

Sewers: The Things You Wish You Knew... and the Things You Wish You Didn't

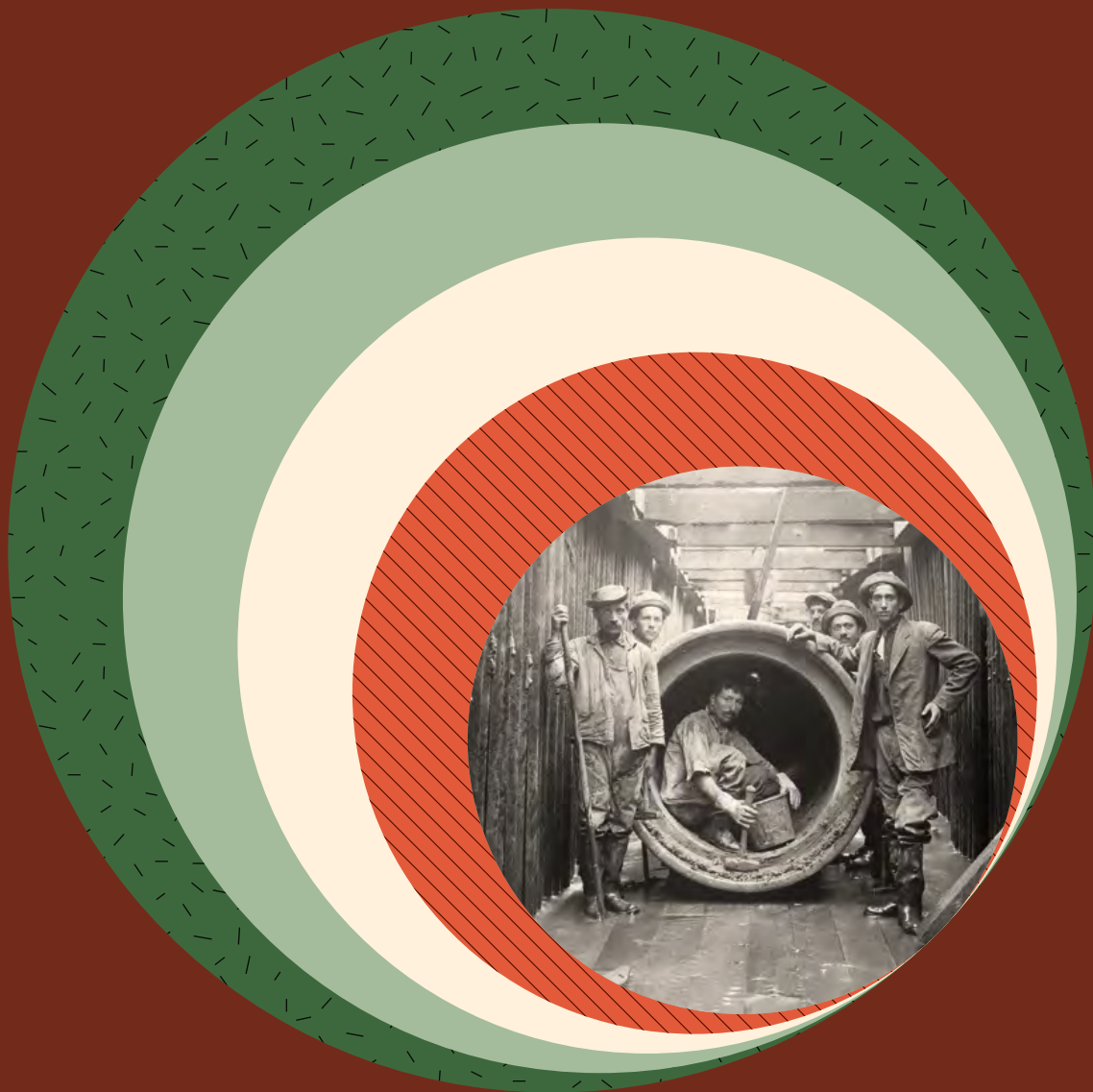
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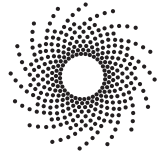
PS 380





Photograph by
Kristy Liebowitz.

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Sewers: The Things You Wish You Knew... and the Things You Wish You Didn't

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Acknowledgments

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PS 380

Victoria Prisinzano, Principal

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NYC Environmental Protection

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COVER IMAGE

Workers building the sewers.

Arthur Weindorf, August 3rd,
1911, photographic print,
V1974.24.172; Brooklyn
Historical Society.

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A Note from Our Editor

Dear Reader,

Brooklyn Historical Society's Young Scholars afterschool program reinforces three valuable lessons: the importance of research, facts and fact-checking, the relevance of historical information to today's world, and the unstoppable passion of youth as they discover their voice and power.

