Pennsylvania Department of Environmental Protection

Northwest Regional Office
CLEAN WATER PROGRAM

NPDES PERMIT FACT SHEET INDIVIDUAL SEWAGE

Application Type	**Renewal**	Application No.	**PA0287903**
Facility Type	**Non-Municipal**	APS ID	**1133754**
Major / Minor	**Minor**	Authorization ID	**1520736**

Applicant and Facility Information

Applicant Name	**Adventure Bound Sv LLC**	Facility Name	**Adventure Bound Shenango**
Applicant Address	905 16th Place	Facility Address	559 E Crestview Drive
	Vero Beach, FL 32960		Transfer, PA 16154-2503
Applicant Contact	Harry Klekamp	Facility Contact	
Applicant Phone	(772) 584-3628	Facility Phone	
Client ID	336287	Site ID	465512
Ch 94 Load Status	Not Overloaded	Municipality	Delaware Township
Connection Status	Self Imposed Connection Prohibition	County	Mercer
Date Application Received	March 21, 2025	EPA Waived?	Yes
Date Application Accepted		If No, Reason	

Purpose of Application: This application is for the renewal of a minor sewage facility that serves an existing campground.

Summary of Review

This facility is currently under a CO&A with the Department, currently the agreement of the CO&A is that the permittee will send a monthly update to the Department regarding any violations or operational problems the system may be having. Based on the most recent updates from the current operator they appear to be getting into a groove and figuring out how to properly operate the system. There are still consistent violations at the facility but there is less variability in the violations, and the frequency of these violations is becoming less.

Treatment at the facility consists of (WQM Permit No. 4320404): Two gravity flow sanitary sewer subsystems, two pump stations, and one force main. An influent pump station, a 5,000-gallon trash trap, and four 10,500-gallon equalization tanks. A biological treatment train consisting of a 4,196-gallon pre-anoxic tank, a 7,693-gallon aerobic tank, an 8,393-gallon post-anoxic tank. A mini-MBR skid containing two membrane modules, a backwash tank, two UV disinfection units, an electrical control panel, alarm systems, pumps, blowers, chemical feed systems, and a control room. A 1,000-gallon post-aeration tank, a 5,000-gallon aerobic sludge holding tank and a fence around the treatment system.

Act 14 – Notifications were submitted and received.

There are currently two open violations in WMS for the subject Client ID (336287) as of 2/24/26. The open violations are from the Safe Drinking Water program out of the NWRO.

The Shenango River above the Shenango River Lake Dam is known as a critical habitat for T&E Mussel populations. A mussel evaluation will be completed for the discharge, however there is not expected to be any impact from a sewage treatment plant of this size that does not receive industrial wastewater. Additionally, the receiving stream for the facility is a small unnamed tributary above the Shenango River, based on evaluations from the Departments biologists, state and federally listed species of mussels are not believed to be present in the tributary.

Approve	Deny	Signatures	Date
X		Dustin Hargenrater Dustin Hargenrater / Project Manager	February 24, 2026
X		Adam Olesnanik Adam Olesnanik, P.E. / Environmental Engineer Manager	March 30, 2026

Summary of Review

Sludge use and disposal description and location(s): 0.63 Dry Tons of sludge/biosolids are produced and disposed of at the Reynolds Disposal Company WWTP.

Public Participation

DEP will publish notice of the receipt of the NPDES permit application and a tentative decision to issue the individual NPDES permit in the *Pennsylvania Bulletin* in accordance with 25 Pa. Code § 92a.82. Upon publication in the *Pennsylvania Bulletin*, DEP will accept written comments from interested persons for a 30-day period (which may be extended for one additional 15-day period at DEP's discretion), which will be considered in making a final decision on the application. Any person may request or petition for a public hearing with respect to the application. A public hearing may be held if DEP determines that there is significant public interest in holding a hearing. If a hearing is held, notice of the hearing will be published in the *Pennsylvania Bulletin* at least 30 days prior to the hearing and in at least one newspaper of general circulation within the geographical area of the discharge.

Discharge, Receiving Waters and Water Supply Information

Outfall No.	001	Design Flow (MGD)	.015
Latitude	41º 20' 13.97"	Longitude	-80º 22' 23.90"
Quad Name	Fredonia	Quad Code	41080C3
Wastewater Description:	Sewage Effluent		
Receiving Waters	Unnamed Tributary of Shenango River (WWF)	Stream Code	36099
NHD Com ID	130034777	RMI	0.1900
Drainage Area	0.1	Yield (cfs/mi^2)	0.0046
Q_{7-10} Flow (cfs)	0.00046	Q_{7-10} Basis	USGS - StreamStats
Elevation (ft)	926	Slope (ft/ft)	---
Watershed No.	20-A	Chapter 93 Class.	WWF
Existing Use		Existing Use Qualifier	
Exceptions to Use		Exceptions to Criteria	
Assessment Status	Attaining Use(s)		
Cause(s) of Impairment			
Source(s) of Impairment			
TMDL Status		Name	

Background/Ambient Data		Data Source
pH (SU)	7.7	POFU Study - 2020
Temperature (°F)	25	Default - WWF
Hardness (mg/L)	100	Default
Other:		

Nearest Downstream Public Water Supply Intake		Aqua Pennsylvania Inc. – Shenango Valley WTP	
PWS Waters	Shenango River	Flow at Intake (cfs)	143.8
PWS RMI	28.88	Distance from Outfall (mi)	21.1

Changes Since Last Permit Issuance: No changes since last permit issuance.

