



2024

ANNAPOLIS ROYAL WHARF

STRUCTURAL ASSESSMENT AND CONDITION REPORT

Prepared For

Prepared By



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- Additional Wharf Pictures

1 INTRODUCTION

In 2022, the Town of Annapolis Royal approached ABLE Engineering Services Inc., “ABLE”, to complete an annual structural assessment of the town wharf. The following report will represent the third annual structural assessment performed by ABLE.

The existing wharf was constructed in the 1980’s by D.J Lowe Contracting. At that time, sheet piles were installed around an existing wooden structure, filled with rock and the surface then paved.

Presently, the Town of Annapolis Royal has only one wharf which is used by local fisherman, recreational boaters, and as parking for the downtown area. Nearly a century ago, there were a dozen wharfs on the Annapolis side of the Annapolis Basin, and 8 to 10 on the Granville Ferry side. An image of the wharfs in Annapolis Royal in July 1931 can be seen in Figure 1.

In 2022, the wharf was found to be nearing the end of its useful life. At that time, the remaining service life was estimated at five years, meaning the wharf would need to be replaced or rebuilt by 2027. The below recommendations have been put forth to maximize the service life remaining of the wharf:

- Parking to be reduced to the inner two-thirds of the wharf’s surface
- Sacrificial anodes be installed on the sheet piling
- Fallen tire fenders be repaired or replaced
- Ladders be repaired or replaced
- Timbers be repaired or replaced
- General hole patching of sheet piling, where possible.

Continued maintenance will be required until the structure is eventually replaced.



Figure 1 - Annapolis Royal in July 1931

2 STRUCTURAL ASSESSMENT AND CONDITION REPORT

2.1 INVESTIGATION

On May 14th, 2024, ABLE conducted a visual inspection of the wharf during low tide to ensure the sheet piling was exposed.

Wharf Measurements

Each year, the top width of the wharf was measured at 5-metre intervals for its full length to document irregularities and to be used for comparison of sheet piling displacement over time. ABLE took its first set of wharf measurements on June 7, 2022, then again in 2023 and 2024. Comparative measurements to the inside edge of the timber curb can be found in Figure 2 on the following page.

When returning to site in June of 2023, it was observed the curb was displaced to facilitate the addition of a new sign. Measurements for 2023 were again taken to the timber curb, see Figure 2, but a second set of measurements to steel angle iron were also taken. Measurements from 2024 have been added to Figure 2 showing measurements from the angle iron have been stable over time.

Readings this year were stable compared to last year with most stations having only a centimeter or two of change. The measurements taken in 2024 indicate the width of the wharf has shown little change in the past year.

Sheet Piling

It is exceptionally important to mention the holes on the northeast end of the wharf at the bottom of the piles have continued to expand as the steel continues to rust away. Noting some of these sheet piles have rusted more than halfway off. Complicating this is that they rusted at the bottom of the structure where loads are heaviest. It is, therefore, urgent these are repaired as soon as possible to prolong the useful life of the wharf. Failure to complete this work could result in further damage, seepage of the internal rock material and/or the potential for the end of the wharf to collapse (noting the possibility of all this occurring is heightened during storm events).

