The University of Chicago Center for International Studies presents *Global Lessons* as part of its commitment to providing educational resources for K-12 educators. These materials offer thematic international & area studies content on topics including culture, economics, politics, history, and environmental issues. With *Global Lessons*, CIS aims to provide classroom materials that will not only help to expose students to global issues, but also to empower them to think critically about their role as global citizens.

**Water: An Interdisciplinary Examination of the World’s Most Essential Resource**

*Chicago’s Water*

The University of Chicago Center for International Studies
The Center for International Studies’ Summer Teacher Institute, “Water: An Interdisciplinary Examination of the World’s Most Essential Resource,” was held on the University of Chicago campus from June 28-30, 2010. In addition, a curriculum development workshop was hosted on July 1st and an optional field trip to the Stickney Water Reclamation Plant and the Chicago Center for Green Technology took place on July 2nd.

The Institute provided an in-depth and multifaceted review of global water issues, as well as those that specifically affect the Great Lakes region. Daily topics addressed included: water issues in politics, effective water management, impacts of dams, water scarcity, sanitation, agriculture, and economics.

Thirteen professors, researchers, environmental engineers, and civic leaders from the University of Chicago and other educational institutions from around the world, spoke each day. Sixty elementary, high school, and college teachers from thirty-eight Illinois schools, as well as 20 other education-stakeholders attended the Institute.

The Institute was cosponsored by the University of Chicago Center for International Studies, the Center for East Asian Studies, the Center for Middle Eastern Studies, the Center for East European and Russian Eurasian Studies, the South Asia Language and Area Resource Center, and the Center for Latin American Studies.

The following lesson was created by Jill Krysinski, Honors Biology and Environmental Science Teacher at Bloom High School, and edited by Jamie Bender, Outreach Coordinator for the Center for International Studies at the University of Chicago. The lesson is based on speakers’ presentations at the Institute.

For more information on the Center for International Studies, additional resources and classroom lessons developed based on this Institute, and to download resources from other events, please visit the Center’s website: http://cis.uchicago.edu/
Chicago’s Water

Lesson Overview: In this lesson students will learn about how Chicago residents and suburban residents get clean water from Lake Michigan. Students will learn about the Metropolitan Water Reclamation District of Greater Chicago and understand how the MWRDGC manages wastewater and storm water. Students will read about the history of the Chicago River and create a timeline. This lesson is based on information presented at the 2010 University of Chicago Teacher Institute, “Water: An Interdisciplinary Examination of the World’s Most Essential Resource.”

Written By: Jill Krysinski, Honors Biology and Environmental Science Teacher, Bloom High School

Subject(s): Biology, Environmental Science, Social Studies, Geography

Suggested Grade Level(s): Middle School and High School

Time Duration: Three, 40 minute class periods

IL Learning Standards Addressed:

Social Studies
14.C.3 Compare historical issues involving rights, roles and status of individuals in relation to municipalities, states and the nation.
16.E.3a (US) Describe how early settlers in Illinois and the United States adapted to, used and changed the environment prior to 1818.
16.E.3b (US) Describe how the largely rural population of the United States adapted, used and changed the environment after 1818.
16.E.3c (US) Describe the impact of urbanization and suburbanization, 1850 - present, on the environment.

English
3.B.4a Produce documents that exhibit a range of writing techniques appropriate to purpose and audience, with clarity of focus, logic of organization, appropriate elaboration and support and overall coherence.

Objectives:

• Understand how water from Lake Michigan is distributed to Chicago residents and the surrounding suburbs.
• Explain the changes made to the Chicago River through the building of man-made canals.
• Create a timeline of events in the history of the Chicago River.
• Analyze the consequences of re-reversing the Chicago River.
Materials:

- PowerPoint “History of Chicago’s Water”
- LCD projector and speakers
- Computer with Internet access
- “History of Chicago’s Water” PowerPoint Presentation – Skeleton Notes
- “History of Chicago Rivers” Student Worksheet
- “History of Chicago Rivers” Student Worksheet Answer Key
- Markers or colored pencils
- Rulers

Activities and Procedures:

1. Go over the following terms with your students before you begin the lesson:
   - Runoff
   - Effluent water
   - Intake crib
   - Reservoir
   - Flocculation
   - Divert
   - Water main
   - Sewer main
2. Show the following YouTube videos on Illinois Drinking Water:
   - [http://www.youtube.com/watch?v=vXom1ObYl5c](http://www.youtube.com/watch?v=vXom1ObYl5c)
   - [http://www.youtube.com/watch?v=ijxJixq4G2U](http://www.youtube.com/watch?v=ijxJixq4G2U)
3. Give each student a copy of the “History of Chicago’s Water” PowerPoint Presentation Skeleton Notes and show your students the History of Chicago’s Water” PowerPoint Presentation.
   - Have students fill in the blank terms on the worksheet, as you go over each slide.
4. The History of Chicago Rivers Activity
   - Give each student a copy of “Brief History of the Chicago River” by Friends of the Chicago River and History of Chicago Rivers Student Worksheet.
   - In the first part, students will trace the water ways of Chicago in various colors.
   - Next, ask students to read the article and answer the questions on the History of Chicago Rivers worksheet.
   - Then, ask students to go back through the article and match the years to events.
   - In the end, have students make a timeline of the events.
5. Should the Chicago River be re-reversed?
   - Give each student a copy of the “Should Chicago Re-reverse the Chicago River?”
   - Students will read the integrated article, “Michigan sues to protect Great Lakes from Asian carp,” by Kari Lydersen, a staff writer for the Washington Post on December 27, 2009.
   - Students will list the reasons why Michigan is suing Illinois.
   - At the end, Students will answer this question. “If Chicago does re-reverse the flow of the Chicago River, what would be the outcomes (positive and negative)?”

Assessments:

   - “History of Chicago’s Water” PowerPoint Presentation – Skeleton Notes
   - “History of Chicago Rivers” Student Worksheet
     “Should Chicago Re-reverse the Chicago River?” Worksheet

Adaptations:

   - Take a field trip to the Chicago River  http://www.wendellaboats.com/  and http://www.chicagoriver.org/education/field_trips/field_trip_sites/
   - Invite Friends of the Chicago River to come to your classroom. A Friends staff member or volunteer will come to your school to share the history of the Chicago River with your students. Pre- and post-lessons are available for certain programs. Programs are 45 minutes long, but can be tailored to your class length. http://www.chicagoriver.org
   - Chicago Historical Society – lesson on the Chicago River

Extra Credit/Additional Resources:

   - Friends of the Chicago River
     http://www.chicagoriver.org/education/curricula/lesson_plans/
   - Chicago Shedd Aquarium
     http://www.sheddaquarium.org/children_and_teens.html
   - Chicago Wilderness
     http://www.chicagowilderness.org/
   - Sea Grant Michigan
     http://www.miseagrant.umich.edu/explore/greatlakes/lake-michigan.html
   - Chicago History Museum
     http://www.chicagohistory.org/
   - Burnham Plan Centennial
     http://burnhamplan100.uchicago.edu/learning/classroom_resources/curricula_lesson_plans
## The History of Chicago’s Water

### Skeleton Notes

<table>
<thead>
<tr>
<th>Chicago's Water</th>
<th>Department of Water Management must:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• How do we get clean water?</td>
</tr>
<tr>
<td></td>
<td>• Where does our dirty water go?</td>
</tr>
<tr>
<td></td>
<td>• Where does the storm water go?</td>
</tr>
<tr>
<td></td>
<td>• Deliver __________________________.</td>
</tr>
<tr>
<td></td>
<td>• Remove __________________________.</td>
</tr>
<tr>
<td></td>
<td>• Remove ____________________________ from the streets.</td>
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</table>

<table>
<thead>
<tr>
<th>Path of Water</th>
<th>Lake Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ___________</td>
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<td>2. ___________</td>
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<td>3. ___________</td>
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<td>5. ___________</td>
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<td>6. ___________</td>
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<td>7. ___________</td>
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<tr>
<td>8. ___________</td>
<td></td>
</tr>
</tbody>
</table>
### City of Chicago Water Network
- ________________
- ________________
- ________________
- ________________
- ________________
- ________________

All require constant upkeep and maintenance.

### Chicago Underground Pipes
- ________________ miles of pipe to move water –
- Every year ________________ miles of pipe are fixed.

### Chicago Water Distribution
- The City of Chicago delivers ________________.
- All residents of ________________ and 125 ________________ everyday.

### The Sewer System
- ________________ waste water and storm runoff.
- The ________________ water is diverted to the Metropolitan Water Reclamation District of Greater Chicago for treatment.