In late fall and early winter 2019, the over 80 Young Scholars who entered the sixth year of the Young Scholars program had no idea that their research on sewers and sanitation would become so relevant to their understanding of the spread of the Covid19 Virus. They studied archival documents from the earliest recorded history of Brooklyn in 1624 that revealed the impact of germs and viruses and the spread of cholera, yellow fever, and smallpox, to records of the 1918 Spanish Flu. As they dug deeper into information about local sanitation and environmental issues in the neighborhoods surrounding their schools, and visited the Newtown Creek Wastewater Treatment Plant, they continued to deepen their knowledge about the importance of clean water and different strategies for minimizing the spread of germs.

This book represents the of the extraordinary Young Scholars of PS 380. The book represents the combined efforts of these fourth- and fifth-grade students, their program educator, Lynn Yellen, and their cooperating teacher Stephanie Espinosa. This cohort was close to finishing their book when NYC, the schools and BHS closed in

response to the Covid19 pandemic. Using their notes and writings, Lynn and I completed their book about the sewers.

Congratulations to the Young Scholars of PS 380. I enjoyed listening to their conversations about sewers and watching them discover the joy of learning t each of them, I loved listening to their conversations, debates about their research, and enjoyed their questions. Through their journals, I saw their critical thinking skills grow, and watched them expand their knowledge about sewers, rain gardens, and water. As they explored their voices as writers, it was also clear that they were finding power in their role as citizens who have something to contribute.

I thank you, the parents, and guardians, for allowing them to participate in the program this year. To their educator, Lynn Yellen, thank you for all your hard work. I appreciate all of you. Thank you.

Sincerely,

Shirley Brown Alleyne

Manager of Teaching & Learning
Brooklyn Historical Society

In December, after weeks of my own research and preparation, I met the 2020 Young Scholars of PS 380. Nine of them are seniors—enthusiastic fifth graders who are veterans of the program. So as a new member of Brooklyn Historical Society’s team of educators, I was grateful for their experience. Five dynamic, smart fourth graders brought fresh energy.

On the first day that I went to PS 380, I asked the young people to complete a survey which included the prompt to write any questions they have about sewers. The group generated a long list, about half of which came from one especially curious senior scholar. We would go on to sort those questions into clusters, and our big five research questions became the framework for our book.

Most memorable for me were our field trips. The first one was a visit to BHS’s building on Pierrepont Street. We gathered in the lower level classroom with Shirley Brown Alleyne, the program manager. She brought out a chamber pot purchased on eBay for an object observation. The students took off the cover, looked at the decorations, noticed the single handle. A casserole dish? A fruit bowl? A giant sugar bowl? When Shirley finally told them what it was used for, the room erupted with groans and questions! “Ewww! You let us touch that?” “Wait, why would they poop in a pot?” We explored the “Taking Care of Brooklyn” exhibition and forged an important mental connection between health and clean water. The Young Scholars got their



Drawing of PS 380 Young Scholars at a rain garden.
Drawing by Lynn Yellen.

first look at a 1902 map of Brooklyn's sewers and were amazed to learn about cholera, yellow fever, and other diseases that routinely killed people living in the city before there was a clean water supply and a safe way to remove waste. We walked to BHS DUMBO to see the Waterfront exhibition where we got an introduction to the original wastewater treatment system...oysters!

Our Wednesday afternoons in the classroom, usually began by drawing. We used drawings to remember what we saw and read, and to collect the perspective of each person in the group. For a number of weeks, the young people, especially the seniors (fifth graders), wondered aloud when we were going to get started on the book. They hadn't realized that each week, as we worked with primary documents, I was collecting and typing up their written work in a series of google documents and archiving their drawings.

At the end of January, we went on an unforgettable trip to the Newtown Creek Wastewater Treatment Plant. When students were anticipating what they would see and smell on our field trip, they imagined really bad smells and even seeing sewage. What a surprise to see and smell a modern wastewater treatment facility, without even a whiff of sewage!

I am including one of my own drawings here, too. I made this after our last field trip, which was my favorite. Having begun to understand the concepts of CSOs and wastewater treatment (it's all in here, dear reader), the young people needed

to see how the system could sustain itself. Our trip to two rain gardens near our school made a big impression. Once they noticed the curb cuts and the other special features of what looked like a littered tree pit, they started to see how this rain garden that no one had noticed before was like a friendly, unobtrusive alien living among us.

A loving thank you to the beautiful young scholars of PS 380 and their wonderful teacher, Stephanie. And thank you to Shirley, who promised that it would all come together.

Lynn Yellen

Young Scholars of PS 380 Program Educator
Brooklyn Historical Society

Chapter 1 Why Did People in Brooklyn Need Sewers?