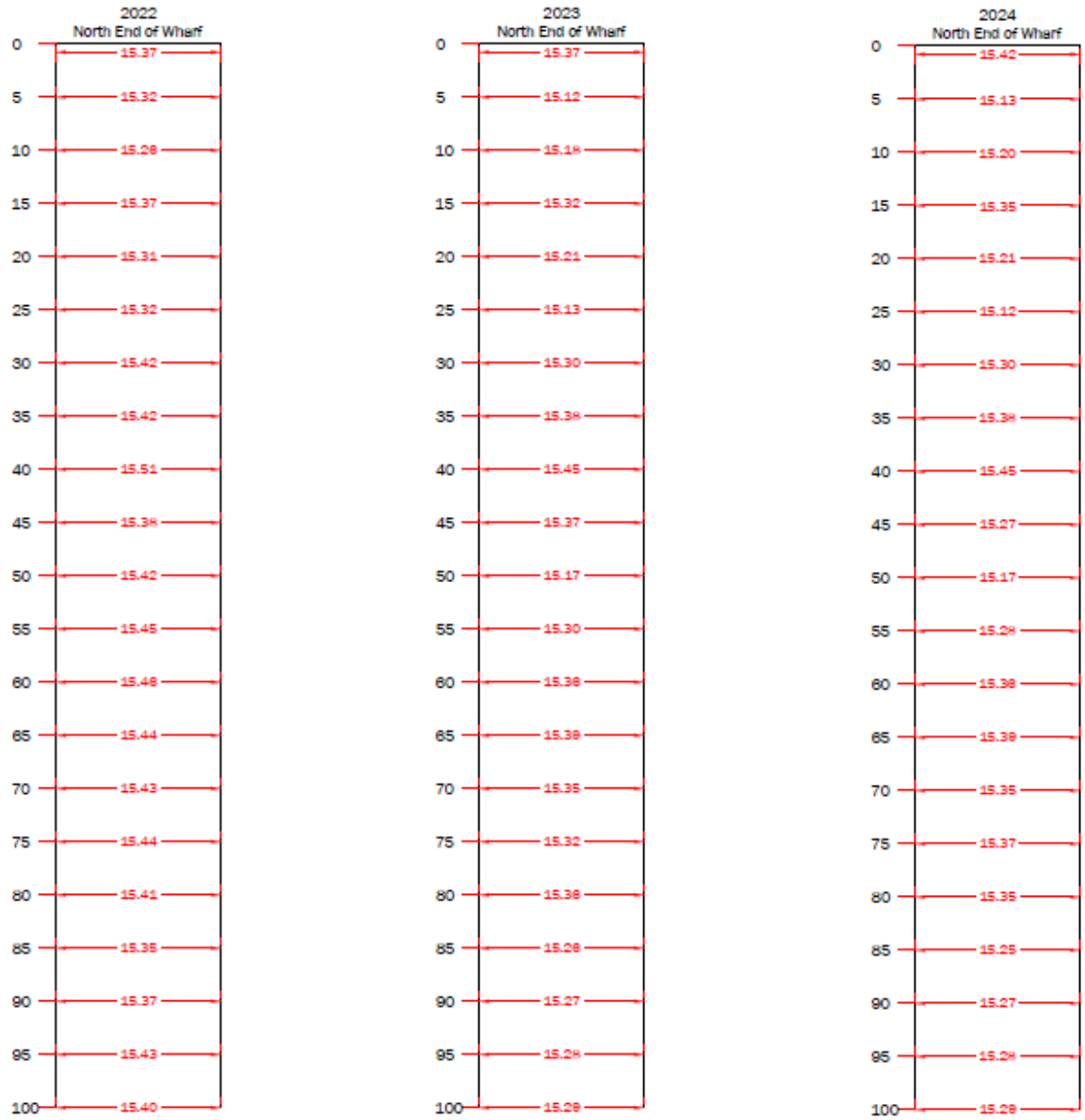


Figure 2 – Annual Wharf Measurements (2022 to 2024, inclusive)

Further deterioration and holes left unpatched from the 2023 assessment were also noted during the May 2024 inspection, particularly on the east side of the wharf. There were several large holes completely through the sheet piles which will allow the rock to wash out if not patched.

The sheet pile deterioration was most pronounced on the lower sections of the east side near the north end (see Figures 3 and 4). It was noted that there are six large holes near the bottom of the wharf where the floating ramp sits at low tide.



Figure 3 – Rust Deterioration on Lower East Side of Wharf

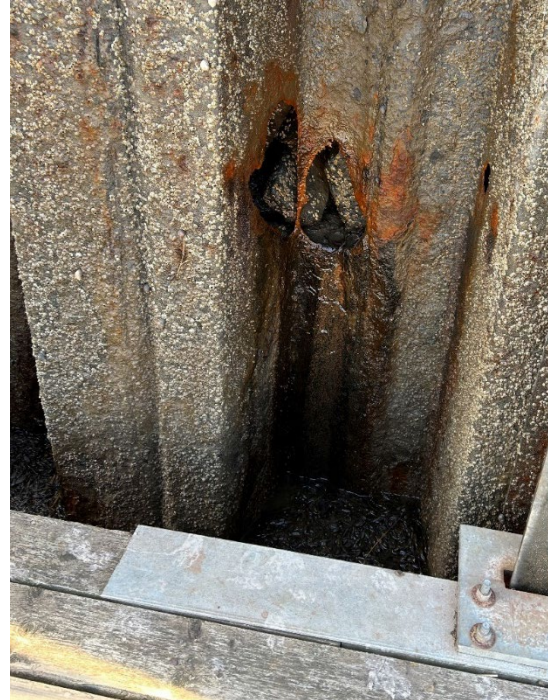


Figure 4 - Sheet Pile Deterioration at Drainage System Level, East Side of Wharf Near North End

Area of rust deterioration at the bottom of the structure should be fixed immediately to avoid further loss of integrity. As mentioned previously, the weight of the structure rests on these piles. Further damage could result in interior rock spilling out and the structure collapsing.

