

Technical Report:

Summary of the Environmental Assessment for Estabrook Dam

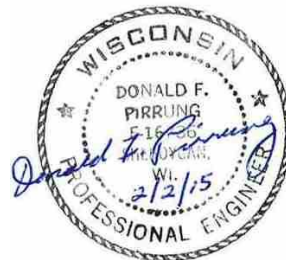
Milwaukee County, Wisconsin



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1.0 Introduction to Estabrook Dam Environmental Assessment

This technical report summarizes the findings of the Environmental Assessment for Estabrook Dam. The project background is presented in this section. Subsequent sections discuss alternatives, environmental impacts, estimated costs, funding, and public input.

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 draw down 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 island is owned by Milwaukee County.

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 (EA) Report for Estabrook Dam analyzed 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.

Milwaukee Riverkeeper has sued Milwaukee County claiming Estabrook Dam is a public nuisance and that the dam should either be removed or repaired. Judge Foley has agreed with Milwaukee Riverkeeper. The Milwaukee River Preservation Association (MRPA) has requested the judge to be a party to the suit against Milwaukee County and Judge Foley has agreed to allow MRPA to be a party to the suit. On December 5, 2014, Judge Foley requested Milwaukee County to submit a technical report summarizing the major issues for the two dam alternatives by February 2, 2015. The judge has scheduled a hearing for the week of July 20, 2015, to accept testimony and will then decide which alternative will be selected.

The MRPA requested Milwaukee County to address in further detail Alternative 1 – Rehabilitate the Dam. The EA identified Alternative 1, but eliminated it from further consideration because Alternative 1A – Rehabilitate the Dam and Add Provisions for Fish Passage, was a more environmentally sound solution. For this technical report, Alternative 1 will be further addressed as requested by MRPA.

The technical report will address the two feasible alternatives in addition to Alternative 1 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

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 owned by Milwaukee County. 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 was removed during late 2014 and is scheduled for completion during the first half of 2015, including the sediment immediately upstream from the dam and extending to where the first phase ended.

Improvements to rebuild 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), Bureau of Land Management (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. Permitting for either dam repair or removal is required by WDNR and the US Army Corps of Engineers.

Milwaukee County requested a time extension to repair or remove the dam in a letter dated December 23, 2014, from John Dargle, Milwaukee County Parks Director, to Tanya Lourigan, P.E., WDNR. The reasons for the time extension include the need to prepare the Environmental Assessment for Estabrook Dam, and to resolve the Milwaukee Riverkeeper lawsuit with Milwaukee County, to allow time for the County to solicit for grants, and to allow for a full construction season to perform the work. Ms. Lourigan approved the time extension in a letter to Mr. Dargle dated January 12, 2015. The dam must be removed by December 31, 2016. The WDNR approval is contingent on the County submitting technical documents to WDNR regarding repair or dam removal. The correspondence regarding the time extension is provided in Attachment 16. Dam photographs are provided in Attachment 17 showing the existing dam condition.

The EA included two public meetings and a number of updates to the Milwaukee County Parks, Energy, and Environment Committee. The technical findings and public input favor removal of the dam based on environmental benefits and substantially reduced project costs when compared to the other dam alternatives.

For many years, Milwaukee County's official position had called for repair of the dam, and funds has been included in the capital budget. As part of the budget deliberation in November 2014, however, the County's official position changed to support removal. No funds were budgeted to support that position, however.

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 were 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 presents 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 had voted to implement Alternative 1 in 2010. 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 is a significant environmental benefit. 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. Fish passage also directly benefits other species such as mussels, which use specific species of fish as hosts as part of the mussel's life cycle.

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 cost less than the 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. Alternative 4 provides a deeper impoundment than Alternative 3A and, therefore, Alternative 4 has more recreational benefits than Alternative 3A. During the EA process, public support for Alternative 4, rock ramp, has been very limited. Public support has favored either repair of the dam or dam removal. For these reasons, Alternative 4, rock ramp, will be eliminated from further consideration in this technical report.

As previously mentioned, the MRPA requested Alternative 1 – Rehabilitate the Dam, to be further addressed, though this alternative has significant environmental impacts due to no year-round fish passage.

3.0 Evaluation of Feasible Alternatives

The evaluation of feasible alternatives and Alternative 1 for Estabrook Dam is addressed in this section. This technical report identifies the primary topics for the three alternatives.

3.1 Aquatic Environment

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 River is located in Estabrook and Kletzsch Parks.

Recent mussel survey⁷ 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.

