APPENDIX A-2

Renewable Power Consulting, PA's Technical report on March 2021

TOWN OF LINCOLN, MAINE

TECHNICAL REPORT

For the
CAMBOLASSE STREAM DAMS
WATER LEVEL ORDER

at the

LONG POND, CAMBOLASSE DAM, STUMP POND DAM AND HASKELL DAMS

(NID No. ME00117, ME00322, ME00176 and ME00743)

March 2021

STATE OF MAINE
ALFRED NASH
7686
LICENSED
PROFESSIONAL ENGINEER

Prepared by:
Renewable Power Consulting, PA
Palmyra, ME

RPC

CAMBOLASSE STREAM DAMS WATER LEVEL ORDER

LONG POND, CAMBOLASSE, STUMP AND HASKELL LUMBER DAMS
(NID No. ME00117, ME00322, ME00176, and ME00743)

TECHNICAL REPORT

TABLE OF CONTENTS

Table of Contents (cont'd)

1.0 *INTRODUCTION*

The Cambolasse Stream Dams include the Long Pond Dam (NID ME00177, State ID 00740) (Long Dam), the Cambolasse Pond Dam (NID ME00322, State ID 00739), the Stump Pond Dam (NID ME00176, State ID 00738), and the Haskell Lumber Dam (NID ME 00743, State ID 00737). These four dams control the water levels in Long-Caribou-Egg Ponds, Cambolasse Pond, Stump Pond and the Cambolasse Steam Reservoir (a.k.a: Haskell Pond).

The dams are privately owned and formerly operated by the Haskell Mill. The Mill ceased operations and local residents have undertaken operation and general maintenance of the dams. The Town of Lincoln, ME intends to issue a Water Level Order (Order) pursuant to the Lincoln Lakes Water Level and Minimum Flows Ordinance (Ordinance) establishing target water level requirements for each pond to reasonably ensure that public and private interest are maintained. The Town, through Farrell, Rosenblatt & Russell, retained Renewable Power Consulting, PA (RPC) to review technical information for use in development of the Order requirements. The information included in this report is limited to information associated with the requirements of the Order and does not include a review of the dam condition or design. This report is intended to provide a description and analysis of the information utilized to form the suggested water level for each pond and associated dam. The analysis is based on the requirement to consider both public and private interests without consideration of costs or alternative means to maintain the current function of the dams.

2.0 *HISTORIC WATER LEVELS AND CONDITIONS*

The four dams associated with the Cambolasse Stream were originally operated by Haskell Lumber to support downstream mill operations. Haskell Lumber used each pond as a storage reservoir with water from the dams being released during mill operations days and releases stopped or significantly reduced during the night time or non-mill operational days. These operations resulted in pond level changes of several feet throughout the year.

The State, in a limited capacity, assumed dam operations upon the mill cessation of water uses for mill operations. The State does not currently actively manage the dam sites or adjust water levels. Local residents have subsequently adjusted water level based upon local experience and experimentation. Typical the pond level is maintained throughout the non-winter period and lowered before ice formation on the various ponds.

The dams are of similar construction throughout the stream route. The dams generally consist of earthen embankments, a concrete overflow spillway section with provisions to add wooden planks and a side sluiceway. The side sluiceways are typically provided with a butterfly type of flow release mechanism (except the Haskell Dam). These mechanisms are not currently operational.

3.0 *INFORMATION SOURCES AND DATUM*

The information contained in this report was developed from interviews with Lee Haskell (dam owner), Sandra and Charles Hatch (Cambolasse Pond resident), Aaron Corro (Cambolasse Pond resident), Mr. Coleman (Long Pond resident), Roger Ryder (Caribou Pond resident), Mark Boyington (Long Pond resident), Mike McLaughlin (Long Pond resident), Jeff Gifford (former Stump Pond resident), David Hofer (Stump Pond resident) and Town officials. Additional information was solicited from the Maine Department of Environmental Protection (MDEP), the Maine Inland Fisheries and Wildlife (MIF&W), and the Maine Emergency Management Agency (MEMA). Information regarding each dam was also obtained from September 2020 Inspection Report prepared by Kleinschmidt of Pittsfield, ME, the National Inventory of Dams (NID) and the Lakes of Maine organization. Hydrology information was obtained from the USGS StreamStats database, the October 2007 Historic Flooding in Major Drainage Basins- Maine, and the USGS Water Supply Paper 2424 Flood of April 1987 in Maine.

The elevation used in this report are based upon information obtained from the above referenced sources. Verification of the reported elevations was not conducted as part of the water level review. The elevations noted in this report used the North American Datum of 1983 (NAD83).