Other Comments: No mussel survey has been completed for this discharge, this discharge was compared to the Camp Nazareth discharge and the mussel survey conducted at that facility was used to evaluate this discharge. The discharge was evaluated using the mussel impact evaluation spreadsheet which determines the expected impact areas for endangered mussels based on the concentrations of Chloride, Total Nickel, Total Zinc, Total Copper, and Ammonia-Nitrogen in the discharge. For this case the model was completed for the Shenango River since there have been no confirmations of mussels in the tributary. The expected concentrations and impact areas are expected to be less than that calculated by the spreadsheet due to the discharge being to a small drainage channel that runs into the Shenango River which would allow for additional assimilative capacity as well as greater mixing of the discharge since it is flowing in the channel for an additional 0.19 miles before reaching the Shenango River.

Compliance History

DMR Data for Outfall 001 (from January 1, 2025 to December 31, 2025)

Parameter	DEC-25	NOV-25	OCT-25	SEP-25	AUG-25	JUL-25	JUN-25	MAY-25	APR-25	MAR-25	FEB-25	JAN-25
Flow (MGD) Average Monthly			0.009007	0.008704	0.008274	0.005745	0.004396	0.00564				
pH (S.U.) Instantaneous Minimum			7.31	7.30	7.22	7.17	7.03	6.74				
pH (S.U.) Instantaneous Maximum			7.94	7.90	7.61	7.68	8.2	7.66				
DO (mg/L) Instantaneous Minimum			6.14	6.11	6.08	6.03	6.02	6.18				
CBOD5 (mg/L) Average Monthly			< 3.0	< 3.0	< 3.0	6.13	< 4.8	< 3.0				
TSS (mg/L) Average Monthly			< 5.0	< 5.0	< 5.0	< 5.0	< 7.5	< 5.0				
Fecal Coliform (No./100 ml) Geometric Mean			< 1	< 1	< 1	< 1	< 1	< 1				
Fecal Coliform (No./100 ml) Instantaneous Maximum			< 1	< 1	< 1	< 1	< 1	< 1				
UV Transmittance (%) Average Monthly			193	187	184	136	142	165				
Total Nitrogen (mg/L) Average Monthly			< 0.876	< 0.977	< 6.456	E	< 1.7	< 21.525				
Ammonia (mg/L) Average Monthly			< 0.392	< 0.3	< 0.3	0.332	< 0.3	24.4				
Total Phosphorus (mg/L) Average Monthly			0.0235	< 0.04	0.3	2.10	0.1	0.020				
Total Nickel (mg/L) Average Quarterly	< 0.00650			< 0.00650			< 0.00650					
Chloride (mg/L) Average Monthly			87.4	91.7	127	101	FF	138				

Compliance History

Effluent Violations for Outfall 001, from: February 1, 2025 To: December 31, 2025

Parameter	Date	SBC	DMR Value	Units	Limit Value	Units
Total Nitrogen	05/31/25	Avg Mo	< 21.525	mg/L	5.0	mg/L
Total Nitrogen	08/31/25	Avg Mo	< 6.456	mg/L	5.0	mg/L
Ammonia	05/31/25	Avg Mo	24.4	mg/L	1.5	mg/L
Total Phosphorus	07/31/25	Avg Mo	2.10	mg/L	.5	mg/L

Summary of Inspections: There has been one inspection since the facility was installed. The inspection was in 2022, and no violations were noted.

Other Comments: The facility has had several problems with getting the facility to operate correctly. Currently for the CO&A at the facility, the operator sends updates to the compliance chief, Eric Kicher, on a monthly basis when operating. Looking back through the history of these updates, the operator seems to be getting the system into a good operating order going from 8 effluent violations in 2023, to 4 violations in 2024, and 4 violations in 2025. The facility is expected to continue this trend of decreasing the number of effluent violations until they eventually optimize the operation of the facility and have no violations.

Development of Effluent Limitations

Outfall No. 001 **Design Flow (MGD)** .015
Latitude 41º 20' 12.00" **Longitude** -80º 22' 25.00"
Wastewater Description: Sewage Effluent

Technology-Based Limitations

The following technology-based limitations apply, subject to water quality analysis and BPJ where applicable:

Pollutant	Limit (mg/l)	SBC	Federal Regulation	State Regulation
pH	6.0 – 9.0 S.U.	Min – Max	133.102(c)	95.2(1)
Fecal Coliform (5/1 – 9/30)	200 / 100 ml	Geo Mean	-	92a.47(a)(4)
Fecal Coliform (5/1 – 9/30)	1,000 / 100 ml	IMAX	-	92a.47(a)(4)
Fecal Coliform (10/1 – 4/30)	2,000 / 100 ml	Geo Mean	-	92a.47(a)(5)
Fecal Coliform (10/1 – 4/30)	10,000 / 100 ml	IMAX	-	92a.47(a)(5)

Comments: More stringent WQBELs based on the Intermittent Stream criteria exist for CBOD5, TSS, and Dissolved Oxygen.

Water Quality-Based Limitations

The WQBELs in DEP's "Policy and Procedure for Evaluating Wastewater Discharges to Intermittent and Ephemeral Streams, Drainage Channels and Swales, and Storm Sewers" for CBOD5, TSS, Total Nitrogen, Dissolved Oxygen, and Total Phosphorous will be retained for this permit renewal.

Modeling was performed using WQM 7.0 v 1.1 per the SOP for Establishing Effluent Limitations in Individual Sewage Permits. The WQM 7.0 Model takes into consideration receiving stream flow, discharge flow rate, existing concentrations of parameters, and stream temperature to create a mass balance equation and produce WQBELs for CBOD5, Ammonia-Nitrogen, and Dissolved Oxygen.

The modeling results suggest that the limitations for CBOD5 are adequate for the facility at 10 mg/l Average Monthly and 20 mg/l Instantaneous Maximum. The modeling results also suggested that the Dissolved Oxygen minimum limitation of 6.0 mg/l is also adequate. The modeling results suggested slightly more stringent limits of 1.26 mg/l Average Monthly and 2.52 Instantaneous Maximum limits for Ammonia-Nitrogen. These limits will be implemented as a 1.2 mg/l Average Monthly limit and a 2.5 mg/l Instantaneous Maximum limit.

