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# **Arboricultural Assessment of Effects**

of

Trunk Sewer line construction in Herne Bay, resulting in alteration to street and reserve trees.

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	Victoria Street West	Date	9 June 2023
	Auckland 1142	Job ref #	2590

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## 1. Introduction

- 1.1. Watercare Services Limited ('Watercare') is New Zealand's largest water and wastewater utility provider, responsible for the planning, maintenance, and operation of water and wastewater services to communities throughout Auckland and the northern Waikato regions. Watercare has supplied wholesale water supply and wastewater services since 1991 and is a Council Controlled Organisation (CCO), wholly owned by the Auckland Council.
- 1.2. As a lifeline utility, Watercare's services are vital for life, ensuring the safety and wellbeing of communities and helping them to flourish. Watercare's key services are:
  - the collection, treatment, and distribution of drinking water from various dams, rivers and groundwater sources.
  - the collection, treatment, and disposal of wastewater at various wastewater treatment plants.
  - the transfer, treatment, and disposal of trade wastes; and
  - the provision of commercial laboratory services.
- 1.3. Watercare is responsible for the management of over 410 million litres of wastewater daily, which is collected, treated, and disposed of in environmentally responsible ways. The wastewater network operated by Watercare consists of over 8,000 kilometres of pipes and 518 pump stations, directing wastewater to 18 treatment plants throughout the region.
- 1.4. Watercare is continually reviewing its activities and identifying maintenance, replacement, upgrading and new infrastructure projects to ensure it meets customer's needs, business objectives and statutory requirements. New infrastructure is frequently required across the region to cater for Auckland's growing population, to upgrade our assets, and to improve the security of its services.
- 1.5. Over the coming 20 years, Auckland's population is expected to grow by 29%, adding another 476,000 people to the current population of 1.7 million. To build a resilient water and wastewater system for this growing population, and ensure reliability of service, Watercare will invest about \$18.5 billion in renewing and upgrading critical assets over the next 20 years.
- 1.6. Watercare is joint with Auckland Council in delivering a programme of infrastructure improvement works to reduce wastewater overflows and improve water quality at local beaches. The programme of works is known as the Western Isthmus Water Quality Improvement Programme ('WIWQIP').
- 1.7. To build resilient wastewater system and ensure reliability of service and reduced overflows, Watercare is proposing to construct a new wastewater trunk sewer for the Herne Bay catchment, to connect into the proposed Central Interceptor('CI') tunnel extension to Point Erin Park.

The scope of the works involves:

- Installation of approximately 1.5 km of 2.1m internal diameter trunk sewer line, constructed via a tunnel-boring machine ('TBM').
- Installation of approximately 150m of 600mm diameter trunk sewer within Marine Parade, constructed via open-cut trenching.
- Construction of 8x primary tunnel shafts, ranging in diameter from 3.5m to 11m, along with 4x 3.5m diameter intercepting shafts.
- Installation of 4x interception pipes and 11x connections to existing engineered overflow points ('EOP's).
- Establishment of two construction support areas ('CSA's) in public reserves; and,
- Relocation and reinstatement of utilities as required.

The resource consent application is prepared for the activities described above; hereafter referred to as 'the Project'.



- 1.8. The Tree Consultancy Company has been engaged by Watercare to provide an arboricultural assessment of the Project's effects on existing trees within the road corridor, reserve trees and Notable trees, where the Project passes by and within Construction Support Areas (CSA). This arboricultural assessment considers the activities proposed adjacent to trees where resource consent or tree owner approval may be required and assesses the impacts on trees as a result of the Project. The scope of this report is to:
  - Undertake a ground-based tree inspection and capture relevant tree data to identify relevant root zone areas, of those trees where open excavations may occur.
  - Provide a general overview of the remaining trees within the Project extent, where only tunnelling works will be occurring in their root zone.
  - Assess the general condition of the individually identified trees and works that are likely to
    occur adjacent.
  - Prepare a tree inventory table and tree plan depicting the above.
  - Prepare a replanting plan for the proposal.
  - Prepare an arboricultural assessment of effects of the Project.

#### 2. Site description and summary of proposed activities

2.1 The Project site considered for this assessment is located in the northern reaches of the Herne Bay suburb and includes two Construction Support sites at Salisbury Reserve and 94A & 94B Shelly Beach Road. The proposed Herne Bay Tunnel runs from Marine Parade (at the intersection of Bella Vista Road) to the southern half of Point Erin Park, along Upton Street, a short section of Herne Bay Road, along the entire length of Argyle Street, before turning north along Wallace Street. The tunnel then passes beneath Sarsfield Street, connecting to the proposed Central Interceptor extension at Point Erin Park. The streets are lined with many tree and palm species of varying age and stature. Some of the more dominant trees include mature London planes and elms. Four notable trees are in private properties adjacent to the Project works extent. Figure 1 below depicts the Project site, which is the subject of this assessment.



Figure 1 – The subject site within the road corridor (cyan box)

- 2.2 The extent of the proposed works for the Project can be separated into five aspects:
  - a) The first aspect is the creation of eight shafts, within the road corridor, which range in diameter between 3.5 m and 11 m. At these shaft sites, cranes and large excavators will be needed to construct them to depths of up to 22.6m. Large overhead clearances and boom swing areas will be needed during the course of the works. Some smaller trees and tall palms will require removal to establish the working areas, and excavations in the root zone of other trees will be required.
  - b) The second aspect of the work comprises tunnelling the new pipe at depths that exceed 9 m. All of the tunnelling works will be within the road corridor and will be beneath the root zone of many trees.
  - c) Open-cut trenching is needed for the section of upgraded pipe work between Shaft 7 and Shaft 8 (the section along Marine Parade). The alignment of the trench is within the road, and outside of the grass berm that is in the road reserve. This section of Marine Parade is lined with an avenue of magnolia trees on either side of the road.
  - d) Engineered overflow points (EOP) are proposed to connect into the Herne Bay Tunnel, at either the primary shaft locations or through secondary shafts (SE). The SE connections will be up to 3.5 m in diameter.
  - e) The final aspect of the project is the establishment of two Construction Support Areas (CSAs) at Salisbury Reserve (12 Argyle Street) and within 94A and 94B Shelly Beach Road (referred to as McConnell Dowell's yard to the north of Point Erin Park). The McConnell Dowell site was used several years ago for a large infrastructure project, and an accessway off the Curran Street onramp is present. At the northern entrance of Salisbury Reserve two Kermadec põhutukawa are present, along with one mature melia tree in the road berm. With the construction activities and the extent of material and equipment needed, a separate entry and exit point will be required to enter the park. This entrance establishment encroaches on the two Kermadec põhutukawa.
- 2.3 The Project is depicted in the following drawings, which have been relied upon for my assessment. The final layout for the works has undergone numerous revisions to ensure that the encroachments on trees are minimised to the extent practicable. More detail on the site optimisation process is provided in the Assessment of Effects on the Environment prepared by WSP.
  - Project Overview plans Draft (Drawing No. W-SL007 001 to 002, Issue 1).

#### 3. Site assessment and limitations

3.1 I visited the Project site on the 23<sup>rd</sup> of January 2023, and investigated the principal trees within the proposed work area (tunnel alignment). The construction support areas (CSAs) were visited, and a tree inspection was undertaken in March 2023. I recorded species and measured the trunk diameter of the trees immediately surrounding areas where open excavations are proposed to occur. I estimated the tree height and the farthest radial crown spread to depict the Auckland Unitary Plan protected root zone. Qualitative observations of tree condition (form, structure, vitality) and quantitative estimates of live crown volume, which can help to inform an overall picture of tree vitality, were undertaken. The tree location was recorded using the GPS capabilities of a smartphone, and all relevant data was entered into a data collection application. The tree inspection comprised a ground-based visual inspection in the realms of what is defined as Level 2 Visual Tree Assessment, and any obvious tree risk features noted. For public trees where only tunnelling works are occurring within their root zone, a cursory inspection was undertaken, and no tree details were recorded as no arboricultural effects are anticipated. Following this initial tree inspection, a draft GIS tree plan and tree inventory table were prepared and presented to Watercare for discussion, along with potential arboricultural constraints.

- 3.2 A second site visit of the Project area was undertaken on the 7<sup>th</sup> of February 2023, with the wider Project team, including contractors with experience in delivering tunnelling projects. At this meeting, discussions were had around the types of construction activities that were likely to occur within the Project area, and refinements in the alignment were made to minimise impacts on trees, where constraints were initially identified.
- 3.3 On the 15<sup>th</sup> of February, I returned to the Project site to collect data on additional public and Notable trees that are near the proposed Engineered Overflow Points (EOP) along the tunnel alignment that will connect to the Herne Bay Tunnel via the shafts or SE manholes. Tree plans and tree inventory tables were updated to reflect the additional trees captured. The Notable trees were assessed from public land, and therefore, the extent of tree inspection is in the realm of a limited visual inspection. Although a limited visual inspection, the site conditions and tree health were assessed, therefore, and assessment of potential effects on the trees is able to be undertaken.
- 3.4 On the 14<sup>th</sup> of April 2023, a site walkover was undertaken with Council's senior urban forest specialist. I provided an overview of the Project and work that was proposed to be undertaken to minimise work footprints and encroachment towards street and reserve trees. We also discussed the rationale for tree removal and replacement planting that is recommended to be undertaken, and in particular, the grade of new trees to be provided.

