pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOUTHCENTRAL REGIONAL OFFICE
CLEAN WATER PROGRAM

Application Type	**Renewal**	Application No.	**PA0030643**
Facility Type	**Sewage**	APS ID	**275994**
Major / Minor	**Major**	Authorization ID	**1244400**

NPDES PERMIT FACT SHEET ADDENDUM

Applicant and Facility Information

Applicant Name	**Shippensburg Borough**	Facility Name	**Shippensburg Borough STP**
Applicant Address	111 N Fayette Street	Facility Address	963 Avon Drive
	Shippensburg, PA 17257-1101		Shippensburg, PA 17257-8121
Applicant Contact	John Epley	Facility Contact	Wade Farner
Applicant Phone	(717) 532-5414	Facility Phone	(717) 532-5414
Client ID	121190	Site ID	452150
SIC Code	4952	Municipality	Shippensburg Borough
SIC Description	Trans. & Utilities - Sewerage Systems	County	Cumberland
Date Published in PA Bulletin	August 27, 2022	EPA Waived?	No
Comment Period End Date	September 27, 2022	If No, Reason	Major Discharge, CB Significant Discharge
Purpose of Application	Application for a renewal of an NPDES permit for discharge of treated Sewage		

Internal Review and Recommendations

A draft permit was prepared on August 15, 2022 and published in the *Pennsylvania Bulletin* on August 27, 2022 for public comments for 30 days. During the public commenting period, US EPA has provided comments via email dated September 15, 2022. Several correspondences have exchanged between DEP and EPA. These emails have been attached to this fact sheet addendum.

A meeting was held on October 13, 2022 with Shippensburg Borough. During the meeting, the Borough indicated that the currently-installed units are sufficient enough to handle wastewater and no further upgrade is needed which includes the IFAS media that was proposed/permitted previously. At the request of DEP, the Borough submitted a post-construction certification form along with a detailed report indicating that all construction pertaining to the WQM permit is finished.

Based on this and given the fact that the draft permit was prepared more than 6 months ago, a redraft is recommended. The redraft will no longer have any interim conditions that were developed for a pre-construction period since the construction is officially completed. This redraft will be published in the *Pennsylvania Bulletin* for 30 days for public comments.

Approve	Return	Deny	Signatures	Date
X			*Jinsu Kim* Jinsu Kim / Environmental Engineering Specialist	June 1, 2023
X			Dan W. Martin Daniel W. Martin, P.E. / Environmental Engineer Manager	June 14, 2023
X			Maria D. Bebenek Maria D. Bebenek, P.E. / Program Manager	June 16, 2023

Kim, Jin Su

From: Kim, Jin Su
Sent: Monday, October 31, 2022 7:53 AM
To: Hales, Dana
Subject: RE: [External] PA0030643 Shippensburg Borough STP

No. there will only be one set for the upgraded plant as the interim WET dilution would no longer be needed.

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Monday, October 24, 2022 4:47 PM
To: Kim, Jin Su <jikim@pa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Jinsu,

Thanks for the follow up email. If the upgrade is not expected to be completed during the permit cycle, do you intend to keep the two sets of WET dilutions in the permit? Sorry, I just wasn't sure I was clear on your thoughts for that scenario.

Thanks,
Dana

Dana Hales (she/her)
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Water Division, Clean Water Branch
Permits Section
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Philadelphia, PA 19103-2852

Phone: 215.814.2928
Email: hales.dana@epa.gov

From: Kim, Jin Su <jikim@pa.gov>
Sent: Thursday, October 20, 2022 2:16 PM
To: Hales, Dana <Hales.Dana@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Dana,

I apologize for the late response. I wanted to respond your email once I meet with Shippensburg. Based on the information we have, it appears the upgrade may be completed in the near future. Please note that this upgrade has been ongoing for a few years now (even prior to the last permit renewal I believe). I should have more information

shortly but if the upgrade is in fact completed during this permit renewal review period, I will revise the current draft to eliminate any interim (or any schedule) associated with this upgrade which of course would include the WET testing schedules we have discussed. The revised draft permit will once again be sent to EPA for review/comment for another 30 days.
Thanks,
Jinsu

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Monday, September 26, 2022 4:36 PM
To: Kim, Jin Su <jikim@pa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Jinsu,

I appreciate the creativity here, and to be honest I had to think about this one for a little bit. I understand what you're trying to do, but I think what's still missing with this proposal is the fact that the WET testing will need to represent the data after plant construction (capturing the TIWC for a plant pre-construction wouldn't capture that). Since we don't know when the construction will be completed, I think the concern is in trying to avoid requiring the facility to submit too much "extra" WET testing – is that correct?

The only thing I can think to suggest is that the permit language be modified to just require quarterly WET testing with the renewal application. I know this is not PA's template for WET language, and you may not want to venture that far off of the statewide procedures (or want to confer with Central Office before doing so), but in making this change you could require quarterly WET testing with the application that would either involve pre or post construction WET testing. This would give the facility the majority of the permit cycle to see where the construction status is, and if the facility hasn't completed construction, its WET tests would represent the plant at the 4.3 MGD design flow. If the facility has completed construction, they could complete quarterly WET testing for the upgraded plant (4.95 MGD flow). Of course if the facility needed additional time to submit the renewal application to conduct quarterly tests for the upgraded plant, they would have to get that approval from DEP in accordance with 40 CFR 122.21(d). Quarterly WET testing for the permit renewal application is also consistent with federal regulatory requirements at 122.21(j)(5)(iv).

Let me know if you need to discuss.
Dana

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Phone: 215.814.2928
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From: Kim, Jin Su <jikim@pa.gov>
Sent: Friday, September 23, 2022 9:48 AM
To: Hales, Dana <Hales.Dana@epa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <Martinsen.Jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Dana,

Based on internal discussion, we would like to make a slight change to the WETT requirement and I wanted to see if the proposed change is acceptable to EPA. Instead of requiring them conducting a WET testing using a standard dilution series based on the TIWC, we would modify the dilution series so that such dilution series covers TIWCs under both construction phases. I believe this would likely address your concern and more importantly it would not require any additional WET tests. See tables below. Please let me know your thoughts on this. Thanks. Jinsu

Current Proposed Requirement

Phases	Design Flow (MGD)	Dilution Series	TIWC
During Construction	4.3	17%, 34%, 68%, 84% and 100%	68%
Upon Completion of Construction	4.95	18%, 36%, 71%, 86%, and 100%	71%

New Requirement

Phases	Design Flow (MGD)	Dilution Series	TIWC
During Construction	4.3	17%, 34%, 68%, 71% and 100%	68%
Upon Completion of Construction	4.95		71%

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Thursday, September 22, 2022 8:44 AM
To: Kim, Jin Su <jikim@pa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Great, thank you.
Dana

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Email: hales.dana@epa.gov

From: Kim, Jin Su <jikim@pa.gov>
Sent: Thursday, September 22, 2022 8:42 AM
To: Hales, Dana <Hales.Dana@epa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <Martinsen.Jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Sure. I will send you a fact sheet addendum prior to finalizing the permit.

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Thursday, September 22, 2022 8:35 AM
To: Kim, Jin Su <jikim@pa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

OK, thanks Jinsu. The response to #2 is a recommendation we have made for similar types of situations. I think it's going to be a judgement call about how soon the upgrade is completed. If there is adequate time left in the permit cycle (post-construction) for the permittee to collect the four WET tests for consideration in the renewal, that would be most appropriate. If the timing is such that this is not possible, the recommendation in #2 is certainly an option.

Can you share the fact sheet addendum with us when it is ready? I know we would ultimately get this when the permit is issued, but having this in advance documents PADEP's response to the comment.

Thanks!
Dana

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From: Kim, Jin Su <jikim@pa.gov>
Sent: Thursday, September 22, 2022 7:58 AM
To: Hales, Dana <Hales.Dana@epa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <Martinsen.Jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Dana,

Thanks for your response. I think you answered my questions and the response to Item No. 2 is quite interesting. I am supposed to have a meeting with Shippensburg sometime in mid-October for different reasons but I will discuss this with them. A fact sheet addendum will address this as well.
Jinsu

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Wednesday, September 21, 2022 4:46 PM
To: Kim, Jin Su <jikim@pa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Jinsu,

Thanks for the questions. I've tried to provide some responses below in blue font, next to each of your questions. Let me know if my responses address your questions or if we need to talk further, which I am of course happy to do.

Dana

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From: Kim, Jin Su <jikim@pa.gov>
Sent: Friday, September 16, 2022 8:13 AM
To: Hales, Dana <Hales.Dana@epa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <Martinsen.Jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

I completely understood what you are looking for but I have some questions as to why it is absolutely necessary to use only WETT results done post-construction for an RP assessment; I would appreciate it if you can provide further guidance.

1. 40 CFR 122.21(j)(5)(iv)(B) requires permittees to submit four tests with the application but does not seem to consider the facility condition. 40 CFR 122.44(d)(1)(ii) only discusses the "sensitivity of the species to toxicity testing" in an RP assessment using WETT. Can you provide any regulatory citation that addresses situation(s) like this so I can use it in my justification to apply the requirement you recommended? You're correct, the regulations just indicate that four quarterly or four annual WET tests need to be conducted and submitted with

the permit application. It does not specify the facility condition, but there are a few reasons why the four WET tests would need to capture the upgrades to the facility. First, the upgrade includes an increase to the design flow. With a change to the design flow, the TIWC changes as well. The TIWC is the critical effluent concentration at which WET RP would be evaluated. So, if the upgrade occurs before the end of the permit cycle (say in year 2 or 3), I think you would need to evaluate the WET tests post-upgrade to see if they show RP for WET or not. Additionally, PADEP uses the TST to evaluate WET data. EPA's 2010 NPDES Test of Significant Toxicity Technical Document (see Section 4.6 RP WET Analysis) states that using the TST to evaluate RP for WET necessitates having a minimum of four valid WET tests to address effluent representativeness (the TST approach is intended for larger data sets (four or more) because it does not use an RP multiplying factor). To me that indicates that you need a minimum of four valid tests that evaluate toxicity at the TIWC in question.

2. This is not likely the case for this facility but what would happen if the facility did not get to complete the construction prior to submitting the next renewal application but completed the construction prior to the end of the permit term (or prior to my review on the next renewal application)? Would I need to put the application on hold until I receive 4 additional tests? I certainly do not want them to conduct four weekly/monthly testing but can accept quarterly testing which means I would have to wait at least one year to receive all four test results. I hear the question. I do think that if the facility has completed four WET tests for the current design flow and submits that with the permit application, but happens to complete construction prior the expiration date of the permit without having adequate time to conduct WET tests for the upgraded design flow – I think PADEP could consider basing the WET RPA on the tests completed for the current design flow, and including accelerated (i.e., quarterly WET testing) in the first year of the permit to evaluate those results. The expectation in this kind of situation would be that if RP is demonstrated in the first year of the permit term, the permit would need to be modified to include effluent limits for WET. But in this scenario, the permit reissuance would not be held up an additional year waiting for WET test data for the upgraded plant.
3. When you discussed the upgrade, are you referring to only the change in design flows? Is there a degree (or type) of upgrade that would trigger this requirement? Many facilities tend to continuously improve (or upgrade) their facilities without changing the design flow (i.e., expansion). Is it just an expansion that you would consider to apply this requirement? Do you have any example that perhaps you can share? I think the most common reason to modify the WET testing requirements would be related to the change in the Q7-10 flow and/or the facility's design flow, as either of those two factors could change the critical effluent concentration at which WET RP is evaluated (the TIWC). So I think that a change in the design flow of the facility would be the main upgrade that would trigger a change in the WET condition requirements.
4. If the change in design flow is the factor, what if the facility only expects to receive additional flows only from residential/commercial units? I do not believe effluent toxicity would significantly be different if additional flows are only from residential/commercial units. Toxicity may not be different, but I think we need to remember that with a change in design flow, the TIWC is likely to change and it needs to be demonstrated that there is no toxicity at that critical effluent concentration.

I am sorry to bother you with all these questions but when I apply this requirement, I expect the permittee to ask some of these questions which I do not have any answer for them.
Jinsu

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From: Hales, Dana <Hales.Dana@epa.gov>
Sent: Thursday, September 15, 2022 3:11 PM

To: Kim, Jin Su <jikim@pa.gov>
Cc: Martin, Daniel <daniemarti@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hi Jinsu,

Thanks for the prompt reply! I am good with your response to #1. That sounds like an appropriate approach.

