MONROE CITY COUNCIL

Agenda Bill No. 20-055

SUBJECT:	***Authorize Mayor to Sign the Consultant Agreement with Kennedy Jenks for the Waste Water Treatment Plant (WWTP) CIP 1 Design***

DATE:	DEPT:	CONTACT:	PRESENTER:	ITEM:
04/28/2020	Public Works	Brad Feilberg	John Lande	Consent Agenda #7

Discussion: 02/12/2019
Attachments:
1. Consultant Agreement
2. pH Engineering Report

REQUESTED ACTION: *Move to Authorize the Mayor to Sign the Consultant Agreement with Kennedy Jenks for the Wastewater Treatment Plant CIP 1 Design, and expressly authorize minor revisions to the extent deemed necessary or appropriate.*

POLICY CONSIDERATION:
On March 24, 2020, Governor Jay Inslee issued Proclamation 20-28, relating to the Open Public Meetings Act and Public Records Act; the proclamation restricted the ability of public agencies to take action to only those actions that are necessary and routine, or to respond to the COVID-19 outbreak and public health emergency. The proclamation was effective through April 23, 2020 and subsequently extended through May 4, 2020.

In accordance with Section 4.2 of the Procurement Policies & Procedures, contracts costing $100,000 or more require City Council approval.

- *Necessary – This item is a requirement of NPDES. The time necessary to compete the design requires the consultant to begin May 1. No further delay can occur.*
- *Routine – This process is consistent with the city's Procurement Policy and follows protocol.*

DESCRIPTION/BACKGROUND:
The Monroe Wastewater Treatment Plant (WWTP) is required to comply with the conditions contained in the National Pollutant Discharge Elimination System (NPDES) permit issued by the Washington State Department of Ecology. The City's wastewater NPDES Permit was renewed on 10/31/2019. The current permit contains new, more stringent final effluent pH requirements. The current treatment operation cannot consistently or reliably meet the new pH limits. Therefore, the Department of Ecology has given the City a timeline to complete a series of submittal items which ultimately lead to the construction of facilities to achieve compliance. The submittal items and timeline are as follows:

Submittal	Due Date	Status
Draft pH Engineering Report	12/31/2019	Completed
Design and Specifications	12/31/2020	CA Pending
Declaration of Construction	12/31/2022	Pending
New pH Limits Enforced	01/01/2023	

The Draft pH Engineering Report was submitted to Ecology in December 2019. Kennedy Jenks Consultants are currently working on the WWTP Engineering Report. They have developed the methods and systems to address the pH treatment methods and identified this project as CIP 1.

A project specific Request for Proposals was issued on 02/28/2020. Kennedy Jenks Consultants submitted and were selected to create the design and specifications to WWTP CIP 1.

The modifications to be designed include:

- New magnesium hydroxide system to include storage and metered pumping
- Aeration Basin baffling on two aeration basins
- Optimization of the mixed liquor recirculation pumping system with the addition of a nitrate probe
- New RAS sodium hypochlorite addition system will be added to aid in filamentous control
- New sodium hydroxide chemical storage and metered feed system will be added to plant effluent

A scope of work and fee was negotiated that fits the city's needs and budget.

FISCAL IMPACTS:

The 6 year Sewer CIP Plan has a budget of $200,000 for CIP 1 Design for the year 2020. Kennedy Jenks has a fee of $199,886 to complete the design and specifications as required. There is adequate funding for this project.

TIME CONSTRAINTS:

The timeline necessary to complete the design requires the consultants to receive a notice to proceed May 1.

- *Necessary – This item is a requirement of NPDES. The time necessary to compete the design requires the consultant to begin May 1. No further delay can occur.*

- *Routine – This process is consistent with the city's Procurement Policy and follows protocol.*

ALTERNATIVES:

1. None.

CONSULTANT AGREEMENT	
PROJECT TITLE AND IDENTIFICATION NUMBER 1 WWTP CIP 1 Design	**WORK DESCRIPTION** 2 Prepare plans and specifications according to the requirements of WAC 173-240-070 for any facility improvements needed to meet final effluent limits for pH.
CONSULTANT 3 Kennedy Jenks 32001 32nd Avenue S, Suite 100 Federal Way, WA 98001	**CONSULTANT CONTACT NAME, AND TELEPHONE NO.** 4 Christopher Stoll 206-753-3412 chrisstoll@kennedyjenks.com
FEDERAL I.D. NO. 5 94-2147007	**BUDGET OR FUNDING SOURCE** 6 422-000-120-594-35-65-00
PROJECT ADMINISTRATOR NAME, ADDRESS AND TELEPHONE NO. 7 John Lande Water/Wastewater Manager City of Monroe 806 W Main St Monroe, WA 98272 jlande@monroewa.gov	**MAXIMUM AMOUNT PAYABLE, IF ANY** 8 $199,886.00 ** City of Monroe Business License required to receive Notice to Proceed **
COMPLETION DATE 9 December 31, 2022	10 ☐ Lump Sum ☐ Cost Plus a Fixed Fee ☐ Schedule Rate/Time and Materials ☒ Time and Materials/Not to Exceed

THIS AGREEMENT is entered into on _____, 2020 between the City of Monroe, Washington, hereinafter called "the CITY", and the above person, firm or organization, hereinafter called "the CONSULTANT".

WHEREAS, the CITY desires to accomplish the above-referenced project; and

WHEREAS, the CITY does not have sufficient staff or expertise to meet the required commitment and therefore deems it advisable and desirable to engage the assistance of a CONSULTANT to provide the necessary services for the project; and

WHEREAS, the CONSULTANT has represented to the CITY that the CONSULTANT is in compliance with the professional registration statutes of the State of Washington, if applicable, and has signified a willingness to furnish consulting services to the CITY, now, therefore,

IN CONSIDERATION OF the terms and conditions set forth below, or attached and incorporated and made a part hereof, the parties agree as follows:

1. Retention of Consultant - Scope of Work. The CITY hereby retains the CONSULTANT to provide professional services as defined in this agreement and as necessary to accomplish the scope of work attached hereto as Exhibit A and incorporated herein by this reference as if set forth in full. The CONSULTANT shall furnish all services, labor and related equipment necessary to conduct and complete the work, except as specifically noted otherwise in this agreement.

2. Completion of Work. The CONSULTANT shall not begin any work under the terms of this agreement until authorized in writing by the CITY. The CONSULTANT shall complete all work required by this agreement according to the schedule attached as Exhibit B and incorporated herein by this reference as if set forth in full. A failure to complete the work according to the attached schedule, except where such failure is due to circumstances beyond the control of the CONSULTANT, shall be deemed a breach of this agreement. The established completion time shall not be extended because of any delays attributable to the CONSULTANT, but may be extended by the CITY, in the event of a delay attributable to the CITY, or because of unavoidable delays caused by circumstances beyond the control of the CONSULTANT. All such extensions shall be in writing and shall be executed by both parties.

3. Payment. The CONSULTANT shall be paid by the CITY for satisfactorily completed work and services satisfactorily rendered under this agreement as provided in Exhibit C, attached hereto and incorporated herein by this reference as if set forth in full. Such payment shall be full compensation for work performed or services rendered and for all labor, materials, supplies, equipment, and incidentals necessary to complete the work specified in the Scope of Work attached. The CONSULTANT shall be entitled to invoice the CITY no more frequently than once per month during the course of the completion of work and services by the CONSULTANT. Invoices shall detail the work performed or services rendered, the time involved (if compensation is based on an hourly rate) and the amount to be paid. The CITY shall pay all such invoices within 45 days of submittal, unless the CITY gives notice that the invoice is in dispute. In no event shall the total of all invoices paid exceed the maximum amount payable set forth above, if any, and the CONSULTANT agrees to perform all services contemplated by this agreement for no more than said maximum amount.

4. Changes in Work. The CONSULTANT shall promptly make such changes and revisions in the complete work provided by this agreement as may be necessary to correct errors made by the CONSULTANT and appearing therein when required to do so by the CITY. The CONSULTANT shall make such corrective changes and revisions without additional compensation from the CITY. Should the CITY find it desirable for its own purposes to have previously satisfactorily completed work or parts thereof changed or

revised, the CONSULTANT shall make such revisions as directed by the CITY; this work shall be considered as Extra Work and will be paid for as provided in Section 5.

5. Extra Work.

A. The CITY may, at any time, by written order, make changes within the general scope of the agreement in the services to be performed. If any such change causes an increase or decrease in the estimated cost of, or the time required for, performance of any part of the work or services under this agreement, whether or not changed by the order, or otherwise affects any other terms or conditions of the agreement, the CITY shall make an equitable adjustment in the (1) maximum amount payable; (2) delivery or completion schedule or both; and (3) other affected terms, and shall modify the agreement accordingly.

B. The CONSULTANT must submit any "proposal for adjustment" under this clause within 30 days from the date of receipt of the written order to make changes. However, if the CITY decides that the facts justify it, the CITY may receive and act upon a proposal submitted before final payment of the agreement.

C. Failure to agree to any adjustment shall be a dispute as provided in Section 18. Notwithstanding any such dispute, the CONSULTANT shall proceed with the agreement as changed.

D. Notwithstanding any other provision in this section, the maximum amount payable for this agreement shall not be increased or considered to be increased except by specific written amendment of this agreement.

6. Ownership of Work Product. Any and all documents, drawings, reports, and other work product produced by the CONSULTANT under this agreement shall become the property of the CITY upon payment of the CONSULTANT'S fees and charges therefore. The CITY shall have the complete right to use and re-use such work product in any manner deemed appropriate by the CITY, provided, that use on any project other than that for which the work product is prepared shall be at the CITY'S risk unless such use is agreed to by the CONSULTANT. Electronic versions of all work products shall be provided to the CITY in a format compatible with CITY software, except to the extent expressly waived in the attached exhibits.

7. Independent Contractor. The CONSULTANT is an independent contractor for the performance of services under this agreement. The CITY shall not be liable for, nor obligated to pay to the CONSULTANT, or any employee of the CONSULTANT, sick leave, vacation pay, overtime or any other benefit applicable to employees of the CITY, nor to pay or deduct any social security, income tax, or other tax from the payments made to the CONSULTANT which may arise as an incident of the CONSULTANT performing services for the CITY. The CITY shall not be obligated to pay industrial insurance for the services rendered by the CONSULTANT.

8. Indemnity. The CONSULTANT agrees to hold harmless, indemnify and defend the CITY, its officers, agents, employees and volunteers from and against any and all claims, injuries, losses, suits, costs or liability, including attorneys' fees (collectively, "Claims"), specifically including without limitation Claims resulting from injuries, sickness or death of employees of the CONSULTANT and/or damage to property, arising out of or otherwise resulting from the acts, errors, or omissions of the CONSULTANT, its officers, agents, subconsultants or employees, in connection with the services required by this agreement, provided, however, that: The CONSULTANT's obligation to indemnify, defend and hold harmless shall not extend to Claims caused by or resulting from the sole willful misconduct or sole negligence of the City.

Should a court of competent jurisdiction determine that this agreement is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the CONSULTANT and the CITY, its officers, officials, employees, and volunteers, the CONSULTANT's liability, including the duty and cost to defend, hereunder shall be only to the extent of the CONSULTANT's negligence.

It is further specifically and expressly understood that the indemnification provided herein constitutes the CONSULTANT'S waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties.

The CITY's acceptance or approval of any services or work product under this agreement shall not be deemed to reduce, abridge, limit or otherwise alter the CONSULTANT's obligations as set forth in this section, unless such intent is expressly stated in writing by the CITY.

The provisions of this section shall survive the expiration or termination of this agreement.

9. Insurance. The CONSULTANT shall procure and maintain for the duration of the agreement, insurance against claims for injuries to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the CONSULTANT, its agents, representatives, or employees.

A. Minimum Scope of Insurance

CONSULTANT shall obtain insurance of the types described below:

1. Automobile Liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on Insurance Services Office (ISO) form CA 00 01 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.

2. Commercial General Liability insurance shall be at least as broad as ISO occurrence form CG 00 01 and shall cover liability arising from premises, operations, stop-gap independent contractors and personal injury and advertising injury. The CITY shall be named as an additional insured under the CONSULTANT's Commercial General Liability insurance policy with respect to the work performed for the CITY using an additional insured endorsement at least as broad as ISO CG 20 26.

3. Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington.

4. Professional Liability Professional liability insurance appropriate to the CONSULTANT's profession.

B. Minimum Amounts of Insurance

CONSULTANT shall maintain the following insurance limits:

1. Automobile Liability insurance with a minimum combined single limit for bodily injury and property damage of $1,000,000 per accident.

2. Commercial General Liability insurance shall be written with limits no less than $1,000,000 each occurrence, $2,000,000 general aggregate.

3. Professional Liability insurance shall be written with limits no less than $1,000,000 per claim and $1,000,000 policy aggregate limit.

The amounts listed above are the minimum deemed necessary by the CITY to protect the CITY'S interests in this matter. The CITY has made no recommendation to the CONSULTANT as to the insurance necessary to protect the CONSULTANT'S interests and any decision by the CONSULTANT to carry or not carry insurance amounts in excess of the above is solely that of the CONSULTANT.

C. Other Insurance Provisions.

All insurance shall be obtained from an insurance company authorized to do business in the State of Washington. Excepting the professional liability insurance, the CITY will be named on all insurance as an additional insured. The CONSULTANT shall submit a certificate of insurance to the CITY evidencing the coverages specified above, together with an additional insured endorsement naming the CITY, within fifteen (15) days of the execution of this agreement and prior to the performance of any work specified hereunder. The certificates of insurance shall cover the work specified in or performed under this agreement. The certificate and endorsement must be project and/or site specific.

D. Cancellation.

The CONSULTANT shall provide the CITY with written notice of any policy cancellation within two business days of its receipt of such notice. No cancellation, reduction or modification of the foregoing policies shall be effective without thirty (30) days prior written notice to the CITY.

The CONSULTANT's insurance coverage shall be primary insurance as respect the City. Any insurance, self-insurance, or insurance pool coverage maintained by the CITY shall be excess of the CONSULTANT's insurance and shall not contribute with it.

E. Acceptability of Insurers.

Insurance is to be placed with insurers with a current A.M. Best rating of not less than A:VII.

F. No Limitation.

The CONSULTANT's maintenance of insurance as required by this agreement shall not be construed to limit the liability of the CONSULTANT to the coverage provided by such insurance, or otherwise limit the CITY'S recourse to any remedy available at law or equity.

G. Failure to Maintain Insurance.

Failure on the part of the CONSULTANT to maintain the insurance as required shall constitute a material breach of contract, upon which the CITY may, after giving five business days notice to the CONSULTANT to correct the breach, immediately terminate this agreement or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the CITY on demand, or at the sole discretion of the CITY, offset against funds due the CONSULTANT from the CITY.

H. City Full Availability of Consultant Limits.

If the CONSULTANT maintains higher insurance limits than the minimums shown above, the CITY shall be insured for the full available limits of Commercial General and Excess or Umbrella liability maintained by the CONSULTANT, irrespective of whether such limits maintained by the CONSULTANT are greater than those required by this agreement or whether any certificate of insurance furnished to the CITY evidences limits of liability lower than those maintained by the CONSULTANT.

10. Records Retention and Disclosure. The CONSULTANT shall keep all records related to this agreement for a period of three years following completion of the work for which the CONSULTANT is retained. The CONSULTANT shall permit any authorized representative of the CITY, and any person authorized by the CITY for audit purposes, to inspect such records at all reasonable times during regular business hours of the CONSULTANT. Upon request, the CONSULTANT will provide the CITY with reproducible copies of any such records. The copies will be provided without cost if required to substantiate any billing of the CONSULTANT, but the CONSULTANT may charge the CITY for copies requested for any other purpose. The CONSULTANT shall also provide a complete electronic copy of all reports, plans, and specifications upon completion of the work or upon request of the CITY.

Separate from and additional to the foregoing, the CONSULTANT shall fully cooperate with and assist the CITY with respect to any request for public records received by the CITY and related to any public records generated, produced, created and/or possessed by the CONSULTANT and related to the services performed under this agreement. Upon written demand by the CITY, the CONSULTANT shall furnish the CITY with full and complete copies of any such records within five business days.

The CONSULTANT's failure to timely provide such records upon demand shall be deemed a material breach of this agreement. To the extent that the CITY incurs any monetary penalties, attorneys' fees, and/or any other expenses as a result of such breach, the CONSULTANT shall fully indemnify and hold harmless the CITY as set forth in Section 8.

For purposes of this section, the term "public records" shall have the same meaning as defined by Chapter 42.17 RCW and Chapter 42.56 RCW, as said chapters have been construed by Washington courts.

The provisions of this section shall survive the expiration or termination of this agreement.

11. Notices. All notices required to be given by either party to the other under this agreement shall be in writing and shall be given in person or by mail to the addresses set forth in the box for the same appearing at the outset of this agreement. Notice by mail shall be deemed given as of the date the same is deposited in the United States mail, postage prepaid, addressed as provided in this paragraph.

12. Project Administrator. The Project Administrator shall be responsible for coordinating the work of the CONSULTANT, for providing any necessary information for and direction of the CONSULTANT's work in order to ensure that it generally meets the requirements of this agreement, and for reviewing, monitoring and approving the general quality and quantity of such work. The CONSULTANT shall report to and take any necessary direction from the Project Administrator. Provided, that nothing in this section shall be construed as altering the CONSULTANT'S duty of care or otherwise limiting, abridging, waiving or reducing the CONSULTANT'S obligations under this agreement.

13. Conflict Amongst Main Agreement and Attachments. In case of conflict between the Exhibits to this agreement and the portions of this agreement preceding the signature lines (Sections 1-23), the terms of

Sections 1-23 shall prevail. Any limitations on liability and indemnification expressed in the attached exhibits beyond those specified in Sections 8 and 9 (prior to signature line) shall be null and void.

14. Termination. The CITY reserves the right to terminate this agreement at any time upon ten (10) days written notice to the CONSULTANT. Any such notice shall be given to the address specified in Box 3 on page 1. In the event that this agreement is terminated by the CITY other than for fault on the part of the CONSULTANT, a final payment shall be made to the CONSULTANT for all services satisfactorily performed. No payment shall be made for any work completed after ten (10) days following receipt by the CONSULTANT of the notice to terminate. In the event that services of the CONSULTANT are terminated by the CITY for fault on part of the CONSULTANT, the amount to be paid shall be determined by the CITY with consideration given to the actual cost incurred by the CONSULTANT in performing the work to the date of termination, the amount of work originally required which would satisfactorily complete it to date of termination, whether that work is in a form or type which is usable to the CITY at the time of termination, the cost of the CITY of employing another firm to complete the work required, and the time which may be required to do so.

15. Non-Discrimination. The CONSULTANT agrees not to discriminate against any customer, employee or applicant for employment, subcontractor, supplier or materialman, because of race, color, creed, religion, national origin, marital status, sex, sexual orientation, age or handicap, except for a bona fide occupational qualification. The CONSULTANT understands that if it violates this provision, this agreement may be terminated by the CITY and that the CONSULTANT may be barred from performing any services for the CITY now or in the future.

16. Subcontracting or Assignment. The CONSULTANT may not assign or subcontract any portion of the services to be provided under this agreement without the express written consent of the CITY. Any subconsultants approved by the CITY at the outset of this agreement are named on Exhibit D attached hereto and incorporated herein by this reference as if set forth in full.

17. Non-Waiver. Payment for any part of the work or services by the CITY shall not constitute a waiver by the CITY of any remedies of any type it may have against the CONSULTANT for any breach of the agreement by the CONSULTANT, or for failure of the CONSULTANT to perform work required of it under the agreement by the CITY. Waiver of any right or entitlement under this agreement by the CITY shall not constitute waiver of any other right or entitlement.

18. Resolution of Disputes; Governing Law and Venue. This agreement shall be governed by and construed in accordance with the laws of the State of Washington. If any dispute arises out of or in connection with this agreement, including any question regarding its existence, enforceability, interpretation, or validity, the parties will, if practicable, meet and confer in good faith for a period of fourteen (14) days to attempt to resolve such dispute without an adversary proceeding. If at the end of the fourteen (14) day period such attempt at resolution is unsuccessful, the parties may resort to litigation. The exclusive venue for any litigation arising out this agreement shall be the Snohomish County Superior Court. The substantially prevailing party in any such litigation shall be entitled to an award of its reasonable attorneys' fees.

19. Taxes. The CONSULTANT will be solely responsible for the payment of any and all applicable taxes related to the services provided under this agreement and if such taxes are required to be passed through to the CITY by law, the same shall be duly itemized on any billings submitted to the CITY by the CONSULTANT.

20. Code of Ethics. The CONSULTANT and all subconsultants/subcontractors shall also comply with the Monroe Code of Ethics (Exhibit E), Chapter 2.52 MMC. Any violation of Chapter 2.52 MMC by the

CONSULTANT or any of its subconsultants/subcontractors shall be considered a material breach of this Agreement.

21. Entire Agreement. This agreement represents the entire integrated agreement between the CITY and the CONSULTANT, superseding all prior negotiations, representations or agreements, written or oral. This agreement may be modified, amended, or added to, only by written instrument properly signed by both parties hereto.

22. Legal Compliance. In the performance of work under this agreement, the CONSULTANT shall comply with all federal, state and municipal laws, ordinances, rules and regulations that are applicable to the CONSULTANT's business, equipment, and personnel engaged in operations covered by this agreement or accruing out of the performance of such operations.

23. Risk of Loss. The CONSULTANT shall be solely responsible for the safety of its employees, agents and subcontractors in the performance of the work hereunder and shall take all protections reasonably necessary for that purpose. All work shall be done at the CONSULTANT's own risk, and the CONSULTANT shall be solely responsible for any loss of or damage to materials, tools, or other articles used or held for use in connection with the work.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the day and year first above written.

CONSULTANT: KENNEDY JENKS

By: Ronald Walz

Title: Principal

CITY OF MONROE:

Geoffrey Thomas, City Mayor

ATTEST/AUTHENTICATED:

Rabecca R. Hasart, Interim City Clerk

EXHIBIT A

SCOPE OF WORK

The City of Monroe, Washington (City) owns, operates, and maintains a municipal wastewater treatment plant (WWTP) and wastewater collection system. The WWTP is a secondary wastewater treatment plant implementing a Modified Ludzack-Ettinger process with UV disinfection, aerobic digestion, belt press dewatering, and utilizing contract hauling and application of the City's biosolids to a Beneficial Use Facility. The WWTP has a design capacity of 2.84 MGD Maximum Month Design Flow (MMDF). The original primary treatment plant was built in the early 1950's with the modification to secondary treatment in 1976. Major facility upgrades occurred in three phases: mid-1990s (Phase 1), early 2000s (Phase II), and early 2010s (Phase III). Additional facility improvements have been made over the years including, digester blower replacement, aeration basin blower replacement, aeration basin diffuser upgrades, odor control scrubber modifications, WAS thickening and secondary clarifier modifications under the Energy Conservation Projects through the Washington State Department of Enterprise Services program.

The NPDES permit for the WWTP was revised in 2018 to include more stringent pH limits with the implementation schedule outlined below. The City is interested in implementing process improvements to increase treatment reliability in compliance with the implementation schedule.

Table 1: pH-Specific NPDES Permit Compliance Schedule

	Tasks	Date Due
1	Submit an Engineering Report according to the requirements of WAC 173-240-060 for facility improvements, including those necessary to meet the final effluent limits for pH.	December 31, 2019 (Completed)
2	Submit Plans and Specifications according to the requirements of WAC 173-240-070 for any facility improvements needed to meet final effluent limits for pH.	December 31, 2020
3	Complete construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submit a Declaration of Construction of Water Pollution Control Facilities (WAC 173-240-090).	December 31, 2022

Proposed improvements as detailed in the pH and Filament Control Engineering Report include:

- Upgraded Magnesium Hydroxide Feed System: Replace the existing magnesium hydroxide feed system with a system that provides greater reliability and improved operation and control of pH buffering within the biological system.
- Secondary Effluent Sodium Hydroxide Feed System: Add a system to feed sodium hydroxide into the secondary effluent as a pH control back-up.
- Baffling of Aeration Basins: Add baffles in the existing aeration basins to allow tapered aeration for a reduction of dissolved oxygen in the mixed liquor recycle to improve denitrification and associated alkalinity recovery and yield energy savings.
- Permanent Return Activated Sludge Chlorination: Add a chlorination system to the return activated sludge (RAS) system for improved filament control and sludge settleability.

Modifications and omissions from the improvements as originally detailed in the pH and Filament Control Engineering Report are as follows:

- Mixed Liquor Return Optimization (modified): Instead of installing a flow meter, the existing pump speed will be controlled to pace with flow using a user defined pump curve or will modulate pump speed directly based upon the signals from a new nitrate probe, which will improve denitrification and biological alkalinity recovery with either mode.
- Surface Wasting (omitted): The improvements for surface wasting will be deferred to a future project.

This scope of services will develop a design (plans and specifications) for these proposed improvements for submission to the Washington State Department of Ecology (Ecology) for review, comment and approval. The following scope of work details the following tasks for the work to be performed:

- Task 1 – Develop Plans and Specifications
- Task 2 – Project Meetings
- Task 3 – Project Management and Quality Assurance/Quality Control

Task 1 – Develop Plans and Specifications

CONSULTANT will work with the City to develop and submit plans and specifications meeting the Ecology deadline of December 31, 2020.

CONSULTANT Services:

- Preliminary Design
    - Prepare preliminary design calculations for the appropriate design disciplines and improvement elements including hydraulics, civil, structural, mechanical, and electrical. Also prepare instrumentation control strategies.
    - Prepare preliminary design drawings including preliminary general drawings, site plans, mechanical drawings and process and instrumentation diagrams (P&IDs).
    - Prepare initial specifications set consisting of the initial front-end documents, technical specifications for major equipment, and draft control strategies.
    - Prepare preliminary opinion of probable construction cost.

- Detailed Design for City and Ecology Review/Approval
    - Complete preparation and quality reviews of design calculations for the appropriate design disciplines and improvement elements including hydraulics, civil, structural, mechanical and electrical, as well as review of the instrumentation control strategies.
    - Complete design drawings including general drawings, site plans, structural, mechanical, electrical and P&IDs.
    - Complete all specifications consisting of final front-end documents and technical discipline specifications including all necessary equipment (e.g., mechanical, electrical and instrumentation) and materials specifications.
    - Complete opinion of probable construction cost and finalize the construction sequence.

- Final Design for Bid

    - Incorporate Ecology and City comments on the Detailed Design submittal.
    - Complete and issue signed bid documents to the City for bidding.

City Responsibilities:

- The City may be asked to provide additional information to supplement record drawings that plant staff should be able to provide.
- The City may be asked to perform minor potholing within the plant site to identify the location of underground facilities in locations where tight construction space is a concern.
- Participate in discussion(s) with CONSULTANT as design progresses.
- Inform CONSULTANT if any goals change during the project in ways that could impact the scope, deliverables, schedule, and/or budget.

Assumptions:

- No field work such as survey or geotechnical investigations are required.
- Kennedy Jenks standard drawing and specifications templates will be used including the front-end (boiler plate) specifications.
- City staff will provide requested information to the extent that the information is available and accessible. Consultant analyses will be limited to the information available.
- Monroe WWTP record drawing files will be used as the basis for developing the drawings and no survey will be conducted. Where possible, the Consultant will attempt to verify the accuracy of these drawings. For areas of the WWTP where record drawings in Auto CAD are not available, the Consultant will develop drawing backgrounds based on available PDF and hard copy record drawings or utilize photographs where appropriate.
- Where appropriate and as directed by the City, the Consultant will design around equipment makes and models that the City has standardized upon.
- Building modifications may be needed for the addition of sodium hydroxide storage. Building modifications will be kept to a minimum but will be in coordination with the Fire Marshall. No new buildings or modifications to buildings will be included in the design for the other elements of the project.
- The project will be bid only once.
- New control panels and PLCs will not be required for the proposed improvements at the WWTP, though a new remote I/O panel may be utilized with the new chemical systems to collect I/O. This will avoid having to make hardware modifications to older control panels and simplify signal and communications conduit and wiring. The Consultant will select control associated hardware in compliance with the City's standards.
- New motor control centers and panel boards will not be required for the proposed improvements at the WWTP and the existing MCCs and panel boards at the WWTP have enough space/capacity to accommodate these improvements.
- Permitting support or other work not specifically outlined in this scope of work is not included in this contract but may be added by amendment.

Deliverables:

- Preliminary design documents (work in progress) for workshop.
- Detailed design set will be submitted via PDF.

- Final design bid set will be submitted in both electronic PDF and hardcopy (Full Size)

Task 2 – Project Meetings

CONSULTANT will prepare agendas, document meeting notes, maintain a design decision log, and attend the following planned meetings during the project design phase.

CONSULTANT Services:

- Kickoff meeting and site walk.
- Preliminary design workshop with the City with follow-on site review (if necessary).
- Detailed design review meeting with the City and Ecology with follow-on site review (if necessary).
- Project status meetings to occur every other week.

City Responsibilities:

- Provide meeting space when needed.
- Review and comment on meeting agendas and meeting notes.
- Participate in site walk and site reviews, as necessary.

Assumptions:

- Kick-off meeting will include a site walk and discussion estimated to last 3 hours with up to 5 consultants attending. Three (3) hours of preparation, follow-up and travel time is assumed for each consultant.
- Meeting with Ecology will be set-up by CONSULTANT with up to 5 consultants present and will last for 3 hours with 3 hours of travel and preparation time.
- Project status phone calls will be hosted by CONSULTANT. Phone calls will be held no more than twice per month and will last 1 hour with 2 consultants present with 1 hour of preparation and follow-up per consultant.
- A design decision log will be maintained to track major design decisions that emerge from meetings/calls.

Deliverables:

- Meeting agendas and notes in electronic PDF format.
- Design decision log.

Task 3 – Project Management and Quality Assurance and Quality Control

CONSULTANT will manage the project with regards to scope compliance, budget control, timeline adherence, project team / subcontractor coordination, and quality reviews.

CONSULTANT Services:

- Develop Project Plan and Project Setup
- Prepare Subcontractor Agreements
- Health and Safety Plan Development
- Team Oversight

- Budget Tracking and Monthly Invoicing
    - Invoices will include a summary of monthly activities
- Schedule Confirmation and Schedule Tracking
- Change Management
    - Project Manager will monitor project and use tools such as resource allocation, budget reallocation, and schedule reconfiguration to manage the overall delivery of the project within the timelines and budgets. PM will contact the City to discuss any changes that impact deliverables and deadlines.
- Project status phone calls will be held with the City's project manager.
- QA/QC
    - Quality Plan development – at beginning of project
    - Internal 'concept and criteria review' meeting to provide direction to team
    - Quality reviews of each major deliverable prior to submittal to City

City Responsibilities:

- Participate in status phone calls.
- Provide input related to any changes to budget, schedule, etc.
- Make decisions based upon CONSULTANT's analyses.
- Provide CONSULTANT with feedback if anything isn't going to the City's satisfaction.

Assumptions:

- Project duration is assumed to be 9 months.
- Invoices will be sent monthly.
- Project schedule will be updated twice through the course of the project.

Deliverables:

- Project schedule (electronic copy to the City)
- Invoices and status letters

Additional Tasks to be added by Amendment – Bid Period and Construction Services

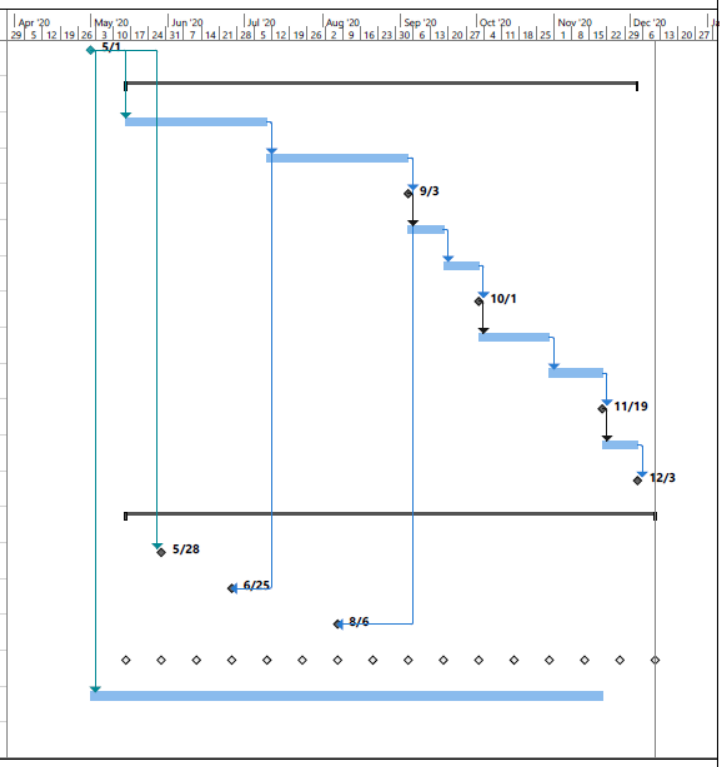
CONSULTANT will provide additional services as agreed upon by the City by amendment which will outline the additional scope, schedule and budget for those services.

EXHIBIT B

COMPLETION SCHEDULE

Exhibit B: Completion Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
1		Notice to Proceed	0 days	Fri 5/1/20	Fri 5/1/20
2		**Task 1 - Develop Plans and Specifications**	**145 days**	**Fri 5/15/20**	**Thu 12/3/20**
3		Preliminary Design	40 days	Fri 5/15/20	Thu 7/9/20
4		Detailed Design	40 days	Fri 7/10/20	Thu 9/3/20
5		Submit to City	0 days	Thu 9/3/20	Thu 9/3/20
6		City Review	10 days	Fri 9/4/20	Thu 9/17/20
7		Incorporate City Comments	10 days	Fri 9/18/20	Thu 10/1/20
8		Submit to Ecology	0 days	Thu 10/1/20	Thu 10/1/20
9		Ecology Review	20 days	Fri 10/2/20	Thu 10/29/20
10		Final Design/Bid Documents	15 days	Fri 10/30/20	Thu 11/19/20
11		Submit to City	0 days	Thu 11/19/2(	Thu 11/19/20
12		Incorporate City Comments	10 days	Fri 11/20/20	Thu 12/3/20
13		Submit Final Bid Documents	0 days	Thu 12/3/20	Thu 12/3/20
14		**Task 2 - Project Meetings**	**150 days**	**Thu 5/14/20**	**Thu 12/10/20**
15		Kickoff	0 days	Thu 5/28/20	Thu 5/28/20
16		Preliminary Design Review	0 days	Thu 6/25/20	Thu 6/25/20
17		Detailed Design Review	0 days	Thu 8/6/20	Thu 8/6/20
18		Bi-Weekly Meetings	**150 days**	**Thu 5/14/20**	**Thu 12/10/20**
35		**Task 3 - Project Management and QA/QC**	145 days	Fri 5/1/20	Thu 11/19/20
36		**Bid Period and Construction Services (Added by Amendm**	1 day?	Thu 3/5/20	Thu 3/5/20



Project: ProjectCIP1 pH Control
Date: Tues 3/31/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

Page 1

EXHIBIT C

FEE SCHEDULE

Task 1 - Develop Plans and Specifications	$149,001.00
Task 2 - Project Meetings	$21,811.00
Task 3 - Project Management and QA/QC	$29,075.00
Task 4 - Management Reserve Fund	$ -
TOTAL	**$199,886.00**

Compensation will follow the Schedule of Charges below:

PERSONNEL COMPENSATION

Classification	Hourly Rate
Engineer-Scientist Specialist 1	$133.90
Engineer-Scientist Specialist 2	$144.20
Engineer-Scientist Specialist 3	$154.50
Engineer-Scientist Specialist 4	$164.80
Engineer-Scientist Specialist 5	$180.25
Engineer-Scientist Specialist 6	$195.70
Engineer-Scientist Specialist 7	$206.00
Engineer-Scientist Specialist 8	$221.45
Engineer-Scientist Specialist 9	$236.90
CAD-Technician	$103.00
Senior CAD-Technician	$123.60
CAD-Designer	$139.05
Senior CAD-Designer	$154.50
Project Administrator	$123.60
Administrative Assistant	$92.70
Aide	$77.25

In addition to the above Hourly Rates, an Associated Project Cost charge of $5.00 per hour will be added to Personnel Compensation for costs supporting projects including telecommunications, software, information technology, internal photocopying, shipping, and other support activity costs related to the support of projects.

Direct Expenses

Reimbursement for direct expenses, as listed below, incurred in connection with the work, will be at cost plus five percent for items such as:

a. Maps, photographs, 3rd party reproductions, 3rd party printing, equipment rental, and special supplies related to the work.
b. Consultants, soils engineers, surveyors, contractors, and other outside services.
c. Rented vehicles, local public transportation and taxis, travel and subsistence.
d. Project specific telecommunications and delivery charges.
e. Special fees, insurance, permits, and licenses applicable to the work.
f. Outside computer processing, computation, and proprietary programs purchased for the work.

Reimbursement for vehicles used in connection with the work will be at the federally approved mileage rates or at a negotiated monthly rate.

If prevailing wage rates apply, the above billing rates will be adjusted as appropriate.

Overtime for non-exempt employees will be billed at one and a half times the Hourly Rates specified above.

Rates for professional staff for legal proceedings or as expert witnesses will be at rates one and one-half times the Hourly Rates specified above.

Excise and gross receipts taxes, if any, will be added as a direct expense.

The foregoing Schedule of Charges is incorporated into the agreement for the services provided from the effective date of the agreement through December 31, 2020. The Schedule of Charges may be adjusted annually by three percent to reflect salary and benefit cost changes.

EXHIBIT D

SUBCONSULTANT LIST

BHC Consultants, LLC
Tom Giese
950 Pacific Avenue, Suite 905
Tacoma, WA 98402
253-344-5084

EXHIBIT E

MONROE CODE OF ETHICS

Chapter 2.52
CODE OF ETHICS

Sections:

2.52.010 Purpose – Construction.
2.52.020 *Repealed.*
2.52.030 Award of contracts prohibited.
2.52.040 *Repealed.*
2.52.050 *Repealed.*
2.52.060 *Repealed.*

2.52.010 Purpose – Construction.

The city of Monroe hereby adopts the code of ethics for municipal officers codified at Chapter 42.23 RCW, inclusive of any future amendments thereof. It is the city's specific intent that the ethical standards set forth at Chapter 42.23 RCW shall govern the conduct of municipal officers within the city of Monroe. Except as expressly provided in this chapter, and Chapter 4.30, Ethics Board, the city disclaims any intent to impose substantive standards of conduct that are more stringent than or otherwise different from those set forth in Chapter 42.23 RCW with respect to the subject matter of said chapter.

2.52.020 *Repealed.*

2.52.030 Award of contracts prohibited.

Members of the city of Monroe, Washington, boards, commissions, and city staff are prohibited from being awarded contracts with the city. Exceptions to this rule are those covered by the CBA, RCW and WAC. This section was submitted to the Monroe city council as an initiative with enough required signatures to be submitted to the voters. The city council adopted the initiative as an ordinance as an alternative to placing on the ballot. Consequently, to the extent required by law, this subsection shall be construed as superseding any conflicting city requirements or requirements that otherwise operate to illegally amend the requirements of an initiative.

2.52.040 *Repealed.*

2.52.050 *Repealed.*

2.52.060 *Repealed.*

EXHIBIT F

TITLE VI

During the performance of this contract, the consultant, for itself, its assignees and successors in interest (hereinafter referred to as the "consultant") agrees as follows:

1. Compliance With Regulations – The consultant shall comply with the Regulations relative to nondiscrimination in federally-assisted programs of United States Department of Transportation (USDOT), Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination – The consultant, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, sex, or national origin in the selection and retention of sub-consultants, including procurement of materials and leases of equipment. The consultant shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontracts, Including Procurement of Materials and Equipment – In all solicitations either by competitive bidding or negotiations made by the consultant for work to be performed under a sub-contract, including procurement of materials or leases of equipment, each potential sub-consultant or supplier shall be notified by the consultant of the consultant's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, sex, or national origin.

4. Information and Reports – The consultant shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the contracting agency or the appropriate federal agency to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of a consultant is in the exclusive possession of another who fails or refuses to furnish this information, the consultant shall so certify to WSDOT or the USDOT as appropriate, and shall set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance – In the event of the consultant's noncompliance with the nondiscrimination provisions of this contract, the contracting agency shall impose such contract sanctions as it or the USDOT may determine to be appropriate, including, but not limited to:

- Withholding of payments to the consultant under the contract until the consultant complies, and/or;
- Cancellation, termination, or suspension of the contract, in whole or in part

6. Incorporation of Provisions – The consultant shall include the provisions of paragraphs (1) through (5) in every subcontract, including procurement of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The consultant shall take such action with respect to any sub-consultant or procurement as the contracting agency or USDOT may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event a consultant becomes involved in, or is threatened with, litigation with a sub-consultant or supplier as a result of such direction, the consultant may request WSDOT enter into such litigation to protect the interests of the state and, in addition, the consultant may request the USDOT enter into such litigation to protect the interests of the United States.

Kennedy Jenks

1191 2nd Avenue, Suite 630
Seattle, WA 98101
206-753-3400

Engineering Report
City of Monroe
Wastewater Treatment Plant
pH and Filament Control
FINAL

March 2020

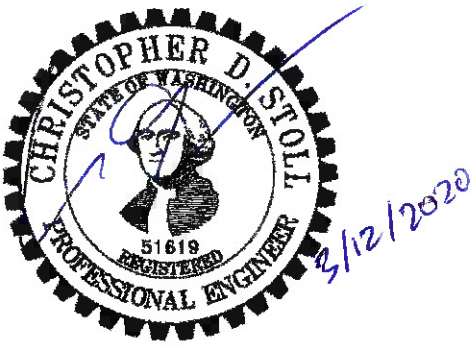
Prepared for

City of Monroe
John Lande, Manager
806 West Main Street
Monroe, WA 98272

KJ Project No. 1997002*00

Engineering Report
City of Monroe
Wastewater Treatment Plant
pH and Filament Control
FINAL

March 2020



Kennedy Jenks
1191 2nd Avenue, Suite 630
Seattle, Washington 98101
206-753-3400

BHC CONSULTANTS
1601 Fifth Avenue, Suite 500
Seattle, Washington 98101
206-505-3400

KJ Job No. 1997002*00

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Acknowledgments

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City of Monroe	Brad Feilberg John Lande Donovan Sheppard
Department of Ecology	Lazaro Eleuterio Amber Corfman
Wastewater Solutions Incorporated	Brad Musick

https://kiewit.sharepoint.com/sites/cityofmonroe-wwtpengreport/shared documents/task 8 - engineering report/2019 engineering report_short version_cip1 only/final_city of monroe wwtp engineering report pH and filament control.docx

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List of Acronyms and Abbreviations

%	percent
°C	degrees Celsius
ºF	degrees Fahrenheit
AA	average annual
AACE	Association for the Advancement of Cost Engineering
AAF	average annual flow
AOTE	actual oxygen transfer efficiency
AVG	average
BHC	BHC Consultants, LLC
BOD	biochemical oxygen demand
BOD/TSS	biochemical oxygen demand/total suspended solids
BOD_5	5-day biochemical oxygen demand
$CaCO_3$	calcium carbonate
$cBOD_5$	5-day carbonaceous biochemical oxygen demand
City	City of Monroe
cfm	cubic feet per minute
cfu	coliform forming unit
CWA	Clean Water Act
DO	dissolved oxygen
DOC	Department of Corrections
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency (also referred to as “United States Environmental Protection Agency”)
F/M	food-to-microorganism ratio
FEMA	Flood and Emergency Management Agency
FIRM	Flood Insurance Rate Map
ft	feet
ft^2	square foot (square feet)
gpcd	gallons per capita per day
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
GMA	Growth Management Act
HDPE	high-density polyethylene
I/I	infiltration and inflow
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
lb	pound
MDF	maximum day flow
mg	milligram(s)
mg/L	milligrams per liter
mg-N/L	milligrams per liter as nitrogen
MGD	million gallon(s) per day
Mg(OH)2	magnesium hydroxide

mJ/cm^2	millijoules per centimeter squared
ml	milliliter(s)
MLE	Modified Ludzack-Ettinger
MLR	mixed liquor recycle
MLSS	mixed liquor suspended solids
MLVSS	Mixed Liquor Volatile Suspended Solids
mm	millimeter
MM	maximum month
MMF	maximum month flow
MP	*Microthrix parvicella*
NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPV	net present value
O&M	operations and maintenance
OPCC	Opinion of Probable Construction Costs
Orange Book	*Criteria for Sewage Works Design* published by the Washington State Department of Ecology
pH	potential hydrogen (also referred to as “power of hydrogen”)
PHF	peak hour flow
ppcd	pounds per capita per day
psi	pounds per square inch
RAS	return activated sludge
RBC	rotating biological contactor
RCW	Revised Code of Washington
SBC	submerged biological contactor
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
SERP	State Environmental Review Process
SFHA	Special Flood Hazard Area
SIU	Significant Industrial User
SOTEs	standard oxygen transfer efficiencies
SRT	solids retention time
TIN	total inorganic nitrogen
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TSS	total suspended solids
UV	ultraviolet
VAR	vector attraction reduction
VSS	volatile suspended solids
WA	Washington
WAC	Washington Administrative Code
WAS	waste activated sludge
WSI	Wastewater Solutions Incorporated
WWTP	wastewater treatment plant

Executive Summary

The City of Monroe (City) owns, operates, and maintains the Monroe Wastewater Treatment Plant (WWTP) located at 522 South Sams Street in Monroe. The Monroe WWTP is permitted to discharge to the Skykomish River in accordance with the facility's National Pollutant Discharge Elimination System (NPDES) permit number WA0020486.

