FERGUSON TOWNSHIP PLANNING COMMISSION
Regular Meeting Agenda
Monday, March 13, 2023, 6:00 PM

Hybrid Meeting

REMOTE PARTICIPANTS:

Join Zoom Meeting:
https://us02web.zoom.us/j/81456701356
Meeting ID: 814 5670 1356
Zoom Access Instructions

IN-PERSON PARTICIPANTS:

Ferguson Township Municipal Building
Main Meeting Room
3147 Research Drive
State College, PA

I. CALL TO ORDER

II. CITIZENS INPUT

III. APPROVAL OF MINUTES

1. January 23, 2023, Regular Meeting Minutes

IV. OLD BUSINESS

V. NEW BUSINESS

1. Request for Consideration of a Modification/Waiver
Jenna Wargo, Director of Planning & Zoning

On November 14, 2022, PGH Real Estate Holdings, LLC requested a modification from Chapter 22-516 – Landscaping. The 125 East Pine Grove Road Preliminary Land Development Plan proposes the conversion of a single-family home into a restaurant with indoor and outdoor dining areas. The property is located at 125 East Pine Grove Road (24-009A-030-0000) and is zoned Village (V). The property is approximately 0.496 acres.

The applicant is requesting a modification from providing the required amount of plantings in the buffer yard under the ordinance. The lot is small in size with overhead utilities that the applicant claims is not conducive to successful plantings. The applicant has proposed alternative landscaping for the buffer yard requirements.

Included in the agenda are the proposed alternatives from the applicant and two memos from the Township Arborist. The first is a memorandum with the Arborist's recommendation and the other outlines the Ferguson Township Tree Commission's recommendation on the request. Staff have reviewed the request and recognizes that §22-516 is challenging to apply to certain zoning districts and is recommending amending §22-516—Landscaping and approval to the Planning Commission.

Recommended motion: Move that the Planning Commission recommend approval of the Application for a Modification from §22-516—Landscaping to the Board of Supervisors for 125 East Pine Grove Road.

Staff Recommendation: That the Planning Commission recommend approval.

VI. COMMUNICATIONS TO THE COMMISSION

VII. OFFICIAL REPORTS AND CORRESPONDENCE

1. Board of Supervisors Report
2. CRPC Report
3. Land Development Plans

PLAN NAME	SUBMISSION DATE	REVIEW PERIOD	PLAN EXPIRATION
All Washed Up Auto Spa Preliminary Land Development Plan	September 12, 2022	First Review Comments returned September 29, 2022	February 26, 2023
Farmstead View Preliminary Subdivision Plan	July 30, 2021	DENIED February 21, 2023	
Peace Center and Cemetery Preliminary Land Development Plan	May 18, ,2021	Second Review comments returned October 12, 2022	March 7, 2023
IMBT Preliminary Subdivision Plan	January 31, 2022	Conditionally Approved September 6, 2022	April 16, 2023
1004 West College Ave Vertical Mixed-Use Building	March 14, 2022	Third Submission Received	May 3, 2023
MP Machinery Final Land Development Plan	January 26, 2023	Recorded	
Salvation Baptist Church Preliminary Land Development Plan	June 1, 2022	Conditionally Approved November 1, 2022	April 16, 2023
125 East Pine Grove Road Preliminary Land Development Plan	October 12, 2022	Third Review Comments returned February 28, 2023	May 7, 2023
165 Volos Lane Minor Land Development Plan	June 3, 2022	Conditionally Approved September 20, 2022	May 16, 2023
LeCrone Minor Subdivision Plan	October 21, 2022	Conditionally Approved January 17, 2023	April 17, 2023
1900 Circleville Road	January 3, 2023	Staff First Review Comments returned January 20, 2023	April 3, 2023
LeCrone Preliminary Land Development Plan	February 1, 2023	First Review comments returned February 20, 2023	May 2, 2023

4. Staff Updates

VIII. ADJOURNMENT

FERGUSON TOWNSHIP PLANNING COMMISSION
REGULAR MEETING MINUTES
MONDAY, FEBRUARY 13, 2023
6:00 PM

ATTENDANCE

The Planning Commission held its first meeting of the month on Monday, February 13, 2023, as a hybrid meeting. In attendance:

Commission:
Jerry Binney – Chair
Dr. Ellen Taricani – Vice Chair
Rob Crassweller - Secretary
Jennifer Eccleston
Shannon Holliday
Bill Keough
Lewis Steinberg
Ralph Wheland
Qian Zhang

Staff:
Jenna Wargo – Director of Planning
Jeff Ressler - Zoning Administrator
Kristina Bassett – Community Planner

Others in attendance: Rhonda R. Demchak, Recording Secretary; Mark Toretti, PennTerra Engineering; Dawn Harpster, Ferguson Township Resident; Jeremie Thompson, Ferguson Township Board of Supervisors

I. CALL TO ORDER

Dr. Taricani called the Ferguson Township Planning Commission's regular meeting to order on Monday, February 13, 2023, at 6:00 p.m. and it has been advertised in accordance with the PA Sunshine Act as a hybrid meeting.

Ms. Wargo took roll call, and the Planning Commission had a quorum.

II. CITIZEN INPUT

There were no comments.

III. APPROVAL OF MINUTES

Mr. Keough moved that the Planning Commission ***approve*** the January 23, 2023, Regular Meeting Minutes. Mr. Wheland seconded the motion. The motion passed unanimously.

IV. OLD BUSINESS

1. MP MACHINERY AND TESTING AT 2161 SANDY DRIVE, STATE COLLEGE FINAL LAND DEVELOPMENT PLAN

Ms. Bassett noted that provided with the agenda a is the MP Machinery and Testing Final Land Development Plan, dated January 24, 2023. The land development plan is located at 2161 Sandy Drive (TP: 24-433-007-0000). The parcel is approximately 1.436 acres and is zoned Light Industry, Research and Development (IRD).

This plan proposes the construction of an 8,088 SF addition to the existing building. On January 3, 2023, the Board of Supervisors reviewed and conditionally approved the preliminary land development plan.

Staff have reviewed the submission and is recommending approval with conditions. Provided with the agenda is a memorandum from the Planning Director dated February 8, 2023, describing the conditions.

Mr. Keough moved that the Planning Commission ***approval*** with conditions to the Board of Supervisors for the MP Machinery and Testing at 2161 Sandy Drive Final Land Development Plan subject to the conditions described in the Planning Director's memorandum dated February 8, 2023. Mr. Crassweller seconded the motion. The motion passed unanimously.

V. NEW BUSINESS

1. REQUEST FOR CONSIDERATION OF A MODIFICATION/WAIVER

Ms. Wargo stated that on February 2, 2023, M. Todd Giddings requested a waiver from Chapter 22- 5C01.1.B.—Off-Street Parking and Loading. This section of the ordinance includes the parking calculations for required parking spaces on a site.

Mr. Giddings has requested a change in use zoning permit at the building located at 3049 Enterprise Drive (TP: 24-004-070Q-0000) for his tenant, Integrated Bodywork School of Massage Therapy. This change in use results in the need for one additional parking space on site. The approved land development plan for this site includes 34 parking spaces and the change in use would require Mr. Giddings to provide 35 parking spaces.

Mr. Giddings operates his business out of this building and Bodywork School of Massage Therapy has been operating at this site for the last 7 years. Mr. Giddings hasn't experienced the parking lot full at any point in time during those 7 years and is requesting a waiver from the one additional parking space to be provided.

Staff have reviewed the request and is recommending approval to the Planning Commission.

Ms. Wargo reported that for the last 7 years they have been operating with a no change in use permit or sign permit.

Mr. Ressler noted that under Chapter 27 Section 902 of the zoning ordinance is where the Change in Use can be located. Mr. Ressler reported that there is a zoning permit fee.

Mr. Keough discussed the Change in Use versus the Change in Tenant and expressed concerns regarding the differences.

Mr. Keough moved that the Planning Commission recommend ***approval*** of the Application for a Waiver to the Board of Supervisors for 3049 Enterprise Drive. Mr. Wheland seconded the motion.

Ms. Eccleston asked if a tenant changed their business slightly would it be considered a change in use. Mr. Ressler stated they wouldn't be concerned since it is the same tenant changing for something minor.

The motion passed unanimously.

VI. COMMUNICATIONS TO THE COMMISSION

Mr. Keough received a phone call regarding the new signs on North Butz Street. Mr. Keough drove to the location and asked if all the new signs were placed. Ms. Wargo stated that she would need to find out from the Public Works Director. Mr. Keough felt that all the signs should be put up at the same time. Ms. Wargo reviewed a map of the location.

Dr. Taricani reported that at the CRPC meeting they discussed the traffic going around the curve and how dangerous the section is.

Mr. Keough expressed disappointment that there was not a joint conversation with the State College Borough Planning Commission that Ferguson Township requested. Ms. Holliday concurred with Mr. Keough's statement and noted that the road is very narrow.

Ms. Eccleston reported that she is a CATA bus operator and is able to negotiate that turn since the island was removed.

Mr. Keough discussed where the new CATA bus stop will be located when the building is finished. Ms. Eccleston stated that a stop on Buckhout would be problematic.

VII. OFFICIAL REPORTS AND CORRESONDENCES

A. Board of Supervisors

Ms. Wargo reported that the Board authorized a public hearing for the new Recreation, Parks and Open Space (RPOS Plan) and received authorization from the Board to amend the Subdivision and Land Development Ordinance specifically for submission requirements and procedures. Ms. Wargo stated that the SALDO amendment will be a big project that will include various people.

Mr. Keough stated that there are some plans that come in that are significantly out of compliance and it places a lot of pressure on staff and consultants. Further discussion ensued regarding plans that come in that are not acceptable from the beginning.

Ms. Wargo reported that the Board discussed the workplans of the ABC's.

B. CRPC Meeting

Dr. Taricani reported that Penn State is trying to redevelop some bicycle paths; discussed artificial grass at the Whitehall Road Regional Park; and viewed a slide show on the population in State College and how it is declining.

C. Land Development Plans

Ms. Bassett reviewed the following plans:

PLAN NAME	SUBMISSION DATE	REVIEW PERIOD	PLAN EXPIRATION
All Washed Up Auto Spa Preliminary Land Development Plan	September 12, 2022	First Review Comments returned September 29, 2022	February 26, 2023
Farmstead View Preliminary Subdivision Plan	July 30, 2021	Conditionally Approved—June 21, 2022	June 21, 2027
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1004 West College Ave Vertical Mixed-Use Building	March 14, 2022	Third Submission Received	May 3, 2023
MP Machinery Final Land Development Plan	January 26, 2023	First Review comments returned February 8, 2023	April 26, 2023
Salvation Baptist Church Preliminary Land Development Plan	June 1, 2022	Conditionally Approved—November 1, 2022	November 1, 2027
125 East Pine Grove Road Preliminary Land Development Plan	October 12, 2022	Second Review Comments returned December 5, 2022	May 7, 2023
165 Volos Lane Minor Land Development Plan	June 3, 2022	Conditionally Approved—September 20, 2022	September 20, 2027
LeCrone Minor Subdivision Plan		Recorded	
1900 Circleville Road	January 3, 2023	Staff First Review Comments returned January 20, 2023	April 3, 2023
LeCrone Preliminary Land Development Plan	February 1, 2023	First Review comments due February 16, 2023	May 2, 2023

Mr. Keough asked if Ferguson Township purchased land on Whitehall Road because he saw it in the newspaper. Mr. Wheland stated that it was Ferguson Township's share of Ag Preservation.

D. Staff Updates

Ms. Wargo reported that they are working internally on how to streamline the process for the land development plans.

Ms. Wargo reported that on March 15th at 6:00 p.m. at the municipal building there will be a 2nd public meeting on the Terraced Streetscape District Rewrite. There will be a zoom option available as well.

Mr. Binney thanked Dr. Taricani for chairing the meeting.

VIII. Adjournment

Mr. Keough made a motion to ***adjourn*** the February 13, 2023, Planning Commission meeting at 6:57 p.m. The motion passed unanimously.

Respectfully Submitted,

Rob Crassweller, Secretary
For the Planning Commission

TOWNSHIP OF FERGUSON
3147 Research Drive • State College, Pennsylvania 16801
Telephone: 814-238-4651 • Fax: 814-238-3454
www.twp.ferguson.pa.us

TO: Planning Commission

FROM: Kristina Bassett, Community Planner

DATE: March 8, 2023

SUBJECT: Application for Consideration of a Modification/Waiver

On November 14, 2022, PGH Real Estate Holdings, LLC requested a waiver from Chapter 22-516 – Landscaping. The 125 East Pine Grove Road Preliminary Land Development Plan proposes the conversion of a single-family home into a restaurant with indoor and outdoor dining areas. The property is located at 125 East Pine Grove Road (24-009A-030-0000) and is zoned Village (V). The property is approximately 0.496 acres.

The applicant is requesting a waiver from providing the required amount of plantings in the landscape buffer yard under the ordinance. The lot is small in size, there are overhead utilities, and the proximity of an existing gravel lane in the buffer area on the northern portion of the western property line is not conducive to successful plantings. The applicant has proposed alternative landscaping for the buffer yard requirements.

1. On the western side (rear), the applicant is proposing landscaping with respect to the overhead utility lines and is requesting approval to count a blue spruce tree in the required canopy tree total.
2. On the eastern side (front), the applicant is proposing landscaping with respect to the overhead utility lines. The existing sidewalks, building and porch are in the 15' buffer. General herbaceous landscaping is proposed.
3. On the eastern side (front), the applicant is requesting approval to replace the required canopy tree with a redbud tree, an understory tree, at the end of the parking bay along East Pine Grove Road/Route26/45.
4. On the north side, along Sparrow Alley, the applicant is proposing a living fence with salt tolerant landscaping.
   Chapter 22, Section 12.B states that in the Village District, the Board of Supervisors may approve the use of a fence or wall in place of the buffer yard. The fence or wall shall be placed in the 3-foot side yard setback.
5. On the east end of the south side (adjacent to Pine Grove Hall), the applicant is proposing a 6' solid wooden fence within 3' side yard setback. There is also a proposed perennial pollinator garden adjacent to the outdoor eating area.
6. On the west end of the south side, the applicant is requesting a reduction in required landscaping due to high voltage overhead utility lines, underground sewer lines, gravel road area and existing tree spread from adjacent properties.

Included in the agenda are the proposed alternative and two memos from the Township Arborist. The first is a

memo with the Arborist's recommendation and the other outlines the Ferguson Township Tree Commission's recommendation on the request. Staff has reviewed the request and isn't recommending any conditions.

Recommended Motion: Move that the Planning Commission recommend granting of the Request for Waiver from §22-516—Landscaing.

Staff Recommendation: That the Planning Commission recommend granting of the request.

Township of Ferguson, PA
Thursday, February 23, 2023

Chapter 22. Subdivision and Land Development

Part 5. DESIGN AND IMPROVEMENT STANDARDS

§ 22-516. Landscaping.

12. Purpose. Buffer yards are intended to aid the Township of Ferguson in protecting the community character of the Township by separating incompatible uses either within the same zoning district and/or between adjacent zoning districts. The purpose of the buffer yard requirements is to alleviate problems which could be encountered by a single standard. The requirements of this section can reasonably accommodate the characteristics of each site and the range of land uses.

    A. All buffer yards shall include:

        (1) A required width of 15 feet.

        (2) A minimum of three canopy trees and four understory trees/evergreen trees per every 100 linear feet of distance along a site's perimeter.

        (3) A minimum of six shrubs per every 100 linear feet of distance along a site's perimeter.

            (a) Areas less than 100 linear feet and/or fraction thereof are to be landscaped with the corresponding ratio by 100 linear feet, rounded up to the nearest whole plant.

        (4) Planting stock to be used as landscape materials for the buffer yard in question are included in the Township's Official Plant List.

    B. Village District. Within the required three-foot side yard setback, the Board of Supervisors may approve the use of a fence or wall in place of the buffer yard which would satisfy the buffer yard requirements as defined above. When landscaping is being provided to buffer against a different use group than is on the site, the required plant material must be evenly distributed within each 100-foot section of the buffer area. The even distribution of plantings is intended to screen objectionable views. When landscaping is being provided to buffer against the same use group as exists on the site, the required plant material may be grouped or unevenly distributed within each 100-foot section of the buffer area.

    C. Corridor Overlay District. In addition to the requirements of § **27-401**, including the buffer yard options set forth in illustrations adopted as part of this chapter and codified at the end of this section, any site located within the Corridor Overlay Zoning District shall comply with the following landscaped buffer yard requirements:

        (1) A landscaped buffer shall be required for all parking areas visible from the corridor street. "Visible" is determined by anyone (as represented by the Township Zoning Administrator) that is either a pedestrian and/or passenger or driver of an average size vehicle on the corridor street. The main purpose of this landscape buffer is to screen parking lot views from the corridor street. The landscaped buffer may be permitted within the required fifty-foot setback.

        (2) To provide flexibility in design of the landscaped buffer yard between the off-street parking lot and the street located in the corridor, one or more of the following landscape treatment

TOWNSHIP OF FERGUSON
3147 Research Drive • State College, Pennsylvania 16801
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TO: Jenna Wargo, Director

FROM: Larry Maginnis, Township Arborist

DATE: March 9, 2023

SUBJECT: ES# 435 125 East Pine Grove Road - Modification Waiver

I have completed my review of the ES# 435 125 East Pine Grove Road – *Application for Consideration of a Modification* as submitted by PGH Real Estate Holdings LLC and as prepared by Stahl Sheaffer Engineering, resubmitted 3-8-2023. The following are comments from my review.

With the new revisions, I believe the applicant has made an attempt to bring the Modification a little closer to ordinance requirements. Although some deviations from Code exist, it is suitable to move forward to the Planning Commission.

Please note: I recognize the need for relief from Landscape Ordinance for the intended use of the property. However, as an agent responsible for administering the Township code, this is a deviation from ordinance requirements. Canopy cover is lost with this Modification request.

1. Sheet 3 – South Side- Lot Line adjacent to Pine Grove Hall (East End) - Within the Village District the Board of Supervisors may approved the use of a fence or wall in place of the buffer yard planting requirements. As proposed, this plan would eliminate the possibility of desirable canopy trees and a loss of canopy cover in an area where street trees are not prevalent. It would be ideal to have trees in this location. Trees would be a welcomed addition to the pollinator garden.

2. Sheet 3 – Suggest using larger (taller) canopy trees in parking lot entrance locations or eliminating easternmost tree altogether. Current species choice may create sight triangle issues with vehicles exiting alley or parking lot onto College Avenue.

3. Existing trees were removed prior to plan review submission nullifying the Tree Preservation Ordinance.

TOWNSHIP OF FERGUSON
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www.twp.ferguson.pa.us

TO: Jenna Wargo, Director

FROM: Larry Maginnis, Township Arborist

DATE: February 22, 2023

SUBJECT: ES# 435 125 East Pine Grove Road PLDP

On behalf of the Ferguson Township Tree Commission, I am forwarding their recommendations for of the ES# 435 125 East Pine Grove Road – *Application for Consideration of a Modification* as submitted by PGH Real Estate Holdings LLC and as prepared by Stahl Sheaffer Engineering, submitted 11-14-2022. The request was reviewed at the monthly Tree Commission meeting on Tuesday February 21st. The following comments are from their review/discussions.

1. The Ferguson Township Tree Commission recognizes the need for relief from Landscape Ordinance for the intended use of the property.

2. The Commission recommends adding 5-6 more medium-large sized trees than what is currently shown in modification waiver plan.

3. The Commission recommends replacing the proposed smaller canopy trees (Redbud) with larger canopy trees where infrastructure and space allow. Particular areas of note are the easternmost parking lot entrance island adjacent to alley and the Northside between trash enclosure and west end.

4. The Commission recommends not planting trees between building and street due to infrastructure conflicts.

5. Due to abundance of Honeylocust trees in the Township, the Tree Commission recommends substituting the Honeylocust with another large form specie of tree.

APPLICATION FOR CONSIDERATION OF A MODIFICATION

Ferguson Township, Centre County

Submittal Date: 11/14/2022

A fee of $50.00 is required at the time of submitting this application.

The undersigned hereby applies for approval of a modification/waiver, submitted herewith and described below:

Applicant Information

PGH Real Estate Holdings, LLC
Name

1323 Sandpiper Dr | State College | 16801
Street Address | City | Zip

814-777-7863
Phone Number

Property/Plan Information

125 E. Pine Grove Road Development
Plan Name

10/07/22 rev 11/11/22
Plan Number | Plan Date

125 E Pine Grove Road | 24-009A-,030-,0000-
Project Location | Parcel Number

PGH Real Estate Holdings, LLC
Name of Property Owner(s)

125 E Pine Grove Road | Pine Grove Mills | 16868
Street Address | City | Zip

Application Type:

- ☐ Subdivision
- ☐ Land Development
- ☐ Terraced Streetscape District (TSD)
- ☐ Traditional Town Development (TSD) District

Modification/Waiver Request Information

Specific Section(s) of the Subdivision and Land Development Ordinance or Design Standards for which a Modification/Waiver is requested:

22-516

APPLICATION FOR CONSIDERATION OF A MODIFICATION

Ferguson Township, Centre County

State any proposed alternative(s) to the requirement:

NORTH SIDE YARD: Living fence instead of structural fence as an alternative to the buffer yard requirements. Landscaping trees/shrubs along back buffer with respect to overhead utility and adjacent trees and in keeping with character of Village District. Red Bud Trees (common in the Village District) desired to promote cohesive community beautification. SOUTH: Landscaping with respect to overhead utility lines and existing tree spread on the adjacent property. SOUTHEAST: Adjacent to public roadway (Sparrow Alley) to be considered as road frontage with no landscaping. SOUTHWEST: A fence with a vining plant conducive of the Village District character.

Please state in full, the grounds and facts of the unreasonableness or hardship the Ferguson Township Subdivision and Land Development Ordinance has placed on the property.

The amount of planting requried in buffer yards under the ordinance and in conjunction with the small size of the parcel would reduce the usable portion of the property to a point that would make the development not feasible for the intended use. In addition, the close proximity of trees located to proposed outdoor eating and gathering areas would have negative affects. Negative affect include bird droppsing, excessive fall leaf accumulation, and attraction of bees and other insects that would all detract from the pleasant experience and usefulness of the proposed outdoor use area.

*If necessary, please continue with your hardship specification on another page.

The undersigned hereby represents that, to the best of their knowledge and belief, all information listed above is true, correct, and complete.

Elizabeth Grace
Signature

11/14/22
Date

-For Office Use Only-

Date Received:_____ By:_____

Date Paid:_____ Check No.:_____ Amount:_____

Advertisement Dates:_____ Planning Commission Review Date:_____

Board of Supervisors Meeting Date:_____

A**pplication for Consideration of a Modification**

Applicant: PGH Real Estate Holdings LLC Property: 125 E Pine Grove Road Development

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Chapter 22, Section 516 – Landscaping Plan

Section 516.12.A – Landscape plan requires a Buffer Yard width of 15 feet.

Section 516.12.B – In Village District, Board may approve use of a fence or wall in place of buffer yard which satisfies the requirements of 12.A.

Section 516.11 Access and Visibility. No tree, shrub, fence, wall… shall be installed in the sight triangle of any corner, street intersection or accessway intersection a public right of way that would cause an obstruction to visibility.

