

## FLOOD PROOF?

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Columbia Theater, Gallia Street near the Esplanade, January 1937 flood (*Carl Ackerman Collection, Southern Ohio Museum*). “One in a Million,” on the marquee, was a film about an Olympic figure skater – but was the 1937 Ohio River flood really “one in a million”? Complete the flood recurrence probability exercise on page 6 to find out!

Portsmouth, Ohio, was established in 1803 on the Ohio River at its confluence with a major tributary, the Scioto River. While Portsmouth’s location at the confluence of the rivers provided significant advantages with regard to transportation and commerce, it also came with a significant risk of flooding. Portsmouth suffered numerous floods throughout its history, including major floods in 1884 and 1913, and a record-setting flood of 74.23 feet in 1937 – more than 24 feet above the Ohio River’s flood stage.

Because of the costly and disruptive nature of the floods, beginning in at least 1897 there was a call to protect Portsmouth from further flooding – in essence, to render Portsmouth “flood proof.” Portsmouth’s first floodwall, constructed in three stages between 1909 and 1930, protected Portsmouth from serious Ohio River floods in 1933 and 1936, but was overtopped by more than 12 feet during the devastating 1937 flood. Since 1950, Portsmouth – along with neighboring New Boston – has been protected from floods by a 77-foot high, 8-mile long system of concrete walls and earthen levees.

### FLOOD PROOF? – Activities & Exercises

1. Watch the documentary film ***River Voices: A Portrait of an American River Community***. This 2002 film, produced by local historian John Lorentz and written and directed by Nathan Lorentz, tells the story of the 1937 Ohio River flood at Portsmouth through historical imagery, primary eyewitness accounts, and the recollections of Portsmouth residents who lived through the worst natural disaster to strike the Ohio Valley in recorded history. This video can be checked out on DVD from the [Scioto County Public Library](#).
2. Browse **historical Portsmouth flood photographs** in the [digital collections of the Scioto County Public Library](#) and in the [Carl Ackerman Collection of Historical Photographs of the Southern Ohio Museum and Cultural Center](#). In particular, look for photos showing some of the following landmark buildings, which are still standing in Portsmouth, to get a sense of the extent and depths of the floods:
  - Washington House (formerly Washington Hotel), 500 Second St. *[built in 1901]*
  - Holy Redeemer Catholic Church, 1325 Gallia St. *[built in 1905]*
  - Portsmouth Public Library, 1220 Gallia St. *[built in 1906]*
  - Columbia Music Arena (formerly Columbia Theater), 832 Gallia St. *[built in 1910]*
  - Southern Ohio Museum (formerly Security Central Bank), 825 Gallia St. *[built in 1918]*
  - Masonic Temple, 602 Chillicothe St. *[built in 1927]*
  - Portsmouth Post Office, 610 Gay St. *[built in 1936]*