The Estabrook Dam is located within the Milwaukee Estuary Area of Concern (AOC). The Milwaukee Estuary, part of the largest fresh surface water resource in the world (the Great Lakes Ecosystem), was designated an AOC in 1987 by the International Joint Commission because of historical modifications and pollutant loads that contributed toxic contaminants to the AOC and Lake Michigan. Sediments contaminated with PCBs, PAHs, and heavy metals were impairing public benefits such as fish consumption, healthy fisheries, boat access, and wildlife habitat. The Remedial Action Plan¹² was updated in December 2014 by the WDNR Office of the Great Lakes and recommends fish passage at Estabrook Park. Eleven of a possible 14 beneficial uses identified by the International Joint Commission are impaired or suspected to be impaired for the Milwaukee Estuary AOC.

3.1.1 Alternative 1 – Rehabilitate the Dam

Alternative 1 creates an impoundment extending to Silver Spring Drive under normal (median) flow conditions, and extending to West Bender Road during high flow events. Year-round fish passage is not 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. Freezing out of the mussels and related impacts on mussels may be an unavoidable consequence with Alternative 1 and Alternative 1A. The impoundment will cause an increase in water temperature which can be detrimental to fish as compared to a free-flowing river. The Estabrook Dam impoundment creates a preferred habitat for non-native common carp (prefer warm water ponded water) and carp can tolerate the poor habitat of the Estabrook Dam impoundment.

The dam operating plan must avoid impacts to aquatic life caused by fluctuating water levels. Dam operations will require County personnel to be on-call whenever the gates are closed to adjust the dam gates to avoid flooding out upstream properties or impacting aquatic life. These operations are long-term costs to Milwaukee County in terms of labor, instrumentation, and related technology to properly control river levels. These operational controls have not ever been practiced for Estabrook Dam and are site-specific because the dam during a flood event of about a 15-year frequency event, can cause flooding upstream to properties unless the dam gates are all open. WDNR regulates the amount of river level fluctuations using the gates to reduce impacts on properties and aquatic life. Flooding out upstream property owners is a liability risk to Milwaukee County.

Alternative 1 impacts mussels as discussed under Alternative 1A. Refer to the Alternative 1A for additional environmental impacts which are similar to Alternative 1. Because Alternative 1 does not provide year-round fish passage, the environmental impacts for Alternative 1 are significantly worse than Alternative 1A.

Alternative 1 does not meet the objectives of the 2014 Remedial Action Plan for the Milwaukee Estuary AOC¹² because fish passage is not provided. This environmental impacts result in a loss of fish and wildlife habitat. Refer to Section 3.1.4, Benefits of Fish Passage for additional information.

3.1.2 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. Freezing out of the mussels and related impacts on mussels may be an unavoidable consequence with Alternative 1A. The impoundment will cause an increase in water temperature which can be detrimental to fish as compared to a free-flowing river. The Estabrook Dam impoundment creates a preferred habitat for non-native common carp (prefer warm water ponded water) and carp can tolerate the poor habitat of the Estabrook Dam impoundment.

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The most highly threatened and rapidly declining group of freshwater organisms is mussels (Vaughn and Taylor, 1999⁹). A major factor in the decline of freshwater mussels has been the large-scale impoundment of rivers over the past 75 years (Vaughn and Taylor 1999⁹). Mussels can live for decades and are vulnerable to habitat disturbance. Mussels are sedentary filter-feeders that may remain in approximately the same location for their entire long life span, so mussels are very limited when their habitat is altered. The effects from altered seasonality of flow and temperature regimes, changed patterns of sediment scour and deposition, changes in particulate organic matter, the food base for mussels are all important factors that can occur with an impoundment (Vaughn and Taylor, 1999⁹).

Dams can have negative impacts on the indigenous mussel population in a river environment. The Estabrook Dam can be expected to have similar negative impacts on the mussel population in the Milwaukee River. Dean⁸, et. al. (2001), states that freshwater mussels have been devastated in North America due to dam impoundments on rivers. Dams change the physical, chemical, and biological aspects of rivers by restricting the movement of fish, altering flow regimes, increasing siltation upstream and from scouring downstream from the dam⁸. Periodic opening of gates can result in slugs of silt moving downstream from the dam and impacting mussels. The results are the mussel

population gets fragmented by the dam, which can alter fish populations and restrict the migration of host fish for the mussels⁸.

Dams affect the dispersion and life cycle of mussels by inhibiting the movement and migration of the host fish species, thereby restricting the dispersal and distribution of mussels.⁸ An integral part of the mussel life cycle is the host fish. The glochidia (mussel larvae) attach themselves through various means to a host fish which will then carry the larvae until they form into juveniles and drop off. Dams may create a barrier for the host fish preventing longitudinal migration. The lack of migration, in turn, adversely affects the dispersion and distribution of mussel species throughout the river system.⁸ Fish passages may allow the host fish to migrate more freely, alleviating these negative effects to the river system.

The impoundment created by a dam can have adverse effects as well. The river section below impoundments differs significantly from free flowing-rivers. These effects include altered seasonal timing of flow and temperature regimes, changes to patterns of scour and deposition of sediment, and altered transport of particulate organic matter, food base for mussels.⁹ The altered seasonal timing of flow can result in abnormally high or low flows, sometimes on a daily basis. These flows can often occur at the “wrong” time of year.

