Hydrology & Hydraulics Report for Country Pond Dam

Dam number:	D179002
Hazard Classification:	Non-menace change to Low
Condition Assessment:	Satisfactory
Dam name(s):	Country Pond Dam
Town:	Newton
Date of inspection:	October 24, 2025
Inspector:	Desislava Pomeroy, PE
Water level:	115.38 ft during normal summer conditions
Report date:	May 15, 2026

1. Executive Summary

Purpose of the modeling is to investigate how the water elevation of Country Pond changes during and after different storm events. Country Pond is part of the Powwow Pond Dam (Trickling Falls Dam) watershed. The watershed is large, with topography that transitions from steeper hills in the north and east to flatter areas in the southwest dominated by wetlands and marshes.

Dams and upstream areas above Country Pond and Great Pond were modeled in HydroCAD because tailwater conditions do not dominate in these locations, and storage characteristics are easily defined. HEC-RAS was used for the lower basins to better represent the tailwater control exerted on Country Pond Dam and the hydraulically connected Great Pond and Powwow Pond.

Under normal summer conditions, the spillway of Country Pond Dam is at elevation 114.73 ft and it is submerged. As a result, the water level in Country Pond is controlled by the spillway elevation of Powwow Pond Dam at 115.38 ft.

During the 1-year and 2-year storm events, the maximum water elevations in Country Pond are 115.52 ft and 115.78 ft, respectively. These elevations closely match the water surface just downstream of Country Pond Dam, indicating that the dam does not provide hydraulic control during these common storm events. For these events, hydraulic control appears to occur at Powwow Pond Dam. Because of the flat terrain, the system stops behaving like a series of discrete lakes and wetlands and instead behaves as one large, slow-responding, backwatered reservoir.

The HEC-RAS model simulates water elevations in Country Pond for nine days following the start of a 24-hour storm event. Even after nine days, the water surface elevation does not fully return to pre-storm levels. During the 10-year storm event and larger events, the New Boston Road bridge over the Powwow River and the railroad culvert across Powwow Pond begin to restrict flow through the system of dams and wetlands, creating tailwater conditions that control the water elevation at Country Pond. During these less frequent rainfall events, the spillway at Country Pond dam only minimally increases the water level in Country Pond as the water levels are primarily controlled further down river.

2. Greater Watershed Description:

Country Pond is part of the larger watershed of the Powwow Pond Dam. There are two main branches that flow into Powwow Pond Dam: Great Pond and Country Pond. Both ponds have outlet dams, and both discharge into a relatively flat, marshy area comprised of the Webster Wildlife Natural Area (also known as the Cedar Swamp Pond area), the Powwow River WMA, the Sargent Estate conservation land, and the Webster Natural Area (owned by the Town of Kingston). Downstream of this marshy area is the New Boston Road bridge. Flow through Powwow Pond is further constrained by the railroad box culvert further downstream. See Figure 1 below.

Country Pond is fed by Colby Brook. There is also an equalizer box culvert on the northeast side of the pond, under Pond Street (the Dan Hill culvert), which connects Country Pond to a small wetland area to the east. There are two dams upstream on Colby Brook: D129009 Colby Brook Dam and D129008 Colby Brooks Dam Ruins. The terrain upstream of Colby Brook Dam is steeper, with fewer wetlands or marshes available to provide additional storage during storm events. Upstream of D129008 Colby Brooks Dam Ruins, the watershed splits into two branches: Colby Brook and Bartlett Brook. D212009 Angle Pond Dam is located on Bartlett Brook, while flow on Colby Brook passes through D059004 Diamond Pond Dam, D059002 Little Cub Pond Dam, and D059001 Cub Pond Dam. See Figure 1 below.

The stream flowing into Powwow Pond is controlled by D129010 Great Pond Dam. Upstream of Great Pond Dam is D129005 Long Pond Dam. See Figure 1 below.

