PHOTO 13 Pierce Island Bridge south approach wall (the granite blocks, not the concrete abutment) – note slope erosion above riprap.

PHOTO 14 Pierce Island Bridge south wingwall undermined by erosion.

The northern approach wall is comprised of a low stack of treated timbers/railroad ties with a single support post at the northeast end. The post is leaning down slope and the stack of timbers is leaning offshore. While there presently is minimal erosion at this

wall, it is recommended that this wall be replaced with a riprap slope, similar to the south approach wall.

PHOTO 15 Pierce Island Bridge north approach wall leaning down slope.

An engineers opinion of probable construction cost has been prepared for these recommended repairs and the estimate, including engineering, bid document preparation and construction phase services, indicate the wall replacement is expected to cost on the order of $40,000 and take approximately 1 week to complete after permits and the construction contract are awarded (or this might be performed by public works crews with an excavator from above). We have assumed that one traffic lane will need to be closed each day for each side (excavator on road) and that a police detail will be needed for traffic control. These walls are not within the Portsmouth Historical District and historical appearance issues are not anticipated. The costs for environmental permitting and permit fees have been excluded as these services may be provided by City staff and the permit fees due the state are not known at this time.

DANIEL STREET BETWEEN HARBOUR PLACE & MEMORIAL BRIDGE

The Daniel Street seawall between Harbour Place and the Memorial Bridge is primarily a stone rubble retaining wall 79 feet in length (56 feet to corner from Harbour Place wharf) and of varying height (7 feet to 11 feet high). The top of wall is at sidewalk level and the toe of wall elevation varying and bordering a gravel and cobble intertidal area. This wall is shown on a 1920 plan as the “City Landing” and shown as an existing wall on the 1921 Memorial Bridge drawings. The Memorial Bridge pier details show the top of the pier footing at 2 feet below mean low water and bedrock at about 14 feet below mean low water level. It is not known if the seawall is founded on soil or pilings.

The seawall borders the Piscataqua River ship channel, near the Memorial Bridge and is in a protected location, exposed primarily to boat and tugboat wave action. The recessed alignment of this wall keeps it away from the strong river tidal currents and it is not expected to be impacted by moving ice floes.

PHOTO 16 Daniel St primary seawall section – note tensioned floating dock mooring chains attached to wall base stones.

The wall here is comprised of two sections. The primary section of wall (56 linear feet) is parallel to the channel and does appear to be stable and in relatively good condition, with a positive inshore batter to the wall face and good quality stonework. There a few isolated locations with missing chinking stones (small wedge-like stones used to fill gaps), often at pipe penetration locations. It was noted that two large mooring chains are attached to wall stones at the base of the wall, presumably securing the Harbour Place floating docks. The Harbour Place floating docks are located in strong tidal currents and have a history of being torn away by the currents, thus there is a likelihood of high loads being applied to these chains and possibility of the mooring chains pulling out wall base stones, which in a worst case, may collapse the wall.

The secondary section of wall connects the primary wall to the Memorial Bridge pier. This section of wall is of rough rubble stone construction, overlaid with a partial concrete veneer, perhaps as a repair. There is a pile of rubble stone in front of this section of wall, which includes a tie-down anchor for the utility pole brace.


PHOTO 17 & 18 Daniel St end seawall section – note gaps under concrete.

There are outfall pipes passing through the wall at stations 0+29, 0+44, 0+61 (sta 0+00 at end by HP wharf). There is a sinkhole behind the corner of the wall, adjacent to the utility pole and also over an outfall pipe. This may have been caused by the utility pole installation, or by soil loss around the outfall pipe.

The main section of wall needs only minor repairs, including replacement of a few missing chinking stones and repointing around the outfall pipe penetrations (if these pipes are still active). The dock mooring chains attached to the wall should be removed as these mooring loads could pull stones out of the wall. The secondary section of wall which connects to the Memorial Bridge pier is apparently stable, but contains open gaps in the stone joints. Near term repairs at this section could include some chinking/pointing of joints and filling of the sinkhole with coarse crushed stone. Longer term, lower priority reconstruction of this section of wall should be considered in the future, and may need to be coordinated with planned bridge repairs.

