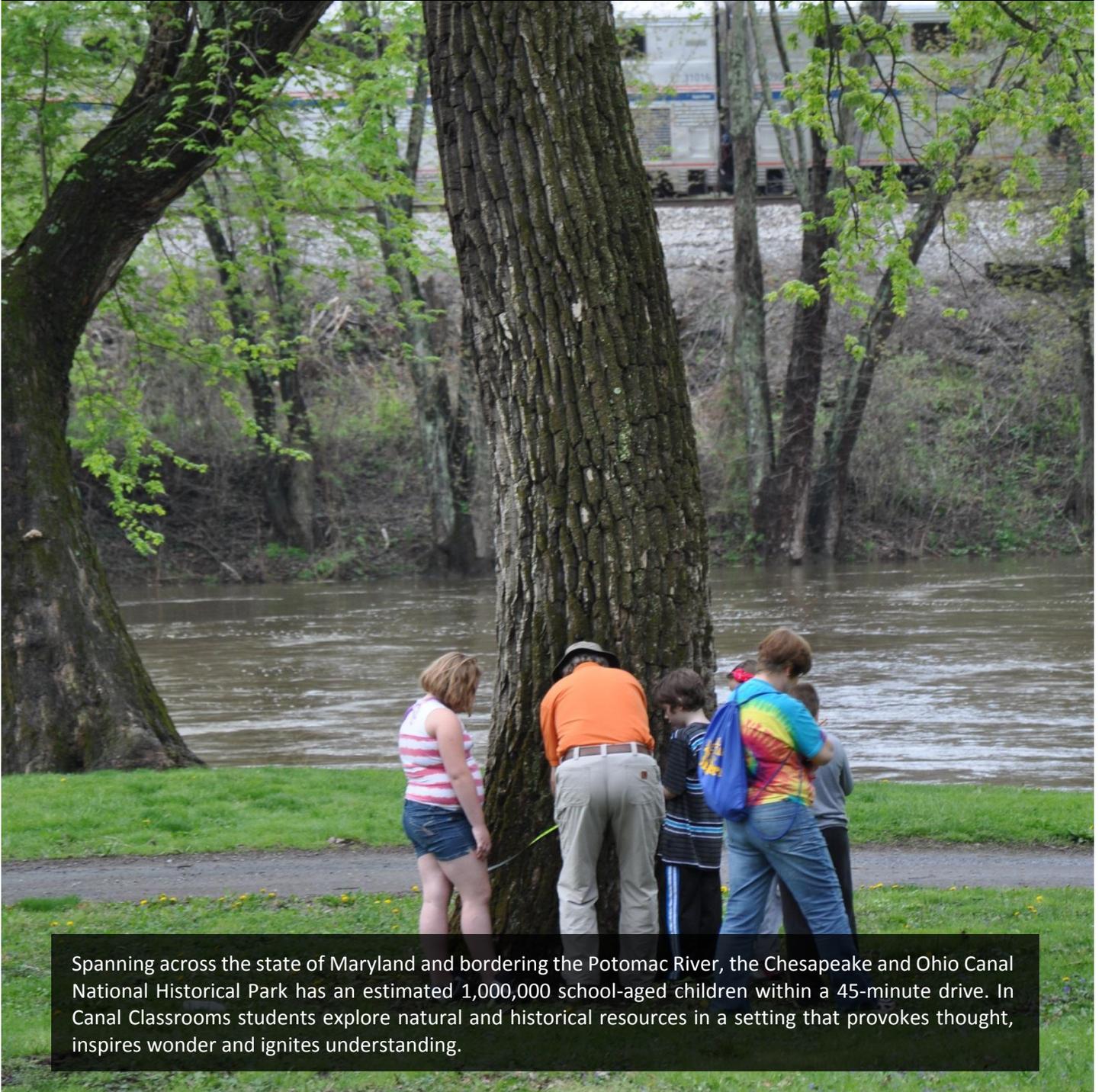




## Time in a Tree



Spanning across the state of Maryland and bordering the Potomac River, the Chesapeake and Ohio Canal National Historical Park has an estimated 1,000,000 school-aged children within a 45-minute drive. In Canal Classrooms students explore natural and historical resources in a setting that provokes thought, inspires wonder and ignites understanding.

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**Need to reach us?** Call 301-714-2213 (the park’s education line) or 301-722-8226 (visitor center desk in Cumberland) or email [cocanaleducation@nps.gov](mailto:cocanaleducation@nps.gov)

**Go digital.** Find teacher resources including field trip reservations and pre- and post-visit classroom activities at [www.nps.gov/choh/forteachers](http://www.nps.gov/choh/forteachers)

**Like us.** Find us on Facebook at *Chesapeake and Ohio Canal National Historical Park*.

# Time in a Tree

Students participate in a ranger hike along the C&O Canal between Lockhouse 75 and Spring Gap. Along the way students participate in hands on activities including field-based science activities while exploring the canal environment.

At the end of the activity, students should be able to...

1. Explain real-life, field-based science applications
2. Understand how historians use historic structures as primary sources
3. Use tools such as thermometers, tape measures, and yard sticks to collect data
4. Understand life on the C&O Canal during its operating years

The park partnered with Allegany County Public Schools to develop this field trip along with pre- and post-visit activities for your classroom. Completing the classroom activities will enhance student learning. The lessons include a canal orientation and a STEM activity. See Appendix A or our website for the materials:

<http://www.nps.gov/choh/forteachers/classrooms/3springgap.htm>.

