BEFORE THE WAIKATO DISTRICT COUNCIL INDEPENDENT HEARING PANEL

IN THE MATTER of Proposed Variation 3, under clause 16A of Schedule 1 of the Resource Management Act 1991, to the Proposed District Plan Change

AND

IN THE MATTER of submissions by Greig Developments No 2 Limited and Harrisville Twenty Three Limited, Tuakau.

To: The Hearings Co-ordinator
Waikato District Council

PRIMARY ECOLOGICAL EVIDENCE OF KELLY MARIE HAYHURST FOR HARRISVILLE TWENTY THREE LTD

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4 July 2023

Counsel Instructed

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MAY IT PLEASE THE PANEL

1. Introduction

1.1 My full name is Kelly Marie Hayhurst.

1.2 I am a Senior Ecologist at Ecology New Zealand Limited (**ENZL**) in Auckland. I hold a Bachelor of Applied Science in Biodiversity from UNITEC and am currently in the last semester of a Post Graduate Diploma in Environmental Science at Auckland University. I am a member of the Environment Institute of Australia and New Zealand (EIANZ) and Auckland Botanical Society.

1.3 My relevant professional experience spans over seven years in both the private and public sectors in New Zealand. I have been in my role at Ecology New Zealand for the last four years. I have been involved in ecological assessments for subdivision and land use (Regional and District) consent applications for both urban and rural projects throughout New Zealand.

1.4 My technical experience includes terrestrial fauna and habitat surveys, terrestrial ecosystem surveys, the preparation of ecological impact assessments, ecological effects management, and terrestrial and wetland habitat management. I have prepared ecological assessments and management plans for a wide range of projects, including residential subdivisions and other landuse consents, for various industries and sectors, including transportation, energy, water and wastewater, construction, and government authorities throughout New Zealand.

1.5 I have provided input to the ecological aspects of several plan changes in the Waikato Region and regularly provide peer review services to Auckland Council on a range of resource consent applications, including terrestrial and wetland ecology.

1.6 I confirm that I have read the 'Expert Witnesses Code of Conduct' contained in the Environment Court of New Zealand Practice Note 2023. My evidence has been prepared in compliance with that Code in the same way as I would if giving evidence in the Environment Court. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

2. Scope of Evidence

2.1 This evidence is provided on behalf of Greig Developments and Harrisville Twenty Three Limited on Variation 3 of the Proposed Waikato District Plan (**PWDP**). My evidence specifically addresses select ecology-related aspects in the matter of the rezoning of land at 23A Harrisville Road to a to Medium Density Residential 2 Zone (**MDRZ 2**) through Variation 3.

2.2 My evidence addresses the following matters:

a) Effects on the Natural Inland Wetland (under the NES-F Regulations).

b) Management of effects on wetland and riparian ecosystems.

c) Management of effects on native bats (*Chalinolobus tuberculatus*) attributable to avoiding death or injury during vegetation removal only.

2.3 I have reviewed the three specialist reports my Ecology New Zealand Limited team prepared, which were written to address specific scopes, and assess the ecological effects on specific values only, attributable to the proposed development of fourteen (14) residential lots at 23 and 23A Harrisville Road, Tuakau. Specifically, the effects on the natural inland wetland and riparian areas, as well as potential bat habitat occupancy during vegetation clearance, were addressed.

2.4 Specifically, the information I have reviewed in preparation for this evidence is as follows:

a) 23 Harrisville Road, Tuakau, **NES-F Wetland Assessment**, dated 31-Aug-2022, report number 22138.1.001, Rev 0, prepared to address any effects from the proposed subdivision on the wetland at the site. Refer to **Appendix A**. Note Amy Bazeley of AB Ecology had previously delineated the wetland before the assessment of the effects by Ecology New Zealand Ltd.

b) 23 Harrisville Road, Tuakau, **Ecological Management Plan**, dated 13-Aug-2022, report number 22138.1-002 Rev 0, prepared by Ecology New Zealand Ltd. Refer to **Appendix B.**

c) 23 Harrisville Road, Tuakau, **Bat Management Plan** (Vegetation Management Protocols), dated 20-Dec-2022, report number 22138.1.003 Rev 0, prepared by Ecology New Zealand Ltd. Note that this was prepared in response to a Section 92 request from the Waikato Regional Council[1]. Refer to **Appendix C.**

d) The updated concept plan for a higher density development under the plan change proposed, prepared by The Surveying Company Ltd. Concept Plan of Lots 9 & 10 DP 136581 - # 23 & 23A Harrisville Road Tuakau, dated June 2023, ref: J1257 Concept Plan 3-A. Refer to the Planning Evidence of Ms Addy.

3. Key Issues and Summary of Prior Conclusions

3.1 A comprehensive ecological impact assessment (**EcIA**) was not completed as part of the previous application. Consequently, the following statements

[1] Waikato District Council Section 92 Request for further information SUB0045/23 and LUC0196/23. Dated 14 November 2022.

are restricted to the effects previously discussed as part of the various reports referenced above.

Natural Inland Wetland

3.2 ENZL previously concluded that the natural inland wetland identified on the subject site would not be adversely affected by the proposed 14-lot subdivision, providing the following management measures were implemented:

a) The hydrology of the wetland was to be maintained, and proposed stormwater spreaders will be designed to dissipate flows at an even rate mimicking pre-development flow.

b) Appropriate engineer reports and controls will be implemented to manage earthwork effects, including during construction.

c) The areas directly in front of the proposed stormwater dispersal trenches proposed in the margin will be planted with indigenous vegetation that provides increased evapotranspiration and filtration function.

d) The 20m wetland riparian setback was to be planted and subject to pest plant and animal management.

e) The proposed planting was recommended to be protected in perpetuity (e.g. by a covenant or similar).

Riparian Margin

3.3 It was previously concluded by ENZL that the management actions specified in the Ecological Management Plan (**EMP**) would improve the riparian area identified on the subject site as:

a) No earthworks were to occur within the riparian 10m setback.

b) The 10 (min) – 72m (max) riparian setbacks were to be planted and subject to pest plant and animal management.

c) The proposed planting was recommended to be protected in perpetuity (e.g. by a covenant or similar).

3.4 It is noted that a full effects assessment on the riparian margin was not undertaken for the development. Therefore, this evidence addresses any effects on the riparian margin through the planting plan improvements.

Bat Management

3.5 The Bat Management Plan prepared by ENZL concluded that the implementation of methodologies that aim to commensurately manage potential direct impacts on long-tailed bats (*Chalinolobus tuberculatus*) (avoiding injury and/or mortality) associated with the removal of vegetation only, as required by the development of the site would be managed by:

a) Avoiding unnecessary tree clearance where feasible.

b) Following a hierarchy of vegetation felling protocols, including roost identification, pre-felling checks, during felling protocols and seasonal constraints on vegetation removal.

3.6 It is noted that a full effects assessment on bats was not undertaken for the development. Therefore, this evidence addresses bat management during tree felling only and the potential for bats to be injured or killed during these activities. This assessment does not address effects on bats in relation to maternity roosts, foraging and commuting pathways or habitat loss.

4. Proposed Zone Change

4.1 The Harrisville submission relief on the proposed plan change is to re-zone the property from Rural-Residential/Large Lot Zoning to Medium Density Residential Standards 2 zoning.

4.2 The Surveying Company states that the lot yield change based on a zone change would increase from seven (7) lots (current Rural-Residential/Large Lot Zoning) to approximately twenty-five (25) developable platforms (MDRS 2 zoning), being 18 additional lots/developable platforms. This is based on ultimate lot sizes of 350m^2 - 450m^2 as well as some larger lots, and only utilising an area of land that does not present unfavourable contours.

4.3 The Surveying Company notes that the difference in lot yield between the current proposed subdivision consent layout producing fourteen (14) lots and the potential yield under MDRS 2 zoning potentially generating twenty-five (25) developable platforms is eleven (11) additional lots/developable platforms.

5. Proposed Zone Change Effects Assessment

Natural Inland Wetland

5.1 It is noted that the wetland effects report by ENZL was prepared specifically to address the effects under the National Environmental Standards for Freshwater (NES-F) (2020) prior to amendments to the standards. Amendments to the standards came into force on 5 January 2023, resulting in no assessment required for the discharge of water to land, which is the case in the application and will remain in any subsequent applications resulting from this plan change.

5.2 The proposed zone change and subsequent density would not change the level of effects on the natural wetland from what was previously assessed by ENZL, based on the assumption that the proposals remain out of the 20m wetland margin and effects be managed in an appropriate manner as was provided in the previous 14-lot application.

Riparian Margin

5.3 The proposed zone change, and subsequent density, would not change the level of effects on the riparian area from what was previously assessed by ENZL, based on the assumption that the proposals remain out of the 10m riparian margin and effects be managed in an appropriate manner as was provided in the previous 14-lot application.

Bat Management

5.4 Bat management is addressed by this effects assessment in terms of effects during vegetation removal only. ENZL has not assessed any effects on bats pertaining to commuting pathways, foraging and habitat use as this was not within the scope of the project, and these are subsequently not addressed by this evidence for the proposed plan change.

5.5 The vegetation management plan prepared for bats would be implemented in both subdivision scenarios. The management required during vegetation clearance does not change or increase with the proposal for re-zoning.

5.6 It is recommended that a full bat effects assessment is undertaken at the subdivision consent stage to ensure that bats are not adversely affected by the final development concept.

6. Conclusion

6.1 In reviewing the proposed concept plan and previous reports prepared by ENZL, I can conclude that additional lots generated by a rezoning on the subject site will not incur additional effects on the wetland and riparian margins at the site than what has been assessed for the 14 lot application previously submitted. Management of bats during vegetation removal is an effect that will remain the same and is not dependent on the subdivision amount. This evidence cannot assess further effects on bats in relation to commuting pathways, foraging and habitat use, as this was not a

component of the scope of works for the previous subdivision or previous reports provided.

Kelly Hayhurst

4 July 2023

APPENDIX A – WETLAND ASSESSMENT

23 Harrisville Road, Tuakau

NES-F Wetland Assessment

Prepared for The Surveying Company

31 August 2022

Report Number 22138.1.001Rev0

ECOLOGY NEW ZEALAND

Document Sign Off

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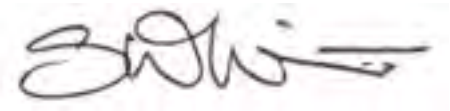
Ecology New Zealand Limited



Revision	Revision Date	Title	Author/Editor	Authorised by
0	30/08/2022	23 Harrisville Road NES-F Wetland Assessment	CR	SW

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1. INTRODUCTION

This report[1] has been prepared by Ecology New Zealand Limited ('ENZL') for The Surveying Company (the 'Client'). A wetland assessment at 23 Harrisville Road, Tuakau (the 'Site') has already been conducted, and a report of the wetland delineation has been completed by AB Ecology Ltd[2]. ENZL was commissioned to assess the composition and health of the identified natural wetland, in relation to the National Environmental Standards for Freshwater (NES-F) and National Policy Statement for Freshwater Management (NPS-FM).

1.1. Proposed Activities

The client proposes to subdivide the site into 14 lots with associated earthworks, wastewater and stormwater infrastructure. This report references the following documents reviewed upon producing this assessment:

- Resource Consent Site Plans by The Surveying Company. Dated June 2022.
- Subdivision Consent Plans by The Surveying Company. Dated June 2021.
- Infrastructure Report by The Surveying Company. Dated 25th July 2022.

