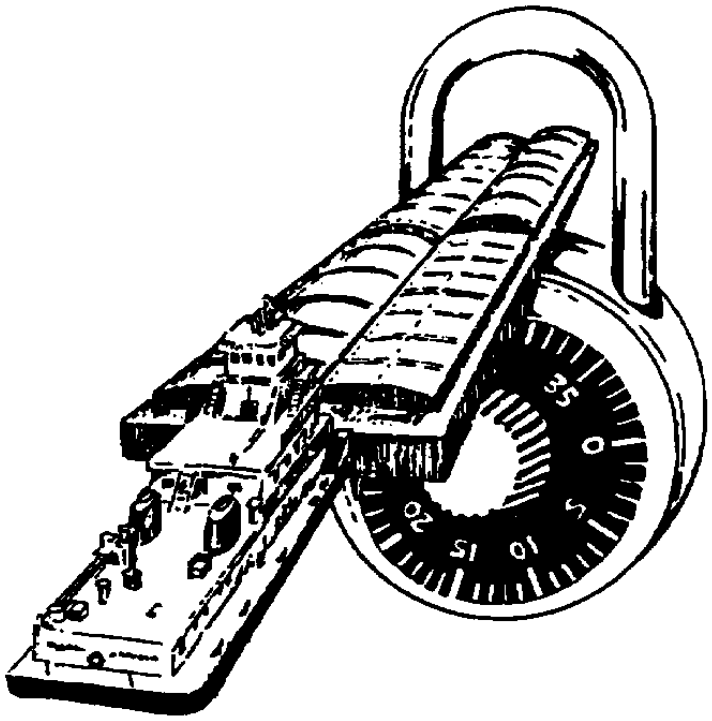
THE MISSISSIPPI AND ITS USES



US Army Corps of Engineers
Rock Island District

The Mississippi River and Its Uses

Objectives:

To identify the various uses of the river.

To understand the role the Corps of Engineers takes in managing the river.

To understand terms such as "locks and dams", "pools", "9 ft. navigation channel", and "tow boat and barges".

To learn about the various wildlife and recreational benefits the Mississippi River provides.

Activities:

Students will each receive a "The Mississippi and It's Uses" study guide. Eco-Test questions will be taken from the study guide. Before the Eco-Test, a short presentation about "The Mississippi and It's Uses" will be presented.

Study Questions:

1. Why did the Corps of Engineers begin making improvements on the Mississippi River? Why did they increase the channel depth to 9 feet?

2. What is the minimum depth the Corps currently maintains in the navigation channel?

3. What is the primary purpose of the dams on the Mississippi? Can navigation dams control flooding? What is the purpose of the locks?

4. What is the "stairway of water"? Where is it found?

5. What are the names of the four sections of the Mississippi River that are described in the Mississippi River Fact Sheet?

The Nine-Foot Channel Navigation Project on the Mississippi River
A Glimpse at the Past

The Upper Mississippi River has long served the people of North America. It has borne the Indian canoe, the explorer's pirogue, the pioneer's keelboat, and later during the golden age of the river steamer, the romantic paddle wheelers, so vividly recalled in song and story. The upper Mississippi River, however, has a history of being a "rebellious and undependable servant." Navigation on this mighty river has been forced to accommodate its whims; often deep-flowing,

but turbulent in times of flooding, or quiet, but too shallow for navigation, in times of drought. In some parts of the river swift and dangerous rapids had to be dealt with; in others, submerged rocks and boulders lay in wait for the unwary riverman. With each storm the river changed so that even an experienced river pilot could be fooled; sand bars shifted and hundreds of overhanging trees would fall into the river to form the "snags" so deadly to the early time wooden-hulled river boats. Considering all the hazards that the old-time riverboat pilots had to face, it is not surprising that the life of a steamer on the upper river during the nineteenth century was usually very short.

As early as the 1830's the Federal Government was aware of the Mississippi River's important role in the settlement of the Mississippi Valley. The Federal Government assigned the job of improving the river for navigation to the Army Corps of Engineers.