Regarding #2 - I completely understand the intent behind the annual WET monitoring in the permit and I think it makes sense. My comment was trying to convey that IF the facility does in fact complete the upgrade prior to the end of the permit term (which I realize is an unknown right now), the permittee may not have completed 4 WET tests for the upgraded facility upon permit reissuance. In this scenario, I think the permittee should understand that if the upgrade is completed prior to permit expiration, 4 WET tests post-construction would be needed in order for PADEP to complete an RP assessment for the upgraded plant's permit reissuance. Without this clarification in the permit, you may have to once again ask for additional tests to evaluate RP for WET for the next reissuance. That was the reason behind the comment. If PADEP wants to maintain the WET condition as it is and ask for additional WET tests, as needed, that is your option. However, I do think the permittee should understand the expectations for the amount of data you will need if the upgrade is completed within the next 5 yrs.

If you choose to keep the WET condition the same, I think the fact sheet should at least clarify the amount of data needed if the upgrade is completed in the next 5 yrs so that the permittee is aware.

Let me know your thoughts.
Thanks,
Dana

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From: Kim, Jin Su <jikim@pa.gov>
Sent: Thursday, September 15, 2022 1:43 PM
To: Fulton, Jennifer <Fulton.Jennifer@epa.gov>
Cc: sefurjanic@pa.gov; Schumack, Maria <maschumack@pa.gov>; Martin, Daniel <daniemarti@pa.gov>; Bebenek, Maria <mbebenek@pa.gov>; Martinsen, Jessica <Martinsen.Jessica@epa.gov>; Hales, Dana <Hales.Dana@epa.gov>; Shuart, Ryan <shuart.ryan@epa.gov>; Sanchez Gonzalez, Natalie <sanchez-gonzalez.natalie@epa.gov>
Subject: RE: [External] PA0030643 Shippensburg Borough STP

Hello,

This is in response to your draft permit comments:

1. Part C.II Condition of the draft permit will be removed and replaced with a following condition: The permittee shall provide a quarterly construction progress report to DEP until completion of construction.

2. The final completion of construction for the proposed upgrade is unclear at this time. Therefore, DEP has determined that requiring annual WET Testing would be the best option to continuously monitor effluent toxicity before and after upgrade. If EPA has any specific suggestions, please let me know.

The change mentioned in Item 1 is considered a minor modification; therefore, DEP tends to finalize the permit unless further comments/questions received from public, permittee or EPA.
Thanks,
Jinsu

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From: Fulton, Jennifer <Fulton.Jennifer@epa.gov>
Sent: Thursday, September 15, 2022 1:19 PM
To: Kim, Jin Su <jikim@pa.gov>
Cc: Furjanic, Sean <sefurjanic@pa.gov>; Schumack, Maria <maschumack@pa.gov>; Martin, Daniel <daniemarti@pa.gov>; Bebenek, Maria <mbebenek@pa.gov>; Martinsen, Jessica <martinsen.jessica@epa.gov>; Hales, Dana <Hales.Dana@epa.gov>; Shuart, Ryan <shuart.ryan@epa.gov>; Sanchez Gonzalez, Natalie <sanchez-gonzalez.natalie@epa.gov>
Subject: [External] PA0030643 Shippensburg Borough STP

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Jinsu,

According to our Memorandum of Agreement, the Environmental Protection Agency (EPA) Region III has received the draft National Pollutant Discharge Elimination System (NPDES) permit for:

Shippensburg Borough STP
NPDES Number: PA0030643
EPA Received: August 17, 2022
30-day response due date: September 16, 2022

This is a major permit that discharges to Middle Spring Creek, is a significant Chesapeake Bay discharger, and is affected by the Conodoguinet Creek Watershed TMDL. EPA has performed a limited review of the draft permit based on the wasteload allocation (WLA) requirements of the approved Chesapeake Bay Watershed and Conodoguinet Creek Watershed TMDLs, Pretreatment, and WET requirements. EPA has completed its review and offers the following comments:

1. The permit includes a compliance schedule for the construction of the upgraded plant to 4.95 MGD, but the schedule does not meet the requirements of 40 CFR 122.47. There is no end date for compliance, nor enforceable milestones leading to compliance. However, it doesn't appear that this upgrade would require a schedule in the permit. Since there are appropriate effluent limitations in the permit for each design flow, this can be viewed as a tiered permit where one set of limitations apply to the 4.3 MGD flow, and another set of limitations apply to the upgraded 4.95 MGD flow when construction is completed. If the upgrade is occurring to meet a proposed final limit, such as a WQBEL, then that situation would need to be considered differently. That

did not appear to be the case, but please clarify if there is a misunderstanding. We would recommend that Part C.II. of the permit be removed, and if PADEP still wants progress reports submitted that requirement can be added as a Part C condition. If PADEP wants to maintain a compliance schedule in the permit for the plant upgrade the permit will need to include a final date for compliance with annual milestones (not solely progress reports) leading to compliance.

2. Regarding the proposed WET monitoring - the permit should be clear that if the plant upgrade is completed before the end of the permit term, a minimum of four WET tests for the upgraded plant would need to be completed and submitted with the permit renewal application so that PADEP can conduct an adequate WET RP analysis for the next permit reissuance.

Please address the above and provide us with any changes to the draft permit and/or fact sheet, if necessary. Please contact Dana Hales on my staff via telephone at 215-814-2928 or via electronic mail at hales.dana@epa.gov.

Thank you,

Jen Fulton

Jennifer Fulton
Acting Chief, Clean Water Branch
US EPA Mid-Atlantic Region
Phone 304-234-0248
Email fulton.jennifer@epa.gov

3800-PM-WSFR0179a 9/2005
Post Construction Certification

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER STANDARDS AND FACILITY REGULATION

WATER QUALITY MANAGEMENT
POST CONSTRUCTION CERTIFICATION

PERMITTEE IDENTIFIER	
Permittee	Borough of Shippensburg
Municipality	Borough of Shippensburg & Southampton Township
County	Cumberland & Franklin
WQM Permit No.	WQ 2105402 issued 12/28/18
Facility Type	Sewage

All of the above information should be taken directly from the Water Quality Management Permit.

CERTIFICATION

This certification must be completed and returned to the permits section of the DEP's regional office issuing the WQM permit within 30 days of completion of the project and received by DEP prior to operation, and if requested, as-built drawings, photographs (if available) and a discussion of any DEP-approved deviations from the design plans during construction.

I, being a Registered Professional Engineer in Pennsylvania, do hereby certify to the best of my knowledge and belief, based upon personal observation and interviews, that the above facility approved under the Water Quality Management Permit has been constructed in accordance with the plans, specifications and modifications approved by DEP. See attached narrative modifying this section.

Construction Completion Date (MM/DD/YYYY): 05/05/2023

Engineer's Seal

Professional Engineer

Name Max E. Stoner, P.E.
(Please Print or Type)

Signature Max E. Stoner

Date 5/5/23

License Expiration Date 9/30/23

Firm or Agency Glace Associates, Inc.

Telephone 717-731-1579

Permittee or Authorized Representative

Name Kevin Plastener
(Please Print or Type)

Signature Kevin Plastener

Title Manager

Telephone 717-532-2147

GLACE ASSOCIATES, INC.
CONSULTING ENGINEERS
3705 Trindle Road
Camp Hill, PA 17011

717-731-1579 FAX • 717-731-1348

SHIPPENSBURG BOROUGH WASTEWATER TREATMENT PLANT
CUMBERLAND AND FRANKLIN COUNTIES

NARRATIVE TO ACCOMPANY THE
WATER QUALITY MANAGEMENT
POST CONSTRUCTION CERTIFICATION

The Borough of Shippensburg is requesting an amendment to its last WQM Permit to address changes to the wastewater process to delete the plastic IFAS media to be installed in the IFAS system. This amendment is being requested for the following reasons:

1. Based on operating experience, the current secondary screening system is not suitable to protect the IFAS media and associated internal process screening from blinding and causing hydraulic issues.
2. The Borough had Glace Associates, Inc. conduct an evaluation of the secondary screening system that would be compatible with the IFAS media and internal process screening. The most cost-effective retrofit would be a complete new structure and 3 new screens. The cost of this option was prohibitive as the Borough and CFJMA boards could not afford to pass the additional expense on to their customers, especially after investing millions of dollars on the recent major upgrades.
3. As the IFAS media's primary purpose was to improve the effluent from BNR to ENR, the wastewater owner's group could not justify the additional expense at this time, as the BNR portion of the upgrade project achieves compliance with the current and anticipated NPDES effluent limits.

The current operating conditions over a several year period demonstrate that the IFAS treatment process without the IFAS media and internal tank media screens meet the effluent discharge limitations in the Borough's current NPDES permit. See attached excerpts from the 2020, 2021 and 2022 Chapter 94 reports. Also, in 2023 there have been no identified effluent violations from the Borough WWTP.

While the flows are not up to the 4.95 MGD design and permitted flow on a routine basis, the previous Part 2 submitted calculations prepared by Hazen and Sawyer in 2014 indicate that the existing treatment process, without the IFAS media and media screens in the tanks, should continue to achieve compliance with the plant's NPDES discharge requirements. All observations to date and sample results taken over the past 3 years indicate that even with the removal of the media and internal tank screens ,the robust aeration system is sufficient to continue compliance with the current NPDES effluent requirements.

GLACE ASSOCIATES, INC.

Therefore, it is our professional opinion that the Borough of Shippensburg Wastewater Treatment Plant is capable of being in compliance with its current and proposed NPDES effluent limitations without the IFAS media and internal screens. The Borough of Shippensburg and its partner in the plant, Cumberland-Franklin Joint Municipal Authority, request approval of this Post Construction Certification with the elimination of the IFAS media and internal screens for the most recent major plant upgrade.

If additional information is required to substantiate this request, do not hesitate to contact me.

Sincerely,

Max E. Stoner, P.E.
President

pc: Borough of Shippensburg
Cumberland-Franklin Joint Municipal Authority
IIT Environmental

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MAX E. STONER
ENGINEER
No. 031770-E
5/5/23

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PADEP Chapter 94 Spreadsheet
Sewage Treatment Plants

Reporting Year: 2020

Facility Name: Shippensburg Borough Authority WWTP

Permit No.: PA0030643

Persons/EDU: 3.6

Existing Hydraulic Design Capacity: 4.3 MGD
Upgrade Planned in Next 5 Years? YES Year: 2021
Future Hydraulic Design Capacity: 4.95 MGD

Existing Organic Design Capacity: 7,531 lbs BOD5/day
Upgrade Planned in Next 5 Years? YES Year: 2021
Future Organic Design Capacity: 7,531 lbs BOD5/day

Monthly Average Flows for Past Five Years (MGD)

Month	2016	2017	2018	2019	2020
January	2.0214	1.957	2.8545	3.447	2.241
February	2.9518	1.975	2.8496	3.286	2.35
March	2.3948	2.046	2.5755	3.831	2.329
April	2.2703	2.217	2.7133	3.32	2.293
May	2.1836	2.158	2.469	3.595	2.521
June	1.9803	1.964	2.266	3.021	2.279
July	1.888	1.929	2.5023	2.665	2.116
August	1.8581	2.2*	2.633	2.824	2.225
September	1.9107	1.992	3.0703	2.263	2.219
October	1.9045	2.037	2.7642	2.293	2.14
November	1.8437	2.104	3.584	2.764	2.085
December	1.9535	1.965	3.1881	2.259	2.322
Annual Avg	2.0949	2.046	2.7208	2.861	2.268
Max 3-Mo Avg	2.539	2.14	3.1768	3.516	2.411
Max : Avg Ratio	1.21	1.05	1.17	1.23	1.06
Existing EDUs	7,603.0	7,670.0	7,796.0	8,000.0	8,129.0
Flow/EDU (GPD)	275.5	266.8	348.9	357.6	279.0
Flow/Capita (GPD)	76.7	76.2	99.7	102.2	79.7
Exist. Overload?	NO	NO	NO	NO	NO

Monthly Average BOD5 Loads for Past Five Years (lbs/day)