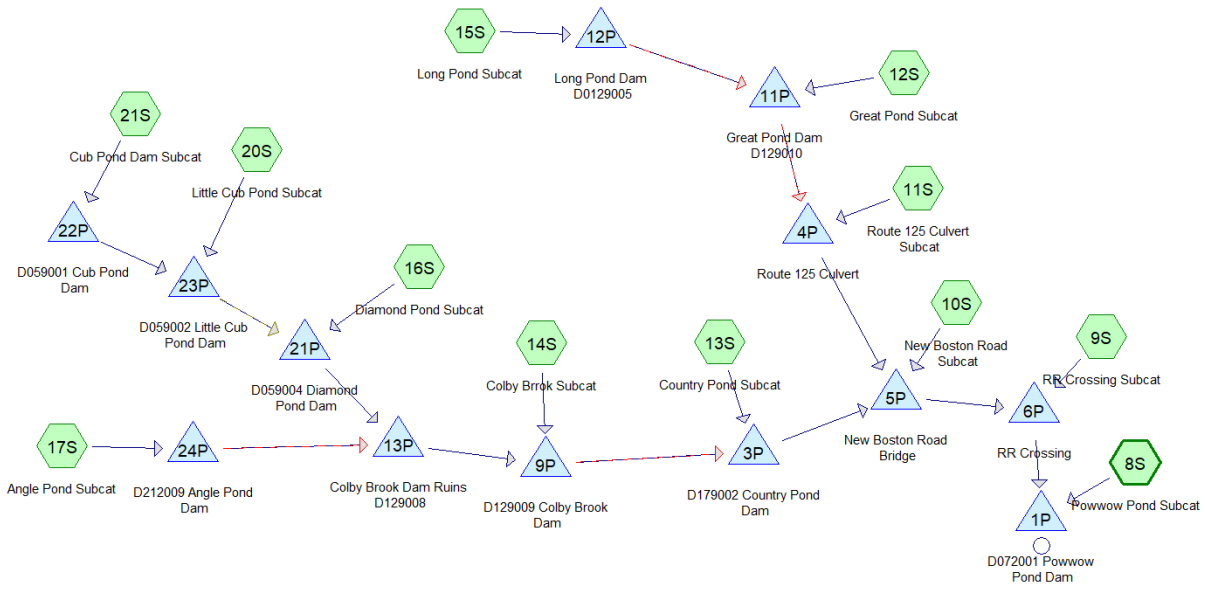

Figure 1: Schematic depicting hydraulic connection between different nodes within the Powwow Pond Dam watershed.

3. Hydrology/Hydraulics Modeling:

- **Assumptions and Limitations:**

DSI performed an updated hydrologic and hydraulic analysis of Country Pond Dam and the greater Powwow Pond Dam watershed using HydroCAD and HEC-RAS. The analysis used data from the NHDES Dam Database, EDP LiDAR, NOAA Atlas 14, the USGS Web Soil Survey, and USGS StreamStats. A site survey was performed in November 2025 for Country Pond Dam, Powwow Pond Dam, the box culvert (Dan Hill culvert) under Pond Street on the northeast side of Country Pond, the New Boston Road Bridge (116/113) over the Powwow River, the Main Street Bridge (99/109) over the Powwow River, the Route 125 Bridge (99/106) over the Powwow River, and the railroad bridge across Powwow Pond. NAVD 1988 vertical datum was used.

The analysis does not explicitly model every road or driveway culvert—only major road crossings were included. Because the Powwow Pond Dam watershed is over 18,795 acres (29.38 square miles), area-reduction factors for rainfall peaks were applied in accordance with Chapter 21, Table 21-3 of the NRCS Part 630 National Engineering Handbook. No beaver dams were included in the model, even though at least two were present during the November 2025 site visit. The two observed beaver dams were located at road crossings, where standard maintenance practices require clearing any obstructions from bridges and culverts. Because beaver dams are temporary features and routinely removed, they are not typically included in hydraulic analyses. The model is designed to evaluate relative water-surface elevations, hydraulic controls, and system behavior under design storm events; therefore, dam breach analysis was not included. No manual dam operations were simulated in the model for Country Pond Dam or Great Pond Dam.