Based on the SOP for New and Reissuance Individual Sewage NPDES Permits for new WQBELs in which the permittee has demonstrated it cannot comply, the draft permit will contain a schedule of compliance to meet final effluent limits that does not exceed three years. Since the facility is unable to meet the proposed Ammonia-Nitrogen limit upon issuance at least 75% of the time, a three-year compliance schedule will be established in the permit.

Best Professional Judgment (BPJ) Limitations

Comments: N/A

Mussel Discussion

Shenango River above the Shenango River Lake has known populations of endangered/threatened species of the Northern Riffleshell and Rabbitsfooot mussels. Although this is not a direct discharge to the Shenango River the discharge is to a direct tributary of the Shenango River which may have the potential to be habitat for endangered mussels. Since no mussel species have been observed in the tributary the discharge was modeled using the Mussel Impact Evaluation

spreadsheet with data inputs being pulled from the Shenango River and based on the past modeling efforts. This spreadsheet calculates an expected impact area for mussels that may be critical to their survival. Based on the spreadsheet the impact area expected from this discharge is nearly 0 square meters for all pollutants with data.

The USFWS has indicated in comment letters on other NPDES permits that in order to protect threatened and endangered mussel species, wastewater discharges containing ammonia-nitrogen (NH_3-N), chloride (Cl^-), copper, zinc and nickel, where mussels or their habitat exist, can be no more than 1.9 mg/l, 78 mg/l, 10.0 µg/l ,13.18 µg/l and 7.3 µg/l, respectively.

The Department utilized its Impact Evaluation spreadsheet to calculate the maximum potential impact area of the STP discharge under the worst-case theoretical scenario. The spreadsheet is included as an attachment to this Fact Sheet under Attachment 2. Based on Method 3 of the Mussel Impact Evaluation spreadsheet the expected area of impact for each of the parameters with data available was 0 square meters. This takes into consideration a limit of 2.5 mg/l instantaneous maximum limit imposed for Ammonia-Nitrogen and monitoring requirements for the remaining parameters other than Total Copper and Total Zinc. The Department will retain monitoring for Chloride and Nickel for the next permit term, during the time of the last renewal Copper and Zinc were not known to be toxic to the mussel population and therefore those parameters were left out of the last renewal. Based on new data from the USFWS regarding the toxicity of metals to the mussel population, Total Copper and Total Zinc monitoring will be imposed for this permit renewal.

Additional Monitoring Requirements

Based on the SOP for Establishing Effluent Limitations for Individual Sewage Permits sewage discharges will include monitoring, at a minimum, for E. Coli in new and reissued permits, with a monitoring frequency of 1/year for facilities with design flows of 0.002 – 0.05 MGD.

Anti-Backsliding

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Average Weekly	Minimum	Average Monthly	Maximum	Instant. Maximum		
Flow (MGD)	Report	XXX	XXX	XXX	XXX	XXX	1/week	Measured
pH (S.U.)	XXX	XXX	6.0 Inst Min	XXX	XXX	9.0	1/day	Grab
DO	XXX	XXX	6.0 Inst Min	XXX	XXX	XXX	1/day	Grab
CBOD5	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
TSS	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
Fecal Coliform (No./100 ml) Oct 1 - Apr 30	XXX	XXX	XXX	2000 Geo Mean	XXX	10000	2/month	Grab
Fecal Coliform (No./100 ml) May 1 - Sep 30	XXX	XXX	XXX	200 Geo Mean	XXX	10000	2/month	Grab
Ultraviolet Light Dosage (mJ/cm^2)	XXX	XXX	XXX	Report	XXX	XXX	1/day	Measured
Total Nitrogen	XXX	XXX	XXX	5.0	XXX	XXX	1/month	8-Hr Composite
Ammonia – Nitrogen (Nov – Apr)	XXX	XXX	XXX	4.5	XXX	9.0	2/month	8-Hr Composite
Ammonia – Nitrogen (May – Oct)	XXX	XXX	XXX	1.5	XXX	3.0	2/month	8-Hr Composite
Total Phosphorus	XXX	XXX	XXX	0.5	XXX	XXX	1/month	8-Hr Composite
Total Nickel	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite
Chloride	XXX	XXX	XXX	Report	XXX	XXX	1/month	8-Hr Composite

Proposed Effluent Limitations and Monitoring Requirements

The limitations and monitoring requirements specified below are proposed for the draft permit, and reflect the most stringent limitations amongst technology, water quality and BPJ. Instantaneous Maximum (IMAX) limits are determined using multipliers of 2 (conventional pollutants) or 2.5 (toxic pollutants). Sample frequencies and types are derived from the "NPDES Permit Writer's Manual" (386-0400-001), SOPs and/or BPJ.

Outfall 001, Effective Period: Permit Effective Date through Three Years After Permit Effective Date.