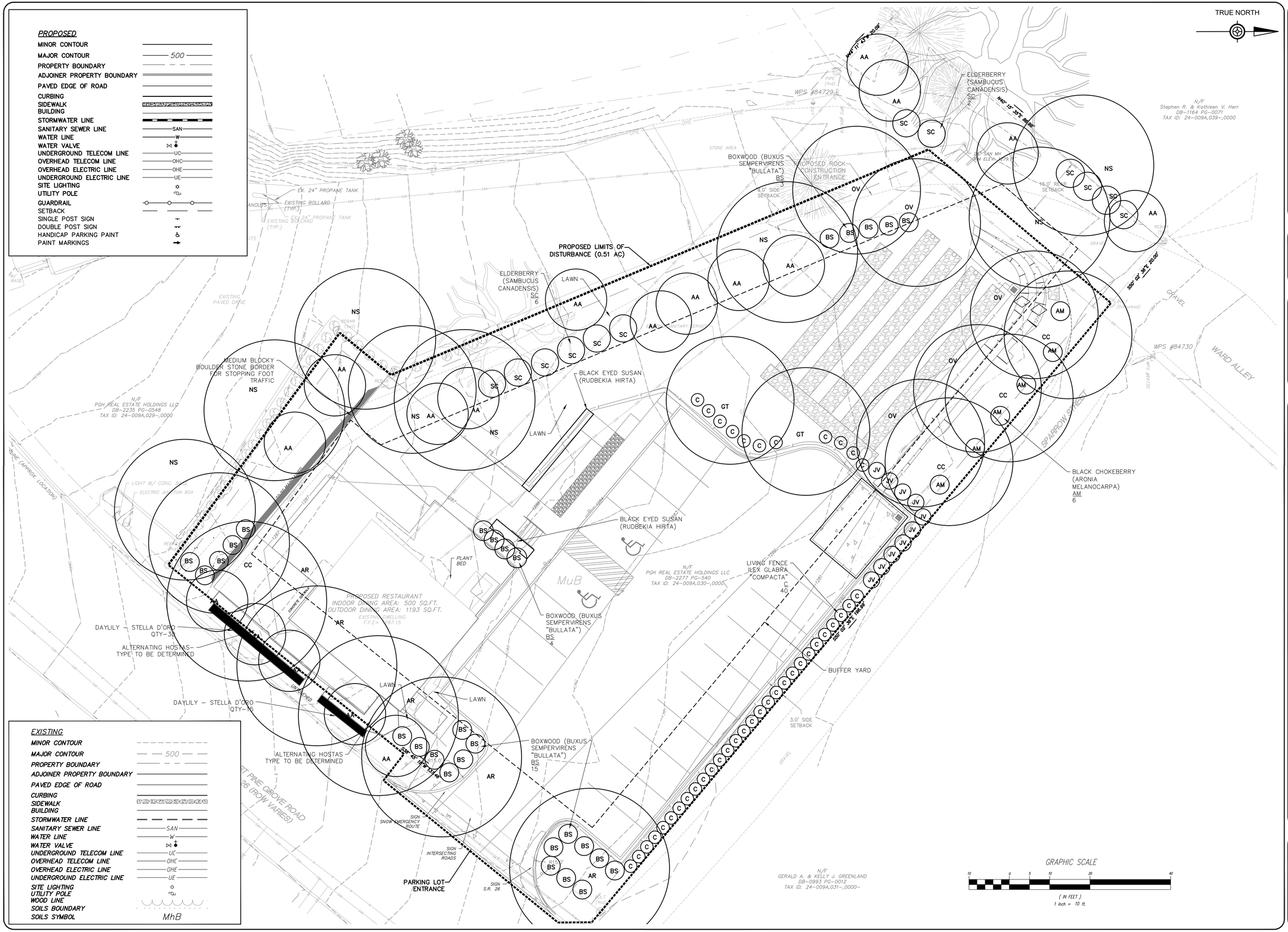
Section 22-516.8.A One existing canopy tree of at least four-inch caliper may be substituted for one new tree that is listed in the Township's official plant list.

_____

State any proposed alternative(s) to the requirements:

REQUIRED (Sheets 1 & 2)	**ALTERNATIVE (Sheets 3 & 4)**
WEST SIDE (BACK YARD) • 15' Buffer Yard	WESTSIDE • Landscaping arrangement with respect to overhead utility lines and existing tree spread on adjacent property. • Request approval to count blue spruce canopy tree in the required canopy tree total
EAST SIDE (FRONT YARD) • 15' Buffer yard	EASTSIDE – Lot line adjacent to Rt 26 • Landscaping arrangement with respect to overhead utility lines, existing sidewalk, existing building and porch. • Request approval to reduce the landscaping requirements to allow a cleaning and clearer look to the building frontage and so as not to encroach on the structure with overhanging branches and leaves. No trees or shrubs are proposed. • General herbaceous landscaping is proposed to fit with the Village District context.

REQUIRED (Sheets 1 & 2)	ALTERNATIVE (Sheets 3 & 4)
NORTH SIDE • 15’ Buffer yard	Lot line is adjacent to public roadway, Sparrow Alley East end of North property line – adjacent to the proposed parking lot and Sparrow Alley – narrow planting strip • Request to provide a living fence with salt tolerant landscaping shrubs that work within the confines of existing overhead utility and adjacent trees. This is also to act as light screening to the northern properties. Section 516.12.B
SOUTH SIDE • 15’ Buffer yard	SOUTH SIDE – Lot line adjacent to Pine Grove Hall East end of the South property line. • Request to provide a 6’ solid wooden fence within the 3 foot side yard setback adorned with vining plants and landscaping shrubs. The main purpose of the fence is to screen headlights from the adjacent parking lot that would shine into the building and onto the outdoor seating area. Section 516.12.B The vegetative adornment of the fence will and to be in keeping with the character of the village. In addition will be a perennial pollinator garden to complement the outdoor eating area atmosphere. West end of the South property line. • Request reduction in required landscaping with respect to high voltage overhead utility lines, underground sewer lines, gravel road area and existing tree spread from adjacent property.
Parking along SR 26	EASTSIDE • Request approval to replace the required canopy tree with a redbud tree at the end of the parking bays along Route 26. The area adjacent to the parking lot and public roadway is better suited for a smaller tree and the redbuds will add to the community cohesiveness as well as provide a nice entryway to the parking lot.



STAHL SHEAFFER ENGINEERING
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STATE COLLEGE, PA 16803
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FAX: 814-689-1885
www.stahlsheaffer.com

SURVEYOR --------- CES
CADD --------- JJN
DESIGNER --------- DDC
MANAGER --------- MRV
FILE: 21-330 DESIGN_LANDSCAPE-REQIRED ORDINA
21-330 DESIGN_LANDSCAPE-REQIRED ORDINANCE.DWG

REV 1 - 11/11/22 - TWP COMMENTS

REVISIONS

PGH REAL ESTATE HOLDINGS LLC

125 E PINE GROVE ROAD DEVELOPMENT

FERGUSON TOWNSHIP, CENTRE COUNTY, PA

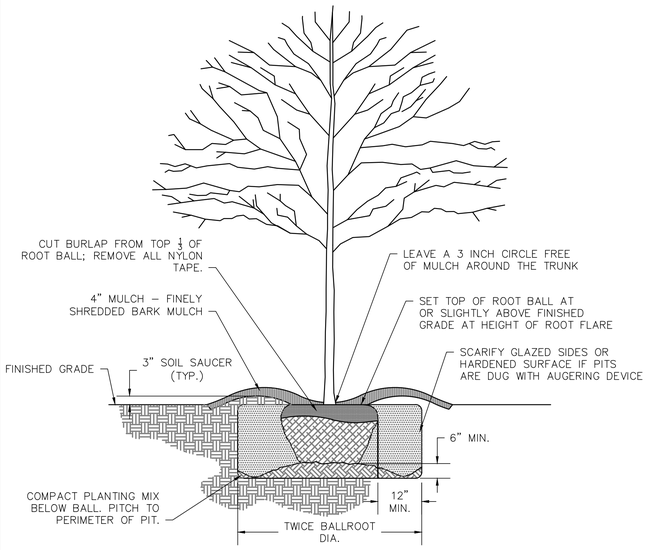
SHEET NAME

R.O. LANDSCAPE PLAN

PROJECT NO.
21-330

DATE
10/07/2022

SHEET NO.
01



NOTES:

1. PRUNE ANY DEAD BRANCHES AT THE TIME OF PLANTING.
2. REJECT ANY PLANTS THAT APPEAR SIGNIFICANTLY STRESSED OR DYING

DECIDUOUS TREE PLANTING

N.T.S.

PLANTING NOTES:

1. TREES AND SHRUBS SHOULD BE PLANTED AFTER FINAL GRADING HAS BEEN PERFORMED, BUT BEFORE THE PERMANENT SEED, MULCH AND FERTILIZER IS APPLIED.
2. UPON DELIVERY ALL TREES AND SHRUBS SHALL BE INSPECTED FOR HEALTH AND VIGOR. TREE LIMBS SHOULD BE PLIABLE, GREEN AND WITHOUT DRY OR DEAD TWIGS. BARK SHOULD BE INTACT WITH NO OPEN WOUNDS. TREE SHOULD NOT BE VISIBLY AFFECTED WITH FUNGUS, INSECT OR OTHER DETRIMENTAL PEST. ANY TREE AND SHRUBS EXHIBITING ANY OF THESE CHARACTERISTICS SHALL BE RETURNED TO THE SUPPLIER AND REPLACED WITH ACCEPTABLE STOCK.
3. PLANTING DATES: TREES AND SHRUBS SHOULD BE PLANTED EITHER DURING THE SPRING OR FALL SEASONS.
   SPRING PLANTING: TREES SHOULD BE PLANTED AFTER THE GROUND HAS THAWED BUT BEFORE BUD BREAK IN THE SPRING. SEASONS VARY AND ADJUSTMENTS SHOULD BE MADE TO PERFORM PLANTING DURING SUITABLE CONDITIONS. RED CEDAR SHOULD BE PLANTED IN THE SPRING. FALL PLANTING OF RED CEDAR IS ACCEPTABLE BUT WILL NORMALLY RESULT IN HIGHER DIE–OFF RATES THAN SPRING PLANTING.
   SUMMER PLANTING: IF PLANTING IS TO BE DONE BETWEEN APRIL 30TH AND SEPTEMBER 25TH, THE NEW PLANTINGS MUST BE WATERED EVERY OTHER DAY DURING PERIODS OF NON MEASURABLE PRECIPITATION. A WATERING IS CONSIDERED SUFFICIENT IF SATURATION OF THE GROUND HAS OCCURRED TO A MINIMUM DEPTH OF SIX INCHES AFTER WATER CEASES. AVOID EXCESSIVE WATERING THAT WASHES AWAY FILL SOIL AROUND THE ROOT BALL OR ATTEMPTS TO PUSH THE ROOT BALL UPWARD OUT OF THE PLANTING HOLE.
4. ALL DIRECTIONS AND DETAILS PROVIDED ON THE DETAIL SHEET SHOULD BE FOLLOWED FOR SUCCESSFUL TRANSPLANTING OF DELIVERED NURSERY STOCK PLANT MATERIAL. THE PLANTING HOLE SHALL BE PREPARED AS SHOWN ON THE DETAILS SHEET OF THE PLANTING PLAN. A PLANTING HOLE, A MINIMUM OF TWO TIMES THE ROOT BALL DIAMETER SHALL BE EXCAVATED FOR THE PLANTINGS. A SOLID BASE SHALL BE PREPARED FOR PLACEMENT OF ROOT BALL. SOIL SHOULD BE REPLACED AND PACKED FIRMLY AROUND THE TREE OR SHRUB ROOT MASS.
5. ALL TREES AND SHRUBS SHALL BE PLANTED IN ACCORDANCE WITH THE "GUIDE TO PLANTING IN FERGUSON TOWNSHIP". (CHAPTER 22, SECTION 516.5)
6. A SOIL TEST FOR pH MUST BE PERFORMED FOR THE PLANTING AREA OF THE ILEX GLABRA. IF THE pH NEEDS ADJUSTED ACCORDING TO THE SOIL TEST RESULT, THE SOIL SHALL BE AMENDED AS DIRECTED FROM THE SOIL LAB. THE INFORMATION MUST BE PROVIDED TO THE ZONING ADMINISTRATOR AND TOWNSHIP ARBORIST FOR VERIFICATION PRIOR TO ISSUANCE OF THE OCCUPANCY PERMIT.

BUFFER YARD

SOUTHCENTRAL 171' LONG 15' WIDE

REQUIRED	PROVIDED
6 CANOPY TREES	6
7 UNDERSTORY TREES	7
11 SHRUBS	11

SOUTHEAST 71.5' LONG 15' WIDE

REQUIRED	PROVIDED
3 CANOPY TREES	3
3 UNDERSTORY TREES	3
5 SHRUBS	5

WESTSIDE BACK YARD 87' LONG 15' WIDE

REQUIRED	PROVIDED
3 CANOPY TREES	2 EXISTING + 1 = 3
4 UNDERSTORY TREES	4
6 SHRUBS	6

NORTHSIDE BETWEEN THE TRASH ENCLOSURE AND WEST END

REQUIRED	PROVIDED
3 CANOPY TREES	3
4 UNDERSTORY TREES	4
6 SHRUBS	6

NORTHSIDE ALONG THE PARKING LOT EDGE, 112' LONG, 15' WIDE. (PARKING LOT)

EVERGREEN, SALT TOLERANT SHRUB HEDGE (LIVING FENCE) PROVIDED IN PLACE OF A FENCE FOR LIGHT BLOCKING

REQUIRED	PROVIDED
4 CANOPY TREES	0 – PARKING LOT
5 UNDERSTORY TREES	0 – PARKING LOT
7 SHRUBS	29

EASTSIDE (FRONT) (SR 26 FRONTAGE) 109' LONG AND 15' WIDE

REQUIRED	PROVIDED
4 CANOPY TREES	4–INCLUDES 1 AT THE END OF PARKING BAYS
5 UNDERSTORY TREES	5
7 SHRUBS	15 (INCLUDES THOSE AT THE END OF THE PARKING BAYS THAT OVERLAP)

PARKING

WEST END

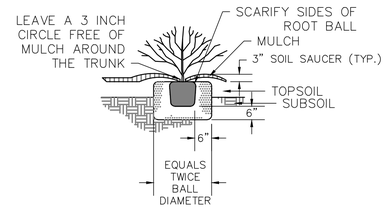
REQUIRED	PROVIDED
2 CANOPY TREES	2
	11 SALT TOLERANT EVERGREEN SHRUBS

SOUTH CORNER OF PARKING LOT ENTRANCE– STONE BEDDING

REQUIRED	PROVIDED
1 CANOPY TREES	1–INCLUDED AS A CANOPY TREE COUNTED IN FRONT BUFFER YARD
	7 SHRUBS FOR DEFINITION AROUND THE PAVED AREA INCLUDED IN THE FRONT BUFFER YARD TOTAL

NORTH CORNER OF PARKING LOT ENTRANCE – STONE BEDDING

REQUIRED	PROVIDED
1 CANOPY TREES	1
	8 SHRUBS FOR DEFINITION AROUND THE PAVED AREA (INCLUDED IN THE FRONT BUFFER YARD TOTAL)



CONTAINER GROWN

NOTES:

1. PLANT TO HEIGHT OF ROOT FLARE

SHRUB PLANTING

N.T.S.

MASTER LANDSCAPE SCHEDULE

SYMBOL		QUANTITIES	SCIENTIFIC NAME	COMMON NAME	TYPE	PLANT SPACING (FT.) O.C.	PLANT HT AT INSTALL (FT)	MATURE HT (FT.)	MATURE SPREAD (FT.)	USE	MIN CALIPER AT INSTALL
UNDERSTORY TREES											
JV	JV	10	JUNIPERUS VIGINIANA "EMERALD SENTINEL"	RED CEDAR	CONTAINER OR B&B	4.0	6.0 MINIMUM	20	4–6	TRASH SCREENING	NA
CC	CC	6	CERCIS CANADENSIS	EASTERN REDBUD	B&B	AS SHOWN	NA	20–30	25–30	BUFFER YARD	1.5"
AA	AA	17	AMELANCHIER ARBOREA	ALLEGHENY SERVICEBERRY	B&B	AS SHOWN	NA	10–25	10–15	BUFFER YARD	1.5"
CANOPY TREES											
GT	GT	2	GLEDITSIA TRIACANTHOS "SKYLINE"	HONEY LOCUST	B&B	AS SHOWN	NA	30–35	25–35	PARKING	2.0
OV	OV	6	OSTRYA VIRGINIANA	AMERICAN HOP HORNBEAM	B&B	AS SHOWN	NA	25–40	20–30	BUFFER YARD	2.0
NS	NS	7	NYSSA SYLVATICA	BLACK GUM	B&B	AS SHOWN	NA	30–50	20–30	BUFFER YARD	2.0
AR	AR	5	ACER RUBRUM	RED MAPLE	B&B	AS SHOWN	NA	40–60	40	BUFFER YARD/PARKING	2.0
SHRUBS											
BS	BS	29	BUXUS SEMPERVIRENS "BULLATA"	BOXWOOD	CONTAINER	5.0	3.0 MINIMUM	6	5	BUFFER YARD/GENERAL	NA
C	C	40	ILEX GLABRA "COMPACTA"	INKBERRY	CONTAINER	2.5	3.0 MINIMUM	5–6	4–6	LIGHT SCREENING	NA
SC	SC	12	SAMBUCUS CANADENSIS	ELDERBERRY	CONTAINER	AS SHOWN	3.0 MINIMUM	6–8	6–8	BUFFER YARD	NA
AM	AM	6	ARONIA MELANOCARPA	BLACK CHOKEBERRY	CONTAINER	3.0	3.0 MINIMUM	6–8	2–6	BUFFER YARD	NA
HERBACEOUS PLANTS											
		18	RUDBECKI HIRTA	BLACKEYED SUSAN	CONTAINER	2.0	NA	NA	NA	GENERAL	NA
		45	HEMEROCALLIS "STELLA DE ORO"	DAYLILLY STELLA DE ORO	CONTAINER	2.0	NA	NA	NA	GENERAL	NA
		TBD	HOSTA "REGAL SPLENDOR"	HOSTA	CONTAINER	TBD	NA	NA	NA	GENERAL	NA

NOTES: B&B IS BALLED AND BURLAP AS PREPARED AT THE NURSERY

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www.stahlsheaffer.com

SURVEYOR -------- CES
CADD -------- JJN
DESIGNER -------- DDC
MANAGER -------- MRV
FILE: 21-330 DESIGN_LANDSCAPE-REQIRED ORDINANCE.DWG

REV 1 - 11/11/22 - TWP COMMENTS

REVISIONS

PGH REAL ESTATE HOLDINGS LLC

125 E PINE GROVE ROAD DEVELOPMENT

FERGUSON TOWNSHIP, CENTRE COUNTY, PA

SHEET NAME

R.O. LANDSCAPING DETAILS

PROJECT NO. 21-330

DATE 10/07/2022

SHEET NO. 02

TRUE NORTH

PROPOSED LIMITS OF DISTURBANCE (0.51 AC)

ELDERBERRY (SAMBUCUS CANADENSIS) SC 6 — N/F Stephen R. & Kathleen V. Herr DB-1164 PG-0071 TAX ID: 24-009A,039-,0000

BOXWOOD (BUXUS SEMPERVIRENS "BULLATA") BS 5

ELDERBERRY (SAMBUCUS CANADENSIS) SC 3

6 FOOT SOLID (NO LARGE SLAT GAPS) WOODEN FENCE WITH CLEMATIS "DIANA'S DELIGHT"

MEDIUM BLOCKY BOULDER STONE BORDER FOR STOPPING FOOT TRAFFIC

PERENNIAL POLLINATOR FLOWER GARDEN

N/F PGH REAL ESTATE HOLDINGS LLC DB-2235 PG-0548 TAX ID: 24-009A,029-,0000

BLACK EYED SUSAN (RUDBEKIA HIRTA)

LAWN

BLACK CHOKEBERRY (ARONIA MELANOCARPA) AM 8

N/F PGH REAL ESTATE HOLDINGS LLC DB-2277 PG-540 TAX ID: 24-009A,030-,0000

PROPOSED RESTAURANT INDOOR DINING AREA: 500 SQ.FT. OUTDOOR DINING AREA: 1193 SQ.FT.

EXISTING DWELLING F.F. 1287.15

BOXWOOD (BUXUS SEMPERVIRENS "BULLATA") BS 4

LIVING FENCE ILEX GLABRA "COMPACTA" C 29

BUFFER YARD

PROPOSED ROCK CONSTRUCTION ENTRANCE

DAYLILY - STELLA D'ORO QTY-30

ALTERNATING HOSTAS - TYPE TO BE DETERMINED

DAYLILY - STELLA D'ORO QTY-15

ALTERNATING HOSTAS TYPE TO BE DETERMINED

BOXWOOD (BUXUS SEMPERVIRENS "BULLATA") BS 15

PARKING LOT ENTRANCE

SIGN SNOW EMERGENCY ROUTE

SIGN INTERSECTING ROADS

SIGN S.R. 26

EAST PINE GROVE ROAD S.R. 26 (ROW VARIES)

SPARROW STREET

WARD ALLEY

N/F GERALD A. & KELLY J. GREENLAND DB-0993 PG-0012 TAX ID: 24-009A,031-,0000-

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)
1 inch = 10 ft.

PROPOSED

MINOR CONTOUR	
MAJOR CONTOUR	500
PROPERTY BOUNDARY	
ADJOINER PROPERTY BOUNDARY	
PAVED EDGE OF ROAD	
CURBING	
SIDEWALK	
BUILDING	
STORMWATER LINE	
SANITARY SEWER LINE	SAN
WATER LINE	W
WATER VALVE	
UNDERGROUND TELECOM LINE	UC
OVERHEAD TELECOM LINE	OHC
OVERHEAD ELECTRIC LINE	OHE
UNDERGROUND ELECTRIC LINE	UE
SITE LIGHTING	
UTILITY POLE	
GUARDRAIL	
SETBACK	
SINGLE POST SIGN	
DOUBLE POST SIGN	
HANDICAP PARKING PAINT	
PAINT MARKINGS	

EXISTING

MINOR CONTOUR	
MAJOR CONTOUR	500
PROPERTY BOUNDARY	
ADJOINER PROPERTY BOUNDARY	
PAVED EDGE OF ROAD	
CURBING	
SIDEWALK	
BUILDING	
STORMWATER LINE	
SANITARY SEWER LINE	SAN
WATER LINE	W
WATER VALVE	
UNDERGROUND TELECOM LINE	UC
OVERHEAD TELECOM LINE	OHC
OVERHEAD ELECTRIC LINE	OHE
UNDERGROUND ELECTRIC LINE	UE
SITE LIGHTING	
UTILITY POLE	
WOOD LINE	
SOILS BOUNDARY	
SOILS SYMBOL	MhB

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REV 1 - 11/11/22 - TWP COMMENTS
REV 2 - 03/08/23 - TWP COMMENTS

REVISIONS

PGH REAL ESTATE HOLDINGS LLC

125 E PINE GROVE ROAD DEVELOPMENT

FERGUSON TOWNSHIP, CENTRE COUNTY, PA

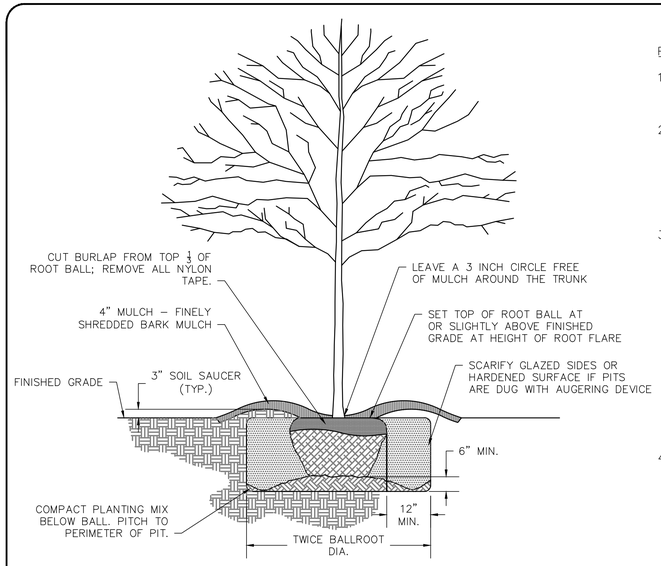
SHEET NAME

LANDSCAPE PLAN

PROJECT NO.
21-330

DATE
10/07/2022

SHEET NO.
03



NOTES:

1. PRUNE ANY DEAD BRANCHES AT THE TIME OF PLANTING.
2. REJECT ANY PLANTS THAT APPEAR SIGNIFICANTLY STRESSED OR DYING

DECIDUOUS TREE PLANTING

N.T.S.