<b>Duration</b>	4 hours
<b>Arrival Time</b>	9:30 (or call us to schedule another time)
<b>Best Time to Plan Trip</b>	Spring or Fall
<b>Cost</b>	Free
<b>Group size</b>	up to 60 in two groups of 30
<b>Rotations</b>	Three (Lockhouse, Nature Hike, Time in a Tree)
<b>Grade</b>	Third Grade
<b>Chaperone to Student Ratio</b>	1 to 5 (maximum); 1 to 8 (minimum)
<b>Maryland Common Core Standards</b>	<p>CCSS.ELA-Literacy.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.</p> <p>CCSS.ELA-Literacy.SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.</p> <p>CCSS.Math.Content.3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.</p>

	<p>CCSS.Math.Content.3.MD.C.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).</p> <p>CCSS.Math.Content.3.NBT.A.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.</p>
<p><b>Maryland State Curriculum Standards</b></p>	<p>SC5a1a-c, 1. Describe the position of an object by locating it relative to another object or to its background.</p> <p>2. Using information from multiple trials, compare the speeds (faster or slower) of objects that travel the same distance in different amounts of time.</p> <p>c. Using information from multiple trials, compare the distances that objects moving at different speeds travel in the same amount of time.</p> <p>5a2c- Observe and describe that objects fall to the ground unless something holds them up</p> <p>(SC2c1a,b) 1. Gather information and provide evidence about the physical environment, becoming familiar with the details of geological features, observing and mapping locations of hills, valleys, rivers, and canyons.</p> <p>1. Identify and describe some natural features of continents.</p> <ul style="list-style-type: none"> <li>• Mountains</li> <li>• Valleys</li> <li>• Rivers</li> <li>• Canyons</li> </ul> <p>2. Describe the natural features in their immediate outdoor environment, and compare the features with those of another region in Maryland.</p>

During this extended outdoor experience, students join a ranger for a hike along the C&O Canal between Lockhouse 75 and Spring Gap, a total of approximately 1.5 miles. Along the way students participate in hands on activities including field based science activities while exploring the canal environment.

**Welcome (10 minutes)**

Children will meet the ranger at the parking lot of Lockhouse 75. If class is larger than 30, we will split into two groups. One group will start the program at Lockhouse 75 and the second group will travel by bus to Spring Gap.

**Lockhouse 75 (45 minutes)**

Students will learn how historians use historic structures like the lock house and the lock to gather data. These primary sources tell us much about canal operations. We will use this data to learn about people on the canal.

**Nature Hike on the Towpath (90 minutes)**

Students will hike from Lockhouse 75 to Spring Gap, approximately 1.5 miles, on the C&O Canal towpath. Along the way, students will observe natural and historical features of the canal and play Nature Bingo.

**Time in a Tree at Spring Gap (45 minutes)**

Working in small groups of 3-5, students will take tree measurements including height and circumference, and compare their data to other groups. Students will play a game to help demonstrate what trees need to live and grow.

**Closing Activity (10 minutes)**

Student scientists will share observations about their data.

<b>Itinerary</b>			
<b>Group A (30 students maximum)</b>		<b>Group B (30 students maximum)</b>	
<b>9:30</b>	Arrive at Lockhouse 75	<b>9:30</b>	Travel to Spring Gap
<b>9:45</b>	Lockhouse 75	<b>9:45</b>	Time in a Tree (at Spring Gap)
<b>10:30</b>	Lunch (at Lockhouse 75)	<b>10:30</b>	Lunch (at Spring Gap)
<b>11:00</b>	Towpath Hike	<b>11:00</b>	Towpath Hike
<b>12:30</b>	Time in a Tree (at Spring Gap)	<b>12:30</b>	Lockhouse 75
<b>1:15</b>	Travel to Lockhouse 75	<b>1:15</b>	Exit Activity
<b>1:30</b> Departure			

# A Letter to Students

*Teachers, please distribute or read to your students*

Dear Students,

We rangers, teachers, and volunteers in the Canal Classroom Corps look forward to meeting you and spending a few hours exploring the C&O Canal together.

A canal is a manmade channel of water used to move goods and people on long cargo boats pulled by a team of mules. The C&O Canal is 184.5 miles long and goes from Georgetown (near Washington, D.C.) to Cumberland, Maryland. Though the canal no longer operates, you can still hike or ride your bike the entire length. You can even ride in a canoe or kayak in some areas of the canal.

On your field trip, we will be taking a hike! We will start at Lockhouse 75. There we will explore the life of a lock keeper and his family. Then we will hike the towpath to Spring Gap, exploring nature and enjoying the quiet along the canal. At Spring Gap, we will hug some trees as we measure and record data for our science activity.

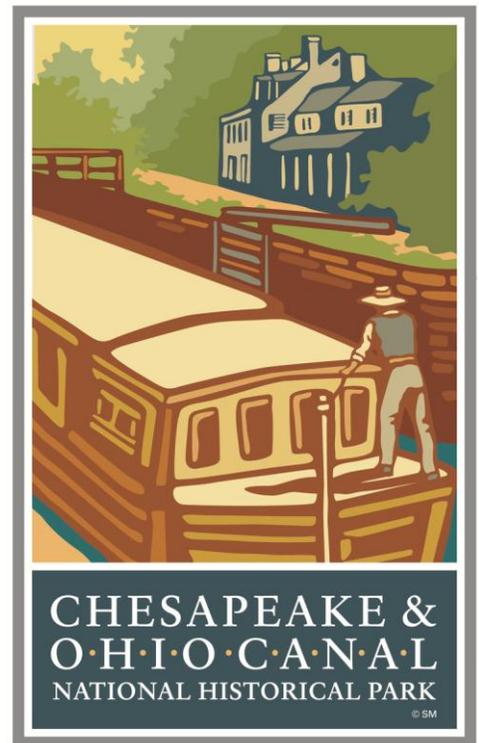
We will be outside the entire day, so dress appropriately! Bring a rain or warm coat and hat. Wear sturdy closed-toe shoes like hiking boots or old tennis shoes. Please bring your lunch and a water bottle.

We can't wait for your visit.

