



Wastewater: The Basics

February 2016



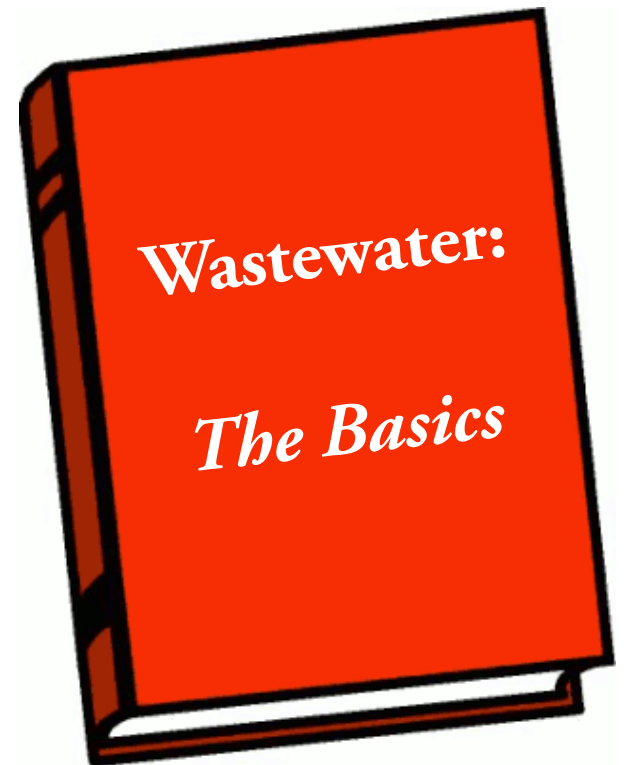
Introduction

The Clean Water Program is a comprehensive, 10-year plan to upgrade San Mateo's sanitary sewer collection system and the San Mateo Wastewater Treatment Plant.

Public outreach and transparency are key components of the Clean Water Program.

Wastewater: The Basics is written to help educate residents and other stakeholders about the complex process of transporting and treating wastewater, and about the different technologies proposed in the Clean Water Program.

If something isn't clear, **tell us!** Chances are someone else has the same question.





Introduction

“Wastewater” means water that has been used or contains dissolved or suspended waste materials₁.

Used water can carry bacteria and viruses that cause diseases, so it must be cleaned before going back into our environment.



Have you ever wondered where used water goes after it is flushed or drained from your home?

Did you know that after treatment, that water eventually reaches the San Francisco Bay?

Thankfully, wastewater must first travel through a sewer collection system and be treated and disinfected at the wastewater treatment plant in order to remove contaminants and harmful bacteria and make sure we are minimizing our impact on our environment.