During the 2024 inspection, it was noted the patches that were completed previously have held up well, most of which were completed on the west side of the wharf near the top (see Figure 5, 6 and 7). These patches appear to remain in good condition and blend in with the rest of the wharf.



Figure 5 – Three Patches Near the High Water Mark on West Side of the Wharf in Good Condition

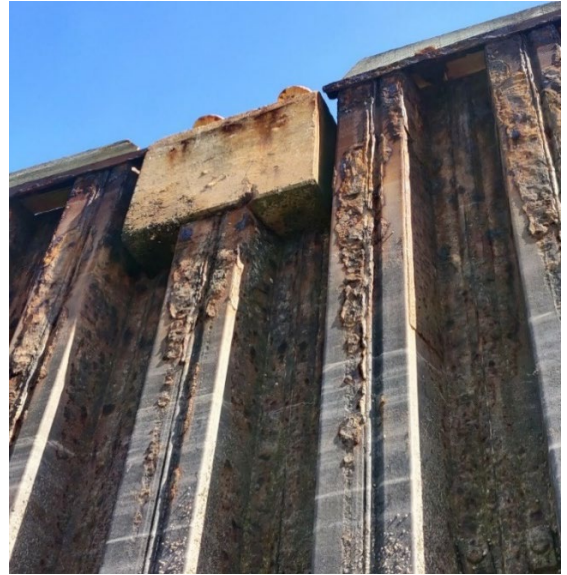


Figure 6 – Patch on West Side of Wharf Near Top in Good Condition



Figure 7 – Patch on East Side of Wharf Near the Bottom

Ladders

During the 2024 inspection, it was noted the existing ladders still require attention. Figure 8 shows the rungs having completely rusted off. It was also noted a new aluminum ladder was installed at the wharf (Figure 9). This ladder is portable and can be moved from one area to another depending on the requirements. If the existing ladders are not to be fixed, and their use

discontinued, they should be removed, or proper signage should be installed noting their failed condition.



Figure 8 - Example of Damaged/Broken Ladder



Figure 9 - New Portable Aluminum Ladder Installed in 2023

Bollards

The steel bollards themselves appear to be in good condition; however, they are supported on top of rusting and deteriorating sheet piling. This infers they are only going to hold as much as the sheet piling beneath them can support the lateral loads. The bollards can be seen in Figure 10.



Figure 10 - Steel Bollards Anchored in Concrete

Timber Curbs and Tire Fenders

The wharf's surface has an 8" x 8" timber curb running along the perimeter. The condition of the curbs has deteriorated and are considered of poor condition. Some of the timbers were seen to be rotting (Figure 12) with a notable difference in the timber on the east side of the wharf compared to the west (in better condition).

The tire fenders that used to hang on the sides of the wharf to prevent vessels from damaging the wharf (and themselves) have all rusted off. The steel cables holding them in place rusted away, and the tires have fallen to the bottom of the wharf (Figure 11). No tire fenders remain on the wharf.



Figure 11 - Timber Curb with Fallen Tires



Figure 12 - Timber Curbs on East Side of Wharf Rotten

The steel that the timbers are fastened to is deteriorating. Large rocks and caution tape have been placed on the east side of the wharf warning of the timbers that have deteriorated to the point that they would no longer stop a vehicle from going over the side. Therefore, the rocks have been placed along the edge to keep vehicles back.

With all the tire fenders except the bumpers on the outer corners, and some of the wooden fenders missing, the wharf is less attractive for recreational boaters due to the damage that could be caused to their boats. Without the cushioning of the tire fenders, damage can and will likely occur to both boats and the wharf itself.

Floating Adjustable Dock

Small boats would likely use the floating adjustable height dock at the east side of the wharf at the north end. This is much newer and was not part of the original construction. It appears to be in much better condition (Figure 14).

Asphalt Deck

The asphalt deck is still in fair condition but has some signs of settlement and longitudinal cracking 12 to 24” from the side of the wharf.

In addition, some grasses and vegetation are starting to grow in the cracks in the asphalt. There does not appear to have been any substantial loss of materials from inside the rusting piles and the depressions that exist along the sides do not appear to be any worse when compared to 2022.

