

# TECHNICAL MEMORANDUM



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**To:** Maranda Nemeth, ASF; Eileen Bader-Hall, TNC  
Mayo Mill Dam Feasibility Study Steering Committee

**From:** Michael Burke, P.E., P.Eng.

**Date:** July 14, 2023

**Re:** Preliminary Project Options Summary & Screening Matrix  
Mayo Mill Dam Feasibility Study

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## 1. Introduction

This memorandum summarizes the identified preliminary project options and the associated screening matrix for the for the Mayo Mill Dam site. The options identified represent the range of potential project alternatives that could be considered in the feasibility study alternatives analysis. The intent of this preliminary summary is to facilitate selection of the short list of project alternatives (3 to 5 alternatives) to be evaluated in detail in the feasibility study report that will be completed later this year.

In the following paragraphs, the options are first described in terms of basic characteristics and constraints. The options are then characterized relative to the objectives and evaluation topics identified through project discussions to date.

## 2. Preliminary Project Options

A Summary Table of the highlights and constraints of each option is included in Table 1. The options are then contrasted against the project objectives in the Comparison Matrix in Table 2. Cartoon schematic sketches of the basic layout configurations discusses are included in the Appendix.

Several key assumptions are relevant to all of the options considered, described below.

### Options Feasibility and Configuration

The options have been established primarily on experience with past projects, technical literature, site characteristics, and professional judgement. Some feasibility limitations may still be uncovered through the additional detailed analysis that will be completed later this year. Additional detailed evaluation in the feasibility and alternatives analysis may result in adaptations of configurations and extents relative to the descriptions included in this memorandum.

### Restoration of Power Generation

Two of the options assume viability of restoring power generation, yet this feasibility has not been proven to date. This will be reassessed following the energy analysis to be completed in summer 2023 and be included in the final detailed analysis.

### Dam Repairs

The extent of dam repairs required to prepare the site to be maintained in perpetuity in a safe and stable manner, if selected, is presently unknown. This element will be reassessed following the dam condition and stability analyses to be completed in summer 2023.

### Spillway Capacity

Conventional contemporary dam safety requirements by FERC and other typical jurisdictions requires the spillway to pass the FEMA Base (100-year) Flood, without overtopping the abutments. The dam presently does not have this capacity, but will be assumed to be required to prepare the dam to be maintained in perpetuity, if selected. See also above assumption on dam repairs.

### Target Fish Species and Population Sizes

Target fish species required to be considered and the associated population size assumptions are based on consultation with NOAA, US Fish and Wildlife Service (USFWS), Maine Department of Marine Resources (MDMR) and Maine Department of Inland Fisheries and Wildlife (MDIFW). Target fish species include Atlantic salmon, Alewife, Blueback herring, American Shad, Eastern lamprey and American eel, along with Eastern brook trout. Population sizes include 578,000 river herring (415,024 alewife, 163,139 blueback), 37,500 shad, and 1,200 Atlantic salmon.

### Fish Passage Technologies

Based on site characteristics, target fish species, and population estimates, the optimal fish passage approach would entail dam removal, while the optimal technical fish passage technology is assessed to be vertical slot fishway. Denil fishway is also considered for cost and footprint contrast, although presents species and biological capacity constraints. Nature-like fishway options are also examined below.

### Landscape Enhancements

The options detailed below primarily focus on changes to the dam, fishway and in-river systems. As part of the larger feasibility study, it is assumed that landscape, access and public amenity enhancements will be optimized in response to the selected options for management of the dam and fishway.

Table 1. Action options summary table. Options with bold type face advanced to preliminary screening matrix in Table 2.

#	Option	Characteristics
<b>HP</b>	<b>Restore Power Generation, Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways</b>	
<i>HP1</i>	<i>New Vertical Slot Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, restore power generation, replace existing fishway with new vertical slot fishway and dedicated downstream passage chute. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require new flood gates to meet spillway capacity requirements.</li> </ul>
<i>HP2</i>	<i>New Denil Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, restore power generation, replace existing fishway with new Denil fishway and dedicated downstream passage chute. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for near-term populations of target species, but not fully restored populations.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require new flood gates to meet spillway capacity requirements.</li> </ul>
<b>F</b>	<b>Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired</b>	
<i>F1</i>	<i>New Vertical Slot Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, retire FERC exemption, replace existing powerhouse and fishway with new vertical slot fishway, dedicated downstream passage chute, and gates for supplemental attraction flow. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> </ul>
<i>F2</i>	<i>New Denil Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, retire FERC exemption, replace existing powerhouse and fishway with new Denil fishway, dedicated downstream passage chute, and gates for supplemental attraction flow. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for near-term populations of target species, but not fully restored populations.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> </ul>
<i>F3</i>	<i>New Vertical Slot Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>
<i>F4</i>	<i>New Denil Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>

**Table 1. Action options summary table. Options with bold type face advanced to preliminary screening matrix in Table 2.**

#	Option	Characteristics
<b>M</b>	<b>Modify Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired</b>	
<i>M1</i>	<i>Create Straight Alignment for New Vertical Slot Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, retire FERC exemption, modify dam with a new non-overflow separation wall on river left to allow the fishway to extend upstream of the dam in a straight alignment.</li> <li>• Replace existing powerhouse and fishway with new vertical slot fishway, dedicated downstream passage chute, and gates for supplemental attraction flow. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> </ul>
<i>M2</i>	<i>Create Straight Alignment for New Denil Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• Repair dam, retire FERC exemption, modify dam with a new non-overflow separation wall on river left to allow the fishway to extend upstream of the dam in a straight alignment.</li> <li>• Replace existing powerhouse and fishway with new vertical slot fishway, dedicated downstream passage chute, and gates for supplemental attraction flow. May require separate dedicated eel passage.</li> <li>• Meets biological capacity for near-term populations of target species, but not fully restored populations.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> </ul>
<i>M3</i>	<i>Create Straight Alignment for New Vertical Slot Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>
<i>M4</i>	<i>Create Straight Alignment for New Denil Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>
<b>L</b>	<b>Modify Dam, Retain Impoundment at Lower Level, Technical Fishways, FERC Exemption Retired</b>	
<i>L1</i>	<i>Straight/Switchback Alignment for New Vertical Slot Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• This option is a variation of F1/M1 described above, but with additional spillway modifications to maintain impoundment level 4 to 5 feet lower.</li> <li>• Objectives in lowering the impoundment include increasing fish passage efficiency potential, potentially reduced fish passage footprint, and reducing flood water surface elevations, along with additional benefits.</li> </ul>
<i>L2</i>	<i>Straight/Switchback Alignment for New Denil Fishway on River Left</i>	<ul style="list-style-type: none"> <li>• This option is a variation of F2/M2 described above, but with additional spillway modifications to maintain impoundment level 4 to 5 feet lower.</li> <li>• Objectives in lowering the impoundment include increasing fish passage efficiency potential, potentially reduced fish passage footprint, and reducing flood water surface elevations, along with additional benefits.</li> </ul>
<i>L3</i>	<i>Straight/Switchback Alignment for New Vertical Slot Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>
<i>L4</i>	<i>Straight/Switchback Alignment for New Denil Fishway on River Right</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to estimated poor fishway attraction relative to river planform, morphology, and prevailing currents.</li> <li>• Option is also not advantageous relative to modifications/replacement of existing facilities and property extent.</li> </ul>