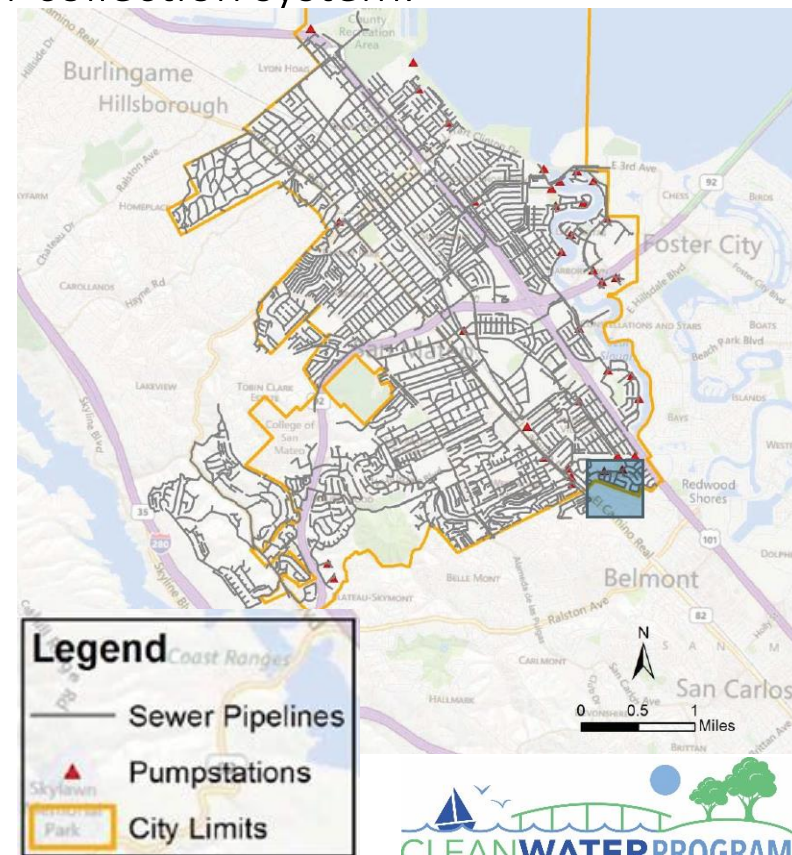


Chapter One: Sewer collection

The City of San Mateo collects and conveys (carries) wastewater from properties to the wastewater treatment plant through a sewer collection system.

- The term **Sewer collection system** refers to the many different parts and components that are needed in order to convey wastewater.
- San Mateo's collection system includes:
 - *About 234 miles of sanitary sewer pipelines*
 - *5,555 sewer manholes*
 - *26 pump stations*
- San Mateo also has a storm drainage system, which is completely separate from its sewer collection system.
 - *Some other cities have larger pipes built to carry both wastewater and storm water.*

San Mateo is responsible for maintaining and replacing failing components of its sewer collection system.

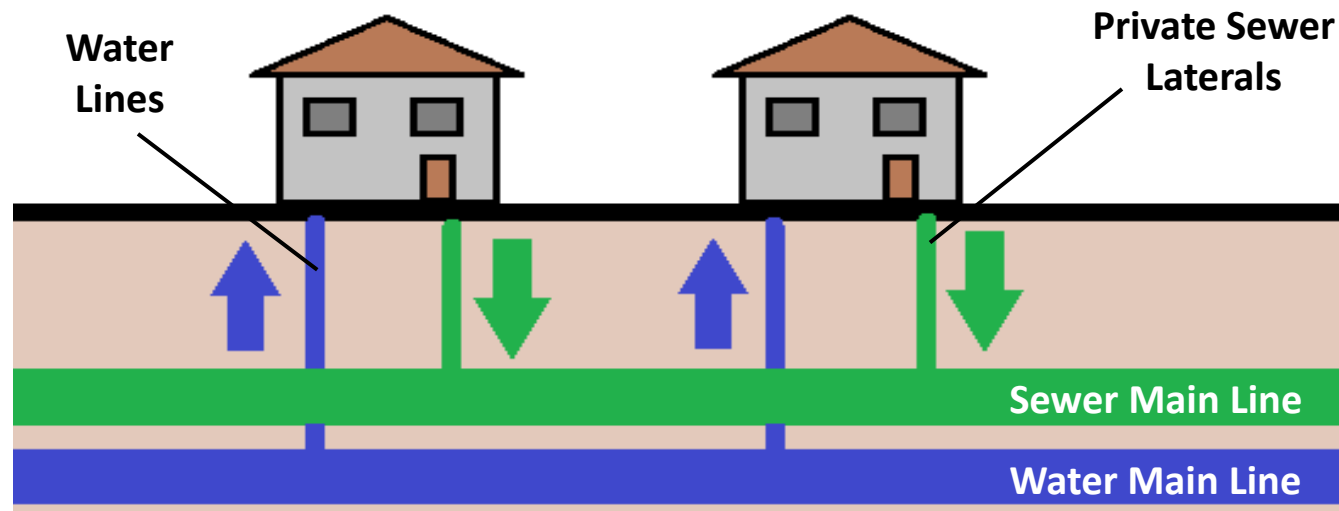




Water Lines & Private Sewer Lines

If we could see under our homes and buildings, we would see pipes which convey (carry) water to and from the building.

- Water lines bring in clean water for your sinks, toilets, irrigation, etc.
 - *The City of San Mateo's water supply is provided by the California Water Service Company.*
 - **Private sewer laterals** are relatively small sewer lines, owned and maintained by property owners, which convey wastewater toward a sewer mainline.



Some properties also have underground storm lines, which are not represented in this diagram.