The asphalt should be observed closely and inspected frequently for any signs of further settlement. An example of asphalt settling along the sides of the wharf can be seen in Figure 15. The Town may consider signage to caution wharf users of the uneven asphalt to mitigate safety concerns.

Sheet piling repairs, as previously mentioned, should be carried out this year to prevent the condition of the asphalt deck and

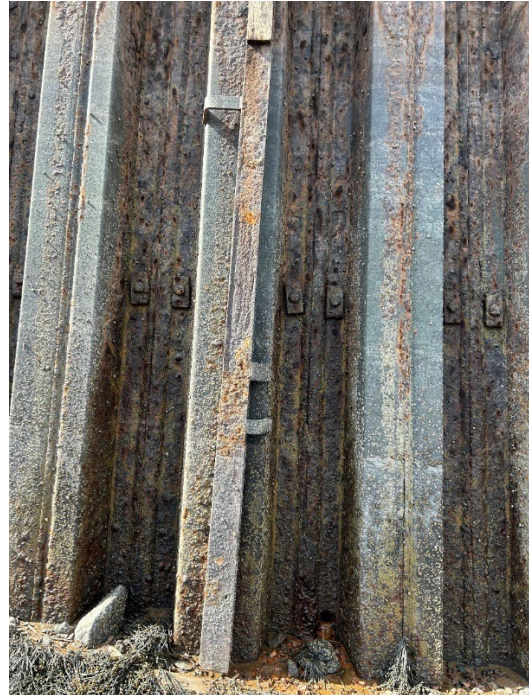


Figure 13 - Wooden Fenders on Side of Wharf Missing



Figure 14 - Floating Dock for Recreational Boaters

wharf from further deterioration. Particular attention should be given to the lower section of the east side.



Figure 15 –Settling Along Sides of Asphalt Deck

Benches & Telescope

New park benches have been installed on the north end of the wharf. These also act as traffic barriers to keep vehicle traffic from driving out to the end of the wharf. In addition, a telescope was installed in this area to allow users to view the water and marine life along the Basin.



Figure 16 - New Bench Seats

2.2 STRUCTURAL ANALYSIS

The wharf working surfaces are supported by rocks and gravel in crib work inside the sheet metal pile walls on three sides. Loads from trucks and vehicles are exerted in a downward direction supported by the underlying stone fill, however, there is a lateral component of this which is resisted by the sheet piling and the steel rods running under the wharf into the

cribwork. The condition of these rods, which would highly likely be deteriorating due to the twice daily saltwater flow, is ultimately unknown.

Previous measurements of the sheet metal pile thickness by Hatch Engineering in 2018 (6 years ago) showed that it was rusted away by as much as half of the original material thickness in some places.

It is recommended the 12 metric tonne weight limit and restrictions on parking, be maintained. No parking should be allowed on the outer 30 metres of the wharf. The addition of the new heavy bench seats on the wharf and a couple of large rocks has effectively blocked traffic from the end of the wharf and made it more attractive for pedestrian use.

It is recommended immediate repairs be made to patch any holes in the sheet piling with ½” steel plate welded in place to solid steel materials around the hole. This will help prevent the loss of rock and fill from inside the structure which would further weaken it, and to help maintain the structural integrity of the sheet piling.

The northeast end of the wharf on the east side has several rather large holes (6) that need immediate repair near the low tide level. These are accessible at low tide from the floating ramp on that side. These appear to have been missed the last two years when repairs were being made, and these are the sheet piles that when they fail will cause the most damage to the wharf.

The wharf should be inspected regularly at low tide to see if any larger holes develop in the sheet piling, and for the loss of any fill from inside. Should this happen, the repairs should be made as soon as possible, and vehicles restricted from parking nearby until the repairs are completed.

A cathode protection system using zinc anodes was recommended starting in 2022 to help protect and slow the loss of the steel to corrosion. This should be installed as soon as possible. If funds are limited, they should first be installed on the outer or north end of the wharf first near the low tide level.

3 EXISTING AND FUTURE USE OF WHARF

As mentioned earlier, the wharf is the only remaining wharf structure in the Town. It has three main uses, each of which helps drive people into the Town (tourists, locals, etc.):

- Parking for access to the downtown core
- Access for recreational boaters to dock and access the town
- Use by local fisherman to dock, complete vessel repairs, etc.

The future use of the wharf will depend on the receipt of funding to do major repairs. It is clear, based on this report and those previous, that the wharf is quickly approaching the end of its useful life. Without significant repairs and maintenance, continued use could pose a significant safety risk. Unfortunately, regular maintenance will not prolong the useful life for much longer.

