

Draft Executive Summary

Environmental Assessment for Estabrook Dam

Milwaukee County, Wisconsin



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1.0 Introduction to Estabrook Dam Environmental Assessment

Milwaukee County, a Wisconsin municipal body corporate, owns and operates Estabrook Dam in the Milwaukee River near Estabrook Drive and W. Hampton Avenue (Attachment 1). The Wisconsin Department of Natural Resources (WDNR) has issued an Administrative Order dated July 28, 2009, requiring the County to drawdown the impoundment until such time as the dam can be either repaired or abandoned.

The dam was built in the 1930's and includes construction on an island in the river. This natural island is under the jurisdiction of the United States Bureau of Land Management (BLM).

In determining whether to repair or abandon the dam, federal and state agency review of the project requires an environmental assessment to meet the National Environmental Policy Act (NEPA) and Wisconsin Environmental Policy Act (WEPA).

The Environmental Assessment Report for Estabrook Dam will analyze a variety of alternatives to determine the most cost-effective and environmentally sound solution to address the dam, and note the short-term and long-term impacts including environmental, historical, social and economic of each alternative.

1.1 Project Background

Estabrook Dam was constructed during the late 1930's by the Civilian Conservation Corps (CCC) and Civil Works Administration (CWA). The dam was constructed with gates that could be opened during times of flooding and closed during low water in order to maintain a pool of water above the dam for recreational purposes. The gated section of the dam extends from County owned parkland on the east bank of the river to a central island under the jurisdiction of the BLM. A fixed crest spillway then extends from the island to private lands on the west shore of the river. On May 26, 1937, Milwaukee County received a permit from the Public Service Commission of Wisconsin to construct, operate and maintain the dam with a fixed pool.

Historical information on the area indicates the Milwaukee River was prone to flooding in the area from the south end of Estabrook Park and extending beyond Silver Spring Drive for several miles. The cause of the flooding was attributed to the relatively flat profile of the river, the serpentine oxbows in this area and a limestone outcrop or ledge about 1 mile long which was located near the current location of the dam north of Capital Drive. The river flowed through the oxbows and over this outcrop restricting the flows at certain times of the year. Downstream of the outcrop was a substantial drop in the river level. The residents upstream requested the local governments to provide relief from the flooding. A flood control project was designed to provide some relief to these residents.

In the fall of 1933, as part of the greater flood control project removal of the rock outcrop was initiated. Residents in the area wanted to continue to use the river for swimming, boating, and canoeing. Removal of the rock outcrop caused the water to drop to such an extent that large boat recreational use was limited, and construction of a dam was initiated to facilitate some control over water levels upstream.

The dam was constructed with gates to allow for adjusting the upstream pool elevation for maintenance and recreational enhancement. The fixed crest section was designed to allow ice to pass over this section. A series of ice breakers were constructed to provide protection of the gates.

The WDNR Administrative Order dated July 28, 2009, requires the County to either repair or abandon the dam and also requires the County to maintain the dam under a drawdown condition until the repairs are completed. The repairs pertain to structural improvements and reconditioning of the gates to maintain proper operation. Some tree removal and bank stabilization near the dam structure is also required.

Milwaukee County retained AECOM to investigate the dam condition in 2010, to assess sediment quality and quantity upstream of the dam, and to design improvements to the dam to meet the WDNR's Administrative Order.

The United States Environmental Protection Agency (USEPA), WDNR and Milwaukee County have investigated the sediments upstream of Estabrook Dam. AECOM found sediment containing polychlorinated biphenols (PCBs) upstream from the dam behind the fixed-crest spillway section. Previously, contaminated sediment containing PCBs was removed from the reaches of the river further upstream of the dam. Additional sediment is scheduled to be removed during the second half of 2014 including the sediment immediately upstream from the dam and extending to where the first phase ended.

Improvements to Estabrook Dam were designed by AECOM and plans and specifications for these improvements are on file at Milwaukee County.