Month	2016	2017	2018	2019	2020
January	3,981	4,453	3,657	4,685	5,532
February	4,915	5,387	3,442	4,167	4,587
March	4,730	3,502	3,393	3,849	5,070
April	3,755	3,786	4,360	3,795	4,174
May	4,880	3,876	3,634	4,827	3,637
June	3,744	2,958	3,631	4,812	3,287
July	3,896	3,405	2,839	3,400	2418.0
August	3,041	3,372	3,186	3,411	2834.0
September	4,075	3,356	2,639	3,397	3128.0
October	4,010	3,352	4,154	3,597	3266.1
November	4,649	4,086	4,381	3,587	3529.9
December	5,129	5,748	3,755	4,313	3776.3
Annual Avg	4,217	3,777	3,589	3,982	3,787
Max Mo Avg	5,129	5,387	4,381	4,827	5,532
Max : Avg Ratio	1.22	1.43	1.22	1.21	1.47
Existing EDUs	7,603	7,670	7,796	8,000	8,129
Load/EDU	0.555	0.492	0.460	0.498	0.463
Load/Capita	0.158	0.141	0.131	0.142	0.132
Exist. Overload?	NO	NO	NO	NO	NO

Projected Flows for Next Five Years (MGD)

	2021	2022	2023	2024	2025
New EDUs	85.0	90.0	95.0	96.0	95.0
New EDU Flow	0.326	0.0275	0.029	0.0293	0.029
Proj. Annual Avg	2.4241	2.4516	2.4806	2.5099	2.5389
Proj. Max 3-Mo Avg	2.7723	2.8036	2.8369	2.8706	2.9036
Proj. Overload?	NO	NO	NO	NO	NO

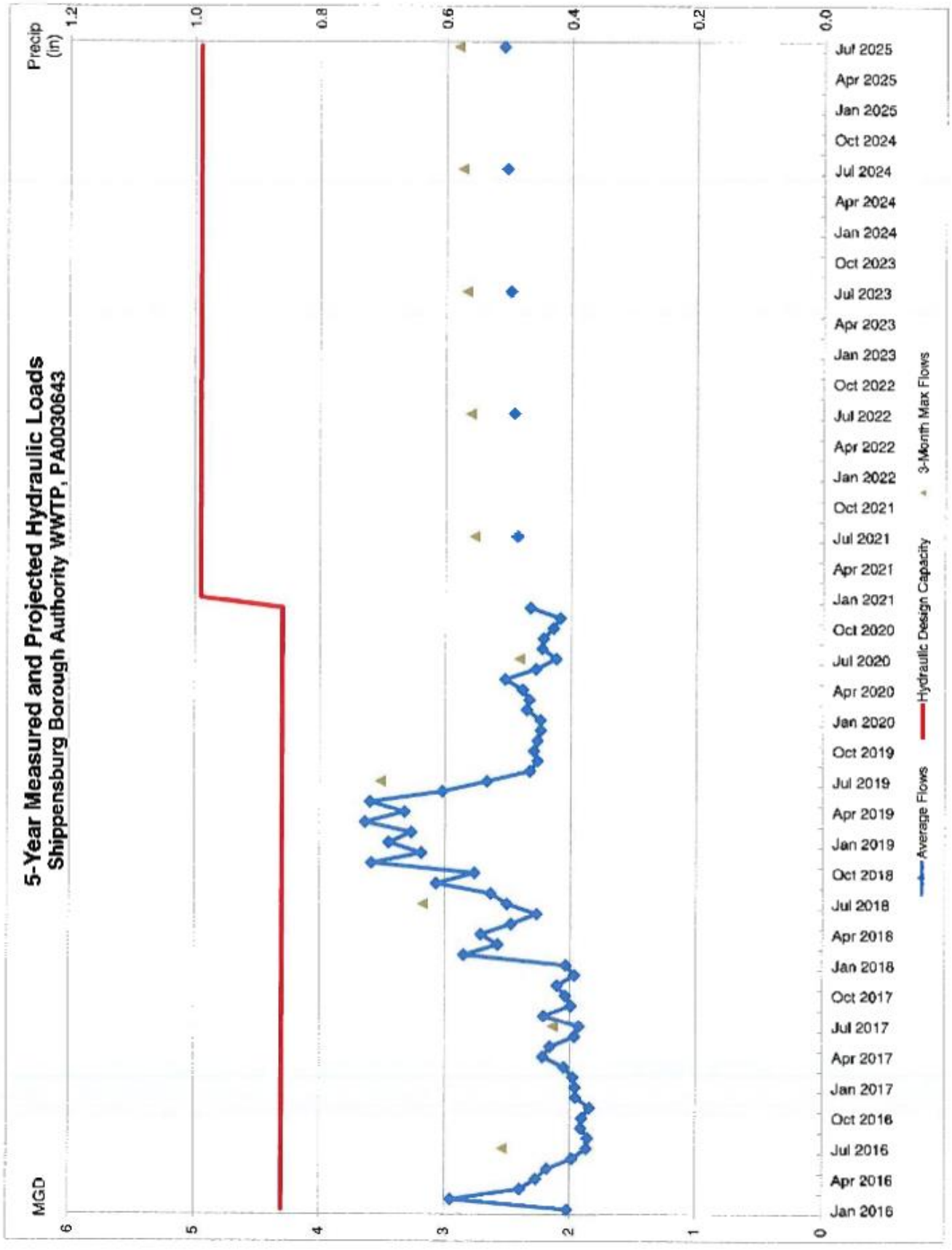
Projected BOD5 Loads for Next Five Years (lbs/day)

	2021	2022	2023	2024	2025
New EDUs	85	90	95	96	95
New EDU Load	41.860	44.429	46.897	47.591	46.897
Proj. Annual Avg	3,908	3,952	3,999	4,047	4,094
Proj. Max Avg	5,116	5,173	5,235	5,297	5,358
Proj. Overload?	NO	NO	NO	NO	NO

Show Precipitation Data on Hydraulic Graph?

Total Monthly Precipitation for Past Five Years (inches)

Month	2016	2017	2018	2019	2020
January	3.62	3.11	2.43	3.98	2.94
February	3.52	1.79	5.77	3.97	2.16
March	1.46	3.53	2.87	4.27	3.53
April	1.48	2.51	4.18	5.07	3.21
May	3.3	4.92	4.58	7.5	1.64
June	3.05	3.94	5.25	4.66	1.84
July	3.92	4.66	7.74	6.0	3.7
August	2.16	5.3	4.9	2.1	4.7
September	3.85	1.51	8.81	1.88	2.7
October	1.18	5.36	2.46	4.0	5.05
November	2.12	2.08	7.47	1.33	2.33
December	2.29	1.28	3.2	3.04	2.18


5-Year Measured and Projected Hydraulic Loads
Shippensburg Borough Authority WWTP, PA0030643
Precip (in)
MGD
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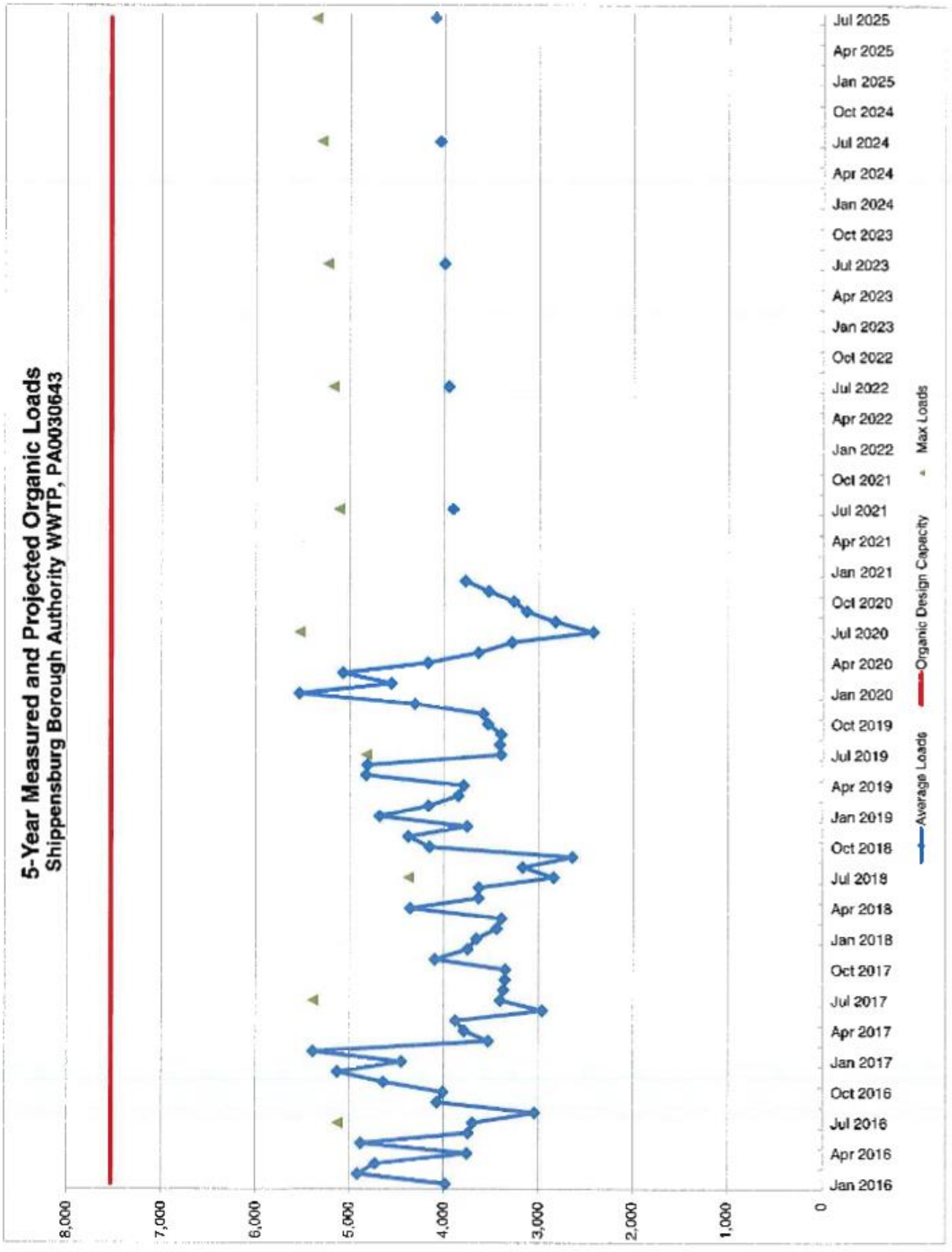
Average Flows
Hydraulic Design Capacity
3-Month Max Flows


5-Year Measured and Projected Organic Loads
Shippensburg Borough Authority WWTP, PA0030643
8,000
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2,000
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Jan 2016
Max Loads
Organic Design Capacity
Average Loads

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PADEP Chapter 94 Spreadsheet
Sewage Treatment Plants

Reporting Year: 2021

Facility Name: Shippensburg Borough Authority WWTP
Permit No.: PA0030643
Persons/EDU: 3.5

Existing Hydraulic Design Capacity: 5 MGD
Upgrade Planned in Next 5 Years? YES Year: 2024
Future Hydraulic Design Capacity: 6 MGD

Existing Organic Design Capacity: 7,581 lbs BOD5/day
Upgrade Planned In Next 5 Years? YES Year: 2024
Future Organic Design Capacity: 8,094 lbs BOD5/day

Monthly Average Flows for Past Five Years (MGD)

Month	2017	2018	2019	2020	2021
January	1.957	2.0345	3.447	2.941	2.395
February	1.975	2.8496	3.266	2.35	2.3816
March	2.046	2.5755	3.634	2.339	2.771
April	2.217	2.7133	3.32	2.363	2.861
May	2.158	2.469	3.595	2.521	2.412
June	1.964	2.266	3.021	2.278	2.023
July	1.929	2.5023	2.665	2.116	2.097
August	2.21	2.633	2.324	2.226	2.089
September	1.992	3.0703	2.263	2.219	2.613
October	2.037	2.7642	2.269	2.14	2.278
November	2.104	3.584	2.264	2.095	2.216
December	1.965	3.1881	2.239	2.322	2.019
Annual Avg	2.046	2.7209	2.961	2.368	2.3247
Max 3-Mo Avg	2.14	3.1759	3.515	2.411	2.6147
Max : Avg Ratio	1.06	1.17	1.23	1.08	1.12
Existing EDUs	7,603.0	7,670.0	7,798.0	8,000.0	8,094.0
Flow/EDU (GPD)	269.1	354.7	366.9	263.5	287.2
Flow/Capita (GPD)	76.9	101.4	104.8	81.0	82.1
Exist. Overload?	NO	NO	NO	NO	NO

Monthly Average BOD5 Loads for Past Five Years (lbs/day)