DAILY LIFE

Have you ever imagined doing your ‘business’ (going to the bathroom) in a pot!? Before sewers, the daily life of the Average American was very different from ours today. Instead of using the bathroom, people in the past used an outhouse or a chamber pot when they had to pass urine or feces. The chamber pot was important because it was used in the house, and helped people put their waste away instead of going to the outhouse. The chamber pot looks like a big fruit bowl. People had to empty out the chamber pot outside.



Chamber pots like this one were used before sewers were built.

Photograph by Anna Rathkopf.



★ DID YOU KNOW

An outhouse or privy is an outdoor shed that contains a pit toilet—usually just a wooden seat over a hole in the ground! The hole in the ground underneath is sometimes called a privy vault.

A Back Yard Examined.

A Back Yard Examined, 1887, photomechanical print, A013582; National Library of Medicine.

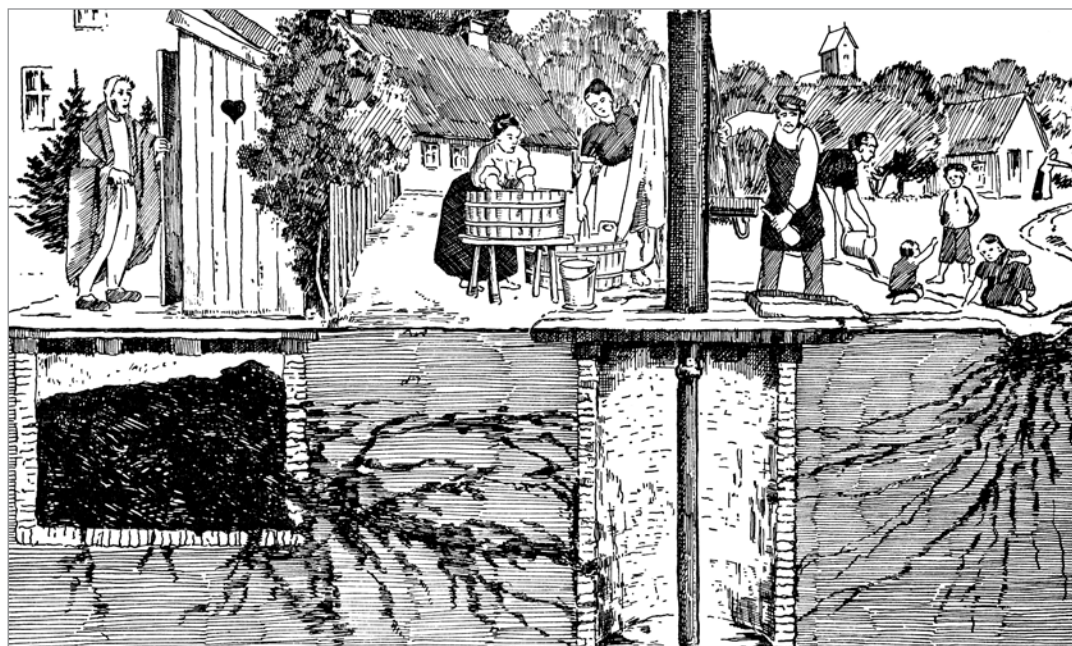


Illustration from 1939
showing how the
bacterium can get into
drinking water.

Thomsen, Oluf and Frode
Rydgaard, eds. *Vore
Sygdomme Deres Oprindelse
Og Vaesen I Almenfattelig
Fremstilling, Volume II.*
Copenhagen: H. Aschehoug
& Co., 1929-30.

People threw their wastewater into a hole where waste was dumped called a cesspool. The illustration below shows that there is a lady pouring a liquid that we think is waste into a cesspool behind her home. We discovered from our research that this is important because her actions would soon lead to people getting sick. This hole was connected to the town's source of clean drinking water. When people drank the water, they got sick because the water was contaminated. The woman was not the only one doing this. Many people were doing this.

When the privy vaults under the outhouses got filled, people had to empty them out. When archaeologists excavated privies in Albany, NY, they learned that the dirt has "night soil" which is human waste which was there for 200 years. The human waste would go on the street and as the population grew the human waste on the street was growing too.



**MICHAEL LONG,
NIGHT-SOIL SCAVENGER AND CARTMAN,
67 Clinton Street, Albany, N. Y.**

☛ Contents of Privies, &c., removed on Reasonable Terms, and Orders promptly attended to.

**HENRY KASS,
NIGHT SOIL SCAVENGER.
63 Bassett St., Albany.**

Orders for Removal of Dirt from Cess Pools or
Out Houses attended to.



Ads for Night-Soil Scavengers.

The Albany Directory, for the year 1874: containing a general directory of the citizens, a business directory, record of the city government, its institutions &c., &c.. Albany, N.Y.: Sampson, Davenport, & Co., 1874.

