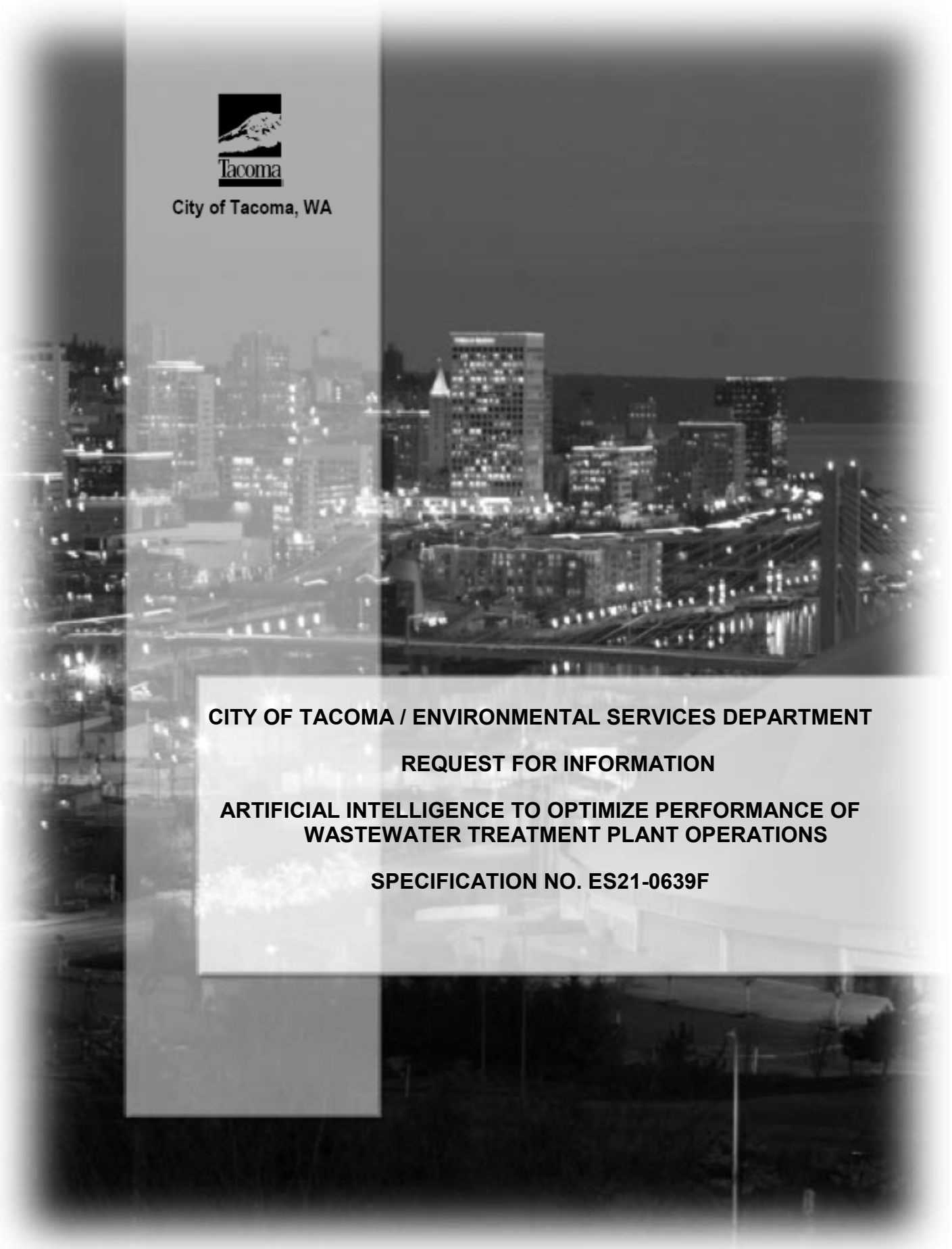


City of Tacoma, WA

# CITY OF TACOMA / ENVIRONMENTAL SERVICES DEPARTMENT

## REQUEST FOR INFORMATION

## ARTIFICIAL INTELLIGENCE TO OPTIMIZE PERFORMANCE OF WASTEWATER TREATMENT PLANT OPERATIONS

## SPECIFICATION NO. ES21-0639F

**City of Tacoma**
**Environmental Services Department**

# REQUEST FOR INFORMATION ES21-0639F
# Artificial Intelligence to Optimize Performance of Wastewater Treatment Plant Operations

**Submittal Deadline: 11:00 a.m., Pacific Time, Tuesday, January 18, 2022**

Submittals must be received by the City's Procurement and Payables Division prior to 11:00 a.m. Pacific Time. For electronic submittals, the City of Tacoma will designate the time of receipt recorded by our email, bids@cityoftacoma.org, as the official time of receipt. This clock will be used as the official time of receipt of all parts of electronic bid submittals.

**Submittal Delivery:** Sealed submittals will be received as follows:

**By Email:**
bids@cityoftacoma.org
Maximum file size: 35 MB. Multiple emails may be sent for each submittal.

**Bid Opening:** Held virtually each Tuesday at 11AM. Attend via this link or call 1 (253) 215 8782. Submittals in response to a RFI will be recorded as received. As soon as possible, after 1:00 PM, on the day of submittal deadline, preliminary results will be posted to www.TacomaPurchasing.org.

**Solicitation Documents:** An electronic copy of the complete solicitation documents may be viewed and obtained by accessing the City of Tacoma Purchasing website at www.TacomaPurchasing.org.

- Register for the Bid Holders List to receive notices of addenda, questions and answers and related updates.
- Click here to see a list of vendors registered for this solicitation.

**Pre-Proposal Meeting:** A pre-proposal meeting will not be held.

**Project Scope:** The City is issuing this Request for Information (RFI) to determine the feasibility of utilizing artificial intelligence (AI) to integrate with existing plant processes and control systems to reduce O & M costs and better manage treatment process effectiveness.

**Estimate:** $300,000

**Paid Sick Leave:** The City of Tacoma requires all employers to provide paid sick leave as set forth in Title 18 of the Tacoma Municipal Code. For more information, visit our Minimum Employment Standards Paid Sick Leave webpage.

**Americans with Disabilities Act (ADA Information:** The City of Tacoma, in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs and activities. Specification materials can be made available in an alternate format by emailing Gail Himes at ghimes@cityoftacoma.org, or by calling her collect at 253-591-5785.

**Title VI Information:**
"The City of Tacoma" in accordance with provisions of Title VI of the Civil Rights Act of 1964, (78 Stat. 252, 42 U.S.C. sections 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration of award.

**Additional Information:** Requests for information regarding the specifications may be obtained by contacting Dawn DeJarlais, Sr.Buyer by email to ddejarlais@cityoftacoma.org

**Protest Policy:** City of Tacoma protest policy, located at www.tacomapurchasing.org, specifies procedures for protests submitted prior to and after submittal deadline.