A series of Technical Advisory Team meetings have taken place with representatives from Milwaukee County, Southeastern Wisconsin Regional Planning Commission (SEWRPC), BLM, WDNR, US Fish and Wildlife Service, US Army Corps of Engineers, Himalayan Consultants, and AECOM participating from 2012 to the present. The representatives provided input on Estabrook Dam and alternatives to the dam. The alternatives included a no-action alternative; repair the dam; repair the dam and provide fish passage; removal of the dam, and a rock ramp (three options) to develop a pool upstream similar to a dam while allowing fish passage.

An environmental assessment is required to evaluate feasible alternatives to the dam and to meet the state and federal regulatory requirements for a WEPA and NEPA project.

2.0 Identification of Alternatives

This section provides an overview of the alternatives considered regarding Estabrook Dam. The alternatives are identified, a preliminary screening of alternatives is performed, and the most feasible alternatives are selected for a more in-depth evaluation of their environmental benefits, impacts, and related costs. Public input and agency input will be solicited to provide Milwaukee County with the information to select the preferred alternative.

2.1 Identification of Alternatives

The Technical Advisory Team identified the following alternatives for consideration for Estabrook Dam. These alternatives are as follows:

- Alternative 1 – Rehabilitate the dam.
- Alternative 1A – Rehabilitate the dam and add provisions for fish passage.
- Alternative 2 – Abandon and remove the dam.
- Alternative 3 – Abandon and remove the dam, providing a 5.5-foot high rock ramp to facilitate fish passage and establish an impoundment.
- Alternative 3A – Abandon and remove the dam, providing a 4-foot high rock ramp to facilitate fish passage and establish an impoundment.
- Alternative 4 – Gated spillway removed, serpentine overflow spillway lowered, and a 6.3-foot-high rock ramp constructed.
- Alternative 5 – No action.
- Alternative 6 – New dam.

2.2 Preliminary Screening of Alternatives

Because Estabrook Dam was constructed in the 1930s, Milwaukee County and the public have decades of experience to weigh the costs and environmental impacts, both positive and negative, associated with the dam. The dam gates have remained open since 2009, which allows Milwaukee County and the public the opportunity to assess environmental conditions as a free flowing river and no dam. These factors allow all parties to objectively evaluate the environmental and social aspects of a dam or a free flowing river.

The following information is provided on each alternative and the preliminary screening of the alternatives.

2.2.1 Alternative 1 – Rehabilitate the Dam

Alternative 1 – Rehabilitate the dam consists of making the structural improvements to the dam to extend its life and to meet the requirements stipulated in the July 28, 2009 WDNR Administrative Order. Other improvements include upgrading the gates and tree removal at the dam structure.

Milwaukee County Board has voted to implement Alternative 1. At that time, the concept of addressing other alternatives to the dam had not been fully evaluated. At the time, the idea of dam removal was dismissed. The NEPA and WEPA requirements include addressing alternatives.

2.2.2 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

Alternative 1A is Alternative 1 with the addition of fish passage features. The provision for fish passage can be considered an environmental benefit. Because of this added environmental benefit of fish passage, the environmental assessment will eliminate Alternative 1 from further consideration and will evaluate Alternative 1A.

Alternative 1A is a refinement of Alternative 1 with added environmental benefits. The fish passage provision allows fish to pass through the dam area in a designated passage section of the dam. This fish passage allows fish to migrate during spawning and other periods of the year which promotes fish diversity, enhances fishing opportunities and is intended to replicate conditions in a free flowing river.

Alternatives 1 and 1A will require long-term annual operation and maintenance cost to operate the gates, remove debris, and to maintain the dam.

2.2.3 Alternative 2 – Abandon and Remove the Dam

Alternative 2 – Abandon and remove the dam would restore the river to a free flowing condition. This alternative would eliminate the County's capital cost for dam repair and also eliminate the need for annual dam operation and maintenance costs. Sediment would not accumulate if the dam was removed and this is another environmental benefit. This alternative has merit and will be further addressed in the environmental assessment.