PLANTING NOTES:

1. TREES AND SHRUBS SHOULD BE PLANTED AFTER FINAL GRADING HAS BEEN PERFORMED, BUT BEFORE THE PERMANENT SEED, MULCH AND FERTILIZER IS APPLIED.
2. UPON DELIVERY ALL TREES AND SHRUBS SHALL BE INSPECTED FOR HEALTH AND VIGOR. TREE LIMBS SHOULD BE PLIABLE, GREEN AND WITHOUT DRY OR DEAD TWIGS. BARK SHOULD BE INTACT WITH NO OPEN WOUNDS. TREE SHOULD NOT BE VISIBLY AFFECTED WITH FUNGUS, INSECT OR OTHER DETRIMENTAL PEST. ANY TREE AND SHRUBS EXHIBITING ANY OF THESE CHARACTERISTICS SHALL BE RETURNED TO THE SUPPLIER AND REPLACED WITH ACCEPTABLE STOCK.
3. PLANTING DATES: TREES AND SHRUBS SHOULD BE PLANTED EITHER DURING THE SPRING OR FALL SEASONS.
   SPRING PLANTING: TREES SHOULD BE PLANTED AFTER THE GROUND HAS THAWED BUT BEFORE BUD BREAK IN THE SPRING. SEASONS VARY AND ADJUSTMENTS SHOULD BE MADE TO PERFORM PLANTING DURING SUITABLE CONDITIONS. RED CEDAR SHOULD BE PLANTED IN THE SPRING. FALL PLANTING OF RED CEDAR IS ACCEPTABLE BUT WILL NORMALLY RESULT IN HIGHER DIE–OFF RATES THAN SPRING PLANTING.
   SUMMER PLANTING: IF PLANTING IS TO BE DONE BETWEEN APRIL 30TH AND SEPTEMBER 25TH, THE NEW PLANTINGS MUST BE WATERED EVERY OTHER DAY DURING PERIODS OF NON MEASURABLE PRECIPITATION. A WATERING IS CONSIDERED SUFFICIENT IF SATURATION OF THE GROUND HAS OCCURRED TO A MINIMUM DEPTH OF SIX INCHES AFTER WATER CEASES. AVOID EXCESSIVE WATERING THAT WASHES AWAY FILL SOIL AROUND THE ROOT BALL OR ATTEMPTS TO PUSH THE ROOT BALL UPWARD OUT OF THE PLANTING HOLE.
4. ALL DIRECTIONS AND DETAILS PROVIDED ON THE DETAIL SHEET SHOULD BE FOLLOWED FOR SUCCESSFUL TRANSPLANTING OF DELIVERED NURSERY STOCK PLANT MATERIAL. THE PLANTING HOLE SHALL BE PREPARED AS SHOWN ON THE DETAILS SHEET OF THE PLANTING PLAN. A PLANTING HOLE, A MINIMUM OF TWO TIMES THE ROOT BALL DIAMETER SHALL BE EXCAVATED FOR THE PLANTINGS. A SOLID BASE SHALL BE PREPARED FOR PLACEMENT OF ROOT BALL. SOIL SHOULD BE REPLACED AND PACKED FIRMLY AROUND THE TREE OR SHRUB ROOT MASS.
5. ALL TREES AND SHRUBS SHALL BE PLANTED IN ACCORDANCE WITH THE "GUIDE TO PLANTING IN FERGUSON TOWNSHIP". (CHAPTER 22, SECTION 516.5)
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BUFFER YARD

SOUTHSIDE WEST 144' LONG 15' WIDE

REQUIRED	PROVIDED
5 CANOPY TREES	2 + 1 EXISTING = 3, 2 NOT INCLUDED – OVERHEAD ELECTRIC, SEWER LINES AND GRAVEL ROADS AND ADJACENT TO AN EXISTING PARKING AREA, ROOT CONCERNS. LIMITED PLANTING SPACE
6 UNDERSTORY TREES	5 – MORE THAN 5 WILL CONFLICT WITH OTHER PLANTINGS AND EXISTING INFRASTRUCTURE. A LINE UP OF ALLEGHENY SERVICEBERRY WILL PROVIDE A NICE EARLY SEASON FLUSH OF WHITE BLOOMS ALONG THIS PROPERTY LINE.
9 SHRUBS	11

WESTSIDE (BACK YARD) 87' LONG 15' WIDE

REQUIRED	PROVIDED
3 CANOPY TREES	2 + 1 EXISTING = 3
4 UNDERSTORY TREES	4
6 SHRUBS	6

NORTHSIDE BETWEEN THE TRASH ENCLOSURE AND WEST END

REQUIRED	PROVIDED
3 CANOPY TREES	3
4 UNDERSTORY TREES	4
6 SHRUBS	8

NORTHSIDE ALONG THE PARKING LOT EDGE.

EVERGREEN, SALT TOLERANT SHRUB HEDGE (LIVING FENCE) PROVIDED IN PLACE OF A FENCE FOR LIGHT BLOCKING

PARKING

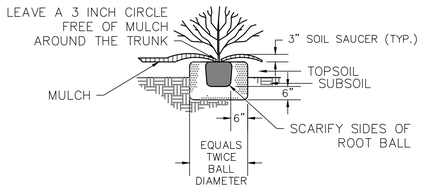
WEST END

REQUIRED	PROVIDED
2 CANOPY TREES	2
	11 SALT TOLERANT EVERGREEN SHRUBS

SOUTHEAST CORNER – A SIX FOOT WOODEN FENCE IS BEING PROPOSED FOR LIGHT BLOCKING IN PLACE OF PLANTINGS.

NORTHEAST CORNER – ENTRY TO PARKING LOT

REQUIRED	PROVIDED
2 CANOPY TREES	0
	2 – UNDERSTORY TREE PROVIDED TO MATCH THE OPPOSITE SIDE ENTRY FOR BALANCE AND APPEAL. REDBUD TREES COMMON IN THE VILLAGE DISTRICT TO PROVIDE COHESIVE COMMUNITY BEAUTIFICATION
	7 SHRUBS FOR DEFINITION AROUND THE PAVED AREA
	8 SHRUBS FOR DEFINITION AROUND THE PAVED AREA



NOTES: CONTAINER GROWN

1. PLANT TO HEIGHT OF ROOT FLARE

SHRUB PLANTING

N.T.S.

MASTER LANDSCAPE SCHEDULE

SYMBOL		QUANTITIES	SCIENTIFIC NAME	COMMON NAME	TYPE	PLANT SPACING (FT.) O.C.	PLANT HT AT INSTALL (FT)	MATURE HT (FT.)	MATURE SPREAD (FT.)	USE	MIN CALIPER AT INSTALL
UNDERSTORY TREES											
(JV)	JV	10	JUNIPERUS VIGINIANA "EMERALD SENTINEL"	RED CEDAR	CONTAINER OR B&B	4.0	6.0 MINIMUM	20	4–6	TRASH SCREENING	NA
(CC)	CC	4	CERCIS CANADENSIS	EASTERN REDBUD	B&B	AS SHOWN	NA	20–30	15–20	BUFFER YARD	1.5"
(AA)	AA	7	AMELANCHIER ARBOREA	ALLEGHENY SERVICEBERRY	B&B	AS SHOWN	NA	10–25	10–15	BUFFER YARD	1.5"
(HV)	HV	4	HAMAMELIS VIRGINIANA	WITCH HAZEL	B&B	AS SHOWN	NA	15–20	15–20	BUFFER YARD	1.5"
CANOPY TREES											
(NS)	NS	4	NYSSA SYLVATICA	BLACK GUM	B&B	AS SHOWN	NA	30–50	20–30	BUFFER YARD	2.0
(OV)	OV	5	OSTRYA VIRGINIANA	AMERICAN HOP HORNBEAM	B&B	AS SHOWN	NA	25–40	20–30	BUFFER YARD	2.0
SHRUBS											
(BS)	BS	24	BUXUS SEMPERVIRENS "BULLATA"	BOXWOOD	CONTAINER	5.0	3.0 MINIMUM	6	5	BUFFER YARD/GENERAL	NA
(C)	C	40	ILEX GLABRA "COMPACTA"	INKBERRY	CONTAINER	2.5	3.0 MINIMUM	5–6	4–6	LIGHT SCREENING	NA
(SC)	SC	9	SAMBUCUS CANADENSIS	ELDERBERRY	CONTAINER	AS SHOWN	3.0 MINIMUM	6–8	6–8	BUFFER YARD	NA
(AM)	AM	11	ARONIA MELANOCARPA	BLACK CHOKEBERRY	CONTAINER	3.0	3.0 MINIMUM	6–8	2–6	BUFFER YARD	NA
HERBACEOUS PLANTS											
		18	RUDBECKI HIRTA	BLACKEYED SUSAN	CONTAINER	2.0	NA	NA	NA	GENERAL	NA
		45	HEMEROCALLIS "STELLA DE ORO"	DAYLILLY STELLA DE ORO	CONTAINER	2.0	NA	NA	NA	GENERAL	NA
		18	CLEMATIS "DIANA'S DELIGHT"	CLEMATIS	QT CONTAINER MIN	3.0	NA	NA	NA	GENERAL	NA
		TBD	HOSTA "REGAL SPLENDOR"	HOSTA	CONTAINER	TBD	NA	NA	NA	GENERAL	NA

NOTES: B&B IS BALLED AND BURLAP AS PREPARED AT THE NURSERY

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DESIGNER -------- DDC
MANAGER -------- MRV
FILE: 21-330 DESIGN_LANDSCAPE.DWG
21-330 DESIGN_LANDSCAPE.DWG

REV 1 - 11/11/22 - TWP COMMENTS
REV 2 - 03/08/23 - TWP COMMENTS

REVISIONS

PGH REAL ESTATE HOLDINGS LLC

125 E PINE GROVE ROAD DEVELOPMENT

FERGUSON TOWNSHIP, CENTRE COUNTY, PA

SHEET NAME

LANDSCAPING DETAILS

PROJECT NO.
21-330

DATE
10/07/2022

SHEET NO.
04

TOWNSHIP OF FERGUSON
3147 Research Drive • State College, Pennsylvania 16801
Telephone: 814-238-4651 • Fax: 814-238-3454
www.twp.ferguson.pa.us

TO: Planning Commission

FROM: Kristina Bassett, Community Planner

DATE: February 22, 2023

SUBJECT: Slab Cabin Run Water Quality Evaluation Report

The Department of Environmental Protection (DEP) conducted an evaluation of the Slab Cabin Run basin in response to Pennsylvania Fish and Boat Commission (PFBC) Class 'A' Wild Trout classifications and an existing use evaluation associated with National Pollutant Discharge Elimination System (NPDES) permit for the UAJA Class A quality reuse discharges to Slab Cabin Run. Slab Cabin Run is currently listed on Pennsylvania's list of impaired waters.

Slab Cabin Run originates from Tussey Mountain in southern Ferguson Township. It flows through karst topography where surface flow increases and decreases based on connectivity with groundwater, limestone and limestone-influenced streams. The stream will therefore display unique qualities.

Figure 1. Slab Cabin Run Basin Station Locations and Current Designated Use

The Slab Cabin Run basin is currently designated High Quality -Cold Water Fishes, Migratory (HQ-CWF) Fishes from the basin source to SR-26 and Cold Water Fishes (CWF), Migratory Fishes from SR-26 to the mouth, excluding Thompson Run (which is designated High Quality -Cold Water Fishes, Migratory Fishes).

In this evaluation, existing uses and designated uses are reviewed. Existing uses are water uses attained in the waterbody and are protected through permit by DEP. Designated uses are water uses identified in regulations that protect a waterbody.

Prior to the *DEP 2022 Integrated Water Quality Report*, Slab Cabin Run was attaining protected uses from the basin source to SR 26. It was noted that the land cover in this area is forested. Downstream of SR 26, the Slab Cabin Run basin was listed as impaired waters (impairments not caused by a pollutant). The land cover in this

area was identified as (53%) agricultural and (48%) urban. Urban runoff, stormwater, grazing related agriculture and golf courses were identified as sources of siltation and flow regulation/modifications were identified as sources of dewatering. Dewatering was shown to have a negative affect on aquatic life. The 2007 SCBWA Source Water Protection Report revealed that Slab Cabin Run ceases to flow during drought conditions and flow is diminished in normal years. The report gives possible explanations for the loss of flow to include sinkhole formations, elevated stream bed in comparison with ground water levels and streambed infiltration.

With UAJA's 2000 UAJA approved Act 537 Plan and upgrade to the UAJA wastewater treatment facility, improvements were made that included beneficial reuse of treated wastewater that could be recycled to users in the service area and be used to augment base flow in Slab Cabin Run.

The DEP recommends that the Slab Cabin Run basin from SR 26 to the confluence with Spring Creek, with the exception of the Roaring Run basin from the source to the sink hole at 40°45'35.1 "N 77°49'26.1 "W and the Thompson Run basin, be redesignated from CWF, MF to HQ-CWF, MF.

This recommendation adds 21.0 stream miles of HQ-CWF waters and 4.1 stream miles of EV waters to Chapter 93.

SLAB CABIN RUN

CENTRE COUNTY

WATER QUALITY STANDARDS REVIEW

DRAFT STREAM EVALUATION REPORT

Segment: Basin
Stream Code: 23036
Drainage List: L

WATER QUALITY MONITORING SECTION
WATER QUALITY DIVISION
BUREAU OF CLEAN WATER
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Prepared by:

Josh Lookenbill
Pennsylvania Department of Environmental Protection
Office of Water Programs
Bureau of Clean Water
11th Floor: Rachel Carson State Office Building
Harrisburg, PA 17105

2023

TABLE OF CONTENTS

INTRODUCTION

The Department of Environmental Protection (DEP) conducted an evaluation of the Slab Cabin Run basin in response to Pennsylvania Fish and Boat Commission (PFBC) Class A Wild Trout classifications and an existing use evaluation associated with National Pollutant Discharge Elimination System (NPDES) permit (PA0234028) for the University Area Joint Authority (UAJA) Class A quality, reuse discharges to Slab Cabin Run. The Slab Cabin Run basin is currently designated High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF) from the basin source to State Route (SR) 26 at 40°43'46"N; 77°52'42.4"W and Cold Water Fishes, Migratory Fishes (CWF, MF) from SR 26 to the mouth, excluding UNT 23037 (Thompson Run), which is designated HQ-CWF, MF. The UAJA Class A quality, reuse discharges to Slab Cabin Run both discharge to the Slab Cabin Run reach that is currently designated CWF, MF.

The stream redesignation process begins with an evaluation of the "existing uses" and the "designated uses" of a stream. "Existing uses" are water uses actually attained in the waterbody. Existing uses are protected through permit or approval actions taken by the DEP. "Designated uses" are water uses identified in regulations that protect a waterbody. Candidates for stream redesignation may be identified by the DEP based on routine waterbody investigations or based on requests initiated by other agencies or from the general public through a rulemaking petition to the Environmental Quality Board (EQB).

GENERAL WATERSHED DESCRIPTION

Slab Cabin Run originates from Tussey Mountain in southern Ferguson Township, Centre County as a freestone surface water. As Slab Cabin Run descends to the valley below, it flows through karst topography which results in a change in its classification from a freestone to a limestone-influenced surface water. Like most limestone-influenced streams, Slab Cabin Run contains losing and gaining reaches where surface flow dramatically increases or decreases based on connectivity with the associated aquifer and aquifer pressure and stage (Yoxtheimer 2007). Because of the connectivity with groundwater, limestone and limestone-influenced streams will exhibit unique seasonal and daily temperature regimes that are different than freestone "cold" water streams or "warm" water streams.

Prior to the DEP's *2022 Integrated Water Quality Report* (DEP 2022), Slab Cabin Run was attaining protected uses from the basin source to SR 26. However, downstream of SR 26, the Slab Cabin Run basin was listed on Pennsylvania's list of impaired waters (Category 5 of the Pennsylvania Integrated Water Quality Report, developed pursuant to section 303(d) of the federal Clean Water Act (CWA) and Category 4c, impairments not caused by a pollutant), based on a 2001-2002 monitoring and assessment effort, for:

- Slab Cabin Run from SR 26 to Roaring Run
  - Source – Grazing Related Agriculture, Cause – Siltation
- Slab Cabin Run from Roaring Run to Thompson Run
  - Source – Flow Regulation/Modification, Cause – Dewatering
  - Source – Grazing Related Agriculture, Cause – Siltation
  - Source – Golf Courses, Cause Thermal Modifications

- Thompson Run
  - Source – Urban Runoff/Storm Sewers, Cause – Siltation
- Slab Cabin Run from Thompson Run to Mouth
  - Source – Urban Runoff/Storm Sewers, Cause – Siltation
  - Source – Golf Courses, Cause – Thermal Modifications
  - Source – Flow Regulation/Modification, Cause – Dewatering
  - Source – Grazing Related Agriculture – Siltation

According to the National Land Cover Database (NLCD) 2016, the dominant land cover for the Slab Cabin Run basin upstream of SR 26 is forested (92%), the portion of the basin located between SR 26 and Roaring Run is agricultural (53%), and for the portion of the basin from Roaring Run to the mouth the dominant land cover is urban (48%) (Dewitz 2019).

DEP's 2001-2002 monitoring and assessment efforts resulted in an aquatic life use (ALU) impairment caused by Flow Alterations or Dewatering, the source was identified as Flow Regulation/Modification, and it was the opinion of DEP's lead investigator at the time that the State College Borough Water Authority (SCBWA) water withdrawals had the greatest impact on the middle reaches of Slab Cabin Run (Hughey 2002). Located just upstream of Roaring Run, along Slab Cabin Run is the SCBWA Thomas Well Field (Wellfield 1) and located along the lower reaches of Roaring Run is the SCBWA Harter Well Field (Wellfield 3). Together the wellfields are permitted to withdraw approximately 4.3 million gallons per day (MGD) of drinking water for State College residents (Yoxtheimer 2007). DEP's 2001-2002 monitoring and assessment effort, as well as the 2007 SCBWA *Source Water Protection Report* describes that in drought years Slab Cabin Run ceases to flow and during normal years flow is diminished (Hughey 2002, Yoxtheimer 2007). The 2007 SCBWA *Source Water Protection Report* further describes Slab Cabin Run as a gaining stream with few exceptions that include the reach in the vicinity of the SCBWA well fields for certain periods. During these periods the loss of flow from Slab Cabin Run has been documented to be much less than the combined groundwater withdrawal from both wellfields, which indicates that not all of the flow from the wells is coming from Slab Cabin Run. The *Source Water Protection Report* goes on to provide possible explanations for the loss of flow including the formation of sinkholes, the elevated stream bed in comparison with ground water levels and streambed infiltration (Yoxtheimer 2007).

UAJA's 2000 approved Act 537 Plan included a $55 million project to upgrade and expand the UAJA wastewater treatment facility. The expansion resulted in an additional three million gallons per day (MGD) designed hydraulic capacity of wastewater. Prior to the expansion, UAJA was permitted to discharge six MGD to Spring Creek, which is designated High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF). In order to satisfy antidegradation requirements for a discharge to a High Quality stream, UAJA evaluated nondischarge alternatives for the three MGD proposed increase capacity. The results of the evaluation included a high level of wastewater treatment and a beneficial reuse which would be recycled to industrial, agricultural and commercial users in the service area and/or be used to augment base flow in Slab Cabin Run. The intent of the flow augmentation was to increase instream flow and improve water quality in Slab Cabin Run, which is currently listed on Pennsylvania's list of impaired waters. The NPDES permit that includes two direct surface water

discharges of 1.05 MGD each to Slab Cabin Run along with several other indirect discharges was first issued in 2012 with a subsequent NPDES permit renewal issued on June 1, 2019.

WATER QUALITY

In response to PFBC's Class A Wild Trout classification of Slab Cabin Run and the request for an existing use evaluation associated with the UAJA NPDES permit for the discharges to Slab Cabin Run, DEP staff conducted an initial evaluation to (1) provide a general characterization of the quality of the data and information currently available, (2) determine if this information has the ability to define an existing use, and (3) determine if this information can be used to support or update the protected use assessment. In order to use data to define an existing use and an assessment of the use, the data must include the appropriate quality assurance and have been collected according to DEP protocols (Lookenbill and Whiteash 2021). Additionally, staff were asked to evaluate the usefulness of submitted data and existing DEP data for determining whether to and how to apply temperature criteria in 25 Pa. Code § 93.7. The data reviewed included 2013 DEP macroinvertebrate data (Appendix B, Table B1) and habitat data (Table 12), in addition to data provided by the PFBC and the UAJA, which included continuous instream monitoring (CIM) temperature data, stage (height of water) and discharge data, water chemistry data, qualitative macroinvertebrate data, and PFBC trout biomass data. The results of this initial evaluation indicated that some of the data may not have been collected according to DEP protocols and did not contain the appropriate quality assurance that would allow DEP staff to perform an existing use evaluation or reassess the ALU and sources and causes of impairment. However, there was enough information available to suggest that a reasonable potential existed for any increase in discharge from the UAJA discharges to affect the existing, instream conditions from a thermal perspective. This reasonable potential along with the 2001 Thermal Modification cause of impairment required the DEP to evaluate the Thermal Modification cause and any reasonable potential to affect existing, instream conditions as part of an existing use evaluation for the UAJA NPDES permit.

Subsequently, in 2019 DEP initiated additional data collection activities throughout the Slab Cabin Run basin, which included physical, chemical and biological data collected from locations throughout the basin through 2020 (Table 1, Figure 1). The effort also included working with PFBC staff and Keystone Water Resources Center (KWRC) staff to collect and evaluate additional biological and physicochemical data consistent with DEP protocols.

Table 1. Slab Cabin Run Basin Station Locations

STATION	DESCRIPTION
1SCR	Slab Cabin Run upstream of Pine Grove Mills and upstream of SR 26, Water Street Ferguson Township, Centre County Lat: 40.7286 Long: -77.8848 2012 & 2019 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates 2019 Fishes Semi-Quantitative 2019-2020 CIM Temperature 2019-2020 Monthly Water Chemistry
2SCR	Slab Cabin Run along SR 26 and downstream of the rise pool behind the Limestone Inn Ferguson Township, Centre County Lat: 40.7415 Long: -77.8750 2020 Fishes Semi-Quantitative
3SCR	Slab Cabin Run downstream of Scott Road near the intersection of SR 26 and SR 45 Ferguson Township, Centre County Lat: 40.7506 Long: -77.8683 2012 & 2019 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates
4SCR	Slab Cabin Run along SR 45 near Musser Gap Ferguson Township, Centre County Lat: 40.7565 Long: -77.8515 2012 & 2019 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates 2019 & 2020 Fishes Semi-Quantitative 2019-2020 DEP CIM Temperature, Sp. Cond., D.O., pH
5SCR	Slab Cabin Run upstream of Roaring Run confluence Harris Township, Centre County Lat: 40.7687 Long: -77.8404 2012 & 2019 Trout Biomass 2019 & 2020 Fishes Semi-Quantitative
6RR	Roaring Run upstream of the Shingletown Reservoir Harris Township, Centre County Lat: 40.7521 Long: -77.8178 2016 Trout Biomass 2019 Fishes Semi-Quantitative
7RR	Roaring Run downstream of the Shingletown Reservoir along Mountain Road Harris Township, Centre County Lat: 40.7576 Long: -77.8198 2016 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates

Table 1 (cont.). Slab Cabin Run Basin Station Locations

STATION	DESCRIPTION
8SCR	Slab Cabin Run downstream of Roaring Run Harris Township, Centre County Lat: 40.7747 Long: -77.8330 2013 Benthic Macroinvertebrates
9SCR	Slab Cabin Run upstream of South Atherton Street State College Borough, Centre County Lat: 40.7825 Long: -77.8343 2013 & 2019 Benthic Macroinvertebrates 2019-2020 KWRC CIM Temperature
10SCR	Slab Cabin Run at the Gordon D. Kissinger Meadow, along East Branch Road and upstream of the UAJA surface water discharges College Township, Centre County Lat: 40.7863 Long: -77.8355 2012, 2015, 2018 & 2019 Trout Biomass 2020 Fishes Semi-Quantitative 2019-2020 KWRC CIM Temperature
11SCR	Slab Cabin Run at the Gordon D. Kissinger Meadow, along East Branch Road and downstream of the UAJA surface water discharges College Township, Centre County Lat: 40.7899 Long: -77.8330 2019 Benthic Macroinvertebrates 2019 Fishes Semi-Quantitative 2019-2020 DEP CIM Temperature, Sp. Cond., D.O., pH
12SCR	Slab Cabin Run upstream of Centre Hills Country Club golf course College Township, Centre County Lat: 40.7914 Long: -77.8318 2020 Fishes Semi-Quantitative
13SCR	Slab Cabin Run downstream of Centre Hills Country Club golf course College Township, Centre County Lat: 40.8038 Long: -77.8279 2020 Fishes Semi-Quantitative
14SCR	Slab Cabin Run at the Slab Cabin Run Park College Township, Centre County Lat: 40.8088 Long: -77.8261 2012 & 2019 Trout Biomass 2019 Benthic Macroinvertebrates 2019 & 2020 Fishes Semi-Quantitative 2019-2020 KWRC CIM Temperature
15WS	Walnut Springs at the Walnut Springs Park College Township, Centre County Lat: 40.8028 Long: 40.8028 2019 & 2020 Fishes Semi-Quantitative

Table 1 (cont.). Slab Cabin Run Basin Station Locations

STATION	DESCRIPTION
16TR	Thompson Run upstream of East College Avenue College Township, Centre County Lat: 40.8059 Long: -77.8402 2019 Fishes Semi-Quantitative
17TR	Thompson Run upstream of the Millbrook Marsh Nature Center and upstream of Bathgate Spring College Township, Centre County Lat: 40.8103 Long: -77.8364 1989 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates 2019 Fishes Semi-Quantitative 2019-2020 DEP CIM Temperature, Sp. Cond., D.O., pH
18SCR	Slab Cabin Run at Puddintown Road College Township, Centre County Lat: 40.8185 Long: -77.8333 2012 & 2019 Trout Biomass 2013 & 2019 Benthic Macroinvertebrates 2019 Fishes Semi-Quantitative
SR	Slate Run downstream of Morris Run Road Brown Township, Lycoming County Lat: 41.5240 Long: -77.5300 2013 Benthic Macroinvertebrates Reference

Figure 1. Slab Cabin Run Basin Station Locations and Current Designated Use

Discrete Physicochemical

Water chemistry data was collected at nine locations (1SCR, 3SCR, 4SCR, 7RR, 9SCR, 11SCR, 14SCR, 17TR, 18SCR) in April 2019 and from six locations (1SCR, 4SCR, 9SCR, 11SCR, 14SCR, 17TR) at an approximate monthly frequency beginning May 2019 through November 2020 (Table 1, Figure 1). The data indicates that water quality is fairly consistent with land cover throughout the basin. Data collected upstream of SR 26 (1SCR) is consistent with a forested dominant land cover. Data collected from locations on Slab Cabin downstream of SR 26 to Roaring Run generally indicates high alkalinity, pH, phosphorus, nitrogen, and total suspended solids concentrations and is indicative of impairments from agricultural land covers. Data collected from locations on Slab Cabin Run between Roaring Run and the mouth of Slab Cabin Run and from Thompson Run generally indicates high concentrations of chlorides and other anions indicative of urban land covers. In addition, elevated concentrations of bromide were found in Thompson Run (17TR) and in Slab Cabin Run (18SCR) downstream of Thompson Run (Appendix A).