This NPDES permit went into effect on December 1, 2018 and includes an interim effluent pH limit range from 6.0 to 9.0 standard units. A stricter final effluent pH limit range of 6.7 to 9.0 standard units will go into effect on January 1, 2023. The NPDES permit compliance schedule outlines the submission of an Engineering Report, plans and specifications, and completion of construction and installation of the facilities to maintain compliance of the new final effluent limits for pH as summarized in Table ES-1.

Table ES-1: pH-specific Requirements per NPDES Permit Compliance Schedule

	Tasks	Date Due
1	Submit an Engineering Report according to the requirements of WAC 173-240-060 for facility improvements, including those necessary to meet the final effluent limits for pH.	**December 31, 2019**
2	Submit Plans and Specifications according to the requirements of WAC 173-240-070 for any facility improvements needed to meet final effluent limits for pH.	**December 31, 2020**
3	Complete construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submit a Declaration of Construction of Water Pollution Control Facilities (WAC 173-240-090).	**December 31, 2022**

The City selected the Consultant team (Team) led by Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) in association with BHC Consultants, LLC (BHC) to prepare this 2019 Engineering Report in accordance with WAC-173-240-060 for facility improvements necessary to meet the final effluent limits for pH. This Report is prepared to fulfill the Engineering Report requirement by the Washington State's Department of Ecology (Ecology) as part of the facility's NPDES permit.

To address the more stringent pH requirements and identify recommendations for pH control, the Team conducted spreadsheet analyses, a process audit including a facility walkthrough, and alternatives evaluations in coordination with the City's personnel. The Team identified low influent alkalinity as a primary challenge for the WWTP, which directly impacts pH. The Team recommended a two-prong approach to pH control: 1) optimization of biological performance to maximize alkalinity recovery within the treatment process through denitrification; and 2) optimization of the use of chemicals to supplement influent alkalinity and control effluent pH. Additionally, optimizing filament control will improve the overall biological performance which in turn will improve biological alkalinity recovery and pH control. In summary, the Team identified

four opportunities to address pH control directly and two opportunities to provide filament control and address pH control indirectly.

The six project elements recommended by the Team for addressing pH and filament control at the WWTP are summarized in Table ES-2. The estimated total project cost for addressing pH and filament control is $1,760,000 (2020 dollars), while the additional annual O&M costs for fully addressing pH and filament control are $14,490 per year. The project cost reflects a Class 4 opinion of probable cost (applicable for 1% to 15% design) as defined by the Association for the Advancement of Cost Engineering (AACE) and has an expected accuracy range of -20% to +30%.

The estimated life cycle cost for this project is $2,050,000 based on 2020 dollars.

Table ES-2: Project and Operations and Maintenance Costs for Six Project Elements Addressing pH and Filament Controls

Project Element	Project Cost (2020 Dollars)	Additional Operations and Maintenance Cost ($/yr, 2020 Dollars)
Mixed Liquor Return Optimization	$320,000	$990
Baffling of Aeration Basins	$350,000	$660
Upgraded Mg(OH)2 Feed System	$270,000	$0
Secondary Effluent NaOH Feed System	$270,000	$3,730
Permanent RAS Chlorination	$140,000	$8,450
Surface Wasting System	$410,000	$660

To ensure compliance with the NPDES permit, the implementation schedule for this project is anticipated to proceed as follows:

- Q4 2019: Submission of draft Engineering Report to Ecology
- Q4 2020: Submission of Plans and Specifications to Ecology
- Q1 2021-Q4 2022: Preparation of bid documents, bidding process, selection of Contractor and construction
- Q4 2022: Completion of construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submission to Ecology of a Declaration of Construction of Water Pollution Control.

Section 1: Introduction

1.1 Report Purpose

The City of Monroe (City) owns, operates, and maintains the Monroe Wastewater Treatment Plant (WWTP) located at 522 South Sams Street in Monroe. The Monroe WWTP is permitted to discharge to the Skykomish River in accordance with the facility's National Pollutant Discharge Elimination System (NPDES) permit number WA0020486.

This NPDES permit went into effect on December 1, 2018 and includes an interim effluent pH limit range from 6.0 to 9.0 standard units. A stricter final effluent pH limit range of 6.7 to 9.0 standard units will go into effect on January 1, 2023. The NPDES permit compliance schedule outlines the submission of an Engineering Report, plans and specifications, and completion of construction and installation of the facilities to maintain compliance of the new final effluent limits for pH as summarized in Table 1-1.

Table 1-1: pH-specific Requirements per NPDES Permit Compliance Schedule

	Tasks	Date Due
1	Submit an Engineering Report according to the requirements of WAC 173-240-060 for facility improvements, including those necessary to meet the final effluent limits for pH.	**December 31, 2019**
2	Submit Plans and Specifications according to the requirements of WAC 173-240-070 for any facility improvements needed to meet final effluent limits for pH.	**December 31, 2020**
3	Complete construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submit a Declaration of Construction of Water Pollution Control Facilities (WAC 173-240-090).	**December 31, 2022**

The City selected the Consultant team (Team) led by Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) in association with BHC Consultants, LLC (BHC) to prepare this 2019 Engineering Report in accordance with Washington Administrative Code (WAC) 173-240-060 for facility improvements necessary to meet the final effluent limits for pH. This Report is prepared to fulfill the Engineering Report requirement by the Washington State's Department of Ecology (Ecology) as part of the facility's NPDES permit. It follows WAC 173-240-060 for facility improvements, primarily focused on those necessary to meet the revised final effluent limits for pH included in the updated permit (WA0020486). The WAC requirements for wastewater facilities plans (also referred to as Engineering Reports) are outlined in Section 1.5 below.

The draft Report was submitted in December 2019 to Ecology for review, comment, and approval to meet the timeline detailed in the "Summary of Permit Report Submittals" within NPDES WA0020486. This Report is the final version which addresses the feedback provided by Ecology on 17 January 2020.

1.2 Background

The City's current Sanitary Sewer System Plan was updated in 2015 as part of the Utility Systems Plan (2015 Utility Plan) (BHC 2015). This Plan provides the public and regulatory agencies with information on the City's plans for sewer system extensions to areas designated as urban under the Growth Management Act. According to the 2015 Utility Plan, several necessary improvements were identified at the WWTP to meet process capacities, equipment obsolescence, and efficiency needs. All the physical improvements for the Plant recommended in the 2015 to 2021 Capital Plan have been completed.

The 2015 to 2021 Capital Plan also identified a need for a detailed WWTP Engineering Report (Report), a WWTP Rerating Study (Capacity Analysis), a Mixing Zone Analysis, and a Biosolids Management Study.

1.3 City of Monroe Service Area and Wastewater Treatment Plant Overview

The City is in western Snohomish County on the Skykomish River as illustrated on Figure 1-1. Founded in 1864, and incorporated in 1902, the City has grown to a population of 17,304 as of the 2010 Census and is estimated at 19,363 as of 2018. The current wastewater system service area encompasses 5,191 acres, which includes the Southwest Study Area identified in the 2015 Utility Plan. The collections system consists of 42.3 miles of gravity sewers, 6.2 miles of force mains, and 10 lift stations.

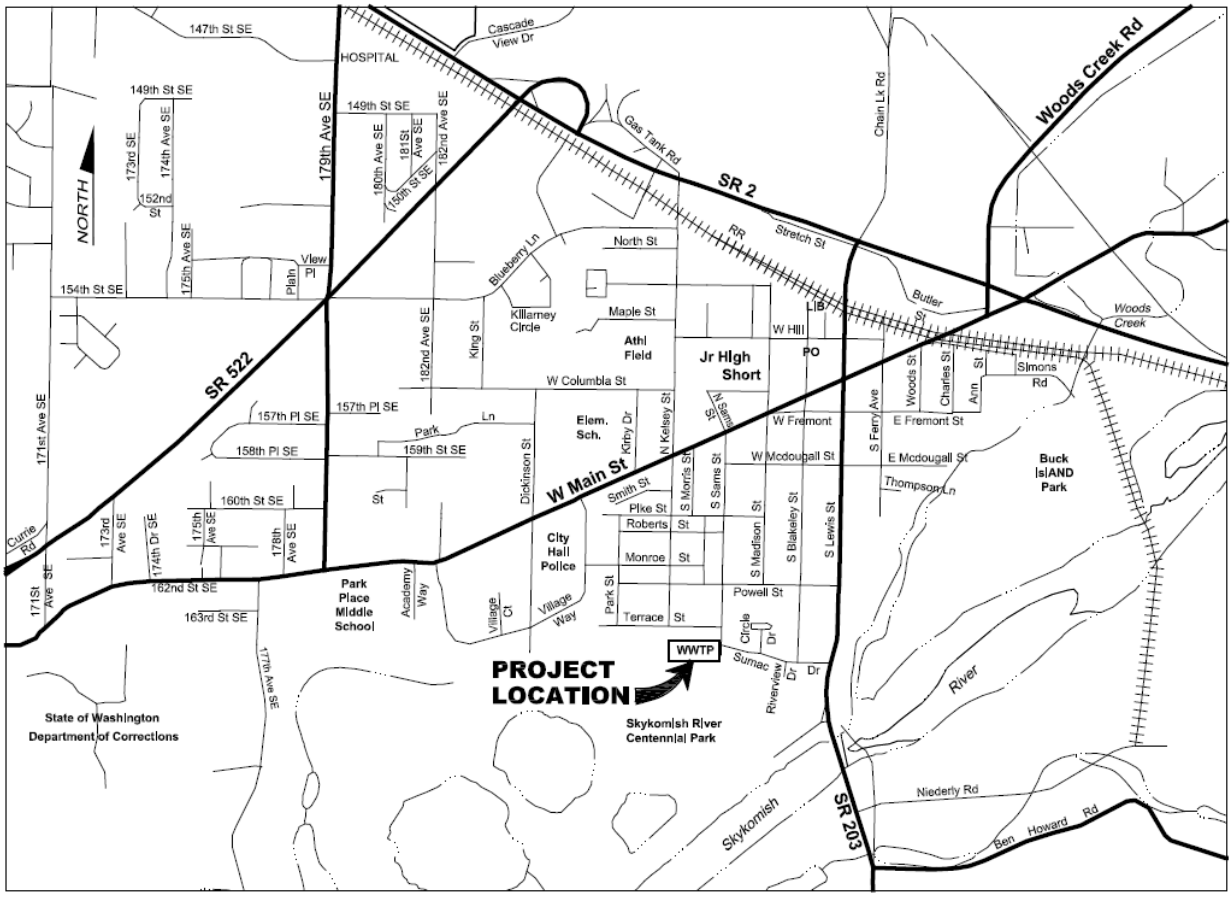
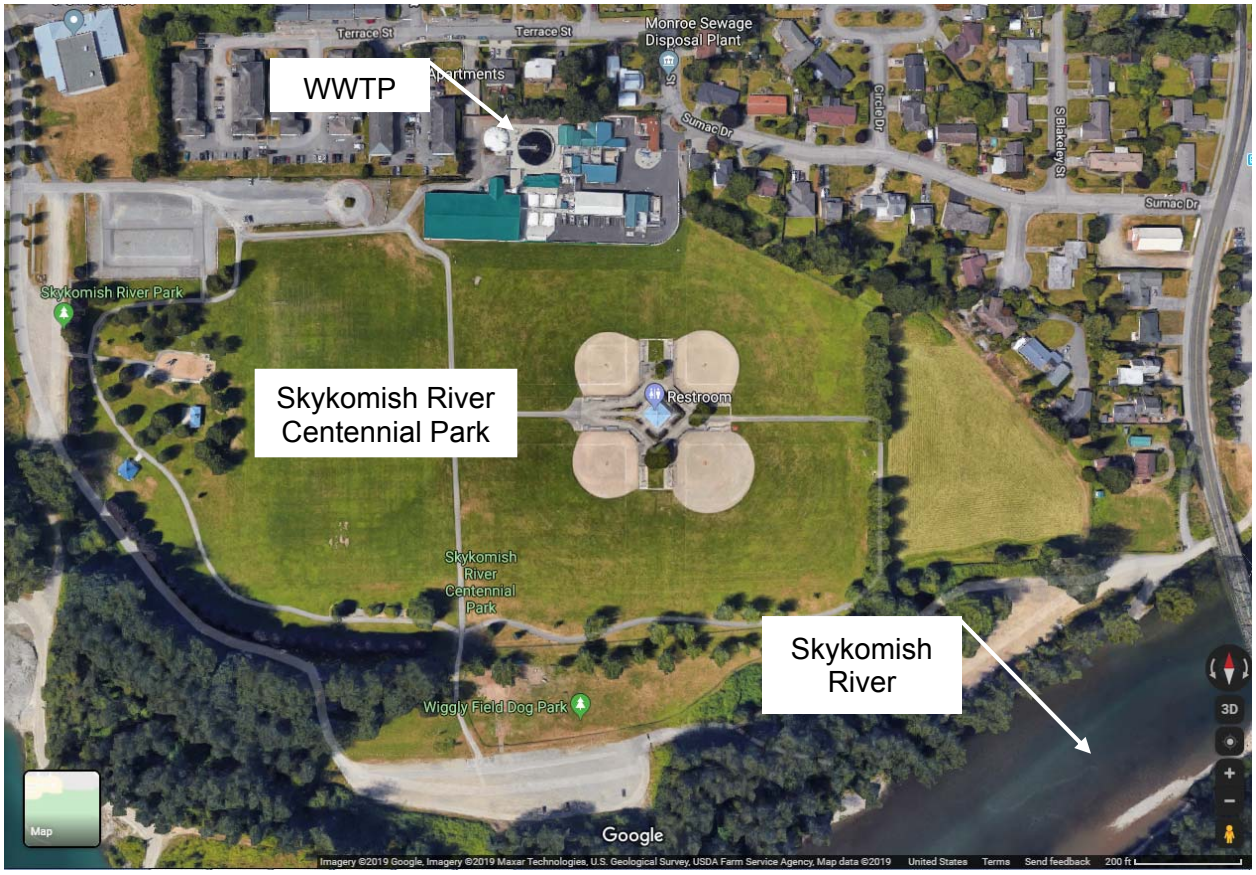


Figure 1-1: Project Location

The City owns, operates, and maintains a secondary WWTP implementing a Modified Ludzack-Ettinger (MLE) process, which is located immediately north of the Skykomish Centennial Park (Figure 1-2). The WWTP has a design capacity of 2.84 million gallons per day (MGD) based on the design Maximum Month Flow (MMF). Further details regarding the extent of the service area tributary to the WWTP are included within the 2015 Utility Plan (Refer to Figure SS 4.1 Existing Sewer System).



(Source: Google Maps)

Figure 1-2: Aerial View of the City of Monroe's WWTP in relation to the Skykomish River Centennial Park and Skykomish River

The WWTP liquid stream consists of a headworks structure with two mechanical fine screens, an influent lift station, and a mechanical vortex type grit removal system that provides preliminary treatment. The screened and de-gritted influent flows by gravity through two rectangular primary clarifiers, three aeration basins with anoxic and aerobic zones, two circular secondary clarifiers, ultraviolet light (UV) disinfection, and an effluent pump station. The disinfected WWTP effluent is discharged to the Skykomish River (Figure 1-2) via a 30-inch diameter final effluent pipe and four 12-inch diameter outfall diffusers.

Solids stream treatment consist of three aerobic digesters in series, sludge transfer pumps, and a belt press for dewatering. The dewatered sludge is hauled by trucks to the former compost facility site at the Monroe Correctional Complex where it is stored for a period and then reloaded onto larger trailers for delivery to a Beneficial Use Facility by a contract hauler. The sludge cake is incorporated into the soil (beneath the surface) in order to meet the vector attraction reduction requirement.

1.4 Establishment of City's Goals

During a workshop held on 12 March 2019 with the Team and the City, the following goals emerged as priorities for the City as they relate to the pH requirements:

- A successful project is defined as one that provides a roadmap to efficient, achievable, reliable, and sustainable compliance.
- The project must ensure that the current processes meet the new pH limit established by the City's new NPDES permit and address operational goals.
- Coordination with Ecology will be important for the project: 1) to ensure the Engineering Report addresses Ecology's requirements; and 2) to remain abreast of the direction of any potential changes to nutrient source reduction requirements into Puget Sound.

1.5 Regulatory and Treatment Requirements

The following sections provide details regarding Washington State's regulatory requirements as they pertain to this Report and the WWTP.

1.5.1 Washington State Regulatory Requirements

The Report must comply with the following requirements: WAC 173-240-060; Revised Code of Washington (RCW) 36.70A, which details the Growth Management Act; and RCW 82.02.

1.5.1.1 Washington State Administrative Code Requirements

Table 1-2 below details the requirements of WAC 173-240-060 as they pertain to the content of this Report.

Table 1-2: Requirements for an Engineering Report per WAC 173-240-060

Text from WAC 173-240-060	Location in Report
The engineering report shall include the following information, together with any other relevant data as requested by Ecology:	
(a) The name, address, and telephone number of the owner of the proposed facilities, and their authorized representative.	• Cover Sheet
(b) A project description including a location map and a map of the present and proposed service area.	• Section 1.3 • Figure 1-1 • 2015 Utility Plan (Figure SS 4.1)
(c) A statement of the present and expected future quantity and quality of wastewater, including any industrial wastes which may be present or expected in the sewer system.	• Section 2.3 • Section 2.4 • Section 2.5
(d) The degree of treatment required based upon applicable permits and regulations, the receiving water, the amount and strength of wastewater to be treated, and other influencing factors.	• Section 1.5

Table 1-2: Requirements for an Engineering Report per WAC 173-240-060 (cont.)

Text from WAC 173-240-060	Location in Report
(e) A description of the receiving water, applicable water quality standards, and how water quality standards will be met at the boundary of any applicable dilution zone. (173-201A-10Q WAC).	• Section 1.5 • Section 3
(f) The type of treatment process proposed, based upon the character of the wastewater to be handled, the method of disposal, the degree of treatment required, and a discussion of the alternatives evaluated and the reasons they are unacceptable.	• Section 4
(g) The basic design data and sizing calculations of each unit of the treatment works. Expected efficiencies of each unit, the entire plant, and character of effluent anticipated.	• Section 3.3
(h) Discussion of the various sites available and the advantages and disadvantages of the site(s) recommended. The proximity of residences or developed areas to any treatment works. The relationship of a 25-year and 100-year flood to the treatment plant site and the various plant units.	• Section 3.2 • Section 5.1
(i) A flow diagram showing general layout of the various units, the location of the effluent discharge, and a hydraulic profile of the system that is the subject of the engineering report and any hydraulically related portions.	• Section 3.2
(j) A discussion of infiltration and inflow problems, overflows and bypasses, and proposed corrections and controls.	• Section 2.5 • 2015 Utility Plan • Appendix B
(k) A discussion of any special provisions for treating industrial wastes, including any pretreatment requirements for significant industrial sources.	• Section 2.5 • 2015 Utility Plan • Appendix C
(l) Detailed outfall analysis or other disposal method selected.	• Section 3.2
(m) A discussion of the method of final sludge disposal and any alternatives considered.	• Section 3.2
(n) Provision for future needs.	• Section 2.1 • Section 2.3 • Section 2.4
(o) Staffing and testing requirements for the facilities.	• Section 5.2 • 2015 Utility Plan
(p) An estimate of the costs and expenses of the proposed facilities and the method of assessing costs and expenses. The total amount shall include both capital costs and also operation and maintenance costs for the life of the project and shall be presented in terms of total annual cost and present worth.	• Section 5.1 • Appendices F
(q) A statement regarding compliance with any applicable state or local water quality management plan or any such plan adopted pursuant to the federal Water Pollution Control Act as amended.	• Section 1.5 • Section 5.2
(r) A statement regarding compliance with SEPA and NEPA, if applicable.	• Section 1.5 • Section 5.2

1.5.1.2 Revised Code of Washington Requirements

The RCW includes guidance and requirements for planning within the City and at the WWTP. Both RCW 36.70 A and RCW 82.02 are pertinent to this Report and the City's implementation of any recommendations within this Report. Additionally, requirements of RCW 90.48 related to water pollution control are captured under WAC 173-240-060 mentioned above.

RCW 36.70A details the role of the Growth Management Act (GMA), which requires comprehensive planning to address population growth in "fast-growing" cities and counties. The City is within Snohomish County, which is one of 18 counties required to incorporate full GMA planning. The GMA includes 14 goals that provide the basis for comprehensive planning. The 14 goals include (refer to RCW 36.70A.020 and RCW 36.70A.480): concentrated urban growth; sprawl reduction; regional transportation; affordable housing; economic development; property rights; permit processing; natural resource industries; open space and recreation; environmental protection; early and continuous public participation; public facilities and services; historic preservation; and shoreline management.

Of additional importance to this Report and the discharge from the WWTP to the Skykomish River, RCW 36.70A.172 highlights the importance of the use of best available science as it pertains to critical areas: "*counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries*."

RCW 82.02 includes guidance regarding the authority of the county, city, and/or town in taxation and charges that are or are not permitted under Washington State law. Of additional importance to this Report and the capital improvements proposed within this Report, RCW 82.02.020 states: "*Nothing in this section prohibits counties, cities, or towns from imposing or permits counties, cities, or towns to impose water, sewer, natural gas, drainage utility, and drainage system charges. However, no such charge shall exceed the proportionate share of such utility or system's capital costs which the county, city, or town can demonstrate are attributable to the property being charged*." RCW 82.02.050 also details the use of impact fees and any limitations.

1.5.1.3 State Environmental Policy Act

The State Environmental Policy Act (SEPA) is Washington State's parallel statute to the National Environmental Policy Act (NEPA). Statewide rules for SEPA compliance are issued by Ecology, with individual agencies maintaining a set of procedures to ensure SEPA compliance with their proposed actions.

As a part of this Report, a SEPA checklist was not completed to perform an environmental review to comply with SEPA. The recommendations included in Section 5 are limited to maintenance related activities and minor alternations to improve operations and maintenance of the existing WWTP, and hence, is exempt from SEPA. As identified in WAC 197-11-800 (3), the "*repair, remodeling, maintenance, or minor alteration of existing private or public structures, facilities or equipment, including utilities, recreation, and transportation facilities involving no material expansions or changes in use beyond that previously existing*" are considered exempt.

As a part of SEPA, the State Environmental Review Process (SERP, WAC 173-98-100) is necessary to be eligible for financial assistance from state water quality grants and loans administered by Ecology. SERP was created to ensure that environmentally sound alternatives are selected and comply with NEPA and other environmental laws and regulations. The City has not expressed an interest in pursuing potential state funding for projects recommended in this Report. However, if that should change, SERP requirements will need to be satisfied and this Report may need to be amended to accommodate SERP.

1.5.2 State Implementation of Federal Clean Water Act

In 1972, the federal government passed the Clean Water Act (CWA) with a goal of reducing pollution in the nation's waterways. The following sections detail the role of the State of Washington in the implementation of the CWA.

1.5.2.1 Washington State Surface Water Quality Standards

In the State of Washington, Ecology serves as the local regulatory body to protect the quality of water by implementing the surface water quality standards and setting pollution limits. The standards include: protections for four types of "designated uses" (including aquatic life, recreation, drinking water supply, and miscellaneous uses); water quality criteria; and policies for protection of the waters against future pollution. The surface water quality standards are implemented via WAC 173-201A. Improvements in this Report will be consistent with those required by CWA and overseen by Ecology.

1.5.2.2 Section 402 and NPDES Permit Requirements

Permits to discharge to waterways were made a requirement of the federal CWA under section 402; hence, the NPDES was put in place to limit pollution from point source discharge. Municipal sewage treatment plants were given guidelines based on technology standards to meet certain treatment limits listed in their NPDES permit. The U.S. Environmental Protection Agency (EPA) has delegated the process of issuing NPDES permits to most states, although a handful of states currently do not issue their own permits. In Washington, Ecology administers NPDES discharge permits to WWTPs. Discharge limits under the current NPDES permit (WA0020486) held by the City are summarized in Table 1-3. The interim pH limit is effective through the end of 2022, with the final limit taking effect at the start of 2023. pH controls are a primary focus of this Report. See Appendix A for further information regarding the permit.

Table 1-3: Monroe WWTP NPDES Permit (WA0020486)

Parameter	Effluent Limits	
	Average Monthly	Average Weekly
5-day carbonaceous biochemical oxygen demand ($cBOD_5$)	30 mg/L	45 mg/L
	711 lbs/day	1066 lbs/day
	85% removal of influent BOD_5	

Table 1-3: Monroe WWTP NPDES Permit (WA0020486) (cont.)

Parameter	Effluent Limits	
Total suspended solids (TSS)	Average Monthly	Average Weekly
	30 mg/L	45 mg/L
	711 lbs/day	1,066 lbs/day
	85% removal of influent TSS	
pH	Minimum	Maximum
	6.0 (Interim)	9.0
	6.7 (Final)	9.0
Fecal Coliform	Monthly Geometric Mean	Weekly Geometric Mean
	100 cfu/100 ml	200 cfu/100 ml
	Influent Limits	
Maximum Month Flow	2.84 MGD	
BOD_5 Loading	6,090 lbs/day	
TSS Loading	5,940 lbs/day	

Notes:

mg/L = milligrams per liter
lbs/day = pounds per day
cfu = coliform forming units
ml = milliliter
% = percent

1.5.2.3 Section 303(d) and Receiving Water Summary

Effluent discharged from the WWTP is received into the Skykomish River, which is a tributary of the Snohomish River. The most recent water quality assessment approved by EPA in 2016 does not indicate any Category 5 listings that would require total maximum daily loads (TMDLs) or other water quality improvement projects for the segment of the Skykomish River that receives the WWTP effluent. Within that segment, the 2016 water quality assessment identifies only copper, silver, and lead as Category 2 listings. A Category 2 listing means the river segment shows some evidence of a water quality problem with respect to the parameters identified, but not enough to show persistent impairment. In such instances, Ecology continues to monitor and collect information on these parameters to determine if a consistent impairment develops.

The river segment immediately upstream of the segment receiving the WWTP effluent has Category 5 listings for temperature and dissolved oxygen (DO).

1.5.2.4 Future Regulatory Considerations

While future permit requirements are presently unknown, it is expected that there will eventually be more stringent effluent limits imposed on nitrogen. Ecology is currently working on the Puget Sound Nutrient Source Reduction Project collaboratively with stakeholders. The result of this study will likely culminate in reductions to nutrient loads and concentrations discharged to Puget Sound. Ecology has indicated nutrient reduction will largely be focused on nitrogen. Initial evaluations by Ecology have used total inorganic nitrogen (TIN) limits of 8 milligrams per liter as

nitrogen (mg-N/L) and 3 mg-N/L, suggesting that concentration limits of around 8 mg-N/L might be applied to WWTPs that are smaller and/or in less critical areas and that limits of around 3 mg-N/L might be applied to WWTPs that are larger and/or in more critical areas.

Although the City is not currently included in the preliminary list of WWTPs to be regulated under a proposed general permit, it is possible that they could be added to an initial general permit or during a future renewal and reissuance of a general permit. This Report primarily focuses on addressing pH control; however, the findings included in Section 3 will inform future actions for the City to undertake to address future regulatory requirements.

1.5.3 EPA Reliability Requirements

Ecology has several requirements regarding reliability of wastewater treatment plants that are outlined in the *Criteria for Sewage Works Design* or "Orange Book" (Ecology 2008). Additionally, EPA has provided additional guidelines in the *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability* (EPA 1974). Table 1-4 summarizes these reliability requirements and guidelines for each component. The Monroe WWTP is permitted with a reliability classification of Class II. Improvements in this Report will be consistent with those required for a Class II facility.

Table 1-4: EPA Class II Reliability Requirements and Design Guidelines

Component	Class II Requirements and Design Guidelines
Reliability classification	Works discharging into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradation but could be damaged by continued (on the order of several days) effluent degradation.
Grit removal	Recommended if sludge is handled.
Mechanically cleaned bar screens	Backup manual screen required.
Pumps	Capacity to handle peak flow with any one pump out of service must be provided.
Primary sedimentation basins	With largest unit out of service, remaining units shall have capacity for at least 50% of the total design flow.
Final sedimentation basins	With largest unit out of service, remaining units shall have capacity for at least 50% of the total design flow; backup not required for chemical sedimentation basins, filters, and activated carbon columns.
Aeration basin	At least two equal volume basins shall be provided.
Aeration blowers or aerators	Sufficient to provide for peak oxygen demands with the largest capacity unit out of service.
Diffusers	Designed so that isolation of the largest section of diffusers does not measurably impair oxygen transfer capability.

Table 1-4: EPA Class II Reliability Requirements and Design Guidelines (cont.)

Component	Class II Requirements and Design Guidelines
Sludge handling	Alternate methods of sludge disposal and/or treatment shall be provided for each sludge treatment unit operation without installed backup capability. No recycles permitted that will compromise liquid treatment.
Sludge holding tanks	May be used to back up downstream tanks.
Sludge pumps	A backup pump shall be provided for each set of pumps that performs the same function. The capacity of the pumps shall be such that with any one pump out of service, the remaining pumps will have capacity to handle the peak flow.
Aerobic sludge digestion	Backup aeration basin not required. At least two blowers shall be provided. Uninstalled backup blower is permissible. Largest section of diffusers can be isolated.
Dewatering	Sufficient number of units to enable the design flow to be dewatered with largest capacity unit out of service or alternate disposal method. The backup unit may be uninstalled.
Electric power source	Two separate and independent sources of electric power shall be provided either from two separate utility substations or from a single substation and a backup generator located at the plant. Power shall be sufficient to operate all vital components, critical lighting and ventilation during peak wastewater flow except that vital components used to support the secondary processes (i.e., aeration basin blowers) need not be operable to full levels of treatment, but shall be sufficient to maintain the biota.
Power distribution	Vital components should be divided between at least two motor control centers. No single fault should result in disruption of electrical service to more than one motor control center.
Instrumentation and control systems	Automatic control systems whose failures could result in a controlled diversion or a violation of the effluent limitations shall be provided with a manual override. Instrumentation whose failure could result in a controlled diversion or a violation of the effluent limitations shall be provided with an installed backup sensor and readout. Alarms shall be provided to monitor the condition of equipment whose failure could result in a controlled diversion or a violation of the effluent limitations. Vital instrumentation and control equipment shall be designed to permit alignment and calibration without requiring a controlled diversion or a violation of the effluent limitations.
Auxiliary systems	If a malfunction of the system can result in controlled diversion or a violation of the effluent limitations and the required function cannot be done by any other means, then the system shall have backup capability.

Section 2: Flows and Loads

Section 2 provides a summary of the historical and projected populations for residential, non-residential, and DOC, as well as historical and projected wastewater flows and loads for the City's sewer service area. The 2015 Plan is referenced throughout this section as it serves as the basis for many of the assumptions made herein.

2.1 Population

The population estimates used in this study are based on those developed in the 2015 Plan. Populations contributing sewage are separated into three groups: residential, non-residential (employment), and Department of Corrections (DOC) inmates. Population estimates and projections were developed for each group for the years 2015, 2021, and 2035 as part of the 2015 Plan. Linear interpolation was used to calculate the populations for in-between years.

Per the 2015 Plan, this study assumes sewered basins begin septic-sewer conversion in 2015, and unsewered basins begin septic sewer conversion in 2025. A 2% growth rate was assumed for both residential and non-residential population growth from 2036-2040. DOC inmate population growth was assumed to linearly increase from 2036 to 2040 at the same rate as for 2015 to 2036 documented in the Plan. The Southwest Study Area referenced in the Plan was assumed to be sewered beginning in 2020.

Table 2-1 summarizes the resulting population numbers used to project wastewater flows and loads. Figure 2-1 graphically illustrates the growth of the three aforementioned populations subsets from 2010 to 2040.

Table 2-1: Sewered Population Forecasts for the City of Monroe and Urban Growth Area

Year	Residential Population[(a)]	Non-Residential Population[(a)]	DOC Inmate Population[(b)]
2010	11,392	7,189	2,536
2015	12,587	7,809	2,500
2020	14,356	8,479	2,585
2026	16,514	9,264	2,686
2040	23,093	11,646	2,923
Build-out	28,573	12,440	3,092

Notes:

(a) Population includes the Southwest Study Area.
(b) The inmate population represents the average daily population.

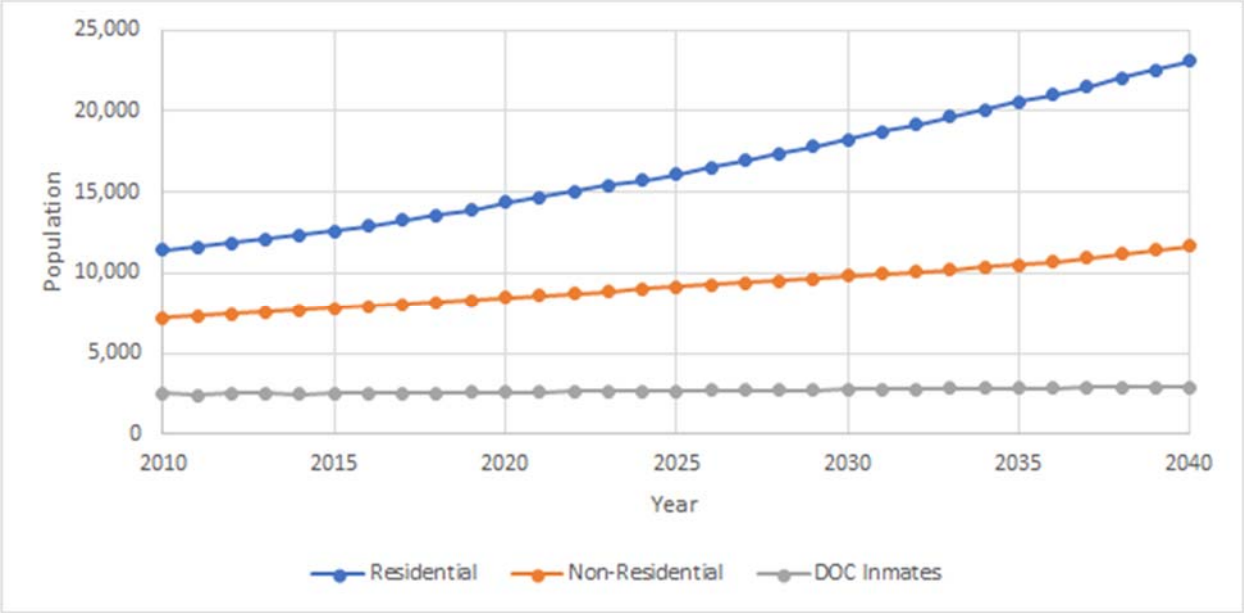


Figure 2-1: Sewered Population Forecast, 2010 through 2040

2.2 Existing Flows

A summary of wastewater flows in MGD for 2011 through 2013 is shown in Table 2-2, which is based on data presented in the 2015 Plan. Because peak hour flow data was not available for 2011 and 2012, the peaking factor for peak hour flow is based on the average peak hour flow for 2013 and 2014 (through 12 November 2014).

Table 2-2: Existing Flows

Year	Average Annual Flow (MGD)	Maximum Month Flow (MGD)	Maximum Day Flow (MGD)	Peak Hour Flow (MGD)
2011	1.50	1.88	2.89	No Data
2012	1.63	2.22	3.64	No Data
2013	1.55	1.94	3.18	6.87
2014	--	--	--	6.68

2.2.1 Diurnal Flows

Hourly flow data were provided for the period beginning on 13 August 2018 and ending on 19 August 2018. These data were averaged for each hour to produce a diurnal curve normalized to the flow rate in MGD, as illustrated on Figure 2-2. A diurnal curve was developed to model performance of the WWTP during diurnal changes in flow and loads to determine whether adequate treatment and capacity are maintained.

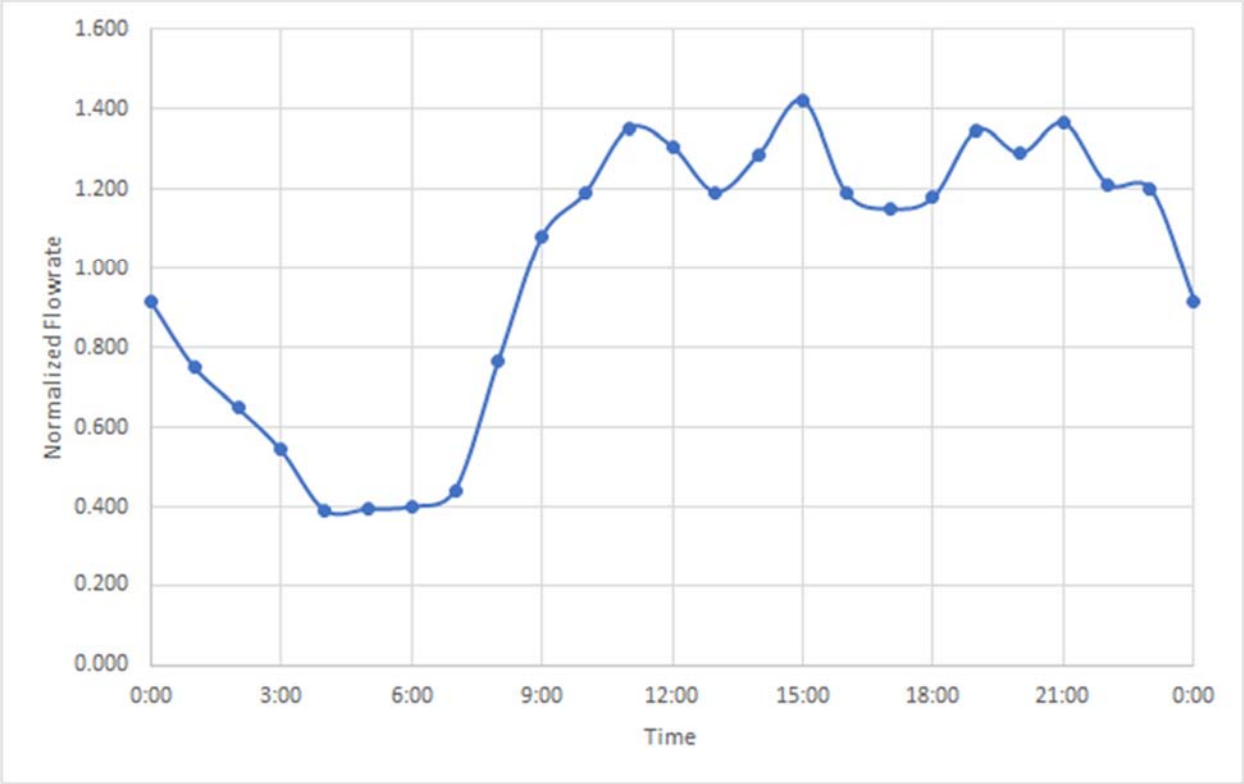


Figure 2-2: Normalized Typical Diurnal Curve (Flow Unitless)

2.3 Projected Flows

The projected flows for the years 2020, 2026, 2040, and build-out include contributions for residential, non-residential, and DOC populations based on per capita flows of 67.4 gallons per capita per day (gpcd), 48.6 gpcd, and 159.4 gpcd, respectively, as established in the 2015 Plan. The residential and non-residential flows include contributions from the Southwest Study Area beginning in 2020. Per-capita flows for each population group were assumed to remain constant throughout the planning period, consistent with the 2015 Plan. As per the 2015 Plan, it was assumed that sewered basins begin septic-sewer conversion in 2015 and that unsewered basins begin the septic-sewer conversion in 2025. A summary of the projected flows is provided in Table 2-3. Projected flows include conditions for average annual flow (AAF), MMF, maximum day flow (MDF), and peak hour flow (PHF). Figure 2-3 graphically illustrates the projected wastewater flow rates between 2010 and 2040. The different flow conditions are defined as follows:

- **Average Annual Flow** – This flow condition is defined as the average of daily flows during the year.
- **Maximum Month Flow** – This flow condition is defined as the highest monthly average flow. This flow condition is of particular interest because the NPDES permit includes a limit for MMF and this flow is typically used as the basis for evaluating capacity of the biological treatment process.

- **Maximum Day Flow** – This flow condition is defined as the maximum day flow in a given year.
- **Peak Hour Flow** – This flow condition is defined as the peak sustained flow rate occurring during a 1-hour period. It is used to size the collection and interceptor sewers, pump stations, flow meters, and WWTP hydraulic processes.

Table 2-3: Projected Wastewater Flow Rates

Year	AAF (MGD)	MMF (MGD)	MDF (MGD)	PHF (MGD)
2020	1.79	2.31	3.71	7.65
2026	1.99	2.57	4.12	8.50
2040	2.59	3.34	5.36	11.0
Buildout	3.02	3.90	6.26	12.9

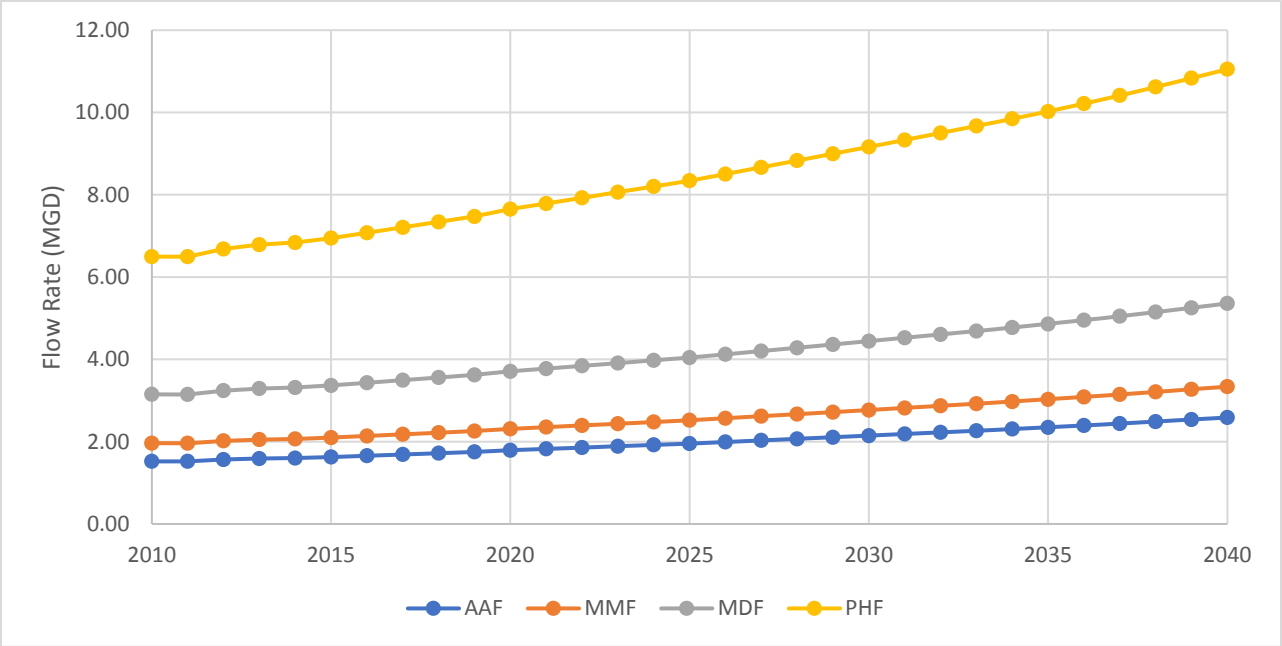


Figure 2-3: Projected Wastewater Flows, 2010 through 2040

2.4 Projected Loads

Consistent with the 2015 Plan, residential and non-residential loading projections assume average annual (AA) biochemical oxygen demand (BOD) loading of 0.166 pounds per capita per day (ppcd), maximum month (MM) BOD loading of 0.203 ppcd, AA TSS loading of 0.167 ppcd, and MM TSS loading of 0.221 ppcd.