The seasonal drawdown proposed for Alternatives 1 and 1A can have a detrimental effect on mussels in the Estabrook Dam impoundment, especially in areas that are relatively shallow under full pool conditions, and then result in little to no water during drawdown. These drawdown conditions result in the mussels being exposed to the elements, which can cause asphyxiation, desiccation, and predation. The mud flats can dry up, the mussels travel at a very slow rate such as 12 inches per day, which leaves them very vulnerable to large changes in water levels, as experienced with a dam drawdown. When the water level is drawn down, predators such as raccoons can readily catch the exposed mussels. If the water levels drop to points that the mussels are exposed to the atmosphere, they can die from asphyxiation. The slow rate of travel does not allow the mussels to move to a deeper area in time. If the mussel travels at 12 inches per day, it would take nearly a year to travel 300 feet. In winter, the seasonal drawdown can result in the mussels exposed and freezing.

A discharge that is either high during the wrong season or high too frequently can have devastating impacts on mussels. High water and high flows can displace juveniles before they can burrow or attach to substrate, resulting in a high mortality rate. The increased flow can produce a rise in erosion and subsequent deposition of material downstream; both of which may result in loss of mussel habitat. The erosion and scour also results in an altered distribution of sediment. Increased sediment deposition can clog mussel siphons and gills which interferes with feeding and reproduction.⁹

A discharge that is too low during the wrong season or abnormally low for extended periods can also have adverse impacts on mussels. Significant periods of low flow below an impoundment can result in stranding mussels. Mortality in these situations is usually due to desiccation, asphyxiation, predation, and thermal stress (mussels lack the ability to regulate their body temperature). If stranding does not result in mortality, the associated physiological stress reduces mussel condition and ultimately reproductive potential. Mussels in shallow isolated pools are also exposed to hypoxia from algal production and ammonia pulses from decaying organics;¹⁵ both of which have a detrimental effect on the mussel population and reproductive potential as a whole.

A recent study⁷ on the Milwaukee River including the Estabrook Dam area identified 11 mussel species; however, 3 of the species were identified from shells and no live specimens were found. A

Special Concern species, Elktote, was found alive in the Milwaukee River. The Ellipse species is a Wisconsin threatened species and no live specimens were found.

It was noted that very few juveniles or sub-adult mussels were located during the study⁷. This may indicate that the current condition of these areas of the river is not conducive to mussel reproduction. This may be due to conditions related to contaminants, low oxygen, silt movement, drought, and temperature change. The impoundment at Estabrook Dam can cause sediment and silt deposition and increase water temperature in the impoundment, and can cause the mussels to be impacted by desiccation, predation, and freezing through the fall seasonal drawdown of the impoundment.

In summary, the seasonal drawdown associated with Alternatives 1 and 1A can have a detrimental effect on mussels.

The impoundment created by Alternatives 1 and 1A can impact mussels through siltation and through the buildup of sediment within the impoundment. Alternatives 1 and 1A can also affect mussels by the sudden release of sediment when the dam gates are opened which can affect mussels downstream from the dam. The fish passage features will allow fish to travel, which will allow mussels to find host fish.

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.

3.1.3 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 a major 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 and avoid the detrimental impacts to mussels as the case with Alternative 1A.

The free flowing river condition has been present since at least 2009, so mussels have already acclimated to the current river levels.

3.1.4 Benefits of Fish Passage

There are substantial environmental benefits provided through fish passage. Alternatives 1A and 2 both provide fish passage. Alternative 1 – Rehabilitate the Dam, does not include fish passage which results in significant environmental impacts.

3.1.4.1 Alternative 1 – Rehabilitate the Dam (No Fish Passage)

From a river ecosystem perspective, there are significant problems with the dam (Alternative 1). First, when the gates are closed, the dam serves as a complete barrier to fish movement between Lake Michigan, the Milwaukee River Estuary, and reaches of the Milwaukee River upstream of the dam. The dam limits potamodromous lithophilic and wetland spawning species (including but not limited to lake sturgeon, walleye, northern pike, and other important game and non-games fish) access to historic spawning grounds generally lacking between the dam and Lake Michigan, but present in river reaches upstream of the dam. The dam also can limit the unique trout and salmon recreational

fishery that developed along the lower reaches of the Milwaukee River following the 1997 removal of the City of Milwaukee's North Avenue Dam at river mile 3.

The need to pass fish is especially important at the Estabrook site since the WDNR and cooperating stakeholders operate a lake sturgeon rearing facility on the Milwaukee River just outside of Newberg, Ozaukee County 50 miles upstream of the Milwaukee River Estuary (WDNR, 2005). Unobstructed access to Lake Michigan is critical to the success of this program.