**Meeting sites are accessible to persons with disabilities. Reasonable accommodations for persons with disabilities can be arranged with 48 hours advance notice by calling 253-502-8468.**

# Table of Contents

**SUBMITTAL CHECK LIST**

This checklist identifies items to be included with your submittal. Any submittal received without these required items may be deemed non-responsive and not be considered for award. Submittals must be received by the City of Tacoma Purchasing Division by the date and time specified in the Request for Information page.

| **The following items make up your submittal package:** | ☑ |
|---|---|
| Letter of Interest | |
| Literature to include technical specifications, safety data information, warranty, brochures | |
| Technical specification sheets | |
| Responses to questions in Section 8 (8.1 - 8.9) | |

## 1. INTRODUCTION

The City of Tacoma (City) / Environmental Services Department is soliciting responses to a Request for Information (RFI) from firms experienced in, and capable of, providing software applications that use artificial intelligence (AI) to optimize performance of the wastewater treatment process at two City of Tacoma treatment plants. The RFI is intended to be the first step in the process of a Request for Proposal (RFP) that will be issued at a later date. At the conclusion of the RFP process, the City will negotiate a contract with the successful proposer.

## 2. BACKGROUND

The City of Tacoma operates two wastewater treatment plants and the SCADA system for 50 pump stations. The plant control system was recently updated to a Rockwell Automation PlantPAx Distributed Control System. The system communicates with Allen-Bradley PLCs dedicated to specific areas throughout the treatment plants which are connected to hundreds of devices and instrumentation. Rockwell FactoryTalk is utilized to support operator controls, alarm and event notifications. Historical data is archived with FactoryTalk Historian. Reports and trends of the historical information is displayed utilizing FactoryTalk VantagePoint, while change management is addressed through FactoryTalk AssetCentre.

The plant control system operates on a private network that consists of 45 Windows servers and network time server, 60 network switches, one domains, 13 workstations and 32 thin clients. The control system has its own Microsoft domain separate from the corporate IT network. Dual firewalls isolate the two systems from each other.

Additional information about the City of Tacoma's wastewater treatment plants can be found in Appendix A under Attachments and the following link.

## 3. PURPOSE

The City is issuing this Request for Information (RFI) to determine th15e feasibility of utilizing artificial intelligence (AI) to integrate with existing plant processes and control systems to reduce O & M costs and better manage treatment process effectiveness. The software application shall be capable of the following:

- Detect real time changes in effluent and propose adjustments to improve effluent water quality.
- Propose operational adjustments to reduce operating costs (i.e., reductions in energy or chemical usage).
- Ensure wastewater treatment remains within permit compliance.
- Able to integrate with existing control systems.

## 4. CALENDAR OF EVENTS

This is a tentative schedule only and may be altered at the sole discretion of the City.

The anticipated schedule of events concerning this RFI is as follows:

| | |
|---|---|
| Question Deadline: | **12/29/2021** |
| Questions and Answers Posted: | **1/7/2022** |
| Submittal Due Date: | **1/18/2022** |

## 5. INQUIRIES

Please submit questions in writing to Dawn DeJarlais via email to ddejarlais@cityoftacoma.org
Make subject line read:

ES21-0639F – Artificial Intelligence to optimize performance of Wastewater treatment plant Operations – *VENDOR NAME*

Please note:

- Questions marked confidential will not be answered or included.
- The City reserves the discretion to group similar questions to provide a single answer
- The City reserves the right to not answer all questions submitted.
- The answers are not typically considered an addendum.
- The City will not be responsible for unsuccessful submittal of questions.
- Written answers to questions will be posted approximately one week after the question deadline.

## 6. DISCLAIMER

Please note that this Request for Information is not a Request for Bids (RFB) or a Request for Proposals (RFP), and there is no guarantee that either a RFB or RFP will be issued. A Respondent's decision to respond, or not to respond, to this RFI will NOT be a factor in the evaluation process in a future RFB or RFP.

While the intent of this RFI is to help identify vendors who meet various requirements for a competitive solicitation, there is no guarantee that any specific information presented by any Respondent will ultimately be included in any future solicitation issued by the City.

Each Respondent shall bear all expenses incurred by the preparation and presentation of its RFI response. The City will therefore reject any claim made against them in this matter, regardless of the results of the subsequent processes, if any.

## 7. QUALIFYING REQUIREMENTS

- **Step 1 (current step):** The City will review and evaluate the information from the RFI based on the contents to be submitted outlined. If the City determines to move forward with the process of potentially implementing the software application, then it will move to Step 2.
- **Step 2:** The City will release a Request for Proposal (RFP).
- **Step 3:** The City will review the results, evaluate the proposals using specified evaluation criteria, and develop a ranking, then select the highest ranked proposer(s).

Firm must be a legal entity with a Washington State Business License and must have experience providing software applications that use artificial intelligence (AI) to optimize performance of the wastewater treatment process.

## 8. CONTENT TO BE SUBMITTED

Submittals should present information in a straightforward and concise manner, while ensuring complete and detailed descriptions of the respondent's/team's abilities to meet the requirement of this RFI. Emphasis will be on completeness of content. Organization of the submittal shall follow the sequence of contents below so that essential information can be located easily during review.

If reference is made to supporting literature or documentation included with your submittal, direct the reader using specific reference to the document that address the topic, including document name, section and page number.

1. Cover letter of interest
    a. Company's Name
    b. Years of experience developing and implementing AI based software applications
    c. Your company's ability to proceed beyond the RFI process
    d. Company's point of contact and contact information

2. General Overview Information

a. Information about your company
    i. Years in business
    ii. Areas of focus and how long
    iii. Staffing Levels and Roles
    iv. Leadership
b. Description of the products and services your company provides.
c. References from other facilities that implemented the application for wastewater treatment plants.
    i. Contact Information
    ii. Date of implementation

3. Information Specific to City of Tacoma Wastewater Treatment Plants
    a. Detailed description of the products your company would recommend for COT wastewater treatment plants.
    b. Description of the AI system used in the application
    c. Type and amount of data required to develop/train the AI system specifically for the COT wastewater treatment plants.
    d. Describe how the operator interfaces with the system
    e. Describe what elements of the application would have to be customized to facilitate the COT wastewater treatment plants.

4. Interface with City Data and Plant Network
    a. Would the system be cloud based or on premise. If the proposed solution is cloud-based, include a specific example of implementation at another city/public utility. Cloud based services require cyber insurance.
    b. Describe how the system would interface with City's corporate and/or private network
    c. Describe how the system would interface with City data
    d. What cybersecurity measures would be taken and measures needed to meet security requirements

5. Implementation and Development Process
    a. Indicate whether your firm is able to provide the City with a demonstration via a webinar. The purpose of the demonstration is to discuss capabilities with the intent of assisting the City in finalizing elements for a potential RFP.
    b. Describe the process your company would use to develop and implement the application for the COT wastewater treatment plants, including the following:
        i. Anticipated timeline for each phase
        ii. Level of City staff involvement for each phase
        iii. Key activities to be performed by the City
    c. Describe the process used at other wastewater treatment plants of similar size. Including the following:

        i. Timeline planned vs actual
        ii. Keys to the success of the implementation
        iii. Lessons learned from the implementation
    d. Provide information about development services if customizations to the product are necessary.
    e. Provide a detailed description of manufacturer's experience accommodating various types of reporting activities.