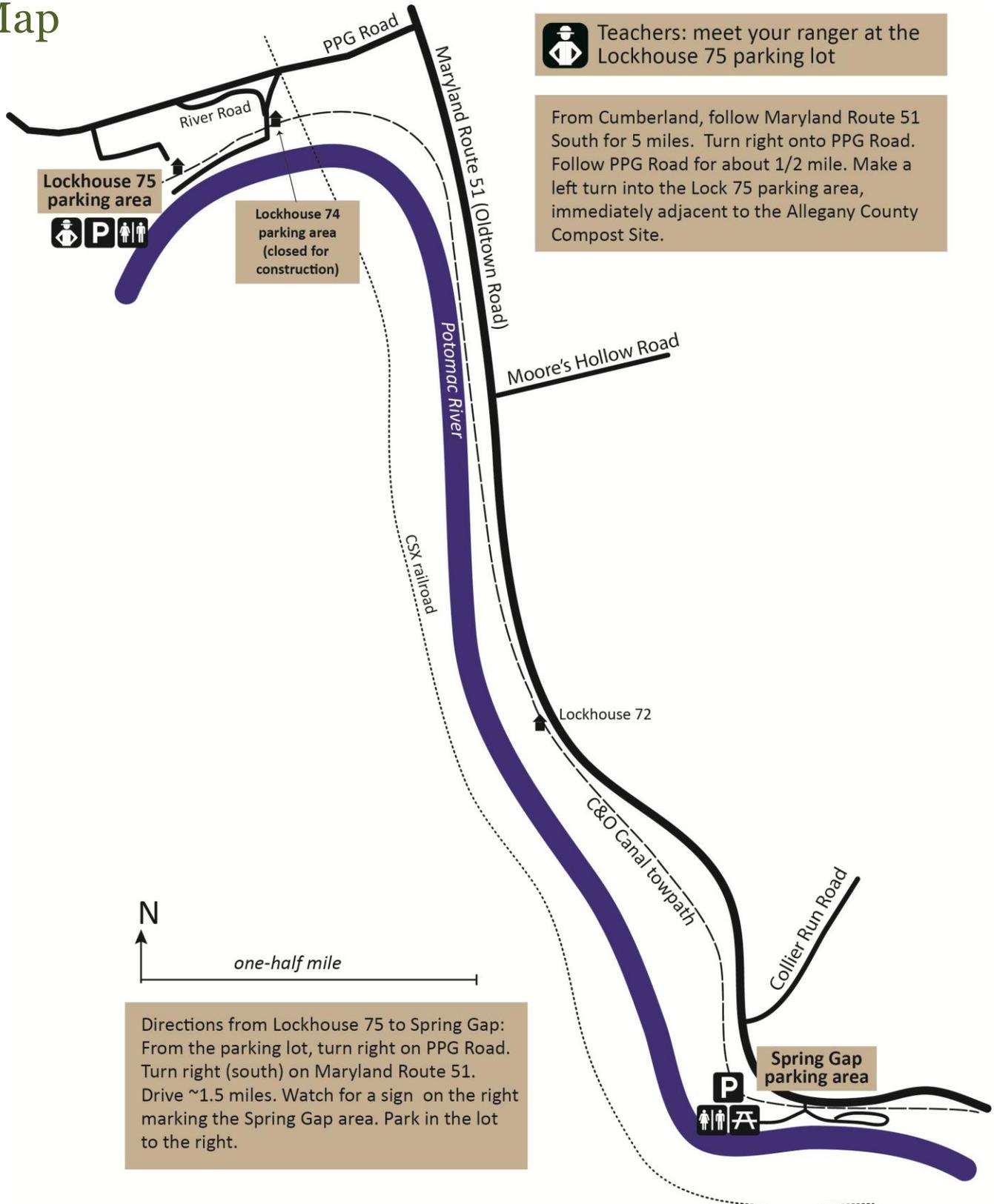
Happy Trails,

*Hollie*

Ranger Hollie



# Map



## Planning a Successful Visit

### What to Wear

- The towpath may be wet and muddy. Remind students to wear closed-toe shoes. Flip flops, slip-on shoes, or sandals are not appropriate.
- We suggest wearing layers. Pants are the best precaution against cool temperatures, bee stings, and the usual outdoor hazards.
- Students may wear hats for sun protection and/or warmth.
- Programs will go on in light rain or snow. Encourage everyone to have proper outer wear such as a rain or warm coat.
- It is extremely helpful to rangers leading the program for students to wear name tags with first names only.

### What to Bring

- There is no running water at Lockhouse 75 or Spring Gap; bring hand sanitizer.
- Drinking water is not available; each student should bring a water bottle (or two).
- Each student should bring a backpack to carry his or her lunch, water bottles, and personal items such as a rain coat.
- The park has no trash receptacles. Please bring bags to take your garbage back to the school.

### Communication

- Cell phone coverage at Lockhouse 75 and Spring Gap is fair.
- For non-emergencies, call (301) 722-8226 (C&O Canal Cumberland visitor center). For emergencies, call 911 or (866) 677-6677 (this is the National Park Service dispatch center).

### Chaperones

- At minimum, please have one chaperone (teacher or other adult) for every eight students. In order to keep programs manageable, do not exceed one chaperone for every five students.
- Chaperones will be an active part of the activities. We will call on chaperones to assist.



## Time in A Tree (Spring Gap Third Grade)

Page 7

- During programs, refrain from holding conversations with other chaperones.
- No smoking during the trip.

### Directions

From Cumberland, follow Maryland Route 51 South for 5 miles. Turn right onto PPG Road. Follow PPG Road for about ½ mile. Make a left turn into the Lock 75 parking area, immediately adjacent to the Allegany County Compost Site.

### Arrival

- Please arrive on time at 9:30.
- The Canal Classroom Corps staff will be waiting at the Lockhouse 75 parking lot.
- For two groups (more than 30 students), one bus will depart for Spring Gap upon arrival. The second ranger will ride the bus to Spring Gap.
- There is a port-a-potty at Lockhouse 75 parking lot and a comfort station at Spring Gap.

### Special Needs

Let us know if any of your students have special needs.

### Protect Your Park

- The Chesapeake & Ohio Canal National Historical Park is a federally protected public use area. Please be good stewards during your visit. Do not pick the plants or take anything from the park.

### Cancellations

Field trips may be cancelled in very cold weather or heavy downpours or storms. The canal floods on average every 10 years. If flooding or severe inclement weather is predicted, a Canal Classroom Corps member will call to reschedule your field trip.

If you need to cancel, let us know as soon as possible by calling (301) 722-8226 (C&O Canal Cumberland visitor center).



# Safety Considerations

## **Ticks**

Students will be in areas where ticks are found. Remind them to take precautions such as wearing insect repellent, staying on the towpath, and checking frequently and thoroughly for ticks.