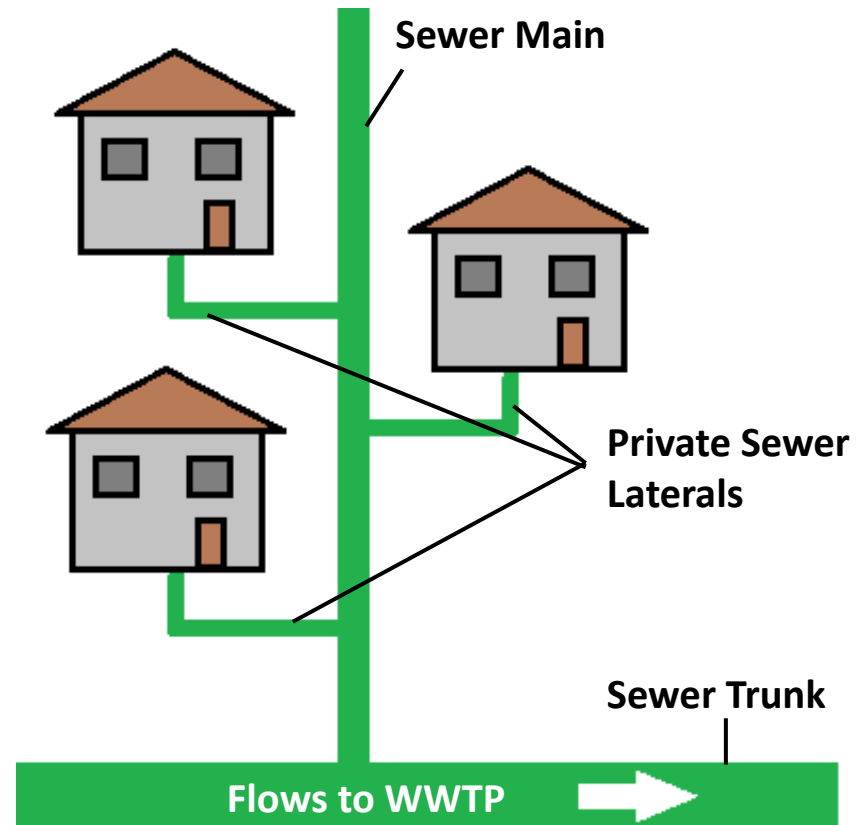


Sewer Mains & Trunks

Private sewer laterals convey (carry) wastewater from properties to the larger, publicly owned and maintained, sewer lines.

- **Sewer Mains** are sewer lines which convey wastewater from private sewer laterals to larger sewer trunks.
- **Sewer Trunks** are larger sewer lines which convey wastewater from sewer mains to the wastewater treatment plant.

In San Mateo, sewer mains and trunks are mostly located under streets and sidewalks, and are maintained by the Public Works Department.