- **Country Pond Dam Description and Pertinent Data:**

Maximum Height:	7.5 ft
Overall Length:	100 ft
Drainage Area:	9,302 acres (14.53 square miles)
50-yr Storm:	543.7 cfs with 1.66 ft freeboard
Type of Construction:	Earth/Stone/Conc
Outlet Works:	20-foot-wide concrete spillway: at 114.73 ft
	12-foot wide stoplog bay inside the concrete spillway: sill at 113.38 ft
	Pond Street (a town road) is over the spillway: bottom of steel I-beam approximately 118.23
	Natural low area northwest of Country Pond Dam
	Natural low area on Green Road

- **Software Selection Rationale**

HydroCAD is used to model the upstream dams because the terrain is steeper, the ponds are more geographically separated, and storage characteristics are easily defined for each dam. The following dams were modeled in HydroCAD: Colby Brook Dam, Colby Brooks Dam Ruins, Angle Pond Dam, Diamond Pond Dam, Little Cub Pond Dam, Cub Pond Dam, and Long Pond Dam. Hydrographs developed

by this HydroCAD model were used as boundary condition inputs in HEC-RAS.

Downstream wetlands, dams, and bridges were modeled only in HEC-RAS because tailwater effects have a significant influence on flow through the system. The area between Country Pond, Great Pond, and Powwow Pond is mostly flat, and proper modeling requires dynamic water-surface profile computations between each dam and bridge. The HEC-RAS model included: Country Pond Dam, the Dan Hill box culvert (on Pond Street), Great Pond Dam, Main Street Bridge, Route 125 Bridge, New Boston Road Bridge, the railroad bridge, and Powwow Pond Dam (Trickling Falls Dam). See Figure 2 below of area modeled in HEC-RAS.