**Table 1. Action options summary table. Options with bold type face advanced to preliminary screening matrix in Table 2.**

#	Option	Characteristics
<b>N</b>	<b>Nature-Like Fishways, Includes Options Which Maintain and Also Lower Impoundment Levels, FERC Exemption Retired</b>	
<i>N1</i>	<i>Lateral Bypass Channel around dam, Either Side</i>	<ul style="list-style-type: none"> <li>• <b>This option was considered, but not advanced to Comparison Matrix</b> due to property and physical space limitations for installation of a suitably large NLF bypass channel, between existing facilities and property extent.</li> </ul>
<i>N2</i>	<i>New Nature-like Fishway In-Channel Bypass on River Left, 3% Slope, Maintain Current Impoundment Level</i>	<ul style="list-style-type: none"> <li>• Repair spillway, retire FERC exemption, modify dam with a new non-overflow separation wall/berm on river left to allow an NLF to extend upstream of the dam in a straight alignment.</li> <li>• Replace existing powerhouse, fishway, and portion of existing spillway with new 3% NLF in-channel 'bypass' channel, supplemental downstream passage chute, and gates for supplemental attraction flow.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> </ul>
<i>N3</i>	<i>New Nature-like Fishway In-Channel Bypass on River Right, 3% Slope, Maintain Current Impoundment Level</i>	<ul style="list-style-type: none"> <li>• Repair spillway, retire FERC exemption, modify dam with a new non-overflow separation wall/berm on river right to allow an NLF to extend upstream of the dam in a straight alignment.</li> <li>• Replace portion of existing spillway with new 3% NLF in-channel 'bypass' channel, supplemental downstream passage chute, and gates for supplemental attraction flow on river right.</li> <li>• Decommission existing fishway to create additional spillway capacity.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current impoundment levels are maintained (typical and flood conditions).</li> <li>• May also require extra gate capacity to meet spillway capacity requirements.</li> <li>• Powerhouse might be retained and restored/repurposed if structurally feasible and above flood level.</li> </ul>
<i>N4</i>	<i>New Nature-like Fishway In-Channel Bypass on River Left, 2% Slope, Retain Impoundment at Lower Level</i>	<ul style="list-style-type: none"> <li>• This option is a variation of N2 described above, but with additional spillway modifications to maintain impoundment level 4 to 5 feet lower.</li> <li>• Objectives in lowering the impoundment include increasing fish passage efficiency potential with a flatter (2% slope), and reducing flood water surface elevations, along with additional benefits.</li> </ul>
<i>N5</i>	<i>New Nature-like Fishway In-Channel Bypass on River Right, 2% Slope, Retain Impoundment at Lower Level</i>	<ul style="list-style-type: none"> <li>• This option is a variation of N3 described above, but with additional spillway modifications to maintain impoundment level 4 to 5 feet lower.</li> <li>• Objectives in lowering the impoundment include increasing fish passage efficiency potential with a flatter (2% slope), and reducing flood water surface elevations, along with additional benefits.</li> <li>• Powerhouse might be retained and restored/repurposed if structurally feasible and above flood level.</li> </ul>
<i>N6</i>	<i>Replace Dam with Bank-to-Bank Nature-Like Fishway, Maintain Current Impoundment Level</i>	<ul style="list-style-type: none"> <li>• Retire FERC exemption, decommission and remove dam spillway and fishway structures.</li> <li>• Extend 3% bank-to-bank NLF from dam location 450 to 550 feet upstream to corner where river widens.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Current typical impoundment level is maintained.</li> <li>• Powerhouse might be retained and restored/repurposed if structurally feasible and above flood level.</li> </ul>

**Table 1. Action options summary table. Options with bold type face advanced to preliminary screening matrix in Table 2.**

#	Option	Characteristics
<b>N7</b>	<b><i>Replace Dam with Bank-to-Bank Nature-Like Fishway, 2% Slope, Retain Impoundment at Lower Level</i></b>	<ul style="list-style-type: none"> <li>• This option is a variation of N6 described above, but reduces impoundment level 4 to 5 feet.</li> <li>• Objectives in lowering the impoundment include increasing fish passage efficiency potential with a flatter (2% slope), and reducing flood water surface elevations, along with additional benefits.</li> <li>• Powerhouse might be retained and restored/repurposed if structurally feasible and above flood level.</li> </ul>
<b>R</b>	<b>Dam Removal, Human-made Impoundment Removed, Natural Ledge Features Exposed, FERC Exemption Retired</b>	
<b>R1</b>	<b><i>Dam Removal</i></b>	<ul style="list-style-type: none"> <li>• Retire FERC exemption, decommission and remove dam spillway and fishway structures down to residual ledge below dam.</li> <li>• Current impoundment levels are lowered (typical and flood conditions).</li> <li>• Manage sediment and stabilize exposed riparian areas with vegetation as needed.</li> <li>• Meets biological capacity for restored populations of target species.</li> <li>• Powerhouse might be retained and restored/repurposed if structurally feasible.</li> </ul>
<b>R2</b>	<b><i>Dam Removal with Ledge Modification</i></b>	<ul style="list-style-type: none"> <li>• This option is a variation of R2 described above, but with potential additional ledge modifications if needed to ensure safe, timely, and effective fish passage.</li> </ul>