#### 4. Summary of tree details and site observations

4.1 Starting from Shaft 1 and the area of works adjacent to and within Point Erin Park, the trees surrounding the works comprise three mature willow myrtles (Trees 116 to 118) that are within the road. Trees 116 and 117 are on the southern side, with Tree 118 being on the northern side and is closest to Point Erin Park. The trees are in good health; however, they have fair or poor branch structures. Figure 2 depicts the three trees in relation to the proposed works.



Figure 2 – Location of trees 116 to 118 in relation to Shaft 1

- 4.2 The tunnel traverses in a westerly direction down Sarsfield Street to the intersection of Wallace Street. Sarsfield Street is well treed with avenues of trees planted within the generous grass berm that is present. The larger and mature trees noted include elm and willow myrtle, interplanted with smaller melia, pūriri, titoki and olive trees.
- 4.3 At the intersection of Hamilton Road, Sentinel Road and Lawerence Street, connections into new EOPs will be required. The most northern section of Hamilton Road is lined with early mature jacaranda trees on either side of the road, planted in a generous grass berm. The trees stand up to some 7 m in height and generally are in good condition. Within 61 Sarsfield Street (at the north-eastern corner of the street intersection) is a mature pōhutukawa tree that is listed as a Notable specimen under the Auckland Unitary Plan. Figure 3 depicts the notable tree and avenue of the jacaranda trees.



Figure 3 – Notable põhutukawa and avenue of jacaranda

4.4 An avenue of mature lime trees, with the occasional water gum trees, are growing on either side of Sentinel Road, again within generous grass berms of up to some 2 m in width. The limes and water gums on the western side of the road have historically been reduce away from the overhead powerlines, creating a low and mop-top-like canopy in some instances. Many of the trees have canopies that are a few meters above the road, which are perhaps sufficient clearance for smaller vehicles parking, but insufficient for larger vehicles and trucks. The trees on the eastern roadside are taller and have a more upright form, with greater clearances over the road. The trees are generally in good health, with no obvious tree risk features that would warrant remedial works. Figure 4 is an example of depicting the lime avenue lined street.



Figure 4 – Lime and water gum trees along Sentinel Road

4.5 At the intersection of Sarsfield and Lawrence Street, two post-mature elm (trees 75 and 77), two willow myrtle and one pūriri are within the road berm, with canopies that enclose a large proportion of the intersection. The elms are significant specimens being large trees in the road reserve and are especially valuable as they have not been infected with Dutch elm disease, a vascular disease that can quickly lead to tree death. Figure 5 depicts the elm trees and the smaller pūriri.



Figure 5 – Trees 75 to 77

- 4.6 Approximately 80 m to the west of tree 75 is the intersection of Sarsfield and Wallace Street, where two juvenile melia trees are present on the Sarsfield Road frontage. To the southwest and on Wallace Street, two rows of closely planted Kermadec põhutukawa (six trees), albizia, titoki and loquat are present in a 1.5 m or so wide grass berm. Some of the trees have canopies that hang low over the road. On the eastern side of Wallace Street, two titoki and a mature cherry tree are present. The health of the trees is generally good.
- 4.7 Two scheduled notable pōhutukawa trees are located at 1 Stack Street, near the southern boundary. The two trees are in good health and are formed with canopies that spread broadly over the road, to near the middle of adjacent Wairangi Street. One stem from the western tree hangs approximately 4.5m over the road.
- 4.8 Along Wairangi Street, between Stack Street and River Terrace, five mature and post-mature melia trees are present, along with one pepper tree, which is all growing in the road berm. An almost complete avenue of melia trees once lined the street, however, at least four have been removed in relatively recent times. The health of the trees is overall fair to good, with no obvious tree risk features noted.
- 4.9 The eastern end of Argyle Street contains two small cherry trees (trees 51 and 55) and one small pseudopanax (tree 50). Both the cherry trees are generally in fair condition and are not specimens that can be classified as arboriculturally significant.
- 4.10 Number 12 Argyle Street is a property zoned open space informal recreation, and this will be utilised as a Construction Support Area. At the entrance, two 4 to 4.5 m tall Kermadec pōhutukawa trees are located within the reserve. They both have broadly spreading canopies and multiple trunks from the base. Two stems have been removed from the western tree (tree 46), and it has been crown lifted quite high. As a result of the historical pruning, the tree has fair form, at best. The eastern tree (tree 47) is more centrally located in the reserve road frontage and has better form. One limb, which has been 'lions tailed', heads towards tree 46. Figure 6 below depicts the two trees.



Figure 6 – Trees 46 and 47, at the entrance of 12 Argyle Street

- 4.11 Outside of 45 Argyle Street is one post-mature pōhutukawa (tree 41), one mature and one early mature pūriri tree, a mature titoki and mature cherry (trees 40, and 42 to 45). Tree 41 is the most significant of the group, and they are all growing in a narrow grass berm. The western canopy edge has some 3.5 m to 4 m over the adjacent vehicle crossing. The tree is situated beneath power lines, and various manholes and catch pits were noted nearby. The tree is overall in good condition, with no obvious tree risk features noted.
- 4.12 The Herne Bay Road section of works contains post-mature London plane trees (trees 22 to 25 and 27 to 31) that reach up to some 17 m in height. The height of the canopy over the road and nearby intersections are between 7 and 8 m above the road. These trees are, arboriculturally, very good examples of the species growing in a street tree environment. A small and relatively unremarkable cherry tree is located outside 72 Argyle Street.
- 4.13 The northern end of Herne Bay Road leads down towards Herne Bay Beach Reserve, a grass reserve abutting the beachfront. A maintenance vehicle access road sweeps from Herne Bay Road/Marine Parade, past several ngaio trees, which overhang. Four mature London plane trees are located within a grass area beyond.
- 4.14 Four 11 to 12 m tall queen palms and four 5.5 to 7 m tall magnolia trees are located outside of 34 and 36 Herne Bay Road, on the Upton Road frontage. The palms can be classified as mature specimens, and the magnolia are early mature. With the exception of Tree 19, the trees are generally in good health. Tree 19 has a thinner canopy and is assessed to be in fair health. Arboriculturally, there are no concerns with the trees that would warrant removal. The trees are growing in a 2 3 m wide grass berm.
- 4.15 The entire length of Marine Parade within the Project extent contains early mature magnolia trees that are generally in good health, and with no obvious tree risk features. These trees are also growing in a generous grass area that supports future growth and development.
- 4.16 Numbers 94A & 95B Shelly Beach Road is the second Construction Support Area proposed for the project. The zoning of the land is a Strategic Transport Corridor and it contains a Significant Ecological Area at its southern extent. The principal vegetation within the Significant Ecological Area overlay comprises pōhutukawa of mature age class. Several juvenile pōhutukawa trees have been planted near the middle of the site.

### 5. Arboricultural assessment of effects

#### Shaft construction

5.1 A total of eight shafts are to be constructed for the Project, which will require excavations in the road corridor between 11 m and 15 m in width (including working room outside the shaft footprint to construct). Shaft 1 lies within the footprint of Tree 117 (willow myrtle), and it will require removal Figure 7. It is also proposed to remove this tree as part of the Central Interceptor extension consent application currently processing by Council and outside of the scope of this Project. Retention of this tree is not feasible.



Figure 7 – Shaft 1 location in relation to trees 116 to 118

- 5.2 The excavations for the shaft are extensive and do not allow for any tree root retention that may lie within. The shaft location is outside of the Protected Root Zone area of both trees 116 and 118 (as defined by the Auckland Unitary Plan), however, it is within the Tree Protection Zone (TPZ) set out in the Tree Owner Approval Guide produced by Community Facilities at Auckland Council. The TPZ is calculated by measuring the trunk diameter at 1.4m and multiplying by 12. Given the inhospitable rooting environment beneath the road, significant root activity between the PRZ and TPZ is unlikely, and indiscriminate root loss for the construction works is likely to have minimal effects.
- 5.3 Overhead canopy clearance from trees 116 and 118 is currently sufficient for road traffic, however, an increase in clearance areas will be required. The extent of pruning in this instance is likely to comprise crown lifting to 4.5m and a careful reduction on the north canopy edges. When undertaken in accordance with accepted practice, insignificant effects will occur.
- 5.4 A secondary shaft (SE01) is to be constructed on the north-western corner of the intersection of Sarsfield Street and Hamilton Road. SE01 has been relocated further west to maximise the distance from a notable pohutukawa tree that is located at 61 Sarsfield Street. (Figure 8 tree 115). The manhole location is outside of both the PRZ and TPZ of trees in the road, as is the case of SE02 (Figure 9). With the pipe being installed using trenchless technologies, effects on the notable tree will be negligible (perhaps nil).