6. License and Fee Structure
    a. Describe the license or fee structure that would be proposed for the development and implementation of the application
        i. Would each plant have its own license or fee structure
    b. Describe the long-term maintenance costs/fees for the application

7. Maintenance and Future Change
    a. Describe how the system would be maintained and updated to reflect changes at the treatment plants.
        i. What level of involvement would be required by City staff
    b. Provide a detailed description of manufacturer's long-term involvement on maintenance and software updates

8. Return on Investment
    a. Describe the anticipated return on investment for the City. Provide information specific to the COT wastewater treatment plants as possible.

9. Project Team
    a. Project manager and direct contact information

## 9. PRICING INFORMATION

Please provide as much general information as possible about your firm's fee structure. During the course and performance of the testing and demo phase, Supplier will provide proof and maintain the insurance coverage in the amounts and in the manner specified in the City of Tacoma Insurance Requirements document applicable to the services, products, and deliverables provided under the possible future RFP. The City of Tacoma Insurance Requirements document will be fully incorporated into the RFP.

## 10. ENVIRONMENTALLY PREFERABLE PROCUREMENT

In accordance with the City of Tacoma's Sustainable Procurement Policy, it is the policy of the City of Tacoma to encourage the use of products or services that help to minimize the environmental and human health impacts of City Operations. Respondents are encouraged to incorporate environmentally preferable products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, products, manufacturing, packaging, distribution reuse, operation, maintenance or disposal of the product or service.

The City of Tacoma encourages the use of sustainability practices and desires any awarded contractor(s) to assist in efforts to address such factors when feasible for:

- Reduction of pollutant releases
- Toxicity of materials used
- Waste generation
- Greenhouse gas emissions, including transportation of materials and services
- Recycle content
- Comprehensive energy conservation measures
- Waste manage reduction plans
- Potential impact on human health and the environment

## 11. EQUITY IN CONTRACTING

The City of Tacoma is committed to encouraging firms certified through the Washington State Office of Minority and Women's Business Enterprise to participate in City contracting opportunities. See the **TMC 1.07 Equity in Contracting Policy** at the City's Equity in Contracting Program website.

## 12. PROPRIETARY OR CONFIDENTIAL INFORMATION

The Washington State Public Disclosure Act (RCW 42.56 et seq.) requires public agencies in Washington make public records available for inspection and copying unless they fall within the specified exemptions contained in the Act, or are otherwise privileged. Documents submitted under this RFI shall be considered public records and, with limited exceptions, will be made available for inspection and copying by the public.

Information that is confidential or proprietary must be clearly marked. Further, an index must be provided indicating the affected page number(s) and location(s) of all such identified material. Information not included in said index will not be reviewed for confidentiality or as proprietary before release.

## 13. ADDENDUMS

In the event it becomes necessary to revise any part of this RFI, an addendum will be issued through the event in Ariba.

## APPENDIX A

Central Treatment Plant Information

North End Treatment Plant Information

## What makes the Central Treatment Plant unique?

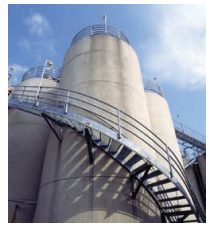
### Peak Wet Weather Flow Treatment Facility

Heavy rains can increase the flow of wastewater to the Central Treatment Plant by as much as six times the amount seen during dry weather. Tacoma's wastewater and surface water are conveyed separately (surface water is untreated and discharges directly to Commencement Bay); however, some groundwater and surface water finds its way into the wastewater system through cracks or leaking joints in the City-owned portion of the system. It also enters through leaks in privately owned side sewers (pipes that connect homes and businesses to the City's sewer pipes) and from roof drains, foundation drains or sump pumps improperly connected to the wastewater system.

In addition to an ongoing, active inflow and infiltration elimination program that works to eliminate these leaks in the sewer system, the City constructed the Peak Wet Weather Flow Treatment Facility to increase the plant's capacity and avoid overflows of untreated and partially treated wastewater in all but the most extreme storms. The innovative and cost-effective Peak Wet Weather Flow Treatment Facility consists of a ballasted sedimentation process which uses coagulant, polymer and microsand to achieve accelerated settling of suspended solids in a small treatment footprint. This technology is currently in use at a handful of wastewater treatment plants in the United States.

### High purity oxygen system

The Central Treatment Plant uses a pressure swing adsorption system to generate oxygen gas of greater than 90 percent purity. The high-purity oxygen is used in the first phase of the dual digestion system and in the oxygenation tanks. The use of high-purity oxygen enables the plant to treat higher flows and loadings in a smaller footprint than would be required otherwise.



### Dual digestion system

The Central Treatment Plant is the only treatment plant in Washington state, and one of a handful in the United States, that uses a dual digestion system to treat its biosolids. The dual digestion system, part of the 1988 plant upgrade, includes two very different types of digesters:

Step 1 – Aerobic digesters operate in an aerobic thermophilic (high temperature) environment maintained by high-purity oxygen. Heat generated by bacteria in the first stage aerobic digesters begins the digestion process. The elevated temperature achieved in the aerobic digesters, maintained over a number of hours, kills pathogenic organisms. This also conditions the sludge, making it easier to anaerobically digest.

Step 2 – Temperature-phased anaerobic digestion is the second step. Three anaerobic digesters are used, beginning with a thermophilic stage and ending in a lower-temperature mesophilic stage. The thermophilic stage of anaerobic digestion produces methane gas and destroys any remaining pathogens. The mesophilic stage of anaerobic digestion gradually cools the solids, cultivating microorganisms that produce fewer odors, resulting in a more stable, better smelling end product. The end product, called biosolids, has a high nutrient value and is prized as a soil conditioner.