DOC inmate loading projections are based on AA BOD loading of 0.366 ppcd, MM BOD of 0.560 ppcd, AA TSS of 0.324 ppcd, and MM of TSS of 0.639, as documented in the 2015 Plan. Assumptions for BOD and TSS removal from DOC pretreatment lagoons are the same as used

in the 2015 Plan, which assumed BOD removal of 83% and TSS removal of 82%. As with the flow projections, the load projections include contributions from the Southwest Study Area beginning in 2020 and assumes that sewered basins begin septic-sewer conversion in 2015 and that unsewered basins begin the septic-sewer conversion in 2025. A summary of the projected wastewater loads is provided in Table 2-4. Figure 2-4 illustrates the increase in loads from 2010 to 2040.

Table 2-4: Projected Wastewater Loads

Year	AA BOD (lbs/day)	MM BOD (lbs/day)	AA TSS (lbs/day)	MM TSS (lbs/day)
2020	3,940	4,890	3,960	5,340
2026	4,440	5,500	4,460	6,000
2040	5,940	7,340	5,970	8,010
Buildout	6,980	8,630	7,030	9,410

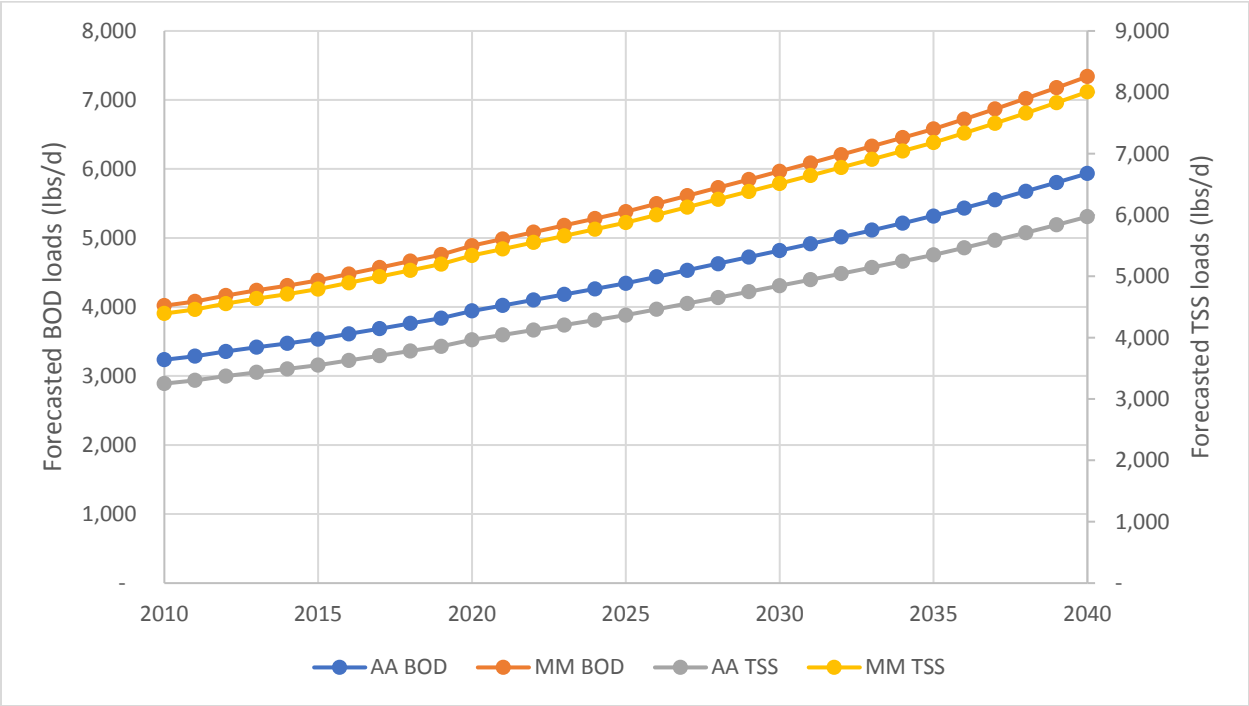


Figure 2-4: Projected Wastewater Loads, 2010 through 2040

2.4.1 DOC Pretreatment Lagoons Removed from Service

While unlikely, it is possible that the DOC could remove its pretreatment lagoons from service within the planning horizon, sending the full BOD and TSS loads to the WWTP. A summary of the projected loads with the pretreatment lagoon removed from service is provided in Table 2-5.

Table 2-5: Forecasted Loads with DOC Pretreatment Lagoon Removed from Service

Year	AA BOD (lbs/day)	MM BOD (lbs/day)	AA TSS (lbs/day)	MM TSS (lbs/day)
2020	4,730	6,090	4,650	6,690
2026	5,250	6,740	5,170	7,410
2040	6,820	8,700	6,750	9,540
Buildout	7,920	10,100	7,850	11,000

Although removal of the DOC pretreatment lagoons results in higher BOD and TSS loading to the WWTP, continuation of pretreatment is considered a worse condition. The pretreatment lagoons remove most of the BOD produced by DOC, which is a valuable carbon source in driving denitrification at the WWTP. Additionally, the pretreatment lagoons not only do not remove nitrogen, but the concentration of ammonia-nitrogen increases through degradation of organic matter in the lagoons. This results in less efficient nitrogen removal, as the influent levels of nitrogen are increased, and the available carbon needed to assist with removal of nitrogen is decreased.

Furthermore, DOC pretreatment often produces algae within the lagoons. Due to the minute size of some algae particles, a significant portion of the algae that reaches the WWTP can pass through the treatment process, as it is difficult to remove, and subsequently reduce UV transmittance, which impacts disinfection, and yield higher effluent BOD and TSS.

Although the wastewater load projections assume the maximum month loads for the DOC and the residential and non-residential populations occur at the same time, this would not necessarily be the case. If these maximum month loads do not overlap, the WWTP could operate without significant changes were the pretreatment lagoons removed from service. If there were only brief spikes during maximum month loading, these could be managed through control of the sludge inventory. However, if increased loadings persist throughout the maximum month, the facility would need to have capacity above the planned 2040 loads presented herein, which may require additional improvements. The 2031 loading with DOC pretreatment lagoons removed from service is approximately equal to 2040 loading with pretreatment.

Although the City does not have specific data for the DOC pretreatment lagoon effluent, the effluent from similar lagoons would be expected to have variable alkalinity and pH depending on algal growth, sludge blanket and seasonal effects (EPA, 2002; Richard, 2003). Due to long retention times within the lagoon, particulate matter will tend to settle and anaerobically degrade, thereby releasing significant ammonia. This greater ammonia load requires increased nitrification, which consumes additional alkalinity and can adversely impact effluent pH. Conversely, BOD will tend to be reduced in the lagoon through biological activity and settling of particulates. This can yield a much lower BOD to nitrogen ratio than seen in typical domestic wastewater making denitrification more challenging. Lagoon effluent can also be a source of filamentous organisms, which can impact settleability of activated sludge in the secondary clarifiers. Each of these items could negatively impact the WWTP's ability to reliably meet more stringent pH criteria. The proposed pH reliability project would improve and expand chemical alkalinity addition capabilities, improve biological alkalinity recovery in the secondary treatment

process and improve the ability to remove filamentous organisms that can inhibit biological treatment goals.

2.5 Additional Considerations

The 2015 Utility Plan provides information regarding additional considerations as required by WAC 173-240-060, such as infiltration and inflow (I/I) problems, overflows and bypasses, and industrial wastes. A summary of these considerations is as follows:

- Section SS 5.4 of the 2015 Utility Plan concludes that I/I is not excessive: "*Previous investigations and the current review of recent flow data indicate that I/I is non-excessive in the City's sewer system. The per capita average annual sewer flows indicate non-excessive I/I in that they are lower than typical per capita rates*." The baseline I/I is reported in Table SS 5-3 of the 2015 Utility Plan. In a letter submitted to Ecology on 5 September 2016, the WWTP Manager noted that the City had non-excessive inflow during wet weather and non-excessive infiltration during dry weather (see Appendix B).
- Section SS 5.5 of the 2015 Utility Plan noted that overflows/violations and bypasses are not an issue at the WWTP: "*The WWTP has consistently met the effluent limitations and remained in compliance with the NPDES Permit. The WWTP has never had to bypass*." Since the authorship of the 2015 Utility Plan, the WWTP had a violation in TSS in February 2017 and violations for TSS and BOD in March 2017 related to *Microthrix parvicella* (MP).
- Section SS 5.2.1 of the 2015 Utility Plan also concludes: "*While there is a non-residential sewage component, there are no significant industrial discharges to the City's sewer system*." Furthermore, the City's staff conducted an Industrial User Survey during the summer through fall 2016. In a letter dated 27 October 2016, the WWTP Manager provided a summary of the five industrial users deemed as either a Significant Industrial User (SIU) or a Potential Significant Industrial User. As noted within the letter, the City did not identify any problems associated with the five SIUs (see Appendix C). Under the current NPDES permit (WA0020486), an Industrial User Survey is due to be submitted to Ecology by 31 December 2022.

Section 3: Existing Conditions

Section 3 provides a description of the WWTP history, processes, and current performance, and an overview of unit process capacity. This section also describes the development, calibration, and validation of biological process and hydraulic models to assess capacity and performance under current and projected wastewater flows and loads. Along with a process audit conducted by Wastewater Solutions Inc. (WSI) and a facility walkthrough, these assessments were used to identify process deficiencies discussed herein.

3.1 Treatment Facility History

Currently, the facility includes influent pumping, screening, grit removal, primary sedimentation, conventional activated sludge, secondary clarification, UV disinfection, effluent pumping, sludge thickening, aerobic digestion, and sludge dewatering.

An overview of the historical improvements at the site of the existing WWTP is as follows:

- Primary Treatment Plant: Primary treatment began at the site of the existing WWTP with the construction of an Imhoff Tank in the 1950s.
- Secondary Treatment Plant: In the mid-1970s, the City upgraded the facility to a secondary treatment plant using rotating biological contactors (RBCs). The upgrades also included the following: influent pumps; an aerated grit chamber; three side hill screens; two rectangular secondary clarifiers; two chlorine contact chambers; two aerobic digesters; and a new outfall to the Skykomish River.
- Phase I Improvements: The WWTP was upgraded beginning in the 1990s for added capacity. These improvements included the addition of two rectangular primary clarifiers, four submerged biological contactors (SBCs), a new circular secondary clarifier, a third aerobic digester, and an effluent pump station. In 2000, the City also replaced the chlorine gas disinfection system with UV light disinfection.
- Phase II Improvements: The upgrades in the early 2000s included removal of the rectangular secondary clarifiers and the RBCs (installed in 1970s upgrades), and the installation of three new aeration basins with anoxic selectors and a second circular secondary clarifier. This phase also included a new belt filter press dewatering system.
- Phase III Improvements: The improvements in early 2010s included a new headworks with new influent screens, influent pumps and grit removal, increased UV disinfection capacity; and new effluent pumps.
- Energy Conservation Projects: Additional facility improvements occurred during the mid-2010s through the Washington State Department of Enterprise Services energy performance savings contracting mechanism with Trane as the energy service provider. The upgrades included digester blower replacement, aeration basin blower replacement, aeration basin diffuser upgrades, new aerobic digester diffusers, replacement of an odor scrubber, modifications to an existing odor scrubber, addition of sludge thickening, replacement for the sludge dewatering polymer system, replacement of a secondary

clarifier collector mechanism, replacement of both primary clarifier collector mechanisms and aluminum covers over the primary clarifier, and aerobic digester tanks.

The unit processes associated with the above improvements are further detailed in Section 3.2 below.

3.2 Unit Processes and Systems

This section provides a detailed narrative describing the existing unit treatment processes and components. A general site layout showing the location of the major unit processes, structures and buildings is illustrated on Figure 3-1.

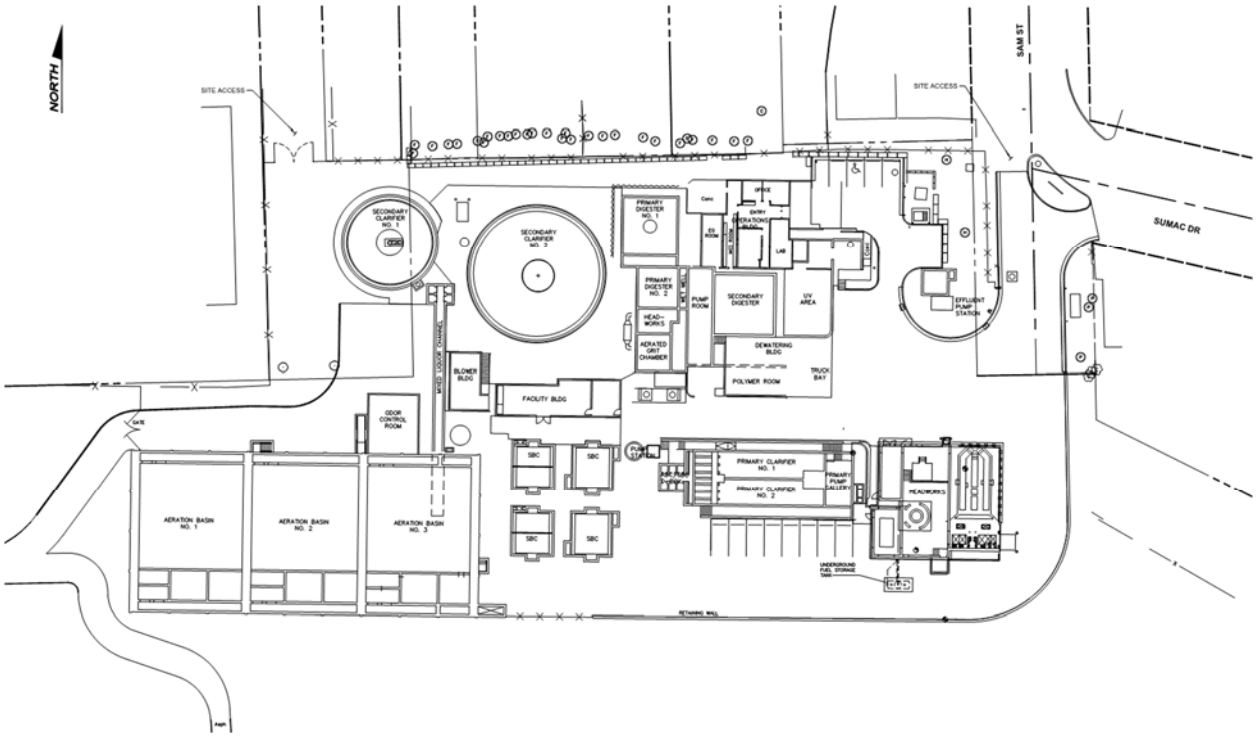


Figure 3-1: WWTP Site Layout

The existing WWTP includes protections against flooding due to its proximity to the Skykomish River. The Flood Insurance Rate Map (FIRM) number 53061C1376F produced by the Federal Emergency Management Agency (FEMA) depicts the flood risks of the WWTP and surrounding areas (see Appendix D). The FEMA Flood Map Service Center provides a publicly available online resource (https://msc.fema.gov/portal/home) for downloading and producing official flood maps. Figures 3-2 and 3-3 below demonstrate the proximity of the facility to the Skykomish River and how the southern portion of the facility is within a Zone AE (depicted in turquoise), which is a type of Special Flood Hazard Area (SFHA). According to FEMA's website (https://www.fema.gov/flood-zones), SFHA are defined as: "*the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood*." The light

brown area along the northern portion of the facility as shown on Figures 3-2 and 3-3 is deemed a “Zone X (shaded)”, which are areas between the 100-year (1% annual chance of flooding) and 500-year flood (0.2% annual chance of flooding). As shown in these figures, the predicted flood elevation at the WWTP is about 54 feet. To protect the WWTP from flooding, the City placed fill along the southern section of the facility to increase the ground elevation and constructed a retaining wall to elevation 60 feet along the southwestern, southern and eastern borders of the facility as part of the Phase II and Phase III WWTP improvements described above in Section 3.1.

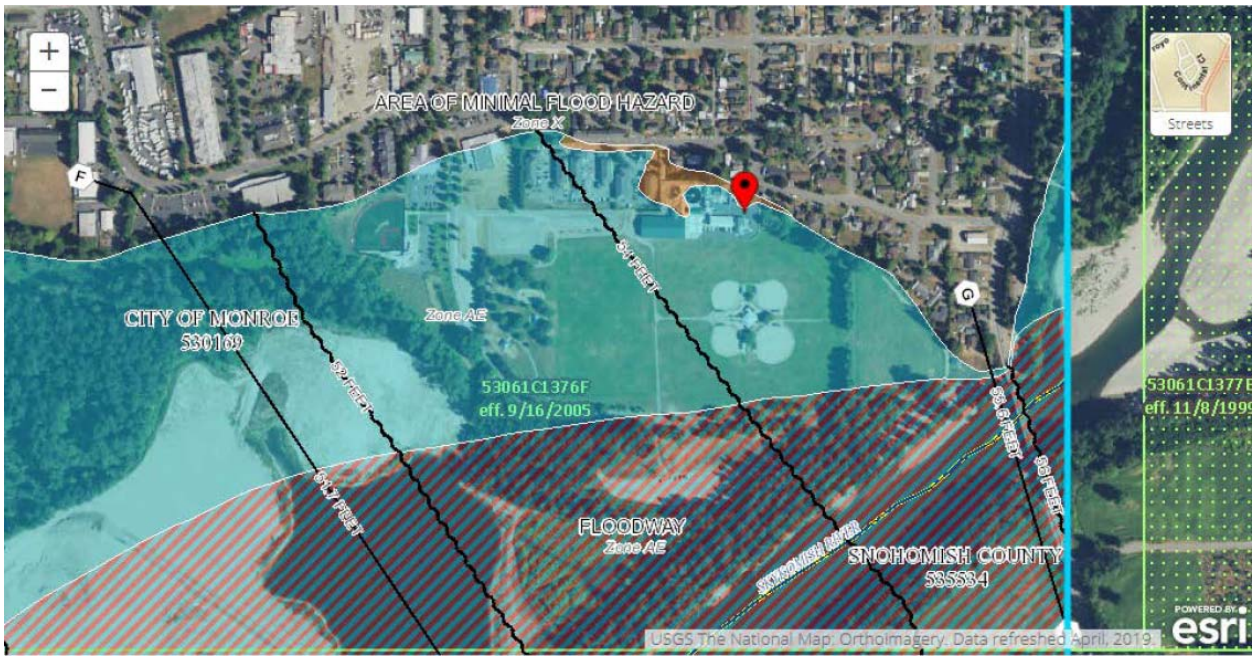


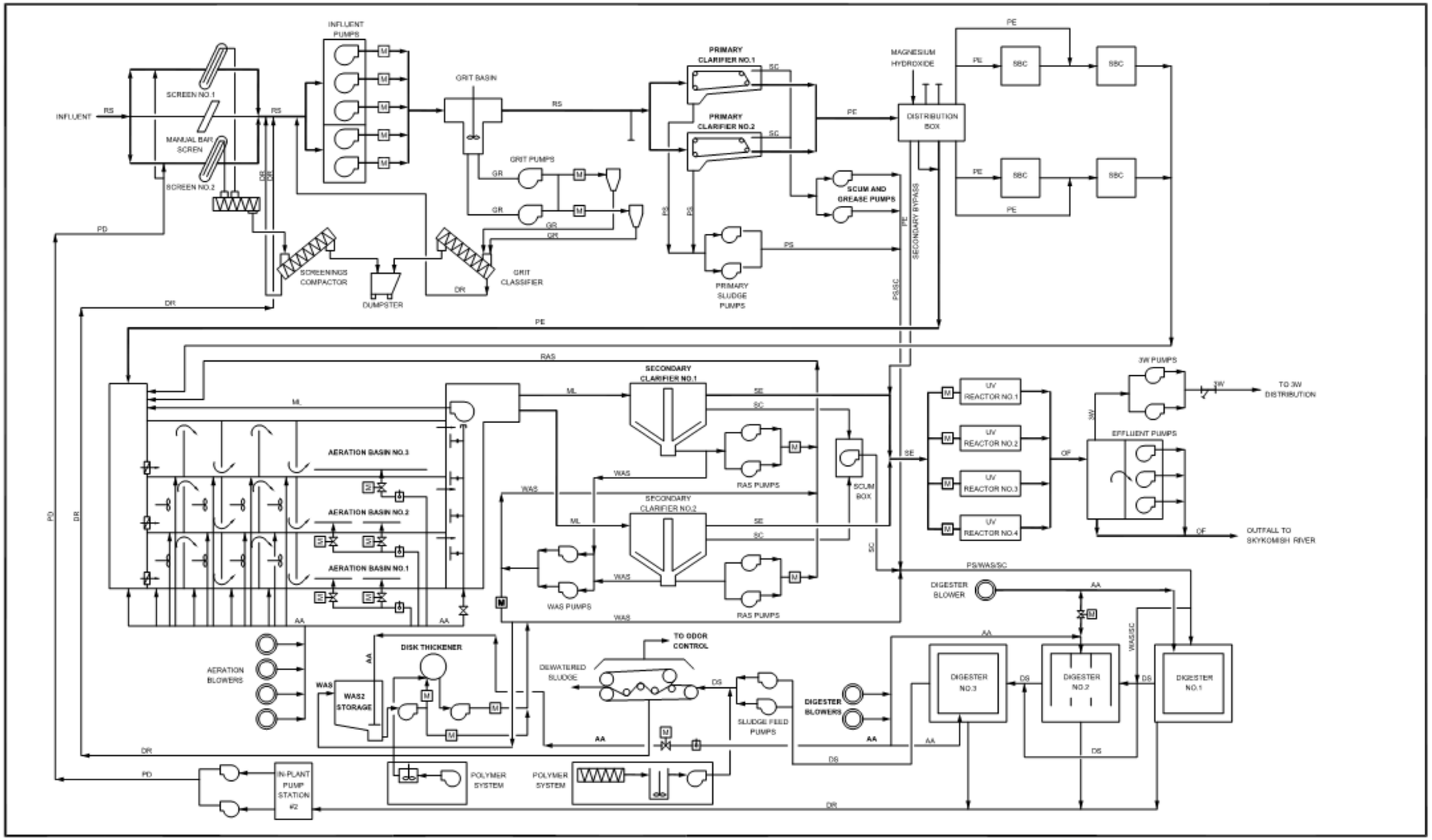
Figure 3-2: Flood Risk Map Generated from FEMA’s Flood Map Service Center to Depict Proximity of City of Monroe’s WWTP (See Red Symbol) to Skykomish River

Figure 3-3: Flood Risk Map Generated from FEMA's Flood Map Service Center to Depict Flood Risk at the City of Monroe's WWTP

3.2.1 Process and Hydraulic Overview

The bold flow lines in the process flow diagram below depict the primary flow path of the liquid treatment process (see Figure 3-4). Flow passes through the mechanical screens and then is lifted by the influent pumps to the grit removal process. After preliminary treatment in the headworks, wastewater flows by gravity through the primary clarifiers, aeration basins, secondary clarifiers, and UV disinfection before being discharge through the outfall. During peak flows and/or high river levels, the effluent pumps will be used to convey effluent through the outfall. Activated sludge settled in the secondary clarifiers is returned to the aeration basins to maintain biomass for treatment. Periodically, a portion of the settled activated sludge is wasted to control the amount of biomass retained for secondary treatment. The waste activated sludge (WAS) is either thickened before being pumped to the aerobic digesters or pumped directly to the aerobic digesters. Sludge settled in the primary clarifiers and scum collected from the secondary and primary clarifiers are pumped directly to the aerobic digesters. Digested sludge is pumped to the belt filter press for dewatering. Dewatered sludge is conveyed into a truck to be hauled off site for beneficial use through application to agricultural land.

Figure 3-5 below depicts the hydraulic profile of the WWTP after completion of the Phase III Improvements described earlier in Section 3.1.



BHC CONSULTANTS

MONROE WASHINGTON

WWTP Process Flow Diagram

November 2019

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Figure 3-4: WWTP Process Flow Diagram

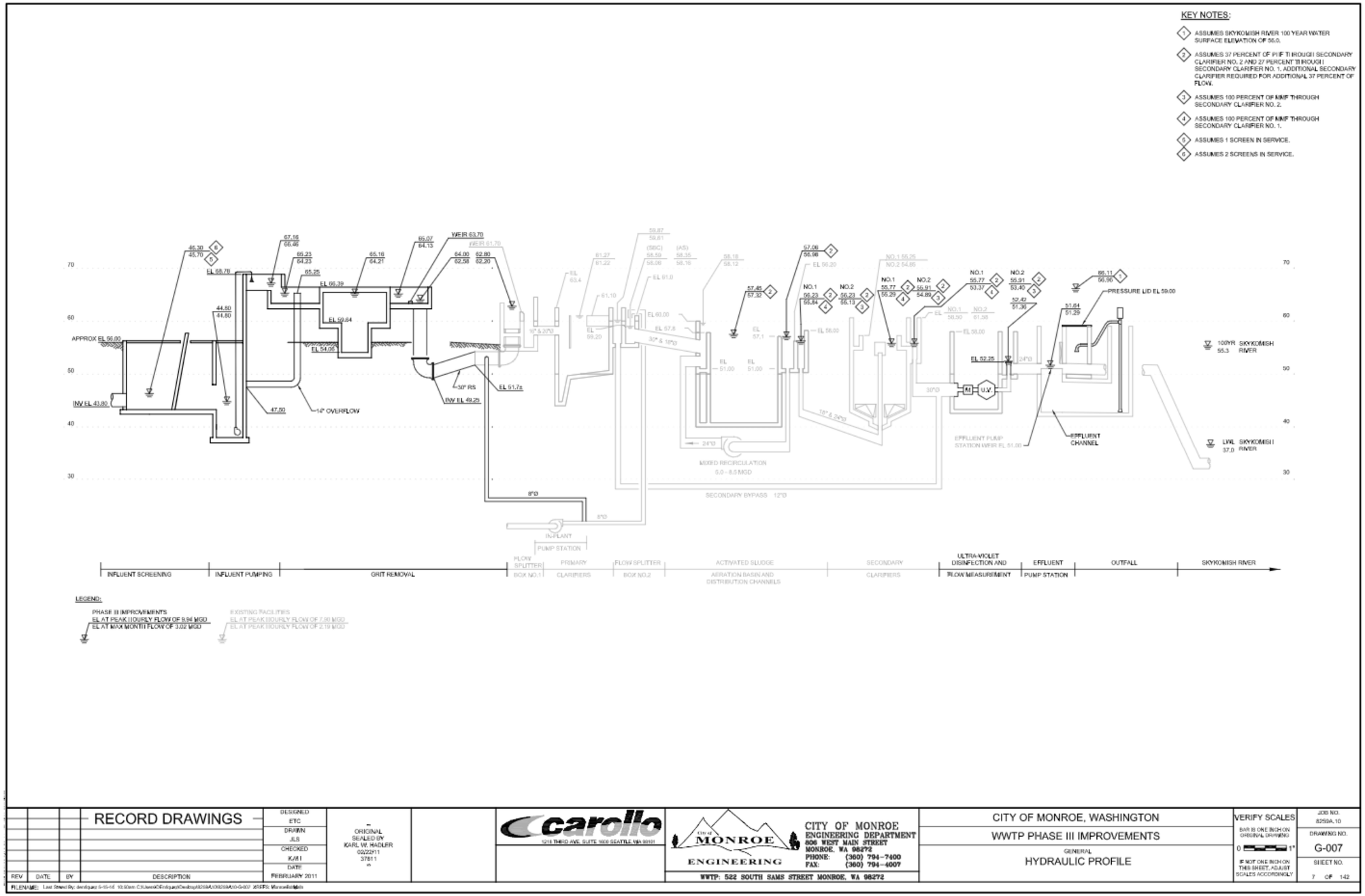

Figure 3-5: WWTP Hydraulic Profile

3.2.2 Headworks

Influent wastewater enters the WWTP at the headworks via gravity flow. The headworks consists of mechanical bar screens (see Figure 3-6), an influent pump station, and grit removal. The screenings process contains two screens with 1/8-inch [3 millimeter (mm)] openings and a 6.17 MGD capacity each, as well as a backup manual bypass bar screen with openings of 3/8 inch (9 mm). Screenings are conveyed to a washer/compactor and then discharged to a dumpster.

After screening, wastewater enters one of two wet wells. The eastern well contains two larger submersible pumps, each with a capacity of 4.0 MGD. The western well contains three submersible pumps, one larger pump with a capacity of 4.0 MGD and two smaller pumps each with a capacity of 1.0 MGD. The total influent pumping capacity is 14.0 MGD, with a firm capacity (largest pump out of service) of 10.0 MGD. Each pump has a separate discharge pipe with flow meter that flows to a single influent grit channel.

The grit chamber is a single 12-foot diameter vortex basin with a capacity of 12.0 MGD. Grit collected from this basin is pumped to two cyclone washing units, each with a capacity of 250 gallons per minute (gpm), before being sent to a grit classifier.

Figure 3-6: Headworks Mechanical Screens

3.2.3 Primary Clarifiers

After the headworks, wastewater flows by gravity to a splitter box which divides the flow between two identical, rectangular primary clarifiers (see Figure 3-7). Each clarifier is 13 feet wide by 66 feet long, proving a surface area of 858 square feet (ft^2) each or a total of 1,716 ft^2. Based on recent data, it is estimated that the clarifiers are capable of removing nearly 55% of influent TSS based on a typical surface overflow rate of 1,200 gallons per day per square foot (gpd/ft^2). At this overflow rate, the MMF capacity is 2.1 MGD. As the MMF has already exceeded 2.1 MGD and is expected to increase to 3.3 MGD by 2036, it is estimated that TSS removal in the primary clarifiers will decrease to around 45% at the resulting increased overflow

rates. Recommendations concerning primary clarifier capacity will be provided in the future engineering report. It should be noted that although the projected flows exceed typical design criteria for primary clarifiers, resulting in reduced capture of TSS, the primary clarifiers have sufficient capacity to pass the projected peak flows. The future engineering report will examine how this decreased TSS capture will impact performance of the secondary treatment process and if improvements to the primary clarifiers are needed to ensure proper performance of the secondary treatment process or if proposed secondary treatment process improvements provide sufficient capacity such that improvements to the primary clarifiers are not needed.

In 2016, the primary clarifier collection mechanisms were replaced, including drives, main and cross collector chains and flights, and the scum skimmers and launders. Primary solids are thickened in-clarifier, producing approximately 3% solids to be sent to digestion. This solids concentration is low for primary sludge and could possibly be increased by reducing the pumping rate/frequency of primary sludge to allow more time for in-clarifier thickening.

Figure 3-7: Primary Clarifiers via a 360-degree View

3.2.4 Aeration Basins

Primary effluent flows into a splitter box that had previously distributed flow among the four SBC tanks and now directs flow to the aeration basin influent channel, which distributes the flow among three identical trains. Each train begins with four small anoxic selector cells, with a total anoxic volume of approximately 102,000 gallons per train. These cells are designed to select against growth of filamentous microorganisms, but also serve to provide some denitrification of the mixed liquor, thereby reducing effluent nitrogen and recovering some alkalinity lost during nitrification.

After the anoxic zone, each train has a single large aeration basin (see Figure 3-8), each with a volume of approximately 368,000 gallons. The solids retention time of the biological process was designed at 9 days with a mixed liquor suspended solids (MLSS) concentration of 3,300 mg/L, which is typically sufficient to maintain nitrification. The nitrification process requires a significant amount of alkalinity; while some of this alkalinity is gained back through denitrification, there is still an insufficient amount to meet the increasingly stringent effluent pH

limits of the facility. Currently, the facility doses approximately 120 gallons per day (gpd) of magnesium hydroxide to add alkalinity and maintaining effluent pH as required by the NPDES permit.

Two new turbo blowers, each with a capacity of 2,000 standard cubic feet per minute (scfm), were recently installed along with new higher efficiency strip diffusers in two of the three aeration basins. Two older centrifugal blowers, each with a capacity of 1,020 scfm are on standby and serve as a backup. Current operations normally require the use of only one turbo blower. It is expected that within the planning horizon, both turbo blowers will need to be operated normally to maintain treatment. At that time, a third turbo blower should be installed to replace the older centrifugal blowers as backup.

Figure 3-8: Aeration Basin No. 2 (Foreground)

3.2.5 Secondary Clarifiers

Mixed liquor is collected from each aeration basin train in a single mixed liquor channel, where it flows to a distribution box that splits the flow to two secondary clarifiers. Clarifier No. 1 was constructed in 1995 with a 42-foot diameter and 13-foot depth and upgraded in 2017 with a new collector mechanism. Clarifier No. 2 was constructed in 2002 with a 68.7-foot diameter and 16-foot depth (see Figure 3-9). The current flow split between the two clarifiers sends 25% of the flow to Clarifier No. 1, underloading it to allow the activated sludge solids to thicken to approximately 10,000 mg/L prior to wasting. WAS is collected solely from Clarifier No. 1; thus, thicker solids are sent to the disk thickener and/or aerobic digesters to minimize the volume entering the digesters and maximize the retention time for digestion. The remaining flow is sent

to Clarifier No. 2, which produces return activated sludge (RAS) at a concentration of around 6,000 mg/L.

Secondary effluent flows by gravity to UV disinfection. Activated sludge solids are collected and returned to the head of the aeration basins using four RAS pumps, two per clarifier (one duty and one standby). Each clarifier has a WAS pump, though each pump can pull WAS from either clarifier; however, WAS is currently only collected from Clarifier No. 1.

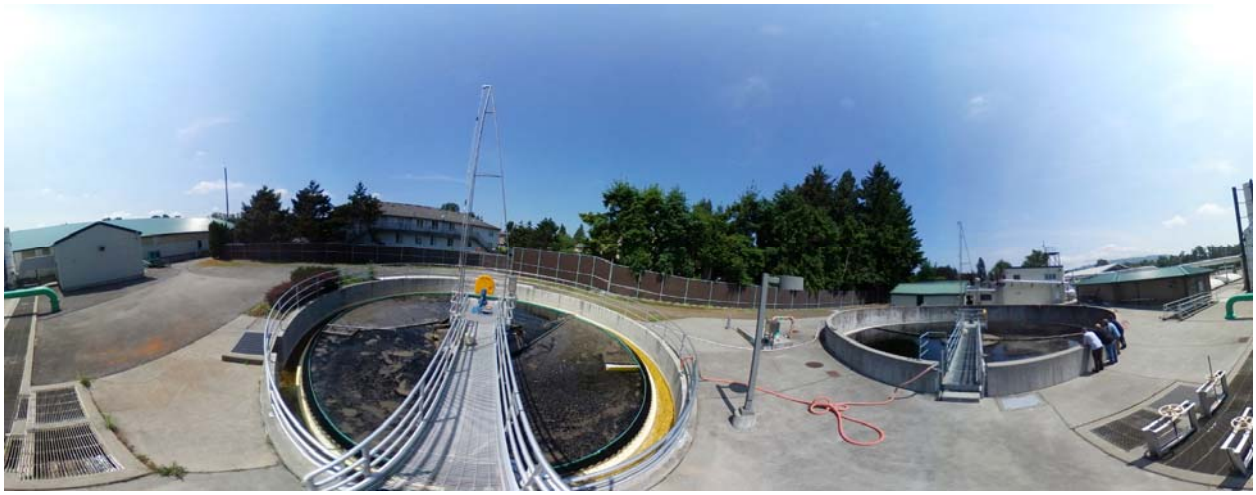

Figure 3-9: Secondary Clarifiers via a 360-degree View

3.2.6 Effluent Disinfection

Secondary effluent flows by gravity to disinfection, which consists of four in-line, closed conduit, low-pressure, high-intensity UV disinfection reactors (see Figure 3-10). The current UV reactors were installed in 2012 as a part of the Phase III upgrades replacing the older and less efficient medium-pressure units. The existing UV reactors have a total capacity of 10 MGD, and a firm capacity of 7.5 MGD based on a capacity of 2.5 MGD per reactor. The UV dose is targeted at 25 millijoules per square centimeter (mJ/cm^2) at a minimum UV transmittance of 55%.

Figure 3-10: One of Four In-Line UV Reactors

3.2.7 Effluent Pump Station, Outfall, and Receiving Waters

After UV disinfection, treated effluent is discharged to the Skykomish River through an outfall (see Figure 3-11). Outfall piping runs from a 30-inch diameter header, which is connected to four 12-inch diameter high-density polyethylene (HDPE) diffuser lines that extend approximately 50 feet into the river channel from the northern bank. The total length of outfall piping is about 1,500 feet.

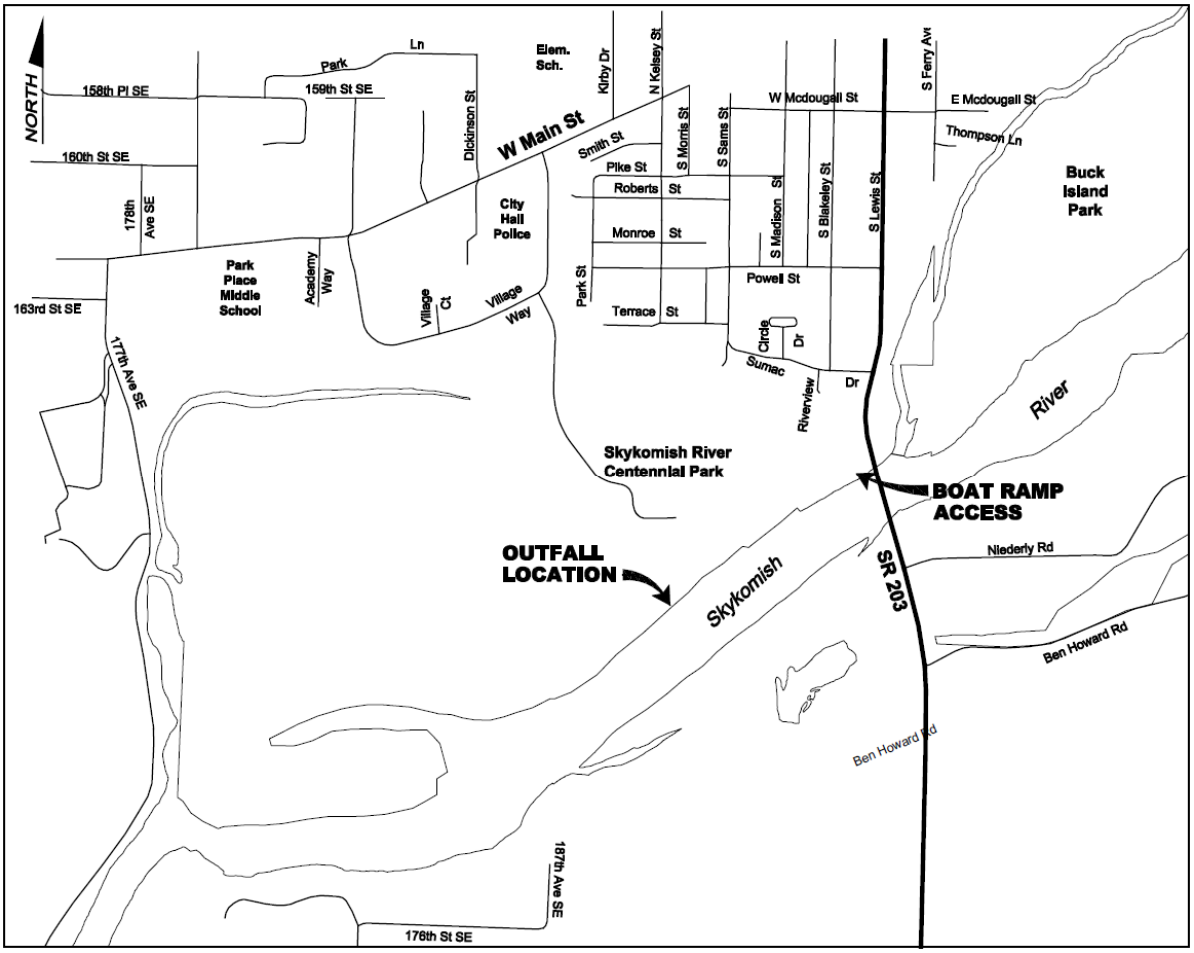

Figure 3-11: Location of the Outfall for the WWTP

Under normal conditions, effluent flows through the outfall by gravity; however, during periods of peak flow and/or high river levels, effluent pumping is required. Three effluent pumps (two duty, one standby), each with a rated capacity of 5.0 MGD at 26.2 feet of head (based on the 100-year flood level), provide a total effluent pumping capacity of 15.0 MGD with a firm capacity (largest pump out of service) of 10.0 MGD. Due to constantly changing conditions in the Skykomish River (see Figure 3-12), the outfall diffuser outlets often transition between being fully unobstructed and partially obstructed. This can result in higher headloss than is factored into the current pump design, which may impact the pumping capacity.

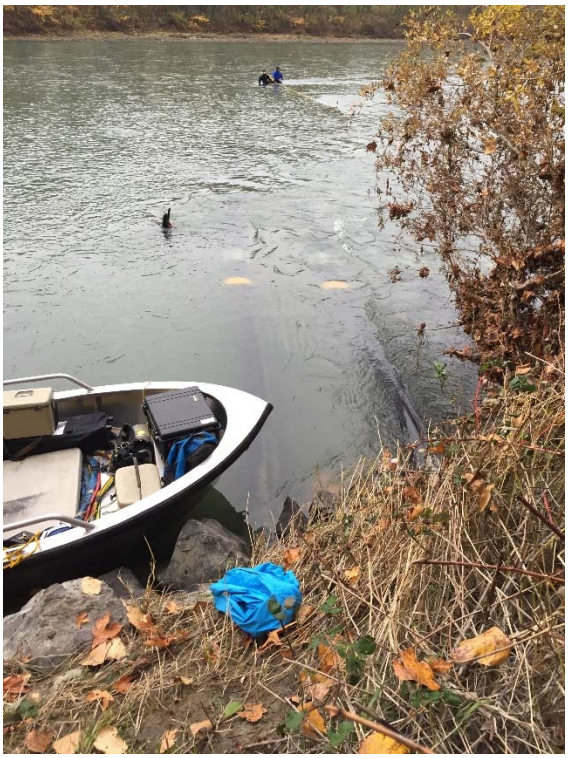

Figure 3-12: View of Outfall from Skykomish Riverbank

3.2.7.1 Existing Condition of Outfall

As required per the NPDES permit, the City conducts annual dye tests to verify the functionality of the individual diffuser lines. In September 2016, the City conducted its annual dye test and subsequently observed that two of the four diffuser pipes (the two upstream-most diffusers) were damaged, which was immediately reported to both Ecology and the Snohomish County Health District. The Monroe Outfall Condition Assessment Technical Memorandum details the damage observed in 2016 and the City's response (BHC 2016). The damaged diffuser pipes were repaired in 2017 to restore full function of the outfall.