### 2 Water Treatment Plants
- The James W. Jardine Water Purification Plant
- The South Water Filtration Plant
- Distribute ________________
- Combined -pump an average of ________________ million gal / day.
Chicago's Water Treatment Plants

- Water from Lake Michigan enters the ____________ at depths of 20 to 30 feet.
- Water enters the purification plant's intake _______________ through a ________________ beneath the lake bed.
- Water is filtered through eight traveling _______________ to catch debris.
- Water is _______________ by low lift pumps up to 25 feet for the first _______________ _______________.
- Water flows from the _______________ ________________ channels.
- Water flows through mixing basins to begin the _______________ process.
- Flocculated water passes into _______________ _______________ to sit for hours allowing floc to settle.
- Water is _______________ through precisely graded sand and gravel performing a “natural polishing.”
- Filtered water flows into _______________ for its final chemical application.
- From finished water reservoirs, water flows to the _______________ _______________ and out to consumers.
| Chemicals Used in Treatment | • _____________: to disinfect the water.  
• _____________: for coagulation – binds together suspended particles which are later filtered out.  
• _____________: to coat pipes and prevent lead leaching.  
• _____________: to remove unpleasant tastes and odors.  
• _____________: to help fight cavities in children's teeth. |
| Problems | • Chicago’s water _____________ is over 100 years old.  
• Crib tunnels and underground water mains are old and _____________.
• They _____________ an estimated _____________ gallons /day. |
| Water Main Repairs | • Every year 70 miles of pipe are fixed.  
• This is not enough, but it is all that the city can afford.  
• If Chicago replaces 1 percent of its 4,200 miles of main each year, it will overhaul the entire system every _____________.
| Waste Water | • “___________”  
• Any water flushed down a drain or toilet.  
• It comes from homes, businesses, industry, agriculture  
• Sewage enters into _____________ ____________.
| Storm Runoff | • Excess water from rain or snow.  
• Too many _____________ ____________ in the city.  
• Soil cannot absorb so much water.  
• Runoff causes water to _____________ or flood. |
| Stormwater Pollution | • Stormwater can pick up debris, chemicals, dirt, and other _____________ and flow into a storm sewer system or directly to a lake, stream, river, wetland,
or coastal water.

- Anything that enters a storm sewer system is discharged ________ into the __________ we use for swimming, fishing and providing drinking water.

<table>
<thead>
<tr>
<th>Metropolitan Water Reclamation District of Greater Chicago</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Government agency that controls __________ and __________.</td>
</tr>
<tr>
<td>- The District has __________ of intercepting sewers that connect to __________ local sewer systems.</td>
</tr>
<tr>
<td>- The District controls 76.1 miles of navigable waterways, which are part of the inland waterway system connecting the Great Lakes with the __________.</td>
</tr>
<tr>
<td>- It also owns and operates 30 stormwater detention __________ to provide regional stormwater flood damage reduction.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Steps in Water Reclamation Plant</th>
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<td>C</td>
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</tbody>
</table>

Optional

<p>| T  | Filter and add chemicals |
|    | Usually skipped in Chicago |
|    | Water Reclamation Plant - Sludge |</p>
<table>
<thead>
<tr>
<th>Solids</th>
<th>• Recycled into _______________ _______________ for farmers.</th>
</tr>
</thead>
</table>
| Water Reclamation Plant - Other | • Test _______________ waste water samples regularly.  
• Plants have _______________ on the amount of pollutants they can dump down the drain.  
• They are charged more _______________ if they over pollute. |
| Water Reclamation Plant | • I & M Canal  
• _____________________________ Canal  
• Cost of $6.5 million  
• _______________ sewage water from Lake Michigan. |
| The Chicago River | • The flow was _______________ in 1900.  
• The reversal prevented the yearly deaths. |
| TARP | • _____________________________ Project  
• Also called “deep tunnel” project  
• Started in 1834 when the Chicago River was used to dump _______________, factory, and other wastes.  
• This _______________ drinking water.  
• People died from _______________ and _______________.  
• Project designed for _______________ and _______________ control.  
• Four tunnel systems |
- 109 miles of tunnels
- 9 to 33 feet in diameter
- 150 to 300 feet underground
History of Chicago Rivers

Trace the Chicago Rivers with the following colors in both maps:

<table>
<thead>
<tr>
<th>River</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago River</td>
<td>Blue</td>
</tr>
<tr>
<td>Sanitary and Ship Canal</td>
<td>Red</td>
</tr>
<tr>
<td>Cal Sag Channel</td>
<td>Orange</td>
</tr>
<tr>
<td>North Branch of Chicago River</td>
<td>Yellow</td>
</tr>
<tr>
<td>North Shore Channel</td>
<td>Green</td>
</tr>
<tr>
<td>Des Plaines River</td>
<td>Purple</td>
</tr>
<tr>
<td>Illinois River</td>
<td>Blue</td>
</tr>
<tr>
<td>Mississippi</td>
<td>Red</td>
</tr>
</tbody>
</table>

Read the “Brief History of the Chicago River” by the Friends of the Chicago River and answer the questions below:
1. What did the Native Americans name Chicago and why?