Month	2017	2018	2019	2020	2021
January	4,453	3,657	4,685	5,532	3,762
February	5,387	3,442	4,167	4,557	4,260
March	3,532	3,393	3,849	6,070	4,229
April	3,786	4,362	3,799	4,174	3,684
May	3,876	3,634	4,827	3,837	3,440
June	2,959	3,631	4,812	3,287	4,032
July	3,405	2,833	3,400	2418.0	3970.0
August	3,372	3,369	3,411	PR24.0	3169.0
September	3,356	2,633	3,397	3128.0	3269.0
October	3,352	4,154	3,537	3266.1	4050.0
November	4,098	4,381	3,587	3529.9	4176.0
December	3,748	3,755	4,313	3778.3	3704.0
Annual Avg	3,777	3,589	3,982	3,767	3,812
Max Mo Avg	5,387	4,381	4,827	5,532	4,260
Max : Avg Ratio	1.43	1.22	1.21	1.47	1.12
Existing EDUs	7,603	7,670	7,798	8,000	8,094
Load/EDU	0.497	0.468	0.511	0.471	0.471
Load/Capita	0.142	0.134	0.146	0.135	0.135
Exist. Overload?	NO	NO	NO	NO	NO

Projected Flows for Next Five Years (MGD)

	2022	2023	2024	2025	2026
New EDUs	127.0	113.0	119.0	100.0	89.0
New EDU Flow	0.0397	0.0353	0.0372	0.0312	0.0278
Proj. Annual Avg	2.4038	2.5131	2.5563	2.5875	2.6153
Proj. Max 3-Mo Avg	2.7973	2.837	2.8738	2.9141	2.9454
Proj. Overload?	NO	NO	NO	NO	NO

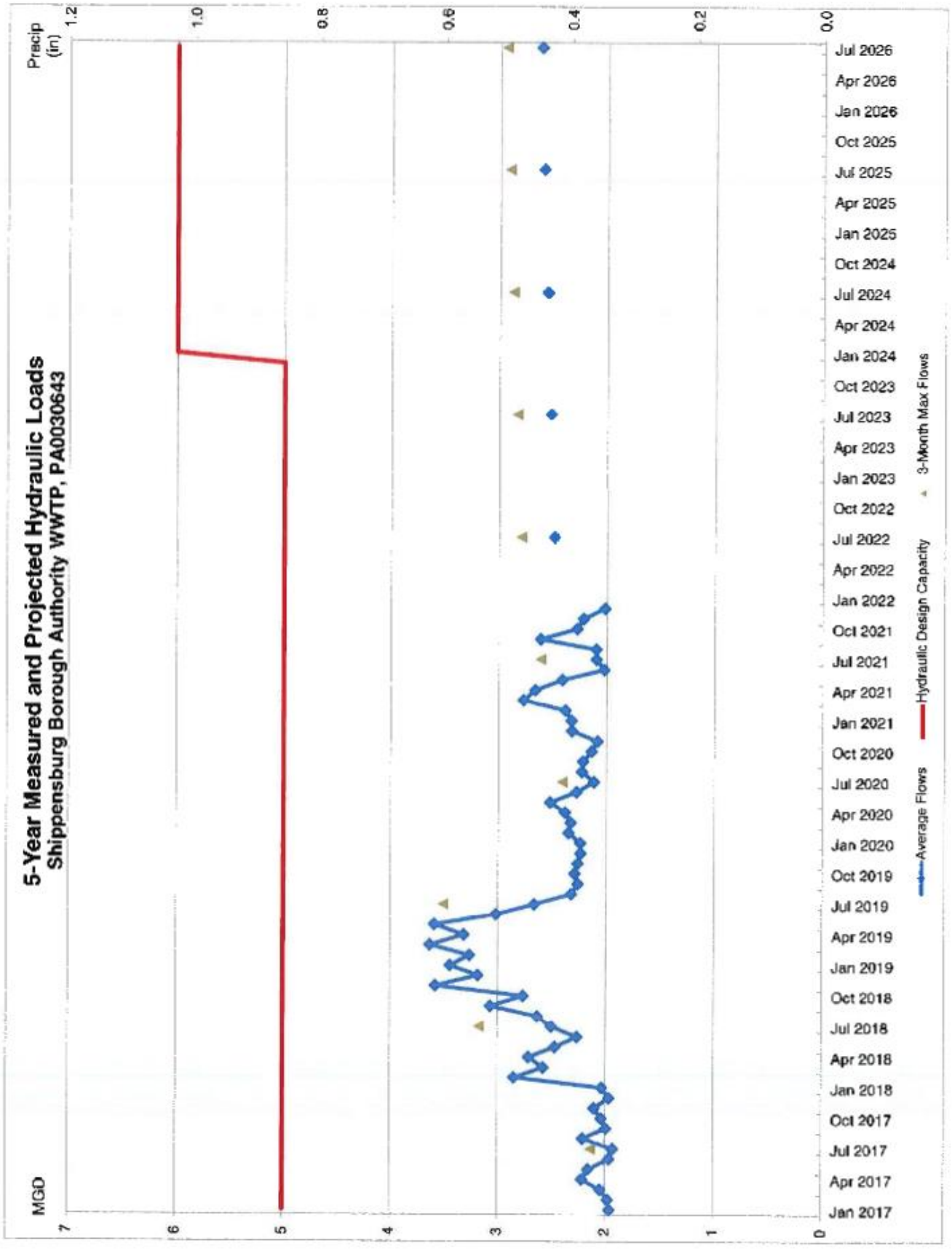
Projected BOD5 Loads for Next Five Years (lbs/day)

	2022	2023	2024	2025	2026
New EDUs	127	113	119	100	89
New EDU Load	61,392	54,625	57,525	48,340	43,023
Proj. Annual Avg	3,947	3,901	3,959	4,007	4,050
Proj. Max Avg	4,959	5,029	5,103	5,166	5,221
Proj. Overload?	NO	NO	NO	NO	NO

Show Precipitation Data on Hydraulic Graph?

Total Monthly Precipitation for Past Five Years (Inches)

Month	2017	2018	2019	2020	2021
January	3.11	2.43	3.99	2.94	1.4
February	1.79	5.77	3.97	2.16	4.25
March	3.53	2.67	4.27	3.53	2.44
April	2.61	4.18	5.07	5.21	2.51
May	4.92	4.58	7.5	1.64	5.14
June	3.94	5.35	4.68	1.64	2.11
July	4.66	7.74	6.0	3.7	3.94
August	5.3	4.9	2.1	4.7	3.51
September	1.51	8.81	1.88	2.7	7.35
October	5.36	2.48	4.0	3.05	2.49
November	2.06	7.47	1.33	2.33	2.15
December	1.28	3.2	3.04	3.18	0.98


5-Year Measured and Projected Hydraulic Loads
Shippensburg Borough Authority WWTP, PA0030643
Precip (in)
MGD
1.2
1.0
0.8
0.6
0.4
0.2
0.0
7
6
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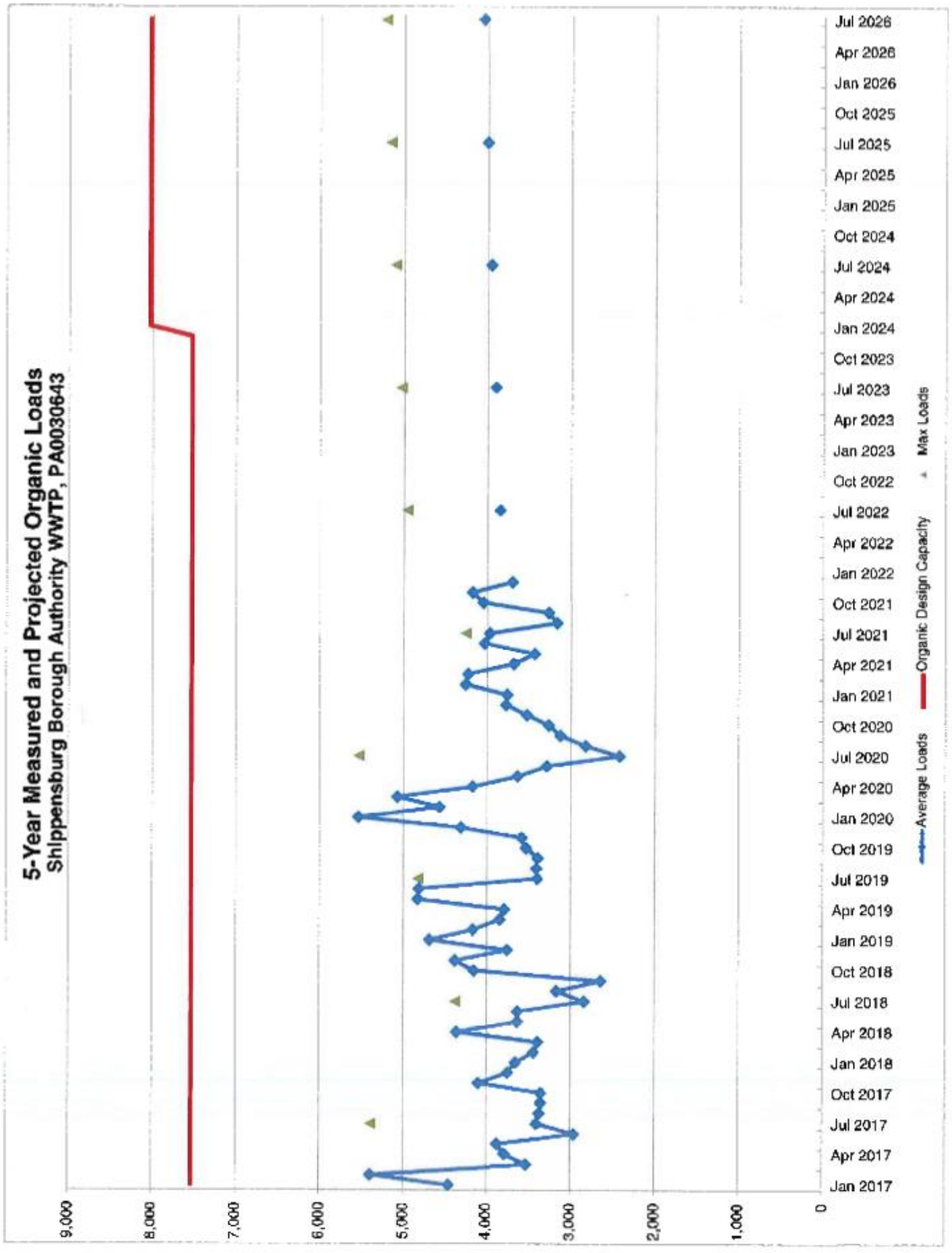
Average Flows
Hydraulic Design Capacity
3-Month Max Flows


5-Year Measured and Projected Organic Loads
Shippensburg Borough Authority WWTP, PA0030643
Jul 2026
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Max Loads
Organic Design Capacity
Average Loads

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PADEP Chapter 94 Spreadsheet
Sewage Treatment Plants

Reporting Year: 2022

Facility Name: Shippensburg Borough Authority WWTP

Permit No.: PA0030643

Persons/EDU: 3.5

Existing Hydraulic Design Capacity: 5 MGD
Upgrade Planned in Next 5 Years? YES Year: 2023
Future Hydraulic Design Capacity: 6 MGD

Existing Organic Design Capacity: 7,531 lbs BOD5/day
Upgrade Planned in Next 5 Years? YES Year: 2023
Future Organic Design Capacity: 8,034 lbs BOD5/day

Monthly Average Flows for Past Five Years (MGD)

Month	2018	2019	2020	2021	2022
January	2.0345	3.447	2.241	2.325	2.108
February	2.8496	3.266	2.35	2.3818	2.505
March	2.5755	3.634	2.329	2.771	2.412
April	2.7133	3.32	2.583	2.661	2.463
May	2.469	3.595	2.521	2.412	2.736
June	2.286	3.021	2.278	2.023	2.127
July	2.5023	2.665	2.116	2.097	2.038
August	2.635	2.324	2.228	2.099	2.132
September	2.0703	2.263	2.219	2.613	2.197
October	2.7842	2.293	2.14	2.278	2.145
November	3.584	2.264	2.085	2.215	2.034
December	3.1881	2.239	2.322	2.019	2.169
Annual Avg	2.7208	2.861	2.268	2.3247	2.253
Max 3-Mo Avg	3.1798	3.516	2.411	2.6147	2.538
Max : Avg Ratio	1.17	1.23	1.06	1.12	1.13
Existing EDUs	9,397.0	9,595.0	9,594.0	9,693.0	9,821.0
Flow/EDU (GPD)	289.5	300.1	236.4	239.8	229.4
Flow/Capita (GPD)	82.7	85.7	67.5	68.5	65.5
Exist. Overload?	NO	NO	NO	NO	NO