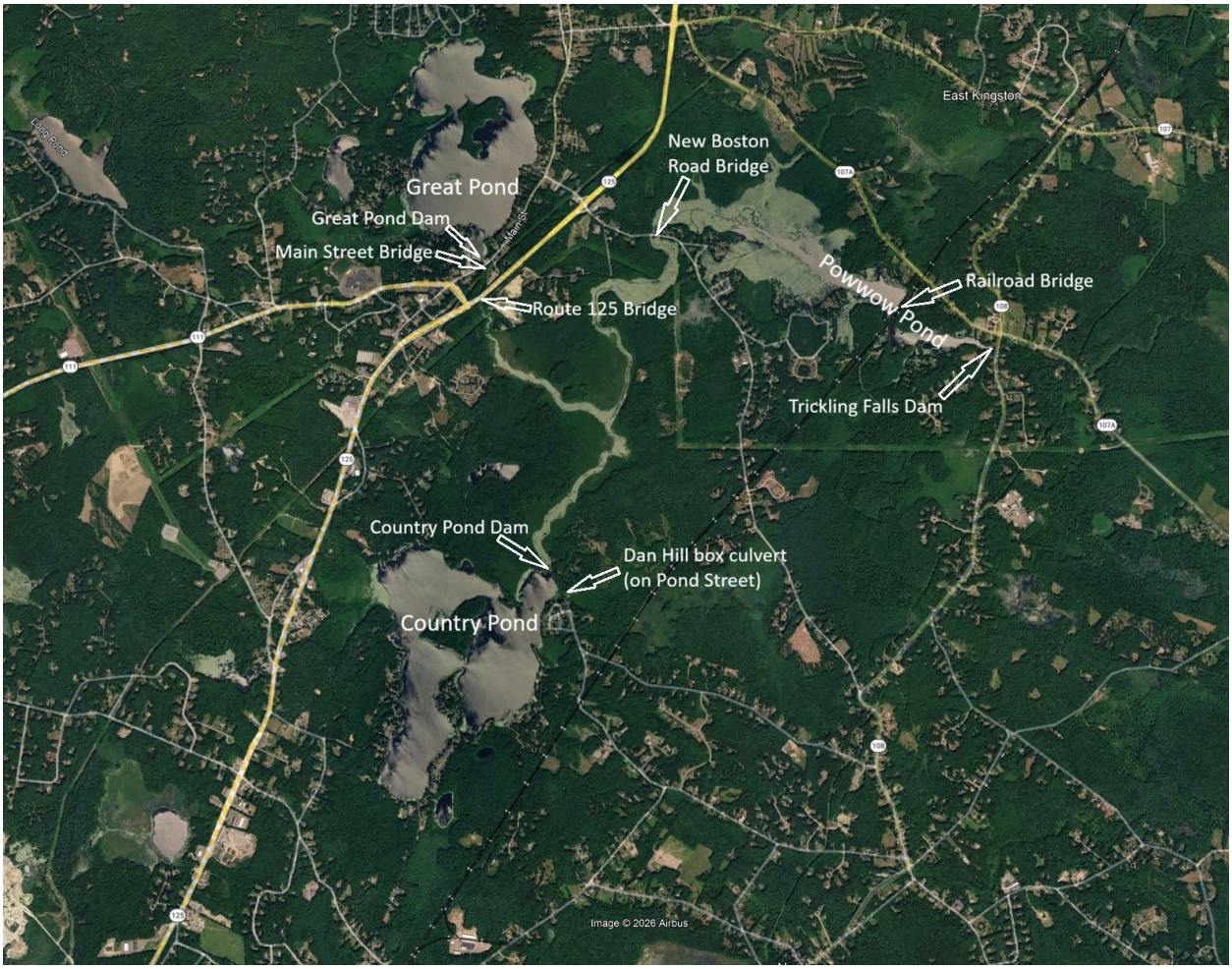

Figure 2 Areal View of area modeled in HEC-RAS

- **Model Results and Observations**

The HEC-RAS model included simulations for the 2-inch storm, as well as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storm events. The overall model error was kept below 1%, and no excessive velocities or abrupt changes in water surface elevation were observed in the results. Some flow oscillations were noted, particularly during the smaller storm events, but these did not occur during the maximum flow rates.

The flat terrain and marshes provide significant storage both upstream and downstream of Country Pond Dam. There is very little head difference between the dams, even during larger storm events. The flow path from Country Pond Dam to Powwow Pond Dam is approximately 10,800 feet (2.04 miles), but the head differentials are less than one foot for the 2 inch, 1-, 2-, 5-, and 10-year storms. Even at the 50-year storm the total elevation difference of the water surface between Country Pond and Powwow Pond Dam is only 1.2 feet, see figure 3. See the table below for maximum water elevations for the different storm events. The water surface tends to flatten across the entire system—from Country Pond Dam through the New Boston Road Bridge, the railroad culvert, and down to Powwow Pond Dam. The upstream lakes and wetlands effectively function as part of the same backwater zone, controlled by the downstream dam or road culverts.

Location	2 -inch storm (feet)	1-year Storm (feet)	2-year Storm (feet)	5-year Storm (feet)	10-year Storm (feet)	25-year Storm (feet)	50-year Storm (feet)
Rainfall Event Depth	2.00 inch	2.50 inch	3.11 inch	4.12 inch	4.96 inch	6.11 inch	6.96 inch
Country Pond Dam	115.4	115.5	115.8	116.3	116.7	117.3	117.7
New Boston Road Bridge	115.4	115.5	115.6	115.9	116.3	116.8	117.3
Railroad Culvert	115.4	115.5	115.6	115.9	116.1	116.5	116.9
Powwow Pond Dam	115.4	115.5	115.6	115.8	116.0	116.3	116.5
Difference between Country Pond and Powwow Pond	**0.0**	**0.0**	**0.2**	**0.5**	**0.7**	**1.0**	**1.2**