4.0 *ORDINANCE CRITERIA AND DISCUSSION*

The Town's Ordinance was adopted in accordance with 30-A M.R.S. §§ 4454-4457, 38 M.R.S. §§ 815-818, and 38 M.R.S. § 843, and approved by the DEP. The Ordinance and State law both require that the following factors be considered in establishing flow and water levels:

A. Maintenance of public rights of access to and use of water for navigation, fishing, fowling, recreation and other lawful public uses;
B. Protect the safety of the littoral (shoreline) or riparian (river line) proprietors and the public;
C. Maintain the level and flow requirements necessary for the maintenance of fish and wildlife habitat and water quality;
D. Prevent excessive erosion of shorelines;
E. Accommodate precipitation and surface water runoff (including snow melt);
F. Maintain public and private water supplies;
G. Maintain any existing use of the dam for power generation; and
H. Maintain public access and use, fish propagation and fish passage facilities, fish and wildlife habitat and water quality downstream of the body of water.

Each of these criterions are reviewed and applied in the following sections.

4.1 Criterion A: Public Access

4.1.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to maintain the public rights of access to and use of the water for navigation, fishing, fowling, recreation and other lawful public uses.

Long Pond Public Boat Launch

4.1.2 Criterion A Discussion

The Long Pond and Stump Pond sites are equipped with public boat launch areas with the potential for additional launch sites at other dams and locations. Access to and use of the launch sites are impacted by water level with higher levels generally beneficial to use and access. Access into Egg Pond could be enhanced through increases to water levels resulting in increased water depth over submerged and exposed rocks and boulders. The current water level reduction at Stump Pond, required by Criterion F, has reduced recreational activities due to the presence of submerge obstacles. Access of ice fishing and similar winter season activities are not significantly impacted by water levels.

A reduction of historic water levels during the non-winter season would generally reduce the existing opportunities as the pond's surface area would be diminished, and fish habitat and depth reduced. In addition, a low pond level would initially expose the loose pond bed material making access and traversing of the area difficult. An increase of historic pond level will provide greater depth over existing submerged obstacles but may impact local basements and shoreline use.

4.1.3 Criterion A Suggested Water Level

Based upon the above discussion, the suggested water level target elevation necessary to satisfy this Ordinance criterion is:

Criterion A: Public Access Water Level

Long Pond Dam	309.0	** Historic Level
Cambolasse Dam	285.4	Historic Level
Stump Pond Dam	243.0	Current Level
Haskell Dam	185.0	Historic Level

** Consider increase if supported by other criteria

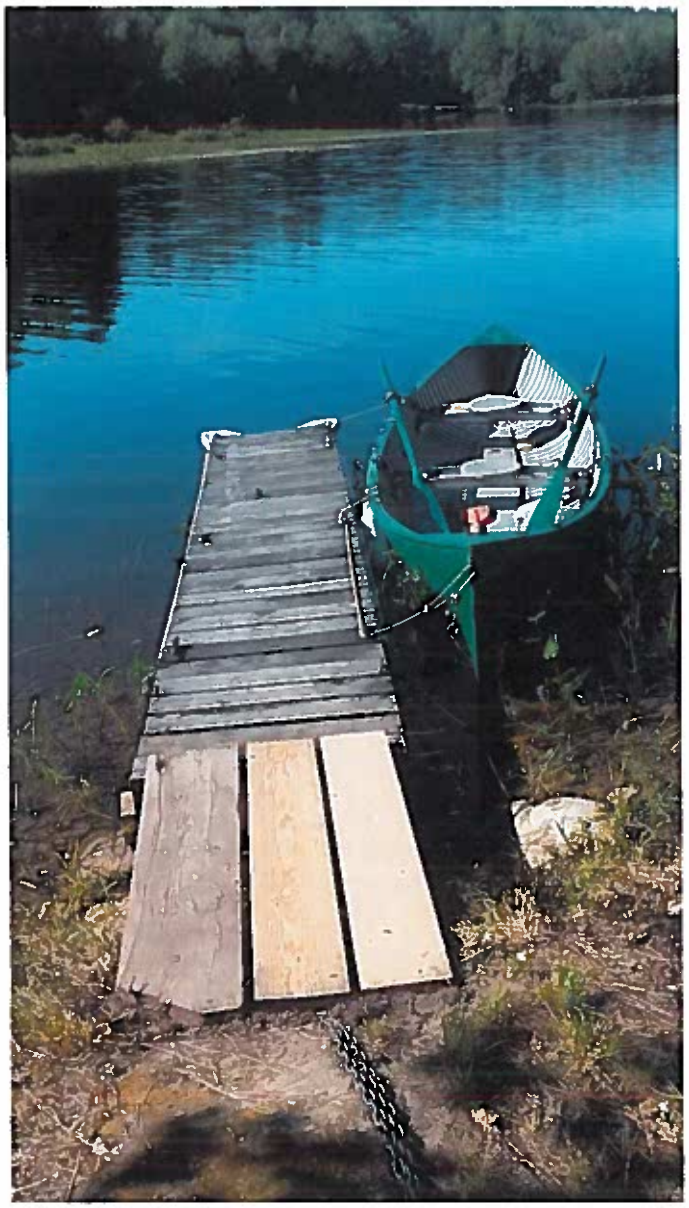
The target pond elevation shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam

4.2 Criterion B: Shoreline Protection

4.2.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to protect the safety of the littoral or riparian proprietors and the public.



Stump Pond private dock installation

4.2.2 Criterion B Discussion

4.2.2.1 Long Pond Dam

There are several shoreline proprietors impacted by water levels and existing shorelines have experienced significant erosion due to historic water level changes and ice movement. There are areas of reported undercutting of the shoreline and open-faced areas of exposed soils. Significant changes to water levels could increase erosion rates along the existing eroded areas. Increases to the historic water levels can result in local basement flooding and impacts to water fowl nesting sites. A reduction in current water levels could result in access along the shoreline being hindered due to the unconsolidated bed material immediately adjacent to the existing shoreline. Water levels below the historic level could also result in exposure of the existing pond bottom to erosive forces until new plant growth could be established.

Ice movement and formation within the pond area has resulted in shoreline damage. Existing stone shoreline protection have become dislodged through changing ice patterns, particularly when the pond level remains high. A reduced water level during the winter season would be beneficial to address this impact.

4.2.2.2 Cambolasse Dam

The former pond level changes during the mill operational period typically exposed "beach" areas throughout the pond region. The more recent historic pond levels have resulted in a loss of use to the local residents for these areas. Residents have also indicated that shoreline areas can have "soft" spots and occasional sinkholes due to recent water levels. Sinkholes or shoreline areas of depression are typically caused through subsurface loss of soils due to changing levels of soil saturation. The historic water level changes of the 1960s era may have resulted in the shoreline areas being saturated and subsequently removed these soils when the water level receded. Sinkholes can be undetected due to this action for numerous years with the results similar to the current experience of "soft" or depressed surfaces when water levels are restored.

The potential damage experienced through the previous large variations in pond levels is an existing condition that cannot be readily corrected. Reduced water levels can be beneficial in reducing the impact by limiting the impact of water saturating the subsurface. An increase in water level would likely exacerbate the impact to the shoreline areas

Ice movement and formation within the pond area has resulted in frequent shoreline damage. Existing stone shoreline protection have become dislodged through changing ice patterns, particularly when the pond level remains high. A reduced water level during the winter season would be beneficial to address this impact.

4.2.2.3 Stump Pond Dam

The Stump Pond has historically been kept higher than current water levels. The current water level was reported to have been established by the State to reduce stress on the dam (refer to the discussion under Criterion F (Water Supply)). The reduced water levels, while currently necessary, have increased water hazards from submerged objects, increase difficulty in accessing the pond and subjected sand bar areas to increase ice movement erosion. A decrease in water level could result in the pond becoming averse to recreational use and increase difficulties accessing the pond. An increase to historic water levels would be beneficial once the dam is considered structurally adequate to support the increase water level.

4.2.2.4 Haskell Dam

The Haskell Dam historically been associated with industrial/commercial pond use and adjacent land use. Therefore, littoral proprietor use and protection can be maintained through the reestablishment of the dam's integrity and return to historic water levels.

4.2.3 Criterion B Suggested Water Level

Based upon the above discussion, the suggested water level target elevation necessary to satisfy this Ordinance criterion is:

Criterion B: Shoreline Protection Water Level

	Non-Winter/Winter	
Long Pond Dam	309.0 / 307.8	Historic Level
Cambolasse Dam	285.0 / 284.3	* 4" below non-Winter Historic Level
Stump Pond Dam	243.0 / 242.5	Current Level
Haskell Dam	185.0 / 183.5	Historic Level

*Consider additional decrease if supported by other criteria

The target pond elevation shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam.

4.3 Criterion C: Fish and Wildlife Habitat and Water Quality

4.3.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels and minimum flow requirements necessary for the maintenance of fish and wildlife habitat and water quality.