The annual dye test recently conducted in August 2019 showed no signs of concern regarding the functionality of the outfall's diffuser system. However, as mentioned above, dynamic changes to the riverbed and bathymetry can result in partial obstruction of the diffuser outlets.

Under the current NPDES permit (WA0020486), an outfall evaluation is due to be submitted to Ecology by 31 December 2022.

3.2.7.2 Mixing Zone Study

A consulting firm prepared the most recent Effluent Mixing Study Report in 2009 (see Appendix E). As a condition of the NPDES permit in place at the time, a mixing zone study was required to determine the degree of mixing at both the acute and the chronic mixing zone boundaries, which are defined on Figure 1 of the 2009 study. According to the study, the riverbank does not influence the effluent plume within the mixing zone. The study noted that the

ambient water quality data of the Skykomish River is extracted from the monitoring station (Station No. 07C070), which is located 1 mile upstream of the outfall. The summary of the findings in 2009 are as follows: "*The critical acute and chronic dilution factors calculated by the dynamic model are 8.05 and 16.8, respectively. Based upon the calculated dilution and available effluent/receiving water contaminant data, there is no reasonable potential to exceed water quality standards. Therefore, discharge limits are not required for ammonia or any of the metal contaminants of concern (copper, mercury, and zinc)*" (pg. 21, Effluent Mixing Study Report, Appendix E).

Under the current NPDES permit (WA0020486), an Effluent Mixing Report is due to be submitted to Ecology by 31 December 2021.

3.2.8 Solids Treatment and Handling

Currently, WAS is collected from Clarifier No. 1 and either pumped to an aerated sludge holding tank before being pumped to the disk thickener, or it is pumped directly to the aerobic digesters. The disk thickener thickens the WAS to approximately 4.5% solids. Although the thickener is capable of producing higher solids concentrations, the City limits the thickening and the amount of WAS thickened so that the ratio of WAS to primary sludge is not too out of balance, which can impact the sludge dewaterability. The combined WAS, thickened WAS, and primary sludge pumped to the aerobic digesters averages a total solids concentration of approximately 2%. Six different positive displacement blowers were replaced in 2016 and 2018 with three hybrid screw blowers, two of which provide 1,000 scfm each, and one 1,380 scfm unit.

Three digesters are operated in series with maximum volumes of approximately 94,200 gallons, 44,800 gallons, and 101,000 gallons, respectively, for a total maximum volume of about 240,000 gallons. However, the second and third digesters normally average around 60% and 40% full, respectively, to allow attenuation of sludge in between operation of the belt filter press for sludge dewatering. Under design conditions, the solids retention time (SRT) of the digesters is about 16 days; whereas an SRT of 40 days is typically desired to produce Class B biosolids without the need to monitor indicator organisms and ensure sufficient vector attraction reduction (VAR). Currently, the City must test for indicator organisms to ensure pathogen densities meet the requirements for Class B biosolids, due to the short SRT. Because the SRT in the secondary process is significant, the City normally does not have an issue meeting Class B biosolids. VAR requirements are typically met by achieving a 38% volatile solids destruction. Due to the short SRT, the City typically does not meet this level of volatile solids destruction but is able to meet VAR requirements by incorporating the biosolids beneath the soil at the application site, though at added cost.

After digestion, the sludge is dewatered to 16% solids on average using a 1.5-meter belt filter press with a hydraulic capacity of 130 gpm (see Figure 3-13). The dewatered sludge cake is hauled to the former composting site of the DOC in a 5-cubic-yard dump truck owned by the City where it is temporarily stored and loaded into larger trucks for transport to the beneficial use site. The existing belt filter press is approximately 20 years old and will need a complete rebuild or replacement within the planning horizon.

Figure 3-13: Belt Filter Press

3.2.9 Odor Control

Foul air generated by the WWTP is treated in order to prevent odor impacts on the adjacent Skykomish River Centennial Park and nearby residences. Two foul air collection and treatment systems exist at the WWTP. One treats foul air from the aerobic digester tanks and the WAS storage tank. This first system uses an engineered media to adsorb hydrogen sulfide, other reduced sulfur compounds and mercaptans. The second treats air from the aeration basins, headworks, primary clarifiers, and sludge dewatering area. This system uses a packed-bed tower with sodium hypochlorite (NaOCl) and sodium hydroxide (NaOH) to remove hydrogen sulfide, ammonia, and other odorous compounds.

3.3 Unit Process Capacity

The individual process capacities are summarized in Table 3-1.

Table 3-1: Monroe WWTP Process Capacity

Component	Design
Flow, MGD	
Average Annual	2.20
Maximum Month	2.84
Maximum Day	4.55
Peak Hour	9.94

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
BOD_5, lbs/day (Pretreatment in DOC Lagoon)	
Average Annual	4,710
Maximum Month	6,090
TSS, lbs/day (Pretreatment in DOC Lagoon)	
Average Annual	4,700
Maximum Month	5,940
Total Kjeldahl Nitrogen (TKN), lbs/day (Pretreatment in DOC Lagoon)	
Average annual (43 mg/L)	789
Maximum Month (47 mg/L)	1,113
Screening	
Mechanical screens:	
Number, each	2
Opening size, mm (inch)	3 (1/8)
Capacity, each, MGD	6.17
Capacity, total, MGD	12.3
Manual screen:	
Number, each	1
Opening size, mm (inch)	9 (3/8)
Influent Pumps	
Type	
Large pumps:	
Number, each	3 (2 duty, 1 standby)
Capacity, each, MGD	4.0
Small pumps:	
Number, each	2
Capacity, each	1.0
Total firm capacity, MGD	10.0
Grit Removal	
Type	
Number, each	1
Diameter, feet	12.0
Capacity, MGD	12.0

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
Primary Clarifiers	
Number, each	2
Straight Length, feet	66
Width, feet	13
Side water depth, average, feet	10.0
Settling Area each, ft^2	858
Volume/unit, gal	68,671
Hydraulic Loading/unit, MGD	
@ design avg annual flow	1.10
@ design max month flow	1.42
@ peak hour flow	4.97
Surface loading rate/unit, gpd/ft^2:	
@ design avg annual flow	1,282
@ design max month flow	1,655
@ peak hour flow	5,793
Detention Time/unit, hour	
@ design avg annual flow	1.50
@ design max month flow	1.16
@ peak hour flow	0.33
Anoxic Tanks	
Number, each	3
Length, feet	54
Width, feet	15
Side water depth, feet	16.33
Total volume each, cubic feet	13,227
Volume each, MG	0.10
Total volume, MG	0.30
Total Detention Time, hour	
@ design avg flow	3.2
@ design max month flow	2.5
@ peak flow	0.7

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
Aeration Basins	
Number, each	3
Length, feet	57
Width, feet	54
Side water depth, feet	16.33
Total volume each, cubic feet	50,264
Volume each, MG	0.376
Total volume, MG	1.13
Hydraulic loading/unit, MGD	
@ design avg annual flow	0.73
@ design max month flow	0.95
Total Detention Time, hour	
@ design avg flow	12.3
@ design max month flow	9.5
MLSS Conc, mg/L	3,500
MLSS mass/basin, lbs	13,863
Mixed Liquor Volatile Suspended Solids (MLVSS):MLSS ratio	0.80
MLVSS mass/basin, lbs	11,090
BOD loading/ basin, lbs	
@ design avg annual BOD	1,178
@ design max month BOD	1,523
Food-to-microorganism (F/M) Ratio, max mo.	0.14
Observed Sludge Yield, lbs/lb BOD	0.50
SRT, days	
@ average annual BOD	18.0
@ design max month BOD	13.9
Aeration Blowers	
Turbine Blowers	
Number, each	2 duty
Capacity, each, cfm @8 pounds per square inch (psi)	2,000

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
Centrifugal Blowers	
Number, each	2 standby
Capacity, cfm @8 psi	1,020
Total firm capacity, cfm	4,040
Oxygen required, lbs/ day @ max mo.	11,820
Standard oxygen transfer efficiency (SOTE), %	36%
Actual oxygen transfer efficiency (AOTE):SOTE ratio	0.44
Air required, cfm @ max mo.	2,983
Secondary Clarifiers	
Number, each	2
Number 1:	
Diameter, feet	47.0
Side water depth, feet	12.0
Settling area, each, sf	1,735
Number 2:	
Diameter, feet	68.7
Side water depth, feet	16.0
Settling area, each, sf	3,703
Total surface area, sf	5,438
Surface loading rate/ gpd/sf	
@ design avg flow	405
@ design max month flow	522
@ peak hour flow	1,828
Solids loading rate/unit, lb/sf·h	
@ design avg flow	0.74
@ design max month flow	0.95
@ peak hour flow	2.78
Surface loading rate/ gpd/sf	
@ design avg flow	634
@ design max month flow	818
@ peak hour flow	2,865
Solids loading rate/unit, lb/ft^2·h	
@ design avg flow	1.16
@ design max month flow	1.49
@ peak hour flow	4.36

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
UV Disinfection	
Type	
Peak design flow, each, MGD	2.5
Number of units	4 + 0
Total firm capacity, MGD	10.0
Design transmittance, %	≥ 55
Total suspended solids, mg/L	≤45
UV Dose, mJ/cm^2	25,000
Effluent Pumps	
Type	
Number, each	2 + 1
Capacity each, MGD:	5.0
Total firm capacity, MGD	10.0
Primary Sludge Production	
Primary sludge, lbs/day	
@ design avg	2,115
@ design max month	2,673
Primary sludge concentration	3.0%
Primary sludge, gpd	
@ design avg	8,453
@ design max month	10,683
Secondary Sludge (WAS) Production	
Secondary sludge, lbs/day	
@ design avg	2,355
@ design max month	3,045
Secondary sludge concentration	1.0%
Secondary sludge, gpd	
@ design avg	28,237
@ design max month	36,511

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
Rotary Disk WAS Thickening	
Number	1
Hydraulic Capacity, gpm	100
Hours/week of Operation @ max mo.	43
Solids Capacity, lbs/hr	500
Loading at max mo., lbs/hr	496
Loading at max mo., gpm	99
Thickened Secondary Sludge	
Thickened WAS concentration	
Thickened WAS, gpd	
@ design avg	6,275
@ design max month	8,114
Total Sludge, gpd	
@ design avg	14,728
@ design max month	18,797
Aerobic Digesters	
Number, each	3
Volume, total, cf	32,100
Volume, total, gallons	240,108
Retention time, days	
@ design avg	16.3
@ design max month	12.8
Volatile solids loading, lbs/cf/day	
@ design avg	0.12
@ design max month	0.15
Assumed volatile suspended solids (VSS) destruction	40%
VSS destruction, lbs/day	
@ design avg	1,520
@ design max month	1,944
Total solids from digester, dry lbs/day	
@ design avg	2,950
@ design max month	3,774
Digested sludge concentration	1.5%

Table 3-1: Monroe WWTP Process Capacity (cont.)

Component	Design
Digested sludge volume, gpd	
@ design avg	23,583
@ design max month	30,167
Digester Blowers	
Primary Digester No. 1 Blower	1
Capacity, cfm	1,380
Pri. Dig. No. 2 & Sec. Digester Blower	2
Capacity, cfm	1,000
Total capacity, cfm	3,380
Total firm capacity, cfm	2,000
Oxygen required, lbs/ day @ max mo.	3,402
SOTE, %	12.4%
AOTE:SOTE ratio	0.40
Air required, cfm @ max mo.	2,711
Belt Filter Press Dewatering	
Number each	1
Hydraulic capacity, gpm	130
Solids capacity, lbs/ hr	1200
Belt press operation @ max month	
Runtime @ 130 gpm, hrs/week	27
Solids Loading, lbs/hr	976

3.4 Baseline Performance and Capacity

A process audit was conducted on 29 and 30 May 2019 by WSI. A facility walkthrough occurred in conjunction with the process audit and included extensive photograph documentation and additional observations of existing conditions.

3.4.1 Process Audit

In May 2019, WSI performed a site visit to conduct a process audit at the WWTP. The process audit focused on improving operations and performance through consideration of operational changes and small modifications that could be made in the near term.

WSI suggested that control of effluent pH could be improved by optimizing use of the anoxic zones, as they are currently not operated under ideal conditions for recovery of alkalinity. If the mixed liquor recycle (MLR) is reduced, the recycle of DO is also reduced, which can increase the portion of the anoxic zones actually operating under anoxic conditions. This will improve the amount of denitrification occurring in the anoxic zones and subsequently increase alkalinity

recovery, which will buffer against a drop in pH. The MLR pumping rate is typically about 3.5 times the average flow (about 6 MGD) based on the pump capacity (6,000 gpm) and typical pump speed setting (70% of full speed), which is often higher than required (typically 2 to 3 times the flow). WSI also recommended installing a chemical system as a backup for pH control. Chemical could be introduced just before or after UV disinfection to ensure permit violations do not occur in the event of a process upset or dramatic change in influent wastewater characteristics that resulted in a low pH in the secondary effluent. It was also noted that the MLR needs a flow meter, which should be paced off of plant flow and/or effluent nitrate. In the latter case, a nitrate meter is recommended on final or secondary effluent. Additionally, the two diffuser zones in the aeration basins should be baffled to allow tapered aeration, which will reduce DO recycle to the anoxic zones. These improvements would further optimize denitrification and alkalinity recovery within the existing secondary treatment process.

WSI also investigated foaming issues caused by MP, which is a type of filament that can be overly abundant in the spring due to seasonal changes occurring at the DOC's pretreatment facilities. To control and optimize the filamentous growth, it is recommended to reduce DO in the anoxic selectors, which can be accomplished through the above recommendations, raise the food-to-microorganism ratio (F/M) during the spring warming months, and reduce mixed liquor concentrations during periods of expected MP growth. Additionally, continuation of RAS chlorination as needed is recommended. However, a more permanent system for RAS chlorination could improve control and ease of use. Another consideration mentioned is the injection of polymer into the MLR discharge line to try to keep the MP in solution or employing surface wasting to selectively waste the foam that is predominately comprised of MP.

During the site visit, poor dewatering performance was noted. This is likely due to the short SRT within the aerobic digesters. WSI suggested additional digester capacity and maximizing the DO in the digesters should be considered to gain capacity and enhance performance. To test this, an experiment may be conducted that further digests the sludge for an extra 5 to 10 days to determine whether dewatering is enhanced.

It was noted that the weir in Secondary Clarifier No. 1 is not level around the circumference of the effluent launder. This needs to be fixed as it will result in higher weir overflow rates that will lead to localized velocity currents that could carry solids over the weir.

A few other suggested improvements were noted that are not directly related to process performance:

- Having the odor control fans ramp down at night has potential to save energy.
- The Plant water (3W) pumps often operate at pressures near shutoff (140 psi) due to the pumps being oversized, which causes unnecessary wear on the pumps. If turn down of the pumps can be improved so that they can operate at lower pressures and reduced output, this could reduce energy use and wear.
- The flow meter on the primary sludge line does not work optimally and relocation and replacement are advisable.

3.4.2 Additional Findings from Facility Walkthrough

Personnel from the team conducted walkthroughs on both days of the process audit and photo documented the facility. Photograph documentation included the use of a Samsung Gear 360-degree camera, which allowed for extensive documentation of the existing facility.

Observations and input received from the facility's personnel during the walkthrough that are relevant to pH control are as follows:

- According to operators, the Mg(OH)2 system for dosing immediately after primary clarification is prone to clogging, especially during cold weather. See Figure 3-13 below.
- According to operators, two of the eight ABS Seltzer mixers within the aeration basins are not working, and the other six mixers are anticipated to only last approximately 1 more year.
- The end of the skimmer on Secondary Clarifier No. 2 (asset 402) gets clogged during foaming events. See Figure 3-14.

Figure 3-13: Primary Clarifiers (left), Distribution Box with Six Gates (center-foreground), and Mg(OH)2 System (center-background)

Figure 3-14: End of Skimmer of Secondary Clarifier No. 2 (Asset 402)

3.5 Anticipated Deficiencies of Existing WWTP

Deficiencies and issues integral to pH control were identified based on the spreadsheet analysis and the process audit with facility walkthrough.

3.5.1 pH Control

The need to control pH already exists as influent alkalinity is low, and nitrification uses a significant portion of the available alkalinity. Currently, the facility adds approximately 120 gpd of magnesium hydroxide to supplement the influent alkalinity and help buffer the pH. The current magnesium hydroxide storage and feed system was constructed by the City to meet immediate needs for pH control. Based on the City's experience operating this temporary system, they have identified improvements to controls, durability and flexibility to be implemented with an upgraded or replacement system for permanent use. It is recommended that flow-pacing and pH monitoring be added to help control dosing of supplemental alkalinity. Additional dosing locations can also be provided to ensure that the magnesium hydroxide, a weak base, has sufficient retention time to fully dissociate. Incorporating carrier water and improving piping can also help with some of the issues associated with handling a slurry such as precipitation and issues with low temperatures.

In addition to improvements for dosing supplemental alkalinity, it is recommended that a backup chemical system also be provided to correct pH in the secondary effluent if there is a significant upset, failure of supplemental alkalinity dosing, or dramatic change in the influent wastewater that would require pH adjustment to maintain compliance with the NPDES permit. This could be

accomplished by dosing sodium hydroxide from an existing storage tank (used for one of the odor scrubbers) just before or after UV disinfection to ensure compliance with the pH limit.

It is also recommended that an MLR flow meter and nitrate meter be added to improve control of MLR pumping and the two diffuser zones in the aeration basins be baffled to allow tapered aeration, all of which will maximize denitrification and alkalinity recovery of the existing system.

3.5.2 Filament Control

In order to optimize biological performance for pH control, it is also beneficial for the WWTP to address challenges related to filament control. The growth of certain types of filamentous microorganisms is a concern at the facility due to poor settling characteristics. This typically occurs during the shoulder seasons and is not typically a year-round issue. Filaments and associated foaming impact performance of the secondary clarifiers during periods in which they are an issue.

Section 4: Alternatives Evaluation

Section 4 identifies improvements to be made for only the pH control and filament control deficiencies summarized in Section 3.5. Where there are viable alternatives to address certain deficiencies, these alternatives are evaluated herein, compared, and an alternative selected for implementation.

4.1 Identification of Alternatives

The Team identified several options for both pH control and filament control.

4.1.1 pH Control

The identification of alternatives for pH control included optimizing the biological performance of the WWTP and two chemical feed options.

4.1.1.1 Alkalinity Recovery through Denitrification

Denitrification can be used to recover alkalinity consumed during nitrification. Some denitrification is currently achieved within the existing anoxic zones, which can be further enhanced by limiting the introduction of DO into the anoxic zones to maximize the volume under anoxic conditions. The amount of DO introduced into the anoxic zones can be reduced by utilizing a flow meter and nitrate meter to minimize MLR pumping. Additionally, installing a baffle between the two diffuser zones in the aeration basins will allow tapered aeration, which will reduce DO in the MLR flow. For example, a target DO of 3.0 mg/L in the first zone and 1.5 mg/L in the second zone would focus the air supply where the demand is highest (in the first zone) and allow reduced DO in the second zone so that there is less in the MLR flow back to the anoxic zones.

4.1.1.2 Upgraded Magnesium Hydroxide System

As discussed previously, the current system for adding magnesium hydroxide to the primary effluent must be improved. The new system will replace the bulk storage tank and chemical metering equipment and enhance control to allow flow pacing and automatic adjustment based on effluent pH measurement. In addition to dosing supplemental alkalinity in the primary effluent, the City would also like the ability to dose supplemental alkalinity upstream of the primary clarifiers, as the magnesium hydroxide is slow to dissociate, which can lead to crystalline magnesium particles settling in the secondary clarifiers.

4.1.1.3 Secondary Effluent Sodium Hydroxide Dosing System

To ensure that the pH of the final effluent discharged to the Skykomish River remains within the discharge permit limit range of 6.7 to 9.0 standard units, a sodium hydroxide system to raise the pH of the secondary effluent prior to discharge is recommended. This would serve to adjust the pH if required and maintain effluent pH levels within permit requirements. Sodium hydroxide is a strong base and will immediately dissociate to provide prompt pH adjustment in the unlikely

event that the dose of magnesium hydroxide is inadequate, there is a secondary process upset, or there are sudden changes in influent wastewater characteristics.

4.1.2 Filament Control

The Team also identified an array of options to provide filament control and address associated foaming events. The options included both application of chemicals, as well as physical removal of filamentous organisms.

4.1.2.1 RAS Chlorination

RAS chlorination is one of the most commonly employed methods of dealing with filamentous organisms. Chlorine is mixed with the RAS at a target dose to kill filaments. At the proper dose, chlorine will kill the filamentous organisms, and flocs of microbes (non-filaments) will have the outer layer damaged, but the floc remains largely intact. The City currently employs RAS chlorination and it is recommended the City continue this practice as needed; however, the existing temporary chlorination system does not allow for proper control. A new permanent RAS chlorination system with improved control and ease of use is needed. This new system would be located at the Facility Building.

4.1.2.2 Surface Wasting

Surface wasting, also known as a classifying selector, would add equipment to remove foam and floating filamentous organisms from the surface at a select location. This selects against filamentous organisms as they predominately reside in the foam that would be wasted from the system. Surface wasting can be seen as addressing the source of foaming issues but does not guarantee that all foaming issues will be eliminated.

Surface wasting could be achieved by installing a concrete scum box adjacent to the existing mixed liquor channel. An angled scum baffle could be used to trap foam and scum and direct it toward the concrete box. An actuated weir gate could be periodically lowered to waste trapped foam and scum into the box. New piping could be installed to convey the wasted foam and scum to the existing WAS pumps in the Facility Building.

4.1.2.3 Polymer Addition

This alternative could add polymer to the secondary clarifiers to solubilize the foam, putting it back into solution. Polymer addition does not target the source of the foam (filaments), but it does treat the symptom. An emulsion polymer makeup system could be located in the Facility Building and drums or totes of emulsion polymer brought in as needed. The polymer solution could be introduced through the existing spray nozzles at the clarifier feed wells and/or into the MLR piping. From a capital cost standpoint, this is a relatively inexpensive option; however, the high cost of polymer contributes to a relatively high operating cost compared to surface wasting.

4.2 Alternatives Selected for Further Evaluation

The alternatives identified in Section 4.1 were reviewed by City personnel. The following sections detail the feedback from the City's personnel.

4.2.1 pH Control

The City prefers to implement all alternatives identified in Section 4.1.1 above for improving pH control. This includes upgrading the magnesium hydroxide system, adding a secondary effluent sodium hydroxide dosing system, and improving denitrification within the existing aeration basins to increase alkalinity recovery. Denitrification improvements will be implemented through two methods: 1) include addition of a flow meter and nitrate meter to minimize MLR pumping and optimize mixed liquor controls; and 2) install a baffle between the two diffuser zones in the aeration basins to allow tapered aeration.

4.2.2 Filament Control

The City noted a desire to continue periodic RAS chlorination for filament control. Therefore, a new permanent RAS chlorination system with improved control and ease of use will be installed. Moreover, the City's personnel requested additional analysis of the two remaining alternatives for filament control – surface wasting and polymer addition – prior to selecting an additional method of filament control at the WWTP.

4.3 Alternatives Evaluation for Additional Filament Control

An alternatives evaluation was performed to compare the two remaining alternatives for filament control – surface wasting versus polymer addition - along a variety of metrics.

4.3.1 Basis of Cost Estimates

All costs developed for evaluation of alternatives are in 2019 dollars. The capital costs reflect a Class 4 opinion of probable cost (applicable for 1% to 15% design) as defined by the Association for the Advancement of Cost Engineering (AACE) and have an expected accuracy range of -20% to +30%. Capital costs were developed using pricing from vendor quotes, comparison to construction cost data for similar project work, and RSMeans online construction cost data, and also include the following markups:

- 10% for mobilization, demobilization, temporary facilities, startup, and testing.
- 2.3% for bonds and insurance.
- 15% for contractor overhead and profit.
- 30% estimate contingency to cover necessary project elements not currently captured in the costs.
- 9.3% sales tax.
- 15% for design and bidding support.
- 10% for construction management.
- 2% for City legal and administrative costs.

- 20% for Owner's contingency to add scope to the project during construction and cover unforeseen conditions (this is reduced to 10% for improvements that are expected to be implemented by 2020).
- 1% for permit, inspection and review fees.

Annual operation and maintenance (O&M) costs were developed considering the average annual additional labor to operate and monitor the process improvements, electricity and chemicals necessary to run the process improvements, and associated maintenance (primarily replacement of parts). The annual O&M costs were converted to a 20-year net present value in 2019 dollars based on an assumed interest rate of 5% and inflation rate of 3% for an effective interest rate of 2%. The following assumptions were used to develop the O&M costs:

- Labor rate of $50 per hour.
- Electricity rate of $0.07 per kilowatt-hour.
- Maintenance cost at 2% per year of the equipment purchase price.
- Emulsion polymer cost of $8.00 per pound.

4.3.2 Criteria

Eight different criteria were used as metrics to compare the different alternatives: performance, reliability, proven technology, future expandability and flexibility, footprint, public perception, operations and maintenance cost, and capital costs. Different weights were applied to each category based on the importance of the criteria in decision making for the City.

4.3.2.1 Performance

This criterion considers if the improvement meets or exceeds the performance requirements and if there are performance benefits to other processes. A weight of 8% was applied to performance.

4.3.2.2 Reliability

Reliability considers redundancy, complexity, points-of-failure, and any known or historical issues. A weight of 12% was applied to this criterion.

4.3.2.3 Proven Technology

The City has expressed that it does not want to be a "guinea pig" in the implementation of new or less proven technologies. This criterion considers maturity of technology, number of installations, and any local track record. A 6% weight was used for this criterion.

4.3.2.4 Future Expandability and Flexibility

Future expandability and flexibility encompass how an improvement might serve the facility with regards to further expansion, modularity, and ability to meet future changes in projections and/or permit limits. The City does not want to select a technology or alternative that unnecessarily

limits future potential treatment modifications in the long run. This criterion was weighted at 15%.

4.3.2.5 Footprint

The existing site is space constrained, with a parking lot and apartments to the east, housing to the north and the west, and a park to the south. By minimizing footprint of improvements, there will be more space for other needs further down the road. This criterion is weighted at 8%.

4.3.2.6 Public Perception

Implementation of certain alternatives could negatively impact public perception, such as requiring use of space in the adjacent park, having greater odor potential than existing processes, increasing noise, or anything else that might be viewed negatively by the public. Conversely, some alternatives could positively impact public perception, such as higher effluent quality or availability of reclaimed water. This criterion was weighted at 7%.

4.3.2.7 Capital Costs

With any capital improvement, cost is one of the most important factors in decision making. The City is no exception, and capital costs were weighted at 22%. A summary of the capital costs associated with each alternative is provided in Table 4-1.

Table 4-1: Comparison of Capital Costs for the Alternatives for Filament Control

	Alternatives for Filament Control	
	Surface Wasting	**Polymer Addition**
Total Capital Cost	$400,000	$330,000

4.3.2.8 Operational Costs

Operational expenses are those incurred during the life of the improvement related to operation and maintenance. As shown in the summary of operational costs in Table 4-2 below, some of the alternatives evaluated are significantly more expensive to operate than others. Of note, the net present values (NPV) were calculated assuming a 20-year life cycle, and a 2% effective interest rate. The total NPV is the sum of the total capital cost from Table 4-1 and the total O&M NPV.

Table 4-2: Comparison of Operation & Maintenance Costs for the Alternatives for Filament Control

	Alternatives for Filament Control	
	Surface Wasting	**Polymer Addition**
Annual O&M Cost	$640	$30,264
Annual O&M Cost NPV	$10,000	$495,000
Total O&M NPV	$10,000	$495,000
Total NPV	$410,000	$825,000

4.3.3 Categorical Ratings

The following tables provide commentary on each of the non-cost criteria for each alternative evaluated for filament control, along with representative scoring that is reflective of the commentary with 1 being the worst score and 5 being the best possible score.

Table 4-3: Filament Control Alternative 1, Surface Wasting

Category	Rating	Comment
Performance	3	Physically captures and removes scum and foam, which yields removal of problematic bacteria, but limited to the one location at the mixed liquor channel. Could still see foam/scum in the clarifier due to biological activity. This process would be continuous. Should not have any adverse impact on thickening or dewatering processes.
Reliability	4	Simple physical process with no chemicals and limited moving parts (just the actuated gate).
Proven Technology	3	Has been proven to be effective at removing foam from locations where installed.
Future Expandability and Flexibility	4	Additional surface wasting locations could be added, such as in the aeration basins to deflect and capture foam in front of the effluent weirs.
Footprint	5	Small footprint and located below grade in an area that would likely not conflict with other current or potential future improvements.
Public Perception	4	Reduction in foam and scum would improve aesthetics of open clarifier tanks and may yield some minor reduction in odor.

Table 4-4: Filament Control Alternative 2, Polymer Addition

Category	Rating	Comment
Performance	3	Reduces foam at the location it is of greatest concern (secondary clarifiers), but does not physically remove problematic bacteria and performance is dependent on selection of the right polymer, providing the correct dose, and beginning dosing at the correct time. Impact on dewaterability of sludge is unknown. Does not impact scum. This process would be implemented as needed.
Reliability	3	Relatively simple process. Chemical reaction kinetics can change with weather, flow and sludge quality. If not dosed continuously, operator must be well aware as to when dosing will be necessary.
Proven Technology	3	Has been proven to be effective at controlling foam when using correct polymer type and dose.
Future Expandability and Flexibility	4	Can be expanded to additional clarifiers.
Footprint	4	Small footprint but would take up some space in the Facility Building that could otherwise be used for other process equipment or as shop space.
Public Perception	5	Reduction in foam would improve aesthetics of open clarifier tanks and may yield some minor reduction in odor.

4.3.4 Final Alternative Selection for Additional Filament Control

The final score for each alternative was based on the sum of the weighted scores. A summary of the scoring is provided in Table 4-5. The highest scoring alternative is the most favorable. For scoring costs, the lowest capital and O&M costs were given a score of 5 and the highest costs were given a score of 1 for each group of alternatives. For an alternative that fell between the highest and lowest costs, its score was based on its proximity to the lowest and highest costs.

Table 4-5: Weighted Score Summary

		Alternatives for Filament Control	
Category	**Weight**	**Surface Wasting**	**Polymer Addition**
Performance	8.0%	4.0	3.0
Reliability	12.0%	4.0	3.0
Proven Technology	6.0%	3.0	3.0
Future Expandability and Flexibility	15.0%	4.0	4.0
Footprint	8.0%	5.0	4.0
Public Perception	7.0%	4.0	5.0
O&M Cost	22.0%	5.00	1.00
Capital Cost	22.0%	5.00	4.15
Total	**100.0%**	**4.27**	**3.37**

Surface wasting has the highest score between the two filament control alternatives. It should be noted that these two alternatives are not exclusive of each other, meaning that both could be installed if desired. The City elected surface wasting as it has a much lower O&M cost, because it does not require chemicals, and is simpler and more reliable. The capital costs of the two alternatives are comparable. Another reason for surface wasting scoring higher is that polymer addition would only treat the symptom of the problem, and the problematic filaments would remain in the system.

Section 5: Recommended Plan

The recommended plan for addressing pH control and filament control is detailed within this section.

5.1 Selection of Improvements

The plan includes six project elements. Four of the project elements primarily target pH control and two elements primarily address filament control.

5.1.1 General Considerations

The following design considerations are applicable to the six project elements:

- Safety: Personnel shower and eyewash facilities will be near new chemical handling and storage.
- Freeze protection: Appropriate measures for freeze protection (e.g., heat tracing) will be included where appropriate, specifically small diameter chemical feed piping.
- Fire protection: Additional fire protection measures are not anticipated for the proposed pH and filament control upgrades.
- Flood protection: New chemical equipment will be located at least 2 ft above the 100-year flood elevation. The new MLR flow meter will be specified for underwater duty and the vault will be designed with a sump to facilitate quick removal of water from the vault after the flooding event.
- Minimizing impacts to nearby residents: Impacts to nearby residents are expected to be negligible. The proposed improvements are primarily equipment installation focused that would not require extensive demolition and construction actives. The proposed chemical feed upgrades are chemicals that are routinely delivered and used at the WWTP currently; hence, no change is anticipated.

5.1.2 Basis of Design for pH Control

The proposed approach to reliably maintaining the effluent pH of the Monroe WWTP is to implement targeted low-cost secondary treatment optimization improvements supported with chemical feed upgrades that assists stabilizing the secondary process and addresses final effluent pH reliability post-secondary treatment.

The proposed secondary treatment process improvements consist of:

- Optimize mixed liquor return to include both flow monitoring/adjustment related to process performance as measured by nitrate in the effluent mixed liquor channel of the aeration basins. This would include installing a below-grade vault east of the aeration basins to house a new flow meter on the MLR pipe and installing channel mounted nitrate sensors in the MLR channel. These improvements would give operators better

control over the MLR flow rate. Also, the improvements would enhance the effectiveness of the anoxic zone and reduce alkalinity consumption, which in turn stabilizes pH. See Figure 5-1 for a proposed location and layout of the mixed liquor return optimization.

- Install a fiberglass separation baffle in the center of the aeration basins to improve low oxygen operation in the second half of the effluent portion of the basin. This would result in improved biological alkalinity recovery. See Figure 5-2 for a proposed location and layout of the fiberglass baffles.

The proposed chemical feed upgrades consist of:

- Upgrade the existing magnesium hydroxide storage and feed system, and
- Install a permanent sodium hydroxide dosing system downstream of UV disinfection.

Magnesium hydroxide chemical feed system

Upgrading the magnesium hydroxide storage and feed system targets pH control prior to secondary treatment and is needed because of relatively low influent wastewater alkalinity required to support the secondary treatment process and therefore, maintain effluent pH within the future treatment standard.

The existing magnesium hydroxide feed system's deficiencies include: aging system; insufficient chemical storage capacity for future flows; lack of redundant chemical storage capacity; lack of an automated dose control; and most importantly, a metering system and feed piping that experiences issues with clogging and insufficient temperature control measures for cold weather conditions.

The proposed improvements for magnesium hydroxide feed include replacement of the bulk chemical storage and metering system located at the western end of the primary clarifiers. See Figure 5-3 for a proposed location and layout of the upgraded magnesium hydroxide system. Redundancy and reliability measures for the improvements include: two storage tanks with independent mixers and heating systems; two chemical feed pumps each sized for maximum month flows during the winter (approximately 1 gpm); and two chemical feed lines to the distribution box. Design dosing requirements were determined using Biowin. The design criteria for the upgraded magnesium hydroxide system to reliably maintain an effluent pH in the range of 6.7 to 9.0 standard units are included in Table 5-1 below.

Table 5-1: Design Criteria for Upgraded Magnesium Hydroxide System

Design Parameter	Design Criteria
Assumed % slurry of Mg(OH)2	60%
Mass flowrate of Mg(OH)2 at AAF	1,032 lbs/day
Pump flowrate (peaking factor of 3)	0.85 gpm
Storage capacity	Two 4,000-gallon tanks

Notes:

*Storage capacity is based upon calculation of 25 days at 2040 AAF and 20 days at 2040 MMF.

Sodium hydroxide chemical feed system

To provide stand-by effluent pH control, a new sodium hydroxide system is proposed to adjust pH downstream of the UV disinfection should it be needed during a secondary process upset. According to the WWTP's operators, adjustments for pH control using the existing magnesium hydroxide system located upstream in the process results in approximately a half-day lag time between the dosing location and the effluent pH meter. This would provide an additional safety factor to quickly address low pH issues with minimal lag time.

The supplemental sodium hydroxide dose would be injected downstream from the UV reactor into the effluent channel as needed. The following table provides the assumed effluent water quality and projected NaOH requirements to raise the WWTP's effluent pH from 6.7 to 7.0.

Table 5-2: Sodium Hydroxide Projected Feed Rates

Instream pH (units)	Initial Alkalinity (mg/L as $CaCO_3$)	TDS (mg/L)	Temperature (°C)	Downstream pH (units)	NaOH (mg/L)
6.7	50	130	12	7.0	7.8
6.7	50	330	12	7.0	7.5
6.7	50	130	24	7.0	6.7
6.7	50	330	24	7.0	6.3

Notes:

CaCo3 = calcium carbonate
°C = degrees Celsius

The proposed project would be designed to feed 25% NaOH which contains 2.66 lbs. of NaOH per gallon and freezes at approximately 6 degrees Fahrenheit (°F). By comparison, 50% NaOH freezes at approximately 54°F which presents a handling issue. Preliminary sodium hydroxide metering pump sizing assumes a peak hour WWTP effluent flow rate of 9.94 MGD (6,900 gpm) and a peak NaOH dose of 7.8 mg/L. The metering pump needs be able to pump 10.1 gallons per hour (gph). Table 5-2 provides the projected NaOH requirements assuming it is necessary to feed NaOH for a 24-hour period at an average dosing rate of 7.05 mg/L.

Table 5-3: Projected 24-Hour Sodium Hydroxide Requirements

Flow Condition	Flow Rate (MGD)	NaOH Dose (mg/L)	25% NaOH Required (gpd)
Average Day	2.20	7.05	49
Maximum Month	2.84	7.05	63
Maximum Day	4.55	7.05	101

If the pH excursion lasts no more than 24 hours, two 55-gallon drums of 25% NaOH would be adequate to raise the pH from 6.7 to 7.0 and provide a margin of safety in complying with the effluent pH requirements.

A smart digital metering pump such as a Grundfos DDA size for 7.5 gallons per hour (180 gpd) with a 1:3,000 turndown ratio is suitable for this application. NaOH could be injected into the UV effluent pipeline just prior to discharge into the effluent channel. The 90-degree bend will assist in mixing NaOH with the wastewater effluent. The chemical reaction should be nearly instantaneous, allowing representative pH monitoring at the effluent pump station downstream.

See Figure 5-4 for a proposed location and layout of the sodium hydroxide system.

