

BEFORE A BOARD OF INQUIRY

EAST WEST LINK PROJECT

UNDER

the Resource Management Act 1991 (**Act**)

AND

IN THE MATTER OF

notices of requirement for designation and resource consent applications by the New Zealand Transport Agency for the East West Link Project

BUNDLE OF DOCUMENTS FOR TR GROUP LIMITED

- | | | |
|----|---|------|
| 1. | TR Group Limited resource consent (Stage 1) (approved 4/10/2011). | 0001 |
| 2. | Ann's Creek Lava Shrublands Management Plan (LSMP) (approved 28/11/2013) (<i>Golder Associates</i>). | 0021 |
| 3. | TR Group Limited resource consent (Stage 2) (approved 14/01/2014). | 0047 |
| 4. | Variation to LSMP (April 2014) (approved 29/04/2014) (<i>Wildland Consultants</i>). | 0080 |
| 5. | Ecological Management Plan (Wetland Component) (approved 19/02/2015) (<i>Wildland Consultants</i>). | 0085 |
| 6. | Ann's Creek Revegetation Project Annual Report (2014-2015) (<i>Wildland Consultants</i>). | 0135 |
| 7. | Ann's Creek Revegetation Project Annual Report (2015-2016) (<i>Wildland Consultants</i>). | 0156 |

Regional Plan Consents 36056, 36058, 36055, 30316 and 36531 for Stage 1

General Conditions

Development Plans

- 1 The activity shall be in general accordance with Stage 1 of the proposal approved by the Environment Court and identified in the Walker SEP Limited Plans 1219-C207 and C208 (both revision A) dated 2 August 2011. The activity shall be in general accordance with relevant aspects of the background resource consent information submitted with the regional and land use application and numbered 36056, 36058, 36055, 30316 and 36531 by the Auckland Council and R/LUC/2008/4724.
- 2 In the detailed design of the fill and earthworks covering areas of existing natural water seepage, reasonable steps shall be taken to incorporate pathways for the continued water seepage within the works.
- 3 Pursuant to section 36(1) of the RMA, consents R/LUC/2008/4724, 36056, 36058, 36055, 30316 and 36531 (or any parts thereof) shall not be exercised until such time as all fixed charges in relation to the receiving, processing and granting of this resource consent are paid in full.
- 4 The Consent Holder shall permit the servants or agents of Auckland Council to have access to relevant parts of the property at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements and/or to take samples.
- 5 The Consent Holder shall ensure that all personnel working on the site shall be made aware of all resource consents held for Stage 1 and have access to the contents of the associated erosion and sediment plan.

Monitoring

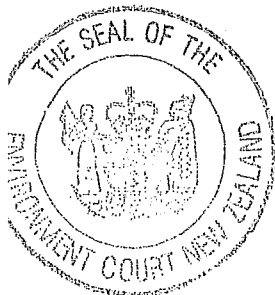
- 6 The Consent Holder shall pay the Council a consent compliance monitoring charge of \$5000 (inclusive of GST), plus any further monitoring charge or charges to recover the actual and reasonable costs that have been incurred to ensure compliance with the conditions attached to this consent.

The \$5000 charge shall be paid as part of the resource consent fee and the Consent Holder will be advised of the further monitoring charge or charges as they fall due. Such further charges are to be paid within one month of the date of invoice.



Environmental Enhancement and Mitigation Works (Lava Shrubland)

- 7 The Consent Holder shall undertake environmental enhancement and mitigation works to the lava shrubland vegetation on the site in accordance with a detailed management plan prepared and approved under condition (8). This work shall be carried out to the satisfaction of the Manager.
- 8 Prior to the commencement of any works on site the Consent Holder shall provide to the Manager for approval a Lava Shrubland Management Plan prepared by a suitably qualified and experienced ecologist (LSMP). The LSMP shall be based on the "Ann's Creek Lava Shrubland Management Plan" prepared by Golder Associates and dated August 2006, updated and amended to reflect the proposed Stage 1 works. The LSMP shall also include details of the following:
 - (a) How the works proposed under the LSMP will be integrated and co-ordinated with the other development and environmental mitigation works proposed by this consent;
 - (b) The programme for the implementation of the LSMP, including an ongoing maintenance programme (including weed and pest control);
 - (c) The programme to be implemented to monitor the short term (see condition 10(d)) and long term success of the enhancement/restoration works required by the LSMP.
- 9 The approved LSMP shall be implemented (excluding ongoing maintenance) within 12 months of the completion of bulk earthworks to the satisfaction of the Manager.
- 10 Pursuant to s108(2)(b) of the Resource Management Act 1991, compliance with Condition (9) shall be secured by way of a bond to the value of \$50,000.00 (valued as at 1 October 2009). The bond shall be adjusted annually according to the Construction Cost Index or other suitable alternative approved by the Manager. The bond shall be prepared at the Consent Holder's expense and to the satisfaction of the Council's solicitor and shall include the following terms (without in any way limiting the other terms which may be included):
 - (a) Performance of the bond shall be guaranteed by a guarantor acceptable to the Council.
 - (b) The duration of the bond shall be for a minimum of 5 years following completion of bulk earthworks.



- (c) After the expiry of the minimum bond period the eConsent hHolder shall be released from its obligations to pay the bond if the LSMP has been fully implemented (excluding ongoing maintenance works) and any enhancement plantings proposed in the LSMP have established on the site. 'Establishment' shall mean that, in the opinion of a suitably qualified and experienced ecologist (appointed by agreement between the Consent Holder and the Council), at least 80% of the plantings can be expected to survive on the basis of a 10 year average annual weather cycle.
 - (d) In the event that establishment as defined in condition 10(c) is not achieved within 5 years after the LSMP has been fully implemented (excluding ongoing maintenance works) then the bond required under this condition may be called up by the Council and taken as a financial contribution to be applied to off-site environmental mitigation works.
- 11 The Consent Holder is to make available to the Auckland Council and the Department of Conservation, at no cost, all surplus plant specimens within the area to be filled for their removal up to a period of 12 months after the granting of this consent.

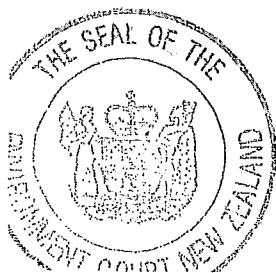
Tangata Whenua/Community Liaison

- 12 The Consent Holder shall consult with and, where appropriate, involve Tangata Whenua and other interested community groups in the implementation of the consent and the environmental enhancement works required. Within 2 months of the anniversary of the commencement of this consent in each year, the consent holder shall report the following information to the Manager:
- (a) the persons consulted with about the development in the preceding 12 month period and the details of the consultation undertaken.
 - (b) the persons involved in the implementation of the consent and the environmental enhancement works and the details of that involvement.
 - (c) initiatives (if any) for the next 12 month period.

The reporting requirement in this condition shall cease 5 years after the commencement of this consent.

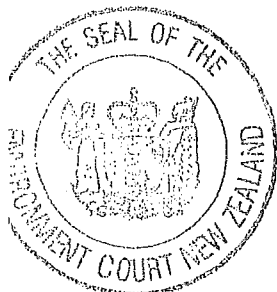
Construction Management

- 13 Prior to commencement of any works on the site, the Consent Holder shall provide to the Manager for approval a construction management plan. The management plan shall set out the specific details for the construction



and management of the Stage 1 works and, as a minimum, shall include:

- (a) Details of the site manager including their contact details (phone, facsimile, email, and postal address). A telephone number for after hour emergencies shall also be supplied.
- (b) The location of a large noticeboard on the site that clearly identifies the name, telephone number and address for service of the site manager.
- (c) Any means of protection of services such as pipes and water mains within the legal road.
- (d) Measures to be adopted to protect the remaining significant ecological features on the balance of the site from damage or destruction during construction.
- (e) Measures to be adopted to maintain the site in a tidy condition in terms of disposal/storage of rubbish, storage and unloading of building materials and similar construction activities.
- (f) Location of workers conveniences (e.g. portaloos).
- (g) Procedures for controlling sediment run off, dust and removal of soil, debris and construction materials onto public roads or places (including identifying the location of a wheel wash facility, if proposed).
- (h) Proposed hours of work on the site.
- (i) Management proposals for construction related traffic, including:
 - Measures to be adopted to ensure that pedestrian access past the site on the public footpaths is safe and not obstructed during works.
 - Proposed numbers and timing of truck movements throughout the day and proposed routes.
 - Location of vehicle and construction machinery access during the period of site works.
 - Measures to ensure that loading and unloading of vehicles is undertaken on the site at all times and that no reverse manoeuvring occurs onto Great South Road.
 - Vehicle parking for site works and sub-contractors.



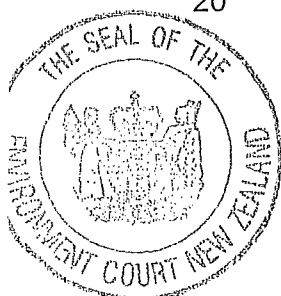
This construction management plan shall be implemented and maintained throughout the entire period of works on the site.

Dust Management

- 14 Prior to commencement of any works on the site, the Consent Holder shall provide to the Manager for approval a Dust Management Plan (DMP).
- 15 Prior to providing the DMP to the Manager for approval, the Consent Holder shall consult with Mighty River Power and Transpower about the contents of the DMP. As a minimum, the DMP shall include a detailed description of procedures, methods and measures that will be used to ensure dust control at a level to prevent excessive dust from being discharged to the air beyond the site boundary. Particular reference must be provided to procedures, methods and measures that will be implemented to ensure protection from dust of power transmission lines and the switchyard, gas turbine intakes, and cooling towers at the Southdown Power Station. In preparing the DMP the Consent Holder shall also have regard to the "Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions" (Ministry for the Environment, September 2001).
- 16 The Consent Holder must ensure that the discharge of dust and/or particulate matter from the earthworks activities within the site does not create any dust hazard or nuisance to Transpower's Henderson-Otahuhu A transmission line, including Tower 19.
- 17 Once approved by the Manager, the DMP shall be implemented and maintained throughout the entire period of Stage 1 construction works on the site and at all times thereafter.

Engineering

- 18 All site works are to be carried out under the supervision of a Chartered Professional Engineer experienced in geotechnical engineering and familiar with the Geotechnical Report by Coffey Geotechnics and dated 4 July 2005 (sic). All works shall follow the recommendations of this Geotechnical Report, to the extent relevant, and are to be carried out to the satisfaction of the Manager.
- 19 On completion of the Stage 1 earthworks, the Chartered Professional Engineer is to provide a certified completion geotechnical report to Council with "as-built" plans. Where necessary, earthworks are to conform to the requirements of relevant New Zealand Standards relating to earthworks.
- 20 All care shall be taken during construction to preserve the integrity and stability of the adjacent road reserve, underground services and



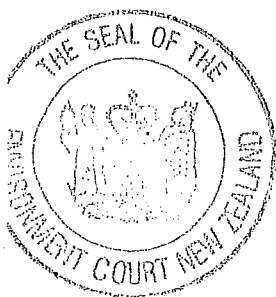
neighbouring sites. The Consent Holder must obtain approval from Watercare Services and Telecom New Zealand for the proposed filling of the existing bulk water supply line and Telecom services network located about ground and within the site. These approvals shall be supplied to the Manager prior to the commencement of the physical construction for Stage 1 works.

Archaeological/Geological Areas

- 21 An archaeologist is to be on site during all vegetation removal and initial earthworks to establish if there are any archaeological sites present.
- 22 In the event any archaeological or cultural heritage sites, including human remains, are exposed during site works then the following procedures shall apply:
 - Immediately it becomes apparent that an archaeological or traditional site has been exposed, all site works shall cease.
 - The site supervision shall immediately secure the area in a way that ensures that any artefacts or remains are untouched.
 - The site supervision shall notify tangata whenua, the New Zealand Historic Places Trust, the Department of Conservation, Council and in the case of human remains, the Police, that an archaeological or traditional site has been exposed so that appropriate action can be taken. This includes such persons being given reasonable time as determined by the Council to record and recover archaeological features discovered before work may recommence on the site.

Overhead Power

- 23 All land use activities, including the construction of new buildings/structures, earthworks, the operation of mobile plant and/or the construction of fences on the site must comply with the New Zealand Code of Practice for Electrical Safe Distances (NZECP 34:2001).
- 24 All machinery and mobile plant operated on the site must maintain a minimum clearance distance of 4m from the Henderson-Otahuhu A transmission line conductors at all times.
- 25 In the case of any tower supporting any conductor, no person may excavate or otherwise interfere with any land (unless otherwise approved by Transpower New Zealand):
 - At a depth greater than 300mm within 6 metres of the outer edge of the visible foundations of the tower; or



- At a depth greater than 3 metres, between 6 metres and 12 metres of the outer edge of the visible foundation of the tower; or
 - In such a way as to create an unstable batter.
- 26 Excavated or other material must not be deposited under or near the Henderson-Otahuhu A transmission line so as to reduce the vertical distance from the ground to the conductors to a distance less than:
- 7.5 metres vertically, across or along driveways or on any other land traversable by vehicles.
 - 6.0 metres vertically, on any land not traversable by vehicles due to inaccessibility; and
 - 4.5 metres in any distance other than vertical on all land.

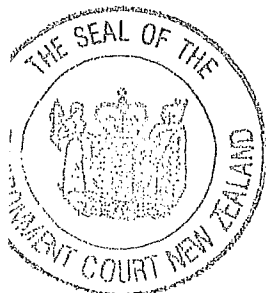
Please note that the distances specified include an allowance for mechanic creep (ie permanent elongation).

Regional Plan Consents Conditions for Stage 1

- 27 Consent 36056 (earthworks) shall expire on 31 April 2021 or two earthworks seasons after the commencement of site earthworks (whichever is the sooner) unless it have been surrendered or cancelled at an earlier date pursuant to the Resource Management Act 1991.
- 28 Consent 36055 (stormwater), Consent 360058 (streamworks), and Consent 30316 (contaminated land) shall expire on 30 December 2046 unless it have been surrendered or cancelled at an earlier date pursuant to the Resource Management Act 1991.

Pre-Construction Works Conditions

- 29 The following plans shall be submitted to the Manager for review and written confirmation at least one month prior to the commencement of the project site works. The specific requirements of these plans are identified in the respective conditions of this consent.
- Construction Management Plan
 - Sediment and Erosion Control Plan
 - Chemical Treatment Management Plan
 - Remediation Action Plan
 - Streamworks Methodology Plan
 - Stormwater calculations and detailed design plans for expansion of existing stormwater management pond to accept and treat additional stormwater from Stage 1 area.
 - Stormwater Operation and Maintenance Plan



- 30 The Consent Holder shall inform the Manager in writing at least two (2) weeks prior to the commencement of the project site-works.
- 31 Prior to the commencement of earthworks the Consent Holder or their agent shall arrange and conduct a pre-construction site meeting between AC and all relevant parties, including the primary contractor at least 5 working days prior to the scheduled commencement date.

Advice Note: A failure to conduct a pre-construction meeting without notification to the Council may result in enforcement action being taken.

- 32 Prior to bulk earthworks and filling operation commencement, a certificate signed by an appropriately qualified and experienced engineer shall be submitted to the Manager for written approval. This will certify the proposed erosion and sediment controls have been constructed meeting TP 90 standards and in accordance with the specific sediment and erosion conditions in this consent. Certification for the following measures shall be supplied immediately upon completion of their construction.

Information supplied if applicable shall include:

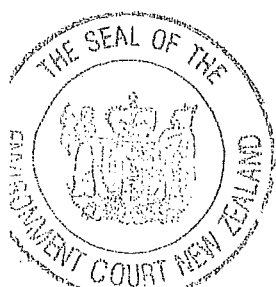
- i. Documentation of construction of all erosion and sediment control practices including stabilised construction entrance, silt fences, etc.
- ii. Contributing catchment area to sediment retention structures;
- iii. Retention volume of sediment retention structures (dead storage and live storage measured to the top of the primary spillway);
- iv. Shape of sediment retention structures (dimensions of structure);
- v. Position of inlets/outlets; and
- vi. Stabilisation of the structure.

Abandonment of works on site

- 33 If the Consent Holder abandons work on site it shall first take adequate preventative stabilisation and other remedial measures to prevent sediment discharge and shall thereafter maintain those measures for so long as necessary to prevent sediment discharge from the site. All such measures shall be of a type and to a standard which are to the satisfaction of the Manager.

Post-Construction Works Conditions

- 34 Prior to the removal of the sediment and erosion control measures from the site, the consent holder shall inform the Manager in writing and provide confirmation from a suitably qualified engineer confirming that earthworks and filling works have been completed and the devices are no



longer required.

Specific Sediment and Erosion Control

- 35 Erosion and sediment control measures shall be carried out in accordance with those described in Land Use Consent: Sediment Control Application No. 36056 and the plans and documents prepared by Walker SEP as outlined in condition 1 and any further amendment as required in the conditions of this consent. A final Sediment and Erosion Control Plan for Stage 1, prepared in accordance with TP90 and the conditions specified in this consent, shall be submitted to Auckland Council at least one month prior to the commencement of earthworks.
- 36 Any amendments to the erosion and sediment control plan shall be reviewed and approved by the Manager in writing prior to the amendments being implemented on site.
- 37 A staging plan shall be submitted to the Manager and to be part of the Sediment and Erosion Control Plan. The Staging Plan shall detail the timing and the area of opened area subject to earthworks, and filling operation.
- 38 All sediment-laden runoff from the site works shall be treated by erosion and sediment control measures approved as part of this resource consent. These structures are to be constructed and maintained in accordance with TP90 and any amendments to this document, except where a higher standard is detailed, in which case this higher standard shall apply.
- 39 Sediment and erosion control structures are to be constructed and maintained in accordance with TP90 and any amendments to this document, except where a higher standard is detailed in the final Sediment and Erosion Control Plan, in which case this higher standard shall apply.
- 40 All sediment and erosion control structures shall be operational before bulk earthworks commence and be maintained to perform at full operational capacity until the site has been adequately secured against erosion (whether by vegetative means, paving or otherwise).
- 41 Prior to the commencement of earthworks, a Chemical Treatment Management Plan shall be provided to the Manager for approval. The Plan shall include as a minimum:
 - Specific design details of chemical treatment system;
 - Monitoring, maintenance (including post-storm) and contingency programme (including a Record Sheet);



- Details of optimum dosage (including assumptions);
 - Results of the initial flocculation trial;
 - A spill contingency plan; and
 - Details of the person or bodies that will hold responsibility for long-term maintenance of the flocculation treatment system and the organisational structure which will support this structure.
 - Any amendments to the Chemical Treatment Plan shall be approved by the Manager, in writing, prior to implementation.
- 42 The Chemical Treatment Management Plan specified above is to be implemented prior to any discharge occurring from the site.
- 43 No sediment laden runoff shall leave the site without approved treatment to retain sediment.
- 44 That all perimeter controls shall be operational before bulk earthworks and importation of fill commence. Specific measures shall be provided to the southern boundary of the bulk earthworks to prevent sediment and sediment laden water entering the coast.
- 45 Any decanting earth bunds shall be sized to provide 3m³ of storage for every 100m² of contributing catchment.
- 46 That all 'cleanwater' runoff from stabilised surfaces including catchment areas above the site shall be diverted away from earthwork areas via a stabilised system, so as to prevent surface erosion.
- 47 Any sediment retention ponds shall be sized to provide 3m³ of storage for every 100 m² of contributing catchment and be constructed to withstand a 1% AEP storm event without breaching and shall incorporate an emergency spillway to accommodate such an event.
- 48 All clean water diversions and sediment laden diversions shall be stabilised with geotextile or similar measures (rip-rap) where longitudinal gradients exceed 2%.
- 49 All accumulated sediment is to be removed from the sediment retention devices before the sediment reaches 20% of the storage capacity of the device and is placed on stable ground where the sediment will not re-enter the device.
- 50 The erosion and sediment controls at the site shall be inspected on a daily basis or within 24 hours of each rainstorm event that is likely to impair the function or performance of the controls. A record shall be maintained of the date, time and any maintenance undertaken in association with this



condition which shall be forwarded to the Manager upon request.

- 51 A wheel wash shall be installed at the site egress with runoff from this device treated within an appropriate sediment control. Notwithstanding the requirement for a wheelwash, all necessary measures shall be installed and operated to prevent the deposition of slurry, clay or other materials on the roads by vehicles leaving the site. Should material be deposited on the road, it shall be removed immediately to the satisfaction of the Manager.

Stabilisation

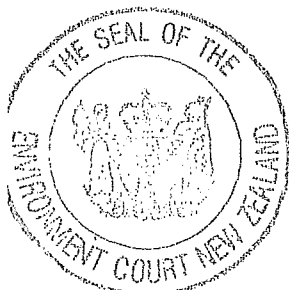
- 52 The site shall be stabilised against erosion as soon as practicable and in a progressive manner as earthworks are finished over various areas of the Stage 1 plan.

Earthworks Restriction

- 53 Revegetation/stabilisation shall be completed by 30 April in the year of bulk earthworks in accordance with measures detailed in TP90 and any amendments to this document, unless a later date is approved in writing by the Manager at least two weeks before 30 April.
- 54 No earthworks shall be undertaken between 30 April and 1 October in any year, without the written approval of the Manager. Earthworks in this regard refers to bulk earthworks (cut/fill/waste) associated with the site.

Stormwater Management

- 55 Prior to the commencement of works on the site, the consent holder shall submit a stormwater management plan to the Manager for written approval. The plan shall include details confirming the following standards can be met:
- The stormwater management system is to be designed to achieve a standard of 75% TSS removal for the existing and increased site impervious area. The determination of pond adequacy will be based on providing adequate pond volume of storage for all contributing areas so that the water quality storm is captured and treated. This analysis shall be confirmed by a suitably qualified engineer.
 - Calculations shall be submitted to demonstrate pond size adequacy.
 - If an existing pond is used, the pond shall be modified to accommodate the stormwater discharges from the existing and additional Stage 1 impervious area and shall be managed and



monitored in accordance with the Stormwater Operation and Management Plan required in condition 61 of this consent.

Overland flow path

- 56 The Consent Holder shall ensure that, for stormwater flows in excess of the capacity of the primary systems, secondary flow paths shall be provided and maintained to allow surplus stormwater from critical storms, up to the 100 year ARI event, to discharge with the minimum of nuisance and damage.

Advice Note: For the purposes of this Consent "major overland flow paths" are those that accompany a primary drainage system of a nominal 600 mm diameter pipe or larger or with peak overland flow exceeding 0.5m³/s in the 100-year ARI event.

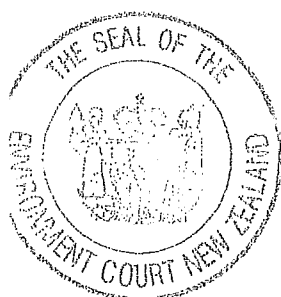
- 57 The Consent Holder shall ensure that major secondary flow paths on land under their control are kept free from significant obstructions such as buildings, and solid fences.
- 58 Where roading kerbs and channels are constructed across secondary flow paths, the Consent Holder shall ensure that kerbs are set at a level that maximises the capture of water by road cesspits. Other than at designated overland flow paths, driveway crossings shall be constructed in order to minimise the overflow of water from the road into private properties.

Outfall erosion

- 59 All stormwater outfalls, including the water quality treatment pond shall incorporate erosion protection measures to minimise the occurrence of bed scour and bank erosion in accordance with TP 10.

Certification of construction works

- 60 Within 30 days of construction completion, As-Built certification and plans of the stormwater management works which are certified as a true record of the stormwater management system shall be supplied to the Manager. The As-Built plans shall include, but not be limited to:
- The surveyed location (to the nearest 0.1 m) and level (to the nearest 0.01 m) of the discharge structure with co-ordinates expressed in terms of the New Zealand Map Grid and LINZ datum.
 - Location, dimensions and levels of the major overland flowpaths including cross-sections and long sections.



- Plans and cross-sections of the stormwater management pond including confirmation of the Water Quality Volume, storage volumes and levels of any outflow control structure.
- Documentation of any discrepancies between the design plans and the As-Built plans.

Operation and Maintenance

61 That the Consent Holder shall submit an Operation and Maintenance Plan for the stormwater management works to the Manager for written approval **within 30 days** of the completion of installation of the stormwater management system. The Operation and Maintenance Plan shall include, but not be limited to:

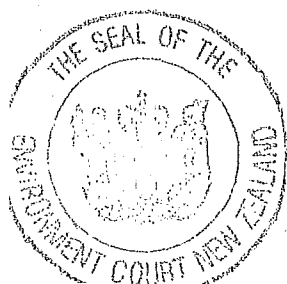
- A programme for regular maintenance and inspection of Works authorised under Condition 54 55 of this Consent;
- A programme for the collection and disposal of debris and sediment collected by the stormwater management devices or practices;
- A programme for inspection and maintenance of outfall erosion;
- A programme for post storm maintenance.
- General inspection checklists for all aspects of the stormwater management system.

Any amendments to the Operation and Maintenance Plan shall be approved by the Manager in writing, prior to implementation.

62 That the Consent Holder shall ensure that the stormwater management works are managed in accordance with the Operation and Maintenance Plan which has been approved by the Manager and as specified in Condition 545.

63 That the Consent Holder shall enter into, and maintain in force, a written maintenance contract with an experienced stormwater management system operator, or a person trained in the stormwater treatment operation by the system designer, approved in writing by the Manager, for the on-going maintenance of the stormwater management system. This contract shall include an inspection and maintenance schedule in accordance with the requirements in Condition 61.

64 A signed copy of this contract shall be forwarded to the Manager **within 30 days** of Stage 1 works completion, and the Consent Holder shall ensure that the Manager is provided with a current copy of such contracts throughout the term of this consent. An operative contract shall be provided to the Auckland Council upon request throughout the term of the consent.



Specific Conditions Streamworks Permit No 36058

65 Prior to any streamworks commencing the consent holder shall submit a streamworks methodology plan for completing the physical works within Ann's Creek i.e. for the extension of the existing culvert into the western tributary of Ann's Creek shall be prepared and submitted to the Manager for written confirmation. The following details must be included:

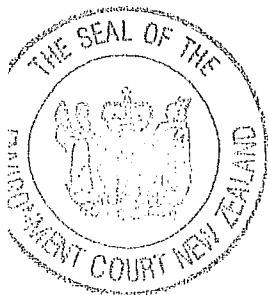
- Method for damming and diverting water away from the construction areas
- Method for protecting the remaining wetland vegetation within the Ann's Creek wetland and the remaining western tributary
- The construction sequence of the proposed works
- Sediment and erosion methodology giving particular regards to the surrounding sensitive receiving environment
- Details of the suitably qualified ecologists undertaking and monitoring the construction works
- Fish relocation methodology incorporating how and where the fishes will be relocated for the western tributary.
- Buffer plan for works in proximity to the western tributary

66 Prior to the physical streamworks on Ann's Creek commencing, a certificate signed by an appropriately qualified and experienced engineer to certify that the erosion and sediment controls have been constructed in accordance with the proposed erosion and sediment control measures (as per consent 36056) shall be submitted for written confirmation. Certification for the following measures shall be supplied immediately upon completion of their construction.

Information supplied if applicable shall include:

- i. The method of diverting Ann's Creek during culvert construction.
- ii. All temporary flowpath dimensions including emergency flowpaths and the relationship to flood levels;
- iii. Details of all velocity dissipation measures;
- iv. Catchment areas, retention volumes and shape of control measures;
- v. Position of inlets/outlets;
- vi. General structural stability; and
- vii. Confirmation of maintenance expectations and provision of access for this purpose.

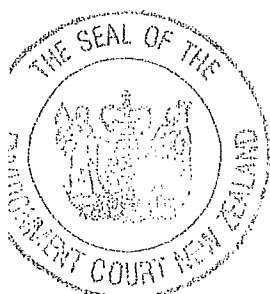
67 When dewatering the area of works, no sediment laden water shall be discharged directly into the watercourse. Any sediment laden discharge pumped or otherwise removed from the works area must be disposed of via a suitable sediment treatment system.



- 68 Appropriate relocation sites and effects on resident fish populations are to be assessed, and included in a written report, by a suitably qualified and experienced freshwater biologist. The consent holder shall submit this report to the Manager within 30 days after the fish is relocated.
- 69 No works shall be undertaken between 30 April and 1 October, without the written approval of the Manager.
- 70 Streamworks shall only be carried out during periods when all flows, up to the 24 hour 20 year return period storm event, can be diverted around the area of works and a two day weather forecast predicts no rainfall for the site location. During periods of flow greater than the capacity of the diversion, up to the 100 year flood event, a stabilised flow path shall be provided to ensure no scour or erosion occurs and so that flows can pass safely around or through the area of works with minimum nuisance and damage and with no sediment generation or discharge.
- 71 There shall be no discharge of contaminants (e.g. oil, diesel, petrol, effluent) to the stream as a result of the exercise of this resource consent.
- 72 All machinery shall be operated in a way, which ensures that spillages of fuel, oil and similar contaminants are prevented, particularly during refuelling and machinery servicing and maintenance. Refuelling and lubrication activities shall be carried out away from any water body such that any spillage can be contained so it does not enter the watercourse associated with this consent. The use of grouts and concrete products shall also be limited adjacent to the watercourse with all mixing of products carried out outside the 100 year floodplain area such that any spillage can be contained so it does not enter the watercourse associated with this consent.
- 73 That any water pooling in the affected stream-bed area drained for the works, and particularly any water displaced by the concrete pouring, shall be treated as a trade waste, prevented from flowing downstream and removed from the stream bed.
- 74 The consent holder shall ensure that unimpeded access is maintained along the waterway outside working hours except through areas that the safety of the public would be endangered as a result of the works.

Contaminated Land

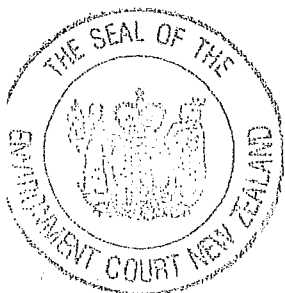
- 75 Should any excavation of the contaminated material be undertaken, the Consent Holder shall comply with the Remediation Action Plan (RAP) dated April 2008 lodged with the original application and any changes to



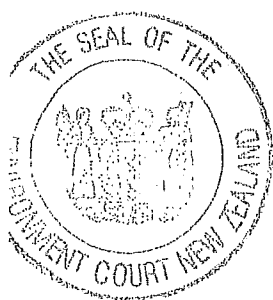
the RAP shall be approved in writing by the Manager prior to implementation and shall be incorporated into a single document.

- 76 Should any excavation of the contaminated material be undertaken, the Consent Holder shall regularly inspect the excavations of the contaminated areas for water accumulation in accordance with the approved RAP.
- 77 Should excavation of the contaminated material be adopted as a site remediation measure, the Consent Holder shall remove contaminated soil and dispose any contaminated groundwater/surface water from the site, in accordance with the approved RAP.
- 78 Should excavation of the contaminated material be adopted as a site remediation measure, the Consent Holder shall complete the site excavation works by no later than three (3) months prior to the expiry of this consent, in accordance with the approved RAP (to allow for validation sampling to be undertaken and reporting to the Manager prior to the expiry of this consent).
- 79 Should surface water or groundwater accumulate in excavated areas or in designated stockpile areas, the Consent Holder shall, in accordance with the approved RAP, take a sample of the water and have it tested at a laboratory for metals, TPH and PAHs. If the test results indicate exceedance of the trigger levels presented in the RAP, then appropriate measures shall be employed to remove the liquid off site for disposal at an appropriate facility. Should hydrocarbon sheen or free product be observed then this liquid will be removed off site for disposal at an appropriate facility without analytical testing.
- 80 During the works the Consent Holder shall call upon the services of a suitably qualified contaminated land consultant who will be required to assess and test, if necessary, any suspect material for the presence of contaminants in accordance with the approved RAP. Any material not meeting acceptance criteria for an approved cleanfill or managed fill site or that cannot be re-used on site, shall be disposed of at a licensed landfill in accordance with the approved RAP. All testing/sampling techniques will be carried out in accordance with the MfE Contaminated Land Management Guidelines or other equivalent standards approved in writing by the Manager.
- 81 For the duration of the site redevelopment the Consent Holder shall ensure that all sediment and stormwater controls are in place and effective in accordance with the approved RAP.

Cleanfill Material

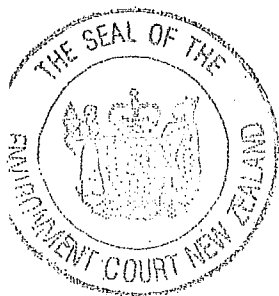


- 82 All imported fill material is to be in accordance with the Ministry for Environment "cleanfill" definition as detailed in "A Guide to the Management of Cleanfills, 2002" or any updated definition which the applicant has been advised of in writing by the Manager.
- 83 Copies of a "Cleanfill Log" are to be supplied to the Manager on a three (3) monthly basis by the Consent Holder throughout the period of earthworks and cleanfilling. The cleanfill log is to include, but not be limited to the following:
- Registration number of the vehicle;
 - Name of transporter;
 - Date and time of arrival at site;
 - Approximate size of the load in m³;
 - Source of cleanfill material (including any known land use history if possible);
 - Name of the disposer of the material;
 - Type of material e.g. topsoil, clay, ash, aggregate, concrete, soil;
 - The on-site disposal location of the fill;
 - Copies of laboratory test certificates of all analytical testing.
- 84 Analytical testing of the fill, not previously tested by the fill generator, at a rate of not less than 1 in every 100 incoming trucks (being approximately every 1000 m³) shall be undertaken. The analytical testing shall be to demonstrate contaminant levels in the fill, including (but not limited to) As, Cd, Cr, Cu, Ni, Pb, Zn, TPH, VOC, PAH and SVOCs.
- 85 All samples shall be analysed in in a laboratory accredited by International Accreditation New Zealand (IANZ) in accordance with the terms of accreditation or other such standards as may be approved by the Manager.
- 86 The records required by the consent conditions are to be made available for inspection by the Manager at any time.



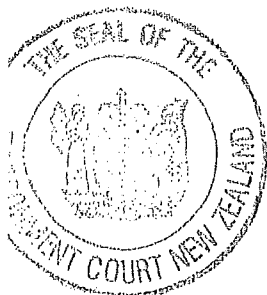
ADVICE NOTES

1. This consent is issued pursuant to an interim decision of the Environment Court (Decision No. [2011] NZEnvC 236) and that it will be subject to further conditions of consent in the final decision. Those conditions of consent will also apply to any works undertaken in reliance upon this interim decision, and may include remediation rehabilitation works, further engineering earthworks or landscaping and/or payment of monies.
2. That the consent holder makes the contractor/consultant associated with the proposed works aware of the Industry Education Programme for Plan Implementers/Preparers available through AC.
3. That the Conditions of Consent should be included with the Contract Documents.
4. All fill material used shall be "clean" as defined by the soil contamination permitted activity criteria of the ACRP:ALW.
5. The consent holder is advised that they will be required to pay to AC any administrative charge fixed in accordance with Section 36(1) of the Resource Management Act 1991, or any additional charge required pursuant to Section 36(3) of the Resource Management Act 1991 in respect of this consent.
6. The Consent Holder is advised that the date of the commencement of this Consent will be as determined by Section 116 of the Resource Management Act 1991, unless a later date is stated as a condition of consent. The provisions of Section 116 of the Resource Management Act 1991 are summarised in the covering letter issued with this Consent.
7. The consent holder is referred to Section 124 of the Resource Management Act 1991, which provides for the exercising of a consent while applying for a new consent for the same activity.
8. The Consent Holder is advised that pursuant to Section 126 of the Resource Management Act 1991, if this Resource Consent has been exercised, but is not subsequently exercised for a continuous period of 5 years, the consent may be cancelled by Council unless other criteria in Section 126 are met.
9. The Consent Holder is advised that should they wish to transfer this Permit to any other person they must do so by advising the Council in writing in accordance with Section 135(1)(a) of the Resource Management



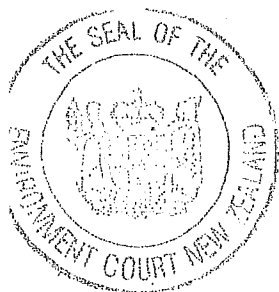
Act 1991. A fee is payable at the time of transfer to cover the cost of administration.

