To:	AECOM 8 Mahuhu Crescent Auckland 1010	**Prepared by** **Reviewed by**	Andrew Benson Andre Le Claire
Attn: **CC:**	Zahni Hefferon Alia Cederman	**Date** **Ref**	19th September 2013 19685

Subject
- **Arboricultural memornadum**
- **Lyon Avenue, St Lukes**

1. Introduction

1.1. Arborlab Consultancy Services Ltd has been requested to provide a brief arboricultural statement in relation to two options to undertake various earthworks associated with the Central Interceptor project at Lyon Avenue, Mount Albert.

1.2. Two options have been prepared which depict the possible designation and earthworks footprints; these options are depicted on the drawings LYON-SK1001 and LYON-SK1101. The various arboricultural implications of each option are briefly discussed.

1.3. The findings and comments contained herein are based on the information captured during the visual ground based assessment undertaken during a single site visit on Monday the 9th of September 2013, and the following documents and communications.

- Drawings LYON-SK1001 and LYON-SK1101
- Various communications with Zahni Hefferon of AECOM.

2. Attachments

2.1. Photoset
2.2. Drawings ARB-19685-01 and 02
2.3. Drawings LYON-SK1001 and LYON-SK1101

3. The proposal

3.1. Watercare have been asked by the Commissioners to consider the effects of the two options described above.

4. MAGS alternative 1 - Pipe jack option

4.1. The option to construct the connecting tunnel using a pipe jack method is depicted on the drawing LYON-SK1001 as well as ARB-19685-01 which shows the various vegetation plots.

4.2. The option to pipe jack the connecting tunnel negates the requirement to install the connection by open trenching, thus any adverse effects to vegetation associated with the additional earthworks would be eliminated.

4.3. Option 1 requires the removal of 46 individual trees, as well as approximately 240 square metres of mixed native vegetation. It is identified that these 240 square metres of vegetation can be described as un-managed and of low quality when considering species diversity and overall plant health.

4.4. In addition, option 1 requires that various works will need to be undertaken within the root zone of at least 19 individual trees. These works are likely to involve various excavations as well as machine tracking.

5. MAGS alternative 2 – Trenched option

5.1. The option to construct the connecting tunnel using an open trenching method is depicted on the drawing LYON-SK1101 as well as ARB-19685-02 which shows the various vegetation plots.

5.2. The option to install the connecting tunnel by means of open trenching will require a large excavation of some 5 – 8 metres deep. Excavations of this magnitude in proximity to trees can often result in the removal of multiple roots. Trees 22, 23 and 24 will be most affected by the trenching. Tree 24 is located directly within the footprint of the proposed trench alignment and so removal of this tree will be required. The excavation will pass approximately 3 metres from the base of tree 23 and 5 metres from the base of tree 22. These excavations will be on the periphery of the critical root zones of each tree, within which the structural root system is anticipated to be encountered. The removal of structural roots is likely to have an adverse effect on the stability of each tree, thus their removal will be required should the trenching option be pursued.

5.3. In addition, it is likely that trees 43 – 45 will also require removal to facilitate the various earthworks and proposed bridge structures.

5.4. In total, option 2 will require the removal of 54 individual trees and 240 square metres of mixed native vegetation, as well as works within the root zone of at least 17 individual trees.

6. Vegetation inventory

6.1. Table 1 on the following pages details the identified vegetation within and immediately adjacent to the project boundaries

