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Arboricultural Assessment of Effects and Tree Protection Plan

For
Removing a dam and culverts, and replacing a wastewater pipe using a wastewater pipe bridge and a staging platform

in
Blake Road Reserve, Māngere

Prepared for	**Leighton Gillespie** *Healthy Waters* Level 17 135 Albert Street Auckland	**Prepared by**	**Andrew Benson** **(Ph.D., BSc, FdSc)** Urban tree ecophysiologist
		Date	31 October 2024
		Job ref #	3053
		Reviewed by:	Craig Webb

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1. Instructions

1.1 Healthy Waters propose to remove a soil bund dam and construct a wastewater pipe bridge in Blake Road Reserve, Mangere. The Tree Consultancy Company have been instructed by Leighton Gillespie of Healthy Waters to provide an arboricultural assessment of effects of the proposal as this relates to protected trees. For this assessment, a 'protected' tree refers to a tree for which a Resource Consent is usually required to undertake activities to and around it that may affect its wellbeing. This report has been prepared to accompany a resource consent application under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024. The scope of services is as follows.

- Attend an on-site project briefing with the project team and other specialists.
- Online meetings with the project team.
- Attend an on-site meeting with Auckland Council's regulatory staff.
- A desktop review of the information provided by the client or their representative.
- Carry out a site visit and arboricultural survey of the principal trees.
- Liaise with the design team around constraints and limitations. Offer design solutions where possible
- Prepare an arboricultural assessment of effects, including a scaled site plan depicting the trees, the arboricultural constraints, and the key proposed site features, as well as recommendations for tree protection and mitigation.
- Lodge an application for tree owner approval, if required.

2. Site description, project background, and proposed activities

2.1 The subject site is Blake Road Reserve, in Mangere. According to the Unitary Plan, the site is within the Open Space – Informal Recreation Zone. There is a coastal estuary at the western portion of the site (Figure 1) with a marine Significant Ecological Area overlay (SEA) over it. Much of the site is open grass lawn. There is a concrete basketball court and what looks like a small motorbike or mountain bike / BMX course in the northern part. The site is bordered to the south by residential properties, and to the northeast by industrial buildings.

2.2 The coastal estuary is dammed with a soil bund containing culverts to convey water through the estuary. The dam also contains a major wastewater pipe (the eastern interceptor) that is buried near the top of the dam (Figure 5). The wastewater pipe is made of concrete and is approximately 2.6 m in diameter. On the banks of the dam and either side of the estuary around the dam, there is dense native vegetation. Within the estuary, there are mangroves.

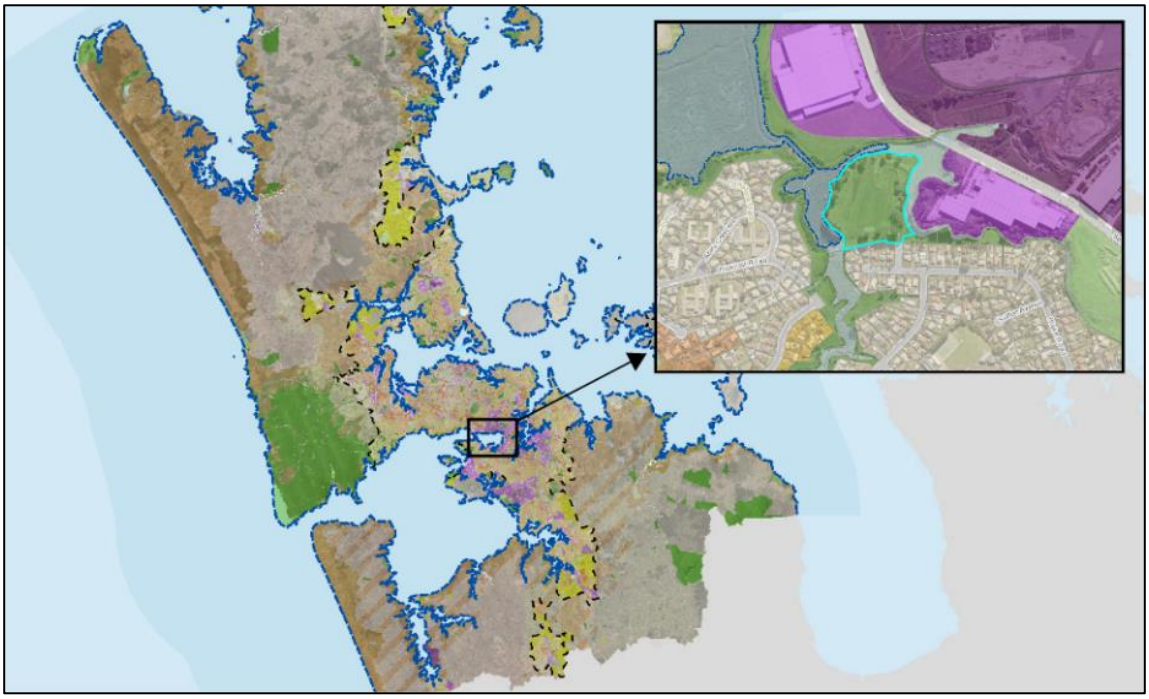

Figure 1: Site location (black rectangle – main image; blue outline (Blake Road Reserve) – inset). Source – Auckland Council GeoMaps

2.3 During the heavy rain events and floods in the early part of 2023, approximately 60 of the residential properties to the south of the site, upstream of the estuary, were flooded. Healthy Waters have identified that the dam and its culverts contributed to the flooding because of the way they negatively impact stormwater conveyance. As such, Healthy Waters propose to remove the dam and culverts and restore the estuary channel and improve hydraulic conveyance.

2.4 A detailed description of the proposed work is provided in the Assessment of Effects on the Environment (AEE) prepared by Beca for the application. In summary, the proposed works will involve removing a section of the wastewater pipe that is buried in the top of the dam. A pipe bridge will be constructed over the estuary which will have a timber boardwalk built on top of it for pedestrians to walk over (Figure 2).

2.5 It is estimated that the project will take approximately 15 months to build. The proposed works will involve the following key steps and will generally follow the sequence set out below. Several of the key construction activities are likely to occur concurrently.

- **Site establishment** – two site compounds will be established at the site that will be fenced off. One access will be from Blake Road (the eastern side of the dam) and one access will be from Bicknell Road (the western side of the dam).
- **Vegetation clearance** - Removal of mangroves and other vegetation around the dam and pipe bridge site.
- **Staging and working platforms** - Construct gravel working platforms either side of the estuary channel on the northern side of the dam. Construct temporary staging platform beginning at the eastern site compound. The staging platform will consist of 900 mm diameter driven piles supporting a platform onto which cranes and other machinery can operate while building the pipe bridge.
- **Coffer dams** - Construct coffer dams in the estuary and subsequently construct three concrete piers to support the pipe bridge.
- **Excavate to make connections in the pipe** - Excavate at the upstream and downstream ends of the existing wastewater pipe so that the new pipe can be connected.
- **Construct new pipe** – Three-metre-long steel pipe sections will be welded together in the reserve until the required length of pipe is made.
- **Install new pipe** - Lift the new pipe sections into place using cranes and weld them together in-situ.
- **Construct a boardwalk** - Build the boardwalk over the pipe.
- **Disestablish** - Disestablish the staging and remove it.
- **Excavate the dam and remove the old pipe** – Excavated material will be removed via the western site access.