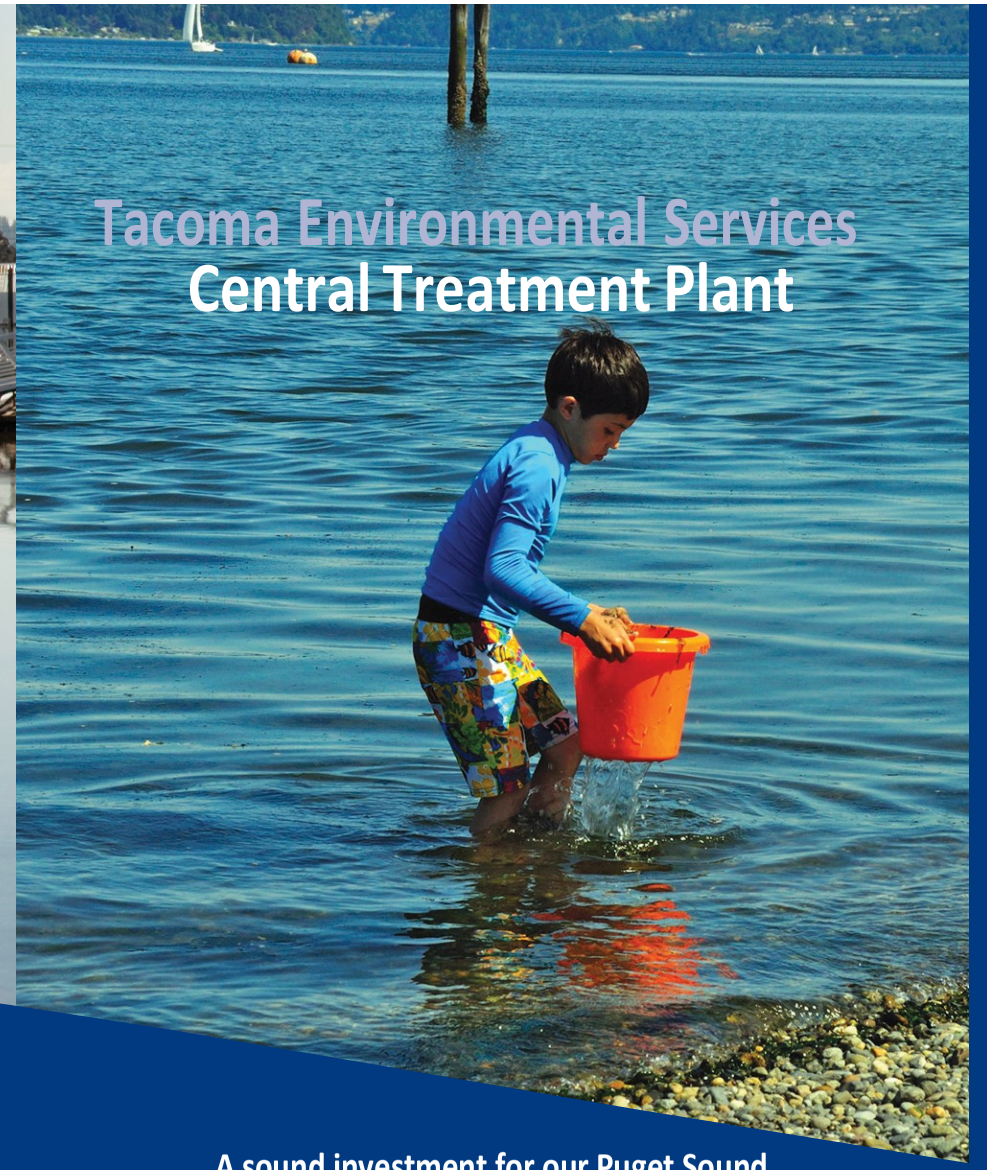
### Biosolids management

Tacoma has recycled all of its biosolids since the first treatment plant was built in 1952. Tacoma began producing a lawn and garden soil amendment called TAGRO in 1991. TAGRO consistently earns the highest safety rating from the U.S. Environmental Protection Agency, "Class A-Exceptional Quality."

Approximately 80 percent of Tacoma's biosolids are recycled as TAGRO's flagship products, TAGRO Mix and TAGRO Potting Soil, which are made of a blend of biosolids, sawdust and other high-quality gardening elements. These products are popular throughout the Puget Sound region. Pierce County agricultural sites account for the remaining 20 percent, primarily in the form of TAGRO Liquid and TAGRO Agricultural Mix. TAGRO staff also has the ability to make special mixes for designer soil applications.

**Together, the City, its citizens and businesses are making great progress in protecting Puget Sound.**

Tacoma
Public Works
Environmental Services
Wastewater Management



# Tacoma Environmental Services
# Central Treatment Plant

**A sound investment for our Puget Sound**

Public Works • Environmental Services • Wastewater Management

**Helping to protect and preserve the Northwest**

## Welcome

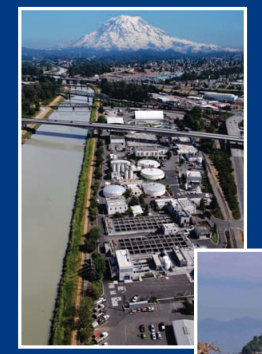
Located along the shores of Commencement Bay and The Narrows waterway, Tacoma's relationship with the water is an important one. Home to one of the world's most active ports, Tacoma's waterways are also a venue for a vast number of recreational activities such as sailing, swimming, scuba diving, kayaking, and combing the beaches for crabs, shells and starfish. The Central Treatment Plant uses some of the most technologically innovative solutions in the country to protect and preserve the quality of life Tacoma enjoys.

### The Central Treatment Plant:

- Began treating wastewater in 1952 as a primary treatment facility.
- Underwent significant expansion of primary treatment facilities in 1979 and was upgraded to a secondary treatment facility in 1988. The most recent plant upgrade, in 2009, included construction of the Peak Wet Weather Flow Treatment Facility. Other improvements included the addition of a new screening facility, a new grit removal facility and new influent and effluent pump stations.
- Handles most of the wastewater flow in the Tacoma area, including the industrialized tidelfats; south, central and northeast Tacoma; and Fircrest, Fife, Milton and some bordering areas in Pierce County and Federal Way. Wastewater from the north end of Tacoma and Town of Ruston is treated at the North End Treatment Plant.
- Has a permitted peak hydraulic capacity of 150 gallons per day.
- Discharges treated wastewater, known as effluent, to Commencement Bay through a dedicated deep-water marine outfall.

### Getting the wastewater to our treatment plants

- **700 miles of wastewater sewer pipes** collect wastewater and bring it to our treatment plants. These pipes range from 4 to 72 inches in diameter. The oldest are more than 120 years old.
- **48 pump stations**, with capacities up to 20 million gallons per day, convey the wastewater to the treatment plants.



**CONTACT**
Wastewater Management
2201 Portland Ave.
Tacoma, WA 98421
(253) 591-5595
www.cityoftacoma.org/wastewater

## Wastewater flow & characteristics

| | |
|---|---|
| **Plant flow** | |
| Average flow for maximum month, MGD | 60 |
| Peak day flow, MGD | 150 |
| **Plant influent** | |
| Biochemical oxygen demand (BOD), mg/l | 264 |
| Lbs/day | 127,000 |
| Suspended solids (SS), mg/l | 228 |
| Lbs/day | 114,000 |
| **Plant effluent** | |
| BOD removal efficiency, % | 85 |
| BOD, mg/l | 30 |
| Lbs/day | 15,01 |
| SS removal efficiency, % | 2 |
| SS, mg/l | 85 |
| Lbs/day | 30 |