2.2.4 Alternative 3 – Abandon and Remove Dam, Providing a 5.5-Foot High Rock Ramp to Facilitate Fish Passage and Establish an Impoundment

Alternative 3 provides the benefits of an impoundment 1,600 feet upstream of the dam site. The ramp would create an impoundment similar to a dam, but without the large capital expense to repair the dam and eliminates the annual operating and maintenance costs associated with the dam gates. But some maintenance, including debris cleaning, is anticipated. The rock ramp allows fish passage, which is an environmental benefit. The passive nature of a rock ramp is similar to a natural river with riffles. Sediment buildup can be expected with a rock ramp, depending on the rock height. Similarly, the rock ramp height will dictate the extent of a pool upstream and will be limited to a height that does not interfere with a 100-year frequency flood elevation. SEWRPC analyzed the 5.5-foot high rock ramp at this location and concluded this option would increase the 100-year frequency flood elevation and is, therefore, eliminated from consideration.

2.2.5 Alternative 3A – Abandon and Remove the Dam, Providing a 4-Foot High Rock Ramp to Facilitate Fish Passage and Establish an Impoundment

Alternative 3A is similar to Alternative 3, but is not as high. SEWRPC modeled this alternative and found that this option complies with the 100-year frequency flood levels. Alternative 3A has merit and will be further addressed in the environmental assessment.

2.2.6 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-foot-high Rock Ramp Constructed

Alternative 4 presents a rock ramp option located at the gated section of the dam. This rock ramp is higher than the rock ramp option in Alternative 3A and therefore provides a deeper impoundment upstream. The rock ramp height results in the structure being considered as a large dam which has some regulatory requirements as follows:

- Operation, inspection, and maintenance plan must be developed.
- Emergency action plan must be developed.
- An owner inspection would be required every 10 years.

Alternative 4 has merit and will be further addressed in the environmental assessment. The height of the rock ramp for Alternative 4 was evaluated by SEWRPC and found to be capable of passing a 100-year frequency flood without exceeding the flood elevation. At the dam location, the water depth is deeper than at the Alternative 3 rock ramp location. Even though Alternative 4 has a 6.3-foot height, the effect on the flood elevations is less than Alternative 3 having a 5.5-foot high rock ramp located upstream at a shallower area in the river.

2.2.7 Alternative 5 – No Action

Alternative 5 – No action refers to Milwaukee County taking no action to repair the dam or to abandon the dam. The No Action alternative would violate WDNR's July 28, 2009 Administrative Order. Alternative 5 would mean the dam gates could not be operated. The dam is in need of structural repair which could lead to continued degradation of the dam. The potential for an impoundment upstream could not be realized under this alternative. Therefore, Alternative 5 – No Action, is eliminated from further consideration because it violates WDNR's Administrative Order and is not a sustainable solution.

2.2.8 Alternative 6 – New Dam

Alternative 6 – New Dam would replace the existing dam. The existing dam, built in the 1930s, is in need of repair, but the costs to construct a new dam would be substantially higher. The dam can be repaired at a much lower cost. For this reason, Alternative 6 is eliminated from further consideration.

2.3 Feasible Alternatives

Based on the preliminary screening of alternatives, the following alternatives are deemed feasible and will be further evaluated in this environmental assessment.

- Alternative 1A – Rehabilitate the dam and add provisions for fish passage.
- Alternative 2 – Abandon and remove the dam.
- Alternative 3A – Abandon and remove the dam, providing a 4-foot high rock ramp upstream of the dam site to facilitate fish passage and establish an impoundment.

- Alternative 4 – Gated spillway removed, serpentine overflow spillway lowered, and a 6.3-foot-high rock ramp constructed.

Further review of Alternative 3A shows this option to have similar features as Alternative 4, but with less recreational benefits as Alternative 4. For the executive summary, Alternative 4 will be further discussed, and Alternative 3A will be eliminated from further discussion.