Monthly Average BOD5 Loads for Past Five Years (lbs/day)

Month	2018	2019	2020	2021	2022
January	3,657	4,685	5,532	3,762	3,839
February	3,442	4,167	4,567	4,260	4,784
March	3,353	3,849	5,070	4,229	3,782
April	4,360	3,793	4,174	3,684	3,882
May	3,624	4,827	3,637	3,440	3,334
June	3,631	4,812	3,267	4,032	4,151
July	2,939	3,400	2,416	3,970	3,467
August	3,168	3,411	2,824	3,169	3,905
September	2,639	3,397	3,126	3,269	3,535
October	4,154	3,537	3,266	4,050	3,648
November	4,381	3,587	2,530	4,176	4,145
December	3,755	4,313	3,776	5,704	3,980
Annual Avg	3,668	3,982	3,767	3,812	3,895
Max Mo Avg	4,381	4,827	5,532	4,260	4,784
Max : Avg Ratio	1.22	1.21	1.47	1.12	1.23
Existing EDUs	9,397	9,595	9,594	9,693	9,821
Load/EDU	0.382	0.415	0.393	0.393	0.397
Load/Capita	0.109	0.119	0.112	0.112	0.113
Exist. Overload?	NO	NO	NO	NO	NO

Projected Flows for Next Five Years (MGD)

	2023	2024	2025	2026	2027
New EDUs	118.0	124.0	110.0	101.0	70.0
New EDU Flow	0.0308	0.0321	0.0285	0.0262	0.0181
Proj. Annual Avg	2.5161	2.5482	2.5767	2.6029	2.621
Proj. Max 3-Mo Avg	2.6742	2.9108	2.9434	2.9753	2.994
Proj. Overload?	NO	NO	NO	NO	NO

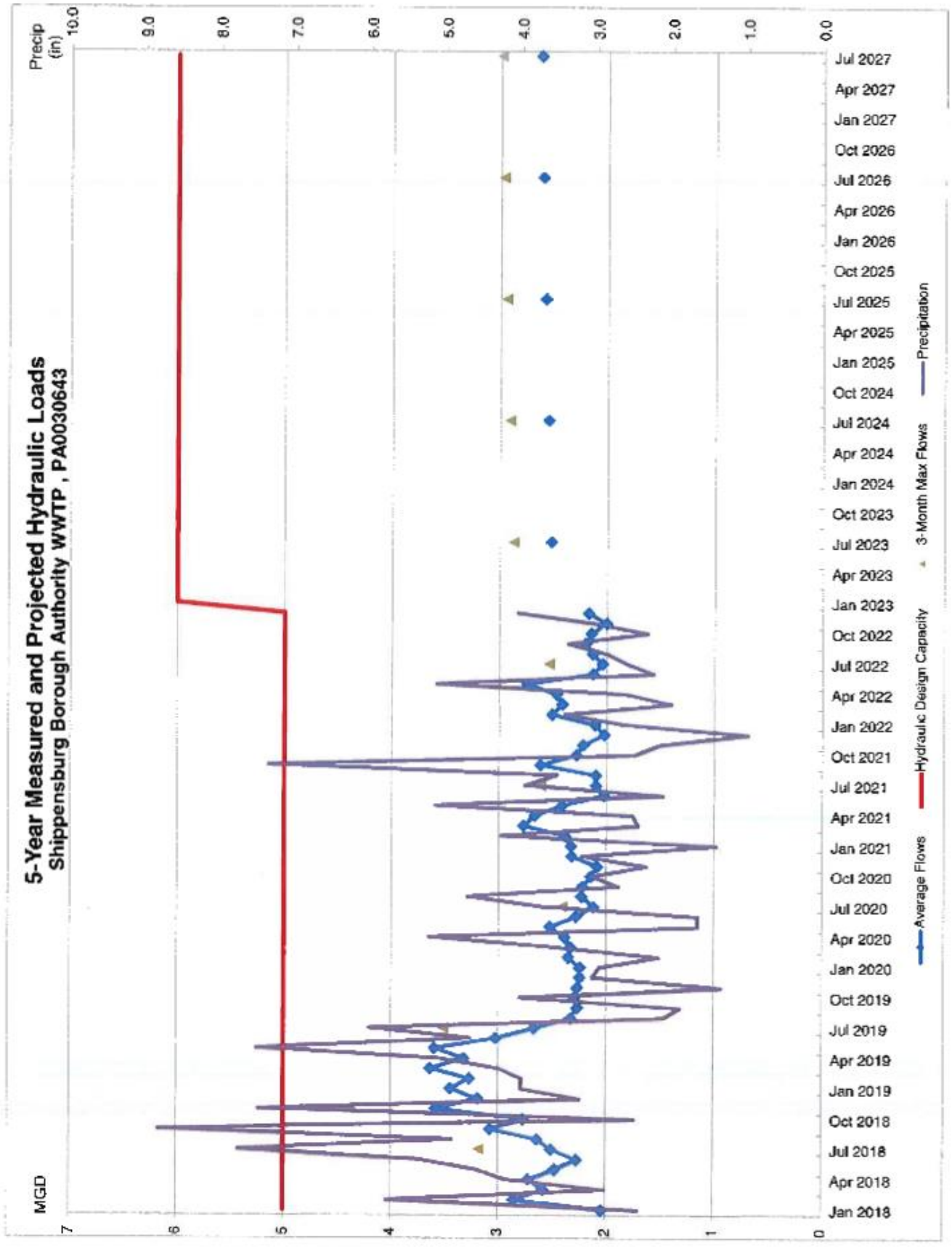
Projected BOD5 Loads for Next Five Years (lbs/day)

	2023	2024	2025	2026	2027
New EDUs	118	124	110	101	70
New EDU Load	46.773	49.151	43.602	40.054	27.747
Proj. Annual Avg	3.855	3.905	3.948	3.988	4.016
Proj. Max Avg	4.818	4.879	4.933	4.984	5.019
Proj. Overload?	NO	NO	NO	NO	NO

Show Precipitation Data on Hydraulic Graph?

Total Monthly Precipitation for Past Five Years (Inches)

Month	2018	2019	2020	2021	2022
January	2.43	3.09	2.91	1.4	2.61
February	5.77	3.97	2.18	4.25	3.41
March	2.87	4.27	3.53	2.44	2.0
April	4.18	5.07	6.21	2.51	2.50
May	4.58	7.5	1.64	5.14	5.12
June	5.35	4.86	1.64	2.11	2.24
July	7.24	6.0	3.7	3.04	2.59
August	4.9	2.1	4.7	3.51	2.86
September	8.81	1.86	2.7	7.35	3.37
October	2.48	4.0	3.05	2.49	2.32
November	7.47	1.33	2.93	2.15	3.03
December	3.2	5.04	3.18	0.98	4.04


5-Year Measured and Projected Hydraulic Loads
Shippensburg Borough Authority WWTP , PA0030643
Precip (in)
MGD
10.0
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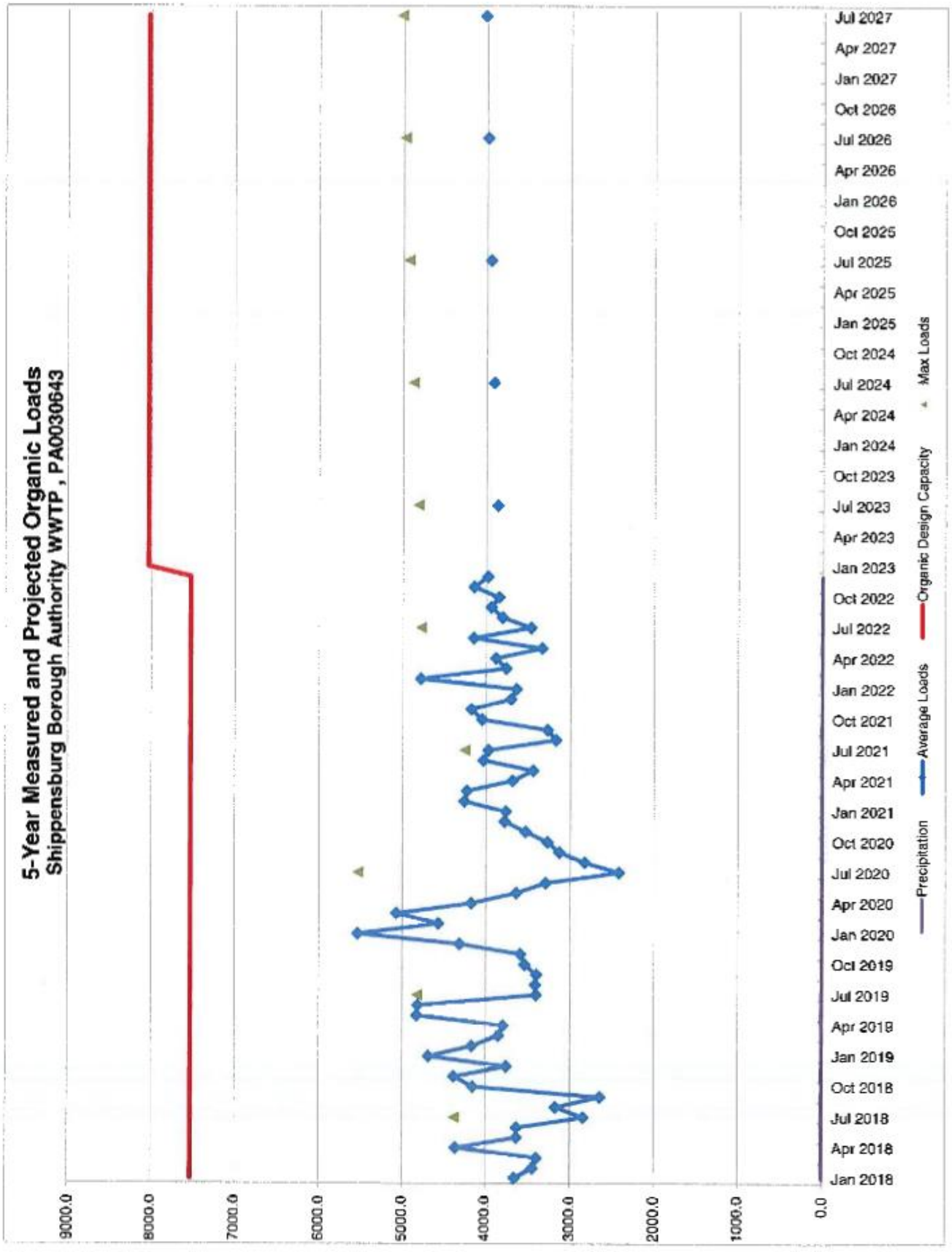
Jan 2018
Precipitation
3-Month Max Flows
Hydraulic Design Capacity
Average Flows


5-Year Measured and Projected Organic Loads
Shippensburg Borough Authority WWTP , PA0030643
Jul 2027
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0.0
Max Loads
Organic Design Capacity
Average Loads
Precipitation

Memorandum

HAZEN AND SAWYER
Environmental Engineers & Scientists

230 Innovation Blvd.
Suite 104
State College, PA 16803

814 272-3332
hazenandsawyer.com

Date: August 26, 2015

To: Andrea Lage, Council President
John Epley, Manager
Samuel E. Wiser Jr., Esq., Solicitor

From: Mark Strahota, PE
Brian Book, PE

Re: Wastewater Treatment Plant Flow Study - REVISED

Background

The purpose of this memorandum is to present the results of an evaluation of peak flows at the Borough of Shippensburg WWTP. The ongoing WWTP Expansion and ENR Upgrade project, which incorporates an IFAS system in the biological treatment tanks, originally proposed an annual average design flow of 4.3 MGD and the peak flows presented in Table 1 (under Scenario A). As part of the corrective actions to the BNR/ENR Upgrade project, an increase in design annual average flow to 4.95 MGD was proposed to support the addition of a new large customer in the Cumberland-Franklin Joint Municipal Authority (CFJMA is tributary to the Shippensburg WWTP) service area.

