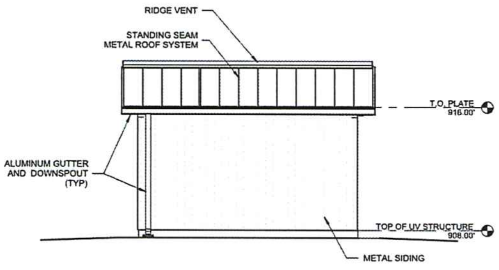
SOUTH ELEVATION

0 2 4 8 FT 1/4"=1'-0"



EAST ELEVATION

0 2 4 8 FT 1/4"=1'-0"



NORTH ELEVATION

0 2 4 8 FT 1/4"=1'-0"

SCALE VERIFICATION

BAR IS ONE INCH LONG ON ORIGINAL DRAWING

DRAWN BY	JL
CHECKED BY	ALT
APPROVED BY	KMZ
ISSUE DATE	NOVEMBER 2022
PROJECT NUMBER	244721-04-001

NO.	DATE	INITIALS	REVISION DESCRIPTION

ROBERT W. HOLDEN, II
No. 10000096
11/23/2022

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US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT

PHASE 1A AND 1B
DIVISION 1 - WASTEWATER TREATMENT PLANT

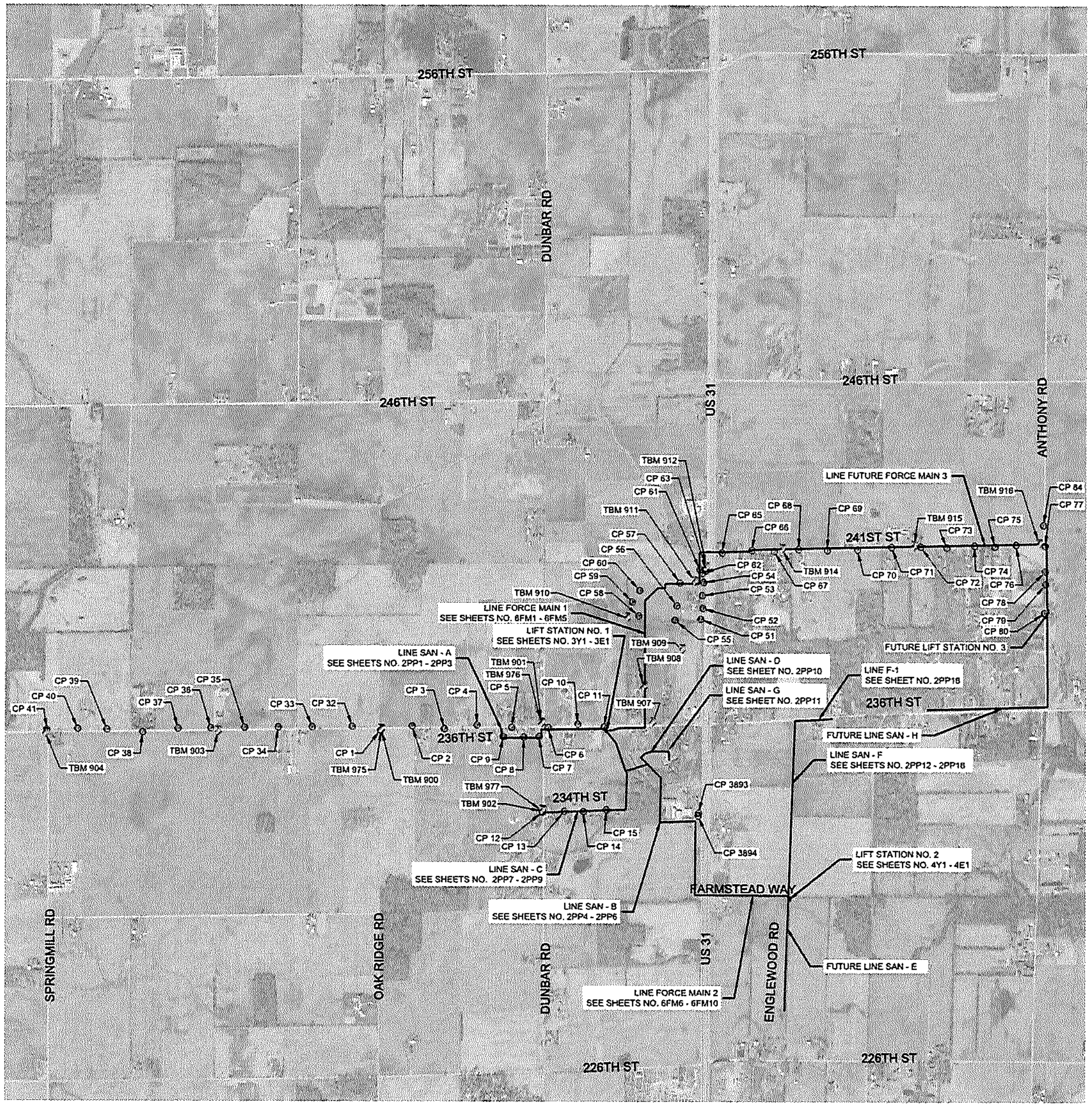
UV STORAGE BUILDING - PLAN, SECTION AND ELEVATIONS

SHEET NO.
10A1

PAGE NUMBER
74

Attachment 1C-1

Drawing: J:\Hamilton County\Projects\244721 Hamilton Co Bakers Corner\CAD\DWG\Sheets\244721-GS.dwg | Layout: 1G4 | Plotted: 11/22/22 @ 10:52:06 | LastSavedBy: JasonW



2012 IMAGERY FROM INDIANA STATE MAP.

LOCATION AND SCOPE OF WORK PLAN

0 500 1000 2000 FT

HORIZONTAL AND VERTICAL CONTROL INFORMATION

NOTES:

1. A FIELD SURVEY WAS PERFORMED IN (JUNE AND SEPTEMBER 2022).
2. COORDINATES (INDIANA STATE PLANE, EAST ZONE, NAD 83) AND ELEVATIONS (NAVD 88) ARE BASED ON INCORS.
3. UNITS ARE U.S. SURVEY FEET.
4. CONTROL POINTS WERE SET USING GPS.
5. A LEVEL LOOP WAS PERFORMED ON THE CONTROL POINTS AND TBMS.

BENCHMARK DESCRIPTION:

1. TBM NO. 900 - RAILROAD SPIKE SET IN WEST SIDE OF POWER POLE APPROXIMATELY 31' SOUTH OF 236TH STREET AND 41' EAST OF OAK RIDGE ROAD.
   EL 919.11
2. TBM NO. 901 - RAILROAD SPIKE SET IN SOUTH SIDE OF VENT POLE APPROXIMATELY 21' NORTH OF 236TH STREET AND 21' WEST OF DUNBAR ROAD.
   EL 913.71
3. TBM NO. 902 - RAILROAD SPIKE SET IN SOUTH SIDE OF POWER POLE APPROXIMATELY 2' WEST OF DUNBAR ROAD AND 16' NORTH OF 234TH STREET.
   EL 920.94
4. TBM NO. 903 - RAILROAD SPIKE SET IN NORTH SIDE OF POWER POLE APPROXIMATELY 10' SOUTH OF 236TH STREET AND 2,550' WEST OF OAK RIDGE ROAD.
   EL 931.49
5. TBM NO. 904 - RAILROAD SPIKE SET IN NORTH SIDE OF POWER POLE APPROXIMATELY 24' SOUTH OF 236TH STREET AND 43' WEST OF SPRINGMILL ROAD.
   EL 928.12
6. TBM NO. 907 - RAILROAD SPIKE SET IN WEST SIDE OF POWER POLE #254788 1' UP APPROXIMATELY 18' NORTH OF 236TH STREET AND 809' WEST OF US 31.
   EL 906.75
7. TBM NO. 908 - TEE POST SET IN CONCRETE WOODLINE OPTION 2 APPROXIMATELY 585' NORTH OF 236TH STREET AND 935' WEST OF US 31.
   EL 912.90
8. TBM NO. 909 - TEE POST SET IN CONCRETE SOUTH EDGE WOODS SOUTH OF WTTP, APPROXIMATELY 1175' NORTH OF 236TH STREET AND 338' WEST OF US 31.
   EL 909.21
9. TBM NO. 910 - TEE POST SET IN CONCRETE SOUTH END OF WEST PROPERTY LINE OF WWTP. APPROXIMATELY 1716' NORTH OF 236TH STREET AND 1240' WEST OF US 31.
   EL 907.14
10. TBM NO. 911 - TEE POST SET IN CONCRETE NORTH PROPERTY LINE OF PROPOSED WWTP. APPROXIMATELY 181' WEST OF US 31 AND 478' SOUTH OF 241ST STREET.
    EL 905.82
11. TBM NO. 912 - CUT SQUARE SOUTH END WEST BRIDGE ABUTMENT AT DISCHARGE DITCH FOR WWTP. APPROXIMATELY 12' WEST OF US 31 AND 240' SOUTH OF 241ST STREET.
    EL 898.09
12. TBM NO. 914 - PWP #5 ±1' UP 4' NORTH OF NORTH EDGE OF PAVEMENT IN FRONT OF 2011 241ST STREET. APPROXIMATELY 1098' EAST OF US 31 AND 5' NORTH OF 241ST STREET.
    EL 907.07
13. TBM NO. 915 - PWP #15 RAILROAD SPIKE SET IN SOUTH SIDE POWER POLE ± 1' UP IN FRONT OF 2880 241ST STREET 5' NORTH OF NORTH EDGE OF PAVEMENT. APPROXIMATELY 3249' EAST OF US 31 AND 5' NORTH OF 241ST STREET.
    EL 892.40
14. TBM NO. 916 - PWP #200-651 RAILROAD SPIKE P15. ±1' UP 3' NORTH OF NORTH EDGE OF PAVEMENT 72' ± WEST OF ANTHONY ROAD 241ST STREET. APPROXIMATELY 5' NORTH OF 241ST STREET AND 62' WEST OF ANTHONY ROAD.
    EL 891.32
15. TBM NO. 975 - RAILROAD SPIKE SET IN WEST SIDE OF POWER POLE APPROXIMATELY 31' SOUTH OF 236TH STREET AND 41' EAST OF OAK RIDGE ROAD.
    EL 919.11
16. TBM NO. 976 - RAILROAD SPIKE SET IN SOUTH SIDE OF VENT POLE APPROXIMATELY 21' NORTH OF 236TH STREET AND 21' WEST OF DUNBAR ROAD.
    EL 913.71
17. TBM NO. 977 - RAILROAD SPIKE SET IN WEST SIDE OF POWER POLE APPROXIMATELY 2' WEST OF DUNBAR ROAD AND 12' NORTH OF 234TH STREET.
    EL 920.94

CONTROL POINTS				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
CP 1	1778691.82	193811.48	917.88	5/8" REBAR
CP 2	1778763.49	194320.12	918.55	5/8" REBAR
CP 3	1778717.81	194839.34	918.91	5/8" REBAR
CP 4	1778777.75	195365.04	916.49	5/8" REBAR
CP 5	1778739.64	195922.17	916.52	5/8" REBAR
CP 6	1778738.60	196506.12	913.43	5/8" REBAR
CP 7	1778595.20	196361.51	914.76	5/8" REBAR
CP 8	1778584.33	196117.88	914.69	5/8" REBAR
CP 9	1778589.91	195787.53	917.75	5/8" REBAR
CP 10	1778794.92	196985.51	909.38	5/8" REBAR
CP 11	1778747.83	197405.95	902.48	5/8" REBAR
CP 12	1777369.22	196421.00	919.39	5/8" REBAR
CP 13	1777382.07	196768.43	918.76	5/8" REBAR
CP 14	1777378.47	197075.77	915.81	5/8" REBAR
CP 15	1777409.60	197445.47	909.05	5/8" REBAR
CP 32	1778752.09	193356.56	918.18	5/8" REBAR
CP 33	1778746.19	192712.12	920.37	5/8" REBAR
CP 34	1778739.60	192164.90	924.01	5/8" REBAR
CP 35	1778732.58	191623.86	928.22	5/8" REBAR
CP 36	1778723.50	191080.23	931.15	5/8" REBAR
CP 37	1778717.46	190552.36	931.79	5/8" REBAR
CP 38	1778656.42	189982.47	939.78	5/8" REBAR
CP 39	1778699.58	189407.64	934.05	5/8" REBAR
CP 40	1778708.74	188937.18	933.82	5/8" REBAR
CP 41	1778692.37	188444.04	925.81	5/8" REBAR
CP 51	1780494.32	198960.90	902.82	5/8" REBAR
CP 52	1780671.41	198993.93	900.83	5/8" REBAR
CP 53	1780881.99	198985.92	902.59	5/8" REBAR
CP 54	1781095.61	199005.36	904.03	5/8" REBAR

CONTROL POINTS				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
CP 55	1780477.48	198547.77	906.30	5/8" REBAR
CP 56	1780716.00	198576.30	907.70	5/8" REBAR
CP 57	1781087.50	198628.54	908.12	5/8" REBAR
CP 58	1780548.97	197962.88	906.01	5/8" REBAR
CP 59	1780778.05	197859.70	906.11	5/8" REBAR
CP 60	1780964.12	197978.64	909.95	5/8" REBAR
CP 61	1781304.49	198944.52	904.80	5/8" REBAR
CP 62	1781248.98	198985.91	900.22	5/8" REBAR
CP 63	1781286.83	199046.16	897.91	5/8" REBAR
CP 65	1781572.24	199300.13	907.17	5/8" REBAR
CP 66	1781613.26	199781.64	908.37	5/8" REBAR
CP 67	1781598.19	200140.94	906.84	5/8" REBAR
CP 68	1781631.50	200532.80	907.16	5/8" REBAR
CP 69	1781615.08	200993.21	905.95	5/8" REBAR
CP 70	1781624.83	201477.89	902.66	5/8" REBAR
CP 71	1781665.45	202027.54	896.41	5/8" REBAR
CP 72	1781678.51	202494.83	891.04	5/8" REBAR
CP 73	1781661.77	202917.19	892.55	6/8" REBAR
CP 74	1781694.85	203360.97	892.58	5/8" REBAR
CP 75	1781877.48	203689.64	888.29	5/8" REBAR
CP 76	1781707.12	204028.63	881.84	5/8" REBAR
CP 77	1781691.11	204497.26	888.53	5/8" REBAR
CP 78	1781286.17	204501.06	879.01	5/8" REBAR
CP 79	1781075.77	204505.50	883.55	5/8" REBAR
CP 80	1780605.24	204486.89	875.52	5/8" REBAR
CP 84	1782028.59	204468.70	891.69	5/8" REBAR
CP 3893	1777356.08	198928.53	910.30	MAGNAIL
CP 3894	1777313.51	198922.41	910.95	MAGNAIL

SCALE VERIFICATION
BAR IS ONE INCH LONG ON ORIGINAL DRAWING

DRAWN BY	JRW
CHECKED BY	TPH
APPROVED BY	DCU
ISSUE DATE	NOVEMBER 2022
PROJECT NUMBER	244721-04-001

NO.	DATE	INITIALS	REVISION DESCRIPTIONS

DEREK C. URBAN
No. 11300068
11/23/2022

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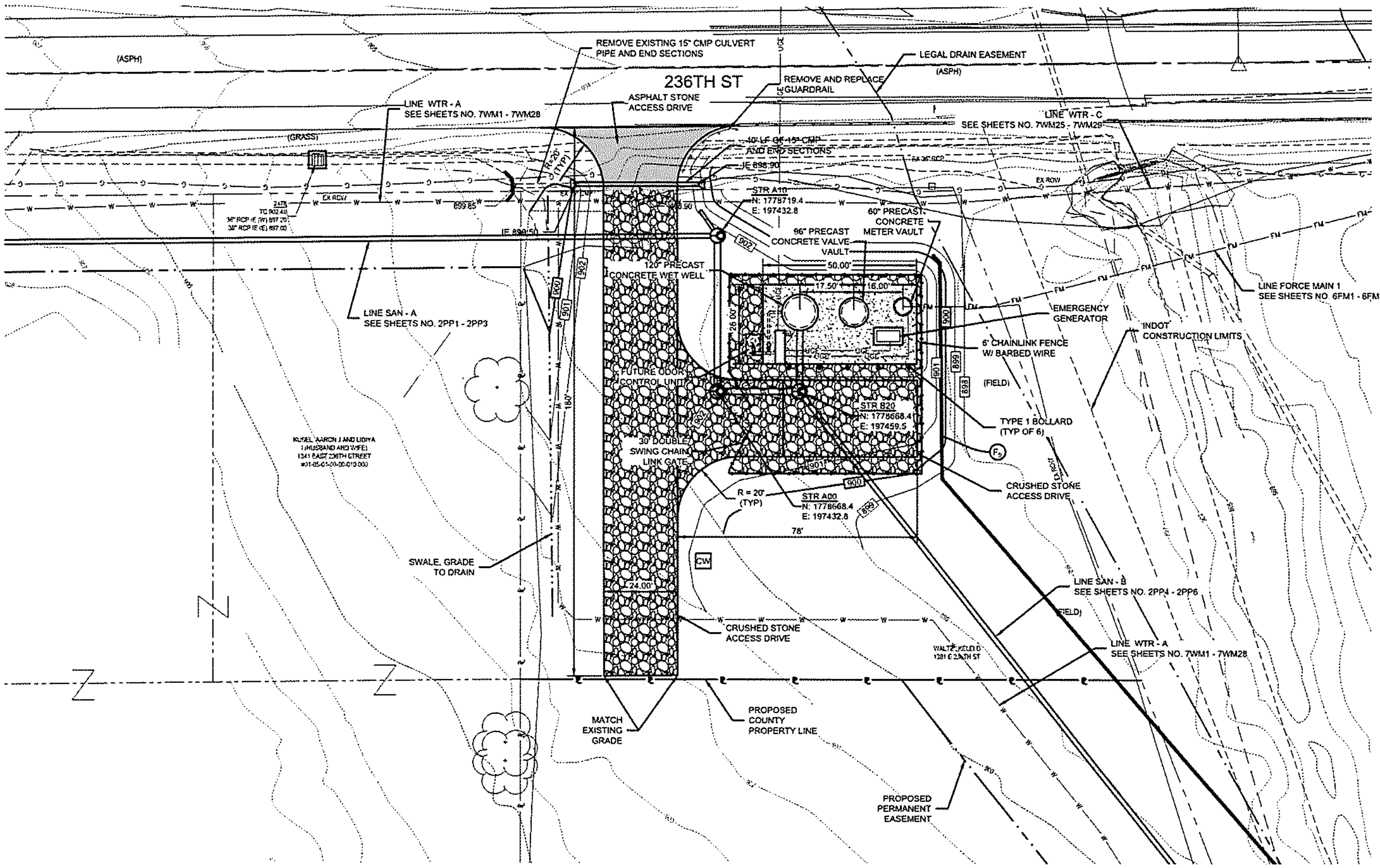
US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT PHASE 1A AND 1B
DIVISION 2 - WATER AND SEWER

HAMILTON COUNTY, INDIANA

LOCATION PLAN AND SCOPE OF WASTEWATER WORK

SHEET NO.
1G4
PAGE NO.

Drawing: J:\Hamilton County\Projects\244721 Hamilton Co Bakers Corner\CAD\DWG\Sheets\244721-SI-1.dwg | Layout: 3Y1 | Plotted: 01/16/23 @ 07:57:17 | LastSavedBy: JasonW



PLAN - NEW LIFT STATION 1

SCALE: 1" = 20'

N

0 10 20 40 FT 1"=20'

KEYED NOTES ○

D	ASPHALT ROAD REPAIR
D_1	ASPHALT COMMERCIAL DRIVE REPAIR
D_2	ASPHALT DRIVE REPAIR
N	CRUSHED STONE SURFACE REPAIR
X	POTENTIAL UTILITY CONFLICT FIELD VERIFY PRIOR TO CONSTRUCTION.
S	1" NEW SERVICE METER AND METER PIT
P	BORE/RECEIVING PIT
F_S	TEMPORARY SILT FENCE OR FILTER TUBE
I	INLET PROTECTION
T	REMOVE EXISTING TREE

LEGEND

▨	ASPHALT ROAD REPAIR
▒	NEW ASPHALT DRIVE
▓	CONCRETE DRIVE REPAIR
▩	CRUSHED STONE DRIVE REPAIR
□	INLET PROTECTION
CW	CONCRETE WASHOUT
▦	EROSION CONTROL BLANKET
~	TEMPORARY SILT FENCE
◡	FILTER TUBE

90% DESIGN DRAWINGS
NOT FOR CONSTRUCTION
1/16/2023

SCALE VERIFICATION	DRAWN BY	JRW	NO.	DATE	INITIALS	REVISION DESCRIPTIONS
BAR IS ONE INCH LONG ON ORIGINAL DRAWING	CHECKED BY	TPH				
	APPROVED BY	DCU				
	ISSUE DATE					
	NOVEMBER 2022					
	PROJECT NUMBER					
	244721-04-001					

11/23/2022

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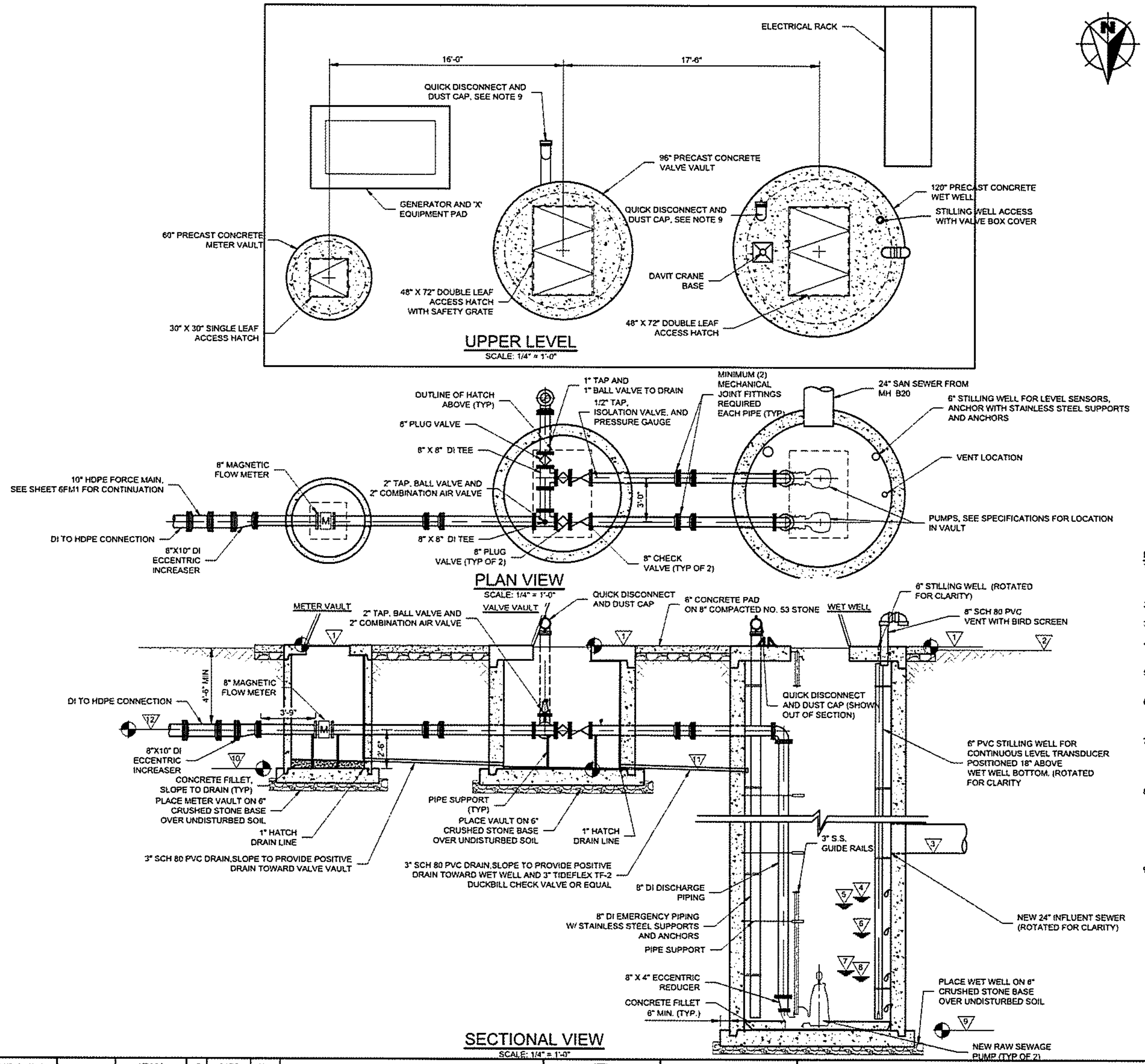
US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT PHASE 1A AND 1B
DIVISION 2 - WATER AND SEWER
HAMILTON COUNTY, INDIANA

NEW LIFT STATION NO. 1 - SITE PLAN

SHEET NO.
3Y1
PAGE NO.