2. What is portaging?

3. How did the French learn about the Chicago River?

4. What happened to the La Mission de l'Ange Gardien?

5. What is the Fort Dearborn massacre?

6. After the Blackhawk War of 1832, the Chicago Treaty was signed in 1833. What did this mean to the Native Americans?

7. What major industry was started in 1850 in Chicago?

8. Why was the Illinois and Michigan Canal built?

9. Why was the traffic backing up in Chicago?

10. How did the Chicago River get polluted?

11. What is the title of the book by Upton Sinclair?
12. What is the job of the Sanitary District of Chicago?

13. Why was the Chicago Sanitary and Ship canal so important?

14. Why did Minnesota, Pennsylvania, New York and Michigan have such a heated debate about Chicago?

15. Who is Captain George Wellington Streeter?

16. Who is Frank Lloyd Wright?

17. Why was the Forest Preserve District of Cook County created?

18. Why did the Sanitary District of Chicago complete construction of their water treatment plants?

19. Why are the Skokie Lagoons important for the Northern suburbs?

20. What public housing developments were built in 1930’s and 1940’s?

21. What are the names of the luxury apartment complexes that changed the value of the riverfront property?

22. What did the Clean Water Act make illegal?
23. Who are the Friends of the Chicago River?

24. Why was TARP started?

25. What is the North Branch Watershed Project?

26. What is the Flatwater Classic?

27. What is on display at the Bridgehouse Museum?
Match the years below with the correct events. Then, create your own timeline detailing the History of the Chicago River.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1673</td>
<td>A. Fish Hotel constructed</td>
</tr>
<tr>
<td>1779</td>
<td>B. North Side Water Reclamation Plant built</td>
</tr>
<tr>
<td>1803</td>
<td>C. Tunnel and Reservoir Plan (TARP) begun</td>
</tr>
<tr>
<td>1848</td>
<td>D. West Side Water Reclamation Plant built</td>
</tr>
<tr>
<td>1889</td>
<td>E. Chicago River Day implemented to clean up litter</td>
</tr>
<tr>
<td>1900</td>
<td>F. The Forest Preserve District of Cook County created</td>
</tr>
<tr>
<td>1904</td>
<td>G. Clean Water Act passed</td>
</tr>
<tr>
<td>1907</td>
<td>H. The North Branch straightened</td>
</tr>
<tr>
<td>1909</td>
<td>I. Daniel Burnham wrote his Plan of Chicago</td>
</tr>
<tr>
<td>1922</td>
<td>J. Cal-Sag Channel completed</td>
</tr>
<tr>
<td>1922</td>
<td>K. Calumet Water Reclamation Plant built</td>
</tr>
<tr>
<td>1928</td>
<td>L. Illinois and Michigan Canal completed</td>
</tr>
<tr>
<td>1928</td>
<td>M. Sanitary District of Chicago created to manage wastewater and clean up pollution</td>
</tr>
<tr>
<td>1939</td>
<td>N. Chicago Sanitary and Ship Canal</td>
</tr>
<tr>
<td>1972</td>
<td>O. The Riveredge Plan of Chicago established</td>
</tr>
<tr>
<td>1974</td>
<td>P. IBM donated money to build parks along the south bank of the river</td>
</tr>
<tr>
<td>1975</td>
<td>Q. Chicago River Rowing and Paddling Center founded</td>
</tr>
<tr>
<td>1975</td>
<td>R. North Branch Watershed Project started</td>
</tr>
<tr>
<td>1979</td>
<td>S. Jolliet and Marquette introduced to the Chicago River</td>
</tr>
<tr>
<td>1992</td>
<td>T. Jean Baptiste Point DuSable built his home near the mouth of the Chicago River</td>
</tr>
<tr>
<td>1999</td>
<td>U. Fort Dearborn built</td>
</tr>
<tr>
<td>2005</td>
<td>V. South Branch of the Chicago River was straightened</td>
</tr>
</tbody>
</table>
History of the Chicago River Timeline

Write the year above the line and the event that occurred that year below the line.
**Should Chicago Re-Reverse the Chicago River?**

**PART I:**
*Read the article below by Kari Lydersen, a staff writer for the Washington Post on December 27, 2009.*

**Michigan sues to protect Great Lakes from Asian carp**

The reversal of the Chicago River a century ago, to send the city's sewage to the Mississippi River instead of into Lake Michigan, was hailed as an engineering marvel. Now Michigan is suing Illinois to potentially re-reverse the river to prevent the movement of voracious, invasive Asian carp into the lake.