3.0 Identification of Alternatives

The affected environment is addressed in the environmental assessment for the feasible alternatives. This executive summary identifies the primary topics for the feasible alternatives. Refer to the Environmental Assessment for a complete evaluation of the alternatives.

3.1 Affected Environment

3.1.1 Aquatic

The fish found within the Milwaukee River and Estuary are typical of riverine systems in Wisconsin. Some of the best smallmouth habitat on the Milwaukee Rivers is located in Estabrook and Kletsch Parks.

Recent mussel survey results for the Milwaukee River Greenway found that the impoundment above the Estabrook Dam contained evidence of 11 species of mussels. However, only 8 of the species were found alive. Mussels use fish as a host species and it is, therefore, important for fish to be able to migrate throughout the river to enhance the mussel population. This is another reason for the fish passage.

Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

Alternative 1A creates an impoundment extending to Silver Spring Drive under normal (median) flow conditions, and extending to West Bender Road during high flow events. Fish passage would be provided.

A dam operating plan is being prepared. The plan will need to address impacts of fluctuating water levels seasonally so as to not freeze out aquatic species and flood out nesting animals. The impoundment will cause an increase in water temperature which can be detrimental to fish as compared to a free-flowing river.

Water level fluctuations will need to be limited to a maximum lowering of 6 inches per day, as per WDNR requirements which are enacted to protect aquatic life as well as to reduce impacts to the environment downstream from the dam.

Alternative 2 – Abandon and Remove the Dam

Alternative 2 results in a free-flowing river with characteristics as currently experienced during normal river flow. Fish passage is an additional benefit. Water temperatures are more compatible for the fish and reduce the potential for higher water temperatures as experienced in an impoundment which can be detrimental to fish. Mussels and other aquatic life can benefit from a free-flowing river.

Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-Foot High Rock Ramp Constructed

This alternative creates an impoundment similar to Alternative 1A but is not as deep. The natural pool and riffles created by the rock ramp replaces the dam gates. The aquatic impacts are similar to a dam in terms of an impoundment and increasing water temperature in summer as compared to a free-flowing river. River level fluctuations are minimized as compared to a dam and the more constant

river levels have a more positive effect on the aquatic systems including fish, turtles, mussels, and benthic organisms.

3.2 Terrestrial

The plant community within and adjacent to the Milwaukee River floodplain is a wetland complex in many areas and consists of wet meadow and second growth, southern wet to wet mesic lowland hardwood. No endangered or threatened plant species were found.

3.2.1 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

Alternative 1A will require removal of some trees and shrubs within 15 feet of the dam structure. The impoundment will reduce the buildup of woody vegetation along the current river edge that has built up since 2009. The impoundment will create a small, shallow lake environment and the vegetation next to the impoundment will develop over time including shrubs, trees, and grass.

3.2.2 Alternative 2 – Abandon and Remove Dam

Alternative 2 results in terrestrial conditions similar to existing conditions. Woody vegetation will continue to develop along the river's bank. The vegetation provides shade and can improve habitat for wildlife and aquatic habitat.

SEWRPC has analyzed the river under this alternative and concluded the vegetation will not appreciably affect the river's capacity to handle major flood events based on similar projects. Similarly, the power of ice moving downstream has the power to mow down vegetation within its path.

3.2.3 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-Foot High Rock Ramp Constructed

This alternative creates an impoundment which is shallower than the Alternative 1A impoundment. Woody vegetation and grasses will develop along the impoundment edge to provide habitat for wildlife and aquatic life.

3.3 Cultural Environment

The cultural aspects refer to the land use and public's use of Estabrook Park and the Milwaukee River area.

3.3.1 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

Alternative 1A is compatible with the land use and is the status quo. The impoundment provides recreational activities including swimming, boating, canoeing, and kayaking.

3.3.2 Alternative 2 – Abandon and Remove the Dam

Alternative 2 is compatible with the land use. Returning the area to a free-flowing river provides recreational activities including swimming, canoeing, and kayaking, but will eliminate boating. Based on similar projects where the dam was removed, the recreation on the river definitely changed from boating to canoeing and kayaking, but the overall use of the river tended to be similar or actually increased. The removal of the North Avenue Dam is a success story in terms of ecological diversity.