Table 1: Maximum water elevation for the different storm events

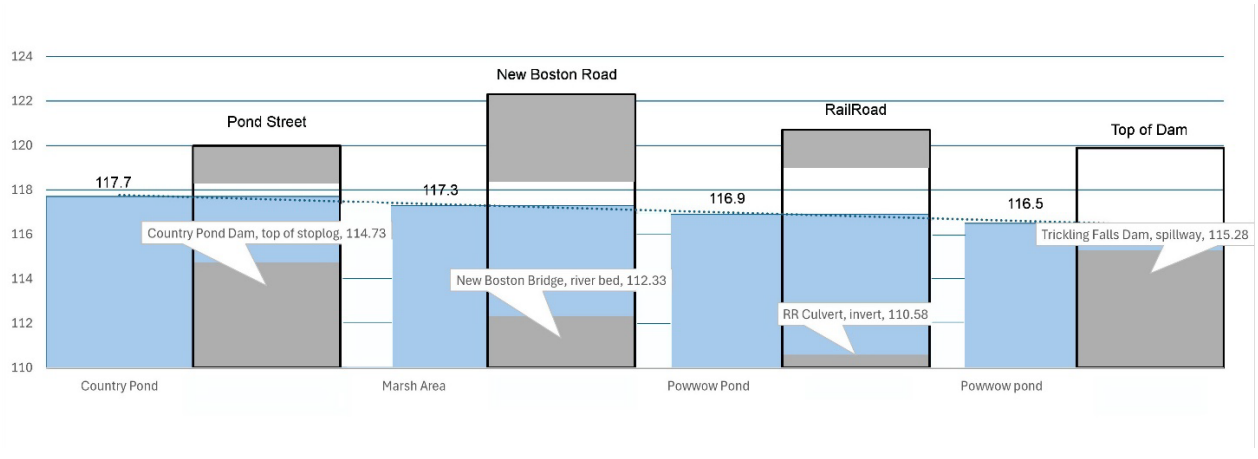

Figure 3: Maximum water elevation for 50-year storm from Country Pond to Powwow Pond (Trickling Falls Dam)

The very small head differences between the dams result in very low conveyance through the system. Even relatively small storm events take more than nine days to pass through the

watershed. Because of the slow routing and the large amount of storage in the marsh areas, the water elevation at Country Pond does not return to pre-storm levels for several days. See Figure 4 below. For smaller storm events, the water elevation at Country Pond and the water surface elevation immediately downstream of Country Pond Dam are nearly identical. See Figure 5 below.