Tree #	N$^{o.}$ Trees	Botanical name	Common name	Height (M)	No. stems at 1.4M	Aggregate girth at 1.4M (mm)	CSR (M)	Protection status	Ownership	Proposal (alt 1)	Proposal (alt 2)	CRR (M)	TPR (M)	Comments
1	1	*Quercus palustris*	Pin oak	14	1	1800	5	P	P	Remove	Remove	2.5	6.9	Mature tree approx. 1.3m from creek edge
2	1	*Metrosideros kermadecensis*	Kermadec pohutukawa	6	4	1290	3	P	P	Remove	Remove	1.6	1.6	Young tree near to creek edge
3	1	*Quercus palustris*	Pin oak	15	1	2000	7	P	P	Remove	Remove	2.7	7.6	Prominent tree approx. 6m from creek edge
4	1	*Syzygium australe*	Brush cherry	9	1	810	3	P	P	Remove	Remove	1.6	1.6	Young tree slightly supressed by adjacent ash
5	1	*Fraxinus sp.*	Ash	10	3	5100	8	P	P	Remove	Remove	2.9	11.5	Form tends to the north
6	1	*Cinnamomum camphora*	Camphor laurel	10	2	3560	5	P	P	Remove	Remove	2.9	11.5	Some canopy decline
7	1	*Cupressus sp.*	Cypress	16	1	2400	4	P	P	Remove	Remove	2.9	2.9	Densely foliated mature tree
8	1	*Cupressus sp.*	Cypress	14	1	2600	8	P	P	Remove	Remove	3.1	3.1	Heavy lean to the north
9	1	*Callistemon sp.*	Bottlebrush	5	3	2050	3	P	P	Remove	Remove	2.0	2.0	Asymmetric tree crown lifted over driveway
10	3	*Pittosporum eugenioides.*	Lemonwood	5	>1	>600	1	P	P	Remove	Remove	1.8	3.7	Young trees on bank
11	2	*Griselinia littoralis*	Puka	5	>1	>600	2	P	P	Remove	Remove	1.8	3.7	Young trees on bank

Tree #	N$^{o.}$ Trees	Botanical name	Common name	Height (M)	No. stems at 1.4M	Aggregate girth at 1.4M (mm)	CSR (M)	Protection status	Ownership	Proposal (alt 1)	Proposal (alt 2)	CRR (M)	TPR (M)	Comments
12	1	*Photinia sp.*	Photinia	6	>1	>600	2	P	P	Remove	Remove	1.8	3.7	Young trees on bank
13	1	*Alectryon excelsus*	Titoki	5	>1	>600	1	P	P	Remove	Remove	1.8	2.8	Young trees on bank
14	9	*Pittosporum eugenioides.*	Lemonwood	4	>1	>600	1	P	P	Remove	Remove	1.6	3.1	Juvenile trees
15	2	*Vitex lucens*	Puriri	4	>1	>600	1	P	P	Remove	Remove	1.6	3.1	Juvenile trees
16	1	*Dacrydium cupressinum*	Rimu	5	1	>600	1	P	P	Remove	Remove	1.6	3.1	Poor condition
17	1	*Eucalyptus cinerea*	Silver dollar gum	21	1	3600	8	P	R	Retain and protect	Retain and protect	3.7	17.2	Large prominent tree. 2M from edge of creek
18	10	*Dacrycarpus dacrydioides*	Kahikatea	12	1	>700	2	P	P	WWRZ	WWRZ	1.7	4.3	A small grove of trees in school grounds
19	9	*Cordyline australis*	Cabbage tree	7	1	>600	1	P	R	Retain and protect	Retain and protect	1.5	2.9	Small group of trees on bank of creek
20	1	*Populus yunnanensis*	Chinese poplar	19	1	1600	6	P	P	Remove	Remove	2.4	4.6	Mature tree within school grounds
21	1	*Dacrycarpus dacrydioides*	Kahikatea	10	1	900	3	P	R	Retain and protect	Retain and protect	1.7	4.3	Tree on edge of wall above creek
22	1	*Pinus radiata*	Monterey pine	13	1	2100	8	P	R	WWRZ	Remove	3.2	10.7	Growing immediately on top of the wall
23	1	*Eucalyptus sp.*	Gum	9	1	1300	6	P	R	Retain and protect	Remove	2.1	5.0	Evidence of *Paropsis.*