The April 2015 Design Engineer's Report (DER) submitted with the Water Quality Management (WQM) Permit Application included Table 1, which summarizes the design flows from: the 2011 Design Engineer's Report by ARRO, recommended design flows based on Hazen and Sawyer's evaluation of historical peaking factors (Scenario A), and recommended design flows at the future condition including 0.65 mgd of additional flow (Scenario B). Because it was anticipated that the new large user connection proposed in the CFJMA service area would have limited inflow and infiltration (I&I), the peak instantaneous flow for Scenario B was proposed to remain the same as the originally approved value in the 2011 DER. For additional background regarding the origin of the design flows in Table 1, refer to the April 2015 DER.

Table 1. Original Design Flows (April 2015 DER)

Flow Scenario	DER (2011)		A (4.3 mgd)[1]		B (4.95 mgd)[2]	
	Peaking Factor	Flow (mgd)	Peaking Factor	Flow (mgd)	Peaking Factor	Flow (mgd)
Average Annual	--	4.3	--	4.3	--	4.95
Maximum Month	1.17	5.0	1.24	5.3	1.20	6.0
Maximum Day	2.25	9.7	2.50	10.8	2.30	11.5
Peak Hourly Flow[3]	2.50	10.8	--	--	--	--
Peak Instantaneous[3]	3.00	12.9	3.00	12.9	2.61	12.9

Notes:
1. Hazen and Sawyer evaluation of current design flows.
2. Hazen and Sawyer evaluation of design flows with additional flow from industry. Assumes annual average flow addition of 0.65 mgd is added to all flow scenarios except peak instantaneous. Peaking factors for scenario B were updated accordingly.
3. Peak hourly and peak instantaneous flows were maintained, pending collection of additional flow data to substantiate the 2011 DER peaking factors.

When reviewing the WQM Permit Application, PA DEP would not accept the assertion that Scenario B, which has an increase in design annual average flow, would have no increase in peak instantaneous flows. The significance of the peak instantaneous flow number is that it dictates sizing of certain portions of the plant, including pump stations, piping, and other unit processes that may be impacted hydraulically during peak flow conditions. For reference, Table 2 presents a summary of the DEP design flow definitions and applications.

Table 2. Summary of DEP Design Flow Guidelines

Design Flow Parameter	General Definition*	Typical Application*
Annual Average Flow	The total flow received at the facility during any one calendar year divided by 365 (the number of days in that period)	The "nominal" design flow of a facility. Used for cost comparisons and annual estimates of O&M costs. Used for water quality modeling. Used for evaluating Act 537 plan updates. Used to determine allowable mass loadings in NPDES permits.
Monthly Average Flow	The total flow received at the facility during any one calendar month divided by the number of days in that month.	A flow reporting parameter used in discharge monitoring reports.
Maximum Monthly Average Flow ("Max Month")	The highest monthly average flow during any one calendar year.	Determine the overall hydraulic design of the facility. Used for evaluating Act 537 plan updates and planning modules. Is the "hydraulic capacity" for Chapter 94 determinations. Establishes the monthly average flow limitation on NPDES permit.
Peak Hourly Flow	***The maximum flow rate received at the facility averaged over a period of one hour.***	***Designing clarifiers, chlorine contact tanks, and other hydraulically sensitive units.***
Peak Instantaneous	***The maximum instantaneous flow rate received at the facility at any given time.***	***Designing comminutors, pump stations, piping, and units subject to peak flow conditions.***
Minimum Hourly Flow	The least flow rate received at the facility over a period of one hour.	Designing pump stations, and other units sensitive to excessive detention times.

*Referenced from PA DEP Document No. 362-0300-001, *Domestic Wastewater Facilities Manual: A Guide for the Preparation of Applications, Report, and Plans.*

This Flow Study is intended to definitively determine design peak flows for Scenario B (4.95 MGD annual average flow) based on a review of the best data currently available. In addition, modifications to the WWTP are identified that will be required to address the DEP design guidelines for peak flows, and an implementation schedule is recommended.

Review of Existing Flow Data

Since this Study is focused on handling flow conditions at the plant, the plant flow data was reviewed, particularly data for wet weather events that resulted in peak flows. There is currently limited data available for flows within the collection system, although the Borough has recently installed insertion flow meters in gravity sewers to evaluate I&I impacts. As the Borough evaluates and processes flow data gathered within the collection system, sources of I&I will be identified, and an aggressive I&I mitigation plan will be undertaken. CFJMA also has a robust I&I elimination program that is already in place and being implemented continuously.

The WWTP has several flow measurement devices at the plant. There is a "stratification" flow meter on the influent force main that matches flow trends with the calibrated effluent meter. However, this meter is inaccurate by about 50% (or more at times), so while the influent flow data is recorded, it is not used for operational decisions.

According to WWTP staff, the effluent chart recorder in the Influent Pump Station/Administration/Laboratory Building tracks flow from the magnetic flow meter downstream of the effluent filters. In the past, the level sensors over the effluent weirs at the post aeration tank were also used to monitor flow, but when the river backs up and submerges the weirs, the flow data would become skewed. The WWTP switched from using the weirs to the magnetic flow meter permanently within the last few years. The analog signal from the chart recorder is also recorded in the SCADA system, which is the source of the data used in this Study.

The SCADA data available in the WWTP's computer system dates back to March 7, 2014. Flow data recorded prior to March 7, 2014 were limited to daily flows rather than instantaneous or hourly flows, which are the focus of this Study. The peak instantaneous flow data from March 7, 2014 through June 23, 2015 was reviewed, and there were many peak flow events that occurred during this time period. However, some events appeared to be a result of short power outages, after which the effluent pumps would run at elevated capacity in response to high levels in their wet well. Therefore the data was carefully pared down only to those events that appeared to be related to wet weather. This review resulted in two storm events that appeared to have the most extreme flow conditions: May 16, 2014 and June 8, 2015.

The May 16, 2014 event occurred when the Shippensburg area received 2.75" of rain in a 2-day period, and the June 8, 2015 event resulted from 3" of rainfall occurring within one hour period. Table 3 presents the peak flows from the two events as well as the current annual average flow of 2.2 MGD, which was identified in Hazen and Sawyer's BioWin and Sampling Results Memo dated June 24, 2014.

Table 3. Peaking Factors from May 16, 2014 and June 8, 2015 Wet Weather Events

Criteria	Flow (MGD)
Current Average Annual Flow	2.2
May 16, 2014 Peak Hourly Flow	8.0
May 16, 2014 Peak Instantaneous Flow	9.0*
June 8, 2015 Peak Hourly Flow	6.2
June 8, 2015 Peak Instantaneous Flow	8.3
*Following short power outage	

Based on the data analysis, the WWTP receives about 6-7 MGD of I&I flows, in addition to the base flow during wet weather events. Adding this I&I flow to the design maximum monthly flow of 6.00 MGD in the April 2015 DER results in a peak flow of about 13 MGD. Another method to calculate a similar peak flow value is to add the 0.65 MGD of proposed new user flow to the previously approved peak instantaneous flow of 12.90 MGD, to get about 13.6 MGD. Accordingly, we calculated the revised design flows listed in Table 4.

Table 4. Revised Design Flows

Criteria	Peaking Factor	Flow (MGD)
Average Annual	1.00	4.95
Maximum Month	1.20	6.00
Maximum Day	2.30	11.50
Peak Hour	2.75	13.60
Peak Instantaneous	3.00	14.85

Peak Flow Mitigation Plan

With the corrective actions it has been established that the design flows listed in Scenario B (Table 1) can be conveyed and treated at the WWTP. However, to handle the revised design flows in Table 4, the Borough will need to take further action in the future. If no additional measures were taken to mitigate peak flows, it is possible that the Scenario B peak flows will be exceeded at the WWTP within the next 20 years. Accordingly, we recommend that the Borough commence peak flow mitigation on several fronts to resolve this concern.

I&I Mitigation

The Borough has already begun gathering data to determine sources of I&I, by 1) comparing potable water meter data and wastewater flow data in various basins, and 2) installing insertion flow meters within the trunk sewers to gather more flow data. Preliminary information has shown that most of the I&I may be originating in the Borough collection system rather than the CFJMA portion of the collection system. Therefore the Borough would lead the effort in conducting I&I reduction, while CFJMA would continue to monitor their system for sources of I&I and resolve any issues as appropriate.

Concurrently, the available flow data and collection system records should be included in a comprehensive hydraulic model of the Borough's sewer system, linked to GIS. The model would be used to identify hydraulic bottlenecks in the system, as well as areas where I&I may be an issue. Once these areas are determined, we recommend that the Borough conduct ongoing video inspections and/or condition assessments using trenchless tools so that detailed repairs can be implemented. The repairs could include lining existing pipes (e.g. slip-lining or CIPP) or, where needed, "open cut" excavation and complete replacement of pipes or fittings.

Ultimately, the peaking factors observed during significant storm events as described above would be reduced through I&I mitigation. This approach would allow the Borough to save costs by treating less flow at the WWTP, and further reduce the risk of significant peak flows impacting the WWTP hydraulically.

Flow Equalization

Because of the difference between peak instantaneous and peak hourly flow, and the potential design impacts of establishing an extraordinarily high peak design flow, we would propose using the design peak hourly flow as the basis for designing unit processes. To attenuate the difference between peak instantaneous and peak hourly flows, we estimate that about 156,000 gallons of storage are needed, as calculated below:

(14.85 MGD – 13.60 MGD) / 24 hrs/d = 52,000 gal per hr X 3 (S.F.) = 156,000 gallons

Schreiber Foods, one of the Borough's largest customers, already maintains flow equalization at their pretreatment facility to attenuate peak flows and loads at the WWTP. During extreme wet weather events, the WWTP staff is able to call Schreiber and request that they postpone discharging up to 350,000 GPD until the peak flow has passed. Similarly, the new customer that is the source of the increase in design annual average flow from 4.3 MGD to 4.95 MGD could be required to install flow equalization and operate under a similar arrangement with the Borough and CFJMA.

In addition, the existing abandoned clarifiers on the north side of the WWTP site have storage volume as presented in Table 5.

Table 5. Storage Volume Available in Existing Abandoned Clarifiers

Clarifier	Available Volume (MG)
Primary Clarifier No. 1	0.178
Primary Clarifier No. 2	0.178
Secondary Clarifier No. 1	0.213
Secondary Clarifier No. 2	0.213
Secondary Clarifier No. 3 (Converted to Thickener)	NA
TOTAL	0.782

By using the available equalization volume on the WWTP site and in the collection system, we believe that the Borough will be able to use the peak hourly flow as the design flow for hydraulic evaluation at the WWTP.

WWTP Modifications

Using the peak hourly flow, an updated hydraulic profile of the WWTP was generated, and is attached to this memorandum. A summary of the water levels at 13.6 MGD is also presented in Table 6. With the necessary corrections implemented (as presented in the April 2015 DER), there are no hydraulic overload conditions or bottlenecks within the gravity flow portion of the WWTP. However, the influent and effluent pumps would not be able to handle the peak hourly flow with one pump out of service. Therefore we would propose adding capacity to the influent and effluent pumps to handle peak flows. In addition, for the clarifiers to handle the additional flows without settling issues, some changes to return activated sludge (RAS) management will be necessary.

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Table 6. Hydraulic Modeling Summary at 13.6 MGD

Structure	Result	Recommended Modifications
MH3		Confirm rim elevation with survey. Manhole cover may need to be bolted down to prevent overflow at peak flows.
Post aeration tanks	Walls overtopped by 0.22' of head.	Increase walls by a minimum of 2 feet.
UV Disinfection		Confirm with manufacturer during future design that existing UV system can accommodate increase in flow and head loss
Filter Bldg. Distribution Box Weir Gate Weir	Weir submerged 1.48'	None
Aeration basin 1A/2A effluent weir (to clarifiers)	Weir submerged 0.1'	None
Aeration basin 1/2 effluent weir (to basins 1A/2A)	Weir submerged 0.06	None
Screen Building splitter box weir (to basins ½)	Weir submerged 0.5'	None
Screen building (upstream of screens)	Freeboard = 1.21'	None
Notes: 1. All flows include 4.3 mgd RAS		

Influent Pumping

Influent pumping must be sized to handle peak flows. The current pumps appear to be sized for 4,480 gpm each (6.45 MGD) based on the shop drawing information, providing a total firm capacity of 12.9 MGD. The recommended influent pumping modifications are focused on increasing the current total capacity under Scenario B to handle the slightly higher total peak flow anticipated under these conditions.