3.3.3 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-Foot High Rock Ramp Constructed

Alternative 4 is compatible with the land use. The impoundment behind the rock ramp provides recreational opportunities for swimming, canoeing, and boating and the impoundment extends to West Bender Road. The depth of the impoundment will be less than Alternative 1A, but does provide for boating opportunities.

3.4 Socio/Economic Impacts

Estabrook Dam is located in the Milwaukee River corridor within the highly urbanized City of Milwaukee. Urbanized development with more impervious areas contributes to flooding concerns in the area. Local residents who live adjacent to the river and impoundment created above the dam claim to have suffered the loss of recreational use, increased flooding, changed aesthetics, and disproportional loss of property values because the dam gates have been open since 2009.

3.4.1 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

Alternative 1A would continue use of the dam with an impoundment for recreational use. Some upstream property owners have indicated to the County that their property values will be affected if the dam is removed. These same property owners enjoy use of their boats in summer made possible by the impoundment, especially for residents upstream from West Silver Spring Drive.

3.4.2 Alternative 2 – Abandon and Remove the Dam

There is a portion of the public who promotes dam removal and restoration to a free-flowing river. This approach tends to be more natural, requires minimal costs by the County to maintain, and is sustainable.

3.4.2.1 Dam Removal Impacts on Property Values

Removal of the Estabrook Dam is expected to have little impact on property values in the area surrounding the existing waterway and current impoundment. Property values, real and assessed, are a significant concern for property owners and taxing authorities. Although little research has been focused on assessing the impacts of dam removal and loss of impoundment on property values, preliminary studies have indicated that riparian property values (after dam removal) have remained unchanged or decreased temporarily with a rebound within 2 years. After 10 years, property values showed no difference from the value prior to dam removal¹. Based upon sales market data between 1993 and 2002, comparison of residential properties in south-central Wisconsin where a small dam remains intact, a small dam was removed, and the river or stream has been free-flowing for more than 20 years, indicate that there is no noticeable increase in property price between properties with shoreline frontage along a small impoundment and properties along a free-flowing river or stream. In fact, if the properties retain frontage on the stream, there is no significant change in property price,

¹ Sarakinos, Helen and S.E. Johnson. "Social Perspectives on Dam Removal." *Dam Removal Research: Status and Prospects*. William Graf (editor). Washington D.C.: The H. John Heinz III Center for Science, Economics and the Environment. Proceedings of The Heinz Center's Dam removal Research Workshop, October 22-23, 2002. 2003.

except for an increase related to the increase in lot size, after the stream has returned to a free-flowing riparian state².

The rebound and potential for increased property values may be related to the desire of potential property buyers for homes with larger lot size, near free-flowing rivers as opposed to properties with less land area near impoundments. The potential for improved water quality and reduced flood risk may also create an increase in the intrinsic value of properties along free-flowing streams as opposed to man-made impoundments. Property adjacent to any water body (stream or impoundment) has a perceived, inherent value. It appears that over time the differences in value between riparian or lake frontage may not be significantly different. The proposed action may have short-term impacts on property values in the area, but values can be expected to rebound to similar levels as expected prior to proposed activity at the dam.

3.4.3 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6-3-Foot High Rock Ramp Constructed

This alternative provides a sustainable approach without the mechanical gates and associated operation and maintenance costs of the dam gates. The alternative provides an impoundment similar to Alternative 1A, but not quite as deep.