Continuous Physicochemical

Continuous instream monitoring (CIM) was implemented by DEP at three locations on Slab Cabin Run (1SCR, 4SCR, 11SCR) and one location on Thompson Run (17TR) beginning in early 2019 and continuing through portions of 2020. CIM is implemented according to DEP protocols (Hoger et al. 2017), and data and reports are located on the DEP CIM website. Also, KWRC staff had previously been collecting CIM data at three locations (9SCR, 10SCR, 14SCR) throughout the basin. DEP staff worked with KWRC staff beginning in 2019 in an effort to ensure that ongoing data collection efforts would be consistent with DEP data collection protocols and would be available for protected use evaluations and assessments. KWRC data from station 10SCR was reviewed and used as an upstream comparison for the purposes of this evaluation. KWRC data from stations 9SCR and 14SCR have not yet been reviewed and were not incorporated in this evaluation.

CIM temperature data available for the existing use evaluation include DEP data from station 4SCR (Figure 2) located along SR 45 near Musser Gap, KWRC data from station 10SCR (Figure 3) located at the Gordon D. Kissinger Meadow upstream of the UAJA discharges, and DEP data from station 11SCR (Figure 4) located downstream of the UAJA discharges (Table 1, Figure 1). The data indicate that for the months that were available to compare across years, 2019 had a warmer spring than 2020, with April and May mean temperatures 1.11 °C and 0.83 °C warmer respectively at 10SCR. The mean daily maximum for April was 13.02 °C in 2019 and 11.58 °C in 2020, and for May the mean daily maximum was 14.97 °C in 2019 and 14.38 °C in 2020. Summer and fall months, however, were the opposite, with 2020 being much warmer than 2019. In June, 10SCR was 1.27 °C warmer on average in 2020, 2.24 °C warmer in July, 2.79 °C in August, 0.59 °C in September, 0.17 °C in October and 2.38°C in November. The 4SCR CIM deployment occurred later and began in June 2019, so the first month that is comparable across years is July. 4SCR data also showed notably higher summer and fall temperatures in 2020 (Tables 2 and 3).

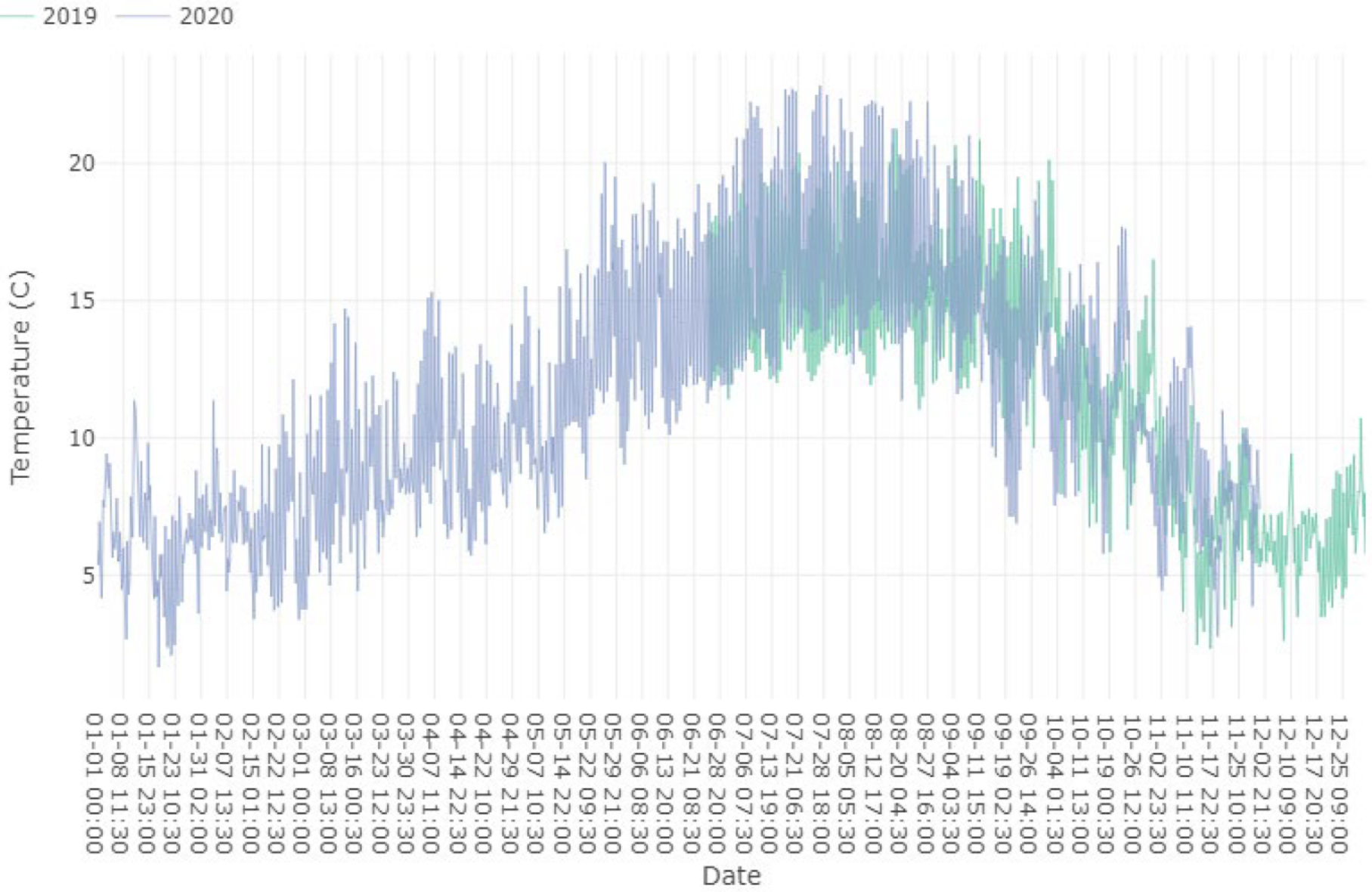

Figure 2. 2019 and 2020 continuous water temperature data at DEP's CIM site on Slab Cabin Run along SR 45 near Musser Gap (4SCR).

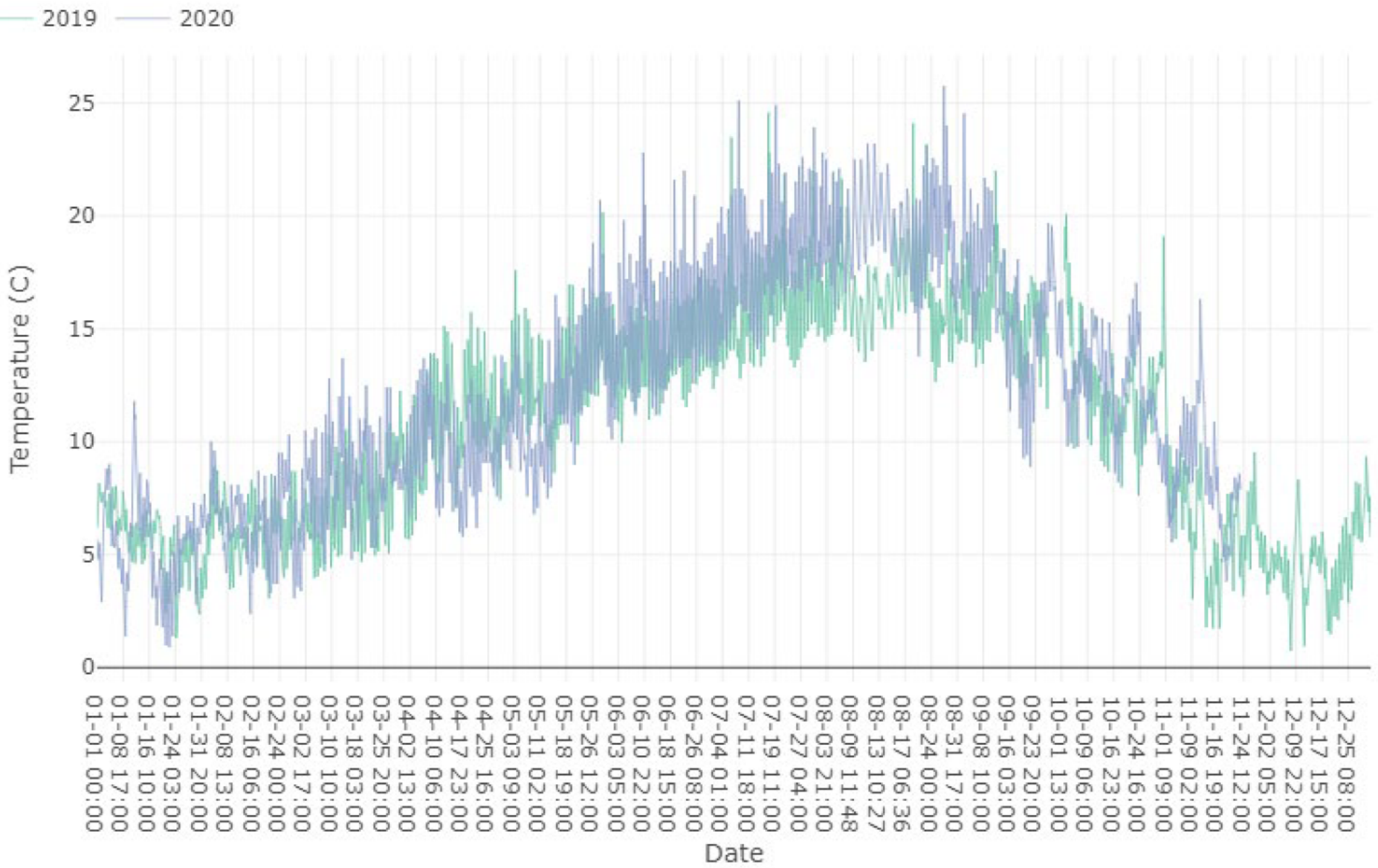

Figure 3. 2019 and 2020 continuous water temperature data at KWRC's CIM site on Slab Cabin Run at the Gordon D. Kissinger Meadow, along East Branch Road and upstream of the UAJA surface water discharges (10SCR).

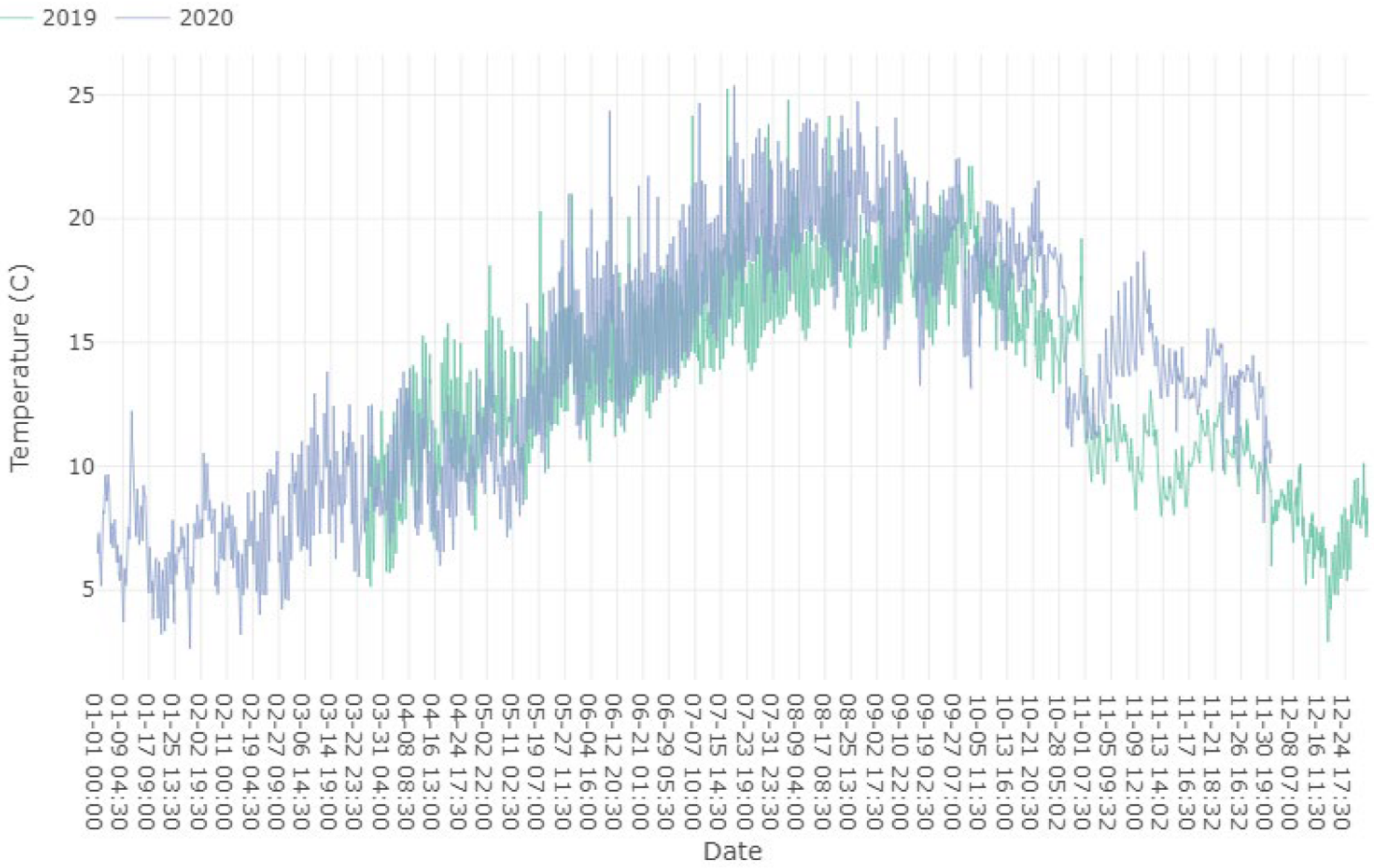

Figure 4. 2019 and 2020 continuous water temperature data at DEP's CIM site on Slab Cabin Run at the Gordon D. Kissinger Meadow, along East Branch Road and downstream of the UAJA surface water discharges (11SCR).

Table 2. 2019 CIM Temperature (°C) Statistics

Station	Year	Month	Days Recorded	Min.	Median	Mean	Max.	Mean Daily Max.	Mean Daily Range
4SCR			6	11.88	14.31	14.68	18.1	17.81	5.48
10SCR	2019	June	30	9.98	13.75	13.94	17.89	16.06	3.82
11SCR			30	10.18	14.03	14.22	20.07	16.53	4
4SCR			31	11.43	14.88	15.29	20.36	18.38	5.46
10SCR	2019	July	31	12.36	15.94	16.04	24.58	18.5	4.42
11SCR			31	13.18	16.45	16.52	25.23	19.13	4.5
04SCR			31	11.05	15.24	15.54	21.24	18.53	5.36
10SCR	2019	August	31	12.65	16.34	16.46	24.1	18.57	3.69
11SCR			31	14.8	17.78	17.88	24.8	20.06	3.69
4SCR			30	9.64	14.74	14.88	20.85	17.67	5.11
10SCR	2019	Sept.	27	11.47	15.59	15.63	22.01	17.23	3.12
11SCR			30	14.9	18.11	18.15	22.08	19.97	3.26
4SCR			31	5.84	11.57	11.66	20.14	13.89	4.09
10SCR	2019	Oct.	30	7.62	12.1	12.28	20.1	13.77	2.72
11SCR			31	12.96	16.42	16.68	22.12	17.94	2.39
4SCR			30	2.33	7.05	7.07	12.4	8.77	3.33
10SCR	2019	Nov.	30	1.75	6.15	6.19	14.39	7.59	2.74
11SCR			29	7.99	10.51	10.49	14.56	11.47	1.86
4SCR			31	2.62	6.2	6.22	10.72	7.6	2.54
10SCR	2019	Dec.	31	0.77	4.69	4.76	9.34	5.87	2.22
11SCR			31	2.92	7.69	7.42	10.13	8.29	1.84

When comparing station 4SCR to 10SCR in 2020, the data show an increasing difference in average temperatures from April (0.18 °C) to August (2.36 °C), a decrease in average temperatures in September (1.96 °C) and in October (0.9 °C), and an increase in November (0.37 °C). When comparing station 10SCR (upstream of UAJA discharge) to 11SCR (downstream of UAJA discharges) in 2020, the data show a similar difference in average temperatures in April (0.24 °C), May (0.35 °C) and June (0.25 °C); and increasing differences in average temperatures in July (0.51 °C), August (1.1 °C), September (2.96 °C) and October (5.29 °C); and a similar difference in November (5.17 °C) (Table 3).

DEP declared drought watch conditions for Centre County, Pennsylvania on August 21, 2020, which continued through November 2020. As a result, Slab Cabin Run experienced low flow conditions as generally described by DEP's 2001-2002 monitoring and assessment effort, as well as the 2007 SCBWA *Source Water Protection Report*, which indicate that in drought years Slab Cabin Run ceases to flow and during normal years flow is diminished (Hughey 2002, Yoxtheimer 2007). DEP data collection efforts on October 26, 2020 revealed low flow conditions. Discrete discharge measurements from upstream to downstream stations were 0.3 cfs (1SCR), 0.39 cfs (4SCR), 0.01 cfs (10SCR), and 2.63 cfs (11SCR). During these low flow conditions Slab Cabin Run is a gaining surface water upstream of the SCBWA wellfields (1SCR to 4SCR), a losing surface water through the reach adjacent to the wellfields (4SCR to 10SCR), and instream flow increases with the flow augmentation provided by the UAJA discharges located further downstream (11SCR). The UAJA NPDES permitted Class A, reuse

stream augmentation discharges, as currently designed and operated, appear to be achieving the 2000 approved Act 537 stated goal of improving water quality and quantity within Slab Cabin Run.

Table 3. 2020 CIM Temperature (°C) Statistics

Station	Year	Month	Days Recorded	Min.	Median	Mean	Max.	Mean Daily Max.	Mean Daily Range
4SCR			31	1.67	6.18	6.14	11.36	7.67	2.9
10SCR	2020	Jan.	31	0.9	5.5	5.44	11.8	6.64	2.47
11SCR			31	2.64	6.5	6.62	12.23	7.69	2.18
4SCR			29	3.39	6.61	6.63	12.1	8.56	3.22
10SCR	2020	Feb.	29	2.4	6.5	6.46	10.3	7.91	2.76
11SCR			29	3.21	7.21	7.11	10.59	8.41	2.5
4SCR			31	3.74	8.21	8.3	14.71	10.91	4.36
10SCR	2020	March	31	3.4	8.4	8.48	13.7	10.42	3.65
11SCR			31	4.59	8.93	9.02	13.81	10.73	3.24
4SCR			30	5.73	9.07	9.35	15.31	12.07	4.57
10SCR	2020	April	30	5.8	9.4	9.53	13.8	11.58	3.71
11SCR			30	6	9.69	9.77	13.94	11.75	3.59
4SCR			31	6.55	11.43	11.71	20.02	14.54	4.89
10SCR	2020	May	31	6.8	11.9	12	20.7	14.38	4.3
11SCR			31	7.13	12.2	12.35	20.98	14.65	4.14
4SCR			30	9.03	13.76	14.12	19.55	17.6	6.07
10SCR	2020	June	30	10.1	15.2	15.21	22.8	18.37	5.62
11SCR			30	11.11	15.35	15.46	24.35	18.59	5.44
4SCR			31	11.96	16.36	16.77	22.82	20.81	7.13
10SCR	2020	July	31	13.4	18.3	18.28	25.1	21.01	5.18
11SCR			31	13.53	18.91	18.79	25.37	21.54	5
4SCR			31	11.38	16.4	16.89	22.36	20.35	6.21
10SCR	2020	August	31	13.81	19.1	19.25	25.74	21.79	4.48
11SCR			31	16.36	20.26	20.35	24.73	22.7	4.1
4SCR			30	6.9	14.5	14.26	21.02	17.18	5.37
10SCR	2020	Sept.	30	8.89	16.36	16.22	24.52	18.11	3.69
11SCR			30	13.26	19.69	19.18	24.09	21.19	3.73
4SCR			31	5.8	11.24	11.52	17.7	13.59	4.01
10SCR	2020	Oct.	31	8.2	12.27	12.42	17.01	13.8	2.64
11SCR			31	10.79	18.19	17.71	21.52	19.13	2.82
4SCR			30	2.77	8.07	8.2	14.05	10.05	3.64
10SCR	2020	Nov.	23	3.83	8.34	8.57	16.3	9.83	2.42
11SCR			30	7.74	13.6	13.74	18.66	15.05	2.75

In addition to discrete discharge measurements made on October 26, 2020, DEP staff also performed cross-section surveys that included temperature, specific conductance, pH, and dissolved oxygen data collection from stations on Slab Cabin Run. The results indicate stable instream temperatures of approximately 10.0°C throughout Slab Cabin Run from station 1SCR to 10SCR. The UAJA discharge 001 had temperature of 20.1°C, which resulted in an instream temperature downstream at 11SCR of

approximately 18.5°C. In addition, a measurable effect can be realized with specific conductance and dissolved oxygen measurements (Table 4).