Drawing: J:\Hamilton County\Projects\244721 Hamilton Co Bakers Corner\CAD-DWG\Sheets\244721-LS-1.DWG | Layout: 3C1 | Plotted: 12/05/22 @ 10:54:42 | LastSavedBy: DerekU



LIFT STATION SCHEDULE		
KEYNOTE	DESCRIPTION	LS 1
	DUPLEX/TRIPLEX	DUPLEX
	DESIGN CAPACITY (GPM)	550
	STATION PIPING SIZE (IN)	8
	STATION PIPING MATERIAL	DI
	FORCE MAIN SIZE (IN)	10
	FORCE MAIN MATERIAL	HDPE DR 11
	FORCE MAIN LENGTH (FT)	SEE FM-1 DRAWINGS
	PUMPS TO:	WWTP
	DESIGN TDH (FT)	61
	HP (EACH PUMP)	15
	PUMP MODEL	N 3153 HT 3~ 4p
	IMPELLER	456 229mm PSTXZ
	DISCHARGE SIZE	4"
	EXISTING GRADE (APPROX)	899.50
	100 YEAR FLOOD ELEVATION	901.90
1	TOP OF WET WELL	902.50
2	FINISH GRADE	902.17
3	INVERT OF LOWEST PIPE	878.90
4	HIGH LEVEL ALARM	878.40
5	LAG ON	877.90
6	LEAD ON	875.90
7	PUMPS OFF	872.20
8	LOW LEVEL ALARM	871.70
9	BOTTOM OF WET WELL	869.20
	WET WELL DIAMETER (FT)	10
	VALVE VAULT DIAMETER (FT)	8
10	BOTTOM OF METER VAULT	894.00
11	BOTTOM OF VALVE VAULT	894.00
12	FORCE MAIN CENTERLINE ELEVATION	897.00

NOTES:

1. THE PUMP EQUIPMENT FOR THE WET WELL, INCLUDING PUMPS, GUIDE RAILS, AND SUPPORT BRACKETS, SHALL BE FURNISHED BY THE SAME MANUFACTURER. SEE SPECIFICATION SECTION 11200 PUMP CONTROLS AND CONTROL PANELS SHALL BE AS DESCRIBED IN THE ELECTRICAL DRAWINGS AND SPECIFICATION SECTION 11200.
2. INSTALL CONCRETE FILLET INTO THE BOTTOM OF THE WET WELL PER PUMP MANUFACTURER'S RECOMMENDATIONS.
3. NO PIPE PENETRATIONS WITHIN WET WELL OR VALVE VAULT SHALL BE ALLOWED WITHIN 12" OF ANY BARREL SECTION JOINT. BARREL SECTION HEIGHTS SHALL BE COORDINATED ACCORDINGLY.
4. ALL NUTS, BOLTS AND HARDWARE IN ALL LOCATIONS, AND BRACKETS, SUPPORTS AND ALL OTHER APPURTENANCES IN WET WELL SHALL BE 316 STAINLESS STEEL UNLESS SPECIFICATION INDICATES OTHERWISE OR AS DIRECTED BY ENGINEER.
5. TAP EACH PUMP DISCHARGE LINE (3 TOTAL) IN THE VALVE VAULT, IMMEDIATELY PRECEDING CHECK VALVES, WITH A ½" STAINLESS STEEL PIPE, ½" ISOLATION VALVE, AND CUP PROVIDE 0-50 PSI PRESSURE GAUGE TO BE FURNISHED LOOSE TO OWNER.
6. WET WELL AND VALVE VAULT TOP SLABS SHALL BE PRECAST REINFORCED CONCRETE, BY SAME MANUFACTURER AS BARREL SECTIONS. ACCESS HATCHES SHALL BE INCLUDED IN CASTING OF TOP SLABS. VERIFY EXACT LOCATION OF WET WELL HATCH WITH PUMP MANUFACTURER. VALVE VAULT HATCH SHALL BE CENTERED OVER STRUCTURE, ALIGNED PERPENDICULAR TO FORCE MAIN PIPING.
7. FURNISH AND INSTALL AN ALUMINUM ACCESS LADDER IN THE VALVE VAULT AND METER VAULT. LADDER CONSTRUCTION SHALL BE ALL WELDED RAILS SHALL BE C3X0258, SPACED AT 14" CENTER TO CENTER RUNGS SHALL BE 1⅛" DIA. RIBBED, SPACED AT 12" CENTER TO CENTER MOUNT TO WALL WITH (4) 2½"X⅜" BENT ALUMINUM TABS, WITH ⅜" DIA STAINLESS STEEL EXPANSION ANCHORS. POSITION FOR EASE OF ACCESS INTO VALVE VAULT, AND TO AVOID INTERFERENCE WITH VALVE OPERATORS.
8. ALL RIGID PIPE CONNECTIONS THROUGH THE WET WELL AND VALVE VAULT WALLS SHALL BE THROUGH CORE DRILLED OR FACTORY FORMED PENETRATIONS. INSTALL WITH MECHANICAL WALL SEAL, LINK SEAL OR EQUAL SIZE OF WALL PENETRATIONS SHALL BE AS RECOMMENDED BY THE MECHANICAL SEAL MANUFACTURER FOR THE SIZE AND MATERIAL OF PIPE TO BE INSTALLED FILL VOIDS BETWEEN MECHANICAL SEAL AND OUTER SURFACES OF THE STRUCTURE WITH NON SHRINK GROUT. THE PVC VALVE VAULT DRAIN SHALL BE INSTALLED BY THE SAME MANNER ALL FLEXIBLE PIPE PENETRATIONS (SEWER) MAY BE INSTALLED BY THE SAME MANNER, OR AS SHOWN IN THE STANDARD SANITARY SEWER MANHOLE DETAIL ON SHEET NO 10C2.
9. FIELD VERIFY ORIENTATION OF QUICK DISCONNECT/DUST CAP WITH UTILITY.

SCALE VERIFICATION

BAR IS ONE INCH LONG ON ORIGINAL DRAWING

DRAWN BY	JRW	NO.	DATE	INITIALS	REVISION DESCRIPTIONS
CHECKED BY	TPH				
APPROVED BY	DCU				
ISSUE DATE					
NOVEMBER 2022					
PROJECT NUMBER					
244721-04-001					

DEREK C. URBAN
No. 11300068
11/23/2022

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US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT PHASE 1A AND 1B
DIVISION 2 - WATER AND SEWER

HAMILTON COUNTY, INDIANA

NEW LIFT STATION NO. 1
PLANS, SECTION AND NOTES

SHEET NO.
3C1
PAGE NO.

DATA SHEET
SUBMERSIBLE NON-CLOG CENTRIFUGAL PUMPS

A. Lift Station 1

1. TITLE: Pumps No. 1 & 2
2. LOCATION: 236th Street, Sheridan, IN 46069.
3. QUANTITY: Two (2)
4. OPERATING CONDITIONS: The pumps shall operate within the entire pumping range specified without cavitation and exceeding the vibration limits established by the Hydraulic Institute.

    a. Material to be Pumped: Unscreened Raw Sewage within temperature range of 32° - 100°F.
    b. Pump Curve

Condition	Discharge Rate	TDH	Pump Speed	Pump Efficiency
1st Curve Point	200 gpm	84'	60 Hz	36%
Design Point	550 gpm	61'	60 Hz	70%
3rd Curve Point	900 gpm	43'	60 Hz	56%

5. SPECIFICATIONS:

    a. Type: Submersible
    b. Minimum Sphere Diameter: 3"
    c. Pump Speed: 1,755 rpm
    d. Discharge Connection: 4"
    e. Impeller: Stainless steel
    f. Motor Data:
        1) Horsepower: 15
        2) Speed: 1,755 rpm
        3) Voltage: 460
        4) Phase: 3
        5) Hertz: 60
        6) Service Factor: 1.15
        7) Inverter-Duty Rated
    g. Classification: Pumps shall meet Class I, Division I, Groups C & D requirements

6. MANUFACTURERS: Flygt, Model NP 3153 HT 3~ 456 (229mm Impeller)

B. Lift Station 2

1. TITLE: Pumps No. 1 & 2
2. LOCATION: Englewood Road, Jackson Township, IN 46034.
3. QUANTITY: Two (2)

4. OPERATING CONDITIONS: The pumps shall operate within the entire pumping range specified without cavitation and exceeding the vibration limits established by the Hydraulic Institute.

   a. Material to be Pumped: Unscreened Raw Sewage within temperature range of 32° - 100°F.
   b. Pump Curve

Condition	Discharge Rate	TDH	Pump Speed	Pump Efficiency
1st Curve Point	100 gpm	72'	60 Hz	36%
Design Point	280 gpm	48'	60 Hz	63%
3rd Curve Point	500 gpm	46'	60 Hz	69%

5. SPECIFICATIONS:

   a. Type: Submersible
   b. Minimum Sphere Diameter: 3"
   c. Pump Speed: 1,745 rpm
   d. Discharge Connection: 4"
   e. Impeller: Stainless steel
   f. Motor Data:
      1) Horsepower: 10
      2) Speed: 1,745 rpm
      3) Voltage: 460
      4) Phase: 3
      5) Hertz: 60
      6) Service Factor: 1.15
      7) Inverter-Duty Rated
   g. Classification: Pumps shall meet Class I, Division I, Groups C & D requirements

6. MANUFACTURERS: Flygt, Model NP 3127 HT 3~ Adaptive 488 (195 mm Impeller)

-END-

Question 2 Attachments

Attachment 2-1

Air Demand Calculations - DESIGN AVERAGE DAY

Project Name: US31 Hamilton County WWTP
Date: 10/13/2022
Updated: 1/24/2023

Design Influent Characteristics

Total Design Average Flow: **0.500** **MGD**

Avg. Day Loadings:	cBOD5:	200	mg/L	834	lbs/day	Effluent Limits:	cBOD5:	10	mg/L	42 lbs/day
	TSS:	200	mg/L	834	lbs/day		TSS:	10	mg/L	42 lbs/day
	NH3-N:	25	mg/L	104	lbs/day		NH3-N:	1	mg/L	4 lbs/day
	TKN:	38	mg/L	158	lbs/day		TKN:	NA	mg/L	NA lbs/day
	tot-P:	6	mg/L	25	lbs/day		tot-P:	1	mg/L	4 lbs/day

SOTR Constants:

Alpha:	0.65	Typical values range from 0.4 to 0.8 for diffused aeration (ME, 4th Ed, Section 5-11, p 429)
Beta:	0.98	
C_T:	10.07	DO saturation concentration at T @760 mm of Hg (ME, 4th Ed., pg.1747)
C:	2	Operating DO in aeration basin, Ten State Standard
Csat,20:	9.08	DO saturation concentration at 20 C @760 mm of Hg (ME, 4th Ed., pg.1747)
Theta:	1.024	
T:	15	Water temperature at site, deg C

SOTE from 10/23/22 email (use lower SOTE to be conservative) Ditch 1 34.90%
Ditch 2 33.70%

Fine Bubble Diffusers

SOTE: 2.25% %/ft — Source: Email from Rick Kochera to Kate Ziino, 10/23/22 (Typ. 2%/ft is used for fine bubble)
Aeration Tank Depth: 15.00 ft — Source: Diffuser Submergence as per Bioloop's proposal (depth to diffusers, not to tank invert)

Conversion Factors

Density of air, lb/ft3 0.075
Weight % of O2 in air 0.232

Aeration Basins

O2 Requirements
Average:

	lbs substrate/day	lb O2 required/ lb substrate	lbs O2/day	lbs O2/hr	lbs O2/min
BOD Removal:	834	1.1	917	38	0.6
NH3-N Removal:	104	4.57	476	20	0.3
Actual Oxygen Required:			1,394	58	1.0
Standard Oxygen Requirement:			2,763	115	1.9

SOR= AOR/(((Beta x (C_T-C))/Csat,20) x theta$^{(T-20)}$ x alpha)

Air Flow Required:		**SCFD**	**SCFH**	**SCFM**		
Average Loading	Fine Bubble	471,267	19,636	327	2 Blowers:	164 scfm, each

Loading = SOR/(SOTE x Depth x Air Density x Weight % O2)

Diffuser Check: Diffuser capacity: 4 scfm/diffuser per Sanitaire — 150 diffusers (75 per Oxidation Ditch)
2.18 scfm/diffuser OKAY

Air Demand Calculations - NEAR-TERM AVERAGE DAY

Project Name: US31 Hamilton County WWTP
Date: 10/13/2022
Updated: 1/24/2023

Near-Term Influent Characteristics

Total Design Average Flow: **0.080** **MGD**

Avg. Day Loadings:	cBOD5:	200	mg/L	133	lbs/day	Effluent Limits:	cBOD5:	10	mg/L	7 lbs/day
	TSS:	200	mg/L	133	lbs/day		TSS:	10	mg/L	7 lbs/day
	NH3-N:	25	mg/L	17	lbs/day		NH3-N:	1	mg/L	1 lbs/day
	TKN:	38	mg/L	25	lbs/day		TKN:	NA	mg/L	NA lbs/day
	tot-P:	6	mg/L	4	lbs/day		tot-P:	1	mg/L	1 lbs/day

SOTR Constants:

Alpha:	0.65	Typical values range from 0.4 to 0.8 for diffused aeration (ME, 4th Ed, Section 5-11, p 429)
Beta:	0.98	
C_T:	10.07	DO saturation concentration at T @760 mm of Hg (ME, 4th Ed., pg.1747)
C:	2	Operating DO in aeration basin, Ten State Standard
Csat,20:	9.08	DO saturation concentration at 20 C @760 mm of Hg (ME, 4th Ed., pg.1747)
Theta:	1.024	
T:	15	Water temperature at site, deg C

SOTE from 10/23/22 email (use lower SOTE to be conservative) Ditch 1 34.90%
Ditch 2 33.70%

Fine Bubble Diffusers

SOTE:	2.25% %/ft	Source: Email from Rick Kochera to Kate Ziino, 10/23/22 (Typ. 2%/ft is used for fine bubble)
Aeration Tank Depth:	15.00 ft	Source: Diffuser Submergence as per Bioloop's proposal (depth to diffusers, not to tank invert)

Conversion Factors

Density of air, lb/ft3	0.075
Weight % of O2 in air	0.232

Aeration Basins

O2 Requirements

Average:

	lbs substrate/day	lb O2 required/ lb substrate	lbs O2/day	lbs O2/hr	lbs O2/min
BOD Removal:	133	1.1	147	6	0.1
NH3-N Removal:	17	4.57	76	3	0.1
Actual Oxygen Required:			223	9	0.2
Standard Oxygen Requirement:			444	18	0.3

SOR= AOR/(((Beta x (C_T-C))/Csat,20) x theta$^{(T-20)}$ x alpha)

Air Flow Required:		**SCFD**	**SCFH**	**SCFM**	
Average Loading	Fine Bubble	75,635	3,151	53	1 Blower, see Blower Capacity Chart

Loading = SOR/(SOTE x Depth x Air Density x Weight % O2)

Diffuser Check: Diffuser capacity: 4 scfm/diffuser per Sanitaire

Only 1 ditch in operation
75 diffusers (75 per Oxidation Ditch)
0.70 scfm/diffuser OKAY

Air Demand Calculations - NEAR-TERM AVERAGE DAY

Project Name: US31 Hamilton County WWTP
Date: 10/13/2022
Updated: 1/24/2023

Near-Term Influent Characteristics

Total Design Average Flow: **0.080** **MGD**

Avg. Day Loadings:	cBOD5:	200	mg/L	133	lbs/day	Effluent Limits:	cBOD5:	10	mg/L	7	lbs/day
	TSS:	200	mg/L	133	lbs/day		TSS:	10	mg/L	7	lbs/day
	NH3-N:	25	mg/L	17	lbs/day		NH3-N:	1	mg/L	1	lbs/day
	TKN:	38	mg/L	25	lbs/day		TKN:	NA	mg/L	NA	lbs/day
	tot-P:	6	mg/L	4	lbs/day		tot-P:	1	mg/L	1	lbs/day

SOTR Constants:

Alpha:	0.65	Typical values range from 0.4 to 0.8 for diffused aeration (ME, 4th Ed, Section 5-11, p 429)
Beta:	0.98	
C_T:	10.07	DO saturation concentration at T @760 mm of Hg (ME, 4th Ed., pg.1747)
C:	2	Operating DO in aeration basin, Ten State Standard
Csat,20:	9.08	DO saturation concentration at 20 C @760 mm of Hg (ME, 4th Ed., pg.1747)
Theta:	1.024	
T:	15	Water temperature at site, deg C

SOTE from 10/23/22 email (use lower SOTE to be conservative) Ditch 1 34.90%
Ditch 2 33.70%

Fine Bubble Diffusers

SOTE: 2.25% %/ft — Source: Email from Rick Kochera to Kate Ziino, 10/23/22 (Typ. 2%/ft is used for fine bubble)
Aeration Tank Depth: 15.00 ft — Source: Diffuser Submergence as per Bioloop's proposal (depth to diffusers, not to tank invert)

Conversion Factors

Density of air, lb/ft3	0.075
Weight % of O2 in air	0.232

Aeration Basins

O2 Requirements
Average:

	lbs substrate/day	lb O2 required/ lb substrate	lbs O2/day	lbs O2/hr	lbs O2/min
BOD Removal:	133	1.5	200	8	0.1
NH3-N Removal:	17	4.57	76	3	0.1
Actual Oxygen Required:			276	12	0.2
Standard Oxygen Requirement:			550	23	0.4

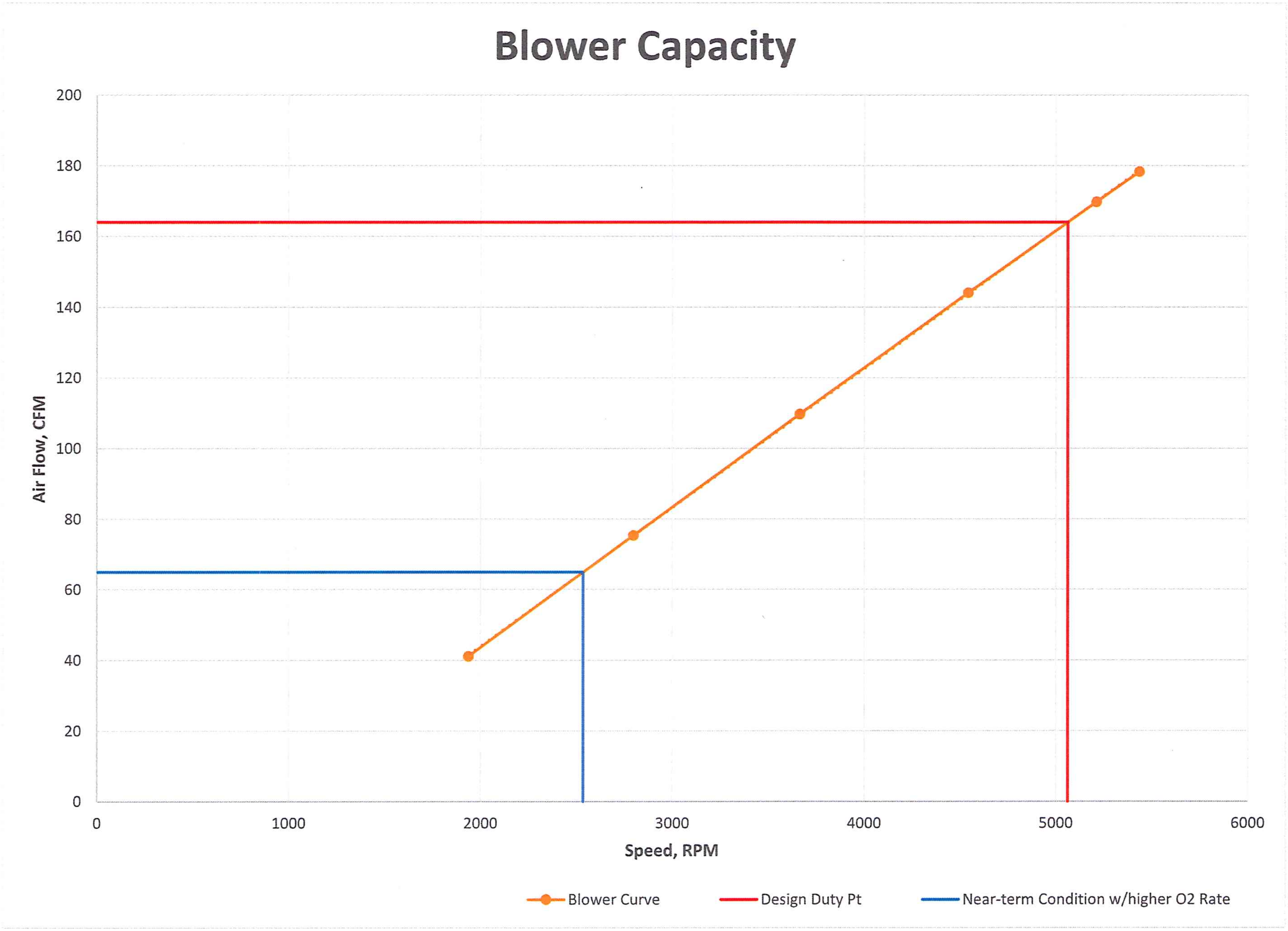
SOR= AOR/(((Beta x (C_T-C))/Csat,20) x theta$^{(T-20)}$ x alpha)

Air Flow Required:		**SCFD**	**SCFH**	**SCFM**	
Average Loading	Fine Bubble	93,737	3,906	65	1 Blower, see Blower Capacity Chart

Loading = SOR/(SOTE x Depth x Air Density x Weight % O2)

Diffuser Check: Diffuser capacity: 4 scfm/diffuser per Sanitaire

Only 1 ditch in operation
75 diffusers (75 per Oxidation Ditch)
0.87 scfm/diffuser OKAY


Blower Capacity
Air Flow, CFM
200
180
160
140
120
100
80
60
40
20
0
0
1000
2000
3000
4000
5000
6000
Speed, RPM
Blower Curve
Design Duty Pt
Near-term Condition w/higher O2 Rate

Attachment 2-2

Bioloop Calculations
Design Flow (0.5 MGD)

Bioloop® Design Proposal - SNDN Process

Bakers Corner, IN Sanitaire #od31015-21

INFLUENT WASTEWATER CHARACTERISTICS AND SITE CONDITIONS

Number of Parallel Biological Trains 1

	Per Biological Train	Total all Bio. trains
Average Annual Flow	0.50 MGD	0.50 MGD
Maximum Month Influent Flow	0.50 MGD	0.50 MGD
Peak Hourly Flow	2.25 MGD	2.25 MGD
BOD5 (20°C)	200 mg/l	
BOD5 (20°C)	834 lb/d	
Suspended Solids	200 mg/l	
TKN	38 mg/l	
Total Phosphorus	6 mg/l	
Max Wastewater Temperature	20 °C	
Min Wastewater Temperature	10 °C	
Ambient Air Temperature	20 - 90 °F	
Site Elevation	910 ft	

Bioloop® SNDN PROCESS EFFLUENT QUALITY (MONTHLY AVERAGE)

BOD_5 (20°C)	10 mg/l
Suspended Solids	10 mg/l
NH_3-N	1 mg/l
Total Phosphorus*	1 mg/l

*Requires chemical precipitation

Bioloop® SNDN PROCESS DESIGN CRITERIA

F / M	0.083 lb BOD5/ lb MLSS / day
SVI (after 30 minutes settling)	150 ml/g
Biological Mixed Liquor Suspended Solids (MLSS) conc.	2,900 mg/l
Waste Sludge Produced (Approx.)	780 lb/d
Volume of Sludge Produced (Approx. 0.58% solids)	16,128 gpd
Aerated Hydraulic Retention Time	19.93 Hrs
Sludge Age	12.9 Days
Sufficient Alkalinity must be provided to maintain basin pH of 6.8	
Chemical dosage (as Alum)	37 mg/l
RAS Pumping Rate	100% of Maximum Month Flow

0.111 lb BOD5/lb MLVSS/day
(assume 75% VS)

Bioloop® SNDN PROCESS BASIN DESIGN DETAILS (PER TRAIN)

<u>Oxidation Ditches operated in Series</u>

	Ditch 1	Ditch 2
Basin Quantity	1	1
Volume/Basin (MG)	0.208	0.208
Basin Length (ft) - *	60.0	60.0
Basin Width (ft)	11.0	11.0
Basin Depth (ft)	16.0	16.0

* - For oxidation ditches, basin length above is straight section length for Side by Side Ditch Type (see ref. drawing)

Bioloop® SNDN PROCESS EQUIPMENT

	Oxidation Ditches operated in Series	
	Ditch 1	Ditch 2
Mixer Motor Hp	6.2	6.2
Fine Bubble Diffuser Quantity / Basin / Train	75	75
Biological blower (scfm/basin/train)	123	159

Biological Blowers (PD type)	2 Duty + 1 Standby with 10 Hp Motor

OSCAR Control Panel

Instruments and Valves in Basins			Quantity
Location	Ditch 1	Ditch 2	
ORP probe	Yes		1
DO probe	Yes	Yes	2
Air modulating valve	1@4 inch	1@4 inch	2
Airflow meter	1@4 inch	1@4 inch	2

Other Instruments and Valves			
Location		Size	
Air pressure transmitter	Bio Blower Discharge		1

Bioloop® SNDN AERATION/MIXING POWER REQUIREMENTS (TOTAL FOR ALL TRAINS)

	Oxidation Ditches operated in Series		
	Ditch 1	Ditch 2	kW-hr/d
Basin Quantity	1	1	

Bio Blowers Operating Power	2	at	8.8 Hp	315

Total kW-hr/d 315

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN***
Project Number: ***od31015-21***
Designer: ***Designer***
Date: ***10/17/2022***

Design Parameters

Number of Parallel Process Trains 1

Flow

	Per process train	Total for all trains
Average Annual Flow	0.50 MGD	0.50 MGD
Maximum Month Flow	0.50 MGD	0.50 MGD
Peak Hourly Flow	2.25 MGD	2.25 MGD

Treatment

	Units	Influent Quality	Effluent Requirement
BOD_5 (20°C)	mg/l	200	10
Suspended Solids	mg/l	200	10
TKN	mg/l	38	N/A
NH_3-N	mg/l	N/A	1.0
Phosphorus	mg/l	6.0	1.0

Environment

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Max. Wastewater Temperature	20	°C
Min. Wastewater Temperature	10	°C
Ambient Air Temperature	20 - 90	°F
Site Elevation	910	ft

Bioloop® Design Parameters

F / M	0.08	lb BOD5/ lb MLSS / day
Aerated HRT	19.93	hrs
SVI (after 30 minutes settling)	150	ml/g
Number of Aerated Reactors in Series	2	
Water Depth	16.0	ft
RAS Pumping Rate	100%	of Maximum Month Flow

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN*** Designer: ***Designer***
Project Number: ***od31015-21*** Date: ***10/17/2022***

Process Calculations

Nitrification Kinetics

Refer to Metcalf and Eddy, Edition IV pages 614 and 705

Constants and Temperature Corrections:

Coefficient	Base Value	Theta	Temperature Corrected	Symbol
Maximum Specific Growth Rate of Nitrifying bacteria, g/ VSS/g VSS•day	0.75	1.07	0.38126	µnm(T)
Half-Velocity constant for nitrifiers	0.74	1.053	0.44152	Kn(T)
Nitrifier decay rate	0.08	1.04	0.05405	Kdn(T)
Dissolved Oxygen in final reactor	2.00		2.00	DO
Half-Velocity Constant for Dissolved Oxygen, mg/l	0.5		0.5	Ko
Minimum Water Temperature, °C	10		10	T
Safety Factor	2.0		2.0	SF

Calculations

$$\mu_n = \left(\mu_{nm}(T) \text{ x } \frac{TENH_3}{TENH_3 + Kn(T)} \text{ x } \frac{DO}{DO + Ko} \right) - Kdn(T)$$

$$\mu_n = \left(0.381 \text{ x } \frac{1.0}{1.0 + 0.44} \text{ x } \frac{2}{2.0 + 0.5} \right) - 0.054 = 0.16 \text{ days}^{-1}$$

$$SRT_{min} = \frac{1}{\mu n} = \frac{1}{0.16} = 6.3 \text{ days}^{-1}$$

$$SRT_{aerobic} = SRT_{min} \text{ x } SF = 6.3 \text{ x } 2.0 = \mathbf{12.9 \text{ days}}$$

Where: µnm(T) = Maximum Temperature Corrected Nitrifier Growth Rate (days^{-1})
μ_n = Specific Nitrifier Growth rate at Temperature, DO, and Effluent NH_3 (days^{-1})
SRTmin = Minimum Sludge age required for Nitrification (days)
SRTaerobic = Design Aerobic Sludge Age (days)
SF = Safety Factor
TENH3 = Anticipated Effluent Ammonia (mg/l)

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN*** Designer: ***Designer***
Project Number: ***od31015-21*** Date: ***10/17/2022***

Sludge Yield

Refer to WEF MOP/8 4th Edition, pg 11-11, Eqn 11.7

$$\boxed{\Delta M = \Bigg(\frac{Y \text{ x } (BODin - BODout)}{1 + (B \text{ x } \theta^{(T-20)} \text{ X } SRT)} + Zio + Zno \Bigg) \text{ x } Q \text{ x } 8.34 \Bigg) + CS}$$

$$\boxed{\Delta M = \Bigg(\Bigg(\frac{0.6 \text{ x } (200 - 10)}{1 + (0.07 \text{ x } 1.04^{(10-20)} \text{ x } 12.9d)} + 40.0 + 60.0 \Bigg) \text{ x } 0.50 \text{ x } 8.34 \Bigg) + 68 = \mathbf{780} \text{ lb/day}}$$

where: ΔM = Mass of Sludge Produced (lb/day)
Y = Volatile Cell Yield (VSS/BOD Removed)
θ = Arrhenius Temperature Correction Factor
B = Decay Rate (day^{-1})
BODout = Anticipated Effluent BOD (mg/l)
SRT = Solids Retention Time (days)
Zio = Influent Nonvolatile Suspended Solids (mg/l)
Zno = Influent Volatile Nonbiodegradable Solids (mg/l)
Q= Maximum month flow, MGD
T = Minimum Wastewater Temperature (°C)
CS = Chemical Sludge from Phosphorus Precipitation with) Alum (lb/day)
(see chemical sludge production calculations below)

$$\boxed{BODL = \frac{Q \text{ x } BOD \text{ x } 8.34}{1{,}000{,}000} = \frac{0.500 \text{ x } 200 \text{ x } 8.34}{1{,}000{,}000} = \mathbf{834 \text{ lb/day}}}$$

where: Q = Max month flow, MGD
BOD = BOD concentration, mg/l

Sludge Yield, Ys, = ΔM / BOBL = 780 / 834 = 0.94

Chemical Dosing

Initial estimate of phosphorus in WAS, based on assumed % of MLVSS as P

$$\boxed{Pw = (BODin – BODout) \text{ x } Ys \text{ x } MLVSS \text{ x } Psa = (200 - 10) \text{ x } 0.94 \text{ x } 0.70 \text{ x } 0.020 : 2.5 \text{ mg/l}}$$

Where: Pw = Phosphorus removed with WAS, mg/l as P
BODin = Influent BOD, mg/l
BODout = Anticipated Effluent BOD (mg/l)
MLVSS = Mixed Liquor Volatile Suspended Solids Concentration
Psa = Assumed % of MLVSS as P

Based on Assumed % of MLSS, estimate phosphorus concentration to be removed with metal salt
Pmb = TPi – Pw - Pe = 6.00 - 2.50 - 1.00 = 2.51 mg/l
Where: Pmb = Phosphorus concentration to be removed with metal salt, mg/l
Tpi = Influent Phosphorus concentration, mg/l

CD = MolR x Pmb / Ion x MWRatio =
Where: CD= Required Alum dosing rate, mg/l
MolR= Mole Ratio (Actual Dose required vs. Stoichiometric Dose)
Ion= Fraction Metal Ion in Alum
MWRatio= Ratio of Molecular Weights, Al:P

Mass of Chemical Sludge

CS = Q x Pmb x MP x 8.34 = 0.50 x 2.51 x 6.48 x 8.34 = 68 lb/d/train

Where: MP = Mass of Precipitate formed per Mass of P removed

Aerated Process Volume

$$Vaer\_design = \frac{\Delta M \times SRT}{MLSS \times 8.34} = \frac{780 \times 12.9}{2,900 \times 8.34} = \mathbf{0.415\ MG}$$

where: Vaer_design = Volume of Aeration Tank, MG
MLSS = Aeration Tank Mixed Liquor Suspended Solids Concentration, mg/l

Reactor	Actual volume		
Ditch 1	0.208 MG		
Ditch 2	0.208 MG		
Total	0.416 MG		

Anoxic Process Volume

Operate first aerated reactors as aerated anoxic for aerated anoxic vol. = 207,608 gallons

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN***
Project Number: ***od31015-21***
Designer: ***Designer***
Date: ***10/17/2022***

Nitrogen Balance

Constants

Coefficient	Value	Symbol
VSS/TSS	69.9%	
Sludge N	0.070	Ns
Effluent Dissolved Organic Nitrogen, mg/l	1.0	EDON

TKN_{ox} = TKN - EDON - TENH3 - N_{assim} - N_{part} = 38.0 - 1.0 - 1 - 13.1 - 0.49 = **22.2 mg/l**

where: TKNox = TKN available for oxidation (mg/l)
TKN = Influent TKN (mg/l)
TENH3 = Effluent NH_3-N (mg/l)
N_{assim} = Nitrogen assimilated into sludge (mg/l)
N_{part} = Nitrogen bound to VSS portion of effluent TSS (mg/l)

$$N_{assim} = \frac{\Delta M \times N_s}{Q \times 8.34} = \frac{780 \times 0.07}{0.50 \times 8.34} = 13.1 \text{ mg/l}$$

N_{part} = TESS x N_s X VSS/TSS = 10 x 0.07 x 0.70 = **0.49 mg/l**

where TESS = Effluent Total Suspended Solids (mg/l)

TENOxN =TKNox X (1 - Denite%) = 22.2 X (1 - 0.76) = 5.3)

where: TENOx = Total effluent nitrate + nitrite nitrogen (mg/l)
Denite % = Predicted denitrification %, based on Anoxic Process Volume and SNDR
SNDR = See Assumed Denitrification Rates in table below

TN = TENH3 + TENOx + EDON + Npart = 1 + 5.3 + 1 + 0.49 = 7.79

where: TN = Effluent Total Nitrogen (mg/l)

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN*** Designer: ***Designer***
Project Number: ***od31015-21*** Date: ***10/17/2022***

Assumed Denitrification Rates

Check Assumed Denite Rate in each Zone

Reactor	1	2	
Description	Ditch	Ditch	
NO3-N mass to remove	66.35	0	lb/d
Mass of MLVSS	3512	3512	lb
Required Denite Rate (SNDR)	0.0189	0.0000	mass NO3-N/mass MLVSS/d
Theoretical Denite Rate at 20C	0.06	0.06	mass NO3-N/mass MLVSS/d
DO Switch Function	1	0.091	At design DO concentration
Temperature Correction	0.463	0.463	At design water temperature
Adjusted Theoretical Denite Rate	0.028	0.003	mass NO3-N/mass MLVSS/d
Assumed Denite rate OK?	YES	YES	

Actual Oxygen Demand

$$\boxed{AOR_T = AOR_C + AOR_N = 1001 + 225 = \mathbf{1225\ lb/day}}$$

where: AOR_T = Total Actual Oxygen Demand, lb/day
AOR_C = Carbonaceous Oxygen Demand, lb/day
AOR_N = Nitrogen Oxygen Demand (Including any denitrification credit), lb/day

Carbonaceous Oxygen Demand

$$\boxed{AOR_C = BODL \times O_{2carb} = 834 \times 1.2 = \mathbf{1001\ lb/day}}$$

where: $O2_{carb}$ = O2/BOD

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: ***Bakers Corner, IN***
Project Number: ***od31015-21***

Designer: ***Designer***
Date: ***10/17/2022***

Nitrogen Oxygen Demand

$\boxed{AOR_N = TKN_{ox(Mass)} \times 4.6 - DNC = 93 \times 4.6 - 202 = \mathbf{225\ lb/day}}$

where: 4.6 = $O2/NH_3$
DNC = Denitrification Credit

$\boxed{TKNox(Mass) = TKN_{ox} \times Q = 22.2 \times 0.50 \times 8.34 = 93\ lb/day}$

$\boxed{DNC = NO3\text{-}Nremoved \times Q \times 2.86 \times DN \times 8.34 = 16.9 \times 0.50 \times 2.86 \times 1 \times 8.34 = 202\ lb/day}$

where: DN = Fraction $NO_3\text{-}N_{removed}$ used to calculate denitrification credit = 100%
Based on 76% denitrication in SNDN process
NO3-Nremoved = 16.9 mg/l

Standard Oxygen Demand

$$\boxed{SOR = \frac{AOR}{AOR/SOR} = \mathbf{2412\ lb/day}}$$

where: SOR = Standard Condition Oxygen Transfer (20°C, 1 atm, $\alpha = \beta = 1$), lb/day
AOR / SOR = Conversion Factor Actual to Standard condition oxygen

$$\boxed{\frac{AOR}{SOR} = \frac{\alpha \times \theta^{(Tsite - 20)} (C^*sat_{20} \times \beta \times P_{site} / P_{std} \times C_T / C_{20} - DO)}{C^*sat20}}$$

where: α = Alpha factor = 0.6
θ = Temperature coefficient = 1.024
Tsite = Water temperature, °C = 20
β = Beta factor = 0.98
Psite = Site Atmospheric Pressure
Pstd = Standard atmospheric pressure, psia
C*sat20 = Dissolved oxygen solubility at standard conditions , mg/l
C_T = Dissolved oxygen solubility at site water temperature, mg/l
C_{20} = Dissolved oxygen solubility at 20°C, mg/l
DO = Residual dissolved oxygen concentration, mg/l

Aeration Design

Reactor	1	2	Total
DO, mg/l	0.0	2	
AOR, lb/d	613	613	1225
AOR/SOR	0.571	0.458	
SOR	1074	1338	2412

Bioloop® Detailed Design Calculations
SNDN Process

Project Name: **_Bakers Corner, IN_**
Project Number: **_od31015-21_**
Designer: **_Designer_**
Date: **_10/17/2022_**

Clarifier Sizing

$A_{design, Max Mo}$ = Qavg / Oavg / No. Clarifiers = 500,000 / 198.4 / 2 = 1260 ft²

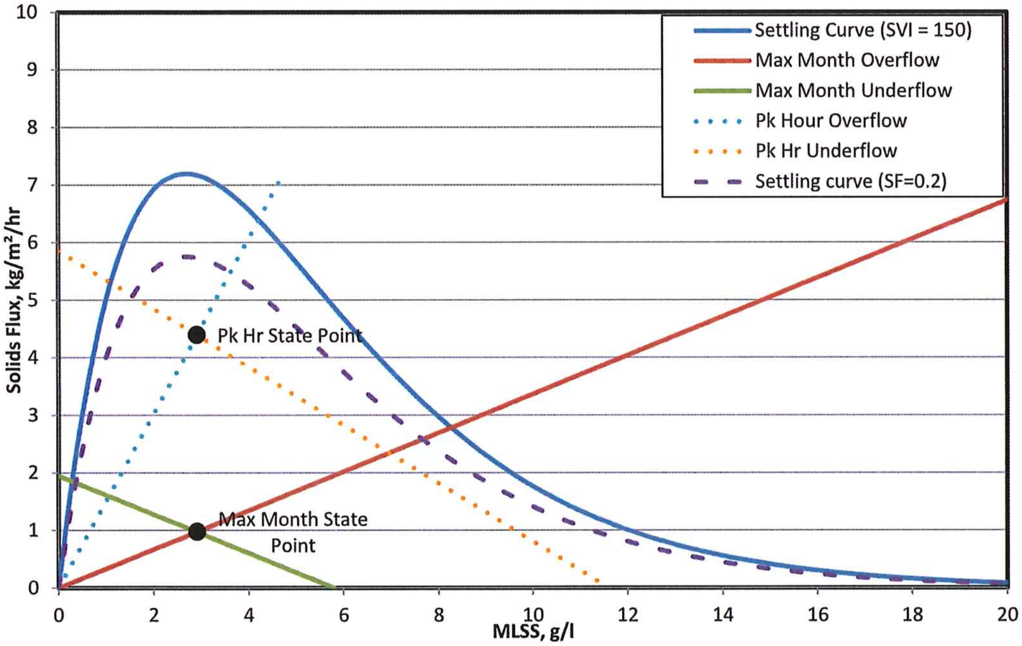
$A_{design, Peak}$ = Qavg / Oavg / No. Clarifiers = 2,250,000 / 892.9 / 2 = 1260 ft²

where:
Q = Flow, gpd
A = Area per clarifier, ft2
O = Surface overflow rate, gpd/ft2

Use Larger Area = 1260 ft²
Dia. design [Area / π x 4]^(1/2) = [1260 / 3.142 x 4] ^(1/2) = **40 ft**

Use Clarifier Diameter = 40 ft
User Clarifier Quantity = 2

Max. Mo. Condition = 2,900 mg/l MLSS and 5,800 mg/l RAS concentration
Peak Condition = 2,900 mg/l MLSS and 11,600 mg/l RAS concentration
State Point Analysis



Max Month State Point is below the settling curve.
Pk Hr State Point is below the settling curve.
Pk Hr Underflow underflow is below the settling curve.
Clarifier design is adequate.

MIXING SELECTION REPORT

Quote Number: 3556-230125-001 (Rev. 0)
Project:
Position: Bakers Corner - Ditch 1

INPUT DATA

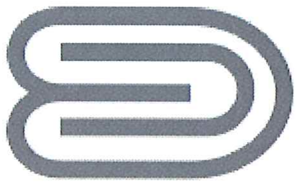
Wastewater Treatment > Biological Treatment Mixing

Biological Treatment	Aerobic - Aeration
Type of pre-treatment	No screening or screen > ½ inch
Outlet location in tank	Top
Recommended average velocity	1.17 ft/s
Accept recommended avg. velocity	Yes
Oxygen transfer guarantee	No
Type of diffuser	9" Sanitaire (Fine)
Diffusers per aerated area	0.24 #/ft²
Covered bottom area fraction	17.76 %
Covered bottom area	308.669 ft²
Total number of diffusers	74
Number of aerated zones	1
Flow per diffuser	1.89 scfm@20°C
Total air flow	139.86 scfm@20°C

TANK DIMENSIONS

Closed Ditch

Total length	158 ft
Width	11 ft
Depth	16 ft
Bend losses	1.2
Friction losses	0.48



PRODUCT DATA

Mixer type	**4530 without Jetring**
Number of mixers	1
Thrust produced/mixer	1959 N
Total thrust produced	1959 N
Total thrust required	1934 N
Power uptake / mixer	4.19 kW (24 % margin to input power)
Total power uptake	4.19 kW
Propeller diameter	47.24 in
Propeller speed	138 RPM
Number of blades	3
Rec. min Submergence	2.62ft
Hub design	Open
Propeller material	Stainless steel
Propeller code	440

MOTOR DATA

Rated Shaft Power	6.2 Hp
Mains frequency	60 Hz
Number Of Phases	3
Rated voltage	460 V D
Number Of Poles	4
Max Input Power	5.5 kW
Approval	STD
Rated Temperature	40 °C / 104 °F

ISO 21630 VALUES

Nominal thrust	2240 N
ISO Input Power	4.32 kW
Efficiency	519 N/kW

Mixer performance data are based on the configuration 400 V Y for 50 Hz and 460 V Y for 60 Hz, for other configurations the data may be different. For mixer performance tolerances, refer to the mixer data chart. Xylem guarantees that the proposed mixer selection will perform the specified duty when all mixers are operating positioned according to Xylem's recommendation. The selection is a function of the input data and the supplier of the data is fully responsible for its correctness.

MIXING SELECTION REPORT

Quote Number: 3556-230125-001 (Rev. 0)
Project:
Position: Bakers Corner - Ditch 2

INPUT DATA

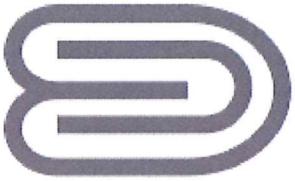
Wastewater Treatment > Biological Treatment Mixing

Biological Treatment	Aerobic - Aeration
Type of pre-treatment	No screening or screen > ½ inch
Outlet location in tank	Top
Recommended average velocity	1.17 ft/s
Accept recommended avg. velocity	Yes
Oxygen transfer guarantee	No
Type of diffuser	9" Sanitaire (Fine)
Diffusers per aerated area	0.24 #/ft²
Covered bottom area fraction	17.76 %
Covered bottom area	308.669 ft²
Total number of diffusers	75
Number of aerated zones	1
Flow per diffuser	2.43 scfm@20°C
Total air flow	182.25 scfm@20°C

TANK DIMENSIONS

Closed Ditch

Total length	158 ft
Width	11 ft
Depth	16 ft
Bend losses	1.2
Friction losses	0.48



PRODUCT DATA

Mixer type	**4530 without Jetring**
Number of mixers	1
Thrust produced/mixer	1959 N
Total thrust produced	1959 N
Total thrust required	1941 N
Power uptake / mixer	4.19 kW (24 % margin to input power)
Total power uptake	4.19 kW
Propeller diameter	47.24 in
Propeller speed	138 RPM
Number of blades	3
Rec. min Submergence	2.62ft
Hub design	Open
Propeller material	Stainless steel
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MOTOR DATA

Rated Shaft Power	6.2 Hp
Mains frequency	60 Hz
Number Of Phases	3
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ISO 21630 VALUES

Nominal thrust	2240 N
ISO Input Power	4.32 kW
Efficiency	519 N/kW

Mixer performance data are based on the configuration 400 V Y for 50 Hz and 460 V Y for 60 Hz, for other configurations the data may be different. For mixer performance tolerances, refer to the mixer data chart. Xylem guarantees that the proposed mixer selection will perform the specified duty when all mixers are operating positioned according to Xylem's recommendation. The selection is a function of the input data and the supplier of the data is fully responsible for its correctness.

Bioloop Calculations
Near-Term Flow (0.08 MGD)

Bioloop® Design Proposal - NIT Process

Bakers Corner, IN Sanitaire #od31015-21

INFLUENT WASTEWATER CHARACTERISTICS AND SITE CONDITIONS

Number of Parallel Biological Trains 1

	Per Biological Train	Total all Bio. trains
Average Annual Flow	0.08 MGD	0.08 MGD
Maximum Month Influent Flow	0.08 MGD	0.08 MGD
Peak Hourly Flow	1.50 MGD	1.50 MGD
BOD5 (20°C)	200 mg/l	
BOD5 (20°C)	133 lb/d	
Suspended Solids	200 mg/l	
TKN	38 mg/l	
Total Phosphorus	6 mg/l	
Max Wastewater Temperature	20 °C	
Min Wastewater Temperature	10 °C	
Ambient Air Temperature	20 - 90 °F	
Site Elevation	700 ft	

Bioloop® NIT PROCESS EFFLUENT QUALITY (MONTHLY AVERAGE)

BOD_5 (20°C)	10 mg/l
Suspended Solids	10 mg/l
NH_3-N	1 mg/l
TN	mg/l
Total Phosphorus*	1 mg/l

*Requires chemical precipitation

Bioloop® NIT PROCESS DESIGN CRITERIA

F / M	0.077 lb BOD5/ lb MLSS / day
SVI (after 30 minutes settling)	150 ml/g
Biological Mixed Liquor Suspended Solids (MLSS) conc.	1,000 mg/l
Waste Sludge Produced (Approx.)	123 lb/d
Volume of Sludge Produced (Approx. 0.20% solids)	7,402 gpd
Aerated Hydraulic Retention Time	62.28 Hrs
Sludge Age	14.0 Days

0.103 lb BOD5/lb MLVSS/day
(assume 75% VS)

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Chemical dosage (as Alum)	38 mg/l
RAS Pumping Rate	100% of Maximum Month Flow

Bioloop® NIT PROCESS BASIN DESIGN DETAILS (PER TRAIN)

	Ditch 1
Basin Quantity	1
Volume/Basin (MG)	0.208
Basin Length (ft) - *	60.0
Basin Width (ft)	11.0
Basin Depth (ft)	16.0

* - For oxidation ditches, basin length above is straight section length for Side by Side Ditch Type (see ref. drawing)

Bioloop® NIT PROCESS EQUIPMENT

	Ditch 1
Mixer Quantity/Basin	1
Mixer Motor Hp	6.2
Fine Bubble Diffuser Quantity / Basin / Train	75
Biological blower (scfm/basin/train)	50

Biological Blowers (PD type) 1 Duty + 1 Standby with 5 Hp Motor

OSCAR Control Panel

Instruments and Valves in Basins		Quantity
Location	Ditch 1	
ORP probe	Yes	1
DO probe	Yes	1
Air modulating valve	1@4 inch	1
Airflow meter	1@4 inch	1

Other Instruments and Valves		
Location		Size
Air pressure transmitter	Bio Blower Discharge	1

Bioloop® NIT AERATION/MIXING POWER REQUIREMENTS (TOTAL FOR ALL TRAINS)

		Oxidation Ditches operated in Series		
		Ditch 1		kW-hr/d
Basin Quantity		1		
Mixers / Basin		1		
Mixer Op. Hp		4.0		72
Bio Blowers Operating Power	1	at	3.8 Hp	68
			Total kW-hr/d	140

Bioloop® Detailed Design Calculations
NIT Process

Project Name: ***Bakers Corner, IN***
Project Number: ***od31015-21***
Designer: ***Designer***
Date: ***2/28/2022***

Design Parameters

Number of Parallel Process Trains 1

Flow

	Per process train	Total for all trains
Average Annual Flow	0.08 MGD	0.08 MGD
Maximum Month Flow	0.08 MGD	0.08 MGD
Peak Hourly Flow	1.50 MGD	1.50 MGD

Treatment

	Units	Influent Quality	Effluent Requirement
BOD_5 (20°C)	mg/l	200	10
Suspended Solids	mg/l	200	10
TKN	mg/l	38	N/A
NH_3-N	mg/l	N/A	1.0
TN	mg/l	N/A	0
Phosphorus	mg/l	6.0	1.0

Environment

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Max. Wastewater Temperature	20	°C
Min. Wastewater Temperature	10	°C
Ambient Air Temperature	20 - 90	°F
Site Elevation	700	ft

Bioloop® Design Parameters

F / M	0.08	lb BOD5/ lb MLSS / day
Aerated HRT	62.28	hrs
SVI (after 30 minutes settling)	150	ml/g
Number of Aerated Reactors in Series	1	
Water Depth	16.0	ft
RAS Pumping Rate	100%	of Maximum Month Flow

Bioloop® Detailed Design Calculations

NIT Process

Project Name: **_Bakers Corner, IN_**
Project Number: **_od31015-21_**
Designer: **_Designer_**
Date: **_2/28/2022_**

Process Calculations

Nitrification Kinetics

Refer to Metcalf and Eddy, Edition IV pages 614 and 705

Constants and Temperature Corrections:

Coefficient	Base Value	Theta	Temperature Corrected	Symbol
Maximum Specific Growth Rate of Nitrifying bacteria, g/ VSS/g VSS•day	0.75	1.07	0.38126	µnm(T)
Half-Velocity constant for nitrifiers	0.74	1.053	0.44152	Kn(T)
Nitrifier decay rate	0.08	1.04	0.05405	Kdn(T)
Dissolved Oxygen in final reactor	2.00		2.00	DO
Half-Velocity Constant for Dissolved Oxygen, mg/l	0.5		0.5	Ko
Minimum Water Temperature, °C	10		10	T
Safety Factor	2.2		2.2	SF

Calculations

$$\boxed{\mu_n = \left(\mu_{nm}(T) \text{ x } \frac{TENH_3}{TENH_3 + Kn(T)} \text{ x } \frac{DO}{DO + Ko} \right) - Kdn(T)}$$

$$\boxed{\mu_n = \left(0.381 \text{ x } \frac{1.0}{1.0 + 0.44} \text{ x } \frac{2}{2.0 + 0.5} \right) - 0.054 = 0.16 \text{ days}^{-1}}$$

$$\boxed{SRT_{min} = \frac{1}{\mu n} = \frac{1}{0.16} = 6.3 \text{ days}^{-1}}$$

$$\boxed{SRT_{aerobic} = SRT_{min} \text{ x } SF = 6.3 \text{ x } 2.2 = \mathbf{14.0\ days}}$$

Where: µnm(T) = Maximum Temperature Corrected Nitrifier Growth Rate (days^{-1})
μ_n = Specific Nitrifier Growth rate at Temperature, DO, and Effluent NH_3 (days^{-1})
SRTmin = Minimum Sludge age required for Nitrification (days)
SRTaerobic = Design Aerobic Sludge Age (days)
SF = Safety Factor
TENH3 = Anticipated Effluent Ammonia (mg/l)