3.5 Flood Carrying Capacity

SEWRPC performed river modeling for the feasible alternatives and addressed multiple river flow events including a 100-year frequency flood. The results are as follows:

3.5.1 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

SEWRPC's modeling indicated Alternative 1A can handle the 100-year frequency flood with all 10 gates open. If the 10 gates are closed, the dam will exceed the 100-year frequency flood levels resulting in flooding to upstream properties, potential liability to the County due to the flooding and violating the Wisconsin Administrative Code NR 116 by exceeding the 100-year flood elevations. Additional precautions must be taken by the County to protect upstream property owners if Alternative 1A is implemented as follows:

1. Develop an Operation Plan for the dam to define the conditions and actions to be taken during significant storm events as well as seasonal operation of the dam. WDNR criteria limits the extent of drawdown on a daily basis to avoid sudden swings in water levels which can be ecologically damaging.
2. Retain a dam gate operator to be available to regulate the dam gates to correspond to high river flows and impending storm events. Predicting significant storm events and high river flows can be a challenge and will require the County to have staff available to continually monitor river and weather conditions. A flood event of about a 15-year frequency is large enough to cause upstream flooding equivalent to a 100-year flood if the 10 gates are closed at the time. This can be a huge liability issue to the County.

² Provencher, Bill, Helen Sarakinos, and Tanya Meyer, "Does Small Dam Removal Affect Local Property Values? An Empirical Analysis." University of Wisconsin-Madison, Department of Agricultural & Applied Economics, Staff Paper Series, July 2006.

3. Provide a contingency plan to operate the dam gates in the event of gate malfunction due to a power outage or gate failure.

3.5.2 Alternative 2 – Abandon and Remove the Dam

This alternative eliminates the County’s liability with the dam and dam operation. SEWRPC’s river model indicates a free-flowing river would have a 100-year flood elevation lower than the present flood map.

3.5.3 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-Foot High Rock Ramp Constructed

This alternative does not require the operational considerations of a dam during a flood event, and is capable of handling the 100-year frequency flood based on the SEWRPC modeling results.

3.6 Capital and Operating Costs

The estimated capital and long-term annual operation and maintenance costs of the three alternatives are as follows:

3.6.1 Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage

The operating costs include a dam gate operator who must be available to adjust the gates during high river flows and impending storm events. This is imperative to avoid flooding out upstream property owners during major storm events. Operating costs include routine dam gate maintenance and repair and debris removal, and these operating costs are long-term.

The capital costs include repair of the dam and adding fish passage.

3.6.2 Alternative 2 – Abandon and Remove the Dam

The capital costs include demolition of the dam and removal. There are no long-term operation and maintenance costs. This is likely the most sustainable alternative based on cost alone.

3.6.3 Alternative 4 – Gated Spillway Removed, Serpentine Overflow Spillway Lowered, and a 6.3-Foot High Rock Ramp Constructed

The capital costs include demolition of the dam’s gated section and revisions to the rest of the dam. Fish passage is included using the rock ramp.

The operating costs include provisions for debris removal similar to a dam. Provisions to annually move around rocks which may have been altered by ice flows is included, which is conservative because most rock ramps require little such maintenance for moving rocks due to their large size (5 feet, 5 ton boulders are typical).

Alternative	Estimated Capital Cost	Estimated Annual Operation and Maintenance Cost
1A	\$2,518,000	\$160,000
2	\$1,674,000	\$0
4	\$2,419,000	\$55,000

The estimated operation and maintenance costs are annual costs and can be expected to increase over time due to inflation. These annual costs are long-term. In addition, these costs will increase for Alternative 1A as the dam gets older.

3.7 Funding

Milwaukee County has \$1,600,000 of Bonding capacity available through its annual budget process. WDNR's Municipal Dam Grant Program has allocated \$400,000 for dam repair. The grant contains criteria for eligibility. The Wisconsin Stewardship Fund has funding up to \$1 million that may be made available to the County for dam repair, dam removal, or fish passage. The US Fish and Wildlife Service has authorized a grant for \$220,000 for fish passage.

The annual operation and maintenance costs for the dam or rock ramp will need to be funded by the County.

3.8 Public Scoping Meeting

On June 5, 2014, a public scoping meeting was held to obtain the public's comments on the proposed alternatives. A survey was available on the County's website. There were 125 responses to the survey as well as several letters sent to the County regarding the project.