## **Snakes**

Two species of poisonous snakes are found in the park: the Northern Copperhead and the Timber Rattlesnake. Students should be cautious where they place their hands and feet.

## **Stinging insects**

Students may be in areas with hornets, wasps, and bees, which can cause severe allergic reactions in sensitive individuals. Chaperones should carry epinephrine pens with them.

## **Rabies**

All animals in the park are wild and their behaviors are unpredictable. Treat all animals with caution.

## **Poisonous plants**

You will be visiting an area with poison ivy and other noxious plants. Stay alert and stay on the towpath or in mowed areas.

## **Sun and Heat Exposure**

Remind students to wear sunscreen and a hat to avoid exposure to sun. Students are invited to carry water (preferably from a refillable water bottle) and stay in the shade to avoid heat exposure.

## **Wind and Inclement Weather**

If severe storms are predicted, we will call to reschedule your program. The bus must stay at the Spring Gap area parking lot in case the weather deteriorates during our field trip.

## Additional On-line Resources about the C&O Canal and the National Park Service

Description		Website URL
C&O Canal NHP	The park's website for teachers hosts classroom materials and on-line resources	<a href="http://www.nps.gov/choh/forteachers">www.nps.gov/choh/forteachers</a>
C&O Canal Trust	The park's partner in education provides 50 short stories about places along the C&O Canal for students to read	<a href="http://www.canaltrust.org">www.canaltrust.org</a>
National Park Service	Learn more about the NPS mission, history, and organization	<a href="http://www.nps.gov/aboutus/index.htm">www.nps.gov/aboutus/index.htm</a>
National Park Service America's Best Idea	More facts about the NPS, including an excellent timeline and movies	<a href="http://www.nps.gov/americasbestidea/">http://www.nps.gov/americasbestidea/</a>

## Pre Visit Activity: Meet the C&O Canal

Use at least one of these lessons as a pre-visit classroom activity, which introduces the canal to the students.

### **Option A: Locking Through Video**

Students watch the five-minute video on the process of how a lift lock operates in the canal system to raise and lower canal boats and discuss in the classroom. The video can be found at:

<http://www.nps.gov/choh/photosmultimedia/multimedia.htm>

### **Option B: Journey on the C&O Canal**

Students complete an activity following Michael O'Leary as he traveled the canal in 1876. This lesson addresses a host of indicators and objectives in both reading and social studies. Students will learn why the C&O Canal is an amazing accomplishment in Maryland's history, understand more about the genre of historical fiction, and describe what a typical nine-year old canal boy and family were like in the late 1800's. Michael's journal may be found in Appendix A. For more information on this lesson's resources and standards please visit:

<http://www.nps.gov/choh/forteachers/classrooms/journey.htm>

### **Option C: Web Rangers (STEM Activity)**

Students complete a National Park Service online activity called Dendrochronology. It is a STEM activity about using growth rings on trees to learn about the past. No registration is required and the activity is free. Other learning modules are available, and students may create a password to help them track their progress at Ranger School.

<http://www.nps.gov/webrangers/activities/dendrochronology/>

### **Option D: Review Vocabulary**

*Canal: a manmade waterway used to move goods, people*

*Circumference: The distance around the edge of a circle (or any curvy shape)*

*Lock: a device for raising and lowering boats between stretches of water of different levels on river and canal waterways*

*Lockhouse: A house located on the canal next to the lock where the lock tender and his family lived*

*Lock Key: a tool used on the canal to open and close the wicket paddles on the bottom of a lock door, allowing water to enter/exit the lock*

*Navigate: to travel by water*

*Range: the distance within which something can be reached*

*Towpath: a dirt path alongside a canal where mules would walk and tow canal boats*

*Transport: move from one place to another*

*Wicket Paddles: Small wooden doors at the bottom of a lock gate used to control the water flow in and out of the lock Tunnel: an artificial underground passage, esp. one built through a hill or under a building, road, or river*

*Weathering: wear away or change the appearance or texture of (something) by long exposure to the air.*

## Post Visit Activity: Real World Science

Use these lessons as a post-visit or stand-alone classroom activity.

### **Option A: Build a Lock (STEM Activity)**

Students build a working lift lock using simple materials. See Build a Lift Lock STEM Guide in Appendix B for more details.

### **Option B: Family Tree Cookie**

Students complete their family tree cookie, incorporating a home/parent connection. See Family Tree Cookie Instruction Sheet in Appendix C for more details.

### **Option C: Complete Junior Ranger Book**

Ask the students to work through the Junior Ranger book. When they are complete, a ranger will come to the school for a swearing in ceremony and students will receive a ranger badge or patch. The book is available on our website (<http://www.nps.gov/choh/forkids/index.htm>).

# Appendix A: Journey Down the C&O Canal (pre-visit)

# A Journey on the Chesapeake and Ohio Canal



Adapted from a previous instructional resource in partnership with Washington County Public Schools and the National Park Service  
September - 2011



# A Journey on the Chesapeake and Ohio Canal

## Introduction

The O' Leary family lives on a canal boat on the Chesapeake and Ohio Canal. William O'Leary is the Captain of their family boat named the "Turn Over."



Captain O'Leary takes care of the family business, which is transporting cargo up and down the length of the C&O Canal.

Captain O'Leary's wife, Anna, takes care of the family. They have three children. Michael O'Leary is nine years old and is a mule driver. Elizabeth O'Leary is seven years old and helps her mother with the family chores. Jeffrey O'Leary is two years old and keeps everyone busy! Everyone in the O'Leary family (except Jeffrey) works together to make the canal boat run. Michael has decided this year to keep a diary of his journeys on the C&O Canal. Let's take a peek into Michael's diary to see what he's been up to.



Monday June 14, 1876

When we got to **Great Falls** today, I took Elizabeth out to see the falls. If it weren't for those waterfalls and all of those rocks in the Potomac River, we wouldn't be here. Folks would have used the river to carry their cargo instead of building this canal.