Figures 8 (left) and 9 (right) – SE01 in relation to the notable pōhutukawa (T115) and location of SE02

- 5.5 SE03 is proposed to be centrally located along Sarsfield Street at the intersection with Lawrence Street. It is within the PRZ and TPZ of tree 75 and the fringe of tree 77, both mature elm trees. Indiscriminate root loss to excavate the 3m wide secondary shaft is sufficiently clear of the trees where extensive root severance is not expected to occur. This is due to the inhospitable growing environment beneath the road, minimising the potential for extensive root growth beneath the road. Effects on the trees will be insignificant.
- 5.6 Overhead canopy pruning for trees 75 and 77 will be required to undertake the works, to enable sufficient space for excavators and cranes to remove debris and install materials. As a worst-case scenario, the elm limbs overhanging the shaft may need reduction by 3 to 4 m in length. The volume of pruning is minimal, and large pruning wounds back to trunks will be avoided. No sustained effects on tree health will result from the pruning.
- 5.7 Proposed Shaft 2 is at the intersection of Sarsfield and Wallace Street, adjacent to a row of Kermadec pōhutukawa trees (tree 62 Figure 10. Excavations for the shaft location are well outside of the root zone of this tree group, and any effects from root zone disturbance will be negligible. The construction area for Shaft 2 will require crown lifting of these trees, to approximately 4.5m in height, and back to kerb line, however, there is scope to retain any large scaffold limbs that are present. The level of pruning can be classified as maintenance for the road corridor clearances.
- 5.8 Shaft 3 is proposed to be located at the intersection of Argyle and Wallace Street and is similarly outside the PRZ and TPZ of street trees. This shaft has a large diameter and requires access for a crane and large excavators. Although street trees are clear from the excavations, the footprint of the construction area is where two Cherry (tree 51 and 55), one pseudopanax (tree 50), and one juvenile pōhutukawa (tree 54) are located and therefore these trees will need to be removed. The cherry trees are in fair health with twiggy deadwood present, and the pseudopanax and pōhutukawa trees are too small to reach protection status. Of the four trees, the pōhutukawa is worthy of relocation to another location in the street. The three remaining trees are arboriculturally insignificant, and their removal can be mitigated with replacement planting. Figure 11 depicts the construction area of Shaft 3



Figure 10 – Shaft 2 location



Figure 11 – Shaft 3 and the construction yard conflict with various trees

- 5.9 Outside of 45 Argyle Street, a 3.5m wide secondary shaft (SE04) is required to be drilled some 7 m deep. The location of the shaft is on the periphery of the PRZ and within the TPZ of a mature pōhutukawa tree (tree 41), which is overall in good health. As with the previous shaft excavations, clearances are such that widespread root severance is highly unlikely, and effects will remain at insignificant levels.
- 5.10 The canopy of tree 41 hangs approximately 6m over the road and pruning to increase canopy clearance will be required. As a worst-case scenario, a reduction of the westernmost limb, which heads towards a manhole in the road, will be needed. The pruning will entail the cutting of a limb with a diameter of approximately 150mm. Provided the pruning is undertaken by a qualified arboricultural contracting company, and the pruning is back to sustainable limbs, no long-term sustained effects will occur to the tree.
- 5.11 Proposed shafts 4 and 5 are on Herne Bay Road, at the intersections of Argyle (Shaft 4) and Upton Street (Shaft 5). Along Herne Bay Road are mature London plane trees that are assessed to be very good examples of the species in a road environment (trees 24, 25, and 27 to 31). The shaft sites and resulting root loss have been placed in a manner where minimal, perhaps negligible effects will occur, however as a theme for the Project, current overhead canopy clearance is insufficient. A crane is likely to be established between trees 28 and 29, for the 18 m to 19 m deep shaft to be constructed. Tree 28 has one limb heading in an easterly direction, which measures some 200 mm in diameter (at the point of attachment, where it connects to a similar-sized limb). Removal of this limb is proposed (Figure 12), as a worst-case scenario to undertake the Project.
- 5.12 Regarding pruning of tree 28, as the main branch divides into two stems of similar size, removing one will create a wound of similar size on the remaining limb. Best arboricultural practice includes ensuring the branch being pruned back to is at least 1/3 of the branch diameter that is being removed. The pruning, in this instance, conforms to this practice. The extent of foliage removed from this limb accounts for a small proportion of the overall canopy, therefore, effects on the tree by pruning this will be insignificant.



Figure 12 – Branch proposed to be removed from tree 28, noting only the stem is indicated

5.13 Construction machinery and storage can be kept away from the remaining London plane trees, however in order to do so, extending the construction area along the eastern section of Upton Street will be required. This impacts three queen palms (trees 15, 20 and 21), four semi-mature magnolia trees (trees 16 to 19), and tree 26 (cherry outside of 72 Argyle Street) where their removal will be required. Arboriculturally, there are no grounds for removal, however, they will ensure machinery and equipment can be kept further away from the more superior London plane trees.

- 5.14 A desktop analysis has been undertaken to explore the feasibility of tree relocating the above trees with the first aspect being a review of underground services and drains, through a before-you-dig search. In this instance, both low-voltage and high-voltage power cables are beneath the ground, some 2.5 m to 4 m from the surrounding property boundaries. In addition to this, a gas pipe is present in the road berm on the southern section of Upton Street. These services render the relocation not feasible without incurring costly temporary service relocation.
- 5.15 Shafts 6, 7, and 8 are all clear of PRZ and TPZ, and there is sufficient overhead clearance to construct. No effects on street trees will occur with the construction of these three shafts.

#### Sewer trunk main pipe construction

- 5.16 The proposed Herne Bay Tunnel between the shafts passes at depth beneath numerous mature trees, which have not been individually identified in this assessment. The depth of the pipe is to have a minimum cover of 9 m, but on average, will be much deeper. At 9 m, no roots from the trees along the alignment are expected to be encountered. Effects on the street trees along the alignment from tunnelling are therefore considered to be negligible.
- 5.17 A 200 m or so section of 600mm diameter pipe will be open cut between Shaft 7 and 8, through roughly the middle of Marine Parade. The depth of the pipe ranges between 2.5 m and 10 m, where it connects to Shaft 7. The alignment has several magnolia trees that are growing in grass berms either side of the road (trees 1 to 10). Being within the road environment, large-scale root disturbance is unlikely to occur, therefore, no long-term sustained effects are expected to occur. With the exception of tree 10, all excavations are outside of the PRZ and TPZ. For tree 10, the excavations are on the periphery of the tree protection zone, and only minimal root disturbance will occur.
- 5.18 Some tree pruning will be required for a handful of the magnolia trees to provide greater overhead clearance. The pruning extent is in the realm of general maintenance to provide conflict-free movement of vehicles along the road corridor.

#### **Engineered overflow points**

- 5.19 Six engineered overflow points (EOP) will be constructed during the Project and will connect into either the primary or secondary shafts (SE). The pipes range between 300 mm and 600 mm in diameter, with installation methods comprising both open-cut and trenchless methods.
- 5.20 An EOP will be constructed on the northern section of Hamilton Road and will be installed by trenchless methods. The cover (top of pipe beneath the ground) will be some 1.1 m at the northern end, extending to some 11.65 m at SE01. At this depth, effects on the street trees will be negligible, including the notable pōhutukawa tree that is located at 61 Sarsfield Street.
- 5.21 Excavations to form the drilling pit and connection into EOP202 will require the removal of a 5 m or so tall semi-mature jacaranda tree (tree 112), and two 3.5 m tall hibiscus trees adjacent. The jacaranda tree is generally in good condition, and there are no arboricultural grounds to warrant removal. Although a good tree, its removal can be adequately mitigated with replacement planting, which is described later in this assessment. Regarding the two hibiscus trees, Mr Santos (in the capacity of the tree owner/asset manager) has requested these two be relocated, rather than removed. Relocation of the trees is feasible from a tree health perspective, and their final location will require consultation with Mr Santos prior to works commencing.
- 5.22 A 450 mm diameter will be open cut down Sentinel Road, between 28 and 56 Sentinel Road, past nine mature lime and two early mature water gum trees on the western side of the road. The earthworks are within the road and will be some 2.5 to 3 m away from the kerb. Significant root activity is not expected to be encountered during the excavations.