1.1.1. Wastewater

The Surveying Company has prepared the wastewater plans for 23 Harrisville Road, and it is expected that the site will connect to the existing public wastewater system through a reticulated wastewater system. The proposed wastewater pipe layout will be located underneath the proposed accessway for the site. Wastewater discharge is not required for this site and the effects of wastewater discharges will not be considered further.

1.1.2. Stormwater

The stormwater disposal for the site will be designed to be low impact in alignment with the Waikato Regional Council's best practice guidelines. The systems are expected to include the on-site retention of stormwater and the disposal of overflows, with a design that achieves flow neutrality conditions under various year storm events. Most of the stormwater will be managed on-site and will flow toward the stream on the northern boundary, except for some stormwater from the beginning of the accessway which will be directed to Harrisville Road. Three stormwater trenches are proposed for the subdivision, one in the north-eastern section of the site at the end of the accessway, and two in the south-western sector of the site[3]. There will be an associated stormwater reticulation pipe network that is proposed to be located beneath the accessway and connect to four stormwater tanks that link to the dispersal trenches[3]. Four raingardens are also proposed for the site to reduce runoff[4].

[1] This report is subject to the Report Limitations provided in Appendix A.
[2] Wetland delineation at 23A Harrisville Road, Tuakau. Prepared by AB Ecology Ltd. Dated 8th December 2021.
[3] Resource Consent Site Plans prepared by The Surveying Company. Dated June 2022.

1.1.3. Earthworks

The expected earthworks at this site involve approximately 600m^3 comprising cuts and filling up to approximately 1,100m^3 to create the proposed accessway for the subdivision[4]. Two pole retaining walls are proposed for the site located between the accessway and the northern boundary, both entailing minor cut and fill requirements[4]. Three overland flow paths will be provided by the proposed development to facilitate runoff from the accessway and lots, and this runoff will be directed to four stormwater tanks, two at the south-west and two at the north-east of the site[4]. Minor earthworks will be required to produce the overland flow path to reach the stormwater tanks at the south-west of the site[5]. A dirty water diversion bund will be installed alongside the southern side of the accessway to direct sediment-laden water towards the decanting earth bund at the south-west corner of the accessway[4]. These works will be subject to best practice erosion and sediment control as per Waikato Council Erosion and Sediment Control[6] and Waikato Regional Councils Earthwork Series[7].

2. WETLAND DELINEATION ASSESSMENT

2.1. Desktop Assessment

A preliminary site scope was undertaken via a desktop assessment. This assessment included an investigation of catchment information and previous land use through Waikato Regional Council Maps layers[8], historical aerial imagery[9] and rainfall data prior to the site visit.

2.2. Results of Desktop Assessment

The site is situated in a rural lifestyle landscape, where the dominant land use is lifestyle living and farming (Figure 1). Desktop analysis of rainfall data indicated 1mm of rain had fallen on the preceding day before the site visit, and there was 2mm of rain recorded within the preceding seven days[10]. Historical images indicated the site has a permanent flow path present at the site, which has been subject to modifications including a pond to the west. Historically, the wider site has been used for grazing[11].

[4] Infrastructure Report for 23 Harrisville Road by The Surveying Company. Dated 25th July 2022.
[5] Resource Consent Site Plans prepared by The Surveying Company. Dated June 2022.
[6] Erosion and Sediment Control – Guidelines for Soil-Disturbing Activities. By Waikato Regional Council, dated January 2009.
[7] Waikato Regional Councils Earthworks Series – Erosion and Sediment Control factsheets for Stabilised Construction Entrance, Decanting Earth Bund, and Diversion Bunds as illustrated on Resource Consent Site Plans for 23 Harrisville Road.
[8] Retrieved from https://waikatomaps.waikatoregion.govt.nz
[9] Retrieved from www.retrolens.nz and Google Earth Aerial Imagery,
[10] As measured at Auckland Council's monitoring station labelled "Ngakoroa at Donovans" on Auckland Council Rainfall Hydrology Environmental Data.
[11] Retrieved from www.retrolens.nz, Google Earth Aerial Imagery

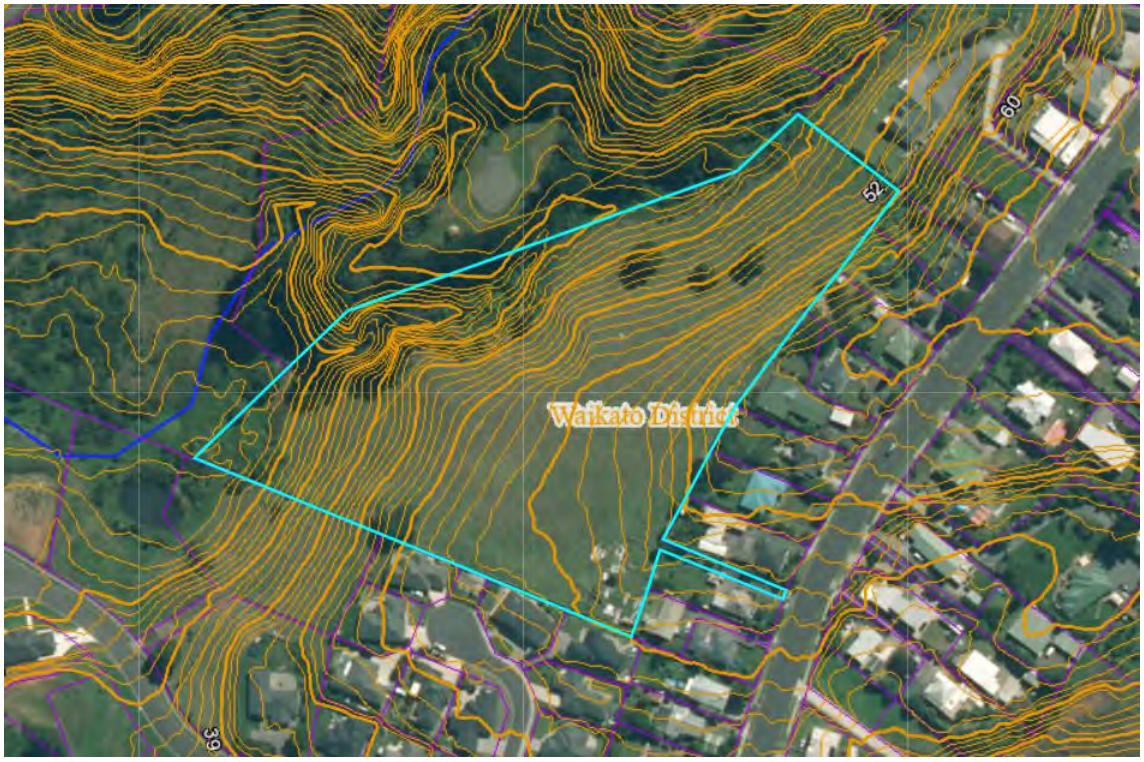


Figure 1: The subject site and Waikato Regional Council overland flow paths and contours layer.

3. NATURAL WETLAND VALUES

The NPS-FM sets out the values of a natural wetland that should be considered when assessing potential effects. Specifically, Subpart 3 details these values as:

- Ecosystem Health
- Indigenous Biodiversity
- Hydrological Functioning
- Māori Freshwater
- Amenity Values.

The following ecological assessment is restricted to considerations of the effects on the values of ecosystem health, indigenous biodiversity, and hydrological functioning. A natural wetland complex was previously identified within the site boundaries[12] (Figure 2).

[12] Wetland delineation at 23A Harrisville Road, Tuakau. Prepared by AB Ecology Ltd. Dated 8th December 2021.

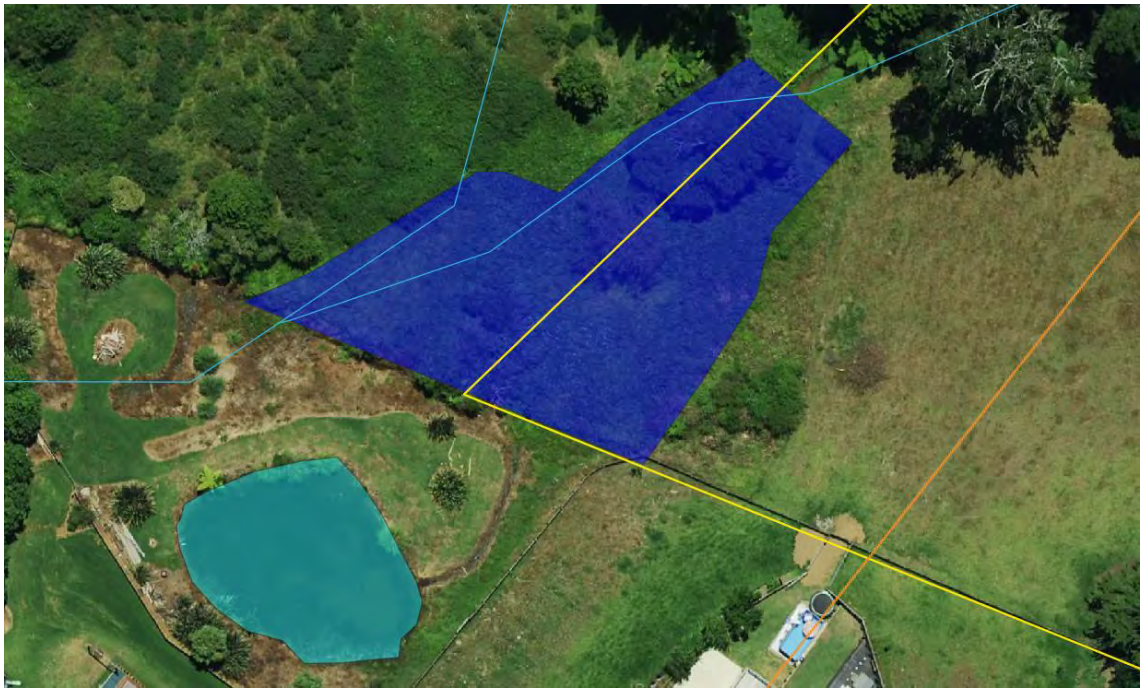


Figure 2: Previously delineated wetland (dark blue) and pond (light blue) to the west of the site.

3.1. Ecosystem Health

The wetland identified was linked with a permanent section of a stream system and associated overland flow paths at the site. The wider riparian system connects to the main stem of the Waikato River[13]. From the site, the stream system flows south and is generally well vegetated and unmodified with some culverting and online ponds along its reach. The wetland and riparian margins at the site considered by this assessment were well vegetated, although pest plants were prevalent at the time of assessment (Figure 3). Pampas (*Cortaderia selloana*), woolly nightshade (*Solanum mauritianum*), blackberry (*Rubus fruticosus*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), wandering jew (*Tradescantia fluminensis*), gorse (*Ulex europaeus*), bindweed (*Convolvulus arvensis*), onion weed (*Allium triquetrum*), and wild ginger (*Hedychium gardnerianum*) were present throughout and surrounding the wetland (Figure 4).

[13] Topographic 2009 Map, Land Information New Zealand.

Figure 3: Pampas infestation invading the wetland complex.

Figure 4: Pest plants including blackberry, woolly nightshade and pampas encroaching on the wetland.

The identified natural wetland contained a channelised stream system flowing through the wetland area to the south-west (Figure 5). There was also a small channel flowing into the wetland from the south-east. The wetland vegetation situated on either side of the channel contained some standing water and had high levels of pest plant impact. There were few indicators of pest animal impact (i.e., grazing damage) and the wetland had been fenced off on the south-east side on-site. When the vegetation was disturbed, the wetland area did not emit sulphurous smell, however, there was evidence of filamentous algae blooms and bacteria in the stream channel flowing through the wetland and additional channel feeding into the wetland from the south-east (Figure 6 and Figure 7). From historical aerial imagery the wetland complex does not appear to have been altered in size.