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Average Weekly	Minimum	Average Monthly	Maximum	Instant. Maximum		
Flow (MGD)	Report	XXX	XXX	XXX	XXX	XXX	1/week	Measured
pH (S.U.)	XXX	XXX	6.0 Inst Min	XXX	XXX	9.0	1/day	Grab
DO	XXX	XXX	6.0 Inst Min	XXX	XXX	XXX	1/day	Grab
CBOD5	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
TSS	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
Fecal Coliform (No./100 ml) Oct 1 - Apr 30	XXX	XXX	XXX	2000 Geo Mean	XXX	10000	2/month	Grab
Fecal Coliform (No./100 ml) May 1 - Sep 30	XXX	XXX	XXX	200 Geo Mean	XXX	10000	2/month	Grab
E. Coli (No./100 ml)	XXX	XXX	XXX	XXX	XXX	Report	1/year	Grab
UV Transmittance (%)	XXX	XXX	XXX	Report	XXX	XXX	1/day	Measured
Total Nitrogen	XXX	XXX	XXX	5.0	XXX	XXX	1/month	8-Hr Composite
Ammonia Nov 1 - Apr 30	XXX	XXX	XXX	4.5	XXX	9	2/month	8-Hr Composite
Ammonia May 1 - Oct 31	XXX	XXX	XXX	1.5	XXX	3	2/month	8-Hr Composite
Total Phosphorus	XXX	XXX	XXX	0.5	XXX	XXX	2/month	8-Hr Composite
Total Nickel	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite
Total Copper	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) [1]		Concentrations (mg/L)				Minimum [2] Measurement Frequency	Required Sample Type
	Average Monthly	Average Weekly	Minimum	Average Monthly	Maximum	Instant. Maximum		
Total Zinc	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite
Chloride	XXX	XXX	XXX	Report	XXX	XXX	1/month	8-Hr Composite

Compliance Sampling Location: Outfall 001, after disinfection.

Other Comments: None.

Proposed Effluent Limitations and Monitoring Requirements

The limitations and monitoring requirements specified below are proposed for the draft permit, and reflect the most stringent limitations amongst technology, water quality and BPJ. Instantaneous Maximum (IMAX) limits are determined using multipliers of 2 (conventional pollutants) or 2.5 (toxic pollutants). Sample frequencies and types are derived from the "NPDES Permit Writer's Manual" (386-0400-001), SOPs and/or BPJ.

Outfall 001, Effective Period: Three Years After Permit Effective Date through Permit Expiration Date.

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Average Weekly	Minimum	Average Monthly	Maximum	Instant. Maximum		
Flow (MGD)	Report	XXX	XXX	XXX	XXX	XXX	1/week	Measured
pH (S.U.)	XXX	XXX	6.0 Inst Min	XXX	XXX	9.0	1/day	Grab
DO	XXX	XXX	6.0 Inst Min	XXX	XXX	XXX	1/day	Grab
CBOD5	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
TSS	XXX	XXX	XXX	10.0	XXX	20	2/month	8-Hr Composite
Fecal Coliform (No./100 ml) Oct 1 - Apr 30	XXX	XXX	XXX	2000 Geo Mean	XXX	10000	2/month	Grab
Fecal Coliform (No./100 ml) May 1 - Sep 30	XXX	XXX	XXX	200 Geo Mean	XXX	10000	2/month	Grab
E. Coli (No./100 ml)	XXX	XXX	XXX	XXX	XXX	Report	1/year	Grab
UV Transmittance (%)	XXX	XXX	XXX	Report	XXX	XXX	1/day	Measured
Total Nitrogen	XXX	XXX	XXX	5.0	XXX	XXX	1/month	8-Hr Composite
Ammonia Nov 1 - Apr 30	XXX	XXX	XXX	3.6	XXX	7.5	2/month	8-Hr Composite
Ammonia May 1 - Oct 31	XXX	XXX	XXX	1.2	XXX	2.5	2/month	8-Hr Composite
Total Phosphorus	XXX	XXX	XXX	0.5	XXX	XXX	2/month	8-Hr Composite
Total Nickel	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite
Total Copper	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) [1]		Concentrations (mg/L)				Minimum [2] Measurement Frequency	Required Sample Type
	Average Monthly	Average Weekly	Minimum	Average Monthly	Maximum	Instant. Maximum		
Total Zinc	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	8-Hr Composite
Chloride	XXX	XXX	XXX	Report	XXX	XXX	1/month	8-Hr Composite

Compliance Sampling Location: Outfall 001, after disinfection.

Other Comments: None.

Attachment 1
WQM 7.0 Modeling Results

WQM 7.0 Wasteload Allocations

SWP Basin	Stream Code	Stream Name
20A	36099	Trib 36099 to Shenango River

NH3-N Acute Allocations

RMI	Discharge Name	Baseline Criterion (mg/L)	Baseline WLA (mg/L)	Multiple Criterion (mg/L)	Multiple WLA (mg/L)	Critical Reach	Percent Reduction
0.100	Adventure Bound	8.69	8.8	8.69	8.8	1	0

NH3-N Chronic Allocations

RMI	Discharge Name	Baseline Criterion (mg/L)	Baseline WLA (mg/L)	Multiple Criterion (mg/L)	Multiple WLA (mg/L)	Critical Reach	Percent Reduction
0.100	Adventure Bound	1.22	1.26	1.22	1.26	0	0

Dissolved Oxygen Allocations

RMI	Discharge Name	CBOD5		NH3-N		Dissolved Oxygen		Critical Reach	Percent Reduction
		Baseline (mg/L)	Multiple (mg/L)	Baseline (mg/L)	Multiple (mg/L)	Baseline (mg/L)	Multiple (mg/L)		
0.10	Adventure Bound	10	10	1.26	1.26	6	6	0	0

Input Data WQM 7.0

SWP Basin	Stream Code	Stream Name	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope (ft/ft)	PWS Withdrawal (mgd)	Apply FC
20A	36099	Trib 36099 to Shenango River	**0.100**	926.00	0.10	0.00000	0.00	☑

Stream Data

Design Cond.	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	Rch Trav Time (days)	Rch Velocity (fps)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Tributary Temp (°C)	Tributary pH	Stream Temp (°C)	Stream pH
Q7-10	0.005	0.00	0.00	0.000	0.000	0.0	0.00	0.00	25.00	7.00	0.00	0.00
Q1-10		0.00	0.00	0.000	0.000							
Q30-10		0.00	0.00	0.000	0.000							

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	Disc Temp (°C)	Disc pH
Adventure Bound	PA0287903	0.0150	0.0150	0.0150	0.000	25.00	7.24