- 5.23 The canopy of the trees 79 to 101 and 103 hangs lowly over the kerb and parking area in the road corridor. Crown lifting will be required, and this should conform to clearance that is required to maintain road traffic access (i.e., 4.5 m above ground level to 500mm behind kerb line). Several scaffold limbs are present over the road, and if their removal falls outside of best arboricultural practice, then they should be retained (i.e., retain limbs that will create a large pruning wound on the parent stem).
- 5.24 A notable totara (tree 102) is located within 80 Sarsfield Street, on the Sentinel Road frontage, and it overhangs the footpath. It is surrounded by a plastered wall, with a garage on the southern aspect. The trenching works to install the new pipework are well outside of the protected root zone area of the tree, and root severance is unlikely to occur. Little to no effects will therefore occur.
- 5.25 Along Stack, Wairangi Streets, and River Terrace, a 450 mm diameter pipe will be installed via trenchless methods. Two notable pōhutukawa trees are located within 1 Stack Street and undertaking the trenchless method at a depth of more than 7 m will ensure no roots are encountered. Excavations are, however, needed to install a manhole (and possibly a drilling pit) at EOP1019 WWMH01 (Figure 13). The manhole has been shifted further west, to a position where insignificant roots are likely to be encountered.



Figure 13 – Notable trees at 1 Stack Street (trees 63 and 64)

- 5.26 In addition to the excavations, light crown lifting of a limb that heads in a westerly direction of tree 64 (notable pōhutukawa) will be required. When pruning back to correct branch collars, the size of limb removal will almost certainly be greater than 50 mm in diameter, but less than 100mm. Figure 14 depicts the limb proposed to be crown lifted.
- 5.27 A 4 m deep manhole will need to be constructed within Herne Bay Road Reserve and trenchless methods will be used to install a 300mm pipe in a southerly direction towards Shaft 4. The excavation to form the manhole is on the periphery of several mature London plane trees PRZ and TPZ, and indiscriminate root loss to construct it will have minimal effects on the trees. Any drilling pits will need to be carefully located to ensure similar clearances are maintained from the trees, in particular tree 37 (Figure 15). Overall, the impact on trees can be managed to acceptable levels.
- 5.28 Access to the manhole will be through the concreted vehicle maintenance accessway off Marine Parade. The accessway passes by two mature ngaio trees that overhang. Pruning to cut the canopy back will be required, along with crown lifting. The pruning will alter the shape of the canopy; however, this is not likely to be significant. From a tree's biological perspective, no long-term sustain effects will occur.

5.29 The remaining two EOP and their pipework are to either be constructed outside of the PRZ and TPZ of street trees, or in the case of near SE04, in a location where root severance is proposed for other works.



Figure 14 – Limb to be crown lifted (shaded out)



Figure 15 – Herne Bay Beach Reserve.

#### Construction Support Areas ('CAS')

- 5.30 Given the scale of works and equipment, and materials that are required to deliver the Herne Bay Tunnel Project, two contractor's yards are required to be established. Two locations have been explored, one being within Salisbury Reserve, with an entrance off Argyle Street, and the second being at 94 Shelly Beach Road, immediately to the north of Point Erin Park, in a grass area access from the Curran Street on ramp.
- 5.31 The Salisbury Reserve yard will have a dedicated entrance and exit off the Argyle Road frontage, where two Kermadec pōhutukawa (trees 46 and 47) and one melia tree (tree 48) are present. Tree 46 is located near the western boundary of the site and is overall in good vitality, however, it is in poor form and with a fair branch structure. This tree is considered arboriculturally insignificant, and its removal will be required to service the contractors entering and exiting the yard. Within the site are three mature cabbage trees (trees 119 to 121), which are generally in fair condition. Two of the trees exhibit large basal decay, and the third tree is in fair form. Their removal will be required to establish the support area. By replanting tree species on a 1:1 basis, the greater ecosystem service benefits will be provided to the immediate area.
- 5.32 Tree 47 is more centrally located and can be retained to allow for access. It too has good vitality and has a fair form and branch structure. A western limb grows acutely from near the base and heads towards tree 46. The removal of this stem (Figure 15) will be required to allow for vehicle access.
- 5.33 Tree 48 is within the road berm outside of the reserve, and is also centrally located, mid-boundary. Two narrow gardens are located along the eastern and western boundary of the reserve, and removal of these gardens (including the low-lying vegetation within, will ensure adequate clearances are achieved from trees 47 and 48.
- 5.34 The second contractor's yard at 94 Shelly Beach Road, also known as the 94A-B Shelly Beach Road Site. This site is zoned Strategic Transport Corridor. Several years ago, the McDowell site was used for an infrastructure project, with access coming from the Curran Street on ramp. Surrounding the southern section of the site is a grouping of native trees (mainly pōhutukawa) that occupy the bank and at the bank toe. The vegetation in this area is within a Significant Ecological Area overlay. Three recently planted pōhutukawa are also present towards the middle of the site. Figure 16 below depicts the site and approximate location of the three trees.





Figure 16 – CSA2; three recently planted pohutukawa in blue

- 5.35 The three pōhutukawa trees are young specimens, likely planted in the past two to three years. As they are juvenile, it is recommended they be relocation elsewhere on the site. All tree relocation should be undertaken by suitably experience arboricultural contractors, with the work according to best arboricultural practice. The trees will require maintenance for a minimum of two years after relocation (i.e. watering during summer, re-mulching, stake re-tying, etc).
- 5.36 At the southwestern corner of the site, a gobi-block accessway is present, and this traverse beneath the canopy of at least one large pōhutukawa tree. Given the site was previous access for an infrastructure project, current overhead canopy clearance is sufficient, and no pruning is required to trees. Furthermore, there is sufficient space within CSA2 to isolate the Significant Ecological Area trees from the yard with temporary protective fencing. Placing this fencing at least 1 m outside of the trees' canopy edge will provide sufficient space to ensure tree alteration does not occur. Overall, effects from establishing the CSA at 94 Shelly Beach Road, will have insignificant effects on surrounding trees.

- 5.36 To mitigate the proposed tree removals, pruning, and works within root zones, it is recommended that standard Watercare and Central Interceptor project practices and tree protection measures set out in **Appendix A** continue to be followed, including:
- 5.37 All tree removal and pruning be undertaken by a suitably qualified and experienced arboricultural contractor, with all work carried out in accordance with current accepted arboricultural techniques (e.g., Arb Australia and NZ Arb Minimum Industry Standard MIS308).
- 5.38 Engagement of a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist') continues on this Project. The role of the supervising arborist is to supervise and coordinate all works and activities within the root zone of trees, and to liaise with the principal contractor around works that are required to protect the retained trees. All works must be undertaken in a fashion that ensures effects on the retained trees are minimal.
- 5.39 Temporary tree protection fencing should be installed at the Tree Protection Zone areas where a permeable surface area exists. The fence should be constructed in accordance with specifications TP-01 and TP-02 in **Appendix B**. The fence must remain in place for the duration of construction activities at each location of the Project. The protective fence may only be removed / relocated, closer to retained trees, at the direction of the appointed supervising arborist. Any site activity which needs to take place within the fence, and Tree Protection Zone, must be done under supervision and in coordination with the supervising arborist.
- 5.40 For mitigation planting, and with the exception of the three cabbage trees, I have used the trees' DBH measurements and modelling from i-Tree to make some inferences about ecosystem services (Nowak & Crane, 2000, The i-Tree Development Team, 2020). The i-Tree software quantifies ecosystem services provided by trees based on input dimensions, known species characteristics and growth rates. Using this tool, it is possible to forecast how a tree will perform over time and specifically how much carbon it is expected to sequester. With reference to the removal of trees, the remedial planting needs to account for lost future benefits since all benefits up to the date of removal have already been received (Nowak & Aevermann, 2019). That is, the replanting needs to account for the future carbon sequestration of the trees being removed.
- 5.41 We used the dimensions of all trees being removed and forecasted the carbon sequestration values for 27 years. A value of 27 years was chosen because a goal has been set for carbon neutrality by the Climate Change Response (Zero-Carbon) Amendment Act (2019) by 2050 and because this was a realistic lifespan for the trees. Therefore, the remedial planting needs to account for this carbon 'footprint' if carbon neutrality is to be achieved.
- 5.42 Using the same tool and with known dimensions of 45 L-grade nursery trees, the benefits of these nursery trees are forecast in the same way. To ensure there is no deficit in atmospheric carbon sequestration to the year 2050, at least forty-six exotic or fifty-one native trees are required to be planted. Liaison with Parks and Community Facilities department at Auckland Council will be required to confirm the location and individual species that are to be planted. Not all trees need to be planted in the road berm, as nearby reserves can be used for replanting.
- 5.43 At the eastern end of Upton Street, it was agreed Council's Urban Forest Specilaist that the replanting of larger-grade trees in the road berm would be appropriate, therefore, 160 L grade specimen trees should be replanted. As the site will be used for construction activities, the underlying soil may become compacted. Undertaking remedial works to the soil, including de-compaction, will aid in the successful establishment, growth, and development of the new trees. Species of the new trees should be those that can develop to comparable dimensions of the existing magnolia trees.
- 5.44 To mitigate the loss of the three cabbage trees within Salisbury Reserve, three new trees are recommended to be planted. Being tree species, rather than a monocot (which cabbage trees are), the ecosystem services benefit the new trees will provide, outweighs the benefits cabbage trees can achieve.