The suit, which is going to the Supreme Court, also challenges Chicago's controversial withdrawal of up to 2 billion gallons of water a day from Lake Michigan.

Environmental groups have long called for the ecological separation of the Great Lakes from the Mississippi River basin to curb the spread of invasive species and to retain Great Lakes water in the Great Lakes basin. It is estimated the Chicago diversion has lowered lakes Michigan and Huron by three inches.

The Chicago River was reversed by connecting it through a system of canals to rivers whose waters flow into the Mississippi. Varying degrees of ecological separation could be achieved by closing the canals: using sluice gates to allow lake water to flow but blocking fish or boats; or using measures such as bubble or sound "curtains," chemicals or electricity to limit the movement of fish and smaller organisms.

Since 2002, the Army Corps of Engineers has run an electric barrier in the canal to block Asian carp. But tests by the University of Notre Dame and the Nature Conservancy in the fall found Asian carp DNA beyond the barrier near Lake Michigan, indicating that it might have failed to keep the voracious fish at bay.

If Asian carp make it into the Great Lakes, environmentalists and policymakers say, they could wipe out plankton that makes up the base of the food chain, severely impacting fishing and lake-based tourism.

"It's a matter of self-defense economically and ecologically for Michigan," said Michigan Attorney General Mike Cox.

Michigan's suit, filed Dec. 21, reopens a 1922 lawsuit filed by Great Lakes states challenging Chicago's right to divert water. That suit resulted in a consent decree limiting the amount of water Chicago sends to the Mississippi. Michigan's suit also calls for a preliminary injunction to force the temporary closure of locks, used for flood control and navigation.

"They've been saying they have this under control, but they really don't, and they're going back to the status quo," said John Sellek, a spokesman for the Michigan attorney general. "Their primary interest is keeping the waterway open, keeping that barge traffic on the canals. But Michigan's interest is far larger than that. The Great Lakes fishing industry is worth $7 billion all by itself, let alone the hundreds of thousands of jobs that are connected to the Great Lakes."

The Corps of Engineers and other federal, state and local authorities would probably be involved in closing the canals or other ecological separation measures, which could also be mandated through legislation.

If the canals were closed, barges could not travel from the Mississippi River into the Great Lakes. Freight would probably have to be transferred to trucks or rail cars and carried over land to Great Lakes ports. That would be a costly undertaking.
The national industry group for barge operators, which opposes closing the locks, says about a quarter-million truck trailers' worth of goods make the passage annually on barges. But national environmental groups say the potential economic impact of Asian carp and other invasive species in the Great Lakes make freight reconfiguration worth the cost.

A 2008 study by the Alliance for the Great Lakes found that ecological separation could be economically beneficial and improve efficiency of freight transport.

The Natural Resource Defense Council has proposed that an environmentally sustainable intermodal freight facility be built to replace barge traffic into the lake, creating "green jobs" and curbing the invasive species risk.

"This way of moving goods may have made sense in the 19th century or 50 years ago, but are we still dependent on those same decisions?" asked Henry Henderson, NRDC Midwest program director. "We built a system without understanding the full implications. Now we have to design and build an engineered solution to a human-created problem."

An ecological separation would probably mean Chicago would have to revamp its wastewater infrastructure.

"The reason Chicago reversed the flow of the river was to protect Lake Michigan from sewage pollution, but that protection is no longer needed because Chicago and every city has the technology now to clean up sewage so it's safe to discharge it into the Great Lakes," said Andy Buchsbaum, National Wildlife Federation Great Lakes regional executive director, who noted that Milwaukee and other cities discharge treated sewage into the Great Lakes.

"Instead of protecting Lake Michigan, the system is now the primary vector for the biggest pollution threat the Great Lakes have faced: invasive species."

Asian carp aren't the only invasive species transported through the canals. It seems likely that zebra mussels and round gobies were introduced to the Great Lakes in ballast from oceangoing ships and then made their way into the Mississippi River basin via the Chicago River and canals. Zebra mussels deplete plankton and clog water-intake structures. Round gobies compete destructively with native fish.