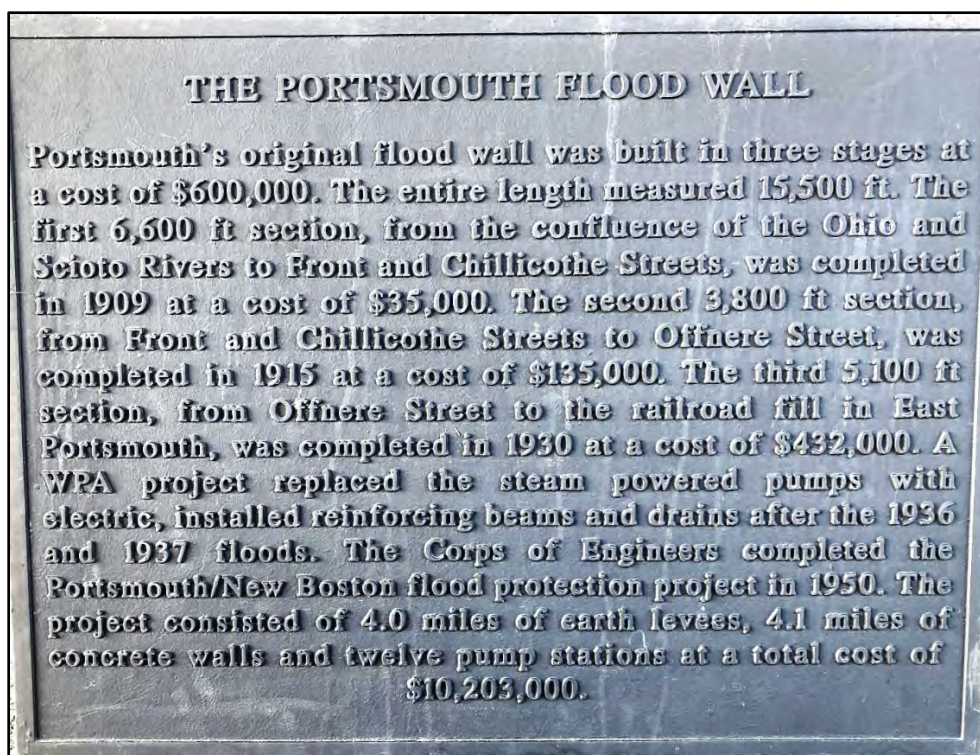


Old Portsmouth Times Building, Chillicothe St. at Front St., March 1913 flood (*Local History Digital Collection, Scioto County Public Library*). The two men are standing on the eastern end-section of Portsmouth's first floodwall, which was built to a height of 61 feet – but did it actually protect Portsmouth against a 61-foot flood?

3. Watch the video “**Portsmouth Flood Models**,” included with this lesson. This video illustrates the extent of floods of different stages in Portsmouth, if Portsmouth’s flood defenses did not exist. It was created using Google Earth and a macro devised by Andrew Thaler, which he originally created to model sea level rise. You can find instructions to **#DrownYourTown** on his website, Southern Fried Science:

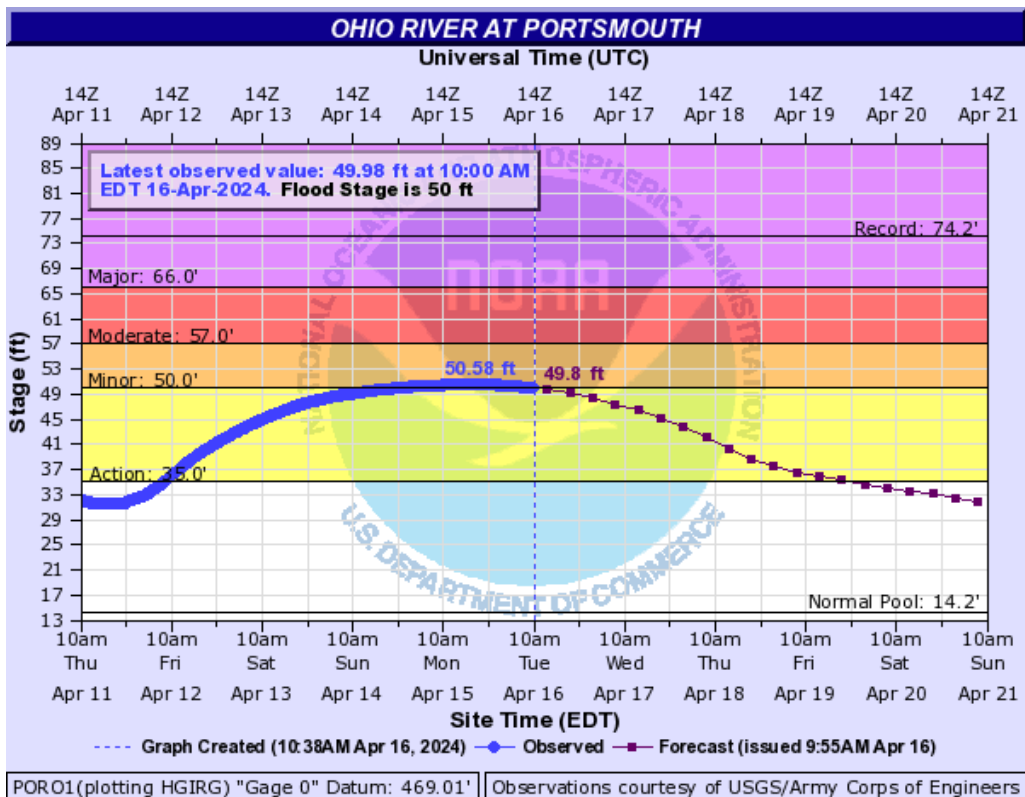
<https://www.southernfriedscience.com/how-to-drownyourtown-a-step-by-step-guide-to-modelling-sea-level-rise-in-google-earth/>

Don’t live in Portsmouth? Want to flood a different river community? Here’s your chance!



Historical marker, located beneath US Grant Bridge.





(top) Ohio River hydrograph for Portsmouth, mid-April 2024 (<https://water.noaa.gov/>).

(bottom) Ohio River at approximate minimum flood stage of 50 feet (near crest on top diagram), April 15, 2024. View is from top of levee looking west across Court Street Landing.



(left) Flood gauge on the Portsmouth Floodwall, on the river side near the Madison & Front St. floodgate. The base of the wall at this point is just under a stage of 56 feet.