In 1878, Congress authorized the Corps of Engineers to build a 4 1/2 foot channel on the Upper Mississippi. This meant that the Corps was to build a "road" in the river that would have at least 4 1/2 feet of water in it. This "road" or channel would be safe for boats to travel through. To do this, workers first had to remove the snags, shoals, and sand bars from the river. In addition to removing the snags, workers also began blasting and excavating rock, and closing off meandering sloughs and backwaters to confine flows to the main channel. By confining the river's flow they could ensure a deeper channel. Later, in 1907, a 6 foot channel was authorized. To increase the depth of the channel the Corps built hundreds of rock and brush "wing dams." Wing dams are low structures (usually under water) that extend from the shore into the river. These wing dams help to direct the flow of the water into the main channel.

Towards the end of the nineteenth century, the great days of the steamboat on the upper river began to fade. Steamboats were being replaced with other forms of transportation that offered faster and more dependable service. During this time it began to seem that the river would no longer play an important role in the economy of the Midwest region.

The Nine Foot Navigation Project

With the coming of the twentieth century however, new advancements in engineering knowledge and techniques brought commerce flowing back to many of the nation's inland waterways. New technical ideas were appearing everyday it seemed.
Electrical "push button" control of big mechanical installations had been perfected. The advantages of the new ideas in lock and dam construction, particularly the roller gate dam, were being tested and proven on the Mississippi and other rivers. Perhaps the most important development of all were the diesel powered riverboats; what we call tow boats. These towboats are capable of pushing a dozen or more large steel barges. With these new concepts of inland waterway navigation, it became apparent that the upper Mississippi Valley region could greatly benefit from the advantages of long haul, low cost water transportation. If a dependable channel of nine-foot depth could be provided on the upper river to accommodate the large tows and powerful towboats beginning to be used on the Ohio and the lower Mississippi, it would, with those waterways and others, form one great system.

In 1930, after extensive studies by the U.S. Army Corps of Engineers, Congress again authorized a new project on the Upper Mississippi River. This project authorized the Corps to create a navigation channel with a minimum depth of 9 feet and a minimum width of 400 feet. To do this the Corps began constructing 29 locks and dams between St. Paul and St. Louis. In addition to building the Lock and Dam system, dredging was also used, and still is, to keep the channel at 9 feet.

The locks and dams create "pools" in the river. The locks act as steps by which vessels are lifted or lowered from one pool to the next, while pools themselves remain practically level. The system is sometimes compared to a stairway, the locks and dams being the risers and the pools being the treads.

Most of the locks in the nine-foot channel navigation project are the same size, 110 feet wide and 600 feet long. The height that a vessel is lifted or lowered in a lock differs widely according to location. For example, 49.2 feet in the upper lock at the Falls of St. Anthony, 5.5 feet in No. 5A, and 38.2 feet in No. 19. The locks fill and empty by gravity, so no power is required except for operation of the machinery controlling the valves and gates.

The dams of the project are low structures and are used primarily for navigation. A few dams (Minneapolis/St. Paul, Rock Island, and Keokuk) also provide hydroelectric power to their communities. These dams were not, and do not, have flood control abilities. The dams' low heights were needed to minimize the amount of land that was flooded when they were built.

In most of the dams, a combination of roller gates and tainter gates were used. Roller gates are large steel cylinders, which roll on tracks built into the dam. Tainter gates are made up of a cylinder, supported at each end by radial arms rotating on pins, anchored in the supporting piers. Both types of gates are movable and can be adjusted to control the amount of water passing through the dam. The gates on both types of dams are changed daily to maintain a constant pool level. When the river reaches flood stage the gates are lifted entirely above the water level, and the dam structure then causes only slight obstruction to the flow of the river.

Today's Commercial Traffic

Since the 9-Foot Navigation Project was opened in 1939, commercial traffic on the river has grown quickly and steadily. Many industries, especially those that ship bulk commodities (grain, coal, etc.) have taken advantage of the low cost transportation made possible by the Project.

The largest single bulk items moved on the river are petroleum products (gasoline, kerosene, and fuel oil), coal, and grain (corn, wheat, oats, etc.). Petroleum products are usually moved up the river from the oil fields of Texas and Louisiana. Coal is also shipped upstream, mainly from the coalfields of central and southern Illinois and western Kentucky. Grain (corn, wheat, oats, barley and rye) is the principal downbound product. It is usually hauled to a riverside elevator and loaded on barges for downstream shipment. Scrap iron ranks second to grain in downbound tonnage. New Orleans is the major port where overseas products are transferred from river barges onto oceangoing vessels.

Many other products in smaller volume are carried on the waterway such as iron and steel products, fertilizers, sulfur, cement, aluminum ingots and plate, sugar, dehydrated molasses, rock salt, and many others.