Table 4. October 26, 2020 Cross-Section Survey Results

LOCATION[1]	TIME	TEMPERATURE (°C)	SPEC. COND. (µS/cm[c])	pH	DISSOLVED OXYGEN (mg/L)
		1SCR			
MID	1347	10	91.7	7.49	10.44
		4SCR			
RDB	1152	9.9	486.3	8.29	11.47
MID	1154	9.9	486.2	8.31	11.47
LDB	1154	9.9	486.1	8.3	11.38
		10SCR			
MID	1237	10.1	801	7.62	6
		UAJA DISCHARGE 001			
	1042	20.1	156.9	7.42	9.56
		11SCR			
RDB	1027	18.2	203	7.69	9.21
MID	1028	18.5	196.1	7.67	9.3
LDB	1028	18.7	190.4	7.7	9.29

[1]MID = Middle, RDB = Right Descending Bank, LDB = Left Descending Bank

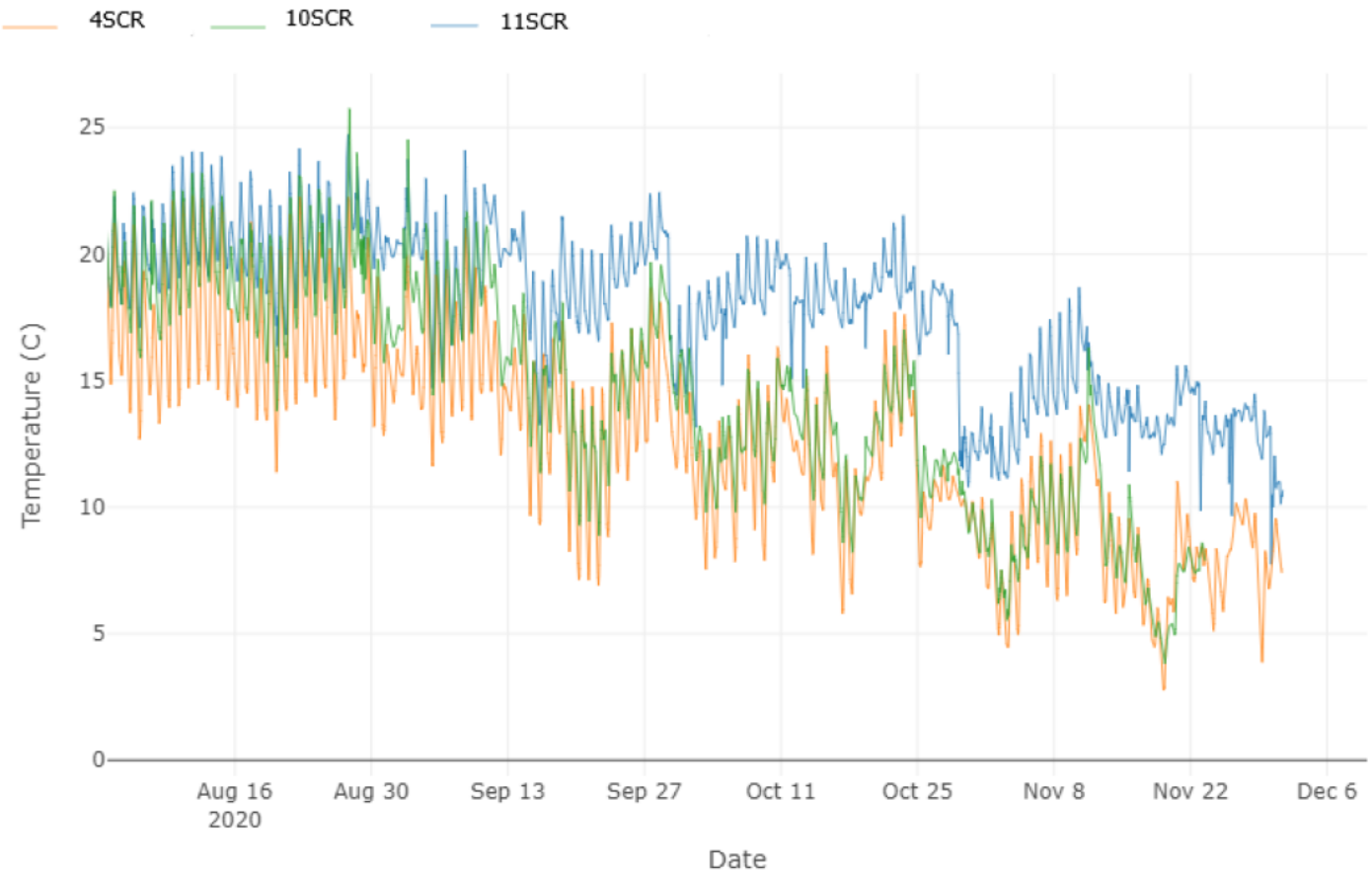

Figure 5. August – November 2020 continuous water temperature data at 4SCR, 10SCR and 11SCR.

CIM data collected from Slab Cabin Run at stations 4SCR and 10SCR and from Thompson Run at station 17TR includes temperature, pH and dissolved oxygen data that is necessary to evaluate Eutrophication as a cause of impairment. Monthly diel DO swing 75th percentiles (p75), monthly diel DO swing-diel pH swing Pearson correlation r-values and monthly diel DO swing-diel water temperature swing Pearson correlation r-values were compared to benchmark values. Eutrophication is determined to be the cause of impairment once ALU impairment is determined via DEP macroinvertebrate assessment methods and if any monthly diel DO swing p75 exceeds the appropriate diel DO swing p75 benchmark value, has a monthly diel DO swing-diel pH swing Pearson correlation r-value >0.66, and has a monthly diel DO swing-diel water temperature swing Pearson correlation r-value <0.61 (McGarrell 2018). Slab Cabin Run at station 4SCR exceeded threshold and r-values in July 2019 and in May, June and August 2020 (Table 5). Slab Cabin Run at station 10SCR exceeded threshold and r-values from April through October 2019 and from April through July 2020 (Table 6). Thompson Run (17TR) exceed threshold and r-values in April and July 2019 and in March 2020 (Table 7).

Table 5. 4SCR Eutrophication Analysis

Year	Month	Diel DO Swing p75 (mg/L)[1]	Diel Swing Corr. pH[2]	Diel Swing Corr. Temp[3]
2019	July	3.31	0.89	0.45
	August	3.58	0.77	0.70
	Sept.	3.73	0.75	0.75
	Oct.	2.54	0.17	0.66
2020	March	2.16	0.67	0.81
	April	2.07	0.66	0.25
	May	5.12	0.95	0.44
	June	3.36	0.87	-0.1
	July	3.81	0.64	0.68
	Aug.	4.01	0.74	0.48
	Sept.	3.92	0.62	0.45
	Oct.	3.80	0.94	0.79

[1] Monthly Diel DO Swing p75 Benchmark Values, Physiographic Region B
March-April > 2.8
May-June > 1.7
July-August > 1.8
Sept.-Oct. > 2.0
[2] Monthly Diel DO Swing-Diel pH Swing Threshold > 0.66
[3] Monthly Diel DO Swing-Diel Water Temperature Swing Threshold < 0.61

Table 6. 10SCR Eutrophication Analysis

Year	Month	Diel DO Swing p75 (mg/L)[1]	Diel Swing Corr. pH[2]	Diel Swing Corr. Temp[3]
2019	April	4.76	0.94	0.42
	May	2.94	0.95	0.55
	June	3.36	0.84	-0.03
	July	4.68	0.86	0.50
	August	3.77	0.85	0.52
	Sept.	4.61	0.80	0.51
	Oct.	3.31	0.79	0.02
2020	March	2.61	0.80	0.72
	April	2.62	0.88	0.20
	May	4.32	0.98	0.35
	June	2.61	0.70	0.53
	July	3.78	0.83	0.54
	August	4.78	0.83	0.67
	Sept.	2.37	0.70	0.67
	Oct.	1.91	0.23	0.42

[1] Monthly Diel DO Swing p75 Benchmark Values, Physiographic Region B
March-April > 2.8
May-June > 1.7
July-August > 1.8
Sept.-Oct. > 2.0
[2] Monthly Diel DO Swing-Diel pH Swing Threshold > 0.66
[3] Monthly Diel DO Swing-Diel Water Temperature Swing Threshold < 0.61

Table 7. 17TR Eutrophication Analysis

Year	Month	Diel DO Swing p75 (mg/L)[1]	Diel Swing Corr. pH[2]	Diel Swing Corr. Temp[3]
2019	April	3.03	0.93	0.18
	May	1.81	0.85	0.82
	June	1.84	0.86	0.61
	July	2.04	0.87	0.55
	August	2.00	0.95	0.90
	Sept.[4]	-	-	-
	Oct.	1.75	0.47	0.04
2020	March	2.85	0.79	0.38
	April	3.44	0.57	0.12
	May	2.20	0.52	0.26

[1] Monthly Diel DO Swing p75 Benchmark Values, Physiographic Region B
March-April > 2.8
May-June > 1.7
July-August > 1.8
Sept.-Oct. > 2.0
[2] Monthly Diel DO Swing-Diel pH Swing Threshold > 0.66
[3] Monthly Diel DO Swing-Diel Water Temperature Swing Threshold < 0.61
[4] Data not available due to lost water quality monitoring equipment

Biological

The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. DEP staff collected macroinvertebrate and/or fish data from stations throughout the Slab Cabin Run basin in 2013, 2019 and/or 2020. In addition, the PFBC has collected

trout biomass data from stations throughout the basin over the past several years, as early as 1989 and most recently in 2019 (Table 1).

Benthos

Benthic macroinvertebrate samples were collected at eight stations throughout the Slab Cabin Run basin and at one reference station located on Slate Run in Lycoming County in April and May 2013 and from nine stations through the Slab Cabin Run basin in March 2019 using the DEP's Rapid Bioassessment Protocols (RBP) benthic macroinvertebrate data collection protocol, which is a modification of the U.S. Environmental Protection Agency's (EPA) RBPs (Plafkin et al. 1989, Barbour et al. 1999, Lookenbill and Whiteash 2021).

While the Slab Cabin Run basin contains freestone, "limestone-influenced" and true limestone reaches, DEP macroinvertebrate data collection protocols and assessment methods incorporate "limestone-influenced" within the freestone classification. With the exception of the Thompson Run station (17TR), which meets true limestone characteristics, the DEP *Wadeable Riffle-Run Stream Macroinvertebrate Data Collection Protocol* (Shull 2017a) and Assessment Method (Shull 2017b) were applied to all stations. Index of Biotic Integrity (IBI) scores for six of seven Slab Cabin Run stations ranged from 16.4 to 42.5 and were all below attainment thresholds for surface waters with a protected use of CWF (50.0) and HQ-CWF (63.0). IBI scores for Slab Cabin Run at station 1SCR in 2013 (72.2) and 2019 (71.4) and Roaring Run at 7RR in 2013 (88.1) and in 2019 (80.4) were above attainment thresholds. The IBI scores for Thompson Run in 2013 (52.4) and in 2019 (24.2) were below the attainment threshold (60.0) for true limestone streams per DEP's *Wadeable Limestone Macroinvertebrate Assessment Method* (Williams 2017). In addition, the 2019 IBI score (24.2) indicates that water quality conditions are getting worse (Tables 8 and 9).

Table 8. 2013 Benthic Macroinvertebrate Metrics and IBI Scores

METRICS	STATIONS[1]							
	1SCR	3SCR	4SCR	7RR	8SCR	9SCR	17TR	18SCR
TAXA RICHNESS	19	14	12	27	18	25	17	18
EPT RICHNESS (PTV 0-4)	11	2	1	16	8	9	2[2]	3
BECKS INDEX V. 3	26	2	2	33	6	10	3[3]	5
HILSENHOFF INDEX	2.68	5.96	6.51	2.32	5.17	5.46	7.47	6.73
SHANNON DIVERSITY	2.12	1.97	1.59	2.74	1.7	1.99	1.83	1.68
% SENSITIVE INDIV. (PTV 0-3)	72	3.5	3	72.1	13.5	11.3	58[4]	6.70
IBI[5]	**72.2**	**30.2**	**24.8**	**88.1**	**41.2**	**48.1**	**52.4[6]**	**31.7**

[1] Refer to Figure 1 & Table 1 for station locations
[2] EPT RICHNESS (PTV ALL)
[3] BECKS INDEX. V. 4
[4] % TOLERANT (PTV 7-10)
[5] IBI < 50(CWF) OR < 63(HQ-CWF) = Impaired
[6] IBI < 60 (Limestone) = Impaired

Fishes

Trout biomass data was collected by PFBC according to PFBC protocols (Miko et al. 2011) at multiple stations throughout the Slab Cabin Run basin from 1989 through 2019. Trout biomass data is evaluated later in the 'Class A Wild Trout – High Quality Qualification' section.

Table 9. 2019 Benthic Macroinvertebrate Metrics and IBI Scores

METRICS	STATIONS[1]								
	1SCR	3SCR	4SCR	7RR	9SCR	11SCR	14SCR	17TR	18SCR
TAXA RICHNESS	16	14	12	24	20	9	21	8	11
EPT RICHNESS (PTV 0-4)	11	3	2	13	5	1	5	0[2]	1
BECKS INDEX V. 3	25	4	2	29	3	0	4	3[3]	0
HILSENHOFF INDEX	2.24	4.92	6.72	2.17	5.41	7.35	5.1	8.06	7.53
SHANNON DIVERSITY	2.06	2	1.48	2.27	2.43	0.95	2.19	0.8	1.44
% SENSITIVE INDIV. (PTV 0-3)	75	9	3.5	75.2	10.9	0	14.6	93.40[4]	0
IBI[5]	**71.4**	**35.3**	**24.7**	**80.4**	**41.5**	**16.4**	**42.5**	**24.2[6]**	**19.9**

[1] Refer to Figure 1 & Table 1 for station locations
[2] EPT RICHNESS (PTV ALL)
[3] BECKS INDEX. V. 4
[4] % TOLERANT (PTV 7-10)
[5] IBI < 50(CWF) OR < 63(HQ-CWF) = Impaired
[6] IBI < 60 (Limestone) = Impaired

DEP staff collected semi-quantitative fish data from nine locations throughout the Slab Cabin Run basin in August 2019 and from seven locations on Slab Cabin Run mainstem in August 2020 according to DEP protocols (Wertz 2021a). Brown trout (*Salmo trutta*) and Slimy sculpin (*Cottus cognatus*) were collected at all Slab Cabin Run mainstem locations with the exception of station 1SCR, where Brown trout were collected but not Slimy sculpin. Brook trout (*Salvelinus fontinalis*) were collected at one location and was the only taxon collected from Roaring Run (6RR). No individuals were collected at the Walnut Springs location (15WS) in 2019 and 2020, which warrants additional investigation to further characterize water quality conditions.

DEP evaluated fish data using the DEP *Stream Fish Assemblage Assessment Method* (Wertz 2021b). The assessment method utilizes a Thermal Fish Index (TFI; Wertz 2021c) to measure a waterbody's ability to support defined ecological communities across six classifications of lotic surface waters. The Assessment Method and the TFI recognize surface water classifications that include limestone and freestone classifications as well as longitudinal drainage area groups (DAGs). The majority of Slab Cabin Run basin station locations fall within the limestone, less than 1000 square kilometers classification with an attainment threshold of 5.7. Scores above attainment thresholds indicate nonattainment. Slab Cabin Run at station 1SCR and Roaring Run at 6RR fall within the freestone, less than 40 square kilometers classification with an attainment threshold of 4.8. TFI scores for all stations fall below the attainment threshold of 5.7 indicating attainment (Tables 10 and 11). Both stations (1SCR and 6RR) contained only salmonid species which warrants additional investigations that should be directed to acid deposition and habitat conditions that may be acting as a barrier for upstream migration.

In addition to implementing the TFI for protected use assessment purposes, the TFI was also implemented using cause and effect sampling design (Lookenbill 2020) to determine if the UAJA discharges may be having a localized impact to Slab Cabin Run. Data collected at 5SCR and 11SCR in 2019 and at 5SCR, 10SCR and 12SCR in August 2020 at the onset of the 2020 drought watch conditions for Centre County result in lower TFI scores downstream of the discharges, which indicates that in addition to not causing or contributing to a protected use impairment, the discharges are not causing a Thermal Modification impact to Slab Cabin Run.

Table 10. 2019 Fish Data

COMMON NAME	SCIENTIFIC NAME	STATIONS[1]									
		1SCR	4SCR	5SCR	6RR	11SCR	14SCR	15WS	16TR	17TR	18SCR
Slimy Sculpin	*Cottus cognatus*	-	170	54	-	69	21	-	115	118	151
Brook Trout (wild)	*Salvelinus fontinalis* (wild)	-	-	-	35	-	-	-	-	-	-
Brown Trout (wild)	*Salmo trutta* (wild)	43	24	14		59	88	-	52	63	54
Rainbow Trout (wild)	*Oncorhynchus mykiss* (wild)	-	-	-	-	-	-	-	2	1	-
Pearl Dace	*Margariscus margarita*	-	-	3	-	-	3	-	-	-	-
Creek Chub	*Semotilus atromaculatus*	-	-	-	-	-	-	-	-	-	-
Cutlip Minnow	*Exoglossum maxillingua*	-	-	-	-	-	2	-	-	-	2
Eastern Blacknose Dace	*Rhinichthys atratulus*	-	13	15	-	25	21	-	-	-	3
Longnose Dace	*Rhinichthys cataractae*	-	12	-	-	2	9	-	-	-	-
Tessellated Darter	*Etheostoma olmstedi*	-	-	16	-	1	1	-	-	-	3
White Sucker	*Catostomus commersonii*	-	-	23	-	25	3	-	-	1	41
TFI		4.0	2.7	5.0	2.0	3.8	4.2	-	2.6	2.7	3.2

[1] Refer to Figure 1 & Table 1 for station locations
"-" indicate taxa was not identified at a particular station

Table 11. 2020 Fish Data

COMMON NAME	SCIENTIFIC NAME	STATIONS[1]								
		2SCR	4SCR	5SCR[2]	5SCR[3]	10SCR	12SCR	13SCR	14SCR	15WS
Slimy Sculpin	*Cottus cognatus*	56	110	70	36	58	56	42	18	-
Brown Trout (wild)	*Salmo trutta* (wild)	5	30	5	26	49	38	44	83	-
Pearl Dace	*Margariscus margarita*	-	-	-	1	2	-	-	-	-
Creek Chub	*Semotilus atromaculatus*	-	-	-	-	1	-	-	-	-
Cutlip Minnow	*Exoglossum maxillingua*	-	-	-	-	1	-	-	1	-
Eastern Blacknose Dace	*Rhinichthys atratulus*	-	7	79	6	17	15	44	19	-
Longnose Dace	*Rhinichthys cataractae*	-	2	2	-	1	8	6	1	-
Tessellated Darter	*Etheostoma olmstedi*	-	-	3	2	-	-	-	-	-
White Sucker	*Catostomus commersonii*	-	-	2	43	13	8	-	4	-
TFI		2.2	2.6	4.2	4.3	3.6	3.6	4.1	4.1	-

[1] Refer to Figure 1 & Table 1 for station locations
[2] Reach 1 of 2, [3] Reach 2 of 2
"-" indicate taxa was not identified at a particular station

Physical

Instream habitat was assessed at each station where benthic macroinvertebrates and fish were collected using the DEP's *Stream Habitat Data Collection Protocol* (Lookenbill 2017) and *Physical*

Habitat Assessment Method (Walters 2017). The habitat evaluation consists of rating twelve parameters to derive a total habitat score along with couplet summations that are indicators of impairment. The 2013 total habitat scores ranged from 115 (17TR) to 214 (7RR) (Table 12). 2019 total habitat scores ranged from 89 (18SCR) to 216 (7RR) (Tables 13 and 14). Total habitat scores generally increased from 2013 to 2019 and decreased from upstream to downstream on Slab Cabin Run (Tables 12 – 15). Habitat data collected in 2013, 2019 and 2020 meets attainment thresholds for Slab Cabin Run stations 1SCR, 2SCR and 3SCR and Roaring Run stations 6RR and 7RR. The total habitat score (117), along with couplet summations (embeddedness + sediment deposition summation (21) and condition of banks + riparian vegetative zone width summation (16)) for station 4SCR in 2013 did not meet attainment thresholds (140, 24 and 24 respectively) indicating Siltation and Habitat Modification causes of impairment (Table 12). A total of three habitat data collection efforts occurred at station 4SCR in 2019 through 2020. Total habitat scores ranged from 162 – 189, embeddedness + sediment deposition ranged from 25 – 30, and condition of banks + riparian vegetative zone width ranged from 20 – 33; with all scores meeting attainment thresholds with the exception of a condition of banks + riparian vegetative zone width (20; Table 14) in 2020, which supports improving conditions, a delisting of the Siltation cause of impairment, but nonattainment of the Habitat Modification cause. Habitat data was not collected at Station 5SCR in 2013 but was once in 2019 and again in 2020. Total habitat scores and couplet summation scores at 5SCR did not meet attainment thresholds with exception of embeddedness + sediment deposition in 2019. In 2013 all Slab Cabin Run stations downstream of Roaring Run did not meet habitat attainment thresholds. Habitat data collected at these stations in 2019 and 2020 did indicate improving conditions, however all stations, with the exception of 12SCR, had at least a total habitat score or couplet summation score that failed to meet attainment thresholds. Habitat data from Thompson Run indicates Siltation and Habitat Modification causes of impairment in 2013, 2019 and 2020. (Tables 12 – 15).

Table 12. 2013 Habitat Evaluation Data Collected with Macroinvertebrate Data

PARAMETER	STATIONS[1]							
	1SCR	3SCR	4SCR	7RR	8SCR	9SCR	17TR	18SCR
1. INSTREAM COVER	13	11	10	16	14	11	13	17
2. EPIFAUNAL SUBSTRATE	18	15	11	17	12	15	9	7
3. EMBEDDEDNESS	17	12	13	16	14	13	7	11
4. VELOCITY/DEPTH	15	10	11	17	9	14	11	12
5. CHANNEL ALTERATIONS	16	15	14	20	17	15	11	11
6. SEDIMENT DEPOSITION	17	13	8	17	6	9	9	4
7. RIFFLE FREQUENCY	18	16	12	18	11	14	8	6
8. CHANNEL FLOW STATUS	17	13	13	17	16	15	13	16
9. BANK CONDITION	19	14	7	19	8	13	7	12
10. BANK VEGETATIVE PROTECTION	20	12	9	18	12	11	12	9
11. GRAZING/DISRUPTIVE PRESSURES	18	8	5	20	12	7	8	8
12. RIPARIAN VEG. ZONE WIDTH	17	5	4	19	13	6	7	8
Total Score[2]	205	144	117	214	144	143	115	121
Rating[3]	OPT	SUB	MAR	OPT	SUB	SUB	MAR	MAR
EMBEDDEDNESS + SEDIMENT DEPOSITION[4]	34	25	21	33	20	22	16	15
CONDITION OF BANKS + BANK VEG. PROTECTION[4]	39	26	16	37	20	24	19	21

[1] Refer to Figure 1 & Table 1 for station locations
[2] ≤ 140 = Impaired
[3] OPT = Optimal (≥192); SUB = Suboptimal (132-192); MAR = Marginal (72-132)
[4] ≤ 24 = Impaired

Table 13. 2019 Habitat Evaluation Data Collected with Macroinvertebrate Data

PARAMETER	STATIONS[1]								
	1SCR	3SCR	4SCR	7RR	9SCR	11SCR	14SCR	17TR	18SCR
1. INSTREAM COVER	17	14	16	20	16	12	15	16	18
2. EPIFAUNAL SUBSTRATE	13	12	13	15	10	10	14	7	7
3. EMBEDDEDNESS	19	14	16	18	13	14	14	8	10
4. VELOCITY/DEPTH	15	13	16	18	12	12	16	15	9
5. CHANNEL ALTERATIONS	15	14	15	19	14	15	13	19	15
6. SEDIMENT DEPOSITION	18	15	14	17	12	12	10	9	10
7. RIFFLE FREQUENCY	19	16	17	18	15	16	17	11	12
8. CHANNEL FLOW STATUS	20	20	20	20	20	20	18	20	20
9. BANK CONDITION	19	15	15	19	13	15	8	13	13
10. BANK VEGETATIVE PROTECTION	17	16	18	16	14	14	8	16	10
11. GRAZING/DISRUPTIVE PRESSURES	18	14	16	18	11	17	11	18	14
12. RIPARIAN VEG. ZONE WIDTH	13	10	13	18	9	14	13	15	11
Total Score[2]	203	173	189	216	159	171	157	167	149
Rating[3]	OPT	SUB	SUB	OPT	SUB	SUB	SUB	SUB	SUB
EMBEDDEDNESS + SEDIMENT DEPOSITION[4]	37	29	30	35	25	26	24	17	20
CONDITION OF BANKS + BANK VEG. PROTECTION[4]	36	31	33	35	27	29	16	29	23

[1] Refer to Figure 1 & Table 1 for station locations
[2] ≤ 140 = Impaired
[3] OPT = Optimal (≥192); SUB = Suboptimal (132-192); MAR = Marginal (72-132)
[4] ≤ 24 = Impaired

Table 14. 2019 Habitat Evaluation Data Collected with Fishes Data

PARAMETER	STATIONS[1]									
	1SCR	4SCR	5SCR	6RR	11SCR	14SCR	15WS	16TR	17TR	18SCR
1. INSTREAM COVER	17	18	8	18	16	15	4	15	9	8
2. EPIFAUNAL SUBSTRATE	18	16	4	20	13	16	1	17	11	5
3. EMBEDDEDNESS	14	11	2	17	10	12	1	7	6	3
4. VELOCITY/DEPTH	10	11	6	14	15	15	3	12	11	4
5. CHANNEL ALTERATIONS	11	12	13	20	13	18	13	6	11	9
6. SEDIMENT DEPOSITION	13	14	3	11	11	12	3	11	10	3
7. RIFFLE FREQUENCY	19	19	3	19	17	17	1	16	16	4
8. CHANNEL FLOW STATUS	13	15	15	11	16	17	18	16	17	16
9. BANK CONDITION	14	10	7	17	16	13	8	12	9	11
10. BANK VEGETATIVE PROTECTION	16	10	9	16	15	13	10	12	11	9
11. GRAZING/DISRUPTIVE PRESSURES	15	12	13	15	16	15	13	9	14	9
12. RIPARIAN VEG. ZONE WIDTH	15	14	11	17	16	16	17	8	13	8
Total Score[2]	175	162	94	195	174	179	92	141	138	89
Rating[3]	SUB	SUB	MAR	OPT	SUB	SUB	MAR	SUB	SUB	MAR
EMBEDDEDNESS + SEDIMENT DEPOSITION[4]	27	25	5	28	21	24	4	18	16	6
CONDITION OF BANKS + BANK VEG. PROTECTION[4]	30	20	16	33	31	26	18	24	20	20

[1] Refer to Figure 1 & Table 1 for station locations
[2] ≤ 140 = Impaired
[3] OPT = Optimal (≥192); SUB = Suboptimal (132-192); MAR = Marginal (72-132)
[4] ≤ 24 = Impaired

Table 15. 2020 Habitat Evaluation Data Collected with Fishes Data

PARAMETER	STATIONS[1]							
	2SCR	4SCR	5SCR	10SCR	12SCR	13SCR	14SCR	15WS
1. INSTREAM COVER	16	16	9	7	11	13	14	4
2. EPIFAUNAL SUBSTRATE	18	17	5	8	11	16	14	1
3. EMBEDDEDNESS	15	15	4	7	9	14	11	1
4. VELOCITY/DEPTH	10	15	11	13	12	14	15	3
5. CHANNEL ALTERATIONS	17	14	14	13	11	16	15	13
6. SEDIMENT DEPOSITION	16	13	6	9	10	14	11	3
7. RIFFLE FREQUENCY	18	16	5	7	11	17	16	1
8. CHANNEL FLOW STATUS	14	15	15	11	10	12	15	18
9. BANK CONDITION	18	13	7	9	7	14	14	8
10. BANK VEGETATIVE PROTECTION	16	13	6	9	5	16	13	10
11. GRAZING/DISRUPTIVE PRESSURES	16	13	8	14	3	15	12	13
12. RIPARIAN VEG. ZONE WIDTH	19	12	8	14	4	16	13	17
Total Score[2]	193	172	98	121	104	177	163	92
Rating[3]	OPT	SUB	MAR	MAR	MAR	SUB	SUB	MAR
EMBEDDEDNESS + SEDIMENT DEPOSITION[4]	31	28	10	16	19	28	22	4
CONDITION OF BANKS + BANK VEG. PROTECTION[4]	34	26	14	18	12	30	27	18

[1] Refer to Figure 1 & Table 1 for station locations
[2] ≤ 140 = Impaired
[3] OPT = Optimal (≥192); SUB = Suboptimal (132-192); MAR = Marginal (72-132)
[4] ≤ 24 = Impaired

CLASS A WILD TROUT – HIGH QUALITY QUALIFICATION

The DEP is required by regulation, 25 Pa. Code § 93.4b(a)(2)(ii), to consider streams for High Quality (HQ) designation when the PFBC submits information that indicates a stream is a Class A Wild Trout stream based on wild trout biomass and the PFBC, after public notice and comment, classifies the stream as a Class A Wild Trout Water. The PFBC approved the addition of the Class A listing for Slab Cabin Run in May 2013, for Roaring Run in April 2017 and for Thompson Run in March 1992. Recommendations for Slab Cabin Run were forwarded to DEP in 2013 (Detar et al. 2013). Recommendations for Roaring Run were forwarded to DEP in 2017 (Kristine et al. 2017). It is unclear when recommendations for Thompson Run were forwarded to DEP, however Thompson Run is currently designated HQ-CWF, MF. DEP staff conducted an independent review of the trout biomass data along with a review of the surface water's basic water quality requirements.