THE STENCH

Have you ever walked down the street and thought it smelled bad? Well, this was a common problem before there were sewers. The streets were disgusting!

The streets were filled with “rubbish, manure, and refuse.”¹ The streets were flooded and were full of the contents of chamber pots,

¹ Gwynneth C. Malin. “Short Narrative on Building the Brooklyn Sewers.” Unpublished paper, Brooklyn Historical Society (2015): 2.

which the local sanitation law called “tubbs of odour and nastiness.” When the waste on the streets became uncontrollable, the government hired people to remove the rubbish at night. The ‘night soil men’ would put it into steamboats and dump it far out in the harbor. The worst thing was they dumped it in the East River. This didn’t work out due to the population growing at a fast rate. Soon enough, this trash would be too much to handle so they decided to create sewers to help it. Sewers would be important to people because the human waste and the flooding made people sick.

★ **DID YOU KNOW**

Hi! I’m a sewer! I’m a long pipe, kind of the same shape as this text box! I carry off

wastewater and drainage from streets. Today, I convey sewage to wastewater treatment plants, but my grandparents carried sewage straight to the nearest river!

★ **DID YOU KNOW**

Charles Pfizer & Company was established in Williamsburg, Brooklyn in 1849. Their first product was santonin, an effective treatment for intestinal worms. Pfizer's santonin was a better medicine to treat intestinal worms than earlier forms of the drug because it tasted like almond toffee. They made this because nobody would eat the previous medicine because it tasted bitter and people rather have these worms in their stomach.



A Pfizer penicillin bottle.
Medicine container, Pfizer,
1944, glass; bhs_m1990.13;
Brooklyn Historical Society.

CONTAMINATED WATER AND DISEASE

The water in the East River moved the human waste to other bodies of water like rivers, oceans, ponds, and more. This made their drinking water unsafe, and people started to get diseases and intestinal worms.

Before we had sewers, people were getting sick with yellow fever and cholera. In places with open cesspools, there were lots of mosquitoes and yellow fever is carried by mosquitoes. It gave people high fever, chills, muscle pain, and nausea. The virus caused a person's skin to turn yellow as their liver failed.

A cholera epidemic hit New York City and Brooklyn in June 1832. People didn't know that cholera was spread by contaminated water. The main symptoms are diarrhea, pains, and puking. The cause of death by cholera is usually dehydration.

The population was increasing. They had to do something to stop people from getting sick by drinking contaminated water. That's why they made sewers.



This picture shows the streets are flooded and have human waste.

Ralph Irving Lloyd, *A Rainy Day*, 1910, lantern slides, V1981.15.176; Brooklyn Historical Society.

Chapter 2 How Were Our Sewers Built?

The year 1857 was important because the New York State Legislature passed an act, so everyone was provided with water. They passed a law which appointed a permanent Board of Water Commissioners. After 1857, the city of Brooklyn built sewers for house drainage. English engineers disagreed with the plan to build smaller sewers because they wanted sewers big enough for men to climb in and clean the pipes. They made the sewer pipes big enough to fit a person.