Parameter Data

Parameter Name	Disc Conc (mg/L)	Trib Conc (mg/L)	Stream Conc (mg/L)	Fate Coef (1/days)
CBOD5	10.00	2.00	0.00	1.50
Dissolved Oxygen	6.00	8.24	0.00	0.00
NH3-N	25.00	0.00	0.00	0.70

Input Data WQM 7.0

SWP Basin	Stream Code	Stream Name	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope (ft/ft)	PWS Withdrawal (mgd)	Apply FC
20A	36099	Trib 36099 to Shenango River	**0.010**	913.00	0.20	0.00000	0.00	☑

Stream Data

Design Cond.	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	Rch Trav Time (days)	Rch Velocity (fps)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Tributary Temp (°C)	Tributary pH	Stream Temp (°C)	Stream pH
Q7-10	0.005	0.00	0.00	0.000	0.000	0.0	0.00	0.00	25.00	7.00	0.00	0.00
Q1-10		0.00	0.00	0.000	0.000							
Q30-10		0.00	0.00	0.000	0.000							

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	Disc Temp (°C)	Disc pH
		0.0000	0.0000	0.0000	0.000	25.00	7.00

Parameter Data

Parameter Name	Disc Conc (mg/L)	Trib Conc (mg/L)	Stream Conc (mg/L)	Fate Coef (1/days)
CBOD5	25.00	2.00	0.00	1.50
Dissolved Oxygen	3.00	8.24	0.00	0.00
NH3-N	25.00	0.00	0.00	0.70

WQM 7.0 Hydrodynamic Outputs

SWP Basin	Stream Code	Stream Name
20A	36099	Trib 36099 to Shenango River

RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope (ft/ft)	Depth (ft)	Width (ft)	W/D Ratio	Velocity (fps)	Reach Trav Time (days)	Analysis Temp (°C)	Analysis pH
Q7-10 Flow												
0.100	0.00	0.00	0.00	.0232	0.02736	.295	1.62	5.5	0.05	0.111	25.00	7.23
Q1-10 Flow												
0.100	0.00	0.00	0.00	.0232	0.02736	NA	NA	NA	0.05	0.112	25.00	7.24
Q30-10 Flow												
0.100	0.00	0.00	0.00	.0232	0.02736	NA	NA	NA	0.05	0.111	25.00	7.23

WQM 7.0 Modeling Specifications

Parameters	Both	Use Inputted Q1-10 and Q30-10 Flows	☑
WLA Method	EMPR	Use Inputted W/D Ratio	☐
Q1-10/Q7-10 Ratio	0.64	Use Inputted Reach Travel Times	☐
Q30-10/Q7-10 Ratio	1.36	Temperature Adjust Kr	☑
D.O. Saturation	90.00%	Use Balanced Technology	☑
D.O. Goal	6		

WQM 7.0 D.O.Simulation

SWP Basin	Stream Code	Stream Name
20A	36099	Trib 36099 to Shenango River

RMI	Total Discharge Flow (mgd)	Analysis Temperature (°C)	Analysis pH
0.100	0.015	25.000	7.234
Reach Width (ft)	**Reach Depth (ft)**	**Reach WDRatio**	**Reach Velocity (fps)**
1.624	0.295	5.502	0.049
Reach CBOD5 (mg/L)	**Reach Kc (1/days)**	**Reach NH3-N (mg/L)**	**Reach Kn (1/days)**
9.84	1.493	1.23	1.029
Reach DO (mg/L)	**Reach Kr (1/days)**	**Kr Equation**	**Reach DO Goal (mg/L)**
6.044	31.081	Owens	6
Reach Travel Time (days)			
0.111			

Subreach Results

TravTime (days)	CBOD5 (mg/L)	NH3-N (mg/L)	D.O. (mg/L)
0.011	9.64	1.22	6.41
0.022	9.44	1.21	6.68
0.033	9.24	1.19	6.88
0.045	9.05	1.18	7.02
0.056	8.87	1.16	7.13
0.067	8.68	1.15	7.21
0.078	8.50	1.14	7.27
0.089	8.33	1.13	7.32
0.100	8.15	1.11	7.36
0.111	7.98	1.10	7.40

WQM 7.0 Effluent Limits

SWP Basin	Stream Code	Stream Name
20A	36099	Trib 36099 to Shenango River

RMI	Name	Permit Number	Disc Flow (mgd)	Parameter	Effl. Limit 30-day Ave. (mg/L)	Effl. Limit Maximum (mg/L)	Effl. Limit Minimum (mg/L)
0.100	Adventure Bound	PA0287903	0.015	CBOD5	10		
				NH3-N	1.26	2.52	
				Dissolved Oxygen			6

Attachment 2
Mussel Impact Evaluation Modeling

2/24/2026

Outfall 001

Facility:	**Adventure Bound Shenango**		
Permit Number:	**PA0287903**	**Effective:**	**Expiration:**
Outfall No:	**001**		
Location:	**Transfer, Mercer County**		
Discharge to:	**Unnamed Tributary 36099 of Shenango River**		
Site Specific Mussel Survey Completed:	**Discharge minimal, mussel survey compared to Camp Nazareth discharge.**		