Although many people find it sad that the picturesque old steamboats no longer travel on this great river, and even though in their day they were marvels of efficiency for their time, they would have been no match for the powerful diesel towboats on the river today. According to old records, one of the largest cargoes ever carried by a river steamer was that of the "Henry Frank" which arrived in New Orleans in 1881 with 9,226 bales of cotton weighing 2,390 tons, stacked so high and solid that the vessel was barely visible.

Today a tow with 20,000 tons of freight loaded onto 12 or 15 barges, with a length greater than that of the "Queen Elizabeth", all powered by one sturdy diesel towboat, scarcely arouses a comment in a 1,500 mile trip from Baton Rouge to St. Paul. The comforts and conveniences of the modern river towboat would also surprise many old rivermen. Hydraulic steering, echo sounders, air conditioning, electric refrigeration for food supplies, television, radio telephone, and radar for operating in fog are all standard equipment today.

On the Upper Mississippi, it is an everyday occurrence now to see open barges for coal, tank barges for petroleum products, and covered barges for grain and mixed cargo. But some highly specialized types of barges have been devised for unusual cargoes. There are some barges that are made of specially treated balsa wood which carry liquefied methane gas, other barges are built like huge vacuum bottles, which carry molten sulfur. And then there are tank barges that carry anhydrous ammonia.

A Part of a System

The project on the Upper Mississippi, although in itself an undertaking of great proportions and of far reaching economic effect, is but one link in the Mississippi Valley's great system of inland waterways. This system includes the Illinois Waterway, the Ohio, the Missouri, the Arkansas, the middle and lower Mississippi, and many others. The integration of all these streams into a single network makes possible the economical shipment of bulk commodities, to or from almost every part of the valley, and indeed, by transshipment to ocean vessels, to or from the ports of the world. As other great navigation projects, the St. Lawrence Seaway, the Calumet-Sag Channel, and the Great Lakes connecting channels, continue to carry a steadily increasing volume of shipping, the inland waterways system can be expected to make progressively greater contributions to the economy of the nation.

Wildlife and Recreational Benefits

In addition to the transportation potential the Upper Mississippi provides us, she also provides a wealth of recreational opportunities and is home to thousands of wild creatures.

The series of pools created by the locks and dams offer, as "extra benefits", a splendid potential for public recreation. Each year millions of people visit the river to observe wildlife, go

camping, participate in environmental education programs, to fish, hunt and enjoy the pleasures of picnicking and boating.

Lands purchased by the U.S. Corps of Engineers for the navigation project have been combined with lands acquired by the U.S. Fish and Wildlife Service to form the Upper Mississippi River Wildlife and Fish Refuge and the Mark Twain National Wildlife Refuges. These wildlife/recreational areas consist of over 200,000 acres of wooded islands, waters and marshes extending 560 miles southward along the river bottoms from Wabasha, Minnesota, to St. Louis, Missouri. Other wildland areas are managed by the Corps and respective states. These wildlife/wildlands, the last pristine areas of the region, remain largely untouched by modern civilization.

The primary management objective of these lands is for migrating waterfowl but, many recreational activities are possible within the area such as sight-seeing, outdoor recreation and nature study. The recreational use of the river wildlife areas is regulated to maintain a balance between human enjoyment of the area's natural resources and the rights of wildlife.

Boating is particularly popular in the summer months. Some may be enjoying just a brief outing while others may be bound for the Gulf of Mexico or north to the Twin Cities of Minneapolis and St. Paul. Boating is facilitated by a number of small boat harbors, which were constructed by the Corps of Engineers and turned over to local groups to operate and maintain. In addition, a number of communities, individuals, private companies and conservation agencies have provided boat launching, docking and servicing facilities, which make boating on the river easier and more pleasurable.

Not all recreationalists use the waterways and trails. A continuous system of highways designated as the Great River Road closely follows the Upper Mississippi River. The highway traveler will find that the river valley is rich in historical lore. Traces of ancient mound building tribes are found along the bluffs and bottomlands. Adventure is waiting. The features are well marked and signs lead visitors to sites of old Indian battlegrounds, villages, forts, trading posts and the routes of early explorers. Names like Marquette and Dubuque recall early French settlement and influence in the Valley.

Developed Corps of Engineers campgrounds and recreation areas are available along both sides of the river, as well as state, county, and city parks. Primitive camping on the Upper Mississippi Refuge beaches is permitted for periods not exceeding 14 days.