Figure 5: Stream system running through the wetland.

Figure 6: Filamentous algae in the stream system running through the wetland.

Figure 7: Bacteria in a channel feeding into the wetland.

3.2. Indigenous Biodiversity

The wetland was c. 1430m^2 in total, with approximately 735m^2 of the wetland within the site boundary. The wetland was dominated by the indigenous carex - *Carex lessoniana* and could be classified as a Carex sedgeland. Other species present were exotic and included soft rush (*Juncus effusus* var. *effusus*), lotus (*Lotus pedunculatus*), creeping buttercup (*Ranunculus repens*), fools' watercress (*Apium nodiflorum*), and willow (*Salix babylonica* and *Salix fragilis*) scattered throughout the wetland. The wetland demonstrated connectivity to the broader catchment as it was connected to the associated riparian margins with no structures inhabiting this connection. The wetland identified was under one hectare and is expected to have limited resource provision for wetland fauna due to its size and semi-urban location.

3.3. Hydrological Functioning

The catchment area of the identified wetland was not subject to significant alterations at the time of assessment with the exception of a pond located on the neighbouring property to the west of the site (Figure 2). The water table was as expected for the wetland's topographic location, catchment size, the time of year and the location.

4. POTENTIAL EFFECTS ASSESSMENT

The infrastructure for the stormwater trenches and shallow earthworks required to direct an overland flow path to the stormwater tanks at the south-west of the site are proposed to be located at the closest point c. 9m upslope from the identified wetland (Figure 8). The earthworks for the accessway to the subdivision and the retaining walls are proposed to be located upslope at the closest point c. 96m and c. 69m from the identified wetland respectively (Figure 8). At the time of this report, no other earthworks were proposed.

Figure 8: The proposed stormwater spreaders (red), stormwater tanks (purple), earthworks (white), and retaining walls (green), site contours (orange), overland flow paths (blue), pond (light blue) and wetland (dark blue).

4.1. Ecosystem Health and Indigenous Biodiversity

4.1.1. Wastewater and Stormwater

The addition of nutrients to a wetland system has the potential to alter the natural wetland's overall health and indigenous composition. Historical and current land use of the area surrounding the wetland was for agriculture. The wetland and associated riparian systems have been subject to little or no filtration and excessive nutrient inputs for many years, as indicated by historical aerial imagery.

The proposed stormwater dispersal trenches are located upslope from the identified wetland. This discharge has the potential to reach the natural wetland due to the short distance (c. 9m) of one of the dispersal trenches. The area between the stormwater spreaders and the wetland, however, is to be planted with appropriate native species to increase evapotranspiration[14]. It is also expected that any stormwater infrastructure will be designed in accordance with the Waikato Regional Council Stormwater Management Guidelines.

[14] Subdivision Consent Plans by The Surveying Company. Dated June 2021.

Additional nutrients are unlikely to reach the identified wetland from the expected and proposed infrastructure associated with stormwater due to the evapotranspiration and topsoil soakage effects from the planting, however, there may be a minor amount of stormwater that reaches the wetland as a result of the close proximity of the dispersal trench. However, it is considered unlikely to have significant impacts on the hydrology of the wetland locally, or as a whole. It is expected that overall, these management measures will not result in a decline in ecosystem health and indigenous biodiversity.

4.1.2. Earthworks

Earthworks can result in excessive sedimentation entering the wetland systems. Earthworks have been and are expected to be undertaken within 100m of the identified wetland but outside of the 10m wetland setback, with the exception of minor earthworks required to construct the overland flow path to the stormwater trench closest to the wetland[15] (c. 9m). The works will be subject to best practice erosion and sediment control during works. In addition, the proposed pole retaining walls will ensure that sediment from any unstable ground in the future will not enter the wetland system. As a result of the above considerations and the distance between the wetland to the proposed accessway infrastructure, it is expected that there will be no adverse effects on ecosystem health and indigenous biodiversity from the earthworks on the identified wetland.

4.1.3. Hydrological Regime

Additional discharge from stormwater infrastructure could affect the wetlands composition by increasing the timing or quality of water feeding the wetland or requiring earthworks that could alter the groundwater levels. Earthworks for the pipe infrastructure will occur during the construction of the accessway[16]. The shallow earthworks for the development of the overland flow path leading to the stormwater tanks at the south-west of the site are unlikely to alter ground water levels and therefore have little impact on the wetland.

Earthworks for the proposed accessway will be undertaken within 96m of the wetland, and earthworks for the proposed retaining walls will be undertaken within 69m of the wetland. Works will involve cut and fill requirements[16]. These works are unlikely to affect the wetland's underlying hydrology, as it is fed predominantly by the associated riparian flow path and its upstream catchment which is not in the location of the earthworks.

It has already been demonstrated above that discharges from the stormwater infrastructure are unlikely to reach the identified wetland and therefore will not affect the underlying hydrology. Considering the design and location of the infrastructure indicated above, it is expected that the earthworks and discharge resulting from the development will not alter the wetland's hydrology.

[15] Infrastructure Report for 23 Harrisville Road by The Surveying Company. Dated 25th July 2022.
[16] Resource Consent Site Plans by The Surveying Company. Dated June 2022.

4.2. Summary of Effects Assessment

Earthworks and the discharge of stormwater within 8 - 100m of the wetland are unlikely to have adverse effects as:

a. The areas directly in front of the proposed stormwater dispersal trenches will be planted with indigenous vegetation that provide increased evapotranspiration functions, to reduce the amount of water reaching the wetland.
b. The proposed stormwater spreaders associated will be designed to dissipate flows at an even rate mimicking pre-development flow.
c. There will be an area of restoration planting between the stormwater spreaders, earthworks, and the wetland.
d. Appropriate engineer reports and controls will be put in place to manage earthwork effects, including during construction.

5. CONCLUSIONS

The assessment undertaken by ENZL identified the health and composition of the pre-delineated natural wetland within 100m of proposed infrastructure and earthworks for the proposed subdivision. This report has demonstrated that there will be no adverse effects on the identified wetland complex from this development.

APPENDIX A

Report Limitations

This Report/Document has been provided by Ecology New Zealand Limited (ENZL) subject to the following limitations:

i) This Report/Document has been prepared for the particular purpose outlined in ENZL's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of ENZL's services are as described in ENZL's proposal and are subject to restrictions and limitations. ENZL did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by ENZL regarding it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been considered in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the Client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that ENZL may have retained sub-consultants affiliated with ENZL to provide Services for the benefit of ENZL. ENZL will be fully responsible to the Client for the Services and work done by all its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages, or other liabilities from ENZL and not ENZL's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against ENZL's affiliated companies, and their employees, officers, and directors.

viii) This Report/Document is provided for sole use by the Client and is confidential to it. No responsibility whatsoever for the contents of this Report/Document will be accepted to any person other than the Client. Any use which a third party makes of this Report/Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. ENZL accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this Report/Document.

ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

APPENDIX B

Wetland Map

Property Boundary
Contours
Wetland
Pond
Proposed Stormwater Spreaders
Proposed Retaining Walls
Proposed Earthworks
Proposed Stormwater Tanks
Overland Flow Paths

ECOLOGY NEW ZEALAND

N

0 25 50 75 m

1: 1000 @ A3

Projection: NZTM 2000 / NZGD 2000
Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ Crown Copyright Reserved

23 Harrisville Road, Tuakau
22138.1.001-500
Date: 30/08/2022 | Revision : 0
Site Map prepared for The Surveying Company
by Ecology New Zealand Limited
Author: CR | Checked: KH

APPENDIX B – ECOLOGICAL MANAGEMENT PLAN

23 Harrisville Road, Tuakau

Ecological Management Plan

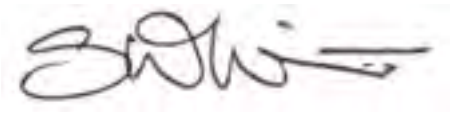
Prepared for The Surveying Company

31 August 2022

Report Number 22138.1-002Rev0

ECOLOGY NEW ZEALAND

Document Sign-off

Author(s):	Carrie Reyden Ecologist Ecology New Zealand Limited	
Review:	Kelly Hayhurst Senior Ecologist Ecology New Zealand Limited	
Sign off:	Steve White Principal Ecologist Ecology New Zealand Limited	

Document Control

Revision	Date	Title	Author/Editor	Authorised by
0	30/08/2022	23 Harrisville Road Ecological Management Plan	CR	SW

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1. INTRODUCTION

This report[1], prepared by Ecology New Zealand Limited ('ENZL') for The Surveying Company ('the Client'), presents an Ecological Management Plan (EMP) to manage the impacts of the proposed subdivision at 23 Harrisville Road, Tuakau ('the Site').

1.1. Background

The site is located in Tuakau, Waikato and is zoned as 'Rural & Rural Residential'. The site is 2.7ha and is comprised mainly of pasture, wetland and a section of indigenous forest (Land Cover Database 1, LCDB1) of primarily broadleaved indigenous hardwoods[2]. A 14-lot subdivision is proposed for the site, with associated earthworks, wastewater and stormwater infrastructure.

2. ECOLOGICAL OUTCOME STATEMENT

This objective of this EMP is to detail the mitigation of the foreseeable ecological effects as a result of the proposed subdivision at 23 Harrisville Road, Tuakau. This EMP will highlight the management of pest plant and animal control and replanting to mitigate ecological effects. If the management measures detailed below are implemented accordingly, the ecological effects of the proposed subdivision are expected to be adequately managed and allow for a positive outcome.

3. GENERAL METHODOLOGY AND DEFINITIONS

A site investigation was carried out by ENZL on the 17th of August 2022. During the investigation, pest plant species were documented on-site along with native fauna.

All pest plants were then classified in alignment with the Waikato Regional Pest Management Plan (WRPMP)[3]. Recommendations are provided for control expectations and specific control methods. Throughout this EMP, reference is made to the need for a suitably qualified restoration professional to implement the works to maximise the likelihood of successful pest control and planting.

4. PEST PLANT CONTROL

The definition of a pest plant can vary depending on the context being applied and the environment in which they are situated. For the purposes of this report, definitions will be guided by the WRPMP. Recommended pest management strategies consider both the WRPMP status of the pest as well as the actual effect of that species on-site. Some exotic or pest plant species may provide local ecological benefits (e.g., exotic trees and shrubs can provide nest sites and food resources for native birds) and, as such, options for the removal or retention of these species will be carefully considered.

A pest plant control programme is to be implemented for a period of five years to remove established pest plants and control any re-infestations within the planting area, riparian margin and wetland. Pest plant species observed at the site have been summarised in Table 1 with

[1] This report is subject to the Report Limitations provided in Appendix A.
[2] Retrieved from https://waikatomaps.waikatoregion.govt.nz
[3] Waikato Regional Pest Management Plan, 2022-2032.

their categorisation under the WRPMP, their relative abundance and the expected control measure.

The following sections provide instructions on how these pest plants are to be managed using best practice methodologies. It is important to note that the plant list is not intended to be exhaustive, and any additional pest plants that may be found when undertaking the works will also be controlled in alignment with the WRPMP.

4.1. Control Methods and Expected Outcomes

Across the site, most pest plant infestations will require initial control with multiple follow-up control visits. It is reasonable to expect that all pest plant infestations will be controlled within one year. It is expected that at this time, no fruiting or flowering pest plants will be present within the planting area, nor will there be any dense/monoculture stands or immature pest plant species. Pest plant control will be initiated six months and three months prior to any restoration planting, as set out in the programme of works in Section 9 below.