Discharge and Stream Characteristics			Comments
Q_S	Stream Flow	7 MGD / 10.5 cfs	
Q_D	Discharge Flow	0.476 MGD / 0.015 cfs	
$C_{S(Cl^-)}$	Instream chloride Concentration	18.79 mg/L	WQN #910 (Carried over from previous renewal)
$C_{E(Cl^-)}$	Discharge chloride (existing)	118.46 mg/L	
$C_{P(Cl^-)}$	Discharge chloride (proposed)	118.46 mg/L	
$C_{S(Ni)}$	Instream nickel Concentration	0 µg/L	No background data available.
$C_{E(Ni)}$	Discharge nickel (existing)	6.3 µg/L	
$C_{P(Ni)}$	Discharge nickel (proposed)	6.3 µg/L	
$C_{S(Zn)}$	Instream zinc Concentration	0 µg/L	No data available for Zinc, impact of Zinc on the receiving waters is expected to be
$C_{E(Zn)}$	Discharge zinc (existing)	0 µg/L	minimal from a sewage treatment plant of this size.
$Zn_{P(Zn)}$	Discharge zinc (proposed)	0 µg/L	Monitoring for Total Zinc will be added to the permit to gather data for future renewals.
$C_{S(Cu)}$	Instream copper Concentration	0 µg/L	No data available for Copper, impact of Copper on the receiving waters is expected to be
$C_{E(Cu)}$	Discharge copper (existing)	0 µg/L	minimal from a sewage treatment plant of this size.
$Zn_{P(Cu)}$	Discharge copper (proposed)	0 µg/L	Monitoring for Total Copper will be added to the permit to gather data for future renewals.
$C_{S(NH3-N)}$	Instream NH^3-N	0.12 mg/L	
$C_{E(NH3-N)}$	Discharge NH^3-N (existing)	3.48 mg/L	
$C_{P(NH3-N)}$	Discharge NH^3-N (proposed)	2.52 mg/L	
pH_S	Instream pH	7.7 S.U.	
T_S	Instream Temp.	25 °C	Default value for a WWF
$C_{C(NH3-N)}$	Ammonia criteria	0.828 mg/L	From ammonia criteria comparison spreadsheet -using instream pH and Temp
$C_{C(Cl^-)}$	Chloride criteria	78 mg/L	USFWS criteria
$C_{C(Ni)}$	Nickel criteria	7.3 µg/L	USFWS criteria
$C_{C(Zn)}$	Zinc criteria	13.18 µg/L	USFWS criteria
$C_{C(Cu)}$	Copper criteria	10 µg/L	USFWS criteria
W_S	Stream width	25.91 meters	Google Earth (Approximate)

Ammonia Criteria Calculations:

	pH_S	7.7	S.U.	*(Default value is 7.0)*
	T_S	25	°C	*(Default value is 20° for a CWF and 25° for a WWF)*

Acute Criteria

	METHOD and UNITS	CRITERIA	Comments	
	Old CMC (mg TAN/L) =	3.078		
	EPA 2013 CMC (mg TAN/L) =	4.431	Oncorhynchus present	* formula on pg. 41 (plateaus at 15.7 C)
		4.431	Oncorhynchus absent	* formula on pg. 42 (plateaus at 10.2 C)

Chronic Criteria

	METHOD and UNITS	CRITERIA	COMMENTS
	Old CMC (mg TAN/L) =	0.902	
$C_{C(NH3-N)}$	EPA 2013 CMC (mg TAN/L) =	0.828	* formula on pg. 46 (plateaus at 7 C)

Endangered Mussel Species Impact Area Calculations:

Existing Area of Impact

☑ N/A - No Site Specific Mussel Survey Completed for this Discharger

Approximate Area of Impact Determined from Survey =	**N/A m^2**	**(Enter N/A if no site specific survey has been completed)**
Existing Mussel Density within Area of Impact =		
Rabbitsfoot *(Quadrula cylindrical)*		**per m^2**
Northern Riffleshell *(Epioblasma torulosa rangiana)*		**per m^2**
Rayed Bean *(Villosa fabalis)*		**per m^2**
Clubshell *(Pleurobema clava)*		**per m^2**
Sheepnose *(Plethobasus cyphyus)*		**per m^2**
Snuffbox *(Epioblasma triquetra)*		**per m^2**
TOTAL	**0**	**per m^2**

Method 1 - Utilizing Site Specific Mussel Survey Information

☑ N/A - No Site Specific Mussel Survey Completed for this Discharger

This method utilizes a simple comparison of the size of the existing area of impact as determined from a site specific mussel survey and the chlorides in the existing discharge compared to the chlorides in the proposed discharge after the facility upgrades treatment technologies. This method is only applicable to where the stream impairment is caused by TDS and/or chlorides as the plume has been delineated through conductivity measurements.

A.	**Area of Impact Determined from Survey:**	**N/A**	**m^2**
B.	**Chlorides in Existing Discharge:**	**118**	**mg/L**
C.	**Chlorides in Proposed Discharge after Treatment Facility Upgrades:**	**118.46**	**mg/L**
D.	**Approximate Area of Impact after Treatment Facility Upgrades:**	**N/A**	**m^2**

A/B = D/C **Therefore, D = (A*C)/B**

2/24/2026

Outfall 001

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Outfall No:	**001**		
Location:	**Transfer, Mercer County**		
Discharge to:	**Unnamed Tributary 36099 of Shenango River**		
Site Specific Mussel Survey Completed:	**Discharge minimal, mussel survey compared to Camp Nazareth discharge.**		

Endangered Mussel Species Impact Area Calculations: (continued...)

Method 2 - Mass Balance Relationship of Loading and Assimilative Capacity of Stream