10. Form oils (separation agents) should be applied to any construction shutters in an area removed from the watercourse such that any excess oil or spillage cannot be washed to the receiving environment.
11. When using concrete retarders, hardeners or accelerators near watercourses care is required to ensure only the minimum amount of chemical is used to achieve the result required and excess chemical is not flushed to the receiving environment.
12. When utilising lime stabilisation for earthworks activities associated with this proposal, care should be taken to ensure that the storage and use of the lime does not lead to a discharge into receiving environments.
13. The consent holder is advised that this consent does not constitute an Authority or Dispensation by the Director-General of Conservation under regulation 42 of the Freshwater Fisheries Regulations (1983) for the construction or maintenance of any structure which has the effect of impeding the natural passage of fish.
14. Subject to section 198 of the Local Government Act 2002 and Auckland Council's Policy on Development Contributions, a development contribution may be payable on this proposal. The development contribution will be assessed at the time of payment and a notice of assessment shall be sent out which outlines the amount of the contribution payable for this development. Please contact the Development contributions team for any queries in this regard.
15. Transpower New Zealand has a right to access its existing assets situated on the site under section 23 of the Electricity Act 1992. Any development must not preclude or obstruct this right of access. It is an offence under section 163(f) Electricity Act to intentionally obstruct any person in the performance of any duty or in doing any work that the person has the lawful authority to do under section 23 of the Electricity Act.
16. The Consent Holder is advised that it will need to obtain the necessary consents from Transpower for works near and under the existing electrical pylon and high tension transmission lines.



DEFINITIONS

Act:	means the Resource Management Act 1991 and further amendments.
AC:	means the Auckland Council.
Site:	means the land defined by the legal description above.
ARI:	means Average Recurrence Interval.
Bulk earthworks:	means major cut/fill/waste works.
Commencement of works:	means the time when the Consent Holder informs the Manager in writing that earthworks are about to commence.
Manager:	means the relevant Team Leader, Natural Resources and Specialist Input, Resource Consents of the Auckland Council; or nominated AC staff acting on the Manager's behalf.
Stabilised:	means an area inherently resistant to erosion such as rock (excluding Sedimentary Rocks), or rendered resistant by the application of aggregate, geotextile, vegetation or mulch. Where vegetation is to be used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once an 80% vegetation cover has been established.
TP10:	means ARC Technical Publication No. 10, <i>Stormwater Management Devices: Design Guideline Manual</i> , May 2003.
TP90:	means ARC Technical Publication No. 90 <i>Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region</i> , March 1999.
TP108:	means ARC Technical Publication No. 108, <i>Guidelines for Stormwater Runoff Modelling in the Auckland Region</i> , April 1999.
TP302:	means ARC Technical Publication No. 302, <i>Stream Ecological Valuation (SEV): a method for scoring the ecological performance of Auckland streams and for quantifying mitigation</i> , June 2006.
ACRP:ALW:	means the Auckland Council Regional Plan: Air, Land and Water operative in Part dated October 2010.



November 2013

Ann's Creek Lava Shrublands Management Plan

Submitted to:

TR Group
PO Box 12541
Mt Wellington
Auckland



Report Number. 1378205374-001-Rev0

REPORT





ANN'S CREEK LAVA MANAGEMENT PLAN

Table of Contents

1.0 INTRODUCTION.....	1
1.1 Background	1
1.2 Aims and Objectives	1
1.3 Site Assessment Methodology	1
2.0 ECOLOGICAL FEATURES	1
2.1 Vegetation Description.....	1
2.2 Ecological Significance	4
2.2.1 Distinctive features.....	4
2.2.2 Early records and other remnants.....	5
3.0 MANAGEMENT PRIORITIES AND METHODS	6
3.1 Overview of Issues	6
3.2 Weed Control.....	6
3.2.1 Basalt outcrops	6
3.2.2 Surrounding embankment.....	12
3.3 Pest Animal Control	12
3.3.1 Overview	12
3.3.2 Rabbits.....	12
3.3.3 Possums	12
3.3.4 Rats.....	13
3.3.5 Post operation reporting.....	13
3.4 Restoration of Lava Shrubland	13
3.4.1 Restoration of basalt outcrops	13
3.4.2 Revegetation of 'Buffer Areas'	15
3.4.3 Planting specifications.....	16
3.5 Preservation of Native <i>Geranium</i> Populations and Habitat.....	16
4.0 COORDINATION WITH OTHER SITE WORKS	17
5.0 SUMMARY OF WORKS SCHEDULE	17
6.0 CONCLUSIONS.....	19
7.0 REFERENCES.....	19



ANN'S CREEK LAVA MANAGEMENT PLAN

TABLES

Table 1: Target species and control methodology.....	7
Table 2: Plant schedule for infill plantings.	15
Table 3: Plant schedule for basalt pavement.	15
Table 4: Plant schedule for embankments.	15
Table 5: Plant schedule for toe of embankment.	16
Table 6: Plant schedule for bund.....	16
Table 7: Programme of implementation for ecological management works.	18
Table 8: Monitoring programme to evaluate progress of ecological management works.	19

FIGURES

Figure 1: Vegetation cover of basalt outcrops and surrounds.	2
Figure 2: Relict lava shrubland communities on basalt outcrops including examples of <i>Astelia banksii</i> and <i>Coprosma crassifolia</i>	3
Figure 3: Rock ferns present at Ann's Creek (<i>Cheilanthes sieberi</i> on left, <i>Pellaea rotundifolia</i> on right).	6
Figure 4: Revegetation layout.	14

APPENDICES

APPENDIX A

Report Limitations



ANN'S CREEK LAVA MANAGEMENT PLAN

1.0 INTRODUCTION

1.1 Background

This document sets out a management plan to protect and rehabilitate a small remnant of indigenous lava shrubland on basalt outcrops within a 6.6 ha property at 791-793 Great South Road in industrial Otahuhu, Auckland City. The lava outcrops and associated indigenous shrubland communities are infested with a number of invasive weeds, and surrounded by exotic scrub and weedfield.

1.2 Aims and Objectives

The objective of this management plan is to protect and rehabilitate the lava shrubland remnants and enable the existing indigenous plant community to become self-sustaining over the long term.

Mechanisms to achieve this objective include:

- Reduce invasive weed populations on the site to the extent that they no longer threaten the viability of the shrubland remnants, and require only a low level of ongoing control.
- Establish a pest control programme for browsing herbivores and seed predators (i.e., possums, rabbits and rats) to facilitate regeneration of lava shrubland species and enhance the site's habitat values.
- Establish a buffer of indigenous forest and shrubland species typical of lava field vegetation on surrounding embankments (composed of plant material sourced from the site, or otherwise appropriate locally sourced material) to reinstate indigenous vegetation characteristic of coastal basalt substrates, remove existing sources of weed re-infestation in the immediate area, and protect the site from weeds dispersing in from elsewhere.
- Carefully delineate areas of basalt outcrops containing lava shrubland vegetation in order to ensure these are protected from disturbance.

1.3 Site Assessment Methodology

An updated map of vegetation cover on and surrounding the basalt outcrops was derived from examination of historic and recent (May 2012) aerial photographs of the site, and from GPS-referenced field notes and site photographs recorded during a walkover survey undertaken in July 2013. All flora observed was recorded, and a list of weed species present (including a broad assessment of distribution and abundance) was compiled. Vegetation descriptions derived from previous surveys were revised and updated.

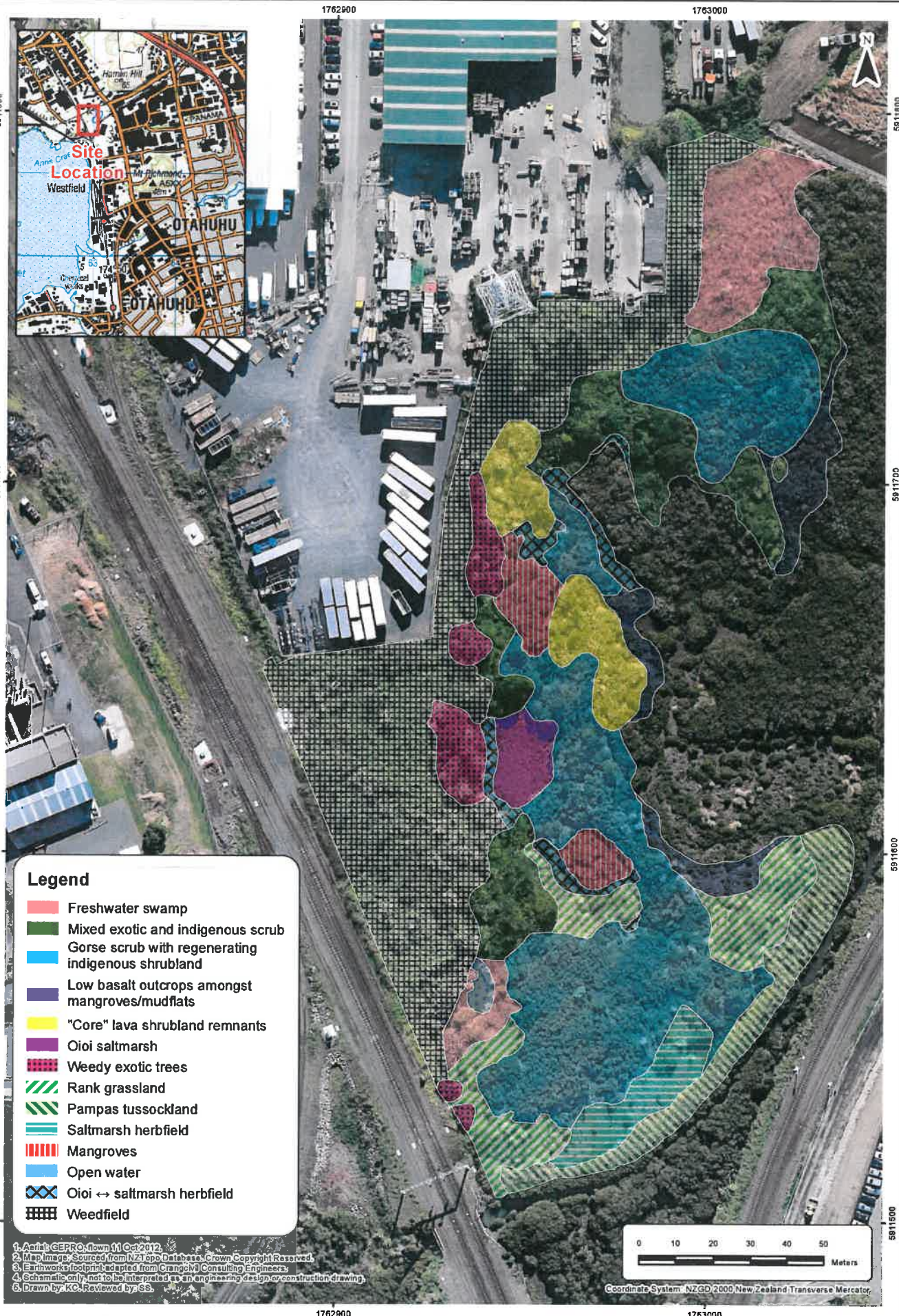
2.0 ECOLOGICAL FEATURES

2.1 Vegetation Description

Vegetation of the basalt outcrops and surrounds are mapped in Figure 1 and described below.

"Core" lava shrubland remnants

Previous surveys identified several basalt outcrops containing small but distinct patches of 'lava shrubland' assemblages dominated by akeake (*Dodonaea viscosa*) and *Coprosma crassifolia*, with a few large clumps of *Astelia banksii* perched on rocks in open sites (Figure 2). However, while the current survey identifies only two distinct 'lava shrubland' remnants (refer Figure 1), this is because akeake and *Coprosma crassifolia* populations have expanded to the extent that they now form a fairly frequent component of gorse scrub and shrubland, at least as seedlings and saplings, rather than being sparsely or patchily distributed.





ANN'S CREEK LAVA MANAGEMENT PLAN



Figure 2: Relict lava shrubland communities on basalt outcrops including examples of *Astelia banksii* and *Coprosma crassifolia*.

Gorse scrub with regenerating indigenous shrubland

Gorse forms a more or less continuous cover over approximately two thirds of the basalt substrate, reaching 2 – 2.5 m tall, commonly with a sparse woody understorey of Chinese privet and native shrubs and a ground cover of weedy lianas (tradescantia, German ivy, etc.,) where the canopy has thinned. *Muehlenbeckia complexa* forms large, shrubby clumps on outcrop margins and in open sites, and is otherwise sparsely interspersed through the lava outcrop vegetation.

Substantial canopy dieback has affected the dense gorse scrub cover over most of the basalt outcrops (the reason for this is unknown but may be due to gorse spider mite, a biocontrol agent), which appears to have facilitated the regeneration of some lava shrubland species (particularly akeake and to a lesser extent *Coprosma crassifolia*) which have substantially increased in distribution and abundance across the basalt outcrops in recent years. *Karo*, *Coprosma macrocarpa* and *C. repens* remain sparsely present, with little sign of regeneration.

Mixed exotic and indigenous scrub

This vegetation type encompasses several fairly small patches, generally comprising gorse with a patchy canopy of emergent native and exotic trees and shrubs. Akeake is a common canopy emergent in the northern 'mixed scrub' patches, while brush wattle, tree privet and Chinese privet are common throughout but are more abundant in south-western patches.

Low basalt outcrops amongst mangroves / mudflats

Blocks of basalt emerge from estuarine mud some way beneath the mangrove canopy. Some are unvegetated, some are largely grass covered, while others have relatively abundant growths of native ferns, herbs and shrubs.

Freshwater swamp (including open water)

Several small areas of freshwater swamp are present within the site, the largest of which is the patch of raupo at the northern end of the basalt outcrop (interspersed in places with marsh clubrush). Small patches of freshwater swamp occur elsewhere, containing raupo, marsh clubrush and giant umbrella sedge, as well as clumps of pampas and rank grass in places.



ANN'S CREEK LAVA MANAGEMENT PLAN

Oioi saltmarsh, saltmarsh herbfield and oioi - saltmarsh herbfield mosaic

Local patches of saltmarsh (comprising a mosaic of bachelor's button (*Cotula coronopifolia*), remuremu (*Selliera radicans*), arrow grass (*Triglochin striata*), wiwi (*Juncus maritimus* var. *kraussii*), oioi (*Leptocarpus similis*) and *Baumea juncea* occur between the rocky outcrops and adjacent embankment towards the south of the site. Patchy fringes of saltmarsh ribbonwood (*Plagianthus divaricatus*), *Austrostipa stipoides* and occasional *Cyperus ustulatus* surround the basalt outcrops where they emerge from the estuarine sediment.

Mangroves

Mangrove scrub (to 3 m tall) forms a closed canopy over the mudflats surrounding the 'seaward' side of the basalt outcrops, and is present in a small, enclosed basin in the central southern portion of the lava flow.

Weedy exotic trees

Clumps of tall woody exotic vegetation, predominantly comprising tree privet and wattle, with scattered monkey apple and a subcanopy of Chinese privet, are present on the steep embankment slopes above the western margin of the basalt outcrops. Native shrubs and trees including karamu, mahoe, matipo and an occasional karo sapling, are sparsely present, along with local patches of pohuehue. Olive trees were also noted.

Rank grassland

Dense swards of native meadow rice grass are present around the southern extent of the basalt outcrops, interspersed with gorse and Chinese privet shrubs and overgrown with blackberry in places, but also containing local copses of *Coprosma crassifolia*.

Pampas tussockland

A dense sward of pampas tussock covers the bund bordering the watercourse that extends along the eastern margin of the site. Pampas tussocks are also widely dispersed throughout the basalt outcrops and form large clumps in open sites.

Weedfield

Vegetation on the basalt pavement and steep embankment of unconsolidated fill to the west and north of the basalt outcrops comprises a mixed assemblage of rank grass and herbaceous weeds (sweet vernal, tall fescue, fennel, wild carrot, etc.,) interspersed with small wattle trees, tree privet, blackberry, pampas and gorse shrubs.

2.2 Ecological Significance

2.2.1 Distinctive features

Ann's Creek is one of the very few pieces of original lava-flat topography remaining on the Auckland isthmus (Gardner 1993). The lava shrubland present in the subject site is a relict community which was once probably widespread in the Auckland region but is now confined (on the mainland) to a small number of degraded remnants as a result of extensive quarrying and development.

Rare basalt substrate habitat is therefore of considerable ecological value, particularly as environmental conditions created by this type of substrate result in a relatively unusual assemblage of native plants. Floristic composition is driven by the physiological ability of the plants present to tolerate desiccation and minimal soil depths.

Ann's Creek is also of scientific importance as the type locality for *Coprosma crassifolia*; the species was described from samples of this species collected there by William Colenso in 1846. Outcrops also contain populations of two regionally threatened species (*Geranium retrorsum* and *G. solanderi*) and several species of native rock fern that have become increasingly uncommon in the Auckland Region.



ANN'S CREEK LAVA MANAGEMENT PLAN

One native (*Geranium solanderi*) and three adventive (*G. gardneri*, *G. dissectum* and *G. purpureum*) geranium species are present in varying abundances. *G. solanderi* is reasonably widely dispersed along the southwestern margin of the site, as well as amongst gravel beside the railway line, though its distribution and abundance has been observed to vary markedly between successive site visits. Another native species, *G. retrorsum*, while previously recorded within the Ann's Creek site, was not sighted during the course of this study. Adventive species vary in abundance. A few scattered individual specimens of *G. gardneri* occur on lava outcrops and lava cliffs. *G. dissectum* and *G. purpureum* are abundant and widely distributed throughout the site.

Surrounding lava outcrops and embankments contain sparse, scattered native plant populations and are subject to severe weed infestations. While these areas are degraded to the extent that they are not themselves ranked as of ecological significance, they will be actively restored and retained to provide a buffer and connective linkage around the core features of ecological value, ensuring the long-term viability of remnants, and enabling the basalt-lava vegetation to expand and colonise surrounding areas over time (Figure 2).

2.2.2 Early records and other remnants

As reported in Esler (1991), Kirk 1871 described native lava field vegetation as typically comprising broadleaf forest dominated by titoki (*Alectryon excelsus*), houpapa (*Pseudopanax lessonii*), rangiora (*Brachyglottis repanda*), mangeao (*Litsea calicaris*) and shining broadleaf (*Griselinia lucida*). Furthermore, Kirk's description of Mt Wellington lava forest flora included abundant kawakawa (*Macropiper excelsum*), common rangiora and "a curious form of karamu" (*Coprosma macrocarpa*), along with *Astelia solandri*, *Peperomia urvilleana*, *Asplenium bulbiferum*, *Hymenophyllum flexuosum*, *H. dilatatum*, *Earina* sp. and *Metrosideros perforata*.

These native plants are likely to have formed main components of the forest surrounding Ann's Creek lava outcrops and the plants of smaller stature would also have been present on the lava outcrops. Of these species, only *C. macrocarpa* has been recorded at the subject site.

Esler (1991) notes that five rock-dwelling ferns mentioned by Kirk (*Cheilanthes humilis* (now *sieberi*), *C. distans*, *Pellaea falcata*, *P. rotundifolia* and *Asplenium flabellifolium*) have become difficult to find on Auckland volcanoes since 1975. At least three of these species (*C. sieberi*, *A. flabellifolium* and *P. rotundifolia*) occur at the subject site (Figure 3).

The above species, along with manuka (*Leptospermum scoparium*) and akeake, both previously recorded in abundance on embankments surrounding Ann's Creek (R. Gardner, pers. comm.), form a useful model for ecological restoration of the site.

While many of the original components of lava flow vegetation are no longer growing at the site, soil seed bank stores are expected to contribute to the recolonisation by some species when appropriate habitat is reinstated. An example of the site's potential for restoration was observed after disturbance by fire when a herbaceous rock-dwelling native species *Pelargonium inodorum* reappeared temporarily in the absence of competition from adventive species (Gardner 2001).



ANN'S CREEK LAVA MANAGEMENT PLAN



Figure 3: Rock ferns present at Ann's Creek (*Cheilanthes sieberi* on left, *Pellaea rotundifolia* on right).

3.0 MANAGEMENT PRIORITIES AND METHODS

3.1 Overview of Issues

Despite the severely degraded condition of shrubland remnants on lava outcrops, a healthy juvenile cohort of plants was observed during the most recent survey. Hence the proposed management approach is to minimise seed and seedling predation and undertake an intensive programme of selective weed control to facilitate natural regeneration. The abundance nitrogen-fixing weeds (e.g., gorse and wattle) throughout the lava shrubland communities may influence community composition as these plants modify soil conditions through nutrient enrichment and soil accumulation. Nevertheless, the senescent gorse is proving to be a useful nurse crop for shrubland species (especially akeake and to a lesser extent *Coprosma crassifolia*), hence gorse cover is to be retained with emphasis on weed control to prevent competitive exclusion by more vigorous exotic species.

Some of the recommended weed control and revegetation work is situated in close proximity to rail lines. Teams responsible for undertaking this work should liaise closely with Kiwirail, undertake appropriate Health & Safety inductions, and prepare a detailed, site specific safety management plan for the operation.

3.2 Weed Control




3.2.1 Basalt outcrops

All basalt outcrops are heavily weed infested. Careful, selective and systematic weed control is required to remove weed infestations from basalt outcrops and surrounding embankments without disturbing remnant populations of desirable plants, especially in areas where sparse indigenous flora populations are interspersed throughout heavily weed-infested areas. Ongoing monitoring and control will be required to prevent re-infestation. Table 1 identifies target species and gives some guidance on a range of appropriate control methods and follow-up required. In general, weed control measures proposed have been selected to reduce the amount and toxicity of herbicide used, and minimise non-target mortality.

Note that the suitability of control method, frequency and duration of weed control for a given species can vary depending on site conditions, hence a reputable operator with expertise and a proven track record working in sensitive ecological areas will be required, and part of their role will be to develop "best practice for the site".

ANN'S CREEK LAVA MANAGEMENT PLAN

Table 1: Target species and control methodology¹.





Pest Plant species	Description	Location on site	Options for control	Timing & follow-up
<i>Asparagus asparagioides</i> smilax	 Climbing perennial creeping herb <3m. Grows from short rhizomes with tuberous roots. Smallish glossy thin green leaves, alternate, broadly ovate, with sharp point. Small greenish-white flowers (Jul-Aug). Small sticky red berries.	Interspersed in small to large patches and as scattered individuals throughout outcrops and embankment.	<ul style="list-style-type: none"> Grub out small scattered plants, ensuring all tubers are removed. Cut vines 60cm above ground, spray lightly (away from desirable vegetation) (200ml glyphosate+20ml penetrant/10L) 	Initial herbicide control in spring-early summer. Follow-up at 2 monthly until no further seedlings emerge in three successive monitoring rounds.
<i>Asparagus scandens</i> , climbing asparagus	 Scrambling & climbing plant. Slender, extensively branched stems wrap around small trees & saplings. Fine, fern-like foliage, small, delicate leaves attached to hook vines. Tiny white flowers (Sept-Dec). Many round, berries ripen green to red-orange.	Interspersed in small to large patches and as scattered individuals throughout outcrops and embankment.	<ul style="list-style-type: none"> Grub out small scattered plants, ensuring all tubers are removed. Spray lightly to avoid runoff, total coverage not required (200ml glyphosate/10L). Pull vinea away from desirable plants. 	Initial herbicide control in spring-early summer. Follow-up at 2 monthly until no further seedlings emerge in three successive monitoring rounds.
<i>Alternanthera philoxeroides</i> , Alligator weed	 Hairless perennial, roots in <2m water; also grows on land. White clover-like flowers (summer). Waxy green leaves in opposite pairs with midrib. Hollow stem. Green-brown stems often red tinged; roots at nodes.	Small patches in raupo swamp adjacent to earthworks.	<ul style="list-style-type: none"> Dig out small patches removing all stem fragments; check for regrowth. Spray aquatic sites (200ml glyphosate/10L, in formulation approved for use over water). Spray terrestrial sites spring - autumn (5g metsulfuron + 10ml penetrant/10L). Take extreme care around waterways. 	Follow up every 2 months until no further seedlings emerge in three successive monitoring rounds.

¹ Photos, species descriptions and control methods are taken/ adapted from Biosecurity pages of Auckland Council website.





ANN'S CREEK LAVA MANAGEMENT PLAN

Pest Plant species	Description	Location on site	Options for control	Timing & follow-up
<i>Araujia hortorum</i> , Moth plant	 Slender evergreen. Arrow-like, opposite leaves, dark green on top, grey-green below. Small cream coloured, waxy, tubular flowers (Dec-May). Abundant parachute-like seeds from choko-like seed pods (autumn - winter).	Local patches on weed infested embankment and margins of basalt outcrops.	<ul style="list-style-type: none"> Dig and pull out seedlings. Cut near ground and stump paint (10ml Tordon BK/1L or Vigilant gel). If using Vigilant gel, paint approx. 20cm of the stem below the cut as well. Remove all seed pods and dispose of in landfill. 	Initial herbicide control in summer. Follow up every 2 months until no further seedlings emerge over an entire spring/ summer season.
<i>Chrysanthemoides monilifera</i> Boneseed	 Much-branched shrub <2m tall. Young stems woolly. Leaves smooth, leathery, oval to elliptic & irregularly serrate. Bright yellow, daisy-like flowers (Sept-Feb). Round, green drupes, ripening to black.	Scattered individuals, generally in open shrubland on basalt outcrops.	<ul style="list-style-type: none"> Hand pull all but the largest plants. Stump paint (100ml glyphosate /1L or 1g metsulfuron/1L or Vigilant gel). 	Initial herbicide control in spring – early summer. Follow up control of seedlings at 6-monthly intervals until no further seedlings emerge in three successive monitoring rounds.
<i>Cortaderia selloana</i> pampas	 Clump-forming grasses <4m tall. Leaves with cutting edges, dark green with hairs on underside of midrib, bluish green above; dead leaves spiral like wood shavings. Showy, erect, white seedheads (Feb-late May).	Scattered clumps in open sites on basalt outcrops; dense sward on bund adjacent to watercourse south-eastern margin of site.	<ul style="list-style-type: none"> Grub out small plants. Spray dense sites where non-target damage is unlikely in summer-autumn (150ml haloxyfop+ 50ml crop oil/10L). 	Foliar spray summer – autumn. Follow-up at least 6-monthly until no further seedlings emerge in three successive monitoring rounds. The extensive sward of pampas adjacent to the railway line constitutes a fire risk, especially once dead. Pampas on the bund should be cut back and removed following treatment due to risk of ignition by sparks thrown from passing trains.
<i>Delairia odorata</i> , German ivy	 Perennial climber. Thin ivy-like leaves on smooth stems with small ear-like projections at base of the leaf stalks. Clusters of yellow daisy-like flowers (May-Oct) without ray florets (petal like flowers). Small, dry hard windborne one-seeded fruit.	Abundant on weed infested embankment and on landward margins of basalt outcrops. Local patches beneath senescent gorse canopy.	<ul style="list-style-type: none"> Grub out scattered plants & seedlings. Cut & paint stems (1g metsulfuron/1L or 100ml glyphosate/1L). Cut stems below waist height, spray remaining foliage (100ml glyphosate+20mlpenetrant/ 10L or 2g metsulfuron +10ml oil/10L). 	Initial herbicide control in spring – early summer. Follow up control of seedlings at 6-monthly intervals no further seedlings emerge in three successive monitoring rounds.




ANN'S CREEK LAVA MANAGEMENT PLAN

Pest Plant species	Description	Location on site	Options for control	Timing & follow-up
<i>Hedychium gardenianum</i> , Kahili ginger	 Herbaceous perennial plants <2m tall. Large, branching rhizomes that form dense layers <1m deep. Broad (20-45 x 10-15 cm), oval-lanceolate, glossy leaves. Large spikes of yellow flowers (Feb-Apr) with conspicuous red stamens.		penetrant/10L). <ul style="list-style-type: none"> Young seedlings can be hand pulled, taking care to remove strings of rhizomes. Slash stems & dig out all rhizomes. Cut above pink "collar" at base & stump paint (1g metsulfuron/1L). Spray dense patches away from roots of vulnerable species, spring - late autumn (5g metsulfuron + 10ml penetrant/10L). 	Maintain rolling front of control, work in from edge of infestation. Follow up at 6 monthly intervals no further seedlings emerge in three successive monitoring rounds.
<i>Lantana camara</i> lantana	 Woody, aromatic perennial shrub <3m high. Brittle, sprawling, scrambling stems. Yellow-green to dark green, pungent-smelling leaves, opposite, rough, strongly veined & serrated. Clusters of yellow, pink, red or orange flowers. Green fruit ripening to a glossy purple-black (summer).	Single shrub noted on landward margin of basalt outcrop, near weedy embankment.	<ul style="list-style-type: none"> Cut & stump paint (200ml glyphosate/1L). 	Year round. Check in following season to ensure stump has not resprouted.
<i>Ligustrum lucidum</i> , tree privet	 Evergreen tree (generally <10m high). Dense foliage of dark green, glossy oval leaves, pointed tips, smooth edges. Long panicles of strongly scented white flowers (Nov-Mar). Berry-like bluish or purplish-black drupes.	Mainly in stands of woody exotic vegetation where weedfield on pavement adjoins western margin of basalt outcrops.	<ul style="list-style-type: none"> Pull or dig seedlings. Cut & stump paint (1g metsulfuron/1L). All year round drill 1 hole per 20cm stem diameter & fill each hole with 2g metsulfuron (dissolved in approx. 50ml water). 	Follow up at 6 monthly intervals no further seedlings emerge in three successive monitoring rounds.
<i>Ligustrum sinense</i> , Chinese privet	 Semi-deciduous shrub reaching 5m tall. Dense foliage of dull green leaves with a rounded tip and a hairy midrib on the underside. White tubular flowers (Oct-Mar) with purple or mauve anthers.	Scattered to locally common throughout areas of gorse scrub and mixed woody exotic vegetation on basalt outcrops.	<ul style="list-style-type: none"> Pull or dig seedlings. Cut & stump paint (1g metsulfuron/1L). All year round drill 1 hole per 20cm stem diameter & fill each hole with 2g metsulfuron (dissolved in approx. 50ml water). 	Follow up at 6 monthly intervals until no further seedlings emerge in three successive monitoring rounds.

ANN'S CREEK LAVA MANAGEMENT PLAN

Pest Plant species		Description	Location on site	Options for control	Timing & follow-up
<i>Lonicera japonica</i> , Japanese honeysuckle		Evergreen climber, can grow <15m/year. Oval leaves, lighter green underneath; in winter or low light conditions may be toothed or cut. Fragrant, paired, white or yellow tubular flowers (Sept-May). Black berries.	Locally common in weedfield on embankment surrounding lava flows; locally present in open sites on outcrops.	<ul style="list-style-type: none"> • Cut & dig roots out. • Cut & paint (5g metsulfuron/1L or 200ml Tordon BK /1L or Vigiant Gel). • Large vines can be cut at head height & sprayed below (5g metsulfuron + 10ml penetrant/10L or 60ml Tordon BK/10L). 	Initial herbicide control in summer. Follow up at 6 monthly intervals until no further seedlings emerge in three successive monitoring rounds.
<i>Paraserianthes lophantha</i> , Brush wattle		Woody evergreen tree <5m high. Frond-like leaves divided into 20-40 pairs of leaflets giving a feathery appearance. Silky down on underside of leaflets. Greenish-yellow flowers (May-Aug) in bottlebrush-like heads. Long, flat, green pods containing hard-coated black seeds.	Scattered to locally common throughout areas of gorse scrub and mixed woody exotic vegetation on basalt outcrops. Abundant regeneration on earthworks adjacent to raupo swamp.	<ul style="list-style-type: none"> • Hand pull seedlings. • Cut larger trees & stump paint (5g metsulfuron/ 1L). 	Initial herbicide control in summer. Follow up at 6 monthly intervals until no further seedlings emerge in three successive monitoring rounds.
<i>Rubus fruticosus</i> , blackberry		Scrambling, thorny perennial shrub, forms thickets <2m tall formed by arching stems or canes <7m long. Dark green leaves, partially shed in winter. Small white or pink flowers (Nov-Apr). Sweet purplish berries (Jan-Mar).	Mainly in weedfield on landward margin of basalt outcrops. Also present in rank grassland in southeastern corner of site.	<ul style="list-style-type: none"> • Dig out small patches. • Stem scrape and paint (glyphosate 100mls/100mls) immediately. • Cut and paint (glyphosate 200-500mls/1L). Only for small patches. 	Initial herbicide control in summer. Follow up at 6 monthly intervals for at least 3 years or until clear.
<i>Solanum mauritianum</i> , woolly nightshade		Shrub or tree <8m tall. Kerosene odour. greyish-green on upper surface, white to yellowish green beneath, covered in dense felt-like hairs. Clusters of purple flowers at end of branches, yellow berries with many seeds.	Sparsely interspersed through gorse scrub and shrubland on lava outcrops.	<ul style="list-style-type: none"> • Pull up all small plants; • Cut & stump paint or frill (100ml/L Tordon BK or triclopyr 100ml/1L or picloram gel). 	Follow-up at 3 monthly intervals for at least 3 years or until clear.

ANN'S CREEK LAVA MANAGEMENT PLAN

Pest Plant species	Description	Location on site	Options for control	Timing & follow-up
<i>Syzygium smithii</i> , monkey apple	 Evergreen tree <18m tall. Shiny, oval, opposite leaves. Bunches of whitish flowers (Oct-Jan). Heavy crops of white to pink-mauve, berry-like fruit.	Scattered trees in mixed woody exotic vegetation, mainly on landward margin of basalt outcrops.	<ul style="list-style-type: none"> • Pull or dig out seedlings. • Cut or drill hole every 10cm stem diameter & fill each cut or hole with 2g metsulfuron (dissolved in approx. 50ml water). • Cut & stump paint (5g metsulfuron/1L). 	Herbicide treatment can be undertaken year round. Follow up annually for at least 3 years or until clear.
<i>Tradescantia fluminensis</i> Tradescantia	 Hairless, succulent creeping plant <50cm tall. Alternate, oval, shining leaves form a sheath around stem. Clusters of white star-shaped flowers (Aug-Nov).	Locally abundant beneath gorse scrub on basalt outcrops (especially adjacent to raupo swamp) and in weedfield on surrounding embankment.	<ul style="list-style-type: none"> • Rake or hand pull small areas during a dry period, working towards centre of infestation. • Weed wipe (250ml triclopyr/L). • Spray larger areas away from desirable vegetation (60ml triclopyr + 10ml penetrant/10L or 300ml glyphosate + 30ml penetrant/10L near waterways). 	Initial herbicide treatment in early summer. Follow up within 2-3 months before plant recovers. 2-3 treatments needed for total control.
<i>Ulex europaeus</i> , gorse	 Erect, spiny, much-branched perennial shrub <2m tall. Green-brown spiny stems & branchlets, woody when mature. Bright yellow pea-like flowers (May-Nov), black seed pods explode in summer.	Forms extensive scrub and shrubland and scrub across much of the basalt substrate.	No control as canopy appears to be undergoing natural large-scale dieback.	Monitor and review annually for signs of significant regeneration.