#### 6. Statutory assessment

6.1 A planning assessment of the Project is outside the scope of this report and will be carried out separately from this assessment. The following rules are applicable to this Project in relation to trees in Open Space and Road zoned land, along with Alteration to Notable trees:

#### E26 – Infrastructure

#### Activity Table E26.4.3.1

- (A84) Tree trimming or alteration that does not comply with Standard E26.4.5.1 (Trees in streets and open space zones) or Standard E26.4.5.3 (Notable trees), as a Restricted Discretionary Activity
- (A88) Works within the protected root zone not otherwise provided for, as a Restricted Discretionary Activity
- (A91) Tree alteration or removal of any tree less than 4 m in height and/or less than 400 mm in girth, as a Permitted Activity
- (A92) Tree alteration or removal of any tree greater than 4 m in height and/or greater than 400 mm in girth, as a Restricted Discretionary Activity
- 6.2 The removal of trees less than 4m in height, or with a trunk girth less than 400mm, is a permitted activity under table E26.4.3.1. Tree 50 is a small pseudopanax that is less than these dimensions, and its removal is, therefore, permitted. Trees 54 is also less than these dimensions however it is a worthy candidate for relocation. The relocation of this tree is a permitted activity. Trees 15 to 21 (tree 21 is a pair of trees), 26, 46, 50, 51, 55 and 112 exceed these dimensions, therefore triggering the requirement to obtain resource consent as a Restricted Discretionary Activity.
- 6.3 The Project also seeks allowances to undertake pruning of trees, including Trees 28, 41, 75 and 77 to allow for greater overhead clearance to construct the shafts and secondary shafts. The permitted standards pertaining to pruning are set out at E26.4.5.1 (1) and allow for the pruning of branches up to a diameter of 100 mm, provided no more than 30% of the live growth is removed, the works conform with arboricultural practice and standards and the natural shape, form and branch habit of the tree must be retained. In this instance, branches greater than 100 mm are likely to pruned for the above listed four trees, and the shape will be altered, therefore, consent is sought to undertake tree pruning that does not comply with the standard. Most of the remaining tree pruning can be undertaken as per standard E26.4.5.1 (2), where maintenance to maintain legal clearance height and width above the road is needed.
- 6.4 Works within the protected root zone of the remaining 87 trees inspected are proposed to occur. The encroachment into the Auckland Unitary Plan defined root zone does not exceed 20%, and in most instances, clearances are sufficient where roots greater than 80 mm in diameter are unlikely to be encountered. It however cannot be ruled out that the occasional root greater than 80mm in diameter may be encountered where its removal will have minimal effects on tree health. The Protect, therefore, seeks consent to undertake works in the root zone of trees that does not comply with the permitted standards set out at E26.4.5.2, as a Restricted Discretionary Activity.
- 6.5 Given trees on roads and on public reserves are to be removed, Tree Owner Approval from Council's Senior Urban Forest Specialist is a requirement for the works to proceed on road and Land Owner Approval from Council's Land Advisory team for works in public reserves. This is outside of the Resource Consent/Resource Management Act process, however, engagement with the relevant council staff member has already commenced, and the project team will continue to do so.

#### 7. Conclusions and recommendations

- 7.1 The Project is to extend the upgrade Branch 5 Sewer in Herne Bay, with the construction of a new 2.1m diameter wastewater tunnel. The proposal will require the construction of shafts, engineered overflow points and secondary shafts in the road corridor. In addition to this, two CSAs are proposed to be established in Salisbury Reserve and at 94 Shelly Beach Road. In summary, the Project will involve the following:
  - Works within the root zone of eighty-one trees in the road corridor are considered to have minor or negligible effects.
  - Tunnelling beneath trees in many more street trees (associated with the Herne Bay Tunnel and ancillary infrastructure) are considered to have negligible effects.
  - Removal of two trees as a permitted activity.
  - Relocation of three trees as a permitted activity (include the two hibiscus).
  - Removal of fifteen trees which exceed the permitted activity size for removal, comprising twelve street trees and three reserve trees.
  - Replanting between forty-nine and fifty-three trees as mitigation planting.
- 7.2 The fifteen trees to be removed are to enable suitable construction areas to be established in the road corridor and construction support area at Salisbury Reserve, and in many instances, areas to maximise distances from superior trees (such as the London plane trees along Herne Bay Road). Relocation of eight of the trees and palms has been explored, and it is assessed to be unfeasible due to the presence of underground low and high-voltage power cables and a gas pipe. The overall design has minimised and configured footprints, and it is the most arboriculturally sensitive available.
- 7.3 In line with standard Watercare and Central Interceptor project practices, it is recommended that all tree removal and pruning is undertaken by a suitably qualified and experienced arboricultural contractor, with all work carried out in accordance with current accepted arboricultural techniques (e.g., Arb Australia and NZ Arb Minimum Industry Standard MIS308).
- 7.4 It is recommended that the Project continues to engage a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist') for the works associated with the Herne Bay tunnel. The role of the supervising arborist is to supervise and coordinate all works and activities within the root zone of trees.
- 7.5 It is recommended that the tree protection measures set out in Appendix A are followed. These measures are also all standard Tree Owner Approval conditions.

Please contact the author for further information.

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Sean McBride Director

#### Bibliography

Nowak DJ, Aevermann T, 2019. Tree compensation rates: Compensating for the loss of future tree values. *Urban Forestry & Urban Greening* **41**, 93-103.

Nowak DJ, Crane DE, 2000. The Urban Forest Effects (UFORE) model: quantifying urban forest structure and functions. In: Hansen M, Burk T, eds. St. Paul, MN, USA: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station, 714-20. (Integrated tools for natural resources inventories in the 21st century.)

The I-Tree Development Team, 2020. *i-Tree Eco V. V.6.35* USA: USDA Forest Service.

#### Appendix A – Tree protection methodology

- 1. Tree protection must form a part of any site-specific hazard management and is to be included in daily toolbox meetings and all site inductions.
- 2. No work shall take place within the root zone of the trees without prior approval from the supervising arborist. Any amendments to the tree protection methodology shall require prior written approval from the supervising arborist. (see 3).

#### Pre-start

- 3. The consent holder is to engage the services of a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist'), who is to supervise and coordinate all works and activities within the root zone of protected trees.
- 4. Prior to any works commencing on site, the consent holder is to arrange a site meeting with the supervising arborist, council's monitoring officer, council's urban forest specialist and the contractor who has overall responsibility of the works. The purpose of this meeting is to discuss conditions of consent. At this meeting, the contractor responsible is to confirm to the satisfaction of the supervising arborist and council the following:
  - Programming of works
  - Site access and transportation of materials
  - Temporary storage areas for materials
  - Silt and sediment controls
  - Excavations in the root zones of trees
  - When the supervising arborist is required to be present

#### Reporting

- 5. At the completion of works, the supervising arborist at their discretion shall 'sign off' the work of the contractor, and if requested, provide a brief account of the project to the council arborist (if necessary, with photos). The account of works shall include, but not be limited to:
  - The effects of the works to the subject trees
  - Any remedial work which may be necessary

#### **Ground protection**

- 6. No material is to be stored, emptied, or disposed of in or around the root zone of any of the trees unless otherwise authorised to do so by the supervising arborist. Any material which is to be stored or temporarily placed in or around the root zone of any of the trees shall be stored carefully on an existing or temporary hard surface such as asphalt or plywood sheets, respectively.
- 7. If, during the course of the works, machinery or vehicle access / manoeuvring is required in or around the permeable / exposed root zone of any of the trees, then those areas are to be covered with a protective overlay sufficient to protect the ground from being muddled, compacted, churned up or otherwise disturbed (for example 'Track Mats', or a layer of mulch or sand/SAP7 overlaid if necessary, with a raft of wired planks, plywood or similar) (see detail TP-04).
- 8. If machinery / vehicles are to be operated or stored within the root zone area on an existing or temporary load-bearing surface, then the machinery / vehicle shall not cause any detrimental effect to the tree(s) through compaction, physical damage, spillage of lubricants and fuels or discharge of waste emissions.

#### Excavations in and around root zones

9. All excavations which are to take place in or around the root zone of any of the trees shall be done so in conjunction with the supervising arborist, through a careful combination of hand digging and machine excavation and to the satisfaction of the supervising arborist. Where the supervising arborist deems it likely that roots will be encountered in the areas, then these areas shall first be explored using hand tools only to check for the presence of such roots.