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24	1	*Pinus radiata*	Monterey pine	14	9	>2000	9	P	R	Retain and protect	Remove	3.7	13.8	Large multi stemmed tree
25	2	*Libocedrus plumosa*	Kawaka	7	1	1140	1.5	P	R	WWRZ	WWRZ	2.0	5.4	Two trees next to boardwalk
26	1	*Podocarpus totara*	Totara	9	1	1520	3	P	R	WWRZ	WWRZ	2.3	7.3	Supressed by adjacent trees
27	1	*Podocarpus totara*	Totara	9	1	1160	3	P	R	Retain and protect	Retain and protect	2.0	5.5	Supressed by adjacent tree
28	1	*Pittosporum eugenioides.*	Lemonwood	10	6	>1000	5	P	R	Retain and protect	Retain and protect	2.4	6.1	Numerous surface roots visible
29	3	*Pittosporum eugenioides.*	Lemonwood	7	>1	>600	2	P	R	WWRZ	WWRZ	1.7	3.4	Supressed by adjacent trees
30	1	*Acer negundo*	Box elder	6	2	2280	4	P	R	Remove	Remove	2.3	2.3	Heavily pruned
31	1	*Podocarpus totara*	Totara	6	1	710	2	P	R	Remove	Remove	1.5	2.7	Some die back in the upper canopy
32	1	*Corynocarpus laevigatus*	Karaka	6	1	840	2	P	R	Remove	Remove	1.6	4.0	Large multi stemmed tree
33	1	*Casuarina cunninghamiana*	She oak	16	5	>1000	6	P	R	Remove	Remove	3.1	12.4	Juvenile trees
34	6	*Vitex lucens*	Puriri	6	1	>400	2	P	R	Remove	Remove	1.3	2.0	Manuka, karamu, karaka and lemonwood.
35	240m^2	*Various natives*	Mixed	>1	>1	>250	0	P	0	Remove	Remove	0.8	1.0	Also a smaller totara adjacent
36	1	*Podocarpus totara*	Totara	8	1	1270	4	P	R	Retain and protect	Retain and protect	2.1	6.1	Established tree near entrance to reserve
37	1	*Metrosideros excelsa*	Pohutukawa	8	7	>1200	4	P	R	Retain and protect	Retain and protect	2.7	5.7	Established tree near entrance to reserve
38	1	*Podocarpus totara*	Totara	10	1	1340	3	P	R	Remove	Remove	2.1	6.4	Semi mature tree
39	4	*Pittosporum spp.*	Pittosporums	6	>3	>1000	2	P	R	Partial removal	Partial removal	1.7	3.4	Small group of *Pittosporums*

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40	1	*Griselinia littoralis*	Puka	5	4	>900	3	P	R	Remove	Remove	1.7	3.4	Leans over footpath
41	1	*Corynocarpus laevigatus*	Karaka	5	1	280	1	P	R	Remove	Remove	0.9	0.9	Juvenile tree
42	1	*Kunzea ericoides*	Kanuka	6	1	1130	3	P	R	WWRZ	WWRZ	1.9	5.4	Sparse canopy
43	1	*Eucalyptus sp.*	Gum	14	1	1100	4	P	R	Retain and protect	Remove	2.1	6.2	Some twiggy die back. Probably due to insect predation
44	3	*Cordyline australis*	Cabbage tree	4	>3	>900	1	P	R	Retain and protect	Remove	1.8	3.7	Group of trees growing on bank
45	1	*Vitex lucens*	Puriri	7	1	>1000	3	P	R	WWRZ	Remove	2.4	8.1	Possibly topped
46	1	*Pinus radiata*	Monterey pine	7	1	>1000	5	P	R	Retain and protect	Retain and protect	3.0	9.5	Grows on top of wall near water course
47	1	*Podocarpus totara*	Totara	6	1	1140	3	P	R	Retain and protect	Retain and protect	2.5	8.6	Also some lemonwoods
48	2	*Populus yunnanensis*	Chinese poplar	14	1	2000	5	P	P	Retain and protect	Retain and protect	2.7	5.7	Mature trees in school grounds
49	2	*Podocarpus totara*	Totara	8	1	2100	5	P	P	Retain and protect	Retain and protect	2.7	10.0	Mature trees in school grounds
50	1	*Vitex lucens*	Puriri	10	1	2100	5	P	P	Retain and protect	Retain and protect	2.7	10.0	Mature tree in school grounds

CSR – Crown Spread Radius. The greatest distance from the edge of the main stem, to the furthest distal branch tip.

CRR – Critical Root Radius – Adapted from Coder (1996) – The radial distance from the stem of the tree within which the main structural root plate is contained

TPR – Tree Protection Radius – Derived from Harris *et al* (2004). The radial distance from the trunk of the tree at which isolation fencing should be placed to adequately protect root zones from damage.

Proposal: WWRZ – Works within the root zone

Ownership: P – Private R - Reserve

Protection status: P – Protected NP – Non-protected

7. Arborist comments

7.1. It is understood that access to the site is likely to be required through the Mount Albert Grammar School (MAGS) entrance from Alberton Avenue, and that this will require modification of the existing access track/road. These modifications will involve widening of the track and the installation of retaining walls near to the stream edge. This will require the removal of vegetation in this location to undertake the physical works.