Sludge Yield

Refer to WEF MOP/8 4th Edition, pg 11-11, Eqn 11.7

$$\Delta M = \left(\left(\frac{Y \text{ x } (BODin - BODout)}{1 + (B \text{ x } \theta^{(T-20)} \text{ X } SRT)} + Zio + Zno \right) \text{ x } Q \text{ x } 8.34 \right) + CS$$

$$\Delta M = \left(\left(\frac{0.6 \text{ x } (200 - 10)}{1 + (0.07 \text{ x } 1.04^{(10-20)} \text{ x } 14.0d)} + 40.0 + 60.0 \right) \text{ x } 0.08 \text{ x } 8.34 \right) + 11 = \mathbf{123} \text{ lb/day}$$

where: ΔM = Mass of Sludge Produced (lb/day)
Y = Volatile Cell Yield (VSS/BOD Removed)
θ = Arrhenius Temperature Correction Factor
B = Decay Rate (day^{-1})
BODout = Anticipated Effluent BOD (mg/l)
SRT = Solids Retention Time (days)
Zio = Influent Nonvolatile Suspended Solids (mg/l)
Zno = Influent Volatile Nonbiodegradable Solids (mg/l)
Q= Maximum month flow, MGD
T = Minimum Wastewater Temperature (°C)
CS = Chemical Sludge from Phosphorus Precipitation with) Alum (lb/day)
(see chemical sludge production calculations below)

$$BODL = \frac{Q \text{ x } BOD \text{ x } 8.34}{1{,}000{,}000} = \frac{0.080 \text{ x } 200 \text{ x } 8.34}{1{,}000{,}000} = \mathbf{133 \text{ lb/day}}$$

where: Q = Max month flow, MGD
BOD = BOD concentration, mg/l

Sludge Yield, Ys, = ΔM / BOBL = 123 / 133 = 0.93

Chemical Dosing

Initial estimate of phosphorus in WAS, based on assumed % of MLVSS as P

Pw = (BODin – BODout) x Ys x MLVSS x Psa = (200 - 10) x 0.93 x 0.69 x 0.020 2.4 mg/l

Where: Pw = Phosphorus removed with WAS, mg/l as P
BODin = Influent BOD, mg/l
BODout = Anticipated Effluent BOD (mg/l)
MLVSS = Mixed Liquor Volatile Suspended Solids Concentration
Psa = Assumed % of MLVSS as P

Based on Assumed % of MLSS, estimate phosphorus concentration to be removed with metal salt
Pmb = TPi – Pw - Pe = 6.00 - 2.40 - 1.00 = 2.56 mg/l
Where: Pmb = Phosphorus concentration to be removed with metal salt, mg/l
Tpi = Influent Phosphorus concentration, mg/l

CD = MolR x Pmb / Ion x MWRatio =
Where: CD= Required Alum dosing rate, mg/l
MolR= Mole Ratio (Actual Dose required vs. Stoichiometric Dose)
Ion= Fraction Metal Ion in Alum
MWRatio= Ratio of Molecular Weights, Al:P

Mass of Chemical Sludge

$$\boxed{CS = Q \times Pmb \times MP \times 8.34 = 0.08 \times 2.56 \times 6.47 \times 8.34 = 11 \text{ lb/d/train}}$$

Where: MP = Mass of Precipitate formed per Mass of P removed

Aerated Process Volume

$$\boxed{\text{Vaer\_design} = \frac{\Delta M \times SRT}{MLSSx\ 8.34} = \frac{123 \times 14.0}{1{,}000 \times 8.34} = \mathbf{0.208\ MG}}$$

where: Vaer_design = Volume of Aeration Tank, MG
MLSS = Aeration Tank Mixed Liquor Suspended Solids Concentration, mg/l

Reactor	Actual volume		
Ditch 1	0.208 MG		
Total	0.208 MG		

Anoxic Process Volume

Nitrogen Balance

Constants

Coefficient	Value	Symbol
VSS/TSS	69.5%	
Sludge N	0.069	Ns
Effluent Dissolved Organic Nitrogen, mg/l	1.0	EDON

TKN_{ox} = TKN - EDON - TENH3 - N_{assim} - N_{part} = 37.5 - 1.0 - 1 - 12.9 - 0.48 = **22.0 mg/l**

where: TKNox = TKN available for oxidation (mg/l)
TKN = Influent TKN (mg/l)
TENH3 = Effluent NH_3-N (mg/l)
N_{assim} = Nitrogen assimilated into sludge (mg/l)
N_{part} = Nitrogen bound to VSS portion of effluent TSS (mg/l)

$$N_{assim} = \frac{\Delta M \text{ x } N_s}{Q \text{ x } 8.34} = \frac{123 \text{ x } 0.07}{0.08 \text{ x } 8.34} = 12.9 \text{ mg/l}$$

N_{part} = TESS x N_s X VSS/TSS = 10 x 0.07 x 0.69 = **0.48 mg/l**

where TESS = Effluent Total Suspended Solids (mg/l)

TENOxN =TKNox X (1 - Denite%) = 22 X (1 - 0.05) = 20.95)

where: TENOx = Total effluent nitrate + nitrite nitrogen (mg/l)
Denite % = Predicted denitrification %, based on Anoxic Process Volume and SNDR
SNDR = See Assumed Denitrification Rates in table below

TN = TENH3 + TENOx + EDON + Npart = 1 + 20.95 + 1 + 0.48 = 23.43

where: TN = Effluent Total Nitrogen (mg/l)

Description Ditch

Actual Oxygen Demand

$AOR_T = AOR_C + AOR_N = 160 + 67 =$ **227 lb/day**

where: AOR_T = Total Actual Oxygen Demand, lb/day
AOR_C = Carbonaceous Oxygen Demand, lb/day
AOR_N = Nitrogen Oxygen Demand (Including any denitrification credit), lb/day

Carbonaceous Oxygen Demand

$AOR_C = BODL \times O_{2carb} = 133 \times 1.2$ = **160 lb/day**

where: $O2_{carb}$ = O2/BOD

Bioloop® Detailed Design Calculations
NIT Process

Project Name: **Bakers Corner, IN** Designer: **Designer**
Project Number: **od31015-21** Date: **2/28/2022**

Nitrogen Oxygen Demand

AOR_N = $TKN_{ox(Mass)}$ x 4.6 - DNC 15 x 4.6 - 0 = **67 lb/day**

where: 4.6 = O2/NH_3
DNC = Denitrification Credit

TKNox(Mass) = TKN_{ox} x Q = 22.0 x 0.08 x 8.34 = 15 lb/day

DNC = NO3-Nremoved x Q x 2.86 x DN x 8.34 = 8 x 2.86 x 0.118517433763673 0 lb/day

where: DN = Fraction NO_3-$N_{removed}$ used to calculate denitrification credit = 12%
Based on 5% denitrication in NIT process
NO3-Nremoved = 1.0 mg/l

Standard Oxygen Demand

$$SOR = \frac{AOR}{AOR/SOR} =$$ **492 lb/day**

where: SOR = Standard Condition Oxygen Transfer (20°C, 1 atm, α = β = 1), lb/day
AOR / SOR = Conversion Factor Actual to Standard condition oxygen

$$\frac{AOR}{SOR} = \frac{\alpha \times \theta^{(Tsite - 20)} (C^*sat_{20} \times \beta \times P_{site} / P_{std} \times C_T / C_{20} - DO)}{C^*sat20}$$

where: α = Alpha factor = 0.6
θ = Temperature coefficient = 1.024
Tsite = Water temperature, °C = 20
β = Beta factor = 0.98
Psite = Site Atmospheric Pressure
Pstd = Standard atmospheric pressure, psia
C*sat20 = Dissolved oxygen solubility at standard conditions , mg/l
C_T = Dissolved oxygen solubility at site water temperature, mg/l
C_{20} = Dissolved oxygen solubility at 20°C, mg/l
DO = Residual dissolved oxygen concentration, mg/l

Aeration Design	
Reactor	1
DO, mg/l	2.0
AOR, lb/d	227
AOR/SOR	0.462
SOR	492

Bioloop® Detailed Design Calculations
NIT Process

Project Name: **Bakers Corner, IN**
Project Number: **od31015-21**
Designer: **Designer**
Date: **2/28/2022**

Clarifier Sizing

$A_{\text{design, Max Mo}}$ = Qavg / Oavg / No. Clarifiers = 80,000 / 50.3 / 1 = 1590 ft²

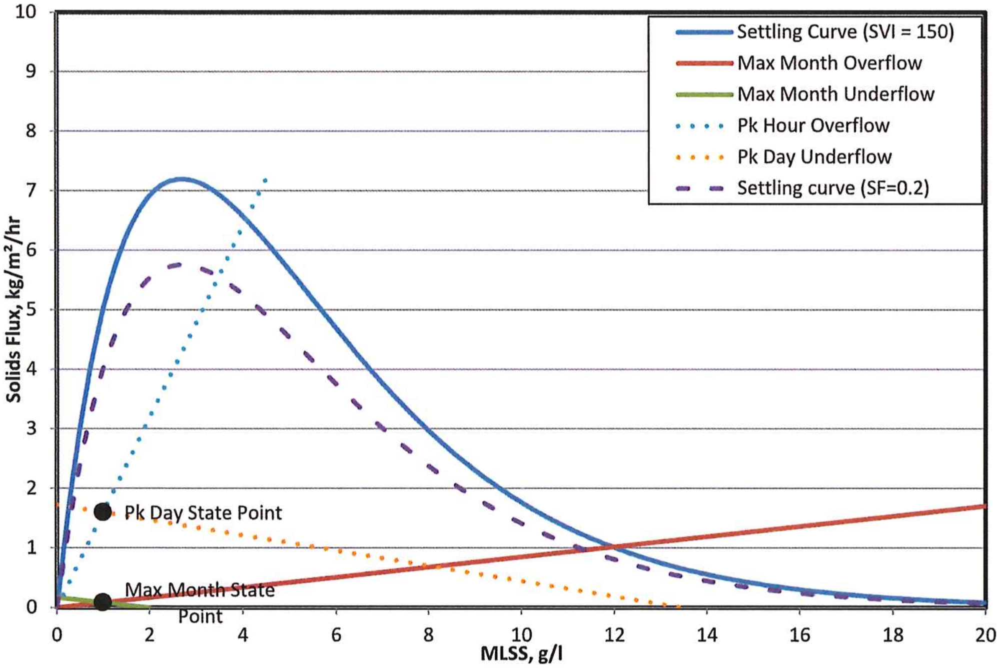
$A_{\text{design, Peak}}$ = Qavg / Oavg / No. Clarifiers = 1,500,000 / 943.4 / 1 = 1590 ft²

where:
Q = Flow, gpd
A = Area per clarifier, ft2
O = Surface overflow rate, gpd/ft2

Use Larger Area : 1590 ft²
Dia. design [Area / π x 4]^(1/2) = [1590 / 3.142 x 4] ^(1/2) = **45 ft**

Use Clarifier Diameter = 45 ft
User Clarifier Quantity = 1

Max. Mo. Condition = 1,000 mg/l MLSS and 2,000 mg/l RAS concentration
Peak Condition = 1,000 mg/l MLSS and 13,500 mg/l RAS concentration
State Point Analysis



Max Month State Point is below the settling curve.
Pk Day State Point is below the settling curve.
Pk Day Underflow underflow is below the settling curve.
Clarifier design is adequate.

Attachment 2-3

US 31 WWTP Design
Clarifier Sizing Calculations

Created	5/15/2022
Updated	11/17/2022

	Oxidation Ditch	Oxidation Ditch
	Avg Flow	Low Flow
Clarifier Diameter (ft)	**40**	**40**
Weir Diameter (ft)	**36.67**	**36.67**
Surface Area (ft^2)	1257	1257
SWD (ft)	**12**	**12**
Volume (ft^3)	15080	15080
Volume (MG)	0.1128	0.1128
ADF (MGD)	**0.5**	**0.1**
PHF (MGD)	**2.25**	**0.36**
RAS Flow Rate (MGD)	**0.5**	**0.1**
Number of Units	**2**	**1**
Process Flow per Unit @ ADF (MGD)	0.25	0.08
Process Flow per Unit @ PHF (MGD)	1.13	0.36
RAS Flow Rate Per Unit (MGD)	0.25	0.08
Total Flow to Each Unit (MGD)- Avg	0.50	0.16
Total Flow to Each Unit (MGD)- Peak	1.38	0.44
MLSS (mg/L)	**2900**	**2600**
Detention Time (hrs)- Average	5.41	16.92
Detention Time (hrs)- Peak	1.97	6.15
Surface Overflow Rate @ PHF (gpd/ft2)	895	286
Weir Overflow Rate (gal/day/ft)	9,766	3,125
Solids Loading Rate (lbs/day/ft2)	26.46	7.59

Channel Width (ft)	1
Channel Wall Thickness (ft)	0.67

Attachment 2-4

Chemical Precipitation for Phosphorus Removal: DESIGN CONDITIONS
US31 Hamilton County Wastewater Treatment Plant

Assumes Chemical applied during or after secondary (biological)
treatment; not to be used to calculate CEPT

By: Wessler Engineering
Date: 7/14/2022 Updated: 1/25/2023

🟩 <-- VERIFY DATA WITH CHEMICAL SUPPLIER
🟦 <-- INSERT DATA

ALUM

Flow, ADF:	0.5	MGD	
Flow, PHF:	2.25	MGD	Changed to 2.25 MGD to match the curren
Flow, Low:	0.08	MGD	
Raw or Primary Effl Total-P*:	6	mg/L	
Effluent P Limit:	1.0	mg/L	
Effluent P Design Goal:	0.8	mg/L	ASSUME NO P REMOVED IN WAS
Effluent TSS Goal:	10	mg/L	Eff limit: 12 mg/L
Effluent particulate P*:	0.25	mg/L	

**Assumes that ~2.5% of effluent TSS is particulate P*

Effluent orthophoshate limit: 0.6 mg/L

Al/P ratio*: 1.51

**Refer to WEF MOP 34, Figure 7.7*

$C_{P,in}$ (ortho-P)*: 5.2 mg/L

**Assumes that nonorthophosphate and particulate phosphorus are at least partially hydrolyzed during biological treatment to orthophosphate*

$C_{P,res}$:	0.6	mg/L
Al:	26.98	g/mol
P:	30.97	g/mol
Mass of P to remove:	22	lbs/day

Al_{dose} = (Al/P) x ($C_{P,in}$ - $C_{P,res}$) x [(26.98 g Al/mol / (30.97 p P/mol)]

Al_{dose}:	**6.84**	**mg/L**	
Al_{req} at ADF:	**29**	**lbs/day**	
Alum solution formula:	**$Al_2(SO_4)_3$ 14 H_2O**		*as supplied by chemical distributor*
Alum solution:	594.4	g/mol	
$Al_{\%}$ in Alum Solution:	4.54%		Al/Alum Solution MW Ratio
$Alum_{solution}$:	48.5%		*as supplied by chemical distributor*
$Alum_{specific\ wt}$:	11.05	lbs/gal	*as supplied by chemical distributor*

$Alum_{req}$ @ ADF: 628 lbs/day Concentration: 150.68 mg/L

$Alum_{req}$, gal/day = ($Alum_{req}$, lbs/day) / [($Alum_{specific\ wt}$, lbs/gal) ($Alum_{sol}$, %)

$Alum_{req}$ @ ADF: 57 gal/day
20,755 gal/year

PUMPING:

At Avg. Flow	2.4	gal/hr	*Avg Feed Rate*
At Avg. Flow	0.04	gal/min	Avg Feed Rate
At Peak Flow	0.18	gal/min	Max Feed Rate
At Peak Flow	10.66	gal/hr	*Max Feed Rate*
At Low Flow	0.01	gal/min	Max Feed Rate
At Low Flow	0.38	gal/hr	*Max Feed Rate*

STORAGE

Desired Storage Period: 30 days
Safety Factor*: 15%

**safety factor accounts for headspace/freeboard in tanks*

DESIGN

TOTAL TANK VOLUME REQ'D: 2,000 Gallons

Design Tank sizing:

Volume (gal)	Diameter (ft)	Height (ft)
2,000	7.0	7.00

Under low flow (near term) conditions: Storage Period 219.83 days
Too long

O&M COST

Chemical Cost:	$ 0.11	per lb	*assumed*
Cost at ADF:	$ 69	per day	
COST AT ADF:	**$ 25,200**	per year	

Al:	26.982	g/mol	O:	15.999	g/mol
S:	32.066	g/mol	H:	1.00794	g/mol
Fe:	55.847	g/mol	Cl:	35.4527	g/mol
Na:	22.990	g/mol			

Elemental Weights taken from "Aquatic Chemistry, Stumm & Morgan, 3rd Edition, 1996"

Chemical Supplier used for design: Liquid Alum Safety Data Sheet (SDS) - Supplier: JMN Special

Chemical Precipitation for Phosphorus Removal: NEAR TERM CONDTIONS
US31 Hamilton County Wastewater Treatment Plant

Assumes Chemical applied during or after secondary (biological) treatment; not to be used to calculate CEPT

By: Wessler Engineering
Date: 7/14/2022 Updated: 1/25/2023

🟩 <-- VERIFY DATA WITH CHEMICAL SUPPLIER
🟦 <-- INSERT DATA

ALUM

Flow, ADF: 0.08 MGD
Flow, PHF: 0.36 MGD Changed to 2.25 MGD to match t
Raw or Primary Effl Total-P*: 6 mg/L
Effluent P Limit: 1.0 mg/L
Effluent P Design Goal: 0.8 mg/L ASSUME NO P REMOVED IN W

Effluent TSS Goal: 10 mg/L Eff limit: 12 mg/L
Effluent particulate P*: 0.25 mg/L
**Assumes that ~2.5% of effluent TSS is particulate P*
Effluent orthophoshate limit: 0.6 mg/L

Al/P ratio*: 1.51
**Refer to WEF MOP 34, Figure 7.7*
$C_{P,in}$ (ortho-P)*: 5.2 mg/L
**Assumes that nonorthophosphate and particulate phosphorus are at least partially hydrolyzed during biological treatment to orthophosphate*

$C_{P,res}$: 0.6 mg/L
Al: 26.98 g/mol
P: 30.97 g/mol
Mass of P to remove: 3 lbs/day

Al_{dose} = (Al/P) x ($C_{P,in}$ - $C_{P,res}$) x [(26.98 g Al/mol / (30.97 p P/mol)]

Al_{dose}: 6.84 mg/L
Al_{req} at ADF: 5 lbs/day
Alum solution formula: **$Al_2(SO_4)_3$ 14 H_2O** *as supplied by chemical distribut*
Alum solution: 594.4 g/mol
$Al_{\%}$ in Alum Solution: 4.54% Al/Alum Solution MW Ratio
$Alum_{solution}$: 48.5% *as supplied by chemical distribut*
$Alum_{specific\ wt}$: 11.05 lbs/gal *as supplied by chemical distribut*

$Alum_{req}$ @ ADF: 101 lbs/day Concentration: 150.68
$Alum_{req}$, gal/day = ($Alum_{req}$, lbs/day) / [($Alum_{specific\ wt}$, lbs/gal) ($Alum_{sol}$, '

$Alum_{req}$ @ ADF: 9 gal/day
3,321 gal/year

PUMPING:

At Avg. Flow	0.4	gal/hr	*Avg Feed Rate*
At Avg. Flow	0.01	gal/min	Avg Feed Rate
At Peak Flow	0.03	gal/min	Max Feed Rate
At Peak Flow	1.71	gal/hr	*Max Feed Rate*

STORAGE

Desired Storage Period: 30 days
Safety Factor*: 15%
**safety factor accounts for headspace/freeboard in tanks*

DESIGN
TOTAL TANK VOLUME REQ'D: 400 Gallons
Near Term Storage: 2 - 250 gal totes

O&M COST

Chemical Cost: $ 0.11 per lb *assumed*
Cost at ADF: $ 11 per day
COST AT ADF: $ 4,000 per year

Al:	26.982	g/mol	O:	15.999	g/mol
S:	32.066	g/mol	H:	1.00794	g/mol
Fe:	55.847	g/mol	Cl:	35.4527	g/mol
Na:	22.990	g/mol			

Elemental Weights taken from "Aquatic Chemistry, Stumm & Morgan, 3rd Edition, 1996"

Chemical Supplier used for design: Liquid Alum Safety Data Sheet (SDS) - Supplier: JMN

Chemical Precipitation for Phosphorus Removal: Storage Review
US31 Hamilton County Wastewater Treatment Plant

Date: 1/25/2023

Background:	Flow	Alum Addition
Design	0.5 MGD	57 gal/day
Near Term	0.08 MGD	9 gal/day

Storage needed under Design Flow Conditions: 2000 gallons
Under Near Term Conditions, storage period: 220 days
THIS IS TOO LONG

In Near Term, chemical storage needed for 30 days: 400 gallons
Provided by: 2 totes, each 250 gallons

Recommend increase size when storage time reaches 10 days

Volume Available (minus 15% safety factor) 425 gallons
Alum Usage at which reach 10 days storage 42.5 gal/day

Flow at which storage becomes limited: 0.37 MGD 75% design capacity

Storage period at limiting flow for Design Storage Tank 47 days for 2000 gal tank
ok

Containment: Title 40 CFR part 264.193: the area to "contain 100% of the capacity of the largest tank within its boundary

Totes: Two 250-gal totes sits on a twin containment pallet: specified pallet, Ultratech 1144
Containment provided: 535 gal > 500 gal total storage, ok

Tank Details:
Tank installed outside of chemical room, 2000 gallons, 7' diameter, 7' height
Tank Containment:

Length (ft)	Width (ft)	Depth (ft)	Total (cf)	Volume (gal)
12	12	2	288	2154.24 > 2000 gal tank, ok

Attachment 2-5

Design Flows

ADF	0.5	MGD	0.77	CFS
PHF	2.25	MGD	3.48	CFS

Cascade Aeration

$$H = \frac{R - 1}{0.11ab(1 + 0.046 * T)}$$

$$R = \frac{C_s - C_0}{C_s - C}$$

Cs: Dissolved O_2 Saturation Concentration @ Temp, mg/l

C_0: Dissolved O_2 Concentration of the Post Disinfection Influent,mg/l

C: Permitted Dissolved O_2 Concentration,mg/l

a: water quality parameter, 0.8 for treated wastewater effluent

b: Weir Geometry Parameter

Weir:	1
Steps:	1.1
Step Weir:	1.3

T: Water Temperature, °C

Summer 20 Winter 12

H: Height through which water falls, ft

Cs:	9.08	mg/l	Summer	C:	6	mg/l	Summer	NPDES Permit (March 4, 2022)
	11.28	mg/l	Winter		6	mg/l	Winter	NPDES Permit (March 4, 2022)
C_0:	2	mg/l						

R=	2.299	**Summer**	a:	**0.8**	T:	**20**	°C, Summer
	1.758	**Winter**	b:	**1.1**		**10**	°C, Winter

H=	6.99	**ft, Summer**
	5.36	**ft, Winter**

Attachment 2-6

US 31 WWTP Design
Estimate of Biosolids Production

Created 4/13/2022
Updated 3/7/2023

BIOSOLIDS DATA

	Low	Avg		
Average Daily Flow, MGD	**0.08**	**0.500**	1	✓
Influent BOD Concentration, mg/L	200	200	1	✓
Organic Loading, lb BOD/day	133	834		
Sludge Yield, lb/lb BOD	0.935	0.935	2,3	← IDEM uses 0.7
Organic Sludge Yield, lb/day	125	780		
Influent TSS Concentration, mg/L	200	200	1	
Influent TNVSS fraction, Percent	0.0%	0.0%	4	← IDEM uses 70% VSS / TSS
Influent TNVSS Concentration, mg/L	-	-	5	
TNVSS Loading, lb TS/day	-	-		
Total WAS Produced w/o Chem P removal, lb TS/day	125	780		
Chemical Addition, lb TS/day	19	119	6	✓
Total WAS Produced w/Chem P Removal, lb TS/day	144	898		
WAS % TS, from clarifier(s)	0.58%	0.58%	2	
WAS Flow, gal/day	2,973	18,579		
WAS, @60% VS, lb VS/day	86	539		

ANNUAL DISPOSAL QUANTITIES

	Low	Avg
Gallons Per Year	1,085,009	6,781,305
Dry Tons Per Year	26.2	163.9

WAS STORAGE: FUTURE AEROBIC DIGESTER

	Low	Avg		
Minimum Residence Time under aeration, days	52.2	8.4		
Mean Temperature, degree C	15	15		
Volatile Solids Destruction, %	55.0%	39.0%	7	← IDEM uses 40 %
Volatile Solids Destruction, lb VS/day	47	210		
Solids Loading after WAS Storage, lb TS/day	96	688		
Estimated WAS %TS after storage	2.0%	2.0%		✓
Sludge after WAS Storage, gal/day	577	4,125		
Additional Volume needed with Supernatant, gal/day	722	5,157	8	
Future Digester/Biosolids Storage, Capacity, gal	155,320	155,320	9	✓
Effective Storage Time, days	215	30		
Aeration Required for Mixing, scfm	623	623	10	✓