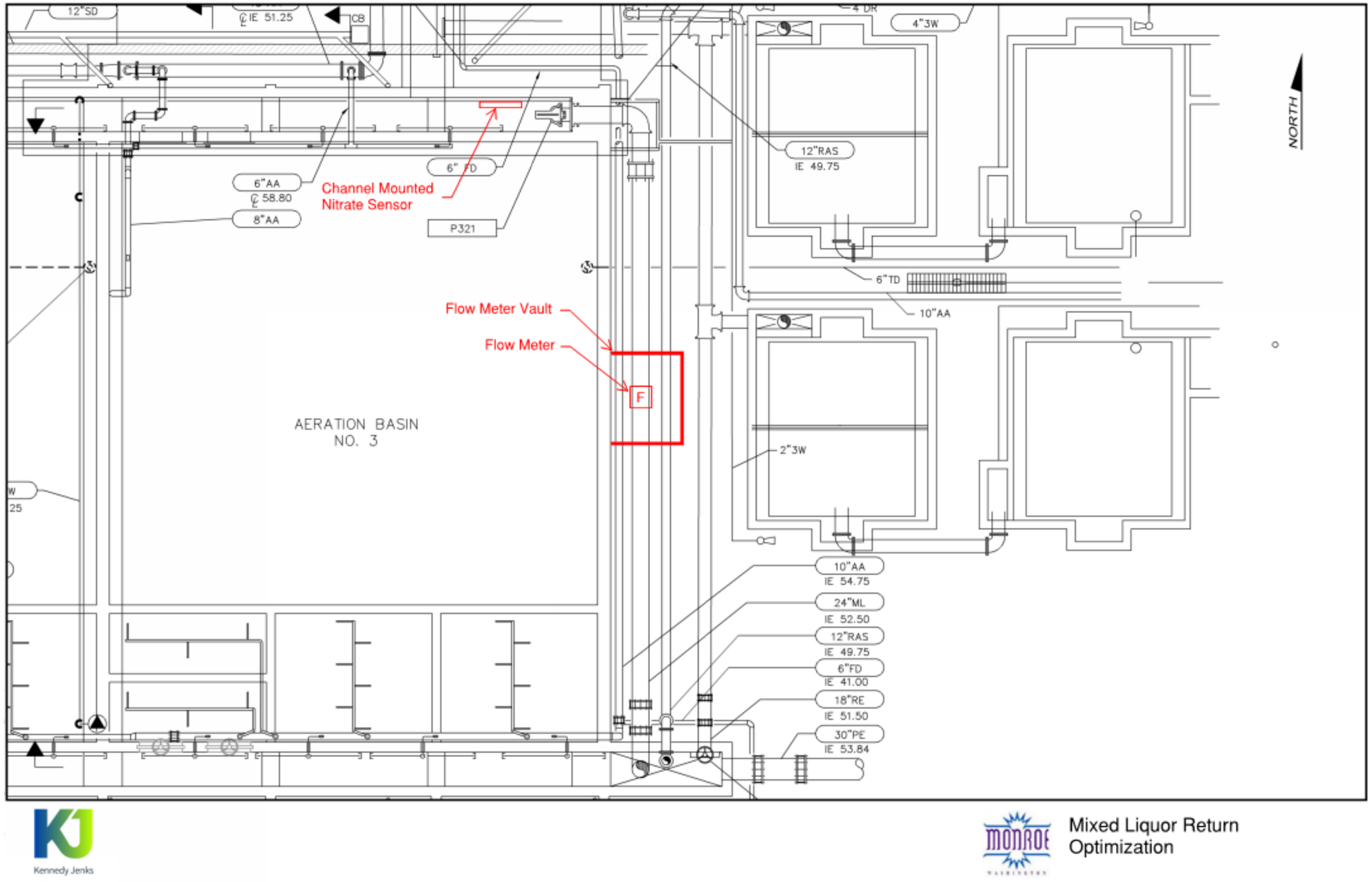

Figure 5-1: Mixed Liquor Return Optimization

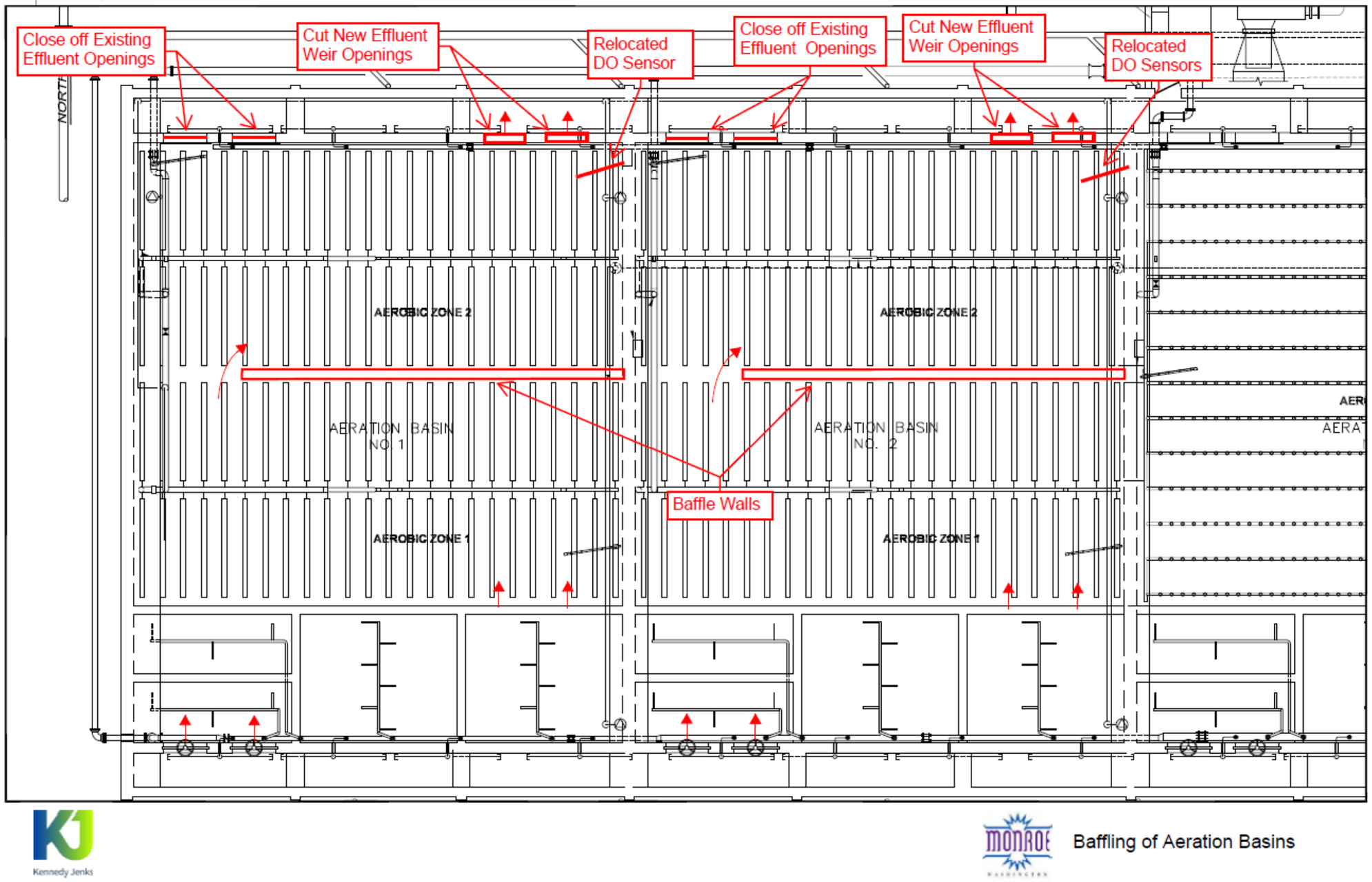

Figure 5-2: Baffling of Aeration Basins

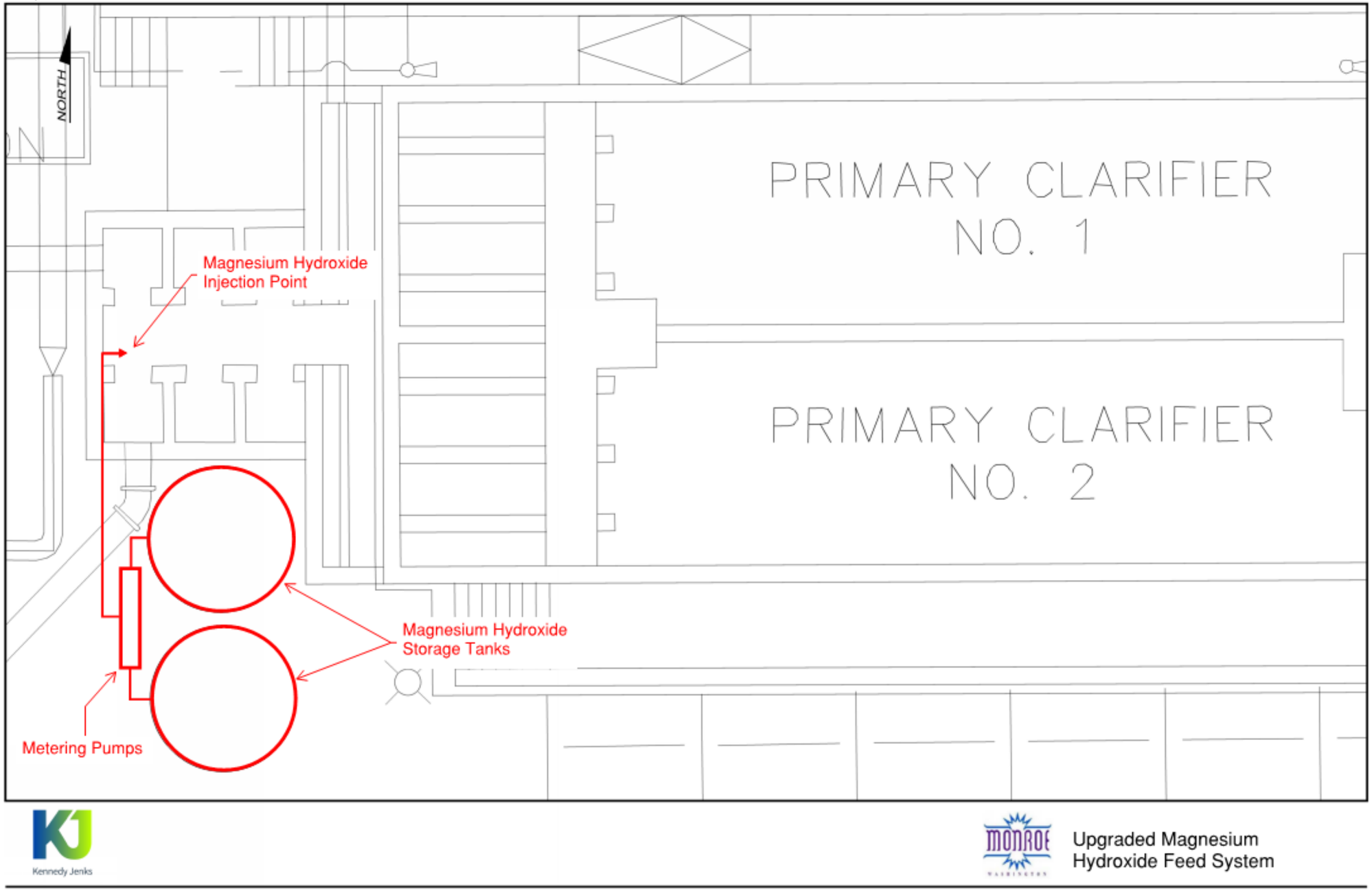

Figure 5-3: Upgraded Magnesium Hydroxide Feed System

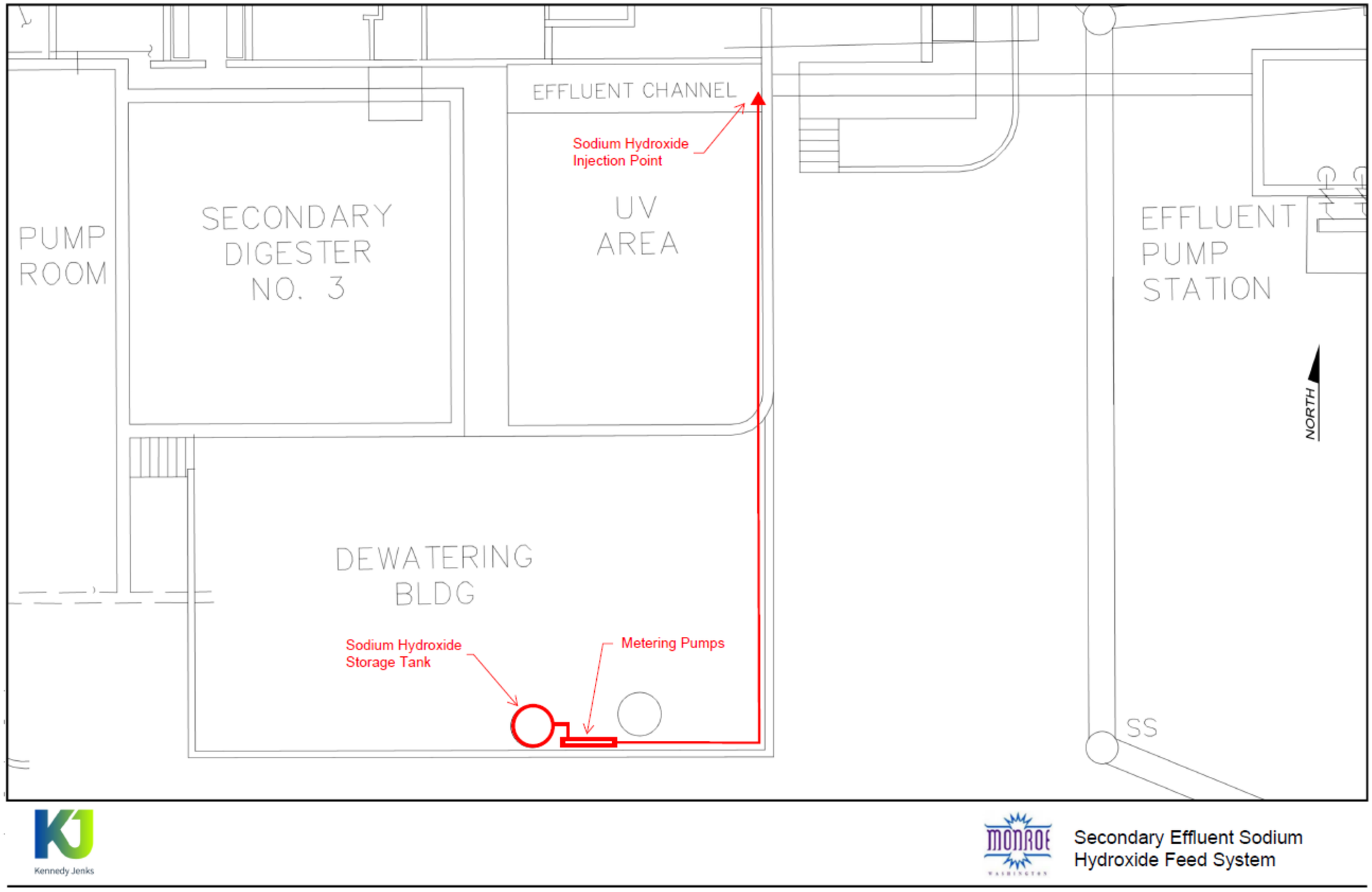

Figure 5-4: Secondary Effluent Sodium Hydroxide Feed System

5.1.3 Basis of Design for Filament Control

Filament control allows for improved secondary clarifier performance, as well as improved sludge quality. The two methods selected by the City's personnel during the alternatives evaluation process include: permanent RAS chlorination system and a surface wasting system.

The first method of filament control is aimed at transitioning from a temporary method of RAS chlorination to a permanent method utilizing improved dose control. This improvement includes: providing a permanent sodium hypochlorite tote storage area in the shop/storage room of the Facility Building; and installing a chemical metering assembly adjacent to the tote storage area. See Figure 5-5 for a proposed location and layout of the permanent RAS chlorination system. The metering system will control dosing into the WAS pump discharge line to limit the growth of filamentous organisms. Dosing will be the same concentration (typically 2 to 8 lbs of chlorine per 1,000 lbs of mixed liquor suspended solids) as utilized in the existing temporary system and dosing will occur on an as-needed basis based upon the operating data, especially during seasonal shifts.

The second method of filament control targets physical removal of undesirable filaments. This improvement will reduce the quantity of filamentous organisms in the secondary treatment process by selectively wasting filamentous organisms (such as MP) that are more buoyant than other organisms. This improvement includes installation of a below-grade vault and an automated weir to divert MLR channel flow to the WAS pump station. See Figure 5-6 for a proposed location and layout of the surface wasting system.

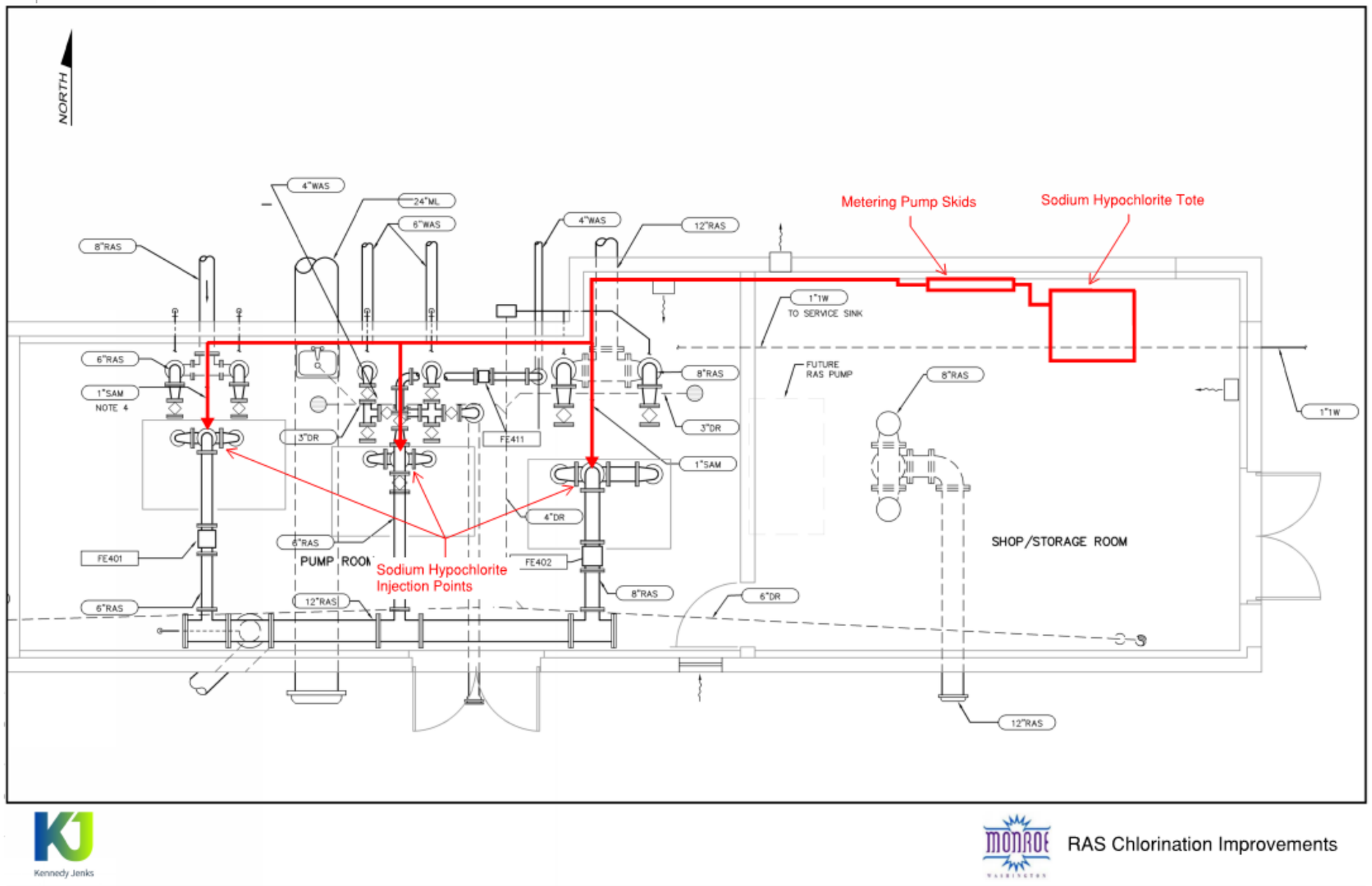

Figure 5-5: RAS Chlorination Improvements

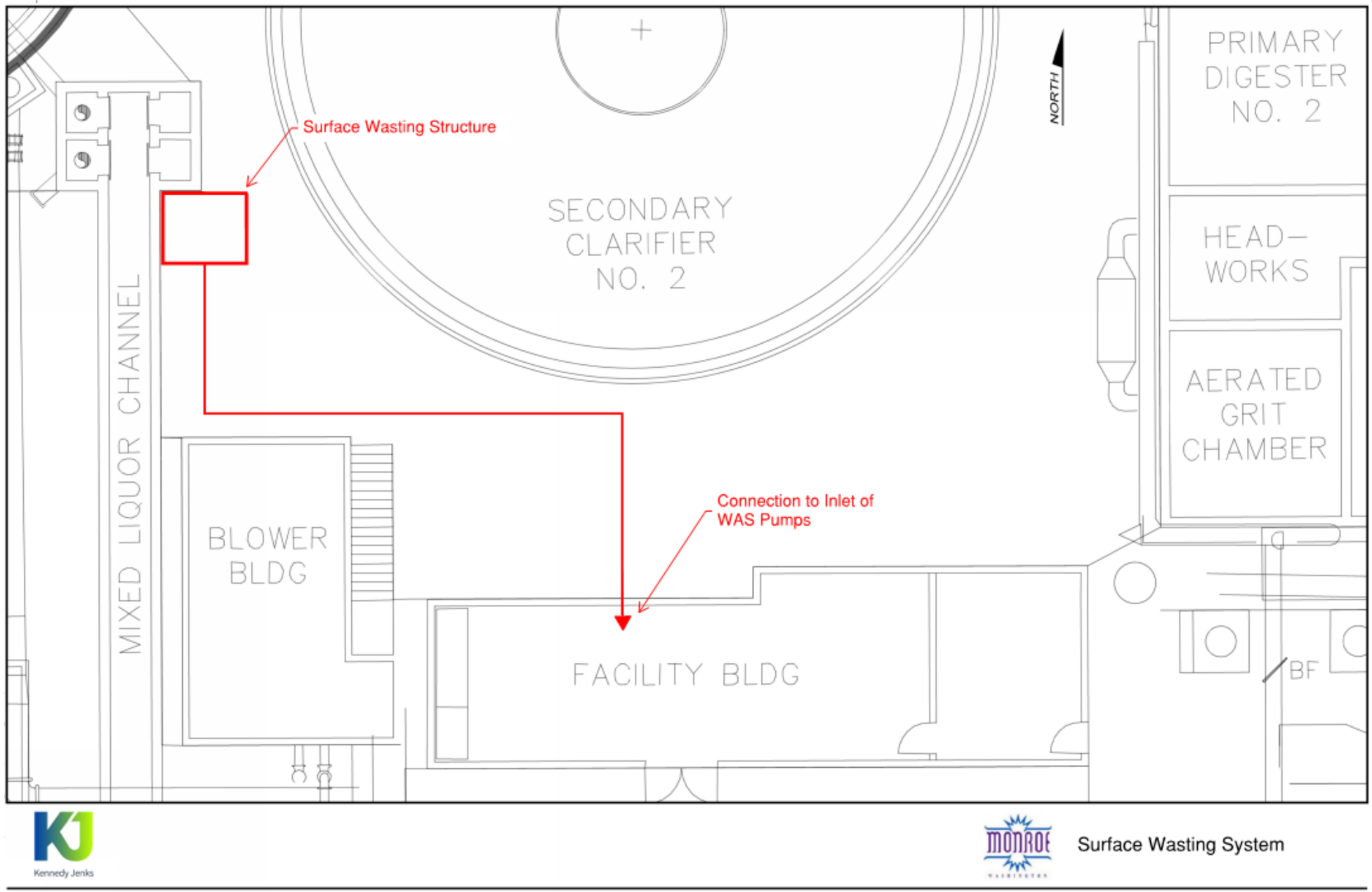

Figure 5-6: Surface Wasting System

5.1.4 Summary of Improvements

The six project elements for addressing pH control and filament control are summarized in Table 5-4. The estimated total project cost for addressing pH and filament control is $1,760,000 (2020 dollars), while the additional annual O&M costs for fully addressing pH and filament control are $14,490/year. Figure 5-7 provides an overview of the locations of the six project elements to address pH and filament within the WWTP. The project cost reflects a Class 4 opinion of probable cost (applicable for 1% to 15% design) with an expected accuracy range of -20% to +30%.

The estimated life cycle cost for this project is $2,050,000 based on 2020 dollars.

Table 5-4: Project and Operations and Maintenance Costs for Six Project Elements Addressing pH and Filament Controls

Project Element	Project Cost (2020 Dollars)	Additional Operations and Maintenance Cost ($/yr, 2020 Dollars)
Mixed Liquor Return Optimization	$320,000	$990
Baffling of Aeration Basins	$350,000	$660
Upgraded Mg(OH)2 Feed System	$270,000	$0
Secondary Effluent NaOH Feed System	$270,000	$3,730
Permanent RAS Chlorination	$140,000	$8,450
Surface Wasting System	$410,000	$660

The detailed Opinion of Probable Construction Costs (OPCC) are included in Appendix F.

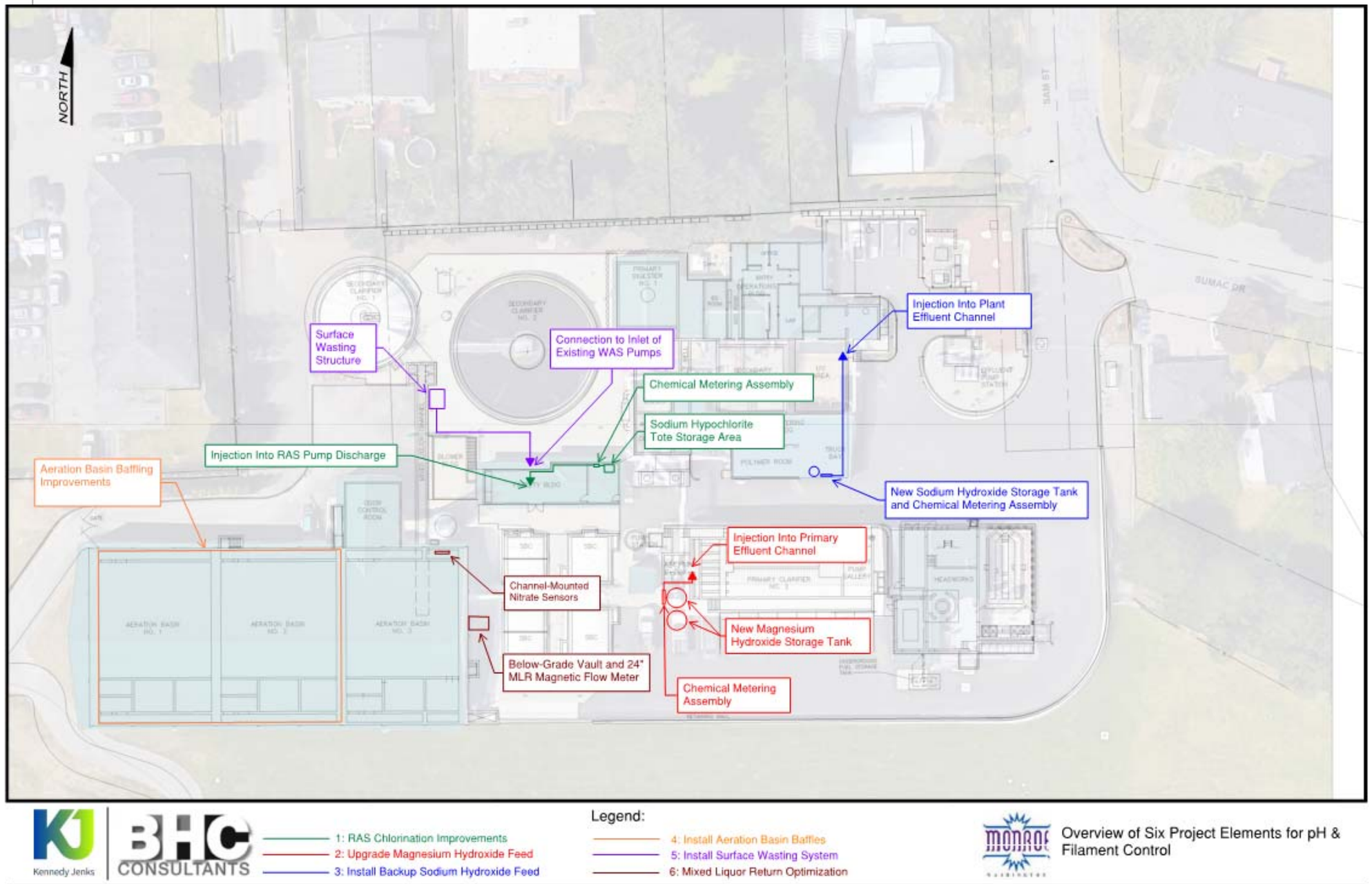

Figure 5-7: Overview of Six Project Elements for pH and Filament Control

5.2 Regulatory, Economic, and Operational Restrictions

This section intends to identify any remaining regulatory, economic, and operational considerations or restrictions as follows:

- Regulatory: The Team does not anticipate additional regulatory considerations beyond existing requirements. The proposed project elements will be in compliance with any applicable state or local water quality management plan or any such plan adopted pursuant to the federal Water Pollution Control Act as amended. As noted in Section 1.5, a SEPA checklist is not included in this Report as the project elements are considered maintenance activities and minor alterations aimed at addressing pH and filament control to meet the more stringent NPDES permit limits. The City does not intend to seek EPA funding for this project.
- Economic: The City intends to fund this project primarily through existing reserves and revenue generated from the rates and fees. The City does not intend to seek grants, federal loans, or state loans for this project.
- Operational: The City does not anticipate additional staffing requirements for this project. Additional sample collection and testing may be included to ensure NPDES permit compliance but not beyond the capabilities of existing personnel. The staffing and testing requirements of the WWTP are further detailed in the 2015 Utility Plan.

5.3 Implementation Schedule

To ensure compliance with the NPDES permit, the implementation schedule for this project is anticipated to proceed as follows:

- Q4 2019: Submission of draft Engineering Report to Ecology
- Q4 2020: Submission of Plans and Specifications to Ecology
- Q1 2021-Q4 2022: Preparation of bid documents, bidding process, selection of Contractor and construction
- Q4 2022: Completion of construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submission to Ecology of a Declaration of Construction of Water Pollution Control.

References

BHC Consultants. 2015. *City of Monroe Utility Systems Plan: Sanitary Sewer, Water and Stormwater*. April 2, 2015 (Draft).

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United States Environmental Protection Agency. 1974. *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability* [EPA-430-99-74-001]. Washington, D.C.: Office of Water Program Operations, United States Environmental Protection Agency.

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Appendix A

Monroe WWTP NPDES WA0020486 Final Permit (20181128)

Issuance Date: November 28, 2018
Effective Date: December 1, 2018
Expiration Date: November 30, 2023

National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0020486

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

CITY OF MONROE
806 West Main Street
Monroe, WA 98272

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 522 South Sams Street Monroe, WA 98272	**Receiving Water:** Skykomish River
Treatment Type: Activated Sludge	**Discharge Location:** Latitude: 47.844501 Longitude: -121.974614

Rachel McCrea

Rachel McCrea
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

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Summary of Permit Report Submittals

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A	Discharge Monitoring Report (DMR)	Monthly	January 15, 2019
S3.A	Discharge Monitoring Report (DMR)	Quarterly	April 15, 2019
S3.A	Permit Renewal Application Monitoring Data	Annual	January 15, 2020
S3.A	DMR - Priority Pollutant Data - Single Sample Data	Annual	January 15, 2020
S3.F	Reporting Permit Violations	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S5.F	Bypass Notification	As necessary	
S5.G	Operations and Maintenance Manual Update	As necessary	
S6.E	Industrial User Survey	1/permit cycle	December 31, 2022
S8.A	Effluent Mixing Report	1/permit cycle	December 31, 2021
S9	Outfall Evaluation	1/permit cycle	December 31, 2022
S10.A	Acute Toxicity Effluent Test Results	2/permit cycle	April 15, 2022 October 15, 2022
S11.A	Chronic Toxicity Effluent Test Results	2/permit cycle	April 15, 2022 October 15, 2022
S12	Engineering Report	1/permit cycle	December 31, 2019
S12	Plans and Specifications	1/permit cycle	December 31, 2020
S12	Declaration of Construction of Water Pollution Control Facilities	1/permit cycle	December 31, 2022
S13	Application for Permit Renewal	1/permit cycle	December 31, 2022
G1	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G20	Compliance Schedules	As necessary	
G21	Contract Submittal	As necessary	

Special Conditions

S1. Discharge limits

S1.A. Effluent limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

Beginning on the effective date of this permit, the Permittee may discharge treated domestic wastewater to the Skykomish River at the permitted location subject to compliance with the following limits:

Effluent Limits: Outfall 001 Latitude: 47.844501, Longitude: -121.974614		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Biochemical Oxygen Demand (5-day) (BOD_5)	30 milligrams/liter (mg/L) 711 pounds/day (lbs/day) 85% removal of influent BOD5	45 mg/L 1066 lbs/day
Total Suspended Solids (TSS)	30 mg/L 711 lbs/day 85% removal of influent TSS	45 mg/L 1066 lbs/day
Parameter	**Minimum**	**Maximum**
pH – INTERIM LIMIT [c]	6.0 standard units	9.0 standard units
pH – FINAL LIMIT [d]	6.7 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria [e]	100/100 milliliter (mL)	200/100 mL

a	Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.
b	Average weekly discharge limit means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. See footnote c for fecal coliform calculations.
c	Interim limits for pH will apply from the effective date of the permit through December 31, 2022.
d	Final limits for pH will be effective as of January 1, 2023.
e	Ecology provides directions to calculate the monthly and the weekly geometric mean in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: https://fortress.wa.gov/ecy/publications/SummaryPages/0410020.html

S1.B. Mixing zone authorization

Mixing zone for Outfall 001

The following paragraphs define the maximum boundaries of the mixing zones:

Chronic mixing zone

The width of the chronic mixing zone is limited to a distance of 81 feet. The length of the chronic mixing zone extends 100 feet upstream and 301feet downstream of the outfall. The mixing zone extends from the bottom to the top of the water column. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The width of the acute mixing zone is limited to the most restrictive of the following: 10 feet upstream and 30.1 feet downstream of the outfall, or 2.5% of the river flow. The mixing zone extends from the bottom to the top of the water column. The concentration of pollutants at the edge of the acute zone must meet acute aquatic life criteria.

Available Dilution (dilution factor)	
Acute Aquatic Life Criteria	8.0
Chronic Aquatic Life Criteria	16.8
Human Health Criteria - Carcinogen	16.8
Human Health Criteria - Non-carcinogen	16.8

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
(1) Wastewater influent			
Wastewater Influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.			
Biochemical Oxygen Demand (BOD_5)	mg/L	3/week	24-hour composite [1]
Biochemical Oxygen Demand (BOD_5)	lbs/day	3/week	Calculated [2]
Total Suspended Solids (TSS)	mg/L	3/week	24-hour composite
Total Suspended Solids (TSS)	lbs/day	3/week	Calculated
(2) Final wastewater effluent			
Final Wastewater Effluent means wastewater exiting the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process.			
Flow	MGD	Continuous [3]	Metered/recorded
BOD_5	mg/L	3/week	24-hour composite
BOD_5	lbs/day	3/week	Calculated
BOD_5	% removal [4]	1/month	Calculated
TSS	mg/L	3/week	24-hour composite
TSS	lbs/day	3/week	Calculated
TSS	% removal	1/month	Calculated
Fecal Coliform [5]	# /100 ml	3/week	Grab [6]
pH [7]	Standard Units	Daily	Grab

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
Temperature [8]	Degrees centigrade (°C)	Continuous	Measurement
7-DAD Max Temperature [9]	°C	Daily	Calculated
(3) Whole effluent toxicity testing – final wastewater effluent			
Acute Toxicity Testing	See Section S10	2/permit cycle	24-hour composite
Chronic Toxicity Testing	See Section S11	2/permit cycle	24-hour composite
(5) Effluent characterization – final wastewater effluent			
Total Phosphorus	mg/L as P	Quarterly [10]	24-hour composite
Soluble Reactive Phosphorus	mg/L as P	Quarterly	24-hour composite
Total Ammonia	mg/L as N	Quarterly	24-hour composite
Nitrate plus Nitrite Nitrogen	mg/L as N	Quarterly	24-hour composite
Total Kjeldahl Nitrogen (TKN)	mg/L as N	Quarterly	24-hour composite
(6) Permit renewal application requirements – final wastewater effluent			
The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report.			
Dissolved Oxygen	mg/L	Once per year	Grab
Oil and Grease	mg/L	Once per year	Grab
Total Dissolved Solids	mg/L	Once per year	24-hour composite
Total Hardness	mg/L	Once per year	24-hour composite
Cyanide	micrograms/liter (µg/L)		Grab
Total Phenolic Compounds	µg/L		Grab
Priority Pollutants (PP) – Total Metals	µg/L; nanograms (ng/L) for mercury	Once per year	24-hour composite Grab for mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	24-hour composite
PP – Base-neutral Compounds	µg/L	Once per year	24-hour composite

1	24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.
2	Calculated means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day
3	Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance. The time interval for the associated data logger must be no greater than 30 minutes.
4	% removal = $\frac{\text{Influent concentration (mg/L)} - \text{Effluent concentration (mg/L)}}{\text{Influent concentration (mg/L)}} \times 100$ Calculate the percent (%) removal of BOD_5 and TSS using the above equation.
5	Report a numerical value for fecal coliforms following the procedures in Ecology's *Information Manual for Wastewater Treatment Plant Operators*, Publication Number 04-10-020 available at: http://www.ecy.wa.gov/programs/wq/permits/guidance.html . Do not report a result as too numerous to count (TNTC).
6	Grab means an individual sample collected over a fifteen (15)-minute, or less, period.
7	Report the daily pH and the minimum and maximum for the monitoring period.
8	The Permittee must determine and report a daily maximum from half-hour measurements in a 24-hour period. Continuous monitoring instruments must achieve an accuracy of 0.2°C and the Permittee must verify accuracy annually.
9	Calculate a 7-DAD Max for each day by averaging each days maximum temperature value with the daily maximum temperatures of the three (3) days prior and the three (3) days after that specific date.
10	Quarterly sampling periods are January through March, April through June, July through September, and October through December. The Permittee must begin quarterly monitoring for the quarter beginning on January 1, 2019, and submit results by April 15, 2019.

S2.B. Sampling and analytical procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501-503]) unless otherwise specified in this permit . Ecology may only specify alternative methods for parameters without permit limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement and continuous monitoring devices

The Permittee must:

1. Select and use appropriate flow measurement and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records. The Permittee:
    a. May calibrate apparatus for continuous monitoring of dissolved oxygen by air calibration.
    b. Must calibrate continuous pH measurement instruments using a grab sample analyzed in the lab with a pH meter calibrated with standard buffers and analyzed within 15 minutes of sampling.
    c. Must calibrate continuous chlorine measurement instruments using a grab sample analyzed in the laboratory within 15 minutes of sampling.
4. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
5. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S3. Reporting and recording requirements

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S3.A. Discharge monitoring reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic discharge monitoring report (DMR) form provided by Ecology within the Water Quality Permitting Portal. Include data for each of the parameters tabulated in Special Condition S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.
2. Ensure that DMRs are electronically submitted no later than the dates specified below, unless otherwise specified in this permit.
3. The Permittee must also submit an electronic copy of the laboratory report as an attachment using WQWebDMR. The contract laboratory reports must also include information on the chain of custody, QA/QC results, and documentation of accreditation for the parameter.
4. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, quarterly, annual, etc.) at the reporting schedule identified below. The Permittee must:
   a. Submit **monthly** DMRs by the 15th day of the following month.
   b. Submit **quarterly DMRs**, unless otherwise specified in the permit, by the 15th day of the month following the monitoring period. Quarterly sampling periods are January through March, April through June, July through September, and October through December. The Permittee must submit the first quarterly DMR on April 15, 2019 for the quarter beginning on January 1, 2019.
   c. Submit **annual DMRs**, unless otherwise specified in the permit, by January 15 for the previous calendar year. The annual sampling period is the calendar year.
5. Enter the “No Discharge” reporting code for an entire DMR, for a specific monitoring point, or for a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.

6. Report single analytical values below detection as "less than the detection level (DL)" by entering < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum DL and quantitation level (QL) identified in the permit, report the actual QL and DL in the comments or in the location provided.
7. Report single analytical values between the detection level (DL) and the quantitation level (QL) by entering the estimated value, the code for estimated value/below quantitation limit (j) and any additional information in the comments. Submit a copy of the laboratory report as an attachment using WQWebDMR.
8. Not report zero for bacteria monitoring. Report as required by the laboratory method.
9. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
10. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using:
    a. The reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If the Permittee takes multiple samples in one day it must use the arithmetic average for the day in the geometric mean calculation.
    b. The detection value for those samples measured below detection.
11. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A OR S2.
12. Calculate average values and calculated total values (unless otherwise specified in the permit) using:
    a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.
    b. One-half the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.
    c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for the reporting period.
13. Report single-sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detected, detection limit (DL) (as necessary), and laboratory quantitation level (QL) (as necessary).

S3.B. Permit submittals and schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all other written permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard-copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

Water Quality Permit Coordinator
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The dates the analyses were performed.
4. The individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.

2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

a. Immediate reporting

The Permittee must **immediately** report to Ecology and the Local Health Jurisdiction (at the numbers listed below), all:

- Failures of the disinfection system.
- Collection system overflows.
- Plant bypasses resulting in a discharge.
- Any other failures of the sewage system (pipe breaks, etc).

Northwest Regional Office	425-649-7000
Snohomish Health District	425-339-5252
Snohomish Health District	425-339-5295 (after hours)

Additionally, for any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4), the Permittee must notify the appropriate MS4 owner or operator.

b. Twenty-four-hour reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

1. Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.
2. Any unanticipated bypass that causes an exceedance of an effluent limit in the permit (See Part S5.F, "Bypass Procedures").
3. Any upset that causes an exceedance of an effluent limit in the permit (See G.15, "Upset").
4. Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Section S1.A of this permit.
5. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

c. Report within five days

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under subparts a or b, above. The report must contain:

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.

3. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
5. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

d. Waiver of written reports

Ecology may waive the written report required in subpart c, above, on a case-by-case basis upon request if the Permittee has submitted a timely oral report.

e. All other permit violation reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in subpart c, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

S3.G. Other reporting

a. Spills of oil or hazardous materials

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm .

b. Failure to submit relevant or correct facts

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S3.H. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility loading

S4.A. Design criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Maximum Month Design Flow (MMDF)	2.84 MGD
BOD_5 Influent Loading for Maximum Month	6,090 lbs/day
TSS Influent Loading for Maximum Month	5,940 lbs/day

S4.B. Plans for maintaining adequate capacity

a. Conditions triggering plan submittal

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.
2. The projected plant flow or loading would reach design capacity within five years.

b. Plan and schedule content

The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan.

1. Analysis of the present design and proposed process modifications
2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system
3. Limits on future sewer extensions or connections or additional waste loads
4. Modification or expansion of facilities
5. Reduction of industrial or commercial flows or waste loads

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

S4.C. Duty to mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S4.D. Notification of new or altered sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
   b. Is not part of an approved general sewer plan or approved plans and specifications.
   c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.

2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42(b)].

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class III plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts.

S5.B. Operation and maintenance program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.
2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.C. Short-term reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out according to the approved O&M manual or as otherwise approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.

2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

S5.D. Electrical power failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

The Permittee must maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant. Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but must be sufficient to maintain the biota.

S5.E. Prevent connection of inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However the Permittee must comply with the monitoring requirements specified in special condition S2.B.

2. Anticipated bypasses for non-essential maintenance

   Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.

a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:

- A description of the bypass and the reason the bypass is necessary.
- An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
- A cost-effectiveness analysis of alternatives.
- The minimum and maximum duration of bypass under each alternative.
- A recommendation as to the preferred alternative for conducting the bypass.
- The projected date of bypass initiation.
- A statement of compliance with SEPA.
- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

c. Ecology will determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:

- If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
- If the bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. “Severe property damage” means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.
- If feasible alternatives to the bypass exist, such as:
  - The use of auxiliary treatment facilities.

- Retention of untreated wastes.
- Stopping production.
- Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.
- Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

a. O&M manual submittal and requirements

The Permittee must:

1. Review the O&M Manual at least annually.
2. Submit to Ecology for review substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
3. Keep the approved O&M Manual at the permitted facility.
4. Follow the instructions and procedures of this manual.

b. O&M manual components

In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Table G1-3 in the *Criteria for Sewage Works Design* (Orange Book), 2008. The O&M Manual must include:

1. Emergency procedures for cleanup in the event of wastewater system upset or failure.
2. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
3. Wastewater system maintenance procedures that contribute to the generation of process wastewater.
4. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
5. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).
6. The treatment plant process control monitoring schedule.
7. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

S6.A. General requirements

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

S6.B. Duty to enforce discharge prohibitions

1. Under federal regulations (40 CFR 403.5(a) and (b)), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC 173-216-060.
2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
   a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).
   b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
   c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.
   d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
   e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.
   f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.
   g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities such that the temperature at the POTW headworks exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.
   h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).

3. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:

   a. Noncontact cooling water in significant volumes.

   b. Stormwater and other direct inflow sources.

   c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

4. The Permittee must notify Ecology if any industrial user violates the prohibitions listed in this section (S6.B), and initiate enforcement action to promptly curtail any such discharge.

S6.C. Wastewater discharge permit required

The Permittee must:

1. Establish a process for authorizing non-domestic wastewater discharges that ensures all SIUs in all tributary areas meet the applicable state waste discharge permit (SWDP) requirements in accordance with chapter 90.48 RCW and chapter 173-216 WAC.

2. Immediately notify Ecology of any proposed discharge of wastewater from a source, which may be a significant industrial user (SIU) [see fact sheet definitions or refer to 40 CFR 403.3(v)(i)(ii)].

3. Require all SIUs to obtain a SWDP from Ecology prior to accepting their non-domestic wastewater, or require proof that Ecology has determined they do not require a permit.

4. Require the documentation as described in S6.C.3 at the earliest practicable date as a condition of continuing to accept non-domestic wastewater discharges from a previously undiscovered, currently discharging and unpermitted SIU.

5. Require sources of non-domestic wastewater, which do not qualify as SIUs but merit a degree of oversight, to apply for a SWDP and provide it a copy of the application and any Ecology responses.

6. Keep all records documenting that its users have met the requirements of S6.C.

S6.D. Identification and reporting of existing, new, and proposed industrial users

1. The Permittee must take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewer system (see **Appendix C** of the fact sheet for definitions).

2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be a significant industrial user (SIU), the Permittee must notify such user by registered mail that, if classified as an SIU, they must apply to Ecology and obtain a State Waste Discharge Permit. The Permittee must send a copy of this notification letter to Ecology within this same 30-day period.
3. The Permittee must also notify all Potential SIUs (PSIUs), as they are identified, that if their classification should change to an SIU, they must apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

S6.E. Industrial user survey

The Permittee must complete an industrial user survey listing all SIUs and potential significant industrial users (PSIUs) discharging to the POTW. The Permittee must submit the survey to Ecology by December 31, 2022. At a minimum, the Permittee must develop the list of SIUs and PSIUs by means of a telephone book search, a water utility billing records search, and a physical reconnaissance of the service area. Information on PSIUs must include, at a minimum, the business name, telephone number, address, description of the industrial process(s), and the known wastewater volumes and characteristics.

For industrial users for which there are potentially significant non-domestic discharges, the Permittee must obtain and include in the report the minimum information described in the paragraph above for PSIUs.

S7. Solid wastes

S7.A. Solid waste handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S7.B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC.

S8. Mixing study

S8.A. General requirements

The Permittee must

1. Update the Effluent Mixing Zone Study (Cosmopolitan, 2009). Submit a Plan of Study to Ecology for review by December 31, 2020, prior to initiation of the effluent mixing study.
2. Use the Guidance for Conducting Mixing Zone Analyses (Appendix C of Ecology's *Permit Writer's Manual*, 2015) and the protocols identified in S8.C.

3. Include the results of the effluent mixing study in the Effluent Mixing Report and submit it to Ecology for approval by December 31, 2021.
4. If the results of the mixing study, toxicity tests, and chemical analysis indicate that the concentration of any pollutant(s) exceeds or has a reasonable potential to exceed the state water quality standards, chapter 173-201A WAC, Ecology may modify this permit to impose effluent limits to meet the water quality standards.