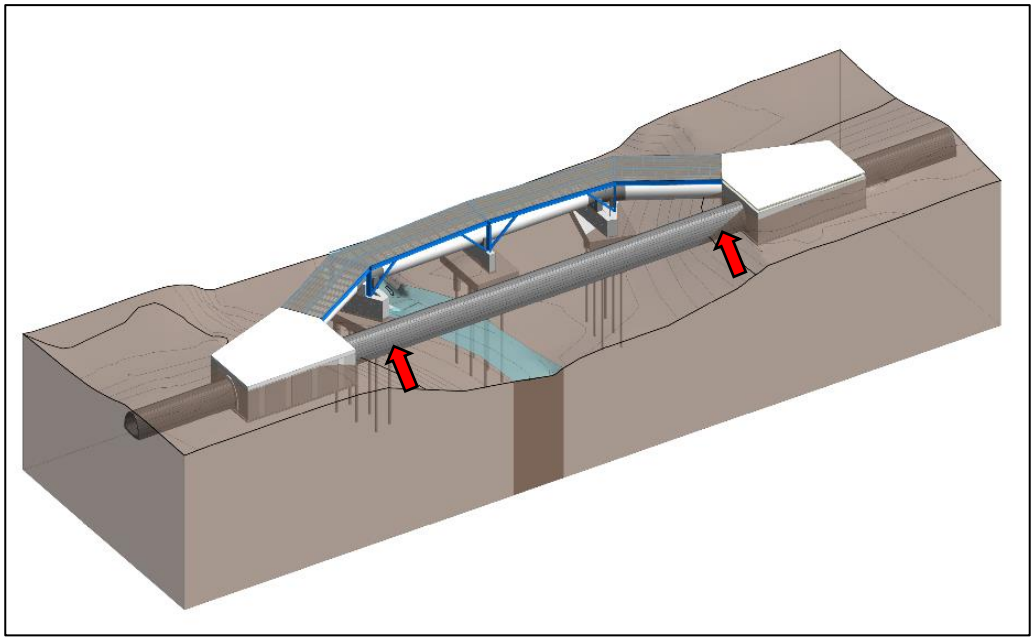

Figure 2: Overall 3D view of the proposed pipe bridge. The arrows point to the existing wastewater pipe section that will be removed and is currently buried at the top of the dam. Source – ACH drawing 240345-S003 (July 2024)

2.6 The new pipe will be made of steel and will be approximately 2.7 m internal diameter. Pipe sections will be welded together in the flat area of the reserve to the east of the estuary in line with their final alignment on the pipe bridge piers, until they are long enough to form complete pipe sections, of which there will be three. The longest pipe section will be approximately 30 m long.

2.7 The proposal has been depicted and described in the information referenced below which has been relied upon to inform this assessment of effects.

- Fulton Hogan *Harania Culvert Construction Methodology* (undated, unreferenced)
- ACH design drawings *HARANIA CREEK PIPE BRIDGE.* 24035 (July 2024)
- Tonkin and Taylor drawing set 1017033.2002. rev 1 (30/10/2024)
- Boffa Miskell planting plans BM230171_D500 (rev B), D501 (rev C), D505 (rev B) (18/10/2024)

3. Site investigations and methodology

3.1 I visited the site on the 19th of June 2024, with the project team, to receive an overview and briefing of the project. I visited the site again on the 29th of August 2024, with the project team and members of the Auckland Council regulatory team, to brief the council specialists on the project and to answer any questions posed by my expert counterpart at Auckland Council.

3.2 I visited the site again on the 4th of September 2024, to undertake an arboricultural site survey of the principal trees potentially impacted by the proposal. For each individual tree, I recorded its location using the GPS capability of a smartphone and recorded its species. Except for a row of trees growing alongside the estuary which I could not access safely to make accurate measurements, I measured each tree's trunk diameter at 1.4 m above ground level with a measuring tape, and measured tree height and canopy diameter using a Nikon Forestry Pro II digital laser rangefinder. I also made qualitative observations of tree condition (form, structure, vitality) and made quantitative estimates of live crown volume, which can help to inform the overall picture of tree vitality. For the row of trees along the estuary, the dimensions were estimated. Elsewhere, around the estuary and dam, I made broad observations about species characteristics of the vegetation that is present, as well as approximations of size and age class.

3.3 I also applied the British Standard (BS5837) tree categorisation system to grade the trees based on their arboricultural attributes (British Standards Institute, 2012). The British system was used because New Zealand does not have its own system of tree categorisation. The categorisation system places trees in one of four categories, being A, B, C, and U, in descending order of quality. It is an objective means of grading trees and a useful design tool when considering design alternatives, or to better understand or qualify impacts.

3.4 Trunk diameter measurements are used to ascribe structural root zone radii (Coder, 1996) and tree protection zone radii (Benson et al., 2019a), which are planning and design tools to help inform setbacks and clear zones around trees. The structural root zone is the area around a tree within which the tree's main supporting, structural roots are found. The tree protection zone is the area around a tree within which there is a sufficient volume of soil and roots to sustain healthy tree function.

3.5 Vegetation clearance footprints in areas of contiguous vegetation have been estimated using a geospatial analysis, by overlaying the earthworks footprint onto a 2024 Near Maps aerial photograph and projecting an 8 m buffer zone around the earthworks footprint. The extent of the vegetated area was manually estimated from the 2024 aerial photograph and the cleared area estimated from the intersection of the two vector layer polygons (the vegetated area and the earthworks buffer area).

3.6 The arboricultural information collected during the fieldwork was also used to carry out an ecosystem services analysis using iTree (The i-Tree Development Team, 2022). iTree is a software application that computes ecosystem services such as carbon sequestration, pollutant adsorption, as well as estimating canopy cover based on data inputs. The impacts of vegetation clearance were quantified in terms of canopy cover deficits in 2050, computed by iTree using the in-built forecasting tool. The year 2050 is chosen because that is when Auckland Council have set their canopy cover targets for (Auckland Council, 2019).

3.7 Additionally, the proposed planting palette proffered by Boffa Miskell referenced in **Error! Reference source not found.** was input into iTree (The i-Tree Development Team, 2022) to compute canopy cover growth. Full canopy cover closure was assumed to have occurred when the proposed planting achieved the current canopy cover of the vegetation around the stream, which is an approximately 3 m buffer around the proposed planting area (the trees' canopy will grow beyond the edge of the area of ground in which they are planted).

3.8 iTree was also used to estimate canopy cover growth for 95 different species of tree using known dimensions of 45 L-grade nursery trees up to 2050, to estimate the canopy cover growth for a 'typical' new tree. A new 45 L-grade tree will have 24 m^2 of canopy cover in 2050 if it is planted today. The number of new 45 L-grade trees required to be planted in addition to the proposed planting palette proffered by Boffa Miskell was calculated based on the canopy cover deficits to 2050 once canopy closure of the planting palette had been achieved, and adding one extra tree to account for some attrition. The process is set out, with calculations, in Section 6.

4. Summary of tree details

4.1 There are few trees within the reserve, but those that are there and that were recorded in the survey, are mature exotic specimens ranging between 8 m and 27 m in height. At the Blake Road entrance, there is a group of four trees – two Category A gum trees (*Eucalyptus sp.*) (trees 3 and 4) and two Mexican cypress trees (*Cupressus lusitanica*) (trees 1 and 2). One of the cypress trees (tree 2) is in poor condition (Category C), but the other one (tree 1) is in better condition (Category B). There are four redwood trees (*Sequoia sempervirens*) growing in a row just south of the basketball court (trees 11 to 14). Two of the redwoods are Category A trees, one is a Category C tree and the other is Category U, being almost dead with less than 10% of its live crown remaining. The row of trees alongside the estuary are Monterey cypress trees (*Cupressus macrocarpa*). Two trees at the southern end of the row are subordinate and there is one dead one. The remainder are stout, mature specimens with full crowns.

4.2 Either side of the dam, the slopes are vegetated with a closed canopy of establishing native trees and plants in the order of 3 m to 7 m tall. Species observed were cabbage tree (*Cordyline australis*), karamū (*Coprosma robusta*), mahoe (*Melicytus ramiflorus*), lemonwood (*Pittosporum eugenioides*), mānuka (*Leptospermum hoipolloi*), kānuka (*Kunzea robusta*) and flax (*Phormium tenax*). Pest plants were also observed, including tree privet (*Ligustrum lucidum*), brush wattle (*Paraserianthes lophantha*), and woolly nightshade (*Solanum mauritianum*).

4.3 The trees, their structural root zones, tree protection zones, and the key proposed site features are shown on the site plan (3053_001_B) in Appendix C with the arboricultural information presented in the tree inventory in Appendix D using corresponding numbering.

Figure 3: Blake Road entrance (arrow). The trees on the right of the entrance are the two gum trees (3 and 4) and the two cypress trees (1 and 2) (04/09/2024)

Figure 4: Four redwood trees (arrowed). Left to right, 11 to 14 (04/09/2024)

Figure 5: Looking west from the crest of the existing dam. The top of the concrete wastewater pipe can be seen (arrow) (04/09/2024)

Figure 6: The row of Monterey cypress trees (04/09/2024)

5. Arboricultural assessment of effects

5.1 The assessment has been based on an indicative construction methodology and concept design provided by the contractor and design team, to accompany the resource consent application. Whilst the construction methodology and design details have not been finalised, a reasonable worst-case scenario and effects envelope has been assumed within this assessment to account for potential changes to activities and programme. Minor changes to the final construction methodology and detailed design are unlikely to change the overall envelope of effects as presented in this report.