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>HP - Restore Power Generation, Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways</b>													
HP1: New Vertical Slot Fishway on River Left	<ul style="list-style-type: none"> <li>Requires energy analysis</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current</li> </ul>	<ul style="list-style-type: none"> <li>Current: No change</li> <li>Future: May increase</li> <li>Enhancements: consider gates to meet spillway capacity</li> </ul>	<ul style="list-style-type: none"> <li>Current: repair required</li> <li>Spillway capacity: no</li> <li>O&amp;M: required in perpetuity</li> <li>O&amp;M costs: substantial</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: no change</li> <li>Sea plane: no change</li> <li>Docks: no change</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: moderate</li> <li>Attraction: may require augmentation</li> <li>Species: All</li> <li>Capacity limitation: no</li> <li>Eel: requires dedicated facility</li> <li>Downstream: requires facility</li> <li>Compliance: requires operation</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: no change</li> <li>Habitat restoration: no change</li> <li>Non-native species: provides habitat</li> <li>Watershed connectivity: sink, no change</li> <li>Climate resilience: no change</li> </ul>	<ul style="list-style-type: none"> <li>Current: no change</li> <li>Future: enhance, as consistent with pond &amp; water levels</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse upgrades</li> <li>Educational: enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: no change</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: high</li> <li>Grant eligibility: low to moderate</li> </ul>	<ul style="list-style-type: none"> <li>Costs: high</li> <li>Revenue: yes</li> </ul>	<ul style="list-style-type: none"> <li>Energy development feasibility</li> <li>Extent of dam repairs</li> <li>Constructability</li> <li>Funding</li> </ul>
HP2: New Denil Fishway on River Left	<ul style="list-style-type: none"> <li>Requires energy analysis</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current</li> </ul>	<ul style="list-style-type: none"> <li>Current: No change</li> <li>Future: May increase</li> <li>Enhancements: consider gates to meet spillway capacity</li> </ul>	<ul style="list-style-type: none"> <li>Current: repair required</li> <li>Spillway capacity: no</li> <li>O&amp;M: required in perpetuity</li> <li>O&amp;M costs: substantial</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: no change</li> <li>Sea plane: no change</li> <li>Docks: no change</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: fair</li> <li>Attraction: may require augmentation</li> <li>Species: Shad and Lamprey limited</li> <li>Capacity limitation: river herring and shad</li> <li>Eel: requires dedicated facility</li> <li>Downstream: requires facility</li> <li>Compliance: requires operation</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: no change</li> <li>Habitat restoration: no change</li> <li>Non-native species: provides habitat</li> <li>Watershed connectivity: sink, no change</li> <li>Climate resilience: no change</li> </ul>	<ul style="list-style-type: none"> <li>Current: no change</li> <li>Future: enhance, as consistent with pond &amp; water levels</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse upgrades</li> <li>Educational: enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: no change</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: high</li> <li>Grant eligibility: low to moderate</li> </ul>	<ul style="list-style-type: none"> <li>Costs: high</li> <li>Revenue: yes</li> </ul>	<ul style="list-style-type: none"> <li>Energy development feasibility</li> <li>Extent of dam repairs</li> <li>Constructability</li> <li>Funding</li> </ul>

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>F - Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired</b>													
F1: New Vertical Slot Fishway on River Left	• Retired	• Maintain current	• Current: No change • Future: May increase • Enhancements: consider gates to meet spillway capacity	• Current: repair required • Spillway capacity: no • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: no change • Sea plane: no change • Docks: no change	• Upstream effectiveness: moderate • Attraction: may require augmentation • Species: All • Capacity limitation: no • Eel: requires dedicated facility • Downstream: requires facility • Compliance: requires operation	• Water quality: no change • Habitat restoration: no change • Non-native species: provides habitat • Watershed connectivity: sink, no change • Climate resilience: no change	• Current: no change • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: no change	• Initial cost: high • Grant eligibility: low to moderate	• Costs: high • Revenue: no	• Extent of dam repairs • Constructability • Fish attraction • Funding
F2: New Denil Fishway on River Left	• Retired	• Maintain current	• Current: No change • Future: May increase • Enhancements: consider gates to meet spillway capacity	• Current: repair required • Spillway capacity: no • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: no change • Sea plane: no change • Docks: no change	• Upstream effectiveness: fair • Attraction: may require augmentation • Species: Shad and Lamprey limited • Capacity limitation: river herring and shad • Eel: requires dedicated facility • Downstream: requires facility • Compliance: requires operation	• Water quality: no change • Habitat restoration: no change • Non-native species: provides habitat • Watershed connectivity: sink, no change • Climate resilience: no change	• Current: no change • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: no change	• Initial cost: high • Grant eligibility: low to moderate	• Costs: high • Revenue: no	• Extent of dam repairs • Constructability • Fish attraction • Funding



Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>M - Modify Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired</b>													
M1: Create Straight Alignment for New Vertical Slot Fishway on River Left by Extending Separation Wall Upstream of Dam	<ul style="list-style-type: none"> <li>Retired</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current</li> </ul>	<ul style="list-style-type: none"> <li>Current: No change</li> <li>Future: May increase</li> <li>Enhancements: consider gates to meet spillway capacity</li> </ul>	<ul style="list-style-type: none"> <li>Current: repair required</li> <li>Spillway capacity: no</li> <li>O&amp;M: required in perpetuity</li> <li>O&amp;M costs: substantial</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: no change</li> <li>Sea plane: no change</li> <li>Docks: no change</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: moderate to better</li> <li>Attraction: may require augmentation</li> <li>Species: All</li> <li>Capacity limitation: no</li> <li>Eel: requires dedicated facility</li> <li>Downstream: requires facility</li> <li>Compliance: requires operation</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: no change</li> <li>Habitat restoration: no change</li> <li>Non-native species: provides habitat</li> <li>Watershed connectivity: sink, no change</li> <li>Climate resilience: no change</li> </ul>	<ul style="list-style-type: none"> <li>Current: no change</li> <li>Future: enhance, as consistent with pond &amp; water levels</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse removal mitigation required</li> <li>Educational: enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: no change</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: high</li> <li>Grant eligibility: low to moderate</li> </ul>	<ul style="list-style-type: none"> <li>Costs: high</li> <li>Revenue: no</li> </ul>	<ul style="list-style-type: none"> <li>Extent of dam repairs</li> <li>Design of separation wall</li> <li>Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall</li> <li>Constructability</li> <li>Fish attraction</li> <li>Funding</li> </ul>
M2: Create Straight Alignment for New Denil Fishway on River Left by Extending Separation Wall Upstream of Dam	<ul style="list-style-type: none"> <li>Retired</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current</li> </ul>	<ul style="list-style-type: none"> <li>Current: No change</li> <li>Future: May increase</li> <li>Enhancements: consider gates to meet spillway capacity</li> </ul>	<ul style="list-style-type: none"> <li>Current: repair required</li> <li>Spillway capacity: no</li> <li>O&amp;M: required in perpetuity</li> <li>O&amp;M costs: substantial</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: no change</li> <li>Sea plane: no change</li> <li>Docks: no change</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: fair to moderate</li> <li>Attraction: may require augmentation</li> <li>Species: Shad and Lamprey limited</li> <li>Capacity limitation: river herring and shad</li> <li>Eel: requires dedicated facility</li> <li>Downstream: requires facility</li> <li>Compliance: requires operation</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: no change</li> <li>Habitat restoration: no change</li> <li>Non-native species: provides habitat</li> <li>Watershed connectivity: sink, no change</li> <li>Climate resilience: no change</li> </ul>	<ul style="list-style-type: none"> <li>Current: no change</li> <li>Future: enhance, as consistent with pond &amp; water levels</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse removal mitigation required</li> <li>Educational: enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: no change</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: high</li> <li>Grant eligibility: low to moderate</li> </ul>	<ul style="list-style-type: none"> <li>Costs: high</li> <li>Revenue: no</li> </ul>	<ul style="list-style-type: none"> <li>Extent of dam repairs</li> <li>Design of separation wall</li> <li>Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall</li> <li>Constructability</li> <li>Fish attraction</li> <li>Funding</li> </ul>

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>L - Modify Dam, Retain Impoundment at Lower Level, Technical Fishways, FERC Exemption Retired</b>													
L1: Variation of F1 or M1 to Lower Impoundment Level 4 to 5 feet New Vertical Slot Fishway on River Left	• Retired	• Lowered 4 to 5 feet	• Current: Improved • Future: Improved • Enhancements: dam modifications to provide lower level and spillway capacity	• Current: repair required • Spillway capacity: yes • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: requires adaptation • Sea plane: requires adaptation • Docks: requires adaptation	• Upstream effectiveness: moderate to better • Attraction: may require augmentation • Species: All • Capacity limitation: no • Eel: requires dedicated facility • Downstream: requires facility • Compliance: requires operation	• Water quality: incremental improvement • Habitat restoration: incremental improvement • Non-native species: incremental improvement • Watershed connectivity: incremental improvement • Climate resilience: incremental improvement	• Current: incremental change, • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: incremental change	• Initial cost: high • Grant eligibility: moderate to better	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Optimize revegetation • Funding
L2: Variation of F2/M2 to Lower Impoundment Level 4 to 5 feet New Denil Fishway on River Left	• Retired	• Lowered 4 to 5 feet	• Current: Improved • Future: Improved • Enhancements: dam modifications to provide lower level and spillway capacity	• Current: repair required • Spillway capacity: yes • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: requires adaptation • Sea plane: requires adaptation • Docks: requires adaptation	• Upstream effectiveness: moderate to better • Attraction: may require augmentation • Species: Shad and Lamprey limited • Capacity limitation: river herring and shad • Eel: requires dedicated facility • Downstream: requires facility • Compliance: requires operation	• Water quality: incremental improvement • Habitat restoration: incremental improvement • Non-native species: incremental improvement • Watershed connectivity: incremental improvement • Climate resilience: incremental improvement	• Current: incremental change, • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: incremental change	• Initial cost: high • Grant eligibility: moderate to better	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Optimize revegetation • Funding

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>N - Nature-Like Fishways, Includes Options Which Maintain and Also Lower Impoundment Levels, FERC Exemption Retired FERC Exemption Retired</b>													
N2: New Nature-like Fishway (3%) In-Channel Bypass on River Left, Maintain Current Impoundment Level	• Retired	• Maintain current	• Current: incremental • Future: May increase • Enhancements: consider gates to meet spillway capacity	• Current: repair required • Spillway capacity: no • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: no change • Sea plane: no change • Docks: no change	• Upstream effectiveness: moderate to better • Attraction: better, may require augmentation • Species: All • Capacity limitation: no • Downstream: requires facility • Compliance: requires operation	• Water quality: no change • Habitat restoration: no change • Non-native species: provides habitat • Watershed connectivity: sink, no change • Climate resilience: no change	• Current: no change • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: no change	• Initial cost: high • Grant eligibility: moderate to better	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall/berm • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Funding
N3: New Nature-like Fishway (3%) In-Channel Bypass on River Right, Maintain Current Impoundment Level	• Retired	• Maintain current	• Current: No change • Future: May increase • Enhancements: consider gates to meet spillway capacity	• Current: repair required • Spillway capacity: no • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: no change • Sea plane: no change • Docks: no change	• Upstream effectiveness: moderate to better • Attraction: better, may require augmentation • Species: All • Capacity limitation: no • Downstream: requires facility • Compliance: requires operation	• Water quality: no change • Habitat restoration: no change • Non-native species: provides habitat • Watershed connectivity: sink, no change • Climate resilience: no change	• Current: no change • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse repurpose potential • Educational: enhance interpretation	• Consistent with plans: yes • View: no change	• Initial cost: high • Grant eligibility: moderate to better	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall/berml • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Funding
N4: New Nature-like Fishway (2%) In-Channel Bypass on River Left, Retain Impoundment at Lower Level	• Retired	• Lowered 4 to 5 feet	• Current: Improved • Future: Improved • Enhancements: dam modifications to provide lower level and spillway capacity	• Current: repair required • Spillway capacity: yes • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: requires adaptation • Sea plane: requires adaptation • Docks: requires adaptation	• Upstream effectiveness: moderate to better • Attraction: better, may require augmentation • Species: All • Capacity limitation: no • Downstream: requires facility • Compliance: requires operation	• Water quality: incremental improvement • Habitat restoration: incremental improvement • Non-native species: incremental improvement • Watershed connectivity: incremental improvement • Climate resilience: incremental improvement	• Current: incremental change, • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse removal mitigation required • Educational: enhance interpretation	• Consistent with plans: yes • View: incremental change	• Initial cost: high • Grant eligibility: better to good	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Optimize revegetation • Funding