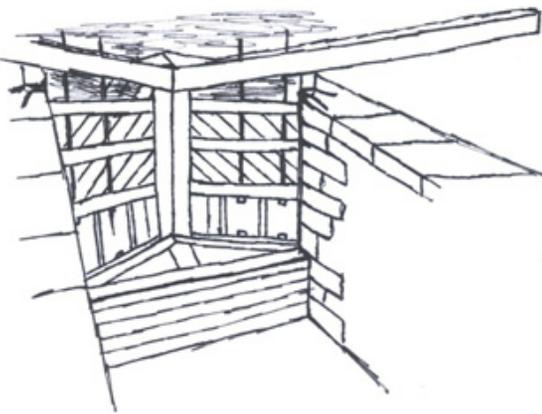
You can tell when we're close to the city, lots of people come and watch the boats. At the Crommelin House (Great Falls Tavern) the lockkeeper added a hotel to his home so all the folks visiting would have a place to stay.

When we got into **Georgetown** today, we had to wait in line awhile for our boat to be unloaded. Mother went shopping and bought fabric, some for 15 cents a yard and some calico for 8 cents a yard, to make new clothes. Elizabeth and I got to buy some candy, four pieces for a penny! When we got back to the "Turn Over", all the coal had been unloaded. The company doesn't always get all the coal off so I crawled underneath the hatches and swept up what coal they left so we can use it in our stove to cook with on our way back. Tonight we sleep in the city, and tomorrow we'll head back for Cumberland.

the stone from here to make the Smithsonian Museum in Washington. Tonight we've been invited to the Eaton's boat to listen to some music and sing songs. A couple of other families are coming too. I hope there are some other boys there my age. We're bringing some freshly made cornbread to share that Elizabeth helped Mother make.

Sunday June 13, 1876

Since today is Sunday, Father decided we should take the day off. We walked to a nearby church and then visited with the lockkeeper, at **Rileys Lock**. Mr. Riley let me help him "lock through" a couple of boats. I helped him push open and push closed the big lockgates, and he even let me turn the lock key to let the water out of the lock to make the boats lower. Tomorrow we're going to stop at Great Falls for awhile, and then we'll be in Georgetown.



# DIARY

Monday June 7, 1876

Today we left **Cumberland** where the canal begins and started our trip to Georgetown where the canal ends.

The men from the Consolidated Coal Company used huge buckets to fill up the "Turn Over" with 120 tons of Coal. Cumberland gets real busy sometimes with everybody hurrying to start their trip. We were the second boat in line this morning, so we got a good start.



I hitched Frances and Ida (our mules) up all by myself, and Dad steered instead of Mother since there were so many boats nearby. This is my third year walking these mules up and down the towpath. I hope next year Dad will let me steer the "Turn Over". After we'd been on our way for a few hours, Mother sent Elizabeth out on the towpath with me. I have to teach her how to be a mule driver. She can say "Whoa" and "Come Up" all right, but she never fixes the harnesses right. I have to watch her all the time.

Tuesday June 8, 1876

We stopped last night just after we got out of the **Paw Paw Tunnel**. It was dark and I get the creeps walking through the tunnel even in daylight. I say the tunnel is haunted, Dad says he isn't going to find out! Too many unexplained things happen at the tunnel at night.



I heard of this one Captain who tied his boat up for the night too close to the tunnel. He and his family hadn't been settled down for more than an hour or two and were eating supper. That's when they noticed the line tying them to the shore had mysteriously come undone. Well, everybody jumped up and used the poles to push the boat back over and tie it up again. Then the Captain noticed that the mules were very restless on the towpath and were not eating their grain. That night after everyone was in bed, the Captain heard the heavy hatches covering the coal being lifted. When he got up to see what was wrong, everything was in place perfectly. Well, that was enough. The Captain and his family and the mules were getting no rest. So they all got up and moved the boat a

Saturday June 12, 1876

It is so hot today that Mother let us go swimming for awhile. Elizabeth could only jump off the boat into the canal, but I dove. We passed a boat today that was headed upstream towards Cumberland which was carrying a bunch of watermelons. A few of them fell off, so I swam over and brought two back to our boat. Dad scooped them out of the water and brought them onboard the "Turn Over".

I also got to do some fishing from the boat today. I caught two perch, a catfish, and a sunfish. Dad caught some fish too so we had fish for dinner, corn, and watermelon for dessert. We had a contest to see who could spit the seeds the farthest and Dad won.

Some of the farmers along the canal leave the two rows of corn closest to the canal for the boatmen and their families to pick as kind of a neighborly thing to do. Elizabeth picked enough for supper tonight. We never pick more corn than we can use or else the farmers might not be so generous.

I saw some people crossing the Potomac River as we passed by **Whites Ferry** today, and there were a lot of folks out fishing the river's bank. There is a mill here where they cut sandstone used in making buildings. I know they used

Friday June 11, 1876

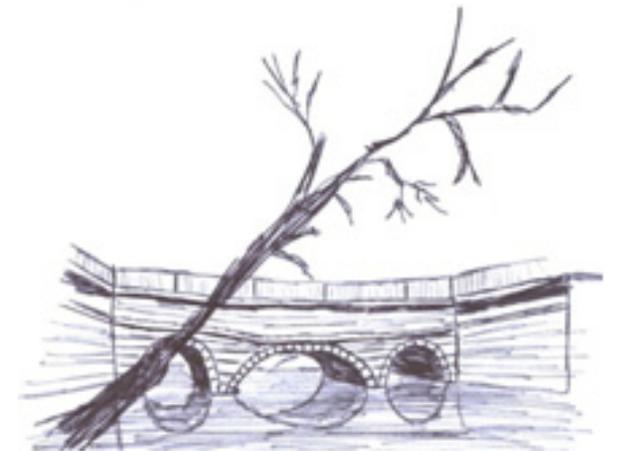
It rained today. Not too hard, but enough to be a bother. We were a few miles from the Antietam Battlefield today where a giant battle took place during the Civil War. I learned in school that the battle at Antietam was the single bloodiest day in all of American History! We also studied John Brown's raid at **Harpers Ferry** where he tried to get guns to the slaves.