## Equipment & tankage

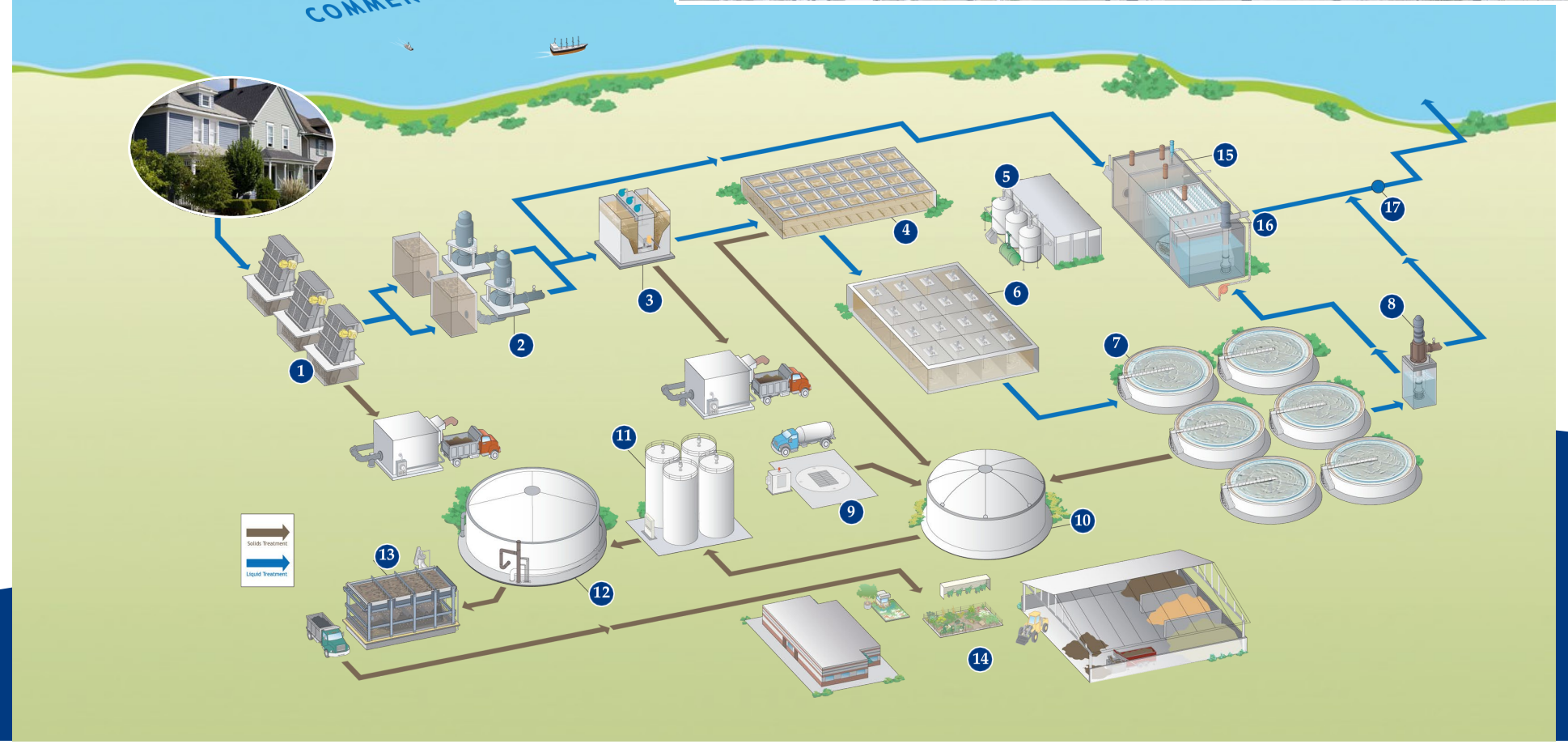
| Unit description | No. of units | Capacity (each) |
|---|---|---|
| **Screening facility** | | |
| Mechanical bar screens | 3 | 75 MGD |
| Screenings washer / compactors | 2 | 141 CF/hour |
| **Influent pump stations** | | |
| Raw wastewater pumps (Old influent pump station) | 2 | 39 MGD (Capacity per pump based on two pumps online) |
| Raw wastewater pumps (New influent pump station) | 3 | 45 MGD |
| **Aerated Grit Removal Facility** | | |
| Grit removal tanks | 3 | 40 MGD |
| Grit pumps | 9 | 300 GPM |
| Grit classifier / washers | 2 | 290 GPM |
| **Primary clarifiers** | | |
| Number of tanks | 4 | -- |
| Detention time @ 20 MGD | 4 | 0.66 hours |
| Surface settling rate @ 20 MGD | 4 | 2,906 GSFD |
| Scum dewatering unit | 1 | -- |
| **Oxygenation tanks** | | |
| Number of tanks | 4 | -- |
| Tank volume | | 1,026,765 gallons |
| Surface aerators | 16 | 40-100 HP |
| **Oxygen generation** | | |
| Pressure swing adsorption (PSA) | 2 | 30 tons/day |
| **Secondary clarifiers** | | |
| Detention time @ 13.3 MGD | 6 | 1.8 hours |
| Surface settling rate @ 13.3 MGD | 6 | 1,180 GSFD |
| **Peak Wet Weather Facility** | | |
| Ballasted sedimentation tanks | 2 | 38 MGD |
| **Disinfection Facility** | | |
| Sodium hypochlorite storage tanks | 2 | 10,300 gallons |
| Disinfectant supply pumps | 4 | 70 GPM |
| **Effluent pump stations** | | |
| Secondary effluent pumps | 3 | 40 MGD (Capacity per pump based on two pumps online) |
| Peak wet weather effluent pumps | 5 | 47 MGD (Capacity per pump based on three pumps online) |
| **Solids handling** | | |
| Raw solids pumps | 4 | 160 GPM |
| Solids receiving station pumps | 2 | 300 GPM |
| Return activated sludge pumps | 3 | 4.67 - 9.33 MGD |
| Waste activated sludge pumps | 2 | 350-700 GPM |
| Thickened solids pumps | 4 | 100 GPM |
| **Dissolved air flotation thickeners** | | |
| Thickeners surface area | 4 | 400 square feet |
| **Biosolids processing** | | |
| Belt presses | 4 | 120 GPM |
| Biosolids blender | 1 | 95,000 lbs/8 hours |
| **Biosolids digestion** | | |
| Aerobic digesters (4A, 4B, 4C) | 3 | 88,000 gallons |
| Detention time, wet season | | 1.04 days |
| Anaerobic digesters (3, 5, and 6) | 3 | 1,046,000 gallons |
| Detention time, wet season | | 17.7 days |
| Overall volatile solids reduction | | 65% |
| **Digester gas** | | |
| Gas holders | 2 | 3,000 CF |

## A close-up look at the Central Treatment Plant

More than 220,000 people rely on the City of Tacoma to properly and safely treat their wastewater. A portion of Tacoma's wastewater is treated at the North End Treatment Plant and the remainder is treated at the Central Treatment Plant.