Control techniques will differ between species and will depend on the nature and size of infestations. Methods that will be utilised include one or more of the following as appropriate: cutting and pasting, foliar spraying, hand-pulling and drill and fill. Table 1 summarises the recommended control methods and herbicide for each species observed.

4.2. Agrichemical Use

Agrichemical use will be assessed individually for each area and species, with the intention of minimising herbicide as much as practicable without comprising the efficacy of control. All herbicide application will be undertaken by a Registered Chemical Applicator or as a minimum by a Growsafe Approved Handler. This is particularly important for any herbicide application around or near waterways. Operators must apply industry best practice methods and be in alignment with the Management of Agrichemicals (NZS 8409:2004) guidelines.

Records of herbicide application must be kept, including what has been used, the location, application rates and date of application. An example of a pest plant control monitoring form is provided in Appendix D.

4.3. Pest Plants Detected On-site

Pest plants observed at the time of the site investigation occurred in low to high densities throughout the entire site. Weed species were generally found in the highest densities within the riparian margin (Figure 1) and wetland (Figure 2). Due to the wider wetland area outside the site boundaries being heavily infested with pest plants, constant incursions are likely to occur. It is therefore recommended the landowners work together in a landscape approach to control pests.

Figure 1: Example of pest plants within the riparian margin.

Figure 2: Example of pest plants within the wetland.

Table 1: Pest plant species recorded on-site and management methodology.

Common Name	Species Name	WRPMP Category	Abundance Low · Med ·· High ···	Control Measure	Control Method
Chinese privet	*Ligustrum sinense*	Site-led (wetlands)	•••	To zero density	Cut low at stump and apply 5g metsulfuron-methyl/1L or foliar spray seedlings with 5g metsulfuron-methy + penetrant/10L.
Woolly nightshade	*Solanum mauritianum*	Sustained control	••	To zero density	Cut low at stump and apply 60ml/L triclopyr/1L or ringbark large trees with 60ml triclopyr /L.
Wild ginger	*Hedychium gardnerianum*	Sustained control	•	To zero density	Cut stump above pink collar and apply 5 g/L metsulfuron to cut stump Or Dig out rhizomes and hang in trees/remove from site or cut above pink collar and apply 250ml glyphosate/L if in a riparian area.
Arum lily	*Zantedeschia aethiopica*	Site-led (wetlands)	•	To zero density	Cut and stump paint 2.5g metsulfuron/1L. Or dig out rhizomes if in a riparian area.
Blackberry	*Rubus fruticosus*	Site-led (wetlands)	•••	To zero density	Foliar spray (knapsack sprayer) using 60ml triclopyr/10L.
Wandering jew	*Tradescantia fluminensis*	NA/Environmental pest	•	To zero density	Foliar spray (knapsack sprayer) using 60ml triclopyr + penetrant/10L Or Foliar spray (knapsack sprayer) using 400ml glyphosate/10L if in a riparian area.
Crack willow	*Salix fragilis*	Site-led (Wetlands)	•	Multi-levelled approach	Cut stump and apply 250ml glyphosate/1L or drill and poison using 5g metsulfuron/L.
Pampas	*Cortaderia selloana*	Sustained control Site-led (Wetlands)	••	Multi-levelled approach	Foliage spray (knapsack sprayer) using 200ml glyphosate/10L.
Gorse	*Ulex europaeus*	Sustained control Site-led (Wetlands) Site-led (Project Yellow)	••	Multi-levelled approach	Foliar spray (knapsack sprayer) using 60ml/10L triclopyr or cut stump low and paste with 60ml triclopyr/L.

Common Name	Species Name	WRPMP Category	Abundance Low · Med ·· High ···	Control Measure	Control Method
Onion weed	*Allium triquetrum*	NA/Environmental pest	·	To zero density	Foliar spray (knapsack sprayer) with 200ml glyphosate/10L.
Japanese honeysuckle	*Lonicera japonica*	Site-led (wetlands)	··	To zero density	Foliar spray (knapsack sprayer) using 60ml triclopyr/10L or 5g metsulfuron-methyl + penetrant/10L.
Bindweed	*Convolvulus arvensis*	NA/Environmental pest	·	To zero density	Foliar spray (knapsack sprayer) using 60ml triclopyr/10L.
Radiata pine	*Pinus radiata*	Progressive containment	···	To zero density	Pull or dig out small plants or drill and fill with 1g metsulfuron/50ml or foliar spray 200ml glyphosate/10L or 5g metsulfuron/10L. **IMPORTANT:** For the currently unstable pines that risk falling into the stream and damaging plants underneath, it is recommended that an arborist is consulted on the most effective and safe way to remove the trees, e.g., climb and top.

5. PEST ANIMAL CONTROL

Pest animal control is best undertaken using a site-wide approach (Appendix B), however, given the intensity of the lots to be developed on-site, it is recommended that control is only implemented within the riparian margin. Animal pest control in these areas will have a "halo" effect on the adjacent residential properties. Control of possums and mustelids in the riparian margin will reduce the numbers of these pests up to 100m beyond the control areas.

Management will be implemented for a period of five years. Management of pest animals will increase the quality of habitat for native fauna and protect new plantings from pest browsing. Given the habitat and food sources available on-site and in the surrounding area, it is reasonable to assume that pest animals are present in at least low abundance on-site.

5.1. Expected Outcomes

Given the geographical location of this property and its linkages with neighbouring properties pest animal control intends to maintain and enhance native biodiversity by reducing pest animal populations. Given the near certainty of ongoing pest animal re-invasion from adjacent properties, it is unreasonable to expect eradication at this site.

5.2. Control Methods

There is no single technique for successful pest animal control and methods can vary between and within each species. Often a combination of multiple methods can have the best outcome and the recommended plan below takes into consideration the most practical methods to meet the expected outcomes. It is recommended that an experienced pest animal control professional be appointed to implement pest animal control, commencing with trap instalment. A record of catch and bait take should be recorded on the website/mobile application trap.nz or on a pest animal monitoring form, an example is provided in Appendix D.

Possums and mustelids are classified as pest animals under the WRPMP and can cause significant damage to plants as well as preying upon native birds, lizards and insects. Control of possums is to involve the installation of two AT220 Possum & Rat traps at a rate of 1 trap / ha (lines 100m apart and traps spaced every 100m) placed in the riparian vegetation and planting area. These will be installed as per the manufacturer's guidelines. The AT220 Possum & Rat trap should be baited with NZAutoTraps lure. The trap should be placed on the largest tree within the target area or on a fence pole and blaze powder should be sprinkled around the area, leading to the trap.

Control of rodents is to involve the installation a trap network of six Goodnature A24 traps installed at a rate of two traps/hectare (lines 100m apart and traps spaced 50m apart). Traps will be installed within the riparian vegetation and planting area along watercourses, bush lines, roads, ridges or fence lines, where pest animals are most likely to traverse. The traps will be installed as per the manufacturer's guidelines and baited with Diphacinone bait (block type) or a suitable alternative recommended by the implementing professional such as Goodnature Chocolate or Nut Butter Lure.

The traps will be serviced as part of a pulse cycle, being set during February, May, August and November. The Goodnature traps should be checked once during each service month and be left set between service checks.

Control of mustelids will be via the installation of a single DOC 200 double kill trap at a rate of one trap / 20ha. The trap should be placed within the vegetation on-site along a watercourse, bush line, road, ridge, sheltered fence line, where the animals are most likely to traverse. Specifically for this site, the trap should be placed along the wetland boundary. The trap should be baited with eggs and serviced at the same time as the possum traps (see above).

Table 2: Animal pest management summary.

Species Name	Maori Name	Common Name	WRPMP Recommended Management Programme	Control Method
***Mustela* spp.**	Toriura, tori uaroa, tori hura	Mustelids (stoat, weasel, ferrets)	Site-led programme	Trapping Network
Mus musculus	Kiore	Mouse	Sustained control	Trapping Network
***Rattus* spp.**	Kiore	Rats (ship and Norway)	Sustained control	Trapping Network
Trichosurus vulpecula	Paihamu	Possum	Sustained control	Trapping Network

5.2.1. Maintenance of Traps

It is important to maintain the traps and bait stations to ensure they are in working order during the pulse cycle. This involves clearing the area directly around traps (i.e., in front of the trap), checking the security of the traps and checking the trap's moving parts. DOC traps should be subject to weight testing prior to use and then checked annually.

5.3. Cat Management[4]

Cats, both feral and domestic, have the potential to negatively impact native fauna populations through predation. It is encouraged that landowners take greater steps to protect native wildlife from predation. Residents of the development will be provided with information to understand that key fauna values can be at risk from roaming cats which hunt a range of species which can include native birds, lizards, and large insects. Information provided to cat owners based on recommendation from Auckland Council will suggest:

- Keeping cats inside or in a safe enclosed area away from wildlife habitat
- Keeping cats indoors at night reducing its chances of hunting wildlife
- Monitoring outdoor time
- Getting a Birdsbesafe collar, and attaching a bell to their collar
- Avoiding feeding birds in your backyard
- De-sex kittens before they reach puberty or desex older cats as soon as possible
- Consider installing a 'catio' or cat-proof fencing to keep the cat contained within the property
- If a cat does catch and injure any native wildlife, the Department of Conservation should be contacted on their hotline on 0800 362 468 immediately.

[4] Auckland Council Care for the environment by being a responsible pet owner. https://www.aucklandcouncil.govt.nz/dogs-animals/keeping-other-animals/Pages/care-environment-being-responsible-pet-owner.aspx

6. PLANTING

The purpose of this section is to provide specific planting protocols to restore and enhance the riparian margin. The enhancement will result in increased habitat and resources for native fauna and reduce the opportunity for exotic/pest plants to re-establish. The planting site is c. 8,886m^2 and extends from the wetland at the north-west of the site along the northern boundary to the eastern boundary.

6.1. Site Preparation

Site preparation for planting will be completed as part of the pest plant strategy specified above in Section 4. Non-invasive grasses/groundcovers are not recommended for control and will be left uncontrolled where possible with the intention of providing a living mulch effect to protect the native plantings from drought, frost and wind damage. The plants will require releasing periodically from any existing grasses and weedy vegetation to ensure these do not overtop the new plantings.

6.2. Plant Selection

Plant selection is based on several considerations, including the replication of native plant communities present on-site and in the surrounding area, the likelihood of establishment, the benefit to native fauna and the mapped Current Ecosystem Extent (Broadleaved Indigenous Hardwood vegetation[5].). These characteristics are crucial in the selection of plants that will survive and perform important ecological functions such as filtration, stabilisation and ensure quick re-establishment of canopy cover. Species will be distributed at appropriate percentages and according to species niche preferences and ground conditions.

The planting schedules outlined below provide appropriate species selections for this site based on the characteristics described. As mentioned in Section 3 it is recommended that experienced professional ecological restoration contractors undertake this planting work. This will enable the planting implementor to best define the number of plants needed and be permitted to make appropriate changes to site preparation and timing based on site-specific conditions when deemed necessary.

6.3. Plant Sourcing

Plant stock is to be of good quality and eco-sourced from the Lower Waikato River District[6]. Eco-sourcing is key to ensure plants are well adapted to local conditions, increasing survivorship through to establishment. Plants purchased will also be of pure stock with no hybrids used.

Prior to any *Myrtaceae* species being delivered to the site (e.g., kānuka), a signed Myrtle Rust Nursery Management Declaration must be provided to the planting implementer by the nursery to indicate that the plant producer has implemented the New Zealand Plant Producers Incorporated Myrtle Rust Nursery Management Protocol.