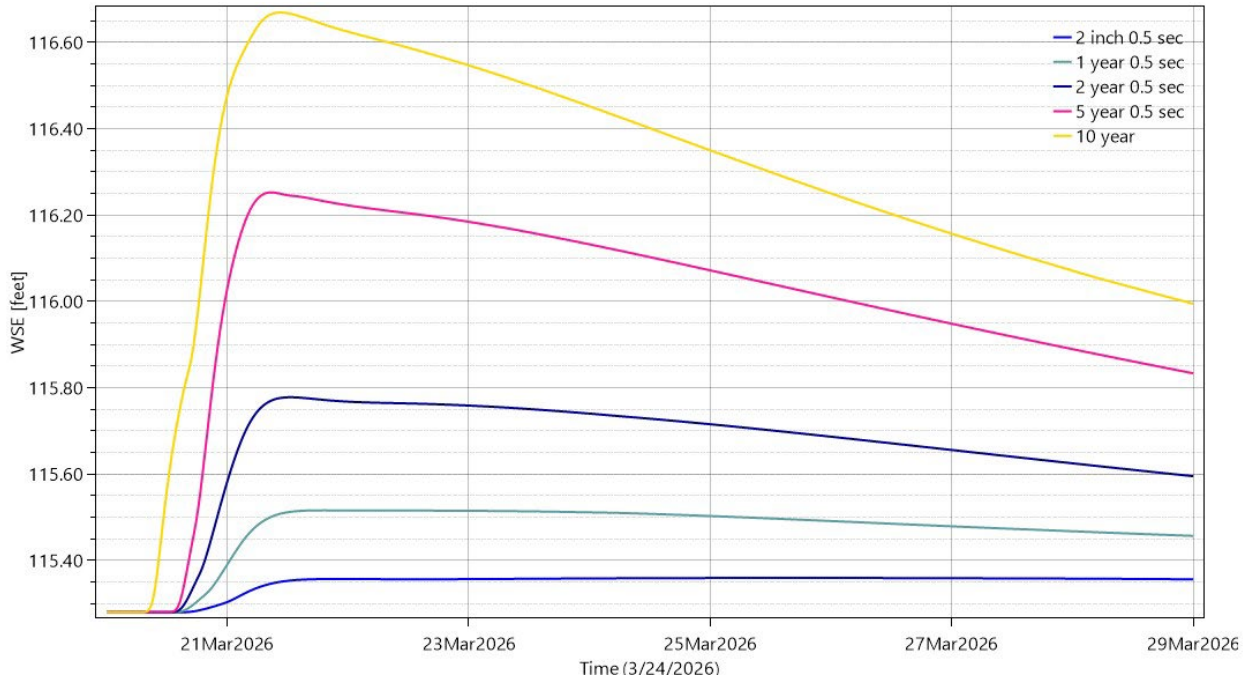

Figure 4: Water surface elevation (WSE) at Country Pond Dam during different storm events

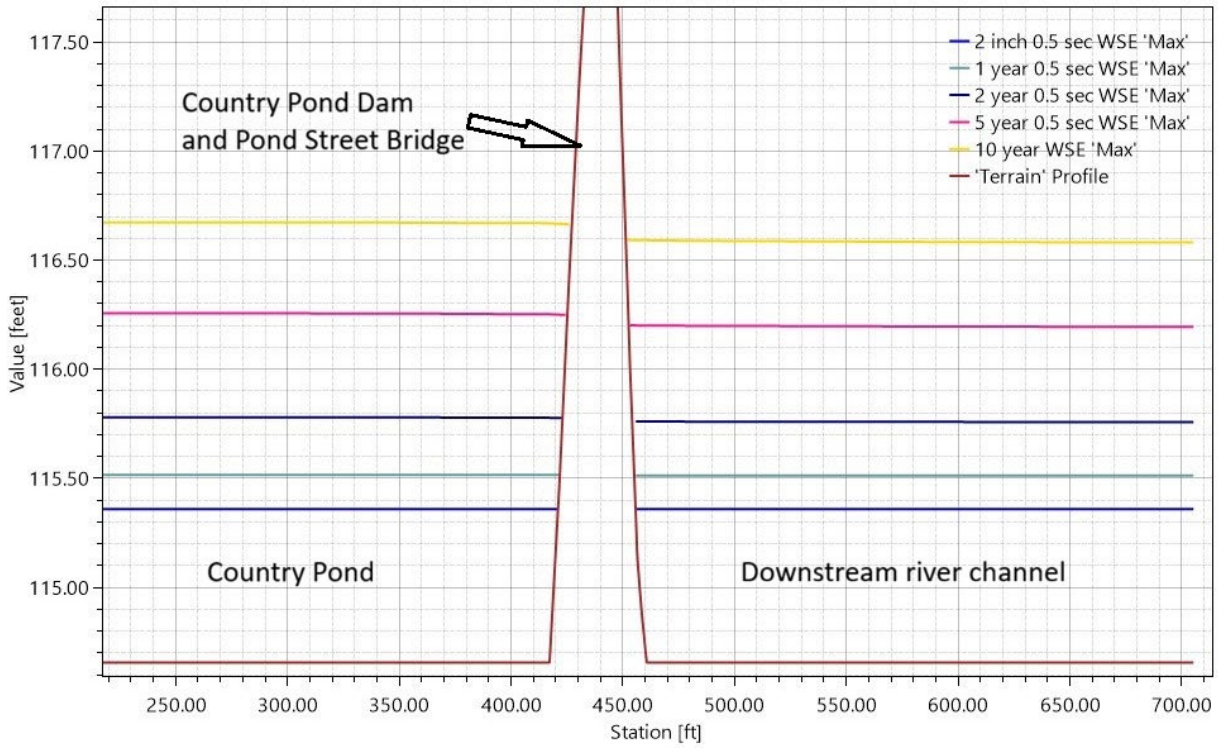

Figure 5: Water surface elevation immediately upstream and downstream of Country Pond Dam for different storm events

Based on elevations obtained from LiDAR, Country Pond has two natural low spots that can act as auxiliary spillways during larger storm events: one located along Green Road near Cedar Swamp Pond, and another approximately 840 feet northwest of Country Pond Dam. These two low areas convey flow only during larger storm events, such as the 100-year storm. See Figure 6 below.