The electric barrier was originally proposed to block round gobies, but wasn't implemented fast enough. The barrier didn't operate at full strength until this year because of safety and other concerns. Now the Corps of Engineers plans to spend at least $6 million in stimulus funding on a stronger electric barrier.

"I was skeptical of that barrier from the get-go," Henderson said. "This has all been ad hoc herky-jerky responses to discreet problems, when the underlying problem is staring us in the face."

Buchsbaum called the Michigan lawsuit "seismic for the Great Lakes" because it addresses the invasive species threat but also reopens the nearly century-old legal battle over Chicago's diversion of Great Lakes water.

The Great Lakes-St. Lawrence River Basin Water Resources Compact -- signed by President George W. Bush last year after a decade-long legislative process -- bans almost all diversions of Great Lakes water out of the basin, with Chicago given the only significant exemption.

About 1 percent of the Great Lakes' water is replenished each year, and advocates worry that unchecked diversions could slowly drain the lakes.
**PART 2:**

List the reasons Michigan wants Chicago to re-reverse the Chicago River.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
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**PART 3:**

If Chicago does re-reverse the flow of the Chicago River, what would be the (positive and negative) outcomes? Write a paragraph to answer this question. Support your answer with real details.

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### The History of Chicago’s Water
#### Skeleton Notes

<table>
<thead>
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<tbody>
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<tr>
<th>Path of Water</th>
<th>Lake Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lake Michigan</td>
<td>2. Water Treatment Plant</td>
</tr>
<tr>
<td>3. Water Main Pipes</td>
<td>4. Consumers</td>
</tr>
<tr>
<td>7. Sanitary and Ship Canal (Chicago River)</td>
<td>8. Mississippi River</td>
</tr>
<tr>
<td>9. Gulf of Mexico</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City of Chicago</th>
<th><strong>Department of Water Management must</strong></th>
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</thead>
<tbody>
<tr>
<td>1. Deliver clean water</td>
<td>2. Remove waste water</td>
</tr>
<tr>
<td>3. Remove storm runoff from the streets</td>
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</tbody>
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<thead>
<tr>
<th>City of Chicago Water Network</th>
<th></th>
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<tbody>
<tr>
<td>• Purification plants</td>
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<td>• Tunnels</td>
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<tr>
<td>• Pumping stations</td>
<td></td>
</tr>
<tr>
<td>• Water mains</td>
<td></td>
</tr>
<tr>
<td>• Sewer mains</td>
<td></td>
</tr>
<tr>
<td>• All require constant upkeep and maintenance.</td>
<td></td>
</tr>
</tbody>
</table>
| Chicago Underground Pipes | • 4,200 miles of pipe to move water –  
• Every year 70 miles of pipe are fixed; |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago Water Distribution</td>
<td>• The City of Chicago delivers 1 billion gal/ day to all residents of Chicago and 125 suburban communities everyday</td>
</tr>
</tbody>
</table>
| The Sewer System | • Removes waste water and storm runoff  
• The effluent water is diverted to the Metropolitan Water Reclamation District of Greater Chicago for treatment |
| 2 Water Treatment Plants | • The James W. Jardine Water Purification Plant  
• The South Water Filtration Plant  
• Distribute clean water  
• Combined -pump an average of 1,048 million gal / day |
| Chicago’s Water Treatment Plants | 1. Water from Lake Michigan enters the intake crib at depths of 20 to 30 feet.  
2. Water enters the purification plant’s intake basin through a tunnel beneath the lake bed.  
3. Water is filtered through eight traveling screens to catch debris.  
4. Water is pumped by low lift pumps up to 25 feet for the first chemical treatment.  
5. Water flows from the chemical application channels.  
6. Water flows through mixing basins to begin the flocculation process.  
7. Flocculated water passes into settling basins to sit for hours allowing floc to settle.  
8. Water is filtered through precisely graded sand and gravel performing a "natural polishing".  
9. Filtered water flows into clearwells for its final chemical application.  
10. From finished water reservoirs water flows to the water mains and out to consumers |
### Chemicals Used in Treatment
- **Chlorine**: to disinfect the water.
- **Aluminum Sulfate or Alum**: for coagulation - binds together suspended particles which are later filtered out.
- **Blended Polyphosphate**: to coat pipes and prevent lead leaching.
- **Activated Carbon**: to remove unpleasant tastes and odors.
- **Fluoride**: to help fight cavities in children's teeth

### Problems
- Chicago’s water *infrastructure* is over 100 years old
- Crib tunnels and underground water mains are old and cracked
- They leak an estimated *84 million* gallons /day

### Water Main Repairs
- Every year 70 miles of pipe are fixed
- This is not enough, but all the city can afford
- If Chicago replaces 1 percent of its 4,200 miles of main each year, it will overhaul the entire system every *100 years*.