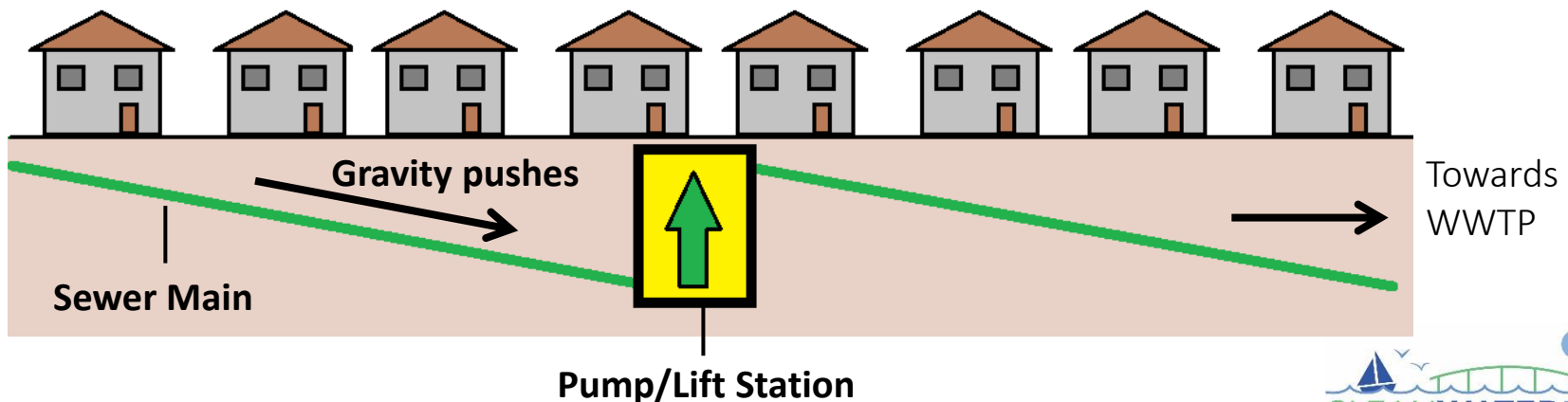




Pump Stations

Underground sewer lines are slanted downward so that the wastewater may flow by gravity downhill towards the wastewater treatment plant.

- **Pump (or “lift”) Stations** are pumps which raise wastewater to a higher elevation so that it can continue downhill (underground) again.
- Think of sewer lines as a series of underground “slides”, connected with a series of elevators.
 - *Once the wastewater gets to the end of the sewer pipe (the bottom of the slide), a pump station lifts the wastewater to the top of the next slide (like an elevator) so that gravity can do its work again.*





Chapter Two: Wastewater Treatment

The basic concept of wastewater treatment is to use different methods to separate and remove any solid material from wastewater and disinfect the remaining liquid before releasing it back into our environment.

- Wastewater treatment occurs at wastewater treatment plants (WWTP's).
- Different WWTP's may use different technologies. This chapter provides an overview of the six wastewater treatment processes the San Mateo WWTP plans to use:
 - *Preliminary Treatment*
 - *Primary Treatment*
 - *Secondary Treatment*
 - *Biosolids Treatment*
 - *Disinfection*
 - *Effluent System*

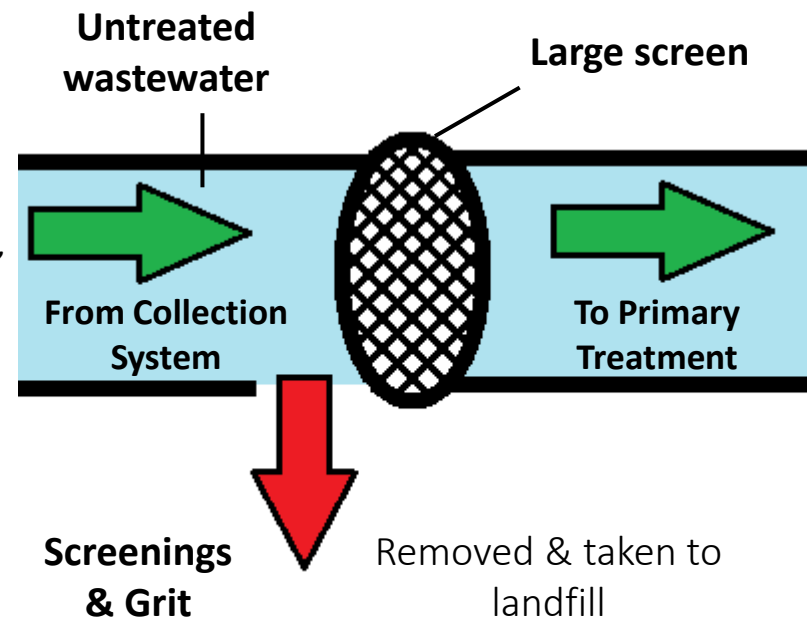




Step #1) Preliminary Treatment

Once wastewater is pumped into the WWTP, it contains a variety of solid materials that need to be removed in order to protect the equipment used in the later stages of treatment.

- Preliminary treatment removes **screenings** and **grit** from the raw wastewater to protect downstream mechanical equipment.
 - **Screenings** – large debris like rags, wipes, wood, toys, stones, etc.
 - **Grit** – fine debris and abrasive material like sand, gravel, egg shells, coffee grounds, etc.
- Removing these materials early in the treatment process can significantly reduce maintenance time and costs.