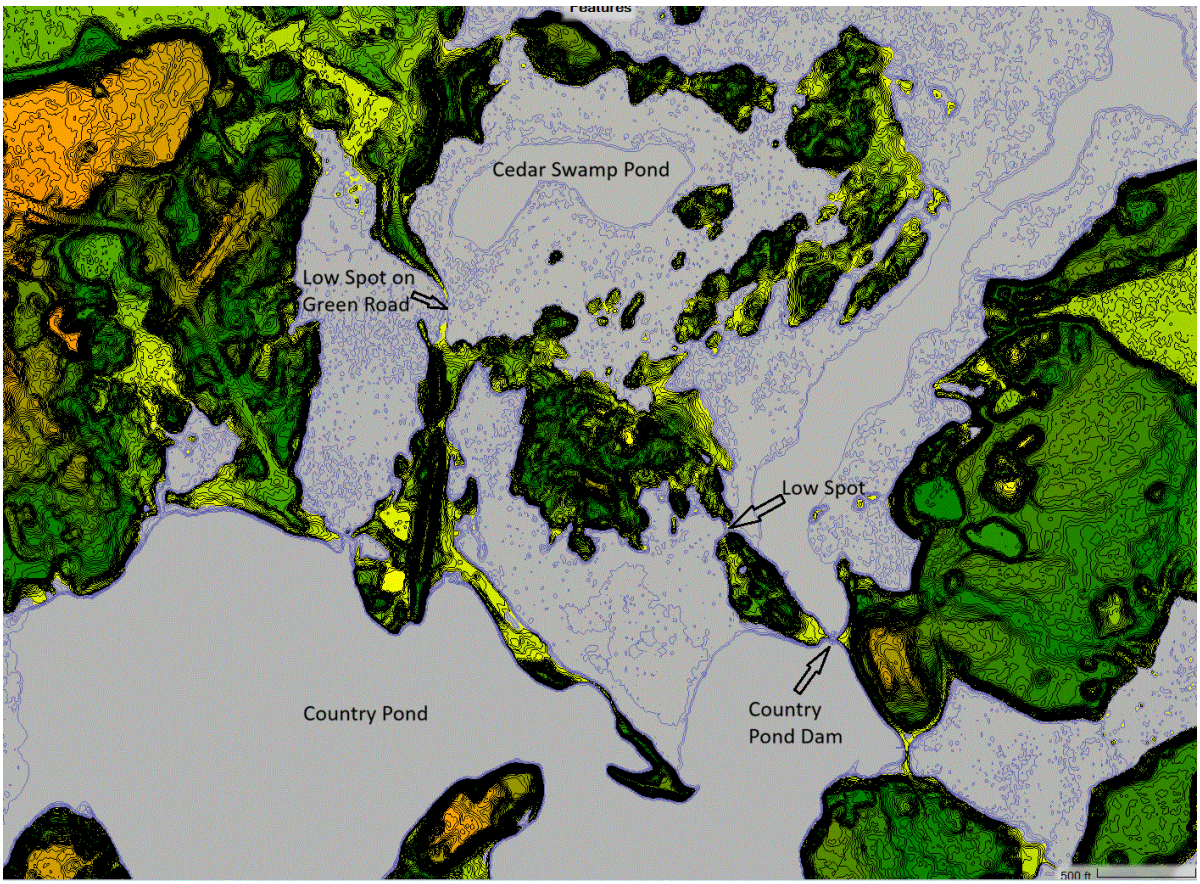

Figure 6: Natural low areas around Country Pond Road

- **Powwow Pond Dam Operations**

Since the water surface elevation at Country Pond is controlled by downstream infrastructure, it is important to model how changes at Powwow Pond Dam propagate upstream to Country Pond. Powwow Pond Dam has two stoplog bays that are routinely used by the NHDES Dam Bureau to manage water levels and conduct winter drawdowns.

Model simulations were performed to evaluate how removing stoplogs at the start of a storm event affects water levels at Country Pond. The modeled operation at Powwow Pond Dam consisted of removing approximately 1.9 feet of stoplogs from the two stoplog bays (three strings total).

