



MEMORANDUM

TO: Town of Wrentham and Town of Norfolk

FROM: Charles River Watershed Association

DATE: June 26, 2023

SUBJECT: Eagle Dam Removal Phase II Downstream Impact
Sub-task 2.10 Downstream Impact

As part of Phase II of the Municipal Vulnerability Preparedness (MVP) Action Grant for Eagle Dam Phase II Feasibility Assessment in Wrentham, Massachusetts, Weston & Sampson completed field work and technical analyses looking at potential flooding impacts should Eagle Dam be removed. To date, no decision on the future of Eagle Dam has been made; the dam is in unsafe condition and must either be replaced or removed to meet Massachusetts dam safety regulations. The dam has a documented history of failure in the past. If Eagle Dam were to be removed, it would significantly reduce and potentially eliminate the threat of potential dam failure and associated liabilities for the Town of Wrentham. The analyses completed by Weston & Sampson found that dam removal would not increase peak flood levels or velocities at the Route 140 crossing immediately downstream or in the FEMA A zone between the dam and Main Street in Norfolk. The following memorandum summarizes the flood modeling results.

Weston & Sampson's technical analysis is documented in the April 12, 2023 report and technical memorandums titled *Eagle Dam Removal Phase II Sub-task 3.1 Field "Survey" and "Investigations"* and *Eagle Dam Removal Phase II Sub task 3.2 Updated Charles River Flood Model for Eagle Brook and Sub-task 3.3 Hydraulic Analysis*. Weston & Sampson collected field data on February 24, 2023 in the Eagle Brook corridor from Lakes Archer and Pearl to City Mills. This information was also used to update the Charles River Flood Model to look at potential changes in flooding in the Eagle Brook Corridor from Lake Pearl to City Mills in Norfolk in a potential dam-removal scenario.

The Charles River Flood Model (CRFM) is a PC-SWMM-based flood model of the upper and middle Charles River watershed, including the Towns of Norfolk and Wrentham, that identifies where and when flooding will occur under various present day (baseline) and future rainfall scenarios. The CRFM geographic extent covers the whole or part of 33 municipalities and a total

area of 273 square miles. The technical details of developing, calibrating and validating the CRFM are available in the Charles River Flood Model report found on the CRWA website¹.

The design rainfall depths and distributions in the CRFM were updated to reflect the latest guidance on present day climate² and future climate scenarios³.

The CRFM was modified to evaluate flooding under a dam-out condition. Ten simulations were conducted of the dam-out model and compared to the existing conditions. Those ten simulations represented the 2-, 10-, 50-, 100-, and 500- year, 24-hour design storms under both present day and 2070 climate scenarios. The dam-out peak water levels upstream and downstream of the dam were compared to their existing condition, dam-in counterparts at five locations, including Lake Pearl, the current Eagle Dam location, the upstream face of Route 140, the downstream face of Route 140, and at an unnamed dam at the Angler's Club at 160 Mill Street in Wrentham.

The model results found there are no changes in flood elevations, extents, or peak discharge rates and velocities anywhere in the downstream area under a dam-out scenario for any present day design storm. These findings are consistent with no increased flooding impacts or flood risk at downstream residences or infrastructure or to the hydraulic performance of Route 140 immediately downstream or at the Angler's Club Dam further downstream.

Model results similarly indicated no change in flooding under all 2070 climate design storms evaluated as well, with the exception of the 500-year flood, where the model reported an increase in peak water surface of between 0.01 and 0.02 feet at the upstream face of the Route 140 crossing only. This simulated increase is well within the margin for error of the PC-SWMM-based model, and, as they are associated with future climate scenario design storms, are not relevant to Federal Emergency Management Agency (FEMA) and Massachusetts Department of Transportation (MassDOT) regulations.

As noted above, model results indicate that the removal of Eagle Dam will have no significant impact on the peak water surface or velocities at the Route 140 bridge. MassDOT regulations require a minimum clearance of 2 feet between the bridge deck bottom and flood water surface of design storms. Model results found that there is currently 2.8 feet of clearance under existing conditions; the removal of Eagle Dam would have no impact on the bridge's hydraulic performance and its ability to meet MassDOT requirements.

Future analyses using HEC-RAS or similar software may be warranted to confirm these findings and to support other evaluations relevant to the feasibility, design and permitting of removing

¹ www.crwa.org/watershed-model

² National Oceanic and Atmospheric Administration (NOAA) Atlas 14 https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

³ Resilient Massachusetts Action Team (RMAT) Climate Resilience Design Standards Tool https://resilientma.mass.gov/rmat_home/designstandards/

Eagle Dam, such as potential impacts to Red Dam upstream, sediment transport, scour analysis, and channel morphology among others.

In conclusion, the model found that removal of the dam would not negatively impact downstream flooding. Although not analyzed in this study, the removal of the dam would eliminate or greatly reduce the potential for dam failure and the associated downstream impacts. Dam removal is feasible, and further design and permitting work is needed before either removal or replacement moves forward.