I only get to go to school about three to four months a year when the canal is closed for the winter. The rest of the time I work with my family on the canal. Sometimes it's hard to keep up with the other children who are in school the full time. The boys who work on some of the nearby farms don't get a full school year either so it works out all right. I keep up pretty well with the other students, though. I'm going on McGuffey's Third Eclectic Reader this winter, only one behind the boys my age who go to school full time. Mother says keeping this diary is a good way for me to practice my penmanship and orthography (that means spelling). Tonight we are all going to gather together and listen to Father tell stories about the war.

couple of miles further downstream. The mules settled down right away and ate their grain. Nothing else unusual happened for the rest of the night. I don't know about Dad, but I sure believe in ghosts!

Wednesday June 9, 1876

I can hardly believe it! Dad let me steer the boat today. It was great. Once we got into **Hancock**, Dad called out, "Hey Michael, I think it's time you started learning a new job. How about taking a turn at the tiller?" I nearly jumped right over Frances and Ida to get on the boat. I didn't think I'd get to steer the "Turn Over" until I was ten, when most other boys start learning, but Dad thinks I'm big enough now.



I started out at Little Pool, since the canal's wide and straight there. I did a good job, too. You have to push the tiller arm to the left to make the boat go to the right, and push the tiller arm to the right to make the boat go to the

left. Seems backwards to me, but it works! I steered all the way until just before the **Licking Creek Aqueduct**. Then Dad took over again and I went back to the mules. We didn't want Elizabeth walking the mules over the aqueduct alone for her first time. An aqueduct is like a bridge which carries the canal, water and all, and towpath over a creek or a stream. The towpath is pretty narrow and high above the ground. No need getting the mules spooked for nothing. Elizabeth just needs practice. Maybe if I get her to be a good mule driver, Dad will let me steer some more.....

Thursday June 10, 1876

We passed through **Williamsport** today. Lots of warehouses. Seems like all we did today was chores. I gave the mule stables a good cleaning this morning before starting. Dad spliced a new towline since our old rope that leads from the boat to the mules was starting to get worn out. Mother and Elizabeth washed just about everything in sight. They scrubbed the cabin, top to bottom, trying to get rid of some of the coal dust. Then they washed clothes and hung them on a line Dad and I put up on the deck.

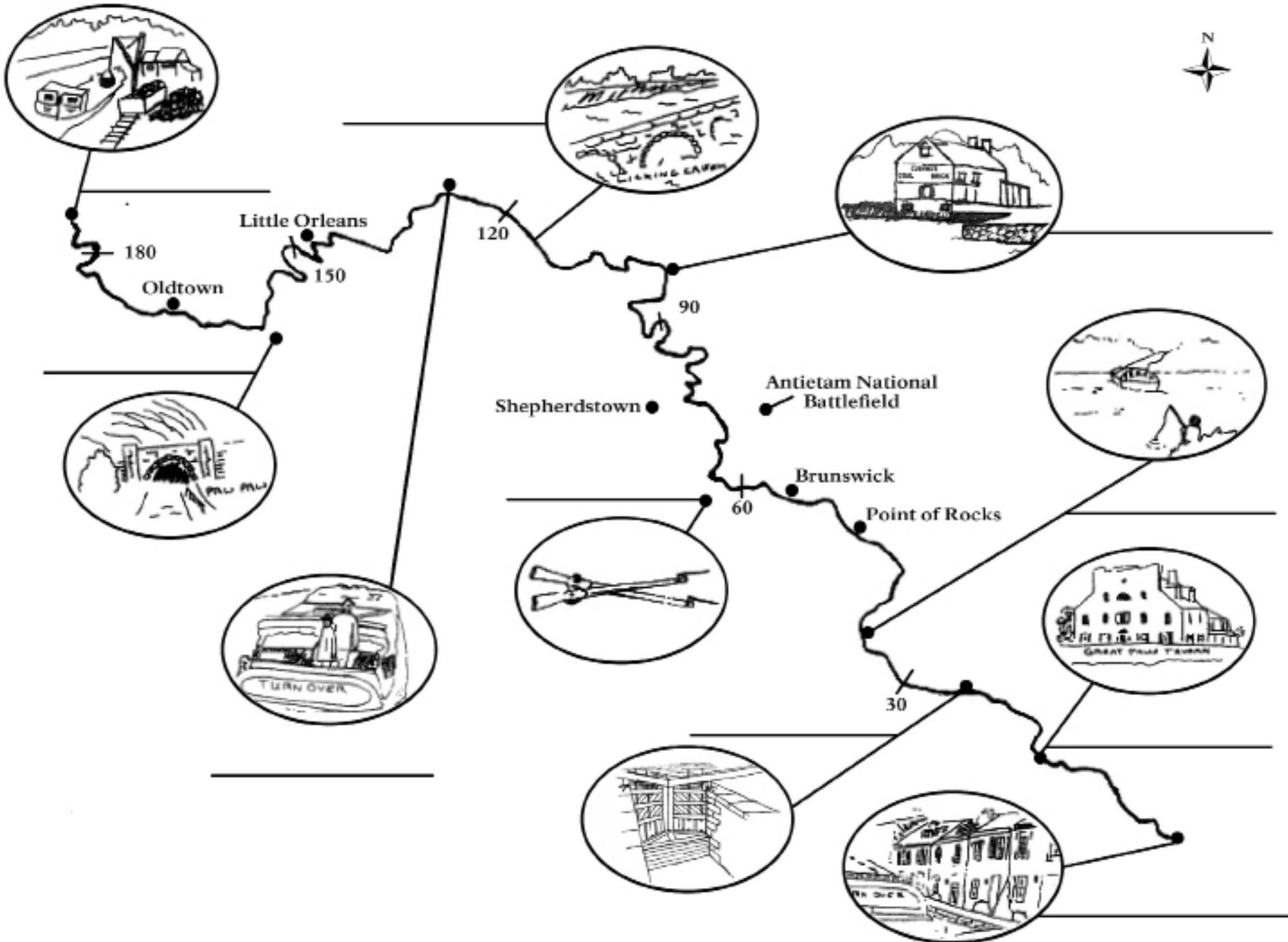
Jeffrey was tied to the roof all day today. We put him in a kind of harness with a long rope attached to a ring on the deck. That way he can wander around and play without any of us having to watch him too closely. If he falls off the boat, we just pull him in like a big fish.