5.2 All construction projects carry an inherent risk of damage to nearby trees. Such damage can be caused by machine tracking through tree root zones, soil churning and soil compaction in tree root zones, overhead branch strikes, spillage, or discharge of phytotoxic substances such as petrol or diesel. These sorts of collateral impacts can, in extreme cases, cause damage to trees, but can be practicably managed through an arboricultural work specification. A critical component of this is to appoint an appropriately qualified and experienced supervising arborist to supervise and assist with the work. The assessment of effects in this section is predicated on the recommended tree protection measures in Appendix A being implemented on site during construction.

5.3 With respect to the proposed construction entrance from Blake Road, during the site meeting in June, I advised the construction management team that, the group of four trees (1-4) at the reserve entrance was a group of trees worthy of preservation through design and construction management. In that regard, the haul road / access road has been oriented to favour the preservation of these trees, although one Category C redwood tree (tree 9) will likely need to be removed. Tree 9 is growing atop a soil bund / low bank that will probably need to be cut to form the haul road into the site in order to avoid a tight turning radius that would otherwise mean trees 1-4 (or some of them) would need to be removed.

5.4 According to the construction management plan, a short section of the proposed haul road will need to be constructed using a concrete slab supported on short piles to protect the eastern interceptor sewer pipe, which has shallow cover in this area. The potential impacts to the adjacent trees (1-4) are that excavations to form the new concrete slab and its piles may sever / damage roots. Likewise, when the site is disestablished, these same impacts are possible as the concrete slab is removed. Most trees will tolerate some localised, selective root cutting within little or no lasting detriment (Costello & Jones, 2003, Benson et al., 2019b), but wholesale root cutting, such as for soil stripping, could have severe consequences for this group of trees, likely consisting of protracted and chronic hydraulic stress. Elsewhere, the site access road is likely to be formed using stabilised compacted aggregates.

5.5 Whilst the removal of trees 1-4 can likely be avoided, the site access road will require works to be undertaken in their root zones. Outside of the section of concrete slab, the haul road will need to be established by first laying a carpet of wood-chip mulch to the soil (approx. 100 mm thick), then adding a sheet of geofabric, and then using a cellular confinement mesh such as GeoWeb[1] into which aggregates can be placed (e.g., Figure 7). Then, the underlying root zone of the gum trees (and others) will remain undamaged, or with minimal damage. Some localised anaerobiosis of the soil could be expected after 15 months as the wood chip breaks down, but the soil will recover once the site is disestablished. The mulch can be left in-situ to avoid accidental soil stripping when the haul road is removed.

5.6 Pile excavations for the concrete section will need to be done so in conjunction with the supervising arborist, selecting pile locations strategically around the trees' major woody roots. Localised root cutting is acceptable. Cutting major woody roots or structural roots is not. On the basis that the haul road is established this way, the impacts to the gum trees and cypress trees (trees 1-4) will be little more than short-term hydraulic stress from which they will recover. Adding mulch to their root zones would be beneficial and help to alleviate the impacts of root disturbance.

[1] https://www.prestogeo.com/products/soil-stabilization/geoweb-load-support/

Figure 7: An example of a cellular confinement mesh (Presto Geo Systems)

5.7 The eastern site compound is the larger of the two site compounds, and encapsulates three of the redwood trees, being trees 12, 13, and 14. During the June site visit, I discussed the pipe welding process with the construction team, and it was described to me that the pipe sections would need to be laid out and welded in line, approximately, with the piers on which they will ultimately be placed. Essentially, the pipe will be constructed, lifted off the ground with cranes, and then moved into place along the tagging and onto the piers. The three redwoods are on this alignment, and so to be able to weld the pipe sections to the correct length, the redwoods will need to be removed. Whilst it is not currently anticipated, it is possible that the embankment on which they are growing will need to be locally excavated to form level ground on to which the pipes can be welded. Either way, the organic soil horizon (the upper 100 mm) will almost certainly by damaged. The stumps of the redwoods will also likely need to be removed, either by wrenching / excavating, or by way of stump grinding. The impacts will be that three of the four redwood trees (12-14) will be removed. Whilst it is not currently anticipated, if soil stripping is required in the vicinity of tree 11, it may sustain root zone impacts from cutting and benching of the slope and surrounding soil that will result in chronic water stress. Some reduction in the tree's overall vitality including twiggy dieback and crown sparseness, could be expected over the five to ten years following the project. A layer of cured wood chip mulch laid under the tree would help to alleviate some of the stress effects and promote new fine root growth.

5.8 The row of cypress trees will not be within the construction compound, but the staging will be erected within approximately 5 m of the southern cypress tree (tree 15). The dead cypress tree, which has not been included in the survey, will be removed, and conceivably tree 15 will need to be removed as well. The remaining cypress trees are anticipated to not need to be removed but will likely sustain some minor to moderate degree of root zone disturbance from construction traffic and piling. The impacts of such disturbance could result in some brief stress on the trees, but each is in good vitality at the moment, and none are expected to noticeably deteriorate. This is contingent on the site compound being established outside of their tree protection zones and no soil stripping taking place within them.

5.9 With reference to the western site compound, and specifically the construction access route from Bicknell Road, there is a Category B honey locust tree (*Gleditsia triachanthos* 'Inermis') (tree 20) near to the proposed access within the road reserve The honey locust tree and its tree protection zone will not be impacted directly by the construction access route. However, collateral impacts from construction traffic must be considered. To ensure that the tree is not inadvertently impacted by construction traffic movements, it must be isolated with construction exclusion fencing, which is the simplest way of preventing trees from becoming damaged during construction. If tree 20 is isolated in this way, the impacts to it will be nil.

5.10 Another tree nearby within the reserve a Category C karo tree (*Pittosporum crassifolium*) (tree 19) – may be impacted by construction traffic when the road is formed and the construction compound established. The karo tree is unremarkable and unworthy of mandatory preservation through design and construction management, based on its arboricultural attributes. Conservatively, the impacts are that the karo will be removed, but, if practicable, the haul road will be configured to effect the karo's preservation and protection.

5.11 Vegetation clearance around the dam will be inevitable, both to install staging, but also to carry out the earthworks and reshape the land. The estimated area of terrestrial vegetation clearance around the dam and estuary channel (i.e., excluding mangroves) is 1,870 m^2 and is comprised of the vegetation described earlier in 4.2.

6. Canopy cover analysis and remediation planting

6.1 The canopy cover loss from the vegetation clearance, including the forecast canopy cover for individual trees, is approximately 2,529 m^2. Boffa Miskell have proposed 1,106 m^2 of new woody plants (ground area) which will achieve approximately 2,267 m^2 of canopy cover once established, which will take approximately 21 years. The outstanding canopy cover deficit is 262 m^2, requiring 12 new 45 L-grade trees.

6.2 The new trees need to be medium- to large-growing, climate-ready trees (Kendal. D, 2022) capable of thriving in Auckland's future climate (Cabrelli et al., 2014, Fitzharris, 2007). The following tree species are suggested.

- *Metasequoia glyptostoboides* – Dawn redwood
- *Chiranthodendron pentadactylon* – Monkey palm tree
- *Calocedrus formosana* – Incense cedar
- *Fraxinus griffithii* – Griffith's ash
- *Afrocarpus falcatus* – Common yellowwood
- *Quercus nigra* – Water oak
- *Metrosideros bartlettii* – Bartlett's rata
- *Nestigis apetala* – coastal maire

7. Statutory assessment

7.1 Chapter E26 of the Unitary Plan contains the rules for vegetation alteration during infrastructure projects. Since this project involves building a wastewater pipe and improving stormwater function, it qualifies as an infrastructure project. Activity Table E26.3.3.1 contains the rules for vegetation alteration in coastal areas and riparian areas, and Activity Table E26.4.3.1 contains the rules for vegetation alteration in Open Space zones and roads.

7.2 With reference to the Permitted Standards for the rules in Activity Table E26.3.3.1, Permitted Standard E26.3.5.2 stipulates, among other things, that vegetation alteration or removal must not include trees that are taller than 6 m or have a trunk circumference of more than 600 mm. The assessment has demonstrated that, vegetation removal either side of the estuary channel and on the banks of the dam will involve removing native vegetation that may be up to 7 m tall. Therefore, the Permitted Standard is not met in relation to vegetation alteration in riparian and coastal areas.

7.3 With reference to the Permitted Activity thresholds and Permitted Standards for the rules in Activity Table E26.4.3.1, rule E26.4.3.1 (A91) states that it is a Permitted Activity to remove trees that are up to 4 m tall or with a trunk circumference of 400 mm. The assessment has demonstrated that, tree removal in the Open Space zone involves trees that are taller than 4 m or have trunk circumferences more than 400 mm, therefore the Permitted Activity threshold is exceeded.

