

# Navigating New York City's Wastewater System

---

## Description:

This lesson will introduce students and teachers to New York City's underground infrastructure. Using images of storm drains, sewers, and wastewater resource recovery facilities, students will piece together the larger picture of the NYC water cycle and discover their role in helping to protect water as the effects of climate change intensify.

By developing a greater understanding of the wastewater treatment system in NYC, students should be able to identify the system's environmental impacts.

Optional: This lesson is a great continuation of DEP's [Discovering New York City's Water Supply System](#) lesson. In that lesson, students follow a similar procedure to create the drinking water supply system. The wastewater system and the water supply system are two distinct pieces of New York City's water story, and can be explored together or separately. If your class created the water supply system already, keep that on the side and at the end of this lesson, discuss the ways these two systems should connect. You can also provide information on both systems all at once and have students create one large water system from start to finish.

## Objectives:

- Understand local phenomenon related to NYC's wastewater treatment system
- Understand our role and responsibilities in the effective treatment of wastewater and stormwater

- Model systems thinking by constructing a flow chart and considering all of the pieces that play a part

## Vocabulary:

Biosolids, biogas, catch basins, compost, green infrastructure, infrastructure, resiliency, runoff, sewers, sludge, stormwater, sustainability, wastewater, wastewater resource recovery facility

## Materials:

- Markers
- Tape
- Printed picture cards (samples included)
- Blank picture cards (printed on color paper)
- Large sheet of white paper
- Optional: string or yarn

## Background Information:

NYC's wastewater treatment system is an essential process that cleans more than one billion gallons of wastewater each day. Wastewater travels through two types of sewer systems in NYC: combined and separate. The combined system carries waste and stormwater together in one pipe to a wastewater resource recovery facility. The separate sewer system carries stormwater and wastewater in separate pipes, where untreated stormwater flows directly into local waterways, and wastewater flows to a wastewater resource recovery facility. In dry weather, the sewer system functions well, however in wet weather, the combined sewer system may overflow and release a diluted, untreated mix of stormwater and wastewater into nearby waterways.

Climate change is shifting the global water cycle and NYC’s wastewater treatment system will be affected by this shift. Overall, the occurrence of storms and rain events are predicted to increase, which will affect the amount of stormwater entering the sewer system and potentially lead to increased combined sewer overflows (CSOs). NYC’s wastewater resource recovery facilities are all located on or near local waterbodies, which makes these facilities more vulnerable to sea level rise, coastal flooding, and increased storms.

## Method:

- Ask students, “How have you used water today? Where do you think your wastewater goes?”
- Explain to students what happens to our wastewater in NYC, including how it is conveyed from our homes and schools through the sewer system, and treated at one of 14 wastewater resource recovery facilities before it is released back into NYC’s local waterways.
- NYC Department of Environmental Protection (DEP) is the city agency responsible for providing New Yorkers with clean drinking water and treating wastewater. With a growing focus on NYC’s sustainability, DEP is turning the City’s wastewater treatment plants into wastewater resource recovery facilities.
- Ask students why they think we are transitioning from treatment plant to resource recovery facility. What does resource recovery mean?
- After hearing their initial thoughts, explain that wastewater resource recovery facilities are designed to treat used water and stormwater before being discharged into receiving waterbodies and turn its

byproducts into beneficial use. These facilities work to recover energy, nutrients, water, and materials in their operations. The new term encompasses all of the work we do to recover these resources, beyond simply treating wastewater.

- Project sample pictures of the wastewater resource recovery facilities for the class to see or pass out sample picture cards (examples at end of lesson). Ask students to try to identify what they observe.

## Part I:

- Break students into small groups. Explain that each group will use the materials provided to create a flow chart or illustration of the wastewater treatment system.
- Using a large sheet of white paper, tape and markers, each group will organize picture cards to depict the flow of water through the wastewater treatment system.
- Have students begin by using the provided picture cards, or select a set of picture cards, including:
  - a. **Wastewater** – Produced from homes, schools, businesses, and industry
  - b. **Drains** – function of toilets, sinks, etc. that collects wastewater (and often other household waste)
  - c. **Catch basins** – drains that collect stormwater, and sometimes litter, off of the street
  - d. **Sewer pipes** – pipes that convey wastewater
  - e. **Wastewater resource recovery facilities** – 14 facilities where NYC’s wastewater and stormwater is cleaned

- f. **Wastewater treatment process** – cleaning wastewater and releasing it into NYC waterways
  - g. **NYC waterways** – where water is safely released after being treated
  - h. **Green Infrastructure** – engineered natural spaces that absorb stormwater from streets, sidewalks and rooftops
- Allow students 5-10 minutes to look through the pictures cards.
  - Give students another 15 minutes to create their wastewater treatment system. Students can connect the picture cards by drawing how the water flows from one place to the next (i.e. sewer pipes, waterways). Have students add arrows to show the direction of flow.
  - *Optional:* students can also tape string/yarn to connect the picture cards in the flow chart. Students will then manipulate the string/yarn in Part II as new picture cards are added to the flow chart.
  - Have groups share out with the class and discuss their decision-making process, and their understanding of interconnections.