Only he doesn't actually fall in the water. We made sure the line wouldn't reach the water so he can't drown. We all started calling Jeffrey "fish bait" today, though. He fell over at least three times, just dangling about two feet above the water teasing all the catfish.

Elizabeth sewed some buttons on Dad's shirts while Mother cooked up some bean soup and biscuits for supper tonight. Dad says when we return to Cumberland, he and I are going to do some painting on the "Turn Over" so she'll look fresh and new again. I'll sleep good tonight. I'm extra tired and Dad said I could sleep in the hay cabin tonight, since I worked so hard cleaning it and all. Plus we went 30 miles today, and I had to walk extra with the mules while everyone was busy with other chores.

# Michael's Journey on the C & O Canal



## Appendix B: Build a Lock STEM Guide (post-visit)



# C&O Canal STEM Activity – Build a Lift Lock

**Design a lift lock using simple materials in the classroom.**

Activity Time: 60-120 minutes

This can be an individual, group or whole class activity.

Suggested materials: Recyclable materials including cardboard, paper, paper towel roll, plastic bottles and caps; glue, tape and/or adhesive material; rope or string; paint, markers (optional).

 Teacher Idea: Work with art teacher to complete lesson or identify materials.

## **Directions:**

Step 1: Watch the Pre visit video “Locking Through” asking students to examine the lock. <http://www.nps.gov/choh/photosmultimedia/multimedia.htm> and read “How a lock works” handout (page 3).

Step 2: Complete and review page 5 in the Junior Ranger Booklet “Locking Through” and examine how a canal lift lock operates.

Step 2: Review the scope of work to provide students with facts and questions to consider when designing/building their lift lock (see page 2).

Step 3: On a blank sheet of paper, ask students to design their own lift lock. This will include a detailed sketch of their design with parts identified and labeled.

Step 4: Using recyclable materials, ask students to build a lift lock. It is okay if the lift lock is not identical to the canal lift lock. The goal is for students to create their own design.

## **Scope of work for lift lock design**

### **SIZE**

1 inch represents 10 feet

Lift locks must be at least 10 inches long to accommodate a 95 foot canal boat.

Lift locks must be at least 2 inches wide to accommodate a 15 foot canal boat.

Will your lock move boats larger than canal boats? Will it move more than one boat at a time? If so, how long/wide will you make your boat?

### **WORKING PARTS**

Lift locks raise and lower boats on a body of water. To do this, boats must be able to enter and exit the lock from a body of water, such as a canal, river or lake.

How will boats be able to enter and exit your lift lock design?

Canal lift locks have specially designed gates (doors) called miter gates. Miter gates close at an angle to hold back thousands of pounds of pressure from the water in the lock.

How does your lock hold water?

### **WATER**

How will water be used to raise and lower boats in the lift lock?

How will water enter your lift lock? How will it exit?

Where will the water come from?

Who will control the water coming in and out of the lift lock? How will they do this?

## How a lock works

A lock is a device for raising and lowering boats between stretches of water of different levels on river and canal waterways. The distinguishing feature of a lock is a fixed chamber whose water level can be varied.

Locks have three elements:

- A watertight **chamber** connecting the upper and lower canals, and large enough to enclose one or more boats and the chamber's water level can vary.
- Two **gate doors** at either end of the chamber. The two doors of the gate are opened to allow a boat to enter or leave the chamber; when closed, the gate is watertight.
- A **valve** that allows water both in and out of the chamber.

To move upstream, a boat enters the lock through the lower gate and the gate doors are closed. The boat now sits in the bottom of the lock chamber and will need to rise eight feet to become even with the lock walls and the water level upstream.

Each gate door has two small paddles at the bottom. These paddles are connected to metal rods that run vertically up the height of the door. These rods stick out the top of the doors several feet. By using a lock key, essentially a giant wrench, a crew member can twist the metal rods and open the paddles.

When it is time to fill the lock with water and raise the boat, the four paddles on the upstream gate are opened one at a time. A total of 90,000 gallons of water will rush in over several minutes. This will raise the surface of the water until it is level with the water upstream.

As the water comes and the chamber is filled, the boat will need to be stabilized to prevent the rushing water current from crashing it into the lock walls. This can be accomplished either by using the engine to steer the boat accordingly or by crew members using boat poles.

While there remains any difference in surface level between the water inside the lock chamber and the water upstream, the upper gate is impossible to open because of the accumulated pressure on the upstream side. As soon as the water levels, and therefore the water pressure, are equal on either side of the gates, the doors can open. The boat can then continue traveling upstream.

To move downstream, the process is basically reversed. The boat enters the lock with the chamber already filled with water. The gate doors are closed behind it. The boat will now have to be lowered eight feet in order to continue downstream. The four paddles of the downstream gate doors are opened, releasing 90,000 gallons of water out of the chamber and into the next level. Again, the boat will have to be stabilized in position as the water level decreases. Once the water levels and pressure are equalized on either side of the downstream gate, the doors will open and the boat can continue downstream.