The second problem is that the impoundment created by the dam is severely degraded in terms of water quality and wildlife habitat. Specifically, the replacement of a naturally flowing stream channel with an essentially stagnant pool of water eliminates extensive wetlands and floodplains by covering them with water. It also results in higher water temperatures and lower dissolved oxygen levels. Other impacts include sedimentation, degraded sediment, and impacts to stream channel structure. These conditions have been identified as a major cause for the decline in fish community diversity, abundance, and structure in Wisconsin. These cumulative impacts can directly and indirectly impact the overall viability of individual fish species, reproduction, food supply and growth, predation, resistance to disease and stress, etc.

If there is no fish passage, the dam can impact the game fish populations of two highly prized potadromous game fish (walleye and northern pike) within the AOC and upstream areas, as well as two threatened fish (greater redhorse, longear sunfish), one species of special concern (lake sturgeon), and at least two endangered species (striped shiner, ellipse mussel). The factors that benefit populations of these fish will also benefit other resident native game fish including smallmouth bass; a variety of panfish including bluegills, crappies, and rock bass; and channel catfish. The native forage fish which many game fish depend upon will also benefit from better access to tributary streams, downstream areas, and isolated stream reaches. Alternative 1 would not comply with the 2014 Remedial Action Plan¹² for the Milwaukee Estuary AOC goal of fish passage at Estabrook Park to improve fish and wildlife habitat.

The lack of year-round fish passage directly impacts the recreational fishing opportunities of the public on the Milwaukee River for the following reasons:

- Less river miles for recreational fishing due to the dam.
- Reduced fish populations and fish diversity due to the dam restricting fish travel to preferred spawning grounds.

The area has the most demographically diverse population in the state of Wisconsin who will be directly impacted by the reduced fishing opportunities due to Alternative 1.

The following information is presented regarding the environmental benefits for fish passage at Estabrook Dam provided by either Alternative 1A or Alternative 2. The information is based on discussions with WDNR staff and other technical personnel.

Estabrook Dam is located 6.9 miles upstream of the Milwaukee River confluence with Lake Michigan. The dam is considered a "complete" barrier to fish passage. The Kletzsch Dam is located at river mile 10.4 and is considered an "effective" barrier to fish passage. The Kletzsch Dam is routine partially submerged during spring flows, and as such, may not prevent all native fish from Lake Michigan, the Estuary and lower Milwaukee River from moving upstream to reach preferred spawning habitats. The next "complete" barrier to fish passage is the Milwaukee River Bridge Street Dam at

Grafton and river mile 32. There is about 1 acre of wetland spawning habitat in the Milwaukee River Estuary and lower Milwaukee River below Estabrook Dam. Upstream of Estabrook Dam, there are about 2,400 acres of riparian wetlands along the river and its principal tributaries. These wetlands are critical for phytophilic spawning fishes, or fishes that spawn on flooded vegetation (e.g., Northern pike, some members of the catfish family, etc.). Spawning habitat for lithophilic spawning fishes (fish that spawn on coarser and clean substrate) improves in terms of quality and quantity as one proceeds upstream. In particular, the reach below the Thiensville Dam and the fractured dolomite escarpments that were restored with the removal of the Chair Factory and Lime Kiln Dams at Grafton (river miles 30-32) are optimal for Lake Sturgeon.

As noted in the EA for Estabrook Dam, there has been a substantial investment in fish passage both upstream and downstream from Estabrook Dam. These improvements include Ozaukee County fish passages involving dam removal or fish passages around the dam, or improvements to culverts and bridges totaling over \$10 million. The removal of the North Avenue Dam downstream from Estabrook Dam (\$4,700,000) has been a huge success story for fish diversity and increased fish populations, recreational use of the Milwaukee River, plus the other social aspects of expanded commercial and residential development as an urban renewal program. In addition, Milwaukee Metropolitan Sewerage District has invested heavily in Lincoln Creek upstream of Estabrook Dam to improve aquatic habitat in the watershed.

Enabling fish passage is a goal of the Milwaukee Estuary AOC Program for restoring fish and aquatic life beneficial uses. Other benefits include an increase in relative abundance of habitat needed by native lotic (flowing water) species and a decrease in preferred habitat for non-native common carp (prefer water ponded waters) and carp can tolerate the poor habitat of the Estabrook Dam impoundment. Alternative 2, dam removal, has the additional benefit over Alternatives 1 or 1A in that the dam impoundment which creates the undesirable warm water condition in summer is eliminated.

Fish passage provides enhanced access to recreational fishing opportunities for some of the most demographically diverse populations in the state of Wisconsin and is another benefit for fish passage. More areas for the public to fish are an important benefit resulting from fish passage.

3.2 Terrestrial Environment

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 1 – Rehabilitate the Dam

Alternative 1 has the same environmental conditions as Alternative 1A regarding the terrestrial environment as presented below.