4.3.2 Criterion C Discussion

Every dam is required to release a minimum flow into the outlet stream or river below a dam to maintain aquatic habitat and water quality. The State agencies typically use the median flow for August (typically the lowest flow month) as the aquatic base flow to set the required minimum flow. These flows can also be varied throughout the year to seek to mimic typical seasonal flow variations. Mean monthly flows at each dam were obtained using the USGS StreamStats data with the following results:

Cambolasse Stream Mean Monthly Flows (cfs)

Month	Long Pond Dam	Cambolasse Dam	Stump Pond Dam	Haskell Dam
January	21.5	24.3	31.1	32.4
February	11.2	12.9	17.4	18.1
March	13.6	14.1	18.0	18.7
April	39.0	41.6	54.1	56.3
May	50.0	63.2	89.1	92.8
June	19.0	21.9	29.3	30.5
July	6.7	7.8	10.6	11.0
August	3.8	4.4	6.0	6.2
September	4.2	4.9	6.5	6.8
October	19.1	21.6	27.9	29.1
November	32.3	36.8	47.9	49.9
December	30.4	34.6	44.9	46.8

The minimum flow amount is currently released through flow over the top of the dam crest or boards and or through sluiceway valve leakage.

The periods in which the inflow to the system is less than the indicated amounts would likely be accompanied by gradual reduction in pond level and during a high temperature and low precipitation period. The ponds are not required to be used to maintain the discharge during these short duration events and the release can be reduced to inflows into the pond to maintain a constant water level. The historic extreme low inflow during the month of August (typical low inflow period) varies between 0.4 to 0.7 cfs per the USGS developed StreamStats database (7Q10 inflow). This flow rate represents the lowest 7-day average flow that occurs on average once every 10 years. A review of the impact of the current minimum flow release requirements using the 7Q10 inflow indicates that the potential pond level change during a 30-day period for the various ponds varies from 3 to 23 inches and can therefore be significant. The minimum flow releases will require adjustment during these periods to maintain water

levels and associated water quality through avoidance of shoreline erosion. A reduction in the flow will generally be automatically accomplished when all flows are passed over the dam crest/boards or through adjustment of the sluiceway valve once (if) they are returned to service.

The manner in which the flow is released impacts downstream water quality. Water releases which cascade down into the receiving water entrap air and thereby increase dissolved oxygen (DO) in the water. The current manner in which the flows are release result in the potential for enhanced DO concentration levels and thereby improved water quality.

The State has previously stocked Long-Caribou-Egg ponds with brook trout. An increase in historic water levels may increase fisheries habitat while reducing terrestrial habitat. An increase in water level could also result in shoreline area inundation causing potential soil erosion from waves (wind or as a result of recreational boating activity) or wind uprooting vegetation. Shoreline erosion would degrade the water quality of the pond and downstream waters through contamination of the waters. Reducing the water level below established norms could result in the exposure of unstable soils causing water quality impacts. Therefore, maintaining historic water levels is beneficial for littoral preservation and water quality.

4.3.3 Criterion C Suggested Water Level

Based upon the above discussion, the suggested water level necessary to satisfy this Ordinance criterion is:

Criterion C: Habitat and Water Quality Water Level

	Elevation	Minimum Flow (cfs)[1]
Long Pond Dam	309.0 Historic Level	3.8
Cambolasse Dam	285.4 Historic Level	4.4
Stump Pond Dam	243.0 Current Level	6.0
Haskell Dam	185.0 Historic Level	6.2

1. Adjust during low inflow periods

The target pond shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam. The current means of suppling a minimum outflow shall be maintained at all times. Outflows shall be adjusted during period of low inflows to maintain target pond level.

4.4 Criterion D: Erosion Protection

4.4.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to prevent excessive erosion of shorelines.

Typical shoreline or embankment erosion

4.4.2 Criterion D Discussion

The maintenance of consistent water levels minimizes the potential for shoreline erosion as vegetation protection can be established. The historic pond levels have been established for several years which has permitted the shorelines to stabilize and establish protective vegetative growth. The Dam's presence permits the ability to minimize water level changes through adjustment of the Dam's discharge mechanisms.

Fast moving water and ice movement can cause shoreline erosion to occur. In addition, killing of large trees or brush can result in pull out of the root system exposing the soil beneath and the immediately surrounding area of the root system being exposed to erosion. Raising the water level above the historic level may result in saturation of the soil and increased exposure to erosion and local slope failure. A reduction in historic pond level may expose the immediate non-vegetated pond bed to be exposed. The exposed pond bed would likely become covered with vegetation but in the near term newly exposed pond base would be subject to erosive forces during the spring thaw flows and ice (if present) movement.

Residents have reported that significant damage to the shoreline occurs during the winter season from ice movement or build up if the ponds are not lowered sufficiently. This condition indicates that seasonal levels should be considered.