Plant quality will be assessed upon delivery from the nursery/supplier. The foliage and roots of the supplied plants must be in good health. Plant quality will be tested by the planting

[5] Retrieved from https://waikatomaps.waikatoregion.govt.nz
[6] Planting guide for Lower Waikato River. Retrieved from https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/local-planting-guides/ecological-restoration-in-the-waikato/

implementor with visual inspections, and by lifting no less than 10 supplied plants by the stem to confirm whether the planter bag/root trainer of each plant is supported (i.e., the plant does not pull out of the bag too easily). Plants considered by the planting implementor to be of poor quality will be rejected and will need to be replaced.

6.4. Plant Layout, Density and Grade

Plant layout is important to maximise plant survival and establishment and needs to be considered across the planting site. Plants are to be planted in clusters of one or more species while avoiding the creation of large areas of open ground. Clusters replicate the natural process of seed dispersal, establishment and prevent the creation of larger monoculture areas or conversely, intentionally separating species. General plant layout will also be somewhat random as opposed to a grid or row layout mimicking natural regeneration.

Planting grades to be used will generally be of 0.5 to 2-litre grade plants. This takes into consideration the greater success of transplanting smaller plants, the larger root mass to leaf area ratio and the economics of large-scale planting. It is recommended that some specimen trees are planted within the riparian margin to encourage rapid canopy closure, 3 or 5-litre grade plants can be used for this purpose. It is recommended that eco-sourced native tree canopy species be incorporated into the wider landscape plan for the subdivision.

Planting is to be undertaken at an average density of 1m^2 (1 plant per 1 square metre); however, sedges will be planted at a higher density of 0.5m^2 (2 plants per 1 square metre). Large, specimen trees will be planted at a density of 5m^2. This density will enable canopy closure to be achieved quickly where required and the understorey to be re-instated as quickly as possible. Planting placement will take into consideration the current indigenous species that are scattered around the site.

6.5. Planting Methodology

Timing of planting will be mid-autumn to early winter (May – July), ideally after rain but before winter frosts. Planting directly into damp soil will benefit the plants through water availability and through soil compressibility, getting a good packing of soil around exposed roots. Holes are to be dug approximately twice the size of the root ball. Holes dug with hand tools are preferred, but machinery can be used (e.g., motorised auger) as long as the walls of each hole are scarified to facilitate root penetration. Plant roots are to be slightly loosened at the base of the root mass to aid roots to grown outward once plated, rather than remain in a tight root ball. Care must be taken when removing plants from bags/pots to minimise root disturbance, and plants will need to be pressed/heeled in firmly once in the ground to minimise air pockets around the root system.

The goal of the Stage 2 planting is to speed up the transition from a regenerating ecosystem to the indigenous broadleaved hardwood ecosystem and introduce successional species into the planting area. The Stage 2 planting will be implemented in year 3 from the Stage 1 planting to facilitate regeneration and increase biodiversity. The Stage 2 planting may require the creation of lightwells within the Stage 1 planting to provide enough light for successional

species. This can be achieved be removing shrubs/saplings/trees as required to create gaps that have a radius equal to half of the canopy height[7].

6.5.1. Wetland Planting Zones

Plant layout is important to maximise plant survival and establishment and needs to be considered across the planting site. Figure 3 has been used as a guide to zone planting layout within the wetland area and it will be used to allocate planting zones as part of the planting schedule below. The wetland planting can be broken up into four planting zones:

Wet Zone: An area that is capable of being permanently submerged at the pond ground surface and plant roots may be waterlogged permanently.

Marginal Zone: An area that would likely become submerged or partially submerged during a 2-year storm event.

Lower Bank Zone: An area that may be occasionally submerged in events more severe than the 2-year return-period storm, plants should be capable of being inundated for short time periods.

Upper Bank Zone: An area where plants can sustain damp roots for short periods but do not get fully inundated.

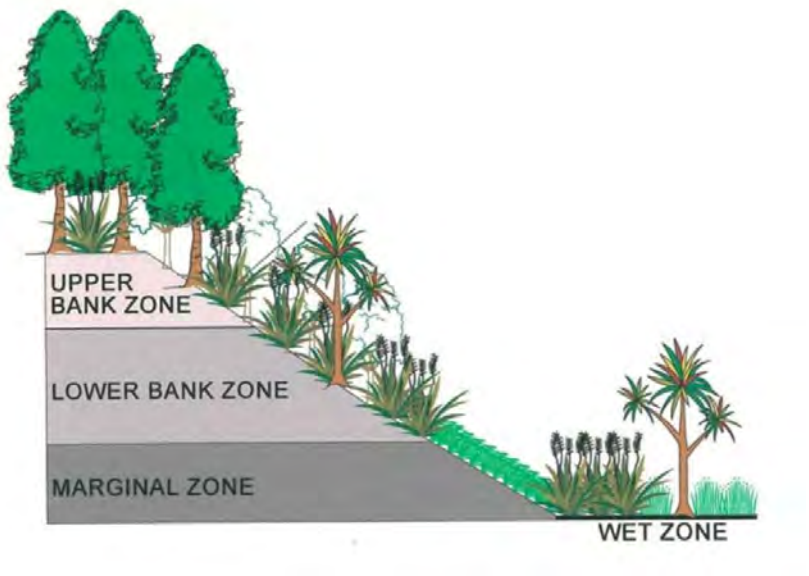

Figure 3: Example of wetland cross section showing different zones[8].

6.5.2. Riparian Planting Zones

It is recommended that the riparian margin be divided into separate zones based on soil wetness, and the appropriate plant species allocated accordingly. The following sections are generalised riparian zones that can be estimated at each riparian planting area and are shown in Figure 4.

Flood Zone: This includes low-lying areas in the flood plain of the stream that are subject to temporary flooding during high rainfall events, therefore species selected for this zone need to

[7] Forbes AS, Wallace KJ, Buckley HL, Case BS, Clarkson BD, Norton DA 2020. Restoring mature-phase forest tree species through enrichment planting in New Zealand's lowland landscapes. New Zealand Journal of Ecology. 44:1, 3404
[8] Adapted from: Planted Stormwater Devices. Hamilton City Council Volume 2 - Design Guide.

be tolerant of these conditions. Suitable species include sedges and rushes which can lie prostrate during floods reducing the chance of being torn from the ground.

Middle Planting Zone: This zone is adjacent to the flood zone on this site. It may be damp but is subject to less flooding than the flood zone. Species within this area need to be able to withstand periods of wetness.

Outer Planting Zone: The area of least wetness, where species suitable do not have to be tolerant of prolonged periods of wetting.

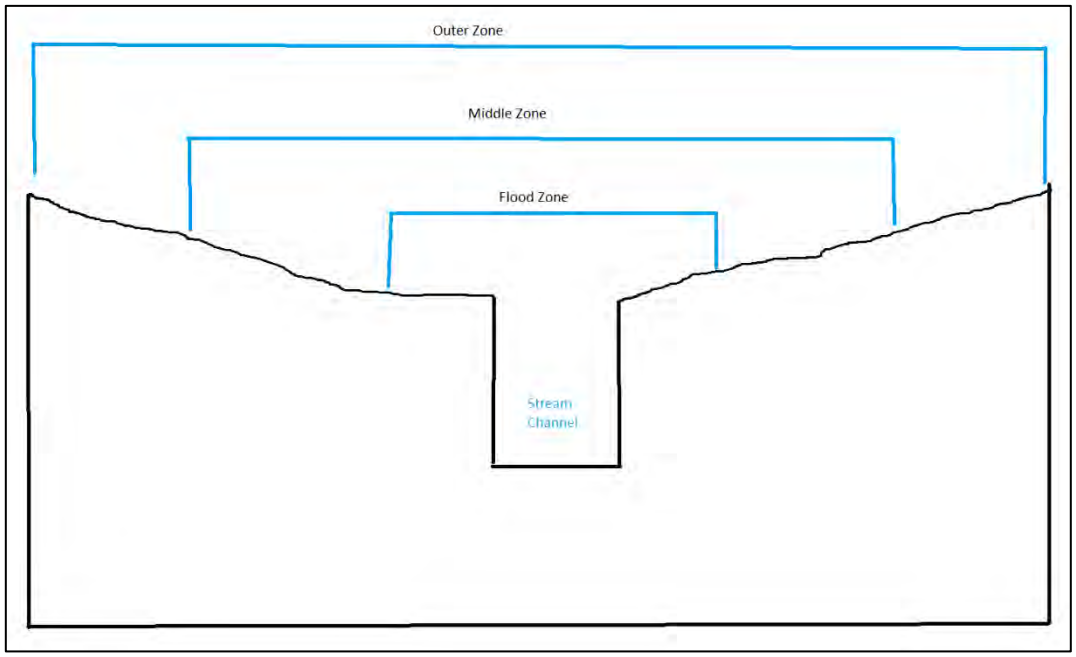

Figure 4: Indicative stream cross-section showing different zones.

6.6. Planting Schedule

The species recommended for planting the riparian margin at 23 Harrisville Road have been provided in Tables 3-6. Planting will be undertaken by an experienced professional ecological restoration contractor who will determine the quantity of plants required and make appropriate changes to species if necessary. The planting schedule in Table 3 is intended for use in wetland/flood zones, the planting schedule in Table 4 is intended to provide planting lists for the middle and outer zones, and Table 5 provides planting lists for areas surrounding the proposed stormwater trenches. See Appendix C for the different zones located at this site.

Table 3: Wetland/flood zone planting schedule for 23 Harrisville Road.

Common Name	Botanical Name	Grade (L)	Spacing (m^2)	Zone
Rautahi	*Carex lessoniana*	1	0.5	Wet/marginal
Toetoe	*Austroderia fulvida*	1	1	Wet/marginal/lower bank
Ti kouka	*Cordyline australis*	1	1	Wet/marginal/lower bank/upper bank
Harakeke	*Phormium tenax*	1	1	Wet/marginal/lower bank/upper bank
Karamu	*Coprosma robusta*	1	1	Lower bank/upper bank

Common Name	Botanical Name	Grade (L)	Spacing (m^2)	Zone
Kānuka	*Kunzea robusta*	1	1	Lower bank/upper bank

Table 4: Middle and upper zone planting schedule for 23 Harrisville Road.

Common Name	Botanical Name	Grade (L)	Spacing (m^2)	Zone
Mamaku	*Cyathea medullaris*	1	1	Middle
Māhoe	*Melicytus ramiflorus*	1	1	Middle
Kawakawa	*Piper excelsum*	1	1	Middle
Hangehange	*Geniostoma ligustrifolium*	1	1	Middle
Karamu	*Coprosma robusta*	1	1	Outer
Kānuka	*Kunzea robusta*	1	1	Outer
Māpou	*Myrsine australis*	1	1	Outer
Ti kouka	*Cordyline australis*	1	1	Outer

Table 5: Planting schedule for areas surrounding stormwater trenches at 23 Harrisville Road.

Common Name	Botanical Name	Grade (L)	Spacing (m^2)
Patē	*Schefflera digitata*	1	1
Purei	*Carex virgata*	1	0.5
Harakeke	*Phormium tenax*	1	1
Mingimingi	*Coprosma propinqua*	1	1

Table 6: Planting schedule for Stage 2 infill planting in riparian areas.

Common Name	Botanical Name	Grade (L)	Spacing (m^2)
Kahikatea	*Dacrycarpus dacrydioides*	5	5
Taraire	*Beilschmiedia taraire*	5	5
Kōwhai	*Sophora microphylla*	5	5
Pūriri	*Vitex lucens*	5	5

6.7. Planting Completion / Plant Maintenance

Upon completion of the initial works, all plantings will be periodically monitored for five years or until an average of 80% canopy closure and a 90% survival rate is achieved. This maintenance involves undertaking regular pest plant control to minimise any effects attributable to pest plant re-invasion and releasing plants from grasses and other competitors in the early stages.