1. **Bar screens**—As flow comes into the plant, screens remove large debris such as rags, sticks, stones and plastic bags from the flow. If not removed, these materials can damage equipment downstream. Screened material is dewatered (excess water is squeezed out), compacted and conveyed to bins for disposal at a landfill. The mechanical bar screens are designed to remove debris larger than ¾-inch.
2. **Influent pump stations**—The Central Treatment Plant has two influent pump stations with a combined pumping capacity equal to approximately 150 million gallons per day. The influent pump stations lift the wastewater so that it can flow by gravity through the plant.
3. **Grit Removal Facility**—Wastewater is pumped from one or both of the influent pump stations to the Grit Removal Facility. The aerated grit tanks are designed to allow heavier particles with higher settling velocities, such as sand and gravel, to settle to the bottom of the tanks. Lighter particles (organic material) remain suspended in the wastewater and are conveyed to the primary clarifiers. Grit is removed because it will interfere with treatment processes downstream, use valuable digester space, and cause unnecessary wear on piping and mechanical equipment. After the grit is removed, it is washed and hauled to a landfill.
4. **Primary clarifiers**—Rectangular primary clarifiers are used to remove settleable and floatable solids from the wastewater. Wastewater flows slowly from one end of the tanks to the other, allowing the solid materials to settle to the bottom of the tanks. The settled solids are scraped off the bottom of the primary clarifiers and pumped to the blended solids tank. Scum, grease and other floating material is collected, dewatered and taken to a landfill.
5. **High-Purity Oxygen Generation Facility**—Pure oxygen required for the oxygenation tanks and aerobic digesters is continually manufactured by the pressure swing adsorption system. To produce oxygen, air is pumped by high-pressure air compressors into one of three tanks which contain molecular sieves. While pressure is maintained, the sieve captures and holds the air's nitrogen, permitting nearly pure oxygen to pass through. As the molecular sieve becomes saturated, automatic valves operate to remove the saturated tank from service and replace it with a fresh tank. When pressure is relieved from the saturated tank, the sieve loses its attraction for nitrogen and the tank is purged.
6. **Oxygenation tanks**—Partially treated wastewater from the primary clarifiers enters the covered oxygenation tanks and is mixed with return activated sludge from the secondary clarifiers. High-purity oxygen is added to the tanks. Microorganisms in the tanks use the oxygen while consuming the organic material remaining in the wastewater. The microorganisms form a floc (particles or impurities that are clumped together) which is kept in suspension by the mixing action in the tank. The microorganisms continually reduce organic material and form new microorganism cells.
7. **Secondary clarifiers**—The floc formed in the oxygenation tanks is settled in the secondary clarifiers (each about 120 feet in diameter). The settled solids contain active, living organisms and are called activated sludge. About 80 percent of the settled solids are returned to the oxygenation tanks (return activated sludge) to keep up the microorganism population. The remaining solids are pumped to the dual digestion system for treatment.
8. **Secondary effluent pump station**—Water from the secondary clarifiers is pumped out a 5-foot-diameter pipeline (about 3 miles long) to diffusers located approximately 120 feet deep in Commencement Bay. When the Peak Wet Weather Flow Treatment Facility is operating, flow from the secondary effluent pump station is routed through the peak wet weather effluent pump station.

# An illustrated tour of the Central Treatment Plant


9. **Solids receiving station**—Solids from Tacoma's North End Treatment Plant (and, occasionally, other treatment plants in the area) are trucked to the solids receiving station for further processing at the Central Treatment Plant.
10. **Blended solids tank**—Solids collected from the primary clarifiers, secondary clarifiers and solids receiving station are mixed in the blended solids tank before processing in the plant's digesters. A thickening process called dissolved air flotation is used to remove water from some or all of the solids before they are sent to the blended solids tank so the solids take up less room in the digesters. After leaving the blended solids tank, the solids are preheated prior to being pumped to the aerobic digesters.
11. **Aerobic digesters**—This system consists of three groups (or quads) of four reactors. High-purity oxygen is introduced into each reactor by diffusers near the bottom of the tank and is mixed with the solids in the tank. Aerobic microorganisms consume the oxygen and waste material in the solids and generate heat to kill pathogens. The temperature in the digesters is maintained or varied by adjusting the oxygen feed. At this plant, solids are maintained at 140 degrees Fahrenheit for 24 to 48 hours to ensure TAGRO products are safe.
12. **Anaerobic digesters**—This process consists of three, 90-foot-diameter tanks. The solids leaving the aerobic digesters are introduced into the anaerobic environment for additional digestion of solids, resulting in the production of methane gas. The gas is collected in the gas dome of the digester covers and in gas holding tanks. The gas is used to fuel the plant's boilers, which heat buildings and provide hot water for process needs. Any excess gas is burned in the plant's flares.
13. **Solids dewatering process**—Belt filter presses are used to dewater the digested biosolids. The biosolids are conditioned by mixing them with a cationic polymer to lower their affinity for binding water. The water is then squeezed out in the presses, leaving a moist, cake-like product.
14. **TAGRO Blending Facility**—At the TAGRO Blending Facility, biosolids are blended with bark, sand and sawdust to produce various TAGRO premium soil products rich in nutrients recovered from the wastewater treatment process.
15. **Peak Wet Weather Flow Treatment Facility**—When it rains hard in Tacoma, a lot of rainwater flows into the sewer system. This excessive flow is diverted from the main part of the plant and processed by this innovative treatment facility before being blended with the effluent from the secondary clarifiers and discharged to Commencement Bay.
16. **Peak wet weather effluent pump station**—During periods of extreme wet weather, huge pumps combine the treated water from the Secondary clarifiers and the Peak Wet Weather Flow Treatment Facility and pump it down the outfall pipe to exit deep in Commencement Bay.
17. **Disinfection**—Sodium hypochlorite is added at the secondary effluent pump station and peak wet weather effluent pump station to disinfect the water before it is pumped to Commencement Bay. Disinfectant can also be added as needed at various other places in the plant, such as the return activated sludge (for filamentous growth prevention) and the secondary clarifiers (for algae control) and is used in the odor scrubbers associated with the dissolved air flotation process and solids dewatering process.

## A unique process to protect Puget Sound

The North End Treatment Plant was originally constructed to be a primary treatment facility and was designed to handle a maximum of 10 million gallons per day. Since then, treatment standards have risen and influent flow to the plant has increased. The City has been innovative in meeting those demands.

**1968**—The North End Treatment Plant began operation.

**1985**—In response to the Federal Clean Water Act's call for stricter standards on wastewater discharge, the Washington State Department of Ecology required the plant to meet secondary treatment standards by 1991. The conventional solution to this requirement, a pure-oxygen secondary plant design, came with a $38 million price tag and would have required the demolition of all original structures.

**1986**—The City began testing an alternative physical-chemical treatment process, using liquid aluminum sulfate and dry anionic polymer to achieve secondary treatment results while using the original plant infrastructure. The process was able to achieve the required average monthly effluent concentration of 30 milligrams per liter or less of total suspended solids and biochemical oxygen demand (BOD), but the plant was unable to consistently meet the 85 percent BOD removal requirement due to soluble BOD in the plant effluent.

**1988**—The City was confident that adding a biologically active filter after the physical-chemical processes would address soluble BOD and provide the additional treatment needed in a much more cost-effective manner than tearing down the existing facilities to build a conventional secondary plant. So the City returned $19 million in federal grant money earmarked for construction of a conventional secondary plant.

**1986-1994**—The City negotiated with the Washington State Department of Ecology and the U.S. Environmental Protection Agency to prove that the nontraditional method was effective in meeting secondary treatment requirements.