PFBC staff collected trout biomass data from seven locations on the Slab Cabin Run mainstem in 2012 and again in 2019. Locations generally correlate with DEP stations 1SCR, 2SCR, 3SCR, 7SCR, 8SCR, 13SCR, and 17SCR. Brown trout (*Salmo trutta*) were collected at all seven locations in 2012 and in 2019. Biomass estimates in 2012 ranged from 39.81 kg/ha in the vicinity of station 7SCR to 273.71 kg/ha in the vicinity of 17SCR. Brown trout biomass (39.81 kg/ha) in the vicinity of 7SCR was the only estimate below the biomass threshold (40 kg/ha; Detar et al. 2011) for Class A Brown Trout. The mean biomass across all seven stations in 2012 was approximately 132 kg/ha (Detar et al. 2013). Biomass estimates in 2019 ranged from 29.07 kg/ha at 1SCR to 388.89 kg/ha in the vicinity of 13SCR. Brown trout biomass (29.07 kg/ha) at 1SCR was the only estimate below the biomass threshold (40 kg/ha) for Class A Brown Trout. The mean biomass across all seven stations in 2019 was approximately 201 kg/ha (Detar et al. 2020).

PFBC staff collected trout biomass data from two locations on Roaring Run in 2016. Locations generally correlate with DEP stations 7RR and 6RR. Brook trout (*Salvelinus fontinalis*) were collected at both locations with biomass estimates (69.35 kg/ha and 84.27 kg/ha) above the biomass threshold (30 kg/ha; Detar et al. 2011) for Class A Brook Trout (Kristine et al. 2017).

PFBC staff collected trout biomass data from one location on Thompson Run in 1989 in the vicinity of DEP station 16TR. The brown trout (*Salmo trutta*) estimate was 66.57 kg/ha, which is above the biomass threshold (40 kg/ha) for Class A Brown Trout (PFBC Raw Data).

Based on applicable regulatory definitions and requirements of 25 Pa. Code § 93.4b(a)(2)(ii) the entire Slab Cabin Run basin (approximately 33.5 stream miles) qualifies as HQ-CWF based on PFBC Class A Wild Trout classifications.

INTEGRATED BENTHIC MACROINVERTBRATE SCORING TEST

The DEP applied its integrated benthic macroinvertebrate scoring test described at 25 Pa. Code § 93.4b(b)(1)(v) to Slab Cabin Run at 1SCR and to Roaring Run at 7RR. Selected benthic macroinvertebrate community metrics calculated for the basin stations evaluated were compared to a

station on Slate Run in Lycoming County. Slate Run was chosen as an EV reference because it has comparable drainage area, is found in similar geologic settings as the candidate stations, it has demonstrated an existing use of EV based on biological measures, and the macroinvertebrate community has demonstrated best attainable biological communities by scoring well above the top 25th percentile of Pennsylvania EV reference streams. In addition, the Slate Run reference has optimal habitat and similar gradient, drainage area, pH and alkalinity to the candidate stream stations (DEP 2013). The comparisons were done using the following metrics that were selected as being indicative of community health: taxa richness, modified EPT index, modified Hilsenhoff Biotic Index (HBI), percent dominant taxon, and percent modified mayflies.

Based on these five metrics, the candidate station on Roaring Run (7RR) exceeded the EV qualifying criterion of 92% (Table 16).

Table 16. Slab Cabin Run and Roaring Run – RBP Metric Comparison

METRIC	STATIONS[1]		REFERENCE[2]
	1SCR	7RR	SR
TAXA RICHNESS	19	27	33
Cand/Ref (%)	58	82	
Biol. Cond. Score	0	8	8
MOD. EPT INDEX	11	16	19
Cand/Ref (%)	58	84	
Biol. Cond. Score	2	8	8
MOD. HBI	2.68	2.32	2.43
Cand-Ref	0.25	-0.11	
Biol. Cond. Score	8	8	8
% DOMINANT TAXA	28	18.8	11.5
Cand-Ref	16.5	7.3	
Biol. Cond. Score	4	8	8
% MOD. MAYFLIES	34.2	43.8	63
Ref-Cand	28.8	19.2	
Biol. Cond. Score	3	6	8
TOTAL BIOLOGICAL CONDITION SCORE	17	38	40
% COMPARABILITY TO REFERENCE	43	95	

[1] Refer to Figure 1 & Table 1 for station locations
[2] Refer to Figure 1 for station location

PROTECTED USE ASSESSMENT

The Slab Cabin Run basin was previously listed on Pennsylvania's list of impaired waters for:

- Slab Cabin Run from SR 26 to Roaring Run
  - Source – Grazing Related Agriculture, Cause – Siltation
- Slab Cabin Run from Roaring Run to Thompson Run
  - Source – Flow Regulation/Modification, Cause – Dewatering
  - Source – Grazng Related Agriculture, Cause – Siltation
  - Source – Golf Courses, Cause Thermal Modifications

- Thomspon Run
  - Source – Urban Runoff/Storm Sewers, Cause – Siltation
- Slab Cabin Run from Thompson Run to Mouth
  - Source – Urban Runoff/Storm Sewers, Cause – Siltation
  - Source – Golf Cources, Cause – Thermal Modifications
  - Source – Flow Regulation/Modification, Cause – Dewatering
  - Source – Grazing Related Agriculture – Siltation

Data collected 2013 through 2020 indicates that 1) Slab Cabin Run is meeting HQ-CWF protected use attainment thresholds from the source to SR 26 at Pine Grove Mills; 2) the basin from SR 26 at Pine Grove Mills to the mouth, including Thompson Run but excluding Roaring Run does not meet aquatic life nor special protection attainment thresholds and continues to be listed as impaired; and 3) the Roaring Run basin is currently meeting EV attainment thresholds for the portion of the basin upstream of the sink hole located at 40°45'35.1"N 77°49'26.1"W.

Slab Cabin Run – SR 26 to Roaring Run

- Habitat data collected in 2013 from one of three station locations on Slab Cabin Run from SR 26 to Roaring Run characterize Siltation and Habitat Modification causes of impairment. Habitat data collected in 2019 for this reach characterizes improving conditions with all stations meeting or exceeding impairment thresholds, with the exception of the condition of banks + riparian vegetative zone width couplet summation, which supports delisting the Siltation cause of impairment and adding the Habitat Modification cause for this reach.
- CIM data collected in 2019 and 2020, which includes temperature, pH and dissolved oxygen data from station 4SCR located on Slab Cabin Run between SR 26 and Roaring Run indicates that Eutrophication is a cause of impairment.
- The 53% agricultural land cover along with elevated alkalinity, pH, phosphorus, nitrogen and total suspended solids (TSS) concentrations support an Agriculture source of impairment. The source of impairment was previously Grazing Related Agriculture, however there are a variety of agricultural activities, in addition to grazing, within the basin and the general source of “Agriculture” is the most appropriate source delineation.

Roaring Run

- Data collected from Roaring Run was conducted upstream of the sink hole located at 40°45'35.1"N 77°49'26.1"W. The reach of Roaring Run, approximately one mile, from the sink hole to the confluence of Slab Cabin Run is considered a losing reach and surface water flow is intermittent.
- Habitat data collected from Roaring Run in 2013 and 2019 meet attainment thresholds.
- The 2013 benthic macroinvertebrate sample had an IBI score of 88.1, which exceeds attainment thresholds for EV (63.0) and establishes existing and baseline water quality conditions that shall be maintained and protected.
- The 2019 benthic macroinvertebrate sample had an IBI score of 80.4 and is within method precision estimates when compared to the 2013 sample baseline score (88.1), demonstrates maintenance of existing conditions and attainment of EV.

Slab Cabin Run – Roaring Run to Thompson Run

- Habitat data collected in 2013 from the four stations evaluated on Slab Cabin Run from Roaring Run to Thompson Run characterize Siltation and Habitat Modification causes of impairment. While habitat data results collected for this reach in 2019 show improvement, three of four locations continue to indicate Siltation as a cause and two of four locations indicate Habitat Modification as a cause.
- CIM data collected in 2019 and 2020; which includes temperature, pH and dissolved oxygen data; from station 11SCR located on Slab Cabin Run between Roaring Run and Thompson Run indicates that Eutrophication is a cause of impairment.
- CIM temperature data from station 10SCR and 11SCR indicates that dramatic instream temperature increases occur for very short time periods just after major precipitation events during warm weather months that correlate with known pervious surface runoff, which supports the Impervious Surface/Parking Lot Runoff source.
- CIM temperature data from 10SCR, which is located upstream of the UAJA discharges, when compared to 11SCR, which is located downstream of the UAJA discharges, does indicate that temperatures downstream are warmer at times, especially during the 2020 drought watch conditions. Semi-quantitative fish survey data from 10SCR and 12SCR does not support the Thermal Modification cause. In addition, fish survey data from all stations throughout the Slab Cabin Run basin do not characterize a Thermal Modification cause and supports a delisting of this cause.
- The 24% agricultural land cover along with elevated alkalinity, pH, phosphorus, nitrogen and total suspended solids (TSS) concentrations support the Agriculture source of impairment. The source of impairment was previously Grazing Related Agriculture, however there are a variety of agricultural activities, in addition to grazing, within the basin and the general source of "Agriculture" is the most appropriate source delineation. The 29% urban land cover along with elevated levels of pollutants including chlorides and other anions support the Urban Runoff/Storm Sewers source.
- Golf Courses were previously identified as a source of impairment and conditions observed in 2019 and 2020, including the lack of riparian buffer and bank vegetative protection throughout the Centre Hills Golf Course continues to support Golf Courses as a source.
- The Flow Regulation/Modification source and Dewatering caused impairment will continue to be maintained based on the low flow conditions documented in 2020. Additional efforts will be required to further investigate.

Thompson Run

- Habitat data collected in 2013 and 2019 from two Thompson Run stations (16TR and 17TR) and from one station on Walnut Springs (15WS) characterize Siltation and Habitat Modification causes of impairment throughout the entire Thompson Run basin.
- CIM data collected in 2019 and 2020, which includes temperature, pH and dissolved oxygen data from station 17TR located on Thompson Run indicates that Eutrophication is a cause of impairment.
- The 88% urban land cover along with elevated levels of pollutants including chloride, bromide and other anions support the Urban Runoff/Storm Sewers source.
- CIM temperature data from Thompson Run indicates that dramatic instream temperature increases occur for very short time periods just after major precipitation events during warm weather months that correlate with known pervious surface runoff, which supports the Impervious Surface/Parking Lot Runoff source.

Slab Cabin Run – Thompson Run to Mouth

- Slab Cabin downstream of Thompson Run is affected by impaired water quality conditions from upstream sources within the basin, described previously, including Urban Runoff/Storm Sewers and Agriculture.
- While some of the highest concentrations of chloride, bromide and other anions were found within the Thompson Run basin, the highest concentrations of anions in Slab Cabin Run were found downstream of Thompson Run, which is indicative of the effect that impaired water quality conditions of Thompson Run have on Slab Cabin Run.
- Habitat data collected in 2013, 2019 and 2020 from Slab Cabin Run downstream of Thompson Run (18SCR) continues to characterize Siltation and Habitat Modification causes of impairment.
- The Flow Regulation/Modification source and Dewatering caused impairment will continue to be maintained based on the low flow conditions documented in 2020. Additional efforts will be required to further investigate.

PUBLIC NOTICE AND REQUEST FOR TECHNICAL DATA

The Department provided public notice of this redesignation evaluation and requested any technical data from the general public through publication in the *Pennsylvania Bulletin* on April 20, 2019 (49 Pa.B. 1967). The Centre Region Council of Governments, ClearWater Conservancy (now Keystone Water Resources Center (KWRC)), Centre County Conservation District, Pennsylvania State University, Centre County Planning and Community Development Office, College Township, Halfmoon Township, Ferguson Township, State College Borough, Harris Township, Centre County Planning Commission, Centre Regional Planning Commission, State College Borough Water Authority, University Area Joint Authority (UAJA), Pennsylvania Fish and Boat Commission (PFBC), and Trout Unlimited were notified of the evaluation in a letter dated April 19, 2019. In addition, a notification was posted on the DEP's website. In response to the public notice, comments and data were received from the Centre County Pennsylvania Senior Environmental Corp, College Township, PFBC and the State College Borough Water Authority.

RECOMMENDATION

The Slab Cabin Run basin is currently designated HQ-CWF, MF from the basin source to SR 26 and CWF, MF from SR 26 to the mouth, excluding Thompson Run, which is currently designated HQ-CWF, MF.

Based on applicable regulatory definitions and requirements of 25 Pa. Code § 93.4b(a)(2)(ii) (the Class A Wild Trout HQ qualifier), the DEP's independent review of the trout biomass data along with a review of the surface water quality, the Slab Cabin Run basin from SR 26 to the confluence with Spring Creek qualifies for redesignation to HQ-CWF, MF. The DEP recommends that the Slab Cabin Run basin from SR 26 to the confluence with Spring Creek, with the exception of the Roaring Run basin from the source to the sink hole at 40°45'35.1"N 77°49'26.1"W and the Thompson Run basin, be redesignated from CWF, MF to HQ-CWF, MF. In addition, based on applicable regulatory definitions and requirements of § 93.4b(b)(1)(v) (the DEP's integrated benthic macroinvertebrate scoring test), the DEP recommends that the Roaring Run basin from the source to the sink hole at 40°45'35.1"N 77°49'26.1"W be redesignated from CWF, MF to EV, MF.

This recommendation adds **21.0** stream miles of HQ-CWF waters and **4.1** stream miles of EV waters to Chapter 93.

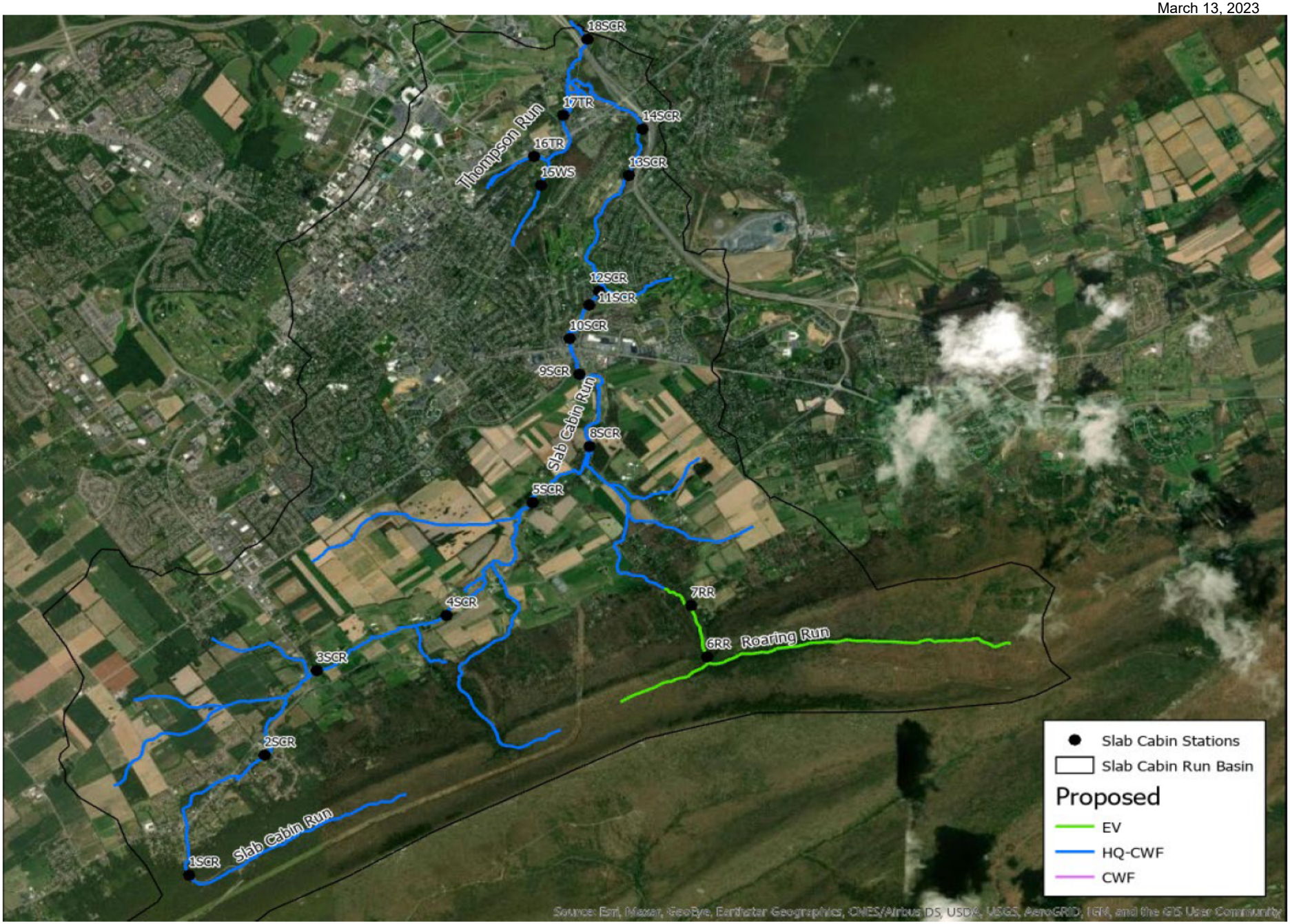

Figure 6. Slab Cabin Run Basin Station Locations and Recommended Designated Use

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APPENDIX A – WATER CHEMISTRY DATA

Table A1. April 16 – 24, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS								
			1SCR	3SCR	4SCR	7RR	9SCR	11SCR	14SCR	17TR	18SCR
METALS AND IONS	ALUMINUM D	ug/L	14.6	14.1	<10	23.6	10.1	<10	<10	<10	<10
	ALUMINUM T	ug/L	42.9	327	181	269	136	211	144	23.6	176
	BARIUM T	ug/L	27	28	28	22	24	26	32	30	34
	BORON T	ug/L	<200	<200	<200	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	<25	<25	46.86	29.29
	CADMIUM D	ug/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	CALCIUM T	mg/L	3.91	29.9	42.5	2.72	37.6	39.7	41.8	76.1	48.81
	CHLORIDE T	mg/L	17.06	21.17	19.01	0.99	17.15	24.6	27.02	104	50.98
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	321	513	277	238	209	241	222	<100	258
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.54	18	15	1.2	14.3	15.3	16	31	19.14
	MANGANESE D	ug/L	<10	<10	11	10	11	10	<10	<10	<10
	MANGANESE T	ug/L	13	18	21	30	21	22	17	<10	21
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.4	1.22	<1	1.23	1.31	1.36	1.68	1.64
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	10.8	11.9	10.4	0.87	8.65	12.4	13.9	43.2	25.01
	STRONTIUM T	ug/L	19	187	204	15	144	160	243	112	231
	SULFATE T	mg/L	7.05	10.79	11.44	6.39	10.92	11.7	12.32	24.09	16.6
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.3	1.43	2.41	0.17	2.25	2.27	2.24	3.54	2.37
	NITRATE & NITRITE T	mg/L	0.3	1.45	2.41	0.19	2.24	2.26	2.24	3.54	2.39
	NITROGEN D	mg/L	0.254	1.449	2.496	0.138	2.278	2.33	2.357	3.701	2.602
	NITROGEN T	mg/L	0.31	1.51	2.48	<0.25	2.4	2.32	2.32	3.61	2.51
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.028	0.02	0.32	0.017	0.017	0.02	<0.01	0.21
PHYSICAL/OTHER	ALKALINITY	mg/L	8.8	88.4	144	6	135	140.2	148.6	251.2	165.6
	CBOD	mg/L	<0.2	-	0.62	-	0.68	1.35	0.93	0.69	-
	DISSOLVED OXYGEN	mg/L	10.66	11.45	10.87	11.77	12	12.14	11.44	11.41	11
	HARDNESS T	mg/L	16	108	168	12	153	162	170	318	201
	OSMOTIC PRESSURE	mosm	1	2	6	<1	5	6	6	13	8
	pH	SU	7.09	7.22	7.93	6.91	8.01	8.01	8.06	8.01	7.55
	SPECIFIC COND	µS/cm[c]	99.5	271	385	33	356.9	390.7	413.9	865	517
	TDS	mg/L	60	168	208	40	196	218	214	454	296
	TSS	mg/L	<5	14	10	8	<5	<5	<5	<5	<5
	TOC	mg/L	0.86	1.28	1.04	1.24	1	0.99	1.45	0.68	0.97

"<" indicate concentrations below the reporting limit

Table A2. May 20, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	36.8	16.5	19.6	16.2	17.1	<10
	ALUMINUM T	ug/L	100	379	400	289	441	56.6
	BARIUM T	ug/L	24	30	29	29	35	27
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	29.88
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	3.343	35.69	32.4	31.48	35.95	63.04
	CHLORIDE T	mg/L	9.71	15.45	13.78	18.06	20.85	77.06
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	142	467	728	607	742	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.17	11.68	11.68	11.48	13.32	24.26
	MANGANESE D	ug/L	<10	20	16	15	<10	<10
	MANGANESE T	ug/L	21	42	43	45	43	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.32	1.51	1.5	1.64	1.55
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	7.16	9.64	8	10.03	12.06	36.2
	STRONTIUM T	ug/L	18	193	144	146	225	113
	SULFATE T	mg/L	6.11	9.5	9.07	9.43	10.3	19.29
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	0.03	0.04	0.04	0.06	0.04	0.03
	AMMONIA T	mg/L	0.03	0.05	0.04	0.06	0.08	0.02
	NITRATE & NITRITE D	mg/L	0.26	1.72	1.68	1.67	1.8	2.81
	NITRATE & NITRITE T	mg/L	0.26	1.74	1.68	1.68	1.79	2.8
	NITROGEN D	mg/L	0.377	1.968	1.966	2.05	2.083	3.08
	NITROGEN T	mg/L	0.41	1.97	2.07	2.13	2.15	3.05
	ORTHO PHOSPHORUS D	mg/L	<0.01	0.011	0.015	0.015	0.017	0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.015	0.016	0.017	0.018	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.016	0.02	0.021	0.021	0.011
	PHOSPHORUS T	mg/L	0.011	0.035	0.049	0.055	0.055	0.023
PHYSICAL/OTHER	ALKALINITY	mg/L	6.8	117.8	111.8	111.2	124	199.8
	CBOD	mg/L	0.45	<0.2	0.94	0.66	1.41	1.75
	DISSOLVED OXYGEN	mg/L	10.3	10.19	9.6	9.78	10.06	10.56
	HARDNESS T	mg/L	13	137	129	126	145	258
	OSMOTIC PRESSURE	mosm	1	-	-	-	5	10
	pH	pH units	6.81	7.27	7.49	7.5	7.61	7.68
	SPECIFIC COND	µS/cm[c]	67.6	300.8	283.6	301.4	338	668
	TDS	mg/L	72	206	196	216	2864	428
	TSS	mg/L	<5	12	24	16	20	<5
	TOC	mg/L	2.07	2.49	2.89	2.9	2.6	1.48