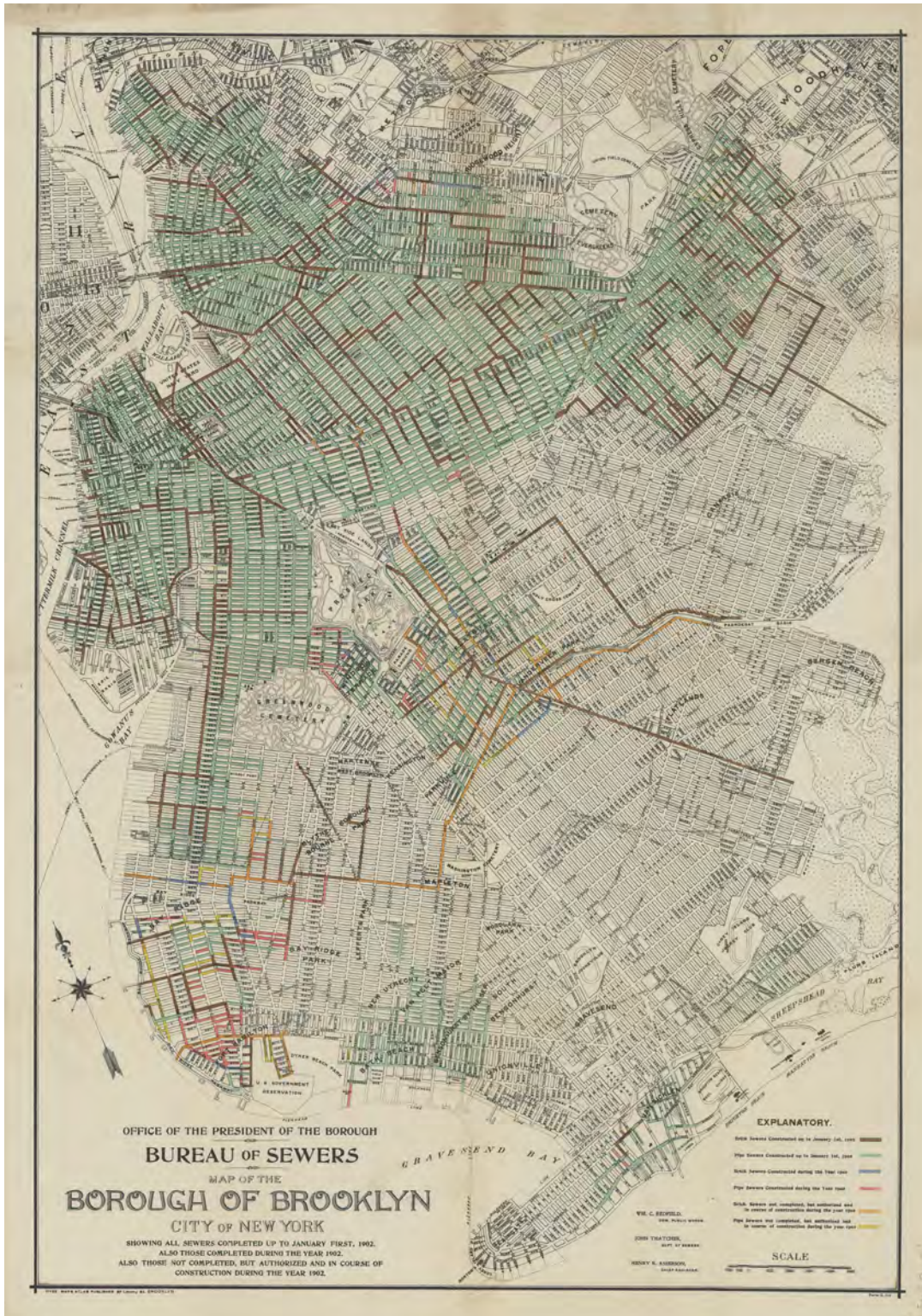


This photograph from the late nineteenth and early twentieth centuries shows workers building the sewers.

Arthur Weindorf, August 3rd, 1911, photographic print, V1974.24.172; Brooklyn Historical Society.

★ DID YOU KNOW

Williamsburg was a separate town until 1855, when it was incorporated into the city of Brooklyn. By 1860, Brooklyn was the third largest city in the nation with over a quarter of a million people. Later, in 1898, Brooklyn became part of Greater New York, or what we know as the five boroughs of New York City. Brooklyn had already begun building sewers before becoming part of New York City, and its need for a steady supply of clean drinking water was a major motivation for giving up its independent status.



Map of the Borough of Brooklyn City of New York, showing all sewers completed up to June 1st 1902. Also those completed during the year 1902. Also those not completed, but authorized and in the course of construction during the year 1902.

1902; Flat Maps B A-[1902].F1; Brooklyn Historical Society.

Chapter 3 What Happens to All of Our Sewage After We Flush?

Most people don't know how sewer systems work. People are not aware of them because most parts of the system are underground or hidden from view. Have you ever wondered what happened when you flush the toilet? Well, this is going to be the chapter that's going to tell you all about it.

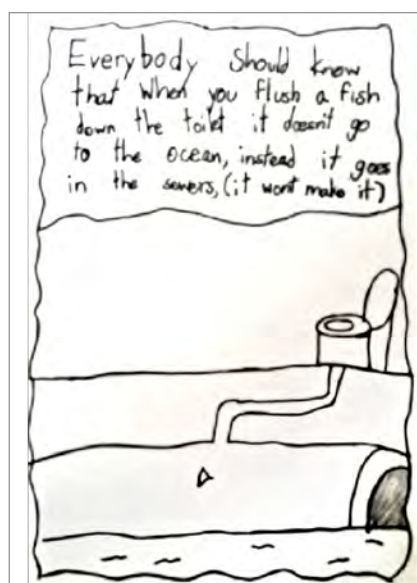
Before there were sewage treatment plants, the sewage drained into water sources like Wallabout Bay and the East River. New York City continued to dump sewage into the ocean until the early 1900s. Today, wastewater flows through 7,400 miles of pipes on its way to one of the city's wastewater treatment plants.

There are two kinds of sewers in NYC! Most of New York City has a combined sewer system, which means that the water and waste that runs into the storm sewers combines with the sewage from buildings into pipes that run towards wastewater treatment plants.

