LONG MILL DAM
Addressing the Concerns
• Dam was built in 1894 by Dan River Power & Manufacturing Co. to provide waterpower to the Long Mill complex.
• Length: 1,144 feet
• Height: Approximately 5 feet tall
• Construction Material: Stone/masonry block
Dam Information

- Current Owner: City of Danville
- Currently serves no function
- Designated as a “Low-Head Dam”
- Hazard signs have been placed on both sides of the dam
- Not listed in the National Register of Historic Places
What are Low-Head Dams?

- Small overflow type dams across the full width of the river or channel
- Typically less than 15 ft. high
- Low-head dams regulate fluctuations in the depth of the river upstream
- Typically, they impound water to be used for hydropower, mill ponds, irrigation, water supply, navigation, and recreation
Hazards of Low-Head Dams

- When water flows over a low-head dam, it forms a hydraulic jump or intense recirculation of the water below the dam.

- This “roller” type recirculation directs the water flow back upstream toward the face of the dam.

- If anything should get into this recirculating current such as boaters, swimmers, fishermen, etc., the consequences can be deadly.
Hazards of Low-Head Dams

- Objects can get caught in the backwash of a low-head dam for two main reasons:
  - Recirculating current pulls objects into the reverse rotating roller.
  - The turbulence causes the water to become super-aerated significantly reducing an object’s buoyancy making it very difficult to stay afloat.
Dan River Watershed

- The Dan River drains approximately 2,050 square miles at the Long Mill Dam.
- During the 100 year flood event, river flow over the Long Mill Dam is 78,100 cubic feet per second.
Low-Head Dam Drowning Statistics

- Nationally, there have been an increasing number of drownings at low-head dams.
- Research by Dr. Bruce Tschantz, P.E., Ph.D. has shown that of all the documented deaths at low-head dams in the U.S., 69% of them have occurred in the last 15 years.
- An increase in water-related public recreation has contributed to the recent increase in low-head dam fatalities.
- The upward trend indicates these numbers will continue to rise along with rises in recreational activity.
Examples of Low-Head Dam Drowning Incidents

• **4/23/06 – Lexington, VA:** 16-yr old boy swimming in Maury River. City of Lexington found negligent in a wrongful death lawsuit; Ordered by court to award victim’s family $100,000. The City has installed signs & buoys as a result.

• **7/9/06 – Boone, IA:** 22-yr old woman tubing in Des Moines River. Lawsuit resulted in City of Boone awarding victim’s family $95,000 and a stipulation for City to modify dam to remove hazard. A rock-ramp was installed. The dam could not be removed since it was used to impound water for the water treatment plant intake.

• **6/6/09 – Rocky Mount, VA:** 36-yr old man canoeing in Blackwater River. A rock-ramp was installed. The dam could not be removed since it was used to impound water for the water treatment plant intake.
Examples of Low-Head Dam Drowning Incidents

- **7/23/09 – Rocky Mount, VA:** 21-yr old woman canoeing on Blackwater River. A rock-ramp was installed. The dam could not be removed since it was used to impound water for the water treatment plant intake.

- **4/12/10 – Danville, VA:** 5-yr old boy at Brantley Steam Plant Dam on Dan River. Dam was removed in response to drowning.

- **3/29/16 – Richmond, VA:** 36-yr old woman wading on James River. City of Richmond currently has not announced a plan to address the dam hazard.
Hazards of Low-Head Dams

• Since 1965, there have been four drownings at low-head dams in the Dan River.
• The tragic drowning of five-year-old Kolton Karnes at the Brantley Dam on April 12, 2010 focused the City’s attention on the hazards presented by low-head dams.
• Public activity has increased near the Long Mill Dam due to new developments, the Riverwalk Trail, and removal of existing buildings and fencing that acted as barriers.
• The City wants to take a proactive approach to improve the safety of the river.
Dam Remediation Options

1. **No Action**
   - Dam remains in place with buoys, additional signage, and fencing installed

2. **Modification**
   - Install a “Rock-Ramp” to remove hydraulic recirculation

3. **Removal**
   - Demolish dam, returning river to its natural flow
Option 1: **No Action**

- Leave dam in place.
- Install buoys, additional signage and fencing upstream and downstream of dam to show boaters and river-goers the potential hazard.
Option 1: No Action

**Advantages:**
- Cheapest option ($20,000 estimated)

**Disadvantages:**
- Safety hazard remains
- Fish and aquatic wildlife migration pathway remains obstructed
- Maintenance of dam, signs, buoys, etc. remains
Option 2: Modification

- Installation of a “Rock-Ramp” on the downstream side of the dam to remove hydraulic recirculation.
Option 2: Modification

• Various sized rocks would be filled into the river to gently slope the flow from the top of the dam back down to the riverbed.