"<" indicate concentrations below the reporting limit

Table A3. June 25, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<10	<10	<10	<10	<10	<10
	ALUMINUM T	ug/L	43.7	102	173	167	88.3	22
	BARIUM T	ug/L	22	33	29	28	33	26
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	43.32
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	3.59	49.2	47.1	45.5	46.7	68
	CHLORIDE T	mg/L	15.08	22.09	22.15	30.77	31.95	93.4
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	175	218	176	140	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.53	16.7	17.9	17.5	18.1	27.7
	MANGANESE D	ug/L	<10	43	<10	<10	<10	<10
	MANGANESE T	ug/L	12	54	22	17	12	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.35	1.7	1.69	1.6	1.61
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	9.73	11.6	11.3	17	19.6	39.9
	STRONTIUM T	ug/L	18	237	176	190	280	103
	SULFATE T	mg/L	6.14	11.95	12.39	12.83	12.99	22.96
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	0.03	0.03	0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	0.03	0.04	0.03	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.28	3.18	3	2.87	2.81	3.43
	NITRATE & NITRITE T	mg/L	0.28	3.19	3	2.88	2.92	3.87
	NITROGEN D	mg/L	0.311	3.405	3.244	3.069	3.007	3.608
	NITROGEN T	mg/L	0.3	3.39	3.3	3.22	2.96	4.09
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.014	0.011	0.011	0.011	<0.01
	PHOSPHORUS T	mg/L	0.01	0.023	0.023	0.022	0.019	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	10.4	188.8	183	179.4	186.2	244
	CBOD	mg/L	0.65	0.95	1.26	0.81	0.59	1.07
	DISSOLVED OXYGEN	mg/L	10.23	9.95	9.88	9.81	9.71	10.78
	HARDNESS T	mg/L	15	192	191	186	191	284
	OSMOTIC PRESSURE	mosm	1	7	7	10	7	12
	pH	pH units	7.76	7.87	7.76	7.74	7.73	7.74
	SPECIFIC COND	µS/cm[c]	90.8	449.5	438.1	465.8	476.2	793
	TDS	mg/L	56	264	264	276	268	476
	TSS	mg/L	<5	8	6	<5	<5	<5
	TOC	mg/L	0.72	1.2	1.33	1.37	1.04	1.09

"<" indicate concentrations below the reporting limit

Table A4. July 25, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<10	<10	<10	<10	<10	<10
	ALUMINUM T	ug/L	26.5	105	34.5	38.3	21.2	10.6
	BARIUM T	ug/L	24	35	32	34	41	31
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	41.32
	CADMIUM D	ug/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	CALCIUM T	mg/L	4.196	54.8	61.35	60.86	60.1	74.45
	CHLORIDE T	mg/L	15.01	22.91	26.96	35.79	36.98	89.53
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	187	<100	<100	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.82	18.52	23.14	23.19	22.91	30.38
	MANGANESE D	ug/L	<10	15	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	31	20	12	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.5	2.03	2.15	1.96	1.78
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	9.65	11.8	13.15	19.97	20.97	37.57
	STRONTIUM T	ug/L	19	302	227	256	388	103
	SULFATE T	mg/L	4.5	12.45	15.04	15.06	15.47	23.18
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	30	32	30	30	30	30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.24	4	4.06	3.7	3.36	3.68
	NITRATE & NITRITE T	mg/L	0.22	3.95	4.06	3.69	3.34	3.63
	NITROGEN D	mg/L	0.303	4.229	4.232	3.903	3.633	3.865
	NITROGEN T	mg/L	0.31	4.26	4.27	3.92	3.47	3.83
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	0.011	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.02	0.014	0.015	0.011	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	13.2	195	222.4	213	214.4	242.2
	CBOD	mg/L	1	<0.02	1.2	1	1	0.4
	DISSOLVED OXYGEN	mg/L	95.1	10.65	10.42	10.51	9.47	10.79
	HARDNESS T	mg/L	18	213	249	248	245	311
	OSMOTIC PRESSURE	mosm	1	7	8	9	9	12
	pH	pH units	7.67	8.03	7.96	7.88	7.84	7.84
	SPECIFIC COND	µS/cm[c]	90.5	472.5	540	554	558	788
	TDS	mg/L	64	296	332	348	346	480
	TSS	mg/L	<5	8	<5	<5	<5	<5
	TOC	mg/L	<0.5	0.82	1.02	1.03	1	0.73

"<" indicate concentrations below the reporting limit

Table A5. August 22, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<10	<10	<10	29.1	<10	<10
	ALUMINUM T	ug/L	25.2	101	45.4	62.5	22.6	37.9
	BARIUM T	ug/L	25	37	33	31	35	28
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	49.55
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.607	57.43	63	49.9	50.8	72.8
	CHLORIDE T	mg/L	15.04	22.62	28.62	31.15	33.69	87.89
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	178	106	<100	<100	106
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.03	20.23	23.7	19.1	19.6	29.9
	MANGANESE D	ug/L	<10	13	11	<10	<10	<10
	MANGANESE T	ug/L	<10	24	14	13	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.51	2.04	1.7	1.69	1.55
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	9.4	11.52	13.5	19.9	21.7	34.2
	STRONTIUM T	ug/L	21	327	230	216	370	94
	SULFATE T	mg/L	4.08	12.95	15.42	12.46	13.36	22.29
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	0.031	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	0.15	0.03	<0.02
	NITRATE & NITRITE D	mg/L	0.19	4.17	4.27	3.34	2.95	3.6
	NITRATE & NITRITE T	mg/L	0.19	4.2	4.26	3.25	2.95	3.65
	NITROGEN D	mg/L	0.167	4.492	4.534	3.654	3.215	3.888
	NITROGEN T	mg/L	0.38	4.57	4.64	3.54	3.11	3.73
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	0.011	0.012	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	0.012	0.011	0.016	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.014	0.013	0.016	0.017	0.01
	PHOSPHORUS T	mg/L	<0.01	0.022	0.019	0.018	0.018	0.017
PHYSICAL/OTHER	ALKALINITY	mg/L	14.4	193.4	233.6	197	198.8	252.2
	CBOD	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	DISSOLVED OXYGEN	mg/L	9.93	9.98	9.57	9.87	8.82	10.68
	HARDNESS T	mg/L	20	227	255	203	208	305
	OSMOTIC PRESSURE	mosm	1	4	8	8	8	12
	pH	pH units	7.36	8.12	7.91	7.99	7.74	7.93
	SPECIFIC COND	µS/cm[c]	90.8	472.5	558	508	512	767
	TDS	mg/L	70	310	356	292	312	478
	TSS	mg/L	<5	<5	<5	6	8	14
	TOC	mg/L	<0.5	0.97	1.02	0.88	0.95	0.82

"<" indicate concentrations below the reporting limit

Table A6. September 19, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	24.4	<15	<15	<15
	ALUMINUM T	ug/L	16.5	92.8	60.1	36.8	<15	<15
	BARIUM T	ug/L	23	35	32	24	34	25
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	38.27
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.76	56.6	66.9	42.6	46.7	74.8
	CHLORIDE T	mg/L	16	23.58	31.55	28.02	30.64	79.38
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	151	<100	<100	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.1	20.3	25.2	16.3	18.1	31.5
	MANGANESE D	ug/L	<10	11	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	19	14	<10	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.64	2.12	1.61	1.69	1.58
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	9.19	10.4	14.8	23.5	24.5	33.6
	STRONTIUM T	ug/L	21	308	242	212	416	92
	SULFATE T	mg/L	3.76	13.34	15.87	10.58	11.77	22.07
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	0.093	0.052	0.033	0.025	<0.02	0.02
	AMMONIA T	mg/L	<0.02	0.02	<0.02	<0.02	0.02	0.02
	NITRATE & NITRITE D	mg/L	0.21	4.68	4.44	2.81	2.62	3.73
	NITRATE & NITRITE T	mg/L	0.21	4.66	4.43	2.83	2.61	3.72
	NITROGEN D	mg/L	0.222	5.187	4.56	3.006	2.758	3.808
	NITROGEN T	mg/L	<0.25	5.23	4.61	3.02	2.75	3.81
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.012	<0.01	0.011	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.013	0.011	0.013	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.022	0.017	0.018	<0.01	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	16	198.6	232.4	170.2	183.8	247.2
	CBOD	mg/L	<0.02	<0.02	0.7	<0.02	<0.02	<0.02
	DISSOLVED OXYGEN	mg/L	9.84	10.67	9.97	10.18	9.88	10.94
	HARDNESS T	mg/L	20	225	271	174	191	317
	OSMOTIC PRESSURE	mosm	2	8	9	7	7	12
	pH	pH units	7.98	8.33	8.07	8.22	8.18	8
	SPECIFIC COND	µS/cm[c]	95.9	487.2	576	441.8	478.5	765
	TDS	mg/L	70	306	344	258	294	428
	TSS	mg/L	6	12	8	10	6	6
	TOC	mg/L	<0.5	1.03	1.02	0.84	0.94	0.74

"<" indicate concentrations below the reporting limit

Table A7. November 4, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	25.3	191	138	184	38.5	<15
	BARIUM T	ug/L	29	46	38	31	38	32
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	39.74
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	5.507	54.03	57.2	43.83	45.46	75.2
	CHLORIDE T	mg/L	25.18	31.78	36.8	32.45	36.33	89.27
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	276	161	252	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.39	16.34	19.48	15.25	16.1	31.21
	MANGANESE D	ug/L	<10	<10	16	16	<10	<10
	MANGANESE T	ug/L	<10	18	21	27	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.96	2.24	1.88	1.83	1.83
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	12.92	16.96	18.96	25.73	26.68	38.07
	STRONTIUM T	ug/L	26	373	294	254	471	110
	SULFATE T	mg/L	6.59	15.97	17.2	12.02	13.96	23.58
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	0.06	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.5	3.26	3.23	2.44	2.27	3.66
	NITRATE & NITRITE T	mg/L	0.5	3.24	3.23	2.41	2.28	3.57
	NITROGEN D	mg/L	0.613	3.602	3.688	2.729	2.462	3.94
	NITROGEN T	mg/L	0.64	3.66	3.66	2.72	2.54	3.87
	ORTHO PHOSPHORUS D	mg/L	<0.01	0.016	0.013	0.012	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.017	0.014	0.012	0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.019	0.016	0.013	0.013	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.031	0.027	0.028	0.017	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	12.2	177.4	202	159.2	174.8	245.2
	CBOD	mg/L	0.9	<0.02	1	<0.02	<0.02	0.9
	DISSOLVED OXYGEN	mg/L	10.87	11.64	11.52	10.73	11.38	11.38
	HARDNESS T	mg/L	24	202	223	172	180	316
	OSMOTIC PRESSURE	mosm	-	-	-	6	-	11
	pH	pH units	7.96	8.31	8	8.01	8.1	8.06
	SPECIFIC COND	µS/cm[c]	123.9	463.6	517	426.6	457.4	762
	TDS	mg/L	84	280	308	238	268	444
	TSS	mg/L	<5	<5	<5	6	<5	<5
	TOC	mg/L	0.84	1.19	1.25	0.91	1.06	<0.5

"<" indicate concentrations below the reporting limit

Table A8. November 20, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	20.9	59.9	92.3	65.7	19.1	<15
	BARIUM T	ug/L	26	35	37	21	29	28
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	42.8
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.642	51.2	60.23	30.99	36.15	71.88
	CHLORIDE T	mg/L	19.7	24.41	32.89	22.03	25.59	78.7
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	<100	139	<100	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.2	18.76	22.54	11.84	13.69	30.48
	MANGANESE D	ug/L	<10	<10	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	<10	12	<10	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.4	2.02	1.34	1.39	1.52
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	10.9	11.12	16.22	23.25	25.8	33.09
	STRONTIUM T	ug/L	21	305	293	187	391	94
	SULFATE T	mg/L	4.76	13.57	15.91	8.23	9.75	21.83
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.3	4.32	4.07	2.41	2.12	3.8
	NITRATE & NITRITE T	mg/L	0.3	4.33	4.04	2.42	2.12	3.78
	NITROGEN D	mg/L	0.388	4.697	4.481	2.617	2.348	4.035
	NITROGEN T	mg/L	0.39	4.7	4.48	2.64	2.27	4.08
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.012	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.017	0.015	0.013	<0.01	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	13.2	182.2	214.2	137.2	152.2	247
	CBOD	mg/L	<0.2	1.1	<0.2	1.4	<0.2	1.4
	DISSOLVED OXYGEN	mg/L	11.16	12.57	11.95	10.48	12.44	12.01
	HARDNESS T	mg/L	21	205	243	126	147	305
	OSMOTIC PRESSURE	mosm	2	7	8	<1	5	11
	pH	pH units	8.14	8.5	8.17	8.2	8.37	8.25
	SPECIFIC COND	µS/cm[c]	106.5	457.6	539	337.8	382.7	739
	TDS	mg/L	84	278	324	210	220	418
	TSS	mg/L	<5	10	<5	<5	<5	6
	TOC	mg/L	0.51	0.76	0.79	0.57	0.65	<0.5

"<" indicate concentrations below the reporting limit

Table A9. December 19, 2019 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	15.9	<15
	ALUMINUM T	ug/L	23.2	126	370	368	47.2	41.2
	BARIUM T	ug/L	28	36	34	31	38	29
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	50.1
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.83	46.3	47.9	44.2	46.3	71.6
	CHLORIDE T	mg/L	27.07	38.02	36.01	38.38	45.23	100.96
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	167	412	444	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.16	13.3	16	15.1	16.4	29.6
	MANGANESE D	ug/L	<10	<10	12	20	<10	<10
	MANGANESE T	ug/L	<10	<10	22	33	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.54	1.76	1.68	1.58	1.62
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	13.9	19.4	17.8	22.3	25.8	43.5
	STRONTIUM T	ug/L	23	306	249	260	516	98
	SULFATE T	mg/L	6.75	13.5	13.94	12.84	15.14	21.65
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	0.023	0.024	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.44	2.57	2.55	2.39	2.25	3.89
	NITRATE & NITRITE T	mg/L	0.45	2.57	2.55	2.41	2.31	3.64
	NITROGEN D	mg/L	0.515	2.746	2.73	2.642	2.441	3.929
	NITROGEN T	mg/L	0.49	2.76	2.79	2.66	2.44	3.92
	ORTHO PHOSPHORUS D	mg/L	<0.01	0.011	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.013	0.011	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.012	0.011	0.011	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.019	0.033	0.035	0.013	<0.01
PHYSICAL/ OTHER	ALKALINITY	mg/L	8.2	144.8	163.2	155.6	169.8	246.2
	CBOD	mg/L	2	1.2	2.2	1.2	3.2	0.8
	HARDNESS T	mg/L	21	170	186	173	183	301
	OSMOTIC PRESSURE	mosm	<1	5	2	7	4	12
	TDS	mg/L	88	258	262	258	294	486
	TSS	mg/L	<5	16	10	18	<5	<5
	TOC	mg/L	0.73	0.94	1.17	1.1	1	<0.5

"<" indicate concentrations below the reporting limit

Table A10. January 29, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	21.6	114	85.2	124	43.1	63.9
	BARIUM T	ug/L	25	30	29	31	41	27
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	43.05
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.046	39.93	47.26	46.5	52.48	70.08
	CHLORIDE T	mg/L	21.78	34	31.22	35.45	43.44	88.77
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	148	153	183	<100	104
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.86	12.24	16.73	16.79	19.06	29.18
	MANGANESE D	ug/L	<10	<10	<10	14	<10	<10
	MANGANESE T	ug/L	<10	<10	12	18	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.34	1.63	1.62	1.66	1.61
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	11.37	15.56	15.05	17.02	22.73	37.1
	STRONTIUM T	ug/L	19	267	236	249	497	98
	SULFATE T	mg/L	6.2	12.36	13.07	13.44	14.68	21.18
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.4	2.7	2.9	2.88	2.71	3.9
	NITRATE & NITRITE T	mg/L	0.38	2.71	2.89	2.86	2.71	3.89
	NITROGEN D	mg/L	0.371	2.811	3.019	2.991	2.847	4.071
	NITROGEN T	mg/L	0.34	2.83	3.03	2.96	2.8	4.02
	ORTHO PHOSPHORUS D	mg/L	<0.01	0.014	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.014	0.011	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.016	0.012	0.012	<0.01	<0.01
	PHOSPHORUS T	mg/L	0.01	0.024	0.023	0.023	0.011	0.013
PHYSICAL/OTHER	ALKALINITY	mg/L	8.6	139.8	172.6	172.4	184.8	244
	CBOD	mg/L	0.8	0.9	1.1	1.4	1.1	0.9
	DISSOLVED OXYGEN	mg/L	11.96	13.4	13.31	13.78	12.33	11.86
	HARDNESS T	mg/L	18	150	187	185	210	295
	OSMOTIC PRESSURE	mosm	<1	5	6	6	7	11
	pH	pH units	8.12	8.55	8.27	8.33	8.18	8.13
	SPECIFIC COND	µS/cm[c]	112.4	417.8	464	483	534	801
	TDS	mg/L	86	240	270	286	316	460
	TSS	mg/L	<5	6	6	<5	<5	10
	TOC	mg/L	0.9	1.09	1.26	1.34	1.2	1.7

"<" indicate concentrations below the reporting limit

Table A11. March 4, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	23.5	24.1	19.5	42.1	46.4	44.5
	ALUMINUM T	ug/L	57.2	210	193	178	175	113
	BARIUM T	ug/L	24	30	27	23	31	26
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	43.66
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.445	37.55	46.15	39.33	43.29	68.85
	CHLORIDE T	mg/L	18.61	32.28	25.39	25.86	30.76	87.23
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	4.93
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	299	274	236	200	162
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.57	11.56	16.81	14.13	15.71	27.98
	MANGANESE D	ug/L	<10	<10	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	11	12	11	12	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.37	1.63	1.48	1.56	1.65
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	10.23	15.54	12.51	17.34	19.64	36.99
	STRONTIUM T	ug/L	19	247	210	190	318	101
	SULFATE T	mg/L	6.67	12.42	13.22	11.27	12.39	21.44
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	-	-	-	-	-	-
	AMMONIA T	mg/L	-	-	-	-	-	-
	NITRATE & NITRITE D	mg/L	0.43	2.36	2.84	2.48	2.38	3.65
	NITRATE & NITRITE T	mg/L	0.29	2.32	2.77	2.4	2.33	3.62
	NITROGEN D	mg/L	0.209	2.323	2.819	2.401	2.476	3.827
	NITROGEN T	mg/L	<0.25	2.33	2.8	2.4	2.4	3.81
	ORTHO PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.017	0.018	0.016	0.015	0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	9	129.2	161.2	146.2	160	241.4
	CBOD	mg/L	0.2	0.4	0.7	0.8	0.8	0.8
	DISSOLVED OXYGEN	mg/L	11.72	12.69	12.12	12.01	11.61	11.58
	HARDNESS T	mg/L	18	142	185	156	173	287
	OSMOTIC PRESSURE	mosm	<1	4	5	5	5	10
	pH	pH units	8.16	8.33	8.03	8.05	8.16	8.02
	SPECIFIC COND	µS/cm[c]	124.3	489.5	545	509	554	978
	TDS	mg/L	74	224	262	230	238	448
	TSS	mg/L	<5	12	<5	<5	<5	<5
	TOC	mg/L	1.43	1.64	1.61	1.42	1.86	1.65

"<" indicate concentrations below the reporting limit

Table A12. June 17, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	20.4	119	128	79.7	41.4	<15
	BARIUM T	ug/L	23	34	28	28	35	28
	BORON T	mg/L	0.6	0.7	1	0.6	0.4	0.8
	BROMIDE	ug/L	<25	<25	<25	<25	<25	42.02
	CADMIUM D	ug/L	<200	<200	<200	<200	<200	<200
	CALCIUM T	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CHLORIDE T	mg/L	17.21	24.24	25.83	34.58	38.91	84.18
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	221	260	196	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.8	17.05	21.08	20.22	20.95	30.79
	MANGANESE D	ug/L	<10	11	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	21	15	13	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.43	1.71	1.64	1.62	1.7
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	10.59	12.51	12.24	19.71	22.2	37.04
	STRONTIUM T	ug/L	18	257	197	214	359	99
	SULFATE T	mg/L	6.46	12.16	13.69	13.32	14.68	22.68
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	0.03	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.3	3.11	3.5	3.24	3.04	3.67
	NITRATE & NITRITE T	mg/L	0.29	3.11	3.52	3.22	3.04	3.67
	NITROGEN D	mg/L	0.376	3.338	3.811	3.431	3.141	3.761
	NITROGEN T	mg/L	0.32	3.31	3.88	3.41	3.17	3.79
	ORTHO PHOSPHORUS D	mg/L	0.01	0.014	0.012	0.012	0.011	0.011
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.015	0.012	0.011	0.011	<0.01
	PHOSPHORUS D	mg/L	0.012	0.015	0.011	0.012	0.011	<0.01
	PHOSPHORUS T	mg/L	0.011	0.029	0.034	0.019	0.015	0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	11.2	164.8	202	193.2	198.4	250
	CBOD	mg/L	3.931	48.14	52.63	49.99	52.03	71.39
	DISSOLVED OXYGEN	mg/L	10.53	11.5	10.5	10.75	10.04	10.88
	HARDNESS T	mg/L	17	190	218	208	216	305
	OSMOTIC PRESSURE	mosm	<1	5	5	6	6	10
	pH	pH units	6.9	8.1	7.94	8.07	8.16	8.07
	SPECIFIC COND	µS/cm[c]	97.4	425.1	489.3	498	538	774
	TDS	mg/L	60	234	294	312	304	480
	TSS	mg/L	6	18	16	8	14	10
	TOC	mg/L	0.51	1	1	0.9	0.86	0.8

"<" indicate concentrations below the reporting limit

Table A13. July 16, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	47.6	<15	<15
	ALUMINUM T	ug/L	24.1	211	64.4	86.4	20.1	55.8
	BARIUM T	ug/L	23	36	32	25	32	27
	BORON T	mg/L	0.8	1.3	1	0.5	0.2	1
	BROMIDE	ug/L	<25	<25	<25	<25	<25	39.33
	CADMIUM D	ug/L	<200	<200	<200	<200	<200	<200
	CALCIUM T	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CHLORIDE T	mg/L	14.09	20.43	25.54	27.13	31.66	81.69
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	188	111	128	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	1.92	20.16	24.67	18.03	19.14	31.38
	MANGANESE D	ug/L	<10	12	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	22	<10	14	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.6	1.92	1.69	1.64	1.63
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	9.49	10.43	13.09	22.39	24.28	33.79
	STRONTIUM T	ug/L	18	292	226	194	383	92
	SULFATE T	mg/L	4.92	12.35	14.71	11.32	13.19	22.1
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	0.03	0.027	0.024	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.18	4.27	4.3	3.24	2.89	3.92
	NITRATE & NITRITE T	mg/L	0.18	4.24	4.3	3.24	2.88	3.88
	NITROGEN D	mg/L	0.232	4.248	4.257	3.223	2.834	3.831
	NITROGEN T	mg/L	<0.25	4.18	4.28	3.23	2.77	3.82
	ORTHO PHOSPHORUS D	mg/L	0.012	0.013	0.01	0.011	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	0.011	0.016	0.01	0.011	<0.01	<0.01
	PHOSPHORUS D	mg/L	0.011	0.013	<0.01	<0.01	<0.01	<0.01
	PHOSPHORUS T	mg/L	0.012	0.026	0.016	0.017	<0.01	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	12.6	181.4	220.8	177.4	189.8	243.2
	CBOD	mg/L	4.101	53.79	60.05	43.58	46.5	71.75
	DISSOLVED OXYGEN	mg/L	10.09	10.39	9.27	9.18	9.45	10.75
	HARDNESS T	mg/L	18	218	252	183	195	309
	OSMOTIC PRESSURE	mosm	<1	6	7	6	8	10
	pH	pH units	7.14	8.2	7.99	8.02	8.33	7.97
	SPECIFIC COND	µS/cm[c]	87.9	453	533	455.2	478.9	749
	TDS	mg/L	62	286	318	262	274	460
	TSS	mg/L	<5	<5	<5	<5	<5	6
	TOC	mg/L	<0.5	1.01	0.94	0.82	0.85	0.61