A combined sewer system was a good idea, before the wastewater treatment plants were built, rainwater in storm drains would wash all the sewage out to the waterways. This meant people would not have to clean the waste out of the sewers. One of the challenges of having a combined sewer system is that when there's heavy rainfall these sewers receive more than normal amounts of stormwater.

★ DID YOU KNOW

What is Sewage? Sewage is the waste of the population, collected into water. Sewage is not only a mixture of water from different places, for example water from a bathtub, and it's not just water, it's soap. Take, for example your kitchen sink, it could have oils, and bits of food.



Cartoon by
Chelsea Huertas

★ **DID YOU KNOW**

Ever heard of the ‘myth’ of alligators being in NYC’s sewers? Well, alligators in the sewers actually exist. They got here, not the way you would expect. Back in the day people sold baby alligators for \$1.50. Images below from the New York Times

Once they grew big and ‘ugly,’ people either flushed them down the toilet or dumped them in the storm drains. They never came out because they were stuck there in the pipes or killed. But the sewers weren’t very infested, thank the lord. The most sensational sewer-gator story is that a 16-year-old and a 19-year-old found an 8-foot gator. Two boys were clearing snow when they heard a splashing. They grabbed the alligator and

it snapped at them! Then, they took things into their own hands and used their snow shovels to beat it to death. They even tied it up! It weighed 125 lbs.! After this happened the Department of Environmental Protection adopted an alligator as its mascot!



“Baby Alligators Are Now Carried by Parcel Post,” *The Brooklyn Daily Eagle*, December 10 1922, 1.

Williamsburg has a combined system. In some parts of the city, like Bergen Beach, they have a separate sewer system, which

means that the storm drains connect directly to local waterways.

NYC's sewage does not always get treated because of Combined Sewer Overflow. Combined Sewer Overflow (CSO) is when it rains or snows a lot and the capacity of the treatment facilities, like Newtown Creek, is not big enough for water with garbage and sewage. Wastewater treatment plants are necessary in New York because with a big population, there would just be feces and other things lying on the streets causing people to get sick.

The parts of wastewater treatment are preliminary treatment, primary treatment, secondary treatment, disinfection and finally, sludge treatment. Wastewater, called influent, is screened through vertical bars, spaced about one inch apart. This preliminary part of the process removes large pieces of trash like sticks, newspaper, plastic water bottles and other debris. Most of this material, which is sent to landfills for proper disposal, comes from litter that washes from our streets into the storm drains and enters the sewer system.

Disease-causing organisms can still be left in wastewater even after primary and secondary treatment. Disinfection is when there are still germs that may not come out after primary and secondary treatment. A small amount of bleach—9 gallons for every 100,000 gallons of water—is added to disinfect treated wastewater before it is released to the rivers, bays, and the ocean. We make about 1.3 billion gallons of wastewater each day.

★ **DID YOU KNOW**

Wastewater Treatment Plants speed up the natural processes that filter water, which is important because of the huge volume of wastewater produced by people in the city every day. After the preliminary treatment, the remaining sewage is pumped to the plants for primary treatment. The sewage then goes to tanks where some of the sludge will settle at the bottom and 'floatable trash' will be skimmed off the top. The secondary treatment involves aeration. The oxygen in the air helps the growth of bacteria that will get to work to break down the sewage into sludge. The whole process, including disinfection, takes 7-9 hours. The digestion eggs need a few weeks to break down the sludge.

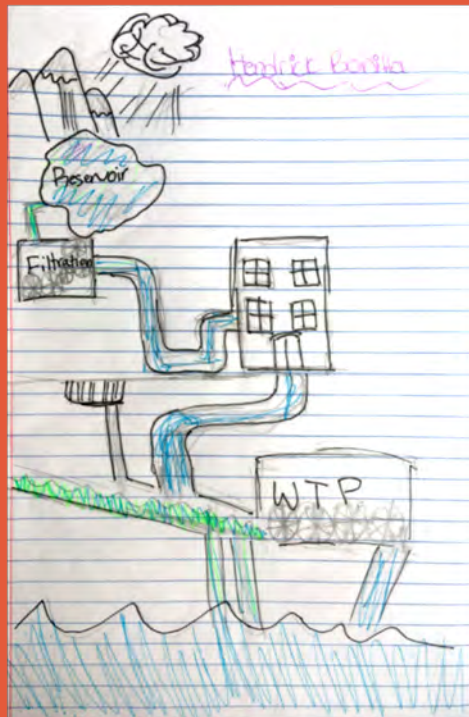
★ **DID YOU KNOW**

Did you know that the New York City water system is not just in New York City?

In this illustration of the water system, you can see that our drinking water comes from upstate New York. The watershed is not a real shed, it is a run-off. When the rain hits the watershed, the rain runs off and the soil and hills filter the rainwater which goes into nineteen reservoirs and three protected lakes. Nature does a lot of the cleaning, but there is also a filtration plant.