#### Part II:

- Have groups share out with the class and discuss their decision-making process, and their understanding of interconnections.
  - Ask students, “How do we fit in this system”? Explain that in many ways we play a role in this system. Encourage students to brainstorm how their actions and behaviors relate to the wastewater treatment system, and depict their influence on the system by using additional blank picture cards that students can write and draw on. Give groups another 10-15 minutes to use the provided blank cards (printed on color paper and pre-cut before the exercise) to illustrate our role and involvement in this system.
- Remind students that how we play a role in the system can be considered both good and bad (some activities may help optimize the system while others harm it).
  - Some examples may include:
    - a. **Water use and conservation**
    - b. **Street litter and pollution**
    - c. **Cooking grease and harmful household waste products**
    - d. **School gardens and street tree care**
    - e. **Harbor water quality monitoring**
    - f. **Recreation**
    - g. **Education and stewardship**
  - Flow charts will vary. Students can create systems that are cyclical, linear, or branch-like (showing numerous directions or inputs/outputs).
  - Ask each group to share out what they added to their flow chart in Part II.

#### Part III:

- Now, have students consider what they know about climate change. How are the water cycle and climate change interconnected? How do you think such changes affect NYC’s wastewater treatment system?
- Encourage students to brainstorm how their flow chart of the system will now look with the influence of climate change. Students can use markers to alter and/or highlight how climate change affects the different components of their system.
- Consider including:
  - a. **Temperature** – higher temperatures, greater water use
  - b. **Precipitation** – heavy storms and coastal flooding

- c. **Water quality** – stormwater runoff, combined sewer overflows
- Have groups share out and discuss.

### Discussion:

- Where do we fit in this system? How do we affect this system?
- Were you unfamiliar with any part of the wastewater treatment system?
- How can we be good stewards to help the system function properly?
- What are actions we can take to help improve this system and our local environment?
- How does climate change impact this system?
- How do NYC's wastewater resource recovery facilities connect to the concepts of resiliency and sustainability?
- Link the water system to climate change by discussing the ways in which water use connects to energy (i.e. the more water we use, the more energy is needed to treat the wastewater once it is sent to a treatment facility).

### Extension:

- Bring students on a field trip to the Visitor Center at the Newtown Creek Wastewater Resource Recovery Facility in Brooklyn. The Visitor Center allows students and educators

to learn how DEP treats wastewater each day at the largest wastewater resource recovery facility in NYC. Visit DEP's website to schedule your field trip to the [Visitor Center at Newtown Creek](#).

- Use DEP's map, [New York City's Water Story: From Mountain Top to Tap](#), to help students explore the history and present-day narrative about our water resources.
- Brainstorm some connections between your school and the wastewater treatment system in NYC (i.e. bathrooms, rainwater that falls onto your school, water fountains, water used in cafeterias, etc.). Another interesting connection between your school and wastewater treatment is the food waste produced in your school's cafeteria. Newtown Creek wastewater resource recovery facility receives some food waste from schools, which is then processed and turned into biogas, a renewable energy that is used to heat and cool some homes in NYC. This is a great example of a systems thinking concept that illustrates the importance of proper waste sorting in cafeterias, the potential for large-scale sustainable energy systems in NYC, and the circular nature of human and natural systems more broadly.

**NYC Department of Environmental Protection**

[educationoffice@dep.nyc.gov](mailto:educationoffice@dep.nyc.gov)

For more information visit [www.nyc.gov/dep](http://www.nyc.gov/dep)



### Sample Picture Cards

**Instructions:** Below you will find some sample picture cards that depict the wastewater treatment system. You can also include additional pictures. Blank boxes are provided for the picture cards that will be included in Part II of the lesson.



**Wastewater**



**Catch Basin**



**Drains**



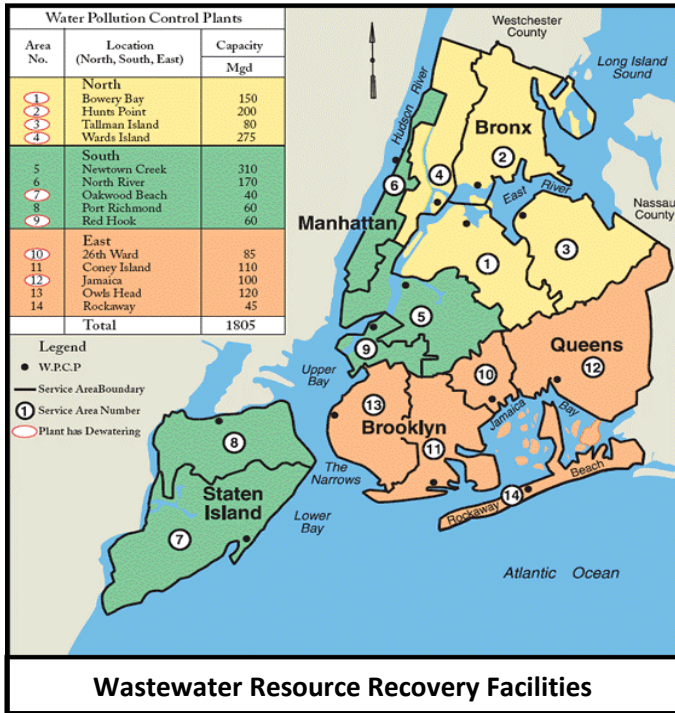
**Sewer Pipes**



**Wastewater Treatment Process**



**NYC Waterways**



|  |
|--|
|  |
|  |

|  |
|--|
|  |
|  |

|  |
|--|
|  |
|  |

|  |
|--|
|  |
|  |

|  |
|--|
|  |
|  |

|  |
|--|
|  |
|  |