ANN'S CREEK LAVA MANAGEMENT PLAN

3.2.2 Surrounding embankment

The embankment (including basalt pavement and unconsolidated fill substrates) on the landward margin surrounding the basalt outcrops is largely devoid of indigenous vegetation, and foliar herbicide spray is appropriate to remove the dense, weedy sward covering this area prior to replanting. However, this area and the immediate surrounds is the main location for *Geranium solanderi*, hence care is required to identify and avoid any *Geranium solanderi* populations. Due to the dynamic nature of the population, a botanist with expertise distinguishing *Geranium solanderi* from the common exotic *Geranium* species present should survey the site immediately prior to herbicide treatment, clearly mark any populations discovered, and show them to the weed control operator undertaking the work.

3.3 Pest Animal Control

3.3.1 Overview

Faecal pellets have indicated the presence of rabbit and possum populations within the site during previous surveys, while rats are ubiquitous throughout Auckland's urban and natural environments wherever they are not actively controlled. Seed and seedling predation by these three species is likely to adversely affect regeneration of indigenous shrubland, while rats (and to some extent possums) are also a threat to prospective bird and lizard populations. Pest animal control is to be ongoing to ensure pest animals stay at target levels.

Pest animal control will be undertaken by professional contractors, targeting rabbits, rats and possums together with revegetation of embankments and restoration of lava shrubland remnants. Animal pest management will follow best practice guidelines and protocols for monitoring and control of rabbits, rats and possums. The following information on target species is summarised from National Pest Control Agencies Guidelines (NZPCA 2009a, 2009b, 2010 & 2012) and advice from Auckland Council's technical staff.

3.3.2 Rabbits

An individual rabbit's daily food requirement is approximately 500g wet weight of vegetable matter. Under favourable conditions, rabbits breed throughout the year. Gestation is 28-30 days, and the female usually becomes pregnant within 12 hours of giving birth and may produce three to seven litters (average litter size is 5-6) in a year. Average life expectancy for feral rabbits is 18 months, with mortality mainly due to disease or predation by cats, mustelids and harrier hawks.

Rabbits will be controlled using poison bait (Pindone). The optimum time to poison rabbits depends on their breeding condition and the effects of this on territoriality. March to August, immediately prior to the main rabbit breeding season, is the optimum time for poisoning. August to February is breeding season and poisoning during this time is difficult due to territorial behaviour and an abundance of natural food.

Daytime monitoring of rabbit populations will be undertaken using the modified McLean Rabbit Infestation Scale (NZPCA 2012) to provide population trend data and establish whether the target control threshold (1 on the MMS) has been reached.

3.3.3 Possums

Possums can live for more than 12 years. Females usually breed after their first year and typically bear one offspring per year in the autumn (March-May). If abundant food is available they may give birth again in spring (September-November). The young remain with their mothers for 5-8 months, after which males, and to a lesser extent females, may disperse up to 20 km.

Possum control will be undertaken using Timms traps and bait stations containing Broadifacoum (Pestoff) pellets. Stations are to be filled 3-4 times over a 2-3 week period, 3-4 times per year (December / January, April / May and August / September). Control measures will be ongoing for the duration of the pest control interval, while possum population monitoring will be undertaken at least annually using the wax tag protocol



ANN'S CREEK LAVA MANAGEMENT PLAN

set out in NZPCA (2010). If wax tag monitoring indicates little activity, Timms traps (or similar, provided they are humane and are designed to avoid harming non-target fauna) can be used for 'maintenance' control.

3.3.4 Rats

Rats can breed throughout the year if conditions are suitable, with a female producing up to five litters a year. Gestation is 21 days, and litter sizes range from 7 to 14 offspring. Rats reach sexual maturity in about five weeks and can live up to three years although the premature mortality rate is high. Bush-dwelling rats are seed predators, as seeds are a key nutrient source during winter when animal protein (invertebrates, lizards, eggs and chicks) is in short supply.

Rat control will be undertaken year-round, utilising bait stations set up for possums, provided bait station grids are at a small enough scale (i.e., spaced at 50 m intervals). Following each interval of possum control, baits will be switched to D Block Diphacinone (bait stations can be serviced every 4 to 6 weeks unless baits are depleted more rapidly than this). A further seasonal pulse of control will be undertaken in late winter / early spring will use rat traps in combination with toxic baits to achieve a rapid knockdown of the population prior to an increase in the abundance of food resources.

3.3.5 Post operation reporting

Reports for all pest control and monitoring operations will include:

- Locations of bait / monitoring stations (GPS reference and map)
- Date of toxic baiting, quantity of bait distributed, and quantity recovered
- Weather conditions for each day
- Evidence of pest species activity (monitoring stations and casual observations)
- Any other field observations that may have affected the operation
- Names of the field staff responsible for the operation

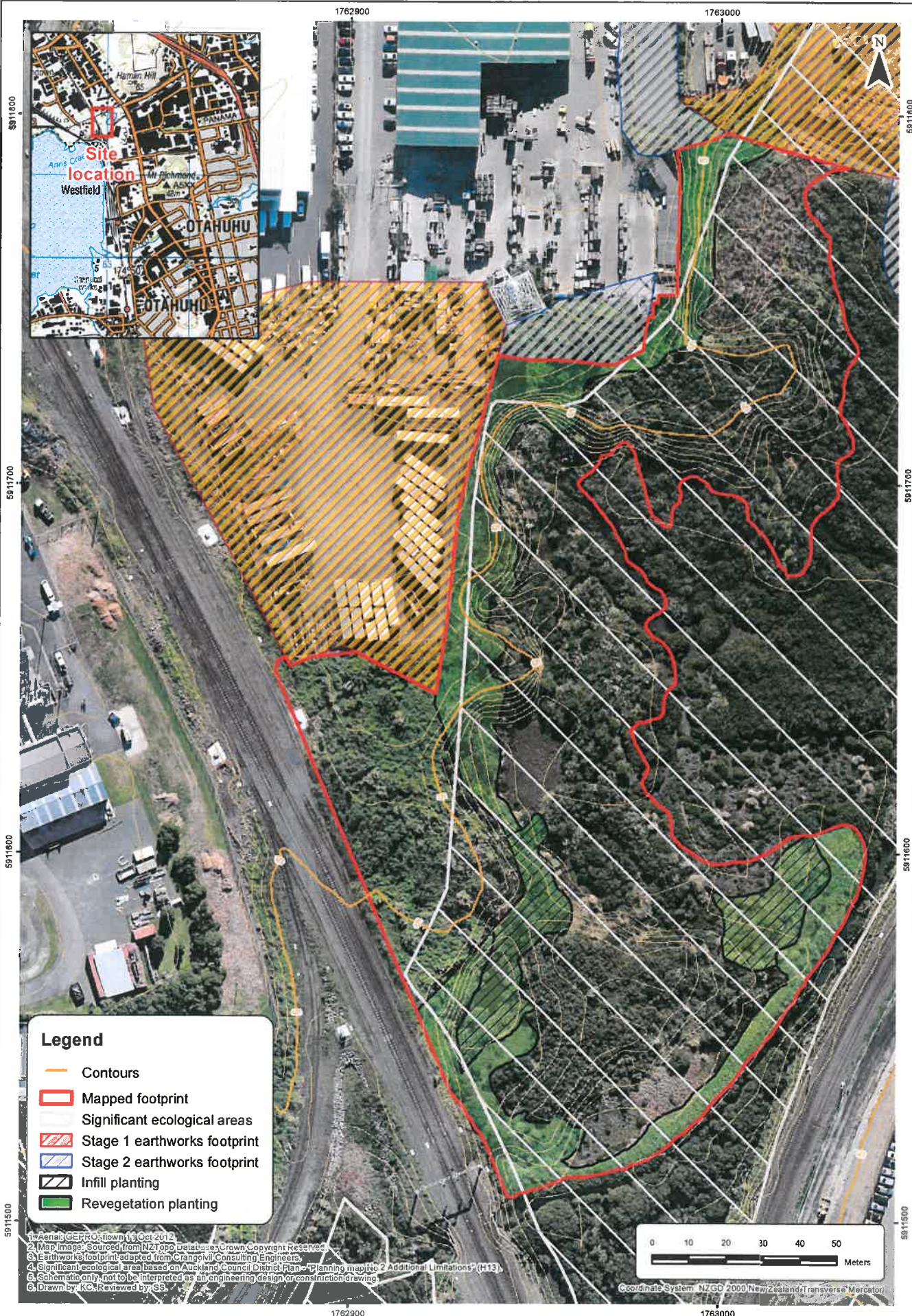
3.4 Restoration of Lava Shrubland

3.4.1 Restoration of basalt outcrops

Facilitation of natural regeneration by removal of browsing weeds and weed competition is the preferred method restoring of lava shrubland communities on basalt outcrops, therefore no planting is proposed over most of this portion of the site, including all areas currently vegetated in gorse and scrub, as shown in Figure 4.

Local infill planting is proposed over small portions of lava outcrops (approximately 0.2 ha; refer Figure 4) where removal of woody weeds is likely to cause significant disturbance, or where the grass and weedfield sward is so dense that further natural seedling establishment is likely to be inhibited.

Infill planting will comprise plant material recovered from the site as seed, translocated seedlings, or seedlings germinated from the soil seed bank (Table 2). Root trainers planted at relatively high densities (0.25 m spacings, or 4 per m²) are recommended for mass plantings on steep or exposed sites where the substrate comprises thin soil over basalt rock, as smaller plants are expected to adjust more readily to the harsh conditions. Otherwise, larger (PB3) specimens will be used.





ANN'S CREEK LAVA MANAGEMENT PLAN

Table 2: Plant schedule for infill plantings.

Species	Spacing (approx.)	No. of specimens	Size
<i>Coprosma crassifolia</i>	2.5 m	100	PB3
<i>Dodonaea viscosa</i> / akeake	2.5 m	100	PB3
<i>Pittosporum crassifolium</i> / karo	2.5 m	80	PB3
<i>Coprosma repens</i> / taupata	2.5 m	60	PB3
<i>Olearia solandri</i>	2.5 m	60	PB3

3.4.2 Revegetation of 'Buffer Areas'

Mangrove scrub currently provides shelter and protection to surrounding estuarine margins of the basalt outcrops containing lava shrubland, however the landward margins of the outcrops provide little protection but harbour pest fauna and are a source of weed propagules to the shrubland area. These prospective 'buffer' areas, including steep embankments that extend around the northern and western margins of the outcrops, will be revegetated to establish a scrub/shrubland using species propagated from the site.

A continuous strip of harakeke / flax (*Phormium tenax*) planted along the terrestrial outer edge of buffer areas (adjacent to railway tracks and industrial areas) will buffer weed encroachment in these areas and help prevent sparks generated from passing trains from penetrating the site and causing an outbreak of fire. The target for revegetation is achieving 80 % cover. This plan anticipates that this target will be achieved 3 years after commencement.

Planting is divided into the following four zones:

- 1) Basalt pavement (5 m wide strip of the flat area along the top of the embankment on the western margin of basalt outcrops).
- 2) Steep embankments on western margin of basalt outcrops.
- 3) Toe of embankments adjoining wetland or open water.
- 4) Bund alongside the watercourse adjacent to the railway line.
- 5) Planting schedules for each of these zones is set out in Table 3, Table 4 Table 5 and Table 6.

Table 3: Plant schedule for basalt pavement.

Species	Spacing	No. of specimens	Size
<i>Muehlenbeckia complexa</i> / pohuehue	1 m	255	PB3
<i>Phormium tenax</i> / flax	0.5 m	1000	root trainers

Table 4: Plant schedule for embankments.

Species	Spacing	No. of specimens	Size
<i>Leptospermum scoparium</i> / manuka	0.5 m	2,000	root trainers
<i>Dodonaea viscosa</i> / akeake	1 m	2500	PB3
<i>Coprosma crassifolia</i>	1 m	1900	PB3
<i>Pittosporum crassifolium</i> / karo	1 m	1200	PB3
<i>Coprosma repens</i> / taupata	1 m	1200	PB3
<i>Olearia solandri</i>	1 m	1200	PB3



ANN'S CREEK LAVA MANAGEMENT PLAN

Table 5: Plant schedule for toe of embankment.

Species	Spacing	No. of specimens	Size
<i>Plagianthus divaricatus</i>	1 m	510	PB3
<i>Olearia solandri</i>	1 m	190	PB3
<i>Muehlenbeckia complexa/ pohuehue</i>	1 m	190	PB3
<i>Apodasmia similis/ oioi</i>	0.5 m	1530	PB3

Table 6: Plant schedule for bund.

Species	Spacing	No. of specimens	Size
<i>Phormium tenax/ flax</i>	0.5 m	1500	root trainers

3.4.3 Planting specifications

Where possible, seed should be sourced from the site, ideally from a number of healthy individuals to maintain genetic diversity, and grown under contract at a suitable nursery. The composition of planted vegetation should comprise species or genetic stock from Manukau Harbour or comparable lavafield vegetation within the Tamaki Ecological District, and should exclude taxa that may have the potential to outcompete, or hybridise with, local remnant populations. In particular, planting of any *Coprosma* species sourced off-site should be avoided, to minimise the potential for hybridisation which could compromise the value of the site as a source of "type specimens" for *Coprosma crassifolia*.

Following site preparation, planting should be undertaken between May and July to allow roots to establish prior to the onset of spring and summer when soils may become dry. Revegetation must occur in the first planting season post earthworks.

The plants recommended for revegetation are pioneer (early successional) species and specialise in growing on exposed open sites that are hotter and drier than those shaded by trees or shrubs. Pioneer species grow rapidly and if closely planted will quickly establish vegetative cover across the site and reduce the opportunity for weed invasion. Small plants (root trainer size) should be spaced at a maximum of one metre intervals to ensure rapid canopy closure. Other native species will establish naturally leading to greater forest diversity. Natural processes should dictate the regeneration of forest canopy species, rather than intentional planting for forest diversity.

Maintenance of the revegetation will be required until canopy closure is achieved (an estimated three year period). Periodic release of plantings using hand-pulling, cut and paint, and if necessary, carefully conducted spot spraying, should be carried out at least six monthly. Infill plantings will be required to replace dead or diseased plants to ensure light wells do not develop within the canopy, as these are likely to be sites of weed invasion.

3.5 Preservation of Native *Geranium* Populations and Habitat

G. solanderi and *G. retrorsum* are now uncommon plants in the north island of New Zealand (Gardner 1984). Both species have been previously recorded within the subject site, growing on lava outcrops (tongues) and lava cliffs. *G. solanderi* appears to be relatively abundant while *G. retrorsum* is either extremely sparse or absent. Seed of both species may be present within these areas in soil seed banks.

Monitoring for *G. retrorsum* should be undertaken on basalt outcrops over two the summer seasons following initial weed control to determine whether it reappears from the soil seed bank. Soil plugs will also be removed from previously colonised sites to attempt recovery via germination from soil. If these methods are unsuccessful, *G. retrorsum* will be re-introduced to the site from the Auckland Botanic Gardens population.



ANN'S CREEK LAVA MANAGEMENT PLAN

Recommended management of the native geranium populations and habitat is as follows:

- Identify and delineate populations to ensure these are not lost when weed control is undertaken (refer Section 3.2.2).
- Colour photographs of each geranium species will be supplied to all contractors involved in weed control, with a written description of characteristics and key habitats where these plants may occur.
- Only suitably qualified and experienced contractors with a good botanical knowledge should be selected for carrying out weed management operations.
- Undertake weed control at the time of lowest risk to geranium populations. Native geraniums germinate in autumn, grow throughout winter, flower and produce seed in spring, then die back in summer. Hence herbicide weed control within areas of known geranium habitat (lava outcrops, lava cliffs and adjacent to railway line) should be undertaken during late summer/ autumn, following flowering and seed production.
- The over-riding goal of ecological restoration of the site is to reduce invasive weed populations and facilitate recovery of native lava shrubland communities. If weed management of lava outcrops and lava cliffs over summer months (as proposed to protect geranium populations) is insufficient to reduce weed populations to the required (low) densities, weed control should be undertaken throughout the year as required, taking care to avoid any geranium plants unless positively identified as non-threatened species.

4.0 COORDINATION WITH OTHER SITE WORKS

This management plan has been updated to reflect the proposed Stage 1 works as required by Condition 8 of the Environment Court Decision No. [2011] NZEnvC 326 (4 October 2011).

Condition 8 requires this plan to include details of how management and restoration works proposed will be integrated and coordinated with other development and environmental mitigation works proposed by this consent. Works associated with Stage 1 are confined to the northern corner of the site and do not impinge on or affect the lava shrubland areas, or influence the scheduling and implementation of the LSMP.

Nevertheless, clear delineation of the extent of basalt outcrops and associated buffer areas on-site and in updated site contour maps is a key priority in order to ensure these features are recognised and accommodated in subsequent stages of works.

A review and revision to this LSMP is required if subsequent plans for site works in the vicinity impinge on the footprint of the lava shrublands, or have the potential to affect the functioning of the lava shrubland ecosystem present on site as a result of site works.

5.0 SUMMARY OF WORKS SCHEDULE

The following Table 7 and Table 8 provide a schedule of management and monitoring tasks to take place in the lava shrubland (Consent Condition 8b). The timing of works is planned in order to comply with Condition 9 which states that the plan is to be implemented within 12 months of completion of bulk earthworks (February/March 2014).



ANN'S CREEK LAVA MANAGEMENT PLAN

Table 7: Programme of implementation for ecological management works.

Management Task	Commence	Duration
Weed control	Weed control on basalt outcrops and clearance of weeds from 'buffer' area to be undertaken in summer 2013/2014.	Follow up control in buffer area at quarterly intervals for three years after plantings are established. Weed control in lava shrubland area to be progressive and ongoing, with monitoring to determine requirements for facilitation and maintenance of natural regeneration, and/or restoration planting at a microsite scale.
Animal Pest Control	Possum and rat control to commence in December/January 2013/2014. Rabbit control to commence between March-Aug 2014.	Ongoing monitoring and control to ensure pest animals stay at or below target levels.
Collection and propagation of plant material from site	Collection of plant and seed material to commence in summer 2013/2014.	Collection and propagation of plant material likely to require two to three years in order to compile sufficient stock for revegetation plantings.
Ordering of supplementary plant material for buffer planting	December/January 2013/2014	Initial stock order for bulk plantings to obtain appropriately eco-sourced material for 2014 planting season.
Revegetation	May - July 2014	Initial cover of buffer planting (manuka, pohuehue, flax) to be established in 2014/2015, and maintained and for three years following planting, with evaluation of plant condition at two years of age to determine whether further maintenance over and above this interval will be required. Infill planting revegetation using plant material sourced from the site will be undertaken incrementally, with a completion target of five years after commencement (the rate of progress may be constrained by the availability of plant material from the site).



ANN'S CREEK LAVA MANAGEMENT PLAN

Table 8: Monitoring programme to evaluate progress of ecological management works.

Monitoring Task	Frequency	Deliverable
Animal pest monitoring	Data compiled at each site visit to restock bait stations/reset traps.	Monitoring reports to be provided at quarterly intervals with an annual review to appraise progress and assess need for modification to approach.
Weed control audit	Assess efficacy of weed control in buffer area prior to replanting; compiled at each site visit to undertake follow-up control.	Monitoring reports to be provided at quarterly intervals with an annual review to appraise progress and assess need for modification to approach.
Revegetation	Plant health to be assessed at three monthly intervals.	Monitoring reports to be provided at three monthly intervals with recommendations for replacement planting if mortality is observed. Review report at two years to evaluate plant condition and determine whether further maintenance over and above the three year 'viability' target will be required.
Restoration of lava shrubland	Progress against detailed planting/restoration plan to be assessed at quarterly intervals.	Monitoring reports to be provided at quarterly intervals with an annual review to appraise progress and assess need for modification to approach.

6.0 CONCLUSIONS

The key objectives are to facilitate recovery of lava-shrubland remnants on basalt outcrops and ensure that rare and scientifically important plant species are protected. In order to achieve this, it is recommended that plant and animal pest control is undertaken to allow natural regeneration of lava-shrubland vegetation from seed sources present within the site and surrounding coastal margin. A buffer of mangroves and revegetated coastal embankments will be retained to connect and buffer shrubland patches.

Control of plant and animal pests is a key priority and must be undertaken during the initial phase of restoration to protect threatened species, allow natural regeneration of shrubland communities and ensure successful revegetation of embankments. Ongoing monitoring and maintenance is required to detect and control new incursions.

7.0 REFERENCES

- Cameron EK 1999. Mt. Eden rock forests. *Auckland Botanical Society Journal* 54(2):46-54.
- Esler AE 1991. Changes to the native plant cover of urban Auckland, New Zealand. *New Zealand Journal of Botany* 29:177-196.
- Gardner RO 1984. *Geranium solanderi* and allies in New Zealand. *New Zealand Journal of Botany* 22: 127-134.
- Gardner RO 1993. Botany of Ann's Creek (Southdown Lava Flats). Report to Planning and Development Services, Auckland City Council.



ANN'S CREEK LAVA MANAGEMENT PLAN

Gardner RO 2001. I've seen this place from the train: Bot Soc visit to Ann's Creek and Hamlin's Hill, 18th August 2001. *Auckland Botanical Society Journal* 56(2):69.

Norton DA, Roper-Lindsay J 2004. Assessing significance for biodiversity conservation on private land in New Zealand. *New Zealand Journal of Ecology* 28 (2): 295-305.

National Pest Control Agencies 2009a. Private land owners' guide to possum control- control tools and techniques. Good practice guideline A3.

National Pest Control Agencies 2009b. Kill traps - a guideline to trap possums, ferrets, stoats and feral cats using kill traps. Good practice guideline A4.2.

National Pest Control Agencies 2010. Possum population monitoring using the waxtag method. Good practice guideline A2.

National Pest Control Agencies 2012: Pest rabbits monitoring and control. Good practice guideline A5.

Preston-Jones H 2001. Botanical Society field trip to the Otuaatua Stonefields. *Auckland Botanical Society Journal* 56(1): 6-8.



APPENDIX A

Report Limitations



ANN'S CREEK LAVA MANAGEMENT PLAN

Report Limitations

This Report/Document has been provided by Golder Associates (NZ) Limited ("Golder") subject to the following limitations:

- i) This Report/Document has been prepared for the particular purpose outlined in Golder'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 Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder 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 Golder in regards to it.
- iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder 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. Golder's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed Golder 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 Golder for incomplete or inaccurate data supplied by others.
- vii) The Client acknowledges that Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all of its subconsultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golder'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 Golder'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. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report/Document.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australia & NZ	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

AUCKLAND

Tel +64 9 486 8068
 Fax +64 9 486 8072

Level 2
 Nielsen Centre
 129 Hurstmere Road
 Takapuna
 Auckland 0622

PO Box 33-849
 Takapuna 0740

TAURANGA

Tel +64 7 928 5335
 Fax +64 7 928 5336

78 Maunganui Road
 Tauranga 3116

 PO Box 13611
 Tauranga Central
 Tauranga 3141

HAMILTON

Tel +64 7 859 2356
 Fax +64 9 486 8072

Room 31 in the Homestead
 Ruakura Research Centre
 10 Bisley Road
 Hamilton 3214

 PO Box 19-479
 Hamilton 3244

NELSON

Tel +64 3 548 1707
 Fax +64 3 548 1727

Level 3
 295 Trafalgar Street
 Nelson 7010

PO Box 1724
 Nelson 7040

CHRISTCHURCH

Tel +64 3 377 5696
 Fax +64 3 377 9944

Level 1
 214 Durham Street
 Christchurch 8011

PO Box 2281
 Christchurch 8140

DUNEDIN

Tel +64 3 479 0390
 Fax +64 3 474 9642

Level 9A
 John Wickliffe House
 265 Princes Street
 Dunedin 9016

PO Box 1087
 Dunedin 9054

Annexure A

TR GROUP LIMITED & AUCKLAND COUNCIL AGREED CONDITIONS 12 DECEMBER 2013

INTEGRATED CONSENT CONDITIONS – 781, 791 – 793 GREAT SOUTH ROAD,
PENROSE, AUCKLAND FOR TR GROUP LIMITED

1. GENERAL CONDITIONS

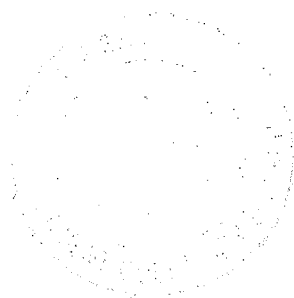
Interpretation

- 1.1 These conditions relate to the following activities/applications made by TR Group Limited to the former Auckland City Council and Auckland Regional Council in 2008:
- (a) R/LUC/2008/4724 – land use (earthworks, vegetation removal);
 - (b) 36055 – diversion and discharge of stormwater from new impervious surface;
 - (c) 36056 – earthworks/land disturbance associated with construction of new hardstand;
 - (d) 36058 – streamworks/culverting and reclamation;
 - (e) 30316 – disturbance and remediation of contaminated land;
- 1.2 Partial consent to the Applications was granted pursuant to an interim decision of the Environment Court (Decision No. [2011] NZEnvC 236) on 4 October 2011) (**attached**) (**Stage 1 Consent**), pending a final decision of the Environment Court on the balance of the Applications. A final decision on the Applications was issued by the Environment Court on 16 November 2011 (Decision No. [2011] NZEnvC 364). These conditions of consent apply to the additional works approved by the final decision of the Environment Court (**Stage 2 Consent**). Subject to conditions 1.3, 1.4, 7.8, 8.1 and 8.2, these conditions stand-alone from the conditions of the Stage 1 Consent and set out the conditions on which the additional (Stage 2) development works on the site may proceed.
- 1.3 Where the Stage 2 Consent Conditions conflict with the Stage 1 Consent, the Stage 2 Consent Conditions shall prevail.
- 1.4 For the avoidance of doubt the requirement for the wetlands component of the EMP (as per conditions 7.4 and 7.5) and the components of the EMP required by conditions 7.2(b) and 7.7 are mitigation in part for the Stage 1 Works, these conditions take effect, to the extent required by condition 7.8, on the grant of this consent by the Environment Court.
- 1.5 In these conditions the following terms have the following meanings:
- | | |
|------|--|
| Act: | means the Resource Management Act 1991 and further amendments. |
| AC: | means the Auckland Council. |



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

Applications:	means the applications described in condition 1.1.
ARI:	means Average Recurrence Interval.
Bulk earthworks:	means major cut/fill/waste works.
Commencement of works:	means the time when the Consent Holder informs the Manager in writing that earthworks are about to commence.
Consent Holder:	means T R Group Limited and includes its successor(s) in title or the approved transferees of any of the consents where required.
District Plan:	means the Auckland Council District Plan (Isthmus Section) (operative 1999).
Management Plans:	means the management plans described in condition 2.1 and 7.1.
Manager:	means the relevant Team Leader, Natural Resources and Specialist Input, Resource Consents of the Auckland Council; or nominated AC staff acting on the Manager's behalf.
Regional Plan:	means the Auckland Council Regional Plan: Air, Land and Water (operative in Part October 2010).
Site:	means the land located at 781 and 791-793 Great South Road, Penrose described respectively as Lots 1 and 3 DP328383 and Section 1 SOP 69440.
Stabilised:	means an area inherently resistant to erosion such as rock (excluding Sedimentary Rocks), or rendered resistant by the application of aggregate, geotextile, vegetation or mulch. Where vegetation is to be used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once an 80% vegetation cover has been established.
Stage 2 Consent Conditions:	means these conditions of consent.
Stage 2 Development Plans:	means the plans described in condition 1.12.
Stage 1 Works:	means the works authorised by the interim decision of the Environment Court (Decision No. [2011] NZEnvC 236) on 4 October 2011.



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

Stage 2 Works:	means the additional works (over and above the Stage 1 works) authorised by the final decision of the Environment Court (Decision No. [2011] NZEnvC 364) on 16 November 2011.
TP10:	means ARC Technical Publication No. 10, <i>Stormwater Management Devices: Design Guideline Manual</i> , May 2003.
TP90:	means ARC Technical Publication No. 90 <i>Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region</i> , March 1999.
TP108:	means ARC Technical Publication No. 108, <i>Guidelines for Stormwater Runoff Modeling in the Auckland Region</i> , April 1999.

- 1.6 For the purposes of this consent "approved" and "approval" means assessed by AC staff acting in a technical certification capacity, and in particular as to whether the document or matter is consistent with, or sufficient to meet, the conditions of this consent, such "approval" to be provided in a timely and reasonable fashion.

Charges and Site Inspection

- 1.7 Pursuant to section 36(1) of the RMA, these consents shall not be exercised until such time as all fixed charges in relation to the receiving, processing and granting of this resource consent are paid in full.
- 1.8 The Consent Holder shall permit the servants or agents of AC to have access to relevant parts of the property at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements and/or to take samples.
- 1.9 The Consent Holder shall ensure that all personnel working on the site shall be made aware of the Final Consent Conditions for the development of the site and have access to the contents of all associated and approved management plans.

Monitoring

- 1.10 The Consent Holder shall pay AC any actual and reasonable charge or charges incurred by the Council in monitoring compliance with the Final Consent Conditions as they fall due. Such further charges are to be paid within one month of the date of invoice.

Background Information

- 1.11 Except as amended or altered by these Stage 2 Consent Conditions the development shall be undertaken in general accordance with the relevant aspects of the background resource consent information submitted with the Applications as listed in Schedule 1.



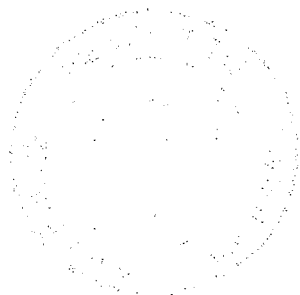
**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

Stage 2 Development Plans

- 1.12 Development of the site shall proceed in accordance with the following attached plans prepared by Crang Civil:
- (a) C200 Rev A (July 2013) – Stage 2 Earthworks Footprint.
 - (b) C201 Rev 0 (June 2013) – Stage 2 Earthworks Cross-Sections.
 - (c) C210 Rev A (August 2013) – Compiled Footprint Plan.
 - (d) C410 Rev A (July 2013) – Constructed Wetland Plan.
 - (e) C220 Rev A (August 2013) – Conservation Areas Plan.
 - (f) C167 Rev A (November 2013) – Marginal Strip/Public Access Stage 1 Plan.
 - (g) C166 Rev B (July 2013) – Marginal Strip/Public Access Stage 2 Plan
- 1.13 If there is any conflict between the Stage 2 Consent Conditions and the Stage 2 Development Plans, the Stage 2 Consent Conditions shall prevail.

2. PRE-CONSTRUCTION CONDITIONS

- 2.1 Prior to the commencement of works on site (excluding works previously authorized by, and undertaken in accordance with, the Stage 1 Consent), the Consent Holder shall submit to the Manager for review and approval the following plans:
- (a) Construction Management Plan (refer condition 3.1).
 - (b) Remediation Action Plan (refer conditions 3.4 to 3.9).
 - (c) Sediment and Erosion Control Management Plan (refer condition 4.1).
 - (d) Stormwater Management Plan (refer condition 5.1).
 - (e) Streamworks Methodology Plan (refer condition 6.1).
- 2.2 The specific requirements to be addressed in the Management Plans are identified in the conditions of this consent. Where a matter is required to be addressed in one of the plans, the requirement is to be treated as a condition of this consent. Any amendments to the Management Plans following first approval by the Manager shall be reviewed and approved by the Manager in writing prior to being implemented on site.
- 2.3 Prior to the commencement of the earthworks activity, the consent holder shall hold a pre-start meeting that:
- (a) is located on the Site;



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

- (b) is scheduled not less than 5 days before the anticipated commencement of earthworks;
- (c) includes an officer from the Earthworks and Contaminated Land Team, NRSI, Resource Consents, Auckland Council; and
- (d) includes representation from the contractors who will undertake the works.

The final approved SECMP shall be made available at the pre-start meeting. A pre-start meeting shall be held prior to the commencement of the earthworks activity in each period between October 1 and April 30 that this consent is exercised.

- 2.4 Within ten (10) working days following implementation and completion of the specific erosion and sediment control works referred to in conditions 4.1 to 4.15, and prior to the commencement of earthworks activity on the subject site, a suitably qualified engineering professional shall provide written certification to the Team Leader Earthworks and Contaminated Land, Resource Consents, AC4, that the erosion and sediment control measures have been constructed and completed in accordance with TP90 unless a different standard has been specifically approved by a condition. Written certification shall be in the form of a report or any other form acceptable to the Council and should include:

- (a) Documentation of construction of all erosion and sediment control practices including stabilised construction entrance, silt fences, etc.
- (b) Contributing catchment area to sediment retention structures;
- (c) Retention volume of sediment retention structures (dead storage and live storage measured to the top of the primary spillway);
- (d) Shape of sediment retention structures (dimensions of structure);
- (e) Position of inlets/outlets; and
- (f) Stabilisation of the structure.

3. CONSTRUCTION MANAGEMENT

Construction Management Plan

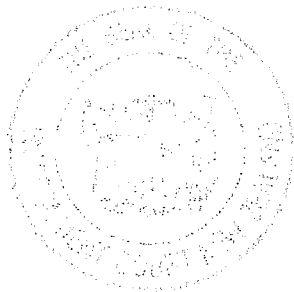
- 3.1 The Construction Management Plan (CMP) shall set out the specific details for the construction and management of the development works and, as a minimum, shall include:

- (a) Details of the site manager including their contact details (phone, facsimile, email, and postal address). A telephone number for after hour emergencies shall also be supplied.
- (b) The location of a large noticeboard on the site that clearly identifies the name, telephone number and address for service of the site manager.



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- (c) Any means of protection of services such as pipes and water mains within the legal road.
- (d) Measures to be adopted to protect the remaining significant ecological features on the balance of the site from damage or destruction during construction.
- (e) Measures to be adopted to maintain the site in a tidy condition in terms of disposal/storage of rubbish, storage and unloading of building materials and similar construction activities.
- (f) Location of workers conveniences (e.g. portaloos).
- (g) Procedures for controlling sediment run off and dust onto, and removal of soil, debris and construction materials from, public roads or places. This shall include details of a stabilised entry/exit point with wheel wash facilities being installed to minimise any contamination of the road reserves and drainage systems in accordance with the District Plan (Annexure 14 Silt and Sediment Control Measures) and TP90. There shall be no deposition of earth, mud, dirt or other debris on any public road or footpath resulting from earthworks activity on the site. In the event that such deposition does occur, it shall immediately be removed. In no instance shall roads or footpaths be washed down with water without appropriate erosion and sediment control measures in place to prevent contamination of the stormwater drainage system, watercourses or receiving waters.
- (h) The measures to be taken to control silt contaminated stormwater at all times during the earthworks in accordance with the District Plan (Annexure 14 Silt and Sediment Control Measures) and TP90.
- (i) Proposed hours of work on the site.
- (j) Management proposals for construction related traffic, including:
 - Measures to be adopted to ensure that pedestrian access past the site on the public footpaths is safe and not obstructed during works.
 - Proposed numbers and timing of truck movements throughout the day and proposed routes.
 - Location of vehicle and construction machinery access during the period of site works.
 - Measures to ensure that loading and unloading of vehicles is undertaken on the site at all times and that no reverse manoeuvring occurs onto Great South Road.
 - Vehicle parking for site works and sub-contractors.



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

- (k) A detailed description of procedures, methods and measures that will be used to ensure dust from development earthworks is controlled at a level to prevent excessive dust from being discharged to the air beyond the site boundary and in accordance with the Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, Ministry for the Environment (2001). Particular details must be provided of the procedures, methods and measures to be implemented to ensure that the discharge of dust and/or particulate matter from the earthworks activities within the site does not create any dust hazard or nuisance to:

- the switchyard, gas turbine intakes, and cooling towers at the Southdown Power Station; and
- Transpower's Henderson-Otahuhu A transmission line, including Tower 19.