Notes

1 *Based upon flow and loads spreadsheet*
2 *As per Bioloop Calculations*
3 *Yield provided in Bioloop Calculations already includes VSS yield*
4 *Set to zero since VSS already included in sludge yield fraction*
5 *TNVSS = Total Non-Volatile Suspended Solids*
6 *Estimate of Additional Sludge Production due to Chem-P Removal*
7 *Based on temperature x solids retention time, Figure 20.51 from 2006 Water Environment Federation*
8 *Additional 25% volume added for supernatant per 10 State Standards, Sec 85.31*
9 *Storage Capacity based on liquid depth (ft) of* 20.4 *and diameter (ft) of* 36
Note: Assumption for sizing is that solids are landfilled, not land applied, which needs 60 day storage.
If land application is considered when aerobic digester installed in the future, double number of digesters.
10 *Aeration based on 10 State Standards, Sec 85.5* 30 *cfm of air required per 1000 cf of storage volume*

influent - permit
200mg/L - 10mg/L

sludge = (834 - 42) × 0.7
555 lb/day

volatile = 555 × 70 %
388 lb/day

after digestion = 555 - (388 × 40%)
399 lb/day

+15% chemical sludge
+ 83.2 lb/day

= 483 lb/day

dentention time = 43 days

US 31 WWTP Design
Estimate of Additional Sludge Production due to Chem-P Removal

Created 4/13/2022
Updated 1/25/2023

Bio-P Removal? NO

Design Avg Condition 0.5 MGD
Low Flow Condition 0.08 MGD

Description	Design Conditions	Unit	Design Conditions	Unit	Comments
Flow Rate	0.5	MGD	0.08	MGD	
Influent Phosphorus Concentration	6	mg/L	6	mg/L	
Post EBPR Phosphorus Concentration	NA	mg/L	NA	mg/L	
Effluent Phosphorus Goal	0.8	mg/L	0.8	mg/L	Set below 1.0 mg/L to be conservative
Amount of Phosphorus to be Removed	21.7	lbs/day	3.5	lbs/day	Q*8.34*ΔP
MW of Phosphorus	30.974	lbm/lbmmole	30.974	lbm/lbmmole	
moles of Phosphorus to be removed	0.70	moles/day	0.11	moles/day	mass/molar mass
Al/P Mole Ratio	1.51		1.51		WEF MOP 34 Figure 7.7
MW of Al	26.982	lbm/lbmmole	26.982	lbm/lbmmole	
moles of Al added for Phosphorus Removal	1.06	moles/day	0.17	moles/day	molar ratio (Al/P) * moles of P
MW of $Al_{0.8}(H_2PO_4)(OH)_{1.4}$	142.40	lbm/lbmmole	142.40	lbm/lbmmole	WEF MOP 34 page 266
Stoichiometric Al required for Phosphorus Removal (to produce $Al_{0.8}(H_2PO_4)(OH)_{1.4}$)	0.56	moles/day	0.09	moles/day	WEF MOP 34 page 266 (0.8* Moles P removed)
Excess Al added (produces $Al(OH)_3$)	0.50	moles/day	0.08	moles/day	Total Al added - Amount required for Phosphorus Removal
MW of $Al(OH)_3$	78	lbm/lbmmole	78	lbm/lbmmole	
$Al_{0.8}(H_2PO_4)(OH)_{1.4}$ produced	79.75	lbs/day	12.76	lbs/day	MW of $Al_{0.8}(H_2PO_4)(OH)_{1.4}$ * moles of $Al_{0.8}(H_2PO_4)(OH)_{1.4}$
lbs of $Al(OH)_3$ produced	38.77	lbs/day	6.20	lbs/day	MW of $Al(OH)_3$ * moles of $Al(OH)_3$
Amount of Additional Sludge Produced	**119**	lbs/day	**19**	lbs/day	Total $Al_{0.8}(H_2PO_4)(OH)_{1.4}$ and $Al(OH)_3$produced
Additional Volume of Sludge Produces at 1.0% WAS	**1421**	gal/day	**227**	gal/day	

Estimated WAS production without Chem-P	16,128	gal/day	2,580	gal/day
% increase with Chem-P	8.81%		8.81%	

Sources:
Periodic Table
WEF Manual of Practice No. 34, Page 266
Liquid Alum Safety Data Sheet (SDS) - Supplier: JMN Specialities, Inc

Element	MW
P	30.974
Al	26.982
O	15.999
H	1.008

US 31 WWTP Design
Geotextile Dewatering

Created 4/13/2022
Updated 2/23/2023

BIOSOLIDS DATA	No Aerobic Digester		Aerobic Digester
	Low	Avg	Avg
Average Daily Flow, MGD	**0.08**	**0.500**	**0.500**[1]
WAS Sludge Production, lb/day	**144**	**898**	**688**[1]
Daily Sludge Volume, gal	**2,973**	**18,579**	**4,125**[1]

SOLIDS PRODUCTION

Weekly Sludge Volume, gal.	20,808	130,052	28,877
Monthly Sludge Volume, gal.	89,179	557,368	123,760
Annual Sludge Volume, gal.	1,085,009	6,781,305	1,505,750
Annual Sludge Weight, dry tons	26.2	163.9	125.6
WAS wasting schedule, hrs/week @ 100 gpm rate	3.5	21.7	4.8[2]

DEWATERING BAG REQUIREMENTS

20cy Container Bag Capacity, gal.	96,000	96,000	96,000[3]
Typical Polymer Feed Rate, gph.	0.915	0.915	0.915[4]
Days to fill a bag	32	5	23[5]
Bags per Year, #	12	71	16[6]
Polymer Usage per Year, gal.	165	1034	230[7]
Polymer Usage, per bag gal.	14	15	14[8]
Polymer Dilution Water Req., gpm	15	0	15[9]
Max Dilution Water Vol., gal	13,563	0	14,116[10]
Bag Sludge Concentration, percent	13.1%	13.8%	47.1%[11]

Notes

1 *From Estimate of Sludge Production spreadsheet - note this value is for sludge after WAS storage for Aerobic Digester column.*

2 *Recommended sludge pumping rate into geotextile bags, per Blue River, is 100 gpm. Preferred wasting schedule is 8 hours a day, 1-2 days for a 7-day week. Sludge storage, in the form of an aerobic digester, will be considered once wasting exceed 16 hours per 7-day week.*

3 *See Table A: Container Bag Capacity (Blue River) on Geotextile Capacity spreadsheet, estimated based on WAS TS % provided in Bioloop Calculations*

4 *See Table B: Typical Polymer Usage (Blue River) on Geotextile Capacity spreadsheet, estimated based on WAS TS % provided in Bioloop Calculations and 100 gpm. feed rate*

5 *Container Bag Capacity divided by the Daily Sludge Volume*

6 *Annual sludge capacity divided by the container bag capacity.*

7 *The annual sludge volume produced by the plant divided by the 100 gpm. rate of sludge dewatering multiplied by the usage rate of polymer.*

8 *Polymer usage per year divided by the number of bags per year*

9 *per Blue River (Mike Conwell) - 4/7/18*

10 *Maximum volume of water required to initially fill the bag. The maximum volume will need to be multiplied if more than one bag is being filled.*
Example: 15 gpm. x 60min per hr. x 14 gal / .915 gph = 13,563 gal of H_2O

11 *Theoretical goal for dewatered sludge concentration in bags.(Dry tons per bag divided by the expected weight each bag could carry.)*

US 31 WWTP Design
Geotextile Capacity

Created 4/13/2022
Updated 1/25/2023

Table A: Container Bag Capacity (Blue River)

Percent Solids	Container Bag (gal.)
1.00%	56,000
1.50%	37,000
2.00%	28,000
2.50%	23,250
3.00%	18,500

Percent TS based on Bioloop Calculations:
0.58% 96,000 calculated

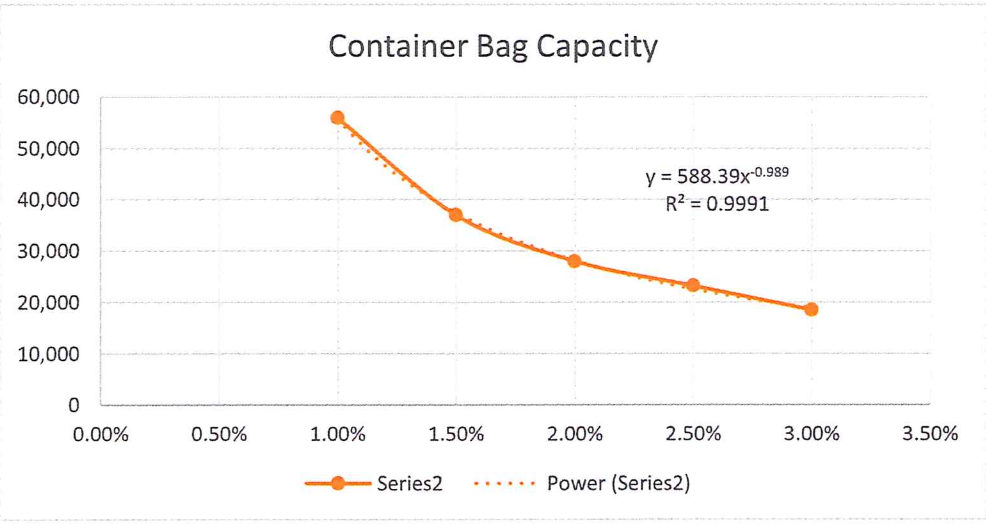
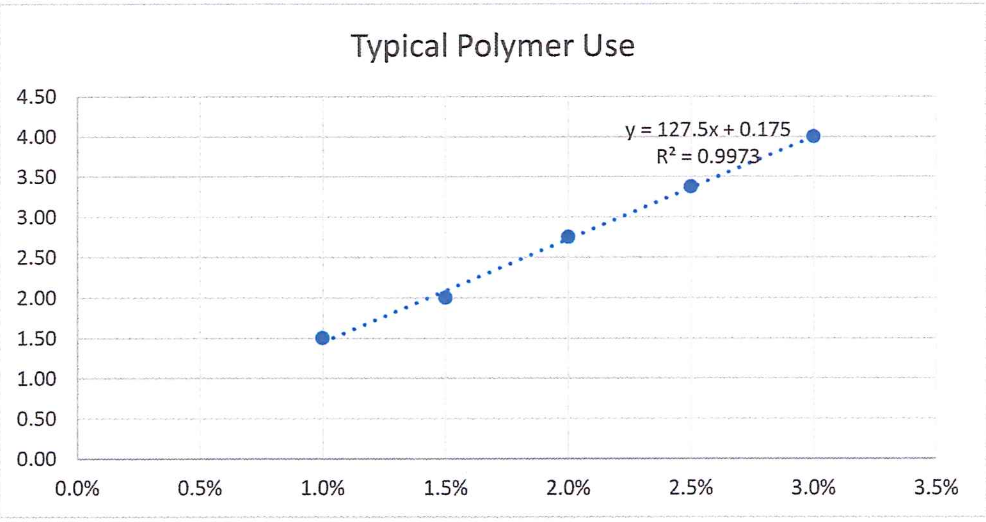


Table B: Typical Polymer Usage (Blue River)

Percent Solids	100 GPM Flow (gph)	
1.0%	1.50	
1.5%	2.00	
2.0%	2.75	
2.5%	3.38	
3.0%	4.00	

Percent TS based on Bioloop Calculations:
0.58% 0.9145 calculated



Question 3 Attachment 3-1

Project Location: Hamilton County, Indiana (Bakers Corner)
Project: US 31 Wastewater Treatment Plant
Project #: 244721.04.001

Calculated by: SG
Date: July 11, 2022
Checked by: ALT
Date: August 10, 2022

Minor Loss Coefficients

Value	Fitting	Source
0.3	*90-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.2	*45-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.1	*11.25-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 418*
0.5	*Entrance*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 419*
1.0	*Submerged Exit*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 420*
0.3	*45-deg Wye (flow through)*	*Applied Hydraulics In Engineering pg 114*
1.8	*Tee (flow through branch)*	*Applied Hydraulics In Engineering pg 115*
0.3	*Tee (flow through run)*	*Applied Hydraulics In Engineering pg 116*
0.8	*45° Wye, through side outlet*	*Applied Hydraulics In Engineering pg 117*
0.3	*45° Wye, straight run*	*Applied Hydraulics In Engineering pg 118*
0.8	*Plug Valve*	
2.5	*Check Valve (swing check)*	
Varies	*Increaser*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=2.6*(sin(q/2))*(1-(d_1^2/d_2^2))^2$*; when q<45-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
Varies	*Reducer*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=0.8*(sin(q/2))*(1-(d_1^2/d_2^2))$*; when q<45-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
5.55	*Screen (assume 1/4" spacing, 1/4" bars = 2.0 open:obstruction ratio)*	

Pipe Losses (Solve Hazen Williams Equation)

$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$

Where: h_L = *Friction Headloss (ft)*
Q = *Flow (cfs)*
C = *Roughness coefficient*
d = *Pipe Dia. (ft)*
L = *Pipe length (ft)*

Hydraulic Design Handbook, pg 10.9, Equation 10.11a
$V = 1.318*C*R^{0.63}*S^{0.54}$
$S = h_L/L$

Channel Losses (Solve Manning's Equation)

$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$

Where: h_L = *Friction Headloss (ft)*
Q = *Flow (cfs)*
n = *Roughness coefficient*
R = *Hydraulic Radius (ft)*
$R = (d*w/(w+2d))$ *for rectangular channel)*
$R = (d*w/(2w+2d))$ *for rectangular conduit)*
A = *Area* (ft^2)
L = *Pipe length (ft)*

Hydraulic Design Handbook, pg 10.11, Equation 10.14
Civil Engineering Reference Manual, pg 19-4
$V = (1.49/n)*R^{2/3}*S^{1/2}$
$V = Q/A$
$S = h_L/L$

Minor Losses

$h_m = K(V^2/2g)$

Where: h_m = Minor Headloss (ft)

K = minor loss expression

V = velocity (ft/s)

Loss Across Sluice Gate

$H = v^2/2g*(1/C_d^2)$

Where: v = velocity (ft/s)

g = gravity acceleration (ft/s^2)

C_d = sluice gate coefficient (assume = 0.7)

Head over weir (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

$Q = KH^{2.5}$ for 90° V-Notch weirs

Where: Q_n = flow per v-notch

K = constant (2.500 for units in cfs)

$Q = KLH^{1.5}$ for rectangular weirs without end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

$Q = K(L - 0.2H)*H^{1.5}$ for rectangular weirs with end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

Equivalent Pipe Diameter (Civil Engineering Reference Manual, 9th Ed.)

$D_e = (2*L_1*L_2)/(L_1 + L_2)$ (for rectangular conduit flowing full)

Where: D_e = equivalent diameter (ft)

L_1 = width (ft)

L_2 = height (ft)

$D_e = (4*h*L)/(L + 2*h)$ (for rectangular conduit flowing partially full)

D_e = equivalent diameter (ft)

L = width (ft)

h = depth (ft)

Parshall Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b/H_a

Where: H_a = head upstream of throat (ft)

H_b = head at throat (ft)

0.8 Max allowable submergence for flumes 8 to 50 feet wide for discharge to not be reduced

Discharge Equation (for flumes 8 to 50 feet wide)

$Q = (3.688*W + 2.5)*H^{1.6}$

Where: Q = flow (cfs)

W = throat width (ft)

H = head upstream of throat (ft)

Headloss through flume

$H_L = H_a - H_b$

Cutthroat Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b/H_a

Where: H_a = *head upstream of throat (ft)*

H_b = *head downstream of throat (ft)*

Discharge Equations

$Q = KW^{1.025} H^{n} = CH^{n}$

Where: Q = *flow (cfs)*

W = *throat width (ft)*

H = *head upstream of throat (ft)*

K = *free-flow coefficient*

C = *free-flow coefficient*

n_1 = *free-flow exponent*

Headloss through flume

$H_L = H_a - H_b$

Throat Size	*Transition Submergence for free flow*
1.0	79.0%
1.5	81.0%
2.0	83.0%
2.5	84.0%
3.0	85.0%
4.0	86.0%
5.0	87.0%
6.0	88.0%

Table 1 of "Design and Calibration of Submerged Open Channel Flow Measurement Structures, Part 3 - Cutthroat Flumes" by Skogerboe, Gaylord, et.al, Utah Water Research Laboratory, 1967

Orifice (Cameron Hydraulic Data)

(when $d_1/d_2 < 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2$

(when $d_1/d_2 > 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2*(1-(d_1/d_2)^4)$

Where: Q = *flow (gpm)*

C = *Discharge coefficient (0.61 for sharp-edged)*

d_1 = *Diameter of orifice (in)*

h = *differential head (ft)*

Bar Screens

$H_L = \beta\ (w/b)^{1.33}\ h \sin\Phi$

$h_L = (V^2 - V^1)/(2g + (1/0.7))$

Kirschmer's Equation Where,

H_L = *Headloss*

β = *Bar Shape Factor*

w = *maximum cross-sectional width of bars facing upstream (0.31" for Bar Spacing <= 3/8" and 0.47" for bar spacing >3/8")*

b = *minimum clear spacing of bars*

h = *upstream velocity head*

Φ = *angle of bar screen with horizontal*

Note that while using the Kirschmer's Equation for calculating the Headloss, use the Bar Shape Factor as 1 instead of 0.76 and this is done in order to account for a factor of safety.

Net Positive Suction Head

$NPSH_A = S - H_s + (P_{atm} - P_{vp})\ x\ 2.31 / SG$

Where: S = *Static Suction Head (ft)*

H_s = *Head Losses in Suction System (ft)*

P_{atm} = *Pressure Head (psi)*

P_{vp} = *Vapor Pressure of Liquid (psi)*

SG = *Specific Gravity*

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022

Hazen Williams roughness coefficient (C Factor) = 120

Manning's roughness coefficient (n) = 0.013

		FLOW				
		Low	ADF	PDF	PDF OTOOS	Future PDF
Influent Flow	mgd	0.08	0.5	2.25	2.25	6.0
Return Activated Sludge (RAS) Percentage	%	100%	100%	100%	100%	100%
RAS Flow	mgd	0.08	0.5	0.5	0.5	1.5
Total Flow	mgd	0.16	1.0	2.8	2.8	7.5

				WSE	WSE	WSE	WSE	WSE
	Influent Junction Structure			914.05	914.39	914.38	914.86	915.81
A	Screening Influent			914.05	914.39	914.37	914.85	915.72
	Screening Effluent			913.55	913.64	913.86	913.86	914.21
	Screening Building Effluent			912.07	912.20	912.84	913.01	913.00
	Oxidation Ditch Elevation			912.07	912.15	912.30	912.48	912.38
	Secondary Splitter Box			912.07	912.15	912.29	912.47	912.36
	Secondary Splitter Box Weir	Adjustable	912.00					
	Splitter Box Effluent			910.54	910.58	910.78	911.34	910.95
	Final Clarifier Influent			910.53	910.55	910.60	910.63	910.61
	Final Clarifier Weir	Adjustable	910.50					
	Final Clarifier Effluent			905.19	905.23	905.69	906.16	906.24
	Disinfection Tank Influent			905.19	905.22	905.34	905.34	905.62
	Disinfection Weir	Adjustable	905.00					
	Disinfection Tank Effluent			902.67	903.04	903.89	903.89	903.60
	Cascade Aeration Effluent			897.74	897.79	898.60	898.60	899.21
	Ditch Effluent		897.74					
	25 Yr Flood							
	100 Yr Flood	X	897.74					

🟩 = Conditions where free drop is greater than 6-inches at we

= Conditions where free drop is less than 6-inches at weir

🟥 = Conditions where weir is submerged

NOTES:

1. Ground elevation varies between ~ 905-908'
2. 100 yr flood elevation was chosen as 897.74 ft based on the calcs and using the downstream 100 yr elevation data provided in IDNR report.
3. OTOOS: One tank out of service

Wessler Engineering

Plant Hydraulics

Project Location: Hamilton County, Indiana (Bakers Corner)
Project: US 31 Wastewater Treatment Plant
Project #: 244721.04.001

Calculated by: SG
Date: July 11, 2022
Checked by: ALT
Date: August 10, 2022
C Factor: 120
Manning's coefficient (n): 0.013

Influent Flow				mgd	0.08	0.50	2.25	2.25	6.00
				cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
Headworks Influent Elevation					*914.05*	*914.39*	*914.37*	*914.85*	*915.72*
Screening Building									
Channel Width, ft	2.00								
Channel Height, ft	1.50								
Channel Length, ft	35								
Conduit Area, ft^2	3.00								
Wetted Perimeter, ft	5.00								
Hydraulic Radius, ft	0.60								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*
Flow (cfs)				Influent Flow	*0.12*	*0.77*	*3.48*	*3.48*	*4.64*
Velocity (fps)					*0.04*	*0.26*	*1.16*	*1.16*	*1.55*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.00*	*0.02*	*0.02*	*0.04*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*0*	*0.5*	*0*					
	Submerged exit	*0*	*1*	*0*					
			Total	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Equipment Losses									
	Screen Loss				*0.50*	*0.75*	*0.50*	*0.98*	*1.50*
$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$					*0.00*	*0.00*	*0.01*	*0.01*	*0.01*
Total losses for section					*0.50*	*0.75*	*0.51*	*0.99*	*1.51*
Screen Channel Effluent					*913.55*	*913.64*	*913.86*	*913.86*	*914.21*
Screen Channel Invert				*913.5*					
Screen Building Effluent Pipe Water Surface Elevation					*912.07*	*912.20*	*912.84*	*913.01*	*913.33*

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

Influent Flow	mgd	0.08	0.50	2.25	2.25	6.00
	cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
Return Activated Sludge Flow	mgd	0.08	0.50	0.50	0.50	1.50
	cfs	**0.12**	**0.77**	**0.77**	**0.77**	**2.32**
Total Flow	mgd	0.16	1.00	2.75	2.75	7.50
	cfs	**0.25**	**1.55**	**4.26**	**4.26**	**11.61**

Screen Building Effluent Pipe Water Surface Elevation					*912.07*	*912.20*	*912.84*	*913.01*	*913.33*

Screening Building to RAS Feed Structure

Pipe Material	*Ductile Iron - 250 psi*								
Pipe Diameter, in	*16*								
Pipe Diameter, ft	*1.33*								
Inside Diameter, ft	*1.40*								
Pipe Length, ft	*50*								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*
Flow (cfs)				Influent Flow	*0.12*	*0.77*	*3.48*	*3.48*	*4.64*
Velocity (fps)					*0.08*	*0.50*	*2.26*	*2.26*	*3.01*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.00*	*0.08*	*0.08*	*0.14*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					
	90 Degree Bend		*0.3*	*0*					
	Exit	*1*	*1*	*1*					
			Total	*1.5*	*0.00*	*0.01*	*0.12*	*0.12*	*0.21*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$					*0.00*	*0.00*	*0.07*	*0.07*	*0.11*
Total losses for section					*0.00*	*0.01*	*0.19*	*0.19*	*0.32*

RAS Feed Effluent Elevation					*912.07*	*912.20*	*912.65*	*912.83*	*913.00*

RAS Feed Structure to Oxidation Ditch

Pipe Material	*Ductile Iron - 250 psi*								
Pipe Diameter, in	*18*								
Pipe Diameter, ft	*1.50*								
Inside Diameter, ft	*1.57*								
Pipe Length, ft	*70*								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*
Flow (cfs)				Total Flow	*0.25*	*1.55*	*4.26*	*4.26*	*5.80*
Velocity (fps)					*0.13*	*0.80*	*2.19*	*2.19*	*2.98*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.01*	*0.07*	*0.07*	*0.14*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					
	90 Degree Bend	*1*	*0.3*	*0.3*					
	Tee	*1*	*1.8*	*1.8*					
	Exit	*1*	*1*	*1*					
			Total	*3.6*	*0.00*	*0.04*	*0.27*	*0.27*	*0.50*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$					*0.00*	*0.01*	*0.08*	*0.08*	*0.13*
Total losses for section					*0.00*	*0.05*	*0.35*	*0.35*	*0.63*

Aeration Basin Influent Elevation					*912.07*	*912.15*	*912.30*	*912.48*	*912.38*

Oxidation Ditch Pass-Through Slide Gate

Percentage of Flow					*100.0%*	*100.0%*	*100.0%*	*100.0%*	*50.0%*
Flow				Total Flow	*0.25*	*1.55*	*4.26*	*4.26*	*5.80*
Length, ft	*3*								
Width, ft	*3*								

Print Date: 1/26/2023

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

Influent Flow		mgd	0.08	0.50	2.25	2.25	6.00
		cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
Return Activated Sludge Flow		mgd	0.08	0.50	0.50	0.50	1.50
		cfs	**0.12**	**0.77**	**0.77**	**0.77**	**2.32**
Total Flow		mgd	0.16	1.00	2.75	2.75	7.50
		cfs	**0.25**	**1.55**	**4.26**	**4.26**	**11.61**
Area, sq ft	*9*						
Cd constant	*0.7*						
Velocity (fps)			*0.03*	*0.17*	*0.47*	*0.47*	*0.64*
Head through gate H = $(Q/(Cd*A))^2/(2g)$			0.00	0.00	0.00	0.00	0.00
Total losses for section			*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
			912.07	*912.15*	*912.30*	*912.48*	*912.37*
Oxidation Ditch Effluent Slide Gate							
Percentage of Flow			*100.0%*	*100.0%*	*100.0%*	*100.0%*	*50.0%*
Flow		Total Flow	*0.25*	*1.55*	*4.26*	*4.26*	*5.80*
Length, ft	*2*						
Width, ft	*2*						
Area, sq ft	*4*						
Cd constant	*0.7*						
Velocity (fps)			*0.06*	*0.39*	*1.06*	*1.06*	*1.45*
Head through gate H = $(Q/(Cd*A))^2/(2g)$			0.00	0.00	0.01	0.01	0.01
Total losses for section			*0.00*	*0.00*	*0.01*	*0.01*	*0.01*
			912.07	*912.15*	*912.29*	*912.47*	*912.36*
Splitter Box Weir Loss							
Percentage of Flow			*100.0%*	*50.0%*	*50.0%*	*100.0%*	*25.0%*
Flow		Total Flow	*0.25*	*0.77*	*2.13*	*4.26*	*2.90*
Rectangular Weir, ft	*4*						
K constant (for cfs units)	*3.33*						
Head over weir H = $(Q_n/(KL))^{(1/1.5)}$			*0.07*	*0.15*	*0.29*	*0.47*	*0.36*
Total losses for section			*0.07*	*0.15*	*0.29*	*0.47*	*0.36*
Splitter Box Weir		*912.00*					
Splitter Box Effluent			*910.54*	*910.58*	*910.78*	*911.34*	*910.95*