4.4.3 Criterion D Suggested Water Level

Based upon the above discussion, the suggested water level target elevation necessary to satisfy this Ordinance criterion is:

Criterion D: Erosion Protection Water Level

	Non-Winter/Winter	
Long Pond Dam	309.0 / 307.8	Historic Level
Cambolasse Dam	285.4 / 284.3	Historic Level
Stump Pond Dam	243.0 / 242.5	Current Level
Haskell Dam	185.0 / 183.5	Historic Level

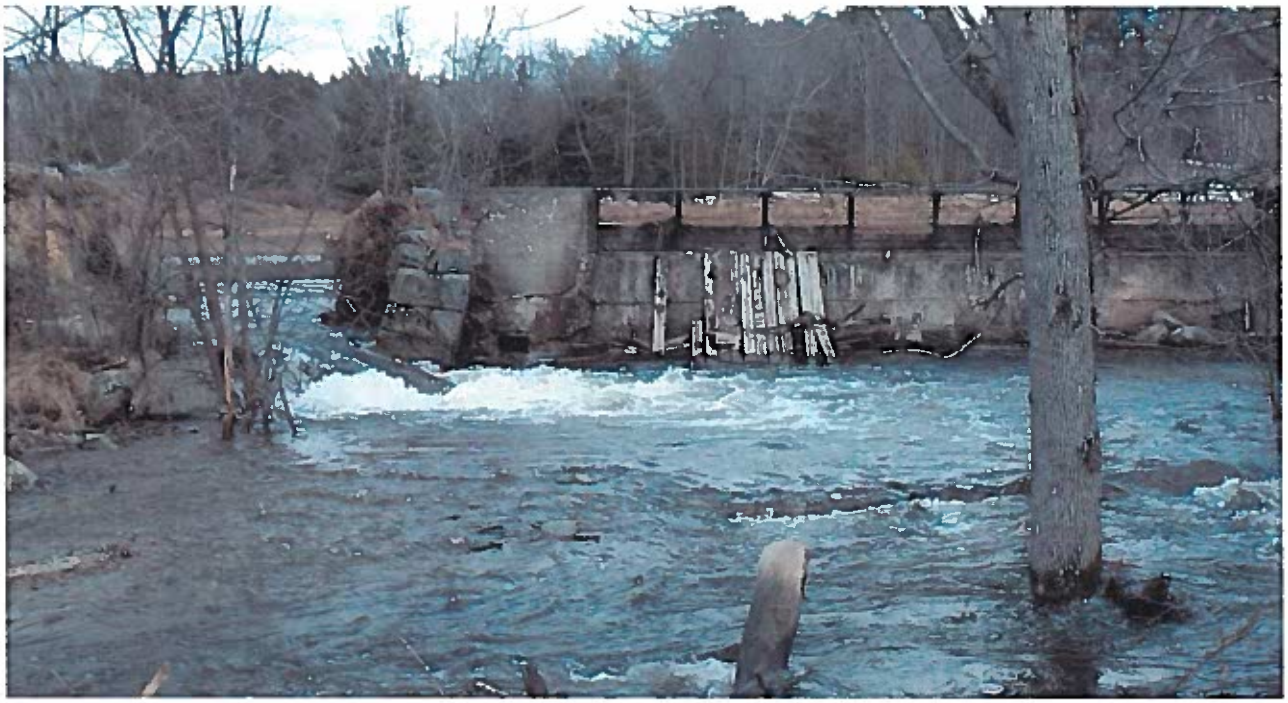
The target pond elevation shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam.

4.5 Criterion E: Flood Protection

4.5.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to accommodate precipitation and run off waters.



Haskell Dam Failure in 2020 due to Flood Flows

Stump Pond Discharge

4.5.2 Criterion E Discussion

The Cambolasse Stream dams, except the Haskell Dam, are equipped with a main concrete overflow spillway and a side sluiceway. The Haskell Dam is equipped with a diversion channel which formerly served a similar function as the sluiceways of the other dams located on the Cambolasse Stream. The details of each sluiceway control mechanism are unknown and the sluiceways, except for the Stump Pond Dam, are inoperable. The Stump Pond Dam's sluiceway valve has failed and discharge flows through the sluiceway are restricted by a wooden baffle installed upstream of the control valve.

Flows over the overflow spillway are impacted by the installation of removable boards across the entire width of each spillway. The discharge capacity calculations are based upon all boards being removed and flow discharge controlled by the permanent concrete crest elevation.

The discharge capacity at each dam was calculated and compared to the Spillway Design Flood (SDF) for each dam. The calculated discharged did not include, except for Stump Pond, discharge through the sluiceway. The Stump Pond sluiceway discharge was calculated with the wooden baffle installed. The discharge capacities were calculated based on reported dimensions and assumptions without field verification of the dimensions.