"<" indicate concentrations below the reporting limit

Table A14. August 27, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS					
			1SCR	4SCR	9SCR	11SCR	14SCR	17TR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	18.5	147	82.8	97.2	25.4	37.3
	BARIUM T	ug/L	22	37	32	24	40	24
	BORON T	ug/L	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	<25	37.3
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.54	58.2	64.8	35.3	48.8	68.7
	CHLORIDE T	mg/L	12.83	19.68	30.69	25.35	36.63	70.71
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	208	136	183	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.04	22.6	26.9	14.9	20.5	30.4
	MANGANESE D	ug/L	<10	<10	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	16	11	16	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.4	2.06	1.64	1.8	1.48
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	7.83	8.53	14.4	23.2	24.3	28.7
	STRONTIUM T	ug/L	20	295	246	195	547	82
	SULFATE T	mg/L	3.68	12.42	15.12	9.06	13.98	21.09
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.21	4.8	4.14	2.6	2.51	3.87
	NITRATE & NITRITE T	mg/L	0.19	4.8	4.14	2.59	2.48	3.89
	NITROGEN D	mg/L	0.179	5.047	4.288	2.627	2.569	3.878
	NITROGEN T	mg/L	<0.25	4.84	4.3	2.71	2.48	3.87
	ORTHO PHOSPHORUS D	mg/L	0.011	0.011	0.01	0.017	0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	0.012	0.011	0.01	0.015	0.01	<0.01
	PHOSPHORUS D	mg/L	0.01	0.01	0.011	0.016	0.013	<0.01
	PHOSPHORUS T	mg/L	0.01	0.022	0.017	0.026	0.015	<0.02
PHYSICAL/OTHER	ALKALINITY	mg/L	15.8	194.4	214.6	149.6	197	230.8
	DISSOLVED OXYGEN	mg/L	9.6	9.11	9.03	9.37	9.46	10.85
	HARDNESS T	mg/L	20	239	273	150	206	297
	pH	pH units	7.12	8.07	8.11	8.25	8.36	8.17
	SPECIFIC COND	umhos/cm	85	479.6	547	425.5	513	720
	TDS	mg/L	48	292	322	198	296	408
	TSS	mg/L	<5	<5	<5	<5	<5	<5
	TOC	mg/L	<5	1.07	1.33	1.22	1.4	0.64

"<" indicate concentrations below the reporting limit

Table A15. September 17 and 28, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS						
			1SCR[1]	4SCR[1]	9SCR[1]	11SCR[1]	14SCR[1]	17TR[1]	17TR[2]
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	<15	<15	<15	<15	<15
	ALUMINUM T	ug/L	<15	74.7	41.9	52.4	<15	39.8	17.7
	BARIUM T	ug/L	21	32	28	28	41	27	28
	BORON T	ug/L	<200	<200	<200	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	<25	<25	25.61	37.79	35.11
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.34	54.8	54.8	40	43.9	69	70.44
	CHLORIDE T	mg/L	14.54	22.49	38.47	35.72	43.53	74.04	70.69
	COPPER D	ug/L	<4	<4	<4	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100	<100	<100	<100
	IRON T	ug/L	<100	117	<100	209	<100	<100	<100
	LEAD D	ug/L	<1	<1	<1	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.02	22.2	24.6	17.7	18.9	30.9	31.1
	MANGANESE D	ug/L	<10	<10	<10	<10	<10	<10	<10
	MANGANESE T	ug/L	<10	10	<10	11	<10	<10	<10
	NICKEL D	ug/L	<50	<50	<50	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.26	1.98	1.58	1.5	1.57	1.65
	SELENIUM T	ug/L	<7	<7	<7	<7	<7	<7	<7
	SODIUM T	mg/L	7.77	9.01	16.8	25.7	29.3	30.4	30.24
	STRONTIUM T	ug/L	20	296	252	309	699	89	84
	SULFATE T	mg/L	4	14.4	17.45	12.65	16.91	18.36	19.22
	ZINC D	ug/L	<30	<30	<30	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	0.19	5.03	3.97	2.61	1.86	3.77	3.83
	NITRATE & NITRITE T	mg/L	0.21	4.99	3.95	2.59	1.87	3.76	3.85
	NITROGEN D	mg/L	0.111	5.207	3.994	2.709	1.903	3.864	4.033
	NITROGEN T	mg/L	<0.25	5.13	4.09	2.58	2.06	3.86	4.01
	ORTHO PHOSPHORUS D	mg/L	0.01	0.01	0.01	0.019	<0.01	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	0.013	0.01	0.011	0.018	<0.01	<0.01	<0.01
	PHOSPHORUS D	mg/L	<0.01	0.01	<0.01	0.022	<0.01	<0.01	<0.01
	PHOSPHORUS T	mg/L	<0.01	0.016	0.014	0.026	<0.01	<0.01	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	15.8	199.4	209.6	170.6	191.4	236.4	238.4
	DISSOLVED OXYGEN	mg/L	10.23	10.54	10.31	10.16	11.81	11.56	11.93
	HARDNESS T	mg/L	19	228	238	173	188	300	304
	pH	pH units	7.08	8.17	8.06	8.19	8.49	8.27	8.23
	SPECIFIC COND	umhos/cm	86.6	486	537	453.1	507	713	715
	TDS	mg/L	70	292	306	266	262	408	444
	TSS	mg/L	<5	<5	<5	<5	<5	<5	<5
	TOC	mg/L	<0.5	0.8	1.2	1.19	1.17	0.83	<0.5

[1] September 17, 2020

[2] September 28, 2020

"<" indicate concentrations below the reporting limit

Table A16. October 26, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS			
			1SCR	4SCR	9SCR	11SCR
METALS AND IONS	ALUMINUM D	ug/L	<15	<15	21.6	<15
	ALUMINUM T	ug/L	<15	61.9	265	41.1
	BARIUM T	ug/L	25	35	44	10
	BORON T	ug/L	<200	<200	<200	<200
	BROMIDE	ug/L	<25	<25	29.67	<25
	CADMIUM D	ug/L	<0.2	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	4.864	53.37	74.8	5.569
	CHLORIDE T	mg/L	14.1	20.98	96.52	13.44
	COPPER D	ug/L	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4
	IRON D	ug/L	<100	<100	<100	<100
	IRON T	ug/L	<100	100	560	<100
	LEAD D	ug/L	<1	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25
	MAGNESIUM T	mg/L	2.32	22.57	26.2	1.98
	MANGANESE D	ug/L	<10	<10	27	<10
	MANGANESE T	ug/L	<10	<10	35	12
	NICKEL D	ug/L	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50
	POTASSIUM T	mg/L	<1	1.58	4.42	1.54
	SELENIUM T	ug/L	<7	<7	<7	<7
	SODIUM T	mg/L	8.23	9.07	47.2	32.39
	STRONTIUM T	ug/L	21	297	227	91
	SULFATE T	mg/L	3.1	12.85	22.07	1.67
	ZINC D	ug/L	<30	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	0.049	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	0.04	<0.02
	NITRATE & NITRITE D	mg/L	0.1	-	2.12	-
	NITRATE & NITRITE T	mg/L	0.1	4.84	2.11	2.03
	NITROGEN D	mg/L	0.141	-	2.588	-
	NITROGEN T	mg/L	<0.25	5.24	2.66	2.08
	ORTHO PHOSPHORUS D	mg/L	<0.01	-	0.028	-
	ORTHO PHOSPHORUS T	mg/L	<0.01	0.012	0.025	0.01
	PHOSPHORUS D	mg/L	<0.01	0.016	0.035	0.014
	PHOSPHORUS T	mg/L	<0.01	0.022	0.065	0.017
PHYSICAL/OTHER	ALKALINITY	mg/L	17.2	206.2	246.4	71.2
	DISSOLVED OXYGEN	mg/L	10.44	11.47	6	8.59
	HARDNESS T	mg/L	22	226	295	22
	pH	pH units	7.49	8.29	7.62	7.83
	SPECIFIC COND	umhos/cm	91.7	486.3	801	222.2
	TDS	mg/L	68	226	462	110
	TSS	mg/L	<5	6	14	<5
	TOC	mg/L	0.65	1.32	2.35	<0.5

"<" indicate concentrations below the reporting limit

Table A17. December 1, 2020 Water Chemistry

	PARAMETER	UNITS	STATIONS		
			4SCR	11SCR	14TR
METALS AND IONS	ALUMINUM D	ug/L	<15	42.7	<15
	ALUMINUM T	ug/L	164	66.3	22.9
	BARIUM T	ug/L	44	23	29
	BORON T	ug/L	<200	<200	<200
	BROMIDE	ug/L	<25	51.22	34.48
	CADMIUM D	ug/L	<0.2	<0.2	<0.2
	CALCIUM T	mg/L	55.17	29.24	67.72
	CHLORIDE T	mg/L	36.78	32.53	70.67
	COPPER D	ug/L	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4
	IRON D	ug/L	<100	<100	<100
	IRON T	ug/L	242	137	<100
	LEAD D	ug/L	<1	<1	<1
	LEAD T	ug/L	<1	<1	<1
	LITHIUM D	ug/L	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25
	MAGNESIUM T	mg/L	13.07	10.29	29.02
	MANGANESE D	ug/L	<10	<10	<10
	MANGANESE T	ug/L	<10	<10	<10
	NICKEL D	ug/L	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50
	POTASSIUM T	mg/L	2.08	2.29	1.7
	SELENIUM T	ug/L	<7	<7	<7
	SODIUM T	mg/L	19.18	31.91	31.17
	STRONTIUM T	ug/L	369	211	91
	SULFATE T	mg/L	17.8	10.59	20.09
	ZINC D	ug/L	<30	<30	<30
	ZINC T	ug/L	<30	<30	<30
NUTRIENTS	AMMONIA D	mg/L	<0.02	<0.02	<0.02
	AMMONIA T	mg/L	<0.02	<0.02	<0.02
	NITRATE & NITRITE D	mg/L	2.78	3.06	3.62
	NITRATE & NITRITE T	mg/L	2.88	3.06	3.61
	NITROGEN D	mg/L	3.034	3.219	3.843
	NITROGEN T	mg/L	2.99	3.25	3.8
	ORTHO PHOSPHORUS D	mg/L	0.017	<0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	0.018	0.01	<0.01
	PHOSPHORUS D	mg/L	0.019	0.013	<0.01
	PHOSPHORUS T	mg/L	0.034	0.018	<0.01
PHYSICAL/OTHER	ALKALINITY	mg/L	165	128.6	234
	DISSOLVED OXYGEN	mg/L	11.07	10.89	11.52
	HARDNESS T	mg/L	192	115	289
	pH	pH units	8.25	7.93	8.21
	SPECIFIC COND	umhos/cm	475.9	385.5	703
	TDS	mg/L	270	216	380
	TSS	mg/L	6	8	<5
	TOC	mg/L	2.15	1.48	0.82

"<" indicate concentrations below the reporting limit

APPENDIX B – BENTHIC MACROINVERTEBRATE DATA

Table B1. 2013 Benthic Macroinvertebrate Data

TAXA		STATIONS[1]								REF[1]
		1SCR	3SCR	4SCR	7RR	8SCR	9SCR	17TR	18SCR	SR
Ephemeroptera (Mayflies)										
Baetidae	*Acentrella*	-	-	-	-	-	-	-	-	27
	Baetis	10	-	4	13	-	5	5	2	3
	Diphetor	-	-	-	-	-	-	-	-	1
Isonychiidae	*Isonychia*	-	-	-	-	-	-	-	-	8
Heptageniidae	*Epeorus*	14	-	-	16	-	-	-	-	8
	Leucrocuta	-	-	-	-	-	-	-	-	12
	Stenacron	-	-	-	-	-	-	-	4	-
	Maccaffertium	-	-	-	-	5	3	-	-	5
	Cinygmula	-	-	-	7	-	-	-	-	-
Ephemerellidae	*Drunella*	-	-	-	-	-	-	-	-	24
	Ephemerella	63	2	1	29	-	1	-	-	18
	Eurylophella	-	-	-	-	-	-	-	-	3
	Dannella	-	-	-	-	3	2	-	-	-
	Teloganopsis	-	-	-	-	-	-	-	-	21
Leptophlebiidae	*Paraleptophlebia*	-	-	-	39	2	3	-	1	22
Leptohyphidae	*Tricorythodes*	-	-	-	-	-	1	-	-	-
Plecoptera (Stoneflies)										
Pteronarcyidae	*Pteronarcys*	1	-	-	7	-	-	-	-	-
Peltoperlidae	*Peltoperla*	-	-	-	1	-	-	-	-	-
Nemouridae	*Amphinemura*	42	-	-	2	6	9	-	-	-
Leuctridae	*Leuctra*	4	-	-	3	-	1	-	-	10
Perlidae	*Agnetina*	-	-	-	-	-	-	-	-	1
	Acroneuria	-	-	-	-	-	-	-	-	1
	Perlesta	-	-	-	-	2	2	-	-	-
Perlodidae		-	-	-	-	1	-	-	-	-
	Malirekus	-	-	-	1	-	-	-	-	-
	Isoperla	15	-	-	11	-	-	-	-	-
Chloroperlidae	*Haploperla*	-	-	-	-	-	-	-	-	2
	Sweltsa	7	-	-	1	-	-	-	-	1
Trichoptera (Caddisflies)										
Philopotamidae	*Dolophilodes*	6	-	-	-	-	-	-	-	13
Psychomyiidae	*Lype*	-	-	-	-	-	-	-	1	-
Polycentropidae	*Polycentropus*	-	-	-	-	-	-	-	-	1
Hydropsychidae	*Parapsyche*	6	-	-	-	-	-	-	-	-
	Diplectrona	-	-	-	9	-	-	-	-	1
	Cheumatopsyche	-	-	-	-	5	20	-	3	5
	Hydropsyche	-	4	15	3	5	5	-	3	3
Rhyacophilidae	*Rhyacophila*	1	-	-	5	-	-	-	-	-
Glossosomatidae	*Agapetus*	-	-	-	-	3	8	-	-	-
Hydroptilidae	*Palaeagapetus*	1	-	-	-	-	-	-	-	-
	Hydroptila	-	-	2	-	-	-	13	1	-
Lepidostomatidae	*Lepidostoma*	-	-	-	1	-	-	-	-	1
Thremmatidae	*Neophylax*	-	3	-	13	4	-	-	-	5
Molannidae	*Molanna*	1	-	-	-	-	-	-	-	-
Leptoceridae	*Triaenodes*	-	-	-	-	-	-	-	1	-
Odontoceridae	*Psilotreta*	-	-	-	1	-	-	-	-	-

Table B1 (cont.). 2013 Benthic Macroinvertebrate Data

TAXA		STATIONS[1]								REF[1]
		1SCR	3SCR	4SCR	7RR	8SCR	9SCR	17TR	18SCR	SR
Diptera (True Flies)										
Ceratopogonidae	*Probezzia*	-	-	-	-	-	3	1	-	-
Psychodidae	*Pericoma*	1	-	-	-	-	-	1	-	-
Empididae	*Chelifera*	-	-	-	-	-	-	-	-	1
	Hemerodromia	-	-	-	-	-	-	1	-	-
	Neoplasta	-	-	-	-	-	-	-	3	-
Tipulidae	*Antocha*	-	2	6	2	5	-	1	12	3
	Dicranota	1	-	-	-	-	-	-	-	-
	Hexatoma	1	-	-	1	-	-	-	-	-
Limoniidae	*Pseudolimnophila*	-	-	-	-	-	-	-	-	1
Simuliidae	*Prosimulium*	-	-	-	1	-	-	-	-	-
	Simulium	4	-	1	2	-	1	-	1	2
Chironomidae		46	19	47	19	122	127	32	100	23
Odonata (Dragon/ Damselflies)										
Gomphidae	*Lanthus*	-	-	-	2	-	-	-	-	1
Coenagrionidae	*Enallagma*	-	-	-	-	-	-	1	-	-
Spongillaflies (Spongeflies)										
Sisyridae	*Climacia*	-	-	-	-	-	-	-	2	-
Coleoptera (Aquatic Beetles)										
Dytiscidae	*Agabus*	-	-	-	-	-	1	-	-	-
Psephenidae	*Psephenus*	-	-	-	-	-	-	-	-	3
Elmidae	*Dubiraphia*	-	-	-	-	6	6	-	-	-
	Optioservus	-	25	22	9	33	17	-	5	4
	Oulimnius	-	-	-	9	-	-	-	-	-
	Promoresia	-	-	-	-	-	-	-	-	1
	Stenelmis	-	-	-	-	8	3	-	1	-
Non-Insect Taxa										
Turbellaria		-	4	-	-	-	-	30	-	-
Nematoda		-	-	-	-	-	2	6	1	-
Hydrobiidae		-	37	-	-	-	-	13	-	-
Physidae		-	1	-	-	-	-	3	-	-
Sphaeriidae		-	1	-	-	-	-	2	-	-
Hirudinea		-	-	-	-	-	2	-	-	-
Oligochaeta		-	3	2	1	2	9	134	17	-
Crangonyctidae	*Crangonyx*	-	-	-	-	1	6	-	-	-
Gammaridae	*Gammarus*	-	56	19	-	-	-	94	-	-
Asellidae	*Caecidotea*	-	-	-	-	2	2	-	-	-
	Lirceus	-	39	115	-	-	-	-	81	-
Ostracoda		-	-	-	-	-	-	12	-	-
Hydracarina		1	3	1	-	-	1	3	-	-
Total		225	199	235	208	215	240	352	239	235
IBI[2]		**72.2**	**30.2**	**24.8**	**88.1**	**41.2**	**48.1**	**52.4[3]**	**31.7**	**94.2**

[1] Refer to Figure 1 and/or Table 1 for station locations
[2] IBI < 50(CWF) OR < 63(HQ-CWF) = Impaired
[3] IBI < 60 (Limestone) = Impaired
"-" indicate taxa was not identified at a particular station

Table B2. 2019 Benthic Macroinvertebrate Data

TAXA		STATIONS[1]								
		1SCR	3SCR	4SCR	7RR	9SCR	11SCR	14SCR	17TR	18SCR
Ephemeroptera (Mayflies)										
Baetidae	*Baetis*	33	11	9	18	35	42	71	-	9
Ephemerellidae	*Ephemerella*	64	13	-	83	-	-	1	-	-
Heptageniidae	*Cinygmula*	-	-	-	1	-	-	-	-	-
	Epeorus	3	-	-	6	-	-	-	-	-
	Maccaffertium	-	-	-	-	2	-	20	-	-
Leptophlebiidae	*Paraleptophlebia*	1	-	-	13	-	-	-	-	-
Plecoptera (Stoneflies)										
Chloroperlidae	*Sweltsa*	2	-	-	-	-	-	-	-	-
Leuctridae	*Leuctra*	40	-	-	9	-	-	-	-	-
Nemouridae	*Amphinemura*	15	-	-	5	13	-	-	-	-
Peltoperlidae	*Peltoperla*	-	-	-	1	-	-	-	-	-
Perlodidae	*Isoperla*	14	-	-	11	-	-	-	-	-
Pteronarcyidae	*Pteronarcys*	-	-	-	5	-	-	-	-	-
Trichoptera (Caddisflies)										
Glossosomatidae	*Agapetus*	-	-	-	-	7	-	-	-	-
Hydropsychidae	*Cheumatopsyche*	-	3	-	-	12	-	2	-	-
	Diplectrona	7	-	-	6	-	-	-	-	-
	Hydropsyche	-	3	10	2	10	1	9	-	5
	Parapsyche	3	-	-	-	-	-	-	-	-
Lepidostomatidae	*Lepidostoma*	1	-	-	1	-	-	-	-	-
Philopotamidae	*Chimarra*	-	-	-	-	12	1	11	-	1
	Dolophilodes	-	-	-	2	-	-	-	-	-
Polycentropidae	*Polycentropus*	-	-	-	-	-	-	1	-	-
Rhyacophilidae	*Rhyacophila*	5	5	1	4	-	-	7	-	-
Thremmatidae	*Neophylax*	-	1	6	-	1	-	2	-	-
Diptera (True Flies)										
Ceratopogonidae	*Bezzia*	-	-	-	-	1	-	1	-	-
	Probezzia	-	-	-	1	-	-	-	-	-
Chironomidae		16	26	8	16	59	10	36	4	16
Empididae	*Chelifera*	1	-	-	-	-	-	-	-	-
	Hemerodromia	-	-	-	-	1	-	1	-	-
Psychodidae	*Pericoma*	-	2	-	-	-	-	-	-	-
Simuliidae	*Prosimulium*	1	-	-	1	-	-	-	-	-
	Simulium	-	3	1	-	9	-	2	-	1
Tipulidae	*Antocha*	-	-	-	3	-	-	-	-	-
	Hexatoma	-	-	-	1	-	-	-	-	-
	Tipula	-	-	-	-	-	-	4	1	-
Odonata (Dragonflies)										
Gomphidae	*Lanthus*	-	-	-	2	-	-	-	-	-
Coleoptera (Aquatic Beetles)										
Elmidae	*Optioservus*	-	26	20	1	10	3	16	-	10
	Oulimnius	-	-	-	9	-	-	-	-	-
	Stenelmis	-	-	-	-	12	-	12	-	2
Psephenidae	*Psephenus*	-	-	-	-	-	-	3	-	-
(Water Mites)										
Hydrachnidia	*Acari*	-	-	-	-	1	-	-	-	-

Table B2 (cont.). 2019 Benthic Macroinvertebrate Data

TAXA		STATIONS								
		1SCR	3SCR	4SCR	7RR	9SCR	11SCR	14SCR	17TR	18SCR
Non-Insect Taxa										
Hirudinea		-	1	2	-	-	1	-	1	-
Oligochaeta		2	-	3	-	8	1	2	55	6
Crustacea										
Asellidae	*Caecidotea*	-	-	-	-	10	-	1	-	-
	Lirceus	-	13	119	-	-	-	-	-	54
Crangonyctidae	*Crangonyx*	-	-	-	-	4	5	1	-	-
Gammaridae	*Gammarus*	-	78	20	-	-	-	-	3	-
Mollusca										
Hydrobiidae		-	26	1	-	3	153	2	240	117
Planorbidae		-	-	-	1	1	-	-	3	-
Sphaeriidae		-	-	-	-	-	-	-	-	1
Valvatidae		-	-	-	-	-	-	-	10	-
Total		**208**	**211**	**200**	**202**	**211**	**217**	**205**	**317**	**222**
IBI[2]		**71.4**	**35.3**	**24.7**	**80.4**	**41.5**	**16.4**	**42.5**	**24.2[3]**	**19.9**

[1] Refer to Figure 1 and/or Table 1 for station locations
[2] IBI < 50(CWF) OR < 63(HQ-CWF) = Impaired
[3] IBI < 60 (Limestone) = Impaired
"-" indicate taxa was not identified at a particular station

TELL US WHAT **YOU THINK!**

State Transportation Commission (STC)
2023 Public Outreach Campaign for the Update of the 12-Year Program

Stakeholders Initial Email: **Wednesday, March 1**

You are a key stakeholder in transportation planning, and we encourage you to share the following information with your audience!

The State Transportation Commission (STC) and the Pennsylvania Department of Transportation are excited to announce the 2023 Public Comment Period for the update of the 12-Year Program. The Public Comment Period is open Wednesday, March 1, through Sunday, April 30, 2023.

The STC recently released the 2023 Transportation Performance Report (TPR). This report contains information about how Pennsylvania's transportation system performed over the last two years. We encourage you to read and share the report and then - Tell Us What YOU Think!

Your feedback is important! Please take a few minutes to complete our Transportation Survey online or contact us at 717-783-2262 to request a paper copy or to complete the survey over the phone.

We also encourage you to join us for the Online Public Forum on Wednesday, April 12, 2023, featuring a presentation from PennDOT State Transportation Commission officials and a live Q&A session. More details will follow, so you'll be hearing from us again soon!

The internet links included in this content may be blocked due to internet security settings. To view the content referenced in these links, please visit the State Transportation Commission website at TalkPATransportation.com.

Thank You!