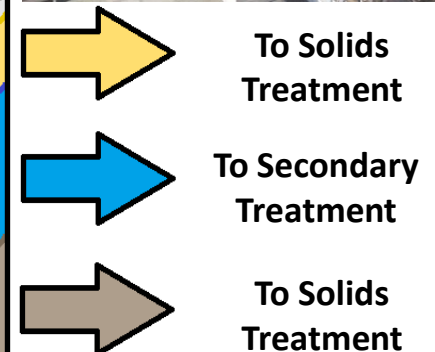
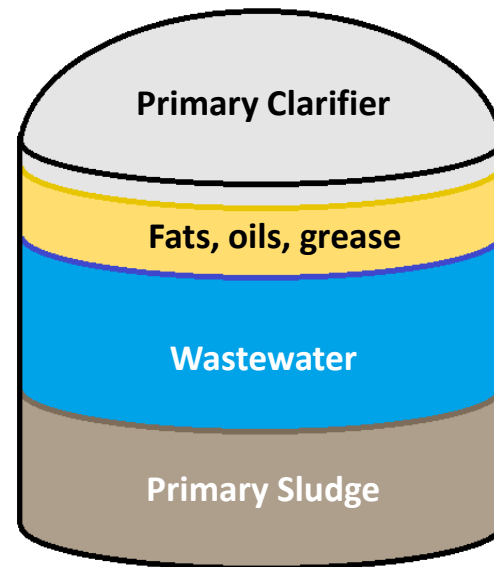


Step #2) Primary Treatment

Wastewater is then passed through clarifiers so that gravity can naturally separate the bulk of the wastewater from the solids, fats, oils, and grease.

Primary clarifiers are very large tanks in which most of the primary treatment process takes place. During this process:

- Scum and garbage are removed using mechanical skimmers.
 - *Scum is the term used to describe the fats, oils, and grease that float in wastewater*
- Primary sludge is removed using mechanical scrapers and sent to a solids treatment system.
 - *Primary sludge is the term for solid material which sinks in the wastewater during Primary Treatment, due to having a higher density than wastewater.*





Step #3) Secondary Treatment

After unwanted materials and solids are removed from the wastewater in the preliminary and primary treatment stages, bacteria are added to the wastewater during secondary treatment.

- Bacteria consume the waste & nutrients.
- Chemicals can be added to aid removal of certain nutrients like Phosphorus.
- At the end of the process, the bacteria is separated from the water by use of **membranes**.

— *Membranes are special filters with extremely small holes that are smaller than the bacteria, so that only water can pass through.*



Liquid with bacteria

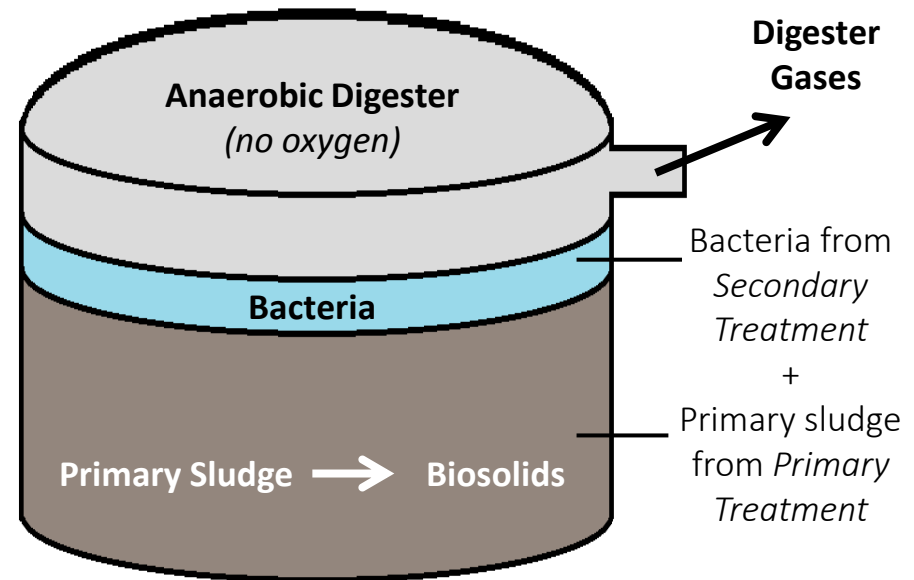
Liquid after pushed through a membrane



Step #4) Solids Treatment

During solids treatment, the primary sludge which was removed during primary treatment gets combined with the bacteria used during secondary treatment in a large tank void of oxygen called an anaerobic digester.