10. Where concrete is to be poured into excavations containing exposed roots, then all exposed roots shall first be covered in a layer of polythene to prevent the concrete from contacting the exposed root (see detail TP-06).

#### Tree pruning

11. All tree pruning is to be confirmed to the satisfaction of the works arborist, after liaison with the contractors represented around the extent of clearance required and practical options that may be available to retain large limbs. All pruning is to be undertaken by a suitably experienced arboricultural contractor, with the work conforming to best industry practice, such as Arb Australia and NZ Arb Minimum Industry Standard MIS308.

#### Protecting and pruning roots

- 12. Every effort shall be made to avoid root severance from all trees by exploring on-site alternatives to construction / engineering, i.e., adjusting finished levels and basecourse depths etc. Where root severance is unavoidable, the severance of any root is to be carried out by the supervising arborist, who shall select the most appropriate implement for the task. Roots shall be cut cleanly to ensure that the traumatic cambium is able to initiate new root growth as effectively as possible, and the exposed cut faces should be covered over immediately with moist soil.
- 13. Where roots to be retained are encountered, and there is need for these roots to remain exposed in order that works are not impeded, then those roots shall be covered with a suitable protective material (such as moist Hessian, or a wool mulch) in order to protect them from desiccation and/or mechanical damage until such a time as the area around the root can be backfilled with the original material. The wrapping or covering of any roots shall be undertaken by the supervising arborist.

# Appendix B – Tree protection details









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Herne Bay Waste Water Tunnel Tree Location Plan

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Watercare

Herne Bay Waste Water Tunnel Tree Location Plan



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# Appendix D – Tree inventory

Tree number	Number of trees	Species	Common name	Height (m)	DBH (cm)	AUP root zone radius (m)	Structural root zone radius (m) (Coder, 1996)	Tree protection zone radius (m) AC 12x)	Overall vitality	Branch structure	Form	Age class	Protection status	Proposed activity	Number exotic trees req'd	Number native trees req'd	Arboricultural comments and observations
1	1	Magnolia grandiflora	Evergreen magnolia	4.7	23.6	3	1.5	2.8	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 1.3m from inside kerb edge
2	1	Magnolia grandiflora	Evergreen magnolia	4.7	24.8	3	1.6	3.0	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 1.5m from inside kerb edge
3	1	Magnolia grandiflora	Evergreen magnolia	6.7	39.2	4	2.0	4.7	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 900mm from inside kerb edge. Crack in kerb, however not confirmed from roots
4	1	Magnolia grandiflora	Evergreen magnolia	4.5	22.0	3	1.5	2.6	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 1.4m from inside kerb edge. Two small cordyline beneath
5	1	Magnolia grandiflora	Evergreen magnolia	4.5	25.1	3	1.6	3.0	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 1.1m from inside kerb edge.
6	1	Magnolia grandiflora	Evergreen magnolia	3.6	20.4	2	1.4	2.4	Good	Good	Fair	Early mature	Protected	WWRZ			Trunk centre 1.3m from inside kerb edge.
7	1	Magnolia grandiflora	Evergreen magnolia	6.8	22.9	3	1.5	2.8	Good	Good	Fair	Early mature	Protected	Prune			Trunk centre 3.2m from inside kerb edge. Footpath separates tree from kerb
8	1	Magnolia grandiflora	Evergreen magnolia	6.8	45.2	5	2.2	5.4	Good	Good	Fair	Early mature	Protected	Prune			Trunk centre 2.5m from inside kerb edge. Footpath separates tree from kerb. 2.2m overhang into road. Multiple strikes on stems that are over the road. Pruning will be requires for traffic control, regardless Of which side trench is down
9	1	Magnolia grandiflora	Evergreen magnolia	5	36.6	4	2.0	4.4	Good	Good	Good	Early mature	Protected	WWRZ			Trunk centre 3.2m from inside kerb edge. Footpath separates tree from kerb. 1.1m overhang into road. Pruning will be requires for traffic control, regardless Of which side trench is down.
10	1	Magnolia grandiflora	Evergreen magnolia	4.5	28.6	2	1.7	3.4	Good	Good	Good	Early mature	Protected	WWRZ			Trunk centre 1.3m from inside kerb edge. Footpath separates tree from kerb.
11	1	Magnolia grandiflora	Evergreen magnolia	4.6	34.7	3	1.9	4.2	Good	Good	Good	Early mature	Protected	WWRZ			Trunk centre 1.3m from inside kerb edge. Footpath separates tree from kerb.
12	1	Syagrus romanzoffiana	Queen palm	11.6	33.4	6	1.9	4.0	Good	Good	Good	Mature	Protected	No works			Trunk centre is 1300mm from kerb edge
13	1	Syagrus romanzoffiana	Queen palm	11.6	33.4	6	1.9	4.0	Good	Good	Good	Mature	Protected	No works			Trunk centre is 1300mm from kerb edge
14	1	Syagrus romanzoffiana	Queen palm	11.6	33.4	6	1.9	4.0	Good	Good	Good	Mature	Protected	WWRZ			Trunk centre is 1300mm from kerb edge
15	1	Syagrus romanzoffiana	Queen palm	11.6	36.3	6	2.0	4.4	Good	Good	Good	Mature	Protected	Remove	2	2	Palm requires removal for works
16	1	Magnolia grandiflora	Evergreen magnolia	5.5	28.0	4	1.7	3.4	Good	Good	Good	Early mature	Protected	Remove	4	5	Trunk centre 1.4m from inside kerb edge. Requires removal for works
17	1	Magnolia grandiflora	Evergreen magnolia	5.5	21.6	4	1.5	2.6	Good	Good	Good	Early mature	Protected	Remove	4	4	Trunk centre 1.4m from inside kerb edge. Requires removal for works
18	1	Magnolia grandiflora	Evergreen magnolia	5.5	23.6	4	1.5	2.8	Good	Good	Good	Early mature	Protected	Remove	4	4	Trunk centre 1.4m from inside kerb edge. Requires removal for works
19	1	Magnolia grandiflora	Evergreen magnolia	6.9	29.9	4	1.8	3.6	Fair	Good	Good	Early mature	Protected	Remove	4	5	Trunk centre 1.4m from inside kerb edge. Thinnish canopy for trees in the immediate area.
20	1	Syagrus romanzoffiana	Queen palm	11.6	36.3	6	2.0	4.4	Good	Good	Good	Mature	Protected	Remove	2	2	Palm requires removal for works. Girth estimated
21	2	Syagrus romanzoffiana	Queen palm	7	24.5	3.5	1.6	2.9	Good	Good	Good	Mature	Protected	Remove	2	2	Palm is 1.2m from kerb. Growing beneath canopy of liquidambar in private property
22	1	Platanus x acerifolia	London plane	17	77.3	8	3.0	9.3	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 6 to 7 m above ground level



23	1	Platanus x acerifolia	London plane	17	83.4	8	3.1	10.0	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 6 to 7 m above ground level
24	1	Platanus x acerifolia	London plane	17	75.4	8	2.9	9.1	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 5 to 7 m above ground level
25	1	Platanus x acerifolia	London plane	17	72.9	8	2.9	8.7	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 5 to 7 m above ground level. Catch pi in Road near base
26	1	Prunus serrulata	Flowering cherry	4	30.9	3	1.8	3.7	Fair	Fair	Fair	Post- mature	Protected	Remove	2	2	Some twiggy dieback present in the canopy. Old pruning wounds exhibit decay, however not uncommon. Tree is approx 300 from kerb
27	1	Platanus x acerifolia	London plane	17	74.8	8	2.9	9.0	Fair	Fair	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 5 to 7 m above ground level. Western trunk exhibits fungus on bark. Query saprophytic. Isolated cambial/wound wood on trunk. Query pathogen?
28	1	Platanus x acerifolia	London plane	17	78.3	8	3.0	9.4	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 5 to 7m about ground level.
29	1	Platanus x acerifolia	London plane	17	75.1	8	2.9	9.0	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Road renewal has recently occurred. Canopy at intersection is 5 to 7m about ground level.
30	1	Platanus x acerifolia	London plane	17	71.6	8	2.8	8.6	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Healthy tree. Overhead clearance should be sufficient
31	1	Platanus x acerifolia	London plane	17	78.0	8	3.0	9.4	Good	Good	Good	Post- mature	Protected	WWRZ			Tree that has historically been pollarded in the past, now canopy has matured. Healthy tree. Overhead clearance should be sufficient
32	1	Myoporum laetum	Ngaio	7	27.9	5	1.7	3.3	Good	Good	Fair	Mature	Protected	Prune			Crown lifting over accessway needed. No branches greater than 100mm in diameter needs pruning, however, some pruning will involve change in canopy form
33	1	Myoporum laetum	Ngaio	7	25.1	5	1.6	3.0	Good	Good	Fair	Mature	Protected	Prune			Phototropic form. Recent snap from ex. cyclone. Minor lift over accessway needed
35	9	Myoporum laetum	Ngaio	7	22.3	5	1.5	2.7	Good	Fair	Fair	Mature	Protected	Prune			Group of five ngaio, one põhutukawa (southern edge near gate), two karo.
36	1	Platanus x acerifolia	London plane	18	101.5	14.2	3.5	12.2	Good	Good	Good	Mature	Protected	WWRZ			Original pollard at 2-3 m. Second topping of the regrowth at 7-8 m. Crown formed from regrowth from that point. Trunk measured at 500 mm. A few dead branches from the secondary regrowth. One failed and hanging in the tree.
37	1	Platanus x acerifolia	London plane	18	77.3	10.1	3.0	9.3	Good	Good	Good	Mature	Protected	WWRZ			Original pollard at 2-3 m. Second topping of the regrowth at 7-8 m. Crown formed from regrowth from that point. Trunk measured at 500 mm. A few dead branches from the secondary regrowth. One failed and hanging in the tree.
38	1	Platanus x acerifolia	London plane	14	80.5	10.5	3.0	9.7	Good	Good	Good	Mature	Protected	WWRZ			Original pollard at 2-3 m. Second topping of the regrowth at 7-8 m. Crown formed from regrowth from that point. Trunk measured at 500 mm. A few dead branches from the secondary regrowth. One failed and hanging in the tree.
39	1	Platanus x acerifolia	London plane	14	91.7	14.2	3.3	11.0	Good	Good	Good	Mature	Protected	No works			Original pollard at 2-3 m. Second topping of the regrowth at 7-8 m. Crown formed from regrowth from that point.