The highest reservoir is 1280 feet above sea level. Gravity pumps drinking water to New York City. You can also see how the water in a combined sewer system all goes to the wastewater treatment plant,

except when there's a combined sewer overflow (CSO). And you can see the spiny things that screen out the garbage during the primary treatment at the treatment plant.



Drawing by
Hendrick Bonilla.

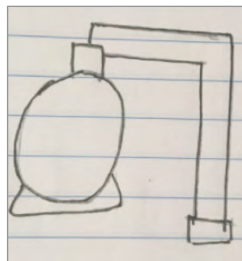
This photograph shows Digester Eggs at Newtown Creek. The eggs are 199 feet tall.

Photograph by Lita Riddock.



Chunky water, better known as sludge, is feces and bacteria that clumps together. The sludge goes into the digester eggs and the bacteria eats the poop. Boats carry the sludge to companies to make it into soil and fertilizer. They sell it to farmers!

There are many parts of our sewer system: catch basins, wastewater pumping stations, sewers, pumping stations, and fourteen wastewater treatment facilities. If we didn't have sewers, our water supply would get contaminated by our waste. Our waste would also end up on the streets, which would stink up the city, and we would get diseases such as yellow fever.



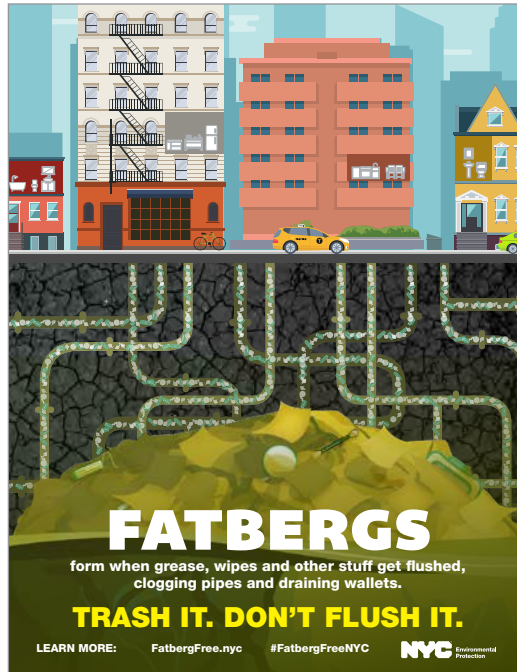
Digester egg.

Drawing by Cody Jefferson.

Chapter 4 Why Are Our Sewers Under Stress?

Did you know you should not flush a baby wipe even if it says ‘flushable’ on the packet? This has become a big problem in sewers and in sewage treatment plants. Grease and oil can clog the sewers. Wipes make the oil and grease hard. Fat and grease and wipes make solid ‘fatbergs’ that block the sewers and can cause a sewer back-up (the sewage goes back where it came from). Even though

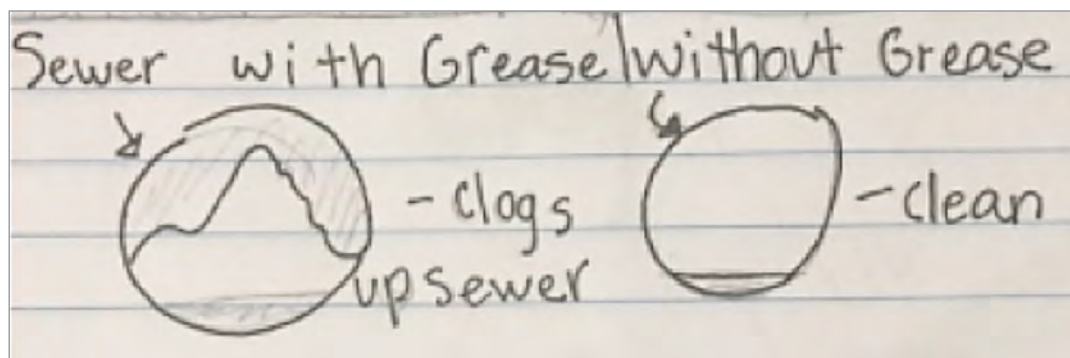
they say that the wipes are flushable, they are not. They get stuck in the spiny things at the treatment plant, mechanical screens, that clean out the garbage. The wipes can break the machine. They tried adding an extra step to chop up wipes, to make it easier, but it didn’t work. The wipes still all stuck together. The extra step was too extra.



« The photograph shows Cottonelle wipes in Brooklyn. Wipes are not flushable. NYC DEP. Photograph by Lynn Yellen.

◀ Fatbergs. Used with permission by the City of New York and the NYC Department of Environmental Protection.

Drawing by
Hendrick Bonilla.