- 3.2 The CMP shall be held on site, implemented and updated as required throughout the entire period of works on the site.

Supervision

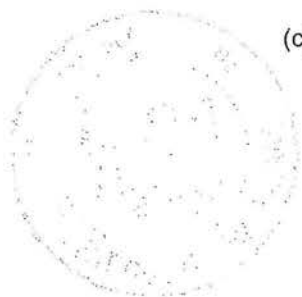
- 3.3 All site works are to be carried out under the supervision of a Chartered Professional Engineer experienced in geotechnical engineering and familiar with the Geotechnical Investigation Report by Coffey Geotechnics and dated 4 July 2005. All works shall follow the recommendations of this Geotechnical Report, to the extent relevant, and are to be carried out to the satisfaction of the Manager.

Contamination Remediation

- 3.4 The "Remedial Action Plan, 791-793 Great South Road, Penrose" (RAP) prepared by Groundwater and Environmental Services (19 September 2008) shall be revised in accordance with the recommendations contained in the report by AC's Environmental Health Specialist dated 12 February 2009. The revised RAP shall be submitted to the Manager for approval prior to the excavation of contaminated material.

- 3.5 Within three (3) months of the completion of remediation works, a Site Validation Report (SVR) shall be provided to the Manager. The SVR shall be prepared by a suitably qualified contaminated land professional in accordance with Schedule 13 (A5) of the Auckland Council Regional Plan: Air, Land and Water (ARCP: ALW). The SVR shall contain sufficient detail to address the following matters:

- (a) A summary of the works undertaken, including a statement confirming whether the remediation of the site has been completed in accordance with the approved Remedial Action Plan (RAP);
- (b) A statement confirming whether all works have been carried out in accordance with the conditions of the consent;
- (c) The location and dimensions of the excavations carried out, including a



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

relevant site plan;

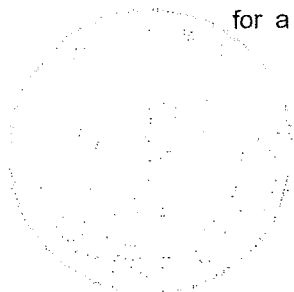
- (d) A summary of any testing undertaken, including tabulated analytical results, and interpretation of the results in the context of the contaminated land rules of the ARCP: ALW;
- (e) Copies of the disposal dockets for the material removed from the site;
- (f) Records of any unexpected contamination encountered during the works, if applicable; and
- (g) Details regarding any complaints and/or breaches of the procedures set out in the approved RAP and the conditions of this consent.

3.6 Should any excavation of contaminated material be undertaken the Consent Holder shall:

- (a) comply with the revised RAP approved under condition 3.4.
- (b) regularly inspect the excavations of the contaminated areas for water accumulation in accordance with the approved RAP.
- (c) remove contaminated soil and dispose of any contaminated groundwater/surface water from the site, in accordance with the approved RAP.
- (d) complete the site excavation works by no later than three (3) months prior to the expiry of this consent, in accordance with the approved RAP (to allow for validation sampling to be undertaken and reporting to the Manager prior to the expiry of this consent)

3.7 Should surface water or groundwater accumulate in excavated areas or in designated stockpile areas, the Consent Holder shall, in accordance with the approved RAP, take a sample of the water and have it tested at a laboratory for metals, TPH and PAHs. If the test results indicate exceedance of the trigger levels presented in the RAP, then appropriate measures shall be employed to remove the liquid off site for disposal at an appropriate facility. Should hydrocarbon sheen or free product be observed then this liquid will be removed off site for disposal at an appropriate facility without analytical testing. Any perched groundwater, groundwater, or surface run-off water encountered within the remediation area shall be considered as potentially contaminated, and shall not be discharged to the stormwater system or surface waters unless testing demonstrates its compliance with the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) for the protection of 95 percent of freshwater species.

3.8 During the works a suitably qualified contaminated land professional shall assess and test, if necessary, any suspect material for the presence of contaminants in accordance with the approved RAP. Any material not meeting acceptance criteria for a cleanfill or managed fill site, or that cannot be re-used on site, shall be



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

disposed of at a licensed landfill in accordance with the approved RAP. All testing/sampling techniques will be carried out in accordance with the MfE Contaminated Land Management Guidelines or other equivalent standards approved in writing by the Manager.

- 3.9 For the duration of the site redevelopment the Consent Holder shall ensure that all sediment and stormwater controls are in place and effective in accordance with the approved RAP.

Services

- 3.10 All care shall be taken during construction to preserve the integrity and stability of the adjacent road reserve, underground services and neighbouring sites. The Consent Holder must obtain approval from Watercare Services and Telecom New Zealand for any proposed filling over the existing bulk water supply line and Telecom services network located above ground and within the site. These approvals shall be supplied to the Manager prior to the commencement of works.

Vegetation Removal, Earthworks and Cleanfill

- 3.11 The Consent Holder shall make available to the AC and the Department of Conservation, at no cost, all surplus plant specimens within the area to be filled for their removal prior to commencing filling activities.
- 3.12 No earthworks shall be undertaken between 30 April and 1 October in any year, without the written approval of the Manager. Earthworks in this regard refers to bulk earthworks (cut/fill/waste) associated with the site.
- 3.13 All imported fill material shall:
- (a) Comply with the definition for 'cleanfill' in the Ministry for the Environment publication *'A Guide to the Management of Cleanfills'* (2002);
 - (b) Be solid material of a stable, inert nature; and
 - (c) Not contain hazardous substances or contaminants above recorded natural background levels of the receiving site.
- 3.14 Copies of a "Cleanfill Log" are to be supplied to the Manager on a three (3) monthly basis by the Consent Holder throughout the period of earthworks and cleanfilling. The cleanfill log is to include, but not be limited to the following:
- Registration number of the vehicle;
 - Name of transporter;
 - Date and time of arrival at site;
 - Approximate size of the load in m³;
 - Source of cleanfill material (including any known land use history if possible);



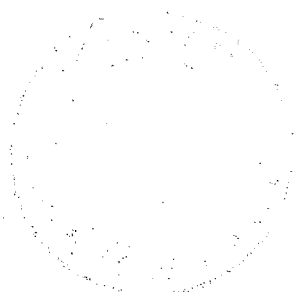
**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

- Name of the disposer of the material;
 - Type of material e.g. topsoil, clay, ash, aggregate, concrete, soil;
 - The on-site disposal location of the fill;
 - Copies of laboratory test certificates of all analytical testing.
- 3.15 Analytical testing of the fill, not previously tested by the fill generator, at a rate of not less than 1 in every 100 incoming trucks (being approximately every 1000 m³) shall be undertaken. The analytical testing shall be to demonstrate contaminant levels in the fill, including (but not limited to) As, Cd, Cr, Cu, Ni, Pb, Zn, TPH, VOC, PAH and SVOCs.
- 3.16 All samples shall be analysed in a laboratory accredited by International Accreditation New Zealand (IANZ) in accordance with the terms of accreditation or other such standards as may be approved by the Manager.
- 3.17 The records required by the consent conditions are to be made available for inspection by the Manager at any time.
- 3.18 On completion of the earthworks, a Chartered Professional Engineer is to provide a certified completion geotechnical report to AC with "as-built" plans. Where necessary, earthworks are to conform to the requirements of relevant New Zealand Standards relating to earthworks.

Archaeological/Cultural Sites

- 3.19 An archaeologist is to be on site during all vegetation removal and initial earthworks to establish if there are any archaeological sites present. The contact details of the archaeologist engaged by the consent holder shall be submitted to the Manager.
- 3.20 In the event any archaeological or cultural heritage sites, including human remains, are exposed during site works then the following procedures shall apply:
- (a) Immediately it becomes apparent that an archaeological or traditional site has been exposed, all site works shall cease.
 - (b) The site supervisor shall immediately secure the area in a way that ensures that any artefacts or remains are untouched.
 - (c) The site supervisor shall notify tangata whenua, the New Zealand Historic Places Trust, the Department of Conservation, Council and in the case of human remains, the Police, that an archaeological or traditional site has been exposed so that appropriate action can be taken. This includes such persons being given reasonable time as determined by the Council to record and recover archaeological features discovered before work may recommence on the site.

Overhead Transmission Lines



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

- 3.21 All land use activities covered by this consent, including the construction of new buildings/structures, earthworks, the operation of mobile plant and/or the construction of fences on the site must comply with the New Zealand Code of Practice for Electrical Safe Distances (NZECP 34:2001).
- 3.22 All machinery and mobile plant operated on the site must maintain a minimum clearance distance of 4m from the Henderson-Otahuhu A transmission line conductors at all times.
- 3.23 In the case of any tower supporting any conductor, no person may excavate or otherwise interfere with any land (unless otherwise approved by Transpower New Zealand):
- (a) At a depth greater than 300mm within 6 metres of the outer edge of the visible foundations of the tower; or
 - (b) At a depth greater than 3 metres, between 6 metres and 12 metres of the outer edge of the visible foundation of the tower; or
 - (c) In such a way as to create an unstable batter.
- 3.24 Excavated or other material must not be deposited under or near the Henderson-Otahuhu A transmission line so as to reduce the vertical distance from the ground to the conductors to a distance less than:
- (a) 7.5 metres vertically, across or along driveways or on any other land traversable by vehicles.
 - (b) 6.0 metres vertically, on any land not traversable by vehicles due to inaccessibility; and
 - (c) 4.5 metres in any distance other than vertical on all land.

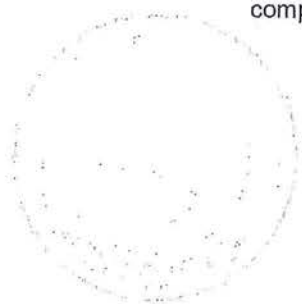
(Note: The distances specified include an allowance for mechanic creep (ie permanent elongation)).

Abandonment of works on site

- 3.25 Within 10 working days following the completion or abandonment of earthworks on the subject site all areas of bare earth shall be permanently stabilised against erosion to the satisfaction of the Team Leader Earthworks and Contaminated Land, Resource Consents, Auckland Council.

Completion of Construction Works

- 3.26 Prior to the removal of the sediment and erosion control measures from the site, the consent holder shall inform the Manager in writing and provide confirmation from a suitably qualified engineer confirming that earthworks and filling works have been completed and the devices are no longer required.



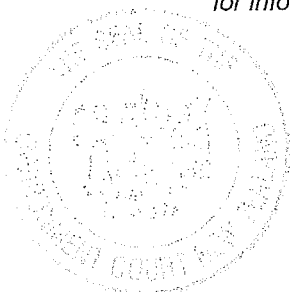
**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

4. SEDIMENT AND EROSION CONTROL

- 4.1 The Sediment and Erosion Control Management Plan (**SECMP**) shall set out the specific procedures, methods and measures to be used to control erosion and potential sediment discharges from the site in accordance with TP90 and the conditions specified in this consent. As a minimum the SECMP, shall include:
- (a) Where chemical treatment of sediment laden water is proposed:
- Specific design details of chemical treatment system;
 - Monitoring, maintenance (including post-storm) and contingency programme (including a Record Sheet);
 - Details of optimum dosage (including assumptions);
 - Results of the initial flocculation trial;
 - A spill contingency plan; and
 - Details of the person or bodies that will hold responsibility for long-term maintenance of the flocculation treatment system and the organisational structure which will support this structure.
- (b) A staging plan detailing the timing and the area of opened area subject to earthworks, and filling activities.
- 4.2 During earthworks construction, sediment treatment areas shall not be located within the Wetland Management Area or Lava Shrubland Management Area as shown on the plan described at condition 1.12(e).
- 4.3 All sediment-laden runoff from the site works shall be treated by erosion and sediment control measures constructed and maintained in accordance with TP90 and any amendments to this document, except where a higher standard is detailed, in which case this higher standard shall apply.
- 4.4 All sediment and erosion control structures shall be operational before bulk earthworks commence and be maintained to perform at full operational capacity until the site has been adequately secured against erosion (whether by vegetative means, paving or otherwise).
- 4.5 The site shall be progressively stabilised against erosion at all stages of the earthwork activity, and works shall be sequenced to minimise the discharge of contaminants to groundwater or surface water in accordance with the approved SECMP.

Advice Note:

Please refer to Auckland Regional Council, Technical Publication No. 90, Erosion & Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region for information on appropriate stabilisation.



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

- 4.6 Revegetation/stabilisation shall be completed by 30 April in the year of bulk earthworks in accordance with measures detailed in TP90 and any amendments to this document, unless a later date is approved in writing by the Manager at least two weeks before 30 April.
- 4.7 No sediment laden runoff shall leave the site without approved treatment to retain sediment.
- 4.8 All perimeter controls shall be operational before bulk earthworks and importation of fill commence. Specific measures shall be provided to the southern boundary of the bulk earthworks to prevent sediment and sediment laden water entering the coast.
- 4.9 Any decanting earth bunds shall be sized to provide 3m³ of storage for every 100m² of contributing catchment.
- 4.10 All 'cleanwater' runoff from stabilised surfaces including catchment areas above the site shall be diverted away from earthwork areas via a stabilised system, so as to prevent surface erosion.
- 4.11 Any sediment retention ponds shall be sized to provide 3m³ of storage for every 100 m² of contributing catchment and be constructed to withstand a 1% AEP storm event without breaching and shall incorporate an emergency spillway to accommodate such an event.
- 4.12 All clean water diversions and sediment laden diversions shall be stabilised with geotextile or similar measures (rip-rap) where longitudinal gradients exceed 2%.
- 4.13 All accumulated sediment is to be removed from the sediment retention devices before the sediment reaches 20% of the storage capacity of the device and is to be placed on stable ground where the sediment will not re-enter the device.
- 4.14 The erosion and sediment controls at the site shall be inspected on a daily basis or within 24 hours of each rainstorm event that is likely to impair the function or performance of the controls. A record shall be maintained of the date, time and any maintenance undertaken in association with this condition which shall be forwarded to the Manager upon request.
- 4.15 Notice shall be provided to the Team Leader Earthworks and Contaminated Land, Resource Consents, Auckland Council, at least two (2) working days prior to the removal of any erosion and sediment control works specifically required as a condition of resource consent or by the approved SECMP.

5. STORMWATER MANAGEMENT

- 5.1 The Stormwater Management Plan (SMP) shall set out the specific procedures, methods and measures that will be used to manage and treat stormwater discharges from the Stage 2 fill area following completion of the Stage 2 Consent construction earthworks. The SMP shall include:



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- (a) Details of how the stormwater management system is to be designed to achieve the removal of 75% TSS in accordance with TP10 for the existing and increased site impervious area. The design shall be confirmed by a suitably qualified engineer prior to construction; and
 - (b) Details of any planting plan and associated maintenance as required by Condition 5.2; and
 - (c) Details of how the SMP will be implemented and over what timeframe.
- 5.2 Calculations shall be submitted to demonstrate that the proposed stormwater management system is sized adequacy in accordance with TP10 and that any associated planting plan addresses the requirements of Condition 5.2.
- 5.3 For any new pond or constructed wetland, native wetland plants are to be established for the purpose of stormwater quality improvement, and to maintain and enhance ecological values of the receiving estuarine environment. Vegetation will be established within the water detention cells and on surrounding bunds and embankments.

Details of planting and maintenance of wetland vegetation will be set out in the SMP, which will be implemented (excluding ongoing maintenance) prior to commissioning of any stormwater pond/constructed wetland, and will include the following specifications:

- (a) Wetland vegetation will comprise indigenous species recorded from within the subject site and immediate surrounds prior to development.
- (b) Species selected will be tolerant of brackish water conditions.
- (c) All plant material used will be eco-sourced from the Manukau Harbour and watercourses in its catchment.
- (d) Targets for establishment of vegetation include 80% survivorship of specimens at least 3 years after placement on-site, and 80% canopy closure across the plantation footprint (i.e., excluding any areas of open water).

The SMP will contain a protocol for reviewing and restoring/ maintaining the condition of planted wetland vegetation following sediment removal or other maintenance of stormwater treatment functions.

- 5.4 All stormwater flows in excess of the capacity of the primary systems, and all secondary flow paths shall be provided for and maintained to allow surplus stormwater from critical storms, up to the 100 year ARI event, to discharge with the minimum of nuisance and damage.

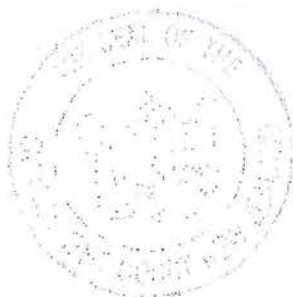
Advice Note: For the purposes of this Consent "major overland flow paths" are those that accompany a primary drainage system of a nominal 600 mm diameter pipe or larger or with peak overland flow exceeding 0.5m³/s in the



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

100-year ARI event.

- 5.5 All major secondary flow paths on land under the Consent Holder's control shall be kept free from significant obstructions such as buildings and solid fences.
- 5.6 Where roading kerbs and channels are constructed across secondary flow paths, the Consent Holder shall ensure that kerbs are set at a level that maximises the capture of water by road cesspits. Other than at designated overland flow paths, driveway crossings shall be constructed in order to minimise the overflow of water from the road into private properties.
- 5.7 All stormwater outfalls, including from the water quality treatment pond/constructed wetland shall incorporate erosion protection measures to minimise the occurrence of bed scour and bank erosion in accordance with TP10.
- 5.8 Within 30 days of construction completion, As-Built certification and plans of the stormwater management works, certified as a true record of the stormwater management system, shall be supplied to the Manager. The As-Built plans shall include, but not be limited to:
- (a) The surveyed location (to the nearest 0.1 m) and level (to the nearest 0.01 m) of the discharge structure with co-ordinates expressed in terms of the New Zealand Map Grid and LINZ datum.
 - (b) Location, dimensions and levels of the major overland flowpaths including cross-sections and long sections.
 - (c) Plans and cross-sections of the stormwater management pond/constructed wetland including confirmation of the Water Quality Volume, storage volumes and levels of any outflow control structure.
 - (d) Documentation of any discrepancies between the design plans and the As-Built plans.
- 5.9 Within 30 days of completion of the stormwater management system the Consent Holder shall submit an Operation and Maintenance Plan for the stormwater management works to the Manager. The Operation and Maintenance Plan shall include, but not be limited to:
- (a) A programme for regular maintenance and inspection of the stormwater management system constructed in accordance with this consent;
 - (b) A programme for the collection and disposal of debris and sediment collected by the stormwater management devices;
 - (c) A programme for inspection and maintenance of outfall erosion;
 - (d) A programme for post storm maintenance;



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- (e) General inspection checklists for all aspects of the stormwater management system.

Any amendments to the Operation and Maintenance Plan shall be advised to the Manager in writing, prior to implementation.

- 5.10 The stormwater management system shall be maintained in accordance with the approved Operation and Maintenance Plan required by condition 5.9. Where a proprietary stormwater treatment device is used, a written maintenance contract with an experienced stormwater management system operator shall be entered into, and maintained in force, for the duration of this consent. Alternatively, for other devices, the Consent Holder shall demonstrate to the Manager that an appropriately trained person in stormwater treatment maintenance and operation is responsible for the on-going maintenance of the stormwater management system. This contract/contact person shall include/utilize the inspection and maintenance schedule contained in the approved Operation and Maintenance Plan required by condition 5.9.

- 5.11 A signed copy of any contract entered into shall be forwarded to the Manager within 30 days of the completion of the stormwater management system. An operative contract shall be provided to the AC upon request throughout the term of the consent. Alternatively, the name of the appropriately trained person who will undertake the stormwater management system's operation and maintenance shall be specified in the Operation and Maintenance Plan required by condition 5.9.

6. STREAMWORKS

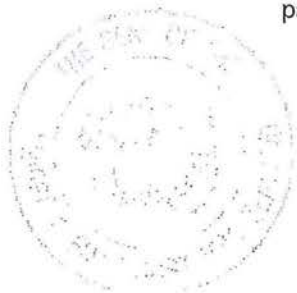
- 6.1 Prior to any streamworks commencing the Consent Holder shall submit a Streamworks Methodology Plan (STMP) for completing the physical works within Ann's Creek (i.e. for the extension of the existing culvert into the western tributary of Ann's Creek) to the Manager for approval. The STMP shall include:

- (a) Methods for damming and diverting water away from the construction areas.
- (b) Methods for protecting the remaining wetland vegetation within the Ann's Creek wetland and the undisturbed portion of the western tributary.
- (c) Methods for the removal of, or avoidance of damage to, fishes in the portion of the western tributary to be culverted.
- (d) The construction sequence of the proposed works.
- (e) Sediment and erosion control methodology having particular regard to the surrounding sensitive receiving environment.
- (f) Details of the suitably qualified ecologists undertaking and monitoring the construction works.
- (g) Buffer plan for works in proximity to the western tributary



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- 6.2 Prior to the physical streamworks on Ann's Creek commencing, a certificate signed by an appropriately qualified and experienced engineer to certify that the erosion and sediment controls have been constructed in accordance with the conditions of this consent shall be submitted for written confirmation. Certification for the following measures shall be supplied immediately upon completion of their construction. Information supplied if applicable shall include:
- (a) The method of diverting Ann's Creek during culvert construction.
 - (b) All temporary flowpath dimensions including emergency flowpaths and the relationship to flood levels;
 - (c) Details of all velocity dissipation measures;
 - (d) Catchment areas, retention volumes and shape of control measures;
 - (e) Position of inlets/outlets;
 - (f) General structural stability; and
 - (g) Confirmation of maintenance expectations and provision of access for this purpose.
- 6.3 When dewatering the area of works, no sediment laden water shall be discharged directly into the watercourse. Any sediment laden discharge pumped or otherwise removed from the works area must be disposed of via a suitable sediment treatment system.
- 6.4 Streamworks shall only be carried out during periods of low flow and when those flows can be diverted around the area of works and a two day weather forecast predicts no rainfall for the site location. During periods of flow greater than the capacity of the diversion, up to the 100 year flood event, a stabilised flow path shall be provided to ensure no scour or erosion occurs and so that flows can pass safely around or through the area of works with minimum nuisance and damage and with no sediment generation or discharge.
- 6.5 There shall be no discharge of contaminants (e.g. oil, diesel, petrol, effluent) to the stream as a result of the exercise of this resource consent.
- 6.6 All machinery shall be operated in a way which ensures that spillages of fuel, oil and similar contaminants are prevented, particularly during refuelling and machinery servicing and maintenance. Refuelling and lubrication activities shall be carried out away from any water body such that any spillage can be contained so it does not enter the watercourse associated with this consent. The use of grouts and concrete products shall also be limited adjacent to the watercourse with all mixing of products carried out outside the 100 year floodplain area such that any spillage can be contained so it does not enter the watercourse associated with this consent.
- 6.7 Any water pooling in the affected stream-bed area drained for the works, and particularly any water displaced by concrete pouring, shall be treated as a trade



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

waste, prevented from flowing downstream and removed from the stream bed.

- 6.8 Within 30 days of construction completion, As-Built certification and plans of the streamworks, certified as a true record of those works, shall be supplied to the Manager. The As-Built plans shall include, but not be limited to:

- (a) The surveyed location (to the nearest 0.1 m) and level (to the nearest 0.01 m) of the discharge structure with co-ordinates expressed in terms of the New Zealand Map Grid and LINZ datum.
- (b) Plans and cross-sections of the culvert and discharge structure.
- (c) Documentation of any discrepancies between the design plans and the As-Built plans.

7. ECOLOGICAL MANAGEMENT PLAN

- 7.1 The Consent Holder shall undertake ecological enhancement and mitigation works within the Lava Shrubland Management Area (**LSMA**) and Wetland Management Area (**WMA**) (as identified on the plan described at condition 1.12(e)) in accordance with an Ecological Management Plan (**EMP**) to be prepared and approved in accordance with the following conditions.

- 7.2 The EMP shall be prepared by a suitably qualified and experienced ecologist and shall, as a minimum, include provisions for:

- (a) the maintenance and enhancement on the site of:
 - (i) lava shrubland;
 - (ii) wetlands, including the ecotone created by the transition from fresh water to salt water;
 - (iii) inanga spawning and juvenile raising habitat; and
- (b) the integration and co-ordination of the methods to be employed and works to be undertaken in maintaining and enhancing these three distinct yet interrelated ecological features of the site;
- (c) the control of weeds and animal pests in those parts of the site that are outside the areas specifically covered by the EMP.

- 7.3 The lava shrubland component of the EMP (as per condition 7.2(a)(i)) shall comprise the Lava Shrubland Management Plan (**LSMP**) approved by the Manager under condition 8 of the Stage 1 Consent, but modified/updated (if necessary) to take into account the conditions of this Stage 2 Consent. Any such revised/updated LSMP shall be submitted to the Manager for approval within 3 months of the grant of the Stage 2 Consent.

- 7.4 The objective of the wetlands component of the EMP (as per condition 7.2(a)(ii))



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

shall be the maintenance and enhancement of the retained wetlands in the WMA, to be achieved by:

- (a) Removing and controlling weeds and animal pests in the WMA;
- (b) Clearing areas of mangroves in the WMA to facilitate the establishment of other wetland vegetation types;
- (c) Ensuring that the diversity and extent of other wetland vegetation types within the WMA as were present before development are maintained;
- (d) Monitoring the vegetation types in the WMA on a regular basis and undertaking re-vegetation / mitigating work if the objective in condition 7.4(c) above is not being achieved.

7.5 As a minimum, the following matters shall be addressed in the wetlands component of the EMP:

- (a) Identification and mapping of the composition and extent of vegetation types in the WMA;
- (b) The areas of mangroves within the WMA to be cleared during the initial implementation of the wetland component of the EMP;
- (c) Monitoring of the composition and extent of vegetation types in the WMA, to be undertaken by a suitably qualified and experienced ecologist, following the completion of construction works;
- (d) The programme for subsequent monitoring of the vegetation types, to be conducted for no less than 5 years, and the reporting on such monitoring to the Manager;
- (e) The process for the development of specific Wetland Mitigation Work Plan(s), which may involve vegetation removal or re-location, or other physical works within the WMA, in the event that monitoring indicates that the objective of this component of the EMP is not being achieved.
- (f) The opportunities (if any), for the relocation/re-establishment within the WMA of vegetation types that may have been lost, or had their area reduced, as a consequence of giving effect to this consent and the Stage 1 Consent, and the methodology to undertake that work;
- (g) Ongoing weed and animal pest control.

7.6 The objective of the Inanga habitat component of the EMP (as per condition 7.2(a)(iii)) shall be the maintenance and enhancement of the retained Inanga habitat following the completion of construction. To achieve that objective, as a minimum, the following matters shall be addressed in this component of the EMP:

- (a) Identification of the areas of the site within the WMA that provide habitat



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

for Inanga spawning and juvenile rearing (Inanga Areas);

- (b) The specific methods or works to be employed (if any) to enhance the Inanga Areas as habitat for Inanga (e.g., retention and or staged replacement of vegetation (including weed species), planting, earthworks, controls on sediment and other discharges);
- (c) The programme for the implementation of any proposed works and its co-ordination with other works to be undertaken in the wetlands under the EMP;
- (d) Ongoing maintenance and/or additional planting work, and weed and animal pest control in the Inanga Areas;
- (e) The program to be implemented to monitor the success of the works to enhance Inanga habitat.

7.7 The EMP shall also include:

- (a) details of the programme for maintaining indigenous biodiversity, and controlling weeds and animal pests, in those parts of the site under the control of the Consent Holder that are outside the specific areas covered by the EMP;
- (b) details of consultation undertaken by the Consent Holder with local iwi and how any specific cultural issues identified by iwi have been addressed within the EMP and the various ecological enhancement and restoration works it proposes.

7.8 The wetland component of the EMP (as per conditions 7.4 and 7.5) and the components of the EMP required by conditions 7.2(b) and 7.7 shall be submitted to the Manager for approval within three months of the grant of this consent and implemented (excluding ongoing maintenance) within 12 months of the completion of the Stage 1 Works to the satisfaction of the Manager.

7.9 The Inanga habitat component of the EMP (as per conditions 7.2(a)(iii) and 7.6) shall be submitted to the Manager for approval no less than three months prior to the completion of the Stage 2 Works and implemented (excluding ongoing maintenance) within 12 months of the completion of the Stage 2 Works to the satisfaction of the Manager.

LSMP Bond

7.10 Pursuant to s108(2)(b) of the Act, implementation of the LSMP has been secured by way of a bond to the value of \$50,000.00 in favour of the Council as required by the conditions of the Stage 1 Consent (**LSMP Bond**). As described in the LSMP Bond, after the expiry of the minimum bond period the Consent Holder shall be released from its obligations to pay the bond if the LSMP has been fully implemented (excluding ongoing maintenance works) and the enhancement



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

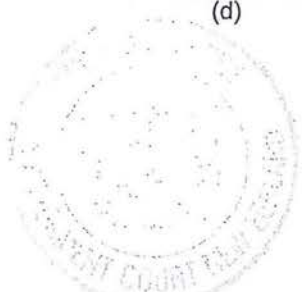
plantings proposed in the LSMP have established on the site (refer Stage 1 Consent).

EMP Bond

- 7.11 Pursuant to s108(2)(b) of the Act, compliance with conditions 7.8 and 7.9 shall be secured by way of a bond to the value of \$50,000.00 (valued as at 1 December 2013) (**EMP Bond**). The EMP Bond shall be adjusted annually according to the Construction Cost Index or other suitable alternative approved by the Manager. The EMP bond shall be prepared at the consent holder's expense and to the satisfaction of the Council's solicitor and shall include the following terms (without in any way limiting the other terms which may be included):
- (a) The bond may be in cash or its performance guaranteed by a guarantor acceptable to the Council.
 - (b) The duration of the bond shall be for a minimum of 5 years following completion of the bulk earthworks authorized by this Stage 2 Consent, but shall extend for a further period of 2 years in the event that any Wetland Mitigation Work is completed on the site in accordance with the EMP between the 3rd and 5th years following the completion of bulk earthworks.
 - (c) After the expiry of the minimum bond period the Consent Holder shall be released from its obligations to pay the bond if the EMP has been fully implemented (excluding ongoing maintenance works).

Protection of Conservation Areas

- 7.12 Within six months of the completion of the bulk earthworks authorized by the Stage 1 Consent the Consent Holder shall provide evidence to the satisfaction of the Manager that a land covenant pursuant to section 108(2)(d) of the Act has been registered against the Certificate of Title(s) of the site in favour of AC protecting and restricting the use of the LSMA area on the site (as identified on the plan described at condition 1.12(e)) (but excluding any area subject to an easement in favour of the Crown (NZ Rail), or held as Marginal Strip by the Crown) (**LSMA Covenant**).
- 7.13 The LSMA Covenant shall include the following requirements/restrictions that the owners will, unless otherwise required pursuant to the LSMP:
- (a) Comply with the provisions of the Bio-Security Act 1993;
 - (b) Undertake an ongoing programme of weed and animal pest control within the covenant areas as per the LSMP;
 - (c) Not cut down, fell, trim, burn, clear, damage, destroy any of the vegetation except in accordance with the LSMP;
 - (d) Not light any fires (except where part of a weed control programme);

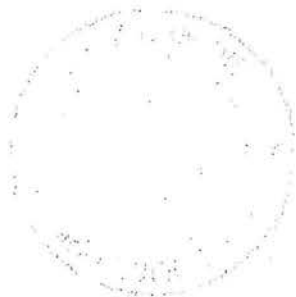


T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- (e) Not plant sow or scatter any trees, shrubs or plants of any trees shrubs or plants which are not otherwise in accordance with the LSMP;
 - (f) Not dump or store any hazardous substances;
 - (g) Not excavate, move or remove any rock, earth or sediment;
 - (h) Not use herbicides other than those specified in the LSMP;
 - (i) Restrict entry of stock; and
 - (j) Not erect any physical structures or buildings within the covenant area other than as specified in the LSMP.
- 7.14 Within six months of the completion of the bulk earthworks authorized by the Stage 2 Consent the Consent Holder shall provide evidence to the satisfaction of the Manager that a land covenant pursuant to section 108(2)(d) of the Act has been registered against the Certificate of Title(s) of the site in favour of AC protecting and restricting the use of the WMA area on the site (as identified on the plan described at condition 1.12(e)) (but excluding any area subject to an easement in favour of NZ Rail, or held as Marginal Strip by the Crown) (**WMA Covenant**).
- 7.15 The WMA Covenant shall include the following requirements/restrictions that the owners will, unless otherwise required pursuant to the approved EMP:
- (a) Comply with the provisions of the Bio-Security Act 1993;
 - (b) Undertake an ongoing programme of weed and animal pest control within the covenant areas as per the EMP;
 - (c) Not cut down, fell, trim, burn, clear, damage, destroy any of the vegetation except in accordance with the EMP;
 - (d) Not light any fires (except where part of a weed control programme);
 - (e) Not plant sow or scatter any trees, shrubs or plants of any trees shrubs or plants which are not otherwise in accordance with the EMP;
 - (f) Not dump or store any hazardous substances;
 - (g) Not excavate, move or remove any rock, earth or sediment;
 - (h) Not use herbicides other than those specified in the EMP;
 - (i) Restrict entry of stock; and
 - (j) Not erect any physical structures or buildings within the covenant area other than as specified in the EMP.

**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

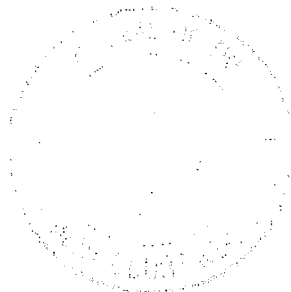
- 8.1 Within six months of the completion of the bulk earthworks authorized by the Stage 1 Consent, the Consent Holder shall provide for public pedestrian access over the site from Great South Road to the marginal strip on Section 1 SO 69440 and over Section 1 SO 69440 at any location where the marginal strip is not continuous, generally in accordance with the plan described in condition 1.12(f). The public access may be provided (at the Consent Holder's option) by way of vesting all or some of the access road as public road or private road (if constructed), or by way of a 4m wide easement in gross in favour of AC, to be prepared, approved and registered at the Consent Holder's cost. For the avoidance of doubt, the provision of this public access does not require the Consent Holder to undertake any physical works.
- 8.2 In the event that the marginal strip is wholly or partly removed from Section 1 SO 69440 after the public pedestrian access is provided under condition 8.1, the Consent Holder shall make further provision for such access over that part of Section 1 SO 69440 that was formerly marginal strip, generally in accordance with the plan described in condition 1.12(g), with the intent that public pedestrian access through Section 1 SO 69440 from Great South Road to the boundary of that site with the North Auckland Railway rail corridor is available in perpetuity.
- 9 LAPSE, EXPIRY AND REVIEW**
- 9.1 These consents will lapse 5 years after they commence unless they are given effect to or the Council decides to grant an extension to a longer period.
- 9.2 Consents 36056 (earthworks), 36058 (streamworks/culverting and reclamation) and 30316 (disturbance and remediation of contaminated land) shall expire on 31 April 2023 or three earthworks seasons after the commencement of site earthworks (whichever is the sooner), unless they have been surrendered or cancelled at an earlier date pursuant to the Act.
- 9.3 Consent 36055 (stormwater diversion and discharge) shall expire on 30 December 2048 unless it has been surrendered or cancelled at an earlier date pursuant to the Act.
- 9.4 The Council may, in the month of every third anniversary after the commencement of this consent, serve notice on the consent holder under section 128(1) of the Act of its intention to review the conditions of this consent for any of the following purposes:
- (a) To deal with any adverse effect on the environment which may arise or potentially arise from the exercise of this consent and which it is appropriate to deal with at a later stage;
 - (b) At any time, if it is found that the information made available to Council in the application contained inaccuracies which materially influenced the decision and the effects of the exercise of consent are such that it is necessary to apply more appropriate conditions.