																	Trunk measured at 500 mm. A few dead low branches on the northern side above the bench. A few noted that have been truncated with stub cuts.
40	1	Prunus sp.	Cherry	4	25.8	2	1.6	3.1	Poor	Fair	Poor	Mature	Protected	WWRZ			Has historically been topped. Some topping wounds have died back. Basal wounds.
41	1	Metrosideros excelsa	Põhutukawa	15	106.6	9	3.5	12.8	Good	Good	Fair	Post- mature	Protected	WWRZ Prune			Has been reduced from overhead lines. Girth measured at base. Pruning required to form connection
42	1	Vitex lucens	Pūriri	6.5	24.2	3	1.6	2.9	Good	Good	Fair	Early mature	Protected	WWRZ			Approx 1m from base of pohutukawa. Suppressed by tree, and reduced from powerlines
43	1	Alectryon excelsus	Titoki	7	31.5	4	1.8	3.8	Good	Good	Fair	Mature	Protected	WWRZ			Tree situated under powerlines
44	1	Vitex lucens	Pūriri	9	50.0	5	2.3	6.0	Fair	Good	Good	Mature	Protected	WWRZ			Tree has thinning canopy on western edge. Should be well clear of the works
45	1	Metrosideros excelsa	Pōhutukawa	8	47.4	4	2.3	5.7	Good	Good	Good	Early mature	Protected	WWRZ			MEMORIAL TREE. May need pruning for traffic control
46	1	Metrosideros kermadecensis	Kermadec pōhutukawa	4	21.7	4	1.5	2.6	Good	Fair	Poor	Mature	Protected	Remove	6	7	Multiple branches and two stems from base have been removed. Crown lifted high. Overall poor to fair tree . Removal needed to establish access
47	1	Metrosideros kermadecensis	Kermadec põhutukawa	4.5	35.4	4	1.9	4.2	Good	Fair	Fair	Mature	Protected	WWRZ Prune			Broadly spreading canopy formed from multiple limbs at or near base
48	1	Melia azedarach	Indian bead tree	6.5	43.0	4.5	2.1	5.2	Good	Fair	Good	Mature	Protected	WWRZ			Some branch wounds; of little concern. Good tree
49	1	Prunus sp.	Cherry	2.5	11.8	1	1.0	1.4	Dead	Fair	Fair	Early mature	Non- protected	WWRZ			Dead tree
50	1	Pseudopanax arboreus	Five finger	2	4.8	1	0.6	0.6	Good	Good	Good	Early mature	Non- protected	Remove	2	2	No trunks greater than 250mm in girth, at 1.4m agl.
51	1	Prunus serrulata	Flowering cherry	3	21.6	1.5	1.5	2.6	Fair	Fair	Fair	Mature	Protected	Remove	2	2	Short, stout tree. Previously have ivy on trunk which has been severed. Extensive basal growth. Fair tree
52	1	Prunus serrulata	Flowering cherry	5	21.3	2.5	1.5	2.6	Fair	Fair	Good	Early mature	Protected	WWRZ			Some twiggy dieback occurring
53	1	Melia azedarach	Indian bead tree	9	58.6	5	2.5	7.0	Good	Good	Good	Mature	Protected	WWRZ			J plant at the base. Overall a good tree.
54	1	Metrosideros excelsa	Pōhutukawa	1.5	4.8	1	0.6	0.6	Good	Good	Good	Juvenile	Non- protected	Transplant			Recently planted tree. Looks replacement for a previously removed tree
55	1	Prunus serrulata	Flowering cherry	5	18.1	2.5	1.3	2.2	Fair	Good	Good	Early mature	Protected	Remove	2	2	Twiggy dieback in canopy.
56	1	Alectryon excelsus	Titoki	4	20.4	2.5	1.4	2.4	Fair	Good	Good	Mature	Protected	WWRZ			Thinning canopy
57	1	Melia azedarach	Indian bead tree	6.5	39.5	3.5	2.0	4.7	Good	Good	Good	Early mature	Protected	WWRZ			Healthy tree
58	1	Melia azedarach	Indian bead tree	8	49.0	5	2.3	5.9	Good	Good	Fair	Early mature	Protected	WWRZ			Leans towards the east
59	1	Eriobotrya japonica	Loquat	5	29.5	4	1.7	3.5	Good	Good	Good	Early mature	Non- protected	WWRZ			Pest plant species
60	1	Albizia julibrissin	Silk tree	5	40.1	5	2.1	4.8	Good	Good	Good	Mature	Protected	WWRZ			Canopy low over the road. May need crown lift
61	1	Alectryon excelsus	Titoki	6.1	19.1	3	1.4	2.3	Fair	Good	Good	Mature	Protected	No works			Thinning canopy
62	6	Metrosideros kermadecensis	Kermadec põhutukawa	9	50.9	5	2.4	6.1	Good	Good	Good	Mature	Protected	WWRZ			Measured largest tree in row. Healthy trees
63	1	Metrosideros excelsa	Pōhutukawa	10	63.7	8	2.7	7.6	Good	Good	Good	Post- mature	Protected	WWRZ			Notable tree. Not measured. Should be unaffected by the works
64	1	Metrosideros excelsa	Põhutukawa	10	63.7	8	2.7	7.6	Good	Good	Good	Post- mature	Protected	WWRZ			Notable tree. Not measured. Pruning to lift canopy over the road required. Machinery will need to work under scaffold limbs
65	1	Melia azedarach	Indian bead tree	8	64.6	5	2.7	7.8	Good	Fair	Fair	Post- mature	Non- protected	WWRZ			Some bark wounds on stems. Canopy overhead clearance should be sufficient
66	1	Melia azedarach	Indian bead tree	8	33.7	4	1.9	4.0	Fair	Fair	Fair	Mature	Non- protected	No works			Suppressed by adjacent ulmus. Fair tree.