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
N5: New Nature-like Fishway (2%) In-Channel Bypass on River Right, Retain Impoundment at Lower Level	• Retired	• Lowered 4 to 5 feet	• Current: Improved • Future: Improved • Enhancements: dam modifications to provide lower level and spillway capacity	• Current: repair required • Spillway capacity: yes • O&M: required in perpetuity • O&M costs: substantial	• Bridge: no change • Hydrant: requires adaptation • Sea plane: requires adaptation • Docks: requires adaptation	• Upstream effectiveness: moderate to better • Attraction: better, may require augmentation • Species: All • Capacity limitation: no • Downstream: requires facility • Compliance: requires operation	• Water quality: incremental improvement • Habitat restoration: incremental improvement • Non-native species: incremental improvement • Watershed connectivity: incremental improvement • Climate resilience: incremental improvement	• Current: incremental change, • Future: enhance, as consistent with pond & water levels	• Historical: consistent, powerhouse repurpose potential • Educational: enhance interpretation	• Consistent with plans: yes • View: incremental change	• Initial cost: high • Grant eligibility: better to good	• Costs: high • Revenue: no	• Extent of dam repairs • Design of separation wall • Hydraulic and sedimentation response to fishway hydraulic inlet/separation wall • Constructability • Fish attraction • Optimize revegetation • Funding
N6: Bank-to-Bank NLF (3%), Maintain Current Impoundment Level	• Retired	• Maintain current from Cove US	• Current: reduced from Cove DS • Future: May increase from Cove US • Enhancements: none	• Current: removed • Spillway capacity: N/A • O&M: substantially reduced • O&M costs: substantially reduced	• Bridge: no change • Hydrant: require adaptation • Sea plane: may require adaptation • Docks: require adaptation from Cove DS	• Upstream effectiveness: better • Attraction: excellent • Species: All • Capacity limitation: no • Downstream: excellent • Compliance: not required	• Water quality: incremental improve • Habitat restoration: incremental improve • Non-native species: provides habitat, incremental improve • Watershed connectivity: sink, incremental improve • Climate resilience: incremental improve	• Current: incremental change, adapt Cove DS • Future: enhance, as consistent with NLF, US pond & water levels	• Historical: consistent, powerhouse repurpose potential • Educational: high, enhance interpretation	• Consistent with plans: yes • View: incremental change, NLF/riffle from Cove DS	• Initial cost: high • Grant eligibility: good to high	• Costs: low to N/A • Revenue: no	• Hydraulic design confirmation • Constructability
N7: Bank-to-Bank NLF (2%), Lower Impoundment Level 4.5 feet	• Retired	• Level reduced 4.5 feet, extends from Cove US	• Current: substantial reduction • Future: reduction • Enhancements: none	• Current: removed • Spillway capacity: N/A • O&M: substantially reduced • O&M costs: substantially reduced	• Bridge: no change • Hydrant: require adaptation • Sea plane: may require adaptation • Docks: require adaptation	• Upstream effectiveness: high • Attraction: excellent • Species: All • Capacity limitation: no • Downstream: excellent • Compliance: not required	• Water quality: substantial improve • Habitat restoration: substantial improve • Non-native species: provides reduced habitat, notable improve • Watershed connectivity: reduced sink, notable improve • Climate resilience: notable improve	• Current: moderate change, adapt to lower level • Future: enhance, as consistent with NLF, US pond & water levels	• Historical: consistent, powerhouse repurpose potential • Educational: high, enhance interpretation	• Consistent with plans: yes • View: incremental change, NLF/riffle from Cove DS	• Initial cost: high • Grant eligibility: high	• Costs: low to N/A • Revenue: no	• Hydraulic design confirmation • Constructability • Optimize revegetation

Table 2. Evaluation table comparing project options to identified evaluation criteria.

Option	Hydropower Generation	Impoundment Water Level	Flooding and Resiliency	Dam Structure & Facilities	Impacts to Facilities and Infrastructure	Fish Passage Effectiveness	Ecology & Water Quality	Public Access and Use	Historical & Educational Value	Community Plans & Aesthetic	Relative Construction Cost	Long-Term Life Span Costs	Key Uncertainties & Focus Factors
<b>R - Dam Removal</b>													
R1: Dam Removal	<ul style="list-style-type: none"> <li>Retired</li> </ul>	<ul style="list-style-type: none"> <li>Level reduced, some residual pool may persist</li> </ul>	<ul style="list-style-type: none"> <li>Current: greatest reduction</li> <li>Future: reduction</li> <li>Enhancements: none</li> </ul>	<ul style="list-style-type: none"> <li>Current: removed</li> <li>Spillway capacity: N/A</li> <li>O&amp;M: N/A</li> <li>O&amp;M costs: N/A</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: require adaptation</li> <li>Sea plane: require adaptation</li> <li>Docks: require adaptation</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: high</li> <li>Attraction: excellent</li> <li>Species: All</li> <li>Capacity limitation: no</li> <li>Downstream: excellent</li> <li>Compliance: not required</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: substantial improve</li> <li>Habitat restoration: greatest improvement</li> <li>Non-native species: habitat eliminated</li> <li>Watershed connectivity: greatest improvement</li> <li>Climate resilience: greatest improvement</li> </ul>	<ul style="list-style-type: none"> <li>Current: adapt to lower level and river flow</li> <li>Future: enhance, as consistent with lower level and river flow</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse repurpose potential</li> <li>Educational: high, enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: change from pond to flowing river</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: likely least cost</li> <li>Grant eligibility: greatest</li> </ul>	<ul style="list-style-type: none"> <li>Costs: N/A</li> <li>Revenue: no</li> </ul>	<ul style="list-style-type: none"> <li>Sediment management</li> <li>Ledge manipulation requirements</li> <li>Optimize revegetation</li> </ul>
R2: Dam Removal with Additional Ledge Modifications	<ul style="list-style-type: none"> <li>Retired</li> </ul>	<ul style="list-style-type: none"> <li>Level reduced, some residual pool may persist</li> </ul>	<ul style="list-style-type: none"> <li>Current: greatest reduction</li> <li>Future: reduction</li> <li>Enhancements: none</li> </ul>	<ul style="list-style-type: none"> <li>Current: removed</li> <li>Spillway capacity: N/A</li> <li>O&amp;M: N/A</li> <li>O&amp;M costs: N/A</li> </ul>	<ul style="list-style-type: none"> <li>Bridge: no change</li> <li>Hydrant: require adaptation</li> <li>Sea plane: require adaptation</li> <li>Docks: require adaptation</li> </ul>	<ul style="list-style-type: none"> <li>Upstream effectiveness: highest</li> <li>Attraction: excellent</li> <li>Species: All</li> <li>Capacity limitation: no</li> <li>Downstream: excellent</li> <li>Compliance: not required</li> </ul>	<ul style="list-style-type: none"> <li>Water quality: substantial improve</li> <li>Habitat restoration: greatest improvement</li> <li>Non-native species: habitat eliminated</li> <li>Watershed connectivity: greatest improvement</li> <li>Climate resilience: greatest improvement</li> </ul>	<ul style="list-style-type: none"> <li>Current: adapt to lower level and river flow</li> <li>Future: enhance, as consistent with lower level and river flow</li> </ul>	<ul style="list-style-type: none"> <li>Historical: consistent, powerhouse repurpose potential</li> <li>Educational: high, enhance interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with plans: yes</li> <li>View: change from pond to flowing river</li> </ul>	<ul style="list-style-type: none"> <li>Initial cost: likely least cost</li> <li>Grant eligibility: greatest</li> </ul>	<ul style="list-style-type: none"> <li>Costs: N/A</li> <li>Revenue: no</li> </ul>	<ul style="list-style-type: none"> <li>Sediment management</li> <li>Ledge manipulation requirements</li> <li>Optimize revegetation</li> </ul>