### Waste Water
- “Sewage”
- Sewage is any water flushed down a drain or toilet
- It comes from homes, businesses, industry, agriculture
- Sewage enters into *sewer pipes*

### Storm Runoff
- Excess water from rain or snow
- Too many *impermeable surfaces* in the city
- Soil cannot absorb it
- Causes water to flow or flood
| Stormwater Pollution | - Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water.  
- Anything that enters a storm sewer system is discharged untreated into the water bodies we use for swimming, fishing and providing drinking water. |
|----------------------|--------------------------------------------------------------------------------------------------|
| Metropolitan Water Reclamation District of Greater Chicago | - Government agency that controls waste water and storm water.  
- The District has 554 miles of intercepting sewers that connect to 10,000 local sewer systems.  
- The District controls 76.1 miles of navigable waterways, which are part of the inland waterway system connecting the Great Lakes with the Gulf of Mexico.  
- It also owns and operates 30 stormwater detention reservoirs which prevent flood damage. |
| Steps in Water Reclamation Plant | **Sewer Pumps**  
- Pump water 60 ft up  
- Through large screens  
- Large screens collect debris  
- Water is sent to the “wet well”  

**Aeration / Grit Chamber**  
- Air is pumped into the water  
- Grit settles to the bottom  
- Grit is moved on a conveyer belt  
- Water moves to a settling tank  

**Preliminary Settling Tank**  
- Collects water  
- Sludge settles to the bottom  
- Oils float to the top  
- Wooden planks skim the top and bottom  

**Secondary Settling Tank**  
- Air is added to the water  
- Microorganisms grow and eat pollutants  
- Microorganisms settle to the bottom of the tank  

**Clean Water**  
- Released into the Illinois Sanitation and Ship Canal  

**Optional Tertiary Settling Tank**  
- Filter and add chemicals  
- Usually skipped in Chicago |
<table>
<thead>
<tr>
<th>Solids</th>
<th>• Recycled into <strong>fertilizer</strong> pellets for farmers.</th>
</tr>
</thead>
</table>
| Water Reclamation Plant - Other | • Test **industry** waste water samples regularly  
• Plants have **limits** on the amount of pollutants they can dump down the drain  
• They are charged more **money** if they over pollute |
| Water Reclamation Plant | • I & M completed in 1848  
• **Illinois and Michigan** Canal  
• Cost of $6.5 million  
• **Diverts** sewage water from Lake Michigan |
| The Chicago River | • The flow was **reversed** in 1900  
• The reversal prevented the yearly deaths |
| TARP            | • **Tunnel and Reservoir Project**  
• Also called “deep tunnel” project  
• Started in 1834 when the Chicago River was used to dump **sewage**, factory, and other wastes  
• This **contaminated** drinking water  
• People died from **cholera and typhoid**  
• Project designed for **pollution and flood** control.  
• Four tunnel systems  
• 109 miles of tunnels  
• 9 to 33 feet in diameter  
• 150 to 300 feet underground |
History of Chicago Rivers

Trace the Chicago Rivers with the following colors in both maps:

<table>
<thead>
<tr>
<th>River</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago River</td>
<td>Blue</td>
</tr>
<tr>
<td>Sanitary and Ship Canal</td>
<td>Red</td>
</tr>
<tr>
<td>Cal Sag Channel</td>
<td>Orange</td>
</tr>
<tr>
<td>North Branch of Chicago River</td>
<td>Yellow</td>
</tr>
<tr>
<td>North Shore Channel</td>
<td>Green</td>
</tr>
<tr>
<td>Des Plaines River</td>
<td>Purple</td>
</tr>
<tr>
<td>Illinois River</td>
<td>Blue</td>
</tr>
<tr>
<td>Mississippi</td>
<td>Red</td>
</tr>
</tbody>
</table>

Read the “Brief History of the Chicago River” by the Friends
of the Chicago River and answer the questions below:

1. What did the Native Americans name Chicago and why?

Chicagoua means garlic, Chicago was named for the wild garlic plants that grew on the river banks.

2. What is portaging?

Portaging means to carry a canoe, they carried their canoes across the river.

3. How did the French learn about the Chicago River?

Native American guides showed some French fur traders the Chicago River portage.