67	1	Melia azedarach	Indian bead tree	4	20.4	3	1.4	2.4	Fair	Fair	Fair	Mature	Non- protected	No works	Overall fair tree. Some bark wounds present
68	1	Schinus molle	Peruvian pepper	5	33.1	4	1.9	4.0	Poor	Fair	Fair	Mature	Protected	No works	Overall fair tree, which is in decline
69	1	Melia azedarach	Indian bead tree	9	58.6	7	2.5	7.0	Good	Fair	Fair	Post- mature	Non- protected	WWRZ	Some bark wounds on stems. Canopy overhead clearance should be sufficient. Previous tear out in NW trunk aspect.
70	1	Melia azedarach	Indian bead tree	9	59.8	7	2.6	7.2	Good	Good	Good	Post- mature	Non- protected	WWRZ	Canopy overhead clearance should be sufficient. Good tree
71	1	Olea europaea	Olive	7	43.9	4	2.2	5.3	Good	Good	Good	Mature	Protected	WWRZ	Healthy tree
72	1	Melia azedarach	Indian bead tree	3	7.6	1.5	0.8	0.9	Good	Good	Good	Juvenile	Non- protected	WWRZ	0
73	1	Melia azedarach	Indian bead tree	3	6.4	1.5	0.7	0.8	Good	Good	Good	Juvenile	Non- protected	WWRZ	0
74	1	Agonis flexuosa	Willow myrtle	11	112.8	6	3.7	13.5	Fair	Poor	Fair	Post- mature	Protected	WWRZ	Tree is located close to the kerb. Large base. Have decay visible in main union. Only limited visual inspection undertaken. Thinning canopy. Fair tree, but none the less, a mature specimen
75	1	Ulmus minor	English elm	18	96.1	9	3.3	11.5	Good	Good	Good	Mature	Protected	WWRZ	Dutch elm disease protocols required. Good mature tree
76	1	Vitex lucens	Pūriri	7	26.4	3.5	1.6	3.2	Good	Good	Fair	Early mature	Protected	WWRZ	Suppressed by adjacent elm. Healthy tree
77	1	Ulmus minor	English elm	18	100.6	9	3.4	12.1	Good	Good	Good	Mature	Protected	WWRZ	Dutch elm disease protocols required. Good mature tree
78	1	Agonis flexuosa	Willow myrtle	11	132.0	6	4.0	15.0	Fair	Poor	Fair	Post- mature	Protected	WWRZ	Old separation in main union, with fungal bracket visible. Further investigation into trees structure should be carried out
79	1	Tilia x europaea	Lime	7	44.9	4	2.2	5.4	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree, canopy Low over road
80	1	Tilia x europaea	Lime	7	48.1	4	2.3	5.8	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree, canopy Low over road
81	1	Tristaniopsis laurina	Water gum	7	22.6	3.5	1.5	2.7	Good	Good	Fair	Early mature	Protected	WWRZ	Beneath powerlines. Minor pruning may be required
82	1	Tilia x europaea	Lime	7	51.2	4	2.4	6.1	Good	Fair	Fair	Mature	Protected	WWRZ	 Historically topped tree, canopy Low over road
83	1	Tilia x europaea	Lime	7	44.9	4	2.2	5.4	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree, canopy Low over road
84	1	Tilia x europaea	Lime	7	46.2	4	2.2	5.5	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree, canopy Low over road
85	1	Tilia x europaea	Lime	7	58.6	4	2.5	7.0	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree. Thin canopy
86	1	Tilia x europaea	Lime	7	5.4	4	0.7	0.7	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree, canopy Low over road
87	1	Tilia x europaea	Lime	7	49.7	4	2.3	6.0	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree. Thin canopy
88	1	Tristaniopsis laurina	Water gum	12	59.2	6	2.6	7.1	Good	Good	Good	Early mature	Protected	WWRZ	 Beneath powerlines. Minor pruning may be required
89	1	Tilia x europaea	Lime	9	49.7	5	2.3	6.0	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree. May need crown lifting
90	1	Tilia x europaea	Lime	9	65.9	6	2.7	7.9	Good	Fair	Fair	Mature	Protected	WWRZ	Historically topped tree. May need crown lifting
91	1	Tilia x europaea	Lime	9	55.1	6	2.5	6.6	Good	Fair	Fair	Mature	Protected	No works	Historically topped tree. May need crown lifting
92	1	Tilia x europaea	Lime	9	55.1	6	2.5	6.6	Good	Fair	Fair	Mature	Protected	No works	Historically topped tree. May need crown lifting
93	1	Tilia x europaea	Lime	9	55.1	6	2.5	6.6	Good	Fair	Fair	Mature	Protected	No works	Unlikely any pruning needed
94	1	Tilia x europaea	Lime	9	55.1	6	2.5	6.6	Good	Fair	Fair	Mature	Protected	No works	Minor pruning may be required
95	1	Tilia x europaea	Lime	12	55.1	6	2.5	6.6	Fair	Fair	Fair	Mature	Protected	WWRZ	Unlikely any pruning requires. Things canopy
96	1	Tilia x europaea	Lime	12	55.1	6	2.5	6.6	Good	Fair	Fair	Mature	Protected	WWRZ	Minor pruning may be required
97	1	Tilia x europaea	Lime	9	55.1	5	2.5	6.6	Good	Fair	Fair	Mature	Protected	WWRZ	Minor pruning may be required
98	1	Tilia x europaea	Lime	12	55.1	5	2.5	6.6	Good	Fair	Fair	Mature	Protected	WWRZ	Minor pruning may be required
99	1	Tilia x europaea	Lime	12	55.1	5	2.5	6.6	Fair	Fair	Fair	Mature	Protected	WWRZ	Minor pruning may be required
100	1	Tristaniopsis laurina	Water gum	12	44.2	6	2.2	5.3	Good	Good	Good	Early mature	Protected	WWRZ	 Minor pruning may be required
101	1	Tristaniopsis laurina	Water gum	8	36.6	3	2.0	4.4	Good	Good	Good	Early mature	Protected	WWRZ	Minor pruning may be required
102	1	Podocarpus totara	Tōtara	12	63.7	6	2.7	7.6	Good	Good	Fair	Mature	Notable	No works	Notable tree. In private property we'll clear if works
103	1	Tristaniopsis laurina	Water gum	6	4.7	3.5	0.6	0.6	Good	Good	Good	Mature	Protected	WWRZ	Minor pruning may be needed

104	1	Agonis flexuosa	Willow myrtle	5.3	73.2	3.5	2.9	8.8	Fair	Fair	Fair	Mature	Protected	WWRZ			Some twiggy dieback in two stems.
105	1	Agonis flexuosa	Willow myrtle	9.2	142.0	4.5	4.2	15.0	Good	Fair	Good	Post- mature	Protected	WWRZ			Large mature street tree
106	1	Agonis flexuosa	Willow myrtle	9.5	60.8	4.5	2.6	7.3	Good	Fair	Good	Mature	Protected	WWRZ			Large mature street tree
107	1	Jacaranda mimosifolia	Jacaranda	5	31.8	3	1.8	3.8	Poor	Fair	Good	Early mature	Protected	WWRZ			Half dead
108	1	Jacaranda mimosifolia	Jacaranda	5	25.5	4	1.6	3.1	Good	Good	Good	Early mature	Protected	WWRZ			Healthy tree
109	1	Jacaranda mimosifolia	Jacaranda	5	25.5	4	1.6	3.1	Good	Good	Good	Early mature	Protected	WWRZ			Minor pruning may be needed
110	1	Jacaranda mimosifolia	Jacaranda	5	25.5	4	1.6	3.1	Good	Good	Good	Early mature	Protected	WWRZ			Minor pruning may be needed
111	1	Jacaranda mimosifolia	Jacaranda	7	25.5	4	1.6	3.1	Fair	Good	Good	Early mature	Protected	WWRZ			Minor pruning may be needed
112	1	Jacaranda mimosifolia	Jacaranda	5	25.5	4	1.6	3.1	Good	Good	Good	Early mature	Protected	Remove	5	6	Minor pruning may be needed
113	1	Jacaranda mimosifolia	Jacaranda	4	25.5	4	1.6	3.1	Fair	Fair	Fair	Early mature	Protected	WWRZ			Minor pruning may be needed. Prunus also adjacent to the trunk
114	1	Jacaranda mimosifolia	Jacaranda	5	12.7	4	1.1	1.5	Good	Good	Good	Early mature	Protected	WWRZ			Minor pruning may be needed
115	1	Metrosideros excelsa	Pōhutukawa	10	79.6	12	3.0	9.5	Good	Fair	Fair	Post- mature	Protected	WWRZ			Notable tree. Works being pushed away
116	1	Agonis flexuosa	Willow myrtle	7.7	93.6	6	3.3	11.2	Good	Fair	Good	Mature	Protected	WWRZ			Close to kerb. Healthy mature street tree
117	1	Agonis flexuosa	Willow myrtle	7.5	82.5	5	3.1	9.9	Good	Poor	Fair	Mature	Protected	Remove	5	6	Old tear out on road side. Recent kerb works have occurred. This tree is proposed to be removed as part of CI extension
118	1	Agonis flexuosa	Willow myrtle	9	95.5	6	3.3	11.5	Good	Fair	Good	Mature	Protected	WWRZ			Close to kerb. Healthy mature street tree. May need pruning
119	1	Cordyline australis	Cabbage tree	4.3	-	2.1	-	-	Fair	Poor	Fair	Mature	Protected	Remove	1	1	Large cavity at base and track up stem. Poorly structured tree
120	1	Cordyline australis	Cabbage tree	3.5	-	1.75	-	-	Fair	Fair	Fair	Mature	Non- protected	Remove	1	1	Small stout tree that is overall in fair condition
121	1	Cordyline australis	Cabbage tree	6	-	3	-	-	Fair	Fair	Fair	Mature	Protected	Remove	1	1	Formed from three stems at the ground. Moderate basal cavity on one trunk