• Outside design firm would need to prepare design based on river channel flow.

• Permits are required to construct rock-ramp in river.
Option 2: Modification

- To estimate the cost to install a rock-ramp on the Long Mill dam, several other rock-ramp projects were evaluated along with consultation from a rock-ramp design engineer.
- The total costs for rock-ramp projects like the following were broken down into a cost-per-linear-foot of dam and then, this unit cost was applied to the Long Mill dam.

<table>
<thead>
<tr>
<th>City</th>
<th>Total Cost</th>
<th>Dam Length</th>
<th>Unit Cost</th>
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</thead>
<tbody>
<tr>
<td>Frankenmuth, MI</td>
<td>$3.5 Million</td>
<td>250 feet</td>
<td>$14,000/LF</td>
</tr>
<tr>
<td>Boone, IA</td>
<td>$400,000</td>
<td>212 feet</td>
<td>$1,887/LF</td>
</tr>
<tr>
<td>Toledo, OH</td>
<td>$227,000</td>
<td>100 feet</td>
<td>$2,270/LF</td>
</tr>
<tr>
<td>Fargo, ND</td>
<td>$117,871</td>
<td>108 feet</td>
<td>$1,091/LF</td>
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- An average unit cost calculated from numerous similar rock ramp projects is approximately $2,000/LF.
- Applying this to the length of the Long Mill Dam (1,144 ft.) results in an estimated cost range of $1 million - $3 million.
Option 2: Modification

**Advantages:**
- Removes hydraulic roller at toe of dam
- Restores fish and aquatic wildlife migration pathway

**Disadvantages:**
- Major design & construction costs ($1 million to $3 million estimated based on linear foot of dam)
- Protection of north and south bank sewer lines (added cost)
- Maintenance of dam & rock ramp (accumulation of debris more likely)
- Potential increase in floodplain at adjacent properties
- Per communication with Permitting Agencies, not likely to be permitted based on lack of need compared to removal option.
Option 3: Removal

- Demolish dam, removing down to river bottom
- Permit required
- City Public Works crew would perform demolition
Option 3: Removal

**Advantages:**
- Removes safety and liability concern
- Returns river to natural stream channel
- Restores fish & aquatic wildlife migration pathway
- Eliminates future maintenance of dam, buoys, signs, etc. and potential dam failure
- Increases recreational opportunities (opens more river)
- Decreases upstream floodplain
- Restores natural movement of sediment
- Reduces streambank erosion

**Disadvantages:**
- Moderate cost to remove. Estimated to be roughly $57,200 ($50 per linear foot)
## Options Summary

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1: No Action</strong></td>
<td>• Cheapest Option</td>
<td>• Safety hazard • Fish passage obstructed • Maintenance</td>
<td>$20,000 (plus annual maintenance)</td>
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<tr>
<td><strong>Option 2: Modification</strong></td>
<td>• Removes safety hazard • Restores fish passage</td>
<td>• Major costs • Sewer line needs protection • Maintenance • Floodplain increase • Not likely to be permitted</td>
<td>$1 million - $3 million (plus annual maintenance)</td>
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<tr>
<td><strong>Option 3: Removal</strong></td>
<td>• Removes safety hazard • Restores fish passage • Natural river channel • No maintenance • Increases recreation • Decreases floodplain • Natural sediment movement • Reduces bank erosion</td>
<td>• Moderate costs</td>
<td>$57,200 ($50/linear ft.)</td>
</tr>
</tbody>
</table>
• If you would like to express your opinion on what should be done to address the issue of the Long Mill Dam, please do so on one of the provided surveys. We greatly appreciate your input.

• City Staff is available to answer any questions.