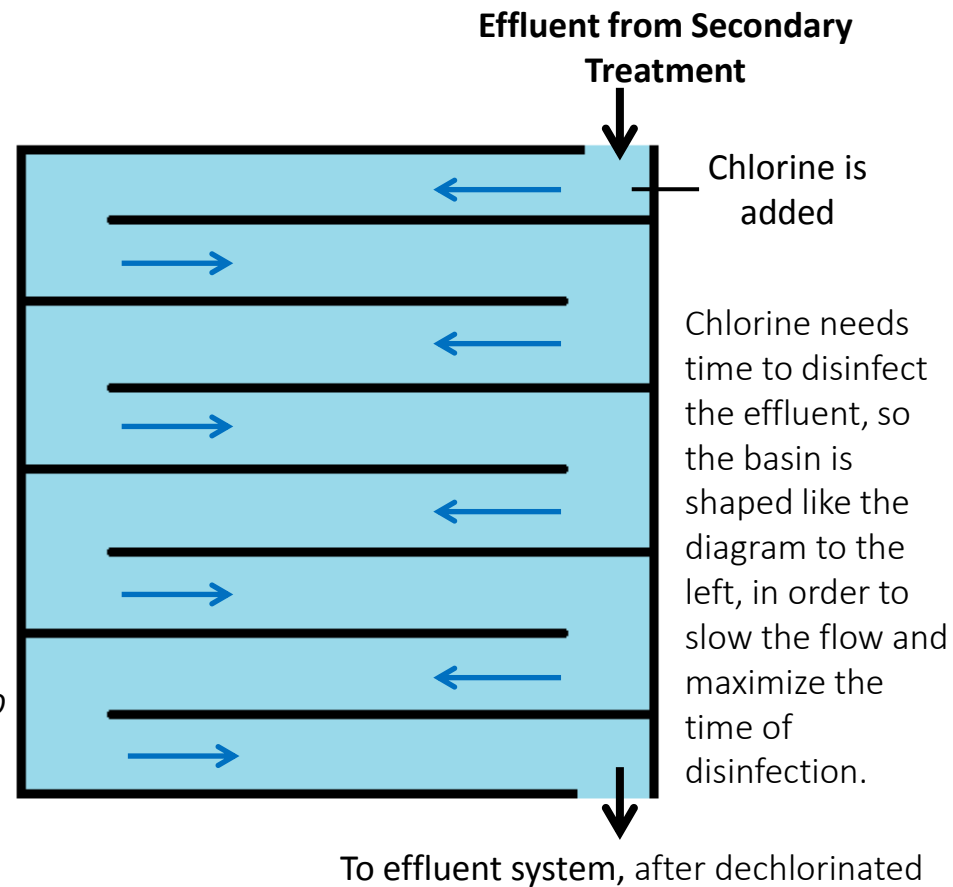
- Inside anaerobic digesters, bacteria that live in an oxygen-free environment “digest” or “reduce” the material by converting solids to gas, including methane gas.
- The treated solids, now known as biosolids, are dewatered.
- There are possible uses for biosolids or gases produced during this solids treatment process.
 - *Biosolids can be used for soil or fertilizer.*
 - *Digester gases can be converted to compressed natural gas to fuel vehicles.*





Steps #5 & 6) Disinfection & Effluent System

- During the disinfection stage, harmful bacteria and viruses are inactivated to eliminate threats to humans and the environment.
 - Chlorine is added to disinfect the effluent in a large basin.
 - Once the water is disinfected, other chemicals are added which dechlorinate the effluent.
- Finally the treated water is pumped out through an **effluent system**.
 - Effluent systems are the pump and piping systems which pump out the disinfected water from the WWTP into an outfall (water way).
 - Effluent means outflowing water, in this context it means the treated water flowing out of the WWTP into the SF Bay.





Chapter Three: The Clean Water Program





Clean Water Program Overview

The goals of the Clean Water Program are to:

- Replace aging infrastructure and facilities
- Build wet weather sewer system capacity assurance to prevent overflows
- Meet current and future regulatory requirements
- Align with the City of San Mateo and Foster City's sustainability goals.