Much of the river is open to hunting during state seasons. Specially designated areas along the river are closed for the protection of migratory waterfowl during the migrating season.

Fishing for crappies, bass, catfish, walleyes and many other species is excellent at varied locations in the pools and backwaters. Fishing is especially good immediately below the locks and dams. Rental boats, bait and other necessities for fishing, including advice, can be had at many points on the river. For the hardy anglers, fishing is available the year 'round, especially in the northern reaches of the river where ice fishing has become extremely popular. There is also commercial fishing, which plays an important part in the river economy. The stabilized

water levels throughout the year have led to a remarkable expanse of different types of wildlife habitat.

The bald eagle, our national symbol, winters in large numbers on the Upper Mississippi Refuge. Eagles often concentrate below the dams where fish provide a ready food supply.

Spectacular migrations of other birds are seen during spring and fall when many warblers, vireos, thrushes and sparrows drift through the trees and shrubs of the river islands and bluffs.

Furbearers and other mammals are abundant, plus about 40 smaller non-game species.
The recreational opportunities afforded by the Upper Mississippi River Projects are very important. Above and beyond the economic benefits are those that contribute to the general welfare of the public through goods, and healthful outdoor recreation.

General Statistics - Mississippi River

- Mississippi River was named after an Ojibwa Indian word "Misipi" meaning "Great River". Area explorers referred to the Mississippi as the "Father of Waters".

- The Mississippi River System including it's tributaries touches 31 U.S. states and 2 Canadian provinces.

- The Miss. River is 2552 miles long. The longest river in North America. It is the 3rd longest in the world, 3rd in drainage in the world. Carries 1.5 mil. tons of sediment/day.

- The river begins at Lake Itasca, MN. and ends at the Gulf of Mexico in Louisiana.

- The Miss. River is used by man for drinking water, recreation, industry, and freight (20o of all goods shipped in U.S.), 160 other countries ship freight on the Miss. River.

Geological History: Beginning of the River System
Volcanoes turned the earth to granite and ash. Rains, over millions of years, eroded the land leaving deposits of sand and clay on the land. Oceans covered the land, turning sand into sandstone, clay into shale, small crustaceans into limestone. As the earth cooled, 3 main Glaciers formed in N. America. The glaciers crushed granite mountains, and moved land and rock hundreds of miles. The glaciers covered the present Miss. River to Southern Illinois. North America was reshaped forever. As the icy glaciers melted, they pushed torrents of water down the Miss. River valley silting the lower basins.

Head Waters
As the glaciers melted and receded they left behind rock, gravel and lakes. Lake Itasca, in northern Minnesota, is the origin of the Mississippi River. Here you can walk across the river where it begins its flow. Lake Itasca, MN. to St. Paul, MN. is known as above the wall. At St. Paul there is a waterfall where the river drops 16 ft. called St.Anthony Falls. Rapids below the falls drop 80 ft. in the next 1/2-mile. This area is known as the wall. This area of river is narrow and rugged.

Mid-Mississippi River Basin
Also known in navigation terms as the Upper Mississippi River, goes from the Wall to the Ohio River in so. Illinois. This area of the river drops 420 ft. in elevation and contains all 29 locks and dams on the Miss. River.

Lower Mississippi River Basin (Delta)
Begins at the joining with the Ohio and **Missouri Rivers** in southern IL. and ends at the Gulf of Mexico in Louisiana.

When these two rivers join the Mississippi, it slows, widens, deepens and begins to snake. Due to the wider and deeper river, no locks and dams are needed for safe navigation.

As the receding glacier had gauged a ditch in the Upper Mississippi and filled it with water from melting ice, it also sent silt down the lower Mississippi valley, which had consisted of the Gulf of Mexico at that time. As the Gulf of Mexico receded, the lower Mississippi river valley formed out of glacial silt into the meandering river of the lower delta.

Bayou
Pirates came to this area and buried treasure. The Bayou is constantly changing as silt is deposited here. Hurricanes move islands, more silt moves in. Big ships come in the main channel.

Human History - Uses and Abuses of the Mississippi River
Native American Ancestors were the first to use the river. They trapped, hunted, fished, gathered seeds, and traveled up and down this part of the river. The mound builders of the Woodland and Mississippian time periods (thousands of years ago) are the oldest ancestors to have used the river. Most mounds are located on the high bluffs of the Mid Mississippi River.

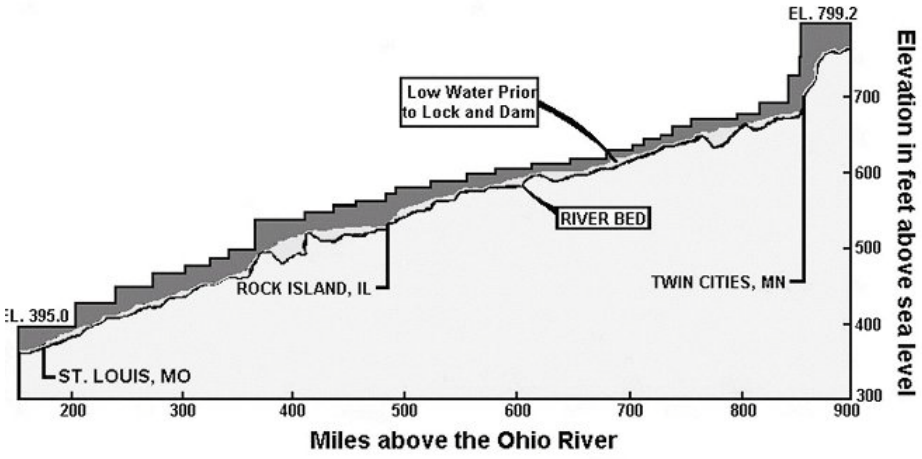
The later, or more recent Native Americans of hundreds of years ago, arrived. Included were major tribes of Mississippi, Ohio, Missouri, Arkansas Rivers and Great Lakes. Tribes included the Chippewa, Sioux, Iowa, Fox, Wisconsin, Blackfeet. These tribes established great trade networks through the use of major rivers, as trading was important and made their lives easier.

Europeans (white men) arrived in the Miss. River Valley as a result of trapping, due to the abundance of wildlife species at the time. Over 1/2 of all North American bird species live along the Miss. River system. Other reasons Europeans came and settled in the Miss. River Valley was for the abundance of timber, and soon the logging industry was developed. The river was used to transport lumber.

As commercial uses of the river expanded and boats improved and became larger, the river was improved to provide safe navigation in a hazardous and often times shallow river.

Modern Problems
Organic pollution: sewage, fertilizer, and algae dies due to C02.
Habitat destruction: Shorelines, wetlands filled, siltation.

Why Are There Locks and Dams on the Mississippi River?



The Mississippi River, above St. Louis, Missouri, has been changed into a series of “steps” (locks and dams), which river tows, and other boats, either “climb” or “descend” as they travel upstream or downstream.

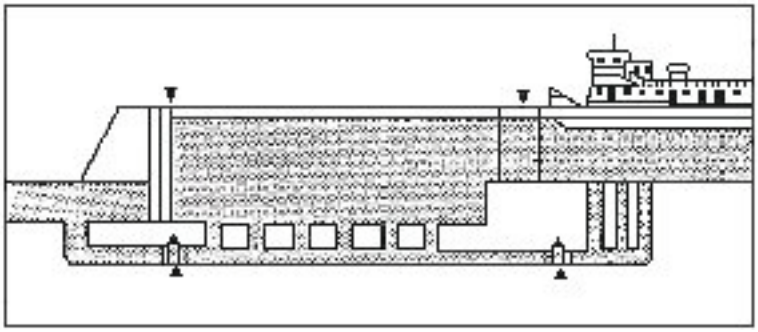
Starting in the 1830’s, the Federal Government began improvements on the river. In 1930, Congress authorized the nine-foot channel navigation project on the Upper Mississippi River. This legislation provided for a navigation channel of 9-foot depth and a minimum width of 400 feet, to be achieved by construction of a system of locks and dams. Construction of this system mainly occurred between 1930-1940.

The Mississippi has a fall of about 420 feet between the 669 miles of river between Minneapolis-St Paul, Minnesota and St. Louis.

Locking a Boat (Headed down river)

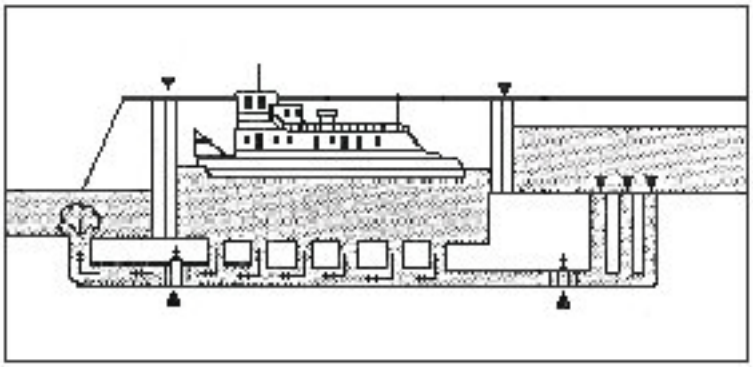
In the picture below, the towboat wants to go down river. It is on a higher step wanting to move to a lower step. How can it do this? It needs an "elevator," or lock. The lock chamber is filled or emptied with gravity. There are four valves: Two upper and two lower, with a connecting 12' x 12' tunnel - one set in each wall. By closing the lower valves and opening the upper valves, the water flows into the tunnels and out of the 4' x 4' port holes that lead off of the tunnels and into the chamber, thus filling the chamber. The reverse of this process is done to empty the chamber.

Towboat Enters Lock



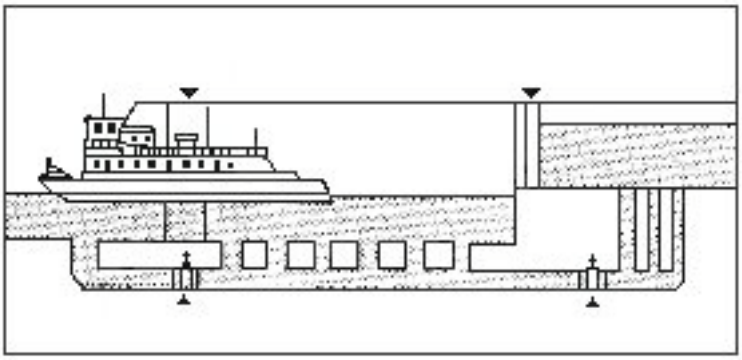
Before the boat enters the lock, the lock chamber is filled with water by opening the filling valves. The water flows through big tunnels and then into the lock.

Towboat is Lowered



Once inside the lock, the upper gates are closed. The emptying valves are opened Opening the emptying valves is like pulling the plug on a bathtub! It drains the water out of the lock, but not all of it.

Towboat Leaves Lock



As the water drains out, the lower gates are opened, and the towboat leaves the lock.
For a towboat heading up river, the procedure is reversed.

Commonly Asked Questions
On the Mississippi Locks and Dams:

Q: **What cargo is carried in the barges?**
A: Generally grain travels down the river. Coal and fertilizer travel upward. In 1996, 80,372,000 tons of cargo was shipped by barges on the upper Mississippi.

Q: How long does It take to get through all the locks and dams on the Mississippi (St. Paul, MN to St. Louis, MO)?
A: By towboat, it takes approximately 7-9 days to cover the 669 miles.

Q: **How many people work on a tow?**
A: About nine people work on each tow: One captain, one pilot, two mates, two deckhands, one call watch person, one cook and one engineer. These people keep the tow running around the clock. They work six hours on duty and six hours off for about 30-45 days at a time.

Q: **Who pays for this lockage? How much do the towboats pay? How much does it cost for pleasure boats that use the river?**
A: The expense of lock and dams is covered by the US Government, under control of the US Army Corps of Engineers; however, it is subsidized by the towing industry, which pays a substantial fuel tax to cover the upkeep of the lock and dams. *Pleasure* boats lock through with no direct charge.

Q: **How do you get the first half of the tow out of the lock chamber?**
A: The first half, or "first cut" of a tow is pulled out by a "tow haulage," or winching device. After a short pull, the weight of the barges act as momentum to carry the first cut clear of the gates-

Q: Who locks first: Pleasure or commercial vessels?
A: Lock personnel have a priority list of which boats lock first: Government vessels first, passenger craft for *hire lock* second, commercial craft lock third and pleasure craft lock fourth. Lock staff does take consideration for pleasure craft and lock them between commercial craft. Outside of this order, boats are locked on a first-come, first-serve basis, thus keeping waiting at a minimum.

Q: What are the poles in front of the barges at the head of the tow used for?
A: The poles are transducers, which inform the towboat's pilot of the depth of the river under the front of the tow.