3.2.2 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.

3.2.3 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.

3.3 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 1 – Rehabilitate the Dam

Alternative 1 has similar cultural impacts as Alternative 1A except Alternative 1 does not provide year-round fish passage which impacts recreational fishing opportunities due to anticipated less fish, less diversity of fish, and more limited areas to fish due to the dam.

3.3.2 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, fishing, boating, canoeing, and kayaking.

3.3.3 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, fishing, 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 and increased recreational use of canoes and kayaks.

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, changed aesthetics, and disproportional loss of property values because the dam gates have been open since 2009.

3.4.1 Alternative 1 – Rehabilitate the Dam

Alternative 1 would have similar socio/economic impacts as Alternative 1A as presented below.

3.4.2 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.

3.4.3 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. Public surveys showed more support for dam removal than rebuilding the dam. This approach tends to be more natural, requires little or no costs by the County to maintain, and is sustainable. Removal of the dam supports the ongoing actions in Ozaukee County to provide fish passage along the Milwaukee River. Ozaukee County has invested about \$10,000,000 in fish passage in recent years. The success of Ozaukee County's fish passage is likewise tied to the removal of Estabrook Dam or fish passage associated with Alternative 1A.

3.4.3.1 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 removal³. Based upon sales market data between 1993 and 2002, comparison of residential properties in south-central (Madison regional area) 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, except for an increase related to the increase in lot size, after the stream has returned to a free-flowing riparian state⁴.

The Provencher Study⁴ included 14 impoundments ranging in size from 8 to 194 acres and impoundment depths ranging from 5 to 15 feet. There were three impoundments in the study greater than 100 acres. In comparison, Estabrook Dam impoundment is 103 acres with a normal depth similar to the studied impoundments. Therefore, three of the impoundments in the Madison regional area of Wisconsin had sizes and features similar to the Estabrook Dam impoundment.

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 of dam removal may have short-term impacts on property values in the area, but values can be expected to rebound to similar levels within about 2 years.⁴

The assessed property values for residential properties with river frontage from Estabrook Dam to West Bender Road is \$36,331,900, based on 2014 Milwaukee County records. There are 163 residential properties with river frontage along the Estabrook Dam impoundment. The average residential assessed value for these properties is \$222,900.

AECOM contacted the City of Milwaukee assessor's office to obtain input as to how an impoundment would be assessed compared to the dam removed and having river frontage. The City representative indicated the City's assessment guidelines include a discretionary increase by the assessor of 25 percent for property having water access. An impoundment or river frontage would be reviewed as water access and, therefore, there would not necessarily be a change in the assessed property value.

AECOM contacted the appraisal firm retained by the City of Glendale, which is Accurate Appraisal, LLC in Menasha, Wisconsin, who indicated that property value along a free flowing river or an impoundment can be affected by the property owner's personal preference. For example, a boater may prefer an impoundment, but a fisherman may prefer a free flowing river. The appraiser recommended reviewing property sales in the area to determine if there is a trend in property values with waterfront access.

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 1 – Rehabilitate the Dam

Alternative 1 will have very similar flood carrying capacity as Alternative 1A as noted below. Alternative 1 likewise has potential liability to the County due to flooding and violating Wisconsin Administrative Code NR 116 by exceeding the 100-year flood elevations if the 10 dam gates are closed. The dam operation plan for Alternatives 1 and 1A are the same.

3.5.2 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 limit the extent of drawdown to 6 inches maximum 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 significant liability issue to the County.

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

The dam operation plan adds substantial cost to the County's annual budget for Estabrook Dam. Additional information on the annual operating costs is discussed below. In addition to the operating costs, the County will face liability costs due to potential flooding upstream to properties if some or all of the 10 gates are closed during a flood event.

3.5.3 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.

3.6 Capital and Operating Costs

The estimated capital and long-term annual operation and maintenance costs of the alternatives (Attachment 9) are as follows:

3.6.1 Alternative 1 – Rehabilitate the Dam

The Alternative 1 estimated capital costs are very similar to Alternative 2. Alternative 1 capital costs are less than Alternative 1A because fish passage is deleted with Alternative 1.

The estimated operating costs for Alternative 1 are the same as Alternative 1A. Future considerations with Alternative 1 are the same as Alternative 1A regarding removal or rebuilding the dam in 20 years and dealing with sediment removal costs after about 20 years.

3.6.2 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.

The estimated operation and maintenance (O&M) 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.

The estimated project life for Alternative 1A is 20 years. At that time, the dam will be approaching 100 years old. It may be possible to further rebuild the dam in 20 years, but it is more likely that the dam will need to be removed at that time. The estimated cost to remove the dam in the future was not calculated, but based on current costs would be similar to the capital cost of Alternative 2 of \$1,674,000 plus the cost of inflation over the next 20 years.