Wastewater Treatment Plant

The San Mateo Wastewater Treatment Plant (WWTP) also treats wastewater from Foster City and the Estero Municipal Improvement District (EMID, the utility district for Foster City), the Town of Hillsborough, the City of Belmont, the Crystal Springs County Sanitation District (CSCSD), and other portions of unincorporated San Mateo County.

San Mateo WWTP operates under a **Joint Powers Agreement (JPA)** between the City of San Mateo and EMID.

- San Mateo owns approximately 75% of the WWTP and EMID owns approximately 25% of the WWTP.

The WWTP components of the Clean Water Program are a joint effort between the cities of San Mateo and Foster City.





Replacing Aging Infrastructure

The first goal of the Clean Water Program is to replace aging infrastructure.

- Many of the City's sewer pipes are past their expected lifespan and require significant maintenance.
 - *Sewer pipes have an average lifespan of 50-60 years, but most of San Mateo's sewer pipes were constructed between 1900-1960.*
 - *Many of the City's original sewer pipes are 6" in diameter or smaller, but the City's current standard for pipes are to be 8" in diameter or greater. Smaller diameter pipes have a greater risk of blockages.*
 - *Many pipes experience problems with tree roots and water infiltration.*
- The Wastewater Treatment Plant has many components that are over 75 years old
 - *Nearly half of the system is reaching the end of its useful life.*

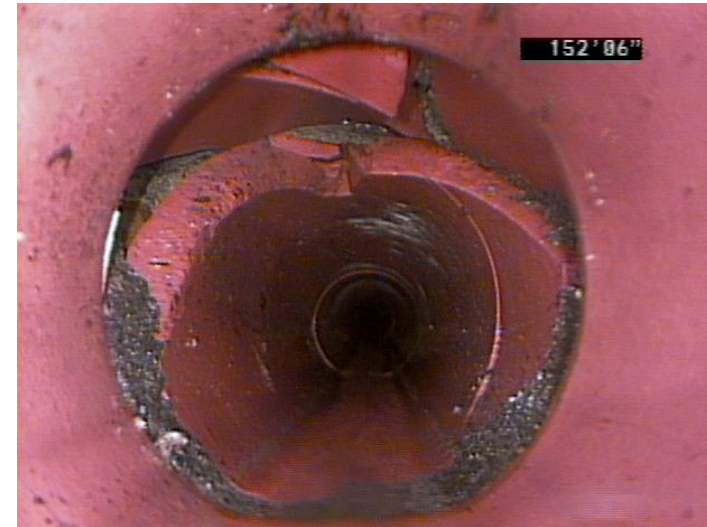




Building Wet Weather Capacity Assurance

“Wet Weather Capacity Assurance” means that our sewer collection system and wastewater treatment plant have sufficient capacity to consistently convey and treat wastewater, even during large rainfall events.

- Currently San Mateo sewer pipes are challenged with infiltration and inflow problems, a problem which is worse during wet weather events.
 - *Infiltration* – when storm water seeps into cracks and joints in our sewer pipes.
 - *Inflow* – when stormwater lines are illegally connected to and flow into sewer lines.
- Once stormwater reaches contact with wastewater, it becomes wastewater itself and must be treated at the WWTP.
 - *Typically during dry weather, the WWTP treats about 11 million gallons per day (mgd).*
 - *During storms, the WWTP can receive a peak flow of wastewater over eight times greater than is expected in dry weather.*



(Above) Inside a cracked sewer pipe



Meet Current and Future Regulatory Requirements

The regulatory requirements that protect our community continue to change. We are responding to the current direction of our regulators requiring specific corrective actions to ensure wet weather capacity.

- The San Francisco Bay Regional Water Quality Control Board (RWQCB)₃ regulates the operation of our sanitary sewer collection system and wastewater treatment plant.
 - In 2009 the RWQCB issued a Cease and Desist Order to San Mateo, the Town of Hillsborough, and the Crystal Springs Sanitation District, mandating the elimination of **Sanitary Sewer Overflows**
 - Sanitary Sewer Overflow (SSO) – the release of untreated sewage from a sanitary sewer into the environment before reaching the WWTP.





Align with Sustainability Goals

Improvements to the Wastewater Treatment Plant and sewer collection system have added environmental benefits.