The potential flows for each of dam with varying frequency intervals were obtain and are indicated in the following table. The dams successfully passed high flows during the 1987 flood event which has a recurrence interval of around 65-years, which is below typical SDF values. The SDF magnitude is unknown for the dams but is typically equal to the 100-year flood flow for low hazard and low to intermediate height dams. The 100-year flow was compared to the calculated discharge capacity to review the potential for overtopping or breach of the dam system.

Flood Frequency Flows (cfs)				
Recurrence Interval	Long Pond	Cambolasse Pond	Stump Pond	Haskell Pond
1-year	76	241	310	323
2-year	261	275	347	361
5-year	409	418	522	544
10-year	509	522	648	675
25-year	669	661	816	850
50-year	772	769	945	984
100-year	905	885	1080	1125

4.5.2.1 Long Pond Dam:

The maximum calculated discharge from the Long Pond dam is around 505 cfs which has a recurrence interval of around 10-years. Flow above the discharge capacity will likely result in overtopping of the dam and adjacent dike. The 100-year flood level would result in approximately 5-inches of overtopping and would likely result in a breach of the dike area immediately adjacent to the side overflow spillway. Restoration of the sluiceway discharge valve operation and function may reduce or eliminate the discharge deficiency.

The Pond storage capacity is insufficient to significantly modify the water flows through the site during unusually high run off events (flood flow events). However, lowering of the pond level to near the concrete crest elevation (Elevation 307.8 ft) can provide limited relief from significant flow events.

The volume capacity created by this reduction would, with all boards removed, result in the containment of the 100-year flood flow event for approximately 1.5 days before overtopping would occur. A return to service of the sluiceway valve would potentially double the delay in overtopping. The additional retainage time would likely be beneficial as flows may recede quickly and thereby reducing the risk of overtopping.

A suggested water level from local residents is to maintain the winter pool level around 3-inches above the crest of the dam (Elevation 308.1 ft). The increase in level was believed to be an enhancement for access into the Egg pond. A water level of 3 ½" above the crest (standard 2x4 dimension) would result in a decrease of the time before overtopping of around 3 hours from a pond level at the crest. This potential impact to overtopping delay

is not considered significant and could be adopted by the Town at a future date should access to Egg Pond be significantly impacted.

4.5.2.2 Cambolasse Dam:

The calculated discharge from the Cambolasse Pond dam is greater than the 100-year flood flow of 885 cfs. The pond level during the 100-year flood flow is around 6 inches below the embankment crest when all boards are removed from the concrete crest. Typical dam criterion is to maintain a minimum of 12-inches "free board" (difference between water level and top of water retaining device). The limited amount of remaining embankment above the theoretical flood level is sufficient to warrant removal of all boards in preparation for flood flows.

4.5.2.3 Stump Pond Dam:

The calculated discharge from the Stump Pond dam is greater than the 100-year flood flow of 1,080 cfs. The pond level during the 100-year flood flow is around 5 inches below the embankment crest when all boards are removed from the concrete crest. Typical dam criterion is to maintain a minimum of 12-inches "free board" (difference between water level and top of water retaining device). The limited amount of remaining embankment above the theoretical flood level is sufficient to warrant removal of all boards in preparation for flood flows.

4.5.2.4 Haskell Dam:

The Haskell Dam failed in 2020 through a breach in the dike portion abutting the concrete overflow spillway. Approximately 22-inches of boards were installed at the time of the breach. The breach occurred at the embankment to concrete interface and was potentially a result of a design or construction error. The calculated discharge from the concrete spillway portion of the Haskell Pond dam is greater than the 100-year flood flow of 1,125 cfs when all boards are removed. The theoretical pond level during the 100-year flood flow is around 4 inches below the embankment crest when all boards are removed from the concrete crest. Removal of the boards during the 2020 breach may have prevented the breach from occurring. The limited amount of remaining embankment above the theoretical flood level is sufficient to warrant removal of all boards in preparation for flood flows.

4.5.3 Criterion E Suggested Water Level

Based upon the above discussion, the suggested water level target elevation necessary to satisfy this Ordinance criterion is:

Criterion E: Flood Protection Water Level [2, 3]		
Long Pond Dam	307.8	Historic Level
Cambolasse Dam	284.3	Historic Level
Stump Pond Dam	242.5	Current Level
Haskell Dam	183.5	Historic Level

2. All boards removed
3. Restoration of sluiceway valves may permit higher pond levels if human intervention and operation is available

The target pond elevation shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam.

4.6 Criterion F: Water Supply

4.6.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to maintain public and private water supplies.