3.6.3 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.

Alternative	Estimated Capital Cost	Estimated Annual Operation and Maintenance Cost
1	\$1,660,000	\$160,000
1A	\$2,518,000	\$160,000
2	\$1,674,000	\$0

3.6.4 Present Worth Analysis

A present worth analysis considers the capital and O&M costs over a 20-year period to determine the overall project costs for the alternatives. The annual O&M costs are converted to a present worth based on an inflation rate of 2 percent per year over the 20-year period. The resulting present worth is the theoretical amount of money needed at today's costs to pay for the annual O&M costs over the next 20 years. The total present worth cost is the capital cost plus the present worth of the annual O&M costs over 20 years. The following chart summarizes these present worth costs.

Present Worth Analysis

Alternative	Estimated Total Present Worth Costs
1	\$4,276,000
1A	\$5,134,000
2	\$1,674,000

Based on the present worth analysis, Alternative 1A has the highest total present worth cost. Alternative 2 has the lowest present worth cost and is about \$3,460,000 lower in present worth than Alternative 1A. In terms of present worth, Alternative 1A is about three times as expensive as Alternative 2. If Alternative 1 or 1A was selected, the County would also need to consider dam removal or repair in about 20 years plus sediment behind the dam removal, and these costs are not included in this estimate.

Alternative 1 is about the same estimated capital cost as Alternative 2, but Alternative 1 has an estimated total present worth cost of 2.5 times the cost of Alternative 2.

3.7 Funding

Milwaukee County has \$1,600,000 of Bonding capacity through its annual budget process. This bonding capacity is available for dam repair (Alternative 1 or 1A), but not available for dam removal (Alternative 2). There are funding sources available which are discussed as follows:

1. WDNR's Municipal Dam Grant Program

WDNR has allocated \$400,000 for either repair or removal of Estabrook Dam. The County is requesting WDNR to change the grant request from dam repair to dam removal. The County cost share is 50 percent of the first \$400,000, then 25 percent of the next \$800,000, with a maximum grant amount of \$400,000 for a \$1,200,000 project.

2. WDNR's Stewardship Fund

The Stewardship Fund has funding up to \$2,000,000 that may be made available to the County for dam repair or dam removal. The County's share is 75 percent of the costs and the Stewardship Fund would cover the 25 percent of the capital costs.

3. US Fish & Wildlife Service Grant

The US Fish & Wildlife Service offers grants to communities for construction costs related to fish passage. This grant applies to either Alternative 1A or Alternative 2 but not Alternative 1. The potential funding would be about \$150,000 to \$220,000.

4. Sustain Our Great Lakes

Sustain Our Great Lakes offers grants to non-profits and municipalities for dam removal and environmental restoration within the Great Lakes basin. The dam removal, Alternative 2, would be eligible. The grant amounts can vary by project from \$25,000 to \$1,500,000. A 1:1 matching grant is preferred. The Sustain Our Great Lakes program is a public-private sponsorship which includes Arcelor-Mittal, USEPA, US Fish & Wildlife Service, US Forest Service, National Fish and Wildlife Foundation, National Oceanic and Atmospheric Administration, and US Department of Agriculture. Fish passage for Alternative 1A may also be grant eligible.

5. National Oceanic and Atmospheric Administration (NOAA)

The NOAA grant is made available to municipalities for environmental restoration projects such as fish passage and dam removal. Habitat restoration projects in the Great Lakes Areas of Concern are of special interest and Estabrook Dam is within this area. The grant amounts can range from \$500,000 up to \$6,000,000.

6. Fund for Lake Michigan

The Fund for Lake Michigan offers grants to non-profits and municipalities for environmental improvement projects including fish passage and dam removal. The typical grant amount is in the range of \$25,000 to \$200,000.

The annual operation and maintenance costs for the dam (Alternative 1 or 1A) would 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 early in the evaluation process. 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.
- Remove the dam to return the river to a natural state.
- Remove the dam to save costs and improve the environment.
- The impoundment directly benefits about 200 property owners (riparian owners) and all Milwaukee County tax payers end up paying the long-term costs of the dam. Remove the dam.

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 1 or 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.

Alternative 2 can 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 Public Information Meeting

On September 3, 2014, a public information meeting was held to update the public on the EA and to discuss the alternatives for Estabrook Dam. Milwaukee County Parks personnel went on record to implement Alternative 2 to remove the dam. There were over 125 people attending the September 3, 2014 meeting. A written survey resulted in 85 responses during the meeting.

The written public comments are summarized as follows. The public's opinion of the three alternatives is shown as a percentage. For example, 32.6 percent of the public responses endorsed Alternative 1A, Rebuild the Dam with Fish Passage.