The preliminary results from the survey indicate 73 responses favored repairing the dam, 31 responses endorsed removing the dam, 5 responses endorsed a rock ramp, and the rest of the comments did not indicate a preference but provided general comments on the study.

Some of the comments raised in the public survey are as follows:

- Provide a public boat launch upstream of the dam to allow people other than the property owner's access to the river/impoundment.
- The dam provides flood protection, and the other alternatives do not.
- The dam provides boating, canoeing, and kayaking opportunities with the impoundment.
- The current river levels allow for limited canoeing and kayaking because the river is either too high with fast current, or too low with rocks protruding.
- The impoundment directly benefits about 350 property owners and all Milwaukee County tax payers end up paying the long-term costs of the dam. Remove the dam.

The multiple comments about the dam providing flood protection were received. The technical basis needs to be clarified. The dam creates a huge blockage in the river when the 10 gates are closed and the impoundment is in place. When the 10 gates are open, the dam can handle a 100-year frequency flood. The public views the gates open as flood relief, which is a true statement. If the 10 gates are closed, the dam will cause additional flooding upstream during an approximate 15-year frequency flood similar to a 100-year flood event. The County needs to be vigilant to monitor the weather and river flows to guard against this occurring if Alternative 1A is selected. If the gates malfunction due to a power outage or mechanical failure, the County is potentially liable for the upstream flooding caused by the dam.

The other two alternatives, 2 and 4, can each handle a 100-year frequency flood. Alternative 2 with a free-flowing river, actually lowers the 100-year flood levels as compared to the current levels used for the Flood Insurance Map.

3.9 Summary, Conclusions, and Recommendations

3.9.1 Summary

The Environmental Assessment identified a variety of alternatives in addition to rehabilitating the dam. Four alternatives were found to be feasible. Alternative 3A – Abandon and Remove the Dam, Providing a 4-Foot High Rock Ramp for Fish Passage was ruled out because Alternative 4 had similar traits but additional benefits for recreation. Therefore, Alternative 3A was eliminated. The three feasible alternatives are:

- Alternative 1A – Rehabilitate the Dam
- Alternative 2 – Abandon and Remove the Dam
- Alternative 4 – Gated Spillway Removed, Serpentine Overflow Lowered, and a 6.3-Foot High Rock Ramp Constructed

Alternative 1A continues use of the dam, thereby creating an impoundment which provides boating recreation upstream and the aesthetics of the impoundment. This alternative requires the largest capital investment and the largest long-term annual operation and maintenance cost of all alternatives. Environmentally, dams create environmental issues with sediment buildup over time, and increase the water temperature which can be detrimental to some fish and aquatic species. The dam requires a gate operator to control water levels to avoid flooding out upstream properties in the event of a major flood or during periods of impending storms if the 10 gates are closed at the time. There is increased liability on the County due to the dam operation and its potential impact on flooding.

Alternative 2 returns the river to a free-flowing condition similar to the present situation during normal flows. During a 100-year frequency flood, Alternative 2 will actually have lower flood levels than with the current dam and the gates open. Nationally, there is a trend toward removing dams, as is the case with the success of the North Avenue Dam where biological diversity is well documented. Alternative 2 has the least capital cost and no operating cost.

Alternative 2 provides recreational opportunities that are more conducive to a river, such as kayaking and canoeing. Based on similar projects where a dam was removed, the recreational opportunities were either constant or improved after the dam was removed, but the types of recreation changed from boating to kayaking and canoeing.

Alternative 4 provides a compromise between Alternatives 1A and 2. An impoundment would be created for boating and for the aesthetics of an impoundment. The water depth is less than Alternative 1A, but provides recreational opportunities for boating. The costs for this alternative are similar to Alternative 1A for capital, but have lower operational costs.

3.9.2 Conclusions and Recommendations

Conclusions and recommendations will be provided after the August 2014 Public Information Meeting in order to obtain additional public input on the alternatives.