Memorandum

To: Peter and Pat King

From: Alison Clarke – 4Sight Consulting Ltd

Date: 09/02/2022

Subject: 340E Pahoia Road Seawall Options Assessment

Introduction and Background

4Sight Consulting Limited (4Sight) has been engaged by Peter and Pat King to undertake a high level options assessment for the seawall at 340E Pahoia Road, Whakamarama. The section of interest is the portion of the wall and reclamation located just beyond the south-eastern corner of the property where the structure extends into an IBDA A ecological area (**Figure 1** and **Figure 2** refer). We understand that the Bay of Plenty Regional Council (BOPRC) has assessed this portion of the seawall as a prohibited activity, and are therefore in discussion with the applicant around the removal of this section of wall in favour of soft protection measures along the southern boundary.

This memo has been prepared to investigate the various options available to appease the council and considers any potential negative environmental impacts of retaining/removing the southern sections of the seawall in the long term. This assessment builds on previous work undertaken by 4Sight[1] in relation to the coastal processes operating at the site. We recommended the original assessment be read alongside this memo. Note that the following provides discussion around potential remediation options for the southern-most end and return section of the structure (i.e. where the wall extends beyond the property boundary into the IDBA) as indicated by the yellow arrow in Figure 1. It does not consider remedial options for the remainder of the structure located along the seaward margin of the property.

Figure 1: The subject site at 340E Pahoia Road. The area in red is the IDBA. The orange polygon indicates the property boundary. The yellow arrow indicates the area of reclamation and area of non-complying activity. Source: BOPRC.

[1] 4Sight Consulting Ltd (2020). 340E Pahoia Road, Whakamarama: Coastal Processes Impact Assessment. Prepared for Dave McFarlane. July 2020.

Figure 2: The southern-most portion of the seawall which extends into the IDBA ecological area.

Option 1: Retain the existing seawall structure

This option is to retain the existing seawall structure in its current position and include restoration planting with appropriate salt-tolerant species within the IDBA area. For this option to be feasible, initially there are some planning considerations to overcome given that the BOPRC's current thinking is that the southern portion of the wall is a prohibited activity if it is considered to be an entirely new structure.

We note that the coastal margin at the subject site is a highly modified environment, with some form of hard protection structure present for at least 15 years and further modifications with the placement of fill. It has been inferred from aerial photographs that the seaward extent of the main property parcel was delineated by a low retaining uPVC sheet-piling wall since at least 2007. In 2017, the previous owners constructed a new retaining wall positioned inland of the original wall. The new retaining wall similarly extends the full length of the seaward margin of the main property parcel and extends to a higher level. The narrow strip between the two structures was then covered with concrete creating a combined 'stepped' structure.

At around this same time a new section of retaining wall was constructed at the southern end of the existing structure. The seawall extension is approximately 27m long and sweeps westwards at the southern end of the property (see **Figure 2**). As outlined in our prior coastal processes impact assessment[1], the return design of the southern portion of the seawall helps to mitigate the potential for end effects to develop which could otherwise impact the area immediately south. The assessment concludes that overall the potential for any adverse effects from the seawall are considered to be low over the short to medium term (assuming the structure remains in a similar condition as it is currently), and this is partly due to the return design of the southern point of the structure. Therefore, from a practical and functional point of view we consider the return portion of the timber seawall to be an extension to the existing coastal protection structure. Further, given the southern seawall extension has been in place approximately 5 years it is anticipated that the geomorphology and sediments within the vicinity have largely adjusted to its presence.

The structural assessment completed by Kirk Roberts in 2020[2] indicates that the structural integrity of the timber wall is "acceptable" and estimates the expected design life of the structure to exceed 20 years. Adopting an adaptive management approach, we would recommend an appropriate monitoring programme be established to enable the detection of any potential structural failure over time. Given the relatively low energy receiving environment, monitoring of the condition of the structure and adjacent areas should be undertaken on a two-year basis and/or following storm events, undertaking maintenance and repair as required. Should observations be made during these regular checks of any changes to the integrity of the structure, including movement or material decomposition, we would suggest a condition be placed on the consent which requires the retaining wall to be removed or replaced with a more traditional and robust design.

Compensatory planting within the IDBA area could also be implemented to support this option, which may include native saltmarsh species such as sea rush, oioi and saltmarsh ribbon wood. At the sides of the estuary rushes could give way to larger plants like flax. The protection afforded by the small deflection groyne at the end of the wall will aid in the establishment of planting within this area. Given the dynamic nature of estuarine environments, the input of an ecologist or botanist will be pertinent to identify and suggest appropriate salt-tolerant, hardy species which can handle varying levels of inundation by seawater. Careful consideration would need to be given around the types of plants going in there as it can get quite deep in that area.

Option 2: Removal of the section of wall within the IDBA

This is the option suggested by the BOPRC and entails removing the section of the wall and reclamation at the southern end where the wall extends into the IBDA A area. To achieve this it has been proposed to pull the fill landward during dry weather conditions back to the natural surface. The area to be pulled back is approximately 150m^2. Intensive planting of native species would then take place along what would be the new southern boundary (orange line in **Figure 1**) to help mitigate the potential for accelerated erosion due to end effects.