7.2. The trees in this location are currently contributing positively to the amenity at this site, particularly the mature pin oaks and the cypress.

8. Conclusions

8.1. The following table summarises the conclusions of each of the two alternatives in terms of the likely effects to vegetation.

	Lyon Ave site*	MAGS alternative 1 – Pipe jack	MAGS alternative 2 – Open trench
Number of trees removed	107	46 + 240m^2	54 + 240m^2
Number of trees WWRZ	None identified	19	17
Number of trees retained**	None identified	47	39

* Refers to June 2012 Arborlab inventory
** Total number of retained trees includes all trees with WWRZ

9. References

Coder. K. (1996) *Construction damage assessments: Trees and sites.* University of Georgia Cooperative Extension Service Forest Resources Bulletin FOR96-39.

Harris. R, Clark. J, and Mathney. P. (2004) *Arboriculture. Integrated Management of Landscape Trees, Shrubs and Vines.* 4th ed. Prentice Hall, New Jersey, USA. Pp. 262

Appendix 1: Photoset

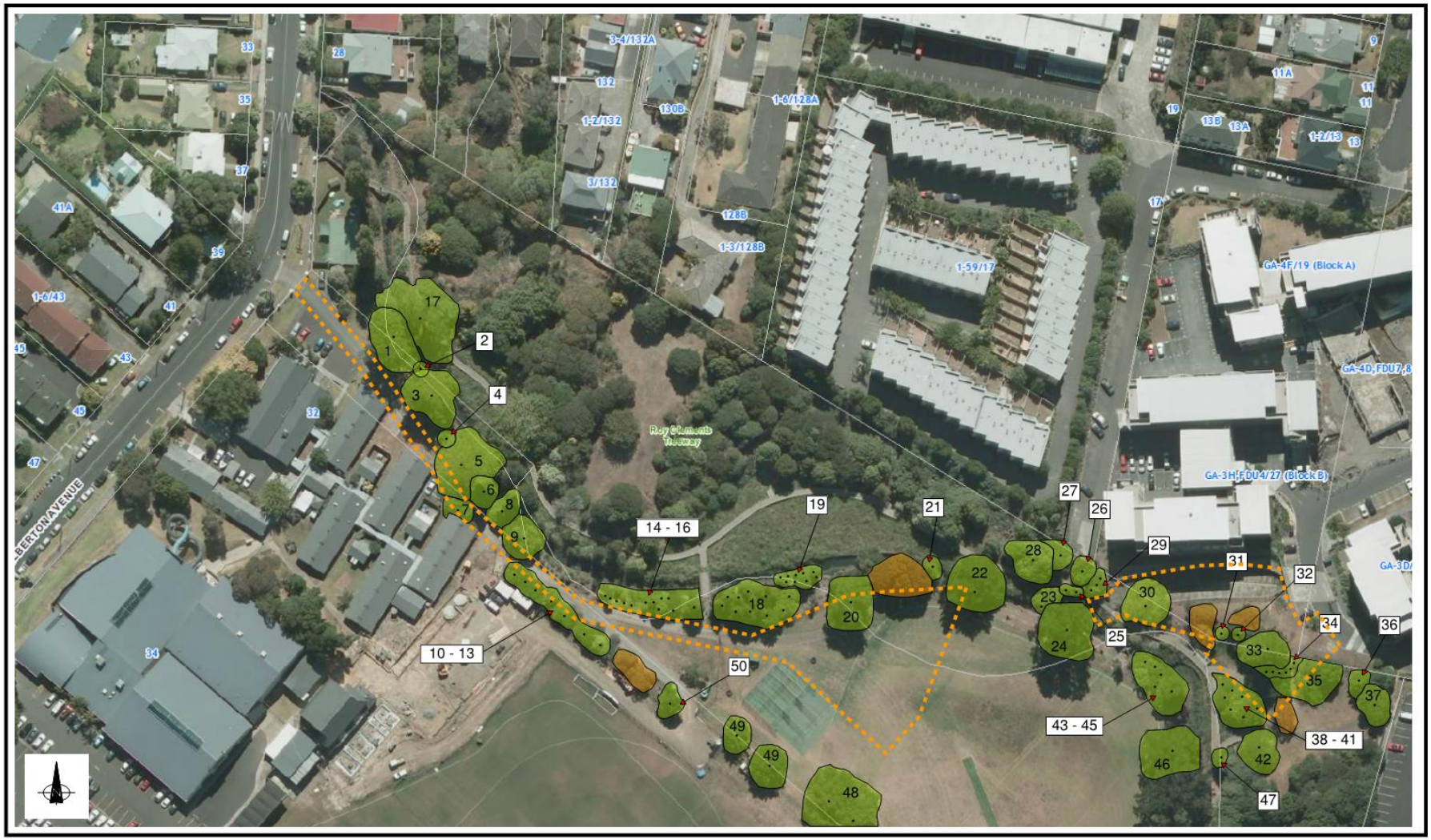