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

	Influent Flow			mgd	0.08	0.50	2.25	2.25	6.00
				cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
	Return Activated Sludge Flow			mgd	0.08	0.50	0.50	0.50	1.50
				cfs	**0.12**	**0.77**	**0.77**	**0.77**	**2.32**
	Total Flow			mgd	0.16	1.00	2.75	2.75	7.50
				cfs	**0.25**	**1.55**	**4.26**	**4.26**	**11.61**
			Splitter Box Effluent Elevation		*910.54*	*910.58*	*910.78*	*911.34*	*910.95*
Splitter Box to Final Clarifier									
Pipe Material	*Ductile Iron - 250 psi*								*Ductile Iron - 250 psi*
Pipe Diameter, in	*14*								*14*
Pipe Diameter, ft	*1.17*								*1.17*
Inside Diameter, ft	*1.23*								*1.23*
Pipe Length, ft	*80*								
Percentage of Flow					*100%*	*50%*	*50%*	*100%*	*25%*
Flow (cfs)				Total Flow	*0.25*	*0.77*	*2.13*	*4.26*	*2.90*
Velocity (fps)					*0.21*	*0.65*	*1.80*	*3.59*	*2.45*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.01*	*0.05*	*0.20*	*0.09*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					
	90 Degree Bend	*2*	*0.3*	*0.6*					
	Exit	*1*	*1*	*1*					
			Total	*2.1*	*0.00*	*0.01*	*0.11*	*0.42*	*0.20*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$					*0.00*	*0.01*	*0.08*	*0.29*	*0.14*
Total losses for section					*0.00*	*0.02*	*0.19*	*0.71*	*0.34*
			Clarifier Basin Influent Elevation		*910.53*	*910.55*	*910.60*	*910.63*	*910.61*
Final Clarifier weir loss									
Percentage of Flow					*100.0%*	*50.0%*	*50.0%*	*100.0%*	*25.0%*
Flow				Influent Flow	*0.12*	*0.39*	*1.74*	*3.48*	*2.32*
V-notch spacing, in				*6*					
Number of V-notches per foot of Weir				*2.00*					
Clarifier Diameter, ft				*40*					
Effluent Trough Width, ft				*1*					
Trough Wall Width, ft				*0.67*					
Clarifier Weir Diameter, ft				*36.67*					
Effluent Weir Length, ft				*115*					
Total Number of V-notch Weirs/Clarifier				*230*					
Flow Per V-notch (Q_n)*, cfs*					*0.00*	*0.00*	*0.01*	*0.02*	*0.01*
K constant (for cfs units)				*2.50*					
Head over weir H = $(Q/K)^{(1/2.5)}$					*0.03*	*0.05*	*0.10*	*0.13*	*0.11*
Total losses for section					*0.03*	*0.05*	*0.10*	*0.13*	*0.11*
	Clarifier Basin Weir			*910.50*					
					905.20	*905.26*	*905.80*	*906.38*	*906.39*
Final Clarifier 12" x 12" Opening to Effluent Box									
Percentage of Flow					*100.0%*	*50.0%*	*50.0%*	*100.0%*	*25.0%*
Flow				Influent Flow	*0.12*	*0.39*	*1.74*	*3.48*	*2.32*
Depth, ft	*0.5*								
Width, ft	*1*								
Area, sq ft	*0.5*								
Cd constant	*1*								
Velocity (fps)					*0.25*	*0.77*	*3.48*	*6.96*	*4.64*
Head through gate H = $(Q/(Cd*A))^2/(2g)$					0.01	0.02	0.11	0.22	0.14

Project Location: Hamilton County, Indiana (Bakers Corner)
Project: US 31 Wastewater Treatment Plant
Project #: 244721.04.001

Calculated by: SG
Date: July 11, 2022
Checked by: ALT
Date: August 10, 2022
C Factor: 120
Manning's coefficient (n): 0.013

Influent Flow	mgd	0.08	0.50	2.25	2.25	6.00
	cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
Return Activated Sludge Flow	mgd	0.08	0.50	0.50	0.50	1.50
	cfs	**0.12**	**0.77**	**0.77**	**0.77**	**2.32**
Total Flow	mgd	0.16	1.00	2.75	2.75	7.50
	cfs	**0.25**	**1.55**	**4.26**	**4.26**	**11.61**
Total losses for section		*0.01*	*0.02*	*0.11*	*0.22*	*0.14*
Clarifier Basin Effluent Elevation		*905.19*	*905.23*	*905.69*	*906.16*	*906.24*

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

	Influent Flow			mgd	0.08	0.50	2.25	2.25	6.00
				cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
	Clarifier effluent elevation				905.19	905.23	905.69	906.16	906.24
Final Clarifier Effluent Box to Final Clarifier Junction Manhole									
Pipe Material	*Ductile Iron - 250 psi*								
Pipe Diameter, in	*12*								
Pipe Diameter, ft	1.00								
Inside Diameter, ft	1.03								
Pipe Length, ft	*40*								
Percentage of Flow					*100%*	*50%*	*50%*	*100%*	*25%*
Flow (cfs)				Influent Flow	*0.12*	*0.39*	*1.74*	*3.48*	*2.32*
Velocity (fps)					*0.15*	*0.46*	*2.08*	*4.15*	*2.77*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.00*	*0.07*	*0.27*	*0.12*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					
	Exit	*1*	*1*	*1*					
			Total	*1.5*	*0.00*	*0.00*	*0.10*	*0.40*	*0.18*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$					*0.00*	*0.00*	*0.06*	*0.23*	*0.11*
Total losses for section					*0.00*	*0.00*	*0.16*	*0.63*	*0.29*
	Manhole Effluent Elevation				*905.19*	*905.23*	*905.53*	*905.53*	*905.96*
Final Clarifier Combination Manhole to UV									
Pipe Material	*Ductile Iron - 250 psi*								*Ductile Iron - 250 psi*
Pipe Diameter, in	*16*								*16*
Pipe Diameter, ft	1.33								1.33
Inside Diameter, ft	1.40								1.40
Pipe Length, ft	*55*								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*
Flow (cfs)				Influent Flow	*0.12*	*0.77*	*3.48*	*3.48*	*4.64*
Velocity (fps)					*0.08*	*0.50*	*2.26*	*2.26*	*3.01*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.00*	*0.08*	*0.08*	*0.14*
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					
	45 Degree Bend		*0.2*	*0*					
	Exit	*1*	*1*	*1*					
			Total	*1.5*	*0.00*	*0.01*	*0.12*	*0.12*	*0.21*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$					*0.00*	*0.00*	*0.07*	*0.07*	*0.12*
Total losses for section					*0.00*	*0.01*	*0.19*	*0.19*	*0.33*
	UV Disinfection Influent Elevation				*905.19*	*905.22*	*905.34*	*905.34*	*905.62*
UV Channel									
Channel Width, ft	*1.00*								
Channel Height, ft	*1.56*								
Channel Length, ft	*26.00*								
Channe Area, ft^2	1.56								
Wetted Perimeter, ft	4.12								
Hydraulic Radius, ft	0.38								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*100%*
Flow (cfs)				Influent Flow	*0.12*	*0.77*	*3.48*	*3.48*	*9.28*
Velocity (fps)					*0.08*	*0.50*	*2.23*	*2.23*	*5.95*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.00*	*0.08*	*0.08*	*0.55*
Minor Losses		***Qty***	***K***	***Total***					
	90 degrees bend	*0*	*0.3*	*0*					
	Submerged exit	*0*	*1*	*0*					
	Reducer	*1*	*0.1*	*0.1*					
			Total	*0.10*	*0.00*	*0.00*	*0.01*	*0.01*	*0.05*
$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$					*0.00*	*0.00*	*0.04*	*0.04*	*0.26*

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

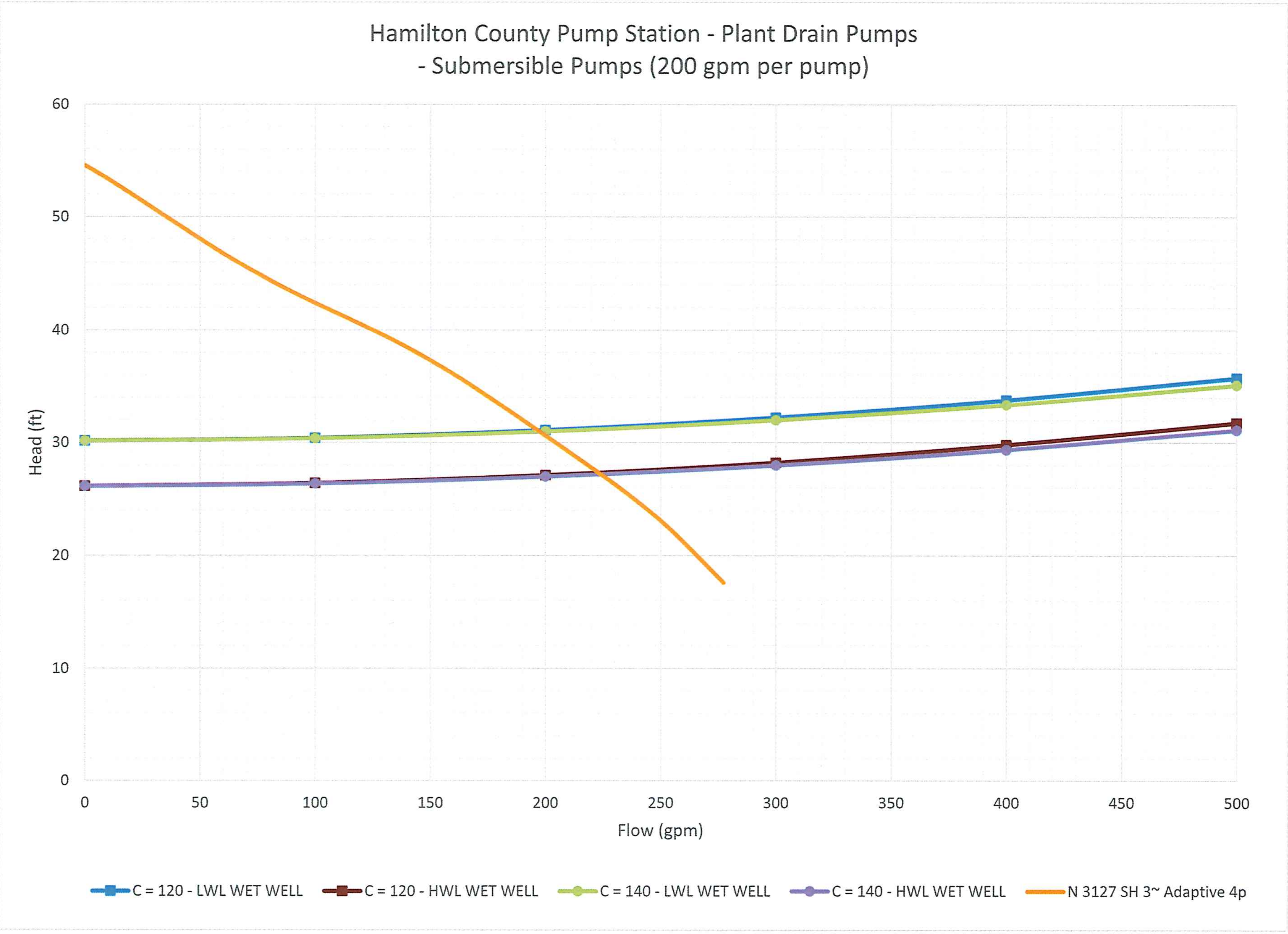
Influent Flow				mgd	0.08	0.50	2.25	2.25	6.00
				cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
Total losses for section					*0.00*	*0.00*	*0.05*	*0.05*	*0.31*
UV bulb loss					*0.18*	*0.18*	*0.18*	*0.18*	*0.18*
UV WSE Elevation					*905.01*	*905.04*	*905.11*	*905.11*	*905.13*
UV Disinfection Weir Losses									
Flow				Influent Flow	*0.12*	*0.77*	*3.48*	*3.48*	*9.28*
Level Control Weir, ft	*28.0*								*60.00*
K constant (for cfs units)	*3.33*								
Head over weir $H = (Q_n/(KL))^{(1/1.5)}$					*0.01*	*0.04*	*0.11*	*0.11*	*0.13*
Total losses for section					*0.01*	*0.04*	*0.11*	*0.11*	*0.13*
	Disinfection Tank Weir			*905.00*					
UV Effluent					*902.67*	*903.04*	*903.89*	*903.89*	*903.60*
UV to Cascade Aeration									
Channel Width, ft	4.00								
Channel Height, ft	1.65								
Channel Length, ft	20.00								
Channel Area, ft^2	6.60								
Wetted Perimeter, ft	7.30								
Hydraulic Radius, ft	0.90								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*100%*
Flow (cfs)				Influent Flow	0.12	0.77	3.48	3.48	9.28
Velocity (fps)					0.02	0.12	0.53	0.53	1.41
Velocity Head (ft) $= V^2/2g$					0.00	0.00	0.00	0.00	0.03
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*0*	*0.5*	*0*					
	90 degrees bend	*0*	*0.3*	*0*					
	Submerged exit	*0*	*1*	*0*					
			Total	0.00	0.00	0.00	0.00	0.00	0.00
$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$					0.00	0.00	0.00	0.00	0.00
Total losses for section					0.00	0.00	0.00	0.00	0.00
Cascade Aeration Influent					902.67	903.04	903.89	903.89	903.60
Parshall Flume Loss									
6'' Parshall Flume Head Loss					0.17	0.54	1.39	1.39	1.10
HL = (Q/2.06)^(1/1.58) - for 6" Parshall Flume									
Level Floor of Parshall Flume					902.50	902.50	902.50	902.50	902.50
					901.24	901.29	902.10	902.10	902.71
Cascade Aeration Loss									
	Cascade aeration Loss (ft)			*3.50*					
WSE at effluent from Cascade Aeration					897.74	897.79	898.60	898.60	899.21
Cascade Aeration to Discharge									
Pipe Material	*Ductile Iron - 250 psi*								*Ductile Iron - 250 psi*
Pipe Diameter, in	*16*								*16*
Pipe Diameter, ft	1.33								1.33
Inside Diameter, ft	1.40								1.40
Pipe Length, ft	*520*								
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*
Flow (cfs)				Influent Flow	0.12	0.77	3.48	3.48	4.64
Velocity (fps)					0.08	0.50	2.26	2.26	3.01
Velocity Head (ft) $= V^2/2g$					0.00	0.00	0.08	0.08	0.14
Minor Losses		***Qty***	***K***	***Total***					
	Entrance	*1*	*0.5*	*0.5*					

Project Location:	Hamilton County, Indiana (Bakers Corner)	**Calculated by:**	SG
Project:	US 31 Wastewater Treatment Plant	**Date:**	July 11, 2022
Project #:	244721.04.001	**Checked by:**	ALT
		Date:	August 10, 2022
		C Factor:	120
		Manning's coefficient (n):	0.013

Influent Flow			mgd	0.08	0.50	2.25	2.25	6.00
			cfs	**0.12**	**0.77**	**3.48**	**3.48**	**9.28**
45 degrees bend	*4*	*0.2*	*0.8*					
Exit	*1*	*1*	*1*					
Total			*2.3*	*0.00*	*0.01*	*0.18*	*0.18*	*0.32*
$h_L = ((4.73L)/(d^{4.87}))*((Q_I/C)^{1.852})$				*0.00*	*0.04*	*0.68*	*0.68*	*1.15*
Total losses for section				*0.00*	*0.05*	*0.86*	*0.86*	*1.47*
100 yr flood elevation				*897.74*	*897.74*	*897.74*	*897.74*	*897.74*
Invert of 12'' at Cascade Aeration Effluent				*892.75*	*892.75*	*892.75*	*892.75*	*893.75*
Ditch IE				890.91	*890.91*	*890.91*	890.91	890.91

Question 4 Attachments

Attachment 4-1


Hamilton County Pump Station - Plant Drain Pumps
- Submersible Pumps (200 gpm per pump)
Head (ft)
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
500
Flow (gpm)
C = 120 - LWL WET WELL
C = 120 - HWL WET WELL
C = 140 - LWL WET WELL
C = 140 - HWL WET WELL
N 3127 SH 3~ Adaptive 4p

Wessler Engineering

Pump Headloss Calculations

Project Location: US31 Hamilton County WWTP
Pump Location: Plant Drain Pump Station
Project #: 244721.04.001

Calculated by: SG
Date: August, 10 2022
Checked by: KMZ
Date: August, 17 2022

Minor Loss Coefficients

Value	Fitting	Source
0.3	*90-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.2	*45-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.1	*11.25-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 418*
0.5	*Entrance*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 419*
1.0	*Submerged Exit*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 420*
0.3	*45-deg Wye (flow through)*	*Applied Hydraulics In Engineering pg 114*
1.8	*Tee (flow through branch)*	*Applied Hydraulics In Engineering pg 115*
0.3	*Tee (flow through run)*	*Applied Hydraulics In Engineering pg 116*
0.8	*45° Wye, through side outlet*	*Applied Hydraulics In Engineering pg 117*
0.3	*45° Wye, straight run*	*Applied Hydraulics In Engineering pg 118*
0.8	*Plug Valve*	
2.5	*Check Valve (swing check)*	
Varies	*Increaser*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=2.6*(sin(q/2))*(1-(d_1^2/d_2^2))^2$; *when q<45-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
Varies	*Reducer*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=0.8*(sin(q/2))*(1-(d_1^2/d_2^2))$; *when q<45-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
5.55	*Screen (assume 1/4" spacing, 1/4" bars = 2.0 open:obstruction ratio)*	

Pipe Losses (Solve Hazen Williams Equation)

$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$

Where: h_L = Friction Headloss (ft)
Q = Flow (cfs)
C = Roughness coefficient
d = Pipe Dia. (ft)
L = Pipe length (ft)

Hydraulic Design Handbook, pg 10.9, Equation 10.11a
$V = 1.318*C*R^{0.63}*S^{0.54}$
$S = h_L/L$

Channel Losses (Solve Manning's Equation)

$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$

Where: h_L = Friction Headloss (ft)
Q = Flow (cfs)
n = Roughness coefficient
R = Hydraulic Radius (ft)
$R = (d*w/(w+2d))$ *for rectangular channel)*
$R = (d*w/(2w+2d))$ *for rectangular conduit)*
A = Area (ft^2)
L = Pipe length (ft)

Hydraulic Design Handbook, pg 10.11, Equation 10.14
Civil Engineering Reference Manual, pg 19-4
$V = (1.49/n)*R^{2/3}*S^{1/2}$
$V = Q/A$
$S = h_L/L$

Minor Losses

$h_m = K(V^2/2g)$

Where: h_m = Minor Headloss (ft)
K = minor loss expression
V = velocity (ft/s)

Loss Across Sluice Gate

$H = v^2/2g*(1/C_d^2)$

Where: v = velocity (ft/s)

g = gravity acceleration (ft/s ^{2})

C_d = sluice gate coefficient (assume = 0.7)

Head over weir (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

$Q = KH^{2.5}$ for 90° V-Notch weirs

Where: Q_n = flow per v-notch

K = constant (2.500 for units in cfs)

$Q = KLH^{1.5}$ for rectangular weirs without end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

$Q = K(L - 0.2H)*H^{1.5}$ for rectangular weirs with end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

Equivalent Pipe Diameter (Civil Engineering Reference Manual, 9th Ed.)

$D_e = (2*L_1*L_2)/(L_1 + L_2)$ (for rectangular conduit flowing full)

Where: D_e = equivalent diameter (ft)

L_1 = width (ft)

L_2 = height (ft)

$D_e = (4*h*L)/(L + 2*h)$ (for rectangular conduit flowing partially full)

D_e = equivalent diameter (ft)

L = width (ft)

h = depth (ft)

Parshall Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b/H_a

Where: H_a = *head upstream of throat (ft)*

H_b = *head at throat (ft)*

0.8 *Max allowable submergence for flumes 8 to 50 feet wide for discharge to not be reduced*

Discharge Equation (for flumes 8 to 50 feet wide)

$Q = (3.688*W + 2.5)*H^{1.6}$

Where: Q = *flow (cfs)*

W = *throat width (ft)*

H = *head upstream of throat (ft)*

Headloss through flume

$H_L = H_a - H_b$

Cutthroat Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b/H_a

Where: H_a = *head upstream of throat (ft)*

H_b = *head downstream of throat (ft)*

Discharge Equations

$Q = KW^{1.025}H^{n} = CH^{n}$

Where: Q = *flow (cfs)*

W = *throat width (ft)*

H = *head upstream of throat (ft)*

K = *free-flow coefficient*

C = *free-flow coefficient*

n_1 = *free-flow exponent*

Headloss through flume

$H_L = H_a - H_b$

Throat Size	*Transition Submergence for free flow*
1.0	79.0%
1.5	81.0%
2.0	83.0%
2.5	84.0%
3.0	85.0%
4.0	86.0%
5.0	87.0%
6.0	88.0%

Table 1 of "Design and Calibration of Submerged Open Channel Flow Measurement Structures, Part 3 - Cutthroat Flumes" by Skogerboe, Gaylord, et.al, Utah Water Research Laboratory, 1967

Orifice (Cameron Hydraulic Data)

(when $d_1/d_2 < 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2$

(when $d_1/d_2 > 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2*(1-(d_1/d_2)^4)$

Where: Q = *flow (gpm)*
C = *Discharge coefficient (0.61 for sharp-edged)*
d_1 = *Diameter of orifice (in)*
h = *differential head (ft)*

Bar Screens

$H_L = \beta (w/b)^{1.33}\ h \sin\Phi$

$h_L = (V^2 - V^1)/(2g + (1/0.7))$

Kirschmer's Equation Where,
H_L = *Headloss*
β = *Bar Shape Factor*
w = *maximum cross-sectional width of bars facing upstream (0.31" for Bar Spacing <= 3/8" and 0.47" for bar spacing >3/8")*
b = *minimum clear spacing of bars*
h = *upstream velocity head*
Φ = *angle of bar screen with horizontal*

Note that while using the Kirschmer's Equation for calculating the Headloss, use the Bar Shape Factor as 1 instead of 0.76 and this is done in order to account for a factor of safety.

Net Positive Suction Head

$NPSH_A = S - H_s + (P_{atm} - P_{vp})\ x\ 2.31 / SG$

Where: S = *Static Suction Head (ft)*
H_s = *Head Losses in Suction System (ft)*
P_{atm} = *Pressure Head (psi)*
P_{vp} = *Vapor Pressure of Liquid (psi)*
SG = *Specific Gravity*

Wessler Engineering

Pump Headloss Calculations

Project Location: US31 Hamilton County WWTP
Pump Location: Plant Drain Pump Station
Project #: 244721.04.001

Calculated by: SG
Date: August, 10 2022
Checked by: KMZ
Date: August, 17 2022

Wet Well High Water Level: 886.50
Wet Well Low Water Level: 882.50
Max Downstream Elevation: 912.65

C Factor #1: 120
C Factor #2: 140
Pump Centerline: 882

TOTAL DYNAMIC HEAD

				FLOW			
	gpm	0	100	200	300	400	500
	mgd	0.000	0.144	0.288	0.432	0.576	0.720
Flow Scenarios	cfs	0.000	0.223	0.446	0.668	0.891	1.114
C = 120 - LWL WET WELL		**30.150**	**30.403**	**31.110**	**32.233**	**33.790**	**35.753**
C = 120 - HWL WET WELL		**26.150**	**26.403**	**27.110**	**28.233**	**29.790**	**31.753**
C = 140 - LWL WET WELL		**30.150**	**30.373**	**30.990**	**31.993**	**33.370**	**35.123**
C = 140 - HWL WET WELL		**26.150**	**26.373**	**26.990**	**27.993**	**29.370**	**31.123**

$NPSH_A = S - H_s + (P_{atm} - P_{vp}) \times 2.31 / SG$

Specific Gravity	1.00						
Liquid Vapor Pressure (at 70-degree F), psi	0.363						
Pressure Head, psi	14.7						
At Low Wet Well Level		33.62	33.62	33.62	33.62	33.62	33.62

Number of Pumps Running	1	1	1	1	1	1

STATION LOSSES

Pipe Section Pump Column/Valves

Pipe Material	*Ductile Iron - 250 psi*
Pipe Diameter, in	*6*
Pipe Diameter, ft	*0.50*
Inside Diameter, ft:	*0.52*
Pipe Length, ft	*40*

	Qty	*K*	*Total*						
Percentage of Flow				*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Flow (cfs)				*0.00*	*0.22*	*0.45*	*0.67*	*0.89*	*1.11*
Velocity (fps)				*0.00*	*1.06*	*2.11*	*3.17*	*4.22*	*5.28*
Velocity Head (ft) = $V^2/2g$				*0.00*	*0.02*	*0.07*	*0.16*	*0.28*	*0.43*
Minor Losses									
Entery Loss	*1*	*0.5*	*0.5*						
90 Degree Bend	*2*	*0.3*	*0.6*						
6x4 reducer	*0*	*0.1*	*0*						
Check Valve	*1*	*2.5*	*2.5*						
Plug Valve	*1*	*0.8*	*0.8*						
		Total	*4.4*	*0.00*	*0.08*	*0.30*	*0.69*	*1.22*	*1.90*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$				*0.00*	*0.04*	*0.15*	*0.31*	*0.53*	*0.80*
Total losses for section (C = 120)				*0.00*	*0.12*	*0.45*	*1.00*	*1.75*	*2.70*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$				*0.00*	*0.03*	*0.11*	*0.23*	*0.40*	*0.60*
Total losses for section (C = 140)				*0.00*	*0.11*	*0.41*	*0.92*	*1.62*	*2.50*

Total Station Losses (C = 120)	*0.00*	*0.12*	*0.45*	*1.00*	*1.75*	*2.70*
Total Station Losses (C = 140)	*0.00*	*0.11*	*0.41*	*0.92*	*1.62*	*2.50*

DISCHARGE (SYSTEM) LOSSES

Pipe Combine to RAS Feed Structure

Pipe Material	*PVC SDR21*
Pipe Diameter, in	*6*
Pipe Diameter, ft	*0.50*
Inside Diameter, ft:	*0.51*
Pipe Length, ft	*80*

	Qty	*K*	*Total*						
Percentage of Flow				*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Flow (cfs)				*0.00*	*0.22*	*0.45*	*0.67*	*0.89*	*1.11*
Velocity (fps)				*0.00*	*1.09*	*2.19*	*3.28*	*4.37*	*5.46*
Velocity Head (ft) = $V^2/2g$				*0.00*	*0.02*	*0.07*	*0.17*	*0.30*	*0.46*
Minor Losses									
45-deg Wye (flow through)	*1*	*0.3*	*0.3*						
45° Wye, through side outlet	*1*	*0.8*	*0.8*						