7.4 Permitted Activity Standard E26.4.5.2 specifies the permitted thresholds for work in the protected in the protected root zone. The Unitary Plan defines the protected root zone as an arbitrary circle centred around the tree's trunk with a radius equivalent to the distance of the farthest extending branch, or half the height of the tree for upright, columnar trees. The Permitted Standard stipulates, among other things, that if the works are not overseen by an appointed supervising arborist, no more than 10% of the protected root zone may be disturbed, no roots greater than 35 mm in diameter may be severed, and that excavations must not exceed 1 m^2. If the works are overseen by an appointed supervising arborist, the works must not disturb more than 20% of the protected root zone and no roots exceeding 80 mm in diameter may be severed. For both options, excavators must be fitted with straight-blade buckets and work from existing or temporary load-bearing surfaces.

7.5 A geospatial analysis of the proposed site features reveals that between 1% and 17% of the protected root zones of trees will be disturbed. However, what cannot be revealed is the diameter of the roots that will be encountered when the site compound is established and when the haul road is built. If the haul road construction is overseen by an appointed arborist, the other Permitted Standards are met, and the recommendations contained in Section 9 of this report are followed, then the work would likely meet the Permitted Standard criteria. If one or more of the Permitted Standards are not followed (e.g., if the access road from Blake Road is formed without a supervising arborist present or roots greater than 80 mm in diameter are severed from any tree), then the Permitted Standards will not be met. Conservatively, and to ensure the necessary consents are in place, the Permitted Standards will not be met.

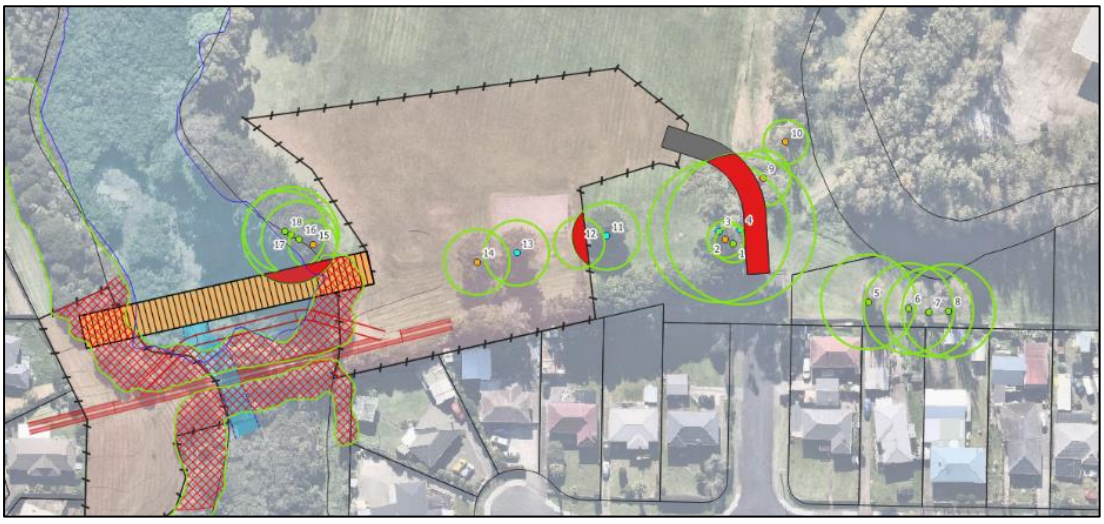

Figure 8: A screenshot from a geospatial analysis depicting protected root zone (green circles around trees) incursions (red areas).

8. Conclusions

8.1 Healthy Waters propose to remove a dam and culverts from an estuary at Blake Road Reserve, and to build a wastewater pipe bridge for the eastern interceptor wastewater pipe. The impacts of the proposal are:

- Removal of seven individual trees taller than 4 m, and 1,870 m^2 of terrestrial vegetation yielding a 2,529 m^2 canopy cover deficit by 2050.
- Site works for a new access / haul road from Blake Road that will likely result in some localised root severance for cypress trees (1 and 2) and gum trees (3 and 4) and render the underlying soil locally anaerobic but with negligible or nil consequences to the four trees nearby (1-4), provided that the recommendations in relation to tree protection in this report are followed.
- Soil stripping / benching of the ground in the tree protection zone of one redwood tree (11) that will likely initiate a period of chronic water stress with manifestations of reduced vitality becoming visible in the crown over the five to ten years following the project.

9. Recommendations

9.1 It is recommended that a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist'), be engaged at the start of the project. The role of the supervising arborist will be to coordinate, supervise, and document activities on the site that may affect vegetation, e.g., vegetation clearance, constructing the haul roads, etc.

9.2 Subject to approvals, it is recommended that vegetation removal be limited to trees 9, 10, 12-15, and tree 19, and no more than 1,870 m^2 of terrestrial vegetation either side of the dam and estuary (as shown on the appended site plan (3053_002_B). All vegetation clearance is to be carried out by trained and experienced arboricultural professionals in a manner which avoids any unnecessary damage or disturbance to any retained vegetation and their root zones.

9.3 In the event that any branches need to be pruned from any tree during the project, it is recommended that the branch pruning be undertaken by trained and experienced arboricultural professionals in a manner that avoids any unnecessary damaged or disturbance to any retained vegetation and their root zones. All pruning must be carried out in accordance with current accepted arboricultural best practice (e.g., MIS308).

9.4 Prior to works commencing, construction exclusion fences are to be erected around the trees as shown on the appended site drawing (3053_003_B) and in accordance with detail TP-02 in Appendix B. The fence must remain in place for the duration of works. There is to be no storage or stockpiling of materials, tools and equipment within the area enclosed by the fence. The protective fence may only be removed / relocated at the direction of the appointed works arborist.

9.5 No person vehicle or machinery are to enter the area enclosed by the fence unless otherwise authorised to do so by the supervising arborist. If for any reason it becomes necessary to move the protective fence, then the area previously enclosed by the fence shall be regarded in the same way as if the fence were still in place.

9.6 Suitably visible weather-resistant signs are to be hung on each face of the fence, translated as necessary to read.

CONSTRUCTION EXCLUSION ZONE
PROTECTED TREES
KEEP OUT

9.7 The haul roads / access roads must be formed without soil stripping within tree protection zones. The haul roads / access roads must be formed by first laying a 100 mm thick layer wood chip mulch over the ground, then adding a layer of geofabric, and then emplacing a cellular confinement mesh into which aggregates are installed. If necessary, the confinement mesh can be locally pinned to the ground with narrow (e.g., 20 mm) steel pins or pegs.

9.8 Silt and sediment control measures are to consist of aboveground methods when within the root zone of trees, as per GD05 recommendations[2], e.g., a filter sock.

9.9 In conjunction with the Boffa Miskell planting plans (BM230171_D501 rev C (18/10/2024)), within the first planting season after works are complete (May to September), it is recommended that at least 12 climate-ready (Kendal. D, 2022), 45 L-grade trees be planted at or near to (e.g., in local streets) the site. Tree planting locations must be selected strategically to avoid any future civil works or park upgrades that might necessitate their removal. The trees must be planted in accordance with the specification in Appendix E and be maintained for a period of three years, with the stakes removed after one year. If any tree should die, become damaged or vandalised, or otherwise become irrecoverably deteriorated, it must be replaced *like-for-like* with another 45 L-grade tree and maintained thereafter for three years.

9.10 The final species selection must include exotic and native trees at a ratio of 2:1 (e.g., 8 exotic trees and 4 native trees). Suitable species include:

- *Metasequoia glyptostoboides* – Dawn redwood
- *Chiranthodendron pentadactylon* – Monkey palm tree
- *Calocedrus formosana* – Incense cedar
- *Fraxinus griffithii* – Griffith's ash
- *Afrocarpus falcatus* – Common yellowwood
- *Quercus nigra* – Water oak
- *Metrosideros bartlettii* – Bartlett's rata
- *Nestigis apetala* – coastal maire

Please contact the author for further information.

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[2] "***Do not*** *install silt fences across watercourses or in areas of concentrated flows. Avoid trench excavations within the root zones of protected trees and trees that are to be retained."* – Section F-Sediment control practices. P113

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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 tree protection 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 person or organisation who has ultimate responsibility for the project 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 person or organisation who has ultimate responsibility for the project is to arrange a site meeting with the supervising arborist, council's monitoring officer, council's arborist 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
    - Vegetation removal
    - Site access, haul roads, and transportation of materials
    - Temporary storage areas for materials
    - Silt and sediment controls
    - Tree protection measures including fencing
    - Excavations within the vicinity of protected 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

Silt and sediment control

6. Silt and sediment control measures are to consist of aboveground methods when within the root zone of trees, as per GD05 recommendations[3], e.g., a filter sock.