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

ADVICE NOTES

1. The consent holder is advised that this consent does not constitute an Authority or Dispensation by the Director-General of Conservation under regulation 42 of the Freshwater Fisheries Regulations (1983) for the construction or maintenance of any structure which has the effect of impeding the natural passage of fish.
2. Subject to section 198 of the Local Government Act 2002 and Auckland Council's Policy on Development Contributions, a development contribution may be payable on this proposal. The development contribution will be assessed at the time of payment and a notice of assessment shall be sent out which outlines the amount of the contribution payable for this development. Please contact the Development Contributions team for any queries in this regard.
3. The Consent Holder is advised that it will need to obtain the necessary consents from Transpower for works near and under the existing electrical pylon and high tension transmission lines. Transpower NZ has a right to access its existing assets on the site under s23 Electricity Act 1992. Any development must not preclude or obstruct this right of access. It is an offence under s163(f) Electricity Act 1992 to intentionally obstruct any person in the performance of any duty or in doing any work that the person has the lawful authority to do under s23 Electricity Act 1992.
4. The Consent Holder is advised that Permit No. 36531 granted by the former Auckland Regional Council in 2009 (and not appealed) authorises the long term discharge of contaminants to land or water from the site subject to compliance with various conditions including a Long Term Monitoring and Management Plan (MMP).
5. The Consent Holder is advised that the provision of pedestrian access over the Marginal Strip will require the Department of Conservation's approval. In addition, the 4m easement width specified in condition 8.1 is unlikely to provide sufficient access for walkway construction (and possibly ongoing maintenance). A separate agreement will need to be negotiated with the Consent Holder for additional construction and maintenance access outside of the legal easement.



**T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013**

SCHEDULE 1 – BACKGROUND INFORMATION

- Assessment of Effects entitled "Proposal for Site Development and Rehabilitation – Resource Consent Applications and Assessment of Effects on the Environment" prepared by Osborne Hay Limited and dated July 2008;
- Report entitled "Ann's Creek Aquatic Assessment" prepared by Golder Associates and dated May 2007;
- Report entitled "Ann's Creek Lava Shrubland Management Plan" prepared by Golder Associates and dated August 2006;
- Report entitled "Proposed Plan Change for 791-793 Great South Road (Sect 1 SO 69440): Archaeological Assessment" prepared by Clough & Associates Limited and dated February 2008;
- Report entitled "TR Group, Report on 791-793 Great South Road, Detailed Site Investigation" prepared by GHD Limited and dated July 2006;
- Report entitled "TR Group, 791-793 Great South Road, Preliminary Site Investigation" prepared by GHD Limited and dated November 2004;
- Report entitled "TR Group, Report on 791-793 Great South Road, Geotechnical Report Addendum" prepared by GHD Limited and dated August 2007;
- Report entitled "TR Group, Geotechnical Investigation, 791-793 Great South Road, Penrose" prepared by GHD Limited and dated July 2006;
- Report entitled "Civil Engineering Report, Proposed earthworks at 781, 791-793 Great South Road, Penrose for TR Group Ltd" prepared by Walker SEP Limited and dated 4 April 2008;
- Report entitled "Geotechnical Investigation Report on Proposed Land Development at 791 to 793 Great South Road, Penrose" prepared by Coffey Geotechnics and dated 4 July 2005;
- Application plans entitled "Great South Road, Mt Wellington", being sheets C100-C101, and C150, prepared by Walker SEP Limited, and dated 14 January 2008;
- Application plans entitled "Great South Road, Mt Wellington", being sheets C102, C203-C204, C251-C252, C300-C302, C350, and C400-C403, prepared by Walker SEP Limited, and dated 13 December 2007;
- Application plans entitled "Great South Road, Mt Wellington", being sheets C200-C202 Revision A prepared by Walker SEP Limited, and dated 4 September 2008;
- Application plans entitled "Great South Road, Mt Wellington", being sheets C205-C208, prepared by Walker SEP Limited, and dated 27 March 2008;



T R GROUP LIMITED & AUCKLAND COUNCIL
AGREED CONDITIONS
12 DECEMBER 2013

- Application plan entitled "Great South Road, Mt Wellington", being sheet C250 revision A, prepared by Walker SEP Limited, and dated September 2008;
- Application plan entitled "Great South Road, Mt Wellington", being sheet C404, prepared by Walker SEP Limited, and dated 1 January 2007;
- Application plans entitled "Great South Road, Mt Wellington", being sheets C405-C406, prepared by Walker SEP Limited, and dated May 2008;
- Letter entitled "Re: Application 36055, 36056 and 36057. Response to S92 Request Dated 8 August 2008" prepared by Osborne Hay Limited and dated 22 September 2008;
- Report entitled "Remedial Action Plan, 791-793 Great South Road, Penrose" prepared by Groundwater and Environmental Services and dated 19 September 2008;
- Letter entitled "RE: TR Group Ltd – ARC Section 92 Request for Additional Information dated 8 August 2008" prepared by Walker SEP Limited and dated 16 September 2008;
- Letter entitled "RE: TR Group Ltd – ARC Section 92 Emailed Request for Additional Information dated 20 October 2008" prepared by Walker SEP Limited and dated 20 October 2008;
- Letter entitled "Re: 781, 791-793 Great South Road (TR Group) – Response to S92 Request" prepared by Osborne Hay Limited and dated 23 October 2008;
- Letter entitled "RE: TR Group Ltd – ACC Section 92 Request for Additional Information dated 11 December 2008" prepared by Walker SEP Limited and dated 17 December 2008;
- Report entitled "Ann's Creek Hydraulic Analysis" prepared by Dr Steven Joynes and dated December 2008;
- Letter entitled "RE: TR Group Ltd – ACC Section 92 Request for Additional Information dated 12 January 2009" prepared by Walker SEP Limited and dated 13 January 2009;
- Report entitled "Ann's Creek Lava Shrubland and Wetlands, Assessment of Avifauna Values" prepared by Golder Associates and dated March 2009; and
- Statements of evidence and associated plans and materials presented by the applicant at the hearing.





NOTES:

BEARING AND COORDINATE DATUM IS GEODETIC 2000 ORIGIN IS 16 MT. EDEN, 800 000mN, 450 000mE. PROJECTION IS TRANSVERSE MERCATOR. DISTANCE PRODUCTION DISTANCES MULTIPLY BY 0.9999. CONTRACTORS TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK.

LEGEND

APPROVED STAGE 1 & PROPOSED STAGE2 FOOTPRINT



Annexure A(a)

REVISION	DESCRIPTION	DATE
A	DETAILS AMENDED	VC 20/11/13
O	ORIGINAL ISSUE	VC 10/04/13

Supersedes:
This document and the copyright in this document remain the property of Crang Consulting Ltd. The contents of this document may not be reproduced or stored in any retrieval system without the prior written consent of Crang Consulting.

CRANG CIVIL
CONSULTING ENGINEERS
+64 9 291 4779
www.crangcivil.co.nz
4 Arundel Road, Sylvia Park, Auckland, NZ
PO Box 42-069, Ormiston, Auckland 1746, NZ



PROJECT
GREAT SOUTH ROAD
MT WELLINGTON

TITLE
0073
COMPILED FOOTPRINT
PLAN

DATE	AUG 2013	SCALE	AS 1:750
DRAWN	EX		
DESIGNED			
PROJECT NO.	C210	1 of 1	REVISION A



NOTES

BEARING AND COORDINATE DATUM IS GEODETIC 2000 ORIGIN IS 16 MT. EBN 600 000mL, 600 000mN. ALL DISTANCES ARE TO BE MEASURED TO CENTRE OF ROAD OR RAILWAY. TO OBTAIN PROJECTIONS DISTANCES MULTIPLY BY 0.9999

CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK

LEGEND

- STAGE 2 BOUNDARY
- STAGE 2 CONTOUR
- 6.0
- APPROVED STAGE 1 FOOTPRINT

REVISION	CHANGED	CHECKED	DATE
0	DETAILS AMENDED	VC	26/07/13
0	ORIGINAL ISSUE	VC	26/07/13

Copyright
This document and its copyright in this document remains the property of Crang Consulting Ltd. The contents of this document are not to be reproduced or used in any way without the written consent of Crang Consulting Ltd.

CRANG CIVIL
CONSULTING ENGINEERS

+64 9 231 4779
www.crangcivil.co.nz
6 Arundel Road, Sylvania Park, Auckland, NZ
PO Box 42-059, Ormiston, Auckland 1715, NZ



CLIENT

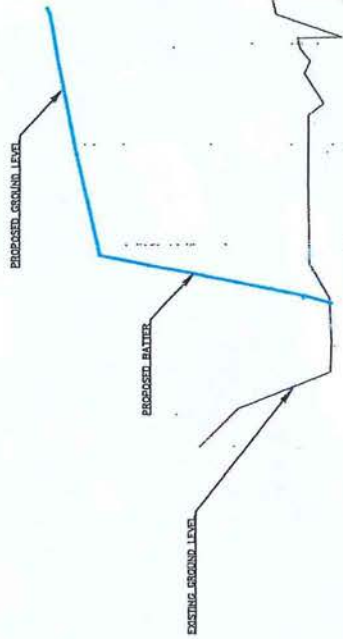
GREAT SOUTH ROAD
MT WELLINGTON

0074
STAGE 2 EARTHWORKS
FOOTPRINT

DATE	SCALE
JUL 2013	AS 1:750
REVISION	BY
01	BX
DESIGNED	SCALE
C200	AS 1:1500
PROJECT	REGION
1.1	A



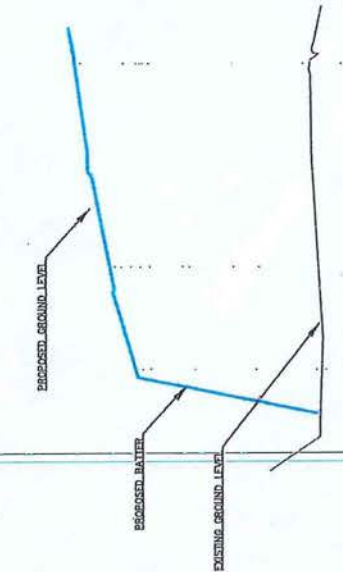
Annexure A(b)



DATUM: 0.00

DESIGN LEVELS	EXISTING LEVELS	CHAINAGE
91.20	91.20	0.00
91.18	91.18	10.00
91.16	91.16	20.00
91.14	91.14	30.00
91.12	91.12	40.00
91.10	91.10	50.00
91.08	91.08	60.00

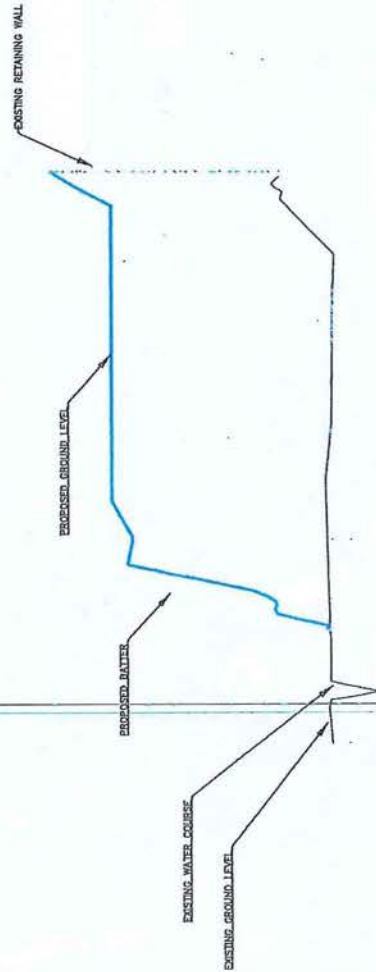
SECTION B-B
SCALE: 500/100



DATUM: 0.00

DESIGN LEVELS	EXISTING LEVELS	CHAINAGE
91.20	91.20	0.00
91.18	91.18	10.00
91.16	91.16	20.00
91.14	91.14	30.00
91.12	91.12	40.00
91.10	91.10	50.00
91.08	91.08	60.00

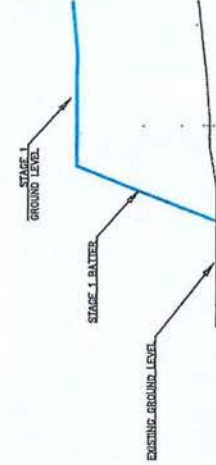
SECTION A-A
SCALE: 500/100



DATUM: 0.00

DESIGN LEVELS	EXISTING LEVELS	CHAINAGE
112.47	112.47	0.00
112.45	112.45	10.00
112.43	112.43	20.00
112.41	112.41	30.00
112.39	112.39	40.00
112.37	112.37	50.00
112.35	112.35	60.00
112.33	112.33	70.00
112.31	112.31	80.00
112.29	112.29	90.00
112.27	112.27	100.00

SECTION C-C
SCALE: 500/100



DATUM: -2.00

DESIGN LEVELS	EXISTING LEVELS	CHAINAGE
64.79	64.79	0.00
64.77	64.77	10.00
64.75	64.75	20.00
64.73	64.73	30.00
64.71	64.71	40.00
64.69	64.69	50.00
64.67	64.67	60.00

SECTION D-D
SCALE: 500/100

REVISION	NO.	ORIGINAL ISSUE	VC	DATE
0				

CRANG CIVIL CONSULTING ENGINEERS
144 37 281 4779
8 Arenal Road, Suite 101, Auckland, NZ
PO Box 12-057, Auckland 1145, NZ

PROJECT: GREAT SOUTH ROAD MT WELLINGTON
STAGE 2 EARTHWORKS CROSS-SECTIONS
DATE: JUN 2013
SCALE: 1:500
DRAWN BY: J.BX
CHECKED BY: J.BX
APPROVED BY: J.BX
C201/ENVY/1/1-1000

Annexure A(d)

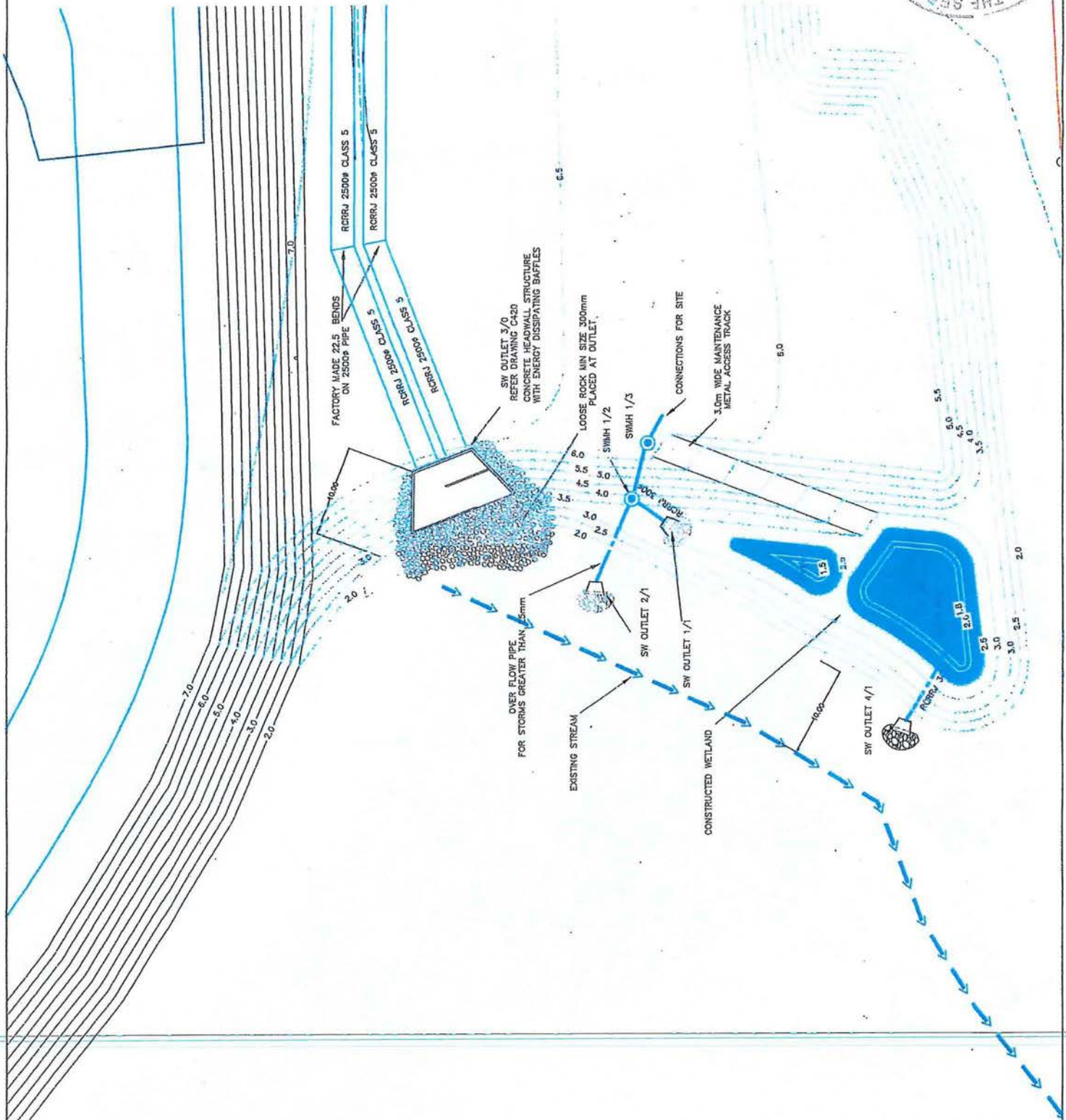


NOTES:

BEARING AND COORDINATE DATUM IS GEODETIC
2000 ORIGIN IS 16 MT. EBN
ALL DIMENSIONS ARE IN METERS
CONTRACTOR TO VERIFY ALL DIMENSIONS ON
SITE BEFORE COMMENCING ANY WORK

LEGEND

- 3.0 — STAGE 2 CONTOUR
- 6.0 — STAGE 1 CONTOUR
- — PROPOSED STORMWATER
- PROPOSED STORMWATER MANHOLE



REVISION	CHANGES	CHECKED	DATE
A	DETAILS AMENDED	VC	27/11/13
0	ORIGINAL ISSUE	VC	23/01/13

This document and the copyright in it are the property of Crang Consulting Ltd. The copyright in this document is reserved by Crang Consulting Ltd. No part of this document may be reproduced or transmitted in any form or by any means electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without the prior written consent of Crang Consulting.

CRANG CIVIL
CONSULTING ENGINEERS

+64 9 381 4779
www.crangcivil.co.nz
4 Mount Road, Spots Park, Auckland, NZ
PO Box 42-097, Ormiston, Auckland 1715, NZ



PROJECT		GREAT SOUTH ROAD MT WELLINGTON	
FILE		0076	
DATE		JUL-2013	
DRAWN		BX	
CHECKED		BX	
SCALE		1:200	
SHEET		1 of 1	



BEARING AND COORDINATE DATA IS GEODETIC
2000 COORDINATE IS 16 METRE GRID
400 COORDINATE IS TRANSVERSE
INDICATOR TO OBTAIN PROJECTION DISTANCES
MULTIPLY BY 0.99999
CONTRACTOR TO VERIFY ALL DIMENSIONS ON
SITE BEFORE COMMENCING ANY WORK

LEGEND

- STAGE 2 BOUNDARY
- APPROVED STAGE 1
- FOOTPRINT
- CONSERVATION AREA



LMA (LAW SHRUBLAND
MANAGEMENT AREA)
RMA (RURAL
MANAGEMENT AREA)

A	DETAILS AMENDED	VC	27/11/13	
D	ORIGINAL ISSUE	VC	12/08/13	
UNP/2011	CHANGES	CHANGED	DATE	

CONTRACTOR
The contractor is responsible for obtaining all necessary permits and approvals for the project. The contractor shall ensure that all work is carried out in accordance with the relevant legislation and standards. The contractor shall also ensure that all work is carried out in a safe and sound manner.



CRANG CIVIL
CONSULTING ENGINEERS
+64 9 231 8777
PO Box 100, Auckland 1142, NZ
PO Box 100, Auckland 1142, NZ



PROJECT

GREAT SOUTH ROAD
MT WELLINGTON

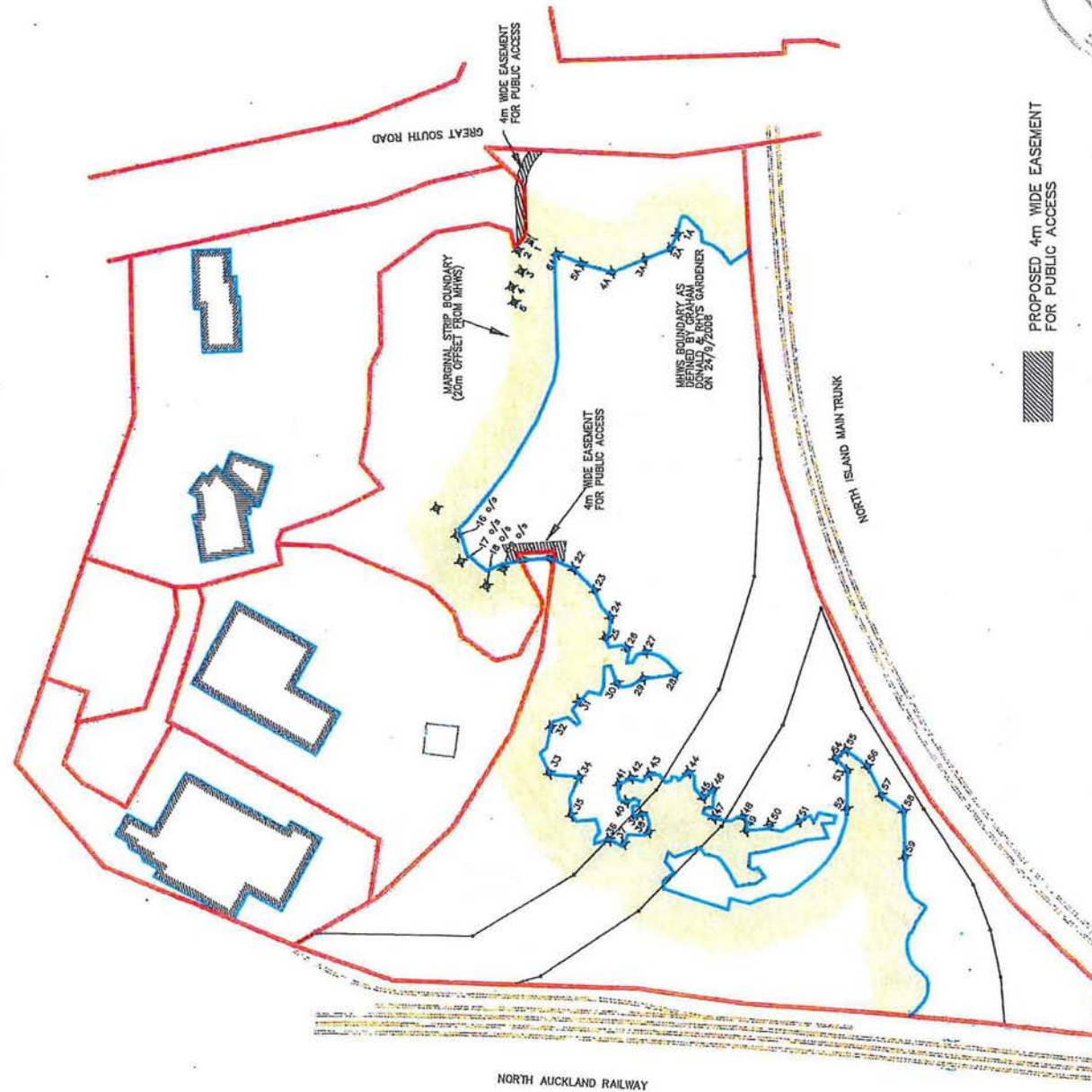
00777
CONSERVATION AREA
PLAN

DATE	AUG 2013	SCALE	AS 1:750
DRAWN	BX	AS 1:1500	
DESIGNED			
REVISIONS	C220	1 of 1	A



Annexure A(e)

Annexure A(f)



PROPOSED 4m WIDE EASEMENT
FOR PUBLIC ACCESS



NOTES:

BEARING AND COORDINATE DATUM IS GEOIDETIC
2000 ORIGIN IS 19.011. EDCN 800.000m. 400
TO OBTAIN PROJECTIONS OF THE MARGINAL STRIP
TO OBTAIN PROJECTIONS OF THE MARGINAL STRIP
BY 0.009 AREAS AND BOUNDARY DIMENSIONS
ARE SUBJECT TO A FINAL LAND TRANSFER
SURVEY CONTRACTOR TO VERIFY ALL
DIMENSIONS ON SITE BEFORE COMMENCING ANY
WORK.

ORIGIN OF SURVEY

SS 4189
SS 5533
SS 5534
480368.82ME
RL 8.785m
(M FOOTPATH OF SYDIA PARK ROAD)

CONFIRMED BY

IT (ON SITE)
7/8/2013
CRANG CIVIL ENGINEERS LTD
(IRON TUBE BY DRAIN)

REVISION	CHANGES	DRAWN	CHECKED	DATE
A	DETAILS AMENDED	VC	27/11/13	
C	ORIGINAL ISSUE	VC	27/11/08	

COPYRIGHT

This document and the copyright in this document remain the
property of Crang Consulting Ltd. The contents of this document
are confidential and may be subject to legal proceedings.
No part of this document may be reproduced or transmitted in
any form or by any means electronic or mechanical, including
photocopying, recording, or by any information storage and
retrieval system, without the prior written consent of Crang Consulting.

CRANG CIVIL
CONSULTING ENGINEERS

144 07 281 4779
www.crangcivil.co.nz
6 Arnold Road, Sydia Park, Auckland, NZ
PO Box 42 289, Ormiston, Auckland 1715, NZ



CREDIT

PROJECT
GREAT SOUTH ROAD
MT WELLINGTON

TITLE
MARGINAL STRIP
/ PUBLIC ACCESS
STAGE 1

DATE	NOV/2013	SCALE	AI 1:1000
ENGINEER	BX		
DRAWN			
CHECKED			
APPROVED			
REVISION	C167	1 of 1	A

0078

Annexure A(g)



NOTES:

BEARING AND COORDINATE DATUM IS GEODETIC
2000 ORIGIN IS 16 MT. EDSH 100 000N 400
000E PROJECTION IS TRANSVERSE MERCATOR
TO OBTAIN PROJECTION DISTANCES MULTIPLY
BY 0.999 996 33 AND TO OBTAIN PROJECTION
AREAS MULTIPLY BY 0.999 992 67. ALL DISTANCES
ARE SUBJECT TO FINAL LAND TRANSFER
SURVEY CONTRACTOR TO VERIFY ALL
DIMENSIONS ON SITE BEFORE COMMENCING ANY
WORK.

ORIGIN OF SURVEY

SS 4185
SO 83223
75579 000N
75579 000E
RL 8 178m
(ON FOOTPATH OF SYLVIA PARK ROAD)

CONTRIBUTED BY

IT, JON EDSH
THAMES EDSH
400001378E
(ORIGIN TIME BY DESIGN)

REVISION	CHANGES	CHECKED	DATE
B	DETAILS AMENDED	VC	28/11/13
A	DETAILS AMENDED	VC	27/11/13
0	ORIGINAL ISSUE	VC	14/08/13

Comments:
This document is the property of Crang Consulting Ltd. The contents of this document may not be reproduced without the prior written consent of Crang Consulting.



444 83 381 4379
www.crangcivil.co.nz
4 Arnold Road, Sylvia Park, Auckland, NZ
PO Box 42-881, Orakei, Auckland 1745, NZ



PROJECT

GREAT SOUTH ROAD
MT WELLINGTON

0079
MARGINAL STRIP
/ PUBLIC ACCESS
STAGE 2

DATE	JUL 2013	SCALE	A1 1:1000
DRAWN	BX		
CHECKED			
APPROVED	C166	1 of 1	B



PROPOSED 4m WIDE EASEMENT
FOR PUBLIC ACCESS



NORTH AUCKLAND RAILWAY

**PROPOSED VARIATIONS (REVISED) TO THE IMPLEMENTATION OF
RECOMMENDATIONS DESCRIBED IN ANN'S CREEK LAVA
SHRUBLANDS MANAGEMENT PLAN**

April 2014

1. INTRODUCTION

TR Group Ltd (TR Group) has a requirement to undertake the restoration of the Ann's Creek lava shrublands as part of a resource consent condition associated with development of their Great South Road site. Golder Associates (2013) prepared a management plan for the site. The management priorities and recommendations detailed within the management plan form the basis of the implementation works at the site required as part of the consent condition. TR Group has engaged Wildland Consultants Ltd (Wildlands) to undertake the restoration of the lava shrublands, based on our extensive restoration experience, skilled botanical staff and knowledge (including threatened and uncommon plants), and the ability to work on a challenging site.

A desktop review of the Golder Associates (2013) report, and a site visit, were undertaken in December 2013. Initial recommendations regarding the implementation were provided to the client (TR Group). Some of these recommendations related to the practicalities, and ecological value, of implementing some of the required management priorities and methods. Wildland's requested that these recommendations be discussed with Council before proceeding with any restoration works at the site.

A further site visit was undertaken in February 2014 to confirm our concerns and our initial recommendations for the site. Staff also took the opportunity to look for *Coprosma crassifolia* seed for propagation. Unfortunately no seed (or flowers) were found. Staff did however, collect akeake (*Dodonaea viscosa*) seed from several locations.

The purpose of this report is to:

- Identify the management priorities and methods that we have some concern over;
- Discuss the issues;
- Provide suitable recommendations to discuss with Council ecologists and planners.

2. **REVIEW AND DISCUSSION**

We have reviewed relevant parts of the Golder Associates (2013) management priorities and methods, and discuss these below.

2.1 **Pest animal control (Section 3.3 in Golder Associates, 2013)**

We accept that faecal pellets of rabbit (*Oryctolagus cuniculus*) and possum (*Trichosurus vulpecula*) have been recorded at the site (though neither has been recorded by Wildlands staff in our two visits to the site). We also accept that both ship rats (*Rattus rattus*) and Norway rats (*R. Norvegicus*) will also be present, and that all these pest animal species can have impacts on indigenous plant species through seed and seedling predation (as well as leaf, flower and fruit browse of mature plants). We also accept that pest animal predators are likely to pose a threat to 'prospective' bird and lizard populations at the site.

Discussion

Due to the shape and the relatively small size of the site, Wildlands feel that the ecological benefits of pest animal control will be negligible. The industrial land and rail corridors surrounding the site will act as constant sources of pest mammal reinvasion and it is unlikely that pest mammal control will be able to reduce populations for long enough to provide any ecological benefits.

However, following feedback from Garrick McCarthy (Biosecurity Officer – Pest Animals), we propose to undertake pest control three times per year for possums and rats as Garrick considers that the use of Brodifacoum three times per year will reduce rat numbers sufficiently to facilitate ecological gains.

As per Garrick's feedback we propose to undertake rabbit control on a response basis. Rabbit control methods (such as shooting, and/or poisoning with pindone) will be undertaken if plant damage/rabbit sign is recorded as part of ongoing monitoring of the restoration plantings and threatened plant populations.

2.2 **Restoration of basalt outcrops (Section 3.4.1 in Golder Associates, 2013)**

We agree that facilitation of natural regeneration is the preferred method of restoring the lava shrubland on basalt outcrops. Through principally pest plants control, rather than pest animal control (refer Section 2.1 above).

We agree with the method and level of infill planting proposed in the management plan.

We have some concerns over the methods proposed for sourcing and planting these sites.

Discussion

We agree that it is best to source seed from the site, where it is available. Due to the lack of *Coprosma crassifolia* seed on site, Wildlands proposes to source seed from

other geographically close populations within the same ecological district. Auckland Council has suggested Hamlin's Hill Regional Park. Wildlands is in the process of applying for a permit through Ali Meade (Senior Ranger Conservation – Southern Regional Parks) to collect seed from both Hamlin's Hill and Ambury Regional Parks. Sourcing seed will require a longer lead in time for propagation. As such, Wildlands are proposing to undertake the initial planting of *Coprosma crassifolia* over the 2015/16 winters as plants become available.

We would preclude translocating seedlings, as if these have established naturally, they should be left. Due to the high pest plant populations, soil seed bank sources are likely to contain predominantly pest plant species, which pose a weed hygiene hazard for nurseries.

The proposed planting schedule specifies PB3 grade plants. Given the substrate at the site (lava outcrops), Wildlands staff attempted to dig some potential planting holes within these areas. As a result, it will be difficult to plant many PB3 grade plants on these sites. It is recommended that only root trainer or tube stock be supplied and planted, with the exception of *C. crassifolia*, which will be provided in a larger grade (0.5 L or PB¾), as it is difficult to grow good cuttings in root trainers.

2.3 Restoration of “buffer areas” (Section 3.4.2 in Golder Associates, 2013)

We agree with the main direction of this section, and the planting zone breakdown.

We have some concerns over the planting grades and spacings proposed for these sites.

Discussion

With regard to plant spacing, one metre centres will be suitable for both harakeke (*Phormium tenax*) and manuka (*Leptospermum scoparium*) - 0.5 metre spacing is far too close for these species. One metre centres will also be suitable for oioi (*Apodasmia similis*) as this species rapidly spreads once established. It may be difficult to maintain the one metre centre spacing across the entire site due to the substrate, but one metre centres will remain the target spacing.

The proposed planting schedule specifies PB3 grade plants. Given the substrate across most of these zones (lava rock, or debris) it is recommended that the bulk of the plants are supplied in root trainer grades, and those species that require a larger grade are supplied in 0.5 litre (or PB¾). These species recommended to be supplied in the larger grade would include *C. crassifolia*, pohuehue (*Muehlenbeckia complexa*), saltmarsh ribbonwood (*Plagianthus divaricatus*) and taupata (*Coprosma repens*).

The planting schedule for the embankment includes 1,900 *C. crassifolia*. This number may be difficult to propagate from cuttings without detrimental effects on the existing plants, so may have to be reviewed.

2.4 Planting specifications (Section 3.4.3 in Golder Associates, 2013)

We agree with the statements regarding eco-sourcing, and the sourcing of *C. crassifolia* stock from the Ann's Creek site only.

We agree that planting should be undertaken between May and July, as part of sound planting practice. Refer to our discussion below regarding the timing of the initial planting.

We agree with the statements regarding pioneer (early successional) species, and the maintenance requirements for the site.

Discussion

Wildlands is proposing to undertake the initial planting in May-July 2015 to allow time for suitable plant stock to be propagated. We are proposing to contract the propagation of the *C. crassifolia* to Oratia Native Plant Nursery. As part of TR Group's commitment to engage community in this restoration project, we are proposing to contract the propagation of most of the remaining plant stock to the Ngati Whatua nursery (pending confirmation of their rates and ability to do this).

2.5 Preservation of native *Geranium* populations and habitat (Section 3.5 in Golder Associates, 2013)

We agree with the majority of this section.

Discussion

Wildlands proposes to carefully monitor the existing habitats, rather than attempt propagating soil plugs, due to the same concerns regarding seed bank propagation described in Section 2.2 above.

4. RECOMMENDATIONS

As a result of our review of the management plan and the site itself, the following recommendations have been made:

- Undertake rat and possum control three times per year.
- Undertake response control of rabbits if impacts are identified during regular monitoring of restoration plantings and threatened plant populations.
- Revise plant grades to a mix of root trainer and 0.5 L (PB¾) grades as described above.
- Revise plant spacing requirements to one metre centres for all species, other than for the infill plantings.
- Source *C. crassifolia* seed from nearby populations at Hamlins Hill/Mutukaroa and Ambury Regional Parks, as soon as practicable, to allow propagation lead in time.