TOTAL DYNAMIC HEAD

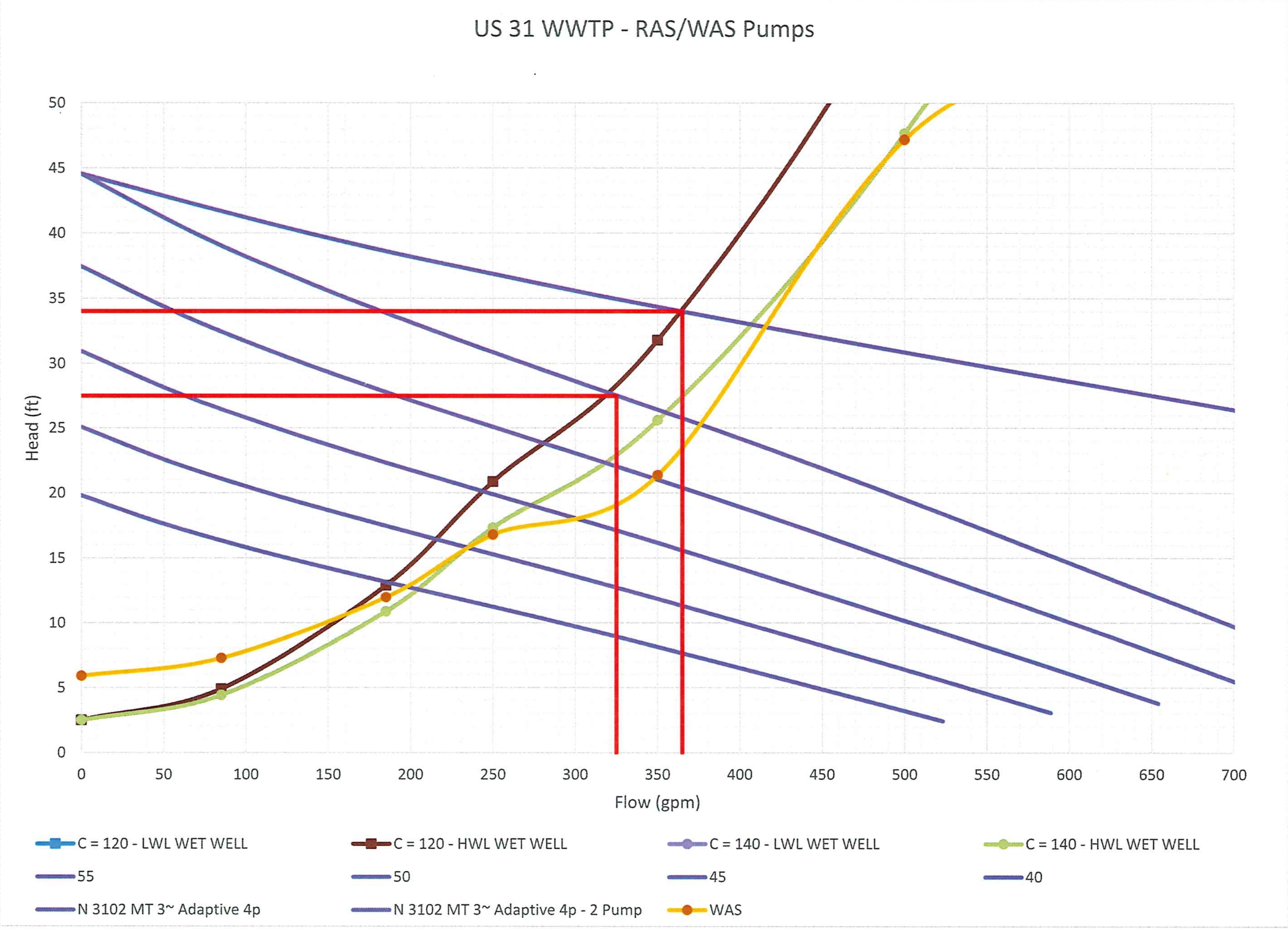
				FLOW					
			gpm	0	100	200	300	400	500
			mgd	0.000	0.144	0.288	0.432	0.576	0.720
Flow Scenarios			cfs	0.000	0.223	0.446	0.668	0.891	1.114
90 Degree Bend	*0*	*0.3*	*0*						
45 Degree Bend	*2*	*0.2*	*0.4*						
Plug Valve	*0*	*0.8*	*0*						
Exit	*1*	*1.0*	*1*						
		Total	*2.50*	*0.00*	*0.05*	*0.19*	*0.42*	*0.74*	*1.16*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				*0.00*	*0.09*	*0.32*	*0.67*	*1.15*	*1.74*
Total losses for section (C = 120)				*0.00*	*0.14*	*0.51*	*1.09*	*1.89*	*2.90*
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				*0.00*	*0.07*	*0.24*	*0.51*	*0.86*	*1.31*
Total losses for section (C = 140)				*0.00*	*0.12*	*0.43*	*0.93*	*1.60*	*2.47*
Total Discharge Loss, ft (C = 120)				*0.00*	*0.14*	*0.51*	*1.09*	*1.89*	*2.90*
Total Discharge Loss, ft (C = 140)				*0.00*	*0.12*	*0.43*	*0.93*	*1.60*	*2.47*

TOTAL DYNAMIC HEAD CALCULATIONS

Static Head (@ Max Static Head)		*30.15*	*30.15*	*30.15*	*30.15*	*30.15*	*30.15*
Total Dynamic Head (calculation check) *(Static Head + Discharge Losses)*	*Max WSE*	*30.15*	*30.29*	*30.66*	*31.24*	*32.04*	*33.05*
C = 120 - LWL WET WELL							
Pump Centerline	*882*						
Static Suction Head (Well WSE - Pump Center Line)		*0.50*	*0.50*	*0.50*	*0.50*	*0.50*	*0.50*
Static Discharge Head (Discharge Elev. - Pump Center Line))		*30.65*	*30.65*	*30.65*	*30.65*	*30.65*	*30.65*
Total Dynamic Suction Head (Static Suction Head - Suction Losses)		*0.50*	*0.50*	*0.50*	*0.50*	*0.50*	*0.50*
Total Dynamic Discharge Head (Static Discharge Head + Station + Discharge Losses)		*30.65*	*30.90*	*31.61*	*32.73*	*34.29*	*36.25*
TOTAL DYNAMIC HEAD		*30.15*	*30.40*	*31.11*	*32.23*	*33.79*	*35.75*
Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head							
C = 120 - HWL WET WELL							
Pump Centerline	*882*						
Static Suction Head (Well WSE - Pump Center Line)		*4.50*	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
Static Discharge Head (Discharge Elev. - Pump Center Line))		*30.65*	*30.65*	*30.65*	*30.65*	*30.65*	*30.65*
Total Dynamic Suction Head (Static Suction Head - Suction Losses)		*4.50*	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
Total Dynamic Discharge Head (Static Discharge Head + Station + Discharge Losses)		*30.65*	*30.90*	*31.61*	*32.73*	*34.29*	*36.25*
TOTAL DYNAMIC HEAD		*26.15*	*26.40*	*27.11*	*28.23*	*29.79*	*31.75*
Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head							
C = 140 - LWL WET WELL							
LOW WATER WET WELL WSE SCENARIO							
Pump Centerline	*882*						
Static Suction Head (Well WSE - Pump Center Line)		*0.50*	*0.50*	*0.50*	*0.50*	*0.50*	*0.50*
Static Discharge Head (Discharge Elev. - Pump Center Line))		*30.65*	*30.65*	*30.65*	*30.65*	*30.65*	*30.65*
Total Dynamic Suction Head (Static Suction Head - Suction Losses)		*0.50*	*0.50*	*0.50*	*0.50*	*0.50*	*0.50*
Total Dynamic Discharge Head (Static Discharge Head + Station + Discharge Losses)		*30.65*	*30.87*	*31.49*	*32.49*	*33.87*	*35.62*
TOTAL DYNAMIC HEAD		*30.15*	*30.37*	*30.99*	*31.99*	*33.37*	*35.12*

TOTAL DYNAMIC HEAD								
			FLOW					
		gpm	0	100	200	300	400	500
		mgd	0.000	0.144	0.288	0.432	0.576	0.720
Flow Scenarios		cfs	0.000	0.223	0.446	0.668	0.891	1.114
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head							
C = 140 - HWL WET WELL								
	Pump Centerline	*882*						
	Static Suction Head (Well WSE - Pump Center Line)		*4.50*	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
	Static Discharge Head (Discharge Elev. - Pump Center Line))		*30.65*	*30.65*	*30.65*	*30.65*	*30.65*	*30.65*
	Total Dynamic Suction Head (Static Suction Head - Suction Losses)		*4.50*	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
	Total Dynamic Discharge Head (Static Discharge Head + Station + Discharge Losses)		*30.65*	*30.87*	*31.49*	*32.49*	*33.87*	*35.62*
	TOTAL DYNAMIC HEAD		*26.15*	*26.37*	*26.99*	*27.99*	*29.37*	*31.12*
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head							

Attachment 4-2


US 31 WWTP - RAS/WAS Pumps
Head (ft)
0
5
10
15
20
25
30
35
40
45
50
Flow (gpm)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
C = 120 - LWL WET WELL
C = 120 - HWL WET WELL
C = 140 - LWL WET WELL
C = 140 - HWL WET WELL
55
50
45
40
N 3102 MT 3~ Adaptive 4p
N 3102 MT 3~ Adaptive 4p - 2 Pump
WAS

Project Location: US 31 Hamilton County
Pump Location: RAS/WAS Pump Station
Project #: 244721

Calculated by: SG
Date: July 5, 2022
Checked by: ALT
Date: August 23, 2022

Minor Loss Coefficients

Value	Fitting	Source
0.3	*90-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.2	*45-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 417*
0.1	*11.25-deg bend*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 418*
0.5	*Entrance*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 419*
1.0	*Submerged Exit*	*Metcalf & Eddy Collection & Pumping of Wastewater pg 420*
0.3	*45-deg Wye (flow through)*	*Applied Hydraulics In Engineering pg 114*
1.8	*Tee (flow through branch)*	*Applied Hydraulics In Engineering pg 115*
0.3	*Tee (flow through run)*	*Applied Hydraulics In Engineering pg 116*
0.8	*45° Wye, through side outlet*	*Applied Hydraulics In Engineering pg 117*
0.3	*45° Wye, straight run*	*Applied Hydraulics In Engineering pg 118*
0.8	*Plug Valve*	
2.5	*Check Valve (swing check)*	
Varies	*Increaser*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=2.6*(sin(q/2))*(1-(d_1^2/d_2^2))^2$ *; when* $q<45$*-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
Varies	*Reducer*	*Cameron Hydraulic Data for friction loss due to change in pipe size (Uses Equation) -* $K=0.8*(sin(q/2))*(1-(d_1^2/d_2^2))$*; when* $q<45$*-deg;* d_1 *= small pipe;* d_2 *= large pipe; based on velocity in small pipe*
5.55	*Screen (assume 1/4" spacing, 1/4" bars = 2.0 open:obstruction ratio)*	

Pipe Losses (Solve Hazen Williams Equation)

$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$

Where: h_L = *Friction Headloss (ft)*

Q = *Flow (cfs)*

C = *Roughness coefficient*

d = *Pipe Dia. (ft)*

L = *Pipe length (ft)*

Hydraulic Design Handbook, pg 10.9, Equation 10.11a

$V = 1.318*C*R^{0.63}*S^{0.54}$

$S = h_L/L$

Channel Losses (Solve Manning's Equation)

$h_L = ((L)*(n^2)*(Q^2))/((2.208)(R^{4/3})*(A^2))$

Where: h_L = *Friction Headloss (ft)*

Q = *Flow (cfs)*

n = *Roughness coefficient*

R = *Hydraulic Radius (ft)*

$R = (d*w/(w+2d))$ *for rectangular channel)*

$R = (d*w/(2w+2d))$ *for rectangular conduit)*

A = *Area* (ft^2)

L = *Pipe length (ft)*

Hydraulic Design Handbook, pg 10.11, Equation 10.14

Civil Engineering Reference Manual, pg 19-4

$V = (1.49/n)*R^{2/3}*S^{1/2}$

$V = Q/A$

$S = h_L/L$

Minor Losses

$h_m = K(V^2/2g)$

Where: h_m = *Minor Headloss (ft)*

K = *minor loss expression*

V = *velocity (ft/s)*

Loss Across Sluice Gate

$H = v^2/2g*(1/C_d^2)$

Where: v = velocity (ft/s)

g = gravity acceleration (ft/s ^{2})

C_d = sluice gate coefficient (assume = 0.7)

Head over weir (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

$Q = KH^{2.5}$ for 90° V-Notch weirs

Where: Q_n = flow per v-notch

K = constant (2.500 for units in cfs)

$Q = KLH^{1.5}$ for rectangular weirs without end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

$Q = K(L - 0.2H)*H^{1.5}$ for rectangular weirs with end contractions

Where: Q = flow (cfs)

K = constant (3.330 for units in cfs)

L = crest length

Equivalent Pipe Diameter (Civil Engineering Reference Manual, 9th Ed.)

$D_e = (2*L_1*L_2)/(L_1 + L_2)$ (for rectangular conduit flowing full)

Where: D_e = equivalent diameter (ft)

L_1 = width (ft)

L_2 = height (ft)

$D_e = (4*h*L)/(L + 2*h)$ (for rectangular conduit flowing partially full)

D_e = equivalent diameter (ft)

L = width (ft)

h = depth (ft)

Parshall Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b / H_a

Where: H_a = *head upstream of throat (ft)*
H_b = *head at throat (ft)*

0.8 *Max allowable submergence for flumes 8 to 50 feet wide for discharge to not be reduced*

Discharge Equation (for flumes 8 to 50 feet wide)

$Q = (3.688*W + 2.5)*H^{1.6}$

Where: Q = *flow (cfs)*
W = *throat width (ft)*
H = *head upstream of throat (ft)*

Headloss through flume

$H_L = H_a - H_b$

Cutthroat Flumes (ISCO Open Channel Flow Measurement Handbook, 6th Ed.)

Percent Submergence

Submergence Ratio = H_b / H_a

Where: H_a = *head upstream of throat (ft)*
H_b = *head downstream of throat (ft)*

Discharge Equations

$Q = KW^{1.025} H^{n} = CH^{n}$

Where: Q = *flow (cfs)*
W = *throat width (ft)*
H = *head upstream of throat (ft)*
K = *free-flow coefficient*
C = *free-flow coefficient*
n_1 = *free-flow exponent*

Headloss through flume

$H_L = H_a - H_b$

Throat Size	*Transition Submergence for free flow*
1.0	79.0%
1.5	81.0%
2.0	83.0%
2.5	84.0%
3.0	85.0%
4.0	86.0%
5.0	87.0%
6.0	88.0%

Table 1 of "Design and Calibration of Submerged Open Channel Flow Measurement Structures, Part 3 - Cutthroat Flumes" by Skogerboe, Gaylord, et.al, Utah Water Research Laboratory, 1967

Orifice (Cameron Hydraulic Data)

(when $d_1/d_2 < 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2$

(when $d_1/d_2 > 0.3$; d_2 = diameter of pipe in which orifice is placed)

$h = (Q/(19.635*C*d_1^2))^2*(1-(d_1/d_2)^4)$

Where:

Q = *flow (gpm)*

C = *Discharge coefficient (0.61 for sharp-edged)*

d_1 = *Diameter of orifice (in)*

h = *differential head (ft)*

Bar Screens

$H_L = \beta (w/b)^{1.33}\ h \sin\Phi$

$h_L = (V^2 - V^1)/(2g + (1/0.7))$

Kirschmer's Equation Where,

H_L = *Headloss*

β = *Bar Shape Factor*

w = *maximum cross-sectional width of bars facing upstream (0.31" for Bar Spacing <= 3/8" and 0.47" for bar spacing >3/8")*

b = *minimum clear spacing of bars*

h = *upstream velocity head*

Φ = *angle of bar screen with horizontal*

Note that while using the Kirschmer's Equation for calculating the Headloss,
use the Bar Shape Factor as 1 instead of 0.76 and this is done in order to account for a factor of safety.

Net Positive Suction Head

$NPSH_A = S - H_s + (P_{atm} - P_{vp})\ x\ 2.31 / SG$

Where:

S = *Static Suction Head (ft)*

H_s = *Head Losses in Suction System (ft)*

P_{atm} = *Pressure Head (psi)*

P_{vp} = *Vapor Pressure of Liquid (psi)*

SG = *Specific Gravity*

Wessler Engineering

Pump Headloss Calculations

Project Location:	US 31 Hamilton County	**Calculated by:**	SG
Pump Location:	RAS/WAS Pump Station	**Date:**	July 5, 2022
Project #:	244721	**Checked by:**	ALT
		Date:	August 23, 2022
Wet Well High Water Level:	907.60	**C Factor #1:**	120
Wet Well Low Water Level:	907.60	**C Factor #2:**	140
Max Downstream Elevation:	910.10	**Pump Centerline:**	891.5

TOTAL DYNAMIC HEAD

		FLOW							
	gpm	0	85	185	250	350	500	700	1000
	mgd	0.000	0.122	0.266	0.360	0.504	0.720	1.008	1.440
Flow Scenarios	cfs	0.000	0.189	0.412	0.557	0.780	1.114	1.560	2.228
C = 120 - LWL WET WELL		2.500	4.906	12.906	20.859	31.797	59.662	109.940	212.297
C = 120 - HWL WET WELL		2.500	4.906	12.906	20.859	31.797	59.662	109.940	212.297
C = 140 - LWL WET WELL		2.500	4.426	10.886	17.319	25.597	47.672	87.560	168.997
C = 140 - HWL WET WELL		2.500	4.426	10.886	17.319	25.597	47.672	87.560	168.997

$NPSH_A = S - H_s + (P_{atm} - P_{vp}) \times 2.31 / SG$

Specific Gravity	1.00								
Liquid Vapor Pressure (at 70-degree F), psi	0.363								
Pressure Head, psi	14.7								
At Low Wet Well Level		49.22	49.22	49.22	49.22	49.22	49.22	49.22	49.22
Number of Pumps Running		1	1	1	1	2	2	2	2

STATION LOSSES

From pump (east) to upstream of second wye

Pipe Material	*Ductile Iron - 250 psi*										
Pipe Diameter, in	*4*										
Pipe Diameter, ft	*0.33*										
Inside Diameter, ft:	*0.35*										
Pipe Length, ft	*30*										
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*50%*	*50%*	*50%*	*50%*
Flow (cfs)					*0.00*	*0.19*	*0.41*	*0.56*	*0.39*	*0.56*	*0.78*	*1.11*
Velocity (fps)					*0.00*	*2.01*	*4.37*	*5.90*	*4.13*	*5.90*	*8.26*	*11.80*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.06*	*0.30*	*0.54*	*0.27*	*0.54*	*1.06*	*2.16*
Minor Losses		*Qty*	*K*	***Total***								
	90 Degree Bend	*2*	*0.3*	*0.6*								
	Check Valve	*1*	*2.5*	*2.5*								
	Plug Valve	*1*	*0.8*	*0.8*								
	Wye (branch flow)	*1*	*0.8*	*0.8*								
			Total	*4.7*	*0.00*	*0.29*	*1.39*	*2.54*	*1.25*	*2.54*	*4.98*	*10.17*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$					*0.00*	*0.16*	*0.67*	*1.18*	*0.61*	*1.18*	*2.20*	*4.25*
Total losses for section (C = 120)					*0.00*	*0.45*	*2.06*	*3.72*	*1.86*	*3.72*	*7.18*	*14.42*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$					*0.00*	*0.12*	*0.51*	*0.89*	*0.46*	*0.89*	*1.65*	*3.20*
Total losses for section (C = 140)					*0.00*	*0.41*	*1.90*	*3.43*	*1.71*	*3.43*	*6.63*	*13.37*
Total Station Losses (C = 120)					*0.00*	*0.45*	*2.06*	*3.72*	*1.86*	*3.72*	*7.18*	*14.42*
Total Station Losses (C = 140)					*0.00*	*0.41*	*1.90*	*3.43*	*1.71*	*3.43*	*6.63*	*13.37*

DISCHARGE (SYSTEM) LOSSES

From second wye through tee in meter room

Pipe Material	*PVC SDR21*											
Pipe Diameter, in	*4*											
Pipe Diameter, ft	*0.33*											
Inside Diameter, ft:	*0.35*											
Pipe Length, ft	*330*											
Percentage of Flow					*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Flow (cfs)					*0.00*	*0.19*	*0.41*	*0.56*	*0.78*	*1.11*	*1.56*	*2.23*
Velocity (fps)					*0.00*	*2.01*	*4.38*	*5.92*	*8.29*	*11.84*	*16.57*	*23.67*
Velocity Head (ft) = $V^2/2g$					*0.00*	*0.06*	*0.30*	*0.54*	*1.07*	*2.18*	*4.26*	*8.70*
Minor Losses		*Qty*	*K*	***Total***								
	Wye (straight run)	*2*	*0.3*	*0.6*								
	Tee (flow through run)	*1*	*0.3*	*0.3*								
	45 Degree Bend	*5*	*0.2*	*1*								
	Exit	*1*	*1.0*	*1*								
			Total	*2.90*	*0.00*	*0.18*	*0.86*	*1.58*	*3.09*	*6.31*	*12.37*	*25.24*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$					*0.00*	*1.77*	*7.48*	*13.06*	*24.35*	*47.13*	*87.89*	*170.14*
Total losses for section (C = 120)					*0.00*	*1.95*	*8.34*	*14.64*	*27.44*	*53.44*	*100.26*	*195.38*
$h_L = ((4.73L)/(d^{4.87}))*((Q_i/C)^{1.852})$					*0.00*	*1.33*	*5.62*	*9.81*	*18.30*	*35.43*	*66.06*	*127.89*
Total losses for section (C = 140)					*0.00*	*1.51*	*6.48*	*11.39*	*21.39*	*41.74*	*78.43*	*153.13*
Total Discharge Loss, ft (C = 120)					*0.00*	*1.95*	*8.34*	*14.64*	*27.44*	*53.44*	*100.26*	*195.38*
Total Discharge Loss, ft (C = 140)					*0.00*	*1.51*	*6.48*	*11.39*	*21.39*	*41.74*	*78.43*	*153.13*

TOTAL DYNAMIC HEAD CALCULATIONS

Static Head (@ Max Static Head)		*2.50*	*2.50*	*2.50*	*2.50*	*2.50*	*2.50*	*2.50*	*2.50*
Total Dynamic Head (calculation check)									
(Static Head + Discharge Losses)	*Max WSE*	*2.50*	*4.45*	*10.84*	*17.14*	*29.94*	*55.94*	*102.76*	*197.88*

TOTAL DYNAMIC HEAD

		FLOW							
	gpm	0	85	185	250	350	500	700	1000
	mgd	0.000	0.122	0.266	0.360	0.504	0.720	1.008	1.440
Flow Scenarios	cfs	0.000	0.189	0.412	0.557	0.780	1.114	1.560	2.228
C = 120 - LWL WET WELL									
Pump Centerline	*891.5*								
Static Suction Head (Well WSE - Pump Center Line)		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Static Discharge Head (Discharge Elev. - Pump Center Line)		*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*
Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*		*18.60*	*21.01*	*29.01*	*36.96*	*47.90*	*75.76*	*126.04*	*228.40*
TOTAL DYNAMIC HEAD *Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head*		*2.50*	*4.91*	*12.91*	*20.86*	*31.80*	*59.66*	*109.94*	*212.30*
C = 120 - HWL WET WELL									
Pump Centerline	*891.5*								
Static Suction Head (Well WSE - Pump Center Line)		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Static Discharge Head (Discharge Elev. - Pump Center Line)		*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*
Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*		*18.60*	*21.01*	*29.01*	*36.96*	*47.90*	*75.76*	*126.04*	*228.40*
TOTAL DYNAMIC HEAD *Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head*		*2.50*	*4.91*	*12.91*	*20.86*	*31.80*	*59.66*	*109.94*	*212.30*
C = 140 - LWL WET WELL									
LOW WATER WET WELL WSE SCENARIO									
Pump Centerline	*891.5*								
Static Suction Head (Well WSE - Pump Center Line)		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Static Discharge Head (Discharge Elev. - Pump Center Line)		*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*
Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*		18.60	20.53	26.99	33.42	41.70	63.77	103.66	185.10
TOTAL DYNAMIC HEAD *Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head*		2.50	4.43	10.89	17.32	25.60	47.67	87.56	169.00
C = 140 - HWL WET WELL									
Pump Centerline	*891.5*								
Static Suction Head (Well WSE - Pump Center Line)		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Static Discharge Head (Discharge Elev. - Pump Center Line)		*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*	*18.60*
Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*		*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*	*16.10*
Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*		18.60	20.53	26.99	33.42	41.70	63.77	103.66	185.10
TOTAL DYNAMIC HEAD *Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head*		2.50	4.43	10.89	17.32	25.60	47.67	87.56	169.00

Project Location:	US 31 Hamilton County	**Calculated by:**	SG
Pump Location:	RAS/WAS Pump Station	**Date:**	July 5, 2022
Project #:	244721	**Checked by:**	ALT
		Date:	August 23, 2022

Wet Well High Water Level:	907.60	**C Factor #1:**	120
Wet Well Low Water Level:	907.60	**C Factor #2:**	140
Max Downstream Elevation:	913.50	**Pump Centerline:**	891

TOTAL DYNAMIC HEAD

		FLOW							
	gpm	0	85	185	250	350	500	700	1000
	mgd	0.000	0.122	0.266	0.360	0.504	0.720	1.008	1.440
Flow Scenarios	cfs	0.000	0.189	0.412	0.557	0.780	1.114	1.560	2.228
C = 120 - LWL WET WELL		**5.900**	**7.276**	**11.992**	**16.783**	**21.353**	**47.182**	**64.182**	**121.384**
C = 120 - HWL WET WELL		**5.900**	**7.276**	**11.992**	**16.783**	**21.353**	**47.182**	**64.182**	**121.384**
C = 140 - LWL WET WELL		**5.900**	**7.076**	**11.192**	**15.363**	**19.103**	**42.062**	**56.022**	**105.614**
C = 140 - HWL WET WELL		**5.900**	**7.076**	**11.192**	**15.363**	**19.103**	**42.062**	**56.022**	**105.614**