Trunk and branch protection

7. Prior to works commencing, the tree trunk of trees 1 and 4 must be wrapped and protected to a height of 4 m according to detail TP-03 in Appendix B. The trunk protection must remain in place for the duration of the project, be periodically checked to ensure that it is not too tight and causing damage to the trees, or not too loose that it is falling off.

[3] "***Do not*** *install silt fences across watercourses or in areas of concentrated flows. Avoid trench excavations within the root zones of protected trees and trees that are to be retained."* – Section F-Sediment control practices. P113

Protective fencing

8. Prior to works commencing, construction exclusion fences are to be erected around the trees as shown on the appended site drawing (3053_003_B) and in accordance with detail TP-02 in Appendix B. The fence must remain in place for the duration of works. There is to be no storage or stockpiling of materials, tools and equipment within the area enclosed by the fence. The protective fence may only be removed / relocated at the direction of the appointed works arborist.

9. No person vehicle or machinery are to enter the area enclosed by the fence unless otherwise authorised to do so by the supervising arborist. If for any reason it becomes necessary to move the protective fence, then the area previously enclosed by the fence shall be regarded in the same way as if the fence were still in place.

10. Suitably visible weather-resistant signs are to be hung on each face of the fence, translated as necessary to read.

CONSTRUCTION EXCLUSION ZONE
PROTECTED TREES
KEEP OUT

11. No material is to be stored, emptied or disposed of in or around the tree protection zone of any tree unless otherwise authorised to do so by the supervising arborist. Any material which is to be stored or temporarily placed in or around the tree protection zone of any tree shall be stored carefully on an existing or temporary hard surface such as asphalt or plywood sheets, respectively.

Ground protection

12. If, during the course of the works, machinery or vehicle access / manoeuvring is required in or around the tree protection zone of any of the trees, then those areas are to be covered with a protective overlay sufficient to protect the ground from being muddied, 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).

13. If machinery / vehicles are to be operated or stored within the tree protection 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

14. 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, hydro-excavation, pneumatic excavation, 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 or hand tools only to check for the presence of such roots.

15. 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).

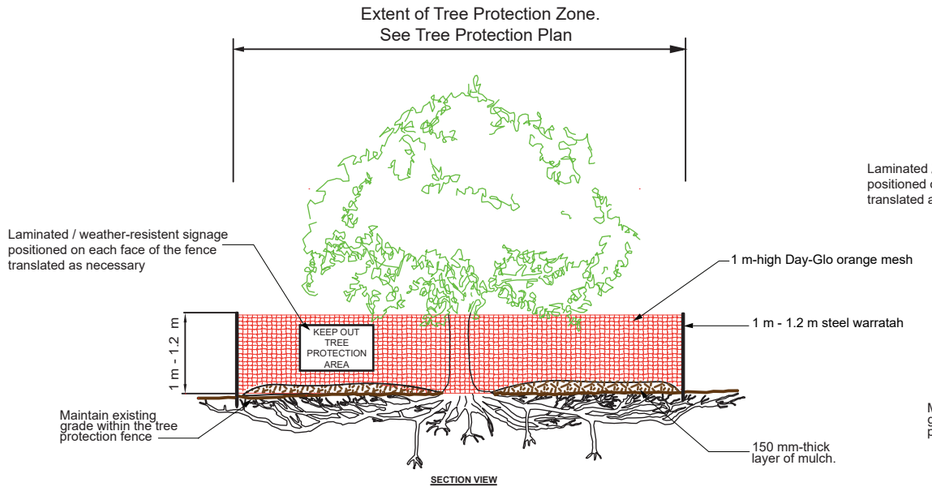
16. The cutting, breaking and lifting of any concrete and / or asphalt in and around the tree protection zone of any of the trees shall be done so in conjunction with the supervising arborist, through a careful combination of machine and hand operated equipment (for example, if the existing Blake Road concrete driveway needs to be reinstated). Ideally, the concrete / asphalt will first be cracked or broken with a steel bar or sledgehammer, and the sections carefully lifted out by hand. At the discretion of the supervising arborist, the cutting, cracking, lifting and removal of concrete / asphalt may proceed with machinery, such as a concrete cutter, and / or small excavator. All excavators and machinery shall sit on the existing concrete / asphalt surface and work slowly backwards away from the trees.

Protecting and pruning roots

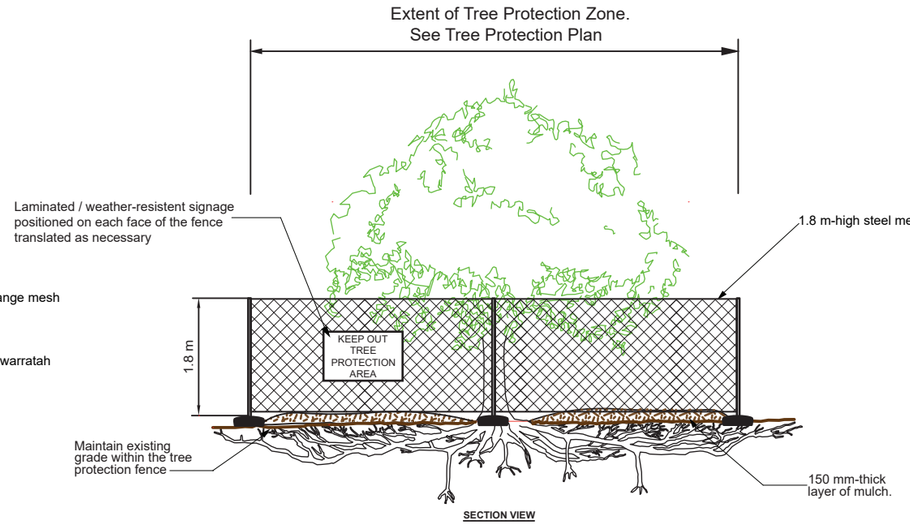
17. Every effort shall be made to avoid root severance from all trees by exploring on-site alternatives to construction / engineering. Where root severance is unavoidable, the severance of any root is to be carried out by the supervising arborist, who shall select the most appropriate implement for the 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.

18. 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.