Photo 1: Tree 1. Pin oak

Photo 2: Tree 43.Gum and Tree 45. Puriri

Photo 3: Tree 36. Totara and Tree 37. Pohutukawa

Photo 4: Tree 23. Gum

Appendix 2: Drawings ARB-19685-01 and 02



Aerial images may not accurately reflect the actual vegetation cover. Vegetation is plotted as accurately as possible using existing landmarks and property boundaries. The size of the plot may not accurately represent the dimensions of the actual vegetation. Unless otherwise stated, project specific vegetation only has been plotted and captured.

Vegetation alteration/removal may be subject to resource consent requirements/conditions. It shall be the client's responsibility to determine whether or not this is the case.

Works within the root zone of any tree requires supervision from an appointed works arborist.

Legend

- Vegetation plot
- Vegetation no longer present

waterCare services limited

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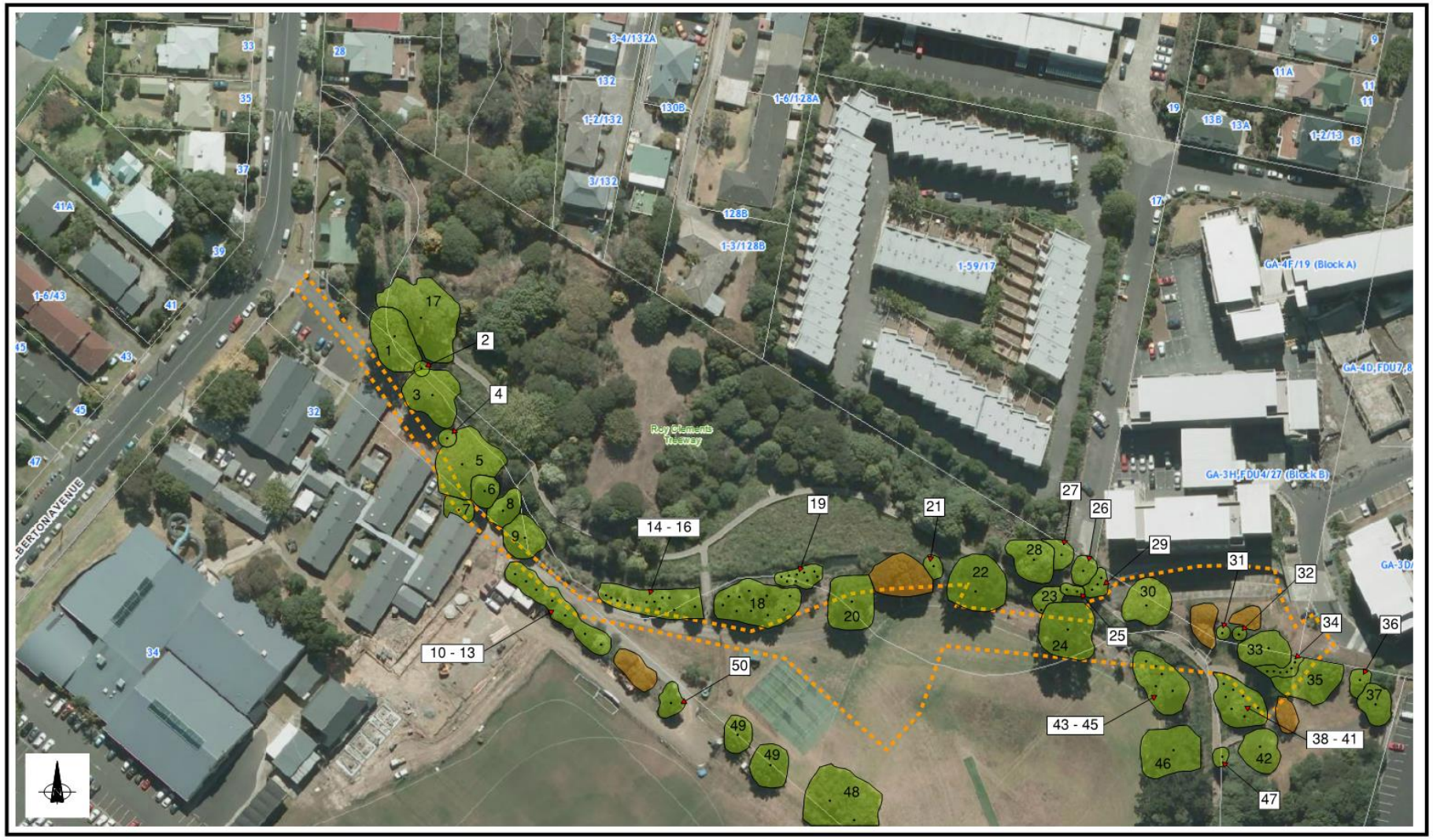
Lyon Avenue
Central Interceptor