S8.B. Reporting requirements

The mixing zone study must include:

1. A statement confirming that AKART has been applied to the discharge.
2. A description of the size of the mixing zone allowed under WAC 173-201A.
3. An analysis showing how mixing zones have been minimized based on using the lowest dilution from hydraulic limitation, width limitations, distance limitation and that predicted by the model.
4. A clear description of the critical conditions used for dilution factors:
   a. For ambient freshwater (unidirectional flow) use 7Q10 flows for acute, chronic and non-carcinogen pollutants, and harmonic flow for carcinogens.
   b. Generally, use depth of outfall at 7Q10 flows for rivers. For assessing human health in freshwater, depths of outfall should be established at the applicable flow (e.g. harmonic mean flow or 30Q5 flows).
   c. For unidirectional flow use centerline dilution factor for acute and chronic conditions, and flux average for human health dilution factors.
5. Diffuser information:
   a. Location, orientation, description and dimension of diffusers and ports.
   b. Port elevation above bottom and the depth of the diffuser/port below water surface based on 7Q10 flow for rivers.
   c. Plan view maps showing the mixing zone size and dimensions in relation to the diffuser.
   d. Schematic of waterbody cross-section, showing channel width, depth, and diffuser location in relation to shoreline and bottom.
   e. Report on the integrity of the diffuser and the ports being modeled.
6. Discharge characteristics:
   a. Existing and projected maximum daily, maximum monthly average, and annual average flows.
   b. Discharge density (temperature and salinity).
7. Ambient water characteristics:
   a. Critical stream flow statistics (7Q10, 30Q5, harmonic flow).
   b. Velocity profile in the vicinity of the diffuser.

c. Manning's roughness coefficient, if used.

d. Available information regarding background concentrations of chemical substances in the receiving water for which there are criteria in chapter 173-201A WAC.

8. Model selection and results:

a. Model selection and application discussion. Consider model applicability to single or multiport diffuser, opposing port configuration, submerged, surface or above-surface discharge, buoyant or non-buoyant discharge, and potential plume attachment to boundaries.

b. Description of mixing and plume dynamics (nearfield, farfield, tidal buildup/reflux).

c. Sensitivity analysis.

d. Calibration to empirical data (tracer studies), if applicable.

e. Provide model output and summary table of results.

S8.C. Protocols

The Permittee must determine the dilution ratio using protocols outlined in the following references, approved modifications thereof, or by another method approved by Ecology:

1. Doneker, R.L. and G.H. Jirka, *CORMIX User Manual: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, EPA-823-K-07-001, Dec. 2007. http://www.mixzon.com/downloads/.

   A complete list of general reference for CORMIX is at: http://www.cormix.info/references.php

2. Frick, W.E., Roberts, P.J.W., Davis, L.R., Keyes, D.J., Baumgartner, George, K.P. 2003. *Dilution Models for Effluent Discharges, 4th Edition (Visual Plumes)*. Ecosystems Research Div., USEPA, Athens, GA, USA.

3. Ecology, Water Quality Program, *Permit Writer's Manual*. 2015. Washington State Department of Ecology. Publication No. 92-109, Revised January 2015. https://fortress.wa.gov/ecy/publications/summarypages/92109.html.

4. Ecology, Guidance for conducting mixing zone analysis (Appendix C, Water Quality Program *Permit Writer's Manual*. 2015). https://fortress.wa.gov/ecy/publications/summarypages/92109.html.

5. Kilpatrick, F.A., and E.D. Cobb, *Measurement of Discharge Using Tracers, Chapter A16, Techniques of Water-Resources Investigations of the USGS*, Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1985.

6. Wilson, J.F., E.D. Cobb, and F.A. Kilpatrick, *Fluorometric Procedures for Dye Tracing, Chapter A12. Techniques of Water-Resources Investigations of the USGS*, Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1986.

S9. Outfall evaluation

The Permittee must inspect the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, the Permittee must include such verification in the report. By December 31, 2022, the Permittee must submit the inspection report to Ecology through the Water Quality Permitting Portal – Permit Submittals application.

The inspector must at a minimum:

- Assess the physical condition of the outfall pipe, diffuser, and associated couplings.
- Determine the extent of sediment accumulation in the vicinity of the diffuser.
- Ensure diffuser ports are free of obstructions and are allowing uniform flow.
- Confirm physical location (latitude/longitude) of the diffuser section of the outfall.
- Assess physical condition of anchors used to secure the outfall pipe and diffuser sections.

S10. Acute toxicity

S10.A. Testing when there is no permit limit for acute toxicity

The Permittee must:

1. Conduct acute toxicity testing on final effluent two times, during the following quarters:
   a. January - March 2022.
   b. July - September 2022.
2. Conduct acute toxicity testing on a series of at least five concentrations of effluent, including 100% effluent and a control.
3. Use each of the following species and protocols for each acute toxicity test:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia, Daphnia pulex,* or *Daphnia magna*	EPA-821-R-02-012

4. Submit the results electronically to Ecology using the Water Quality Permitting Portal – Permit Submittals application by April 15, 2022, and October 15, 2022.

S10.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.

2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Subsection C and the Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the acute critical effluent concentration (ACEC). The ACEC equals 12.5% effluent.
8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S11. Chronic toxicity

S11.A. Testing when there is no permit limit for chronic toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent during the following two quarters:
   a. January - March 2022.
   b. July - September 2022.

2. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 12.5% effluent. The series of dilutions should also contain the CCEC of 6.0% effluent.
3. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.
4. Submit the results electronically to Ecology using the Water Quality Permitting Portal – Permit Submittals application by April 15, 2022, and October 15, 2022.
5. Perform chronic toxicity tests with all of the following species and the most recent version of the following protocols:

Freshwater Chronic Test	Species	Method
Fathead minnow survival and growth	*Pimephales promelas*	EPA-821-R-02-013
Water flea survival and reproduction	*Ceriodaphnia dubia*	EPA-821-R-02-013

S11.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Section C and the Ecology Publication no. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Subsection C or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.

7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The CCEC equals 6.0% effluent. The ACEC equals 12.5% effluent.
8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S12. Compliance schedule

By the dates tabulated below, the Permittee must complete the following tasks:

	Tasks	Date Due
1	Submit an Engineering Report according to the requirements of WAC 173-240-060 for facility improvements, including those necessary to meet the final effluent limits for pH.	**December 31, 2019**
2	Submit Plans and Specifications according to the requirements of WAC 173-240-070 for any facility improvements needed to meet final effluent limits for pH.	**December 31, 2020**
3	Complete construction and installation of facilities and equipment necessary to maintain compliance with final effluent limits for pH. Submit a Declaration of Construction of Water Pollution Control Facilities (WAC 173-240-090).	**December 31, 2022**

For engineering documents, the Permittee must submit an electronic copy and one half-size paper copy to Ecology at the address listed in Special Condition S3.B.

S13. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by **December 31, 2022.**

The Permittee must also submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

General Conditions

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.
   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
      - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
      - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   b. In the case of a partnership, by a general partner.

   c. In the case of sole proprietorship, by the proprietor.

   d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

   Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
   a. The authorization is made in writing by a person described above and submitted to Ecology.

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section must make the following certification:

   "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   a. Violation of any permit term or condition.
   b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
   c. A material change in quantity or type of waste disposal.

d. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.

e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

f. Nonpayment of fees assessed pursuant to RCW 90.48.465.

g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

a. A material change in the condition of the waters of the state.

b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

g. Incorporation of an approved local pretreatment program into a municipality's permit.

3. The following are causes for modification or alternatively revocation and reissuance:

a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).
2. A significant change in the nature or an increase in quantity of pollutants discharged.
3. A significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

   This permit may be automatically transferred to a new Permittee if:

   a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.

   b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

Appendix A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a quantitation limit (QL) to Ecology with appropriate laboratory documentation.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122.), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit Appendix A list does not include those parameters.

CONVENTIONAL POLLUTANTS

Pollutant	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L
Fecal Coliform		SM 9221E,9222	N/A	Specified in method - sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H^+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as CaCO3
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G		50.0

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as CaCO3
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S^2F/D/E/G		0.2 mg/L

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature (max. 7-day avg.)		Analog recorder or use micro-recording devices known as thermistors		0.2º C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5
Total Coliform		SM 9221B, 9222B, 9223B	N/A	Specified in method - sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total dissolved solids		SM2540 C		20 mg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
METALS, CYANIDE & TOTAL PHENOLS					
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
METALS, CYANIDE & TOTAL PHENOLS					
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
ACID COMPOUNDS					
2-Chlorophenol	24	95-57-8	625.1	3.3	9.9
2,4-Dichlorophenol	31	120-83-2	625.1	2.7	8.1
2,4-Dimethylphenol	34	105-67-9	625.1	2.7	8.1
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625.1/1625B	24	72
2,4 dinitrophenol	59	51-28-5	625.1	42	126
2-Nitrophenol	57	88-75-5	625.1	3.6	10.8
4-Nitrophenol	58	100-02-7	625.1	2.4	7.2
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625.1	3.0	9.0
Pentachlorophenol	64	87-86-5	625.1	3.6	10.8
Phenol	65	108-95-2	625.1	1.5	4.5
2,4,6-Trichlorophenol	21	88-06-2	625.1	2.7	8.1

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
VOLATILE COMPOUNDS					
Acrolein	2	107-02-8	624	5	10
Acrylonitrile	3	107-13-1	624	1.0	2.0
Benzene	4	71-43-2	624.1	4.4	13.2
Bromoform	47	75-25-2	624.1	4.7	14.1
Carbon tetrachloride	6	56-23-5	624.1/601 or SM6230B	2.8	8.4
Chlorobenzene	7	108-90-7	624.1	6.0	18.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624	1.0	2.0
Chloroform	23	67-66-3	624.1 or SM6210B	1.6	4.8
Dibromochloromethane (chlordibromomethane)	51	124-48-1	624.1	3.1	9.3
1,2-Dichlorobenzene	25	95-50-1	624	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624	4.4	17.6
Dichlorobromomethane	48	75-27-4	624.1	2.2	6.6
1,1-Dichloroethane	13	75-34-3	624.1	4.7	14.1
1,2-Dichloroethane	10	107-06-2	624.1	2.8	8.4
1,1-Dichloroethylene	29	75-35-4	624.1	2.8	8.4
1,2-Dichloropropane	32	78-87-5	624.1	6.0	18.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) [6]	33	542-75-6	624.1	5.0	15.0
Ethylbenzene	38	100-41-4	624.1	7.2	21.6
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
VOLATILE COMPOUNDS					
Methyl chloride (Chloromethane)	45	74-87-3	624	1.0	2.0
Methylene chloride	44	75-09-2	624.1	2.8	8.4
1,1,2,2-Tetrachloroethane	15	79-34-5	624.1	6.9	20.7
Tetrachloroethylene	85	127-18-4	624.1	4.1	12.3
Toluene	86	108-88-3	624.1	6.0	18.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624.1	1.6	4.8
1,1,1-Trichloroethane	11	71-55-6	624.1	3.8	11.4
1,1,2-Trichloroethane	14	79-00-5	624.1	5.0	15.0
Trichloroethylene	87	79-01-6	624.1	1.9	5.7
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Acenaphthene	1	83-32-9	625.1	1.9	5.7
Acenaphthylene	77	208-96-8	625.1	3.5	10.5
Anthracene	78	120-12-7	625.1	1.9	5.7
Benzidine	5	92-87-5	625.1	44	132
Benzyl butyl phthalate	67	85-68-7	625.1	2.5	7.5
Benzo(*a*)anthracene	72	56-55-3	625.1	7.8	23.4
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625.1	4.8	14.4
Benzo(j)fluoranthene [7]		**205-82-3**	625	0.5	1.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625.1	2.5	7.5
Benzo(r,s,t)pentaphene		**189-55-9**	625	1.3	5.0
Benzo(*a*)pyrene	73	50-32-8	610/625.1	2.5	7.5
Benzo(*ghi*)Perylene	79	191-24-2	610/625.1	4.1	12.3
Bis(*2-chloroethoxy)*methane	43	111-91-1	625.1	5.3	15.9
Bis(*2-chloroethyl*)ether	18	111-44-4	611/625.1	5.7	17.1
Bis(*2-chloroisopropyl*)ether	42	39638-32-9	625	0.5	1.0
Bis(*2-ethylhexyl*)phthalate	66	117-81-7	625.1	2.5	7.5
4-Bromophenyl phenyl ether	41	101-55-3	625.1	1.9	5.7
2-Chloronaphthalene	20	91-58-7	625.1	1.9	5.7
4-Chlorophenyl phenyl ether	40	7005-72-3	625.1	4.2	12.6
Chrysene	76	218-01-9	610/625.1	2.5	7.5
Dibenzo (a,h)acridine		**226-36-8**	610M/625M	2.5	10.0
Dibenzo (a,j)acridine		**224-42-0**	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625.1	2.5	7.5
Dibenzo(a,e)pyrene		192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene		189-64-0	625M	2.5	10.0
3,3-Dichlorobenzidine	28	91-94-1	605/625.1	16.5	49.5
Diethyl phthalate	70	84-66-2	625.1	1.9	5.7
Dimethyl phthalate	71	131-11-3	625.1	1.6	4.8
Di-n-butyl phthalate	68	84-74-2	625.1	2.5	7.5
2,4-dinitrotoluene	35	121-14-2	609/625.1	5.7	17.1

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
2,6-dinitrotoluene	36	606-20-2	609/625.1	1.9	5.7
Di-n-octyl phthalate	69	117-84-0	625.1	2.5	7.5
1,2-Diphenylhydrazine (*as Azobenzene*)	37	122-66-7	1625B	5.0	20
Fluoranthene	39	206-44-0	625.1	2.2	6.6
Fluorene	80	86-73-7	625.1	1.9	5.7
Hexachlorobenzene	9	118-74-1	612/625.1	1.9	5.7
Hexachlorobutadiene	52	87-68-3	625.1	0.9	2.7
Hexachlorocyclopentadiene	53	77-47-4	1625B/625	2.0	4.0
Hexachloroethane	12	67-72-1	625.1	1.6	4.8
Indeno(*1,2,3-cd*)Pyrene	83	193-39-5	610/625.1	3.7	11.1
Isophorone	54	78-59-1	625.1	2.2	6.6
3-Methyl cholanthrene		**56-49-5**	625	2.0	8.0
Naphthalene	55	91-20-3	625.1	1.6	4.8
Nitrobenzene	56	98-95-3	625.1	1.9	5.7
N-Nitrosodimethylamine	61	62-75-9	607/625	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625	1.0	2.0
Perylene		**198-55-0**	625	1.9	7.6
Phenanthrene	81	85-01-8	625.1	5.4	16.2
Pyrene	84	129-00-0	625.1	1.9	5.7
1,2,4-Trichlorobenzene	8	120-82-1	625.1	1.9	5.7

PRIORITY POLLUTANT	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
DIOXIN					
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
PESTICIDES/PCBs					
Aldrin	89	309-00-2	608.3	4.0 ng/L	12 ng/L
alpha-BHC	102	319-84-6	608.3	3.0 ng/L	9.0 ng/L
beta-BHC	103	319-85-7	608.3	6.0 ng/L	18 ng/L
gamma-BHC (Lindane)	104	58-89-9	608.3	4.0 ng/L	12 ng/L
delta-BHC	105	319-86-8	608.3	9.0 ng/L	27 ng/L
Chlordane [8]	91	57-74-9	608.3	14 ng/L	42 ng/L
4,4'-DDT	92	50-29-3	608.3	12 ng/L	36 ng/L
4,4'-DDE	93	72-55-9	608.3	4.0 ng/L	12 ng/L
4,4' DDD	94	72-54-8	608.3	11ng/L	33 ng/L
Dieldrin	90	60-57-1	608.3	2.0 ng/L	6.0 ng/L
alpha-Endosulfan	95	959-98-8	608.3	14 ng/L	42 ng/L
beta-Endosulfan	96	33213-65-9	608.3	4.0 ng/L	12 ng/L
Endosulfan Sulfate	97	1031-07-8	608.3	66 ng/L	198 ng/L
Endrin	98	72-20-8	608.3	6.0 ng/L	18 ng/L
Endrin Aldehyde	99	7421-93-4	608.3	23 ng/L	70 ng/L
Heptachlor	100	76-44-8	608.3	3.0 ng/L	9.0 ng/L
Heptachlor Epoxide	101	1024-57-3	608.3	83 ng/L	249 ng/L
PCB-1242 [9]	106	53469-21-9	608.3	0.065	0.195

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
PESTICIDES/PCBs					
PCB-1254	107	11097-69-1	608.3	0.065	0.195
PCB-1221	108	11104-28-2	608.3	0.065	0.195
PCB-1232	109	11141-16-5	608.3	0.065	0.195
PCB-1248	110	12672-29-6	608.3	0.065	0.195
PCB-1260	111	11096-82-5	608.3	0.065	0.195
PCB-1016 [9]	112	12674-11-2	608.3	0.065	0.195
Toxaphene	113	8001-35-2	608.3	240 ng/L	720 ng/L

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer (64 FR 30417).
   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).
3. Soluble Biochemical Oxygen Demand method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.
4. NWTPH Dx - Northwest Total Petroleum Hydrocarbons Diesel Extended Range – see https://fortress.wa.gov/ecy/publications/documents/97602.pdf
5. NWTPH Gx - Northwest Total Petroleum Hydrocarbons Gasoline Extended Range – see https://fortress.wa.gov/ecy/publications/documents/97602.pdf
6. 1, 3-dichloroproylene (mixed isomers) You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).
7. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.
8. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 14/42 ng/L.
9. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

Appendix B

Monroe Infiltration and Inflow Evaluation (2016)

MONROE
WASHINGTON

September 5, 2016

Ms. Laura Fricke
Department of Ecology
Northwest Regional Office
3190 160th Ave Se
Bellevue, WA 98008-5452

Re: 2015 Infiltration and Inflow (I/I) Evaluation, City of Monroe WWTP

Dear Ms. Fricke:

Based on EPA publication #97-03 Infiltration/Inflow:

1. Daily Wet Weather Peak Flow (December 2015): 3.700 MG
   Population Served: 18,090
   Gallons Per Capita Per Day (gpcd): 204

The EPA guideline states that if the wet weather flow is ≤ 275 gpcd, then a determination of non-excessive inflow has been made. As the 2015 wet weather peak flow was 204 gpcd, the City of Monroe had non-excessive inflow during wet weather.

2. Daily Dry Weather Flow (September 2015): 0.944 MG
   Population Served: 18,090
   Gallons Per Capita Per Day (gpcd): 52

The EPA guideline state that if the dry weather flow is ≤ 120 gpcd, then a determination of non-excessive infiltration has been made. As the 2015 dry weather flow was 52 gpcd, the City of Monroe had non-excessive infiltration during dry weather.

Sincerely,

John Lande
WWTP Manager

THE ADVENTURE STARTS HERE
806 West Main Street, Monroe, WA 98272
Phone (360) 794-7400 Fax (360) 794-4007
www.monroeadventure.org

Appendix C

Monroe Industrial User Survey (2016)

MONROE
WASHINGTON

October 27, 2016

Ms. Laura Fricke
Washington State Department of Ecology
Northwest Regional Office
3190 160th Ave Se
Bellevue, WA 98008-5452

Re: City of Monroe WWTP Industrial User Survey

Dear Ms. Fricke,

The City of Monroe WWTP Staff performed the Industrial User Survey (IUS) during the summer and fall of 2016. All establishments that have business licenses within the City of Monroe were surveyed. The initial list of 989 businesses was reduced to 146 businesses that would get further review. Water billing records, internet searches, telephone interviews, and site visits were conducted on the remaining businesses to further survey their potential as a Significant Industrial User (SIU) or Potential Significant Industrial User (PSIU). In all, five (5) establishments were identified meeting the criteria, as determined by staff, which classified them as a SIU or PSIU.

The following list includes:

(1) Valley General Hospital (VGH)
14701 179th Ave Se
Monroe WA 98272

VGH is subject to categorical pretreatment standards 40 CFR part 460. The WWTP does not identify any problems associated with this SIU.

(2) Ocean Beauty Seafoods (OBS)
14651 172nd
Monroe WA 98272

OBS currently operates under Washington Permit #ST-7377. OBS is a fish processing facility which includes smoking and brining fish and seafoods. OBS is subject to categorical pretreatment standards 40 CFR part 408.180 and/or 408.190.

Based on consumption, OBS daily use exceeds 25,000 gpd on some months. The WWTP does not identify any problems associated with this SIU.

(3) Thermo Tech
17197 Tye St SE
Monroe WA 98272

Thermo Tech is subject to categorical pretreatment standard 40 CFR part 433. Thermo Tech is a powder coating facility. The WWTP does not identify any problems associated with this SIU.

(4) Metal Tech
14792 172nd Dr SE
Monroe WA 98272

Metal Tech is an electroplating and powder coating company. They are supposed to be zero discharge. They are subject to categorical pretreatment standard 40 CFR parts 423 and 433. The WWTP does not identify any problems associated with this SIU.

(5) Washington State Dept of Corrections (DOC)
PO Box 777
Monroe WA 98272

The DOC is a state prison that operates an aerated pretreatment lagoon for their wastewater. The DOC effluent flow from the lagoon is approximately 27% of the total flow of the WWTP. There is great potential for pass through and interference of suspended algae that populates the lagoon seasonally. Additionally, any other pollutant has the same potential based on volume of flow of 0.420 MGD. Currently, the WWTP does not identify any problems associated with this SIU.

The WWTP staff is notified of any new business or business alteration during the business application process. This ensures that any new or altered sources is brought to the attention of staff allowing for continual survey for any PSIU or SIU.

If you have any further questions regarding any of these sources or any other business information including our field notes or site visits, please let me know.

Respectfully,

John Lande
WWTP Manager
Public Works Division

Appendix D

Flood Insurance Rate Map No. 53061C1376F

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevation** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' National Geodetic Vertical Datum (NGVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map is Universal Tranverse Mercator (UTM) zone 10. The **horizontal datum** is NAD27, CLARKE1866 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242,** or visit their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the Snohomish County Geographic Information Systems Department and from the City of Everett.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

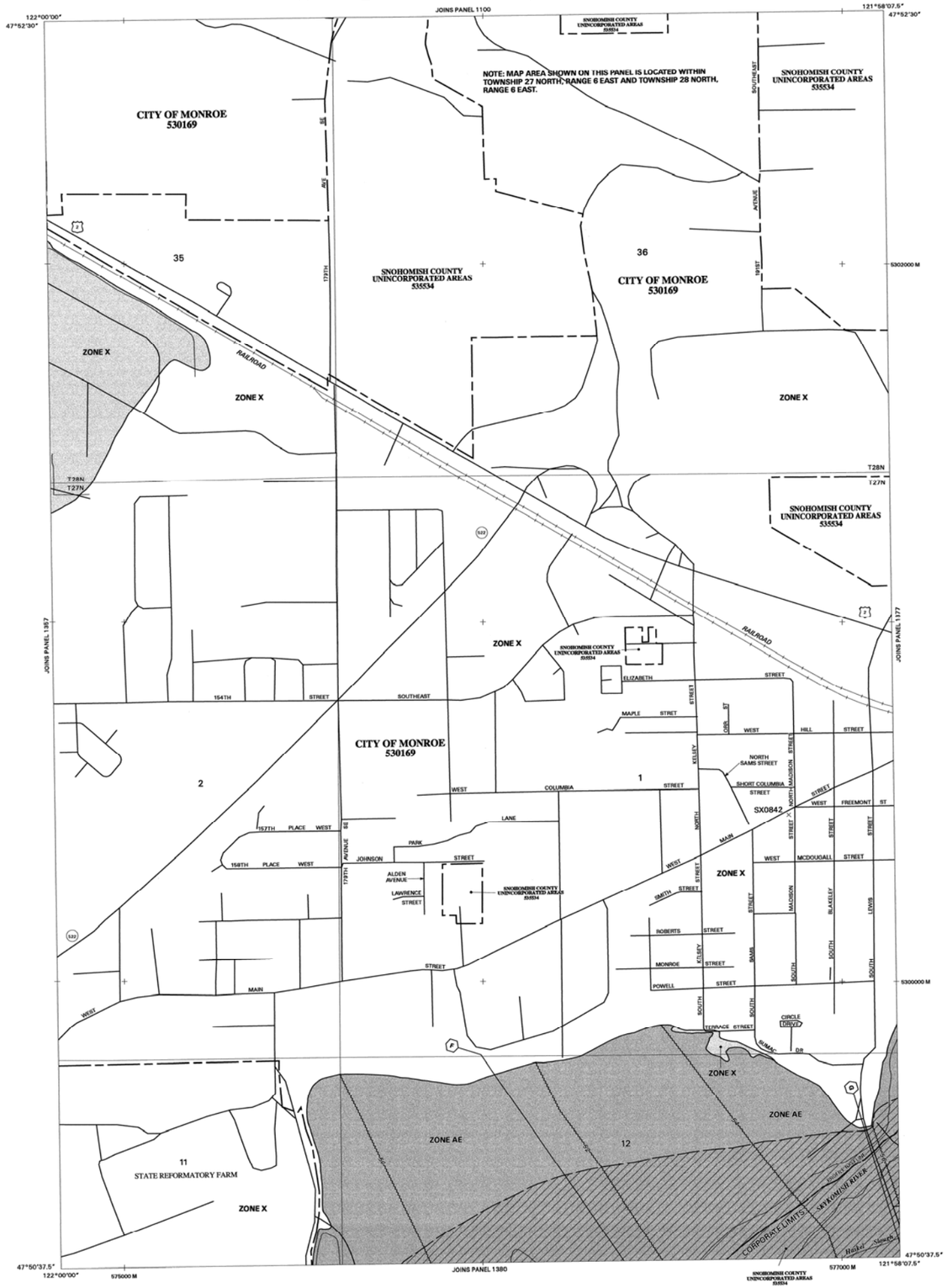
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
www.fema.gov/msc

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on this map.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

ZONE A	No base flood elevations determined.
ZONE AE	Base flood elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.
ZONE A99	Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodpain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the National Geodetic Vertical Datum of 1929

A — A	Cross Section Line
23 - - - - - 23	Transect Line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1927 (NAD 27)
4276000M	1000-meter Universal Transverse Mercator grid values, zone 10
600000 FT	5000-foot grid ticks
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel).
• M1.5	River Mile

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
NOVEMBER 6, 1989

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 16, 2005: to increase base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to add roads and road names, and to reflect updated topographic information.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1376F

FIRM
FLOOD INSURANCE RATE MAP
SNOHOMISH COUNTY,
WASHINGTON
AND INCORPORATED AREAS

PANEL 1376 OF 1575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SNOHOMISH COUNTY, UNINCORPORATED AREAS	535534	1376	F
MONROE, CITY OF	530169	1376	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
53061C1376F

MAP REVISED:
SEPTEMBER 16, 2005

Federal Emergency Management Agency

Appendix E

Monroe Effluent Mixing Study Report (2009)

COPY

COSMOPOLITAN ENGINEERING GROUP

Civil, Environmental, and Recreational Consulting

City of MONROE

NPDES Permit WA-002048-6 Condition S8

Effluent Mixing Study Report

Prepared for:

City of Monroe
806 W Main Street
Monroe, Washington 98272

October 2009
MNR001

P.O. Box 1678
Tacoma, WA
98401-1678
(253) 272-7220
Fax: (253) 272-7250

Printed on Recycled Paper

NPDES Permit WA-002048-6 Condition S8
Effluent Mixing Study Report

Prepared for:

City of Monroe
806 W Main Street
Monroe, Washington 98272

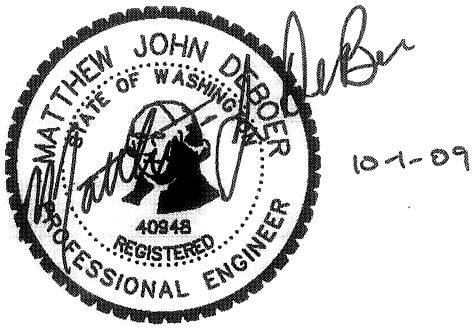
Prepared by:

Cosmopolitan Engineering Group, Inc.
PO Box 1678 ◆ Tacoma, Washington 98401-1678
711 Pacific Avenue ◆ Tacoma, Washington 98402

October 2009
MNR001

CERTIFICATE OF ENGINEER

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a professional engineer licensed to practice as such, is affixed below.



Matthew J. DeBoer, P.E.
Cosmopolitan Engineering Group, Inc.

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LIST OF ACRONYMS

CEG	Cosmopolitan Engineering Group
cfs	Cubic Feet per Second
DMR	Discharge Monitoring Report
Ecology	Washington State Department of Ecology
NPDES	National Pollutant Discharge Elimination System
RPA	Reasonable Potential Analysis
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAC	Washington Administrative Code
WWTP	Wastewater Treatment Plant
WY	Water Year

SECTION 1: INTRODUCTION

1.1 BACKGROUND

In December 2005, the Washington State Department of Ecology (Ecology) issued National Pollutant Discharge Elimination System (NPDES) Permit WA-002048-6 for the City of Monroe (City) Wastewater Treatment Plant (WWTP). Permit Condition S8 requires the City to conduct a mixing zone study to determine the degree of mixing at the acute and chronic mixing zone boundaries authorized in Permit Condition S1.B. Permit Condition S8 specifies the use of a dye tracer study to establish mixing zone dilution ratios, but also allows use of mixing models as an alternative to a dye study "if the critical ambient conditions necessary for model input are known or well established with field studies" and the outfall "is visually inspected for integrity or has been tested for performance."

1.2 PREVIOUS MIXING ZONE ANALYSIS

Cosmopolitan Engineering Group (CEG) performed the most recent mixing study for the City outfall in 2004, documented in the *City of Monroe WWTP Mixing Zone Study Report* (CEG, July 2004). The 2004 study evaluated multiple analysis strategies, including both steady-state and continuous simulation (dynamic) modeling to establish dilution factors and analysis of water quality standards. The 2004 report concluded that there was no reasonable potential to exceed water quality standards using the results of the dynamic modeling analysis.

Dilution factors for both the steady state and dynamic scenarios were calculated using the Ecology RIVPLUM spreadsheet (*Rivplum5.xls*). Table 1 summarizes the calculated dilution factors, including maximum volumetric dilution based upon 2.5 percent (acute) and 25 percent (chronic) of the river discharge.

Table 1 Summary of Dilution Factors Calculated in 2004 Mixing Zone Study

Condition	Acute Dilution Factor	Chronic Dilution Factor
Volumetric	6.70	91.4
Steady State	4.65	21.5
Dynamic	9.19	23.7

1.3 APPROACH

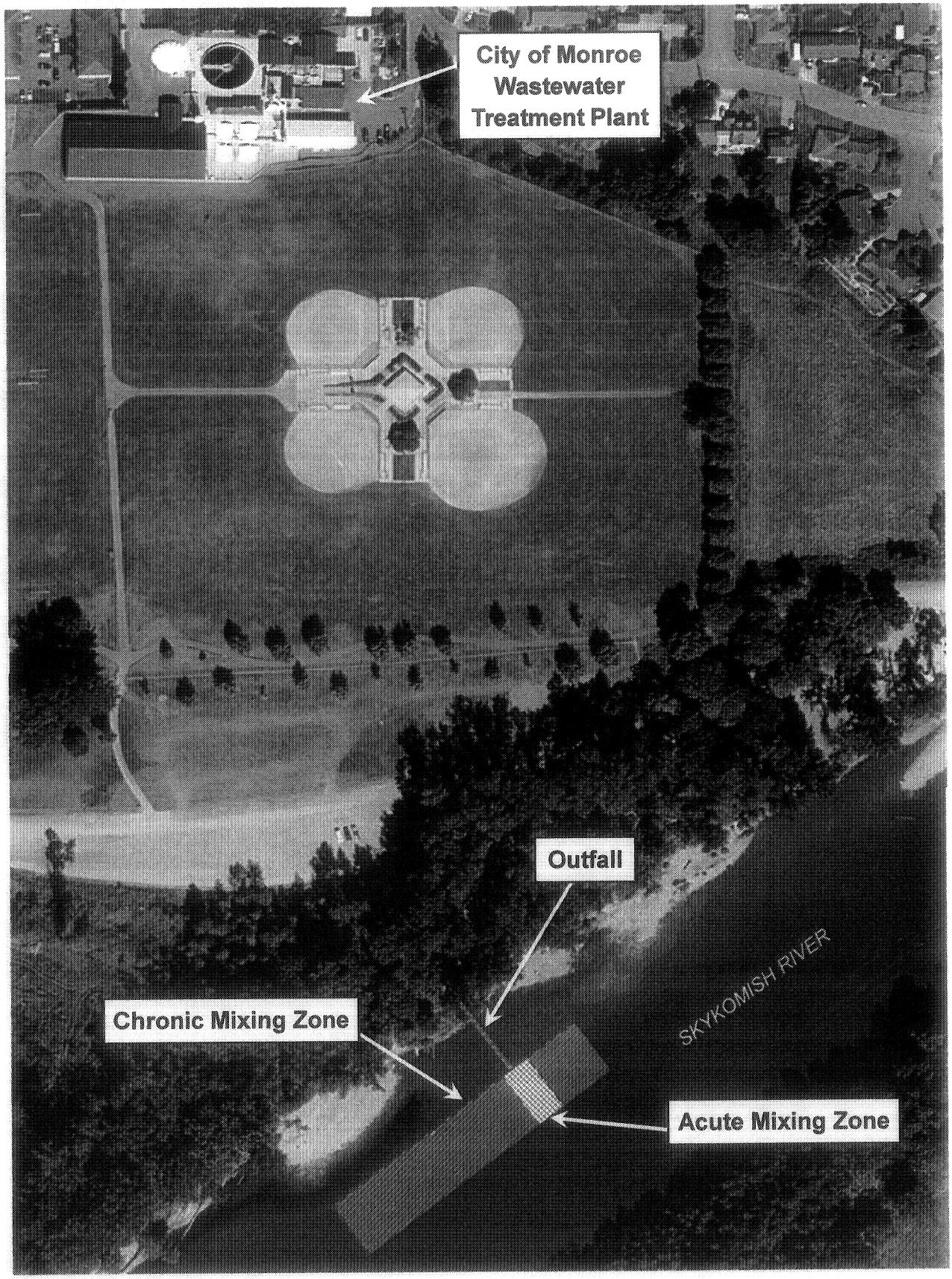
CEG and the City of Monroe believe that updated dynamic model analysis of the mixing zone in lieu of a dye tracer study is sufficient based upon the following:

- Ambient conditions, including river width, depth, and current velocity with respect to river flow, are well known and were documented in the 2004 report.
- Annual outfall inspections performed by the City indicate that the outfall and diffuser are intact and operating as designed.
- The Skykomish River at the discharge location is relatively shallow and steady, thus established river models are believed to be applicable and appropriate without the need to validate with dye tracer studies (see Section 4.1 for discussion of hydrodynamic model applicability).

Therefore, this study updates the dynamic modeling portion of the 2004 study using ambient and effluent data collected over the last five years. Because the dilution model spreadsheet (RIVPLUM) used in 2004 to calculate daily dilution factors was developed for a single port discharge, dilution calculations were modified (see Section 4.1) to better represent the city's 4-port diffuser discharge. The updated water quality analysis also includes analysis of water temperature, in addition to ammonia and metals, as temperature was not evaluated in the 2004 study.

1.4 PURPOSE

The purpose of this study and report is to satisfy the requirements of Condition S8 of the City of Monroe's NPDES Permit.



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Approx. Scale
0′ 300″

Figure 1: Monroe WWTP, Outfall, and Mixing Zone

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Figure 2: 2008 Outfall and Diffuser Inspection

SECTION 3: AMBIENT AND EFFLUENT DATA

Ambient and effluent data used to update the dynamic model developed for the 2004 *Mixing Zone Study Report* (CEG, July 2004) is discussed in the following sections. Data is included for the period between October 1, 2003 and September 30, 2008, incorporating Water Years (WY) 2004 through 2008. The previous report evaluated WY 1998 through WY 2003.

3.1 RIVER DISCHARGE

The Skykomish River in the vicinity of the City (River Mile 24.3) was briefly gauged by the United States Geological Survey (USGS) in 1969, but is not currently monitored. For previous outfall studies, including the 2004 *Mixing Zone Study*, the river discharge at Monroe was calculated as a drainage area ratio of the river's watershed at Monroe (834 square miles) to the Snohomish River watershed area at Monroe (1,537 square miles)[1]. Therefore, a ratio of 0.54 was applied to the Snohomish River discharge as recorded by USGS Monitoring Station 12150800.

3.2 RIVER WIDTH, DEPTH, AND CURRENT VELOCITY

The dilution model spreadsheet requires river width, depth, and current velocity to calculate dilution. Each of these parameters is a function of river discharge. Because it is impractical to measure these parameters on a daily basis, the analysis presented herein uses the same assumptions that were made for the 2004 study to develop input data for the RIVPLUM spreadsheet.

3.2.1 River Width

River width is assumed to be 325 feet (as identified in the NPDES Permit and Fact Sheet) for all river discharges. Because effluent is discharged 50 feet from the riverbank, the effluent plume is not anticipated to contact the bank. Photographs of the effluent plume (Figure 2) confirm that the river bank does not influence the plume within the mixing zone.

[1] Based upon analysis performed by Ecology as part of a Total Maximum Daily Load (TMDL) study for the Snohomish River.

3.2.2 River Depth

A regression equation comparing river depth to river discharge was developed for the 2004 study using data from previous mixing zone studies by Beak (1993) and Earth Tech (2000). Gauge and flow data from an upstream USGS Monitoring Station (No. 12134500, Skykomish River at Goldbar, WA) were used to graphically compare the water depth to river flow response with the regression equation. The regression equation data has a similar shaped curve to the USGS data at similar discharge flow rates. Graphs of the regression data and comparison to USGS data are presented in the 2004 *Mixing Zone Study Report* (CEG, July 2004).

3.2.3 Current Velocity

As performed for the 2004 study, current velocity with respect to river discharge was also calculated using the regression equations developed for the upstream USGS monitoring station.

3.3 AMBIENT WATER QUALITY DATA

Ecology has a long term ambient water quality monitoring station (Station No. 07C070) approximately 1 mile upstream of the outfall discharge. Monthly water quality data for conventional parameters, including ammonia, pH, and temperature, is available for the years 1977 through 2009. Monthly metals data, including hardness, was collected in 2003.

Additional ambient water quality monitoring was performed by the City in 2008 as part of an NPDES permit-required effluent and receiving water study. The City collected ambient ammonia, hardness, temperature, pH, and metals (copper, mercury, and zinc) data during six sampling events. Metals samples were analyzed for total concentrations. Metals translators developed from 2003 Ecology receiving water data (copper = 0.64 and zinc = 0.20) were used to convert city data to the dissolved fraction for the purposes of evaluating reasonable potential (see Section 5).

Ambient water quality data for WY 2004 through 2008 are provided in Appendix B.

3.4 EFFLUENT FLOW RATE AND WATER QUALITY DATA

Daily effluent data is recorded by WWTP staff and submitted to Ecology in month Discharge Monitoring Reports (DMRs). The following parameters, including sampling frequency, are used in the dilution and water quality analyses presented herein:

- Flow Rate — Daily
- Temperature — Daily through June 2004
- pH — Daily
- Ammonia — 2-3/week through 2005
- Copper and Zinc — 1/week through 2005
- Mercury — 1/week through 2005 and 2/month (dry season only) thereafter

As shown above, permit-required monitoring frequency was modified in the existing NPDES Permit effective January 2006. Daily temperature and ammonia data are required input parameters for dynamic model analysis. Therefore, for temperature beyond June 2004, monthly average values were calculated based on data collected between 1997 and 2004. Effluent ammonia concentration beyond 2005 is conservatively assumed to be 1 mg/L. Since WWTP upgrades were installed in June 2002, near complete nitrification has been consistently achieved.

DMR data for the period between October 2003 and September 2008 is provided in Appendix C (enclosed CD).

SECTION 4: DYNAMIC MODEL ANALYSIS

Steady-state modeling considers only a single condition for all independent parameters, which are assumed to be constant, and conservative values are used for all parameters. However, because of a natural variability in flows and water quality parameters, effluent limits based on steady-state modeling are implicitly improbable. Conversely, dynamic modeling techniques explicitly predict the effects of receiving water and effluent flow and concentration variability. This allows for a more precise determination of effluent limits consistent with the probability, duration, and frequency basis for the receiving water criteria.

The United States Environmental Protection Agency (USEPA) (1991) supports two dynamic modeling methods; continuous simulation, and Monte Carlo. Continuous simulation modeling uses daily effluent, river flow, and concentration data to calculate daily acute and chronic dilution factors, ambient criteria, and wasteload allocations for parameters of concern. The critical daily wasteload allocations are then used to establish effluent limits in the same way as steady-state methods.

This section discusses the continuous simulation (dynamic) model developed in the 2004 *Mixing Zone Study Report* (CEG, July 2004) and updated with recent ambient/effluent data as well as dilution calculations appropriate for the 4-port diffuser. The model is an Excel workbook file with multiple linked spreadsheets to calculate dilution and perform continuous simulations for ammonia and metals. A CD containing the dynamic model and input data spreadsheets is included in Appendix C.

4.1 DILUTION MODEL AND DYNAMIC MODEL ANALYSIS

The 2004 study used the Ecology mixing model RIVPLUM to calculate daily dilution factors. RIVPLUM was developed for single port discharges and assumes instantaneous complete vertical mixing. The Skykomish River is shallow (1.4 feet) during low flow conditions and rarely exceeds a depth of 4 feet even during high river discharge; therefore, the complete vertical mixing assumption is applicable. However, discharge from a multi-port diffuser results in significantly higher initial dilution than a single port as the effluent is spread across the length of

the diffuser. Therefore, the dynamic analysis presented herein uses the principle of superposition to evaluate individual ports and superimpose overlapping concentration data from all of the discharge ports at the plume centerline (mid-point of the diffuser).

4.1.1 Two-Dimensional Advection-Dispersion Equation

Similar to RIVPLUM, dilution for the current analysis was calculated using the advection-dispersion equation, as found in *Mixing in Inland and Coastal Waters* (Fischer, et al., 1979, Academic Press). The advection-dispersion equation calculates dilution based solely upon ambient parameters including dimensions of the receiving water, current velocity, and a dispersion coefficient. Chapter 2 of *Mixing in Inland and Coastal Waters* describes the diffusion and advection components of the equation, and presents the 2-dimensional form as equation 2.68. This equation is applied to a continuous effluent discharge in a natural system as follows:

$$C(x,y) = \frac{\dot{M}}{ud\sqrt{4\pi\varepsilon_t\left(\frac{x}{u}\right)}}\ exp\left\{\frac{-y^2u}{4\varepsilon_t x}\right\}$$

Where:

C(x,y)	= concentration as a function of x and y
M	= mass discharge rate
x	= downstream distance
y	= transverse (i.e., cross-stream) distance
u	= stream velocity in x-direction
d	= mean stream depth
ε_t	= transverse dispersion coefficient

Converting from a mass-based term to volumetric fraction (the inverse of dilution) yields the following equation:

$$f = \frac{c(x,y)}{C_o} = \frac{q_o}{ud\sqrt{4\pi\varepsilon_t\left(\frac{x}{u}\right)}}\ exp\left\{\frac{-y^2u}{4\varepsilon_t x}\right\}$$

Where:

f	= plume volumetric fraction

C_o = effluent concentration

q_o = effluent flow rate

4.1.2 Transverse Dispersion Coefficient

The transverse dispersion coefficient (ε_t) is set by the default equation 5.6 in Fischer (1979):

$$\varepsilon_t \frac{\square^*}{du} = 0.6$$

Where:

u* = channel shear velocity

Shear velocity may be determined as a function of channel slope, or bottom friction and river velocity, or a default fraction of river velocity (e.g., 0.1u). In this case, the shear velocity, and therefore the transverse dispersion coefficient, are calculated daily as a function of the river velocity and the stream bed roughness using Manning's equation.

4.1.3 Vertical Mixing

One of the stipulations for using the 2-D equation is that the effluent plume must be mixed very rapidly in the vertical dimension. The date of 9/16/2006 has been chosen as the test date for "near-critical" conditions of effluent and river flow. River velocity and depth were 1.10 fps and 1.43 feet, respectively.