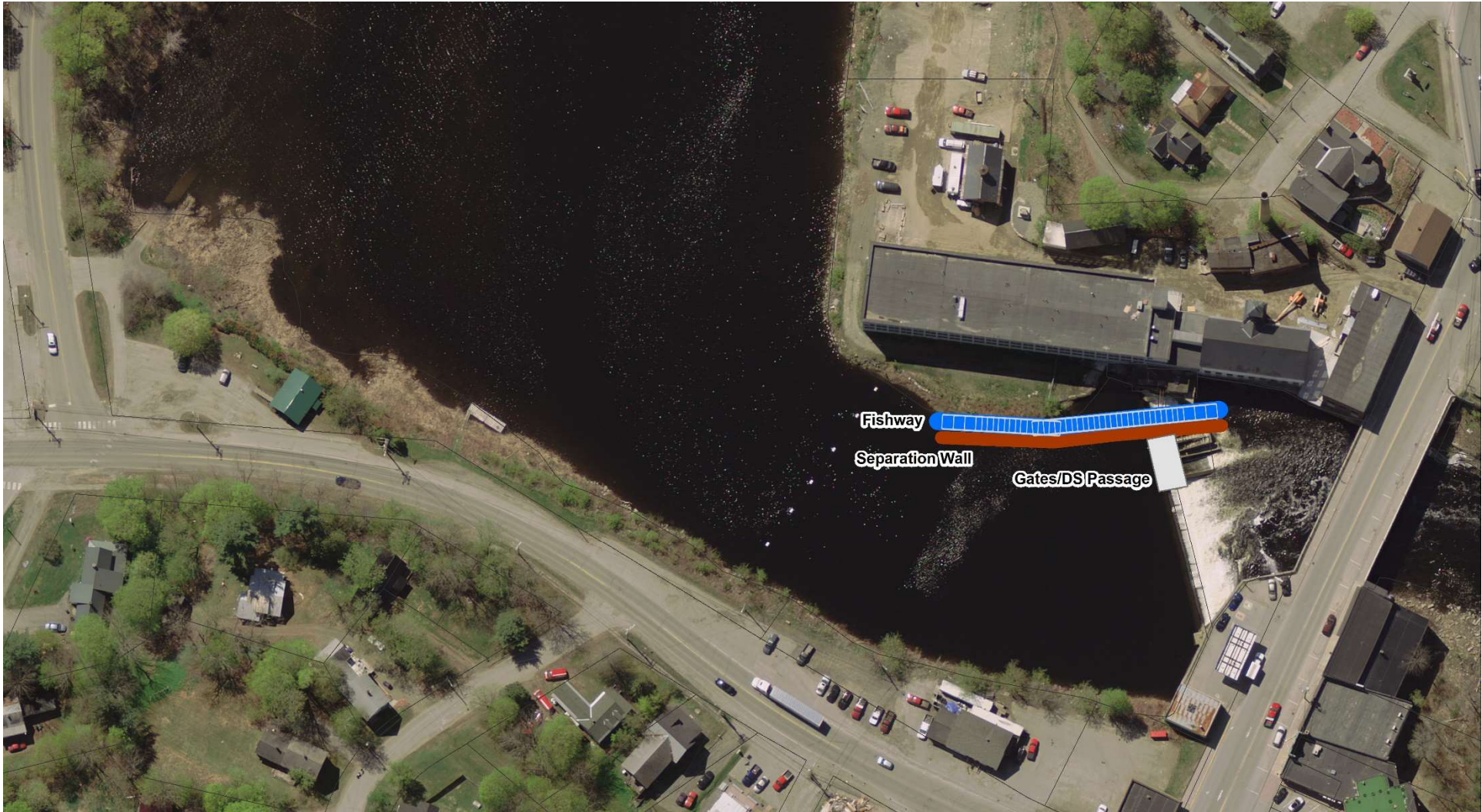
### 3. Appendix – Cartoon Schematic Location Sketches



**Figure 1. General location sketch for options HP 1 and HP 2 (Restore Power Generation, Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways). Actual configuration, orientation, scale and size will vary pending additional development.**

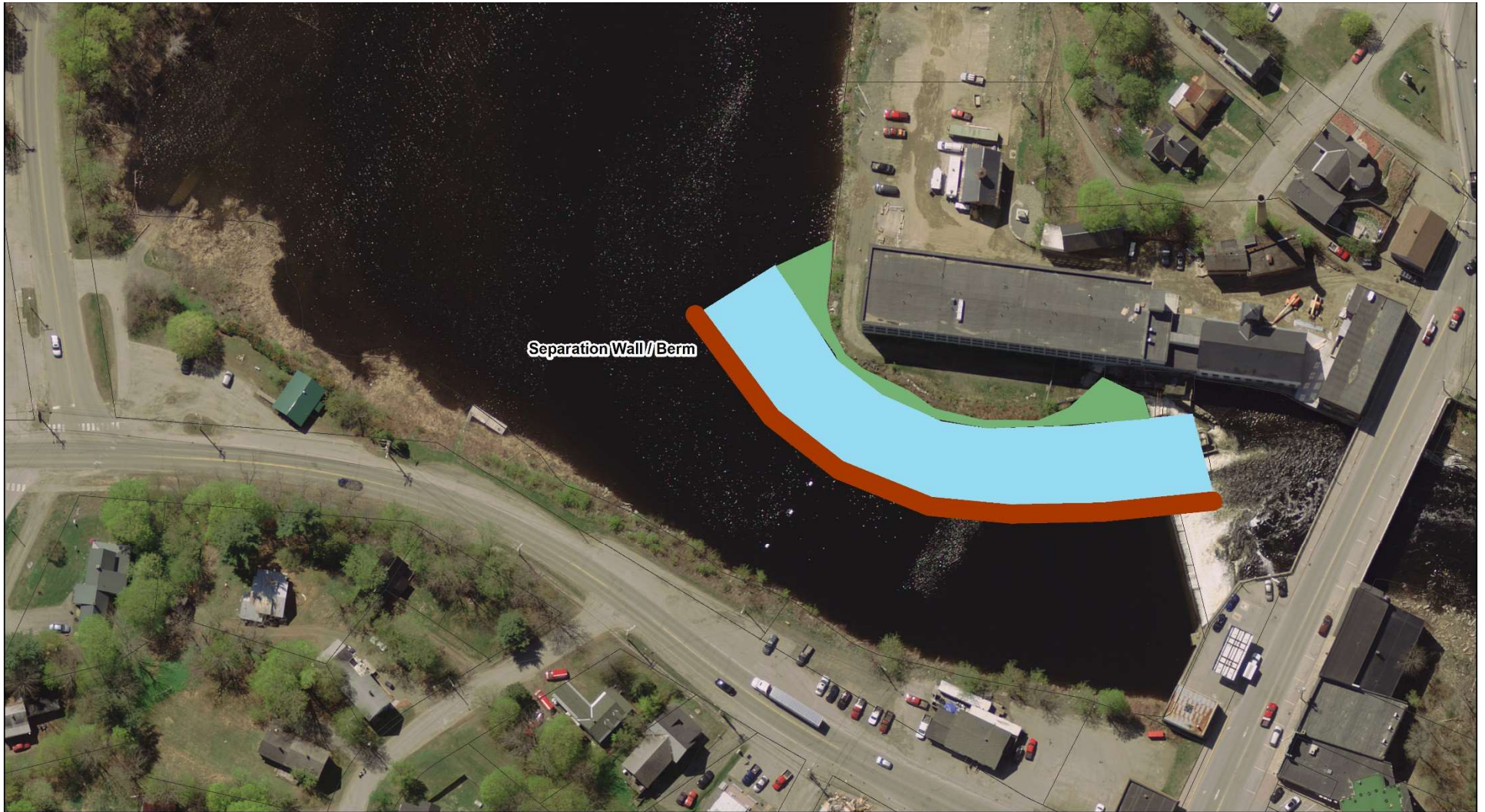


**Figure 2. General location sketch for options F 1 and F 2 (Retain Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired), and L 1 and L 2 (Modify Dam, Retain Impoundment at Lower Level, Technical Fishways, FERC Exemption Retired). Actual configuration, orientation, scale and size will vary pending additional development.**

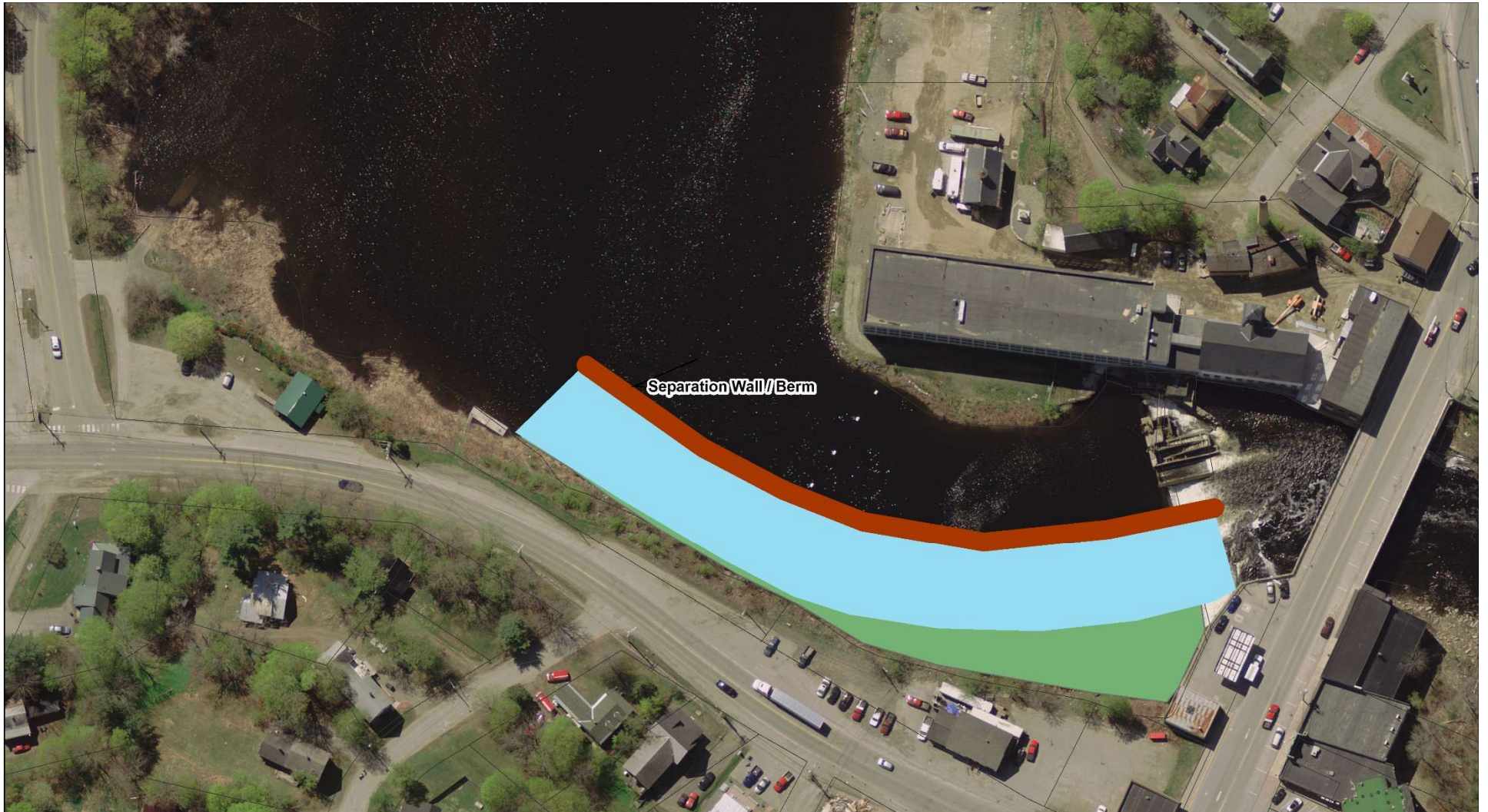


**Figure 3. General location sketch for options M 1 and M 2 (Modify Dam, Maintain Impoundment at Current Levels, Technical Fishways, FERC Exemption Retired), and L 1 and L 2 (Modify Dam, Retain Impoundment at Lower Level, Technical Fishways, FERC Exemption Retired). Actual configuration, orientation, scale and size will vary pending additional development.**



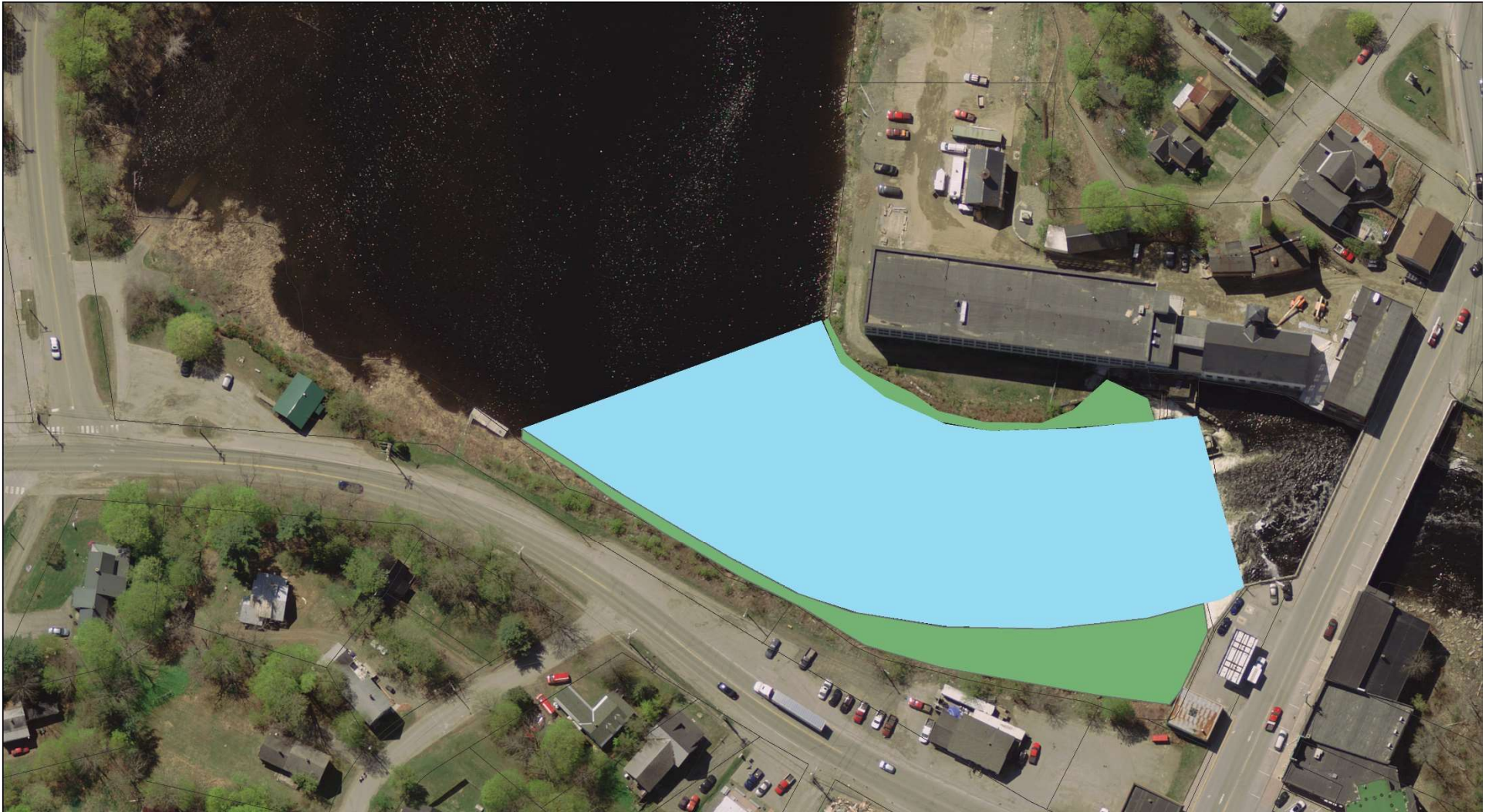


**Figure 4. General location sketch for options N 2 (New Nature-like Fishway (3%) In-Channel Bypass on River Left, Maintain Current Impoundment Level) and N 4 (New Nature-like Fishway (3%) In-Channel Bypass on River Left, Retain Impoundment at Lower Level). Actual configuration, orientation, scale and size will vary pending additional development.**



Separation Wall/Berm

**Figure 5. General location sketch for options N 3 (New Nature-like Fishway (3%) In-Channel Bypass on River Right, Maintain Current Impoundment Level) and N 5 (New Nature-like Fishway (3%) In-Channel Bypass on River Right, Retain Impoundment at Lower Level). Actual configuration, orientation, scale and size will vary pending additional development.**



**Figure 6. General location sketch for options N 6 (Bank-to-Bank NLF (3%), Maintain Current Impoundment Level), N 7 (Bank-to-Bank NLF (2%), Lower Impoundment Level 4.5 feet), and R 1 and R 2 (Dam Removal). Actual configuration, orientation, scale and size will vary pending additional development.**