4. What happened to the La Mission de l’Ange Gardien?

This place was destroyed by Native Americans after the French settled there.

5. What is the Fort Dearborn massacre?

Potawatomi Indians attacked and killed 86 adults and 12 children, along the Chicago River, in the War of 1812.

6. After the Blackhawk War of 1832, the Chicago Treaty was signed in 1833. What did this mean to the Native Americans?

The Native Americans gave up their rights to land in Illinois.

7. What major industry was started in 1850 in Chicago?

Shipbuilding was a major industry.

8. Why was the Illinois and Michigan Canal built?

Ships could not fit in the portage, so they built the I & M canal.

9. Why was the traffic backing up in Chicago?

The movable bridges that were raised to let boats through were raised so often that traffic was always backed up.

10. How did the Chicago River get polluted?

Chicago’s sewage flowed directly into the Chicago River and the Industries dumped waste into the river.

11. What is the title of the book by Upton Sinclair?

The Jungle
12. What is the job of the Sanitary District of Chicago?

Manage wastewater and get rid of the pollution.

13. Why was the Chicago Sanitary and Ship canal so important?

It kept the sewage out of the cities drinking supply and it cleaned the Chicago River.

14. Why did Minnesota, Pennsylvania, New York and Michigan have such a heated debate about Chicago?

Lake Michigan’s water level was very low, they blamed Chicago and all the canals built that took the water out.

15. Who is Captain George Wellington Streeter?

He founded the neighborhood called Streeterville after his ship crashed.

16. Who is Frank Lloyd Wright?

He was a famous architect from Chicago.

17. Why was the Forest Preserve District of Cook County created?

It was created to preserve hundreds of acres of natural area for the benefit of the public.

18. Why did the Sanitary District of Chicago complete construction of their water treatment plants?

The Supreme Court made them.

19. Why are the Skokie Lagoons important for the Northern suburbs?

They provided flood water drainage for the Northern suburbs.

20. What public housing developments were built in 1930’s and 1940’s?

Cabrini Green and the Julia Lathrop Homes

21. What are the names of the luxury apartment complexes that changed the value of the riverfront property?

Marina City and River City

22. What did the Clean Water Act make illegal?

It made dumping pollutants into water without permits illegal.
23. Who are the Friends of the Chicago River?

Chicagoans interested in cleaning the Chicago River.

24. Why was TARP started?

Tunnel and Reservoir Plant is a system of several huge tunnels connected to massive reservoirs under the city and suburbs to contain flood waters.

25. What is the North Branch Watershed Project?

River restoration and storm water management by the Friends of the Chicago River.

26. What is the Flatwater Classic?

It is a canoe race in the Chicago River.

27. What is on display at the Bridgehouse Museum?

It is a moveable bridge and the history of the Chicago River.
Match the years below with the correct events. Then, create your own timeline detailing the History of the Chicago River.

S 1673 A. Fish Hotel constructed
T 1779 B. North Side Water Reclamation Plant built
U 1803 C. Tunnel and Reservoir Plan (TARP) begun
L 1848 D. West Side Water Reclamation Plant built
M 1889 E. Chicago River Day implemented to clean up litter
N 1900 F. The Forest Preserve District of Cook County created
F 1904 G. Clean Water Act passed
H 1907 H. The North Branch straightened
I 1909 I. Daniel Burnham wrote his Plan of Chicago
K 1922 J. Cal-Sag Channel completed
J 1922 K. Calumet Water Reclamation Plant built
V 1928 L. Illinois and Michigan Canal completed
B 1928 M. Sanitary District of Chicago created to manage wastewater and clean up pollution
D 1931 N. Chicago Sanitary and Ship Canal completed
G 1972 O. The Riveredge Plan of Chicago established
O 1974 P. IBM donated money to build parks along the south bank of the river
P 1975 Q. Chicago River Rowing and Paddling Center founded
C 1975 R. North Branch Watershed Project started
Q 1979 S. Native American guides introduced Joliet and Marquette to the Chicago River
E 1992 T. Jean Baptiste Point DuSable built his home near the mouth of the Chicago River
R 1999 U. Fort Dearborn built
A 2005 V. South Branch of the Chicago River was straightened
PART 2:

List the reasons Michigan wants Chicago to re-reverse the Chicago River.

- Water rights
- Water taken out of Lake Michigan is not returned to the Great Lakes
- Water is diverted and goes out into the gulf
- Large amounts of freshwater becomes salt water
- Asian Carp are an invasive species