**1995**—The City gained approval for its alternative secondary treatment process.

**1997**—The plant underwent a significant upgrade to incorporate secondary treatment. This included retrofitting one of the original primary solids digestion tanks with plastic media and converting it to an enclosed biofilter. A second digestion tank was converted to a solids holding tank. All original buildings were retained and refurbished. Two additional buildings were added along with an odor-control tower and a distributed computerized control system.

## Biofilter adds up to big savings

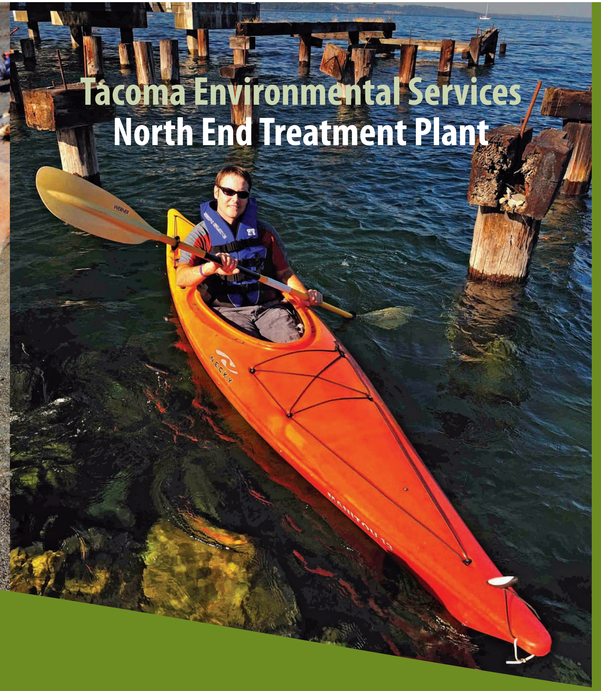
The addition of the biofilter eliminated the need for secondary clarifiers, contributing to big savings in construction costs. In the end, this innovative treatment process cost $10 million, significantly less than a conventional secondary treatment plant would have cost. The operational costs for this process are estimated to be $300,000 less per year than a conventional system. More importantly, the biofilter allows the plant to consistently meet secondary treatment permit requirements.

The cutting-edge, cost-saving approach to engineering the North End Treatment Plant using a combination of chemical and biological treatment processes won a national award sponsored by Rutgers University for creative, unconventional approaches to solving problems.

**Together, the City, its citizens and businesses are making great progress in protecting Puget Sound.**

Public Works
Environmental Services
Wastewater Management

# Tacoma Environmental Services
# North End Treatment Plant



**A sound investment for our Puget Sound**
**Public Works • Environmental Services • Wastewater Management**

## Welcome

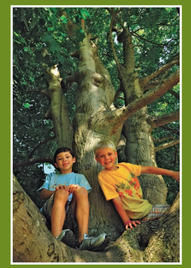
The North End Treatment Plant is located near Tacoma's Old Town, nestled in scenic Mason Gulch and hemmed in by train tracks, hilly topography and existing homes. The North End Treatment Plant is committed to being a good neighbor, preserving the environment and continuing Tacoma's history as a leader in wastewater treatment practices.

**Helping to protect and preserve the Northwest quality of life.**

### The North End Treatment Plant:

- Began treating wastewater in 1968 as a primary treatment facility.
- Underwent an upgrade in 1997 to meet secondary treatment standards.
- Serves more than 50,000 residents of North Tacoma and the Town of Ruston.
- Treats an average of 5 million gallons of wastewater per day, with a design peak hydraulic capacity of 26 million gallons per day.
- Handles mainly domestic sewage (industrial wastewater flow to the plant is minimal).
- Discharges treated wastewater, known as effluent, to Commencement Bay through a dedicated deep-water marine outfall.

The North End Treatment Plant is the second of two wastewater treatment plants in Tacoma. The first, the Central Treatment Plant, was constructed in 1952 and is located on the tideflats along the Puyallup River. The Central Treatment Plant has a permitted peak hydraulic capacity of 150 million gallons per day.

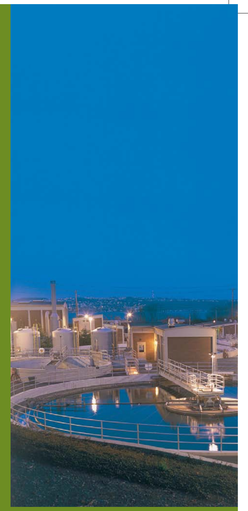


## Being a good neighbor

The North End Treatment Plant is located very close to existing homes and near some areas soon to be developed. The plant has systems in place to mitigate potential impacts of the wastewater treatment process on its neighbors.

**Odor control**—An odor-scrubbing tower and odor-containing solids truck-loading station help minimize odors. The truck-loading station is equipped with a vacuum system to trap odors that might escape when tanker trucks are being filled with partially treated solids destined for further treatment at the Central Treatment Plant.

**Noise control**—Acoustic noise reduction panels are located in buildings throughout the plant.




**CONTACT**

Wastewater Management
2201 Portland Ave.
Tacoma, WA 98421

(253) 591-5595

www.cityoftacoma.org/wastewater

## Wastewater flow & characteristics

| Plant flow | Dry season | Wet season |
|---|---|---|
| Average, MGD | 3.8 | 5.3 |
| **Plant influent** | | |
| Biochemical oxygen demand (BOD), mg/l | 289 | 216 |
| Lbs/day | 8,897 | 8,983 |
| Suspended solids (SS), mg/l | 312 | 223 |
| Lbs/day | 9,749 | 10,197 |
| **Plant effluent** | | |
| BOD, mg/l | 11 | 14 |
| Lbs/day | 345 | 665 |
| SS, mg/l | 4 | 4 |
| Lbs/day | 128 | 236 |

## Equipment & tankage

| Unit description | No. of units | Capacity (each) |
|---|---|---|
| **Influent pumps** | | |
| Raw wastewater pumps | 3 | 13 MGD |
| **Fine bar screens** | | |
| Mechanical bar screens | 2 | 13 MGD |
| Manual bar screen | 1 | 16 MGD |
| Screenings washers | 2 | 16 CF/hour |
| **Grit removal** | | |
| Grit tank | 1 | 31 MGD (at 4 min. HRT) |
| Grit dewatering screw | 2 | 94 to 225 GPM |
| Grit pumps | 2 | 150 GPM |
| **Primary clarifiers** | | |
| Number of tanks | 2 | -- |
| Detention time @ 5.3 MGD | 2 | 5.37 hours |
| Surface settling rate @ 5.3 MGD | 2 | 416 GSFD |
| **Biofilter** | | |
| Biofilter | 1 | 8 MGD |
| Biofilter influent pumps | 2 | 5,560 GPM |
| Biofilter effluent pumps | 2 | 5,560 GPM |
| **Solids handling** | | |
| Solids/scum pumps | 3 | 100 GPM |
| Solids holding tank | 1 | 233,000 gallons |
| Solids transfer pumps | 2 | 700 GPM (recirculation); 600 GPM (solids loading) |
| **Disinfectant contact chamber** | | |
| Detention time @ 5.3 MGD | -- | 1.36 hours |

