The 1913 Dayton Flood and the Birth of Modern Flood Control Engineering in the United States

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Overview of the Dayton Area

- 4 rivers converge in Dayton within one mile of each other
- The Dayton area averaged one major flood every decade
- Miami River watershed covers 3,937 square miles and 115 miles of channel; feeds into the Ohio River
Timeline of Flood Events (1 of 7)

- 21 March 1913 – 60 degrees, freak windstorm begins
- 22 March – sunny day, temperatures fall into the 20s
- 23 March – Easter Sunday, rain begins falling on Ohio and nearby states
- 24 March – heavy rains, at 0700 river reaches high stage for the year at 11.6 ft and continues to rise
25 March –

- 0000: A.M. Fox contacts police after discovering weakening in Herman street levee; Dayton Police start warning sirens and alarms
- 0530: City Engineer Gaylord Cummin discovers water at top of levees and flowing at an unprecedented 100,000 cubic feet per second
25 March –

- 0600: water appears in Dayton streets after levees begin to overtop
- 0800: levees on south side fail, begin flooding downtown business district
25 March – water levels continue to rise throughout Dayton

At the edge of the flood. From high land in southeast Dayton, looking toward the center of the city.
Timeline of Flood Events (5 of 7)

26 March - flood waters reach their crest at 0130

High Street, Hamilton, at daybreak, March 26, 1913, taken when flood was near crest. The depth may be judged from the street lamps which just clear the water surface.
Timeline of Flood Events (6 of 7)

26 March – early morning gas explosion at 5th and Wilkinson (photos taken after water receded)
Timeline of Flood Events (7 of 7)

26 March – panoramic image of Dayton along the swollen Miami River at 1030 (looking North)
Flood Destruction - Casualties

- 700 people died in storm event (467 in Ohio and about 300 from Dayton)
- 1400 horses and 2000 other domestic animals died in flood.
Wood Frame Houses Decimated; lifted off foundations and Tumbled About

Houses piled together.
Houses were moved off their foundations. People trapped in the upper stories of their homes chopped holes in the attic walls and roofs in order to escape. The debris on the roofs was left by the water near the crest of the flood.
Impacts on downtown industrial area
The physical recovery took about a year; but the business recovery took about 10 years.
The Ohio National Guard constructed refugee camps until people could be resettled or relocated.
Some part of the Ohio flooded every year from 1873 to 1913

Engineers did not have an accepted methodology for predicting the maximum probable flood

Levees were the primary form of flood control up to 1913

Dams scared people after the 1889 Johnstown Dam disaster

Flood control was still considered a local or state problem

Most of downtown Dayton was built on the Miami River’s natural floodplain
The City of Dayton vowed that their city would never flood again.

On 27 March, Governor James Cox appointed a Citizens’ Relief Commission.

On 2 May, the Commission began a 10 day fundraiser which raised over $2 million (1913 dollars) from 23,000 subscribers.

The Commission hired Arthur E. Morgan to head the flood control program.
Arthur E. Morgan, C.E.

- Born Cincinnati, OH; grew up in St. Cloud, MN
- Worked various jobs out west and attended the University of Colorado for 6 weeks
- Worked for his father’s engineering practice; drafted engineering code for the State of Minnesota
- Married twice; 2 sons and 3 daughters
- Moved to Dayton, OH in 1913
- President of Antioch College, 1921-33
- Oversaw creation of the Pueblo (Colorado) Conservation District after 1921 Pueblo flood
- First Chairman of the Tennessee Valley Authority (1933-38)
- Committed to social reform and scientific methods
- Lifelong critic of the Corps of Engineers; wrote book *Dams and Disasters* (1973)
- Lived to be 97
Morgan was literally given carte blanche: “The valley has suffered a calamity that must never be allowed to occur again. Find a way out.”

He hires 50 engineers to determine the size the Miami Valley watershed and determine the flood volume.

Used historical data from Europe to estimate that 1000 year recurrence frequency floods are 20% larger than 100 or 200 year frequency events.