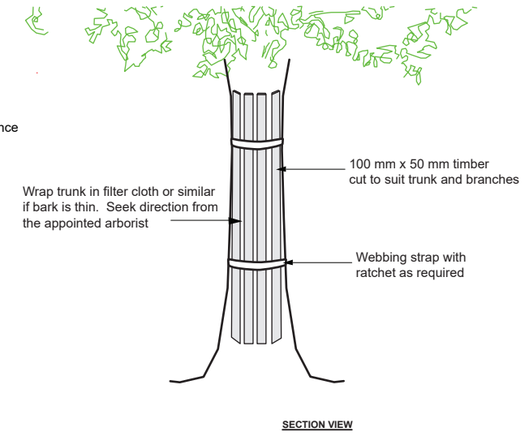
Appendix B – Tree protection details



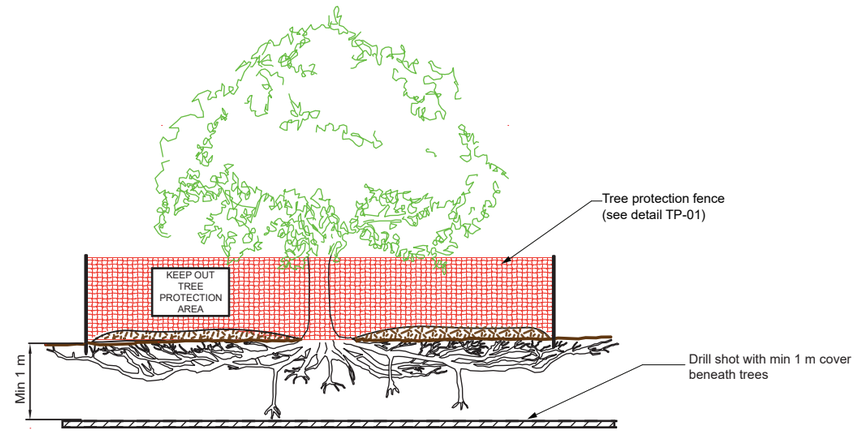
TP-01 TREE PROTECTION - TREE PROTECTION FENCING



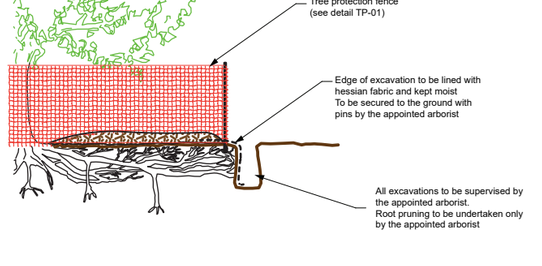
TP-02 TREE PROTECTION - TREE PROTECTION FENCING



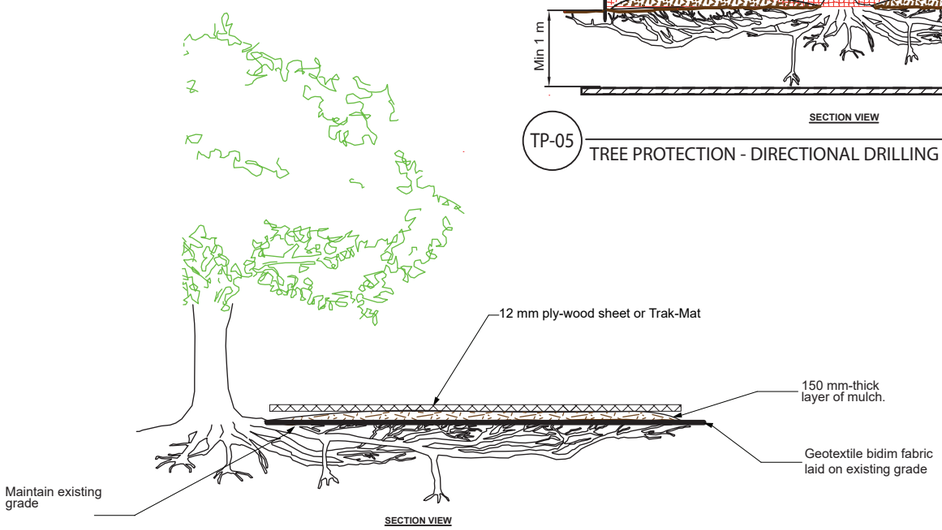
TP-03 TREE PROTECTION - TRUNK PROTECTION



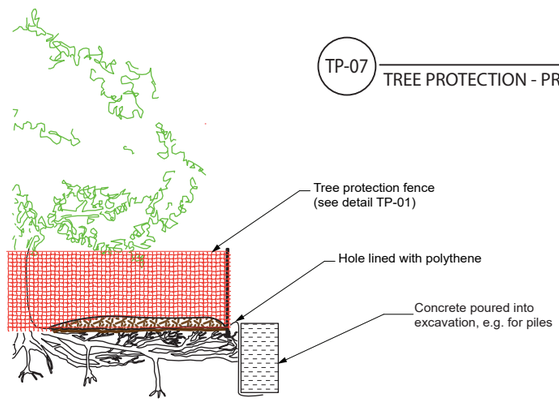
TP-05 TREE PROTECTION - DIRECTIONAL DRILLING



TP-07 TREE PROTECTION - PROTECTING ROOTS



TP-04 TREE PROTECTION - GROUND PROTECTION



TP-06 TREE PROTECTION - EXCAVATIONS CONTAINING ROOTS

All works around trees are to proceed in strict accordance with the tree protection methods
All works around trees are to be supervised by an appointed works arborist
No pruning of branches or roots unless undertaken by the appointed works arborist
No equipment or material is to enter or be stored inside the protective fence
Details scaled as shown

STANDARD TREE PROTECTION DETAIL

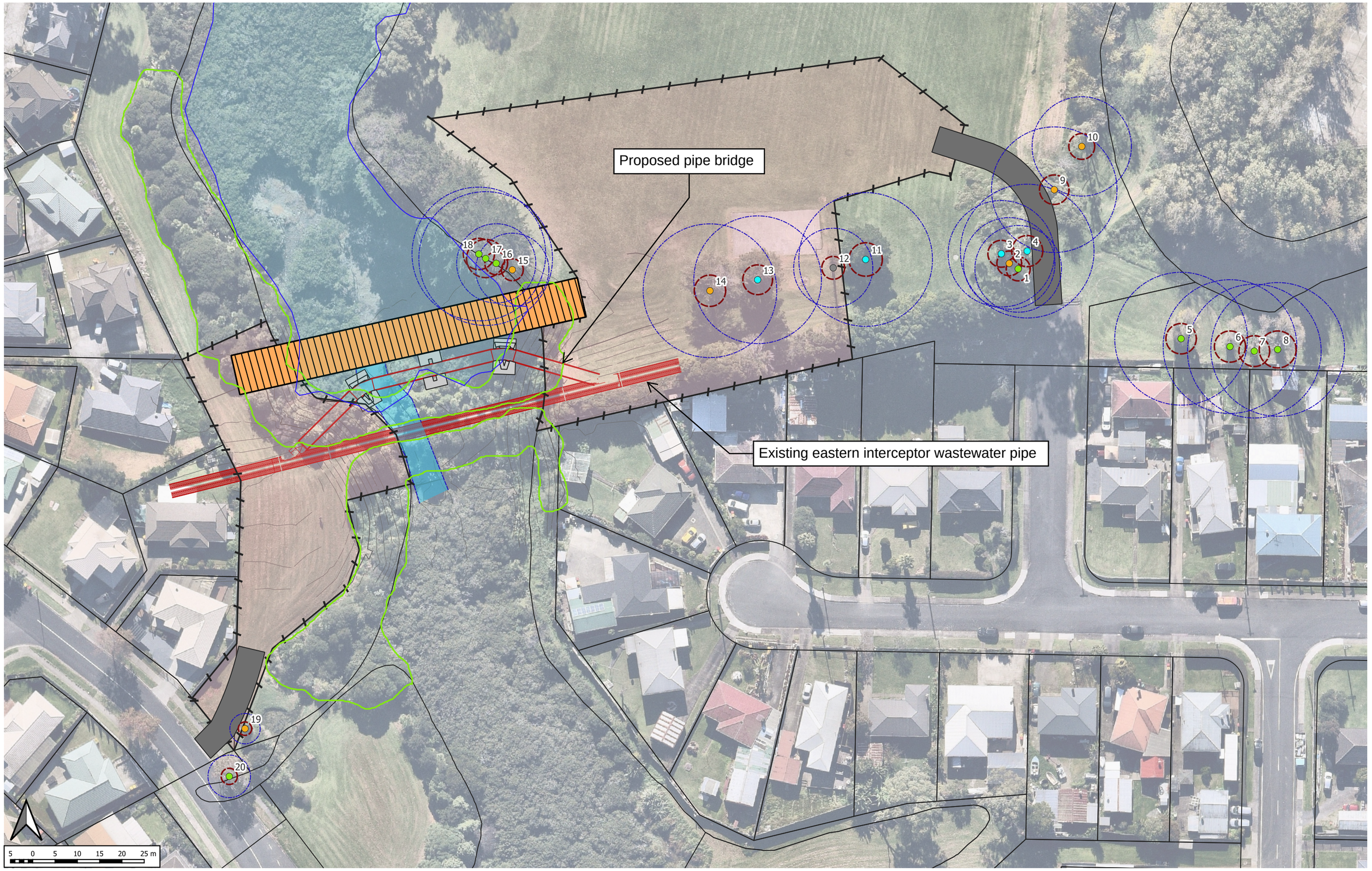
The TREE CONSULTANCY – COMPANY –

Drawing TTCC- TP- 2020

Revision 001

Date 14-08-2020

Appendix C – Arboricultural site plans (3053_001 to 003, rev B)



Trees
- Category A
- Category B
- Category C
- Category U

- Structural root zone
- Tree protection zone
- Terrestrial vegetation
- Marine SEA
- Site compound
- Staging
- Access road
- Proposed stream / estuary

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blake Road Reserve
Tennessee Pipe Bridge
Tree location and site works plan