An engineers opinion of probable construction cost has been prepared for these recommended near term repairs. Including engineering, bid document preparation and construction phase services, the wall replacement is expected to cost on the order of $16,000 and take approximately 1 week to complete after permits and the construction contract are awarded (or this might be performed by public works crews). The costs for environmental permitting and permit fees have been excluded as these services may be provided by City staff and the permit fees due the state are not known at this time. These near term repairs might be permitted by notification and photo documentation, as the repairs are of a maintenance nature.

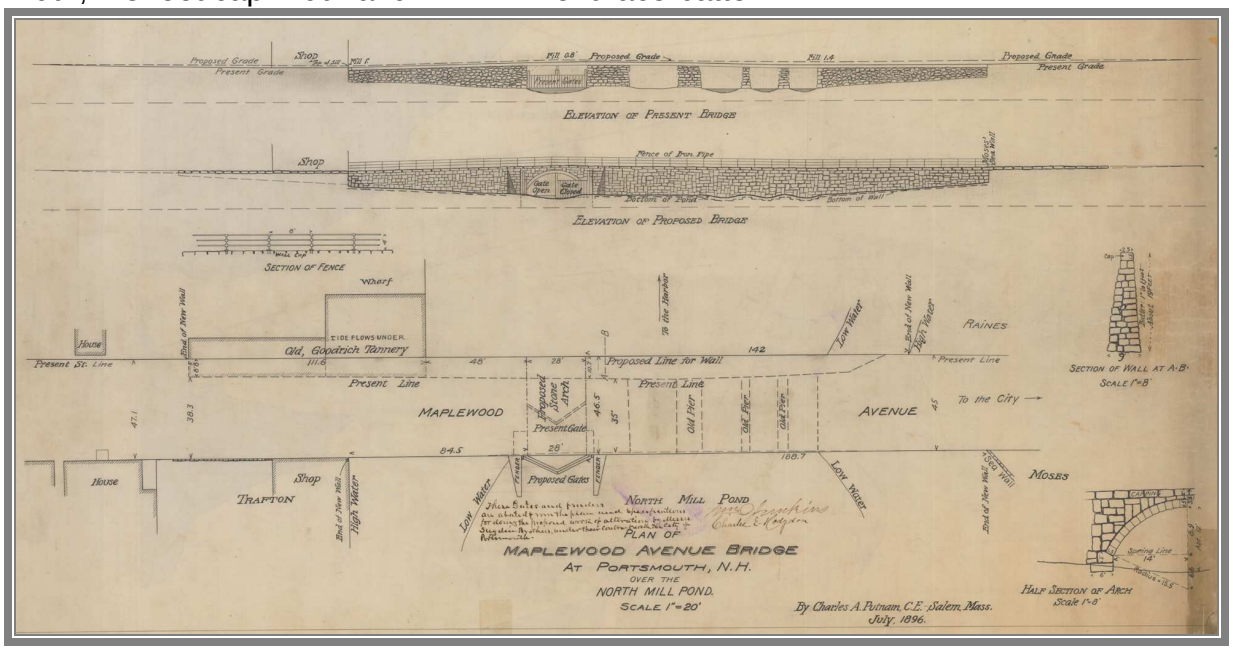
MAPLEWOOD AVENUE AT NORTH MILL POND

The walls here are comprised of three sections, all parallel to Maplewood Avenue where the street crosses North Mill Pond. The north section of wall supports the west bound traffic lane and sidewalk, and its visual appearance is dominated by the abandoned sewer line penetrations, which are nearly parallel to the wall on both sides of the arch culvert penetration. The North side wall is primarily a granite block retaining wall 155

feet in length and of varying height (5 feet to 15 feet high). The top of each wall is at sidewalk level and the toe of wall elevation varying and bordering a gravel and rock rubble intertidal area. The south wall includes a section similar in size to the north wall, plus another 60 linear feet of wall about 90 feet to the east.

Maplewood Avenue crosses North Mill Pond and is in a protected location and it is not expected to be impacted by moving ice floes.

Review of archive documents show this structure as early as 1810 ("Plan of the Bridge at the North Part of the Town of Portsmouth", Akerman, 1810, also referring to the John Bowles Mill and Gideon Walkers Mills, both on the north side of the bridge); and again in 1818. A detailed reconstruction drawing dated 1896 shows filling of 4 of the 5 flow openings (about where the north and south earth fill slopes are now) and proposed tide gates at the present arch opening. The north wall is shown as being reconstructed on this drawing with a wall cross section detail showing a 19 foot wall height, 9 foot base width, 2.5 foot cap width and 1H:12V front face batter.