The sewer system is also under stress in Queens because of a collapsed pipe. In December 2019, a concrete sewer pipe collapsed in Brooklyn. At first, the City blamed people for pouring grease down the drains. The people were insulted. Later, the City had to admit that it was a problem with the pipe. There was a flood and that flood was caused when the pipe collapsed. The flood affected New Yorkers because their homes stunk and smelled like raw sewage. The Department of Environmental Protection must clean any backups

within ten days, and they must be prepared for the next flood. The DEP Commissioner said that “These types of events are extremely rare.... But, you know, once every five years or so, something like this happens.”² It’s a lot of work to maintain thousands of miles of sewers, almost one hundred pumping stations, and fourteen wastewater treatment plants.

² Katie Van Syckle. “Raw Sewage Flooded Their Homes. They Finally Know Why.” *New York Times*. December 19, 2019. www.nytimes.com/2019/12/19/nyregion/queens-sewer-flooding.html

Chapter 5 What Does the Future Hold?

There are multiple programs to address stormwater and run-off in order to protect our sewers. The City's Department of Environmental Protection (DEP) has set up rain gardens and permeable paving to help deal with stormwater and run-off. They help make the system work because they prevent Combined Sewer Overflow (CSO) and prevent problems that can break sewer pipes. CSO happens when the amount of water in the system is too great. CSOs prevent damage to our wastewater infrastructure.

The map shows the locations of the rain gardens in Williamsburg, Brooklyn. Rain gardens, like the one in this photograph, are used to prevent flooding. A rain garden is a giant sponge, so the plants can absorb the water. Did the rainwater pull the trash into the little gardens? The sponge picks up garbage so it won't go in the sewer.



★ **DID YOU KNOW**

Did you know that climate change results in more rainfall?

In the last twenty years, there have been eleven years when rainfall in Central Park was over fifty inches annually. This is dramatically different from earlier eras, when that amount of annual rainfall was unusual. Until 1970, annual rainfall was more likely to be under forty inches than it was to be over fifty inches. With a combined sewer system in much of the City, a wetter climate requires creative solutions to protect our sewer system from overwhelming volumes of rainwater.

PS 380 Young Scholars examining a rain garden in their neighborhood.

Photograph by Lynn Yellen.

Gravel and permeable pavement are used to soak up rain and prevent CSO.

Photograph courtesy of Shirley Brown Alleyne.



EDUCATORS NOTE *The Young Scholars of PS 380 were excited to learn that the City has a program for New Yorkers to become stewards of rain gardens. The City trains members of the community to maintain the rain gardens and provides the necessary tools. On March 4, less than two weeks before the NYC schools were shuttered due to the pandemic, the students agreed that we should become stewards and I contacted raingardens@dep.nyc.gov to request a training. Unfortunately, we could not go forward with our plan.*

Glossary

Aeration the introduction of air into a system or a material.

catch basins storm drains that collect rainwater from the streets.

cesspool a well or pit for holding household sewage.

combined sewer overflow (CSO) the drainage into waterways that occurs when the volume of stormwater plus sewage exceeds the capacity of the water treatment facility.

combined sewer system a sewer system that combines wastewater from homes and factories with the contents of the storm drains on the streets.

fatberg a solid mass of fats and solids, like 'flushable' wipes, that forms in a sewer and blocks it.

feces excrement, human or animal waste.

flushable describes something that can be flushed down a toilet.

green infrastructure physical structures and systems that work with the natural environment.

influent the wastewater, stormwater, and trash that enters a combined sewer system
intestinal worms—organisms that live in a person's stomach or lower intestines.

night soil human excrement collected at night from buckets, cesspools, and outhouses.

permeable paving absorbent materials for the surface of a street (instead of concrete or asphalt).

privy vault the space under an outhouse.

reservoir a large body of water used as a water supply.

sewage a mixture of the waste of the population.

steward a person who cares for and looks after something, in this case, a rain garden.

watershed an area of land that drains into a body of water or a network of reservoirs.

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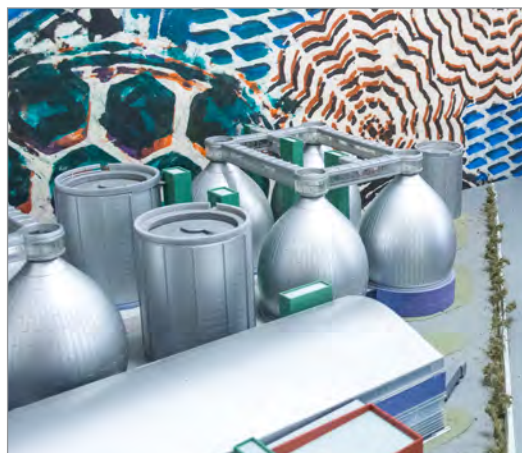
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Credits

2020 Young Scholars of PS 380

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