NPSH$_A$ = S - H$_s$ + (P$_{atm}$ - P$_{vp}$) x 2.31 / SG

Specific Gravity	1.00								
Liquid Vapor Pressure (at 70-degree F), psi	0.363								
Pressure Head, psi	14.7								
At Low Wet Well Level		49.72	49.72	49.72	49.72	49.72	49.72	49.72	49.72
Number of Pumps Running		1	1	1	1	2	2	2	2

STATION LOSSES

From pump (east) to upstream of second wye

Pipe Material	*Ductile Iron - 250 psi*
Pipe Diameter, in	*4*
Pipe Diameter, ft	0.33
Inside Diameter, ft:	0.35
Pipe Length, ft	*30*

	Qty	K	Total								
Percentage of Flow				100%	100%	100%	100%	50%	100%	50%	50%
Flow (cfs)				0.00	0.19	0.41	0.56	0.39	1.11	0.78	1.11
Velocity (fps)				0.00	2.01	4.37	5.90	4.13	11.80	8.26	11.80
Velocity Head (ft) = $V^2/2g$				0.00	0.06	0.30	0.54	0.27	2.16	1.06	2.16
Minor Losses											
90 Degree Bend	2	0.3	0.6								
Check Valve	1	2.5	2.5								
Plug Valve	1	0.8	0.8								
Wye (branch flow)	1	0.8	0.8								
		Total	4.7	0.00	0.29	1.39	2.54	1.25	10.17	4.98	10.17
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				0.00	0.16	0.67	1.18	0.61	4.25	2.20	4.25
Total losses for section (C = 120)				0.00	0.45	2.06	3.72	1.86	14.42	7.18	14.42
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				0.00	0.12	0.51	0.89	0.46	3.20	1.65	3.20
Total losses for section (C = 140)				0.00	0.41	1.90	3.43	1.71	13.37	6.63	13.37
Total Station Losses (C = 120)				0.00	0.45	2.06	3.72	1.86	14.42	7.18	14.42
Total Station Losses (C = 140)				0.00	0.41	1.90	3.43	1.71	13.37	6.63	13.37

DISCHARGE (SYSTEM) LOSSES

From second wye through tee in meter str to Biosolids Dewatering Structure Header

Pipe Material	*PVC SDR21*
Pipe Diameter, in	*4*
Pipe Diameter, ft	0.33
Inside Diameter, ft:	0.35
Pipe Length, ft	*115*

	Qty	K	Total								
Percentage of Flow				100%	100%	100%	100%	100%	100%	100%	100%
Flow (cfs)				0.00	0.19	0.41	0.56	0.78	1.11	1.56	2.23
Velocity (fps)				0.00	2.01	4.38	5.92	8.29	11.84	16.57	23.67
Velocity Head (ft) = $V^2/2g$				0.00	0.06	0.30	0.54	1.07	2.18	4.26	8.70
Minor Losses											
90-deg bend	4	0.3	1.2								
Wye (straight run)	2	0.3	0.6								
Tee (branch flow)	1	1.8	1.8								
45 Degree Bend	1	0.2	0.2								
Exit	1	1.0	1								
		Total	4.80	0.00	0.30	1.43	2.61	5.12	10.44	20.47	41.78
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				0.00	0.62	2.60	4.55	8.48	16.42	30.63	59.29
Total losses for section (C = 120)				0.00	0.92	4.03	7.16	13.60	26.86	51.10	101.07
$h_L = ((4.73L)/(d^{4.87}))*((Q_t/C)^{1.852})$				0.00	0.46	1.96	3.42	6.38	12.35	23.02	44.57
Total losses for section (C = 140)				0.00	0.76	3.39	6.03	11.50	22.79	43.49	86.35
Total Discharge Loss, ft (C = 120)				0.00	0.92	4.03	7.16	13.60	26.86	51.10	101.07
Total Discharge Loss, ft (C = 140)				0.00	0.76	3.39	6.03	11.50	22.79	43.49	86.35

TOTAL DYNAMIC HEAD CALCULATIONS

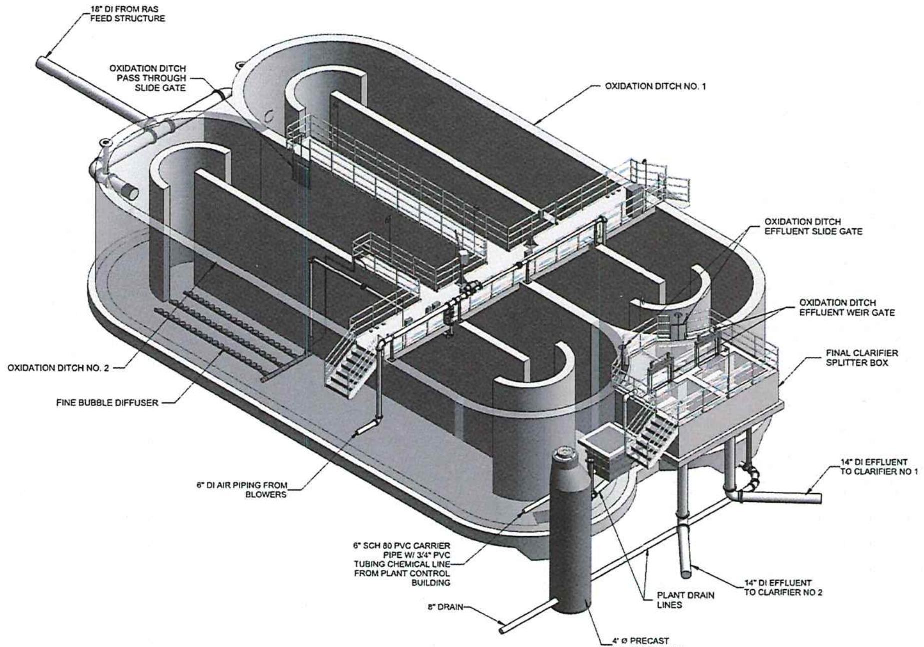
Static Head (@ Max Static Head)		5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
Total Dynamic Head (calculation check)									
(Static Head + Discharge Losses)	*Max WSE*	5.90	6.82	9.93	13.06	19.50	32.76	57.00	106.97
C = 120 - LWL WET WELL									
Pump Centerline	*891*								
Static Suction Head (Well WSE - Pump Center Line)		16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60

TOTAL DYNAMIC HEAD											
				FLOW							
		gpm		0	85	185	250	350	500	700	1000
		mgd		0.000	0.122	0.266	0.360	0.504	0.720	1.008	1.440
Flow Scenarios		cfs		0.000	0.189	0.412	0.557	0.780	1.114	1.560	2.228
	Static Discharge Head (Discharge Elev. - Pump Center Line))			22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50
	Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*			22.50	23.88	28.59	33.38	37.95	63.78	80.78	137.98
	TOTAL DYNAMIC HEAD			5.90	7.28	11.99	16.78	21.35	47.18	64.18	121.38
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head										
C = 120 - HWL WET WELL											
	Pump Centerline		*891*								
	Static Suction Head (Well WSE - Pump Center Line)			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Static Discharge Head (Discharge Elev. - Pump Center Line))			22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50
	Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*			22.50	23.88	28.59	33.38	37.95	63.78	80.78	137.98
	TOTAL DYNAMIC HEAD			5.90	7.28	11.99	16.78	21.35	47.18	64.18	121.38
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head										
C = 140 - LWL WET WELL											
	LOW WATER WET WELL WSE SCENARIO										
	Pump Centerline		*891*								
	Static Suction Head (Well WSE - Pump Center Line)			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Static Discharge Head (Discharge Elev. - Pump Center Line))			22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50
	Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*			22.50	23.68	27.79	31.96	35.70	58.66	72.62	122.21
	TOTAL DYNAMIC HEAD			5.90	7.08	11.19	15.36	19.10	42.06	56.02	105.61
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head										
C = 140 - HWL WET WELL											
	Pump Centerline		*891*								
	Static Suction Head (Well WSE - Pump Center Line)			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Static Discharge Head (Discharge Elev. - Pump Center Line))			22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50
	Total Dynamic Suction Head *(Static Suction Head - Suction Losses)*			16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
	Total Dynamic Discharge Head *(Static Discharge Head + Station + Discharge Losses)*			22.50	23.68	27.79	31.96	35.70	58.66	72.62	122.21
	TOTAL DYNAMIC HEAD			5.90	7.08	11.19	15.36	19.10	42.06	56.02	105.61
	Total Dynamic Head = Total Dynamic Discharge Head - Total Dynamic Suction Head										

Question 7 Attachments

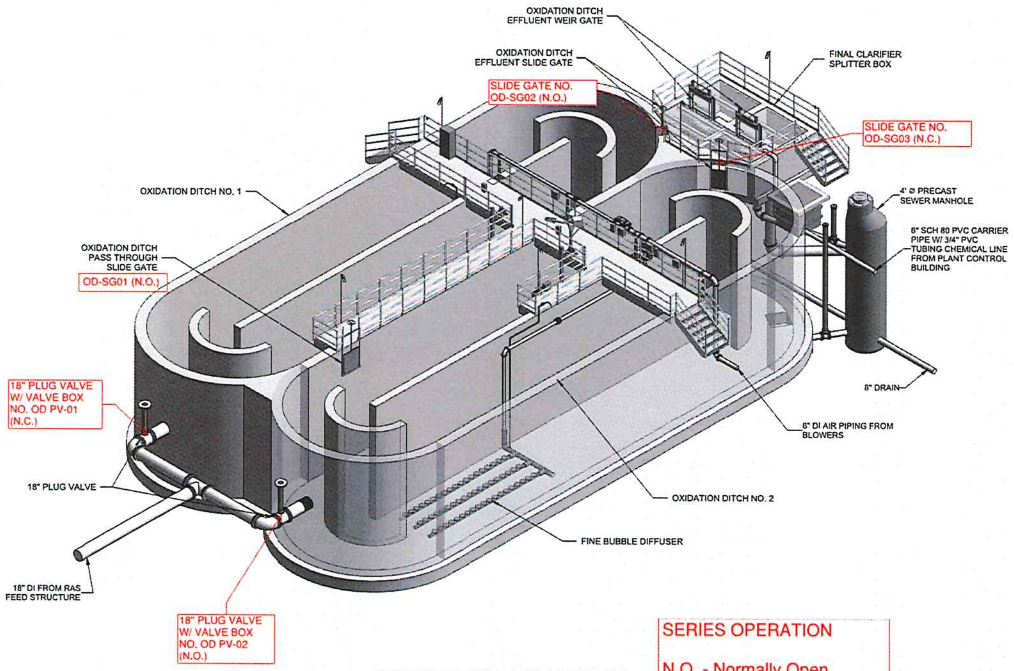
Attachment 7A-1

Plotted: 11/17/2022 11:18:39 AM C:\Users\JonathanL\OneDrive - Wessler Engineering\Documents\244721-OD-CENTRAL-R23_JonathanL_WE.rvt



PERSPECTIVE - SOUTHEAST

SCALE: NONE



PERSPECTIVE - SOUTHWEST

SCALE: NONE

SERIES OPERATION

N.O. - Normally Open
N.C. - Normally Closed

SCALE VERIFICATION

BAR IS ONE INCH LONG ON ORIGINAL DRAWING

DRAWN BY	JL
CHECKED BY	ALT
APPROVED BY	RWH
ISSUE DATE	NOVEMBER 2022
PROJECT NUMBER	244721-04-001

NO.	DATE	INITIALS	REVISION DESCRIPTION

ROBERT W. HOLDEN, II
No. 10000096
11/23/2022

WESSLER
ENGINEERING
More than a Project™

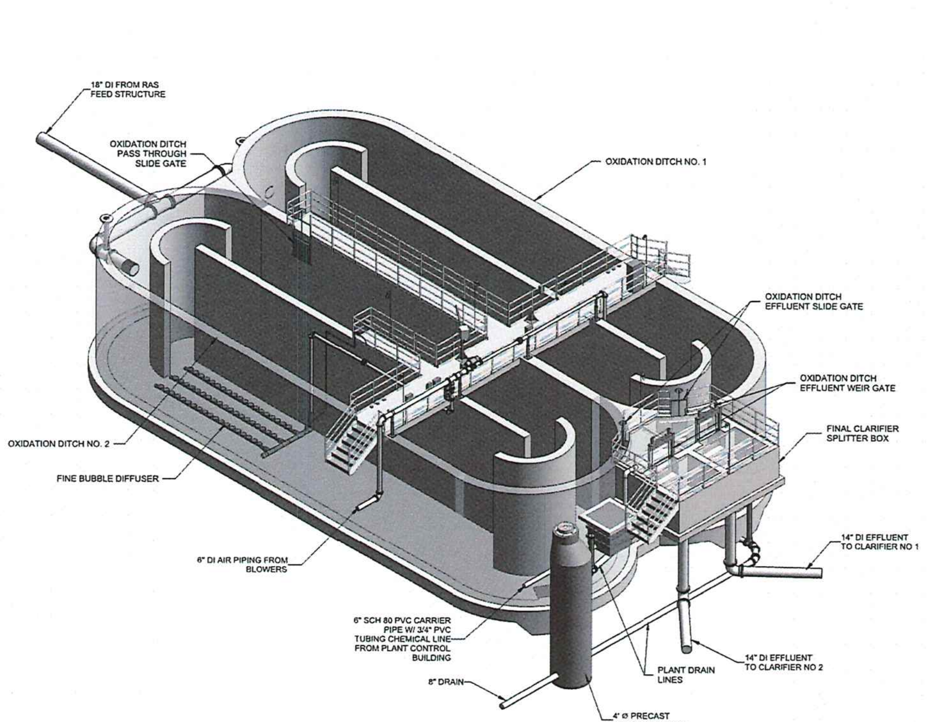
US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT
PHASE 1A AND 1B
DIVISION 1 - WASTEWATER TREATMENT PLANT

OXIDATION DITCH - PERSPECTIVE VIEW

SHEET NO.
4G1

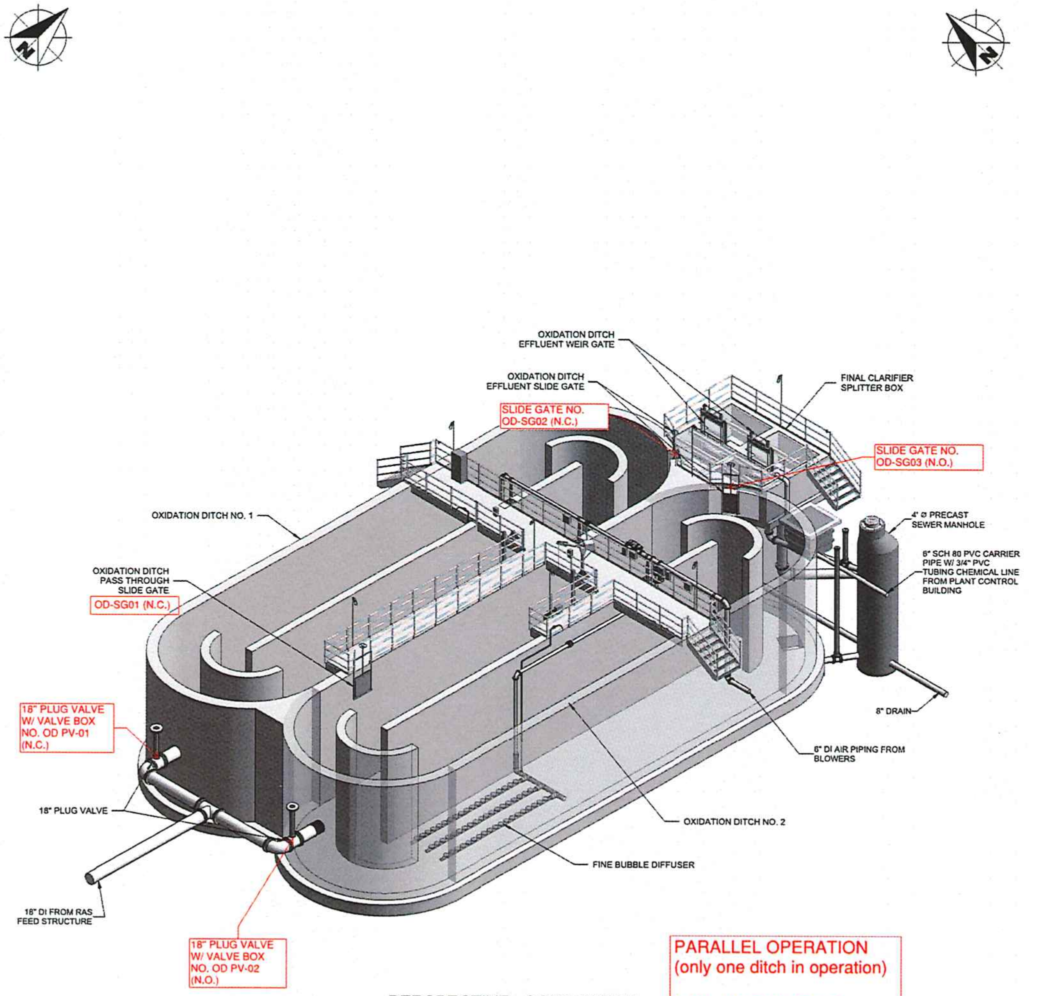
PAGE NUMBER
24

Attachment 7A-2



PERSPECTIVE - SOUTHEAST

SCALE: NONE



PERSPECTIVE - SOUTHWEST

SCALE: NONE

PARALLEL OPERATION
(only one ditch in operation)

N.O. - Normally Open
N.C. - Normally Closed

SCALE VERIFICATION	BAR IS ONE INCH LONG ON ORIGINAL DRAWING
DRAWN BY	JL
CHECKED BY	ALT
APPROVED BY	RWH
ISSUE DATE	NOVEMBER 2022
PROJECT NUMBER	244721-04-001

NO.	DATE	INITIALS	REVISION DESCRIPTION

ROBERT W. HOLDEN, II
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WESSLER
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US 31 CORRIDOR INFRASTRUCTURE INVESTMENT PROJECT
PHASE 1A AND 1B
DIVISION 1 - WASTEWATER TREATMENT PLANT

OXIDATION DITCH - PERSPECTIVE VIEW

SHEET NO.
4G1

PAGE NUMBER
24

Attachment 7B-1

SANITAIRE
a xylem brand

SNDN Process Reference Data

Muncie, IN – SNDN in Conventional Activated Sludge Process

20 MGD Conventional Activated Sludge Plant

4 parallel trains, each with 3 passes in series;
DO levels ~ 0.3 / 1.5 / 4 mg/l

Ave Influent BOD load = 13,981 lb/d (Jan 2017)

Total Basin Volume (3 trains) = 626,400 ft3

Organic Loading Rate = 22.3 #BOD/1000 ft3/d

Effluent Ammonia = 0.1 mg/l

Fond Du Lac, WI

SNDN in Conventional Activated Sludge Process

15 MGD Conventional Activated Sludge Plant
Current Average Flow = 7 to 13 MGD

3 parallel trains, each with anaerobic zone and 3 aeration passes in series;
DO levels at ~ 0.2 / 1 / 2 mg/l

Ave Influent BOD load = 14,544 lb/d (Mar 2020)

Total Basin Volume (3 trains) = 628,763 ft3

Organic Loading Rate = 23.1 #BOD/1000 ft3/d

SRT = 8.3 days

Effluent Ammonia = 1.7 mg/l

Attachment 7B-2

Muncie WPCF

Annual Summation of Monthly Reports of Operation
2017

Plant Design Flow	24
Annual Average Flow	20.114
Capacity Used	84%

PERCENT REMOVAL SUMMARY				
	BOD5	S.S.	Ammonia	Phosphorus
Primary Treatment	39	59		
Secondary Treatment	96	90		
Tertiary Treatment	-21	-5		
Overall Treatment	97	96	99	58

					CHEMICALS USED			RAW SEWAGE									PRIMARY EFFLUENT		AERATION						SECONDARY EFFLUENT	
																			MIXED LIQUOR				RETURN SLUDGE			
	Man-Hours at Plant (Plants less than 1 MGD only)	Precipitation - Inches	Bypass At Plant Site ("x" If Occurred)	Collection System Overflow ("x" If Occurred)	Chlorine - Lbs	Sulphur Dioxide Lbs/Day	Polymer Lbs/Day or Gal./Day	Influent Flow Rate (if metered) MGD	pH	CBOD5 - mg/l	CBOD5 - lbs	Susp. Solids - mg/l	Susp. Solids - lbs	Phosphorus - mg/l	Ammonia - mg/l		CBOD5 - mg/l	Susp. Solids - mg/l	Settleable Solids % in 30 minutes	Susp. Solids - mg/l	Sludge Vol. Index - ml/gm	Dissolved Oxygen - mg/l	Volume - MG	Susp. Solids - mg/l	CBOD5 - mg/l	Susp. Solids - mg/l
Average					442	542.71	144.2	20.113		106	16786.43	131	21162.89	2.4	9.3		65	52	17	2698	63	5.6		8284	3	5
Maximum		3.19			679	779	296.8	32	7.6	356	40292.21	500	102341	4.01	18	0	120	128	30	9620	117	8.2	0	13900	5.6	17
Minimum					222	322	7.6	12.3	7.1	27	7205.76	36	8056.44	1.2	1.75	0	13	12	9	1670	31	3.4	0	4580	0.38	2.5
Totals	0	56.77			94587	116141	46720	7341.3			6127045		7724454										0			
No. of Data		156			214	214	324	365	365	365	365	365	365	12	365	0	365	365	365	364	364	365	0	365	365	365
Estimated Annual Totals (Average X 365)											6,127,045		7,724,454													

		FINAL EFFLUENT																					SLUDGE TO DIGESTER			
							Flow		BOD				Total Suspended Solids				Ammonia				Other					
	Residual Chlorine - Contact Tank	Residual Chlorine - Final	E. Coli - colony/100 ml	pH	Dissolved Oxygen - mg/l	Phosphorus - mg/l	Effluent Flow Rate (MGD)	Effluent Flow Weekly Average	CBOD5 - mg/l	CBOD5 - mg/l Weekly Average	CBOD5 - lbs	CBOD5 - lbs/day Weekly Average	Susp. Solids - mg/l	Susp. Solids - mg/l Weekly Average	Susp. Solids - lbs	Susp. Solids - lbs/day Weekly Average	Ammonia - mg/l	Ammonia - mg/l Weekly Average	Ammonia - lbs	Ammonia - lbs/day Weekly Average	Oil & Grease (mg/l)		Primary Sludge Gal. x 1000	Waste Act. Sludge Gal. x 1000	Temp #5	Temp #6
Average	1.043	0.0143	37		7.6	1.0	20.114		3.0		497.2818		5.3		909.25		0.09		15.239				30.745	11.703	84.455	89.627
Maximum	2.21	0.04	900	7.7	9.5	1.67	32	31.143	9.3	4.3143	1351.89	798.56	14.6	8	3621.7	1693.9	0.65	0.2031	157.3	39.156	0	0	99	28.4	95	100
Minimum	0.35	0.01	10	7.1	6.1	0.4	12.3	13.086	1.1	2.0143	144.1182	282.67	2.5	2.8857	256.61	355.23	0.05	0.0577	5.4243	9.885	0	0	10	2	74	77
Totals							7341.6				181507.8				331878				5546.9		0	0	11222	3300.3	30826	32714
No. of Data	214	214	214	365	365	16	365		365		365		365		365		364		364		0	0	365	282	365	365
Estimated Annual Totals (Average X 365)							7,342				181,508				331,878				5,562							

	DIGESTER OPERATION																									
	Anaerobic Only																									
	pH	Gas Production Cubic Ft. x 1000	Temperature - F	Supernatant Withdrawn hrs. or Gal. x 1000	Supernatant BOD5 mg/l or NH3-N mg/l	Total Solids in Incoming Sludge - %	Total Solids in Digested Sludge - %	Volatile Solids in Incoming Sludge - %	Volatile Solids in Digested Sludge - %	Digested Sludge Withdrawn hrs. or Gal. x 1000																
Average				38.938	633	5	4	61	44	66.632																
Maximum	0	0	0	91.6	793	9.6	6.96	74	51.5	78.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	12.7	491	1.51	0.57	37.4	33.8	14.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		0		2141.6						12727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of Data	0	0	0	55	54	365	190	365	189	191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

US 31 WWTP Design
Reference Plant F/M Ratio Review - Updated

US 31 - Design

Volume: 55615 cf Total for **2** trains in series

	2017 Ave		
Flow	0.5	MGD	Design
CBOD	200	mg/L	Design
MLSS	2,900	mg/L	Bioloop Calculations
Assumed VS %	75%		

Calculated

Secondary Influent CBOD	834	lb/d
MLVSS	7,546	lb
F:M	0.111	lb CBOD/lb MLVSS/day

US 31 - Near-Term

Volume: 27807 cf Total for **1** train

	2017 Ave		
Flow	0.08	MGD	Design
CBOD	200	mg/L	Design
MLSS	1,000	mg/L	Bioloop Calculations
Assumed VS %	75%		

Calculated

Secondary Influent CBOD	133	lb/d
MLVSS	1,301	lb
F:M	0.103	lb CBOD/lb MLVSS/day

Muncie WPCF Example

F:M Check
Background: From 2017 MRO and SNDN_reference_plant_summaries.ppt file
Upstream Primary Clarifier
No upstream anaerobic tank
Volume: 626400 cf Total for 3 trains in parallel

	2017 Ave		
Flow	20.114	MGD	MRO Data
Primary Effluent CBOD	65	mg/L	MRO Primary Effluent
MLSS	2,698	mg/L	MRO Mixed Liquor Sus. Solids
Assumed VS %	75%		

Calculated

Secondary Influent CBOD	10,904	lb/d
MLVSS	79,072	lb
F:M	0.138	lb CBOD/lb MLVSS/day