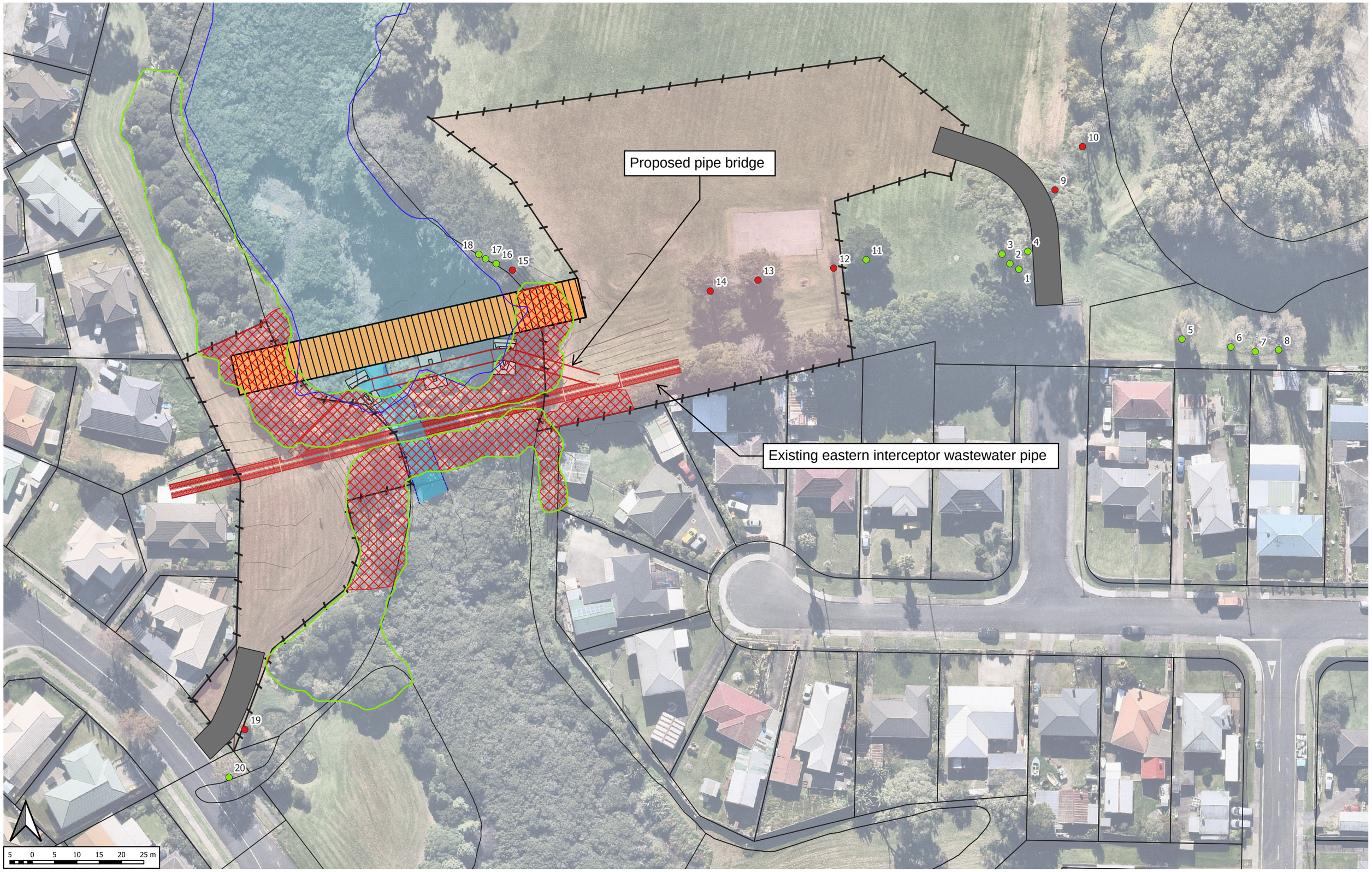
The TREE CONSULTANCY – COMPANY –

Project: 3053

Drawing: 001

Revision: B

22/10/2024



Trees
- Remove
- Retain and protect
- Terrestrial vegetation removal

- Terrestrial vegetation
- Marine SEA
- Site compound
- Staging

- Access road
- Proposed stream / estuary

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blake Road Reserve
Tennessee Pipe Bridge
Vegetation removal plan

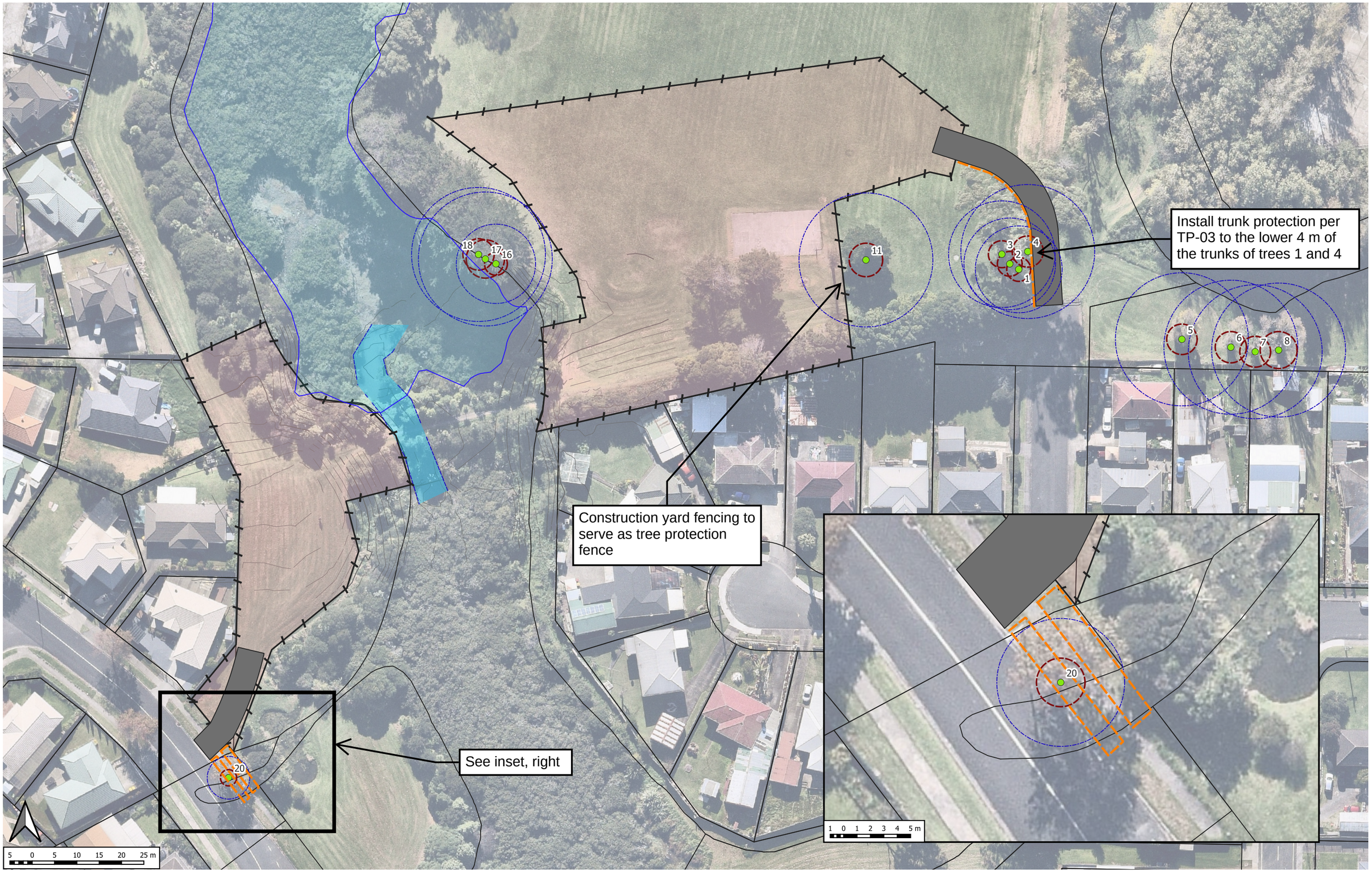
The TREE CONSULTANCY – COMPANY –

Project: 3053

Drawing: 002

Revision: B

22/10/2024



Trees
- Remove
- Retain and protect
- Structural root zone

- Tree protection zone
- Construction exclusion fence (TP-02)
- Marine SEA
- Proposed stream / estuary

- Site compound
- Access road

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blake Road Reserve
Tennessee Pipe Bridge
Tree protection plan