There are further archive drawings in 1922 and 1923 for the dam and spillway; a 1947 steel sheet pile and steel beam bridge (never built?) and a 1948 plan and profile indicating differential settlement monitoring. A 1976 drawing appears to show the installation of the steel sectional arch culvert and culvert footing repairs.

The NH DES Dam Bureau does list this structure as a dam (#199.08), however correspondence with their engineer indicates that this was based on past tidal dam gates (tidal gate replacement proposed in 1981). The Dam Bureau did confirm that in the present condition without tide gates, this structure is not a dam and is not subject to dam inspection and dam maintenance requirements.

PHOTO 19 Maplewood Ave north wall – note abandoned sewer line penetrations.

PHOTO 20 Maplewood Ave north wall – note deterioration at penetrations.

The North wall does have several signs of leaning offshore and of settlement. As observed from the 1948 archive drawing, the wall was apparently being monitored for movement. The wall stone over the arch culvert (on timber pile supported footings per

archive drawings) is higher than the rest of the North wall and the North wall to the west of the culvert also has the most severe lean offshore (up to -1H:12V), with opened joints, some block to block sliding. The earth fill slope to the east of the culvert may also be repair material, placed to stabilize a moving wall. The sidewalk and roadway above the North wall shows signs of differential settlement in the vicinity of the culvert, with perhaps 3 inches of differential settlement on each side of the culvert, road pavement cracking, sidewalk cracking and drainage problems.

The 1896 drawings that built the North wall indicates the outer face of the wall was to lean inshore at a 1H:12V batter, however the 9 foot base width of the wall footing was probably insufficient for a 19 foot high gravity wall founded in the tide zone and with modern highway vehicle loads. The North wall was probably also compromised by the sewer line penetrations (pipe now corroded through), which are almost parallel with the wall and have been patched in with brickwork, which is not a durable material in a salt water freeze/thaw environment.

The South western wall also has signs of leaning offshore (up to -0.4H:12V), and of settlement similar to the North wall and there is a noticeable offshore bulge at mid height of the wall (Photo 22). Many of the mortar pointed stone joints have opened, cracking the mortar, in the vicinity of this bulge. A clay drain pipe outfall at the western end of this wall is cracked and appears to be collapsed within the wall and this may be contributing to the loss of backfill soil.

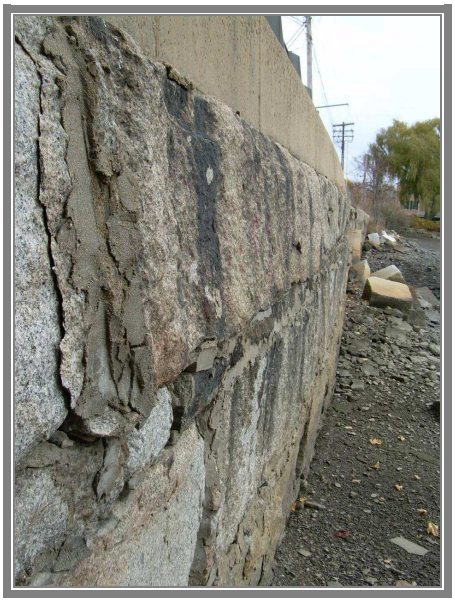


PHOTO 21 & 22 Maplewood Ave south wall west with bulge and opened joints.


PHOTO 23 & 24 Maplewood Ave south wall west drain outfall & opened joints.

PHOTO 25 Maplewood Ave south wall at culvert.

To the east of the culvert on the South wall, there is approximately 90 linear feet of earth fill slope, which in comparison to the 1896 drawing, suggests this was placed in front of the wall, perhaps as an instability repair, or to help reduce water seepage when this was a functioning mill dam (this area contains the 4 filled original water passages shown on the 1896 drawing). The slope area does have some active erosion.

To the east of this slope is another 60 linear feet of stone seawall that appears to be in generally satisfactory condition (Photo 26) with only some upper stone blocks pushed offshore about an inch relative to the blocks below. The easterly most few feet of this wall are comprised of mortared mass waste concrete blocks and some stone blocks (below black chain link fence in Photo 26).