Given the majority of the seawall has been in place for approximately 15 years it is considered that the local coastal processes regime has largely adjusted to its presence. By removing the extension at the southern extent of the seawall some erosion is expected as the system adjusts. This will likely present itself in the form of scour to the area immediately adjacent to the structures new termination point.

Currently, the potential for end effects is considered to be mitigated to some degree by the return design and tethering the structure back into the ground, as well as the inclusion of the small deflection groyne at the end of the wall. The small deflection groyne acts to push any additional turbulence created by the vertical nature of the seawall toward more open waters. If these structures were to be removed, there would likely be added turbulence being focussed around the end of the structure making the unarmed areas of shoreline more susceptible in scour.

Intensive planting will likely reduce the potential for scour. However it is recognised that it could take some time to establish viable populations of hardy species which are sufficiently large to dampen coastal erosion processes and can also recover after a major disturbance such as a storm or flood event. There is a high chance that coastal erosion processes will impact the adjacent softer shoreline while juvenile plants become fully established. As well as coastal processes operating at the coastline, another consideration is the potential impact of fluvial processes as we note the waterway immediately south of the seawall which discharges into the IDBA area, as highlighted in **Figure 3** below. During heavy rainfall events, terrestrial floodwaters coming down from the catchment may impact any newly established soft protection from the landward side.

Given that there is a fair amount of tide received in front of the existing structure consideration should be given to the construction of a small sill protection (e.g. a low rock riprap mound) in front of the planting area to help dissipate wave energy and facilitate the establishment of coastal planting. It will also serve to reduce the potential for end effects by reducing the impact of wave reflection off the vertical seawall structure.

[2] McMillan, D. (2020). Retaining Wall/Seawall Structural Assessment. Report prepared by Kirk Roberts Consulting for Dave McFarlane. July 2020.

Because of the risk associated with this option it would be imperative to establish an appropriate monitoring plan to ensure that any adverse effects on the environment are appropriately managed. Monitoring should include photographic monitoring of the end of the seawall structure and adjacent shoreline/planting areas on a biannual basis. The purpose of the monitoring is to help assess and determine the current state and rate of morphological changes (erosion or sedimentation) occurring immediately downdrift of the new termination point of the structure, as well as the performance of the restoration planting. Monitoring should also include any observed movement or displacement of rock members from within the sill structure.

With the removal of the southern section of the seawall, consideration will also need to be given to incorporate a robust tie-off at the new termination point to prevent accelerated erosion to the adjoining softer shoreline where the coast is no longer protected by a hard structure. This will likely require some refinement on site during construction by a suitably qualified engineer.

Figure 3: Small waterway immediately south of the seawall extension.

Option 3: Rebuild the structure outside of the IDBA

This option is to rebuild the end of the retaining wall along the property's southern boundary (orange line in **Figure 1**) to avoid the IDBA ecological area. Pulling the structure landward means that it will be subject to less regular interactions with coastal processes as the structure will sit higher within the tidal cycle. Given that the relocated wall will be of a similar form (i.e. vertical face), footprint and orientation to the existing, it is likely that it will act in a similar manner to the existing structure and therefore the potential impacts on the coastal environment will likely be less than the existing situation due to its higher position within the tidal cycle. It is noted that this option may require liaison and input from an engineer to refine the design.

By removing the reclamation area, this option allows for a larger planting area than Option 1 (retain the wall in existing position). Appropriate native species may include sea rush, oioi and saltmarsh ribbon wood. Once established, the planting in front of the wall will providing protection against coastal processes as well as sun protection, which will help extend the design life of the structure.

As with the previous options, future monitoring of the system will be essential to ensure that any adverse effects on the environment are appropriately managed.

Recommendations

From a practical point of view and given the highly modified nature of the coastal environment it makes most sense to retain the extended section of the structure in its current position. The impacts of the structure on the surrounding coastal environment are considered negligible[3], and the system appears to have adapted to its presence. To compensate for the hard structure, we understand that the applicant is prepared to offer up compensatory planting within the IDBA with appropriate saltmarsh species. Planting in front of the existing structures is expected to extend their expected design life by providing a buffer against the coastal processes operating at the shoreline as well as providing some protection from the suns UV rays acting directly upon the structures. Active monitoring and an adaptive management approach as outlined above will provide for any potential future increases in hazard exposure.

If the above does not fit within the planning framework, the preferred approach would be to rebuild the structure outside the IDBA (Option 3). This will maintain some hard erosion protection without encroaching within the ecological area of concern, and allows for a larger area for compensatory planting.

With Option 2 the goal would be to establish a viable population of hardy estuarine species and negate the need for a hard engineering solution. This sits well within the resource management planning framework, which encourages soft protection options over hard protection structures for coastal management. However we do have concerns around the viability of planting as a stand-alone option. If this was the preferred approach going forward, consideration should be given to the construction of a small rock sill structure in front of the planting area to dissipate wave energy and help to prevent end effects developing. We note that resource consent for the sill structure will be required from the Bay of Plenty Regional Council which may be difficult to obtain.

[3] We note that the conclusions drawn in this report are only valid as long as the structure remains in good condition. The structural engineer has estimated this as 15 years for the uPVC wall and 20+ years for the timber retaining wall.