From equations 5.3 and 5.10 in Fischer (1979), the approximate distance downstream to the point where complete vertical mixing for the raised diffuser ports can be assumed (L) is:

$$L = 0.1u^{d^2}/\varepsilon_v$$

Where:

ε_v = vertical dispersion coefficient = 0.015 ft^2/sec on 9/16/06

Therefore:

$L = (0.1)(1.1)(1.43)^2/0.015 = 15$ feet

The calculation above is a very conservative test for the assumption of complete mixing because it neglects the initial jet momentum of the discharge itself. We conclude that complete vertical mixing occurs very rapidly at the Monroe WWTP outfall, and thus the 2-D advection-dispersion equation is an applicable mixing zone model for the acute and chronic mixing zone boundary.

Rapid vertical mixing of the effluent plume was also visually confirmed from the dye photo shown in Figure 2.

4.1.4 2-D Model with Superposition

The Monroe mixing zone model combines the 2-D advection-dispersion equation with the principal of superposition. The model is illustrated in Figure 3. The 2-D model is run for each individual port with one-quarter of the total flow rate. The resulting volumetric fraction (f) is the sum of each port at any location of interest (x,y).

A sample calculation for the "near-critical" test date of 9/16/06 is provided in Appendix D. The test calculation shows centerline dilution for both acute and chronic mixing zone boundaries for the test date, and was used to validate the dynamic spreadsheet model discussed below.

4.1.5 Continuous Simulation Dilution Model

Input data for the advection-dispersion equations (see the "2D A-D" tab in Appendix C) include effluent and river flow rate, and physical dimensions based upon the outfall design and the location of mixing zone boundaries. The input data is similar to the data used in 2004 for the RIVPLUM model. The only significant change is the Manning's Roughness Coefficient (n), which is a measure of the roughness characteristics of the riverbed. Higher values indicate a rougher surface, which would create greater mixing. The 2004 study used a value of 0.08; however, a value of 0.04 is more appropriate based upon (Roberson and Crowe, 1975).

Based upon the input data, the equations calculate the centerline dilution at the acute and chronic mixing zone boundaries for each day. The dynamic model (see the "Monroe Dynamic Modeling" tab in Appendix C) then performs the regression statistics per USEPA methodology. Table 2 summarizes the data in the dynamic model spreadsheet, while the following paragraphs discuss the regression statistics used to determine the dilution factors. Additional columns in the dynamic modeling spreadsheet are discussed in later sections as they pertain to the ammonia and metals analyses.

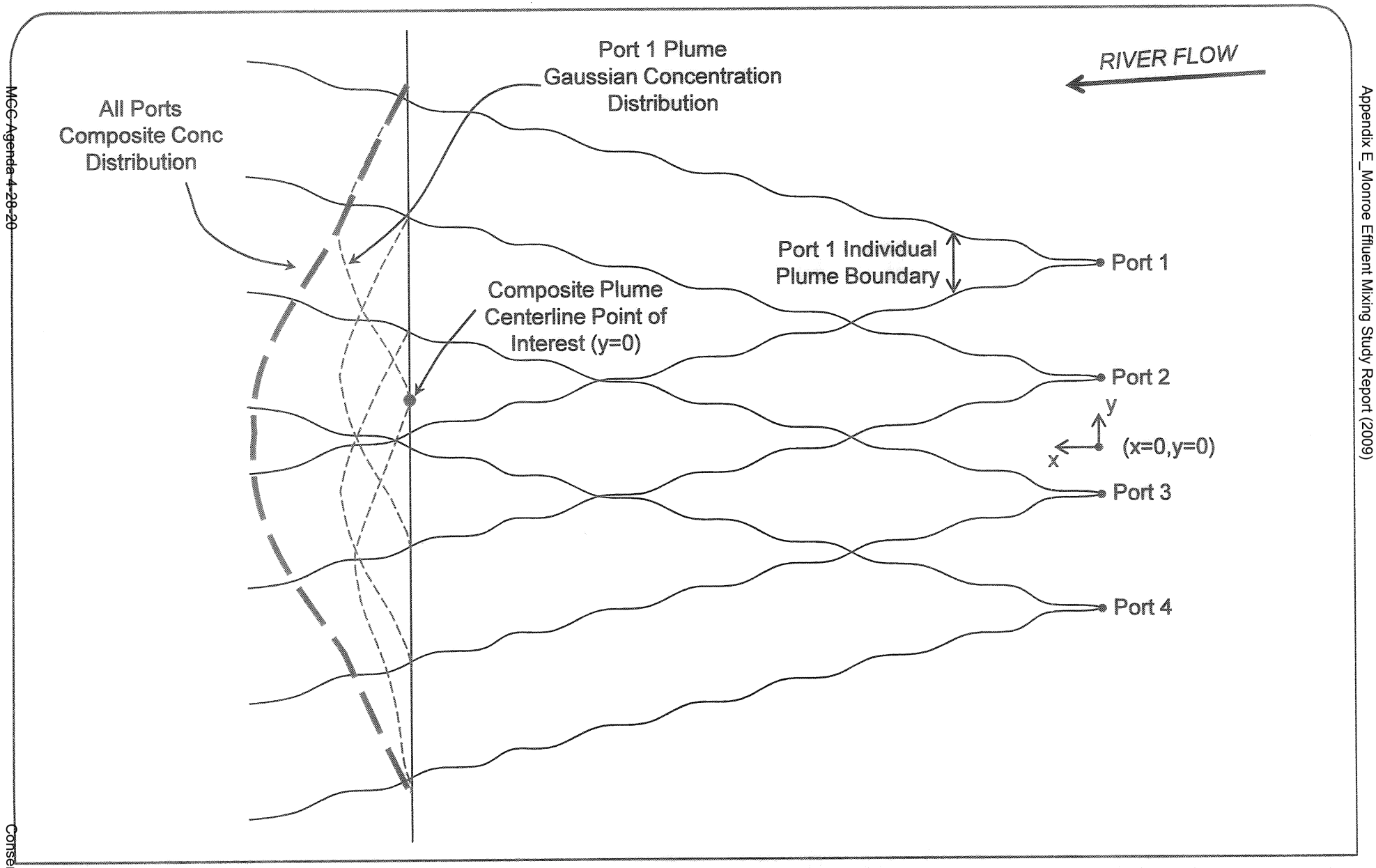

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Figure 3: 2-D Advection-Dispersion Model with Superposition

Table 2 Dynamic Model Spreadsheet Information – Dilution Analysis

Column	Description
A	Date
B	Julian day
C	River flow (cfs) at Monroe from "Skyko Riv Q" worksheet
D*	Effluent flow (cfs) from "2D A-D" worksheet - from DMR data
E	Calculated acute dilution factor from column AK in "2D A-D" worksheet
F	Acute dilution factor based on 2.5 percent of ambient flow from column AL in "2D A-D" worksheet
G	Minimum acute dilution factor of Columns E and F
H	Calculated chronic dilution factor from column BU in "2D A-D" worksheet
I	Chronic dilution factor based on 25 percent of ambient flow from column BV in "2D A-D" worksheet
J	Minimum chronic dilution factor of Columns H and I
K	Running 4-day average chronic dilution factor of Column J

* A conversion error between million gallons per day (mgd) and cubic feet per second (cfs) was identified in the 2004 analysis spreadsheets and corrected for the current analysis.

Rows 3 through 1,829 of the dynamic model spreadsheet include daily data and model results between October 1, 2003, and September 30, 2008. Rows 1,832 through 1843 are the statistics used to calculate the critical dilution factors based on the continuous simulation model. Rows 1,834 through 1,838 list the minimum dilution factors for WY 2004 through 2008. Column G has the acute values and Column K has the 4-day chronic values. Log_{10} transformed values of the annual minima are in Columns H and L. Mean, standard deviation, and z-statistics are provided in Rows 1,840 through 1,842. The resulting dilution factors with a 3-year recurrence probability are presented in Row 1,843.

Based upon the regression statistics, the annual acute and chronic dilution factors for WY 2004-2008 are **8.0 and 16.8**, respectively.

4.2 CONTINUOUS SIMULATION FOR AMMONIA

The water quality criteria for ammonia (see WAC 173-201A-240) vary depending upon the presence or absence of salmon, are dependent on pH and temperature, and are for the un-ionized form of ammonia. The temperature and pH in the mixing zone are a function of the dilution at the mixing zone boundaries. The mixed temperature may be calculated by a simple mixing analysis due to the short duration in the mixing zone (less than 2 minutes to the chronic mixing

zone boundary). However, the mixed pH is a function of the buffering capabilities (*i.e.*, alkalinity) of both the effluent and receiving water.

An Ecology-developed spreadsheet (see the "pH mix" tab in Appendix C) was used to calculate temperature and pH values and the mixing zone boundaries based upon effluent/ambient data and the calculated dilution. A second Ecology-developed spreadsheet (see the "NH3 Criteria tab in Appendix C) was used to calculate ammonia criteria based upon the calculated temperature and pH.

Table 3 summarizes the continuous simulation analysis for ammonia, which is included in the same spreadsheet at the dynamic model analysis (see the "Monroe Dynamic Modeling" tab in Appendix C).

Table 3 Dynamic Model Spreadsheet Information – Ammonia Analysis

Column	Description
L	pH at the acute mixing zone boundary, from "pH mix" tab
M	pH at the chronic mixing zone boundary, from "pH mix" tab
N	Temperature at the acute mixing zone boundary, from "pH mix" tab
O	Acute ammonia-N criterion, from "NH3 criteria" tab
P	Chronic ammonia-N criterion, from "NH3 criteria" tab
Q	Effluent ammonia from "DMRs" tab, interpolated for daily values from DMRs
R	Ambient ammonia from "Ambient Data" tab, data used are from monthly data sets from the period of record (2003-2008) at Ecology monitoring Station 07C070
S	Ammonia-N concentration at the acute mixing zone boundary, a function of ambient concentration, effluent concentration, and acute dilution
T	Ammonia-N concentration at the chronic mixing zone boundary, a function of ambient concentration, effluent concentration, and chronic dilution
U	A logical function comparing the acute mixing zone concentration to the acute criterion
V	A logical function comparing the chronic mixing zone concentration to the chronic criterion
W	Acute wasteload allocation is the effluent ammonia concentration that would exactly meet the acute water quality criterion at the mixing zone boundary
X	Chronic wasteload allocation is the effluent ammonia concentration that would exactly meet the chronic water quality criterion at the mixing zone boundary
Y	Running 4-day average for the chronic wasteload allocations

In rows 1,832 through 1,843, the critical acute and chronic wasteload allocations (in mg/L) are calculated for an annual 3-year return interval. The critical allocations are based on log-transformed values as recommended by USEPA (1991). The critical acute and chronic ammonia allocations are **231.7 mg/L** and **30.7 mg/L**, respectively. The recent WWTP upgrade to nitrify the effluent virtually ensures that the ammonia criteria are met.

4.3 CONTINUOUS SIMULATION FOR METALS

Prior to the most recent NPDES permit modification in December 2005, the City sampled treated effluent for copper, mercury, and zinc. The City currently samples only for Mercury (twice monthly during the dry weather period). The metals analyses herein were performed for copper, mercury, and zinc using available data from the past five years. Because the City does not have daily (or even current monthly) data for effluent metals, the continuous simulation is used to develop metals wasteload allocation. Compliance with metals criteria is evaluated in Section 5 – Reasonable Potential Analysis.

Water quality criteria for copper and zinc (see WAC 173-201A-240) are hardness dependent, while mercury criteria are independent of hardness. The *Permit Writer's Manual* (Ecology, 2008) requires using the lowest ambient hardness value observed during the critical condition if the number of test values is 20 or less, or the 10th percentile value (lognormal transformed) if the hardness data set consists of more than 20 values. Using Ecology and City data provided in Appendix B, a data set consisting of 12 values, results in a critical ambient hardness of 9.78 mg/L. Mixed hardness at the acute and chronic mixing zone boundaries was calculated using a simple mixing equation assuming an effluent hardness of 30 mg/L as used in the 2004 analysis.

Table 4 summarizes the continuous simulation analysis for metals, which is included in the same spreadsheet at the dynamic model analysis (see the "Monroe Dynamic Modeling" tab in Appendix C).

Table 4 Dynamic Model Spreadsheet Information – Metals Analysis

Column	Description
AA	WWTP effluent hardness is the lowest value from the Monroe data
AB	River hardness is the lowest value from the Monroe and Ecology data
AC	Hardness at the acute mixing zone boundary based on simple dilution calculation
AD	Hardness at the chronic mixing zone boundary based on simple dilution calculation
AE	Acute copper criteria (dissolved) calculated on a daily basis as a function of hardness at the acute mixing zone boundary
AF	Chronic copper criteria (dissolved) calculated on a daily basis as a function of hardness at the chronic mixing zone boundary
AG	Critical ambient copper concentration is the geometric mean of the Ecology data set multiplied by 1.74
AH	Acute wasteload allocation is the effluent copper concentration that would exactly meet the acute water quality criterion at the mixing zone boundary
AI	Chronic wasteload allocation is the effluent copper concentration that would exactly meet the chronic water quality criterion at the mixing zone boundary
AJ	The running 4-day average for the chronic wasteload allocations
AK-AP	These columns are identical to AE through AJ, but for mercury
AQ-AV	These columns identical to AE through AJ, but for zinc

In rows 1,832 through 1,843, the critical acute and chronic wasteload allocations are calculated for an annual 3-year return interval. The critical allocations are based on log-transformed values as recommended by USEPA (1991). The critical metals allocations are summarized as follows:

Copper:	Acute = 11.6 μg/L	Chronic = 12.2 μg/L
Mercury:	Acute = 16.9 μg/L	Chronic = 0.16 μg/L
Zinc:	Acute = 137.5 μg/L	Chronic = 227.5 μg/L

4.4 CONTINUOUS SIMULATION FOR TEMPERATURE

Applicable water quality standards for temperature are detailed in WAC 173-201A-200. Temperature standards are specific to the aquatic life uses designated by Ecology for the receiving water. In the vicinity of the WWTP discharge, the Skykomish River is designated as core summer salmonid habitat. The water quality temperature standard (16°C) applies at the chronic mixing zone boundary.

Temperature standards are evaluated in reference to the 7-day average of the daily maximum temperature (7-DADMax) for both the effluent and receiving water. Additional incremental temperature rise criteria apply depending upon the ambient receiving water temperature in respect to the criteria. Currently available temperature data are presented in Section 3.3 (ambient temperature) and Section 3.4 (effluent temperature). The temperature data presented in these sections is somewhat limited as effluent temperature sampling was discontinued in June 2004 and receiving water temperature data is a single daily value collected monthly, rather than a daily maximum value. Therefore, the dynamic analysis for temperature was based upon the following assumptions:

- Effluent temperature – For dates beyond June 2004, monthly average values were calculated based upon data collected between 1997 and 2004. The monthly average temperature was applied for each day of the respective month. Effluent temperature is presented in Appendix C.

- Ambient temperature – Measured data (collected monthly) was assumed to be the daily temperature for each day until a new monthly temperature measurement was collected. Ambient temperature data is presented in Appendix B.

Ecology has developed a spreadsheet (T-mix Fresh) to evaluate compliance with temperature standards using a simple mixing analysis. Ecology's spreadsheet calculations were incorporated into the spreadsheet tab "pH mix" in Appendix C to provide a daily analysis of temperature standards for WY 2004 through 2008. Based upon the available temperature data, the effluent discharge does not exceed water quality standards for temperature.

SECTION 5: REASONABLE POTENTIAL ANALYSIS

5.1 REASONABLE POTENTIAL TO EXCEED WATER QUALITY STANDARDS

The reasonable potential to exceed water quality standards is a standard statistical test developed by EPA and adopted by Ecology to establish the need for effluent limitations in NPDES permits. Reasonable potential analysis (RPA) procedures are outlined in the *Permit Writer's Manual* (Ecology, 2008) and the *Technical Support Document for Water Quality-Based Toxics Control* (USEPA 505/2-90-001, 1991).

The RPA was performed using dilution factors calculated as presented in Section 4.1. Ambient and effluent water quality data used as input values for the RPA are presented in Sections 3.3 and 3.4, respectively. Effluent data are 95th percentile values for the data set while ambient data are 90th percentile values for ammonia (large data set) and the geometric mean x 1.74 for metals (small data set).

5.2 REASONABLE POTENTIAL ANALYSIS RESULTS

Reasonable potential analysis results for ammonia and metals (copper, mercury, and zinc) are summarized in Table 5. The RPA indicates there is no reasonable potential to exceed water quality standards for the parameters evaluated. Table 5 also presents an "RPA Ratio" for each contaminant. The RPA Ratio is the ratio of the predicted contaminant concentration at the mixing zone boundary to the regulatory standard.

All of the RPA Ratio's in Table 5 are less than 1, indicating no exceedance of water quality standards. The higher the RPA Ratio, the closer the predicted contaminant concentration is to the standard. Therefore, each of the metals approaches the standard, which if exceeded, would result in Ecology developing a discharge limit for the respective contaminant[2]. The City currently samples only for mercury (June – October). The reasonable potential analysis presented above indicates that discharge limits are not required for ammonia or any of the metals.

---

[2] Discharge limits would be based upon the continuous simulations and waste load allocations discussed Sections 4.2 and 4.3 for ammonia and metals, respectively.

Table 5 Reasonable Potential Analysis Results Summary

	Copper (µg/L)	Mercury (µg/L)	Zinc (µg/L)	Ammonia (mg/L as N)
Coefficient of Variation	0.56	0.60	0.46	1.99
Number of Sample Points	116	132	116	181
95th Percentile Concentration	15.0	0.20	140.0	6.25
Water Quality Standard				
Acute	2.36	2.10	19.37	15.21
Chronic	1.72	0.012	16.07	2.10
Ambient Concentration(1)	0.92	0.002	1.40	0.10
Mixed Concentration				
@ Acute Boundary	1.82	0.019	16.37	0.43
@ Chronic Boundary	1.35	0.010	8.53	0.21
Reasonable Potential ?				
@ Acute Boundary	NO	NO	NO	NO
@ Chronic Boundary	NO	NO	NO	NO
RPA Ratio				
@ Acute Boundary	0.77	0.01	0.85	0.03
@ Chronic Boundary	0.78	0.83	0.53	0.10

(1) Ambient concentration value is 90th percentile for ammonia (large data set) and the geometric mean x 1.74 for metals (small data set).

Detailed RPA worksheets are provided in Appendix E.

SECTION 6: SUMMARY

The analysis presented in this report was performed to satisfy NPDES Permit Condition S8. The dynamic model developed previously (see Section 1.2) was updated with the ambient and effluent data for the most recent 5-year period (WY 2004 through 2008), and also to better reflect the design of the outfall diffuser. The critical acute and chronic dilution factors calculated by the dynamic model are 8.05 and 16.8, respectively. Based upon the calculated dilution and available effluent/receiving water contaminant data, there is no reasonable potential to exceed water quality standards. Therefore, discharge limits are not required for ammonia or any of the metals contaminants of concern (copper, mercury, and zinc).

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Washington Administrative Code (WAC). *WAC 173-240-060 (d), (e), and (l). Engineering Report.*

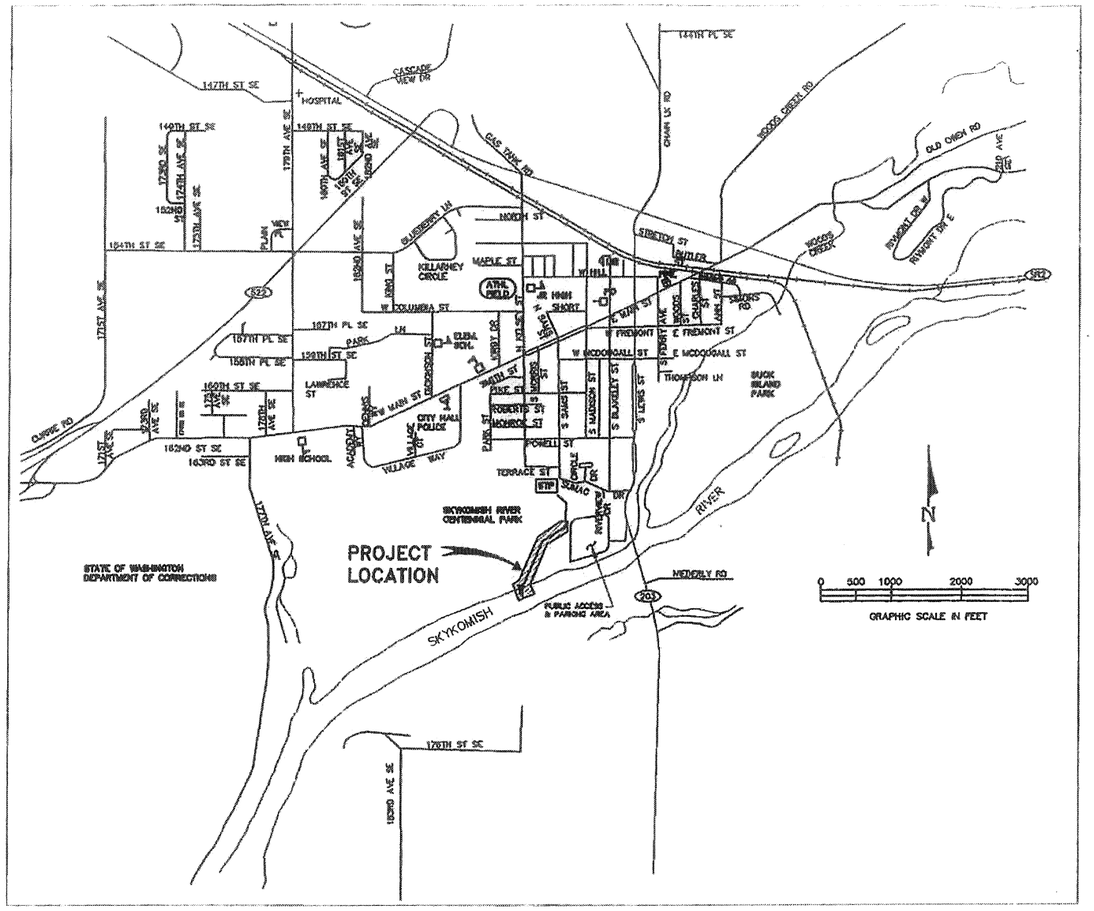
COSMOPOLITAN ENGINEERING GROUP

Appendix A

Outfall Design Drawings

Civil, Environmental, and Recreational Consulting

Printed on Recycled Paper



LOCATION MAP

CITY OF MONROE

WASTEWATER TREATMENT PLANT

OUTFALL REPLACEMENT

MAY, 1995

MAYOR: GORDON TJERNE

COUNCIL: MIKE DONOW
VERN CURLEY
JIM HAGER
BOB HOLMAN
JIM HUNNICUTT
MATT CARROLL
BOB WILCOX

ADDENDA 1 AND 2 INCORPORATED

CITY ADMINISTRATOR: DOUG JACOBSON, P.E.

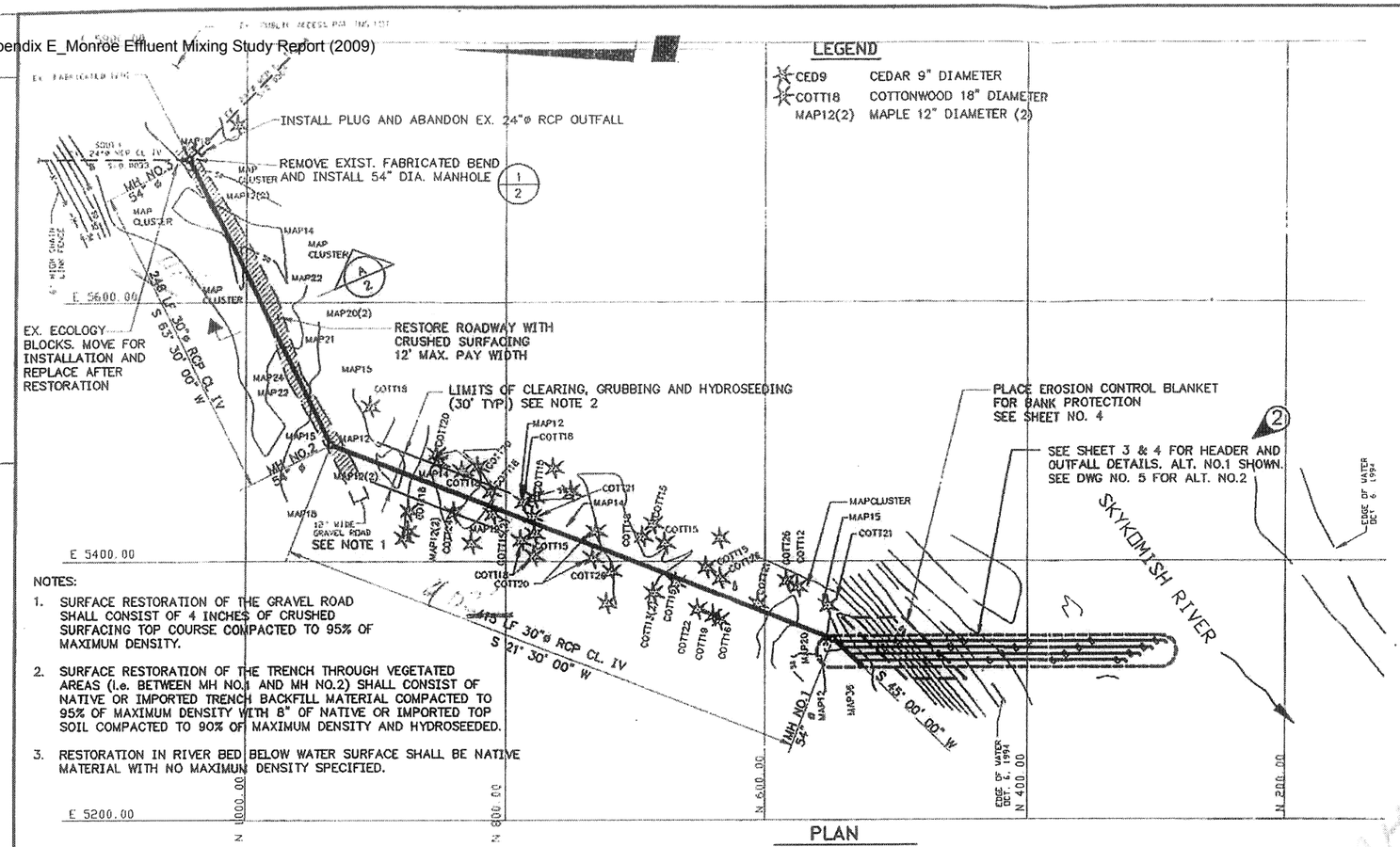
INDEX OF DRAWINGS

Drawing No.	Sheet Title
1	COVER SHEET – LOCATION MAP – INDEX OF DRAWINGS
2	PLAN AND PROFILE
3	DETAILS
4	DETAILS
2 5	HEADER AND OUTFALL ASSEMBLY, ALTERNATIVE NO. 2

7/19/95
IA-STPCOV

REDUCED TO APPROX. HALF SIZE

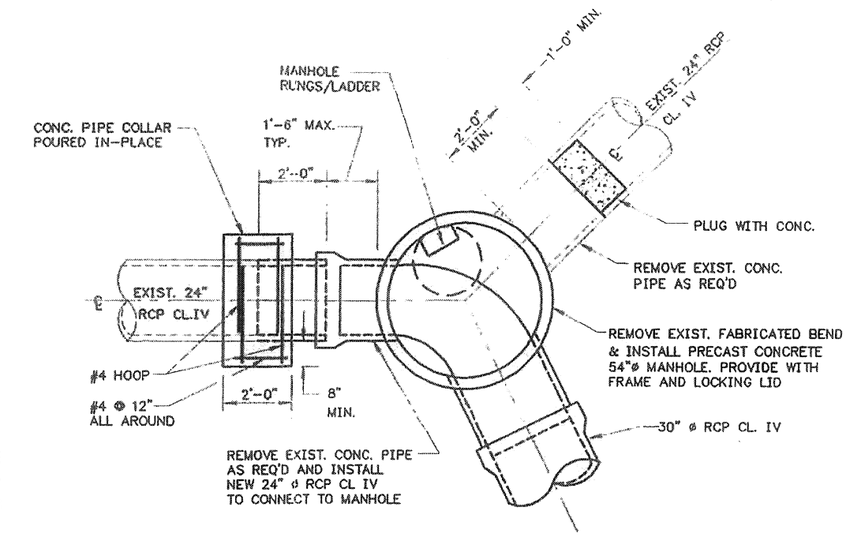
Barrett Consulting Group
10800 N.E. 8th Street, Seventh Floor
Bellevue, WA 98004
Ph. (206) 455-6404
720 S. 333rd
Federal Way, WA 98003
Ph. (206) 838-8202



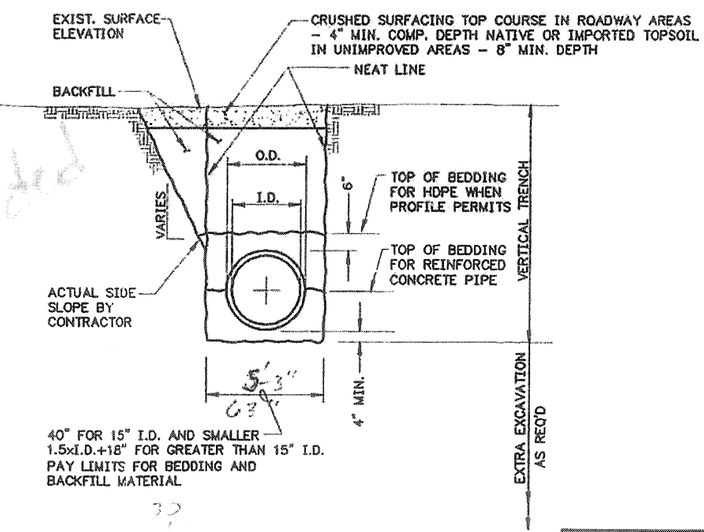
NOTES:

1. SURFACE RESTORATION OF THE GRAVEL ROAD SHALL CONSIST OF 4 INCHES OF CRUSHED SURFACING TOP COURSE COMPACTED TO 95% OF MAXIMUM DENSITY.
2. SURFACE RESTORATION OF THE TRENCH THROUGH VEGETATED AREAS (i.e. BETWEEN MH NO.1 AND MH NO.2) SHALL CONSIST OF NATIVE OR IMPORTED TRENCH BACKFILL MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY WITH 8" OF NATIVE OR IMPORTED TOP SOIL COMPACTED TO 90% OF MAXIMUM DENSITY AND HYDROSEEDED.
3. RESTORATION IN RIVER BED BELOW WATER SURFACE SHALL BE NATIVE MATERIAL WITH NO MAXIMUM DENSITY SPECIFIED.

PLAN
SCALE: 1"=50'

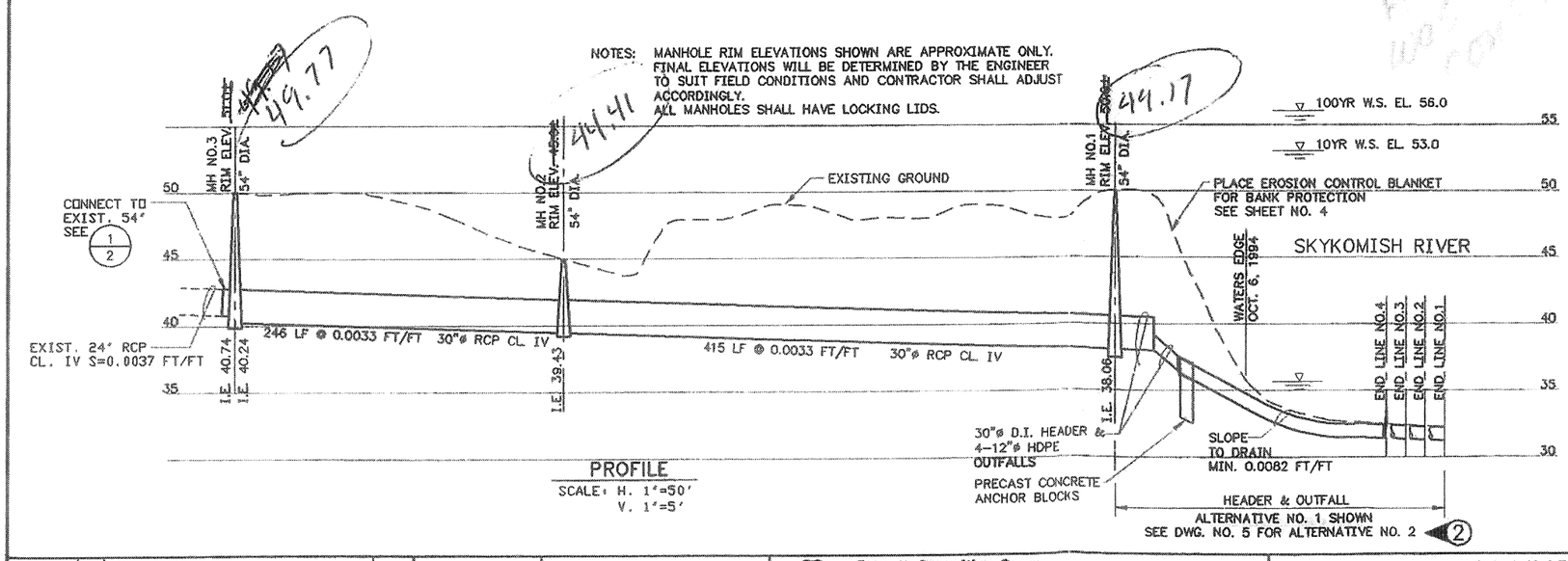


1/2 MANHOLE NO. 3
SCALE: 1/2"=1'-0"



A/2 TYPICAL TRENCH SECTION
N.T.S.

NOTES: MANHOLE RIM ELEVATIONS SHOWN ARE APPROXIMATE ONLY. FINAL ELEVATIONS WILL BE DETERMINED BY THE ENGINEER TO SUIT FIELD CONDITIONS AND CONTRACTOR SHALL ADJUST ACCORDINGLY.
ALL MANHOLES SHALL HAVE LOCKING LIDS.



PROFILE
SCALE: H. 1"=50'
V. 1"=5'

NOTE: COORDINATE GRID SHOWN IS AN EXTENSION OF ASSUMED COORDINATE GRID SHOWN ON DRAWING C-3, SHEET 10 OF 114 OF PLANS FOR CITY OF MONROE WASTEWATER TREATMENT PLANS, TO AVOID NEGATIVE VALUES FOR NORTHINGS N1000 SHOWN HEREON IS EQUAL TO N000 ON THE WASTEWATER TREATMENT PLAN SHEETS.

REDUCED TO APPROX. HALF SIZE

Date	No.	Description	By
6/08/95	2	ADDENDUM NO. 2	DN

REVISION

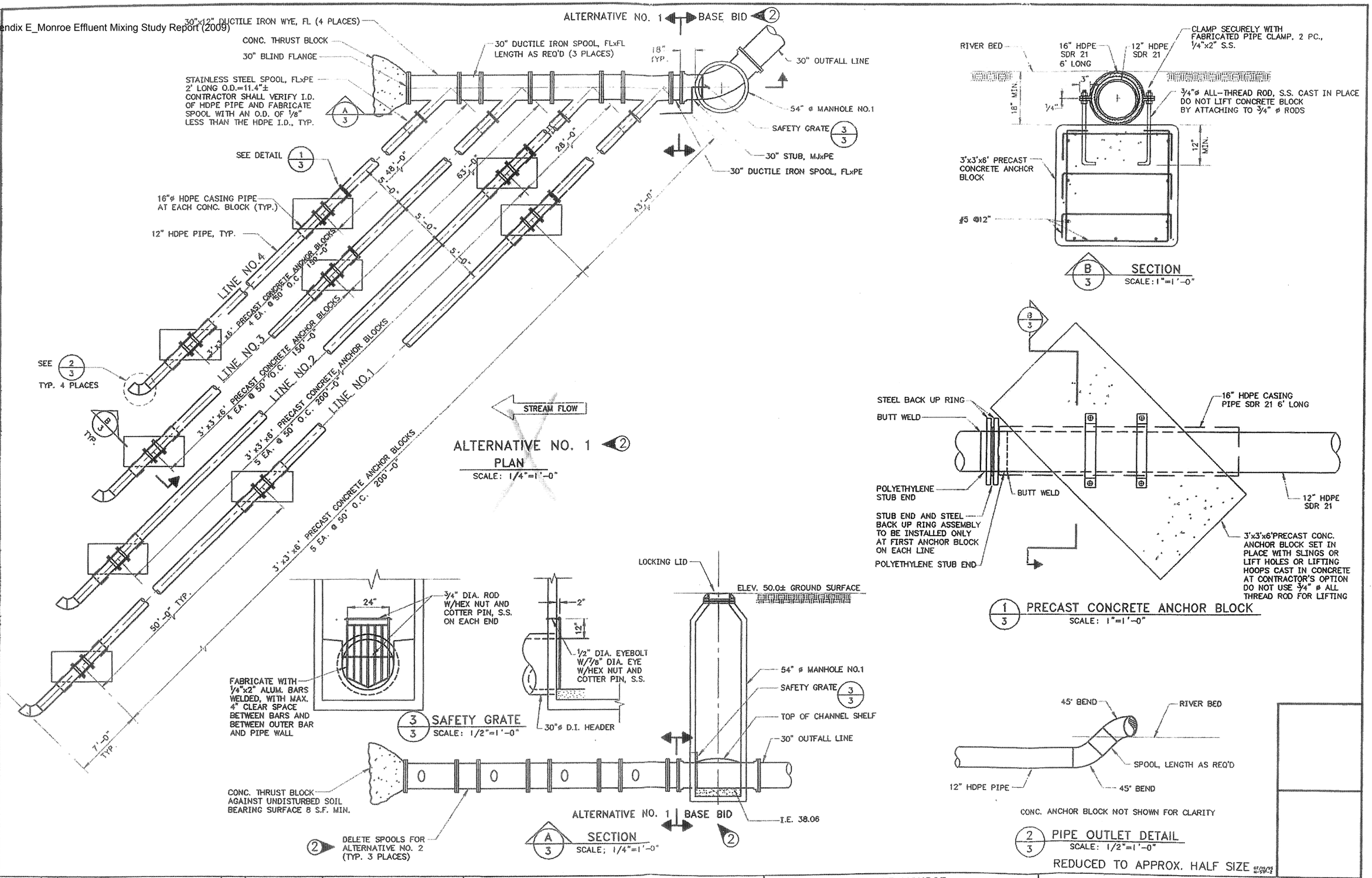
Designed DN
Drawn BF
Checked CC
Approved
Scale NOTED
Date MAY 1995
Project No. 50515102.310

Barrett Consulting Group
Civil / Environmental Engineers

CITY OF MONROE
WASTEWATER TREATMENT PLANT
OUTFALL REPLACEMENT

PLAN AND PROFILE

DWG 2 OF 5



Date	No.	Description	By
6/08/95	2	ADDENDUM NO. 2	DN

REVISION

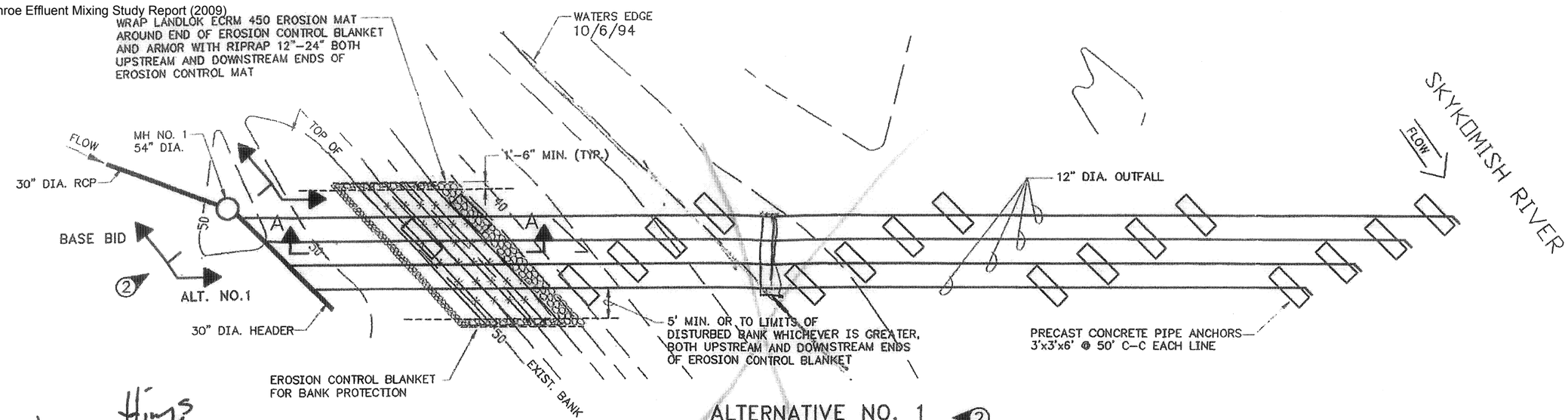
Designed DN | Drawn BF | Checked CHK | Approved | Scale NOTED | Date MAY 1995 | Project No. 50515102.310

Barrett Consulting Group
10800 N.E. 8th Street, 7th Floor, Bellevue, WA 98004, 206 455-9494, Fax 206 455-9470
Civil / Environmental Engineers
203 N. 3rd St. Ste 205, Yakima, WA 98901, 509 575-6102, Fax 509 574-0577
1200 Dupont St. Ste 2-H, Bellingham, WA 98225, 206 734-3202, Fax 206 734-0816

CITY OF MONROE
WASTEWATER TREATMENT PLANT
OUTFALL REPLACEMENT

DETAILS 2

DWG 3 OF 5

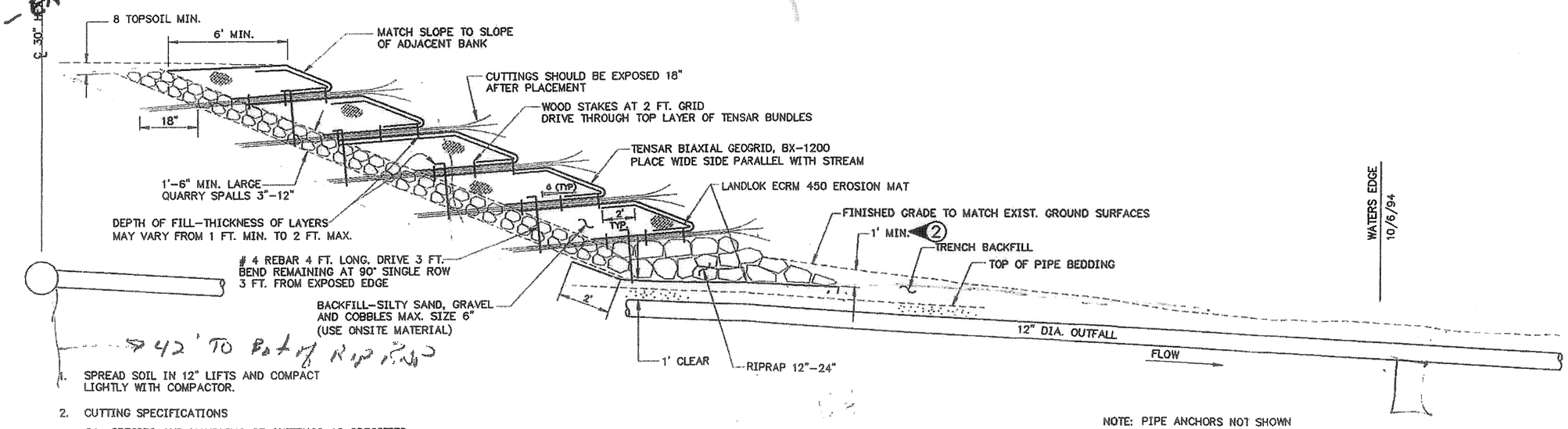


ALTERNATIVE NO. 1 (2)

PLAN VIEW

N.T.S.

Willow cuttings Avail @ END of Oct. – Apr/1 Nov.