PHOTO 26 Maplewood Ave south wall east.

Based on these observations, it is recommended that this wall be monitored to see if the observed wall movement is active. The adjacent south fill slope has some active erosion and stone riprap should be added to halt this erosion.

The North wall should be rebuilt, including removal of the abandoned sewer line and associated brick patching. The South western (main) wall could perhaps be stabilized by excavating unsuitable backfill and adding a concrete or flowable fill mass behind the existing stones and repointing the joints, however the budget estimate assumes full replacement of 155 linear feet of wall on both the north and south sides of the street (requiring road closure during construction). The 24 inch diameter sewer main is visible where it penetrates the culvert walls with an invert near mean high tide level roughly along the road centerline, so it is unlikely to be damaged by a possible wall collapse, but it will be an issue during culvert replacement.

Since this seawall is located in the city historic district, it is expected that the replacement seawall will need to be rebuilt using stone, in a manner consistent with historical seawalls in this area. An engineers opinion of probable construction cost has been prepared for a repair/replacement stone seawall, assuming adequate bearing capacity soils are found below the existing wall to utilize a concrete spread footing and that a pile foundation will not be required. Due to the proximity of the intertidal resource area, it is also expected that the replacement wall will need to be built along the existing alignment with no additional encroachment seaward, thus requiring removal of the existing wall.

We have assumed the existing stone can only be reused for 50% of the new wall construction (to proper thickness) and imported stone will be needed. These costs assume the existing bridge rail can be reinstalled and that a steel picket fence to meet historical district aesthetic standards is not required. An engineers opinion of probable construction cost has been prepared for these recommended repairs and the estimate including allowances for subsurface soil investigation, design engineering, bid document preparation and construction phase services, for the wall replacement is expected to

cost on the order of $958,000 and take approximately 12 weeks to complete (excluding culvert) after permits and the construction contract are awarded. This budget estimate does not include replacement of the steel arch culvert which is severely corroded and inspected by others; however combining the two projects does make sense (perhaps replacing the arch culvert with a pre-fabricated short span bridge for increased storm flow capacity and improved small boat access). The costs for environmental permitting and permit fees have been excluded as these services may be provided by City staff and the permit fees due the state are not known at this time.

SOUTH MILL POND ADJACENT TO LIVERMORE STREET

The South Mill Pond seawall near Livermore Street is a stone rubble retaining wall 234 feet in length and of varying height (1.5 feet to 3 feet high). The top of wall is at backfill level and the toe of wall borders a buried sewer main and created salt marsh and a muddy gravel intertidal area. There is a park lawn area inshore of the wall and a buried sewer main behind a portion of the wall.

South Mill Pond, ice is expected to form each winter; however the site is protected from drifting ice floes and is not exposed to wave action.

The wall is a typical rubble construction stone wall, using mostly irregularly shaped stones with no regular coursing other than the cap stones which do typically use roughly rectangular granite blocks pointed with mortar. A wall is shown in this location on an 1891 archive profile drawing, however no wall details are provided.

PHOTO 27 South Mill Pond near Livermore St.

The wall is does appear to be generally in fair condition, with rough stonework. About half of the length of the wall has a negative batter angle to the face of the wall (leaning offshore) up to -3H:12V. There a few isolated locations with missing chinking stones and lost pointing mortar, resulting in 4 small sinkholes where backfill soil has washed out. There is a missing cap stone at the west end of the wall and a cap stone dislodged at the eastern end of the wall.

Based on these observations, it is recommended that this wall be monitored to see if the observed wall movement is active. Given the low risk for potential damage to infrastructure if the wall was to collapse (sewer inverts below toe of wall elevation), this wall replacement may have a low priority, but should be considered for future planning.