2 pumps w/ VFDs

To handle the peak hourly flow, we recommend installing a new pump station and wet well with two submersible pumps, each sized for 500 GPM (0.7 MGD) to supplement the existing pumps during peak flows. The pumps could then convey influent to the abandoned primary clarifiers for equalization, or to the reactor tanks for treatment. The station would be located between the existing plant pump station and the primary clarifiers, as shown in Figure 1. The estimated cost of this influent pump station expansion is shown in Table 7.

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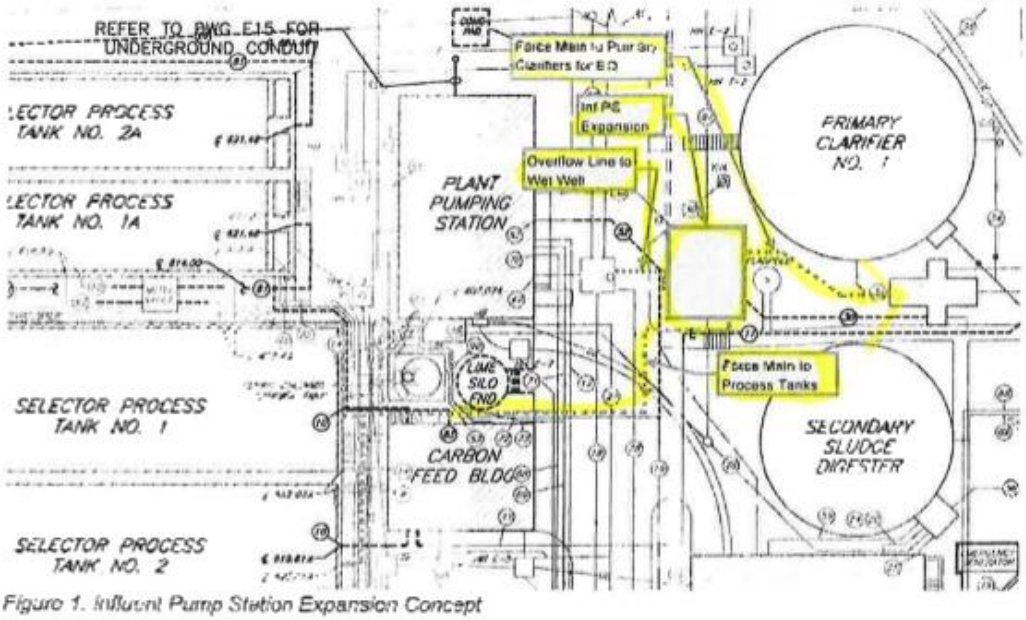

Figure 1. Influent Pump Station Expansion Concept

Table 7. Influent Pumping Costs

Item	Cost
Sitework	$50,000
Structural	$75,000
Mechanical and Equipment	$143,000
Electrical and Instrumentation	$181,000
Subtotal =	$449,000
Contractor Overhead and Profit (20%) =	$90,000
Contingency (30%) =	$152,000
Subtotal =	$791,000
Services and Fees (15%) =	$105,000
Total OPCC[B] =	$896,000[B]

Notes:
A: OPCC: Opinion of probable construction cost
B: Total OPCC rounded to nearest $10,000

With the influent pump station expansion in service, at a high level in the main influent pump station wet well, the influent flow would automatically be diverted to the new wet well via an adjustable overflow weir gate from the influent diversion box. Automated valves would then direct flows to either 1) the primary clarifiers for flow equalization, or 2) the reactor tanks for treatment. Level sensors would be installed on the primary clarifiers to avoid overfilling, and when high levels are reached, the valves would automatically divert flow to the reactor tanks.

Process Tanks

Hydraulic analysis of the process tanks does not indicate any adverse impacts as a result of a 13.6 MGD peak hourly flow, as shown in the attached hydraulic profile. However, in order to accommodate the additional loads associated with the revised design flows, BioWin simulations

indicate that additional aerobic volume will be required. Operation of the post anoxic zone as a swing zone including installation of aeration diffusers is recommended to meet the additional aerobic volume requirements. The estimated cost to install coarse bubble diffusers in the post anoxic zone is $110,000.

As presented in the April 2015 DER, implementation of the corrective actions in the process tanks will allow the WWTP to treat design maximum day loads and meet the instantaneous maximum ammonia limit in the permit. Since the design maximum day flow (11.5 MGD) did not change as a result of the peak flow analysis, no other modifications in the process tanks are required.

Clarifier Capacity

A state point analysis on the existing clarifiers (three 70 ft diameter) was developed to determine the maximum allowable mixed liquor suspended solids (MLSS) concentration at various flow conditions and subsequent treatment capacity of the process. A summary of the design flows and maximum allowable MLSS concentrations for each scenario are provided below:

Process modeling indicates that the plant loses biomass due to washout at normal MLSS concentrations (approximately 4,000 mg/L) during peak flows. Therefore two alternatives were evaluated for reducing the solids loading to the clarifiers during peak flows.

- Flow equalization to reduce peak process flows
- RAS holding during wet weather events to reduce the MLSS concentration and solids loading rate (SLR) to the clarifiers

The implementation of RAS holding would include pumping RAS to a holding tank during peak flow events to reduce the MLSS in the aeration basins and solids loading to the clarifiers. During peak wet weather events, influent organic and nutrient concentrations are typically lower than annual average concentrations and clarifier capacity becomes limiting. Plants can often operate at lower MLSS concentrations temporarily during wet weather and still meet permit compliance. After the high flow event, the MLSS could be returned to the process tankage, which would restore full treatment, bringing Shippensburg back to normal operating conditions sooner than plants that "wash out" biomass under high flow conditions.

Table 8. Secondary Clarifier State Point Analysis Summary

Flow Scenario	Parameter	Value
Annual Average	Influent Flow (mgd)	4.95
	Surface Overflow Rate, SOR (gpd/ft^2)	430
	RAS Flow (mgd)	4.3
	Maximum Allowable MLSS (mg/L)[3]	4,000
	Solids Loading Rate, SLR (lb/day/ft^2)	26.7
Peak Hourly	Flow (mgd)[4]	13.6
	Surface Overflow Rate, SOR (gpc/ft^2)	1,180
	RAS Flow (mgd)	4.3
	Maximum Allowable MLSS (mg/L)[3]	2,300
	Solids Loading Rate, SLR (lb/day/ft^2)	29.7

Notes:
1. Based on SVI of 120 – 140 mL/g. Assumes all clarifiers are in service. Historical SVI data evaluation is recommended to confirm the results of the state point analysis.

The SOR during peak hourly flows will be greater than that recommended in the DEP Design Guidelines; however, with the state point analysis it can be shown that the greater SOR can be accommodated at reduced MLSS concentrations. To reduce the MLSS, we evaluated the impact of offline RAS storage for wet weather events. The calibrated BioWin model was used to evaluate the impact of RAS holding on process performance and is discussed later in this report. The flow equalization or RAS holding tank volume required to reduce the hydraulic and solids loading to the clarifiers is presented in Table 9.

Table 9. Flow Equalization and RAS Holding Tank Comparison

Parameter		Value
Flow EQ	Peak Design Flow (mgd)	13.6
	Flow to clarifiers (mgd)	5.0
	MLSS (mg/L)	4,000
	EQ Volume Required (MG)	6.6
RAS Holding	Flow to clarifiers (mgd)	13.6
	MLSS (mg/L)	2,300
	RAS Holding Tank Volume Required (MG)[2]	0.41

Notes:
1. The WWTP has no existing flow EQ or RAS holding.
2. Based on an assumed RAS concentration of 6,000 mg/L. Values represent the minimum volume required to store enough solids to reduce the MLSS in the process tanks to the values specified above.

The total volume required for RAS holding is less than complete flow EQ and will be less costly. Therefore implementation of RAS holding is recommended.

RAS Holding in Process Tanks

The corrective actions presented in the April 2015 DER include the ability to store RAS in one train of the Process Tanks 1 or 2 (to protect the biomass) while sending forward flow to the other. The forward flow would still be treated biologically in Process Tank 1 or 2 as well as Tanks 1A and 2A. Particularly with the IFAS media retained in their designated zones, even at a lower MLSS concentration there will be biological contact and treatment in the process tanks.

State point analysis indicates that the highest flow that the clarifiers can handle at the design MLSS concentration of 4,000 mg/L is about 7.0 MGD. Therefore the recommended initial setpoint for a flow trigger to implement wet weather operation is 6.5 MGD, which is greater than the peak hourly flow observed during the June 8, 2015 storm event. As presented in the April 2015 DER, the proposed wet weather operating strategy with RAS holding in the process tanks includes:

1. When influent flows exceed an operator selected setpoint for a sustained period of time, the SCADA system will initiate the wet weather strategy.
2. Automated plug valve to Selector Basin no. 2 will close and 100 percent of raw influent flow will be sent to Reactor Basin No. 1.
3. Close motor actuated PV on east side of RAS discharge pipe header to send all RAS flow to Reactor Basin No. 2
4. All internal recycle pumps will be stopped during wet weather events
5. After wet weather event, when flows decrease below operator set point, plug valves slowly activate resume normal operations.

Note that when this operational strategy is used there would be approximately 6' of free board in the Screening building with all flow going to one basin. However, the walls will be overtopped if

the internal recycle (IR) pumps are running, so it is critical that this wet weather strategy includes turning off the IR pumps during a storm event.

The advantage of implementing this strategy now, as part of the corrective actions, is that it allows approximately $2.5M of RAS holding tank modifications to be deferred to a future project. The downside to this strategy is that the plant will lose approximately 25% of its treatment capacity by taking Selector Tank No. 2 offline. Therefore, as flows and loads increase, the RAS holding tank will likely be needed to provide more treatment volume during wet weather events.

RAS Holding Tanks

Two abandoned primary and secondary clarifiers are located on the northwest side of the WWTP site. Based on the drawings of the sludge thickener (repurposed secondary clarifier no. 3, previously abandoned), the approximate volume of each clarifier is 213,000 gallons. Two clarifiers would be required for RAS holding (total working volume = 416,000 gallons). Both sets of clarifiers are good options for RAS holding because both were originally configured for sludge withdrawal. The abandoned secondary clarifiers were selected for this evaluation. A detailed review of the original construction drawings and current condition is recommended during final design to select the tanks that will be repurposed for RAS holding.

RAS holding tank modifications include:

- RAS piping from aeration tanks to former secondary clarifier splitter box
- Suction piping replacement from RAS holding tanks to chemical feed building
- RAS pumps (2) located in the chemical feed building
- Overflow piping to the existing sludge thickener overflow piping
- Clarifier equipment demolition
- Installation of jet aeration mixing system in each RAS holding tank
- Discharge piping from RAS holding tank pumps to influent junction manhole
- Motor actuators installed on three existing plug valves and one new plug valve near the aeration basins.

The proposed wet weather operating strategy with RAS holding includes

1. When influent flows exceed an operator selected set point (likely 6.5 MGD, similar to the strategy for storing RAS in the process tanks) for a sustained period of time, SCADA system will initiate wet weather strategy.
2. Automated plug valves will activate and 100 percent of RAS flow will be diverted to RAS holding tanks.
3. A portion of the RAS pumped to the RAS holding tanks will be returned to the process, similar to current RAS practice. A portion will also be held in the RAS holding tank. The target reduction in mixed liquor concentration is approximately 50% during wet weather.
4. During RAS holding, RAS will be mixed and aerated with jet mixing system.
5. After wet weather event, when flows decrease below operator set point, plug valves slowly activate to divert stored RAS back to the aeration basins (operator initiated).
6. RAS holding tank pumps return stored RAS to the influent pump station to be returned to the aeration basins.