VEGETATION INVENTORY

Scale 1:1000 @ A3

		Date
Requested by	Alia Cederman	
Surveyed by	ARB	09/09/13
Plotted by	ARB	10/09/13
Checked by	ALC	11/09/13
Drawing number	ARB-19685-01	Rev A



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Legend

- Vegetation plot
- Vegetation no longer present

waterCare services limited

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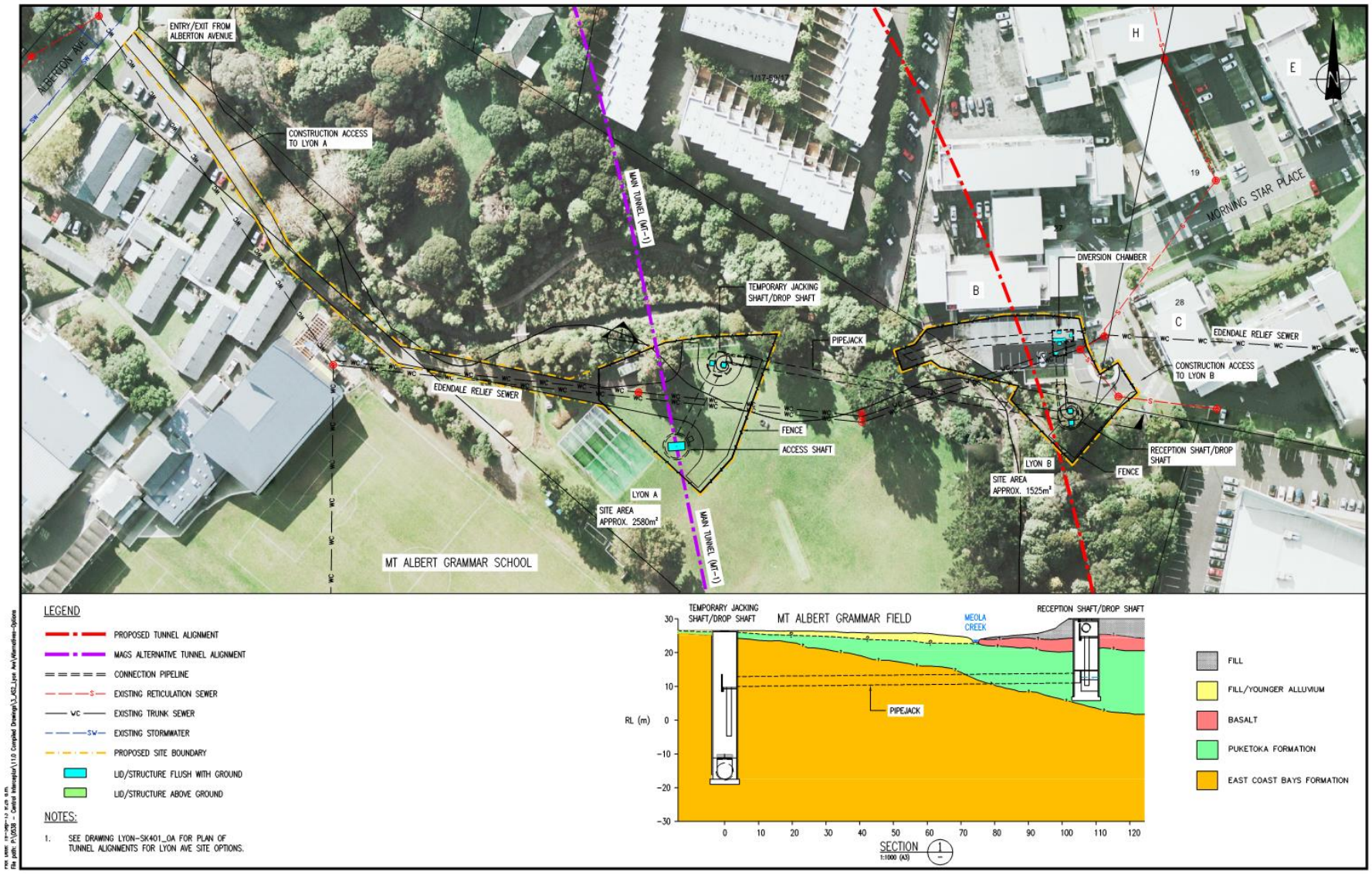
Lyon Avenue Central Interceptor

