PARE CORPORATION

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MEMORANDUM

DATE: May 2, 2023

RE: **Elks Lodge Dock – Preliminary Wave Analysis**
Church Street Dock Expansion
(Pare Project No. 16136.00)

TO: Gregg Marsili, Harbor Master, Town of Bristol

FROM: Brian Dutra, PE, Pare Corporation BD

During the April 19, 2023, Bristol Town Council Meeting, members of the Elks Lodge indicated concerns of increased wave action due to the proximity of the floating wave attenuator at the Town of Bristol's Church Street Marina.

The Elks Lodge Dock consists of a timber floating dock arrangement and is accessed from an aluminum gangway leading up to the Elk's Lodge building. The gangway leads to a 60-foot long terminal float. According to the RICRMC Permit from 2003, the dock is permitted for four (4) transient dock slips for four small boats. Design loads or other design details were not reviewed at the time of this memorandum.

During the boating season of 2022 (May 1, 2022 to October 2022), members of the Elk's Lodge indicated an increase in waves at their dock believed to be due to the installation of the concrete wave attenuators at the Town of Bristol's Church Street Marina. The concrete wave attenuators are approximately 120 feet to the north of the Elk's Lodge dock.

Site Data

Pare obtained wind data for the Boating Season of 2022 to analyze as this was the first boating season since the installation of the wave attenuator in March 2022. The data was downloaded from NOAA Wind Station 8452951, Potter Cove, Prudence Island, RI and consisted of sustained wind values recorded every hour. The data was limited to between May 1, 2022 and October 1, 2022 (154 days) which represents the active boating season. The wind directional values were assigned cardinal directions based on a 16-point compass rose.

Wind fetch lengths were measured from the Elk's Lodge Dock to the nearest point of land. These fetches were measured using aerial photographs taken during the Spring of 2020 and the Summer of 2022 (pre and post wave attenuator installation).

Fetch lengths were also measured for the south and south-southeasterly wind directions that are exposed to the wave-attenuator. Since these are the waves suspected to be reflecting off the wave attenuator and towards the Elks Lodge. The south and south-southeasterly exposures are included in the Post-Wave Attenuator Installation Wave Analysis.

Methods

The American Society of Civil Engineers (ASCE) Planning and Design Guidelines for Small Craft Harbors indicates that Beam Seas (waves perpendicular to the port and starboard [1] sides of the vessel) less than 0.25 feet and occurring once per week is an indication of a site with "Good" wave climate and waves greater than 0.31 feet, once per week, as "moderate wave climate".

[1] Based on site layout, reflected waves would be impacting the Elks site at an oblique angle and would need to be considered during formal analyses.

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As part of this memorandum, Pare analyzed wind data from the 2022 boating season and estimated the number of days exceeding "good" wave climate conditions. Analyses were completed assuming no wave attenuators installed at the marina and with the wave attenuators installed.

For the case of this analysis, wind speeds that correspond to developing waves within the basin were calculated based on a 3-inch resultant wave and measured wind fetches. The wave heights were based on calculations in the Coastal Engineering Manual, Dated August 2008. Reflected waves, detailed below, were applied a stacking factor between 2.0 and 1.25 for waves that impact the wave attenuator at 0 degrees (SSE) and 79 degrees (SW). Wave dissipation within the basin was not analyzed as part of this analysis.

Wave Analysis – Previously Existing

Fetches measured at the existing Elks Lodge Dock ranged from approximately 3.6 miles from the southwest to 0.6 miles to the west.

Winds from the North and north-northwest were ignored due to the short distance between the previously existing wave fence and the Elks Lodge Docks. Additionally for simplicity, it was assumed that wind from the south/south-southeast did not result in any reflected waves from the previously existing wave fence although some reflection likely occurred.

Winds were analyzed for the venue's operating hours, to correspond with anticipated use of the transient facilities. **A total of 49 days** during the 154-day 2022 boating season (32%), experienced wind climate that would have resulted in waves greater than 3 inches in height and therefore a "moderate wave climate" **prior to the construction of the concrete wave attenuator.**

Wave Analysis – Post-Wave Attenuator Installation

Wind fetches measured at the existing Elks Lodge Dock and potential reflections from the Town's wave attenuators ranged from approximately 3.0 miles from the south-southeast, 3.6 miles from the southwest, and 0.6 miles from the west.

Limiting wind speeds were adjusted to account for the doubling of waves (i.e., the wind required to generate a 1.5" wave were utilized in this analysis) from the south-southeast to account for reflection of the waves off of the wave attenuators. In this case, the wind fetch was measured from the wave attenuator to Aquidneck Island and ignored the angles that passed through Bulkhead of the Coastguard Pier to the south. Similarly, waves resulting from winds from the south, to the southwest were applied a stacking factor based on the degree of impact of the wave on the wave attenuator.

Winds from the west-northwest clockwise to the southeast were ignored due to the short distance between the installed floating wave attenuators and the shoreline to the east.

A total of 79 days during the 154-day 2022 boating season (51%), experienced wind climate that would have resulted in waves, including potential reflected waves, greater than 3 inches in height. It should be noted that winds were analyzed for the venue's operating hours.

Results

Based on the wave analyses, the wave attenuator does increase the wave action within the area between the attenuator and marina to a limited extent during periods of high winds (i.e. predicted at 30 days). Note this number does not exclude days of small-craft advisory.

Based on the ASCE Planning and Design Guidelines for Small Craft Harbors wave climate criteria, the climate at the Elks Lodge Dock is considered "moderate" pre and post installation of the Town's concrete wave attenuators.