Since this seawall is located in the city historic district, it is expected that the replacement seawall will need to be rebuilt using stone, in a manner consistent with historical seawalls in this area. An engineers opinion of probable construction cost has been prepared for these recommended repairs and the estimate including allowances for subsurface soil investigation, design engineering, bid document preparation and construction phase services, for the wall replacement is expected to cost on the order of $147,000 and take approximately 6 weeks to complete (excluding grass grow-out) after permits and the construction contract are awarded. We did note that much of the existing wall stone is small or of poor quality and therefore have assumed the existing stone can only be reused for 25% of the new wall construction(to proper thickness) and imported stone will be needed. When this wall is rebuilt, the design should consider keeping the wall drop less than 2.5 feet in order to avoid the need for pedestrian guard railings (most of the present wall is less than 2.5 feet high).

Due to the proximity of the intertidal resource area, it is also expected that the replacement wall will need to be built along the existing alignment with no additional encroachment seaward, thus requiring removal of the existing wall. The costs for environmental permitting and permit fees have been excluded as these services may be provided by City staff and the permit fees due the state are not known at this time.

SOUTH MILL POND ADJACENT TO POLICE STATION

The South Mill Pond seawall near the Police Station is a cast in place concrete retaining wall 420 feet in length and of varying height (2 feet to 3 feet high). The top of wall is generally at backfill level and the toe of wall borders a created salt marsh and a muddy gravel intertidal area. There is a park lawn area inshore of the wall and a line of cherry trees 12 feet inshore and buried sewer main about 25 feet inshore with an invert near high tide level. A wall is shown in this location on a 1959 survey plan, however no other details were found in archive drawing review.

South Mill Pond, ice is expected to form each winter; however the site is protected from drifting ice floes and is not exposed to wave action.

PHOTO 28 South Mill Pond near Police Sta. – note wall rotated offshore.

PHOTO 29 South Mill Pond near Police Sta. – west end with wall rotated offshore.

This wall is quite consistent on height and condition. The wall concrete is in relatively good condition, however it has rotated and the wall leans offshore significantly with the offshore face at a negative batter angle between -2H:12V and -3.5H:12V. The level of deterioration to this wall is minimal, consisting primarily of concrete spalls at some of the construction joints, some of which may have been load induced by the wall movement

shearing force at the joints. The low height of the wall and lack of backfill live loads (no roadway or even pathway), suggest that the wall rotation may have been caused by poor foundation soil conditions.

Based on these observations, it is recommended that this wall be monitored to see if the observed wall movement is active. Given the low risk for potential damage to infrastructure if the wall was to collapse, this wall replacement may have a low priority and the replacement method might be stone riprap as this is not a historical stone wall, the shoreline slope is quite flat and the foundation soils are likely to be weak.

For future planning, an engineers opinion of probable construction cost has been prepared for replacement with a small riprap slope, including design engineering, bid document preparation and construction phase services, this suggests the wall replacement is expected to cost on the order of $108,000 and take approximately 4 weeks to complete after permits and the construction contract are awarded (or this might be performed by public works crews). Given the lack of wave action and relatively low height difference at this wall, the replacement stone slope could be configured as an irregular line of varying size boulders to give a more natural shoreline appearance. The costs for environmental permitting and permit fees have been excluded as these services may be provided by City staff and the permit fees due the state are not known at this time.

GENERAL COMMENTS

The seawall replacement concepts used to establish project budgets all assume the walls must be replaced with stone walls (except for Pierce Island Bridge and South Mill Pond near the Police Station) to provide seawalls consistent with the stone appearance and historically fitting to Portsmouth. Other types of replacement structures, such as stone riprap slopes or piling type walls, are possible and may have less impact on street traffic, but are not in-kind replacements and may not be acceptable to the Historic District Commission and/or the NH Division of Historical Resources. Stone riprap slopes placed offshore of the unstable walls, have previously been allowed by the DES Wetlands Bureau where a road fronts the wall and road excavation would cause disruptions. Stone slopes are typically significantly less costly to build and maintain, compared to walls, they are better at breaking wave action and do offer marine life habitat.

In some locations, including at Maplewood Avenue, the removal and replacement of the walls in the existing location may cause an unreasonable burden on traffic rerouting, emergency services and utilities. While the DES Wetlands Bureau prefers to see the walls replaced with no further encroachment into tidelands, they have previously been reasonable in considering placing the new structures offshore of the existing wall, in order to keep roadways open. The amount of new “fill” in such a replacement method may trigger wetland mitigation requirements, increasing projects cost, and going offshore with the new wall and leaving the existing wall left in place, will eliminate project cost savings possible with existing wall stone reuse.