Plants will be inspected at least annually with any dead or dying plants replaced. Typically, this is accommodated by 10% replacement in year one and 5% replacement in years two and three. The attached plant monitoring form (see Appendix D) will be used annually to inspect the health of all plantings (including documenting survival rate and canopy closure) and recording of any works undertaken to improve planting success such as pest plant control, and replacement planting.

7. PROTECTION

It is recommended that remnant native vegetation areas, wetland area and all restoration/infill planting areas be covenanted. Pest plant and animal control, and vegetation maintenance could be made a consent condition and further protection could be added through specific covenant conditions which are then tied to the title. The aim of this protection measure is to ensure monitoring of both restoration and existing vegetation areas is undertaken and future indigenous vegetation removal is prohibited in perpetuity.

8. CONCLUSION

The objective of this EMP is to appropriately mitigate the ecological impacts associated with the proposed 14-lot subdivision at 23 Harrisville Road, Tuakau. Management of these impacts will be achieved through restoration planting and the implementation of pest plant and animal control. It is expected that once planting has established, adverse ecological effects of the proposed subdivision will be adequately mitigated.

9. PROGRAMME OF WORKS

Table 7: Programme of restoration works for 23 Harrisville Road.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year 1											Fortnightly DOC 200 service Pre-works	Fortnightly DOC 200 service
Year 2	Fortnightly DOC 200 service Initial pest plant control	Pest animal network installation and service	Fortnightly DOC 200 service Follow up pest plant control in planting area (no residual herbicides)	Fortnightly DOC 200 service	Pest animal service Follow up pest plant control in planting area (no residual herbicides)	Initial planting DOC 200 service	DOC 200 service	Pest animal service	DOC 200 service Planting maintenance and follow up pest plant control	Fortnightly DOC 200 service	Pest animal service Fortnightly DOC 200 service	Fortnightly DOC 200 service
Years 2-6	Fortnightly DOC 200 service	Pest animal service Fortnightly DOC 200 service Planting maintenance and follow up pest plant control	Fortnightly DOC 200 service	Fortnightly DOC 200 service	Pest animal service	DOC 200 service	Pest plant maintenance, follow up pest plant control, and infill planting (if required) DOC 200 service	Pest animal service	DOC 200 service	Fortnightly DOC 200 service Planting maintenance and follow up pest plant control	Pest animal service Fortnightly DOC 200 service	Fortnightly DOC 200 service

APPENDIX A

Report Limitations

This Report/Document has been provided by Ecology New Zealand Limited (ENZL) subject to the following limitations:

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iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

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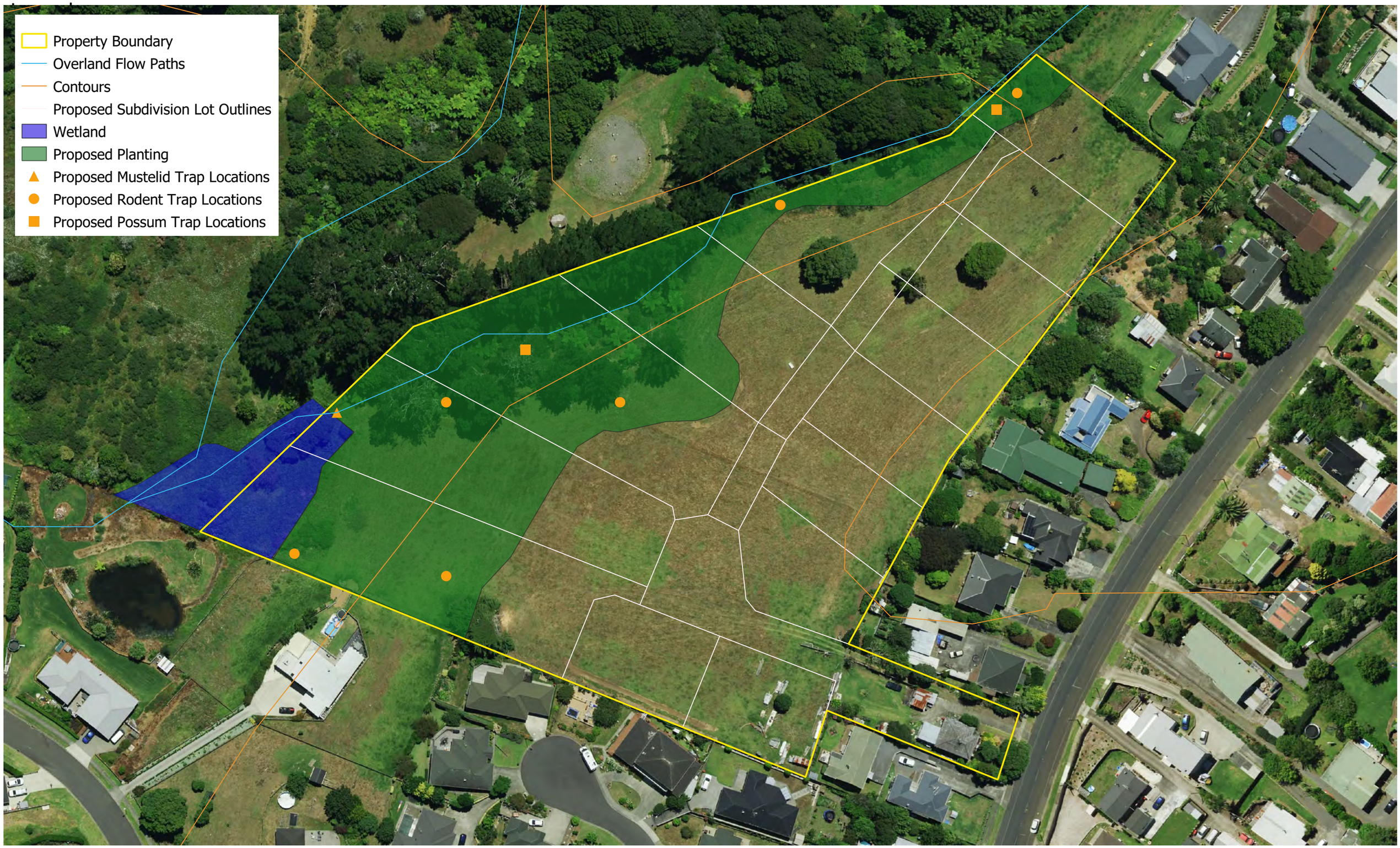
ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

APPENDIX B

Proposed Pest Animal Control Map



ECOLOGY NEW ZEALAND

N

0 25 50 75 m

1: 1000 @ A3

Projection: NZTM 2000 / NZGD 2000

Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ Crown Copyright Reserved

23 Harrisville Road, Tuakau

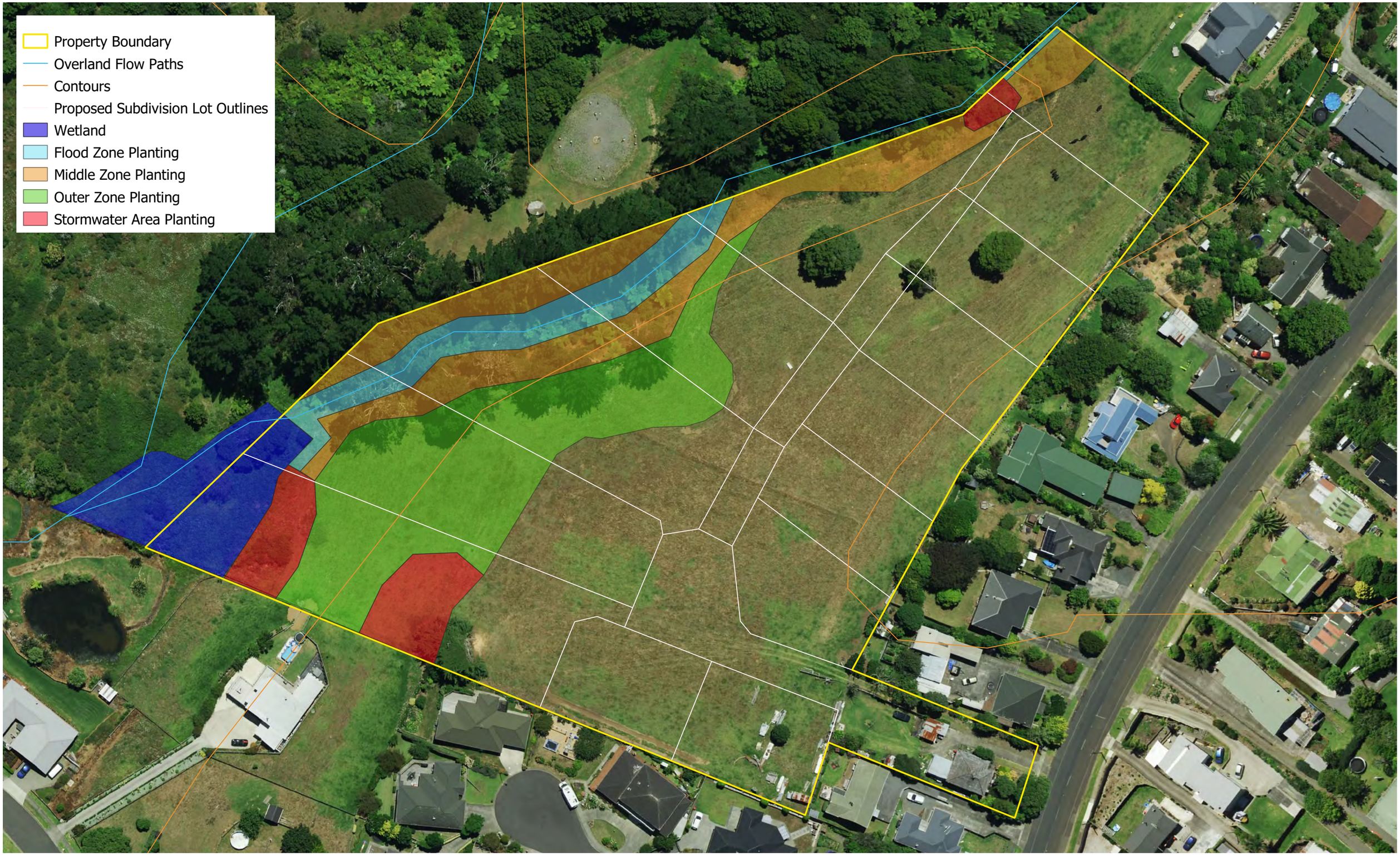
22138.1.002-300

Date: 25/08/2022 | Revision : 0

Pest Animal Control Plan prepared for The Surveying Company
by Ecology New Zealand Limited
Author: CR | Checked: KH

APPENDIX C

Proposed Planting Areas Map



ECOLOGY NEW ZEALAND

N

0 25 50 75 m

1: 900 @ A3

Projection: NZTM 2000 / NZGD 2000

Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ Crown Copyright Reserved

23 Harrisville Road, Tuakau

22138.1.002-300

Date: 25/08/2022 | Revision : 0

Planting Plan prepared for The Surveying Company
by Ecology New Zealand Limited
Author: CR | Checked: KH

APPENDIX D

Monitoring Forms

Pest Plant Control					
Location:		**Commencement Date:**	**Completion Date:**		**Company:**
Target Species	**Method of Control (M/F/C/O)**	**Nature of re-infestation**	**Herbicide Used**	**Application Rates**	**Quantity Used (Concentrate)**

Extra Information (notable observations, future recommendations, etc)

Method of Control
M = Manual
F = Foliar Spray
C = Cut & Paste
O = Other (Specify)

Pest Animal Control			
Location:	**Commencement Date:**	**Completion Date:**	**Company:**

Target Species	Trap/Toxin Used	No. Caught/Bait Taken (g)	Notes

Extra Information (notable observations, future recommendations, etc)

Plant Monitoring					
Planting Area/Covenant:		**Planting Date:**	**Infill Planting Date:**	**Company:**	
Plant Survival					
Canopy Closure (%):	**Plant Survival (%):**	**Approximate Growth (cm/yr):**	**Extra Information:**		
Planted Species		**Number Planted**	**Species Condition (Thriving/Failing)**	**Quantity Replaced**	**Location of Replacement**
Fertilisation					
Date Applied					
Fertiliser Applied					
Quantity					

APPENDIX C – BAT MANAGEMENT PLAN

23 Harrisville Road, Tuakau

Bat Management Plan

Prepared for The Surveying Company

20 December 2022

Report Number 22138.1.003.Rev0

ECOLOGY NEW ZEALAND

Document Sign Off

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Ecology New Zealand Limited

Revision	Revision Date	Title	Status	Author/Editor	Authorised by
0	20/12/2022	23 Harrisville Road Bat Management Plan	Final	CR	SW

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1. INTRODUCTION

This report, prepared by Ecology New Zealand Limited (ENZL) for The Surveying Company (the Client), presents a Bat Management Plan (BMP) for the development of 23 Harrisville Road, Tuakau (the Site)[1]. Specifically, this plan details methodologies that aim to commensurately manage potential direct impacts on long-tailed bats (*Chalinolobus tuberculatus*) associated with the removal of vegetation required by the development of the site.