The TREE CONSULTANCY – COMPANY –

Project: 3053

Drawing: 002

Revision: B

22/10/2024

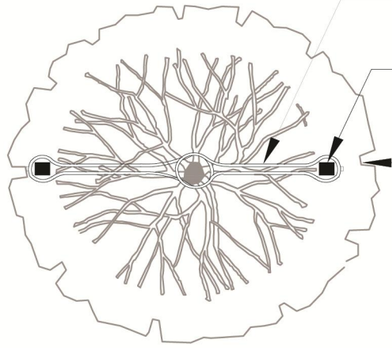
Appendix D – Tree inventory

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
1	*Cupressus lusitanica* / Mexican cypress	8.1	64.8	2.7	9.7	Good	95% - 99%	Fair	Fair	Mature	Category B	Construct haul road. Likely some root cutting for trees 1 and 3. Possible minor, short-term water stress. Minimal or nil long-term impact
2	*Cupressus lusitanica* / Mexican cypress	17.6	68.4	2.8	10.3	Poor	55% - 60%	Fair	Fair	Mature	Category C	
3	*Eucalyptus sp .* / Gum tree	26.8	79.6	3.0	11.9	Good	90% - 95%	Fair	Fair	Mature	Category A	
4	*Eucalyptus sp.* / Gum tree	26.2	103.5	3.5	15.0	Good	90% - 95%	Fair	Fair	Mature	Category A	
5	*Populus nigra* 'Italica' / Lombardy poplar	23.6	99.3	3.4	14.9	Good	95% - 99%	Good	Good	Mature	Category B	Not affected - Nil impact
6	*Populus nigra* 'Italica' / Lombardy poplar	24.4	104.1	3.5	15.0	Good	95% - 99%	Good	Good	Mature	Category B	
7	*Populus nigra* 'Italica' / Lombardy poplar	23.8	101.5	3.5	15.0	Good	95% - 99%	Good	Good	Mature	Category B	
8	*Populus nigra* 'Italica' / Lombardy poplar	25.2	141.0	4.1	15.0	Good	95% - 99%	Good	Good	Mature	Category B	
9	*Sequoia sempervirens* / Coastal redwood	14.7	93.9	3.3	14.1	Poor	75% - 80%	Good	Good	Early mature	Category C	Remove
10	*Eucalyptus sp .* / Gum tree	14.9	74.3	2.9	11.1	Poor	45% - 50%	Poor	Fair	Mature	Category C	
11	*Sequoia sempervirens* / Coastal redwood	18.2	117.8	3.7	15.0	Good	100%	Good	Good	Mature	Category A	Localised earthworks / benching in tree protection zone. Some chronic stress is likely unless the area can be excluded from the earthworks
12	*Sequoia sempervirens* / Coastal redwood	13.6	59.2	2.6	8.9	Poor	5% - 10%	Good	Good	Mature	Category U	Remove
13	*Sequoia sempervirens* / Coastal redwood	17.7	95.5	3.3	14.3	Good	95% - 99%	Good	Good	Mature	Category A	
14	*Sequoia sempervirens* / Coastal redwood	17.1	105.0	3.5	15.0	Fair	65% - 70%	Good	Good	Mature	Category C	
15	*Cupressus macrocarpa* / Monterey cypress	13	54.7	2.5	8.2	Fair	90% - 95%	Fair	Poor	Mature	Category C	
16	*Cupressus macrocarpa* / Monterey cypress	20.6	59.2	2.6	8.9	Good	90% - 95%	Fair	Fair	Mature	Category B	Nil

DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
17	*Cupressus macrocarpa* / Monterey cypress	22	104.4	3.5	15.0	Good	90% - 95%	Fair	Fair	Mature	Category B	Nil
18	*Cupressus macrocarpa* / Monterey cypress	22	149.9	4.3	15.0	Good	90% - 95%	Fair	Fair	Mature	Category B	Nil
19	*Pittosporum crassifolium* / Karo	6.1	22.7	1.5	3.4	Good	100%	Good	Good	Early mature	Category C	Remove
20	*Gleditsia triacanthos* / Honey locust	9.5	31.8	1.8	4.8	Good	100%	Good	Good	Early mature	Category B	Nil - isolate from construction traffic

Appendix E – Tree planting specification

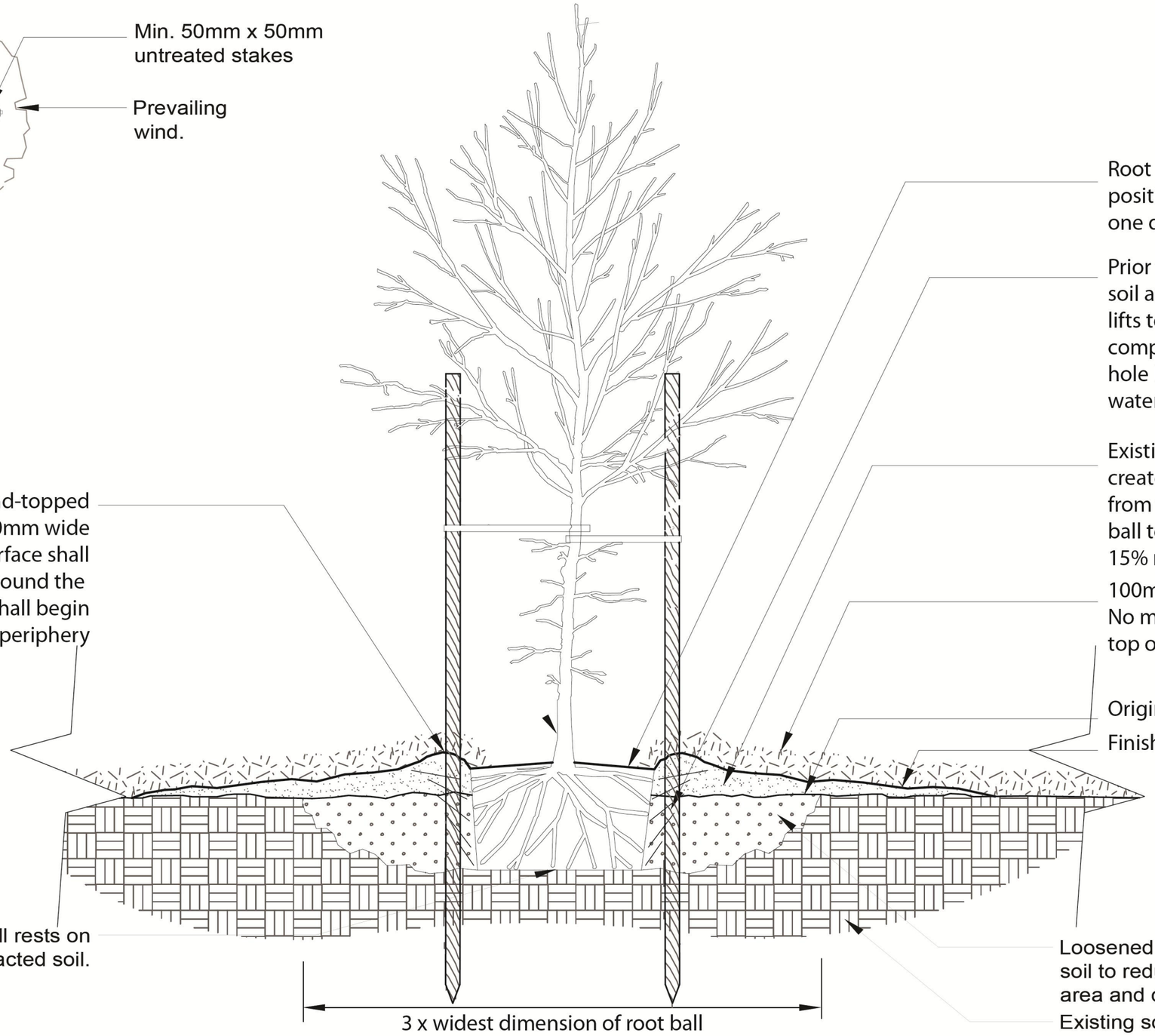


Hessian tree ties.

Min. 50mm x 50mm
untreated stakes

Prevailing
wind.

PLAN VIEW



Round-topped
soil berm 100mm high x 200mm wide
above root ball surface shall
be constructed around the
root ball. Berm shall begin
at root ball periphery

Root ball surface shall be
positioned to be
one quater above finished grade.

Prior to mulching, light tamp
soil around the root ball in 150mm
lifts to brace tree. Do not over
compact. When the planting
hole has been backfilled, pour
water around the root ball to settle the soil.

Existing site soil added to
create a smooth transition
from the top of the raised root
ball to the finished grade at a
15% max. slope.

100mm layer of mulch.
No more than 25mm of mulch on
top of root ball

Original grade

Finished grade

Bottom of root ball rests on
existing or recompacted soil.

Loosened soil. Dig and turn the
soil to reduce compaction to the
area and depth shown.

Existing soil.

3 x widest dimension of root ball

P-1 45L Grade Tree Planting Detail