Chloride (Cl^-)	$L_{S(Cl^-)}$ = Available Chloride Loading in Stream = $C_{C(Cl^-)} - C_{S(Cl^-)} \times Q_S$(MGD) X 8.34 =	3,457 lbs/Day
	$L_{D\text{-}MAX(Cl^-)}$ = Current Maximum Discharge Chloride Loading exceeding criteria = $(C_{E(Cl^-)} - C_{E(Cl^-)}) \times Q_D$(MGD) X 8.34 =	161 lbs/Day
	$\%_{E(Cl^-)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Cl^-)} / L_{S(Cl^-)}$ =	5% of Stream Capacity
	$L_{D(Cl^-)}$ = Proposed Discharge Cl^- Loading exceeding criteria after Treatment Facility Upgrades = $(C_{P(Cl^-)} - C_{P(Cl^-)}) \times Q_D$(MGD) X 8.34 =	160.6197264 lbs/Day
	$\%_{P(Cl^-)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Cl^-)} / L_{S(Cl^-)}$ =	4.65% of Stream Capacity
	Proposed Area of Impact due to Chloride * = $(\%_{P(Cl^-)} \times W_S)^2 \times 0.5$ =	0.72 m^2
	* assuming equal flow across transect and 90° spread at discharge	
Nickel(Ni)	$L_{S(Ni)}$ = Available Nickel Loading in Stream = $C_{C(Ni)} - C_{S(Ni)} \times Q_S$(MGD) X 8.34 =	426 lbs/Day
	$L_{D\text{-}MAX(Ni)}$ = Current Maximum Discharge Nickel Loading exceeding criteria = $(C_{E(Ni)} - C_{E(Ni)}) \times Q_D$(MGD) X 8.34 =	-4 lbs/Day
	$\%_{E(Ni)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Ni)} / L_{S(Ni)}$ =	0% of Stream Capacity
	$L_{D(Ni)}$ = Proposed Discharge Ni Loading exceeding criteria after Treatment Facility Upgrades = $(C_{P(Ni)} - C_{P(Ni)}) \times Q_D$(MGD) X 8.34 =	-3.96984 lbs/Day
	$\%_{P(Ni)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Ni)} / L_{S(Ni)}$ =	-0.93% of Stream Capacity
	Proposed Area of Impact due to Nickel * = $(\%_{P(Ni)} \times W_S)^2 \times 0.5$ =	0.03 m^2
	* assuming equal flow across transect and 90° spread at discharge	
Zinc (Zn)	$L_{S(Zn)}$ = Available Zinc Loading in Stream = $C_{C(Zn)} - C_{S(Zn)} \times Q_S$(MGD) X 8.34 =	769 lbs/Day
	$L_{D\text{-}MAX(Zn)}$ = Current Maximum Discharge Zinc Loading exceeding criteria = $(C_{E(Zn)} - C_{E(Zn)}) \times Q_D$(MGD) X 8.34 =	-52 lbs/Day
	$\%_{E(Zn)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Zn)} / L_{S(Zn)}$ =	0% of Stream Capacity
	$L_{D(Zn)}$ = Proposed Discharge Zn Loading exceeding criteria after Treatment Facility Upgrades = $(C_{P(Zn)} - C_{P(Zn)}) \times Q_D$(MGD) X 8.34 =	-52.3224912 lbs/Day
	$\%_{P(Zn)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Zn)} / L_{S(Zn)}$ =	-6.80% of Stream Capacity
	Proposed Area of Impact due to Zinc * = $(\%_{P(Zn)} \times W_S)^2 \times 0.5$ =	1.55 m^2
	* assuming equal flow across transect and 90° spread at discharge	
Copper (Cu)	$L_{S(Cu)}$ = Available Copper Loading in Stream = $C_{C(Cu)} - C_{S(Cu)} \times Q_S$(MGD) X 8.34 =	584 lbs/Day
	$L_{D\text{-}MAX(Cu)}$ = Current Maximum Discharge Copper Loading exceeding criteria = $(C_{E(Cu)} - C_{E(Cu)}) \times Q_D$(MGD) X 8.34 =	-40 lbs/Day
	$\%_{E(Cu)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Cu)} / L_{S(Cu)}$ =	0% of Stream Capacity
	$L_{D(Cu)}$ = Proposed Discharge Cu Loading exceeding criteria after Treatment Facility Upgrades = $(C_{P(Cu)} - C_{P(Cu)}) \times Q_D$(MGD) X 8.34 =	-39.6984 lbs/Day
	$\%_{P(Cu)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Cu)} / L_{S(Cu)}$ =	-6.80% of Stream Capacity
	Proposed Area of Impact due to Copper* = $(\%_{P(Cu)} \times W_S)^2 \times 0.5$ =	1.55 m^2
	* assuming equal flow across transect and 90° spread at discharge	
Ammonia-Nitrogen (NH_3-N)	$L_{S(NH3\text{-}N)}$ = Available NH3-N Loading in Stream = $C_{C(NH3\text{-}N)} - C_{S(NH3\text{-}N)} \times Q_S$(MGD) X 8.34 =	41 lbs/Day
	$L_{D\text{-}MAX(NH3\text{-}N)}$ = Current Maximum Discharge NH3-N Loading = $C_{E(NH3\text{-}N)} \times Q_D$(MGD) X 8.34 =	14 lbs/Day
	$\%_{E(NH3\text{-}N)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(NH3\text{-}N)} / L_{S(NH3\text{-}N)}$ =	34% of Stream Capacity
	$L_{D(NH3\text{-}N)}$ = Proposed Discharge NH3-N Loading after Treatment Facility Upgrades = $C_{P(NH3\text{-}N)} - C_{C(NH3\text{-}N)} \times Q_D$(MGD) X 8.34 =	7 lbs/Day
	$\%_{P(NH3\text{-}N)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(NH3\text{-}N)} / L_{S(NH3\text{-}N)}$ =	17.07% of Stream Capacity
	Proposed Area of Impact due to NH3-N * = $(\%_{P(NH3\text{-}N)} \times W_S)^2 \times 0.5$ =	9.78 m^2
	* assuming equal flow across transect and 90° spread at discharge	

2/24/2026

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Location:	**Transfer, Mercer County**		
Discharge to:	**Unnamed Tributary 36099 of Shenango River**		
Site Specific Mussel Survey Completed:	**Discharge minimal, mussel survey compared to Camp Nazareth discharge.**		

Endangered Mussel Species Impact Area Calculations: (continued...)