1.1. Background

The site is located in Tuakau, Waikato and is zoned as 'Rural & Rural Residential'. The site is 2.7ha and is comprised mainly of pasture, wetland and a section of exotic and indigenous forest (Land Cover Database 1, LCDB1) of primarily broadleaved indigenous hardwoods[2]. A 14-lot subdivision is proposed for the site, with associated earthworks, wastewater and stormwater infrastructure[3]. This development requires vegetation removal to the north-east of the wetland on steep banks in the riparian margin, including areas of potential bat habitat (Radiata pine, *Pinus radiata*) (Figure 2). The closest records of long-tailed bats in the area are c. 5km from the site. Therefore, in the absence of specific on-site surveying of bat activity, it is assumed that bats are potentially present.

Figure 1: Map of the project site (site boundary in yellow) with overland flow paths (blue), contours (orange) and the indicative area of vegetation removal (red).

[1] This report is subject to the Report Limitations provided in Appendix A.
[2] Retrieved from https://waikatomaps.waikatoregion.govt.nz
[3] Subdivision Consent Plans by The Surveying Company. Dated June 2021.

Figure 2: Potential bat habitat in Radiata pine to be removed.

1.2. Goals and Objectives of this Plan

The goal of this plan is to commensurately manage the foreseeable direct impacts on long-tailed bats, which are classified as a Threatened (Nationally Critical) species[4], through implementation of the Department of Conservation Protocols for minimising the risk of felling bat roosts – Bat Roost Protocols (BRP). Specifically, this plan aims to ensure that *no long-tailed bats are killed or injured during the removal of potential bat roosting habitat.*

2. DEFINITIONS

Competencies: a set of competencies developed by the NZ Bat Recovery Group to ensure that anyone working with bats is competent to do so (refer to Appendix B).

Authorised competent bat worker: A bat worker who has met the required ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group for the work which they are undertaking.

Project Bat Ecologist (PBE): The authorised competent bat worker who shall oversee and implement the BMP.

ABM: automated bat monitoring unit/detector.

Bat Roost Protocol (BRP): the steps required to assess trees for their potential to be a bat roost and management measures required to be implemented prior to felling potential bat roosts.

Potential bat roost: A tree which provides features that are able to be used for bat roosting (refer to Protocol 1, Step 4).

Valid survey night: a night is considered valid for survey where:

[4] O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. 2018: Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. Department of Conservation, Wellington. 4 p.

- nightly temperatures are10°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[5],
- precipitation is < 2.5 mm in the first 2 hours after official sunset, and < 5 mm in the first 4 hours after official sunset.

3. PROJECT BAT ECOLOGIST

The Project Bat Ecologist (PBE) who shall oversee and implement this BMP is Peter van Loon. Peter is an authorised competent bat worker who has met the required technical and ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group. He has undertaken vegetation removal protocols for a range of projects across the country including roading projects of national significance.

Should this BMP not be overseen and implemented by Peter, this BMP shall be implemented by an appointed authorised competent bat worker. The PBE shall be registered on DOC's bat handler competency framework and have the necessary competency sign-off for all tasks required as part of this BMP (Appendix B).

4. AVOIDANCE

Prior to the implementation of BRPs, the project shall consider whether avoidance of impacts can be further achieved. The PBE shall consult with the project team to consider leaving potential bat trees in place, cutting off specific limbs only or relocating the tree. If any felling, partial felling (where the part to be felled has potential bat roost features) or tree relocation takes place you MUST proceed to Bat Roost Protocol detailed in Section 5 below.

5. BAT ROOST PROTOCOL

The following four protocol detail measures require the mitigation of potential injury and mortality risks to bats during vegetation removal works. These measures are detailed following industry best practice and have been employed successfully by ENZL. Table 1 provides a summary of the protocols that are required to be undertaken in areas where bats may be present.

Table 1: Summary of vegetation removal protocols, persons responsible and seasonal constraints.

Management Stage	Persons Responsible	Seasonal constraints
Protocol 1: **Potential Roost Identification** What Trees require management	-Project Bat Ecologist	**No Seasonal constraints**
Protocol 2: **Pre-felling Occupancy Checks** Surveys required immediately prior to clearance to ensure no bats are present.	-Project Bat Ecologist -Climbing Arborist	**October to April Only**

[5] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on data collected in Kinleith plantation forest, centred around Tokoroa, Central North Island; Smith D, Borkin K. 2017. Appendix B: Influence of climate variables on long-tailed bat activity in an exotic conifer plantation forest in the central North Island. P 136-145. In: Smith, D, K Borkin, C Jones, S Lindberg, F Davies and G Eccles (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. 249pp.

Management Stage	Persons Responsible	Seasonal constraints
Protocol 3: **Vegetation Removal** Methods to be adhered to during clearance.	-Project Bat Ecologist -Tree Removal Contractor	**October to April Only**
Protocol 4: **Bat Injury or Mortality** Methods to be adhered to in the event injured or dead bats are discovered.	-Project Bat Ecologist -DOC -Veterinarian.	**October to April Only / No Seasonal constraints**

5.1. Quality Assurance and Seasonal Restrictions

- The felling of potential roost trees can only be undertaken between **1 October and 31 April.**
- The BRP will apply to all trees > 15 cm DBH[6], tree ferns and other vegetation that meet the criteria for a potential bat roost as defined in Section 3.2;
- All practical efforts must be undertaken to ensure that no trees or vegetation containing bats are removed;
- No trees or associated vegetation identified as potential roosts can be felled or cleared without the approval of the PBE;
- Prior to the commencement of surveys, all automated bat monitoring units (ABMs) shall be tested to ensure they are not faulty. This can be achieved using DOC Bat recorder tester v0.1 application or at a site where bat activity is known to be high. Faulty or suspect ABMs are not to be deployed;
- Roost habitat assessments can be undertaken at any time of year; and
- Once the results of the visual surveys and ABM data have been reviewed by the PBE the following communication procedures shall be implemented:
  a. If no bats are sighted or detected, the PBE shall call the vegetation clearance supervisor to give permission for the affected tree(s) and/or vegetation to be removed;
  b. If bats are seen or detected, the PBE shall call the vegetation clearance supervisor to inform them that the affected vegetation cannot be cleared. The PBE will advise on the requirements for on-going visual surveys; and

Protocol 1: Potential Roost Identification (No Seasonal Constraints)

The following roost identification steps shall be followed to provide insight into where management is required across the site. This protocol shall require an approved person at Competency Level 3.2.

1. All locations where vegetation may be directly or indirectly impacted must be classified by the PBE for the presence of 'potential bat roost trees'.
2. All trees ≥15cm Diameter at Breast Height shall be subject to roost classification by the PBE.
3. The PBE shall undertake ground inspections to determine whether each tree/ group of trees contain suitable features which bats may roost in. High powered binoculars will

[6] Borkin K.M. 2010: Ecology of New Zealand long-tailed bat (*Chalinolobus tuberculatus*) in exotic plantation forest. Unpublished PhD thesis. University of Auckland, Auckland, New Zealand.

be used to assist in these surveys. Surveys of large deciduous trees are recommended to be undertaken in autumn and winter where they are free of foliage.

4. The PBE will deem a tree a potential roost if it contains one or more of the following features:
    a. Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to support roosting bat(s);
    b. Sections of loose flaking bark large enough to support roosting bats.
    c. A hollow trunk, stem or branches; and
    d. Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.
5. All potential roost must be clearly marked by the PBE. This can be undertaken by nailing on red track markers and installing flagging tape around these trees. These trees must also clearly be distinguished from trees to be retained.

Refinement of Roost Identification

6. Assessments undertaken by the PBE from ground level may be supplemented with tree climbing inspections. The PBE will work with climbing arborists to investigate potential roosting features identified from the ground to determine if they are indeed suitable to host bats (*e.g.* apparent hollows may not be deep enough for roosting).
    a. The arborist shall relay information about each feature being inspected, (including where appropriate photos), which shall be used to determine roost suitability by the PBE.
    b. Where climbing is undertaken, the climbing arborist shall record photograph and/or video evidence of any possible signs of roost use (*e.g.* bats within roosts, staining on trees, guano).

Protocol 2: Pre-felling Occupancy Checks (1 October – 30 April)

Once potential roosts have been identified (Protocol 1), occupancy by bats will be confirmed immediately prior to felling. No tree shall be felled where there is any evidence of occupancy. Occupancy will be determined through one or more of the following methodologies to the satisfaction of the PBE. This protocol shall require an approved person at Competency Level 3.1, 3.2 and 3.3 (as required for associated methodology).

If during the implementation of the below methods bats are sighted, or sign detected, or a roost (active/inactive) is confirmed, the approved bat ecologist, as soon as possible, shall:

- Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign.
- Provide in writing (*e.g.* by email) to the site manager and if applicable, the bat ecologist representing the council and DOC, details of the results of the survey and an outline of the measures for the protection or relocation of the roost tree.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

ABM Bioacoustic Surveys

This section discusses the use of ABMs to confirm roost occupancy. It is noted that if bat activity is expected to occur consistently in the area and 2 nights with zero bat passes is unlikely to be obtained, visual inspection or roost watching methods shall be used.

1. ABM surveys shall use DOC AR-4 model detectors or similar.
2. Monitoring during a full moon should be avoided.
3. The ABM(s) should be placed so that detection of bats is likely if they are using the potential roost/s.
4. As it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night, monitoring will be undertaken for at least two valid nights immediately prior to clearance.
5. ABM data should be analysed by the PBE on the morning of proposed felling to indicate the potential for bat roosting.
6. If no bats are detected, the vegetation can be removed on the day immediately following the survey following Protocol 3. **OR**
7. If bats are detected, re-consider again whether the tree must be felled. Where the tree requires felling, evidence that bats have vacated the roost shall be confirmed by:
    a. ABM survey must continue until no bat activity is recorded for two consecutive nights; or
    b. Visual inspections methodologies shall be carried out; or
    c. Roost watch methodologies shall be carried out.