## A close-up look at the North End Treatment Plant

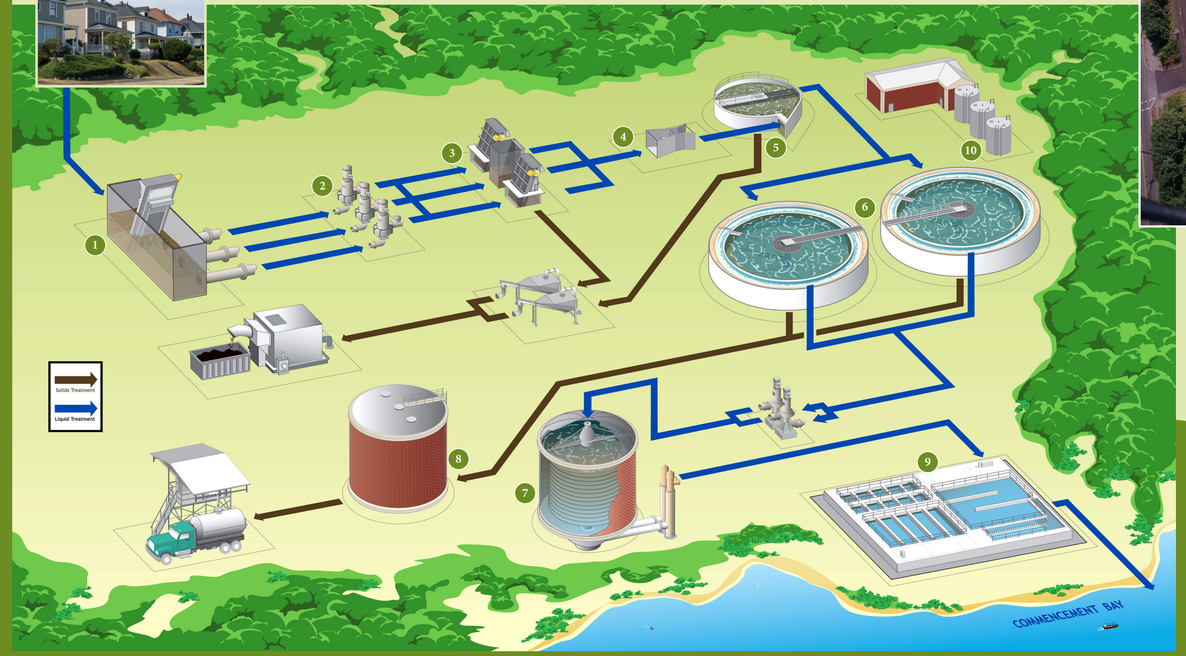
More than 220,000 people rely on the City of Tacoma to properly and safely treat their wastewater. A portion of Tacoma's wastewater is treated at the North End Treatment Plant and the remainder is treated at the Central Treatment Plant.

1. **Influent bar screen**—Wastewater flowing to the plant first passes through the influent bar screen. The influent bar screen consists of bars spaced 1½ inches apart that remove objects like large sticks, rocks and plastic debris. The influent bar screen is critical to prevent clogging or mechanical damage to the influent pumps. Screened material is automatically removed from the screen for disposal at a landfill.
2. **Influent pumps**—Three large pumps, capable of pumping 10 million gallons per day each, lift the wastewater up more than 30 feet so it can flow by gravity almost all the way through the rest of the plant. This saves energy because fewer pumps are needed elsewhere in the plant.
3. **Fine bar screens**—Finer materials like rags, scraps of paper, hygiene products and twigs are removed in two mechanical bar screens which have bars spaced ¼-inch apart. This material is removed to prevent damage to equipment downstream. The debris is automatically raked off the screens, washed and then transported to a landfill. A manually cleaned bar screen with 1-inch bar spacing serves as a backup.
4. **Parshall flume**—The wastewater passes through a flow-measuring device called a Parshall flume. Aluminum sulfate (alum) is added at the Parshall flume and adjusted based on the flow measured in this location. Alum gives wastewater an electrical charge which in turn causes solids to attract one another. This helps solids in the wastewater settle out in treatment processes downstream. When influent flows are higher than 12 million gallons per day, a second chemical (poly aluminum chloride) is added just upstream of the grit removal tank to further enhance settling.
5. **Grit removal tank**—The wastewater slows down as it enters the grit removal tank, allowing heavier particles like sand, dirt, eggshells, gravel and other materials to settle. The settled material is pumped to grit washers and disposed of at a landfill. This material is removed because it is abrasive and can damage equipment downstream.
6. **Primary clarifiers**—The wastewater slows down even more when it enters the large circular primary clarifiers. A liquid polymer solution is added to the center well of each clarifier. This, along with the alum, intensifies the attraction between particles creating a floc (particles or impurities that are clumped together) that is heavier than water. The solids settle to the bottom of the primary clarifiers and are removed by scrapers. Scum and floating material are also skimmed off the surface of the clarifiers. Both the settled solids and the scum are pumped to the solids holding tank.

   The average influent flow to the North End Treatment Plant is 5 million gallons per day. When flows exceed 8 million gallons per day, the higher flows are routed directly from the primary clarifiers to the disinfectant contact chamber. When this happens, the resulting effluent is a blend of treated effluent from both the biofilter and primary clarifier.
7. **Biofilter**—In the biofilter, wastewater trickles down through 13 layers of plastic media with a total depth of 26 feet. Microorganisms growing on the media consume most of the remaining impurities in the wastewater. This biological treatment process further enhances the quality of the plant's effluent by removing soluble biochemical oxygen demand. These pollutants are dissolved in the water and could not be removed by the grit removal and primary clarifier tanks.

   The biofilter is backflushed daily during the early morning hours to remove excessive biological growth. Effluent from backflushing flows to the grit removal tank for additional treatment. Backflushing is an important step in ensuring peak biofilter performance.

# An illustrated tour of the North End Treatment Plant





8. **Solids holding tank**—Both the settled solids and the scum skimmed from the top of the primary clarifier tanks are pumped to the solids holding tank. The material is loaded into tanker trucks and transported to the Central Treatment Plant for treatment in that plant's aerobic and anaerobic digestion process. The digestion process allows bacteria to break down waste material in the solids and generate heat to kill pathogens. Once the biosolids have been fully treated in the Central Treatment Plant's digestion process, they are dewatered (excess water is squeezed out) and made into TAGRO soil products that are widely used in landscaping and gardens.
9. **Disinfectant contact chamber**—Before discharge to Commencement Bay, the treated water is dosed with a disinfecting agent to ensure it is free of pathogens and harmful bacteria. Once disinfected, the water flows to Commencement Bay via a 36-inch outfall pipeline discharging approximately 900 feet offshore and 130 feet below sea level.
10. **Chemical storage area**—Chemicals are added upstream of the grit removal tank, at the Parshall flume, and in the primary clarifier tanks to help particles in the wastewater settle to the bottom of the treatment tanks for removal. There are two alum storage tanks and one tank storing poly aluminum chloride. Equipment for polymer addition is also located in this area.