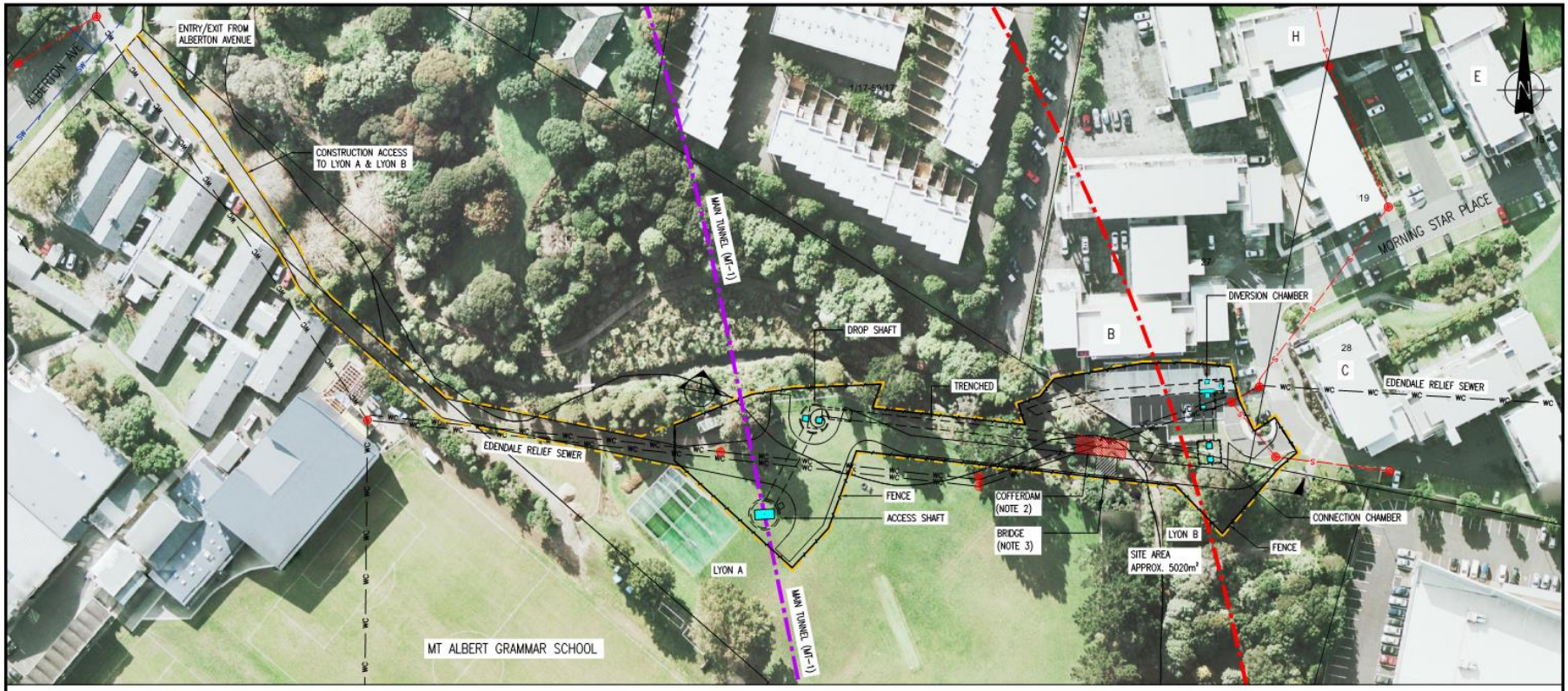
VEGETATION INVENTORY

Scale 1:1000 @ A3

		Date
Requested by	Alia Cederman	
Surveyed by	ARB	09/09/13
Plotted by	ARB	10/09/13
Checked by	ALC	11/09/13
Drawing number	ARB-19685-02	Rev A