4.6.2 Criterion F Discussion

Residents along the various ponds withdraw insignificant water volume for incidental, non-consumption use. Variations of the pond levels are not anticipated to significantly impact these withdrawals or local well water supplies. The ponds provide a water source for public use during fire suppression activities. The Stump Pond is a seasonal water source to support the Jato Highlands Golf Course.

The Haskell Dam is the only pond currently equipped with a "dry" hydrant for fire suppression operations. The dam breach renders this hydrant inoperable. Installation of dry hydrants on other pond may occur in the future, particularly with the ongoing development adjacent to Long Pond.

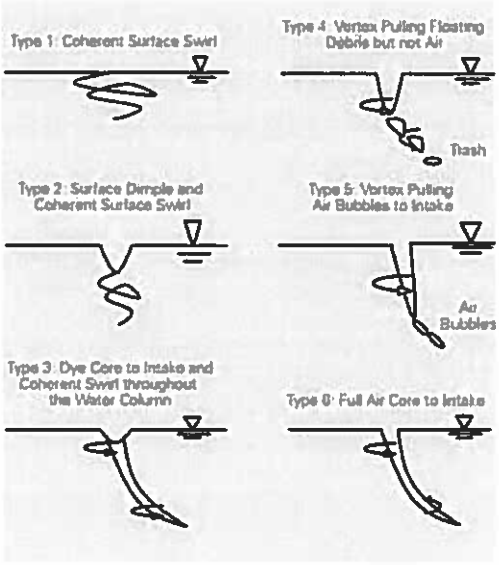
The details of the water withdrawal system at Stump Pond are not currently known but have been reported as a large diesel pump operated during the dry seasons (*i.e.*: July/August). The intake for the pump would typically consists of a single intake pipe that could be adjusted for varying water levels. Dry hydrants typically have a horizontal intake pipe with a perforated pipe section or a screen. The hydrants intakes are often located in "shallow" water (around 3-foot depth).

The Stump Pond Dam is reported to be in poor condition due to its failed sluiceway valve and failed spillway apron. The historic water level for the pond was reduced in the late 2010s to minimize loading on the dam. The loss of the dam would result in the inability to be in compliance with this criterion and therefore the current/recent water levels should be maintained until the dam condition is improved.

Typical Dry Hydrant

An important aspect of efficient pump operation during water supply or fire suppression activities is the avoidance of surface vortices. The formation of vortexes at the suction inlet causes air to enter the suction line which reduces the capacity of the line. The required submergence is typically above a water depth of 24-inches.

Typical surface vortex due to insufficient submergence



Types of vortexes

The pond level should be adequate to permit fire suppression operations to occur while the site experiences low inflows. The historic extreme low

inflow varies between 0.4 to 0.7 cfs per the USGS developed StreamStats database (7-day 10-year low flow). The current dam minimum flow release (discussed in Section 3 of this report) exceeds this potential inflow. The potential drop in water levels during a 30-day period with extreme low inflow varies for the various ponds from 3 to 23 inches and can therefore be significant. The low inflow period would likely coincide with extreme dry surface conditions resulting in increased potential for the need for fire suppression ability. The minimum flow releases will require adjustment during these periods to maintain public water supplies.

A reduction in historic water levels may result in a loss of fire suppression capacity. An increase in historic water levels would potentially enhance fire suppression capacity but may impact the ability to satisfy other criteria. An increase in historic water level does not provide significant impact for this criterion.

4.6.3 Criterion F Suggested Water Level

Based upon the above discussion, the suggested water level target elevation necessary to satisfy this Ordinance criterion is:

Criterion F: Water Supply Water Level

Long Pond Dam	309.0	Historic Level
Cambolasse Dam	285.4	Historic Level
Stump Pond Dam	243.0	***Current Level
Haskell Dam	185.0	Historic Level

*** Current level is approximately 24 inches below historic levels when the dams were operated by Haskell Mill (early 2010 era). The Current level was established by the State to reduce dam loading due to its current condition.

The target pond elevation shall be maintained throughout the year with all inflows being instantaneously passed downstream of the Dam. The Stump Pond Elevation shall be restored to historic level upon repairs to the dam.

4.7 Criterion G: Power Generation Use

4.7.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels and flows necessary for any ongoing use of the dam to generate or to enhance downstream generation of hydroelectric or hydromechanical power.

4.7.2 Criterion G Discussion

The sites do not currently support generation of hydroelectric or hydromechanical power. A cursory review of the hydroelectric potential for the various sites indicates that development of commercial generation would not be economically feasible. The Ordinance criterion for this condition is not applicable for these sites because of the lack of existing facilities and unlikely installation in the near future.