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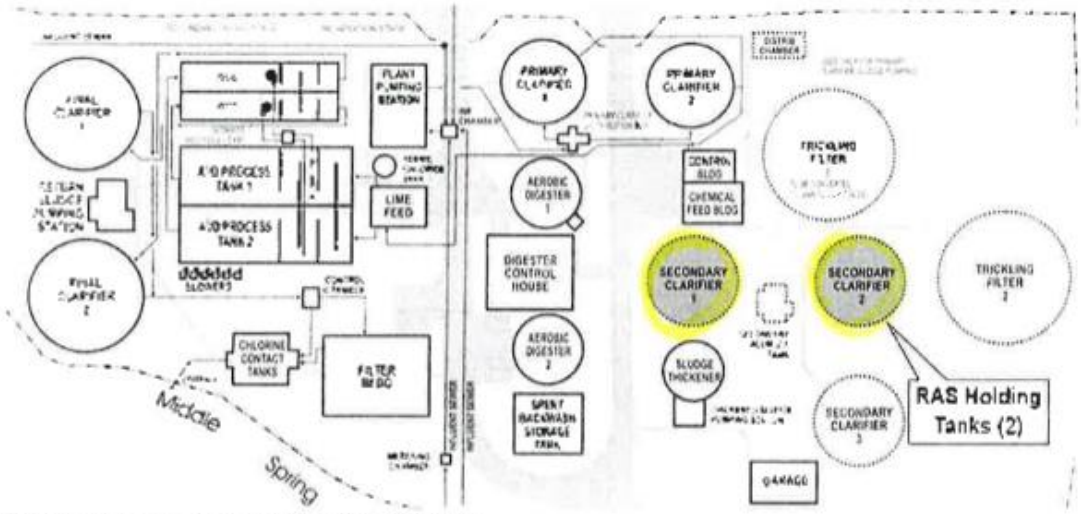

Figure 2. Preliminary location of RAS holding tanks

Estimated costs for the RAS holding tank system are summarized in Table 10.

Table 10. RAS Holding System OPCC

Item	Cost
Sitework	$10,000
Structural	$140,000
Mechanical and Equipment	$1,010,000
Electrical and Instrumentation	$280,000
Subtotal =	$1,440,000
Contractor Overhead and Profit (20%) =	$290,000
Contingency (30%) =	$430,000
Subtotal =	$2,160,000
Services and Fees (15%) =	$320,000
Total OPCC=	$2,480,000

Notes:
1. OPCC: Opinion of probable construction cost
2. Includes rehabilitation of existing tanks and splitter box.

The current condition of the clarifier tanks, piping, splitter box, and chemical feed building is currently unknown. A complete evaluation of these structures is recommended during detailed design of the future project to finalize the scope of modifications and associated costs.

Effluent Pumping (Filter Feed Pumping)

The effluent pumps are located in the Filter/UV Disinfection building, and all plant flow must be pumped through the effluent pumping station. Therefore, the required firm capacity is the peak hourly flow through the plant. The existing effluent pumping firm capacity is 10.8 MGD, so two of the four pumps must be increased in size from 2,500 GPM (3.6 MGD) to 4,500 GPM (6.5 MGD). The estimated costs for the effluent pumping modifications are provided in Table 11.

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Table 11. Effluent Pumping OPCC

Item	Cost*
Sitework	$0
Structural	$10,000
Mechanical and Equipment	$185,000
Electrical and Instrumentation	$224,000
Subtotal =	$420,000
Contractor Overhead and Profit (20%) =	$84,000
Contingency (30%) =	$126,000
Subtotal =	$630,000
Services and Fees (15%) =	$94,000
Total OPCC=	$720,000
*Costs rounded to nearest $10,000.	

Effluent Filters

Effluent filters are required as a barrier for solids removal prior to disinfection and final discharge. They are critical for WWTPs with stringent limits on total phosphorus removal due to the TP that is bound in the biological or chemical solids. Cloth disk filters are currently installed and have a peak firm capacity of 10.8 mgd based on a loading rate of 7 gpm/ft^2. Hazen and Sawyer's maximum recommended loading rate is typically 6 – 6.5 gpm/ft^2 for cloth disk filters. The following table summarizes the filter capacity evaluation. Based on this evaluation, additional filtration capacity is not required assuming total capacity for peak flow conditions. If one of the filters was down during peak flow events, partial bypass of the facility would be required to prevent rapid blinding of the filters and excessive headloss.

Table 12. Effluent Filter Evaluation

Parameter	Value
Peak Instantaneous Design Flow (mgd)	13.6 mgd
Existing Quantity	3
Firm SA installed (ft^2)	1,076
Design Loading (gpm/ft^2)	6.5 (max)
Firm Capacity at design loading (installed)	10.1 mgd
Total Capacity (mgd) currently installed	15.2 mgd
Recommended Modifications	None

UV Disinfection

The existing UV system is manufactured by Trojan and includes three banks with seven modules per bank. The system was designed to provide peak disinfection capacity at 10.8 mgd with one bank out of service. Therefore, the total estimated capacity with all banks in service is 16.2 mgd assuming that the headloss is sufficiently low to pass the peak flow. Design of the UV disinfection facility should be confirmed with Trojan during detailed design of the future project to verify the peak flow hydraulics and sufficient treatment capacity at peak flows. "On the shelf" spare modules are recommended to meet the disinfection demands for both flow scenarios A (12.9 mgd peak) and B (13.6 mgd peak). The estimated cost for providing one spare "on the shelf" module is $15,000.

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Post Aeration Tank

The corrective actions in the WQM permit application include an increase in wall height at the post aeration tank of about 2 ft to prevent overtopping during peak flows. The change in peak hour flow to 13.6 MGD does not require any additional action at this structure.

Electrical Modifications

The existing plant generator capacity (900 kW) was evaluated relative to the additional loads associated with the recommended modifications to handle 13.6 MGD. To accommodate the additional pumping capacity at the influent, effluent, and RAS holding pump stations, an additional 500 kW generator and new paralleling switchgear is recommended to provide sufficient standby power of critical liquid stream treatment processes.

The total estimated cost of the recommended standby electrical modifications is $2,700,000. We believe that these modifications will be needed to accommodate any additional modifications at the WWTP beyond those proposed in the corrective actions. Therefore these electrical modifications are not necessarily linked to the peak flow modifications, since they may be needed beforehand for improvements undertaken in the meantime.

WWTP Modifications Summary

The WWTP modifications (in addition to the corrective actions included in the current WQM permit application) are summarized in Table 13.

Table 13. WWTP Modifications Summary

Process	Description of Modifications	Design Criteria
RAS Holding Tank and Pump Station	Repurpose abandoned secondary clarifiers as RAS holding tanks. Install new RAS holding tank pumps and piping	Limited clarifier capacity at peak flows based on assumed peaking factors and performance.
Electrical Modifications	Install new generator and parallel switchgear	Required due to the additional equipment loads.
Post Anoxic Zone - Swing Zone	Install aeration grid diffusers and air piping	Required to meet peak day nitrification requirements.
Influent Pumping	Install new influent pump station expansion with submersible pumps	Additional influent flow from industry and revised peak hour flow.
Effluent Pumping	Replace two pumps (2,500 gpm ea.) with two pumps (4,500 gpm ea.)	Additional influent flow from industry and revised peak hour flow.
UV	Purchase addition UV module as "on the shelf spare"	Required to meet disinfection requirements at peak day flows.

OPCC Summary

The opinion of probable construction costs for the recommended modifications is summarized in Table 14. Note that all of the modifications and associated costs developed in this Flow Study are conceptual in nature and may be further refined during detailed design or with the results of I&I mitigation as presented in the Flow Study Update (see below).

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Table 14. WWTP Modifications OPCC Summary

Item	Cost[1]
RAS Holding Tank and Pump Station	$2,480,000
Post Anoxic Zone - Swing Zone	$110,000
Influent Pumping and Flow Equalization	$806,000
Effluent Pumping	$720,000
UV	$15,000
Subtotal	**$4,131,000**
Electrical Modifications[2]	$2,700,000
Total OPCC	**$6,831,000**

Notes:
1. Costs are conceptual and include an estimating level of contingency (30%), contractor overhead and profit (20%), and services and fees (15%).
2. Electrical modifications needed for any substantial increase in electrical load at the WWTP not necessarily related to peak flows

Implementation Schedule

The corrective actions included in the outstanding WQM permit application must be completed within 18 months of issuance of the WQM and NPDES permits. The earliest that date may occur is January 31, 2017. To immediately address peak flows, we recommend that the Borough in particular commence I&I mitigation concurrent with the necessary corrective work, in accordance with the schedule below. No additional I&I mitigation action is anticipated to be needed by CFJMA.

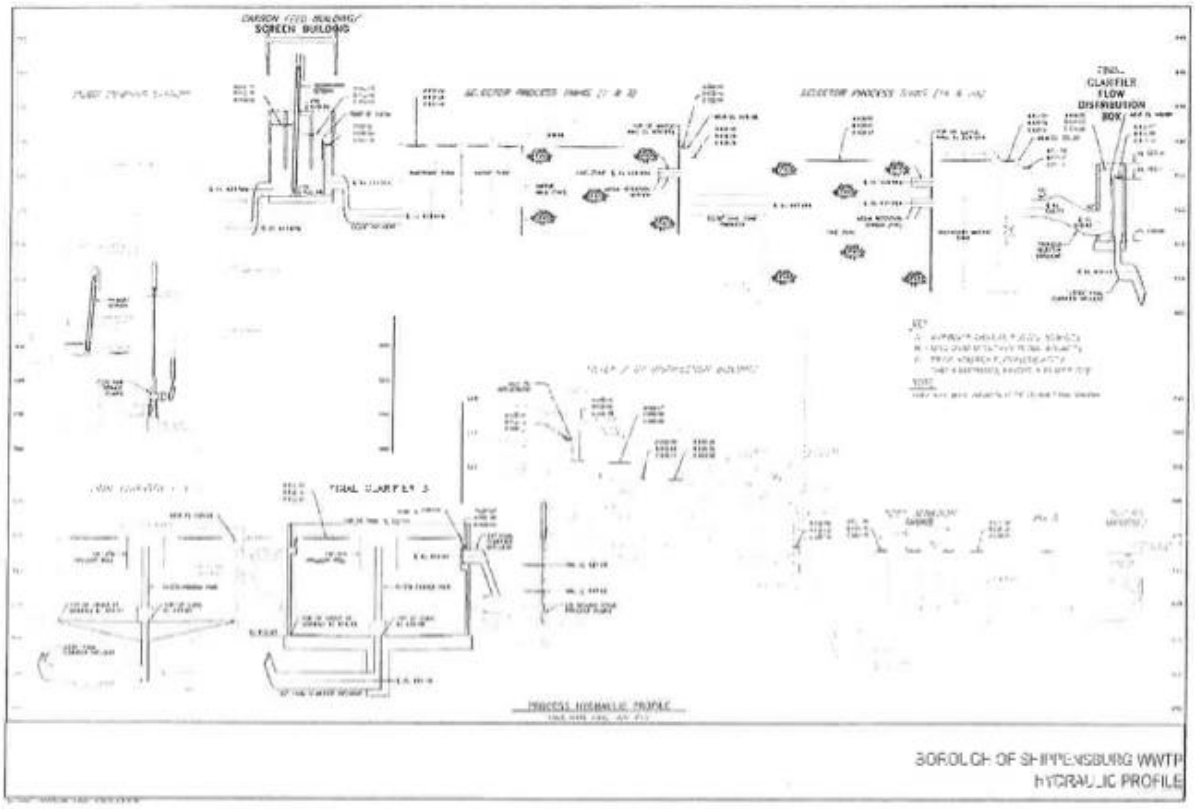
- Complete I&I Evaluation: December 31, 2016
  - Development of hydraulic model of Borough sewer system
  - Continuous flow monitoring using insertion flow meters
  - Data analysis using data from permanently installed wastewater flow meters and other applicable sources
  - Report summarizing findings and potential areas of significant I&I (submit to DEP). This report will result in a prioritized list of where to inspect further for I&I.
- Complete Collection System Inspection: December 31, 2017
  - CCTV inspection and/or other condition assessment technologies to identify areas in need of repair to eliminate I&I
  - Recommend methods to eliminate I&I (e.g. CIPP, slip-lining, full-scale replacement)
  - Report summarizing findings, scope, and schedule of recommended repairs (submit to DEP)
- Complete recommended collection system repairs for I&I reduction: December 31, 2020 or other approved schedule as included in the above report(s)
  - Flow Study Update documenting actual reduction of I&I with collection system repairs implemented (submit to DEP): July 31, 2021

HAZEN AND SAWYER
Environmental Engineers & Scientists

Because current extreme peak flows do not generally exceed about 8 MGD, we do not believe that the WWTP is at risk of approaching a peak hourly flow of 13.6 MGD within the next ten years. Accordingly, we recommend that the WWTP modifications be implemented according to the following schedules:

- Submit WQM Permit Application for WWTP Modifications (as summarized in Table 13 and Table 14): July 31, 2021
- Complete construction of WWTP Modifications: July 31, 2024

are these locked in?


SCREEN BUILDING
FINAL CLARIFIER FLOW DISTRIBUTION BOX
FINAL CLARIFIER 3
PROCESS HYDRAULIC PROFILE
BOROUGH OF SHIPPENSBURG WWTP
HYDRAULIC PROFILE