- | | |
|--------------------------------|-------|
| • Alternative 1A – Rebuild Dam | 32.6% |
| • Alternative 2 – Remove Dam | 53.9% |
| • Alternative 4 – Rock Ramp | 13.4% |

Milwaukee County Parks website contained a public survey for the Estabrook Dam alternatives. There were 341 responses and the public's opinions of the three feasible alternatives are shown as a percentage.

- 105 people support repair of the dam (30%)
- 232 people support removal of the dam (68%)
- 32 people support the rock ramp option (10%)

The percentage adds up to more than 100% because a few people voted in more than one box in the survey. The ratio of approximately 2:1 voted to remove the dam. These results are consistent with the written comments received during the public information meeting where the public favored dam removal 53.9 percent to 32.6 percent for dam rebuilding.

In addition, Milwaukee County received emails from the public and are summarized as follows:

- 6 support repair of the dam.
- 19 support removal of the dam.

The following endorsements were received:

A. Alternative 1 – Rehabilitate the Dam

Endorsements were not sought for Alternative 1 because it was eliminated from further consideration in the EA. Endorsements for Alternative 1 could be expected to be similar to Alternative 1A, and MRPA has indicated that they would prefer Alternative 1 over Alternative 1A.

The public information surveys did not include Alternative 1 because it was eliminated from consideration due to environmental impacts.

B. Alternative 1A – Rebuild Dam with Fish Passage*

- Milwaukee River Preservation Association*
- Local Real Estate Salespeople (39)

* Prefer Rebuilding Dam and No Fish Passage (Alternative 1)

C. Alternative 2 – Remove Dam

- Milwaukee Metropolitan Sewerage District
- River Revitalization Foundation
- Milwaukee Riverkeeper
- River Alliance
- J. Val Klump, JD, PhD, Great Lakes Water Institute
- Colin Johnson, Local Floodplain Administrator

- David Dunker, Zingen & Braun Insurance Agency
- Executive Committee Wisconsin Council of Trout Unlimited
- Ken Leinbach, Urban Ecology Center
- Milwaukee County Board

3.10 Other Wisconsin Dam Removal Projects

There have been a number of dams removed in Wisconsin where the area was restored and has directly benefitted from the dam removal. There have also been cases where the public has challenged the dam owner's right to remove the dam and claim diminished property values due to removal of the dam. A brief overview of some of these projects is as follows.

North Avenue Dam, Milwaukee, Wisconsin

The North Avenue Dam was removed by the City of Milwaukee. The capital costs for the dam removal and remediation were about \$4,700,000. The dam removal allows for fish passage and has greatly improved fish diversity. The Urban Ecology Center upstream from the former North Avenue Dam has documented the diversity of fish and other aquatic life since the dam was removed. The surrounding area near the North Avenue Dam has experienced a renaissance in commercial and residential development and increased property values.

Nemahbin Roller Mill Dam, Delafield, Wisconsin

Margaret Zerwekh owned a dam on the Bark River, and the dam was used to generate electricity. The dam created a pond. The cost to repair the dam was about \$500,000 to \$700,000, and it was no longer cost-effective to generate electricity. Secondly, Ms. Zerwekh was under orders by WDNR to either repair or remove the dam. Ms. Zerwekh sought a WDNR permit to remove the dam. Local property owners sued Ms. Zerwekh on the grounds of lost riparian rights and loss of property value if the pond was gone. The property owners asked for a million dollars in damage. In 2012, the jury unanimously rejected the property owner's claims and Ms. Zerwekh won her case.

Little Hope Dam, Dayton, Waupaca County, Wisconsin

Waupaca County owns Little Hope Dam, which is in need of either repair or removal. The County proposes to remove the dam due to economics among other factors. Some upstream property owners along the dam impoundment are suing Waupaca County because they contend the dam's removal will eliminate the mill pond and reduce their property values. Waupaca County prepared a study investigating property values and concluded that river frontage property values are higher along free flowing rivers than along small impoundments. The research included a technical paper published in the April 2008 Contemporary Economic Policy, a peer-reviewed journal. The lawsuit involving the property owners is still pending. There was a recent contested case hearing regarding the WDNR permit application to remove the dam. The judge's decision is expected in February 2015.

3.11 Historic Structure

Milwaukee County will prepare a Historic American Engineering Record (HAER) study of Estabrook Dam if discussions with the State Historic Preservation Officer conclude a study is warranted. A HAER study may be needed for Alternative 1A and will be needed for Alternative 2.

Based on the results of the HAER study, additional steps may be necessary prior to dam removal (Alternative 2). For similar projects, where the dam is listed on the National Register of Historic Places, signage or a plaque recognizing the dam as a historically significant structure at the former dam site is commonly done. The HAER study also includes past design documents for the dam to be a historic record for the structure.