4 REQUIRED MAINTENANCE AND INSPECTIONS

Below is a list of maintenance and inspections required to be completed this year:

- Patching of the rusted holes along the lower section of the sheet piles at the north end of the wharf.
 - These holes are getting larger. Since they are at the bottom, further pile deterioration could result in rock material from the interior spilling out and the collapse of the north end of the wharf.
 - Potential spillage of rock and materials from inside the wharf on this side, could also damage the floating dock and block the use of the slipway beside the wharf on the east side.
- The useful life of sheet piling can likely be extended, in some areas, with a cathodic protection system using sacrificial anodes, such as zinc bars fastened to the sheet piling. This should be done as soon as possible to slow the rate of corrosion especially around the lower northeast corner of the wharf by the floating dock.
- Continue patching holes as they appear in the sheet piling to stop the loss of rock from inside the wharf structure. **Note: do not weld patches completely over the drain holes near the bottom of the sheet piling as these are needed to allow water pressure to equalize or be minimized from rising and falling tides.** Repairs of further wharf elements are recommended as follows:
- Replace timbers around top of deck, where needed.
 - This can be done with locally obtained rough sawn timbers. Hemlock and cedar are good for this purpose, and it does not need preservatives added to protect.
- Replace tire fenders and wooden fenders along the sides of the wharf that have fallen off at least on the east side as this is the side which is most often utilized as the prevailing winds are from the west.
- Repair ladders up the side of the wharf.
- Patch holes in asphalt where weeds are growing.
- Regular inspections are still recommended.
 - In addition, it is recommended that town staff assess the structure to identify any of the above changes monthly and after any major storm. Should damage, movement or settling of the structure be detected they should request the services of a professional engineer for inspection as soon as possible. The Town may wish to consider a twice-annual inspection as the end of the useful life of the wharf approaches.
- As mentioned previously, measurements of the width of the wharf were taken at 5-metre intervals along the length of the wharf. The results shown within this report show it has been relatively stable over the past year. These measurements should also be checked and compared at a minimum once per year to determine if the sheet piles are moving outward. This will most likely provide a good indication or early warning of failure of the steel tie backs that are not accessible to inspect inside the wharf rock fill.
- Pictures of the wharf and any areas damaged should also be taken each year so visual comparison of the change can be noted over time.

5 RECOMMENDATIONS AND CONCLUSIONS

The wharf is nearing the end of its useful life. The steel piling holding it in place is rusting away and there is no way of stopping this; only slowing its progress. Realistically, the wharf can only be expected to last approximately another few years, and by then its use will be severely limited.

The repairs that were made last year appear to be holding up and have helped to reinforce the sheet piling. This work was mostly done on the west side. Our 2024 inspection revealed that there were several large holes where the sheet piling had rusted all the way through, which appear to have been missed on the east side near the low water level. These expanding holes should be patched as soon as possible. These are most likely to cause an early collapse of the wharf and need to be prioritized.

It is recommended that the above inspections and maintenance be carried out annually, at a minimum, to assess the continued capabilities and safety of this structure.

- The weight limit of 12 tonnes should be maintained on the wharf and vehicle parking can still be allowed on the inner two-thirds of the wharf.
- No parking should be allowed on the outer section of the wharf. If the rock and materials are contained in the structure, the weight of vehicles is being carried by the underlying rock so parking can still be allowed on the inner section.
- Should any buckling, deflection of the sheet piles, or large holes appear in the sheet piling allowing the loss of rock from inside the structure, then use of the wharf should be further restricted in that area and beyond. Similarly, if holes appear in the asphalt surfaces, parking should be restricted in these areas and beyond.
- Patch remaining large holes in sheet piling.
- Attach zinc anodes to the sheet piling to help slow corrosion.
- Repair or discontinue the use of damaged ladders.
- Replace wooden curb timbers on the top of the wharf.
- Provide wooden or tire fenders on the east side of the wharf to help protect it from damage to and from boats contacting with the sheet piling.
- Consider signage for areas with uneven asphalt.
- Consider signage for the improper use of the existing, deteriorated ladders.

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APPENDIX A



East Side of Wharf and Boat Launch



Sheet Pile on Lower East Side Nearly Rusted Through (requires urgent patch).



Top of Ramp to Floating Dock



Tire Corner Fenders on North End of Wharf Still Intact



West Side of Wharf Showing Drainage Holes Near Bottom of Piling