- Source other seed from the site as it becomes available, and contract nursery to grow stock.
- Commence initial planting in May-July 2015.

REFERENCES

Golder Associates Ltd 2013: Ann's Creek Lava Shrublands Management Plan. *Report No. 1378205374-001-Rev0*. 22 pp, plus appendices.

ECOLOGICAL MANAGEMENT PLAN (WETLAND COMPONENT) FOR ANN'S CREEK, 791-793 GREAT SOUTH ROAD, PENROSE



 providing
outstanding
ecological
services to
sustain
and improve our
environments



R3482

ECOLOGICAL MANAGEMENT PLAN (WETLAND COMPONENT) FOR ANN'S CREEK, 791-793 GREAT SOUTH ROAD, PENROSE

Contract Report No. 3482

November 2014

Project Team:

Tim Martin - Field survey, report author
Melissa Marler – Field survey, report author
Nick Ranger – Field survey, technical advice
Jamie MacKay – Report author

Prepared for:

TR Group
PO Box 12541
Mt Wellington
Auckland

CONTENTS

1.	INTRODUCTION	1
2.	PROJECT SCOPE AND OBJECTIVES	1
3.	ECOLOGICAL CONTEXT	2
3.1	Geological history	2
3.2	Lava flow vegetation	2
3.3	Estuarine vegetation and reclamation	3
4.	METHODOLOGY	3
4.1	Overview	3
4.2	Environmental pest plant survey	3
4.3	Planting	4
4.4	Inanga habitat	4
5.	VEGETATION AND HABITATS	4
5.1	Overview	4
5.2	Terrestrial habitats	5
5.3	Intertidal habitats	7
6.	FLORA	8
6.1	Vascular plants	8
6.2	Lichens	8
7.	FAUNA	9
7.1	Freshwater fish	9
7.2	Avifauna	9
7.3	Herpetofauna	9
8.	RESTORATION GOALS AND TARGETS	9
8.1	Wetland Management Area	9
8.2	Inanga spawning habitat	9
9.	RESTORATION METHODS	10
9.1	Wetland Management Area	10
9.2	Inanga spawning habitat	10
9.2.1	Background	10
9.2.2	Restoration works	10
10.	ENVIRONMENTAL PEST PLANTS	11
10.1	Environmental pest plant control priorities	11
10.2	Pest plant control	15
11.	PEST MAMMALS	16
11.1	Overview	16
11.2	Rodent and possum control	16
11.3	Rabbit control	17

12.	PLANTING RECOMMENDATIONS	17
12.1	Overview	17
12.2	Site preparation	18
12.3	Saline wetlands	19
12.3.1	Planting Area A (saltmarsh)	19
12.4	Terrestrial habitats	19
12.4.1	Planting Area B (hillslope)	19
12.4.2	Planting Area C (lava flow)	20
12.4.3	Planting Area D (stream banks)	20
12.4.4	Planting Area E (floodplain)	21
12.4.5	Planting Area F (coastal flats)	21
12.4.6	Planting Area G (banks of tidal creek)	22
12.5	Restoration of the freshwater-saline ecotone	22
12.5.1	Planting Area H (marsh clubrush reedland)	23
12.5.2	Planting Area I (sea rush rushland)	23
12.6	Maintenance	23
12.7	Plant stock and availability	24
12.8	Plant spacing	24
13.	IMPLEMENTATION TIMELINE	24
14.	MONITORING	25
14.1	Overview	26
14.2	Vegetation	26
14.3	Inanga	26
14.4	Pest animals	26
14.5	Assessment of monitoring results	27
15.	CONCLUSIONS	28
	ACKNOWLEDGEMENTS	29
	REFERENCES	29
	APPENDICES	
1.	Vascular plant species recorded at 791-793 Great South Road, Penrose	30
2.	Lichen species recorded on mangroves at 791-793 Great South Road, Penrose	33
3.	Site photographs	34
4.	Environmental pest plant species recorded at 791-793 Great South Road, Penrose	40
5.	Weed control methods	41

Reviewed and approved for release by:



Steve Rate
Senior Ecologist
Wildland Consultants Ltd

© *Wildland Consultants Ltd 2014*

This report has been produced by Wildland Consultants Ltd for TR Rentals. All copyright in this report is the property of Wildland Consultants Ltd and any unauthorised publication, reproduction, or adaptation of this report is a breach of that copyright.

1. INTRODUCTION

TR Group Ltd commissioned Wildland Consultants to prepare Ecological Management Plan (EMP) (Wetland Component), to maintain and enhance wetlands at Ann's Creek, 791-793 Great South Road, Penrose. The implementation of this plan is required as a resource consent condition for earthworks at the site. This will comprise mitigation for the partial loss of this wetland system due to development of the TR Group site. This report provides an ecological management plan for the wetlands as required by the resource consent.

2. PROJECT SCOPE AND OBJECTIVES

The project area comprises the wetland areas (freshwater swamp, saltmarsh and mangroves) at Ann's Creek, 791-793 Great South Road, Penrose. The aim of the project is to develop an Environmental Management Plan (EMP) to maintain and enhance the retained wetland habitats within a defined Wetland Management Area (WMA). The plan will consist of two components: wetland vegetation management, and management of spawning habitat for inanga (*Galaxias maculatus*, a species classified as 'At Risk – Declining by Goodman *et al.* (2014)).

The scope of the wetlands component of the EMP includes:

- (a) Identification and mapping of the composition and extent of vegetation types in the WMA;
- (b) The areas of mangroves (*Avicennia marina* subsp. *australasica*) within the WMA to be cleared during the initial implementation of the wetland component of the EMP;
- (c) Monitoring of the composition and extent of vegetation types in the WMA, to be undertaken by a suitably qualified and experienced ecologist, following the completion of construction works;
- (d) The programme for subsequent monitoring of the vegetation types, to be conducted for no less than 5 years, and the reporting on such monitoring to the Manager;
- (e) The process for the development of specific Wetland Mitigation Work Plan(s), which may involve vegetation removal or re-location, or other physical works within the WMA, in the event that monitoring indicates that the objective of this component of the EMP is not being achieved.
- (f) The opportunities (if any), for the relocation/re-establishment within the WMA of vegetation types that may have been lost, or had their area reduced, as a consequence of giving effect to this consent and the Stage 1 Consent, and the methodology to undertake that work;
- (g) Ongoing weed and animal pest control.

The scope of the inanga habitat component of the EMP includes:

- (a) Identification of the areas of the site within the WMA that provide habitat for inanga spawning and juvenile rearing (inanga areas);

- (b) The specific methods or works to be employed (if any) to enhance the inanga areas as habitat for inanga (e.g., retention and/or staged replacement of vegetation (including weed species), planting);
- (c) The programme for the implementation of any proposed works and its coordination with other works to be undertaken in the wetlands under the EMP;
- (d) Ongoing maintenance and/or additional planting work, and weed and animal pest control in the inanga areas;
- (e) The program to be implemented to monitor the success of the works to enhance inanga habitat.

3. ECOLOGICAL CONTEXT

Ann's Creek is located on the Onehunga foreshore, which runs along the northern edge of the Mangere Inlet. The area lies within the Tamaki Ecological District, and is typical of the district, with its strong coastal influence, abundance of volcanic substrates, and a high level of human modification and use.

3.1 Geological history

The ecological character of the Onehunga area has been heavily influenced by its history of volcanism. The following summary is derived from Searle (1981).

The Manukau lava field was built up by overlapping flows from the volcanic eruptions that formed One Tree Hill, Mount Smart, and Mount Wellington. Of these, Mount Smart was first to erupt, and lava flows spread in all directions, with topographic highs forcing large flows down towards Te Papapa. Flows buckled and formed ridges when they met the sandstone hill to the east, now known as Hamlins Hill. One Tree Hill then continued to build lava fields, with extensive flows south towards what is now the Manukau Harbour, and flows further to the south-east being diverted westward by previous flows from Mount Smart. Finally, about 9,000 years ago, Mount Wellington erupted. Lava flows headed towards Penrose and were temporarily blocked and dammed by the flows from Mount Smart and One Tree Hill. Eventually this lava escaped in a narrow stream between the Mount Smart flows and Hamlins Hill, down the length of what is now Great South Road, and fanned out over what is now Ann's Creek. These eruptions created extensive and often rugged areas of exposed basalt.

3.2 Lava flow vegetation

Prior to the advent of heavy earth-moving machinery, development in this part of Auckland was dictated by the presence of the lava flows. The surfaces were too difficult and expensive to flatten and buildings and roads were placed around them. Until at least the 1940s, extensive areas of lava field vegetation remained in or near Mount Wellington, Ellerslie, and Penrose (Cranwell 1981), and the lava flows of Ann's Creek remained undeveloped until the mid-1980s (Gardner 1992). Today, Auckland's lava flow vegetation, with its unique combination of drought-hardy indigenous plants, is all but gone. The largest areas remaining are in the vicinity of Almorah Road, in Epsom, and at Ann's Creek, in Penrose. For this reason, these sites have been recognized as Significant Ecological Areas under the Proposed Auckland

Unitary Plan (PAUP). Ann's Creek is now the most intact coastal lava field in the Auckland Region. The site contains transitions from freshwater to estuarine wetlands, and supports several nationally threatened or regionally threatened plant species. However, even at Ann's Creek, intensive development and weed invasion on the margins has resulted in the complete loss of coastal forest on terrestrial margins.

3.3 Estuarine vegetation and reclamation

Aside from the extensive loss of lava field vegetation, another major change along the Onehunga foreshore since human settlement has been the infilling/reclamation of intertidal areas and their conversion to industrial land. Onehunga formerly had a convoluted shoreline, with shallow embayments interspersed with intertidal flats and intertidal lava flows. The area supported estuarine vegetation such as mangrove shrubland, saltmarsh, and saltmeadow, and these habitats were probably contiguous along most of the coastline. Aerial photographs taken in 1940 show that intertidal habitats extended inland almost as far as Nielson Street (Auckland Council website, accessed 29 July 2014). Over the past 70 years, substantial reclamation has resulted in significant loss of intertidal habitats, and the development of a more or less straight-edged foreshore from the Port of Onehunga to Ann's Creek, a distance of approximately 2.8 kilometres. Along this shoreline, small patches of estuarine vegetation remain on the eastern side of the northern end of Mangere Bridge and at Green Stream, and larger patches on intertidal lava flows to the south of Miami Parade (Pikes Point Lava Islets), to the south-west of Hugo Johnston Drive (Manukau Foreshore East Lava Outcrops), and immediately adjacent to Hugo Johnston Drive (Ann's Creek Reserve Stormwater Wetland).

4. METHODOLOGY

4.1 Overview

Field surveys were undertaken in July and August 2014. Aquatic and terrestrial vegetation and habitats within the site were mapped (Figure 1) and described, and all plants and fauna present were recorded. Four Gee minnow traps, baited with bread and marmite, were set in freshwater habitats throughout the site. The traps were checked after three hours and the trapped fish were identified and released.

A list of vascular plants recorded during the field visits is provided in Appendix 1. Lichen species present within mangrove forest, scrub and shrubland were collected and identified. Representative site photographs are provided in Appendix 2.

4.2 Environmental pest plant survey

Environmental pest plants are introduced species that threaten the ecological processes and values within the area where they are present. Field survey methods were based on previous environmental pest plant inventories undertaken by Wildland Consultants Ltd (2014). The field survey involved walking through the project area identifying and recording the location, distribution and density of all environmental pest plants encountered.

Environmental pest plant distributions and densities were mapped in the field onto hard copy prints of digital orthophotographs. The maps were then used to digitise the location and distribution of each environmental pest plant species in a GIS (ArcGIS 8.3). Environmental pest plant species were labelled with their common name and a brief description of the extent of the infestation, either as percentage cover or as the number of individuals, and overlaid on the aerial photograph.

The relative priority for the control of each environmental pest plant species was assessed based on the Auckland Regional Pest Management Strategy (RPMS; ARC 2007), the ecological values of the site in which the infestation occurs, the relative vulnerability of the vegetation and habitats present, the level of threat posed by the environmental pest plant species, and the size of the infestation. Environmental pest plant species within each priority level (Levels 1-5 with Level 1 being the highest priority for control) are listed in Section 8 below.

4.3 Planting

Potential restoration planting sites and areas where planting would be advisable were identified during the field survey. These areas include sites where environmental pest plant infestations will be an ongoing problem if planting is not undertaken, and areas that are either species-poor or lacking key indigenous plant species. Areas where formerly saline habitats have been modified by increased freshwater inputs were identified and mapped.

4.4 Inanga habitat

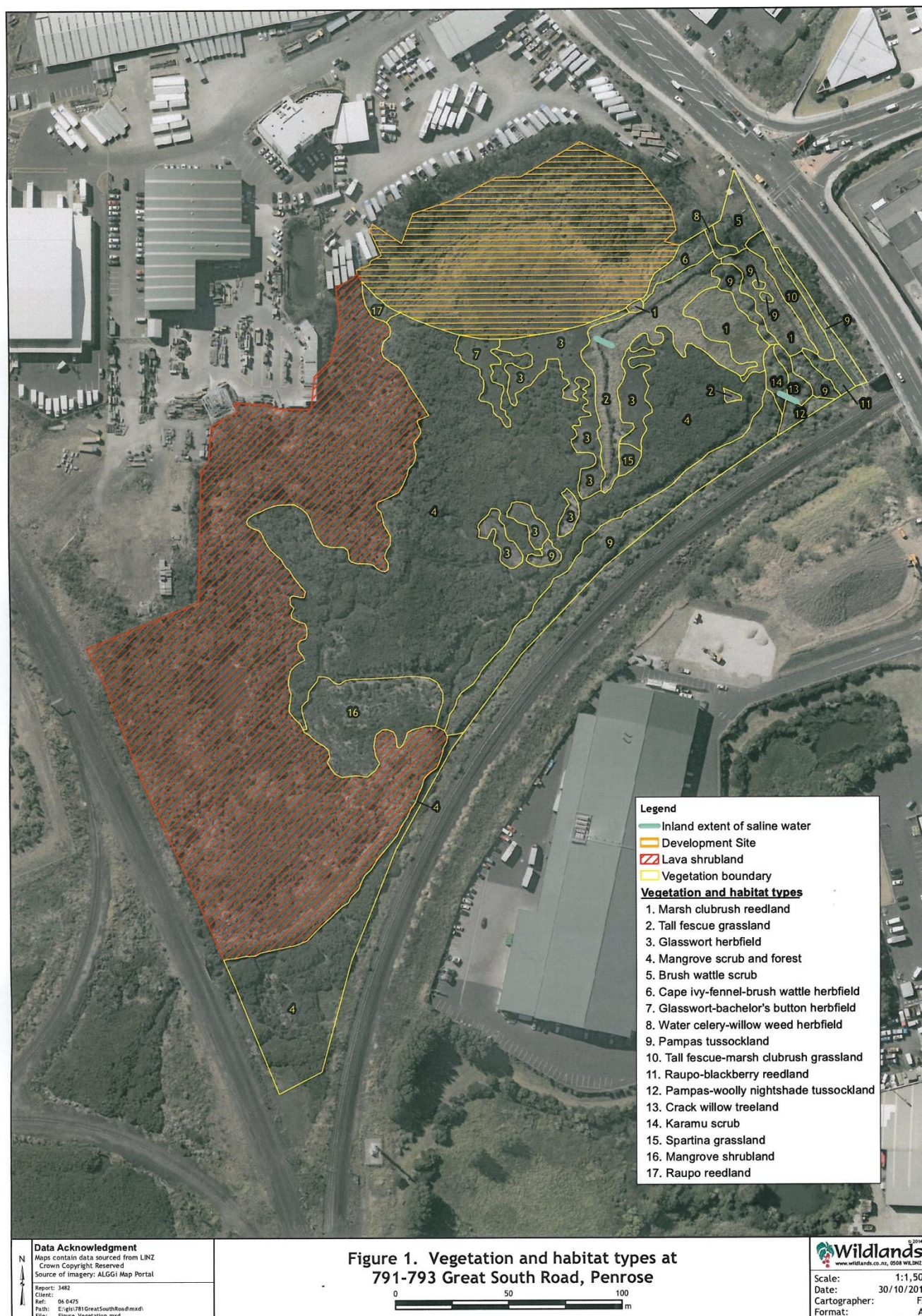
Habitats suitable as spawning or juvenile rearing habitats for inanga were identified and mapped. Areas that could potentially support inanga were also identified, and the management requirements (e.g. weed control, animal pest control, placement of woody debris, planting) for these areas were assessed.

5. VEGETATION AND HABITATS

5.1 Overview

The vegetation within the Wetland Management Area comprises freshwater and saline wetlands, with terrestrial vegetation on the dryer, adjoining slopes. Almost all of the saline wetlands are dominated by indigenous species, as regular inundation by the sea limits the growth of most pest plant species. The freshwater wetlands include vegetation types that are both relatively unmodified and intact, and wetlands that are highly modified and dominated by pest plant species. The dryer slopes adjoining the wetland are almost solely vegetated with pest plant species, with indigenous species only locally present. Vegetation and habitat types are shown in Figure 1.

The maximum inland extent of tidal waters at the site was determined in the field by mapping the seaward limit of willow weed (*Persicaria maculosa*, a freshwater plant) and the inland limit of mangroves (a saline or brackish water plant).



5.2 Terrestrial habitats

Water celery-willow weed herbfield in stream and on stream banks (0.008 ha)

Exotic herbfield, dominated by water celery (*Apium nodiflorum*) and willow weed (*Persicaria maculosa*), occurs along small freshwater streams and drains in the east of the site. Water celery and willow weed are the most common species within the stream channels. On the wet, low-lying banks, these species are again common, but a range of other exotic herbs and vines are also present, including hemlock (*Conium maculatum*), creeping buttercup (*Ranunculus repens*), nasturtium (*Tropaeolum majus*), cape ivy (*Senecio angulatus*), wild radish (*Rhaphanus raphanistrum*), and purple-top (*Verbena bonariensis*).

Marsh clubrush reedland on floodplain (0.136 ha)

Marsh clubrush (*Bolboschoenus fluviatilis*) reedland occurs on areas of permanently moist to wet soils on the low-lying flats and stream banks in the east of the site. Marsh clubrush is the sole dominant, forming a dense, single-species community over most of this vegetation type. This species is winter dormant, and at the time of survey the culms had browned off and were starting to fall (Appendix 3: Plate 1). Blackberry (*Rubus fruticosus* agg.) is occasional on the drier margins of this type.

Tall fescue-marsh clubrush grassland on floodplain (0.045 ha)

The eastern edge of the marsh clubrush reedland, described above, is drier and grades into tall fescue (*Schedonorus phoenix*)-marsh clubrush grassland. These species are co-dominant, with occasional gorse (*Ulex europaeus*) and three-cornered garlic (*Allium triquetrum*).

Tall fescue grassland on floodplain (0.195 ha)

Tall fescue is the dominant species throughout this unit. This grass forms a dense sward approximately 0.3-0.5 m tall, and provides dense, overhanging growth on the banks of the stream (Appendix 3: Plate 2). Along the edges of the stream channel, there are locally scattered mangrove, saltmarsh ribbonwood (*Plagianthus divaricatus*), and marsh clubrush. Blackberry is scattered throughout the eastern portion of this unit.

Raupo-blackberry reedland on low-lying floodplain (0.017 ha)

In the south-eastern corner of the site, there is a small area of raupo (*Typha orientalis*)-blackberry reedland. Raupo is abundant and blackberry is common. Pampas, *Coprosma macrocarpa* var. *minor*, and karamu (*Coprosma robusta*) are occasional on the margins.

Raupo reedland in freshwater swamp (0.012 ha)

On the north-eastern edge of the site, there is a freshwater swamp dominated by raupo (Appendix 3: Plate 3). This area receives freshwater from a stormwater pond to the west of the site.

Pampas-woolly nightshade scrub on railway embankment (0.017 ha)

Pampas (*Cortaderia selloana*) and woolly nightshade (*Solanum mauritianum*) are the dominant species on a small area of hillslope in the south-eastern corner of the site. Kawakawa (*Piper excelsum*) and karamu (*Coprosma robusta*) are locally abundant, with occasional blackberry, *Pteris tremula*, moth plant (*Araujia hortorum*), bindweed (*Calystegia sylvatica*), lantana (*Lantana camara*), and veldt grass (*Ehrharta erecta*).

Brush wattle scrub on hillslope (0.039 ha)

On a well-drained slope in the north-eastern corner of the site, adjacent to Great South Road, there is a small area of brush wattle (*Paraserianthes lophantha*) scrub (Appendix 3: Plate 4).

Cape ivy-fennel-brush wattle herbfield on hillslope (0.027 ha)

This vegetation type occurs on a well-drained slope near the north-eastern corner of the site. Cape ivy (*Senecio angulatus*), fennel (*Foeniculum vulgare*), and brush wattle are common, with hemlock, cocksfoot (*Dactylis glomerata*), pampas, and pie melon (*Cucurbita ficifolia*).

Pampas tussockland on floodplain and drain excavations (0.310 ha)

Pampas tussockland occurs throughout the site. Many areas occur as long thin bands that are parallel with water courses (Appendix 3: Plate 5), and it is probable that the pampas there colonised material excavated from the adjacent drains. Pampas is dominant, forming dense stands, with occasional tall fescue and kikuyu on the margins. Pampas also occurs on small raised areas within the mangrove scrub.

Karamu scrub on low basalt ridge (0.019 ha)

Karamu scrub occurs on a small ridge of basalt in the south-east of the site. Karamu is common, with brush wattle, woolly nightshade, karo (*Pittosporum crassifolium*), taupata (*Coprosma repens*), and moth plant.

Crack-willow treeland on floodplain (0.017 ha)

On the western bank of the stream in the south-east of the site, there is a row of small crack willow (*Salix fragilis*) trees. The trees are single trunked, and approximately 5 m tall with trunks 15-20 cm in diameter.

5.3 Intertidal habitats

Mangrove scrub and forest on intertidal flats (1.868 ha)

Mangroves form a dense scrub across most of the intertidal flats of the site. The majority of this vegetation type is 2-3 m tall, but on the southern edge of the site, close to a tidal channel, there is an area of older mangrove forest with trees to 3.5 m tall (Appendix 3: Plate 6). Smilax (*Asparagus asparagoides*), a pest plant, is an occasional epiphyte in the trunk cavities of older mangroves (Appendix 3: Plate 7).

The mangroves support a moderately diverse lichen flora, with at least 22 indigenous species present.

Mangrove shrubland on intertidal flats (0.184 ha)

Near the south-western edge of the site, there is an area of mangrove shrubland. Low mangrove shrubs 1-2 m tall form a broken canopy, interspersed with open, muddy intertidal flats. Pampas is locally common, especially on any raised surfaces, and glasswort (*Sarcocornia quinqueflora*) and arrow grass (*Triglochin striata*) are also locally common, forming dense patches.

Glasswort herbfield on intertidal flats (0.211 ha)

Glasswort herbfield occurs as a band between the mangrove shrubland and the shoreline (Appendix 3: Plate 8). Glasswort is common, forming patches on the intertidal mudflats, with frequent arrow grass, and occasional bachelor's button (*Cotula coronopifolia*) and spartina (*Spartina* sp.). Mangroves occur as occasional seedlings and small shrubs.

Glasswort-bachelors button herbfield on intertidal flats (0.037 ha)

Glasswort-bachelors button herbfield occurs on an intertidal flat within the mangrove scrub on the northern edge of the wetland (Appendix 3: Plate 9). Glasswort and bachelors button are common, forming a dense low sward. Mangroves occur as occasional low shrubs.

Spartina grassland on intertidal flat (0.010 ha)

On the eastern bank of the stream, close to the western limit of the tall fescue grassland, there is a small area of spartina (*Spartina* sp.) grassland. Glasswort is frequent, with occasional tall fescue on the landward margins.

6. FLORA

6.1 Vascular plants

Eight indigenous and 21 naturalised vascular plant species were recorded during the survey. No nationally 'Threatened' or 'At Risk' species, as per de Lange *et al.* (2013), or regionally threatened or uncommon plants, as per Stanley *et al.* (2005), were recorded at the site.

6.2 Lichens

The mangroves within the site support a moderately diverse lichen flora, comprising at least 22 indigenous species (Appendix 3). The most diverse lichen communities occur on older mangroves alongside the eastern drain. It is notable that the 22 indigenous species within mangrove communities compares to only eight indigenous vascular species within the remainder of the Wetland Management Area. The lichens present include two species listed as "Data Deficient" (de Lange *et al.* 2012).



7. FAUNA

7.1 Freshwater fish

Inanga (*Galaxias maculatus*) were recorded in the northernmost stream. The site is also likely to provide habitat for shortfin eel (*Anguilla australis*). Inanga is classified as “At Risk – Declining” in Goodman *et al.* (2014).

7.2 Avifauna

Four indigenous bird species were recorded at the site: North Island fantail (*Rhipidura fuliginosa placabilis*), black shag (*Phalacrocorax carbo novaehollandiae*), pukeko (*Porphyrio melanotus*), and paradise shelduck (*Tadorna variegata*). Black shag is classified as “At Risk-Naturally Uncommon” in Robertson *et al.* (2013).

7.3 Herpetofauna

No survey for herpetofauna was undertaken at the site. The Department of Conservation’s Bioweb Herpetofauna Database includes records for five species of indigenous lizards within the Tamaki Ecological District, of which two may be present within the site.

Copper skink (*Oligosoma aeneum*) and ornate skink (*Oligosoma ornatum*) may occur in areas with dense terrestrial vegetation. Ornate skink has a conservation status of “At Risk-Declining” (Hitchmough *et al.* 2013), and all indigenous lizards are protected under the Wildlife Act (1953). Rainbow skink (*Lampropholis delicata*), an introduced species, is present in the local area and is also likely to be found at the site.

8. RESTORATION GOALS AND TARGETS

8.1 Wetland Management Area

The Wetland Management Plan will maximise the extent of indigenous wetland vegetation types within the site by undertaking control of pest plants, and planting. For each vegetation type within the site, the underlying hydrology, with respect to the relative influence of fresh versus saline waters, soil moisture, and frequency of inundation, was identified. Most of the site is covered by exotic vegetation, and following control of pest plant species, each vegetation type will be restored with a suite of indigenous plant species that is reflective of the environmental conditions present within each planting unit.

8.2 Inanga spawning habitat

Watercourses at the site will be restored to provide suitable habitat for inanga spawning at the freshwater-saline interface, and for adult and juvenile inanga along within freshwater reaches. It is difficult to measure inanga spawning success without risking damaging egg clusters, and obtaining reliable population estimates of adults is labour intensive and prone to sampling error. Success of inanga habitat restoration will therefore be measured as the length of suitable habitat present (as described in

Section 9.2.1 below), and the presence of juveniles or adults within each stream. In areas where suitable habitat already exists in the form of non-native plant species, these will be allowed to revert to indigenous vegetation naturally with minimal intervention.

9. RESTORATION METHODS

9.1 Wetland Management Area

Existing areas of indigenous wetland vegetation will be enhanced by undertaking control of pest plants and pest animals. All areas of exotic vegetation at the site, both within wetlands and on the terrestrial margins, will be restored by undertaking intensive site preparation and pest plant control, indigenous planting, and control of pest animals. This will maximize the extent of indigenous wetland vegetation at the site, and restore ecotones from freshwater to terrestrial environments. Restoration of coastal shrubland and forest on the margins of the wetlands will ensure wetland areas are well buffered from the surrounding land uses.

9.2 Inanga spawning habitat

9.2.1 Background

Inanga lay their eggs in estuarine environments near the upper limit of saltwater penetration into the estuary. Spawning generally occurs between February and May during spring tides. The adults migrate into the estuary just before high tide and lay their eggs in riparian vegetation temporarily submerged by the tide. The eggs hatch when they are submerged by subsequent spring tides, which can be two to four weeks later. In order to spawn successfully, inanga need areas where the soil remains permanently damp between spring tide events. This normally occurs where the riparian vegetation contains long-leaved grasses or sedges that overhang the water and provide shade to the eggs. The eggs are vulnerable to disturbance through trampling or vegetation clearance, so this must be avoided during the spawning season. The eggs are also predated by rodents (particularly mice), crabs and other fish (including adult inanga). Whilst predation by crabs and fish is hard to control, it is possible to reduce mouse numbers through selective use of bait stations and traps in areas where spawning is known to occur.

Most adult inanga live in freshwater habitats, although fish can also occur in the lower brackish reaches. They survive best in streams with a high level of shading from indigenous vegetation and in streams with deep pools with a range of substrate types and in-stream debris such as wood and rocks.

9.2.2 Restoration works

Adult inanga have been recorded in the main stream at the site (Figure 2). The upper reaches are freshwater and the lower reaches have a saltwater influence at high tide. The riparian vegetation is currently dominated by rank tall fescue grassland. Although

this is a non-native species, it is providing good spawning habitat. Where this species occurs on stream banks, it will be left in place until it is replaced by native vegetation through natural succession. Where appropriate, the successional process will be accelerated through judicious weeding and re-planting of some areas outside of the inanga spawning season.

Inanga have not been recorded in the stream along the south-eastern boundary. However, the stream does offer suitable habitat and it is likely they are present. As with the main stream, there is sufficient saltwater influence to allow inanga spawning, but the present pampas tussockland vegetation does not provide suitable conditions for successful spawning. Pampas will be removed from the banks of the secondary stream and native sedges and rushes will be planted in the riparian zone to provide suitable conditions for inanga spawning.

In-stream habitat in the stream parallel to Great South Road, which is shallow with poorly defined banks, could be enhanced for juvenile and adult inanga by the placement of woody debris to encourage the formation of deeper pools. Planting the banks of this stream with species such as purei (*Carex virgata*), that have dense, fibrous root systems, will lead to greater bank stability, and encourage the formation of a heterogeneous stream bed, including pools, riffles, and undercut banks.

No fish migration barriers were identified in the streams.

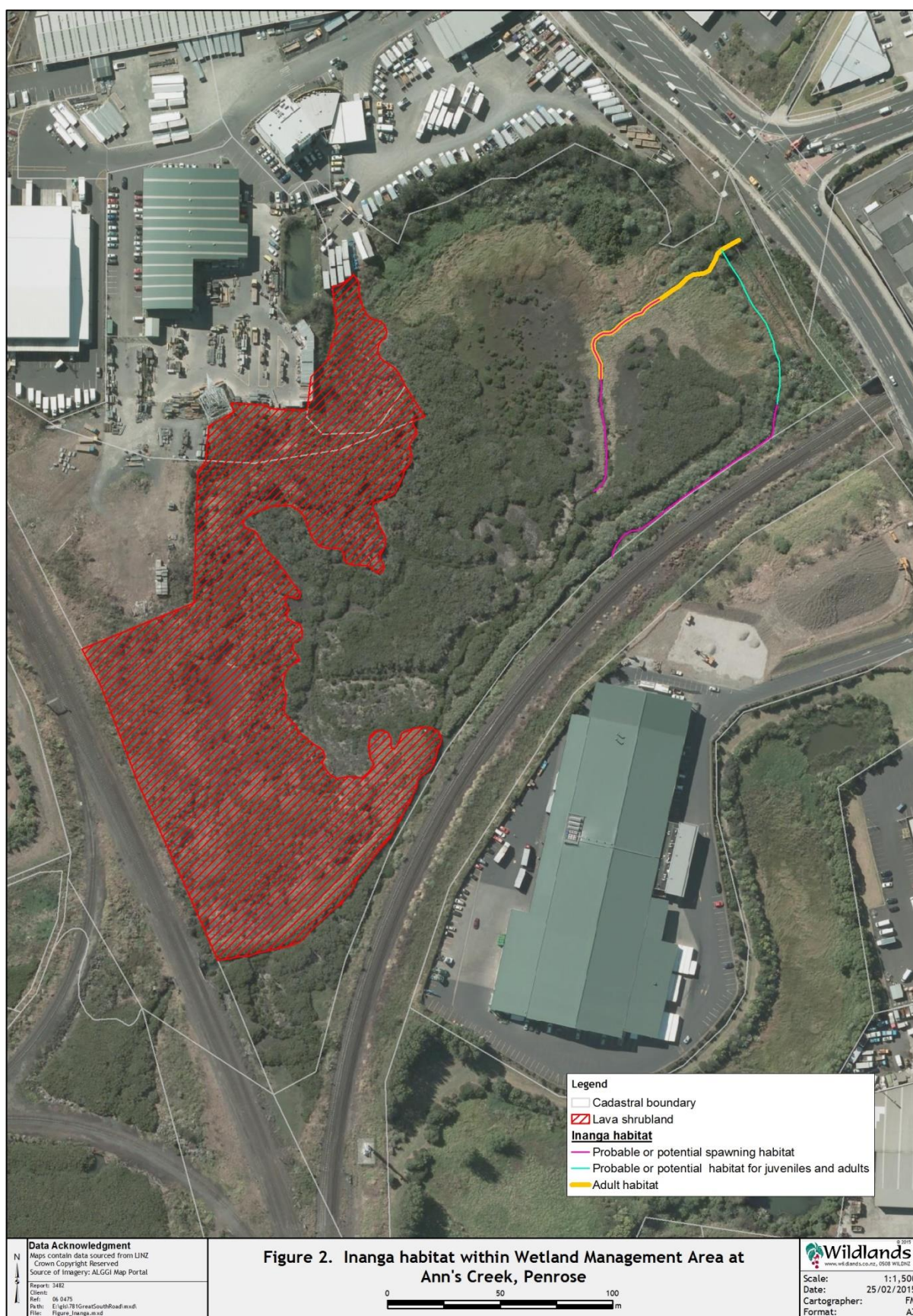
10. ENVIRONMENTAL PEST PLANTS

Twenty-nine environmental pest plant species were identified within the project area. Eleven of these species are not identified in the Auckland Regional Pest Management Strategy (ARC 2007), but control is still recommended, as addressed below. The distributions and abundances of environmental pest plant infestations are mapped in Figure 3.

10.1 Environmental pest plant control priorities

The control of environmental pest plants was prioritised using the three pest plant categories in the Auckland RPMS (ARC 2007): (i) Total Control Pest Plants, (ii) Containment Pest Plants, and (iii) Surveillance Pest Plants.

Two further classes of plants are identified in this report: (iv) environmental pest plants not currently covered by the RPMS (ARC 2007), but for which control is recommended; and (v) exotic plant species which are not considered a threat to the ecology of the reserve, but whose removal would be beneficial. Brief descriptions of the distribution of environmental pest plant species are listed below, separated into their respective categories.





(i) Total Control Pest Plants

Total Control Pest Plants have a limited distribution or density within the Auckland Region, or defined parts of the Region. They are considered to be of high potential threat to the Region, and Auckland Council assumes full responsibility for funding and implementing appropriate management programmes for these species. The aim is to eradicate these plants from the Region or defined parts of the Region, over a period of time, which may exceed the life of the current RPMS (ARC 2007).

There were three Total Control Pest Plants recorded in the project area:

Lantana (<i>Lantana camara</i>)	a) Total Control Pest Plant in the rural areas of the Auckland region; and a b) Surveillance Pest Plant throughout the remainder of the Auckland region.
Madeira vine; mignonette vine (<i>Anredera cordifolia</i>)	a) Total Control Pest Plant in areas where it threatens High Conservation Value sites, as determined by ARC staff; and a b) Surveillance Pest plant throughout the remainder of the Auckland Region.
Spartina (<i>Spartina spp.</i>)	a) Total Control Pest Plant in the Waitemata and Manukau Harbours, and all waterbodies of the east coast of the Auckland region; and a b) Surveillance Pest Plant throughout the remainder of the Auckland region.