- Producing higher-quality effluent water protects the water quality of the San Francisco Bay.
- Replacing facilities with newer technologies can contribute to a new recycled water source and alternative fuel sources for City vehicles.

Currently we have an opportunity to plan for the future and consider using new wastewater treatment technologies for a more sustainable future.





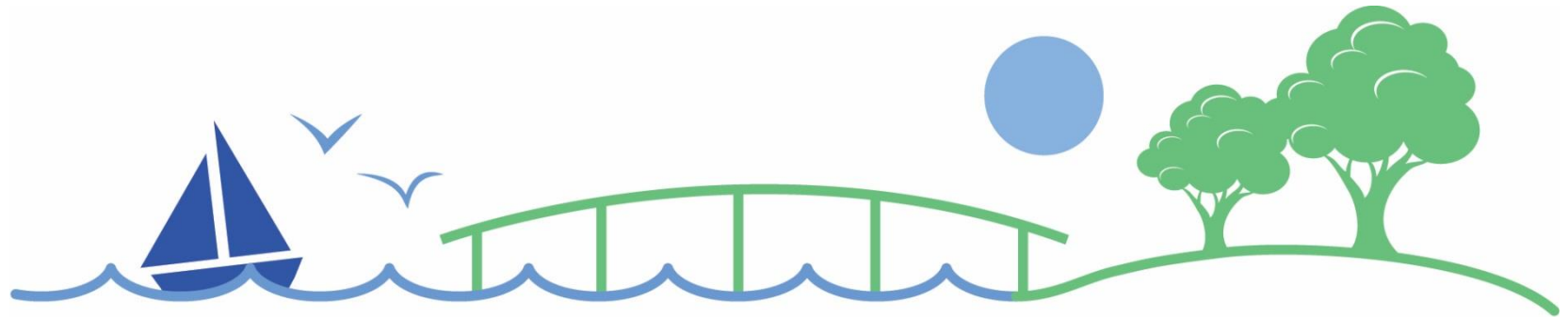
Staying Informed

An important component of the Clean Water Program is constant dialogue and communication. We want you to tell us how we are doing and how we can improve.

Below is a list of ways to keep in touch with the Clean Water Program:

- Check out the Clean Water Program website.
 - www.cleanwaterprogramsanmateo.org/
 - *Read Frequently Asked Questions & let us know if you have a question we haven't answered!*
 - *Keep in the loop for additional informational handouts, maps & fact sheets.*
 - *Contractors & Consultants – Keep in the loop about upcoming bid opportunities.*
- Sign up for email notifications through the City of San Mateo website ("Notify Me").
 - <http://www.cityofsanmateo.org/list.aspx>
 - *Having difficulties? Instructions available on Clean Water Program website.*
- Contact the Clean Water Program.
 - info@cleanwaterprogramsanmateo.org, (650) 727-6870.





CLEAN WATER PROGRAM

PROTECTING THE BAY FOR A SUSTAINABLE FUTURE



References

1. Environmental Protection Agency, "Definition of 'Wastewater'".
<http://www.ecologydictionary.org/EPA-Glossary-of-Climate-Change-Terms/Wastewater>
2. California Water Service Company, "About Us".
<https://www.calwater.com/about/>
3. California Environmental Protection Agency, "State Water Resources Control Board". <http://www.swrcb.ca.gov/>



Other Educational Opportunities

- “*Learn about Water*”, United States Environmental Protection Agency.
— <http://www.epa.gov/learn-issues/learn-about-water>
- “*Wastewater Treatment For Youngsters*”, prepared by the Metropolitan Council (Minneapolis-Saint Paul Metropolitan Area, MN).
— [http://www.metrocouncil.org/Wastewater-Water/Services/Wastewater-Treatment-\(1\)/Wastewater-Treatment-for-Youngsters.aspx](http://www.metrocouncil.org/Wastewater-Water/Services/Wastewater-Treatment-(1)/Wastewater-Treatment-for-Youngsters.aspx) (**please note the wastewater treatment methods explained in the book are slightly different than the methods to be used in San Mateo – instead rely on this presentation for an overview of the technologies to be used at the San Mateo WWTP*).
- “*Layperson’s Guide to California Wastewater*”, prepared by the Water Education Foundation.
— <http://www.watereducation.org/publication/laypersons-guide-california-wastewater>