Appendix 3: Drawings LYON-SK1001 and LYON-SK1101



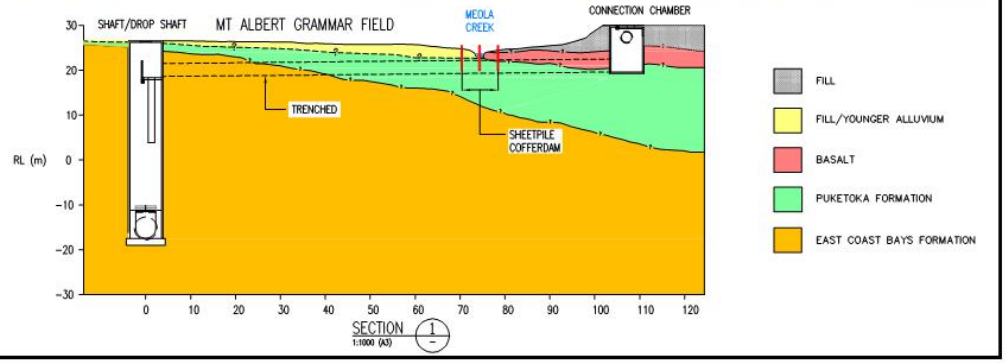


LEGEND

- PROPOSED TUNNEL ALIGNMENT
- MAGS ALTERNATIVE TUNNEL ALIGNMENT
- CONNECTION PIPELINE
- EXISTING RETICULATION SEWER
- EXISTING TRUNK SEWER
- EXISTING STORMWATER
- PROPOSED SITE BOUNDARY
- LID/STRUCTURE FLUSH WITH GROUND
- LID/STRUCTURE ABOVE GROUND

NOTES:

1. SEE DRAWING LYON-SK401_0A FOR PLAN OF TUNNEL ALIGNMENTS FOR LYON AVE SITE OPTIONS.
2. MEAOLA STREAM TO BE DIVERTED LEFT AND THEN RIGHT WITHIN SHEETPILE COFFERDAM TO ALLOW CONSTRUCTION OF TRENCH AND PIPE LAYING. FOOTPATH TO BE DIVERTED.
3. BRIDGE REQUIRED FOR ACCESS ACROSS STREAM (EITHER PERMANENT OR TEMPORARY, DEPENDING ON ACCESS ARRANGEMENTS).



SECTION 1 (1:1000 (A3))

ISSUE	DATE	AMENDMENT	BY	APPD.
C	19/09/13	LEGEND UPDATED	AP	JQC
B	17/09/13	FOR INFORMATION	AP	JQC
A	-	DRAFT	AP	PR

DESIGNED	NL		-
DES. CHECKED	JQC		-
DRAWN	AP		
DWG. CHECKED	NL		-
REV'D P.MGR	JQC		
APP'D P.DIR	CC		
BY	DATE		

OPERATIONS

ASSET MANAGER

SITE LAYOUT AND DESIGNS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN DEVELOPMENT

FOR INFORMATION

water Care services limited

CENTRAL INTERCEPTOR
GENERAL – MT ALBERT GRAMMAR SCHOOL ALTERNATIVE 2
LYON AVENUE (AS2) – CONSTRUCTION ACCESS FROM MAGS (TRENCHED OPTION)

CAD FILE LYON-SK1101 | DATE 19-Sep-13
ORIGINAL SCALE A1 1:1000 A3 | CONTRACT No. 0538
DRAWING No. LYON-SK1101 | ISSUE C

Plot Date: 19-Sep-13 9:25 a.m.
File path: P:\0538 - Central Interceptor\11.0 Compiled Drawings\3_AS2_Lyon Ave\Alternatives-Options

Project No.