(ii) Containment Pest Plants

Containment pest plants are those that are abundant in certain habitats or areas in the region. Landowners/occupiers are required to control these plants whenever they appear on their land. All containment pest plants are banned from sale, propagation, distribution, and exhibition through the entire Auckland Region (ARC 2007).

Four containment pest plants were present in the project area, and their control requirements are listed below:

Gorse (<i>Ulex europaeus</i>)	Boundary control (20 m in rural areas only).
Moth plant (<i>Araujia sericifera</i>)	Removal (Waitakere and Hunua Ranges Weed Control Zones, specified coastal mainland sites and Hauraki Gulf Islands only)
Smilax (<i>Asparagus asparagoides</i>)	Removal (Waitakere Ranges Weed Control Zone and Great Barrier Island only)
Woolly nightshade (<i>Solanum mauritianum</i>)	Removal (Waitakere Ranges Weed Control Zone and Great Barrier Island only). Boundary control (20 m in remainder of Region).

(iii) Surveillance Pest Plants

Surveillance pest plants include species that have been identified as having significant impacts on the biosecurity values of the Auckland Region. Auckland Council seeks to prevent their establishment or spread by prohibiting their sale, propagation, distribution, and exhibition (ARC 2007).

Eleven surveillance pest plants were recorded during the survey:

- alligator weed (*Alternanthera philoxeroides*)
- blackberry (*Rubus fruticosus* agg.)
- brush wattle (*Paraserianthes lophanta*)
- Cape ivy (*Senecio angulatus*)
- Chinese privet (*Ligustrum sinense*)
- crack willow (*Salix fragilis*)
- hemlock (*Conium maculatum*)
- Japanese honeysuckle (*Lonicera japonica*)
- pampas (*Cortaderia selloana*)
- tradescantia (*Tradescantia fluminensis*)
- tuber ladder fern (*Nephrolepis cordifolia*)

(iv) Environmental Pest Plants Not Within the Auckland RPMS

Environmental pest plant species that are present in small to moderate infestations within the project area and are not identified in the RPMS (ARC 2007).

Three species in this category were recorded in the project area:

- bindweed (*Calystegia silvatica*)
- garden nasturtium (*Tropaeolum majus*)
- tall fescue (*Schedonorus arundinaceus*)

(v) Exotic Plant Species Whose Removal Would Be Beneficial

Exotic plant species which are not considered a threat to the ecology of the reserve but which the removal of would be beneficial.

Eight species in this category were recorded in the project area.

- broad-leaved dock (*Rumex obtusifolius*)
- kikuyu (*Cenchrus clandestinus*)
- fennel (*Foeniculum vulgare*)
- onion weed (*Allium triquetrum*)
- pie melon (*Cucurbita ficifolia*)
- water celery (*Apium nodiflorum*)
- willow weed (*Persicaria maculosa*)
- wild radish (*Raphanus raphanistrum* subsp. *raphanistrum*)

10.2 Pest plant control

Pest plant control will be a key factor in the successful implementation of this project. All environmental pest plants within the Wetland Management Area should be controlled. Pest plant control is also required in those parts of the site under the control of the consent holder that are outside of the Wetland Management Area

(Consent Condition 7.7 (a)). Control of pest plants beyond the wetland will reduce the spread of pest plants into the wetland from adjacent land.

Control methods should comprise a combination of knapsack spraying, gunspraying, bore cutting and injecting, drilling and injecting, frilling and spraying, and cutting and stump spraying. Control methods recommended for environmental pest plant species are presented in Appendix 4. All herbicide plant pest control operations should be undertaken in accordance with the Agrichemical Users' Code of Practice, NZS 8409 2004.

Prior to starting any site preparation and weed control works, the boundary of the project area should be clearly defined on the ground.

11. PEST MAMMALS

11.1 Overview

Several introduced mammal species are likely to be present at the site and these will have varying negative impacts on indigenous flora and fauna. Possums (*Trichosurus vulpecula*) and rabbits (*Oryctolagus cuniculus*) have previously been recorded at the site. Both of these species can damage existing vegetation and limit regeneration by eating flowers and fruits (possums) and seedlings or plantings (rabbits). Rats (ship (*Rattus rattus*) and Norway (*R. norvegicus*)) and mice (*Mus musculus*) are almost certainly present at the site. These species prey on native fauna and can also limit forest regeneration through seed predation. Mice have been implicated as a major predator of inanga eggs along waterways (Baker 2006). Pest mammal control within a small area such as Ann's Creek is problematic as there will potentially be high levels of reinvasion from neighbouring properties. However, careful timing of control pulses may provide sufficient respite from pest mammals to allow a short-term improvement in biodiversity values to be observed.

Pest mammal control pulses will occur three times a year in March, July and November. Rodents and possums will be controlled using brodifacoum baits in bait stations. Rabbits will be controlled if they begin to cause damage at the site.

11.2 Rodent and possum control

Rodents and possums will be controlled using Philproof bait stations modified with spikes to secure rodent bait blocks. Bait stations will be placed every 50 m around the perimeter of the site and along the edges of the mangroves. Bait stations will need to be securely attached to a stake and placed approximately 30 cm off the ground.

Ditrac bait blocks will be used to control rodents. The active ingredient in this bait is diphacinone and the baits have a hole through the middle allowing them to be secured into a bait station. Four blocks will be placed into each bait station and left in place for five nights. After five nights eaten blocks should be replaced and left in place for five more nights before all remaining toxin is removed.

Following rodent baiting, 250g of Pestoff waxed possum pellets containing 0.02g/kg brodifacoum will be placed in every second bait station giving a possum bait station spacing of c.100 m. These baits should be left in place for five nights before being checked and replenished if necessary. At the end of the pulse, all baits should be removed from the site. A lure of either flour and icing sugar or a commercially available aerosol lure can be used to increase the attractiveness of bait stations to possums.

If inanga spawning areas are identified, then controlling mice in autumn when spawning occurs is important. Effective control of mice requires bait stations that are not accessible to rats to be placed every 20 m along stream edges identified as potential inanga spawning grounds. Several mouse bait station designs are available and “Rodent baiters for mice” available from Pest Management Services (<http://www.nopests.co.nz/?product=rodent-baiters-mouse>) are ideal. Each station should have two Ditrac blocks placed into it and baits should be checked and replaced after five nights and then cleared after another five nights.

11.3 Rabbit control

Rabbit control will take place on a response basis should ongoing monitoring of the restoration plantings and threatened plant populations detect damage caused by rabbits. Pindone in bait stations or shooting will be used to reduce rabbit numbers.

12. PLANTING RECOMMENDATIONS

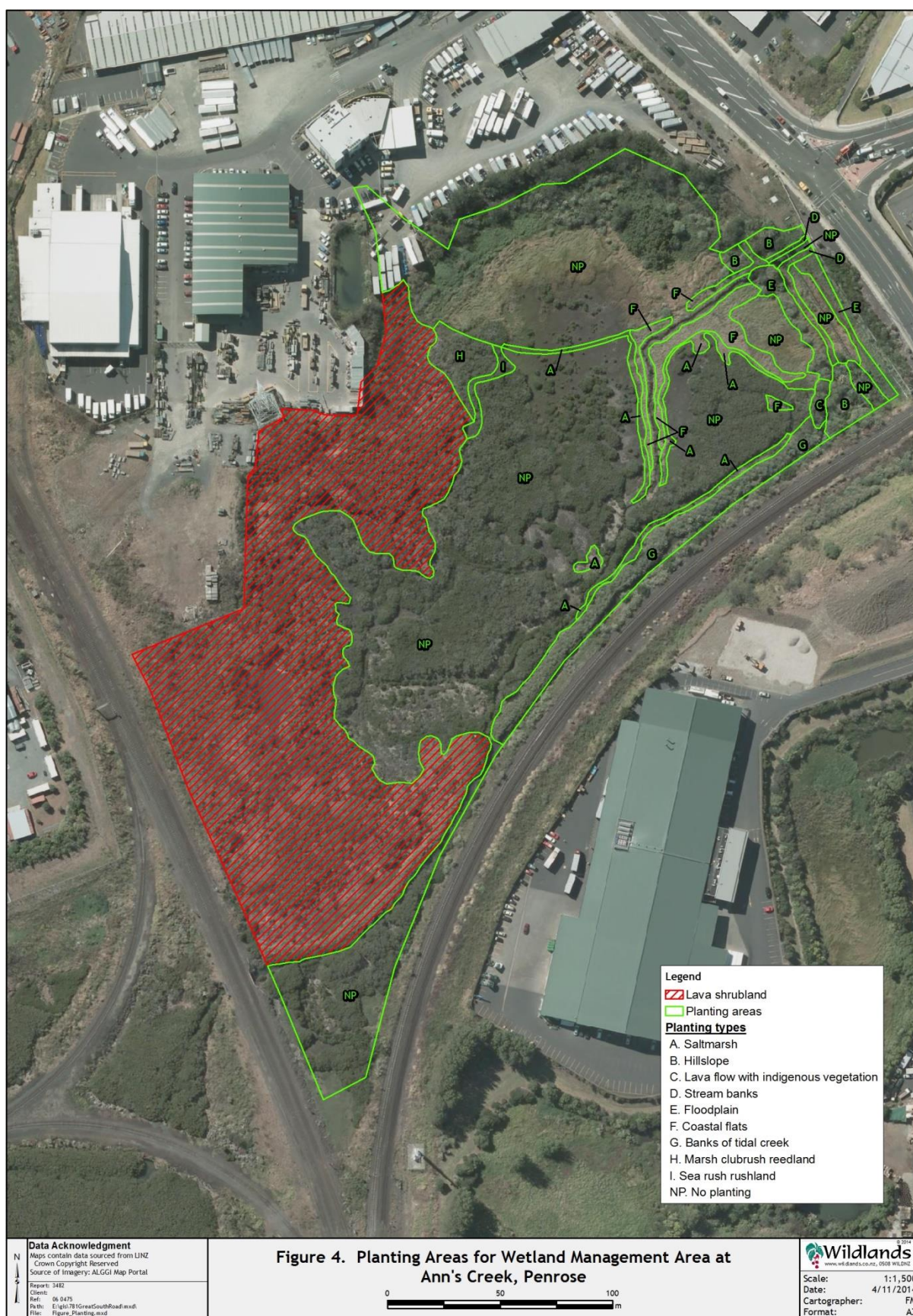
12.1 Overview

The highest priority areas for planting are areas of exotic vegetation. Following control of pest plants, planting in areas dominated by exotic species will restore vegetation types lost from the site, restore ecological sequences and linkages, and reduce the opportunity for reinvasion by pest plants. Approximately 800 m² of mangrove shrubland will be thinned to allow for the planting of marsh clubrush and sea rush. This will occur where increased freshwater input has decreased the salinity of a saline wetland, causing a proliferation of exotic species.

No plantings are needed in areas where indigenous vegetation is relatively intact. Management of these areas should be restricted to control of pest plants and pest animals to facilitate natural successional processes. No planting should occur in the following vegetation types:

- Raupo reedland;
- Marsh clubrush reedland;
- Glasswort herbfield;
- Glasswort-bachelor’s button herbfield.

The proposed areas for planting cover c.0.69 hectares and are shown in Figure 4.



12.2 Site preparation

Site preparation will be a key factor in the successful implementation of this project. All environmental pest plants should be controlled as per Section 10 above, prior to undertaking site preparation. Areas of rank exotic grasses and herbs should be blanket sprayed with Glyphosate 6-8 weeks prior to planting.

12.3 Saline wetlands

12.3.1 Planting Area A (saltmarsh)

Planting Area A includes areas that are inundated by brackish water during spring high tides and dominated by pest plant species. These areas provide an excellent opportunity to restore saltmarsh vegetation, which is presently very limited in extent within the site.

This plant schedule will achieve a dense rushland and shrubland within 3-5 years, and comprises indigenous species that occur naturally in saltmarshes of the Tamaki Ecological District. All of the species included are tolerant of full sun, saline soils, and periodic inundation by spring tides. The plant schedule includes species that vary in their tolerance of water depth. Species that need to be planted on the landward edge of the saltmarsh are identified.

Table 1: Planting Schedule for Planting Area A (1000 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Plagianthus divaricatus</i> ¹	Marsh ribbonwood	2L	1.0	250
<i>Juncus kraussii</i>	Sea rush	0.5L	1.0	450
<i>Apodasmia similis</i>	Oioi	0.5L	1.0	300
Total				

¹ Only plant along landward edge.

12.4 Terrestrial habitats

12.4.1 Planting Area B (hillslope)

Planting Area B includes well-drained hillslopes that are dominated by pest plant species. These areas provide an opportunity to restore coastal shrubland and forest.

This plant schedule will achieve canopy closure within 3-5 years, and comprises indigenous species that occur naturally on hillslopes in coastal areas of the Tamaki Ecological District. All of the species included are tolerant of full sun and summer drought.

Table 2: Planting Schedule for Planting Area B (700 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Pittosporum crassifolium</i>	Karo	2L	1.0	75
<i>Piper excelsum</i>	Kawakawa	0.5L	1.0	50
<i>Coprosma repens</i>	Taupata	0.5L	1.0	50
<i>Coprosma robusta</i>	Karamu	0.5L	1.0	100
<i>Myoporum laetum</i>	Ngaio	2L	1.0	75
<i>Kunzea ericoides</i>	Kanuka	0.5L	1.0	200
<i>Phormium tenax</i>	Harakeke, flax	0.5L	1.0	150
Total				700

12.4.2 Planting Area C (lava flow)

Planting Area C includes existing scrub dominated by karamu. Pest plant species are locally abundant and planting will be required following weed control to restore a closed canopy. This area provides an opportunity to restore coastal shrubland and forest.

This plant schedule will, following removal of pest plants, restore canopy closure within 3-5 years, and comprises indigenous species that occur naturally on lava flows in coastal areas of the Tamaki Ecological District. All of the species included are tolerant of partial shade and summer drought.

Table 3: Planting Schedule for Planting Area C (100 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Pittosporum crassifolium</i>	Karo	0.5L	1.0	25
<i>Piper excelsum</i>	Kawakawa	0.5L	1.0	40
<i>Coprosma robusta</i>	Karamu	0.5L	1.0	25
<i>Myoporum laetum</i>	Ngaio	0.5L	1.0	10
Total				

12.4.3 Planting Area D (stream banks)

Planting Area D includes stream banks currently covered by exotic herbfield. This plant schedule will achieve rapid canopy closure within 3-5 years, and comprises indigenous species that occur naturally on stream margins in coastal areas of the Tamaki Ecological District. The plant schedule includes species with: 1) growth forms that slow overland flow; 2) rhizomatous root-systems for bank stability; and, 3) tolerance of temporary inundation.

Table 4: Planting Schedule for Planting Area D (200 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Coprosma propinqua</i>	Mingimingi	0.5L	1	20
<i>Cordyline australis</i>	Ti kouka, cabbage tree	0.5L	1	20
<i>Dacrycarpus dacrydioides</i> ¹	Kahikatea	2L	5	10
<i>Carex lessoniana</i>	Rautahi	0.5L	1	50
<i>Cyperus ustulatus</i>	Toetoe upokotangata	0.5L	1	50
<i>Leptospermum scoparium</i>	Manuka	0.5L	1	30
<i>Phormium tenax</i> ¹	Harakeke/NZ flax	0.5L	1	30
Total				210

1. Do not plant within 1 m of the stream.

12.4.4 Planting Area E (floodplain)

Planting Area E includes a floodplain between a small stream and the eastern boundary of the property. This planting unit has better soil drainage than Planting Area D and is currently covered by tall fescue grassland and pampas tussockland. Soils will remain moist, but not waterlogged throughout the year, and the area may be occasionally inundated following heavy rain. This area provides an opportunity to restore lowland floodplain forest. This plant schedule will achieve rapid canopy closure within 3-5 years, and comprises indigenous species that occur naturally on floodplains in coastal areas of the Tamaki Ecological District.

Table 5: Planting Schedule for Planting Area E (900 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Coprosma propinqua</i>	Mingimingi	0.5L	1	80
<i>Cordyline australis</i>	Ti kouka, cabbage tree	0.5L	1	100
<i>Dacrycarpus dacrydioides</i>	Kahikatea	2L	5	20
<i>Carpodetus serratus</i>	Putaputaweta	2L	1	40
<i>Leptospermum scoparium</i>	Manuka	0.5L	1	350
<i>Phormium tenax</i> ¹	Harakeke/NZ flax	0.5L	1	320
Total				910

12.4.5 Planting Area F (coastal flats)

Planting Area F includes the extensive flats adjacent to the stream that are currently covered in tall fescue grassland. This stream flat has variable soil moisture, with greater inundation depths occurring in lower-lying depressions and on the stream banks. The inland edge of this planting unit is only likely to be flooded by freshwater, whereas the coastal edge is likely to be occasionally inundated with brackish water, when spring tides coincide with high rainfall. This plant schedule is based on indigenous species that occur naturally on coastal flats elsewhere in the Auckland Region (e.g. on the northern edge of the Puhinui Inlet, 11 km to the south).

Table 6: Planting Schedule for Planting Area F (1200 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Coprosma propinqua</i> ¹	Mingimingi	0.5L	1	70
<i>Cordyline australis</i> ¹	Ti kouka, cabbage tree	0.5L	1	150
<i>Cyperus ustulatus</i>	Toetoe upokotangata	0.5L	1	250
<i>Leptospermum scoparium</i> ¹	Manuka	0.5L	1	200
<i>Olearia solandri</i>	Coastal tree daisy	2 L	1	30
<i>Phormium tenax</i> ¹	Harakeke/NZ flax	0.5L	1	300
<i>Plagianthus divaricatus</i> ²	Marsh ribbonwood	2L	1	200
Total				1200

1. Only plant on higher surfaces further away from the tidal creek.

2. Plant in groups of 3-5 plants, c.1 m back from the edge of the tidal creek.

12.4.6 Planting Area G (banks of tidal creek)

Planting Area G lies on the northern bank of the drain that flows along the southern boundary of the site. This planting unit has soil moisture that is highly variable due to historical earthworks; some areas are low-lying and at or close to the extent of high spring tides, whereas other areas are elevated and well-drained. All of Planting Area G is currently dominated by dense pampas tussockland. For planting along the edge of the tidal creek, this plant schedule includes indigenous species with: 1) growth forms that slow overland flow; 2) rhizomatous root-systems for bank stability; and, 3) tolerance of temporary inundation. The plant schedule maximizes the use of fast-growing species that are tolerant of modified soils, as the rapid establishment of dense cover will limit the future establishment of pampas.

Table 7: Planting Schedule for Planting Area G (2000 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Apodasmia similis</i> ¹	Oioi	0.5L	1	300
<i>Coprosma propinqua</i>	Mingimingi	0.5L	1	100
<i>Coprosma robusta</i>	Karamu	0.5L	1	150
<i>Cordyline australis</i>	Ti kouka, cabbage tree	0.5L	1	250
<i>Juncus kraussii</i> ¹	Sea rush	0.5L	1	200
<i>Leptospermum scoparium</i>	Manuka	0.5 L	1	300
<i>Myoporum laetum</i> ²	Ngaio	2L	1	100
<i>Phormium tenax</i>	Harakeke/NZ flax	0.5L	1	350
<i>Plagianthus divaricatus</i> ¹	Marsh ribbonwood	2L	1	250
Total				2000

1. Only plant along the spring high tide line (as indicated by maximum landward extent of crab holes in mud).

2. Only plant in well-drained soils on top of banks.

12.5 Restoration of the freshwater-saline ecotone

On the north-western edge of the site, the discharge of freshwater from a stormwater pond has modified the former hydrology of a transition zone from raupo reedland to mangrove scrub and forest. Freshwater incursion over the upper intertidal zone has resulted in exotic freshwater plant species, such as broadleaved dock (*Rumex*

obtusifolius) and alligator weed (*Alternanthera philoxeroides*), forming a sparse groundcover under the canopy of mangroves. Thinning of the mangrove canopy, and planting of appropriate indigenous species in the understorey, may result in the establishment of a transition from raupo reedland to marsh clubrush reedland to saltmarsh to mangroves. Within an 800 m² area (refer to Figure 4, Planting Areas H and I), the mangroves should be selectively thinned to approximately 10% of their current number, rather than completely removed. Prior to removal, a botanist will individually mark the mangroves to be retained to allow for the retention of older, high value trees, whilst ensuring light levels are sufficient for the establishment of saltmarsh species. All cut material will be removed from the intertidal zone, and this material either placed in terrestrial habitats to be restored as coastal forest or shrubland, or placed within streams to enhance fish habitat. All movement of material into streams will be overseen by a freshwater ecologist to ensure appropriate locations are selected. On the eastern edge of this ecotone restoration site, there is an area of glasswort-bachelors button herbfield which should be retained as part of the sequence. Following mangrove removal, Planting Areas H and I will be planted as below.

12.5.1 Planting Area H (marsh clubrush reedland)

Planting Area H is located between the raupo reedland and the maximum seaward extent of freshwater. It should be planted with marsh clubrush.

Table 8: Planting Schedule for Planting Area H (600 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Bolboschoenus fluviatilis</i>	Marsh clubrush	0.5L	1.0	600
Total				600

12.5.2 Planting Area I (sea rush rushland)

Planting Area I is located to the seaward side of the marsh clubrush plantings (Planting Area H), and should be planted with sea rush. Sea rush is the saltmarsh species that is the most tolerant of saline waters, and is the best candidate for the establishment of saltmarsh within an area currently dominated by mangroves.

Table 9: Planting Schedule for Planting Area I (200 m²).

Species	Common Name	Grade	Spacing (m)	Number
<i>Juncus kraussii</i>	Sea rush	0.5L	1.0	200
Total				200

12.6 Maintenance

Plantings should be inspected monthly for 12 months following planting operations to identify any management that may be required. Plantings should be released from environmental pest plant competition a minimum of twice a year for the first two years, with further releases at a reduced frequency as required over the following three years.

Limited infill planting¹ may be required in the second planting season. Infill plants should be either a 0.5 litre or one litre grade, depending on the species. Infill planting requirements should be identified in February/March proceeding the upcoming planting season.

12.7 Plant stock and availability

All plants should be sourced from the Auckland Ecological Region, and preferably the Tamaki Ecological District.

12.8 Plant spacing

In general, most species should be planted at 1.0 metre centres (10,000 plants per hectare). Larger-growing species (e.g. kahikatea), should be planted further apart at 5 m centres, with smaller species in the spaces between these species.

13. IMPLEMENTATION TIMELINE

An indicative five-year restoration programme and timeline for implementation of works is outlined below.

¹ Infill planting is required on sites where there are gaps in the planting because of plant mortality or where initial stocking rates were too low.

TASK	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
TIMING:	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Project Management:																				
Site Visits																				
Annual monitoring																				
Final Reporting																				
Pest Animal Control:																				
Set up Bait Stations																				
Bait Station Pulse (possum, rat)																				
Bait Station Pulse (mice at inanga spawning sites)																				
Pest Plant Control:																				
Initial Control																				
Follow Up Control																				
Monitoring and Control as Required																				
Planting Site Preparation:																				
Initial Site Preparation																				
Removal of mangroves																				
Follow Up Site Preparation																				
Planting:																				
Order plants																				
Initial Planting																				
Infill Planting																				
Maintenance:																				
Release planting of weeds																				

14. MONITORING

14.1 Overview

Monitoring involves maintaining regular surveillance by making measurements at regular time intervals over an indefinite, but usually long period of time. Two fundamental reasons for monitoring as part of ecological restoration are (i) to establish baselines representing the current status of ecosystem components and (ii) to detect changes over time. The information gained through monitoring provides quantifiable measures of success and helps inform future decision-making. In short, monitoring lets managers know if what they are doing is actually making a difference. The monitoring for the implementation of this ecological management plan is to be conducted for no less than five years.

14.2 Vegetation

Monitoring of restoration plantings and pest plant species should be maintained throughout the site on an annual basis for at least five years. The establishment of at least five permanent photopoints at key locations will provide a useful visual record of changes in vegetation patterns (and indigenous regeneration) over time, particularly in areas where pest plants have been controlled and plantings have been undertaken. Photographs from permanent photopoints should be taken on an annual basis, and can be done as part of annual monitoring for pest plants. Digital images should contain photopoint information and date and be stored securely. Mapping of vegetation and habitats types, as per Figure 1, should be updated annually to document progress of the restoration works.

14.3 Inanga

The extent of possible inanga spawning habitat will be assessed annually during a high spring tide in March or April. The area of the site that is submerged by the spring tide and has a dense cover of grasses, sedges, or rushes will be mapped. This mapping will be compared to previous annual mapping to show if restoration measures are increasing the extent of possible spawning habitat. During this habitat survey, four Gee minnow traps, baited with bread and marmite, will be deployed in each of the three streams and left for a minimum of two hours. The traps will then be checked and all fish captured will be identified and released. All inanga caught will be classified as juveniles or adults¹. Fish data will be used to determine if restoration measures have increased the extent of adult or juvenile inanga habitat at the site (see Section 14.5).

14.4 Pest animals

Records should be kept for all traps, e.g. the number of operational traps and the number of possums trapped per year. The effectiveness of rodent control can be assessed through measuring bait take from bait stations and by using tracking tunnels and chew cards. Tracking tunnels should be deployed at the same time as rodent bait

¹ Juveniles will be defined as the “whitebait” stage, <60 mm in length and partly or wholly transparent, and adults as >60 mm long, with a tubular body shape, silver bellied with greenish-olive colouring on back.

stations and left in place permanently so they become a part of the environment and rodents become familiar with them making rats and mice more likely to be detected.

Footprint tracking cards baited with peanut butter should be placed in the tunnels two weeks before rodent control takes place and left in place for three nights. The presence of rodent tracking will be recorded for each tunnel. This should be repeated two weeks after rodent control which will allow the effectiveness of the control operation to be judged. If the rodent control has been effective, less tracking tunnels will record rat footprints at the second monitoring occasion compared to the first.

When tracking cards are deployed after baiting, the bait stations should be inspected and the number of bait blocks remaining should be recorded. If monitoring does not show a decrease in rat activity a further pulse of poisoning should be considered.

14.5 Assessment of monitoring results

All wetland areas and inanga spawning sites will be monitored annually to determine if habitats are progressing towards indigenous vegetation communities, and if this is likely to be achieved within the required timeframes. For each habitat type, the monitoring results will be objectively assessed against the following criteria.

Table 10: Criteria for assessing the success of mitigation works.

Timing	Pest plant control	Indigenous plantings	Pest animal control	Inanga habitat enhancement
Year 1	Initial control completed, pest plants <20% cover	Plantings completed	Animal pest control implemented across the site as per requirements	Inanga spawning habitat maintained
Year 2	Pest plants <10% cover	Indigenous species >10% cover	Animal pest control implemented across the site as per requirements	Inanga spawning habitat maintained, juvenile and adult habitat enhanced
Year 3	Pest plants <5% cover	Indigenous species >50% cover	Animal pest control implemented across the site as per requirements	Inanga spawning habitat, and juvenile and adult habitat enhanced.
Year 4	Pest plants <1% cover	Indigenous species >75% cover	Animal pest control implemented across the site as per requirements	Inanga spawning habitat, and juvenile and adult habitat enhanced.
Year 5	Pest plants removed or <1% cover	Indigenous species 80-100% cover	Animal pest control implemented across the site as per requirements	Inanga spawning habitat, and juvenile and adult habitat enhanced.

If a planting or pest plant control unit is identified as not meeting the above requirements, this area will be identified as requiring additional works (planting, pest

plant control, or animal pest control). If additional plantings are required after Year 1, these will be of a larger grade to compensate for loss of growing time.

15. CONCLUSIONS

This report comprises an Ecological Management Plan (Wetland Component) for TR Group Ltd to maintain and enhance wetlands at Ann's Creek, 791-793 Great South Road, Penrose, to meet the conditions for resource consent. Ecological surveys of the restoration site were undertaken in July and August 2014. All vegetation and habitat types were mapped and described, and lists were compiled of the indigenous plants, pest plants, and fauna present. Freshwater and saline wetlands cover approximately 3.68 ha of the site, but of these wetland areas, 0.39 ha is covered with exotic vegetation, and most the remaining 3.29 ha has been invaded by pest plant species. Restoration will require control of pest plant species, planting with indigenous species appropriate to the hydrology and soils of each planting area, pest animal control, measures to enhance inanga habitat, monitoring, and ongoing maintenance. Restoration guidelines and an implementation timeline for restoration works are provided. The successful implementation of this plan will protect and enhance the ecological values of wetland habitats at the site and, with careful site management, is readily achievable. The wider Ann's Creek area is a critical refuge for species of coastal wetland and lava flow habitats, and the restoration of wetland and terrestrial habitats site will significantly enhance the ecology of the local area.

ACKNOWLEDGEMENTS

Neil Bretherton (TR Group) provided client liaison.

REFERENCES

- Auckland Regional Council 2007. Auckland Regional Pest Management Strategy 2007-2012.
- Baker C.F 2006: Predation of inanga (*Galaxias maculatus*) eggs by field mice (*Mus musculus*). *Journal of the Royal Society of New Zealand* 36 (4): 143-147.
- Cranwell L. 1981 The Botany of Auckland. Auckland Museum. 156 p.
- de Lange P.J., Galloway D.J., Blanchon D.J., Knight A., Rolfe J.R., Crowcroft G.M., and Hitchmough R. 2012: Conservation status of New Zealand lichens. *New Zealand Journal of Botany* 50: 303–363.
- de Lange P., Rolfe J., Champion P., Courtney S., Heenan P., Barkla J., Cameron E., Norton D. and Hitchmough R. 2013: Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington. 70 pp.
- Gardner R. 1992: Native vegetation at Ann's Creek, Southdown, July 1992. *Auckland Botanical Society Journal* 47: 39-40.
- Goodman J.M., Dunn N.R., Ravenscoft P.J., Allibone R.M., Boubée J.A.T., David B.O., Griffiths M., Ling N., Hitchmough R., and Rolfe J.R. 2014: Conservation status of New Zealand freshwater fish, 2013. *New Zealand Threat Classification Series 7*. Department of Conservation, Wellington. 12 pp.
- Hitchmough R., Anderson P., Barr B., Monks J., Lettink M., Reardon J., Tocher M., and Whitaker T. 2013: Conservation status of New Zealand reptiles, 2012. *New Zealand Threat Classification Series 2*. Department of Conservation, Wellington. 16 pp.
- Robertson H.A., Dowding J.E., Elliot G.P., Hitchmough R.A., Miskelly C.M., O'Donnell C.F.J., Powlesland R.G., Sagar P.M., Scofield R.P., and Taylor G.A. 2012: Conservation status of New Zealand birds. *New Zealand Threat Classification Series 4*. Department of Conservation, Wellington. 22 pp.
- Searle E.J. 1981. City of Volcanoes: A Geology of Auckland. New Edition. Longman Paul Limited, Auckland.
- Stanley R., de Lange P.J., Cameron E.K. 2005: Auckland Regional Threatened & Uncommon Vascular Plants List. *Auckland Botanical Society Journal* 60(2):152-157.

APPENDIX 1

VASCULAR PLANT SPECIES RECORDED AT 791-793 GREAT SOUTH ROAD, PENROSE

INDIGENOUS SPECIES

Dicot. trees and shrubs

<i>Avicennia marina</i> subsp. <i>australasica</i>	mānawa, mangrove
<i>Coprosma crassifolia</i>	
<i>Coprosma repens</i>	taupata
<i>Coprosma robusta</i>	karamū, kāramuramu
<i>Macropiper excelsum</i> subsp. <i>excelsum</i>	kawakawa
<i>Pittosporum crassifolium</i>	karo
<i>Plagianthus divaricatus</i>	marsh ribbonwood mākaka

Dicot. lianes

<i>Muehlenbeckia complexa</i>	pōhuehue
-------------------------------	----------

Ferns

<i>Pteris tremula</i>	turawera, shaking brake
-----------------------	-------------------------

Sedges

<i>Bolboschoenus fluviatilis</i>	pūrua grass, marsh clubrush
<i>Ficinia nodosa</i>	wīwī

Rushes

<i>Juncus kraussii</i> var. <i>australiensis</i>	wī, wīwī sea rush
--	-------------------

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Triglochin striata</i>	arrow grass
<i>Typha orientalis</i>	raupō

Composite herbs

<i>Cotula coronopifolia</i>	bachelor's button
-----------------------------	-------------------

Dicot. herbs (other than composites)

<i>Geranium homeanum</i>	pinakitere
<i>Sarcocornia quinqueflora</i>	ureure, glasswort



NATURALISED AND EXOTIC SPECIES

Dicot. trees and shrubs

<i>Lantana camara</i>	lantana
<i>Ligustrum sinense</i>	Chinese privet
<i>Paraserianthes lophantha</i>	brush wattle
<i>Salix fragilis</i>	crack willow
<i>Solanum mauritianum</i>	woolly nightshade
<i>Ulex europaeus</i>	gorse

Monocot. lianes

<i>Asparagus asparagoides</i>	smilax
-------------------------------	--------

Dicot. lianes

<i>Anredera cordifolia</i>	madeira vine, mignonette vine
<i>Araujia hortorum</i>	moth plant
<i>Calystegia silvatica</i>	greater bindweed
<i>Cucurbita ficifolia</i>	pie melon
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Senecio angulatus</i>	cape ivy

Grasses

<i>Cenchrus clandestinus</i>	kikuyu grass
<i>Cortaderia selloana</i>	pampas
<i>Dactylis glomerata</i>	cocksfoot
<i>Ehrharta erecta</i>	veldt grass
<i>Schedonorus arundinaceus</i>	tall fescue
<i>Spartina</i> sp.	

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Allium triquetrum</i>	onion weed
<i>Tradescantia fluminensis</i>	tradescantia

Composite herbs

<i>Aster subulatus</i>	sea aster
<i>Lactuca virosa</i>	acrid lettuce
<i>Senecio skirrhodon</i>	gravel groundsel

Dicot. herbs (other than composites)

<i>Apium nodiflorum</i>	water celery
<i>Conium maculatum</i>	hemlock
<i>Foeniculum vulgare</i>	fennel
<i>Galium aparine</i>	cleavers

<i>Geranium robertianum</i>	herb Robert
<i>Linaria purpurea</i>	purple linaria
<i>Persicaria maculosa</i>	willow weed
<i>Ranunculus repens</i>	creeping buttercup
<i>Raphanus raphanistrum</i> subsp. <i>raphanistrum</i>	wild raddish
<i>Rumex obtusifolius</i>	broad-leaved dock
<i>Tropaeolum majus</i>	garden nasturtium
<i>Verbena bonariensis</i>	purple-top



APPENDIX 2

LICHEN SPECIES RECORDED ON MANGROVES AT 791-793 GREAT SOUTH ROAD, PENROSE

<i>Bactrospora arthonioides</i>	(Data Deficient)
<i>Caloplaca mooreae</i>	
<i>Candelariella reflexa</i>	
<i>Dirinaria applanata</i>	
<i>Diriniaria picta</i>	(Data Deficient)
<i>Flavoparmelia sooredians</i>	
<i>Heterodermia japonica</i>	
<i>Heterodermia speciosa</i>	
<i>Hyperphyscia adglutinata</i>	
<i>Lecanora helva</i>	
<i>Lepraria lobificans</i>	
<i>Parmotrema perlatus</i>	
<i>Parmotrema reticulatum</i>	
<i>Pertusaria sp.</i>	
<i>Pertusaria thiospoda</i>	
<i>Physcia adscendens</i>	
<i>Physcia poncinsii</i>	
<i>Ramalina celastri</i>	
<i>Ramalina peruviana</i>	
<i>Teloschistes chrysophthalmus</i>	
<i>Teloschistes xanthorioides</i>	
<i>Xanthoria ligulata</i>	

SITE PHOTOGRAPHS



Plate 1: Marsh clubrush reedland in its winter dormant state. 29 July 2014.