1. SPREAD SOIL IN 12" LIFTS AND COMPACT LIGHTLY WITH COMPACTOR.

2. CUTTING SPECIFICATIONS

   2A. SPECIES AND HANDLING OF CUTTINGS AS SPECIFIED.

   2B. MINIMUM LENGTH 9 FT. WITH 1/2" TO 1 1/2" DIAMETER.

   2C. BRANCHES SHOULD BE PLACED WITH BUTTS BACK INTO BANK & SOME CRISSCROSSING OF STEMS.

   2D. BRANCHES TO BE PLACED 4"–6" APART, APPROX. 100 BRANCHES PER LAYER.

NOTE: PIPE ANCHORS NOT SHOWN

CROSS SECTION A–A

N.T.S.

REDUCED TO APPROX. HALF SIZE

Date	No	Description	By
6/08/95	2	ADDENDUM NO. 2	DN

REVISION

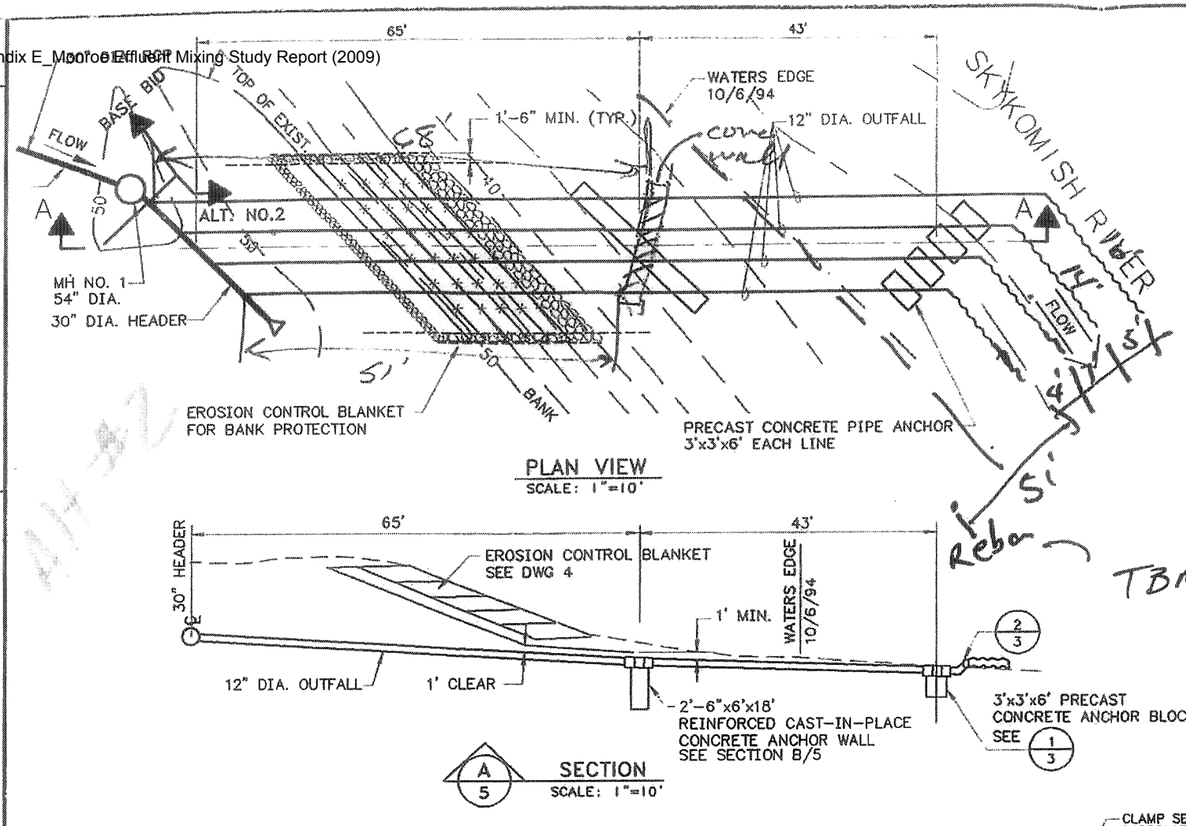
Designed DN | Drawn BF | Checked DVW | Approved | Scale NOTED | Date MAY 1995 | Project No. 50515102.310

Barrett Consulting Group
10600 N.E. 8th Street, 7th Floor, Bellevue, WA 98004, 206 455-9696, Fax 206 455-9470
Civil / Environmental Engineers
120 S. 333 St. Ste 200, Federal Way, WA 98003, 206 838-4202, Fax 206 874-0572
1200 Dupont St. Ste 3-B, Bellingham, WA 98225, 206 734-3302, Fax: 206 734-0818

CITY OF MONROE
WASTEWATER TREATMENT PLANT
OUTFALL REPLACEMENT

DETAILS (2)

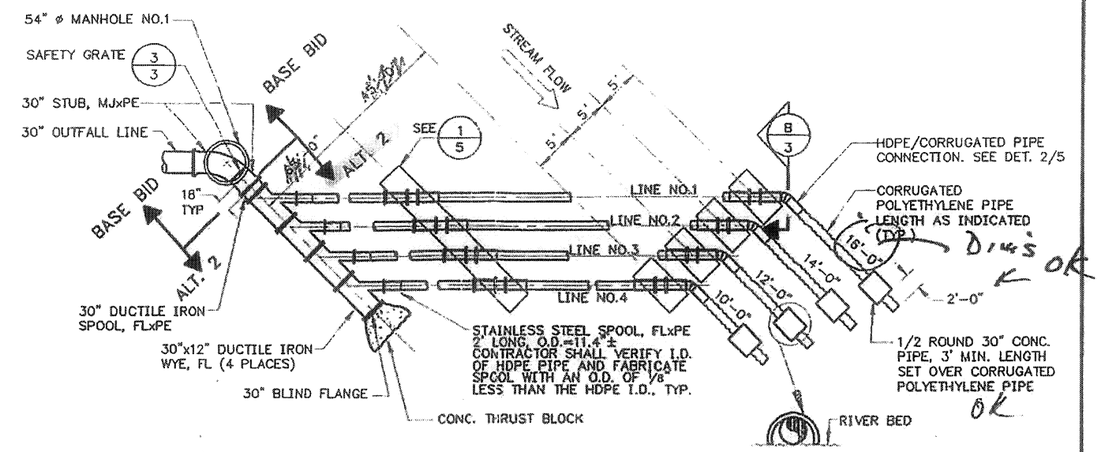
DWG 4 OF 5



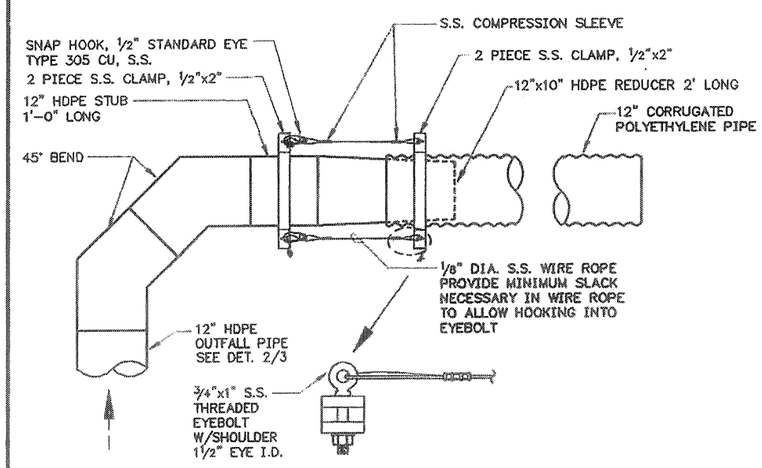
PLAN VIEW
SCALE: 1"=10'

A/5 SECTION
SCALE: 1"=10'

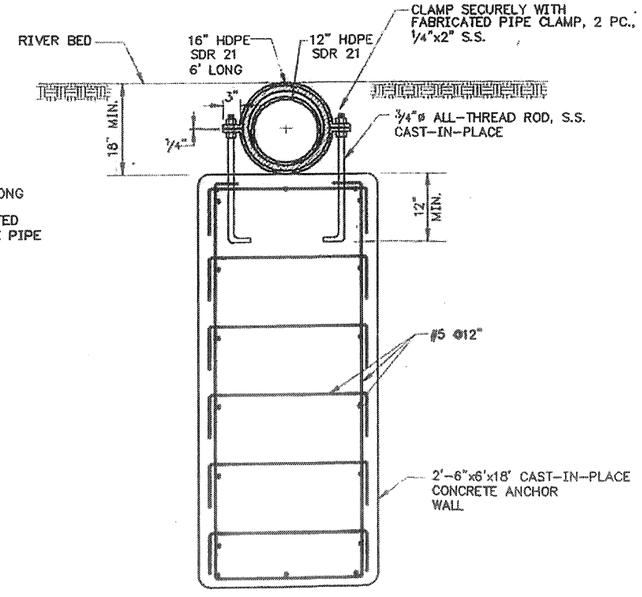
TBM 823-54L
EL 41.26



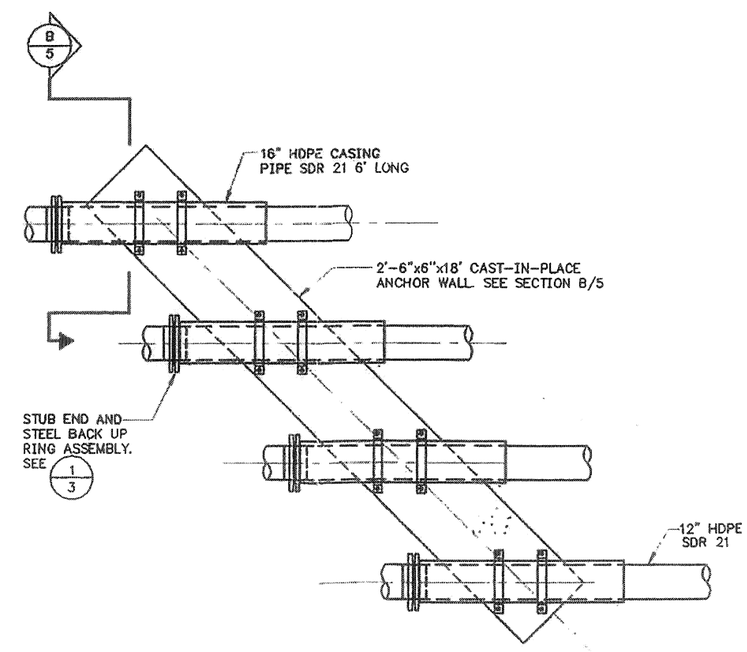
PLAN
SCALE: 1/8"=1'-0"



2/5 HDPE/CORRUGATED PIPE CONNECTION
N.T.S.



B/5 SECTION
SCALE: 1"=1'-0"



1/5 PRECAST CONCRETE ANCHOR WALL
SCALE: 1/2"=1'-0"

REDUCED TO APPROX. HALF SIZE

Date	No.	Description	By
6-6-95		ADDENDUM NO. 2	DN

REVISION

Designed DN
Drawn BF
Checked CHK
Approved
Scale NOTED
Date MAY 1995
Project No. 50515102.310

Barrett Consulting Group
10800 N.E. 8th Street, 7th Floor, Bellevue, WA 98004
206 453-9454 Fax 206 453-9470
Civil / Environmental Engineers
729 S. 333 St. Ste.200, Federal Way, WA 98003, 206 838-6202, Fax 206 874-0577
1200 Dupont St., Ste. 3-B, Bellingham, WA 98225, 206 734-3202, Fax 206 734-0816

CITY OF MONROE
WASTEWATER TREATMENT PLANT
OUTFALL REPLACEMENT

ADDENDUM NO.2 (2)

DWG 5 OF 5

COSMOPOLITAN ENGINEERING GROUP

Appendix B

Ambient Water Quality Data

Civil, Environmental, and Recreational Consulting

Printed on Recycled Paper

Ecology Monitoring Studies 07Cu...

Data qualifiers

code	description
E	Reported result is an estimate.
G	Value is greater than result reported.
J	The analyte was positively identified. The associated numerical result is an estimate.
J?	Converted from older remark codes with various definitions. Result should be considered an estimate.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

date	time	COND (umhos/cm)	FC (#/100ml)	FLOW (CFS)	NH3_N (mg/L)	NO2_NO3 (mg/L)	OP_DIS (mg/L)	OXYGEN (mg/L)	PH (pH)	PRESS (mm/Hg)	SUSSOL (mg/L)	TEMP (deg C)	TP_P (mg/L)	TP_PInLine (mg/L)	TP_P_ICP (mg/L)	TPN (mg/L)	TURB (NTU)	Turb-JTU (JTU)
10/20/2003	11:50	31	73	5557	0.021	0.176	0.0042	10.9	7.11	761.49	9	11			0.0107	0.25	5.5	
11/18/2003	11:00			49143 J														
12/16/2003	11:30	34	5	6254	0.01 U	0.169	0.0032	12.56	7.18	766.32	5	5.2			0.0065	0.23	8.6	
1/27/2004	11:35	33	4	9782	0.01 U	0.229	0.003 U	13.06		765.3	6	4.3			0.0074	0.273	7.4	
2/24/2004	11:35	39	1 U	3860	0.01 U	0.173	0.003 U	12.7	7.27	757.43	1	5.4			0.0034	0.193	2.8	
3/22/2004	10:20	35	1 U	4744	0.01 U	0.113	0.003 U	12.3	7.35	764.29	1 U	7.6			0.0029	0.15	1.9	
4/19/2004	10:45	31	1 U	6311	0.01 U	0.078	0.003 U	11.9	7.46	761.75	17	8			0.0028	0.12	1.3	
5/18/2004	11:20	27	5	6767	0.01 U	0.042	0.003 U	11.7	7.24	761.49	3	9.9			0.0027	0.08	1.7	
6/22/2004	11:10	28	2	5603	0.01 U	0.033	0.003 U	10.6	7.35	758.95	2	13.8			0.0021	0.073	1.6	
7/20/2004	11:25	39	5 J	2158	0.01 U	0.041	0.003 U	11.1	7.54	767.59	2	17.2			0.0019	0.076	0.6	
8/17/2004	10:35	45	12	1367	0.01 U	0.058	0.003 U	9.4	7.46	768.35	2	19			0.003	0.12	1	
9/21/2004	11:25	33	7	5442	0.01 U	0.131	0.003 U	11.11	7.38	771.4	2	11.2			0.0033	0.15	1.5	
10/19/2004	11:05	30	19	9782	0.014	0.132	0.003 U	11.2	7.11	748.76	4	10.1			0.0031	0.18	1.9	
11/16/2004	10:00	36	9 J	5143	0.01 U	0.142	0.003 U	11.7	7.23	770.38	4	7.6			0.0044	0.2	3.1	
12/14/2004	10:25	31	3 J	12366	0.01 U	0.204	0.003 U	12.2	7.16		14	6.3			0.01	0.24	13	
1/25/2005	10:00	27	2	11701	0.01 U	0.132	0.003 U	12.5	7.2	767.08	11	5.4			0.0094	0.15	11	
2/15/2005	10:50	40	2	4185	0.01 U	0.166	0.0037	13.2		776.89	2	3.1			0.0052	0.19	4.1 J	
3/29/2005	10:35	32	10	8132	0.01 U	0.205	0.003 U	12.2	7.19	757.17	7	5.6			0.0069	0.251	7.8	
4/19/2005	9:50	36	4 J	6596	0.01 U	0.187	0.003 U	12	7.24	772.41	4	7.5			0.0047	0.2	2.9	
5/24/2005	10:20	32	4 J	5511	0.01 U	0.07	0.003 U	11.5	7.3	774.19	2	9.7			0.0035	0.094	2.1	
6/14/2005	10:50	35	8	4513	0.01 U	0.067	0.003 U	11.4	7.36	764.79	2	11			0.0022	0.087	1.3	
7/19/2005	11:04	42	40	2589	0.01 U	0.077	0.0042	10.19	7.59	766.32	2	17			0.0025	0.13	1.2	
8/16/2005	10:50	52	33 J	1458	0.01 U	0.076	0.003 U	9.31	7.43	767.59	2	18.7			0.0031	0.13	0.9	
9/20/2005	10:35	47* J	6	1480	0.01 U	0.085	0.003 U	10.19	7.4 J	774.19	3	14.3			0.0042	0.13	1	
10/18/2005	10:25	32	23	5603	0.013	0.139	0.0036	10.8	7.21	767.08	5	11.1			0.0064	0.19	3	
11/15/2005	10:15	32	1 J	9698	0.01 U	0.287	0.0033	12.6	7.14	769.62	4	6.1			0.0046	0.329	2.1	
12/13/2005	11:10	38	8 J	4223	0.01 U	0.191	0.003 U	13.3	7.29	775.97	3	4.3			0.0042	0.22	2.7	
1/24/2006	10:35	34	1	7990	0.01 U	0.246	0.0036	12.8	7.1	767.08	4	4.8			0.0116	0.263	5.4	
2/14/2006	10:20	39	20	4725	0.01 U	0.229	0.0031	13.3	7.21	772.92	2	4.5			0.0034	0.24	2.3	
3/14/2006	10:35	42	1 U	3685	0.01 U	0.237	0.0037	13.1	7.3	758.95	2	5.2			0.0028	0.253	1.6	
4/18/2006	10:25	36	9	5281	0.01 UJ	0.18	0.003 U	12.5	7.25	775.72	3	7			0.0042	0.2	2.7	
5/16/2006	10:00	22	54 J	13733	0.01 UJ	0.07	0.003 U	12.2	7.1	769.62	53	8.2			0.0148	0.1	27	
6/20/2006	11:00	27	3	6966	0.01 U	0.05	0.003 U	11.9	7.15	779.02	3	9.7			0.0027	0.052	2	
7/18/2006	10:25	34	4	3090	0.01 U	0.042	0.003 U	11.1	7.37	774.7	1	14.2			0.0016	0.067	0.6	
8/22/2006	10:15	46	8	1367	0.01 U	0.062	0.003 U	9.5	7.37	774.7	2	17			0.0026	0.094	1.1	
9/19/2006	11:05	46	58	1386	0.01 U	0.078	0.0032	10.4	7.46	772.67	3	13.8			0.0028	0.11	1.2	
10/16/2006	11:55	41	310	3353 J	0.01 U	0.215	0.0035	10.7	7.25	767.33	11	10.6			0.0111	0.308	7.4	
12/18/2006	11:55			8611 J														
1/22/2007	12:15	40	6		0.01 U	0.228	0.0037	13	7.09	774.95	8	4.3			0.0082	0.24	6.9	
2/12/2007	13:30	34	4	6681 J	0.01 U	0.125	0.0031	12.9	7.19	767.59	12	5.7			0.0083	0.14	9.3	
3/19/2007	12:00	25	1		0.01 U	0.099	0.003 U	12.8	7.06	764.03	34	5.6			0.0152	0.12	18	
4/16/2007	11:55	30	1 U	8667 J	0.01 U	0.092	0.003 U	12.6	7.18	768.6	8	6.5			0.0063	0.099	7.2	
5/21/2007	13:50	25	12	9392 J	0.01 U	0.046	0.003 U	12.26	7.28	772.16	11	8.3			0.0092	0.061	6.6	
6/18/2007	12:45	24	16	8303 J	0.01 U	0.044	0.003 U	11.7	7.11	773.68	9	9.1			0.0073	0.073	7.2	
7/23/2007	13:45	33	39	8303 J	0.01 U	0.053	0.003 U	10.5	7.24	768.86	4	15.1			0.0048	0.1	3.7	
8/20/2007	13:15	38 J	12 J	2089 J	0.01 U	0.061	0.003 U	10	7.44	766.57	2	15.2			0.0026	0.098	2.2	
9/24/2007	13:20	46	3	1570 J	0.01 U	0.078	0.003 U	11.18	7.61	774.7	3	12.6			0.0034	0.12	1.3	
10/22/2007	12:10	29	17		0.01 U	0.185	0.0045	11.8	7.15	784.35	15	7.2	0.015			0.25	8.2	
11/26/2007	12:45	37	6		0.01 U	0.17	0.003 U	12.63	7.2	774.19	2	4.5	0.005 U			0.2	1.7	
12/17/2007	12:00	38	10		0.01 U	0.219	0.0042	12.5	7.11	763.78	7	5	0.013			0.24	7.4	
1/28/2008	12:40	45	1 U		0.01 U	0.238	0.0037	13.23	7.11	755.14	2	2.8	0.0054			0.28	2.3	
2/25/2008	12:55	42	2		0.01 U	0.195	0.003	12.95	7.17	770.64	3	5.8	0.0063			0.2	2.1	
3/17/2008	12:45	39	7		0.01 U	0.184	0.0034	13.1	7.15	765.05	5	5.2	0.0069			0.2	3.6	
4/21/2008	11:55	41	2		0.01 U	0.185	0.0033	12.63	7.21	762	5	5.9	0.0079			0.215	3	
5/19/2008	12:00	20	6		0.01 U	0.076	0.003 U	12.7	6.76	755.9	95	6.4	0.084			0.13	65	
6/16/2008	12:50	24	2		0.01 U	0.062	0.003 U	12.1	7.05	760.22	16	8.9	0.013			0.098	7.1	
7/28/2008	12:40	29	1		0.01 U	0.034	0.003 U	11.1	7.5	759.46	4	13.5	0.005 U			0.06	2.1	
8/18/2008	13:40	33	20		0.01 U	0.04	0.003 U	10	7.24	754.89	3	15.7* J	0.0053			0.055	2.5	
9/22/2008	13:00	42	70		0.01 U	0.083	0.003 U	11.1	7.52	764.54	6	12.6* J	0.0084			0.12	2	

COSMOPOLITAN ENGINEERING GROUP

Appendix C

Dynamic Model Spreadsheets
(enclosed CD)

Civil, Environmental,
and Recreational
Consulting

Printed on Recycled Paper

APPENDIX C
DYNAMIC MODEL SPREADSHEETS

Appendix C data can be found on the enclosed CD.

COSMOPOLITAN ENGINEERING GROUP

Appendix D

Sample Calculations for Critical Period

Civil, Environmental, and Recreational Consulting

Printed on Recycled Paper

AMMONIA CRITERIA

INPUT **Annual**

1. Ambient Temperature (deg C; 0<T<30)
2. Ambient pH (6.5<pH<9.0)

OUTPUT - **Annual**

1. Intermediate Calculations:
   - Chronic FT
   - FPH
   - RATIO
   - pKa
   - Fraction Of Total Ammonia Present As Un-ionized

2. Un-ionized Ammonia Criteria
   Acute (1-hour) Un-ionized Ammonia Criterion (ug NH3/L)
   Chronic (4-day) Un-ionized Ammonia Criterion (ug NH3/L)

3. Total Ammonia Criteria:
   Acute Total Ammonia Criterion (mg NH3+ NH4/L)
   Chronic Total Ammonia Criterion (mg NH3+ NH4/L)

4. Total Ammonia Criteria expressed as Nitrogen:
   Acute Ammonia Criterion as mg N
   Chronic Ammonia Criterion as N

METALS CRITERIA

	Acute Hardness	Chronic Hardness	
Hardness =	12.29	10.98	mg/L

		Surface Water Criteria, ug/L			
		Dissolved Criteria		Total Recoverable Criteria	
#	Parameter	Acute	Chronic	Acute	Chronic
1	Arsenic	360	190	360	190
2	Cadmium	0.380331112	0.20040439	0.36864389	0.200116517
3	Chromium (Hex)	15	10	15.2749491	10.3950104
4	Chromium (Tri)	98.5735166	29.1454273	311.941508	33.89003174
5	Copper	2.361021072	1.718321814	2.45939695	1.789918557
6	Iron	---	---	---	---
7	Lead	6.208673695	0.212629869	5.66253142	0.191052379
8	Manganese	---	---	---	---
9	Mercury	2.1	0.012	2.47058824	0.012
10	Nickel	240.2679769	24.24721386	240.749476	24.32017438
11	Selenium	---	---	20	5
12	Silver	0.093747051	---	0.11029065	---
13	Zinc	19.37479272	16.07430092	19.8106265	16.30253643

This spreadsheet calculates the reasonable potential to exceed state water quality standards for a small number of samples. The procedure and calculations are done per the procedure in Technical Support Document for Water Quality-based Toxics Control, U.S. EPA, March, 1991 (EPA/505/2-90-001) on page 56. User input columns are shown with red headings. Corrected formulas in col G and H on 5/98 (GB)

				State Water Quality Standard		Max concentration at edge of...												
	Metal Criteria Translator as decimal	Metal Criteria Translator as decimal	Ambient Concentration (metals as dissolved)	Acute	Chronic	Acute Mixing Zone	Chronic Mixing Zone	LIMIT REQ'D?	Effluent percentile value		Max effluent conc. measured (metals as total recoverable)	Coeff Variation		# of samples	Multiplier	Acute Dil'n Factor	Chronic Dil'n Factor	
Parameter	Acute	Chronic	ug/L	ug/L	ug/L	ug/L	ug/L			Pn	ug/L	CV	s	n				COMMENTS
copper	0.640	0.640	0.9200	2.3610	1.7183	1.82	1.35	NO	0.95	0.975	15.00	0.56	0.52	116	0.85	8.05	16.9	
mercury	0.850	0.850	0.0022	2.100	0.012	0.019	0.010	NO	0.95	0.978	0.20	0.60	0.55	132	0.82	8.05	16.9	
zinc	0.996	0.996	1.4000	19.37	16.07	16.37	8.53	NO	0.95	0.975	140.00	0.46	0.44	116	0.87	8.05	16.9	
ammonia as N			10.0000	15212	2103	426.83	208.55	NO	0.95	0.984	6250.00	1.99	1.27	181	0.54	8.05	16.9	

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Appendix E

Reasonable Potential Analysis Spreadsheets

Civil, Environmental, and Recreational Consulting

Printed on Recycled Paper

COSMOPOLITAN ENGINEERING GROUP
Civil, Environmental, and Recreational Consulting

Job Name: Monroe M.Z. Stud
Job Number: MNR001
By: Fox
Date: 8/7/9

Sheet 1 of 5
Checked
Date

Check calcs for Monroe RIVPLUM modification for 4-port diffuser

Test date 9/16/2006

$Q_e = 2.57$ mgd $= 3.97$ cfs

$q_e = Q_e/4 = 3.97/4 = 0.99$ cfs

$u = 1.10$ fps

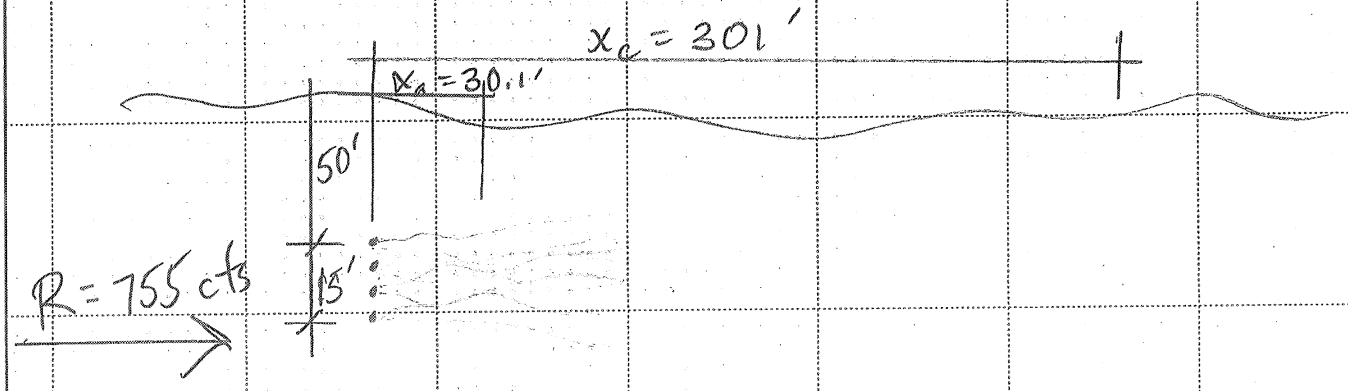
$d = 1.43$ ft

$n = 0.04$

$f = 0.165$

$u_* = 0.158$ fps

$\varepsilon_t = 0.6\, d\, u_* = (0.6)(1.43)(0.158) = 0.136$ ft²/sec



Printed on Recycled Paper

COSMOPOLITAN ENGINEERING GROUP
Civil, Environmental, and Recreational Consulting

Job Name _____ Sheet 2 of 5
Job Number _____ Checked _____
By _____ Date _____ Date _____

Fischer equation 5.7:

$$C = \frac{\dot{M}}{u d \sqrt{4\pi \varepsilon_t (x/u)}} \exp - \left\{ y^2 u / 4 \varepsilon_t x \right\}$$

for each port, set $\dot{m} = q_e C_e$ (C_e = eff conc)

let effluent volumetric fraction $f = \frac{C}{C_e}$

$$f = \frac{C}{C_e} = \frac{q_e}{u d \sqrt{4\pi \varepsilon_t \frac{x}{u}}} \exp - \left\{ \frac{y^2 u}{4 \varepsilon_t x} \right\}$$

<u>Acute M.Z. boundary, diffuser midpoint</u>

$x = 30.1'$

$y_1 = -7.5'$

$y_2 = -2.5'$

$y_3 = +2.5'$

$y_4 = +7.5'$

$$\frac{q_e}{u d \sqrt{4\pi \varepsilon_t \frac{x}{u}}} = \frac{0.99}{(1.10)(1.43)\sqrt{4\pi\, 0.136\, (30.1/1.1)}}$$

$$= \underline{\underline{0.092}}$$

COSMOPOLITAN ENGINEERING GROUP
Civil, Environmental, and Recreational Consulting

Job Name _____ Sheet 3 of 5
Job Number _____ Checked _____
By _____ Date _____ Date _____

Midpoint Diffuser

y	$\left\{\frac{y^2 u}{4\varepsilon_t x}\right\}$	$\exp - \{\ \}$
-7.5	3.78	0.023
-2.5	0.42	0.657
+2.5	0.42	0.657
+7.5	3.78	0.023
	$\Sigma =$	1.36

check @ ℄ port 2

y	$\frac{y^2 u}{4\varepsilon_t x}$	$\exp - \{\ \}$
-5	1.68	0.187
0	0	1.000
+5	1.68	0.187
+10	6.72	0.001
	$\Sigma =$	1.375

Close enough

COSMOPOLITAN ENGINEERING GROUP
Civil, Environmental, and Recreational Consulting

Job Name _____ Sheet 4 of 5
Job Number _____ Checked _____
By _____ Date _____ Date _____

Vol. fraction @ Acute M.Z.

$f = (0.092)(1.36) = 0.125$

Acute Dilution (S_a)

$S_a = \frac{1}{f} = \underline{\underline{8.0}}$

Chronic M.Z. $x = 301'$

$x = 301'$

$$\frac{q_e}{u d \sqrt{4\pi \varepsilon_t \frac{x}{u}}} = \frac{0.99}{(1.10)(1.43)\sqrt{4\pi\ 0.136\ (301/1.10)}}$$

$= \underline{\underline{0.029}}$

@ midpt diffuser

y	$\left\{\frac{y^2 u}{4 \varepsilon_t x}\right\}$	$\exp -\{\ \}$
-7.5	0.378	0.685
-2.5	0.042	0.959
+2.5	0.042	0.959
+7.5	0.378	0.685

$\Sigma = \underline{\underline{3.29}}$

COSMOPOLITAN ENGINEERING GROUP
Civil, Environmental, and Recreational Consulting

Job Name _____ Sheet 5 of 5
Job Number _____ Checked _____
By _____ Date _____ Date _____

Vol. fraction @ Chronic M.Z.

$$f = (0.029)(3.29) = 0.095$$

$$S_c = \frac{1}{f} = \underline{\underline{10.5}}$$

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Assisting clients and communities
in the preservation and enhancement
of the physical environment in which we live.

Appendix F

Opinion of Probable Construction Costs for pH and Filament Control

OPINION OF PROBABLE CONSTRUCTION COST

Client: City of Monroe

Project: Monroe WWTP Capital Improvement Plan - pH and Filament Control

Estimate Type:
- [x] Conceptual
- [ ] Preliminary (w/o plans)
- [ ] Design Development
- [ ] Construction
- [ ] Change Order

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19
Project Number: 1997002*00

Months to Midpoint of Construct 12

Project Element		1	2	3	4	5	6	Total
Description of Improvements		**RAS Chlorination Improvements**	**Upgrade Magnesium Hydroxide Feed**	**Install Backup Sodium Hydroxide Feed**	**Aeration Basin Optimization**	**Surface Wasting System**	**Mixed Liquor Return Optimization**	
Base Cost		$52,563	$103,125	$104,594	$135,350	$157,863	$122,309	**$675,803**
Division 1 Costs @	10%	$5,256	$10,313	$10,459	$13,535	$15,786	$12,231	$67,580
Subtotals		$57,819	$113,438	$115,053	$148,885	$173,649	$134,540	$743,383
Bonds & Insurance @	2.25%	$1,301	$2,552	$2,589	$3,350	$3,907	$3,027	$16,726
Subtotals		$59,120	$115,990	$117,642	$152,235	$177,556	$137,567	$760,110
Contractor OH&P @	15%	$8,868	$17,398	$17,646	$22,835	$26,633	$20,635	$114,016
Subtotals		$67,988	$133,388	$135,288	$175,070	$204,189	$158,203	$874,126
Estimate Contingency @	30.0%	$20,396	$40,016	$40,586	$52,521	$61,257	$47,461	$262,238
Subtotal		$88,384	$173,405	$175,875	$227,591	$265,446	$205,663	$1,136,364
Escalate to Midpt. of Const. Per year @	3.5%	$3,093	$6,069	$6,156	$7,966	$9,291	$7,198	$39,773
Subtotal at Midpt. Of Const.		$91,477	$179,474	$182,030	$235,557	$274,737	$212,862	$1,176,137
Sales Tax	9.3%	$8,507	$16,691	$16,929	$21,907	$25,551	$19,796	$109,381
Estimated Bid Price (Rounded to 1K, 2019 Dollars)		$100,000	$196,000	$199,000	$257,000	$300,000	$233,000	**$1,285,000**
Eng Design + Bid Support + ESDC @	15.0%	$15,000	$29,400	$29,850	$38,550	$45,000	$34,950	$192,750
Construction Mgmt @	10.0%	$10,000	$19,600	$19,900	$25,700	$30,000	$23,300	$128,500
Legal/Admin Costs @	2.0%	$2,000	$3,920	$3,980	$5,140	$6,000	$4,660	$25,700
Owner's Contingency @	10.0%	$10,000	$19,600	$19,900	$25,700	$30,000	$23,300	$128,500
County Permits/Inspections/Agency Reviev	1.0%	$1,000	$1,960	$1,990	$2,570	$3,000	$2,330	$12,850
Estimated Project Price (Rounded to 10K, 2020 Dollars)		$140,000	$270,000	$270,000	$350,000	$410,000	$320,000	**$1,760,000**

Escalate to Year: **2021**
Months to Midpoint of Construct **24**

Escalation Table		1	2	3	4	5	6	Total
Description of Improvements		**RAS Chlorination Improvements**	**Upgrade Magnesium Hydroxide Feed**	**Install Backup Sodium Hydroxide Feed**	**Aeration Basin Optimization**	**Surface Wasting System**	**Mixed Liquor Return Optimization**	
Subtotal (from table above)		$88,384	$173,405	$175,875	$227,591	$265,446	$205,663	$1,136,364
Escalate to Midpt. of Const. Per year @	3.5%	$6,187	$12,138	$12,311	$15,931	$18,581	$14,396	$79,545
Subtotal at Midpt. Of Const.		$94,571	$185,543	$188,186	$243,523	$284,027	$220,060	$1,215,909
Sales Tax	9.3%	$8,795	$17,256	$17,501	$22,648	$26,415	$20,466	$113,080
Estimated Bid Price (Rounded to 1K)		$103,000	$203,000	$206,000	$266,000	$310,000	$241,000	**$1,329,000**
Eng Design + Bid Support + ESDC @	15.0%	$15,450	$30,450	$30,900	$39,900	$46,500	$36,150	$199,350
Construction Mgmt @	10.0%	$10,300	$20,300	$20,600	$26,600	$31,000	$24,100	$132,900
Legal/Admin Costs @	2.0%	$2,060	$4,060	$4,120	$5,320	$6,200	$4,820	$26,580
Owner's Contingency @	10.0%	$10,300	$20,300	$20,600	$26,600	$31,000	$24,100	$132,900
County Permits/Inspections/Agency Reviev	1.0%	$1,030	$2,030	$2,060	$2,660	$3,100	$2,410	$13,290
Estimated Project Price (Rounded to 10K)		$140,000	$280,000	$280,000	$370,000	$430,000	$330,000	**$1,830,000**

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: RAS Chlorination Improvements

Building, Area: Shop / Storage Room

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19

Project Number: 1997002*00

Estimate Type:

X **Conceptual**
Preliminary (w/o plans)
Design Development @

Construction
Change Order
% Complete

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
1	**Sodium Hypochlorite Tote System**					
	Add Secondary Containment	1	LS	$ 6,000.00	$ 6,000	
2	**Sodium Hypochlorite Feed System**				$ -	
	Metering Pump Skid Assembly	1	LS	$ 15,000.00	$ 15,000	
	Chemical Pipe/Tubing	1	LS	$ 6,000.00	$ 6,000	
	Add Taps to Existing Piping for Injection	3	EA	$ 500.00	$ 1,500	
3	Installation (50%)	1	LS	$ 13,750.00	$ 13,750	
4	Electrical / I&C (25%)	1	LS	$ 10,312.50	$ 10,313	
	Additional O&M Cost Items:					
	Purchase Totes	12	EA	600		7,200
	Swap Totes	12	hrs/yr	80		960
	Subtotals				52,563	8,160

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: Upgrade Magnesium Hydroxide Feed

Prepared By: AS
Reviewed By: JH

Building, Area: Field - Near Primary Clarifiers

Date Prepared: 19-Sep-19
Project Number: 1997002*00

Estimate Type: X **Conceptual** **Preliminary (w/o plans)** **Design Development @** **Construction** **Change Order** **% Complete**

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
	Capital Cost Items					
1	**Magnesium Hydroxide Storage System**					
	Demolition of Existing System	1	LS	$ 5,000.00	$ 5,000	
	Storage Tank	1	EA	$ 10,000.00	$ 10,000	
	Secondary Containment (Integral to Tank or Containment Area)	1	LS	$ 6,000.00	$ 6,000	
	Tank Equipment Pad	1	LS	$ 5,000.00	$ 5,000	
	Tank Mixing and Heating System	1	LS	$ 8,000.00	$ 8,000	
2	**Chemical Metering Assembly**				$ -	
	Metering Pump Assembly	1	EA	$ 15,000.00	$ 15,000	
	Chemical Tubing (to PE Channel)	20	LF	$ 50.00	$ 1,000	
	Heat Trace and Insulation	20	LF	$ 250.00	$ 5,000	
					$ -	
3	Installation (50%)	1	LS	$ 27,500.00	$ 27,500	
4	Electrical / I&C (25%)	1	LS	$ 20,625.00	$ 20,625	
	Additional O&M Cost Items:					
	CHEMICAL USAGE		Gal	$ 2.5		$ -
	Subtotals				$ 103,125	$ -

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: Install Backup Sodium Hydroxide Feed

Building, Area: Odor Control Room, Solids Dewatering Room

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19
Project Number: 1997002*00

Estimate Type:

X **Conceptual**
Preliminary (w/o plans)
Design Development @

Construction
Change Order
% Complete

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
	Capital Cost Items					
1	1" NaOH Yard Piping (Double Contained thru existing site paved areas)	240	LF	$ 205	$ 49,200	
2	1" NaOH Interior Piping	50	LF	$ 25	$ 1,250	
3	Install 3,000 gal NaOH Storage Tank (Double Walled)	1	EA	$ 8,000	$ 8,000	
4	NaOH Piping Installation (50%)	1	LS	$ 25,225	$ 25,225	
5	Electrical / I&C (25%)	1	LS	$ 20,919	$ 20,919	
	Additional O&M Cost Items:					
	Chemical Use	2,400	Gal	$ 2		$ 3,600
	Subtotals				$ 104,594	$ 3,600

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: Baffling of Aeration Basins

Building, Area: Aeration Basins

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19
Project Number: 1997002*00

Estimate Type:

X **Conceptual**
Preliminary (w/o plans)
Design Development @

Construction
Change Order
% Complete

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
	Capital Cost Items					
1	Fiberglass baffles and supports for Exist. Aeration Basins	2,224	SF	$ 30	$ 66,720	
2	Install Weir Plates In Existing Effluent Openings	4	EA	$ 200	$ 800	
3	Cut New Effluent Wall Openings	4	EA	$ 1,500	$ 6,000	
4	Relocate Existing DO Sensors	2	EA	$ 500	$ 1,000	
5	Installation (50%)	1	LS	$ 33,760	$ 33,760	
6	Electrical / I&C (25%)	1	LS	$ 27,070	$ 27,070	
	Additional O&M Cost Items:					
	Maintenance Actuated Valves / Clean Vault	8	hrs/yr	80		640
	Subtotals				$ 135,350	640

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: Construct Surface Wasting System

Building, Area: Field, Mixed Liquor Channel, WAS Pump Station

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19
Project Number: 1997002*00

Estimate Type:

X **Conceptual**
Preliminary (w/o plans)
Design Development @

Construction
Change Order
% Complete

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
	Capital Cost Items					
1	Excavation and Haul	15	CY	$ 44	$ 660	
2	Excavation Shoring	480	VSF	$ 30	$ 14,400	
3	Concrete Scum Box	10	CY	$ 1,000	$ 10,000	
4	Surface Sprays	4	EA	$ 2,000	$ 8,000	
5	Water Piping (2")	112	LF	$ 150	$ 16,800	
6	Scum Piping (8")	170	LF	$ 100	$ 17,000	
7	Actuated Weir Gate	1	LS	$ 15,000	$ 15,000	
8	Ultrasonic Level Sensor	1	LS	$ 3,500	$ 3,500	
8	Installation (50%)	1	LS	$ 40,930	$ 40,930	
9	Electrical / I&C (25%)	1	LS	$ 31,573	$ 31,573	
	Additional O&M Cost Items:					
	Maintenance Actuated Valves / Clean Vault	8	hrs/yr	80		640
	Subtotals				$ 157,863	640

OPINION OF PROBABLE CONSTRUCTION COST

Project Element: MLR Optimization

Building, Area: Field, Near Aeration Basins

Estimate Type: X **Conceptual** / **Preliminary (w/o plans)** / **Design Development @** / **Construction** / **Change Order** / **% Complete**

Prepared By: AS
Reviewed By: JH
Date Prepared: 19-Sep-19
Project Number: 1997002*00

Item No.	Description	Qty	Units	$/Unit	Capital Cost	Additional O&M Cost ($/year)
	Capital Cost Items				$ -	
1	Channel-Mounted Nitrate Sensor and Mounting System	2	EA	$ 3,000	$ 6,000	
	MLR Flow Meter					
2	Excavation (Hand or Vactor Excavation)	185	BCY	$ 45	$ 8,325	
3	Shoring	528	VSF	$ 30	$ 15,840	
3	Haul	20	BCY	$ 45	$ 900	
4	Concrete Vault (8L'X6W'X10'D)	1	LS	$ 10,000	$ 10,000	
5	Vault Access Hatches	1	LS	$ 2,500	$ 2,500	
6	24" Flow Meter	1	EA	$ 15,000	$ 15,000	
7	Vault Connection Piping	2	EA	$ 2,500	$ 5,000	
8	24" Flex Cplg (connect to Existing Piping)	2	EA	$ 2,000	$ 4,000	
9	Pipe Supports	2	EA	$ 500	$ 1,000	
7	Installation (50%)	1	LS	$ 29,283	$ 29,283	
8	Electrical / I&C (25%)	1	LA	$ 24,462	$ 24,462	
	Additional O&M Cost Items:					
	Clean Sensors, Maintenance Flow Meter	12	hrs/yr	$ 80		$ 960
	Subtotals				$ 122,309	$ 960