(below) Historical records of flood stages of the Ohio River above 57 feet at Portsmouth. As you can see on the hydrograph on page 4, 50 feet is considered flood stage; 57 feet is a moderate flood; and 66 feet is a major flood.

| Ohio River at Portsmouth<br>above 57 feet |      |            |
|---|------|------------|
| Day                                       | Year | Stage (ft) |
| 17-Feb                                    | 1832 | 61.7       |
| 18-Dec                                    | 1847 | 61.1       |
| 12-Feb                                    | 1883 | 60.5       |
| 13-Feb                                    | 1884 | 66.3       |
| 25-Feb                                    | 1897 | 59.0       |
| 28-Mar                                    | 1898 | 57.5       |
| 26-Apr                                    | 1901 | 58.4       |
| 20-Jan                                    | 1907 | 61.0       |
| 18-Mar                                    | 1907 | 60.8       |
| 14-Jan                                    | 1913 | 58.2       |
| 31-Mar                                    | 1913 | 67.9       |
| 26-Jan                                    | 1927 | 57.2       |
| 22-Mar                                    | 1933 | 60.7       |
| 23-24-Mar                                 | 1936 | 59.2       |
| 27-Jan                                    | 1937 | 74.23      |
| 6-Feb                                     | 1939 | 57.6       |
| 23-Apr                                    | 1940 | 59.71      |
| 3-Jan                                     | 1943 | 61.2       |
| 9-Mar                                     | 1945 | 64.9       |
| 17-Apr                                    | 1948 | 64.1       |
| 9-Mar                                     | 1955 | 60.6       |
| 2-Mar                                     | 1962 | 59.1       |
| 9-Mar                                     | 1963 | 59.7       |
| 12-Mar                                    | 1964 | 60.8       |
| 4-Mar                                     | 1997 | 59.8       |

4. Calculate **flood recurrence probability** for Portsmouth. This is a fairly simple calculation, based on historical records, that is used to estimate the risk, as a percentage, of a flood of a particular severity occurring in any given year. A probability of 1% means that there is only a 1% chance of a flood of that severity occurring in any given year – since “1 percent” literally means “1 per 100” these are sometimes called **100-year floods**. Remember that this is based on *probability* of occurrence and is a not a guarantee of occurrence; while rare, back-to-back 100-year floods can and do occur. By extension, a 0.5% chance would be a 200-year flood, and a 50% chance would be a 2-year flood.

Using the data on the previous page, complete the flood recurrence probability table on the next page.

- Determine the number of years of record (N). Since the data is from Portsmouth, and Portsmouth was founded in 1803, this is simply the current year minus 1803.
- Rank the floods (M). The highest water would be ranked 1; the second-highest ranked 2; etc. Record the date and stage for each.
- Calculate the recurrence interval (R). This is the quantity N plus 1, divided by M. In other words,

$$R = (N+1)/M$$

- Calculate the annual probability. This is just the inverse of the recurrence interval (in other words, 1 divided by R). Record this as a decimal, then convert it to a percent.
- What is the annual probability of Portsmouth experiencing a major flood (i.e., 66 feet)? A moderate flood (57 feet)?

| NUMBER OF YEARS OF RECORD (N) = current year - 1803 |                          |                        |   |   |  |
|---|--------------------------|------------------------|---|---|--|
| N = _____   |                          |                        |   |   |  |
| <u>FLOOD RANK</u><br>(M)<br>[1 = highest]           | <u>DATE</u><br>(mm/yyyy) | <u>STAGE</u><br>(feet) | <u>RECURRENCE INTERVAL (R)</u><br>R = (N+1)/M | <u>ANNUAL PROBABILITY = (1/R)</u><br>as decimal      as percent |  |
| 1   |                          |                        |   |   |  |
| 2   |                          |                        |   |   |  |
| 3   |                          |                        |   |   |  |
| 4   |                          |                        |   |   |  |
| 5   |                          |                        |   |   |  |
| 6   |                          |                        |   |   |  |
| 7   |                          |                        |   |   |  |
| 8   |                          |                        |   |   |  |
| 9   |                          |                        |   |   |  |
| 10  |                          |                        |   |   |  |
| 11  |                          |                        |   |   |  |
| 12  |                          |                        |   |   |  |
| 13  |                          |                        |   |   |  |
| 14  |                          |                        |   |   |  |
| 15  |                          |                        |   |   |  |
| 16  |                          |                        |   |   |  |
| 17  |                          |                        |   |   |  |
| 18  |                          |                        |   |   |  |
| 19  |                          |                        |   |   |  |
| 20  |                          |                        |   |   |  |
| 21  |                          |                        |   |   |  |
| 22  |                          |                        |   |   |  |
| 23  |                          |                        |   |   |  |
| 24  |                          |                        |   |   |  |
| 25  |                          |                        |   |   |  |