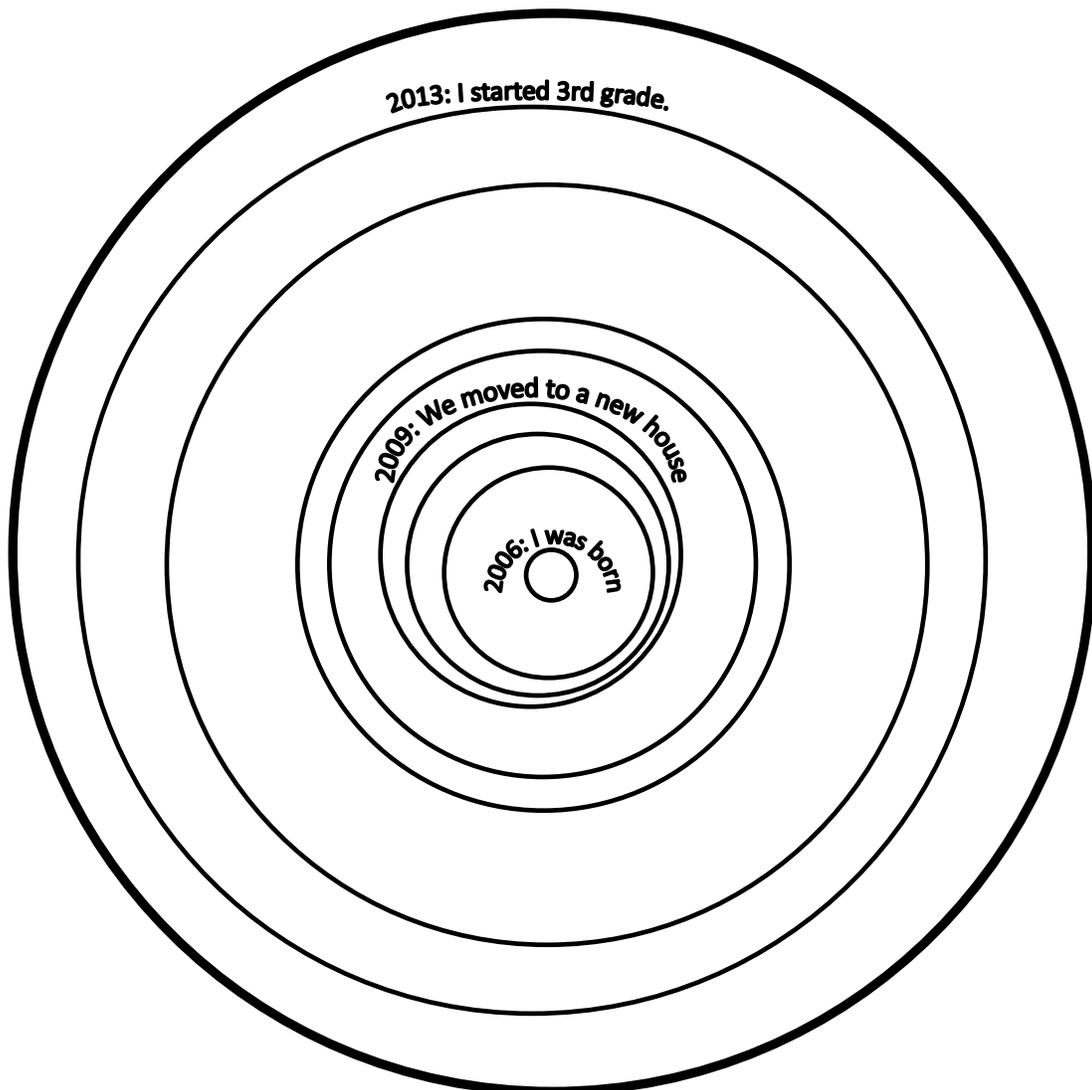
## Appendix C: Tree Cookie Activity (post-visit)



# C&O Canal Tree Cookie

Name \_\_\_\_\_

Using a paper plate, make your own tree cookie. Place important events in your life on a few rings. Make 8 or 9 rings (depending on how old you are) and think of at least 3 important life events to write on your tree cookie plate. Here is an example:



# Appendix D: Transportation Scholarship Application



## **Canal Classrooms Transportation Scholarship Fund**

*This grant is made possible through the park's partners in education, the C&O Canal Association and the C&O Canal Trust, by their generous members and donors. In addition, the National Park Foundation provided funding through the Ticket to Ride Grant Program. If you have questions, please contact [cocanaleducation@nps.gov](mailto:cocanaleducation@nps.gov) or call (301) 714-2213.*

### **Eligibility**

- Public, private, and charter schools.
- Students may be pre-kindergarten through grade 12. University and colleges are not eligible.
- Field trips must take place within the boundary of the C&O Canal National Historical Park and students must participate in curriculum-based (Canal Classrooms) programs or Bridging the Watershed (BTW) programs. Independent Teacher-led field trips are not eligible for funding.
- Schools will be required to complete pre-visit activities and/or post-visit activities to receive funding.
- Schools will be required to send a thank you letter, addressed to partner organizations (more details provided upon confirmation of funding).
- Funding is prioritized for Title I schools.
- Classes are eligible for reimbursement once per school year.

### **Deadlines**

- Requests for reimbursement must be received at least two weeks prior to your field trip date. Confirmation of your application status will be sent via email within one week of submitting the application request.

### **Other information**

- An invoice from the bus company, the district transportation office, the principal's office, or the school board is required as part of the reimbursement request.
- Reimbursement checks will be mailed within 30-days following the field trip and upon receiving the completed reimbursement request and invoice.
- As a condition of funding, park staff and partners may photograph students in the park. Park staff will contact you in advance of the field trip and send a photo release form.

### **Instructions**

1. Complete the reimbursement request form before your field trip.
2. Attach an invoice.
3. Submit the form and invoice via email to [cocanaleducation@nps.gov](mailto:cocanaleducation@nps.gov).
4. We will respond via email confirming or denying the reimbursement request within 5 business days.



**Office Use Only**

Date rec'd: \_\_\_\_\_  
 Reviewed by: \_\_\_\_\_  
 Approved by: \_\_\_\_\_  
 CT  
 CA  
 NPF  
 Check mailed: \_\_\_\_\_

**Transportation Scholarship Application**

Today's date \_\_\_\_\_

School name \_\_\_\_\_

Type  Public school  Private school  Charter school

Title I?  Yes  No

Grade(s) \_\_\_\_\_

e-mail for bus reimbursement \_\_\_\_\_

Sponsoring teachers \_\_\_\_\_

(list all homeroom or subject teachers participating in the field trip)

Program date \_\_\_\_\_

(if the date is dependent on funding or has not been finalized, please provide the anticipated date)

Program location \_\_\_\_\_

(must be in the park)

# of students \_\_\_\_\_

	\$	X		=	\$	
--	----	---	--	---	----	--

# of buses      X      Cost per bus      =      Amount of reimbursement requested

(Contact your bus company or district transportation coordinator for an invoice. You must attach an invoice to this application.)

Check payable to \_\_\_\_\_

Mail check to \_\_\_\_\_

*For marketing purposes only:*

Has your school received a C&O Canal bus reimbursement in the past year?

Yes  No

How did you hear about this grant?

Previous user     NPS website     Partner website     Ranger  
 Other: