Horsley Witten Group
Sustainable Environmental Solutions
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September 28, 2023

MEPA Distribution List

RE: Supplemental Information – Ipswich Mills Dam Removal Expanded Environmental Notification Form

To whom it may concern,

Please note that the EENF you previously received for the proposed Ipswich Mills Dam Removal (the Project) has been amended. This amendment serves to add supplemental information, as requested based on questions received during MEPA public outreach sessions (both virtual and in-person) for the proposed project. The additional project information presented here are:

- Acknowledgement of additional MEPA review thresholds exceeded by the overall secondary impacts of the project;
- Clarification on the data source for the flood zone shown on the existing conditions plans;
- Inclusion of the most recent dam safety report;
- Confirmation of Federal Funding;
- A more detailed discussion of the transport of sediments which would be mobilized as a result of the Project; and
- A more detailed discussion of the alternatives considered during Project planning.

MEPA Review Thresholds

This amendment updates the ENF form to acknowledge additional MEPA review thresholds exceeded by the indirect secondary impacts from the project, rather than just those within the limit of construction work for the project. While quantification of these indirect, secondary impacts was included in the impacts table, the exceeded MEPA thresholds were not specifically listed. The additional thresholds exceeded that were not listed in the initial filing are:

- 301 CMR 11.03(3)(b)(1)(b) – Alteration of 500 or more linear feet of bank along a fish run or inland bank
- 301 CMR 11.03(3)(b)(1)(e) – Alteration of ½ or more acres of any other wetland

The alteration of other wetlands is due to anticipated water level changes upstream from the dam that will result in the conversion of 184,800 square feet from Land Under Waterbodies and Water Ways to Bordering Vegetated Wetlands.

Flood Zone Mapping

The existing conditions flood zone depicted on the project plans is from the FEMA FIRM. The site-specific modeled floodplain is different from the official regulatory floodplain from the

FEMA FIRM. When considering the official FEMA FIRM flood zone, there are zero square feet of impacts to the flood zone from the temporary construction access path.

Dam Safety Report

The most recent dam safety report from September of 2020 is attached here. It states that the dam is classified by the Massachusetts Office of Dam Safety as an Intermediate dam with Significant Hazard Potential.

Federal Funding

Project Permitting is currently being funded through a National Oceanic and Atmospheric Administration (NOAA) Fish Barriers grant. While no formal federal lead agency has yet been assigned for this project, the existing NOAA funding in place makes it likely that NOAA would be the lead federal agency and responsible for ensuring that the project completes the National Environmental Policy Act (NEPA) and Section 106 Historical permitting components. Federal funding will also likely be sought for future construction funding though no specific construction grants have yet been received nor applications submitted.

Sediment Mobilization

This amendment updates the EENF discussion of the anticipated mobilization of impounded sediment behind the dam following dam removal to include more information on the likely fate of those mobilized sediments and potential impacts thereof. Sediment impounded behind the dam will gradually mobilize over a period of years following dam removal. How quickly that sediment mobilizes will depend upon the weather and the corollary size and frequency of flood events that occur. There are approximately 6,900 cubic yards (CY) of potentially mobile sediment impounded behind the dam. The sediment mobilization analysis presented here looks at a range of potential percentages of total sediment mobilization in the first year following dam removal (when the greatest amount of sediment transport is likely to occur), where that mobilized sediment may potentially settle out, and the potential thickness of deposited sediments based on the square footage of those settlement areas.

Subsequent to dam removal, and based on H&H modeling of flow velocities, mobilized sediment is predicted to settle along three general zones:

1. Within the first 1,000 feet downstream of the former dam location between the Choate Bridge and the County Street Bridge (represented in **yellow** in **Figure 1**). Here, coarse sediment that is impounded immediately behind the dam may settle after flood events. This area has been historically starved of sediment due to the effects of the dam. Settlement of coarse sediment in this area will gradually and eventually correct this imbalance and occur primarily by infilling of the existing voids between larger cobbles and boulders and along the banks.

2. In the cove immediately downstream of the County Street Bridge and the lower falls (represented in **blue**). This area is expected to be relatively favorable to sediment

settling, as it is the first location downstream of the dam at which point the river significantly widens, resulting in lower velocities. With its low elevation location beneath the lower falls, it is also the first location along the river that receives nearly full tidal fluctuation and exchange. Tidal influence will tend to redistribute any sediment deposited here over a much broader area over time. Both fine and coarse sediment may settle here.

3. Along the 3.1-mile course of the Ipswich River downstream of the cove (represented in **purple**). Fine and coarse sediment is expected to gradually transport along this large section of the river before ultimately reaching the Atlantic Ocean. This most downstream depositional area represents the low elevation, main stem of the river that receives essentially full tidal influence and will, therefore, be inundated for significant portions of most days. In reality, the tides overtop onto the salt marsh plain during the astronomically highest tides of each cycle dramatically increasing the depositional area for this zone above that show here.

The areas of each sediment settling zone are listed below in **Table 1**. The nearest clam flats downstream of the dam, the Gould Creek Clam Flats (1.5 miles downstream per Town mapping included here as **Figure 2**), are also identified.

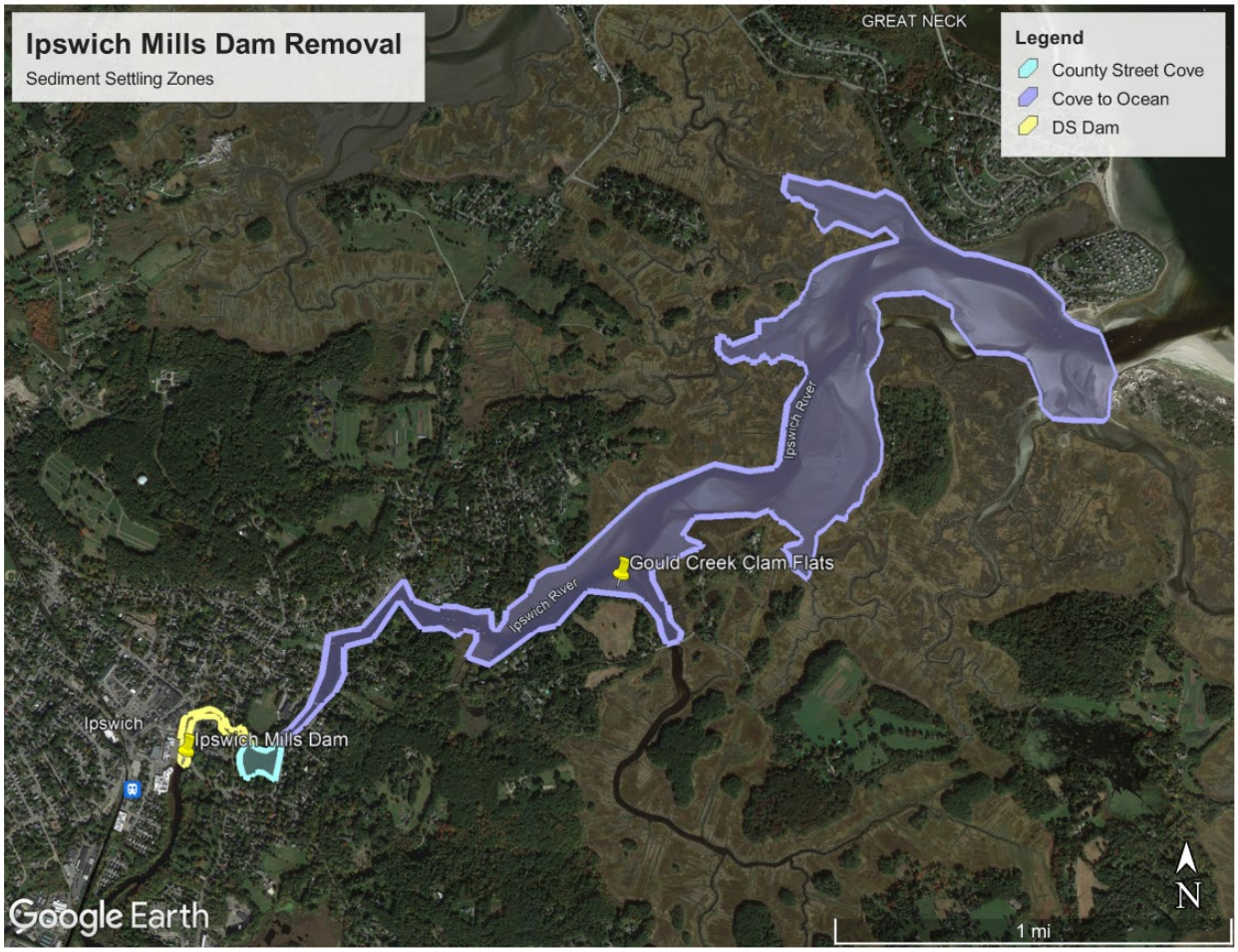


Figure 1. Sediment Settling Zones

Table 1. Sediment Settling Zone Areas

Zone	Area (sf)
Downstream of Dam	143,800
County Street Cove	195,400
Downstream of Cove to Ocean	12,780,800

Sediment impounded behind the dam will gradually mobilize over a period of years following dam removal. How quickly that sediment mobilizes will depend upon the weather and the corollary size and frequency of flood events that occur. H&H modeling predicts that the 2-year return frequency flood event is the most frequent return interval event that will mobilize significant sediment quantities. Based on reviewed academic literature, in the first year after removal of a low-head dam, between 8% to 65% of the total sediment volume impounded by a

dam is typically expected to mobilize, with an average mobilization rate of 28%[1]. Sediment mobilization is typically greatest in the first year subsequent to dam removal when the hydraulic processes in the river experience immediate changes as a result of the dam removal and the quantity of potentially mobile sediment is greatest.

To estimate the sediment mobilization process during the first year after dam removal, HW idealized the annual mobile sediment load as a single volume moving at once from one sediment settling zone to another. This is highly unrealistic as actual sediment mobilization will occur more gradually, but it provides a conservative method for assessing the maximum potential depth and volume of sediment that could temporarily accumulate in a given zone at any one time.

We present below two scenarios for annual sediment mobilization, the maximum value of 65% and the average rate of 28%. To be conservative the minimum rate of 8% was not assessed. Considering our use of only the higher annual sediment mobilization rates, along with the conceptualization of each scenario's entire annualized sediment load being mobilized all at once, the scenarios discussed below present highly conservative maximum sediment accumulation values.

Table 2 lists the maximum potential volume and depth of settled sediment in each zone under the high, 65%, first-year mobilization scenario. In this scenario, 4,490 CY of impounded sediment is modeled to mobilize, of which 940 CY are coarse and 3,550 CY are fine. During flood-driven mobilization events, only coarse sediment was modeled to settle in Zone 1 immediately downstream of the dam, so only the volume of impounded coarse sediment is included in the calculation of settled material in that zone.

Table 2. High Year 1 Mobilization Scenario (65%) – Maximum Sediment Settling

Zone	Maximum Volume of Settled Sediment (CY)	Maximum Depth of Settled Sediment (in)
Zone 1 -Downstream of Dam*	940	2.1
Zone 2 - County Street Cove**	3,550	5.9
Zone 3 - Downstream of Cove to Ocean**	3,550***	0.09

** Only includes impounded coarse sediment. Fine sediment is expected to continue to migrate further downstream during peak flood events.*

*** Only includes impounded fine sediment, as coarse sediment has already been accounted for with deposition in Zone 1. In these zones, the dominant hydrologic influence on*

[1] Sawaske, S. R. and Freyberg, D. L., "A comparison of past small dam removals in highly sediment-impacted systems in the U.S.," Geomorphology Vol. 151-152, May 2012, p. 50-58

sediment migration is tidal, rather than river-driven, so accumulated sediment is expected to redistribute across each tide cycle.

**** Represents the same volume of sediment that mobilizes to Zone 2. This sediment is assumed to continue to migrate downstream to Zone 3 over time.*

Table 3 lists the maximum potential volume and depth of settled sediment in each zone under this typical 28%, first-year mobilization scenario. In this scenario, 1,940 CY of impounded sediment is modeled to mobilize, of which 410 CY are coarse and 1,530 CY are fine. Again, only coarse sediment is included in Zone 1 just downstream of the former dam.

Table 3. Average Year 1 Mobilization Scenario (28%) – Maximum Sediment Settling

Zone	Maximum Volume of Settled Sediment (CY)	Maximum Depth of Settled Sediment (in)
Zone 1 -Downstream of Dam*	410	0.9
Zone 2 - County Street Cove**	1,530	2.5
Zone 3 - Downstream of Cove to Ocean**	1,530***	0.04

** Only includes impounded coarse sediment. Fine sediment is expected to continue to migrate further downstream during peak flood events.*

*** Only includes impounded fine sediment, as coarse sediment has already been accounted for with deposition in Zone 1. In these zones, the dominant hydrologic influence on sediment migration is tidal, rather than river-driven, so accumulated sediment is expected to redistribute across each tide cycle.*

**** Represents the same volume of sediment that mobilizes to Zone 2. This sediment is assumed to continue to migrate downstream to Zone 3 over time.*

Due to the highly conservative assumptions discussed above for these sediment accumulation assessments, the sediment accumulation depth values shown in **Tables 2 and 3** are also highly conservative. In reality, an entire years' worth of sediment load will not accumulate instantaneously but will be spread out over a year's worth of storm events. The more incremental accumulations that will actually occur will then be distributed and spread further about by tidal activity in between storm events.

Impacts to Clam Flats

Settlement of mobilized sediment was evaluated primarily to estimate potential impacts to clam flats located downstream of the Ipswich Mills Dam. As shown in **Figure 2**, all clam flats in the vicinity of the Ipswich River are at least 1.5 miles downstream of the Ipswich Mills Dam and are entirely within the lower half of the Zone 3 sediment settling zone downstream of the County Street cove.

Figure 2. Clam Flat Locations (Numbered)

As shown in **Table 2** and **Table 3**, Zone 3 is predicted to experience the least amount of concentrated sediment settling, with a maximum annual depth of 0.09 inches of sediment expected to accumulate.

Again, the sediment mobilization analysis conducted herein evaluated the conservative, unlikely scenario in which the entire annual volume of sediment that would feasibly migrate in the first year after dam removal mobilizes in a single event. Estimates of sediment migration are likely to be much higher than the actual volume or depth of sediment that would accumulate at any given point in time.

To provide further context, the estimated 3,550 cy maximum annual sediment load to the Zone 3 clam flats area at the mouth of the river is a small fraction of the estimated annual oceanic sediment influx into the area from inflowing tides. According to Hopkinson, 2018, tidal influx is estimated to bring $9.83X10^9$ CY (13,764 MT) into the river from the ocean annually[2]. That quantity of tidal influx is 6 orders of magnitude greater than the estimated down river sediment load.

Over time, all accumulated sediment would be expected to be transported to the ocean or to areas of the river that have been sediment-deprived due to the presence of the Ipswich Mills Dam. Therefore, impacts to clam flats along the Ipswich River are expected to be negligible following dam removal.

[2] Hopkinson, C. et al., "Lateral Marsh Edge Erosion as a Source of Sediments for Vertical Marsh Accretion," Journal of Geophysical Research: Biogeosciences, 2018

Impacts to Kimball Brook

Potential erosion risks in upstream tributaries were previously evaluated in the 2019 Ipswich Mills Dam Removal Feasibility Study. Additional evaluation of the first tributary upstream of the Ipswich Mills Dam, Kimball Brook, was conducted here using the advanced H&H model developed for the permit-level design in order to respond to questions received during the MEPA public meetings.

Predicted areas of sediment transport near the confluence of Kimball Brook and the Ipswich River are shown below in **Figure 3**.

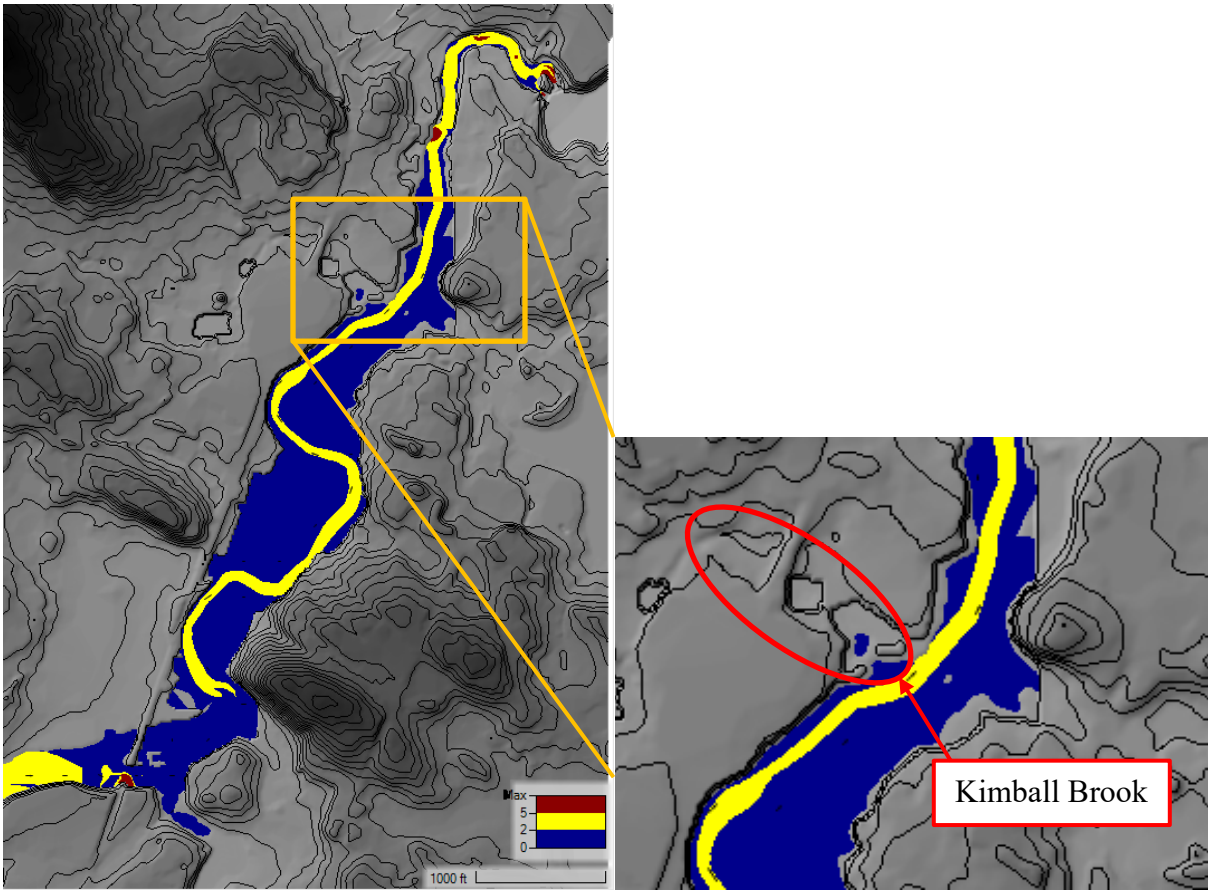


Figure 3. Proposed Channel Velocity During 2-Year Flow – Overall (Left) and Kimball Brook Confluence (Right)

Blue:	**no sediment transport expected (0-2 fps)**
Yellow:	**transport of silt is feasible (2-5 fps)**
Maroon:	**transport of silt, sand, and gravel is feasible (5 fps or greater)**

As shown above, no sediment transport is expected to occur at the immediate confluence of Kimball Brook and the Ipswich River. Transport of silt is expected to occur along the thalweg of the Ipswich River adjacent to the confluence, although this is not expected to have a significant impact on the bathymetry of the banks of the river or closer to the confluence itself. Therefore,

it appears unlikely that downcutting of Kimball Brook will occur as a result of dam removal and that significant additional sediment mobilization from Kimball Brook as a result of dam removal is also unlikely.

Alternatives Analysis

As requested during the MEPA public outreach process, this supplemental information letter provides a more detailed description of the alternatives analysis than was provided in the EENF Project Narrative and includes additional information on how alternatives were assessed during the Project's initial planning process. As stated in the EENF Project Narrative, the goals of the project are fish passage improvement, water quality improvement, upstream flood reduction, liability removal, and recreational improvement. These goals served as the basis for assessing each alternative.

According to IRWA, during the Partial Feasibility Study stage of this project approximately a decade ago, a Town-appointed committee representative of appropriate stakeholders worked in collaboration with the Town Manager, Select Board, and Town staff to assess the following alternatives. Following the assessment of these alternatives the Full Feasibility Study of full dam removal began. The Full Feasibility Study was completed in 2019 and was attached with the EENF submittal.

No Action Alternative

Under this alternative the existing dam and fish ladder would remain as is with no modifications.

- Fish Passage Improvement - Despite the presence of a fish ladder, the Ipswich Mills Dam limits the ability of migratory fish species to move upstream into the watershed to spawn or feed. It also presents hazard to freshwater species as, with the exception of those that are strong swimmers, species that pass over the dam for one reason or another are likely to become permanently trapped and cannot survive long-term below the dam. Leaving the dam in place in its current configuration would not solve either of these existing issues. This project goal would not be met by this alternative.
- Water Quality Improvement – With no action the full vertical extent of the dam would remain in place. Water would continue to warm behind the dam, eutrophication processes in the impoundment would continue without improvement, and dissolved oxygen would continue to be depleted relative to free flowing river conditions. This project goal would not be met by this alternative.
- Upstream Flood Reduction – With no action the full vertical extent of the dam would remain in place. Water would continue to be held back, posing a flood risk in higher precipitation events. This project goal would not be met by this alternative.
- Liability Removal – Through its continued existence in this alternative, the dam would continue to serve as a financial and public safety liability to the Town of Ipswich. This project goal would not be met by this alternative.

- Recreational Improvement – Due to the continued presence of the existing dam and fish ladder it will not be possible to paddle past the dam site. Recreation will neither be improved nor worsened. As such, this project goal would not be met by this alternative.

No project goals would be met by this alternative.

Fish Ladder Reconstruction Alternative

Under this alternative the existing dam would remain as is and the fish ladder would be reconstructed.

- Fish Passage Improvement – The current fish ladder is rated as "good/passable" by the Massachusetts Division of Marine Fisheries. A new fish ladder would not significantly improve fish passage of migratory fish in this location. The dam would continue to serve as a hazard to freshwater fish. This project goal would not be significantly met by this alternative.
- Water Quality Improvement – With the full vertical extent of the dam remaining in place, water would continue to warm behind the dam, eutrophication processes in the impoundment would continue without improvement, and dissolved oxygen would continue to be depleted relative to free flowing river conditions. This project goal would not be met by this alternative.
- Upstream Flood Reduction – With no alterations to the existing dam, the dam would continue to hold back water and pose an upstream flood risk. This project goal would not be met by this alternative.
- Liability Removal – Through its continued existence in this alternative, the dam would continue to serve as a financial and public safety liability to the Town of Ipswich. This project goal would not be met by this alternative.
- Recreational Improvement – The construction of a new fish ladder with no other modifications to the existing dam would not enable water-based passage through the dam site. Recreation will neither be improved nor worsened. As such, this project goal would not be met by this alternative.

One project goal would be minimally met by this alternative. The remaining project goals would not be met. Potential project funders rejected this alternative during the Partial Feasibility Study phase as any marginal benefit of improving fish passage would not be competitive with other projects, and they would be unlikely to fund a replacement fish ladder at a site with a dam rated for removal. The project team, based on feedback from the Town Manager, the Select Board, and Town staff, determined it would be infeasible to expect town taxpayers to fund this alternative.

Partial Dam Removal Alternative

Under this alternative only a portion of the vertical extent of the dam would be removed.

- Fish Passage Improvement - With only a portion of the dam removed, the remaining sections of the dam would continue to serve as a barrier to migratory fish and as a

hazard to freshwater fish species. Freshwater fish would only be able to pass at high tide.

- Water Quality Improvement – With a portion of the full vertical extent of the dam remaining in place, water temperature, eutrophication, and dissolved oxygen conditions would likely improve somewhat relative to existing conditions but continue to be depleted relative to free flowing river conditions. This project goal would be partially met by this alternative.
- Upstream Flood Reduction – Removing a portion of the vertical extent of the dam would reduce upstream flooding in proportion to the amount of dam removed. The remaining portion of the dam would continue to function as a barrier to water flow so the risk of upstream flooding would not be completely reduced. This project goal would be partially met by this alternative.
- Liability Removal – Despite being partially removed the dam would continue to serve as a financial and public safety liability to the Town of Ipswich. This project goal would not be met by this alternative.
- Recreational Improvement – Partial removal of the dam would not enable water-based passage through the dam site. Recreation will neither be improved nor worsened. As such, this project goal would not be met by this alternative.

Removing a portion of the dam would cost nearly as much as the full dam removal with only a fraction of the benefits. Two project goals would be partially met by this alternative. The remaining project goals would not be met. This alternative initially received serious consideration due to concerns over potential structural impacts to the EBSCO building from lowered water levels. However, extensive hydrogeologic studies, documented in the EENF submittal, indicate that the EBSCO building either does not have timber pilings that would be susceptible to damage from lowered water levels, or any such timber piles that may exist are at high enough elevation that partial dam removal would likely pose similar risks to the pilings as would full dam removal. Similar to the fish ladder reconstruction alternative, potential project funders during the Partial Feasibility Study phase were unwilling to fund this alternative and it was determined to be unreasonable, based on feedback from the Town Manager, the Select Board, and Town staff, to expect town taxpayers to fund this alternative.

Nature-like Fish Passage Bypass Alternative

Under this alternative, a bypass-style nature-like fish passage around the existing dam would be constructed. This alternative was determined to be not feasible due to space and habitat constraints. Nature-like fish passages need a significant amount of space in order to achieve the proper river velocities, elevation drops, and resting habitats for migratory fish. The space required for such a design does not exist at the Project site. Due to extensive development up to both of the river's edges, there is no undeveloped, Town-owned land adjacent to the river through which a nature-like fish passage could run and then tie back into the river above the dam. This alternative would also not achieve the project goals of water quality improvements, flood reduction, liability removal, and recreational improvements. As such this alternative was rejected as unfeasible.

Partial Dam Removal with In-River, Nature-Like Fishway Alternative

This alternative is similar to the nature-like fishway bypass option but would turn the actual river channel itself into the fishway due to the lack of available space for a bypass fishway. This alternative would entail lowering a portion of the dam and then creating several succeedingly lower riffle structures downstream with intermediate pools to step the hydraulic grade down.

- Fish Passage Improvement - This alternative would likely result in a significant improvement for fish passage relative to existing conditions, but less of an improvement than would full dam removal.
- Water Quality Improvement – Depending upon how low the dam itself would be lowered, this alternative could potentially result in significant water quality improvements relative to existing conditions, but less of an improvement than would be the case for full dam removal with free-flowing river conditions. This project goal would be partially met by this alternative.
- Upstream Flood Reduction – Removing a portion of the vertical extent of the dam would reduce upstream flooding in proportion to the amount of dam removed. The remaining portion of the dam would continue to function as a barrier to water flow so the risk of upstream flooding would not be completely reduced. This project goal would be partially met by this alternative.
- Liability Removal – Despite being partially removed the dam would continue to serve as a financial and public safety liability to the Town of Ipswich. This project goal would not be met by this alternative.
- Recreational Improvement – Unless the dam itself would be significantly lowered as part of this alternative, this alternative would not enable water-based passage through the dam site. As such, this project goal might or might not be met by this alternative.

Depending upon how low the dam itself would be lowered, this alternative would have variable benefits for the highest project cost. At least three, potentially four project goals would be partially met, though not as fully as would full dam removal, while the remaining project goals would not be met. Further, the degree to which most project goals would be met is dependent on how low the dam itself would be lowered as the first step down of hydraulic grade moving down river. The more of the dam vertical extent that would be removed, and the closer this alternative thereby comes to full dam removal, the greater the project benefits. However, lowering the dam significantly would result in similarly lowered impoundment water levels and, therefore, incur similar opposition from those opposed to lowered impoundment water levels as would full dam removal. In addition, depending upon how many hydraulic steps would be required to facilitate this fishway (with again the maintenance of a higher primary dam spillway requiring more subsequent hydraulic steps down river), discharge from the lowest riffle could occur relatively close to the Choate Bridge and would possibly increase erosive velocities thereby raising concerns about impacts to the bridge.

Full Dam Removal Alternative

The full dam removal alternative is described at length in the Project Narrative previously submitted and has been extensively studied since 2014. The Project will restore the Ipswich River to pre-dam conditions that existed for many thousands of years prior to initial colonial-era dam construction. All project goals would be met to the fullest extent possible. While it will lead to a loss of Land Under Waterbodies and Waterways, that loss will be converted to Bordering Vegetated Wetlands, likely improving overall wetlands habitat conditions overall. Impoundment water levels will decline overall as a result of dam removal but modeling indicates that there will still be sufficient water depth to paddle through the upstream impoundment stretch of river under most hydrologic conditions. In addition, paddling access past the former dam site would be enabled that has not existed for nearly four centuries. All project goals will be met by the Project as currently proposed.

In general, other alternatives than full dam removal are less effective at achieving project goals, are either more or similarly costly to implement, and are only considered when specific site conditions make full dam removable impossible. As has been demonstrated in the decade plus of evaluation work documented in the EENF and this Supplemental Information letter, the Ipswich Mills dam removal project does not have the associated impacts that would require the consideration of other less effective and more costly alternatives. All remaining considerations for the dam removal that may result in project design changes can be addressed during the forthcoming local, state, and federal permitting processes.

Sincerely,

Neal M. Price

Principal Scientist

HORSLEY WITTEN GROUP, INC.

Attachments: 2020 Dam Safety Report

IPSWICH MILLS DAM

PHASE I
INSPECTION/EVALUATION REPORT

Dam Name:	Ipswich Mills Dam
State ID#:	5-5-144-4
NID ID #:	MA00231
Owner Type:	Municipal
Owner:	Town of Ipswich
Town:	Ipswich, MA
Consultant:	Tetra Tech, Inc.
Date of Inspection:	September 4, 2020

EXECUTIVE SUMMARY

This report is based on the results of the Phase I visual inspection of the dam conducted by Tetra Tech, Inc. on September 4, 2020, an interview of Mr. Frank Ventimiglia, Operations Manager, Ipswich Department of Public Works (DPW) conducted during the site inspection, and data provided in the October 20, 2009 Phase I Inspection / Evaluation Report prepared by Haley & Aldrich, Inc. Ipswich Mills Dam is owned and operated by the Town of Ipswich, Massachusetts.

Ipswich Mills Dam is a run-of-the-river dam and retains the Ipswich River in Ipswich. A dam has reportedly existed at the site since 1637. According to records, the existing dam was constructed, or reconstructed, in approximately 1908 to provide a power supply to the adjacent mill buildings.

The dam consists of a cut stone spillway which extends across much of the width of the river. The right side of the dam includes a granite pier with a crest elevation about 5 ft above the spillway invert and the pier extends about 45 ft into the river. The granite pier originally included five low level gates to control water levels in the Ipswich River. Three of the outlets have been plugged over the years. One of the outlets controls flow to a fish ladder constructed in 1996. The middle outlet has a stainless-steel slide gate with a handwheel operator on the upstream side and acts as the low-level outlet for the dam. The three other outlets have been plugged including an outlet to an earlier fish ladder, which is located along the right downstream training wall.

Flow over the spillway discharges onto a rocky river bottom and continues north towards the historic Choate Bridge and flows to Plum Island Sound and the Atlantic Ocean. The river is tidal downstream of the dam. The riverbanks downstream of the dam are built up with commercial and residential buildings on the right riverbank wall. The left bank of the river includes parking lots and other developed areas.

In May 2006, heavy rains caused the dam to overtop and the Ipswich River overflowed the banks and flooded downtown Ipswich. A USGS gaging station located downstream of the Willowdale Dam and the next dam upstream from the Ipswich Mills Dam recorded a flow of 4,600 cfs on 16 May 2006. This flow was the highest recorded flow since the gaging station was installed in 1930.

Deficiencies noted during the 2020 inspection include logs on the spillway crest, small vegetation on the low-level outlet gate and the right concrete abutment walls, and a deterioration of the log boom upstream of the fishway exit channel. No water was flowing over the spillway at the time of the inspection and visual observation of the spillway downstream face indicated minimal leakage through the granite block joints.

The dam is classified by the Massachusetts Office of Dam Safety (ODS) Regulations as an Intermediate dam with Significant Hazard Potential. Failure of the dam would cause property damage and may result in loss of life if the failure occurred without warning and people were within the initial flood wave.

Based on Tetra Tech's visual observation, the dam is judged to be in satisfactory condition.

Dam Evaluation Summary Detail Sheet

1. NID ID:	MA00231	4. Inspection Date:	September 4, 2020
2. Dam Name:	Ipswich Mills Dam	5. Last Insp. Date:	October 20, 2009
3. Dam Location:	Ipswich, MA	6. Next Inspection:	September 4, 2025
7. Inspector:	Thomas C. Cook, PE		
8. Consultant:	Tetra Tech, Inc.		
9. Hazard Code:	Significant	9a. Is Hazard Code Change Requested?:	No
10. Insp. Frequency:	5 Years	11. Overall Physical Condition of Dam:	FAIR
12. Spillway Capacity (% SDF)	>100% SDF w/ no actions by Caretaker		

E1. Design Methodology:	3	E7. Low-Level Discharge Capacity:	4
E2. Level of Maintenance:	3	E8. Low-Level Outlet Physical Condition:	5
E3. Emergency Action Plan:	3	E9. Spillway Design Flood Capacity:	5
E4. Embankment Seepage:	3	E10. Overall Physical Condition of the Dam:	3
E5. Embankment Condition:	N/A	E11. Estimated Repair Cost:	$12,000
E6. Concrete Condition:	3		

Evaluation Description

E1: DESIGN METHODOLOGY
1. Unknown Design – no design records available
2. No design or post-design analyses
3. No analyses, but dam features appear suitable
4. Design or post design analysis show dam meets most criteria
5. State of the art design – design records available & dam meets all criteria

E2: LEVEL OF MAINTENANCE
1. Dam in disrepair, no evidence of maintenance, no O&M manual
2. Dam in poor level of upkeep, very little maintenance, no O&M manual
3. Dam in fair level of upkeep, some maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Dam well maintained, detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN
1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available and filed with MADCR, annual training

E4: SEEPAGE (Embankments, Foundations, & Abutments)
1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Minor seepage or high volumes of seepage with filtered collection
5. No seepage or minor seepage with filtered collection

E5: EMBANKMENT CONDITION (See Note 1)
1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained healthy uniform grass cover

E6: CONCRETE CONDITION (See Note 2)
1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment but with potential for significant structural degradation
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW-LEVEL OUTLET DISCHARGE CAPACITY
1. No low level outlet, no provisions (e.g. pumps, siphons) for emptying pond
2. No operable outlet, plans for emptying pond, but no equipment
3. Outlet with insufficient drawdown capacity, pumping equipment available
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW-LEVEL OUTLET PHYSICAL CONDITION
1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY
1. 0 - 50% of the SDF or unknown
2. 50-90% of the SDF
3. 90 - 100% of the SDF
4. >100% of the SDF with actions required by caretaker (e.g. open outlet)
5. >100% of the SDF with no actions required by caretaker

E10: OVERALL PHYSICAL CONDITION OF DAM
1. UNSAFE – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. POOR - Significant structural, operation and maintenance deficiencies are clearly recognized under normal loading conditions
3. FAIR - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters
4. SATISFACTORY - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result In deficiencies.
5. GOOD - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST

Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Changes/Deviations to Database Information since Last Inspection

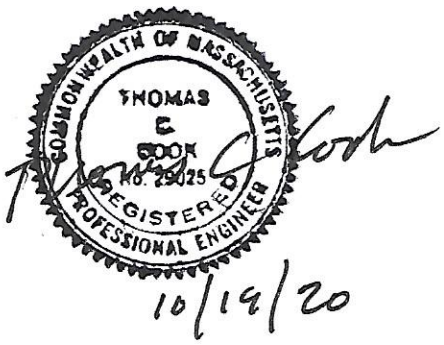
Revised spillway capacity to >100% SDF w/ no actions by operator. See notes for Outlet Works.

PREFACE

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report.

In reviewing this report, it should be realized that the described condition of the dam is based on observations of field conditions at the time of inspection, along with other data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions that might otherwise be detectable if inspected under normal operating environment of the structure.

It is important to note that the condition of a dam is evolutionary in nature and depends on numerous and constantly changing internal and external conditions. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.



Authorized/Licensed Professional's Signature

Thomas C. Cook, P.E.

Massachusetts License No.: 29025

Tetra Tech, Inc.

TABLE OF CONTENTS

Page No.

EXECUTIVE SUMMARY

DAM EVALUATION SUMMARY DETAIL SHEET PREFACE

1.0 DESCRIPTION OF PROJECT 1

1.1 General 1
1.1.1 Authority 1
1.1.2 Purpose of Work 1
1.1.3 Previous Reports 1
1.1.4 Definitions 1
1.2 Description of Project 1
1.2.1 Location 1
1.2.2 Owner *I* Operator 1
1.2.3 Purpose of Dam 2
1.2.4 Description of the Dam and Appurtenances 2
1.2.5 Operation and Maintenance 3
1.2.6 DCR Size Classification 3
1.2.7 DCR Hazard Classification 4
1.3 Pertinent Engineering Data 4
1.3.1 Drainage Area 4
1.3.2 Reservoir 4
1.3.3 Discharges at the Dam Site 4
1.3.4 General Elevations 5
1.3.5 Main/Overflow Spillway 5
1.3.6 Low Level Stoplog Spillway 5
1.3.7 Low Level Gated Outlet 5
1.3.8 Fish Ladder 5
1.3.9 Design and Construction Records 6
1.3.10 Operating Records 6

2.0 INSPECTION 6

2.0 Visual Inspection 6
2.1 General Findings 7
2.2 Dam 7
2.2.1 Spillway 7
2.2.2 Outlet Works 7
2.2.3 Abutment Walls 8
2.2.4 Fish Ladder 8
2.2.5 Log Boom 9
2.2.6 Downstream Discharge Channel 9
2.3 Caretaker Interview 9

TABLE OF CONTENTS

		Page No.
2.4	Operations and Maintenance Procedures	9
2.5	Emergency Warning System	10
2.6	Hydraulic/Hydrologic Data	10
2.7	Structural Stability	10
2.8	Overtopping Potential	10
3.0	**ASSESSMENT AND RECOMMENDATIONS**	11
3.1	Assessments	11
3.2	Additional Studies	11
3.3	Deficiencies	11
3.4	Recommendations	11
3.5	Opinion of Probable Cost	12

FIGURES

Figure 1: Project Locus

APPENDIX A - PHOTOGRAPHS

APPENDIX B - INSPECTION CHECKLISTS

APPENDIX C - PREVIOUS REPORTS AND REFERENCES

APPENDIX D – DEFINITIONS

COMPACT DISC ELECTRONIC FILE: MA01604_Rowley_2017_10_12.pdf

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Town of Ipswich retained Tetra Tech, Inc. to perform a visual inspection and develop this report of conditions for the Ipswich Mills Dam in Ipswich, Massachusetts. This inspection and report were performed in accordance with Chapter 253, Sections 44-50 of the Massachusetts General Laws.

1.1.2 Purpose of Work

The purpose of this investigation is to inspect and evaluate the present condition of the dam and appurtenant structures. This investigation compares the existing structural and hydraulic conditions of the dam to the conditions reported during previous inspections and re-evaluates hazard and size classifications as they relate to present Massachusetts 302 CMR 10.00 Dam Safety Rules and Regulations.

The investigation is divided into four parts: 1) obtain and review readily available reports, investigations, and data pertaining to the dam and appurtenant structures; 2) perform a visual inspection of the site; 3) evaluate the status and need for an emergency action plan for the site; and 4) prepare and submit a final report presenting the results of the evaluation, including recommendations, remedial actions and associated costs.

1.1.3 Previous Reports

Previous reports reviewed for the Ipswich Mills Dam 2020 inspection are listed in **Appendix C.**

The documents were provided by Ipswich DPW and are on file at the Ipswich DPW Office and the Massachusetts Office of Dam Safety in West Boylston, Massachusetts.

1.1.4 Definitions

Definitions of commonly used terms associated with dams are provided in **Appendix D.** Many of these terms may be included in this report. The terms are presented under common categories associated with dams which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; and 5) miscellaneous.

1.2 Description of Project

1.2.1 Location

Ipswich Mills Dam is located in the Town of Ipswich, Massachusetts and is located east of Saltonstall Street and west of South Main Street (Route 133), at a bend in the road south of the Choate Bridge as shown on **Figure 1**. The coordinates of the dam are 42°40.7' north latitude and 70°50.3' west longitude.

1.2.2 Owner/Operator

The dam is owned by the Town of Ipswich Department of Public Works. Frank Ventimiglia, Operations Manager, acts as the primary caretaker for the dam.

	Dam Owner	Dam Caretaker
Name	Town of Ipswich Department of Public Works	Frank Ventimiglia Operations Manager
Mailing Address	25 Green Street	25 Green Street
Town	Ipswich, MA 01938	Ipswich, MA 01938
Daytime Phone	(978) 356-6612	(978) 356-6612
Emergency Phone	911	911
Email Address	frankv@ipswichma.gov	frankv@ipswichma.gov

1.2.3 Purpose of Dam

The first dam at the site was reportedly originally constructed in 1637 by European Settlers for industrial purposes. Over the following centuries, larger dams replaced the original dam at the site, for larger industrial demands. Today, the Ipswich Mill Dam is no longer used for its original industrial purposes and exists for recreational purposes as a viewing area.

1.2.4 Description of the Dam and Appurtenances

Ipswich Mills Dam retains the Ipswich River in Ipswich, Massachusetts. According to the records, many dams have been built and rebuilt at the site since the original dam was constructed in 1637. The records indicate that the existing dam was constructed or reconstructed in 1908.

The dam consists of a main, cut stone and concrete, spillway which spans most of the width of the Ipswich River. The right side of the dam includes a non-overflow granite block wall, or "Granite Pier," which extends from the right abutment about 45 ft into the river to the spillway. The spillway is about 132 ft in length and includes a center pier from a previously demolished steel truss footbridge.

The dam abutments consist of a concrete capped or concrete encased cut stone wall on the left abutment and a cut stone wall on the right abutment. A 3 ft wide low-level spillway exists at the right end of the main spillway and is controlled with stoplogs.

A total of five outlets previously extended through the right granite pier and were controlled with wooden rack and pinion gates. Three of the outlets have been plugged and two outlets remain active. One of the active outlets regulates flow to the active fish ladder and the other active outlet consists of a low-level outlet with a slide gate. The plugged outlets include the inlet to an abandoned fish ladder, constructed in the early 1970s, an outlet blocked by the 1996 fish ladder and an abandoned and concrete plugged outlet located near the middle of the granite pier.

1.2.5 Operation and Maintenance

There are no formal, written, operations and maintenance for the dam known to the Owner. The Massachusetts Division of Marine Fisheries, Department of Fish and Game operate the fish ladder and complete river studies at the dam and they may have formal and /or written operations for the fish ladder, low level stoplog spillway and the low level gated outlet. Attempts to contact the Division of Marine Fisheries were not successful. We understand Dr. Michael Armstrong of the Division of Marine Fisheries currently oversees the river study program at the Ipswich Mills Dam.

The Ipswich River Watershed Association also typically completes, or assists with, river studies at, or near the dam. We contacted the Ipswich River Watershed Association and they are not aware of operations of the dam.

The Owner of the dam does not have an operation and maintenance plan for the dam and there is essentially no operation of the dam by the Owner. The Ipswich Department of Public Works reported that on occasion, the DPW responds to telephone calls about debris on the spillway. Other than infrequent debris removal, the DPW does not operate the dam.

The fish ladder and low level stoplog spillway are reportedly operated by the Division of Marine Fisheries, although we were not able to confirm this.

The low-level gated outlet wheel operator is secured with a chain and lock. The operation of this gate and the key to the gate lock is not known to the Town of Ipswich.

1.2.6 DCR Size Classification

The volume of water between the Ipswich Mills Dam and the next dam upstream, the Willowdale dam, is estimated to be about 200 acre-feet with the river level at the Ipswich Mills Dam spillway crest. This is consistent with the findings in the Phase I Inspection Report completed for the US Army Corps of Engineers in 1980 which stated that the impoundment has a surface area of 40 acres. Some of the volume between the dams would exist without the Ipswich Mills Dam as the dam is a run-of- the-river-dam, or the spillway length is approximately equal to the width of the impoundment.

Based on this information, the storage volume for the dam is estimated to be approximately 100 acre-feet, or half of the total volume between the Ipswich Mills and Willowdale Dams.

According to design plans for the fish ladder dated 1996 by the US Fish and Wildlife Service the streambed elevation at the dam is about El. 3.7 ft, the spillway crest is about El. 9.6 ft and the top of the granite pier is about El. 14.3 ft. The 1993 MA DEM report lists the structural height as 9 ft and the hydraulic height as 5-6 ft. The 1980 USACE report lists the dam height as 7 ft.

Based on the above information, the hydraulic height of the dam is 6 ft and the structural height of the dam is 10-½ ft.

Based on this information and according to the criteria in 302 CMR 10.00, the dam is classified as an INTERMEDIATE sized dam.

1.2.7 DCR Hazard Classification

Failure of the Ipswich Mills Dam would result in temporary flooding of the downstream Ipswich River and the initial flood wave would impact the downstream area including numerous buildings which are built on the downstream channel wall. The flood wave would likely impact the downstream banks which are heavily built up with commercial development and could impact the Choate Bridge, 700 ft downstream of the dam. The results of a preliminary dam failure analysis completed in 1980 using simplistic methods indicates that the Choate bridge would not be overtopped during a breach of the dam.

Failure of the dam would be expected to cause property damage and could possibly result in the loss of life if failure occurred without warning and people were on the riverbanks at the time of failure. The Ipswich Mills Dam is classified as SIGNIFICANT Hazard Potential Dam in accordance with 302 CMR 10.00 Dam Safety.

1.3 Pertinent Engineering Data

1.3.1 Drainage Area

The drainage area for Ipswich Mills Dam includes the Ipswich River watershed, which is approximately 149 square miles. The drainage area for the dam consists mostly of suburban communities of residential, commercial and some industrial developments with highways, local roads and railroads. The watershed also includes isolated areas of urban development with more impervious surfaces. The Ipswich River flows about 40 miles from Wilmington to Ipswich and discharges to the Atlantic Ocean at Plum Island Sound. The watershed is generally flat and ranges in elevation from about El. 150 ft at the uplands to El. 3 ft at the dam. The Ipswich River and portions of the watershed includes areas of marshy lowlands, forested land and isolated agricultural areas.

1.3.2 Reservoir

Ipswich Mills Dam impounds the Ipswich River and is a run of the river dam with the spillway extending most of the river width. The impoundment area is approximately one-half of the area between the Ipswich Mills Dam and the next upstream dam, Willowdale Dam. The impoundment has an area of about 20 acres, less than 1% of the drainage area. The reservoir is approximately 12,500 ft long and averages about 70 ft wide.

	Elevation	Storage Volume (acre-feet)
Normal Pool	9.7	200
Maximum Pool	14	300

1.3.3 Discharges at the Dam Site

Discharges from the spillway flow onto a concrete and stone splashpad at the toe of the spillway and to a rocky area of the Ipswich River. The river flows straight north for 700 ft, past

numerous buildings on the right bank and parking lots on the left bank. The river then turns east under the historic Choate Bridge, a double stone arch bridge and meanders to rocky falls just east of Country Road. The river flows generally east with mostly vegetated banks under Green Street and by the parking lot and boat ramp at East Street and Agawam Avenue. The river takes a sharp turn to the south and continues easterly past residential areas and through marshy lowlands to Plum Island Sound and the Atlantic Ocean.

1.3.4 General Elevations

Elevations referenced in this report are in feet and are based on the National Geodetic Vertical Datum (NGVD).

Normal Pool	El. 9.7 ft
Maximum Pool	El. 14.0 ft
Spillway	El. 9.7 ft
Low-Level Stoplog Spillway Invert	El. 8.7 ft
Low-Level Gated Outlet	El. 7.5+/- ft
Upstream Water at Time of Inspection	El. 9.3 ft
Streambed at Toe of the Darn	average El. 3.0 ft

1.3.5 Main/Overflow Spillway

The main spillway is 132 ft wide and constructed of cut stones with concrete at some locations due to repairs and add-ons completed over the years. The spillway crest is at El. 9.7 ft and the stream bed is at about El. 3.0 ft.

1.3.6 Low Level Stoplog Spillway

A 3 ft wide low-level spillway is fitted with stoplogs at the right end of the main spillway. This low-level outlet was constructed in 1996 to provide a strong flow to attract migratory fish to the fish ladder entrance. The low level stoplog spillway has an invert 1 ft below the main spillway at El. 8. 7 ft.

1.3.7 Low Level Gated Outlet

A low-level outlet exists through the granite pier to the right of the main spillway. Previously, the granite pier included five low level outlets with wooden gates, however, over the years three of them have been abandoned and plugged and another outlet is used for the fish ladder. The low-level gated outlet includes a stainless-steel slide gate with a wheel hand operator and rising stem on the upstream side of the outlet and was installed in 1996. The low-level gated outlet is 4.5 ft wide and 3 ft high with an invert at approximately El. 7.5 ft.

1.3.8 Fish Ladder

Two fish ladders currently exist at the dam and a fish ladder has been in place at the dam since at least 1912. According to the 2009 Inspection Report, a 21 May 1912 inspection report for

the Ipswich Mills Dam includes the note "There is a fish run on the east side."

One fish ladder was a pool and weir fish ladder and was constructed prior to 1973. This fish ladder was in major disrepair by 1993 with the concrete failing and has been abandoned. This fish ladder is straight and is located against the right downstream abutment wall and extends through the granite pier where a concrete plug has been installed to eliminate flow.

The newest fish ladder was constructed in 1996 and includes a turning pool to exit adjacent to the low-level stoplog spillway. This Denil fish ladder extends through the granite pier at the outlet nearest the spillway. The upstream end of the fish ladder is fitted with stoplog grooves to control the water flow.

1.3.9 Design and Construction Records

Several dams have existed at the site reportedly since 1637. Records on file at the Office of Dam Safety indicate the existing dam was constructed or reconstructed in 1908. Design drawings for this dam do not exist. Numerous repairs and alterations to the dam have occurred since construction including plugging outlets, notching walls, repointing, removing and installing gates, fish ladders and similar work. Some of the work completed during the past 100+ years is referenced in the files according to the 2009 Inspection Report.

1.3.10 Operating Records

Operating records for the dam do not exist.

A USGS gaging station is located at the Willowdale Dam, upstream of the Ipswich Mills Dam and flow has been recorded since 1930.

River studies were conducted at the dam site for the 2019 Ipswich Mills Dam Removal Feasibility Study prepared for the Massachusetts Division of Ecological Restoration. These studies included hydrologic and hydraulic modeling, structural assessments on the EBSCO facility, which is located adjacent to the headpond, and historical and archaeological research of the dam buildings. Marine Fisheries, however, we are not aware of what data is collected or recorded.

The Ipswich River Watershed Association (IRWA) has been visually counting fish at the Denil fishway exit channel with volunteers. Recently, a video camera has been used to record fish passage and verify the volunteer fish counts.

2.0 INSPECTION

2.1 Visual Inspection

On 4 September 2020, Tetra Tech, Inc. completed a visual inspection of the Ipswich Mills Dam. The impounded river at the time of the site visit was about El. 9.3 ft, a few inches below the spillway crest elevation. The following sections describe the conditions of the dam observed during the inspection and provide a brief discussion of the deficiencies. In addition, photographs and checklist forms are included in **Appendices A and B**, respectively, for additional information.

Based on the 2020 visual inspection, the dam and appurtenances were found to be in

satisfactory condition, consistent with the previous 2009 inspection.

2.2 General Findings

The dam consists of a run-of-the-river type dam with the spillway spanning most of the river width. The spillway did not have any water flow at the time of the site visit and the downstream face of the granite blocks was visible. There was minimal leakage through the block joints indicating the hydraulic cement sealant on the upstream face is mostly intact. The abutment contacts appear to be visually satisfactory; however, the Denil fishway encases some of the left abutment and prevents complete inspection. Leaks were not observed at the abutments.

The following were noted deficiencies:

- Cracks in the concrete at the left abutment, which are similar to the cracks observed in the 2009 inspection, were noted,
- Logs are on the spillway crest adjacent to the left abutment,
- Vegetation exists on the granite pier and low-level outlet gate,
- Vegetation exists on the right upstream and downstream training / abutment walls,
- The log boom is in disrepair and covered with vegetation,
- The Denil fishway turning pool has some concrete erosion at the wall and bottom slab construction joint.

2.3 Dam

2.3.1 Spillway

The Ipswich Mills Dam consists of a cut stone spillway mortared together with concrete and masonry repairs completed since construction of the existing dam in early 1900s. The downstream face of the spillway was visible during the site visit with no water flowing over the crest. The spillway crest appears to be in good conditions.

The 1993 inspection report included observations of open joints and recommended repointing of the joints. The 2019 Feasibility Reports indicates that the upstream was coated with a 1.5-inch thick layer of hydraulic cement sealant. Observations during the 2020 inspection indicated minimal leakage through the downstream face of the spillway indicating that the upstream face sealant is intact.

At the right end of the main spillway, there is a low-level stoplog spillway which was constructed in 1996 and the invert is 1 ft below the main spillway. The low-level stoplog spillway is fitted with stoplog grooves and is operated to provide a strong adjacent to the fish ladder and attract migratory fish to the fish ladder entrance. The low-level stoplog spillway appears to be in good condition.

2.3.2 Outlet Works

The outlet works for the dam are contained within a granite pier on the right side of the spillway. The granite pier extends into the river about 45 ft and is 5 ft wide.

Originally, the granite pier included five low level outlets which were controlled with wooden, rack and pinion gates. Three of the outlets have been plugged and two remain in service, one provides flow to the active fish ladder and one is gated for a low-level gated outlet. The outlet works appear to be in good condition.

2.3.3 Abutment Walls

The left abutment walls consist of layers of previous constructions and a patchwork of concrete and granite blocks dating to each iteration of construction. As reported in the 2009 Inspection Report, the left abutment leaked in 1948 and caused a scour hole to develop. Several attempts to fix the leaks were only partially successful and in 1952 a whirlpool developed resulting in an emergency condition. Gravel was dumped into the scour and leaks were plugged. Other than brief notes about the leaks and mention of a whirlpool, details of the fix are not available. The location of the leak would be below a constructed parking lot and walkway deck at the dam site today and the area is not accessible for inspection. Leaks or unusual flow at the left abutment were not observed during the 2020 inspection. Cracks in the left abutment wall exist at some locations, which are similar to the 2009 inspection; however, the left abutment appears to be in fair condition.

The right abutment wall consists of a mortared, vertical stone wall. The wall is in a generally straight alignment; however, each property owner along the right bank of the river apparently constructed the wall with different type stones and the different walls are readily identified. Vegetation of varying sizes is growing out of wall, at the toe of the wall and behind the wall. Grasses at the toe of the wall and behind the wall will are acceptable. Trees, woody growth and vegetation larger than about 12 in. in height should be removed to protect the wall and all vegetation should be removed from joints in the wall. The right abutment wall appears to be in fair condition.

2.3.4 Fish Ladder

Two fish ladders currently exist at the dam site. According to the 2009 Inspection Report, previous fish ladders existed at the site dating to at least 1912, maybe earlier. One existing fish ladder is located against the right downstream abutment wall and is in disrepair and has been abandoned in place. The outlet for this abandoned fishway is through the granite pier and has been plugged.

The active fish ladder was constructed in 1996 and the outlet is through the granite pier. The upstream fishway exit is through the granite pier and the outlet is fitted with stainless steel guides for stoplogs. The downstream end of the fish ladder exits adjacent to the low-level stoplog spillway. The fish ladder is operated by the Massachusetts Division of Marine Fisheries and appears to be in good condition. However, there is some concrete deterioration at the horizontal construction joint between the wall and base slab in the Denil fishway turning pool.

2.3.5 Log Boom

An approximately 2 ft diameter log boom is located upstream of the granite pier and is anchored with cable to the upstream right abutment wall. The log boom consists of five boom lengths with Styrofoam covering a steel connecting rods. The steel rods are corroded with Styrofoam surfaces and protective end plates severely deteriorated. The log boom appears to be in poor condition.

2.3.6 Downstream Discharge Channel

Discharges over the spillway flow onto the rocky riverbed and the river is channelized through this reach. The right bank consists of vertical walls and is heavily built up with commercial and residential structures. The left bank is partially vegetated with landscaped strips of grass and trees. Parking lots and paved areas are upland of the vegetated areas.

The downstream discharge channel is generally constant width and straight for about 700 ft downstream of the spillway. The river then bends to the right and flows under the Choate Bridge, a double span arch, stone bridge built in 1767 and renovated in 1989 as stated in the 2009 Inspection Report.

2.4 Caretaker Interview

At the time of the inspection, Mr. Frank Ventimiglia, Operations Manager for the Town of Ipswich Department of Public Works, was interviewed about the operation and maintenance of the dam. Mr. Ventimiglia relayed information from Ms. Vicki Halmen, Ipswich Utilities Department, Ipswich River Watershed Association (IRWA), the Massachusetts Division of Ecological Restoration (DER) and the Massachusetts Division of Marine Fisheries (DMF) concerning operations of the dam.

According to the 2009 Inspection Report, the dam has a long history in Ipswich as an industrial power source and the ownership has been passed to several property owners of the adjacent parcel on the right side for the past 100 years. The Town of Ipswich became the owner of the dam sometime between 1980 and 1993.

In 2019, the DER issued the "Ipswich Mills Dam Removal Feasibility Study" summarizing investigation conducted between 2016 and 2019. These investigations included hydrologic and hydraulic analyses, structural assessment of buildings located adjacent to the Ipswich Mills Dam impoundment and historical and archaeological research for the dam site. Investigations of the impacts on the adjacent building is still ongoing and the Town and resource agencies have not finalized a decision relative to dam removal.

The IRWA and DMF operate the Denil fishway. Volunteers conduct visual observations of fish passage in the fishway exit channel. An underwater camera is also used to record fish exiting the fishway for verification of the visual observations. A staff gage in the headpond at the fishway attraction flow outlet is used to monitor pond levels for adjustment of the Denil baffles to match river conditions and maximize fish passage.

2.5 Operation and Maintenance Procedures

There is little to no operation and maintenance of the dam. The Massachusetts Division of Marine Fisheries operates the fish ladder and apparently operates the low-level stoplog spillway. The low-level stoplog spillway is operated to maintain a strong flow at the downstream end of the fish ladder to attract migratory fish to the fish ladder entrance.

The low-level outlet gate typically remains in the closed position and infrequently opened. The Town of Ipswich does not have operating procedures. The gate hand wheel operator is secured with a chain and lock. According to the 2009 Inspection Report, the lock key may be

maintained by DMF. In August 2016, the low-level outlet gate was opened to inspect the dam for the dam removal feasibility study. According to Mr. Ventimiglia, approximately 2.5 days were required to lower the pond during low flow conditions.

On occasion, the Ipswich Department of Public Works receives phone calls from the public reporting debris on the spillway such as logs, branches and other debris. Typically, the DPW responds to the calls and removes the debris.

2.6 Emergency Warning System

There is no known formal Emergency Warning System for the dam.

2.7 Hydraulic/Hydrologic Data

Based on the DCR size and hazard classification system, the selected test flood for Ipswich Mills Dam is the 100-year storm. Developing the inflow and outflow of the impoundment during the 100-yr storm is beyond the scope of this investigation.

The capacity of the main spillway is estimated to be 3,900 cfs with the river level at El. 14.3 ft, the top of the granite pier, and 4.6 ft above the spillway crest elevation. This is about 8% less than the capacity included in the 1980 Phase I report of 4,238 cfs.

A USGS gaging station (USGS 01102000) is located 200 ft downstream of the Willowdale Dam, (Willowdale Dam is next upstream dam from the Ipswich Mills Dam on the Ipswich River) and flow data has been recorded since 1930. A review of the peak annual flow rate from 1930 to 2019 indicates the flow has exceeded 2,000 cfs on 11 occasions and has exceeded 3,000 cfs on 4 occasions since 1930. The first recorded flow exceeding 3,000 cfs was on 8 April 1987. Flow has exceeded 4,000 cfs once since 1930 with a flow of 4,600 cfs on 16 May 2006. The USGS states that a flow of 4,600 cfs on the Ipswich River is estimated to occurs about once per 150 years.

2.8 Structural Stability

The dam generally appears to be in satisfactory condition. The spillway downstream face was visible during the 2020 inspection with no water flowing over the spillway crest. Minimal leakage was observed between the granite blocks indicating that the joints are well sealed. In August 2016, the headpond was lowered to investigate the integrity of the hydraulic cement sealant on the upstream face of the spillway. The 2019 Ipswich Mills Dam Removal Feasibility Study indicated that the top 3 ft of the upstream face sealant appeared to in good conditions.

2.9 Overtopping Potential

During the period 14 to 16 May 2006, the Ipswich River overflowed its banks and flooded downtown Ipswich. The abutment walls of the Ipswich Mills Dam were overtopped, and the spillway was submerged under about 5 ft of water. As noted above, a USGS gaging station upstream of the dam at Willowdale Dam recorded a peak flow of 4,600 cfs, more than the calculated capacity of the spillway (3,900 cfs). The USGS stated a 4,600 cfs flow is estimated to occur once per 150 years and this was the largest flow recorded since the station was established in 1930. Photos of the 2006 flood are available on the internet and some of the photos from *www.ckollars.org/flood* are included in Appendix A of the 2009 Inspection

Report.

3.0 ASSESSMENT AND RECOMMENDATIONS

3.1 Assessments

The condition of the Ipswich Mills Dam in September 2020 was judged to be satisfactory. No water was flowing over the spillway at the time of the inspection and minimal leakage was observed through the granite block joints.

3.2 Additional Studies

The spillway should be always inspected during low flow conditions to visually observe the dam condition.

3.3 Deficiencies

The following deficiencies were noted during our site visit:

- Cracks exist in the concrete wall at the left upstream abutment wall,
- Isolated, small vegetation exists within the mortar joints of the granite pier to the right of the dam and at areas between the fish ladder and the granite pier.
- Small vegetation exists on spillway crest near the left abutment and on the left abutment walls which could impact the structural condition of the walls.
- Logs are on the spillway crest near the left abutment.
- Vegetation exists on the granite pier, the low-level outlet gate at the right abutment, and the right abutment walls.
- The log boom is severely deteriorated and covered with vegetation.
- A key for the lock on the low-level outlet gate was not available during the inspection.
- Some concrete erosion has occurred at the horizontal construction joint between the wall and base slab in the fishway turning pool

3.4 Recommendations

The assessment of the Ipswich Mills Dam is based on the 4 September, 2020 visual inspection. Information developed for this evaluation is adequate to assess the conditions at the dam.

We recommend the following be completed to repair the dam:

- Cracks noted in the left abutment wall should be monitored for further deterioration.
- Remove vegetation from the mortar joints in the granite pier and between the granite pier and the fish ladder.
- Remove vegetation from the spillway crest and the left abutment walls.
- Remove logs from the spillway crest.
- Remove vegetation from granite pier, the low-level outlet gate at the right abutment, the log boom, and the right abutment walls and monitor the condition of the riverbank wall along the abandoned pool and weir fishway.

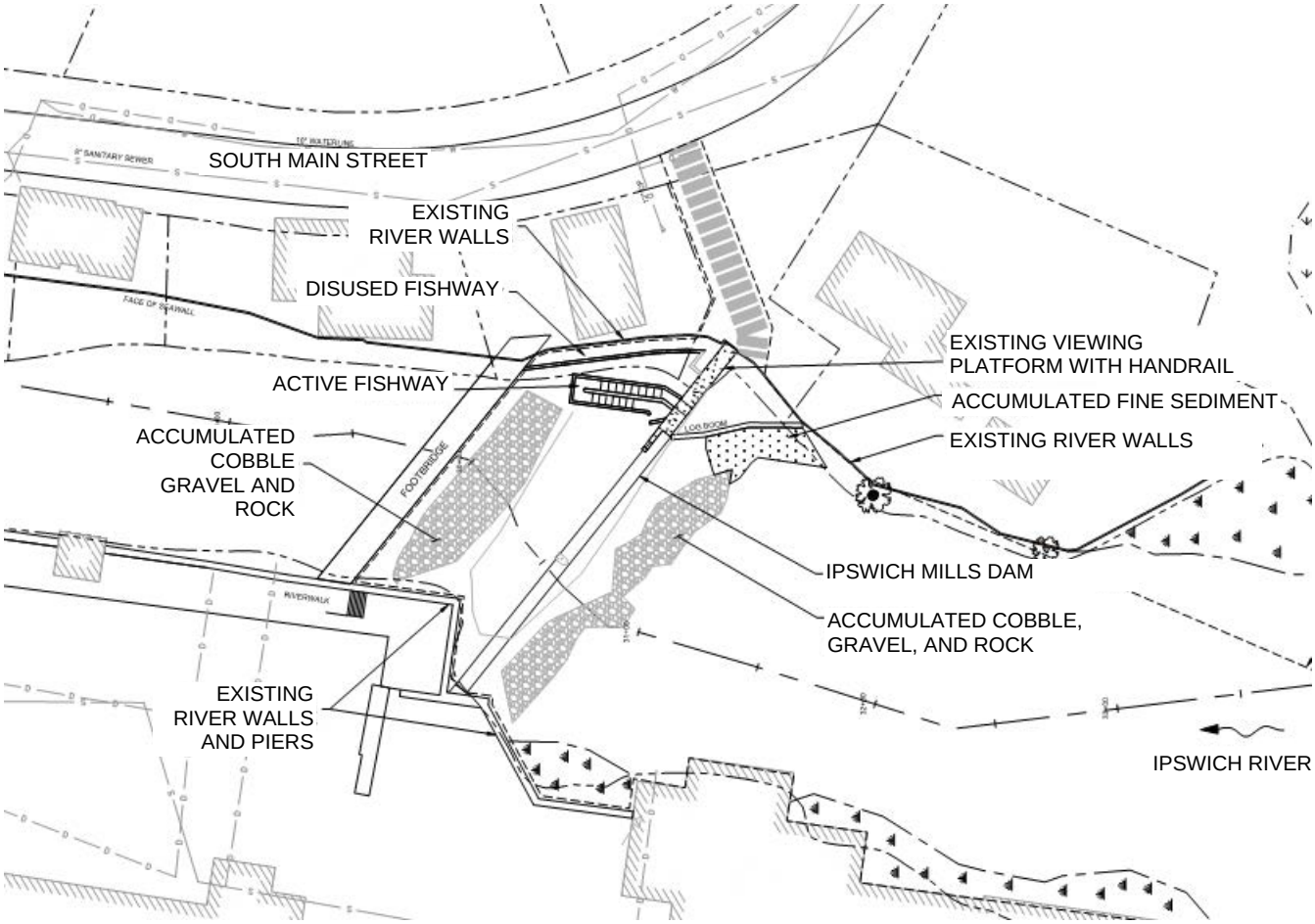
- Replace the log boom positioned upstream of the fishway exit channel and the low-level outlet.
- Obtain duplicate keys for the low-level outlet gate.
- Monitor the concrete erosion at the horizontal construction joint between the wall and base slab in the fishway turning pool.
- Continually inspect the spillway during low flow conditions to observe the condition of the spillway and monitor the condition of riverbank walls.
- Monitor right abutment walls for signs of distress from the trees behind the walls. Vegetation should be removed from the mortar joints of the wall and the trees should be removed if distress to the walls is detected.

3.5 Opinion of Probable Cost

Probable costs to implement the recommendation is estimated to be $12,000 as presented below. Please note that these costs, including estimated labor and material costs, are based on limited investigations and are provided for general information only. Actual costs will vary.

REMEDIAL MEASURE		APPROXIMATE COST
Remove vegetation		$ 2,000
Remove logs from spillway crest		$ 3,000
Replace log boom		$ 5,000
Routine dam and spillway condition monitoring		Town Resources
Contingencies (20%)		$ 2,000
	Total	$12,000

FIGURES



NOT TO SCALE

TETRA TECH

www.tetratech.com

2020 DAM INSPECTION LOCATION FIGURE

IPSWICH MILLS DAM

Project No.: **303747**

Date: SEPT. 23, 2020

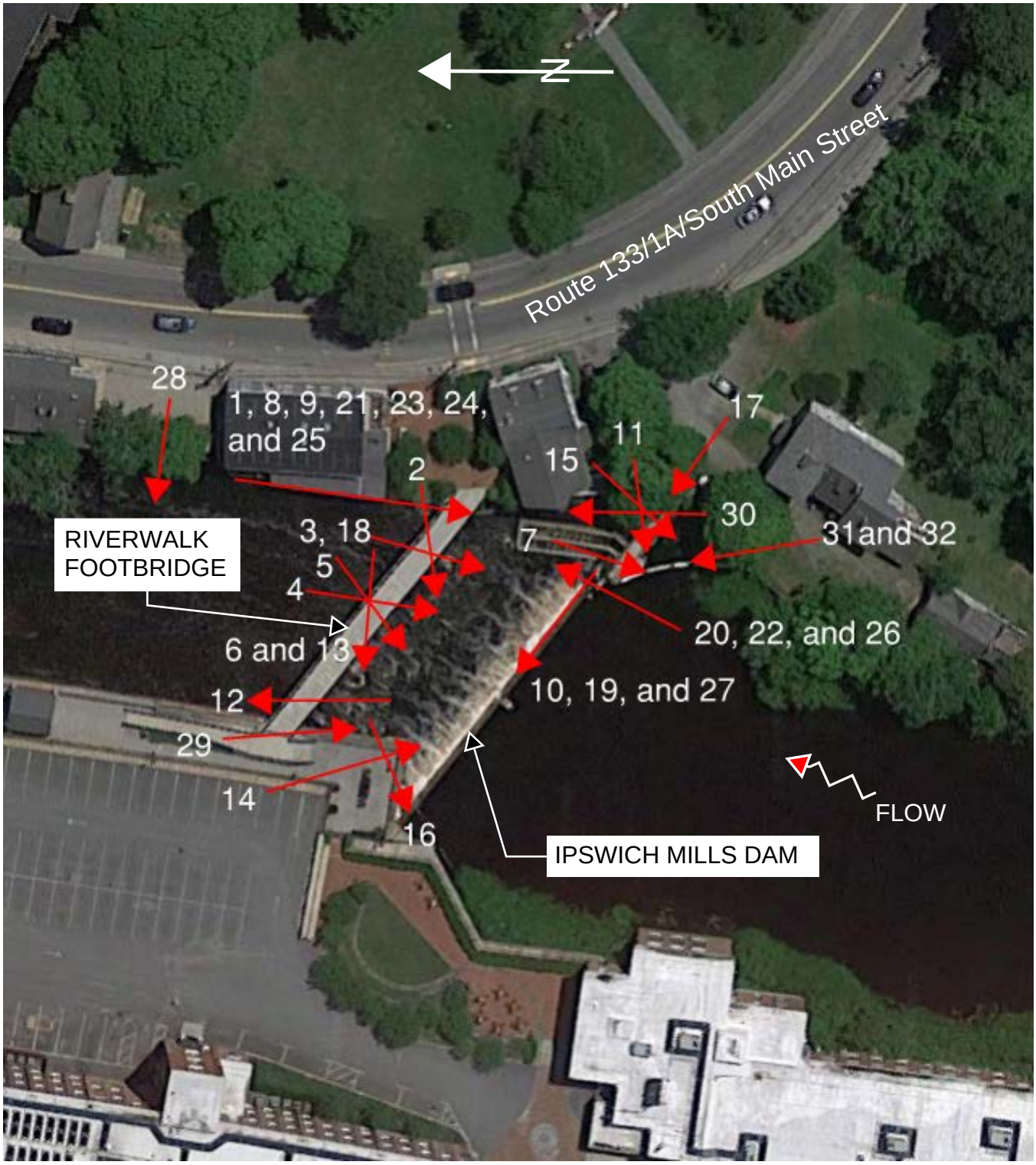
SHEET_TYPE

FIGURE 1

REFERENCE DRAWING: IPSWICH DAM REMOVAL FEASIBILITY STUDY, DWG NO. R-1, INTER-FLUVE

APPENDIX A

PHOTOGRAPH LOCATON PLAN AND PHOTOGRAPHS



NOT TO SCALE

TETRA TECH
www.tetratech.com

2020 DAM INSPECTION PHOTOGRAPH
LOCATION REFERENCE
IPSWICH MILLS DAM

Project No.: **303747**
Date: SEPT. 23, 2020

SHEET_TYPE
FIGURE 2

AERIAL PHOTOGRAPH COURTESY OF GOOGLE

Photograph 1 – Dam, fishway, and right abutment looking from footbridge

Photograph 2 – Dam and left abutment looking from footbridge

Photograph 3 - Dam, fishway, and right abutment looking from footbridge

Photograph 4 – Center of dam looking from footbridge

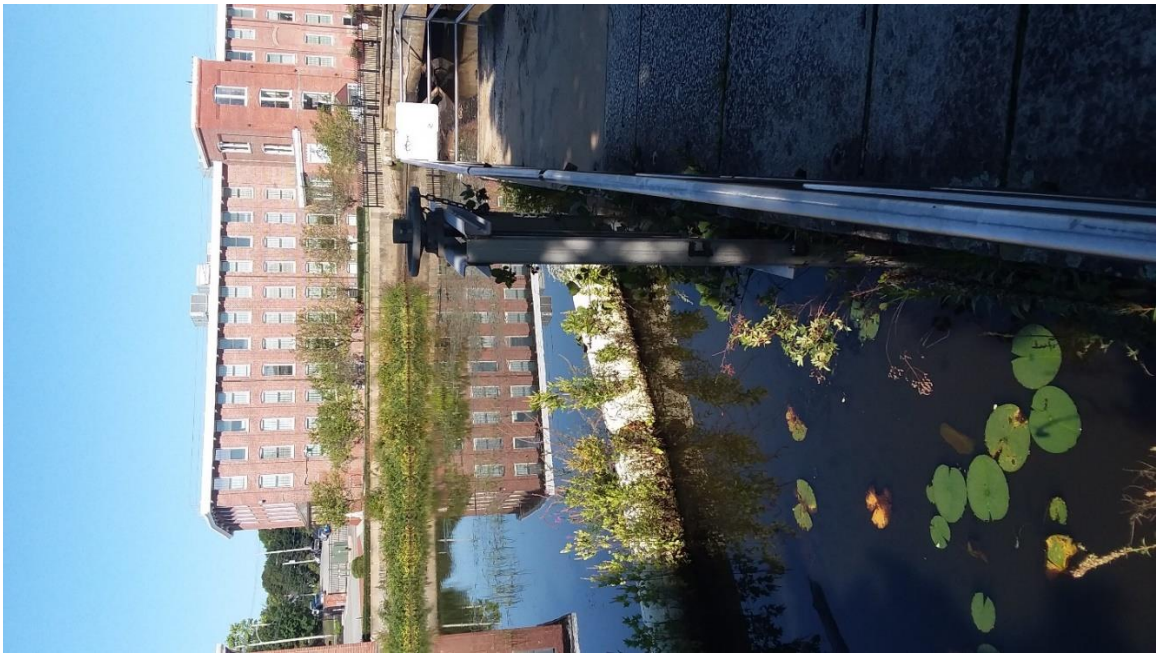
Photograph 5 – Center of dam looking from footbridge

Photograph 6 – Dam left abutment looking from footbridge

Photograph 7 – Log boom upstream of fishway exit channel looking from fishway viewing area.

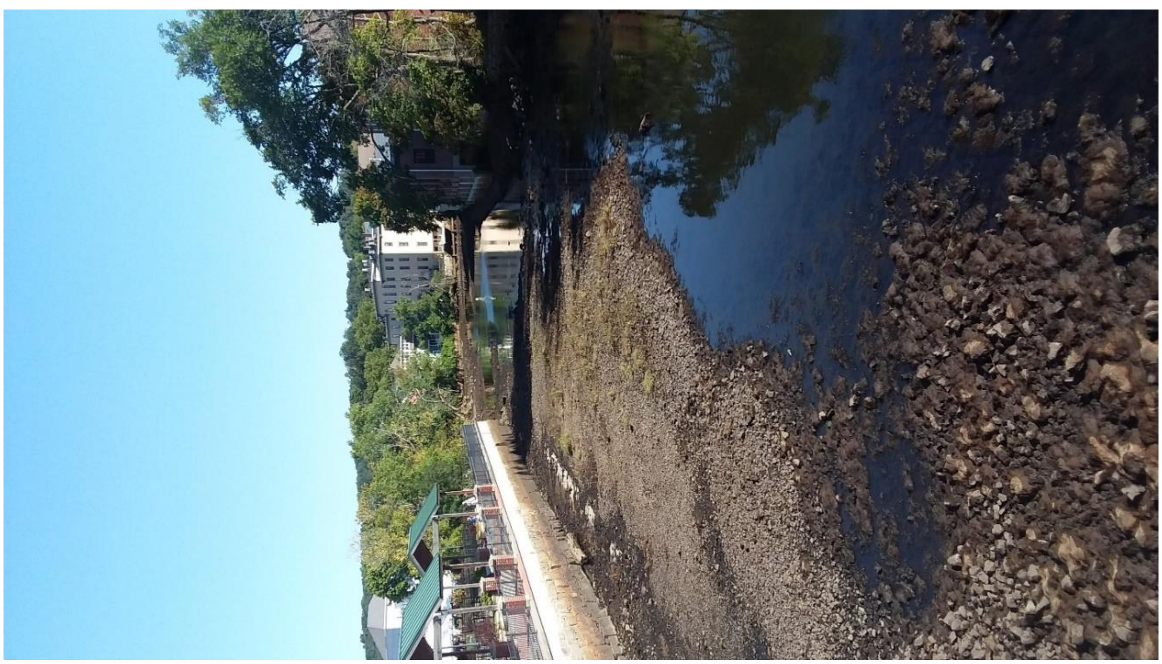
Photograph 8 – Low-level outlet discharge area between abandoned fishway and Denil fishway

Photograph 9 – Abandoned fishway along river bank wall downstream of right abutment



Photograph 10 – Log boom and low-level outlet gate looking from right abutment

Photograph 11 – Low-level outlet gate operator looking from fishway viewing area



Photograph 12 – Left river bank wall downstream of left abutment looking from footbridge

Photograph 13 – Abandoned hydropower discharge outlet downstream of dam left abutment

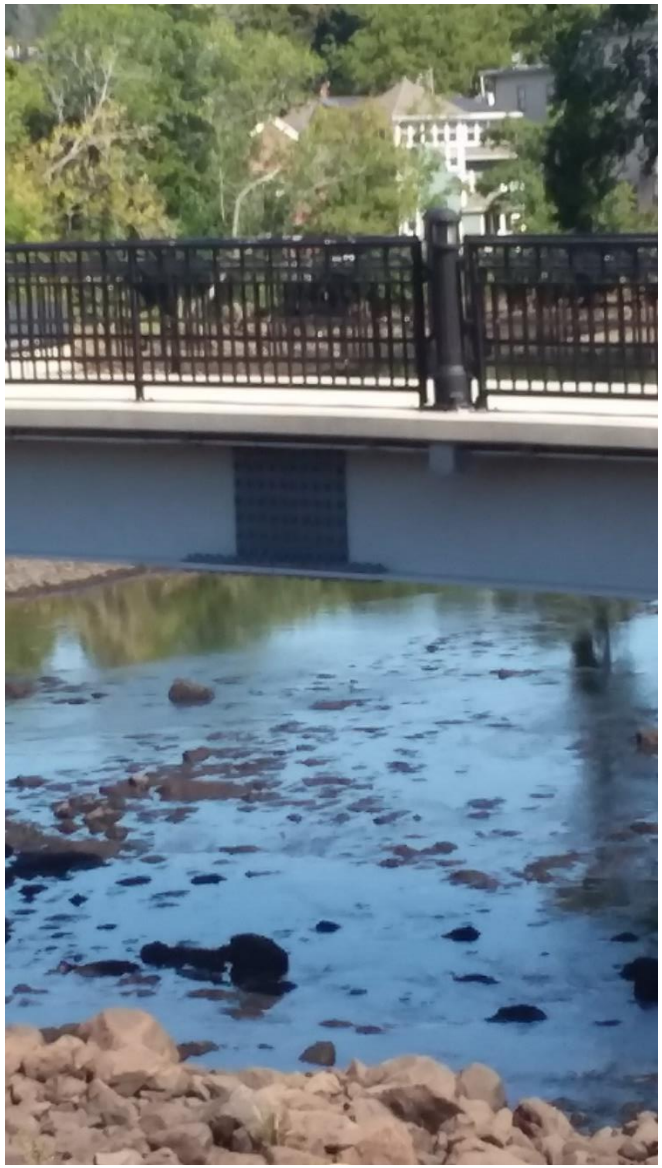
Photograph 14 – Downstream face of dam looking from left abutment

Photograph 15 – Vegetation at log boom upstream of fishway exit

Photograph 16 – Logs on dam crest at left abutment

Photograph 17 – Fishway viewing area at dam right abutment

Photograph 18 – Concrete erosion at fishway turning pool wall and footing construction joint



Photograph 20 – Footbridge beam splice plate painted dark grey looking from fishway viewing area

Photograph 19 – Staff gage at fishway attraction flow outlet looking from fishway viewing area

Photograph 22 – Footbridge abutment adjacent to abandoned fishway looking from Denil fishway

Photograph 21 – Wall and base slab construction joint concrete erosion at fishway turning pool

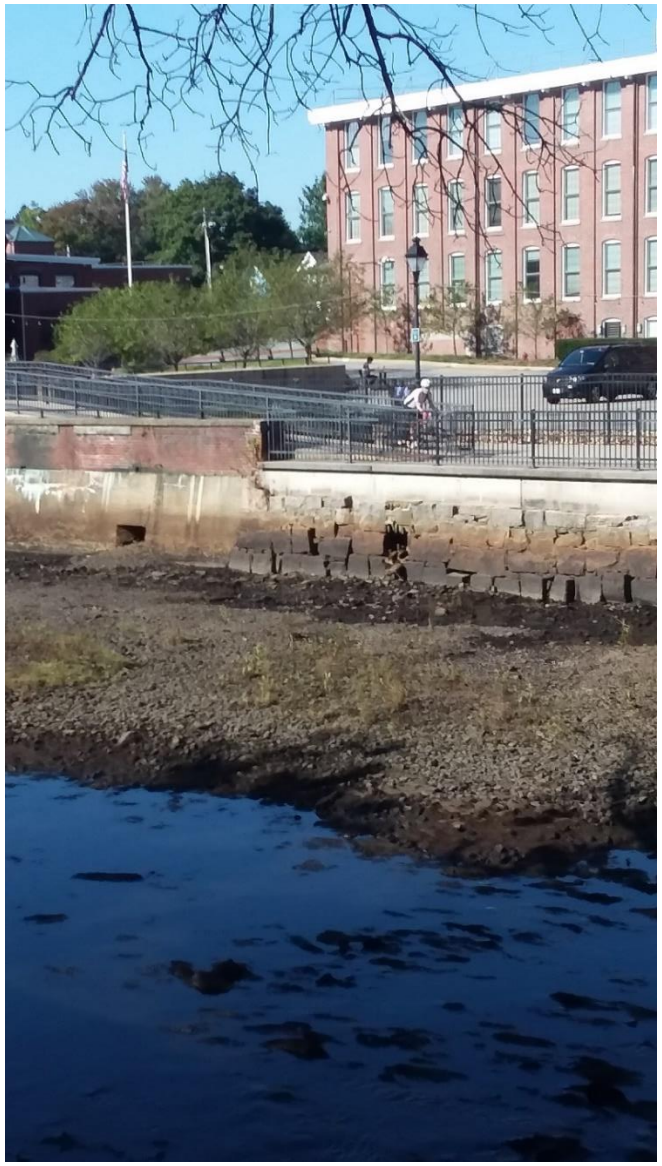
Photograph 23 – Low-level outlet on left, Denil Fishway, and fishway attraction flow outlet on right

Photograph 24 – Low-level outlet channel looking downstream from fishway viewing area

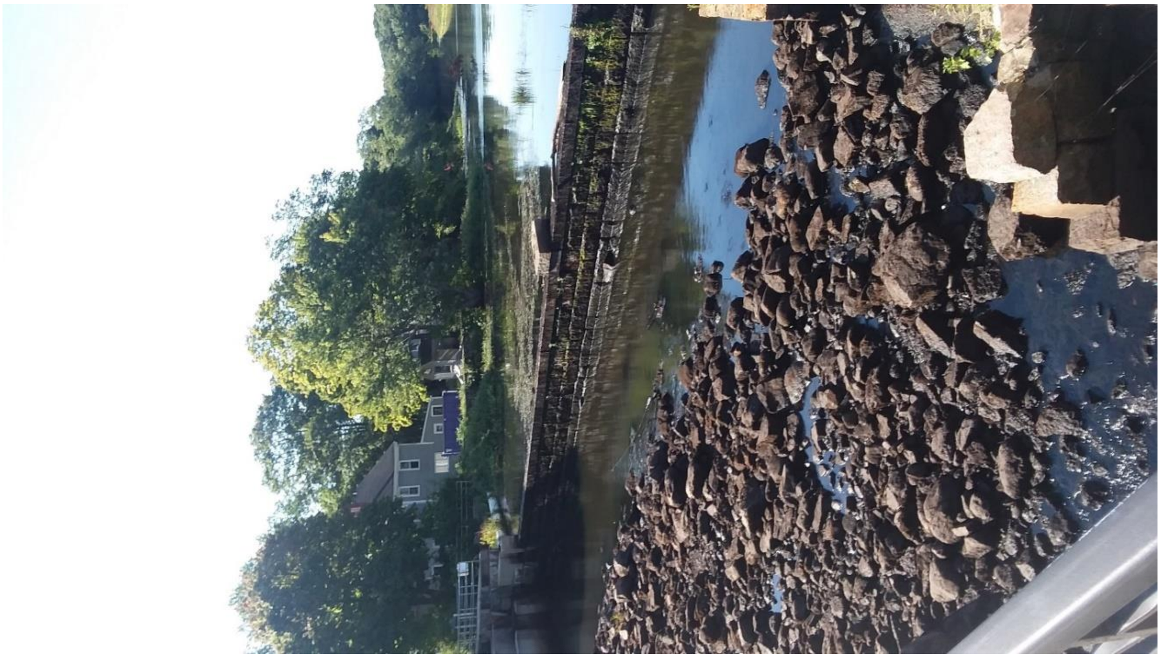
Photograph 26 – Footbridge abutment and right riverbank wall downstream of fishway

Photograph 25 – Fishway attraction flow outlet in center of photograph on dam crest adjacent to fishway

Photograph 27 – Dam crest and fishway attraction flow outlet with staff gage looking from fishway exit



Photograph 28 – Riverbank wall downstream of right dam abutment and footbridge



Photograph 29 – Downstream face of dam center looking from footbridge left abutment

Photograph 30 – Inside of abandoned fishway looking downstream from fishway viewing area

Photograph 31 – Low-level outlet gate looking downstream from right riverbank

Photograph 32 – Low-level outlet gate and Denil fishway exit looking downstream from right riverbank

APPENDIX B

INSPECTION CHECKLISTS

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM: Ipswich Mills Dam
STATE ID #: 5-5-144-4

REGISTERED: ☑ YES ☐ NO
NID ID #: MA00231

STATE SIZE CLASSIFICATION: Intermediate
STATE HAZARD CLASSIFICATION: Significant
CHANGE IN HAZARD CLASSIFICATION REQUESTED?: No

DAM LOCATION INFORMATION

CITY/TOWN: Ipswich
COUNTY: Essex

DAM LOCATION: East of Saltonstall St.
(street address if known)
ALTERNATE DAM NAME: Sylvania

USGS QUAD.: Ipswich, MA
LAT.: 42° 40.7'
LONG.: 70° 50.3'

DRAINAGE BASIN: Ipswich
RIVER: Ipswich River

IMPOUNDMENT NAME(S): Ipswich River

GENERAL DAM INFORMATION

TYPE OF DAM: Run of River, Uncontrolled Overflow Spillway
OVERALL LENGTH (FT): 180

PURPOSE OF DAM: Water Power (Abandoned)
NORMAL POOL STORAGE (ACRE-FT): 200

YEAR BUILT: 1908 - Rebuilt
MAXIMUM POOL STORAGE (ACRE-FT): 300

STRUCTURAL HEIGHT (FT): 11
EL. NORMAL POOL (FT): 9.7

HYDRAULIC HEIGHT (FT): 6
EL. MAXIMUM POOL (FT): 14.0

FOR INTERNAL MADCR USE ONLY

FOLLOW-UP INSPECTION REQUIRED: ☐ YES ☐ NO
CONDITIONAL LETTER: ☐ YES ☐ NO

NAME OF DAM: Ipswich Mills Dam | STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 | NID ID #: MA00231

INSPECTION SUMMARY

DATE OF INSPECTION: September 4, 2020 | DATE OF PREVIOUS INSPECTION: October 20, 2009

TEMPERATURE/WEATHER: 75-80 Deg. F; Sunny | ARMY CORPS PHASE I: ☑ YES ☐ NO If YES, date November 1980

CONSULTANT: Tetra Tech, Inc. | PREVIOUS DCR PHASE I: ☑ YES ☐ NO If YES, date Feb-93

BENCHMARK/DATUM: NGVD 1929

OVERALL PHYSICAL CONDITION OF DAM: FAIR | DATE OF LAST REHABILITATION: 1996

SPILLWAY CAPACITY: >100% SDF w/ no actions by Caretaker

EL. POOL DURING INSP.: 9.5 | EL. TAILWATER DURING INSP.: 3.7 (Low Tide, No Flow)

PERSONS PRESENT AT INSPECTION

NAME	TITLE/POSITION	REPRESENTING
Thomas C. Cook, PE	Principal Civil Engineer	Tetra Tech, Inc.
Robert Parsons, PE	Senior Project Manager	Tetra Tech, Inc.
Frank Ventimiglia	Operation Manager	Ipswich Department of Public Works

EVALUATION INFORMATION

	Click on box to select E-code		Click on box to select E-code
E1) TYPE OF DESIGN	3	E8) LOW-LEVEL OUTLET CONDITION	5
E2) LEVEL OF MAINTENANCE	3	E9) SPILLWAY DESIGN FLOOD CAPACITY	5
E3) EMERGENCY ACTION PLAN	3	E10) OVERALL PHYSICAL CONDITION	3
E4) EMBANKMENT SEEPAGE	3	E11) ESTIMATED REPAIR COST	$12,000
E5) EMBANKMENT CONDITION	N/A	ROADWAY OVER CREST	NO
E6) CONCRETE CONDITION	3	BRIDGE NEAR DAM	NO
E7) LOW-LEVEL OUTLET CAPACITY	4		

NAME OF INSPECTING ENGINEER: Thomas C. Cook, PE SIGNATURE:

NAME OF DAM: Ipswich Mills Dam

STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020

NID ID #: MA00231

OWNER:		CARETAKER:	
ORGANIZATION	Ipswich Department of Utilities	ORGANIZATION	Ipswich Department of Utilities
NAME/TITLE	Vicki Halmen	NAME/TITLE	Vicki Halmen
STREET	272 High Street	STREET	272 High Street
TOWN, STATE, ZIP	Ipswich, MA 01938	TOWN, STATE, ZIP	Ipswich, MA 01938
PHONE	(978) 356-6635 x108	PHONE	(978) 356-6635 x108
EMERGENCY PH. #	911	EMERGENCY PH. #	(978) 356-6635 x108
FAX		FAX	
EMAIL	vhalmen@town.ipswich./ma.us	EMAIL	vhalmen@town.ipswich./ma.us
OWNER TYPE	Municipality or Political subdivision		

PRIMARY SPILLWAY TYPE: Cut stone, fixed crest overflow

SPILLWAY LENGTH (FT): 132

SPILLWAY CAPACITY (CFS): 3,900

AUXILIARY SPILLWAY TYPE: None

AUX. SPILLWAY CAPACITY (CFS): N/A

NUMBER OF OUTLETS: 3

OUTLET(S) CAPACITY (CFS): 200

TYPE OF OUTLETS: Gated low-level and fishway

TOTAL DISCHARGE CAPACITY (CFS): 4,100

DRAINAGE AREA (SQ MI): 149

SPILLWAY DESIGN FLOOD (PERIOD/CFS): 100 yr. (4,600 cfs = 150 yr. period)

HAS DAM BEEN BREACHED OR OVERTOPPED: ☑ YES ☐ NO IF YES, PROVIDE DATE(S): May 6, 2006 overtopped

FISH LADDER (LIST TYPE IF PRESENT): Denil Fishway and a gated fishway attraction flow notch on dam crest.

DOES CREST SUPPORT PUBLIC ROAD? ☐ YES ☑ NO IF YES, ROAD NAME:

PUBLIC BRIDGE WITHIN 50' OF DAM? ☐ YES ☑ NO IF YES, ROAD/BRIDGE NAME: Footbridge 60 ft downstream of dam crest

MHD BRIDGE NO. (IF APPLICABLE):

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

EMBANKMENT (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	1. SURFACE TYPE	NA			
	2. SURFACE CRACKING	NA			
	3. SINKHOLES, ANIMAL BURROWS	NA			
	4. VERTICAL ALIGNMENT (DEPRESSIONS	NA			
	5. HORIZONTAL ALIGNMENT	NA			
	6. RUTS AND/OR PUDDLES	NA			
	7. VEGETATION (PRESENCE/CONDITION)	NA			
	8. ABUTMENT CONTACT	NA			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

EMBANKMENT (D/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S SLOPE	1. WET AREAS (NO FLOW)	NA			
	2. SEEPAGE	NA			
	3. SLIDE, SLOUGH, SCARP	NA			
	4. EMB.-ABUTMENT CONTACT	NA			
	5. SINKHOLE/ANIMAL BURROWS	NA			
	6. EROSION	NA			
	7. UNUSUAL MOVEMENT	NA			
	8. VEGETATION (PRESENCE/CONDITION)	NA			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

EMBANKMENT (U/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	1. SLIDE, SLOUGH, SCARP	NA			
	2. SLOPE PROTECTION TYPE AND COND.	NA			
	3. SINKHOLE/ANIMAL BURROWS	NA			
	4. EMB.-ABUTMENT CONTACT	NA			
	5. EROSION	NA			
	6. UNUSUAL MOVEMENT	NA			
	7. VEGETATION (PRESENCE/CONDITION)	NA			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

INSTRUMENTATION

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	1. PIEZOMETERS	None			
	2. OBSERVATION WELLS	None			
	3. STAFF GAGE AND RECORDER	Headpond water level with recorder	x		
	4. WEIRS	None			
	5. INCLINOMETERS	None			
	6. SURVEY MONUMENTS	None			
	7. DRAINS	None			
	8. FREQUENCY OF READINGS	Water level continously during migration period	x		
	9. LOCATION OF READINGS	Headpond	x		

ADDITIONAL COMMENTS: Water quality upstream of dam is monitored by Ipswich River Water Association (IRWA).
Fish are manually monitored by IRWA at fishway exit by volunteers.
A video camera is used in the fishway exit channel to verify manual fish counts.
River flow is monitored by United States Geologic Survey at Willowdale Gage located upstream of Ipswich Mills Dam

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

DOWNSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S WALLS	1. WALL TYPE	Concrete, Cut Stone, and Field Stone		x	
	2. WALL ALIGNMENT	Fair		x	
	3. WALL CONDITION	Fair		x	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: 10 ft | max: 15 ft | avg: 12 ft		x	
	5. SEEPAGE OR LEAKAGE	None observed		x	
	6. ABUTMENT CONTACT	Fair		x	
	7. EROSION/SINKHOLES BEHIND WALL	None observed		x	
	8. ANIMAL BURROWS	None observed		x	
	9. UNUSUAL MOVEMENT	None observed		x	
	10. WET AREAS AT TOE OF WALL	None observed		x	
				x	

ADDITIONAL COMMENTS: Walls generally in fair condition. Concrete walls have some cracks that should be monitored.
Some bushes along along right and left riverbank walls need to be removed.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

UPSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS			NO ACTION	MONITOR	REPAIR
U/S WALLS	1. WALL TYPE	Cut Stone, Concrete, and Field Stone			x		
	2. WALL ALIGNMENT	Fair				x	
	3. WALL CONDITION	Fair				x	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: 6 ft	max: 8	avg: 7 ft	x		
	5. ABUTMENT CONTACT	Not visible			x		
	6. EROSION/SINKHOLES BEHIND WALL	None observed				x	
	7. ANIMAL BURROWS	None observed				x	
	8. UNUSUAL MOVEMENT	None observed				x	

ADDITIONAL COMMENTS: Walls generally in fair condition. Cracks noticed in concrete left abutment should be monitored.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	1. ABUTMENT LEAKAGE	None observed		x	
	2. FOUNDATION SEEPAGE	None observed		x	
	3. SLIDE, SLOUGH, SCARP	None observed		x	
	4. WEIRS	None observed		x	
	5. DRAINAGE SYSTEM	NA		x	
	6. INSTRUMENTATION	NA	x		
	7. VEGETATION	None observed	x		
	8. ACCESSIBILITY	Limited for 300 ft below dam; visual observations from footbridge and river walk.	x		
	9. DOWNSTREAM HAZARD DESCRIPTION	Significant			
	10. DATE OF LAST EAP UPDATE	Not Applicable			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS
MISC.	1. RESERVOIR DEPTH (AVG)	3 ft
	2. RESERVOIR SHORELINE	Cut stone, field stone, concrete, and earthen banks
	3. RESERVOIR SLOPES	Varies for earthen bank; vertical with walled shoreline.
	4. ACCESS ROADS	NA
	5. SECURITY DEVICES	None
	6. VANDALISM OR TRESPASS	☐ YES ☑ NO WHAT:
	7. AVAILABILITY OF PLANS	☐ YES ☑ NO DATE:
	8. AVAILABILITY OF DESIGN CALCS	☐ YES ☑ NO DATE:
	9. AVAILABILITY OF EAP/LAST UPDATE	☐ YES ☑ NO DATE:
	10. AVAILABILITY OF O&M MANUAL	☐ YES ☑ NO DATE:
	11. CARETAKER/OWNER AVAILABLE	☑ YES ☐ NO DATE: September 4, 2020
	12. CONFINED SPACE ENTRY REQUIRED	☐ YES ☑ NO PURPOSE:

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Run of river, uncontrolled overflow	x		
	WEIR TYPE	Cut Stone, Fixed crest	x		
	SPILLWAY CONDITION	Good		x	
	TRAINING WALLS	Concrete		x	
	SPILLWAY CONTROLS AND CONDITION	NA	x		
	UNUSUAL MOVEMENT	None observed		x	
	APPROACH AREA	Not observed below water, river banks appear stable		x	
	DISCHARGE AREA	River stone between stone and concrete walls		x	
	DEBRIS	Logs on spillway crest at left abutment			x
	WATER LEVEL AT TIME OF INSPECTION	Headpond 6 inches below crest and tailwater level at base of dam.			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

AUXILIARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	NA			
	WEIR TYPE	NA			
	SPILLWAY CONDITION	NA			
	TRAINING WALLS	NA			
	SPILLWAY CONTROLS AND CONDITION	NA			
	UNUSUAL MOVEMENT	NA			
	APPROACH AREA	NA			
	DISCHARGE AREA	NA			
	DEBRIS	NA			
	WATER LEVEL AT TIME OF INSPECTION	NA			

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	**Low Level Outlet**	x		
	INTAKE STRUCTURE	Opening in dam right abutment	x		
	TRASHRACK	None	x		
	PRIMARY CLOSURE	Manual operated slide gate	x		
	SECONDARY CLOSURE	None	x		
	CONDUIT	None	x		
	OUTLET STRUCTURE/HEADWALL	Good condition	x		
	EROSION ALONG TOE OF DAM	None observed	x		
	SEEPAGE/LEAKAGE	None observed	x		
	DEBRIS/BLOCKAGE	None observed	x		
	UNUSUAL MOVEMENT	None observed	x		
	DOWNSTREAM AREA	Discharges to river bed between Denil fishway and abandoned pool and weir fishway. Footing for abandoned fishway deteriorated.		x	
	MISCELLANEOUS				

ADDITIONAL COMMENTS: Low-level outlet gate was operated in August 2016 to inspect dam for dam removal feasibility study. Approximately 2.5 days were required to lower pond during low flow conditions. The low-level outlet discharge capacity is minimal compared to the SDF and does not need to be manually opened to pass the SDF.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	**Denil Fishway**	x		
	INTAKE STRUCTURE	NA	x		
	TRASHRACK	None	x		
	PRIMARY CLOSURE	Stop Logs		x	
	SECONDARY CLOSURE	None	x		
	CONDUIT	None	x		
	OUTLET STRUCTURE/HEADWALL	Concrete, good condition		x	
	EROSION ALONG TOE OF DAM	None observed		x	
	SEEPAGE/LEAKAGE	None observed		x	
	DEBRIS/BLOCKAGE	None observed		x	
	UNUSUAL MOVEMENT	None observed		x	
	DOWNSTREAM AREA	Riverbed appears to be stable		x	
	MISCELLANEOUS				

ADDITIONAL COMMENTS: Some erosion at concrete construction joint between the turning pool downstream wall and footing. This erosion should be monitored.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	**Fishway Attraction Water Outlet**	x		
	INTAKE STRUCTURE	None	x		
	TRASHRACK	None	x		
	PRIMARY CLOSURE	Stoplog on dam crest		x	
	SECONDARY CLOSURE	None	x		
	CONDUIT	None	x		
	OUTLET STRUCTURE/HEADWALL	None	x		
	EROSION ALONG TOE OF DAM	None observed		x	
	SEEPAGE/LEAKAGE	None observed		x	
	DEBRIS/BLOCKAGE	None observed		x	
	UNUSUAL MOVEMENT	None observed		x	
	DOWNSTREAM AREA	Good condition, no rock movement	x		
	MISCELLANEOUS				

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
GENERAL	TYPE	Cut Stone fixed crest spillway; concrete abutments	x		
	AVAILABILITY OF PLANS	Not available for inspection	x		
	AVAILABILITY OF DESIGN CALCS	Not available for inspection	x		
	PIEZOMETERS	None	x		
	OBSERVATION WELLS	None	x		
	INCLINOMETERS	None	x		
	SEEPAGE GALLERY	None	x		
	UNUSUAL MOVEMENT	Not observed		x	

ADDITIONAL COMMENTS:

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

CONCRETE/MASONRY DAMS (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	TYPE	Cut Stone	x		
	SURFACE CONDITIONS	Good		x	
	CONDITIONS OF JOINTS	Good		x	
	UNUSUAL MOVEMENT	None observed		x	
	HORIZONTAL ALIGNMENT	None observed		x	
	VERTICAL ALIGNMENT	None observed		x	

ADDITIONAL COMMENTS: Headpond water level several inches below crest.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

CONCRETE/MASONRY DAMS (DOWNSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S FACE	TYPE	Cut Stone	X		
	SURFACE CONDITIONS	Good; some aquatic vegetation growing below high tide level.		X	
	CONDITIONS OF JOINTS	Minor leakage in some joints		X	
	UNUSUAL MOVEMENT	None observed		X	
	ABUTMENT CONTACT	Good		X	
	LEAKAGE	Minor leakage in some stone joints		X	

ADDITIONAL COMMENTS: Downstream face observations were at low tide and no flow over the dam crest. Only minor leakage was observed. Leakage through granite blocks should be monitored duriing low flow and low tide level conditions to identify deterioration in the hydraulic cement sealant that was installed on the upstream face of the dam during the mid-1960's repair of the dam.

NAME OF DAM: Ipswich Mills Dam STATE ID #: 5-5-144-4

INSPECTION DATE: September 4, 2020 NID ID #: MA00231

CONCRETE/MASONRY DAMS (UPSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S FACE	TYPE	Cut Stone	x		
	SURFACE CONDITIONS	Underwater, Not visible	x		
	CONDITIONS OF JOINTS	Underwater, Not Visible	x		
	UNUSUAL MOVEMENT	Underwater, Not Visible	x		
	ABUTMENT CONTACTS	Underwater, Not Visible	x		

ADDITIONAL COMMENTS: Headpond lowered in August 2016 for dam removal feasibility study. No defects in dam face were reported. The inspection indicated that the 1.5 inch thick hydraulic cement sealant on the upstream face of the top 2 ft of the granite block was relatively intact according to Frank Ventimiglia (Ipswich Public Works Operation Manager). Observations of minimal leakage through the downstream face of the dam duriing the inspection confirm this assessment.

APPENDIX C

PREVIOUS REPORTS AND REFERENCES

The following is a list of reports that were located during the file review or were referenced in previous reports.

"Ipswich Mills Dam, MA 231, Phase I Inspection Report, National Dam Inspection Program," dated November 1980, US Army Corps of Engineers

"Notice of Inspection," dated 17 September 1993, Massachusetts Department of Environmental Management

"Conceptual Plans for Fish Passage, Ipswich Mills Dam, Ipswich River, MA," dated 8 February 1994, US Fish and Wildlife Service

"Ipswich Mills Dam, Phase I Inspection / Evaluation, National Dam Inspection Program," dated October 20, 2009, Haley & Aldrich, Inc.

“Ipswich Mills Dam Removal Feasibility Study, Ipswich, Massachusetts, March 2019, Horsley Witten Group, Inc.

The documents were provided by Ipswich DPW and are on file at the Ipswich DPW Office and the Massachusetts Office of Dam Safety in West Boylston, Massachusetts.

APPENDIX D

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exits, those definitions included within 302 CMR 10.00 govern for dams located within the Commonwealth of Massachusetts.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom. including but not be limited to, spillways; reservoirs and their rims; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

Size Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.

Non-Jurisdictional – structure less than 6 feet in height or having a storage capacity of less than 15 acre-feet.

Hazard Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

High Hazard (Class I) – Shall mean dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard (Class II) – Shall mean dams located where failure may cause loss of life and damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause the interruption of the use or service of relatively important facilities.

Low Hazard (Class III) – Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

General

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.

O&M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acreto a depth of one foot. It is equal to 43,560 cubic feet. On million U.S. gallons = 3.068 acre feet

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Condition Rating

Unsafe - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.

Poor - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

Fair - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

Satisfactory - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

Good - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.