3.12 Summary and Conclusions

3.12.1 Summary

The Environmental Assessment identified a variety of alternatives in addition to rehabilitating the dam. The two feasible alternatives are:

- Alternative 1A – Rehabilitate the Dam with Fish Passage
- Alternative 2 – Abandon and Remove the Dam

The MRPA requested the County to include Alternative 1 – Rehabilitate the Dam, as part of the technical report. Alternative 1 had been eliminated from further consideration in the EA due to environmental impacts because year-round fish passage was not included.

Alternative 1 is very similar to Alternative 1A except year-round fish passage is not included. The environmental impacts for Alternative 1 are similar to Alternative 1A except Alternative 1 will limit fish populations and fish diversity because fish passage is not provided year-round. The 2014 Remedial Action Plan for the Milwaukee Estuary AOC lists fish passage at Estabrook Park as a primary goal to improve fish and wildlife habitat. Alternative 1 will limit fishing opportunities to Southeast Wisconsin residents as compared to the feasible alternatives.

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 1A requires seasonal drawdown of the impoundment which adversely impacts mussels and other aquatic life in the impoundment. The mussels cannot react to the drawdown in a timely fashion which can result in the mussels dying due to desiccation, predation, or freezing. This is a substantial environmental impact. Fresh water mussels can live for decades and are the most highly threatened and rapidly declining group of freshwater organisms in North America (Vaughn and Taylor, 1999⁹).

A recent study⁷ on the Milwaukee River including the Estabrook Dam area identified 11 mussel species; however, 3 of the species were identified from shells and no live specimens were found. A Special Concern species, Elktoe, was found alive in the Milwaukee River. The Ellipse species is a Wisconsin Threatened Species and no live specimens were found.

It was noted that very few juveniles or sub-adult mussels were located during the study⁷. This may indicate that the current conditions of these areas of the river is not conducive to mussel reproduction. This may be due to conditions related to contaminants, low oxygen, silt movement, drought, and temperature change. The impoundment at Estabrook Dam can cause sediment and silt deposition, and increase water temperature in the impoundment, and can cause the mussels to be impacted by desiccation, predation, and freezing through the fall seasonal drawdown of the impoundment.

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. Over a 20-year period, no operation and maintenance costs result in substantial savings to Milwaukee County.

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.

3.12.2 Conclusions

Based on the Environmental Assessment, the following conclusions are made:

1. Estabrook Dam is 78 years old and is in need of repair or removal.
2. Alternative 1 is very similar to Alternative 1A but has additional environmental impacts by not providing year-round fish passage.
3. Both Alternatives 1A and 2 provide fish passage, which is a significant environmental benefit and builds on the multi-million dollar investments made for North Avenue Dam and fish passages on the Milwaukee River in Ozaukee County.
4. Alternative 1 has an estimated capital cost similar to Alternative 2, and an estimated operation and maintenance cost identical to Alternative 1A. The present worth cost for Alternative 1 is \$4,276,000. Alternative 1 has a present worth cost about 2.5 times the cost of Alternative 2 over a 20-year period.
5. Alternative 1A would require a capital cost investment of about \$2,518,000 plus an annual operation and maintenance cost of about \$160,000. The present worth cost over a 20-year period is about \$5,134,000, including capital and operation and maintenance costs. In about 20 years, the County could expect to invest additional funds to either repair or remove the dam, which would be approaching 100 years old at that time.

6. Alternative 1 or 1A will require County staff to monitor river levels, weather information, and gate positions to ensure that all gates are open during a flood event or risk flooding out upstream properties. This is a long-term liability issue to Milwaukee County.
7. Seasonal drawdown of the impoundment is required for Alternative 1 or 1A to protect the gates from ice damage. Seasonal drawdown can negatively impact mussels and other aquatic life in the impoundment through desiccation, predation, and freezing of the mussels.
8. Alternative 1 or 1A provides an impoundment during summer for recreation including fishing, boating, canoeing, and kayaking.
9. Alternative 1 or 1A will continue to build up sediment behind the dam and within the impoundment, resulting in mud flats which can be seen during seasonal drawdown. In addition, sediment will need to be removed upstream from the dam by Milwaukee County in the future, possibly within the next 20 years, due to the dam impoundment.
10. Alternative 2 returns the river to a free flowing condition. The environmental benefits are many and will not adversely impact mussels and other aquatic life, as is the case with Alternative 1 or 1A.
11. Alternative 2 has a similar capital cost as Alternative 1 and no operation and maintenance costs, thereby saving Milwaukee County millions of dollars over the long-term. Based on present worth, Alternative 2 is 40 percent of the Alternative 1 costs and is about one-third the cost of Alternative 1A. In addition, Alternative 2 is the most environmentally protective alternative.
12. Public surveys both through the County website and a written survey at the September 3, 2014, public information meeting, indicate the public endorses the dam removal. The website results were about 2:1 in favor of dam removal (Alternative 2) after the September 3, 2014 public information meeting.
13. The Milwaukee County Board and Milwaukee County Parks endorse dam removal (Alternative 2).

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