When comparing the same storm event with and without these operations, the maximum water surface elevation at Country Pond does not change significantly. However, removing the stoplogs at the start of

the storm allows water levels at Country Pond to return to normal more quickly: within 3 days for a 2 inch storm and within 8 days for the 1-year storm. See Figure 7 below.

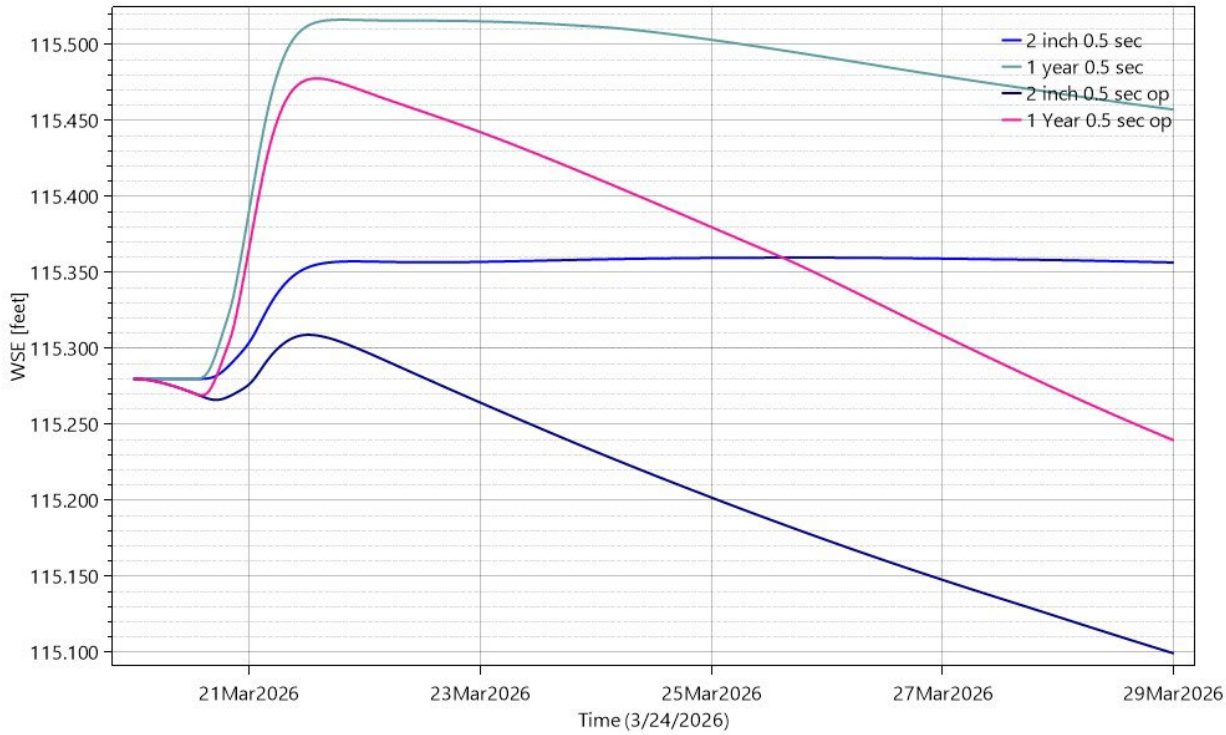

Figure 7: Water surface elevation at Country Pond with and without operations at Powwow Pond Dam.

- **Classification and Downstream Hazzard Review**

The classification of Country Pond Dam is being reviewed and will likely be changed to Low Hazard because the structure exceeds 6 feet in height and is connected to a town road (Pond Street), in accordance with Env-Wr 101.07(b)(5). The earth embankment of the dam also serves as the roadway embankment.

The water surface elevation at Country Pond is controlled by Powwow Pond Dam during normal (sunny-day) conditions. During flood events the water surface elevation at Country Pond is controlled by Powwow Pond Dam, the New Boston Road bridge, and the railroad bridge. Thus, no additional downstream hazard impacts were identified for Country Pond Dam.