Method 3 - Mass Balance Relationship of Stream Flow, Proposed Effluent Quality, and Mussel Protection Criteria

Chloride (Cl^-)	$Q_{A(Cl^-)}C_{S(Cl^-)} + Q_DC_{P(Cl^-)} = Q_TC_{C(Cl^-)}$	
	$Q_{A(Cl^-)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Cl^-)}C_{S(Cl^-)} + Q_DC_{P(Cl^-)} = (Q_D+Q_S)C_{C(Cl^-)}$	
	SOLVING FOR $Q_{A(Cl^-)} = [(Q_DC_{P(Cl^-)} / C_{C(Cl^-)}) - Q_D)] / (1 - C_{S(Cl^-)}/C_{C(Cl^-)}) =$	0.01024996 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Chlorides to Criteria Concentration = $Q_{A(Cl^-)} / Q_S$ (cfs) =	0.0976%
	$W_{I(Cl^-)}$ = Proposed Width of Stream required to Assimilate Chlorides to Criteria Concentration = $W_S \times \%_{P(Cl^-)}$	0.025293 meters
	Proposed Area of Impact due to Chloride * = $(W_{I(Cl^-)})^2 \times 0.5$ = * assuming equal flow across transect and 90° spread at discharge	0.00 m^2
Nickel (Ni)	$Q_{A(Ni)}C_{S(Ni)} + Q_DC_{P(Ni)} = Q_TC_{C(Ni)}$	
	$Q_{A(Ni)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Ni)}C_{S(Ni)} + Q_DC_{P(Ni)} = (Q_D+Q_S)C_{C(Ni)}$	
	SOLVING FOR $Q_{A(Ni)} = [(Q_DC_{P(Ni)} / C_{C(Ni)}) - Q_D)] / (1 - C_{S(Ni)}/C_{C(Ni)}) =$	-0.00205479 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Nickel to Criteria Concentration = $Q_{A(Ni)} / Q_S$ (cfs) =	-0.0196%
	$W_{I(Ni)}$ = Proposed Width of Stream required to Assimilate Nickel to Criteria Concentration = $W_S \times \%_{P(Ni)}$	-0.005070 meters
	Proposed Area of Impact due to Nickel * = $(W_{I(Ni)})^2 \times 0.5$ = * assuming equal flow across transect and 90° spread at discharge	0.00 m^2
Zinc (Zn)	$Q_{A(Zn)}C_{S(Zn)} + Q_DC_{P(Zn)} = Q_TC_{C(Zn)}$	
	$Q_{A(Zn)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Zn)}C_{S(Zn)} + Q_DC_{P(Zn)} = (Q_D+Q_S)C_{C(Zn)}$	
	SOLVING FOR $Q_{A(Zn)} = [(Q_DC_{PZn)} / C_{C(Zn)}) - Q_D)] / (1 - C_{S(Zn)}/C_{C(Zn)}) =$	-0.015 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Zinc to Criteria Concentration = $Q_{A(Zn)} / Q_S$ (cfs) =	-0.1429%
	$W_{I(Zn)}$ = Proposed Width of Stream required to Assimilate Zinc to Criteria Concentration = $W_S \times \%_{PZn)}$	-0.037014 meters
	Proposed Area of Impact due to Zinc * = $(W_{IZn)})^2 \times 0.5$ = * assuming equal flow across transect and 90° spread at discharge	0.00 m^2
Copper (Cu)	$Q_{A(Cu)}C_{S(Cu)} + Q_DC_{P(Cu)} = Q_TC_{C(Cu)}$	
	$Q_{A(Cu)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Cu)}C_{S(Cu)} + Q_DC_{P(Cu)} = (Q_D+Q_S)C_{C(Cu)}$	
	SOLVING FOR $Q_{A(Cu)} = [(Q_DC_{PCu)} / C_{C(Cu)}) - Q_D)] / (1 - C_{S(Cu)}/C_{C(Cu)}) =$	-0.015 cfs
	$\%_{P(Cu)}$ = Percent of Stream Width Required to Assimilate Copper to Criteria Concentration = $Q_{A(Cu)} / Q_S$ (cfs) =	-0.1429%
	$W_{I(Cu)}$ = Proposed Width of Stream required to Assimilate Copper to Criteria Concentration = $W_S \times \%_{PCu)}$	-0.037014 meters
	Proposed Area of Impact due to Copper * = $(W_{I(Cu)})^2 \times 0.5$ = * assuming equal flow across transect and 90° spread at discharge	0.00 m^2
Ammonia-Nitrogen (NH3-N)	$Q_{A(NH3\text{-}N)}C_{S(NH3\text{-}N)} + Q_DC_{P(NH3\text{-}N)} = Q_TC_{C(NH3\text{-}N)}$	
	$Q_{A(NH3\text{-}N)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(NH3\text{-}N)}C_{S(NH3\text{-}N)} + Q_DC_{P(NH3\text{-}N)} = (Q_D+Q_S)C_{C(NH3\text{-}N)}$	
	SOLVING FOR $Q_{A(NH3\text{-}N)} = [(Q_DC_{P(NH3\text{-}N)} / C_{C(NH3\text{-}N)}) - Q_D)] / (1 - C_{S(NH3\text{-}N)}/C_{C(NH3\text{-}N)}) =$	0.035847 cfs
	$\%_{P(NH3\text{-}N)}$ = Percent of Stream Width Required to Assimilate NH3-N to Criteria Concentration = $Q_{A(NH3\text{-}N)} / Q_S$ (cfs) =	0.3414%
	$W_{I(NH3\text{-}N)}$ = Proposed Width of Stream required to Assimilate NH3-N to Criteria Concentration = $W_S \times \%_{P(NH3\text{-}N)}$	0.088458 meters
	Proposed Area of Impact due to NH3-N * = $(W_{I(NH3\text{-}N)})^2 \times 0.5$ = * assuming equal flow across transect and 90° spread at discharge	0.00 m^2