Visual Inspections

Each tree or vegetation with features that make it a potential roost may be inspected to confirm the site as a roost. This may be subsequent or prior to ABM monitoring. Potential roost features must be visually inspected for occupancy in a manner that minimises roost disturbance. This may include inspection from the ground, by climbing or using by using a scissor lift. All climbing must take place under the careful supervision of the PBE to prevent roost damage and injury to roosting bats.

1. To undertake an inspection while climbing, the arborist or trained climber will relay any potential evidence of bats (*e.g.* staining, cavities, guano) by way of live audio-visual equipment and/or photographs for review by a PBE prior to removal. A borescope may be required to inspect deeper cracks and hollows. The climber will be required to check all potential bat roost features:
    - **Can bats be seen** - An endoscopic camera should be available for this step and every possible corner of each potential roosting feature inspected, i.e., cavity/crack etc. Cracks, holes, and splits may lead to cavities or may be superficial. A cavity may be wet indicating no/low potential as a bat roost.
    - **Can bats be heard** - Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then detection of presence listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present. Short-tailed bat social calls are often audible or detected at 25-27 kHz.
    - **Are there signs of bats** - Is guano present or urine staining?
2. If potential roost locations are within tree ferns or other 'delicate' vegetation, climbing will only be undertaken if it is safe to do so for the climber and if this will not damage the roost and potentially roosting bats during the time of inspection.
3. If no bats are detected, the vegetation can be removed on the day of the inspection following Protocol 3. **OR**
4. If the tree is confirmed as a roost, then the tree must not be cut down until bats vacate the roost. At this point re-consider again whether the tree must be felled. Where the

tree requires felling, evidence that bats have vacated the roost shall be confirmed by methods which minimize roost disturbance and a final climbing re-inspection:

a. ABM survey or roost watching methodologies must be followed to determine bats have vacated the roost; and
b. Where evidence indicates the roost is vacated, a final climbing re-inspection shall be undertaken immediately prior to felling.

Roost Watches

If occupancy could not be confirmed using ABMs or visual inspections of the roost, observations of bat roosting activity will provide an alternative roost confirmation methodology. This more labour-intensive method involves watching trees to identify bats emerging from or returning to roosts. It should be used in combination with activity patterns as assessed by previous ABM monitoring at the site. Where watches are being done as the sole survey method, a minimum of two valid nights are required at each potential roost tree. In this instance, the following methodology should be implemented:

Emergence watches

1. Each subject tree must be watched initially from no less than 30 minutes prior to sunset until it becomes too dark to see (~1 hour after sunset) by sufficient people to observe all potential exit points.
2. Ambient temperature should be >10°C and there should be no precipitation (otherwise bats may not emerge);
3. Observations shall be carried out close to the subject roost sites where flying bats are backlit against the sky. It may be useful to have more than one person observing potential roost sites from different angles to determine precise trees or vegetation and exit holes;
4. Hand-held bat detectors will be used to alert the ecologist(s) to the presence of bats nearby, narrowing down the potential roost site locations and allowing roosts to be confirmed; and
5. Infrared cameras and video recorders may also be used to confirm the presence of bats leaving potential roost sites.
6. An ABM will be installed for the period of the watch to ensure no bats have been missed.

Roost re-entry watches

Roost re-entry watch timing should be based on patterns of activity recorded onsite with ABMs. Where this information is not available and at minimum, watches shall begin two hours prior to official sunrise until one hour after sunrise time. The PBE shall trigger longer watches should prior ABM activity indicate potential early roost re-entry.

1. Subsequent to emergence watches described above, observers must return the next morning and watch the tree to determine whether bats return to the subject vegetation.
2. At minimum, watches shall begin two hours prior to official sunrise until one hour after sunrise time.
3. Observations shall be carried out close to potential roost sites where flying bats are back-lit against the sky. It may be useful to have more than one person observing potential roost sites from different angles to determine precise trees or vegetation and exit holes;

4. Hand-held bat detectors will be used to alert the ecologist(s) to the presence of bats nearby, narrowing down the potential roost site locations and allowing roosts to be confirmed; and
5. Infra-red and /or thermal cameras are encouraged to be used as twilight will restrict observers to only see bats up to one hour prior to sunrise.
6. If no bats are detected during emergence and re-entry watches, the vegetation can be removed on the day of the last re-entry watch following Protocol 3. **OR**
7. If the tree is confirmed as a roost, then the tree must not be cut down until bats vacate the roost. At this point re-consider again whether the tree must be felled. Where the tree requires felling, evidence that bats have vacated the roost shall be confirmed by methods which minimize roost disturbance and a final climbing re-inspection:
8. If the tree is confirmed as a roost, then the tree must not be cut down until bats vacate the roost. At this point re-consider again whether the tree must be felled. Where clearance is required, confirmation of bat absence is required over two consecutive nights. The PBE shall consider whether it is appropriate to continue watches or cease and recommence watches one week later over an additional two nights to increase the likelihood bats have shifted roosts. It is unlikely that ABMs or visual inspections are appropriate where roost watches are used, but if so, these shall be considered by the PBE.

Protocol 3: Vegetation Removal

The following methodologies shall be undertaken following the implementation of Protocol 1 and Protocol 3. Vegetation clearance will only occur if trees have been assessed as having no potential for bat roosting or there is sufficient evidence that bats are not occupying potential roost trees. This protocol shall require an approved person at Competency Level 2.1 and 3.3.

Trees With No Roosting Potential

Any tree that is identified as having no potential for bat roosting (*i.e.* ≤14cm DBH or ≥15cm DBH with no roosting features) can be removed at any time of year. The removal of these trees needs to be undertaken in a manner that does not disturb any potential roost trees which may be in its vicinity.

Potential Roost Trees

1. Trees will only be felled between October to April.
2. Vegetation removal must take place on the day of tree inspection or the day immediately following night surveys that confirm that there are no bats present.
3. The PBE will be on-site to supervise the removal of all potential roost trees.
4. If safe to do so, the PBE will immediately inspect felled potential roost trees for signs of bats. To assist in this, the PBE will use a handheld bat detector and endoscope to scan and inspect roosting features to detect injured or stunned bats.
5. If bat activity is observed during vegetation clearance, then clearance will stop immediately and will not commence until further monitoring confirms that the bats have abandoned the roost. Trees and vegetation shall be marked, and site staff briefed immediately to indicate a roost is present.

Protocol 4: Bat Injury or Mortality

The implementation of Protocol 1, 2, and 3 aim to directly mitigate the risk of bats being injured or killed during tree felling. Unforeseen circumstances may still however lead to bats being injured or killed following the fulfilment of these protocol. In this instance, the following procedures will be implemented and supported by an approved person at Competency Level 2.1 and 3.3 versed in guidance documents provided in the below footnote[7,8].

1. If bats are found on the ground or in the tree once felled, all further felling work must immediately cease. The felled tree must be thoroughly inspected for further bats. Felling can only re-start once permission has been obtained from DOC after consultation with an approved bat ecologist at Competency Level 2.1.
2. If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved bat ecologist at Competency Level 2.1 in consultation with the vet and DOC (0800 DOC HOT, 0800 362 468).
3. Bats must be kept for three days under observation and must be kept out of torpor for this time. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved bat ecologist at Competency Level 2.1 and vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.
4. Euthanised bats or any dead bats found must be handed to DOC.
5. An incident investigation report will be prepared by the PBE following the discovery of the injured/dead bats. At minimum, the report shall provide details into the methods used to mitigate the event, the number of animals found injured or dead, the fate of the animals following vet care, and any additional mitigation measures that shall be undertaken prior to further tree removal. This report shall be submitted to DOC and Council within one week of the discovery of the animals.

6. REPORTING

The results of the vegetation removal protocol will be reported to Waikato Regional Council in a completion/compliance report in the form of a letter or memorandum, submitted within 10 working days following the completion of vegetation clearance. The report should include details of the potential bat roost trees monitored including the size, location and type of roost trees or vegetation. The results of all pre- and post-clearance survey effort and shall be submitted to DOC for inclusion to the national bat distribution database.

7. CONCLUSION

This BMP aims to ensure potential direct impacts from the proposed vegetation removal on native bats are commensurately mitigated. All vegetation removal protocols have been prepared in accordance with industry best practice methodologies. The methodologies, scale

[7] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf
[8] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats.pdf

and intensity of management efforts in this BMP are considered appropriate for managing the project's predicted impacts on bats.

APPENDIX A

Report Limitations

This Report/Document has been provided by Ecology New Zealand Limited (ENZL) subject to the following limitations:

i) This Report/Document has been prepared for the particular purpose outlined in ENZL's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of ENZL's services are as described in ENZL's proposal and are subject to restrictions and limitations. ENZL did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by ENZL in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that ENZL may have retained sub-consultants affiliated with ENZL to provide Services for the benefit of ENZL. ENZL will be fully responsible to the Client for the Services and work done by all of its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from ENZL and not ENZL's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against ENZL's affiliated companies, and their employees, officers and directors.

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ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

APPENDIX B

Department of Conservation bat handling competencies

1. Catching bats	1.1 Use of mist nets	1.1.1	Extract 30 individuals of either species
		1.1.2	Demonstrate an understanding of correct mist net placement, mist net attendance, risks and safe extraction and handling
	1.2 Use of harp traps (free standing)	1.2.1	Identify appropriate harp trapping sites and set up and monitor traps(s) on 10+ different nights
		1.2.2	Extract 10+ bats appropriately
		1.2.3	Demonstrate understanding of harp trapping protocols (animal welfare considerations, trapping in the breeding season, rain etc)
	1.3 Use of harp traps (at roost entrances)	1.3.1	Identify appropriate harp trapping sites and set up and monitor traps(s) on 10+ different nights
		1.3.2	Extract 10+ bats appropriately
		1.3.3	Demonstrate understanding of harp trapping protocols at roost entrances (safe trapping, (risk management), predation risks, animal welfare considerations, trapping in the breeding season, rain etc)
2. Handling bats	2.1 Bagging, handling, sexing, aging, measuring, weighing and releasing	2.1.1	Long-tailed bats: 50 individuals
		2.1.2	Short-tailed bats: 50 individuals
	2.2 Banding long-tailed bats	2.2.1	50 individuals
2. Handling bats	2.2 Banding long-tailed bats	2.2.2	Demonstrate knowledge of how to remove bands safely (2 methods; demonstrate on model bat)
	2.3 Pit-tagging short-tailed bats	2.3.1	Pit-tagging short-tailed bats
		2.3.2	Bat handling for pit tagging
	2.4 Attaching radio transmitters	2.4.1	Long-tailed bats: watch 5 individuals being tagged
2. Handling bats		2.4.2	Long-tailed bats: attach 5 individuals correctly under supervision

	2.4 Attaching radio transmitters	2.4.3	Short-tailed bats: watch 5 individuals being tagged
		2.4.4	Short-tailed bats: attach 5 individuals correctly under supervision
	2.5 Taking wing biopsies	2.5.1	Watch 5 individuals having biopsies taken
	2.5 Taking wing biopsies	2.5.2	Take biopsies from 10 individuals under supervision
		2.5.3	Understand and follow the Standard Operating Procedure
3. High risk activities (risk of disturbance and/or injury to bats) – Roost felling	3.1 Assessing roost tree using Automatic Bat Monitors – Demonstrate correct timing, placement, and interpretation of data for 10+ times according to DOC's Bat Roost Protocols		
	3.2 Undertake roost watches/emergence counts at 10+ occupied roosts where the entrance is visible.		
	3.3 In at least two different forest/habitat types, including the forest/habitat type where trees are going to be assessed: evaluate 10+ potential roost features in trees (e.g., cavities, peeling bark, epiphytes)		