03 October 1913, Morgan presents eight different plans to the city.
Flood Protection Plan - 2

- After much debate, the City of Dayton decided on building a system of dry reservoirs citing its precedence in France’s Loire Valley.

- Morgan’s Plan:
  - **Instream Storage**: Five earthen dams with conduits or slots to meter out a limited amount of water
  - **Training levees**: Widening channel substantially through the Dayton area and constructing large levees.
  - **Flood storage areas** to be used as farmland between brief periods of flooding
  - The New channel could convey **40% more volume** than 1913 flood!
### Quantities of Work, by Features

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<td>Channel Improvement</td>
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<td><strong>Subtotals</strong></td>
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<td>Englewood</td>
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Location of works included in the Official Plan.
In 1914, Morgan drafted the Ohio Conservancy Act which was quickly passed and signed into law. The Act allowed local governments to establish “conservancy districts” for flood control (called flood control districts today). After much debate regarding the act’s constitutionality, the Miami Conservancy District (MCD) was established on June 1915 and appointed Morgan as its first president; work immediately began on his Dayton flood control system.
Entire factories were removed where such features had encroached the natural river channel.
Project Construction - 2

The channel of the Miami River was restored to its maximum cross section.

Business and industries which encroached the 1000 year flow channel were razed and relocated.
Project Construction - 3

General map of Dayton channel improvement. Showing the river system, levee work, channel excavation, and spoil banks.

Air view of improved river channel at Dayton.
Dragline at Englewood Dam.

Dragline at Dayton. Mounted on a barge in the Miami River, the dragline loads another barge with material excavated from the channel. In the distance the steam tug “Dorothy Jean” is moving a loaded barge to be unloaded at the spoil bank or for building a levee.
Embankment Flood Storage Basins – basically “dry dams”
Germantown Dam was the largest of the five embankment dams constructed as part of the flood control project.
Morgan employed permanent slots, or openings, in the dams to meter outflow and prohibit between-storm storage; fearing permanent lakes would deter from the primary mission of the dams (flood control).
Huffman Dam Outlet Works

The Huffman trilobite (*Isoletus brachycephalus*). The largest complete trilobite ever found, measuring 14½ inches by 10 inches, found in excavating for the outlet works at Huffman Dam. This fossil is estimated to be about 450,000,000 years old and was found in the late Ordovician or early Silurian limestone. It was probably the most highly developed animal of its day.
Aerial view of Taylorsville Dam. The Taylorsville Dam on the Miami River above Dayton, and part of the retarding basin, looking upstream. This shows how basin lands are used for agricultural purposes. A recreational area has been developed in the wooded tract east (to right) of the river, in cooperation with the National Park Service.

Aerial view of Englewood Dam and part of retarding basin, looking upstream past the dam. The outlet conduits pierce the dam near the center of the picture, and the spillway is seen at the extreme left. Grasses and honeysuckle protect the slopes against erosion. The ponds above the dam are on the site of the borrow pit from which material was taken for the dam. The agricultural use of lands in the basin is indicated by the cultivated fields above the dam. Englewood is 125 feet in height, the highest of the five dams.
Aerial photograph taken in 1993 shows Englewood Dam as it appears today under U.S. Route 40.  

Source: Miami Conservancy District
Mission: Healthy watersheds that support sustainable communities and a higher quality of life for our generation and those to come.

Vision: Protecting the lives, property, and economic vitality by providing unfailing flood protection, preserving water resources, enhancing river corridors and conserving valuable land within the Great Miami River Watershed.
Current Events in the Miami Conservancy District - 2

- Highest water in 2004 occurred on 05 January
- Germantown Basin was 45 feet above normal and at the 8th highest level since the 1913 flood
- All five dams stored water during this event
- 2 to 5 inches of rain fell on the Miami Valley
The Miami Conservancy District maintains an active board of consultants


Original board of consultants
REFERENCES

- www.noaa.gov
- www.miamiconservancy.org
- J. D. Rogers interviews with Dr. Ralph B. Peck