4.7.3 Criterion G Suggested Water Level

Based upon the above discussion, the water level necessary to satisfy this Ordinance criterion is:

Water levels and flows have no CURRENT impact on power generation or mechanical power. The limits established for other conditions shall be established for this criterion.

4.8 Criterion H: Downstream Area Flows and Level

4.8.1 Ordinance Requirement:

The Ordinance requires consideration of the following:

The water levels necessary to provide flows from any dam on the Pond to maintain public access and use, fish population and fish passage facilities, fish and wildlife habitat and water quality downstream of the body of water.

4.8.2 Criterion H Discussion

The limited storage capacity and mechanisms for flow release control at each dam do not provide the ability to enhance public safety downstream of the dams through regulation of dam discharge rates. All inflows to the ponds are instantaneously passed downstream of each dam irrespective of the pond's water level. This results in the downstream stream section's water levels and flow rates fluctuating seasonally in response to varying in flows.

The release of inflows through spillage versus discharges through a submerged orifice (i.e., gate) enhances dissolved oxygen in the water entering the downstream river reach. The water levels established for the dams should be sufficiently above the spillage mechanism to reasonably ensure that discharges will be over the boards or crest and not limited to dam leakage.

4.8.3 Criterion H Suggested Water Level and Flows

Based upon the above discussion, the water level necessary to satisfy this Ordinance criterion is:

All inflows shall be passed over and not through the Dam. The Water level required to satisfy other Ordinance criteria shall be established for this criterion.

5.0 *SUMMARY AND SUGGESTED WATER LEVELS*

There are no current uses of the inflows to the dams except for unscheduled, sporadic fire suppression op withdrawal for the Stump Pond area golf course. The suggested water levels are based upon current conditions. water levels should be considered upon rehabilitation of the Stump Pond dam and rehabilitation of any of the cur valves associated with each dam.

All inflows are passed directly downstream of the Dam. The Order is suggested to include the requirem directly over the dam, except for during fire suppression operations and training and those flows which are passe The Order should also indicate that flows released from the site shall be released through spillage rather than sub types of discharge.

The various criteria required to be considered for the water level and flow Order requires varying water le summarized below using the local datum:

Criterion #	Criterion Title	Long Pond Dam Suggested Non-Winter / Winter Elevation	Cambolasse Dam Suggested Non-Winter / Winter Elevation	Stump Pon Suggested Winter / W Elevati
A	Public Access	309.0 / 309.0	285.4 / 285.4	243.0 / 2
B	Shoreline Protection	309.0 / 307.8	285.0 / 284.3	243.0 / 2
C	Water Quality & Fish and Wildlife Habitat	309.0 / 309.0	285.4 / 285.4	243.0 / 2
D	Erosion Protection	309.0 / 307.8	285.4 / 284.3	243.0 / 2
E	Flood Protection	307.8 / 307.8	284.3 / 284.3	242.5 / 2
F	Water Supply	309.0 / 309.0	285.4 / 285.4	243.0 / 2
G	Power Generation	Not required	Not required	Not requ
H	Enhancement for Downstream Areas	Not required	Not required	Not requ

The main areas of consideration to determine acceptable water levels and flows are the fire suppression needs, erosion control, flood flow mitigation and levels for recreational needs. Fire suppression capacity is not anticipated to be greatly impacted by potential water levels. Erosion control can be maintained through constant water levels. Flooding events typically occur during the spring "run-off" (April) but may occur sporadically throughout the year. Recreational activities impacted by water levels typically occur during the summer and fall months with less impact during other times of the year. The conflicting requirements for flood protection and recreations suggests the required water levels should be seasonally adjusted.

Suggested Water Level and Flow Release Targets:

	Non-Winter Season		Winter Season	
	Elevation	Distance down from top of Abutment (inches)	Elevation	Distance down from of Abutment (inch
Long Pond Dam	309.0	27	307.8	41
Cambolasse Dam	285.0	35	284.3	44
Stump Pond Dam	243.0 [1]	36	242.5	42
Haskell Dam	185.0	33	183.5	51

1. Increase to Elevation 245.0 once dam is rehabilitated

Suggested Water Level Target Schedule:

Non-Winter Season from Mid-April to Mid-October
Winter Season from Mid-October to Mid-April

Changes to the water levels during transition between "seasons" shall be gradual to the extent feas

Minimum Flow Release Adjustment

The target minimum stream flow at the Dam shall be the mean August flow; if required, the flow i control, emergency conditions and when natural conditions (drought) cause inflow to be less, all a of the DEP regulations. Flows during those periods may be reduced to inflow amounts to maintair time and then increased back to the target stream flow as soon as conditions permit.