Plate 2: Tall fescue grassland on coastal flats 29 July 2014.



Plate 3. Raupo reedland on the north-eastern edge of the wetland. 29 July 2014.



Plate 4. Brush wattle scrub on the northern edge of the wetland beside Great South Road.
29 July 2014.



Plate 5. Pampas tussockland on floodplain. 29 July 2014.



Plate 6. Mature mangrove forest alongside the tidal creek near the railway line. This area supports a diverse lichen flora. 29 July 2014.



Plate 7. Smilax growing as an epiphyte in a cavity in an older mangrove tree trunk.
29 July 2014.



Plate 8. Glasswort herbfield in saline wetland. 29 July 2014.



Plate 9: Glasswort-bachelors buttons herbfield in saline wetland. 29 July 2014.

APPENDIX 4

ENVIRONMENTAL PEST PLANT SPECIES RECORDED AT 791-793 GREAT SOUTH ROAD, PENROSE

Common Name	Scientific Name
Alligator weed	<i>Alternanthera philoxeroides</i>
Bindweed*	<i>Calystegia</i> sp,
Blackberry	<i>Rubus fruticosus</i> agg.
Brush wattle	<i>Paraserianthes lophanta</i>
Cape ivy	<i>Senecio angulatus</i>
Chinese privet	<i>Ligustrum sinense</i>
Crack willow	<i>Salix fragilis</i>
Garden nasturtium*	<i>Tropaeolum majus</i>
Gorse	<i>Ulex europaeus</i>
Hemlock	<i>Conium maculatum</i>
Japanese honeysuckle	<i>Lonicera japonica</i>
Lantana	<i>Lantana camara</i>
Madeira vine	<i>Anredera cordifolia</i>
Moth plant	<i>Araujia hortorum</i>
Pampas	<i>Cortaderia selloana</i>
Smilax	<i>Asparagus asparagoides</i>
Spartina	<i>Spartina</i> sp.
Tall fescue*	<i>Schedonorus arundinaceus</i>
Tradescantia	<i>Tradescantia fluminensis</i>
Tuber ladder fern	<i>Nephrolepis cordifolia</i>
Woolly nightshade	<i>Solanum mauritianum</i>

* Not currently included in the RPMS (ARC 2007).

APPENDIX 4

WEED CONTROL METHODS

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Alligator weed (<i>Alternanthera philoxeroides</i>)	Knapsack – foliar spray	Glyphosate	200ml/10 litres water	October-March best results	Thoroughly cover all foliage.
Bindweed (<i>Calystegia sepium</i> × <i>silvatica</i>)	Knapsack - foliar spray	Banvine	Follow label recommendations	October-February	Pull vines away from non-target vegetation before spraying.
	Knapsack - foliar spray	Triclopyr	30ml/10 litres water	October-February	Pull vines away from non-target vegetation before spraying. Okay to spray directly over sedges, flax, cabbage tree.
Blackberry (<i>Rubus fruticosus</i>)	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	December-April	
	Knapsack - foliar spray	Triclopyr	60ml/10 litres water	December-April	
Brush wattle (<i>Paraserianthes lophantha</i>)	Hand pull seedlings/small plants			Year round	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-April	
Cape ivy (<i>Senecio angulatus</i>)	Cut stems and treat stumps	Triclopyr	60ml/1 litre water	November-March	Leave foliage in host to die off.
	Knapsack - foliar spray	Triclopyr	60ml/10 litres water	November-March	
Chinese privet (<i>Ligustrum sinense</i>)	Hand pull seedlings/small plants			Year round	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-April	
	Drill and inject	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	October-April	
Crack willow (<i>Salix fragilis</i>)	Cut and treat stumps	Metsulfuron	10g/1 litre water, plus 2 ml surfactant	October-April	
	Drill and inject/frill and spray	Metsulfuron	10g/1 litre water, plus 2 ml surfactant	October-April	Preferred option as leaving the tree standing avoids broken twigs/branches resprouting on ground.
Garden nasturtium (<i>Tropaeolum majus</i>)	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	November-March	Pull vines away from non-target vegetation before spraying.
Gorse (<i>Ulex europaeus</i>)	Knapsack – foliar spray	Metsulfuron	5g/10 litres water plus 10ml Pulse	November-March	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-March	
Hemlock (<i>Conium maculatum</i>)	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	November-March	
Japanese honeysuckle	Knapsack - foliar spray	Clopyralid	40-50ml/10 litres water	October-March	

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
<i>(Lonicer japonica)</i>	Cut and treat stems	Metsulfuron	5g/10 litres water	October-March	Do not pull vegetation from host plant.
Kikuyu <i>(Cenchrus clandestinus)</i>	Knapsack – foliar spray	Glyphosate	100ml/10 litres water	Year round	Good for initial control
	Knapsack – foliar spray	Haloxypop	70ml/10 litres water	Year round	Grass specific herbicide. Useful for releasing around indigenous plantings to minimise non-target damage.
Lantana <i>(Lantana camara)</i>	Knapsack – foliar spray	Metsulfuron	5g/10 litres water plus 10ml Pulse	November-March	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-March	
Madeira vine, mignonette vine <i>(Anredera cordifolia)</i>	Cut and treat stump	Triclopyr	60ml/1 litre water	October-March	Follow up control required to treat propagules
	Cut and treat stump	Picloram (Vigilant gel)	Apply gel to cut stem	October-March	Follow up control required to treat propagules Carefully remove as many aerial tubers as possible that may drop.
Moth plant <i>(Araujia hortorum)</i>	Hand pull seedlings/ small vines (if small numbers)			Year round	Dispose of off in a safe manner.
	Cut and treat stump	Triclopyr	60ml/1 litre water	October-March	Leave cut vegetation in host to die off. Remove seed pods if possible and dispose of safely.
	Cut and treat stump	Picloram (Vigilant gel)	Apply gel to cut stem	October-March	Leave cut vegetation in host to die off. Remove seed pods if possible and dispose of safely.
Onion weed <i>(Allium triquetrum)</i>	Knapsack – foliar spray	Triclopyr	60ml/10 litres water	September - December	
Pampas <i>(Cortaderia selloana, C. jubata)</i>	Knapsack - foliar spray	Glyphosate	200ml/10 litres water	October-March best results	Thoroughly cover all foliage.
	Knapsack - foliar spray	Haloxypop	150ml/10 litres water	October-March best results	Best on smaller plants.
Pie melon <i>(Cucurbita ficifolia)</i>	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	October-March	
Smilax <i>(Asparagus asparagoides)</i>	Knapsack - foliar spray	Glyphosate	200ml/10 litres water	October-March	Do not add penetrant when spraying against tree trunks.
Tradescantia <i>(Tradescantia fluminensis)</i>	Knapsack - foliar spray	Triclopyr	10ml/litre water + 2ml surfactant per litre water	November-March	Pull away from non-target species before spraying.
Tuber ladder fern <i>(Nephrolepis cordifolia)</i>	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	March to May	
Veldt grass	Knapsack – foliar spray	Glyphosate	100ml/10 litres water	Year round	

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
<i>Ehrharta erecta</i>	Knapsack – foliar spray	Haloxypop	70ml/10 litres water	Year round	Useful for releasing around indigenous plantings to minimise non-target damage
Willow weed (<i>Persicaria maculosa</i>)	Knapsack – foliar spray	Glyphosate	100ml/10 litres water	Year round	
Woolly nightshade (<i>Solanum mauritianum</i>)	Seedlings/small plants - hand pull			Year round	
	Trees - drill and inject	Metsulfuron	20g/litre water, plus 2ml surfactant	Year round	
	Saplings - cut and treat stump	Triclopyr	100ml/1 litre water	Year round	



Call Free 0508 WILDNZ
Ph: +64 7 343 9017
Fax: +64 7 3439018
ecology@wildlands.co.nz

99 Sala Street
PO Box 7137, Te Ngae
Rotorua 3042,
New Zealand

Regional Offices located in
Auckland, Hamilton, Tauranga,
Whakatane, Wellington,
Christchurch and Dunedin

ECOLOGY RESTORATION BIODIVERSITY SUSTAINABILITY

www.wildlands.co.nz

ANN'S CREEK REVEGETATION PROJECT ANNUAL REPORT

JULY 2014 – AUGUST 2015



 providing
outstanding
ecological
services to
sustain
and improve our
environments



Wildlands

R3371

ANN'S CREEK REVEGETATION PROJECT ANNUAL REPORT

JULY 2014 – AUGUST 2015

Contract Report No. 3371

September 2015

Project Team:

Nick Ranger – Project management

Melissa Marler – Threatened plant survey, report author

Sarah Roth – Report author (pest plant control and planting)

Prepared for:

TR Group

PO Box 12541

Mt Wellington

Auckland

CONTENTS

1.	INTRODUCTION	1
2.	THREATENED PLANTS	1
2.1	Threatened plant survey	1
2.2	Initial pest plant control	1
2.3	Monitoring (Round 1)	2
2.4	Follow up pest plant control	2
3.	PEST PLANT CONTROL	2
3.1	Initial pest plant control	2
4.	SITE PREPARATION	3
5.	SEED COLLECTION	4
6.	PLANTING	4
7.	PEST ANIMAL CONTROL 2015 - 2016	6
7.1	Overview	6
7.2	Rodent control	6
7.3	Possum control	6
7.4	Summary	6
8.	UPCOMING WORK SEPTEMBER 2015 – JUNE 30 2016	6
8.1	Restoration planting - Area 2	6
8.2	Threatened monitoring and maintenance pest plant control	7
8.3	Pest plant control and planting maintenance	7
8.4	Pest mammal control maintenance	7
8.5	Planting 2016 – <i>Coprosma crassifolia</i>	7
Appendix		
1.	Site photographs	8
2.	Break down of plant numbers for restoration planting areas and species	15

Reviewed and approved for release by:



Nick Ranger
Auckland Manager
Wildland Consultants Ltd

© *Wildland Consultants Ltd 2015*

This report has been produced by Wildland Consultants Ltd for TR Group. All copyright in this report is the property of Wildland Consultants Ltd and any unauthorised publication, reproduction, or adaptation of this report is a breach of that copyright.

1. INTRODUCTION

An initial site visit was conducted in July 2014 to assess the condition of the site at Ann's Creek on behalf of TR Group. Site assessment focused on embankments, basalt outcrops and basalt pavements within areas outlined in the Golder Associates management plan (2013).

To efficiently and safely undertake planned work, pathways were cut through exotic vegetation to improve access prior to beginning vegetation surveys and restoration work (Plate 1).

All threatened plants found were marked with flagging tape (Plate 2 & Plate 3), and their locations recorded using a hand-held GPS unit prior to undertaking pest plant control.

Representative site photographs were taken and can be found in Appendix 1.

The scope of this project includes the following:

- Conservation management of threatened plants;
- Pest plant control;
- Site preparation;
- Planting;
- Pest animal control; and
- Ongoing maintenance of pest plants, and planting.

2. THREATENED PLANTS

2.1 Threatened plant survey

A threatened plant survey was conducted in early August 2014. Threatened plants recorded at the subject site include: *Geranium retrorsum*, *Geranium solanderi*, *Pellaea falcata*, and *Pellaea falcata x rotundifolia*.

Coprosma crassifolia was also recorded as Ann's Creek is the 'type locality' for this species.

2.2 Initial pest plant control

All areas where the above species occurred were clearly marked, and agrichemical use nearby limited, to reduce the risk of non-target damage to threatened species.

All pest plants within a one metre radius of *Pellaea falcata*, and *P. falcata x rotundifolia* species were controlled manually. Initial control was undertaken in September 2014.

No pest plant control was undertaken around the populations of *Geranium retrorsum* and *Geranium solanderi* in 2014.

2.3 Monitoring (Round 1)

The following species were monitored in June 2015:

- *Geranium solanderi*: A single plant of *G. solanderi* was re-located within the original site. No other *G. solanderi* plants were recorded. This plant was marked clearly with flagging tape.
- *Geranium retrorsum*: The original site of *G. retrorsum* was relocated, and three healthy plants were recorded at this location. An additional site with three healthy *G. retrorsum* plants was found on a basalt outcrop (Plate 3) on the margins of a rushland comprising oioi (*Apodasmia similis*) and sea rush (*Juncus kraussii* var. *australiensis*)
- *Pellaea falcata*: Threatened ferns (*P. falcata*, and *P. falcata* x *rotundifolia*) were relocated, and these appeared healthy.
- *Coprosma crassifolia*: Previously marked *C. crassifolia* plants were checked and were healthy.

2.4 Follow up pest plant control

Pest plants were manually controlled in July 2015 around the threatened geranium species (*G. solanderi*, and *G. retrorsum*) in the three previously recorded locations.

Blackberry (*Rubus fruticosus*) and smilax (*Asparagus asparagoides*) were spot-sprayed where they were found within a three metre radius of *G. retrorsum*.

3. PEST PLANT CONTROL

3.1 Initial pest plant control

Initial pest plant control was carried out between August 2014 and December 2014 in the following areas: basalt outcrops, embankments (including the toe of the embankment) and the bund area. In each instance careful, systematic and selective weed control was carried out to reduce negative impacts on indigenous (non-target) species. Agrichemical application was species-specific to minimise unnecessary application of herbicide. Follow up pest plant control was carried out between December 2014 and March 2015.

The following pest plant species were targeted:

- Dense blocks of mature pampas (*Cortaderia selloana*) along the southeast boundary of the site (Plate & 5) as well as isolated mature pampas throughout control area;
- Mature woody pest plant species along the embankment area particularly Chinese privet (*Ligustrum sinense*), tree privet (*Ligustrum lucidum*), monkey apple (*Syzygium smithii*), woolly nightshade (*Solanum mauritianum*) and boneseed (*Chrysanthemoides monilifera*);

- Brush wattle (*Paraserianthes lophantha*), castor oil tree (*Ricinus communis*), woolly nightshade and pampas were controlled along the steep slope to the northeast of the site, nearest to the raupo (*Typha orientalis*) and the stormwater detention pond ;
- Other pest plant species found and controlled throughout the control area including: blackberry, blue morning glory (*Ipomoea indica*), climbing asparagus (*Asparagus scandens*), climbing dock (*Rumex sagittatus*), German ivy (*Delairea odorata*), Japanese honeysuckle (*Lonicera japonica*), kikuyu grass (*Cenchrus clandestinus*), moth plant (*Araujia hortorum*), smilax and tradescantia (*Tradescantia fluminensis*);
- Additional exotic plants capable of smothering young restoration plants on the embankments include bindweed (*Calystegia* spp.), cleaver (*Galium aparine*) and wild fennel (*Foeniculum vulgare*; Plate 6 & 7). These were controlled but will require regular follow-up during maintenance rounds.

The following control methods were utilised:

- Manual control techniques including hand-pulling and manual removal;
- Chemical control techniques including:
 - basal spray, frill and fill, bore cutting and filling for woody pest plants over 3m tall (left standing);
 - stump cut and spray for those under 3m and pest vines; and
 - foliar spray by knapsack for seedlings and groundcover species;
- Chainsaw and handsaws were used throughout the control area.

4. SITE PREPARATION

The planting areas were prepared by targeting mentioned pest plant species during both the initial control round and then by follow-up control rounds between January 2015 and June 2015 (on two occasions, each control round being two to three days). Areas targeted for preparation included a small portion of the basalt outcrops, the embankment, toe of the embankment and the bund on the eastern side of the site.

Few woody pest plants remained during these control round and were controlled with stump cut and spray or manual removal techniques. Persistent weedy species controlled during this round by foliar spray include: blackberry, blue morning glory, climbing asparagus, climbing dock, German ivy, Japanese honeysuckle, kikuyu grass, moth plant, smilax and tradescantia, as well as bindweed, cleaver and wild fennel.

A final control focusing on cleaver and smilax was carried out two weeks prior to planting using glyphosate; this was to reduce the density of these exotic plants capable of smothering young restoration plantings.

5. SEED COLLECTION

Akeake (*Dodonea viscosa*) and *C. crassifolia* seeds were collected from the subject site in spring 2014 and grown on by approved plant nurseries. A further search for *C. crassifolia* seed was undertaken in February 2015.

6. PLANTING

The planting areas identified in the Golder Associates Report (2013) were further defined and separated into clear units to assist with the planting operation. Eight restoration areas were identified (Figure 1) and seven were planted in July and August 2015.

The planting areas are as follows:

- Restoration Area 1
- Restoration Area 1a – infill planting
- Restoration Area 1b – infill planting
- Restoration Area 3
- Restoration Area 4
- Restoration Area 5
- Restoration Area 6

Restoration Area 2 (Plate 8 & 9) was not planted due to health and safety risks, as the embankment was covered by scaffolding poles (**Error! Reference source not found.**). These will be removed in October 2015 when ACROW scaffolding intends to move locations and tidy this area. As such, Restoration Area 2 will be planted in October 2015.

A total number of 8907 plants were planted July – August 2015; see Appendix 2 for details of plant species and numbers per Restoration Area. A representative photograph of the 2015 planting can be seen in Appendix 1 (Plate 11).

Only 575 *C. crassifolia* could be planted this year due to limited seed availability from Ann's Creek and insufficient growing time resulting in small size of some the plants. The balance of these plants (c. 1,425 plants) are scheduled to be planted in 2016.



7. PEST ANIMAL CONTROL 2015 - 2016

7.1 Overview

Pest control is scheduled to be undertaken three times during the 2015 – 2016 period, with pulses of Ditrac rodent blocks (active ingredient diphacinone) and PestOff possum bait (active ingredient brodifacoum) distributed in bait stations every four months.

Twelve Philproof bait stations were deployed (at c. 100m spacing) along tracks at Ann's Creek on 4 August 2015, and GPS coordinates for each station were recorded.

7.2 Rodent control

Two Ditrac baits were placed in each bait station on the 11 August 2015. Bait stations were checked on the 28 August and bait had been taken from five of the 12 stations.

7.3 Possum control

A handful of brodifacoum wax pellets was placed in each station on the 11 August 2015. Bait take was assessed on 18 August and the 28 August and replaced as necessary. No bait take was recorded at 11 out of 12 stations on the 18 August, and no bait take was recorded in 7 out of 12 stations on the 28 August.

7.4 Summary

Rodent bait take was low with seven out of 12 stations showing no sign of bait take. This may indicate that rat numbers are low at the site (possibly as a result of rodent control taking place in adjacent industrial properties), that rats were unwilling to enter the bait stations, or that the rats were avoiding eating the toxic bait. If bait take is low in the next pulse alternative methods of rat control will be considered.

Possum numbers were expected to be low at the site and this is confirmed by the low level of brodifacoum bait take and lack of possum sign observed. Brodifacoum baits can also be eaten by rats and it is possible that no possums were present and that recorded bait take can be attributed to rats.

8. UPCOMING WORK SEPTEMBER 2015 – JUNE 30 2016

8.1 Restoration planting - Area 2

Planting in Restoration Area 2 will be carried out in October 2016 after ACROW scaffolding company clears away debris otherwise posing a significant health and safety risk for Wildlands staff. Approximately 593 plants will be planted in Area 2 (Appendix 2).

8.2 Threatened monitoring and maintenance pest plant control

Ongoing monitoring of the threatened plant populations, and pest plant control will be undertaken in November 2015 and February 2016.

8.3 Pest plant control and planting maintenance

Three rounds of planting maintenance are scheduled for 2015 – 2016, which will be carried out by a team four staff over two days per round. The first pest plant control round will be carried out in early spring. The same techniques and prescriptions will be used as outlined in Section 3.

The seed banks of species such as gorse, brush wattle and moth plant are prolific and potentially long lived, so it will be necessary to continue to remove seedlings for the foreseeable future, particularly in exposed areas where plantings will likely be slow to establish.

It was noted that in 2014-15 there was a significant amount new weeds establishing from the adjacent seed sources. We will monitor this during 2015-16. Further maintenance pest plant control may be required to keep on top of these pest plants.

8.4 Pest mammal control maintenance

A second pulse of pest mammal control will take place in summer 2015. The same methods will be used.

8.5 Planting 2016 – *Coprosma crassifolia*

The remaining *Coprosma crassifolia* will be planted throughout the site in suitable habitat in winter 2016; approximately 1,425 *C. crassifolia* are expected to be ready at this time.





Plate 1: Access tracks cut through the gorse to allow access for the restoration team. July 2014



Plate 2: *Coprosma crassifolia* marked with pink flagging tape. The blue flagging tape marks the presence of *Pellaea falcata x rotundifolia* at the base of these trees. February 2015.



Plate 3: Marked *Geranium retrorsum* plants following hand control and spot spray of smilax. July 2014.



Plate 4: View from the embankment below the TR Group fence looking southeast prior to weed control. July 2014



Plate 5: Dead pampas visible following weed control (pale areas towards the rear of photograph) with dead fennel and tree privet on the embankment in the foreground. February 2015.



Plate 6: View of the embankment prior to weed control looking south towards Revegetation Area 4. July 2014.



Plate 7: View of the embankment after initial weed control looking south towards Revegetation Area 4. February 2015.



Plate 8: Looking south from the bund towards the raupo reedland prior to weed control in Revegetation Area 2. July 2014.



Plate 9: Looking south from the bund towards the raupo reedland after initial weed control on the embankment in Revegetation Area 2. February 2015.



Plate 4: Restoration Area 2 covered with scaffolding poles posing a serious health & safety risk to Wildlands staff. February 2015



Plate 11: Restoration Area 3 (looking south) with planted *Coprosma repens* and akeake (circled in red) visible in the foreground. September 2015

Table 1. Break down of plant numbers for restoration planting areas and species.

Species	Common Name	Area 1	Area 2*	Area 3	Area 4	Area 5	Area 6	Area 1a	Area 1b
<i>Apodasmia similis</i>	oioi	25	27*	93	187		52		
<i>Coprosma repens</i>	taupata	79	86*	291	582		163	7	53
<i>Dodonaea viscosa</i>	akeake	164	179*	605	1212		340	13	87
<i>Leptospermum scoparium</i>	manuka	33	35*	121	242		68		
<i>Muehlenbeckia complexa</i>	pōhuehue	29	31*	108	216		60		
<i>Olearia solandri</i>	tree daisy	91	99*	337	674		189	7	53
<i>Phormium tenax</i>	harakeke, flax	13	14*	48	97	300	27		
<i>Pittosporum crassifolium</i>	karo	79	86*	291	582		163	11	69
<i>Plagianthus divaricatus</i>	mākaka ; marsh ribbonwood	33	36*	124	247		69		
<i>Coprosma crassifolia</i>				98	166	98	58	33	122
Total		546	593*	2115	4203	398	1190	71	384

* Indicates planting to be carried out at Area 2 in October 2016; numbers are estimates for intended planting.



Call Free 0508 WILDNZ
Ph: +64 7 343 9017
Fax: +64 7 3439018
ecology@wildlands.co.nz

99 Sala Street
PO Box 7137, Te Ngae
Rotorua 3042,
New Zealand

Regional Offices located in
Auckland, Hamilton, Tauranga,
Whakatane, Wellington,
Christchurch and Dunedin

ECOLOGY RESTORATION BIODIVERSITY SUSTAINABILITY

www.wildlands.co.nz

ANN'S CREEK REVEGETATION PROJECT ANNUAL REPORT

JULY 2015 – AUGUST 2016



 providing
outstanding
ecological
services to
sustain
and improve our
environments



Wildlands

R3371

ANN'S CREEK REVEGETATION PROJECT ANNUAL REPORT

JULY 2015 – AUGUST 2016

Contract Report No. 3371

August 2016

Project Team:

Nick Ranger – Project management

Melissa Marler – Threatened plant survey, report author (threatened plants)

Emma Ries – Report author (pest plant control and planting)

Prepared for:

TR Group

PO Box 12541

Mt Wellington

Auckland

CONTENTS

1.	INTRODUCTION	1
2.	PEST PLANT CONTROL	1
2.1	Maintenance pest plant control	1
3.	PLANTING	2
4.	PEST ANIMAL CONTROL	4
4.1	Overview	4
4.2	Rodent control	4
4.3	Possum control	4
4.4	Rabbit control	5
4.5	Summary	5
5.	THREATENED PLANTS	5
5.1	Pest plant control	5
5.2	Seed collection	5
5.3	Monitoring	5
5.4	Seed sowing	7
6.	UPCOMING WORK SEPTEMBER 2016 – AUGUST 2017	7
6.1	Restoration planting	7
6.2	Threatened plant monitoring and maintenance pest plant control	7
6.3	Pest plant control and planting maintenance	7
6.4	Pest mammal control maintenance	7
APPENDICES		
1.	Site Photographs	8
2.	Break Down Of Plant Numbers For Restoration Planting	13

Reviewed and approved for release by:



Nick Ranger
Auckland Manager
Wildland Consultants Ltd

© Wildland Consultants Ltd 2016

This report has been produced by Wildland Consultants Ltd for TR Group. All copyright in this report is the property of Wildland Consultants Ltd and any unauthorised publication, reproduction, or adaptation of this report is a breach of that copyright.

1. INTRODUCTION

Wildlands has been undertaking the revegetation phase of the Ann's Creek Stage 1 site since July 2014. Works have been focused on embankments, basalt outcrops and basalt pavements within areas outlined in the Golder Associates management plan (2013).

Following site preparation, completed in early 2015, planting of the Restoration Areas (outlined in Figure 1) was undertaken July and August 2015. Additional planting was undertaken July and August 2016.

Threatened plants, marked with flagging tape and GPS, were monitored, seed was collected in November 2015, and sowing undertaken in April 2016.

Pest animal control was initiated in July 2015, and is ongoing.

Representative site photographs were taken and can be found in Appendix 1.

The scope of this project includes the following:

- Conservation management of threatened plants;
- Pest plant control;
- Site preparation;
- Planting;
- Planting maintenance; and,
- Pest animal control;

2. PEST PLANT CONTROL

2.1 Maintenance pest plant control

After planting in July and August 2015, maintenance pest plant control was carried out in October 2015 (Round 1), Jan/April 2016 (Round 2), and April/May 2016 (Round 3). This was predominantly throughout the revegetation sites in the embankments (including the toe of the embankment), the bund area, as well as basalt outcrops. In each instance, careful, systematic and selective weed control was carried out to reduce negative impacts on indigenous (non-target) species. Agrichemical application was species-specific to minimise unnecessary application of herbicide.

The pest plant species present were similar to those present in the initial control, and were targeted as follows:

- Continued control of the dense blocks of mature pampas (*Cortaderia selloana*) along the southeast boundary of the site, as well as isolated mature pampas throughout the revegetation areas;
- Occasional mature woody pest plant species along the embankment area, particularly Chinese privet (*Ligustrum sinense*), tree privet (*Ligustrum*

lucidum), monkey apple (*Syzygium smithii*), woolly nightshade (*Solanum mauritianum*) and boneseed (*Chrysanthemoides monilifera*);

- Regeneration of brush wattle (*Paraserianthes lophantha*), castor oil plant (*Ricinus communis*), woolly nightshade and pampas was particularly common along the buffer zone at the southern end of Area 4;
- Other pest plant species found and controlled throughout the control area included: blackberry, blue morning glory (*Ipomoea indica*), climbing asparagus (*Asparagus scandens*), climbing dock (*Rumex sagittatus*), German ivy (*Delairea odorata*), Japanese honeysuckle (*Lonicera japonica*), kikuyu grass (*Cenchrus clandestinus*), moth plant (*Araujia hortorum*), smilax (*Asparagus asparagoides*) and tradescantia (*Tradescantia fluminensis*);
- Additional non-pest exotic plants capable of smothering young restoration plants throughout the site included bindweed (*Calystegia* spp.), cleavers (*Galium aparine*) and wild fennel (*Foeniculum vulgare*). These were regenerating regularly and will require continued follow-up during maintenance rounds.
- Pest plant control was undertaken outside of the planted areas in December 2015, February 2016, and March 2016, mostly targeting the most invasive species such as moth plant, boneseed, and regenerating gorse, privet and woolly nightshade.

The following control methods were utilised:

- Manual control techniques including hand-pulling and manual removal;
- Chemical control techniques including:
 - basal spray, frill and fill, bore cutting and filling for woody pest plants;
 - stump cut and spray for small woody species and pest vines; and
 - foliar spray by knapsack for seedlings and groundcover species;

3. PLANTING

The planting areas identified in the Golder Associates Report (2013) were further defined and separated into clear units in 2014/15 to assist with the planting operation. Eight restoration areas were identified (Figure 1) and seven were planted in July and August 2015.

The planting areas are as follows:

- Restoration Area 1
- Restoration Area 1a – infill planting
- Restoration Area 1b – infill planting
- Restoration Area 3
- Restoration Area 4
- Restoration Area 5
- Restoration Area 6



Restoration Area 2 (Plate 5 & 6) was planted in November 2015 with the remaining plants designated for this area, after removal of the building and scaffolding poles by ACROW scaffolding.

Restoration Area 3 (Plate 3 & 4) required reinstatement planting after earthworks were undertaken in this area. An additional 250 plants were planted in July 2016; see Appendix 2 for details of plant species and numbers per restoration area.

A representative photograph of the 2015 planting can be seen in Appendix 1 (Plate 2).

Further *C. crassifolia* planting was undertaken in winter 2016, with any sufficient sized plants the nursery had been able to grow. A total of 400 plants were planted.

4. PEST ANIMAL CONTROL

4.1 Overview

Pest control was undertaken during the 2015 – 2016, with four pulses of Ditrac rodent blocks (active ingredient Diphacinone) and PestOff possum bait (active ingredient Brodifacoum) distributed in bait stations, and 2 pulses of Pindone rabbit bait.

Twelve Philproof bait stations were deployed (at c.100m spacing) along tracks at Ann's Creek on 4 August 2015, and GPS coordinates for each station were recorded.

4.2 Rodent control

Pulses 1 and 2 of rodent control were completed in August and December 2015. Pulses 3 and 4 were completed in March and June 2016. Two Ditrac baits were placed in each station each time. Bait stations were checked on the 28 August and bait had been taken from five of the 12 stations. In June, bait had been taken from seven of the 12 stations and it was noted that stations were damaged by significant gnawing of the plastic.

4.3 Possum control

Four pulses of possum control were undertaken over the last year. Brodifacoum wax pellets were placed in each station in August and December 2015, and again in March and June 2016:

- Bait take was recorded at 1 out of 12 stations on the 18 August;
- Bait take was recorded in 5 out of 12 stations on the 28 August;
- Bait take was recorded at 10 out of 12 stations on 30 June.

4.4 Rabbit control

Two pulses of control were completed, one in December 2015 and one in March 2016. Rabbit control comprised the broadcast of Pindone pellets over suitable habitats over several nights of dry weather.

4.5 Summary

Rodent bait take was moderate on average and signs of gnawing on stations suggest that a rodent population is present and rodents are taking the bait regularly.

Possum numbers were expected to be low at the site and even though bait take was overall quite high there were no signs of possum observed. Brodifacoum baits can also be eaten by rats and it is possible that no possums were present and that recorded bait take can be attributed to rats.

5. THREATENED PLANTS

5.1 Pest plant control

- All pest plants within a one metre radius of *Pellaea falcata*, and *P. falcata x rotundifolia* species were controlled manually.
- Pest plant control was undertaken around the populations of *Geranium retrorsum* during November 2015 and April 2016. Exotic grasses and smilax (*Asparagus asparagoides*) plants were controlled by hand within a 12 cm radius of the *Geranium retrorsum* plants at the two known sites.

5.2 Seed collection

- The *Geranium retrorsum* plants were fertile at the time of the November 2015 monitoring round, so some of the ripe seed was collected (approximately 100 seeds) for sowing in autumn 2016.

5.3 Monitoring

The following species were monitored during November 2015, and on 29 April 2016:

- *Geranium solanderi*: No *G. solanderi* plants were recorded within the original site.
- *Geranium retrorsum*: The original site of *G. retrorsum* was relocated, and three healthy plants were recorded at this location (Plate 1). An additional site with two healthy *G. retrorsum* plants were found on a basalt outcrop on the margins of a rushland comprising oioi (*Apodasmia similis*) and sea rush (*Juncus kraussii* var. *australiensis*).
- *Pellaea falcata*: Threatened ferns (*P. falcata*, and *P. falcata x rotundifolia*) were relocated, and these appeared healthy.

- *Coprosma crassifolia*: Previously marked *C. crassifolia* plants were checked and were healthy.

5.4 Seed sowing

- *Geranium retrorsum* seeds were broadcast over the basalt pavement and within cracks at the second *G. retrorsum* site on 29 April in the hope of expanding the population at this second site.

6. UPCOMING WORK SEPTEMBER 2016 – AUGUST 2017

6.1 Restoration planting

Of the 2000 *C. crassifolia* to be planted in the area, 575 were planted in 2015, another 400 were planted in 2016, and a further 1025 are due to be planted in winter 2017, pending suitable stock availability.

6.2 Threatened plant monitoring and maintenance pest plant control

Ongoing monitoring of the threatened plant populations, and pest plant control will continue in 2016-2017.

6.3 Pest plant control and planting maintenance

Two rounds of planting maintenance are scheduled for spring 2016 and autumn 2017. The same techniques and prescriptions will be used as outlined above.

The seed banks of species such as gorse, brush wattle and moth plant are prolific and potentially long lived, so it will be necessary to continue to remove seedlings for the foreseeable future, particularly in exposed areas where plantings will likely be slow to establish.

There continues to be a significant amount new weeds establishing from the adjacent seed sources. We will continue to monitor this during 2016-17. Additional maintenance pest plant control visits may be required to keep on top of these pest plants.

6.4 Pest mammal control maintenance

Pest mammal control will be undertaken in 2016/17. The first round will be undertaken in spring/summer. The same methods will be used as in previous years.





Plate 1: Marked *Geranium retrorsum* plant at southern site during monitoring.
July 2016.



Plate 2: Northern end of Restoration Area 4 with mixed native plantings.
July 2016.



Plate 3: View of embankment before site prep and re-instatement planting in Restoration Area 3. February 2016



Plate 4: View of the embankment after re-instatement planting. July 2016.



Plate 5: Looking south from the bund towards the raupo reedland before scaffold removal and planting in Revegetation Area 2. February 2015.



Plate 6: Looking south from the bund towards the raupo reedland after planting and maintenance of plantings in Revegetation Area 2. July 2016.



Plate 7: *Coprosma crassifolia* grown from seed and planted back into the area.
July 2016.

APPENDIX 2

BREAK DOWN OF PLANT NUMBERS FOR RESTORATION PLANTING AREAS AND SPECIES

Species	Common Name	Area 2 (Nov 2015)	Area 3 (July 2016)	Area 4 (July 2016)
<i>Apodasmia similis</i>	oioi	27		
<i>Coprosma crassifolia</i>				400
<i>Coprosma repens</i>	taupata	86	50	
<i>Dodonaea viscosa</i>	akeake	179	50	
<i>Leptospermum scoparium</i>	manuka	35	85	
<i>Muehlenbeckia complexa</i>	pōhuehue	31	15	
<i>Olearia solandri</i>	tree daisy	99		
<i>Phormium tenax</i>	harakeke, flax	14		
<i>Pittosporum crassifolium</i>	karo	86	50	
<i>Plagianthus divaricatus</i>	mākaka ; marsh ribbonwood	36		
Total		593	250	400



Call Free 0508 WILDNZ
Ph: +64 7 343 9017
Fax: +64 7 3439018
ecology@wildlands.co.nz

99 Sala Street
PO Box 7137, Te Ngae
Rotorua 3042,
New Zealand

Regional Offices located in
Auckland, Hamilton, Tauranga,
Whakatane, Wellington,
Christchurch and Dunedin

ECOLOGY RESTORATION BIODIVERSITY SUSTAINABILITY

www.wildlands.co.nz